FINAL EIR

PA 13-0082 WESTPARK PROMENADE

Response to Comments

State Clearinghouse Number 2014021022

Prepared for
City of Wildomar

October 2016

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SECTION 1
Introduction

Contents of this Final EIR

This Final EIR is consistent with the content requirements outlined in State of California Environmental Quality Act (CEQA) Section 15132 and consists of the Draft EIR (provided under separate cover), along with the Response to Comments which is included in this document. The components of the Response to Comments include a list of commenters, a copy of each comment letter on the Draft EIR, responses to each comment, errata clarifying information and providing corrections and additions to the sections of the Draft EIR, and additional information added by the City of Wildomar. The additional information is provided in the attachments to this Final EIR. This Final EIR also includes a mitigation monitoring and reporting program in accordance with State CEQA Section 15097.

Purpose of Response to Comments

In accordance with Section 15088 of the State CEQA Guidelines, the City of Wildomar as the lead agency for the proposed Westpark Promenade Project, has evaluated the comments received on the Draft Environmental Impact Report (Draft EIR), State Clearinghouse No. 2014021022. The Draft EIR was released for public review and comment for a period of 45 days from May 5, 2016 through June 20, 2016. These Responses to Comments and Errata are used by the City of Wildomar and responsible agencies in their review of the proposed project.

Organization of Response to Comments

This Response to Comments for the Westpark Promenade Project presents the following organization of sections:

Section 1: Introduction. Provides a description of the contents of the Final EIR, purpose of the Response to Comments, organization, project summary, and summary of findings.

Section 2: List of Commenters. Provides a list of agencies, organizations, and individuals that commented on the Draft EIR.

Section 3: Responses to Comments. Includes a copy of all of the letters received and provides responses to comments on environmental issues describing the disposition of the issues, explaining the Draft EIR analysis, supporting the Draft EIR conclusions, and/or providing clarifying information or corrections, as appropriate. This section is organized with a copy of the comment letter followed by the corresponding responses.

Section 4: Errata. Includes errata, clarifications, and additions to the Draft EIR.

Section 5: Mitigation Monitoring and Reporting Program. Provides a summary of the mitigation commitments identified in the EIR.

Project Summary

Project Location

The project site is located in the southern portion of the City of Wildomar, on the east side of I-15 freeway, south of Depasquale Road and north of Clinton Keith & Catt Road. The project site is bounded on the west by the I-15 freeway, the north by Depasquale Road and an existing single family residential neighborhood to the north of Depasquale Road, the east by an existing single-family residential neighborhood, and the south by a vacant lot and the USA gas station along Catt Road.

Project Description

The project applicant proposes to develop a one-phase mixed-use residential and commercial project. The project site consists of three parcels. The first parcel encompasses 14.12 acres and would be developed with two 8,000 sf restaurant pads, a 17,354 sf multiple tenant commercial retail building, an 85,000 sf major retail building, and 797 surface parking spaces. The second and third parcels would be developed with 191 multiple family attached townhomes totaling 13.48 acres with 487 residential and guest parking spaces and related site and landscape improvements.

The project is anticipated to generate a total of 13,574 daily vehicle trips that includes 1,110 daily vehicle trips from the townhome component, 2,034 daily vehicle trips from the restaurant components, and 10,430 daily vehicle trips from the retail/major retail component.

The restaurant and retail uses would be located on the westernmost 14.12-acre parcel. The heights of the restaurants would be 21’-8”. The heights of the two commercial buildings would be a maximum of 38’-0”. Preparation of the site would include land clearing, grading, and the installation of utilities, sewers, streets and sidewalks. The sewer, storm drain, gas, telephone, electric, and cable would be underground and extended from Catt Road and Depasquale Road to the project site.

In the eastern portion of the project site, the applicant is proposing the addition of two residential areas on 13.48-acres. The maximum height of these residential structures would be 38’-1”. Preparation of the site would include land clearing, grading, and the installation of utilities, sewers, streets and sidewalks. Improvements would include creation of foundations and building pads for the proposed lots. The residential component would include some recreational facilities including a half basketball court and a tot-lot.

The proposed project includes native and drought-tolerant landscaping throughout the project site. Landscaping would consist of project entry theme trees (i.e., date palm or Mexican fan palm) at

the northern and southern entrances along Westpark Street as well as selective entrances along Westpark Street. The project landscaping also includes evergreen perimeter trees (i.e., blackwood, majestic beauty Shamel ash, and Afgan pine) along the perimeter of the project site as well as portion of Westpark Street. The residential, retail, and recreational areas include various types of trees, shrubs and groundcover. The project also includes enhanced stamped concrete as well as project monuments at project entries, 6-foot high masonry walls with pilasters along the northern, eastern and southern property lines. Along the western property line adjacent to the Caltrans I-15 right-of-way, 6-foot tubular steel fence with pilasters are proposed to allow motorist views of the project site.

The proposed project would include the construction of various drainage facilities throughout the project site. The project would extend an existing 54-inch storm drain located at the existing Murrieta Valley/Depasquale Road south along the proposed Westpark Street to convey the off-site flows to the northernmost concrete headwall located in the Caltrans I-15 right-of-way (ROW). The headwall is the entrance into an existing concrete culvert that extends under and to the west side of I-15. The project site would contain two other storm drains, one of which would tie-in to and accept drainage from the existing unnamed storm drain to the east of the project site and would run along a continuation of Copper Court and through the intersection of Copper Court and Westpark Street, eventually discharging to the existing second northernmost headwall within the Caltrans I-15 right-of-way. This second headwall is the entrance to a second concrete culver that extends under and to the west side of I-15. The third storm drain line would collect stormwater from the southern portion of the project site and would cross Westpark Street, discharging to the southernmost concrete headwall within the Caltrans I-15 right-of-way. This southernmost headwall is the entrance to a third concrete culvert that extends under and to the west side of I-15. Construction of these new storm drains would be adequately sized to capture and convey the anticipated amount of run-on and runoff generated onsite compliant with City drainage control requirements.

The proposed drainage plan also includes structural best management practices (BMPs) to remove pollutants from stormwater. Catch basins are proposed on the project site and would be fitted with inserts designed to capture large floatables and debris, as well as providing some filtration of hydrocarbons. Additional BMPs include bio-retention, sand infiltration, and water quality trench facilities that are located adjacent to proposed storm drain lines. In addition, the project would include detention vault facilities to allow trash and pollutants to settle as well as reduce peak concentration storm flows from exiting the project site.

Primary vehicular access to the project site would be provided by the proposed entry drive located along the southern boundary of Catt Road (Westpark Street) and a northern entry at the intersection of Westpark Street and Depasquale Road. A secondary access to the residential parcels would be provided along Copper Court, which would connect to Westpark Street in an east/west manner. This street would also have a total 44-foot ROW. In addition, both internal and public sidewalks would be developed throughout the site. The public sidewalk system will be connected to the private sidewalk system within each residential area. All sidewalks would be connected beyond the project boundaries to help create a more walkable and connected pedestrian environment.

The project includes two offsite roadway improvements. The project would install a median along Arya Road to prohibit left turns into the existing USA gas station off of Arya Road. A left turn pocket off of Catt Road would also be constructed to allow vehicles to turn into the USA gas station. These improvements will ensure adequate access into and out of the existing USA gas station.

Approximately 1,284 parking spaces would be provided as part of the project, which would be in compliance with the City's requirements for commercial office and multi-family residences. The proposed project would provide a total of approximately 797 spaces for the commercial retail center and restaurant parcel and 487 parking spaces for the larger high density residential parcel. The smaller high-density residential parcel would include 165 parking spaces.

Emergency vehicle access would be provided via Copper Court; however the access would be gated to limit vehicles at this point to emergency vehicles only. Pedestrian access would be encouraged at this location.

Development of the proposed project would include the provision of drainage, sewage disposal, water, solid waste, electricity, natural gas, and telecommunications on the project site. The infrastructure for the project would tie into the existing infrastructure lines that would be extended from Catt Road and Depasquale Road.

Project Objectives

Section 15124(b) of the CEQA Guidelines states that the project description shall contain "a statement of the objectives sought by the proposed project." Section 15124(b) further states that "the statement of objectives should include the underlying purpose of the project." The underlying purpose of the proposed project is to create an integrated mixed-use center within the Wildomar community by providing an array of shopping and dining choices and residential development, in order to enhance the City as a walkable community with options to live, work, and shop.

As set forth by the CEQA Guidelines, the list of objectives that the project applicant and the City of Wildomar seek to achieve for the proposed project is provided below. Several of the proposed project objectives would support many of the goals, objectives, and policies set forth in the General Plan which guide land use in the proposed project area.

The City of Wildomar and the project applicant have developed the following objectives of the proposed project:

- To provide a mixed-use project, emphasizing pedestrian accessibility between the very high density component and the commercial component.
- To provide very high density residential and commercial components will have elements that are both complimentary to each other as well as complimentary to existing development in the project area.

- Construct the project with high quality materials that minimize the carbon footprint of the project as much as possible.
- Provide affordable housing for the City of Wildomar's varied income groups.
- Create walkable community for visitors, employees and residents.
- Encourage sustainable development.
- Provide retail service for the City of Wildomar

Intended Use of the EIR and Project Approvals

The EIR is intended to be used by lead, responsible, and trustee agencies that may have review authority over the project. It is also intended to inform the public of the environmental effects of the proposed project. Actions and approvals required from the City in association with the proposed project include:

- Certification of the Final EIR and adoption of the Mitigation Monitoring and Reporting Plan (MMRP)
- Approval of a General Plan Amendment and Change of Zone
- Approval of a Tentative Parcel Map (TPM 36612)
- Approval of a Tentative Tract Map (TTM 36781)
- Approval of a Tentative Tract Map (TTM 36782)
- Approval of a Plot Plan

Actions and approvals that may be required from other agencies for the proposed project include:

- U.S. Army Corps of Engineers (USACE) – Nationwide Permit for conversion of the concrete drainage channel
- State Water Resources Control Board (SWRCB) – National Pollutant Discharge Elimination System (NPDES) and Storm Water Pollution Prevention Plan (SWPPP)
- San Diego Regional Water Quality Control Board (SDRWQCB) – Section 401, NPDES and SWPPP
- Streambed Alteration Agreement may be required from the California Department of Fish and Wildlife (CDFW), subject to future agency jurisdictional review.

Additional coordination will be required between the proposed project proponent and the Hartford Park Home Owners Association. Specifically, the project would share the use of the parks that are part of the proposed project and the existing parks in the existing adjacent development.

Summary of Findings

These Responses to Comments and Errata clarify, amplify, and expand on the fully adequate analysis and significance conclusions that were already set forth in the Draft EIR for public review. CEQA Guidelines Section 15088.5 makes clear that such clarifications and amplifications are appropriate under CEQA and do not require recirculation of the EIR. Specifically, Section 15088.5 states:

a) A lead agency is required to recirculate an EIR when significant new information is added to the EIR after public notice is given of the availability of the draft EIR for public review under Section 15087 but before certification. As used in this section, the term "information" can include changes in the project or environmental setting as well as additional data or other information. New information added to an EIR is not "significant" unless the EIR is changed in a way that deprives the public of a meaningful opportunity to comment upon a substantial adverse environmental effect of the project or a feasible way to mitigate or avoid such an effect (including a feasible project alternative) that the project's proponents have declined to implement. "Significant new information" requiring recirculation includes, for example, a disclosure showing that:

    1. A new significant environmental impact would result from the project or from a new mitigation measure proposed to be implemented.
    2. A substantial increase in the severity of an environmental impact would result unless mitigation measures are adopted that reduce the impact to a level of insignificance.
    3. A feasible project alternative or mitigation measure considerably different from others previously analyzed would clearly lessen the significant environmental impacts of the project, but the project's proponents decline to adopt it.
    4. The draft EIR was so fundamentally and basically inadequate and conclusory in nature that meaningful public review and comment were precluded.

b) Recirculation is not required where the new information added to the EIR merely clarifies or amplifies or makes insignificant modifications in an adequate EIR.

As set forth in more detail in these Responses to Comments and Errata, none of the clarifications or amplifications set forth herein change the significance conclusions presented in the Draft EIR or the substantially alters the analysis presented for public review. Furthermore, the Draft EIR circulated for public review was fully adequate under CEQA such that meaningful public review was not precluded. Thus, the clarifications provided in these Responses to Comments and Errata do not constitute significant new information that might trigger recirculation.

SECTION 2
List of Commenters

A list of public agencies and private individuals who provided comments on the Draft EIR through June 20, 2016 is presented below. Individual comments within each correspondence have been numbered so comments can be crossed-referenced with responses. The text of the correspondence is reprinted in Section 3, Responses to Comments, immediately followed by the corresponding response.

Comment Letters Received Regarding the Draft EIR

Letter A **State Clearinghouse (June 20, 2016)**
Scott Morgan, Director

Letter B **Department of Transportation (June 17, 2016)**
Mark Roberts, Office Chief, Intergovernmental Review

Letter C **County of Riverside, Department of Environmental Health (June 6, 2016)**
Kristine Kim, REHS

Letter D **Riverside County Fire Department (June 17, 2016)**
Steve Payne, Assistance Fire Marshal

Letter E **Pechanga, Temecula Band of Luiseno Mission Indians (June 16, 2016)**
Tuba Ebru Ozdil, Planning Specialist

Letter F **Rincon Band of Luiseno Indians (May 6, 2016)**
Vincent Whipple, Cultural Resources Department Manager

Letter G **Martha Bridges, John Burkett, and Gerard Ste. Marie (June 20, 2016)**
Private Individuals/Area Residents

Letter H **Blum Collins LLP (June 20, 2016)**
Craig Collins

SECTION 3
Responses to Comments

In accordance with Section 15088 of the California Environmental Quality Act (CEQA) Guidelines, the City of Wildomar, as the lead agency, evaluated the comments received on the Draft EIR (State Clearinghouse No. 2014021022) for the proposed Westpark Promenade Project and has prepared the following responses to the comments received.

Comment Letter A

STATE OF CALIFORNIA

GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH

STATE CLEARINGHOUSE AND PLANNING UNIT

EDMUND G. BROWN JR.
GOVERNOR

KEN ALEX
DIRECTOR

RECEIVED
JUN 22 2016
CITY OF WILDOMAR

June 20, 2016

Matthew C. Bassi
City of Wildomar
23873 Clinton Keith Road, Suite 201
Wildomar, CA 92595

Subject: Westpark Promenade Mixed-Use Development Project (Planning Application No. 13-0082)
Environmental Impact Report (EIR)
SCH#: 2014051022

Dear Matthew C. Bassi:

The State Clearinghouse submitted the above named Draft EIR to selected state agencies for review. The review period closed on June 17, 2016, and no state agencies submitted comments by that date. This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act. A-1

Please call the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process. If you have a question about the above-named project, please refer to the ten-digit State Clearinghouse number when contacting this office.

Sincerely,

Scott Morgan
Director, State Clearinghouse

1400 10th Street P.O. Box 3044 Sacramento, California 95812-3044
(916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

Document Details Report
State Clearinghouse Data Base

SCH# 2014051022
Project Title Westpark Promenade Mixed-Use Development Project (Planning Application No. 13-0082)
Lead Agency Environmental Impact Report (EIR)
Wildomar, City of

Type EIR Draft EIR

Description The project applicant proposes to develop a two phase mixed use residential and commercial project. The project site consists of three parcels. The first parcel encompasses 14.12 acres and would be developed with two 8,000 sf restaurant pads, a 17,354 sf multiple tenant commercial retail building, an 85,000 sf major retail building, and 797 surface parking spaces. The second and third parcels would be developed with 191 multiple family attached townhomes totaling 13.48 acres with 487 residential and guest parking spaces and related site and landscape improvements.

Lead Agency Contact

Name Matthew C. Bassi
Agency City of Wildomar
Phone 951 677-7751 x213 **Fax**
email
Address 23873 Clinton Keith Road, Suite 201
City Wildomar **State** CA **Zip** 92595

Project Location

County Riverside
City Wildomar
Region
Lat / Long
Cross Streets N/E Corner of I-15 and Clinton Keith Rd
Parcel No. 367-410-013, 025, 023
Township 5S **Range** 3W **Section** 31 **Base**

Proximity to:

Highways I-15
Airports Skylark Field
Railways
Waterways
Schools various
Land Use undeveloped/scenic highway commercial/commercial office

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Project Issues Aesthetic/Visual; Air Quality; Archaeologic-Historic; Drainage/Absorption; Flood Plain/Flooding; Geologic/Seismic; Noise; Population/Housing Balance; Public Services; Recreation/Parks; Schools/Universities; Soil Erosion/Compaction/Grading; Solid Waste; Toxic/Hazardous; Traffic/Circulation; Vegetation; Water Quality; Water Supply; Wetland/Riparian; Wildlife; Growth Inducing; Landuse; Cumulative Effects; Other Issues

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Reviewing Agencies Resources Agency; Department of Fish and Wildlife, Region 6; Cal Fire; Department of Parks and Recreation; Department of Water Resources; Office of Emergency Services, California; California Highway Patrol; Caltrans, District 8; Department of Housing and Community Development; Regional Water Quality Control Board, Region 9; Native American Heritage Commission

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Date Received 05/04/2016 **Start of Review** 05/04/2016 **End of Review** 06/17/2016

Note: Blanks in data fields result from insufficient information provided by lead agency.

Response to Letter A

State Clearinghouse

Response to Comment A-1. This comment is noted and acknowledges the submittal of the Draft EIR to selected state agencies for their review and acknowledges the closing of the public review period for the Draft EIR. No specific comments on the Draft EIR were provided; therefore, no further response is necessary.

Comment Letter B

DEPARTMENT OF TRANSPORTATION
DISTRICT 8
PLANNING (MS 722)
464 WEST 4th STREET, 6th Floor
SAN BERNARDINO, CA 92401-1400
PHONE (909) 383-4557
FAX (909) 383-5936
TTY (909) 383-6300
www.dot.ca.gov/dist8

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JUN 21 2016
CITY OF WILDOMAR

Serious drought
Help save water!

June 17, 2016

File: 08-RIV-15-PM-14.023

Mr. Matthew Bassi
Planning Director
Planning Department
City of Wildomar
23873 Clinton Keith Road, Suite 201
Wildomar, CA 92595

Westpark Promenade Mixed-Use Development Project Environmental Impact Report

Mr. Bassi,

The California Department of Transportation (Caltrans) has completed the review of the Environmental Impact Report for the Westpark Promenade Mixed-Use Development Project Environmental Impact Report. The project is located in the City of Wildomar (City) east of and adjacent to I-15, north of Clinton Keith Road, west of a residential community, and south of Depasquale Road. The project proposes the development of 191 multi-family residential units, an 85,000 square foot supermarket, a 17,354 square foot retail shopping center, and 16,000 square feet of restaurants.

As the owner and operator of the State Highway System, it is our responsibility to coordinate and consult with local jurisdictions when proposed development may impact our facilities. As a responsible agency under the California Environmental Quality Act (CEQA), it is also our responsibility to make recommendations to offset associated impacts with the proposed project, which may include traditional mitigation measures, in addition to multimodal transportation access, traffic safety modifications, and travel demand management strategies. Although the project is under the jurisdiction of the City, due to the project's potential impact to State facilities it is also subject to the policies and regulations that govern the State Highway System. B-1

We offer the following comments regarding the Project Environmental Impact Report:

City of Wildomar General Plan

The City General Plan Update website found at http://wildomargp.org/ states that the "process is on indefinite hold and no action is proposed at this time". Absent a General Plan proposed by the City, it is difficult to determine the community goals, plans and policies guiding land use and transportation decisions within the City. We support mixed-use development projects like the Westpark Promenade for their location proximity between housing and services. We recommend restarting the General Plan Update process soon.

Traffic Operations and Forecasting:

Caltrans' Operations and Forecasting units are tasked with analyzing the methodology and mitigation measures found within the TIA. We have the following comments:

- Please provide an opening year analysis. B-2
- There is a discrepancy on the phasing of the development. According to the Project Description in the Executive Summary, the project is a two-phase project. However, page 6 states the project will be completed in one phase. Please address this discrepancy. B-3
- Please include adequate truck volumes and utilize conversion methodologies to estimate truck trip impacts in a passenger car equivalent (PCE) metric. B-4
- Page 59 references Appendix H for detailed LOS counts. However, Appendix H does not provide this information. Please provide detailed LOS count sheets. B-5
- Referring to Figures 4-C and 4-D (Project-Only Volumes)- ramp traffic volumes are low and do not reflect the appropriate Project Trip Distribution percentages. Please revise. B-6
- Referring to Chapter 6.0, recommended off-site improvements include the installation of a traffic signal at the I-15 and Baxter Road Southbound and Northbound Ramps. The City ensure that project fair share fees are collected and that mitigation measures are implemented when necessary. Please include a discussion of local and regional funding mechanisms and project fair share calculations within the TIA. B-7

Multimodal Accessibility:

Caltrans is committed to ensuring that a multimodal transportation system serves every local development project, where feasible. Planning facilities for pedestrians, cyclists, transit riders and car- / van-pooling will encourage more multimodal trips- which will reduce congestion, vehicles miles traveled, greenhouse gas emissions, and our State's effect on climate change. To assist the City in reducing vehicle trips associated with the proposed development, we offer the following comments:

- Referring to Page 27, the TIA states that "it is unlikely that trips will be reduced to/from the site by non-motorized modes of travel due to the lack of; 1) convenient transit opportunities, 2) bike lanes, and 3) pedestrian trails". However, mixed-use developments have been found to reduce vehicle trips specifically due to the location proximity of residential and commercial uses. To reduce vehicle trips between the proposed multi-family neighborhood and the shopping center, design can be utilized which encourages bicycle, pedestrian and transit trips. A strategy of orienting the shopping center towards the apartments and Westpark Street rather than the parking lot may promote multi-modal transportation. Further, due to the B-8

growth in development along Clinton Keith Road, it is apparent that the striping of bike lanes and re-routing of transit will be necessary. B-8

- Considering the internal circulation, please refer to the National Association of City Transportation Officials' Urban Streets Design Guide to Yield Street (http://nacto.org/publication/urban-street-design-guide/streets/yield-street/) or Residential Shared Street (http://nacto.org/publication/urban-street-design-guide/streets/residential-shared-street/) standards. This would provide more space for walking, cycling, playing and socializing for residents. We recommend consideration of sidewalks wider than the minimum requirement of 5 feet, street trees, bioswales, pervious strips, and rain gardens. B-9

- Regarding pedestrian safety, consider mid-block crossings, including striping high-visibility crosswalks, constructing flashing beacons and curb extensions at the intersections of Westpark Street and the retail development. B-10

- Per County of Riverside Circulation Element (December 8, 2015) Policies C 1.7 and C 17.4, we recommend the striping of the following bikeways: B-11

    - Clinton Keith Road: Class IV Separated Bike Lanes per Caltrans DIB 89; at a minimum, Class II Buffered Bike Lanes to connect to the bike lanes terminating at Wildomar city limits to provide a regional bicycle connection in addition to a connection to RTA Route 7. Further, we recommend the inclusion of green paint in conflict areas as an increased safety measure to increase the visibility of cyclists to automobile drivers.
    - Catt Road: Class II Bike Lanes to provide safe multi-modal transportation connections to residents accessing transit.
    - Westpark Street: Class II Bike Lanes to provide safe multi-modal transportation connections to residents accessing the mixed-use community center.

- Consider meeting with the Riverside Transit Agency (RTA) on constructing bus stops and shelters at the corner of Arya Drive and Clinton Keith Road. Consider conditioning the developer to construct these improvements. B-12

Encroachment Permit Requirements:

When development occurs, Encroachment Permits will be needed for any work performed within the State R/W. Furthermore, the applicant's environmental documentation must include such work in their project description and indicate that an Encroachment Permit will be needed. As part of the Encroachment Permit process, the developer must obtain appropriate environmental approval for potential environmental impacts to State Highway R/W. This is separate from the on-site CEQA determination.

Issuance of a Caltrans Encroachment Permit will be required prior to any construction within State R/W. In addition, all work undertaken within I-15 R/W shall be in compliance to all current design standards, applicable policies, and construction practices. Detailed information regarding permit application and submittal requirements is available at:

Office of Encroachment Permits
California Department of Transportation
464 West Fourth Street, 6th Floor, MS 619
San Bernardino, CA 92401-1400
(909) 383-4526
http://www.dot.ca.gov/trafficops/permits/encroachpermits.html

B-13

Thank you for providing us the opportunity to review the Environmental Impact Report for the Westpark Promenade Mixed-Use Development Project and for your consideration of these and future comments. These recommendations are preliminary and summarize our review of materials provided for our evaluation. If this proposal is revised in any way, please forward appropriate information to this office so that updated recommendations for impact mitigation may be provided. In addition, these documents may be reviewed at Encroachment Permit submittal. If you have questions concerning these comments, or would like to meet to discuss our concerns, please contact Dustin Foster (909) 806-3955 or myself at (909) 383-4557.

Sincerely,

Mark Roberts

MARK ROBERTS
Office Chief
Intergovernmental Review, Community and Regional Planning

Response to Letter B

Department of Transportation

Response to Comment B-1. This comment provides a description of the proposed project and identifies Caltrans' responsibility to coordinate and consult with local jurisdictions. This comment also states that due to the project's potential impact on State facilities, it is subject to the policies and regulations that govern the State Highway System. The traffic analysis that was prepared for the proposed project and summarized in Section 3.14 of the Draft EIR evaluated the project's potential effect as well as the cumulative effect on the Caltrans facilities. These evaluations used the thresholds established by Caltrans for the State Highway System.

Furthermore, this comment states that it is difficult to determine community goals, plans and policies guiding land use and transportation decisions as the City General Plan Update is on indefinite hold. The comment recommends restarting the General Plan Update soon. This is not a comment on the content of the Draft EIR. The current community goals, plans and policies guiding land use and transportation decisions are in the City of Wildomar General Plan that was approved in 2008. A discussion of the project's consistency with the General Plan land use policies are provided in Table 3.9-3 in Section 3.9, Land Use and Planning in the Draft EIR and with the General Plan transportation policies in Table 3.14-7 in Section 3.14, Transportation and Traffic. The comment will be forwarded to the City Council regarding your desire to update the General Plan. No further response is required.

Response to Comment B-2. The comment requests that an opening year analysis be provided. An opening year analysis is provided in the Draft EIR, where it is described as the "Existing plus Ambient plus Project (2017) Conditions" scenario discussed in the Draft EIR in Section 3.14 and the Traffic Impact Analysis in Appendix I-1 of the Draft EIR.

Response to Comment B-3. The comment points out a discrepancy between the project description provided in the Draft EIR Executive Summary (stating that the project will be constructed in two phases) and page 6 of the Draft EIR (stating that the project will be constructed in one phase). The proposed project will be developed in one phase and was adequately evaluated in the Traffic Impact Analysis in Appendix I-1 of the Draft EIR.

The first sentence in the second paragraph on page ES-1 of the Draft EIR is revised as follows:

> The project applicant proposes to develop a one~~two~~-phase mixed-use residential and commercial project.

The second sentence in the first paragraph under Section 2.5 of the Draft EIR is revised as follows:

> The project would be developed in one~~two~~ phase~~s~~.

Response to Comment B-4. The comment requests that truck volumes be included and recommend the utilization of conversion methodologies to estimate truck trip impacts in a passenger car equivalent metric. The truck traffic due to the project is anticipated to be minimal

during the peak hours, if any. Most truck traffic to supermarkets and retail uses like those proposed as part of the project occurs outside of the morning peak hours or the evening peak hours. However, even if project truck traffic were to occur during the peak hour, the number of trips would be nominal, due to the size of the project and its proposed uses, and thus there would be a nominal number of trucks that would use freeway ramps. For analysis purposes, if the assumed number of trucks includes four large trucks occurring during peak hours, the conversion methodology that could be used for the trucks being converted into passenger car equivalents is a 3.0 passenger car equivalency (PCE) factor for each large truck. Based on the 3.0 PCE, the four large trucks would be equivalent to 12 PCE's. This additional level of peak hour traffic would not substantially alter the analysis of the northbound and southbound on/off ramps at Clinton Keith Road that is provided in Section 3.14 of the Draft EIR. The minimal truck traffic that may occur during peak hours would not significantly impact the analysis. Because no peak hour truck traffic is anticipated to be associated with the operation of the residential uses, the traffic volumes identified in the Traffic Impact Analysis are considered appropriate.

Response to Comment B-5. The comment included a request for LOS counts which were referenced in Appendix H of the Draft EIR. The LOS counts are in appendices to Appendix H, which were inadvertently not included; however, they are included as Attachment 1 to this Response to Comments.

Response to Comment B-6. The comment refers to Figures 4-C and 4-D and states that the low ramp traffic volumes do not reflect the appropriate Project Trip Distribution percentages. There are two separate distribution patterns: one for the residential component and the second for the commercial component. The following is a summary of the distribution and assignment of trips to the Clinton Keith Road on/off ramps that are used to arrive at the traffic volumes identified for the ramps in Figures 4-C and 4-D.

The total morning peak hour trips on the Clinton Keith Road on/off ramps are based on the distribution of 15 percent of the total morning peak hour residential trips and 5 percent of the total morning peak hour commercial trips. The total evening peak hour trips on the Clinton Keith Road on/off ramps are based on the distribution of 15 percent of the total evening peak hour residential trips and 5 percent of the total evening peak hour commercial trips. These distributions are shown in Figures 4-A and 4-B of the traffic report located in Appendix H of the Draft EIR.

The total trips on the Clinton Keith Road off-ramps are 17 trips during the morning peak hour (2 from the residential component of the project and 15 from the commercial component of the project). The total trips on the Clinton Keith Road on-ramps are 21 trips during the morning peak hour (11 from the residential component of the project and 10 from the commercial component of the project).

During the evening peak hours, the total trips on the Clinton Keith Road off-ramps are 39 trips (10 from the residential component of the project and 29 from the commercial component of the project). The total trips on the Clinton Keith Road on-ramps are 32 trips during the evening peak hour (5 from the residential component of the project and 27 from the commercial component of the project).

As described above, the traffic volumes on the Clinton Keith Road on/off ramps that are shown in Figures 4-C and 4-D are correct.

Response to Comment B-7. The comment refers to Chapter 6 of the Traffic Impact Analysis (TIA) and requests that the City ensure fair share fees are collected and that mitigation measures are implemented when necessary. This comment is noted, and Mitigation Measures TRA-1 and TRA-2 in Section 3.14 of the Draft EIR identify that the fair share will be determined by the City of Wildomar City Engineer. The improvements to these intersections are interim improvements that are not part of the City Development Impact Fee (DIF) or the Transportation Uniform Mitigation Fee (TUMF) programs; therefore, the fair share fees toward the improvements to these intersections are in addition to the DIF and TUMF fees.

Response to Comment B-8. The comment initially states that Caltrans is committed to ensuring that a multimodal transportation system serves every development project, where feasible. The comment further refers to Page 27 of the TIA and states that mixed-use developments have been found to reduce vehicle trips specifically due to proximity of residential and commercial uses. The comment recommends that the project orients the shopping center towards the apartments and Westpark Street rather than the parking lot in order to promote multi-modal transportation. This comment on a redesign of the project is noted; however, redesign is not necessary to promote multi-modal transportation and would not further reduce any significant traffic impacts. The currently proposed design will provide for a reduction in potential traffic volumes due to the proximity of the proposed residential and commercial uses, which in itself promotes walking and biking between the uses. In addition, the proposed project includes sidewalks on the majority of both sides of the project streets, pedestrian and biking linkages between residential and commercial uses, and walking/biking linkages between onsite uses.

The comment also states that due to the growth in development along Clinton Keith Road, striping of bike lanes and re-routing of transit will be necessary. The project includes biking linkages between the proposed residential and commercial uses as discussed in Section 2.4.4 of the Draft EIR and the project will provide bus passenger benches and shelters at any approved transit stop on the project site as discussed in Mitigation Measure AQ-1 in Section 3.2 of the Draft EIR. However, the location and scheduling of bus transit is determined by Riverside Transit Agency. No further restriping or bike lanes or re-routing of transit will be necessary as a result of this Project.

Response to Comment B-9. The comment refers to internal circulation and the use of the National Association of City Transportation Officials' Urban Streets Design Guide to Yield Street or Residential Shared Street standards. The comment requests that wider sidewalks, street trees, bioswales and rain gardens be provided. However, the proposed project already includes sidewalks on the majority of both sides of the project streets, pedestrian and biking linkages between residential and commercial uses, and walking/biking linkages between onsite uses. These project features will provide ample space for walking, cycling, playing and socializing for residents, as requested by this comment. Redesign of the project's internal circulation would not further reduce any significant traffic impacts.

Response to Comment B-10. The comment requests consideration of mid-block crossings, including striping high-visibility crosswalks, and constructing flashing beacons and curb extensions at the intersections of Westpark Street and the retail development to improve pedestrian safety. The proposed project includes three crosswalks on Westpark Street and decorative surfaces at each intersection along Westpark Street as shown in Figures 2-3 and 2-10 in the Draft EIR. These project features will provide for pedestrian safety because the use of decorative surfaces can raise driver awareness and focus pedestrians at specific crossing locations. Design hazards relating to traffic and transportation were analyzed on page 3.14-31 of the Draft EIR.. The addition of mid-block crossings would not further reduce any significant traffic impacts.

Response to Comment B-11. The comment recommends bike lane striping along Clinton Keith Road, Catt Road, and Westpark Street in accordance with the County of Riverside Circulation Element dated December 2015. The proposed project is located within the City of Wildomar and the City adopted the Riverside County General Plan, including the Circulation Element, as it existed upon incorporation on July 1, 2008. The Circulation Element policies cited are not in the version of the County General Plan the City has adopted, and therefore are not applicable within the City or to this project. The proposed project includes bike lanes along Westpark Street to provide safe access between the residential and commercial uses. The project does not include bike access along Catt Road, Arya Drive or Clinton Keith Road because those streets are located outside of the project site.

Response to Comment B-12. The comment recommends meeting with the Riverside Transit Agency (RTA) on constructing bus stops and shelters at the corner of Arya Drive and Clinton Keith Road. As required in mitigation measure AQ-1, the project applicant will be required to cooperate with the local transit agencies to determine bus routing in the project area that can accommodate bus stops at the project access points. In addition, this measure requires bus passenger benches and shelters at any location that the Riverside Transit Agency approves.

Response to Comment B-13. The comment states that the need for an Encroachment Permit from Caltrans if work is performed in the State right-of-way. As described in Chapter 2, Project Description and Section 3.7, Hydrology and Water Quality, there are three existing concrete storm drains that extend under I-15 adjacent to the project site. Each of the three storm drains includes a headwall located immediately adjacent to the project site. The proposed project includes storm drains that will be extended to allow discharge from these proposed storm drains to the concrete headwalls within the Caltrans right-of-way. It is understood that the connection between the proposed storm drains and the concrete headwalls will require an encroachment permit from Caltrans. Section 2.6, Intended Use of the EIR and Project Approvals, is modified to add the required encroachment permits from Caltrans for the storm drain connections with the concrete headwalls. The following bullet is added after the tenth bullet on page 2-23 of the Draft EIR.

- <u>California Department of Transportation – Encroachment permit for the proposed storm drain connections with the concrete headwalls that are located within the Caltrans right-of-way.</u>

Comment Letter C

County of Riverside
DEPARTMENT OF ENVIRONMENTAL HEALTH
P.O. BOX 7909 ● RIVERSIDE, CA 92513-7909
STEVE VAN STOCKUM, DIRECTOR

June 6, 2016

City of Wildomar Planning Department
Attn: Matthew Bassi
23873 Clinton Keith Road, Suite 201
Wildomar CA 92595

SUBJECT: DEIR for the Westpark Promenade Mixed Use Development Project (PA 13-0082)

Dear Mr. Bassi:

Based on the information provided, the Department of Environmental Health (DEH) offers the following initial comments:

WATER AND WASTEWATER:

Provide an original copy of a water and sewer "will-serve" letter from the appropriate water and sewer purveyor. C-1

Any existing wells and/or existing onsite wastewater treatment systems (OWTS) shall be properly removed and/or abandoned under permit with DEH.

INDUSTRIAL HYGIENE - NOISE

The applicant shall obtain written clearance from DEH Office of Industrial Hygiene. Please note that a noise study may be required at their discretion. For further information, please contact the Office of Industrial Hygiene at (951)955-8980. C-2

ENVIRONMENTAL CLEANUPS PROGRAM

The applicant shall obtain written clearance from DEH Environmental Cleanup Programs. Submit a Phase I Environmental Site Assessment for review. For further information, please contact Yvonne Reyes at (951) 955-8980. C-3

REVIEW FEES

Please refer to the attached "Environmental Health Review Fees" Tier chart for the appropriate fees. The minimum initial deposit shall be $1770.00. These fees will need to be collected prior to this Department issuing a final project comments letter.

Should you have any questions regarding this letter, please contact me at (951) 955-8980.

C-4

Sincerely,

Kristine Kim, REHS
County of Riverside, Department of Environmental Health
Environmental Protection and Oversight Division
3880 North Lemon Street, Suite 200
Riverside, CA 92501

Comment Letter C

County of Riverside
DEPARTMENT OF ENVIRONMENTAL HEALTH
P.O. BOX 7909 ● RIVERSIDE, CA 92513-7909
STEVE VAN STOCKUM, DIRECTOR

Environmental Health Review Fees

(Planning Case Transmittals for Contracted Cities)

DESCRIPTION	FEE
Tier 1 - Water and Sewer verification review • Will Serve Letter • Onsite Wastewater Treatment Systems • Advance Treatment Units • Solis Percolation Report • Issuance of a SAN 53 and/or Comments Letter Average time 3 hours for review	$531.00
Tier 2 - Phase I Environmental Site Assessment (ESA) review or Noise Study plus, • Review of items aforementioned in Tier 1 Average time 7 hours for review	$1239.00
Tier 3 - Phase I Environmental Site Assessment (ESA) review and Noise Study plus, • Review of items aforementioned in Tier 1 Average time 10 hours for review	$1770.00

NOTES TO FEE SCHEDULE:

- The fees noted in the fee schedule are minimum fees to be paid at the time of application filing to cover the average Department cost of review. A signed agreement for payment of application processing fees between the Department and the applicant shall be required at the time of application filing. Should actual costs exceed the amount of the fee, the applicant will be billed for additional costs. Services are charged at a rate of $177/hour.
- An hourly rate of $177 shall be charged for other development-related fees which may be required, but are not necessarily limited to, well, and septic system fees.
- The Department reserves the right to charge actual cost (at a rate of $177/hour) on large, complex, unusual, and/or time consuming projects in order to ensure that the fee will cover the actual cost of service.
- An application shall be filled with the Planning Department of the Contracted city prior to submitting any items listed above to this Department for Review. Please provide a copy of the Planning Case transmittal to this Department.

Rev 07/2015

Response to Letter C

County of Riverside, Department of Environmental Health

Response to Comment C-1. The comment requests that a copy of a water and sewer "will serve" letter from the appropriate water and sewer purveyor be provided. The comment also states that any existing wells and/or existing onsite wastewater treatment systems (OWTS) need to be properly removed and/or abandoned under permit with DEH.

The City will provide a copy of the water and sewer "will serve" letters when they are received. Further, there are no existing wells and/or wastewater treatment systems onsite, therefore, no permits relating to the removal or abandonment of wells or treatment systems are required.

Response to Comment C-2. The comment states that the applicant shall obtain written clearance form DEH Office of Industrial Hygiene. This is not a comment on the content of the Draft EIR. The applicant will obtain written clearance from DEH when required. No further response is required.

Response to Comment C-3. The comment states that the applicant shall obtain written clearance from DEH Environmental Cleanup Programs and should submit a Phase I Environmental Site Assessment for review. A Phase I Environmental Site Assessment is provided in Appendix G of the Draft EIR, and will be provided to DEH to obtain necessary clearances.

Response to Comment C-4. The comment refers to the attached "Environmental Health Review Fees" Tier chart for appropriate fees and that fees will be collected prior to the department issuing a final project comment letter. The comment is noted. This is not a comment on the content of the Draft EIR. No further response is required.

Comment Letter D

RIVERSIDE COUNTY FIRE DEPARTMENT

IN COOPERATION WITH
THE CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION

2300 Market St., Ste. #150, Riverside, CA 92501 • Phone (951) 955-4777
• Fax (951) 955-4886
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MORENO VALLEY
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SAN JACINTO
TEMECULA
WILDOMAR

BOARD OF SUPERVISORS:

KEVIN JEFFRIES
DISTRICT 1

JOHN TAVAGLIONE
DISTRICT 2

CHARLES WASHINGTON
DISTRICT 3

JOHN BENOIT
DISTRICT 4

MARION ASHLEY
DISTRICT 5

June 17, 2016

City of Wildomar
Attn: Matthew C. Bassi, Planning Director
23873 Clinton Keith Road, Suite 201
Wildomar, CA 92595

Re: Project PA 13-0082

Dear Mr. Bassi,

In reference to the above project, the Fire Department recommends the following fire protection measures be provided in accordance with Riverside County Ordinances and /or recognized fire protection standards:

1. Fire Protection Water System: The developer of this project shall be responsible to provide all water mains and fire hydrants necessary to provide the required fire flow per California Fire Code. Water systems shall be constructed in accordance with Riverside County ordinances and the California Fire Code. D-1

2. Adverse impacts: The proposed project will have a cumulative adverse impact on the Fire Department's ability to provide an acceptable level of service. These impacts include an increased number of emergency and public service calls due to the increased presence of structures, traffic and population. The project proponents/developers shall participate in the established Development Impact Fee Program to mitigate a portion of these impacts. This will provide funding for capital improvements such as land, equipment purchases and fire station construction. The Fire Department reserves the right to negotiate developer agreements associated with the development of land and/or construction of fire facilities to meet service demands through the regional integrated fire protection response system. D-2

3. Secondary Access: In the interest of public safety, the project shall provide at least two points of access. All access shall be in accordance with Fire Department and City of Wildomar standards. D-3

At least two approved points of access shall be maintained throughout any project phasing. D-3

4. Fire Sprinkler Systems: All residential buildings shall have fire sprinkler systems in accordance with the California Fire Code and California Residential Code, 2013 edition and Riverside County Fire Department standards. All buildings 3,600 square feet or larger shall have an approved fire sprinkler system in accordance with Riverside County Ordinance. All other buildings shall be equipped with fire sprinkler systems in accordance with the California Fire Code. Fire sprinkler systems must be installed per NFPA 13, 13D, or 13R, 2013 edition. A licensed C-16 contractor must submit plans along with the current permit fees to the Fire Department for review and approval prior to installation. D-4

5. Final Fire Requirements: Further review of the project will occur upon receipt of specific project plans. Final fire protection requirements and impact mitigation measures will be determined at that time. D-5

Should you have any questions, or if some items are unclear, please phone our office and speak with a Specialist to assist you with these conditions. 951-955-4777

Steve Payne

Assistant Fire Marshal

Response to Letter D

Riverside County Fire Department

Response to Comment D-1. This comment initially recommends fire protection features and measures in accordance with the Riverside County Ordinances and/or recognized fire protection standards. Please note that the County ordinances are only enforceable in the City if the City has adopted the ordinance as well.

The comment further states that the developer is responsible for providing all water mains and fire hydrants necessary to provide the required flow per the California Fire Code and that all water systems be constructed in accordance with Riverside County Ordinances and the Fire Code. The City of Wildomar and the applicant understand that compliance with the Fire Code and all other applicable fire safety ordinances is required. The City has adopted the Fire Code by reference, with some local amendments (see Chapter 8.28 of the City Code). The comment does not cite specific Riverside County Ordinances, however, as stated above, it is noted that County ordinances are only enforceable in the City if the City has adopted the ordinance as well.

Response to Comment D-2. The comment states that the proposed project will have a cumulative adverse impact on the Fire Department's ability to provide an acceptable level of service due to an increase presence of structures, traffic, and population. The comment then states that the project proponents shall participate in the Development Impact Fee Program to mitigate a portion of those impacts. As described in Chapter 4, Cumulative Impacts, the payment of the City's established Development Impact Fee for fire services would reduce the project's contribution to cumulative impacts to less than cumulatively considerable. The project will also be annexing into CFD 2013-1 prior to the issuance of a building permit. The CFD 2013-1 will also provide funding for the provision of fire services to the project site.

Response to Comment D-3. The comment states that the project needs to provide at least two points of access in accordance with Fire Department and City of Wildomar standards and maintained throughout project phasing. As described in Chapter 2, Section 2.4.2 Access, Parking and Circulation, and shown on Figure 2.3, Project Site Plan, the project would include two points of access; one along Catt Road and an additional access off of George Avenue via Depasquale Road. The project will be developed in one phase.

Response to Comment D-4. The comment states that residential building are required to have fire sprinkler systems and that all buildings 3,600 square feet or larger shall have an approved fire sprinkler system in accordance with Riverside County Ordinances. All other buildings shall be equipped with fire sprinkler in accordance with the California Fire Code and must be installed per NFPA 13, 13D, or 13R, 2013 editions and by a licensed C-16 contactor who must submit plans along with current permit fees to the Fire Department for review prior to installation. The City of Wildomar and the applicant understand that compliance with the Fire Code, Residential Code and applicable ordinances and standards is required. The City has adopted the Fire Code and the Residential Code by reference. The comment does not cite specific Riverside County Ordinances, however, it is noted that County ordinances are only enforceable in the City if the City has adopted the ordinance as well. The project will be required to comply with all applicable

requirements for fire sprinklers and the applicant will be required to submit plans for building permit approval.

Response to Comment D-5. The comment states that further review of the project will occur upon receipt of specific project plans and that final fire protection requirements and impact mitigation measures will be determined at that time. The City understands that the Fire Department will require review of the building plans when they are submitted by the applicant, and Fire Department approval will be required prior to building permit approval.

PECHANGA CULTURAL RESOURCES
Temecula Band of Luiseño Mission Indians

Post Office. Box 2183 • Temecula, CA 92593
Telephone (951) 308-9295 • Fax (951) 506-9491

Chairperson:
Neal Ibanez

Vice Chairperson:
Bridgett Barcello

Committee Members:
Mary Bear Magee
Evie Gerber
Darlene Miranda
Richard B. Scearce, III
Michael Vasquez

Director:
Gary DuBois

Coordinator:
Paul Macarro

Planning Specialist:
Tuba Ebru Ozdil

Cultural Analyst:
Anna Hoover

June 16, 2016

VIA E-MAIL and USPS

Mr. Matthew C. Bassi
Planning Director
City of Wildomar
23873 Clinton Keith Rd. Ste 201
Wildomar, CA 92595

Re: Pechanga Tribe Comments on the Draft Environmental Impact Report (DEIR) for the Westpark Promenade Mixed-Use Development Project (PA 13-0082)

Dear Mr. Bassi:

This comment letter is written on behalf of the Pechanga Band of Luiseño Indians (hereinafter, "the Tribe"), a federally recognized Indian tribe and sovereign government. The Tribe formally requests, pursuant to Public Resources Code §21092.2, to be notified and involved in the entire CEQA environmental review process for the duration of the above referenced project (the "Project"). If you have not done so already, please add the Tribe to your distribution list(s) for public notices and circulation of all documents, including environmental review documents, archaeological reports, and all documents pertaining to this Project. The Tribe further requests to be directly notified of all public hearings and scheduled approvals concerning this Project. Please also incorporate these comments into the record of approval for this Project.

The Tribe thanks the City of Wildomar and the Developer for providing mitigation to preserve and protect the sensitive Luiseño cultural resources that may be identified during earthmoving activities and to require both archaeological and Pechanga tribal monitoring during such activities. In order to provide consistency throughout the document and to ensure that all potential concerns are addressed, we recommended the following minor edits to the Cultural Resources mitigation measures and have included them below for your review.

The State and Federal governments have mandated that cultural resources must be appropriately mitigated for within the confines of development projects. The Tribe appreciates the active role the City takes to maintain the significant history of the Tribe and of all Californians.

E-1

PECHANGA CULTURAL AFFILIATION TO PROJECT AREA

The Pechanga Tribe asserts that the Project area is part of Luiseño, and therefore the Tribe's, aboriginal territory as evidenced by the existence of Luiseño place names, *tóota yixélval* (rock art, pictographs, petroglyphs), traditional landscapes, cultural areas and an extensive Luiseño artifact record in the vicinity of the Project. This culturally sensitive area is affiliated with the Pechanga Band of Luiseño Indians because of the Tribe's cultural ties to this area as well as the close proximity of the Project to the Tribal reservation lands.

The Pechanga Tribe has a specific legal and cultural interest in this Project as the Tribe is culturally affiliated with the geographic area that comprises the Project property and is the closest affiliated tribe to the Property. The Tribe has been named the Most Likely Descendent (Cal. Pub. Res. C. §5097.98) on Projects in the nearby vicinity of the proposed Project and has specific knowledge of cultural resources and sacred places near the proposed Project which we have shared with the City on previous occasions on this and other projects.

The Tribe welcomes the opportunity to meet with the City, its consultants and the Developer to further explain and provide documentation concerning our specific cultural affiliation to lands within your jurisdiction, if so desired.

REQUESTED TRIBAL INVOLVEMENT AND MITIGATION

E-1

The Pechanga Band is not opposed to this Project; however, we are opposed to any direct, indirect and cumulative impacts this Project may have to tribal cultural resources. The Tribe's primary concerns stem from the Project's proposed impacts on Tribal Cultural Resources (TCRs) and Traditional Cultural Landscapes (TCLs). The Tribe is concerned about both the protection of unique and irreplaceable cultural resources, such as landscapes, Luiseño village sites, sacred sites and TCRs which would be displaced by ground disturbing work on the Project, and on the proper and lawful treatment of cultural items, Native American human remains and sacred items likely to be discovered in the course of the work.

The proposed Project is located in sensitive region of Luiseño territory, and the Tribe believes that the possibility for recovering subsurface resources during ground-disturbing activities is high. The Tribe has over thirty-five (35) years of experience in working with various types of construction projects throughout its territory. The combination of this knowledge and experience, along with the knowledge of the culturally-sensitive areas and oral tradition, is what the Tribe relies on to make fairly accurate predictions regarding the likelihood of subsurface resources in a particular location.

The Tribe is in receipt of the Draft Environmental Impact Report (DEIR). Based upon the information provided to the Tribe and that included in the cultural resources report prepared for the Project, there are no known cultural resources located within the Project boundaries. The Tribe was provided the opportunity to participate on the survey with the Project archaeological

consultant and we concur that no known resources were observed on the surface of the property. Therefore, the sensitivity of this Project lies with the potential to impact subsurface, unknown cultural resources during earthmoving activities.

At this time, the Tribe thanks the City of Wildomar for working closely with us to develop appropriate and adequate mitigation measures. These are identified in the DEIR as Cul-1 through Cul-5 and have been copied below. We request that these measures/conditions of approval be incorporated into the final EIR, with the very minor revisions provided below, and into any other appropriate final environmental documents approved by the City. (Underlines are additions, Strikeouts are deletions)

CUL-1: An archaeological monitor shall be present during all earthmoving activities within the project site. The monitor shall work under the direct supervision of a qualified archaeologist (defined as a cultural resources professional who meets the Secretary of the Interior's Professional Qualifications Standards for archaeology [U.S. Department of the Interior, 2008]). The monitor shall be empowered to temporarily halt or redirect construction work in the vicinity of any find until the qualified archaeologist can evaluate it. In the event of a new find, excavation and treatment of the resource shall be in accordance with Mitigation Measures CUL-3 through CUL-5.

E-1

CUL-2: At least 30 days prior to the issuance of a grading permit, the project applicant shall contact the Pechanga to notify them of grading, excavation, and the monitoring program and to coordinate with ~~the City of Wildomar and~~ the Pechanga to develop a Cultural Resources Treatment and Monitoring Agreement. The agreement shall include, but not be limited to, outlining provisions and requirements for addressing the treatment of cultural resources; project grading and development scheduling; terms of compensation for the monitors; treatment and final disposition of any cultural resources, sacred sites, and human remains discovered on the site; and establishing on-site monitoring provisions and/or requirements for professional tribal monitors during all ground-disturbing activities. A copy of this signed agreement shall be provided to the Planning Director and Building Official prior to the issuance of the first grading permit.

CUL-3: Prior to issuance of any grading permit, the Project Archeologist shall file a pre-grading report with the City to document the proposed methodology for grading activity observation with will be determined in consultation with the Pechanga Tribe. Said methodology monitor and a Pechanga Tribal monitor to be present and to have the authority to temporarily stop and redirect grading activities in order to evaluate the significance of any archaeological and cultural resources discovered on the property. Tribal and archaeological monitors shall be allowed to monitor all grading, excavation and groundbreaking activities.

CUL-~~3~~4: If during grading or construction activities cultural resources are discovered on the

project site, work shall be halted immediately within 50 feet of the discovery and the resources shall be evaluated by a qualified archaeologist (retained by the applicant) and the Pechanga. Any unanticipated cultural resources that are discovered shall be evaluated and a final report prepared by the qualified archaeologist. The report shall include a list of the resources discovered, documentation of each site/locality, and interpretation of the resources identified, and the method of preservation and/or recovery for identified resources. In the event the significant resources are recovered and if the qualified archaeologist, the Pechanga~~, and/or Soboba~~ determines the resources to be historical or unique, avoidance and/or mitigation shall be required pursuant to and consistent with CEQA Guidelines Section 15064.5 and 15126.4, Public Resources Code Section 21083.2, and the Cultural Resources Treatment and Monitoring Agreement required by Mitigation Measure CUL-2.

CUL-4~~5~~: All cultural resources, with the exception of sacred items, burial goods, and human remains, which will be addressed in the Cultural Resources Treatment and Monitoring Agreement required by Mitigation Measure CUL-2, collected during the grading monitoring program and from any previous archaeological studies or excavations on the project site shall be curated according to the current professional repository standards. The collections and associated records shall be transferred, including title, to the Pechanga Tribe's curation facility that meets the standards set forth in 36 Code of Federal Regulations (CFR) Part 79 for federal repositories. E-1

~~**CUL-5**: All sacred sites, should they be encountered within the project site, shall be avoided and preserved as the preferred mitigation, if feasible as determined by a qualified professional in consultation with the Pechanga. To the extent that a sacred site cannot be feasibly preserved in place or left in an undisturbed state, mitigation measures shall be required pursuant to and consistent with Public Resources Code Section 21083.2 and CEQA Guidelines Sections 15064.5 and 15126.4.~~

CUL-6 If inadvertent discoveries of cultural or archaeological resources are made, the Project Applicant, Project archaeologist, and Pechanga Tribe shall assess the significance of the resources and meet and confer regarding the appropriate treatment (i.e., preservation, avoidance, and/or mitigation for the resources). Cultural and archaeological resources are inadvertent discoveries when they were not anticipated to be found during the Project's activities. This may include previously unknown sacred sites and items, midden deposits, artifacts, hearths, bedrock outcrops, human remains and other resources, etc.

Consistent with California Public Resources Code Section 21083.2(b) and Assembly Bill 52 (Chapter 532, Statutes of 2014), avoidance shall be the preferred method of preservation for tribal cultural resources and archaeological resources. If the Project Applicant, Project archaeologist, and Pechanga Tribe cannot agree on the significance of, avoidance of, or mitigation for such resources, these issues shall be presented to the Planning Director for determination. The Planning Director shall make the determination based on the

information submitted by the Pechanga Tribe, the religious beliefs, customs, and practices of the Pechanga Tribe, and the provisions of the California Environmental Quality Act regarding tribal cultural and archaeological resources. Notwithstanding any other rights available under law, the decision of the Planning Director shall be appealable to the Wildomar City Council. All sacred sites, should they be encountered within the project site, shall be avoided and preserved as the preferred mitigation, if feasible

CUL-7 If human remains are encountered, consistent with California Health and Safety Code Section 7050.5, no further disturbance shall occur until the Riverside County Coroner has made the necessary findings as to origin of the remains. Further, consistent with California Public Resources Code Section 5097.98(b), human remains shall be left in place and free from disturbance until a final decision as to the treatment and disposition has been made.

If the Riverside County Coroner determines the remains to be Native American, the Native American Heritage Commission shall be contacted within twenty-four (24) hours. The Native American Heritage Commission shall immediately identify the "most likely descendant(s)" and notify them of the discovery. The "most likely descendant(s)" shall make recommendations within forty-eight (48) hours, and engage in consultations with the landowner concerning the treatment of the remains, as provided in Public Resources Code Section 5097.98 and the Agreement described in CUL-2.

E-1

The Pechanga Tribe looks forward to continuing to work together with the City of Wildomar in protecting the invaluable Pechanga cultural resources found in the Project area. Please contact me at 951-770-8113 or at eozdil@pechanga-nsn.gov once you have had a chance to review these comments if you have any comments or concerns. Thank you for continuing to partner with the Pechanga Band to preserve and protect our sensitivity cultural heritage.

Sincerely,

Tuba Ebru Ozdil
Planning Specialist

cc Pechanga Office of the General Counsel

Response to Letter E

Pechanga, Temecula Band of Luiseno Mission Indians

Response to Comment E-1:

The comment letter provided by The Pechanga Tribe (Tribe) identified the project site as being located within the territory of the Pechanga Band of Luiseno Indians. The letter included a request of tribal involvement and mitigation of the potential project impacts to cultural resources. The City has had extensive coordination and meetings with the Pechanga Tribe as development projects are processed within the City of Wildomar. The Pechanga Tribe is included in the distribution list for City of Wildomar contacts during preparation of environmental documents prepared for the proposed project as well as other developments. The City regularly consults with the Tribe in the evaluation of impacts to cultural resources. For this project, the Tribe was sent a Notice of Preparation on May 5, 2014, and the Draft EIR on May 5, 2016. The City received correspondence dated June 5, 2014 from Anna Hoover, Cultural Analyst for Pechanga Cultural Resources, regarding the request to participate in the environmental process, and this letter signed by Tuba Ebru Ozdil, Planning Specialist for Pechanga Cultural Resources, dated June 16, 2016 requesting modifications to the mitigation measures. City staff met with Anna Hoover to discuss the recommended modifications to the mitigation measures included in the Draft EIR, and the City has agreed to accept the modifications.

The comment includes suggestions for modifications to Mitigation Measures CUL-2 through CUL-5 on pages 3.4-18 and 3.4-19 of the Draft EIR, and the addition of one mitigation measure to page 3.4-20 even though the impact to human remains was determined to less than significant in the Draft EIR. The comment also acknowledges that the modifications to the measures are very minor. As stated above, the City agrees to make each of the requested revisions to the Cultural Resources mitigation measures with some modifications to proposed CUL-6 to require an independent archeologist and/or the courts to settle disputes rather than the Planning Director and City Council. These modified mitigation measures are as follows.

Mitigation Measures CUL-2 through CUL-5 on pages 3.4-18 and 3.4-19 of the Draft EIR are revised as follows:

> **CUL-2:** At least 30 days prior to the issuance of a grading permit, the project applicant shall contact the Pechanga to notify them of grading, excavation, and the monitoring program and to coordinate with the ~~City of Wildomar and~~ the Pechanga to develop a Cultural Resources Treatment and Monitoring Agreement. The agreement shall include, but not be limited to, outlining provisions and requirements for addressing the treatment of cultural resources; project grading and development scheduling; terms of compensation for the monitors; treatment and final disposition of any cultural resources, sacred sites, and human remains discovered on the site; and establishing on-site monitoring provisions and/or requirements for professional tribal monitors during all ground-disturbing activities. A copy of this signed agreement shall be provided to the Planning Director and Building Official prior to the issuance of the first grading permit.

CUL-3: Prior the issuance of any grading permit, the project archaeologist shall file a pre-grading report with the City to document the proposed methodology for grading activity observation which will be determined in consultation with the Pechanga Tribe. The archaeological monitor and a Pechanga Tribal monitor will have the authority to temporarily halt and redirect grading activities in order to evaluate the significance of any archaeological cultural resources discovered on the project site. Tribal and archaeological monitors shall be allowed to monitor all grading, excavation and groundbreaking activities.

CUL-~~3~~4: If during grading or construction activities cultural resources are discovered on the project site, work shall be halted immediately within 50 feet of the discovery and the resources shall be evaluated by a qualified archaeologist (retained by the applicant) and the Pechanga. Any unanticipated cultural resources that are discovered shall be evaluated and a final report prepared by the qualified archaeologist. The report shall include a list of the resources discovered, documentation of each site/locality, and interpretation of the resources identified, and the method of preservation and/or recovery for identified resources. In the event the significant resources are recovered and if the qualified archaeologist~~,~~ and/or the Pechanga~~, and/or Soboba~~ determines the resources to be historical or unique, avoidance and/or mitigation shall be required pursuant to and consistent with CEQA Guidelines Section 15064.5 and 15126.4, Public Resources Code Section 21083.2, and the Cultural Resources Treatment and Monitoring Agreement required by Mitigation Measure CUL-2.

CUL-~~4~~5: All cultural resources, with the exception of sacred items, burial goods, and human remains, which will be addressed in the Cultural Resources Treatment and Monitoring Agreement required by Mitigation Measure CUL-2, collected during the grading monitoring program and from any previous archaeological studies or excavations on the project site shall be curated according to the current professional repository standards. The collections and associated records shall be transferred, including title, to the Pechanga Tribe's curation facility that meets the standards set forth in 36 Code of Federal Regulations (CFR) Part 79 for federal repositories.

~~**CUL-5**: All sacred sites, should they be encountered within the project site, shall be avoided and preserved as the preferred mitigation, if feasible as determined by a qualified professional in consultation with the Pechanga. To the extent that a sacred site cannot be feasibly preserved in place or left in an undisturbed state, mitigation measures shall be required pursuant to and consistent with Public Resources Code Section 21083.2 and CEQA Guidelines Sections 15064.5 and 15126.4.~~

CUL-6: If inadvertent discoveries of cultural or archaeological resources are made, the project applicant, project archaeologist, and Pechanga Tribe shall assess the significance of the resources and meet and confer regarding the appropriate treatment (i.e., preservation, avoidance. and/or mitigation for the resources). Cultural and archaeological resources are inadvertent discoveries when they were not anticipated to be found during the project's construction activities (e.g. grading, excavation). This may include previously unknown sacred sites and items, midden deposits, artifacts, hearths, bedrock outcrops, human remains, and other resources, etc.

Consistent with California Public Resources Code Section 21083.2(b) and Assembly Bill 52 (Chapter 532. Statutes of 2014), avoidance shall be the preferred method of preservation for tribal cultural resources and archaeological resources. If the project applicant, project archaeologist, and Pechanga Tribe cannot agree on the significance of, avoidance of, or mitigation for such resources, then the project applicant and the Pechanga Tribe shall agree on an independent qualified archeologist who shall make the determination based on the information submitted by the Pechanga Tribe, the religious beliefs, customs, and practices of the Pechanga Tribe, and the provisions of the California Environmental Quality Act regarding tribal cultural and archaeological resources. The decision of the independent qualified archeologist may be challenged by the City, project applicant or the Pechanga Tribe through any appropriate legal means including, but not limited to, a temporary restraining order (TRO) or a Preliminary Injunction. All sacred sites, should they be encountered within the project site, shall be avoided and preserved as the preferred mitigation, if feasible

Mitigation Measures CUL-11 is added to page 3.4-20 even though the potential impact to human remains is less than significant. As stated in Impact 3.4-3 of the Draft EIR, the treatment of human remains is governed by the California Public Resources Code Section 5097.98 and Health and Safety Code Section 7050.5, and potential impacts would be reduced to less than significant. The following mitigation measure is added based on an agreement between the City and the Pechanga Tribe to include the measure in Section 3.4 of the Draft EIR.

At the end of Impact 3.4-3 on page 3.4-20 of the Draft EIR, the following is added.

Mitigation Measure:

The following mitigation measure is added to duplicate the current state requirement and potentially further reduce a less than significant impact to human remains. Though not required, the measure is included based on an agreement between the City and the Pechanga Tribe.

CUL 11: If human remains are encountered, consistent with California Health and Safety Code Section 7050.5, no further disturbance shall occur until the Riverside County Coroner has made the necessary findings as to origin of the remains. Further, consistent with California Public Resources Code Section 5097.98(b), human remains shall be left in place and free from disturbance until a final decision as to the treatment and disposition has been made.

If the Riverside County Coroner determines the remains to be Native American, the Native American Heritage Commission shall be contacted within twenty-four (24) hours. The Native American Heritage Commission shall immediately identify the “most likely descendant(s)” and notify them of the discovery. The “most likely descendant(s)” shall make recommendations within forty-eight (48) hours, and engage in consultations with the landowner concerning the treatment of the remains, as provided in Public Resources Code Section 5097.98 and the Agreement described in CUL-2.

Comment Letter F

RINCON BAND OF LUISEÑO INDIANS

Cultural Resources Department

1 W. Tribal Road · Valley Center, California 92082 ·
(760) 297-2635 Fax:(760) 749-2639

EIR Comment Letter

RECEIVED
MAY 19 2016
CITY OF WILDOMAR

May 6, 2016

Matthew Bassi
City of Wildomar
23873 Clinton Keith Road, Suite 201
Wildomar, CA 92595

Re: Westpark Promenade Mixed-Use Development Project PA13-0082

Dear Mr. Bassi:

This letter is written on behalf of Rincon Band of Luiseño Indians. We have received your notification regarding the Westpark Promenade Mixed-Use Development Project PA13-0082 and we thank you for the consultation notification. The location you have identified is within the Territory of the Luiseño people.

Embedded in the Luiseño Territory are Rincon's history, culture and identity. The project is within the Luiseño Aboriginal Territory of the Luiseño people however, it is not within Rincon's Historic Boundaries. We do not have any additional information regarding this project but, we defer this project to the Pechanga Band of Luiseño Indians or Soboba Band of Luiseño Indians who are located closer to your project area. F-1

Thank you for the opportunity to protect and preserve our cultural assets.

Sincerely,

Vincent Whipple
Manager
Rincon Cultural Resources Department

Bo Mazzetti, Tribal Chairman · Stephanie Spencer, Vice Chairwoman · Steve Stallings, Council Member · Laurie E. Gonzalez, Council Member · Alfonso Kolb, Council Member

Response to Letter F

Rincon Band of Luiseno Indians

Response to Comment F-1. The comment acknowledged receipt of the Draft EIR and states that the project is within the Luiseno Aboriginal Territory of the Luiseno people; however it is not within Rincon's Historic Boundaries. The comment then defers the project to the Pechanga Band of Luiseno Indians or Soboba Band of Luiseno Indians. This comment is noted. The City has consulted with, and continues to consult with the Pechanga Temecula Band of Luiseño Mission Indians.

June 20, 2016

From: Martha Bridges
35465 Woshka Lane
Wildomar, CA 92595

John Burkett
32721 Mesa Drive
Lake Elsinore, CA 92530

Gerard Ste. Marie
P.O. Box 486
Wildomar, CA 92595

To: City of Wildomar
Attn: Mathew C. Bassi, Planning Director
23873 Clinton Keith Road, Suite 201
Wildomar, CA 92595
[By Email to: mbassi@cityofwildomar.org, dlee@cityofwildomar.org]

Re: **Comments to Westpark Promenade Project Draft EIR (Planning Application No. 13-0082) (SCH No. 2014021022)**

To Director of Planning - Mathew C. Bassi: Please consider the following comments to the Westpark Promenade Project Draft EIR. Please also make this Letter, and all documents referred to in the Letter, a part of the Administrative Record for this Project.

I. <u>The Draft EIR Fails to Discuss Impacts and Mitigation Associated with Project Location in a Very High Fire Hazard Severity Zone</u>

The Draft EIR states that the Project is located within a Very High Fire Hazard Severity Zone, as follows:

> "The project site falls within the Local Responsibility Area (LRA), City of Wildomar within Riverside County. According to the Very High Fire Hazard Severity (VHFHS) Zone LRA map, the project site is within a VHFHS zone under the authority of the City of Wildomar. The project site consists of vacant land and is susceptible to wildland fires." (DEIR, p. 3.8-12.)

G-1

But while acknowledging that the Project site is included on the Very High Fire Hazard Severity (VHFHS) Zone LRA map (see Wildomar Ordinance No. 52), and thus concluding that *"[t]he project site consists of vacant land and is susceptible to wildland fires*," the Draft EIR dismissively concludes that the Project has a "less than significant impact," without adequate analysis. (DEIR, p.

3.8-13.)

However, under established CEQA thresholds of significance, the Project would have potentially adverse fire safety impacts because it would "*expose people or structures to a significant risk of loss, injury or death involving wildfires*." (See "CEQA Guidelines Appendix G Checklist, Section VIII. (h).") G-1

Therefore, in the Final EIR for this Project, please adequately analyze Project location within a Very High Fire Hazard Severity Zone, and please discuss the impacts and mitigation measures which would follow as a matter of course to such analysis. At a minimum, the provisions of Section 4905.2 of the California Fire Code, and the codes referenced therein, should be implemented as mitigation measures for the Project. Section 4905.2 of the California Fire Code provides as follows:

> "***4905.2 Construction methods and requirements within established limits.*** *Within the limits established by law, construction methods intended to mitigate wildfire exposure shall comply with the wildfire protection building construction requirements contained in the California Building Standards Code including the following:*
>
> 1. *California Building Code Chapter 7A,*
> 2. *California Residential Code Section R327,*
> 3. *California Reference Standards Code Chapter 12-7A*
> 4. *and this chapter.* " (Cal. Fire Code § 4905.2)

G-2

To avoid unnecessary danger to human life and needless litigation, please simply add compliance with these mandatory regulations in the Mitigation Monitoring Program and as Conditions of Approval for the Project.

DATED: June 20, 2016

By: Martha Bridges, John Burkett & Gerard Ste. Marie

Response to Letter G

Martha Bridges, John Burkett, and Gerard Ste. Marie

Response to Comment G-1. This comment correctly states that the project site is within a Very High Fire Hazard Severity Zone and expresses disagreement with the Draft EIR's conclusion that impacts related to wildfires are nonetheless less than significant. As described in Section 3.8, Hazards and Hazardous Materials, of the Draft EIR, the project includes design features and urban characteristics which would provide a buffer to potential fire hazards such as open space. The landscaping, as shown in Figure 2-10, would be in compliance with applicable regulations. The project would include the removal of the existing dry vegetation on the project site and as a result substantially reduce the potential for onsite fires. The project would also replace the existing vegetation with the proposed commercial and residential uses. As shown in Figure 2-3, Site Plan and Figure 2-10 Landscaping Plan, the project would include design features which would reduce the exposure of people or structures to the threat of wildfires. The project is surrounded by I-15 and existing residential development as shown in Figure 2-2, Project Location, which would serve as a buffer between the project site and any wildfires in undeveloped areas. The development of the project site would also protect those surrounding developments from risk of wildfire by eliminating dry vegetation that is easily ignitable from the vicinity of those developments. Further, the project would be designed in accordance with Fire Codes and other legal requirements pertaining to fire safety. Therefore, the project will not exacerbate existing conditions and will in fact ameliorate any present risks to people or structures that exist with respect to wildfires.

Response to Comment G-2. The comment requests adequate analysis of the project areas being within a Very High Fire Hazard Severity Zones and implementation of California Fire Codes as mitigation measures. See Response to Comment G-1 for the requested analysis. As the analysis in Response to Comment G-1 shows, there are no significant impacts that require mitigation. Furthermore, the comment requests that mitigation measures be included that reiterate requirements of the Fire Code. CEQA does not require that a lead agency reiterate already mandatory and applicable legal requirements as mitigation measures. Nonetheless, the City will accommodate the request and will incorporate the following as a condition of approval:

> Prior to the issuance of a building permit, the project applicant shall demonstrate on the building plans compliance with the California Building Code, Chapter 7A; California Residential Code, Section R327; California Referenced Standards Code, Chapter 12-7A; and California Fire Code, Chapter 49 as well as any other applicable state and local codes/ordinances.

BLUM | COLLINS LLP

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Los Angeles, California
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213.572.0400 phone
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June 20, 2016

Matthew C. Bassi, Planning Director
Planning Department
City of Wildomar
23873 Clinton Keith Rd., Suite 201
Wildomar, CA 92595
mbassi@cityofwildomar.org

Via Email & U.S. Mail

Re: *Comments on Westpark Promenade DEIR*

Dear Mr. Bassi and the City of Wildomar:

Under the California Environmental Quality Act ("CEQA"), this letter is to serve you with comments on behalf of the SoCal Environmental Justice Alliance ("SEJA") regarding the Westpark Promenade ("the Project") Draft Environmental Impact Report ("DEIR"), State Clearinghouse Number 2014021022. Our comments appear mostly in the order in which matters come up in the DEIR.

Chapter 1 – Introduction

You indicate there were two scoping meetings on the Project and that you provided attendees the opportunity to submit written comments on the Project but none were received. You could have provided for transcription of oral comments.

H-1

Chapter 2 – Project Description

At 2-5 your Project Objectives appear narrowly defined to require development of only this Project.

H-2

Chapter 3 – Environmental Impact Analysis

3.2 Air Quality. You cite to General Plan Policies AQ 2.1 ("land use planning efforts shall assure that sensitive receptors are separated and protected from polluting point sources to the greatest extent possible,") and 2.2 ("Require site plan designs to protect people and land uses sensitive to air pollution through the use of barriers and/or distance from emission sources when possible") and assert the Project is consistent with them.

H-3

The Policies are inconsistent with placing residential uses roughly adjacent to the I-15 freeway. H-3

Impact 3.2-1 The Project would not conflict with or obstruct implementation of an Air Quality Management Plan. You assert that projects that are consistent with regional population, housing and employment forecasts are consistent with the South Coast Air Quality Management District ("SCAQMD") Air Quality Management Plan ("AQMP"), and you claim that because the population growth that is attributable to the Project fits within the projections for Wildomar as a whole, the Project is consistent. It doesn't work this way. Growth should be accounted for according to consistency with a General Plan. Here your Project contradicts the General Plan and requires a General Plan amendment to allow housing on a site designated for office use. This will lead to air quality impacts because residents will more than likely have to commute further to work because of the change in planned uses. H-4

Impact 3.2-2 The Project would violate an air quality standard or contribute substantially to an existing or projected air quality violation. You concede here that operational emissions would exceed thresholds for NO_x by 40%, and you impose several mitigation measures but you concede these measures will not reduce impacts to less than significant levels. Measure AQ-1 is that the applicant will consult with transit agencies and provide bus stops at project access points as directed. CEQA requires you to impose all feasible mitigation measures when an impact is not mitigated to less than significant levels. The applicant for the Baxter Village project is providing fair share payments toward transit service to that community, and this is a feasible mitigation measure you have not imposed here. H-5

Impact 3.2-3 The Project would not expose sensitive receptors to substantial pollutant concentrations. Regarding construction emissions you claim that SCAQMD has not adopted a methodology for analyzing construction emissions of diesel particulate matter ("DPM") "and has not recommended that health risk assessments be completed." We believe you have understated exposures of sensitive receptors to PM_{10} and $PM_{2.5}$ because the closest receptors are closer than 82 feet away. And regarding Toxic Air Contaminants ("TACs"), you could still model acute effects from exposure. Both construction and operational emissions on nearby residents could and should have been modeled. You could use the same exposure calculations with shorter timeframes. H-6

Concerning operational emissions you concede that the maximum predicted cancer risk from the Project is 9.6 in one million using the California Office of Environmental Health Hazard Assessment's ("OEHHA's") methodology. With rounding, this is 10 in a million and you should have found this impact to be significant. And you concede you did not calculate into this number the exposure of residents to additional TAC emissions from loading and unloading activity from trucks at the four bays adjacent to the major retail building. H-7

Impact 3.2-5 The Project would result in a cumulatively considerable net increase of criteria pollutants for which the Project region is non-attainment under an applicable H-8

federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors). You concede that the Project will lead to significant impacts regarding NO_x, but you refuse to calculate cumulative impacts for other pollutants based on SCAQMD guidance. We disagree with this approach and believe it is not based on substantial evidence. Your approach is contrary to the very definition of what a cumulative impact is. Public Resources Code § 20183(b)(2) defines cumulative impacts to mean "that the incremental effects of an individual project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects." In other words, inherent in a cumulative impacts analysis is whether an impact is significant when *combined* with the effects of other past, present, and future projects. This is borne out by the Guidelines. Guidelines § 15130(a)(1) provides "As defined in Section 15355, a cumulative impact consists of an impact which is created *as a result of the combination* of the project evaluated in the EIR together with other projects causing related impacts." (emphasis supplied). Guidelines § 15064(h)(1) provides:

> When assessing whether a cumulative effect requires an EIR, the lead agency shall consider whether the cumulative impact is significant and whether the effects of the project are cumulatively considerable. An EIR must be prepared *if the cumulative impact may be significant and the project's incremental effect, though individually limited, is cumulatively considerable*. *"Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.*

H-8

Guidelines § 15064(h)(1) (emphasis supplied).

Guidelines § 15065(a)(3) requires a mandatory finding of significance when "The project has possible environmental effects that are individually limited but cumulatively considerable," and provides the same definition of "cumulatively considerable."

Finally, Guidelines § 15355 defines cumulative impacts and states:

> *"Cumulative impacts" refer to two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts.*
> (a) The individual effects may be changes resulting from a single project or a number of separate projects.
> (b) The cumulative impact from several projects is the change in the environment which results from the *incremental impact* of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. *Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time.*

Guidelines § 15355 (emphasis supplied). *See also* Gordon & Herson, "Demystifying CEQA's Cumulative Impact Analysis Requirements: Guidance for Defensible EIR Evaluation," *Cal. Env't'l L. Reporter,* 379, 381 (Sept. 2011) (Vol. 2011, Issue 9) ("Critically, a proposed project's incremental effects may be 'cumulatively considerable' even when its individual effects are limited. (citations). *In other words, CEQA does not excuse an EIR from evaluating cumulative impacts simply because the project-specific analysis determined its impacts would be 'less than significant.'*" In short, your cumulative impacts analysis is wholly without a basis in substantial evidence and represents a failure to proceed by law. H-8

In addition, you should *assess* the cumulative emissions of NO_x, rather than merely stating that they are cumulatively significant.

3.3 Biological Resources. You state regarding special status plant species that the round-leaved filaree and the smooth tarplant – both California Native Plant Society ("CNPS") 1.B.1 species – have the potential to occur on the site but they were not surveyed for given recent drought conditions. *See* Appendix C (reflecting that by 2013 no focused surveys were done for plant species on site due to ongoing drought conditions: "CDFW has indicated . . . that conducting focused surveys during the current drought conditions would not provide any useable data on the presence or absence of any sensitive plants given the fact that plants would be unlikely to germinate and be detectable"). Despite this you assert there are no significant impacts to them because you didn't find them when you didn't survey, and "any loss of individuals plants of this species would not threaten to eliminate or reduce the viability of a population or restrict the range of the plant species." This conclusion is directly contrary to CNPS's listing of them as 1.B.1, indicating the plant species is threatened within 80% of its range. You could have surveyed for these species this year after the rains, but apparently you did not. H-9

Concerning special status wildlife, you did not conduct focused surveys for the Stephens kangaroo rat ("SKR"), the black-tailed jackrabbit or the coast horned lizard. Regarding the SKR Appendix C specifically states that SKR "may also occur on the site given the presence of suitable habitat, however live-trapping surveys were not conducted as part of the field investigations. *Consequently the presence of the species [or its absence] cannot be definitively determined at the present time.*" H-10 You note that critical habitat for the coastal California gnatcatcher ("CAGN") is 1200 feet from the site but you provide no map of this habitat and state in a conclusory fashion there is no potential for the species to occur on site even as a stopover. H-11

At 3.3-12 you concede the site could provide "dispersal" habitat for the western spadefoot toad, but you did not survey for it. There could be a significant impact to the toad because of the Project regardless of whether the site provides breeding habitat, and you haven't provided mitigation measures for the toad. H-12

At 3.3-20 in your General Plan consistency analysis you claim the Project follows Policy OS 5.5 (new development will preserve and enhance existing native riparian habitat and prevent obstruction of natural watercourses) even though you are obstructing two H-13

watercourses. You say implementation of mitigation measure ("MM") BIO-5 would provide for offsite restoration and enhancement at a ratio approved by the resource agencies even though (1) the mitigation and its extent has not been determined yet, (2) the General Plan Policy does not intend such a result, and (3) the mitigation is not planned for any location, and will not necessarily be of equivalent habitat values. Similarly, General Plan Policy OS 6.3 states the City should consider wetlands for use as natural water treatment areas that will result in the improvement of water quality. You claim the Project is "consistent" because of MM BIO-5. It's not. Clearly the Policy is aimed at preserving the habitat. H-13

Impact 3.3-1 The Project would not have a substantial adverse effect on any special-status, sensitive, or candidate plant species. You assert as noted above that the smooth tarplant and round-leaved filaree will not be affected because you did not observe them onsite. However you also did not look for them. An individual loss of this species would be significant as noted above. H-14

Impact 3.3-2 The Project has the potential to impact sensitive wildlife species. You say there is no substantial impact to the SKR which you did not survey for onsite because of the payment of fees for the SKR Habitat Conservation Plan ("HCP"). However, individual impacts to SKR can be significant, and you have done nothing about this. H-15

You also say there will be *no* impacts to the nine species you say have a low potential to occur because (1) they weren't seen, even though they weren't looked for in any systematic way, and (2) they are not expected on the site due to "low quality" habitat conditions – even though habitat for the Quino checkerspot butterfly, for example, is only "open habitat." We disagree with your assessment. Impacts are potentially significant absent focused surveys negating the presence of these species immediately prior to ground disturbance. H-16

Regarding your MM's, BIO-1 provides for preconstruction surveys within 30 days of site disturbance for the burrowing owl. Per the California Department of Fish & Wildlife ("CDFW") Burrowing Owl Mitigation Staff Report, this survey should occur within 14 days. *See* Attachment A. BIO-2 provides if burrowing owl are found, active nests will be avoided from February 1 to August 31, and a minimum 250 foot (75 meter) buffer will be provided until fledging has occurred. This is contrary to the required setback distance of 500 meters as recommended in the Staff Report, *see* Attachment A at 9. The Report allows for reduced setbacks but only in the presence of a "broad-scale, long-term, scientifically-rigorous monitoring program," Report at 10, which you do not provide for. You do not provide for qualified biologist monitoring of nesting in most of MM'S BIO-1 and -2. BIO-2 also provides that if paired owls are present within 160 feet of a temporary project disturbance, active burrows will be protected with fencing or flagging and monitored by a qualified biologist throughout the construction to identify losses from nest abandonment. This runs contrary to your earlier stated condition of 75 meters – which again, is insufficient under the Staff Report. H-17

BIO-3 provides for a preconstruction survey and trapping and release of the coast horned lizard and San Diego black-tailed jackrabbit. Do the same for the SKR. And specify a time prior to construction for these surveys – other guidance suggests a maximum of 14 days. H-18

Impact 3.3-3 The Project has the potential to impact raptors and migratory birds during nesting activities. You have proposed MM BIO-4, requiring either all construction outside of the avian nesting season – which you define as February 1 to August 30 – or, if there is construction, vegetation or ground disturbance during this breeding season, a focused survey will be conducted by a qualified City-approved biologist, and nests will not be disturbed until young have fledged from the nest, with a 500 foot setback. However, you have not defined the nesting season properly; it begins in early January for raptors and lasts through at least September 15 and beyond that for passerine species according to CDFW. We have included Attachments B-1 through -3 regarding nesting habits of different birds. H-19

Impact 3.3-4 The Project would not impact critical habitat or sensitive natural communities. You claim there are no sensitive natural communities or critical habitat on site. However, critical habitat is apparently close to the Project site for the CAGN and increased urbanization in the vicinity can affect the species, an impact you did not address. H-20

Impact 3.3-5 The Project has the potential to impact jurisdictional waters including wetlands and riparian habitat. You agree that the grading of two drainage channels is a significant impact but you claim this impact will be mitigated to less than significant levels by MM BIO-5, which requires the applicant to submit a detailed restoration plan to mitigate for loss of 0.36 acres of jurisdictional waters at a ratio approved by the resource agencies but no less than 1:1. The mitigation measure should delineate the monitoring responsibilities and the applicant or the District should be responsible for checking the status of the restoration annually. The mitigation should provide for maintenance responsibilities *in perpetuity*, which is something the applicant cannot manage. The impact is not less than significant. H-21

Impact 3.3-6 The Project would not interfere substantially with the movement of any native resident or migratory . . . wildlife species or with established native resident or migratory wildlife corridors . . . As we've noted, you previously have conceded critical habitat for the CAGN is 1200 feet away. Given this fact your assertions that the proposed Project "is not expected to have an adverse effect on wildlife movements in the area" requires further explanation as it does not seem credible. We dispute your conclusion there is no significant impact. H-22

Impact 3.3-8 The Project could conflict with a HCP. Here you concede the Project could impact riparian/riverine habitat and the burrowing owl, protected under the Western Riverside County MSHCP, and the SKR, covered under the SKR HCP. You assert that payment of the mitigation fee regarding the SKR would reduce impacts to that species to less than significant but not regarding the riparian and riverine habitat or the burrowing H-23

owl. We fail to see the distinction, especially since you are not proposing to catch and release the SKR that may be onsite. You rely on MM BIO-6 to reduce impacts to less than significant regarding the riparian/riverine habitat. First this has nothing to do with the burrowing owl and the loss of its habitat. Second, you are acknowledging there is an urban/wildlife interface, which undercuts your analysis under Impact 3.3-6 above. Third, you fail to discuss what the Guidelines require. This does not comply with CEQA which is meant to ensure the public reviews the environmental impacts of the Project. H-23

3.4 Cultural and Paleontological Resources. MM CUL-3 refers at first to just the Pechanga and later to both the Pechanga and the Soboba. If the Soboba are also involved they should be kept informed. H-24

Impact 3.4-2 Implementation of the Project may adversely affect paleontological resources. You indicate that the Project will disturb ground from "4 to 15 in depth." We later figured out this was feet rather than inches but it is not clear from this part of the DEIR. MM CUL-6 calls for review by a qualified paleontological monitor but your General Plan requires assessment by a paleontologist. H-25

3.5 Geology, Soils and Seismicity. You indicate the nearest "active" fault is the Elsinore Fault approximately 1.9 miles away, but then you concede there is another one nearly at the Project site, and that the fault zone for this fault – the Glen Ivy fault – passes through the Project site. This is a potential significant impact, and General Plan Policy S.2-1 provides that "lifelines" be designed to resist without failure their crossing of a fault should fault rupture occur, and requires trenching studies and analysis.

Impact 3.5-1 The Project would not expose persons or structures to potential substantial adverse effects, including risk of loss, injury or death involving rupture of a known earthquake fault . . . You acknowledge that in 2007, the Working Group on Earthquake Probabilities indicated there was a 97% chance of an earthquake of 6.7 or greater in Southern California over the next 30 years, and that the Elsinore Fault is one of those considered capable of producing significant groundshaking. You fail to address the Glen Ivy fault zone which runs through the property. You assert there would be no significant impact based on construction of the site with shallow foundations with post tensioned slabs. This is not enough under the General Plan, implicitly. H-26

3.6 Greenhouse Gas Emissions and Climate Change. You adopt a 3,000 $MTCO_2e$ threshold based on a SCAQMD working group proposal. You've amortized your construction emissions over 30 years which we think is contrary to the mandates of AB 32 and Executive Order B-30-15, because they call for reductions in the near- and mid-term. H-27

Because you have concluded that your GHG emissions are significant, both under impacts 3.6-1 and -2, you must adopt all feasible mitigation measures. You could have but failed to adopt rooftop solar in the Project or at least in a part of it. Your failure to do so is not based on substantial evidence.

3.7 Hydrology and Water Quality. *Impact 3.7-1 The proposed Project would not violate any water quality standards or waste discharge requirements.* As to construction the DEIR states that the Project "would maximize canopy interception and water conservation by preserving existing native trees and shrubs thereby minimizing vegetation disturbance and associated pollution potential and sedimentation during construction." You have previously indicated that you intend to replace the olive trees onsite. We don't find your assertions believable. H-28

You saw a SWPPP "would be prepared." Why hasn't it been prepared already and provided with the DEIR? You say the BMPs "could include" a long list of items. This means nothing. The final BMPs and the SWPPP should have been provided to the public with the DEIR. H-29

Regarding operation, you state that structural BMPs "would include" several items. You could have provided but did not provide the Water Quality Management Plan with the DEIR. Without these documents we have no assurance that impacts will be modified to less than significant levels. H-30

Impact 3.7-3 The Project would not substantially alter the existing drainage pattern of the site or area, including through alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation offsite. You concede here you will alter the existing drainage pattern and place impervious structures on the site. You again rely on the SWPPP and the WQMP but you have not provided them. You say here that "treatment control BMPs would include treatment of first flush flows in bio retention and sand infiltration facilities." This is directly contrary to what you asserted previously, that the site is already impervious and that such structures cannot be designed for the site. H-31

You assert that the Final WQMP "will demonstrate that BMPs will retain the incremental increase of runoff from a two-year storm event, ten-year storm event, or the BMP Design Volume, whichever is greater," and that therefore impacts regarding alteration of drainage patterns will be less than significant. Since you have not provided the WQMP the public is left to trust you. CEQA does not provide for this. H-32

Impact 3.7-5 The Project would not substantially degrade water quality. Please see our earlier discussion regarding the WQMP and SWPPP. H-33

3.8 Hazards and Hazardous Materials. *Impact 3.8-4 The proposed Project would not expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.* The Project site is undeveloped and near other undeveloped parcels. It qualifies as "where residences are intermixed with wildlands." You concede that the Project site is within a Very High Fire Hazard Severity Zone (VHFHS Zone) under Wildomar's authority. You claim the Project would minimize this risk through hardscapes. This is not enough to prevent wildfire, as the Fort McMurray fire in Canada makes clear. H-34

3.9 Land Use and Planning. You claim in *Impact 3.9-1* that *The proposed Project would not conflict with any applicable land use plan, policy or regulation of an agency with jurisdiction over the Project (including but not limited to the general plan [or] zoning ordinance) adopted for the purpose of avoiding or mitigation an environmental effect*, that the Project would be consistent with the General Plan. This is only because you are amending it, and even then you are rendering the General Plan internally inconsistent. The City has engaged in this "spot zoning" repeatedly, as we will demonstrate briefly. First, though, here are some of the General Plan Policies which you are contradicting with the present Project: H-35

Policy	Consistency	Discussion
LU 3.1 Accommodate land use development in accordance with the patterns and distribution of land use and density depicted on the General Plan Land Use Maps and the Area Plan Land Use Maps in accordance with the following concepts . . . (f) In new towns, accommodate compact, transit-adaptive infrastructure (based on modified standards that take into account transit system facilities or street network).	Inconsistent.	The present Project does not plan for transit and the nearest stop is not adjacent to the Project and it is uncertain whether that stop will remain as the transit agency is reviewing its service plans. The Project contradicts the Land Use Maps which have to be amended to allow the Project to move forward.
LU 6.1 Require land uses to develop in accordance with the General Plan and area plans to ensure compatibility and minimize impacts.	Inconsistent.	The General Plan is being amended to allow this Project to develop.
LU 7.1 Accommodate the development of a balance of land uses that maintain and enhance the County's fiscal viability, economic diversity, and environmental integrity.	Inconsistent.	The original designation of the land was Commercial Office (CO) – a designation the City and County sorely need. The present Project removes this designation to allow for more housing and retail, leading to a greater jobs/housing imbalance and lower wage jobs that will not sustain the residents of the complex or most surrounding communities.
LU 7.2 Promote and market the development of a variety of stable employment and business	Inconsistent.	The General Plan Amendment detracts from this Policy by taking away potential job

H-36

uses that provide a diversity of employment opportunities.		diversity within the City.
LU 7.3 Promote the development of focused employment centers rather than inefficient strip commercial development.	Inconsistent.	The General Plan Amendment is directly contrary to this Policy.
LU 7.6 Create practical incentives for business developments and avoid disincentives.	Inconsistent.	The General Plan Amendment is a disincentive to a proposed business development on the site.
LU 7.10 Locate job centers so they have convenient access to the County's multimodal transportation facilities.	Inconsistent.	The Project is not located next to transit and the nearest stop is under review.
LU 7.12 Improve the relationship and ratio between jobs and housing so that residents have an opportunity to live and work in the County.	Inconsistent.	The Project accomplishes the opposite of this Policy.
LU 9.1 Require new development to contribute their fair share to fund infrastructure and public facilities such as police and fire facilities.	Inconsistent.	While the developer is funding police and fire facilities, there is no mention of payment of a fair share fee toward transit or a transit stop.
LU 9.2 Require a fiscal impact analysis for specific plans and major development proposals so as not to have a negative fiscal impact on the [City].	Inconsistent.	The Project completed no fiscal impact analysis and it may well have a negative impact on the City and County due to the jobs/housing imbalance it exacerbates.
LU 10.1 Provide sufficient commercial and industrial development opportunities in order to increase local employment levels and thereby minimize long-distance commuting.	Inconsistent.	The purchasers of the units will not be taking jobs in the retail development as they cannot sustain their mortgages with that employment.
LU 10.2 Ensure adequate separation between pollution producing activities and sensitive emission receptors, such as hospitals, residences, and schools.	Inconsistent.	The residential uses are 300 feet away from the I-15 freeway. This is contrary to the California Air Resources Board's Air Quality and Land Use Handbook, included as Attachment C.
LU 10.4 Provide options to the	Inconsistent.	The Project does not provide for

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automobile in communities, such as transit, bicycle and pedestrian trails, to help improve air quality.		transit. The applicant should pay its fair share toward a new stop.
LU 12.1 Provide land use arrangements that reduce reliance on the automobile and improve opportunities for pedestrian, bicycle, and transit use in order to minimize congestion and air pollution.	Inconsistent.	Same.
LU 12.3 Locate transit stations in community centers and at places of public, employment, entertainment, recreation, and residential concentrations.	Inconsistent.	Same.
LU 13.8 Avoid the blocking of public views by solid walls.	Inconsistent.	The masonry walls will block residential views of surrounding scenery.

H-36

For the reasons above we dispute your determination of no significant impact.

Impact 3.9-2 The Project would conflict with an HCP. You concede the Project could conflict with the MSHCP and the SKR HCP but claim that the payment of fees toward the SKR HCP and the mitigations regarding the burrowing owl and riparian/riverine habitat will reduce this to less than significant. We disagree for the reasons stated earlier. There should be trapping and release of any SKR by a qualified biologist. H-37

3.10 Noise and Vibration. You assert first that the General Plan controls over the Municipal Code. We disagree. The most stringent rule applies and section 9.48.040 of the Code states the present rule. If it is inaccurate it should be amended. What is codified governs. H-38

You later assert that Wildomar does not have a standard for noise based on Code section 9.48.010(I). We disagree. Section 9.48.040 provides a threshold. We disagree with your use of worker noise safety standards as a threshold for human annoyance. The two are very different things. You also claim that the thresholds are "safe for adjacent residents who are typically farther from the noise source," but this is irrelevant as you have calculate noise *at the receptors.* H-39

Next, you have "calculated" noise levels by simply taking the noisiest piece of equipment and applying a "usage factor" to it to get an L_{eq} level at 50 feet. You should be calculating the noise levels of the pieces of equipment that will be used concurrently. Also using L_{eq} does not reflect the significance of this extremely disturbing sound to neighboring residents. And in setting out your threshold of 85 dBA you did not indicate that it was L_{eq}. H-40

Concerning operational impacts you concede that there would be a greater than 65 dBA CNEL impact on the outdoor residential community area and the restaurants with patios. You impose MM's NOI-4 (a sound wall of 6. 5feet around the recreational use patio in the residential area) and NOI-6 (constructing a 5-foot Plexiglas wall to attenuate noise which will provide a minimum of 5 dBA attenuation). In both cases we doubt that the proposed walls will provide the planned-for attenuation. Attachment D is a Federal Highway Administration analysis indicating that attenuation of 10 dBA requires a wall 15 feet high and eight times the length from the receptor to the noise source. While a wall shorter than that may provide 5 dBA attenuation, it must have sufficient length. We don't believe your MM's are supported by substantial evidence. H-41

Impact 3.10-4 The Project would not result in a substantial temporary or periodic increase in ambient noise levels in the Project vicinity greater than levels existing without the Project. We disagree with this conclusion as to construction noise for the reasons stated above. H-42

3.11 Population and Housing. You say there will be no significant impact because the anticipated housing constitutes only three percent of the population growth anticipated for the City between 2012 and 2035. However, the population growth is in addition to that anticipated in your General Plan because the site is designated for office uses and it will exacerbate the City's jobs/housing imbalance. H-43

3.12 Public Services. By 2012 Wildomar's population was estimated at 32,719 which at 3 acres of parkland per 1,000 residents meant you should have 98 acres of parks. Wildomar has only 15 acres of parks. Clearly the City's Quimby fees, though assessed, will not create additional parkland, and the City cannot prove that the payment of the fees is going toward this essential public service. Therefore Wildomar should require the dedication of parkland for this Project. You assert that "payment of the impact fees would offset any increased deterioration of existing parks," but this is not the standard. The City should create new parks to keep up with its increasing number of residents. H-44

3.14 Transportation and Traffic. You estimate that the nearest transit stop is ¼ mile from the Project site, though you don't identify it, and you subsequently concede that the Riverside Transit Agency is conducting a Comprehensive Operational Analysis and therefore "no information can be provided regarding future bus service in the project area at this time." The developer can pay its fair share toward transit improvements, as did the developer of the Baxter Village development further up the I-15. H-45

At page 3.14-12 you have taken a pass-by reduction of 20% for shopping center trips. On what basis did you reach the conclusion that this number would be accurate? H-46

Impact 3.14-3 Ambient growth, project-generated trips and cumulative projects would result in an increase in existing traffic that would conflict with an applicable plan, ordinance or policy establishing measures of effectiveness (i.e. level of service standards) for the performance of the circulation system. Your cumulative projects list only H-47

includes projects in Wildomar. We don't dispute you have a significant impact but we believe you have underestimated it. H-47

<u>Chapter 4 – Cumulative Impacts</u>

We wish to note that these projects on your cumulative projects list also detract from employment opportunities within the City and lead to a cumulative jobs/housing imbalance contrary to the stated goals of your General Plan:

- Project 14 – Villa Sienna Apartment Project – zone change from IP (industrial park) to R-3 (general residential) H-48
- Project 15 – Grove Park Mixed Use Project – General Plan Amendment from Business Park to Commercial Retail
- Project 16 – Baxter Village Mixed Use – Change of zone from C-P-S (scenic highway commercial) to R-3 and R-4
- Project 17 – Horizons/Strata Mixed Use Project – General Plan Amendment from Business Park to Commercial Retail and High Density Residential

Regarding cumulative impacts to air quality we dispute your use of SCAQMD's "methodology" for the reasons stated above, and you have not calculated the increased emissions of NO_x from the cumulative projects, much less indicated whether you are using the list method or summary of projections method. H-49

Regarding cumulative impacts on hazards, you assert the risks of fire would be reduced because the projects would produce greater access to sites that are undeveloped. The projects are in an extremely high fire hazard area. Your analysis and conclusion are not based on substantial evidence. H-50

Thank you for the opportunity to comment on this Project. We look forward to your responses. Please notify us of the availability of a Final Environmental Impact Report when it becomes available at collins@blumcollins.com and bentley@blumcollins.com. Thank you.

Sincerely,

Craig M. Collins

attachments: A-D

Response to Letter H

Blum Collins LLP

Response to Comment H-1. The initial comment identified the order in which the commenter's comments are presented. This initial comment does not require a response because there was no specific comment on the contents of the Draft EIR.

The commenter notes that while written comments may not have been provided during the scoping meetings held on the project, oral comments may have been provided.. As discussed in Section 1.2.2 of the Draft EIR, two scoping meetings were held for the proposed project. These meetings were held on May 19, 2014 and April 13, 2015. At both public scoping meetings, the proposed project was discussed, the scope of issues to be addressed in the EIR were discussed, and the project schedule was discussed. The City requested that the comments on the scope of the environmental evaluation be provided in written form before the end of the review period for the Notice of Preparation which was June 5, 2014 for the first scoping meeting and April 23, 2015 for the second scoping meeting. The comments on the scope of the EIR that were received prior to those dates are those comments provided on the Notice of Preparation and located in Appendix A-1 of the Draft EIR. No one who commented orally at the scoping meetings objected to the requirement that comments be provided in writing, and CEQA does not require transcription of oral comments at scoping meetings. Furthermore, any oral comments provided during the two scoping meetings were provided in writing.

Response to Comment H-2. The comment expressed concern that the Project Objectives were too narrowly defined and only allow development of the project. CEQA Guideline 15124(b) provides that the purpose of providing a project objective is to assist in identifying a reasonable range of alternatives and the preparation of a statement of overriding considerations, if necessary. For an alternative to be analyzed, it must "feasibly attain most of the basic objectives of the project."(CEQA Guideline 15126.6(a)) There is no requirement that the alternatives analyzed meet all project objectives. Chapter 6 of the Draft EIR includes a reasonable range of alternatives, including a Reduced Project Alternative (Alternative 2) that could meet most of the basic objectives of the proposed project. Therefore, the Project Objectives were not too narrowly defined to only allow development of the proposed project.

Response to Comment H-3. The comment expressed concern whether the proposed project is consistent with City of Wildomar General Plan policies AQ 2.1 and AQ 2.2 due to the placement of the proposed residential uses in proximity to the I-15 freeway. The proposed project includes residential uses on the eastern portion of the project site. The proposed residential units that are nearest to the I-15 freeway are located 300 feet to the east of the freeway. Due to the distance of the proposed residences to the I-15 freeway, a health risk assessment was prepared to determine the level of cancer and non-cancer risks that would occur at the proposed residences from motorist travelling along I-15. The analysis determined that the maximum predicted cancer risk at the project's sensitive/residential receptors using two methodologies. Based on the new Office of Environmental Health Hazard Assessment (OEHHA) guidance methodology with the inclusion of a future long-term increase of the I-15 freeway traffic of 1.25 percent, the maximum predicted cancer risk at the nearest project sensitive receptors (residents who would occupy the residential

units in the southeastern portion of the project site) is estimated to be 9.6 in one million which does not exceed the South Coast Air Quality Management District (SCAQMD) cancer risk significance threshold of 10 in one million from an individual source. The maximum predicted cancer risk at the project's sensitive/residential receptors based on the currently approved SCAQMD guidance methodology of 70-year exposure duration including future I-15 freeway traffic growth is estimated to be 2.6 in one million which does not exceed the SCAQMD cancer risk significance threshold of 10 in one million from an individual source. The maximum predicted acute and chronic non-cancer hazard indices would be 0.01 and 0.003 respectively at ground level. These levels would not exceed the SCAQMD non-cancer risk hazard index threshold of 1 at any receptor location on the project site.

Because the health risk assessment affirms that the nearest location of the proposed residences would not exceed cancer or non-cancer thresholds, the project would be consistent with the City of Wildomar Air Quality Element Policies AQ 2.1 and AQ 2.2 relating to protecting sensitive receptors from polluting point sources such as the motorists along the I-15.

Response to Comment H-4. This comment expressed concern of whether the project would conflict with or obstruct implementation of an Air Quality Management Plan (AQMP). The comment expressed that population growth needs to be consistent with the residential land uses identified in the General Plan. Future population growth forecast within the AQMP does not need to occur only within land uses designated for residential uses; however, the population projections need to be consistent with the projections identified in the AQMP which include projections for each local jurisdiction. As discussed in Impact 3.2-1 of the Draft EIR, the City's population is expected to increase from 31,500 in 2008 to 42,100 in 2020, and finally to 53,700 by 2035. This is a 33.6% increase in population from 2008 to 2020, and a 70.4% increase in growth between 2008 and 2035. To keep on track to meet these numbers, the City's population would have to increase by approximately 2.5% per year.

The California Department of Finance has projected the City's population to be 35,162 as of January 1, 2016. http://dof.ca.gov/Forecasting/Demographics/Estimates/E-1/. This is only an 11% increase in population from 2008, well below the 20% increase in population by 2016 projected in the AQMP. The project would result in a net increase of approximately 630 new residents, which will not cause the City to exceed the population estimates in the AQMP. Consistency with the population growth projections would contribute to meeting the AQMP's strategies toward criteria pollutant attainment within the South Coast Air Basin.

Projects necessitating a General Plan Amendment are not de facto inconsistent with the AQMP. Not every parcel designated with any given land use within the City will be developed. Consistency with the AQMP is therefore determined by the overall projected growth anticipated within the City. As demonstrated within the Draft EIR, the project does not exceed projected and anticipated growth.

Response to Comment H-5. This comment states that all feasible measures to reduce operational emissions of oxides of nitrogen (NOx) need to be provided. Mitigation Measures AQ-1 through AQ-3 are included in Impact 3.2-2 of the Draft EIR to reduce operational emissions of NOx;

however, the NOx emissions are determined to still exceed the regional significance threshold. This comment references the provision of fair share payments toward transit service. As stated in Mitigation Measure AQ-1, the project applicant will be required to provide bus passenger benches and shelters at any approved transit locations within the project site. The commenter is incorrect that the Baxter Village project was required to pay a fair share toward transit *service*. That project was similarly conditioned to provide a fair share toward any transit facilities (shelters, benches) that may be located in or near the project site. The suggested mitigation measure is not feasible, as RTA has not approved a transit mitigation fee program or developed any methodology for determining how a fair share would be calculated.

Response to Comment H-6. This comment is concerned with the minimum distance assumed in the Draft EIR's Localized Significance Threshold (LST) analysis. The minimum LST that is used in the Draft EIR is based on the SCAQMD's "Final Localized Significance Threshold Methodology" which can be accessed via [http://www.aqmd.gov/home/regulations/ceqa/air-quality-analysis-handbook/localized-significance-thresholds] under Appendix C – Mass Rate LST Look-up Table.

As stated on page 3.2-26 of the Draft EIR, the nearest sensitive receptors are located immediately adjacent to the east and north of the project site. As discussed in Chapter 3—Screening Tables and Their Use of the Final Localized Significance Threshold Methodology within the Final Localized Significance Threshold Methodology (Revised July 2008), page 3-3 states that "it is possible that a project may have receptors closer than (82 feet) 25 meters. Projects with boundaries located closer than 25 meters to the nearest receptor should use the LSTs for receptors located at 25 meters." As such, the nearest sensitive receptor distance of 82 feet (25 meters) was utilized in the Draft EIR's analysis, and this methodology is consistent with industry and expert guidance on this issue..

This comment also states that toxic air contaminants could be modeled for acute effects from exposure of construction activities. As stated on pages 3.2-26 and 3.2-27 of the Draft EIR, project construction would result in short-term emissions of diesel particulate matter (PM). Diesel PM poses a carcinogenic health risk that is measured using an exposure period of 70 years. Due to the short time frame (i.e., approximately two years) for construction activities, carcinogenic health risk are considered nominal and as a result, SCAQMD has not adopted a methodology for analyzing such impacts. Further, no high-emitting stationary sources would be used during construction; instead pollutant sources would be limited to off-road equipment and mobile vehicles. Health Risk Assessments are conducted for long-term exposure (9 years, 30 years, or 70 years), not periods as short as two years.

Response to Comment H-7. This comment expresses a concern that the maximum predicted cancer risk did not include loading and unloading activities associated with the proposed major retail building. The TAC analysis provided in the Draft EIR (pages 3.2-26 through 3.2-28) referenced the Health Risk Assessment prepared for the proposed project and included in Appendix B2 of the Draft EIR. The analysis quantitatively evaluated TAC emissions generated from the I-15 freeway and qualitatively evaluated TAC emissions anticipated to be generated from the proposed loading and unloading activities. According to SCAQMD's guidance which

identifies toxic air contaminates (TACs) significance threshold as maximum incremental cancer risk (MICR), the TAC threshold of 10 in one million is for each project and does not include the combination of sources such as from the I-15 freeway mobile sources (a non-project component) and the proposed major retail building with loading and unloading activities (project component) (http://www.aqmd.gov/docs/default-source/ceqa/handbook/scaqmd-air-quality-significance-thresholds.pdf?sfvrsn=2). This threshold is the same TAC thresholds for the issuance of SCAQMD air permits for individual facilities. Neither the TAC emissions from the I-15 freeway nor the TAC emissions from the proposed loading and unloading activities associated with the major retail building would individually exceed the SCAQMD's TAC threshold of 10 in one million.

The qualitative evaluation of the proposed loading and unloading activities associated with the major retail building was based on the quantitative TAC results of emissions from the I-15 freeway. As stated above, the quantitative analysis of emissions associated with the I-15 freeway was determined to be less than the 10 in one million threshold. Due to the low volume of loading and unloading activity at the proposed major retail building proposed in the northern portion of the project site as compared to truck traffic travelling along I-15, the proposed loading and unloading activities would result in substantially less TACs than the I-15 freeway. As such, it can be determined that the TACs from the loading and unloading activities would also be less than the SCAQMD cancer risk significance threshold which is 10 in one million

Furthermore, this comment asserts that the 9.6 in one million should be rounded to 10 in one million. The Health Risk Assessment in Appendix B2 in the Draft EIR used the OEHHA cancer risk guidance with SCAQMD risk parameters, and the model output provides the results in one-tenth decimal (i.e., 9.6). The SCAQMD does not have guidance to round the model results. Therefore, the future residents' exposure of 9.6 in one million cancer risk would not exceed the SCAQMD's 10 in one million cancer risk threshold.

Response to Comment H-8. This comment expresses a concern that cumulative impacts related to criteria air pollutants were not properly evaluated in the Draft EIR. As discussed on page 3.2-29 of the Draft EIR, projects that do not exceed the project-specific thresholds of criteria pollutants are not considered to have a cumulatively considerable contribution to significant cumulative impacts. The SCAQMD recommends this methodology of how to address cumulative impacts from air pollution in the *White Paper on Potential Control Strategies to Address Cumulative Impacts from Air Pollution*. The SCAQMD is the regional agency with responsibility for researching and adopting appropriate thresholds of significance for air pollutant emissions. The project-level thresholds of significance for criteria air pollutants promulgated by SCAQMD establish the points at which a project is determined to have both a significant project-level impact and a cumulatively considerable contribution to a cumulative impact. This is the same methodology that is used in nearly all cumulative impact analyses for air quality impacts in the SCAQMD region. While the commenter is correct that CEQA requires the analysis of cumulative impacts, nothing in CEQA says that the same thresholds cannot be used for both project-level and cumulative impacts analyses.

Response to Comment H-9. This comment expressed concern over the fact that focused surveys were not conducted for two species (round-leaved filaree and smooth tarplant) classified on the California Rare Plant Rank 1B.1. General reconnaissance surveys on the project site were conducted in February and May 2013 by RCA Associates, LLC. In addition, focused surveys for both of these plant species were conducted on August 26, 2016 (see Attachment 2 in the Response to Comments). These species were not observed during the general reconnaissance surveys or the recent focused surveys and suitable habitat was determined to be marginal and fragmented by surrounding development. In addition, these two plant species are covered species in the Multiple Species Habitat Conservation Plan (MSHCP). The City has a standard development condition that requires payment of the MSHCP Mitigation Fee which would reduce the potential impact on these two species because the fee is used for the assembly and management of a coordinated MSHCP Conservation Area for these species as well as other species covered in the MSHCP. Impacts to species covered under the MSHCP are adequately mitigated under CEQA.

Response to Comment H-10. This comment expressed concern that no focused surveys were conducted for the Stephens kangaroo rat (SKR), the black-tailed jackrabbit or the coast horned lizard. As stated in Response to Comment H-9, general reconnaissance surveys were conducted on the project site. Because the project site includes moderate or high suitable habitat for these species, there is a potential for these species to be located on the project site. Therefore, the proposed construction activities could result in potential significant impacts to these species. As identified in Section 3.3 of the Draft EIR, mitigation measures are required to reduce potential impacts to the black-tailed jackrabbit and the coast horned lizard. Both the black-tailed jackrabbit and the coast horned lizard are covered species under the Riverside County Multiple Species Habitat Conservation Plan which allows incidental take of these species. Mitigation measure BIO-3 includes a preconstruction clearance which is a survey to determine if the coast horned lizard or the San Diego black-tailed jackrabbits are on the project site. If they are found on the site, they would be relocated by a qualified biologist. The relocation areas and the survey methods would be developed in consultation with CDFW. The Stephens kangaroo rat is covered under the SKR Habitat Conservation Plan which allows incidental take of this species. The payment of the SKR HCP fee would reduce the potential impact to the SKR to less than significant. This payment of the SKR HCP fee is a standard condition of approval for projects located within the SKR Mitigation Fee Area which the project is located within.

This comment also expressed concern that live-trapping surveys for the SKR were not conducted as part of the field investigations. While the project site is located within the SKR Mitigation Fee Area, the project site is not located within a criteria cell for the SKR. Therefore, under the Habitat Conservation Plan (HCP) for the SKR live-trapping surveys are not required. As stated above, the City of Wildomar includes a standard development condition for projects within the SKR Mitigation Fee Area. The payment of this mitigation fee would reduce the potential impacts on the SKR to less than significant because the fee is used to assemble and manage conservation areas for the species.

Response to Comment H-11. This comment expressed a concern that the Draft EIR stated the presence of critical habitat for the coastal California gnatcatcher (CAGN) is 1,200 feet from the

project site and did not address the potential of the CAGN to use the project site. As stated on Table 3.3-2 of the Draft EIR, suitable habitat for the CAGN is absent from the project site. Due to the absence of suitable habitat, it is not likely that the CAGN would use the project site. In addition, the project site is surrounded by development, and there is no connectivity between suitable habitat and the project site.

Response to Comment H-12. This comment stated that there could be a significant impact to the western spadefoot toad species. As stated on page 3.3-24, there is a low potential for this species to occur on the project site. This species is not expected to be onsite because of the low quality habitat for this species, and the species was not observed on the site during field surveys. Furthermore, a substantial population of this species is not expected to occur on site, and any loss of individual species would not cause the population of this species to drop below self-sustaining levels. Furthermore, the western spadefoot toad species is a covered species under the MSHCP and according to the MSHCP no surveys are required for this species. The City of Wildomar has a standard condition of approval that requires payment of the MSHCP Mitigation Fee. Therefore, the project would result in a less than significant impact on this species, and no mitigation measures are required.

Response to Comment H-13. This comment disagrees with the statement that the project is consistent with Policy OS 5.5 related to preserving and enhancing existing native riparian habitat and preventing the obstruction of natural watercourse. The proposed project will be removing existing onsite native riparian habitat within two onsite drainage channels; however, the project includes a mitigation measure to restore and enhance riverine/riparian habitat on lands owned by the Elsinore Murrieta-Anza Resource Conservation District (EMARCD) located along Clinton-Keith Road in Riverside County or on other lands owned by EMARCD or another conservation district within the watershed of the project site if the land along Clinton Keith Road is not available. The implementation of this mitigation measure would provide for the offsite restoration and enhancement of riverine/riparian habitat at a ratio approved by the resource agencies (i.e., USACE, RWQCB, and CDFW). The implementation of this mitigation measure would result in the project being consistent with Policy OS 5.5. Nothing in Policy OS 5.5 precludes reliance upon mitigation measures to preserve and enhance native riparian habitat and prevention of obstruction of natural water courses.

In addition, the implementation of Mitigation Measure BIO-5 would include permitting approval by the RWQCB. Through the permitting process of the offsite restoration and enhancement, the project will be required to result in a quality of water to the satisfaction of the RWQCB. Meeting RWQCB water quality requirements for the restoration and enhancement of habitat to mitigate for the loss of approximately 0.36 acre of jurisdictional waters would result in the project's consistency with Policy OS 6.3.

Response to Comment H-14. This comment asserts that an individual loss of the round-leaved filaree or the smooth tarplant would constitute a significant impact. These two species are listed on the California Rare Plant Rank list, but have not been listed as a threatened or endangered species by the USFWS or CDFW. Potential significant impacts to the round-leaved filaree or the smooth tarplant occur if the loss of the species on the project site would threaten to eliminate or

reduce the viability of a population or restrict the range of the plant species, and not the loss of an individual plant of these species. As identified in Section 3.3 of the Draft EIR, a general reconnaissance survey was conducted on the project site. Based on the plant communities that occur on the project site, there is marginal habitat present on the site to support these two species. Therefore, there is a low potential for these species to occur on the site. Because these species were not observed onsite, suitable habitat is marginal, and the site is surrounded by development, a substantial population of these species is not expected to occur on the project site. Any loss of individual plants of these species would not threaten to eliminate or reduce the viability of populations or restrict the range of these species. In addition, these two plant species are covered species in the Multiple Species Habitat Conservation Plan (MSHCP). The City has a standard development condition that requires payment of the MSHCP Mitigation Fee which would reduce the potential impact on these two species because the fee is used for the assembly and management of a coordinated MSHCP Conservation Area for these species as well as other species covered in the MSHCP. Impacts to species covered under the MSHCP are adequately mitigated under CEQA. Therefore, the implementation of the proposed project on the project site would result in a less than significant impact on these two plant species.

Response to Comment H-15. This comment states that individual impacts to the SKR species can be significant. The project site is located within the Habitat Conservation Plan (HCP) for the SKR and the City of Wildomar is a signatory agency of the HCP. The City of Wildomar includes a standard development condition for projects located within the SKR Mitigation Fee Area. The fee is used to assemble and manage conservation areas for the species. There are many federal, state, and local agencies that are signatory agencies to the Implementation Agreement for the Long Term Habitat Conservation Plan for the SKR. The USFWS and the CDFW are two of the signatory agencies of this HCP, and the Implementation Agreement includes provisions that state the payment of the fee for potential impacts to the SKR species that could be located within the SKR Mitigation Fee Area is adequate mitigation. Please also see Response to Comment H-10, above.

Response to Comment H-16. This comment states that there is a disagreement with the assessment of the nine wildlife species that have a low potential to occur on the project site, and that, without focused surveys for these species immediately prior to ground disturbance, impacts are assumed to be significant. The assertion that impacts to these species would be potentially significant without focused surveys is not correct. A general site survey, a determination of the quality of the onsite habitat, and the existence of surrounding habitat can be evaluated to determine potential impacts. As stated in Impact 3.3-2 of the Draft EIR, these species were not observed on the project site during biological reconnaissance surveys and based on the assessment of the onsite habitat for these species, the habitat is of low quality. Furthermore, the site is surrounded by existing development. Based on these findings, the discussion in Impact 3.3-2 identified no impact on the Quino checkerspot butterfly and the California red-legged frog and less than significant impact to the remaining seven wildlife species that have a low potential to occur on the project site. CEQA does not require pre-grading focused surveys where substantial evidence supports a conclusion that a given species has a no potential or low potential to occur onsite. Furthermore, both the Quino checkerspot butterfly and the California red-legged frog are covered species under the MSHCP and no surveys for these species are required on the project

site. As stated previously, the City has a standard development condition that requires payment of the MSHCP Mitigation Fee which would reduce the potential impact on these two species because the fee is used for the assembly and management of a coordinated MSHCP Conservation Area for these species as well as other species covered in the MSHCP. Impacts to species covered under the MSHCP are adequately mitigated under CEQA.

Response to Comment H-17. This comment references a Burrowing Owl Mitigation Staff Report prepared in 2012 by CDFW that identifies preconstruction surveys for the burrowing owl for the State of California should occur within 14 days of construction activities. This comment accurately identifies the updated burrowing owl preconstruction surveys for State projects. However, the project site is located within the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP), which was approved by CDFW (then known as the California Department of Fish & Game) in 2004. The provision within the MSHCP identify preconstruction surveys shall be conducted within 30 days of construction activities. This provision has not been updated in the MSHCP; therefore the reference to 30 days within Mitigation Measure BIO-1 in Section 3.3 of the Draft EIR is appropriate.

This comment also expresses a concern regarding the buffer distance from active burrowing owl nests and paired owls during the nesting season that is recommended in Mitigation Measure BIO-2. The comment stated there is a need for a 500-meter setback during the nesting season when there are active burrowing owl nests and paired owls exhibiting breeding activities. This comment is correct, and therefore, to reflect the correct required setback, Mitigation Measure BIO-2 is revised as follows:

> **BIO-2**: If burrowing owls are identified during the 30-day preconstruction survey, the applicant shall take the following actions to offset impacts prior to ground disturbance:
>
> Active nests <u>and paired owls exhibiting breeding activities</u> within the areas scheduled for disturbance or degradation shall be avoided from February 1 through August 31, and a minimum <u>500-meter</u>~~250-foot (75-meter)~~ buffer shall be provided until fledging has occurred. Following fledging, owls may be passively relocated by a qualified biologist.
>
> If impacts on occupied burrows in the non-nesting period are unavoidable, on-site passive relocation techniques may be used if approved by the CDFW to encourage owls to move to alternative burrows outside of the impact area. However, no occupied burrows shall be disturbed during the nesting season. A qualified biologist must verify through noninvasive methods that the burrow is no longer occupied.
>
> If relocation of the owls is approved for the site by the CDFW, the applicant shall hire a qualified biologist to prepare a plan for relocating the owls to a suitable site. The relocation plan must include all of the following:
>
> - The location of the nest and owls proposed for relocation.
> - The location of the proposed relocation site.

- The number of owls involved and the time of year when the relocation is proposed to take place.
- The name and credentials of the biologist who will be retained to supervise the relocation.
- The proposed method of capture and transport for the owls to the new site.
- A description of site preparation at the relocation site (e.g., enhancement of existing burrows, creation of artificial burrows, one-time or long-term vegetation control).
- A description of efforts and funding support proposed to monitor the relocation.

~~If paired owls are present within 160 feet (50 meters) of a temporary project disturbance (e.g., parking areas), active burrows shall be protected with fencing/cones/flagging and monitored by a qualified biologist throughout construction to identify losses from nest abandonment and/or loss of reproductive effort. Any identified loss shall be reported to the CDFW.~~

Response to Comment H-18. This comment requests a preconstruction survey for the SKR similar to the preconstruction survey recommended for the coast horned lizard and San Diego black-tailed jackrabbit identified in Mitigation Measure BIO-3. The SKR HCP does not require preconstruction surveys. Please see Response to Comment H-15 regarding mitigation for potential impacts to the SKR.

Response to Comment H-19. This comment expressed a concern that the nesting season identified in Mitigation Measure BIO-4 needs to be modified to reflect the nesting season beginning in early January and ending September 15th based on nesting habits of different birds that was provided in Attachments B-1 through B-3 appended to this comment letter (see Attachment 3 in this Response to Comments). Attachment B-1 includes the protocol for the Southwestern Willow Flycatcher (SWWF) and Attachment B-3 includes information regarding the least Bell's vireo (LBV). These two bird species have no potential to occur on the project site and nesting behavior of these two species is not relevant to development of the project site. Attachment B-2 includes information from the San Diego Multiple Species Conservation Plan (MSCP). The provisions of the San Diego MSCP do not apply to the Riverside County MSHCP. The breeding season identified in Mitigation Measure BIO-4 is appropriate for raptors and migratory birds that have a potential to occur on the project site.

Response to Comment H-20. This comment states that because the project site is close to existing CAGN habitat, the project would impact the CAGN and its habitat. As discussed in Response to Comment H-11, the proposed project would not impact CAGN or its habitat because suitable habitat for the CAGN is absent from the project site, and the project site is surrounded by existing development. Urbanization on the project site would not impact potential CAGN that may be located within the suitable habitat located 1,200 feet from the project site.

In addition, the California gnatcatcher is a covered species under the MSHCP and no surveys for these species are required on the project site. As stated previously, the City has a standard development condition that requires payment of the MSHCP Mitigation Fee which would reduce the potential impact on this species because the fee is used for the assembly and management of a

coordinated MSHCP Conservation Area for this species as well as other species covered in the MSHCP. Impacts to species covered under the MSHCP are adequately mitigated under CEQA.

Response to Comment H-21. This comment stated that Mitigation Measure BIO-5 should delineate monitoring and maintenance responsibilities. As described in Mitigation Measure BIO-5, the resource agencies will be required to approve a restoration plan to mitigate for the loss of jurisdictional waters. The measure identifies that it is the applicant's intent to restore and enhance riverine/riparian habitat. Mitigation Measure BIO-5 also states that the restoration plan will include a maintenance and monitoring schedule for the proposed mitigation. The performance standards identified in Mitigation Measure BIO-5 regarding coverage and survival as well as the time frame (i.e., 5 years) to meet these performance standards are typically part of regulatory agency permits that include restoration plans for riverine/riparian habitat. Because the restoration would occur on lands held by a conservation district, long-term management will be required.

Mitigation Measure BIO-5 on page 3.3-27 of the Draft EIR is revised as follows and includes a modification that states long-term management of the restoration area shall occur.

> **BIO-5**: Prior to the issuance of a grading permit, the project applicant shall submit a detailed restoration plan that mitigates for the loss of approximately 0.36 acre of jurisdictional waters at a ratio acceptable and approved by the resource agencies (i.e., USACE, RWQCB and CDFW), but no less than 1:1 ratio. The restoration plan shall also be approved by the resource agencies prior to the issuance of a grading permit. The project applicant intends to restore and enhance riverine/riparian habitat on lands owned by the Elsinore Murrieta-Anza Resource Conservation District (EMARCD) located along Clinton Keith Road in Riverside County, or on other lands owned by EMARCD or another conservation district within the watershed if the land along Clinton Keith Road is not available. The restoration and enhancement of habitat is proposed within drainages located on the EMARCD lands to ensure a net gain of riparian/riverine habitat acreage in the region.
>
> A detailed restoration plan will be prepared that will provide a schedule for site preparation and planting. Performance standards will include: (a) increase the canopy cover of native riverine vegetation within the mitigation area by 25 percent with 80 percent survival of planted species after five years following installation, and (b) increase coverage of herbaceous vegetation within the mitigation areas by 25 percent after five years following installation. The restoration plan will also include a maintenance and monitoring schedule for the proposed mitigation. <u>Long-term management of the restoration area shall occur.</u>

Response to Comment H-22. This comment disputes the conclusion of less than significant impact on interfering with wildlife movements in the project area when potential CAGN habitat is located 1,200 feet from the project site. As discussed in Response to Comments H-11 and H-20, the proposed project would not impact CAGN or its habitat because suitable habitat for the CAGN is absent from the project site, and the project site is surrounding by existing development.

Response to Comment H-23. This comment stated that the commenter does not understand the distinction of the payment of the SKR mitigation fee reducing impacts to the SKR to less than

significant and the payment of the MSHCP mitigation fee reducing impacts to the riparian/riverine habitat and the burrowing owl but not to a level of less than significant. Under the SKR HCP, the payment of the SKR mitigation fee is adequate mitigation for any potential impact on the SKR species on the project site which is located within the SKR Mitigation Fee Area as discussed in Response to Comment H-15. Under the MSHCP, payment of a mitigation fee is only one component of the plan to mitigate impacts to covered species and habitats. The MSHCP requires additional mitigation for potentially significant impacts to burrowing owl and riparian/riverine habitats.

The comment also expressed a concern that Mitigation Measure BIO-6 would not reduce the impact to burrowing owl species. This is correct. Mitigation Measures BIO-1 and BIO-2 are also referenced as measures to reduce potential impacts identified in Impact 3.3-8 of the Draft EIR. These two measures along with the payment of the MSHCP fee would reduce potential conflicts with the MSHCP to less than significant.

In addition, this comment states that there is no impact discussion regarding urban/wildlands interface. The urban/wildlands interface was addressed in Impact 3.3-6 of the Draft EIR. The discussion identified that the project would have no impact on the movement of any migratory species, on wildlife corridors, or native wildlife nursery sites. Because the MSHCP requires a plan to demonstrate compliance with the MSHCP Urban/Wildlands Interface Guidelines, Mitigation Measure BIO-6 was provided to ensure compliance with the requirements of the MSHCP. As stated in Mitigation Measure BIO-6, the plan shall provide provisions (such as compliance with NPDES requirements) to ensure that indirect impacts to off-site drainage channels and associated riparian/riverine habitats downstream be minimized to the satisfaction of the City of Wildomar.

Response to Comment H-24. This comment asked if the Soboba are involved in the mitigation measures for cultural resources. Response to Comment E-1 included a revision to Mitigation Measure CUL-3 because the reference to Soboba was inadvertently included. The City of Wildomar has been coordinating with the Pechanga Tribe related to potential impacts and mitigation measures for development projects. As part of the Cultural Resources Report prepared for the project (see Appendix D of the Draft EIR), Native American consultation was conducted. A representative from the Soboba Band of Luiseno Indians was contacted along with eleven other representatives from separate tribes. Only the Pechanga Band of Luiseno Indians contacted the City.

Response to Comment H-25. This comment stated that a paleontologist needs to assess the potential impacts of the proposed project and not just monitor when impacting the paleontologically sensitive Pauba formation. The potential impacts of the proposed project were analyzed by the Natural History Museum (Dr. Sam McLeod) as well as Dr. Michael Williams who is with ESA, the preparer of the Draft EIR. As discussed on page 3.4-9 of the Draft EIR, Dr. Sam McLeod indicated that no vertebrate fossil localities have been identified within the proposed project area; however, the entire project site is mapped as containing the Pauba Formation which is considered paleontologically sensitive. As a result of this finding, the proposed project has a potential to result in a significant impact to paleontological resources when

construction activities result in ground-disturbing activities in native soils or sediments. Based on this significance finding, Mitigation Measure CUL-6 in the Draft EIR (revised as Mitigation Measure CUL-7 in Section 4 of this Response to Comments) includes monitoring during ground-disturbing activities at the project site.

The comment referencing the depth to ground disturbance correctly identified that the referenced depth is four to 15 feet.

The first paragraph under Impact 3.4-2 on page 3.4-19 of the Draft EIR is revised as follows to correctly identify the depth of ground disturbance to be between four and 15 feet.

> The records search conducted by NHM staff indicated that no fossil localities have been previously identified within the project site. However, there are surface exposures of the Pauba Formation on the project site, which is known to contain significant vertebrate fossils. The depth of ground disturbance within the project site is proposed to range between four and 15 feet in depth and has the potential to impact the Pauba Formation. This potential effect on the Pauba Formation could result in significant impacts to unknown paleontological resources.

Response to Comment H-26. This comment states that the Draft EIR does not address the Glen Ivy fault. As discussed on page 3.5-11, the Glen Ivy fault lies close to the northeastern corner of the project site. The Glen Ivy fault does not have an Alquist-Priolo (AP) fault zone designation because this fault is not recognized by the state as an active fault under the Alquist-Priolo Earthquake Fault Zoning Act as discussed on page 3.5-2 of the Draft EIR. The Act requires structures for human occupancy to be setback 50-feet from an AP fault. The proposed project includes structures for human occupancy that are proposed to be located more than the 50-feet from the Glen Ivy fault. Even if the Glen Ivy fault trace was classified as an AP fault, the potential for surface rupture to result in damage, destruction or injury to future structures for human occupancy on the project site would be less than significant.

As identified above, the state does not recognize the Glen Ivy fault as active which is defined as having surface displacement within the past 11,000 years. Based on the locations of the proposed structures for human occupancy are located more than 50 feet from the fault and the fault is not classified as active, the potential seismic shaking impacts on the proposed structures would be less than significant if seismic design requirements of the state and local jurisdictions are implemented as discussed in Impact 3.5-2 in Section 3.5, Geology, Soils, and Seismicity, in the Draft EIR.

Response to Comment H-27. This comment states that amortizing construction emissions over 30 years is contrary to the mandates of AB 32 and Executive Order B-30-15. The South Coast Air Quality Management District (SCAQMD) is the agency in California that is responsible for regulating stationary sources of pollution in the South Coast Air Basin. The SCAQMD adopted an Interim Quantitative GHG Significance Threshold of 10,000 MT CO2e for industrial projects in 2008 and in 2010 a Working Group released a recommended GHG threshold of 3,000 MT CO2e for mixed use projects. In 2008, the SCAQMD's guidance stated that construction emissions will be amortized over the life of the project, defined as 30 years, and added to the

operational emissions. This approach to amortizing construction emissions has been the guidance and industry standard practice since 2008. SCAQMD's approach to determining GHG emissions is not contrary to AB 32 or Executive Order B-30-15.

This comment also requested that additional mitigation measures be implemented to reduce the potential significant greenhouse gas emissions identified on page 3.6-10 of the Draft EIR. The comment suggested the implementation of rooftop solar. As described on page 3.6-9 of the Draft EIR as well as Section 2 of the Draft EIR, the project includes various project features that reduce greenhouse gas emissions. As shown in Table 3.6-3, the majority of the greenhouse gas emissions occur from mobile sources. The project applicant has included design features to reduce vehicle trips and thus reduce greenhouse gas emissions. Most of the greenhouse gas emission reduction features included in the project are to reduce stationary source emissions. As shown on Table 3.6-5, substantial greenhouse gas emissions will remain (10,994.8 MT CO2e, 366 percent higher than the threshold) after the implementation of the project greenhouse gas reduction features. The addition of rooftop solar could reduce the energy utilization, and even if all the energy greenhouse gas emissions were eliminated, the greenhouse gas emissions would be 8,953 MT CO2e which would remain 298 percent higher than the threshold. The implementation of rooftop solar would not provide a substantial reduction in greenhouse gas emissions, and impacts would remain significant and unavoidable.

Response to Comment H-28. This comment asked about the project preserving existing native trees and shrubs. The statement in Section 3.7 of the Draft EIR was inadvertently retained after there was a modification to the project design. As discussed in Impact 3.7-1 in the Draft EIR, the project operator would be required to comply with the NPDES Construction General Permit which would include the preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP would require erosion control, sediment control, non-stormwater and waste and material management BMPs, such as routine inspections and maintenance of equipment that would prevent construction chemicals used on-site from washing into local water bodies. Compliance with the NPDES Construction General Permit by implementing BMPs identified in the analysis provided in Impact 3.7-1 would reduce potential water quality impacts during construction to less than significant.

The first paragraph under Impact 3.7-1 on page 3.7-14 of the Draft EIR is revised to read:

> The project site contains gently rolling hills, with elevations varying from 1,300 to 1,350 feet above mean sea level. In general, soil on slopes tends to be less stable and more susceptible to becoming entrained in stormwater runoff. The project would involve the introduction of structures on a currently undeveloped site. Construction activities such as vegetation removal, grubbing, grading and excavation associated with the proposed project would loosen soil structure and expose bare soil, making it potentially more easily eroded by wind and rain, especially on slopes. ~~However, the project would maximize canopy interception and water conservation by preserving existing native trees and shrubs, thereby minimizing vegetation disturbance and associated erosion potential and sedimentation during construction.~~

Response to Comment H-29. This comment stated that the final BMPs and SWPPP should have been provided in the Draft EIR. Page 3.7-15 include a potential list of BMPs to demonstrate that potential water quality impacts during construction activities could be reduced to less than significant. A final SWPPP along with BMPs are required prior to the City issuing a grading permit for the project. A final SWPPP along with final BMPs are not required prior to preparation of detailed grading plans. Similar to all construction activities, the project contractor will be required to comply with the NPDES Construction General Permit.

Response to Comment H-30. This comment asserts that a Water Quality Management Plan (WQMP) could have been prepared for the project and provided in the Draft EIR. Appendix F-2 in the Draft EIR includes the Preliminary Water Quality Management Plan (PWQMP) prepared for the project. This PWQMP provides the proposed structural BMPs for the project. As discussed in Impact 3.7-1, potential operational impacts to water quality would be less than significant with the incorporation of the project BMPs identified in the PWQMP.

Response to Comment H-31. This comment also asserts that a WQMP was not provided in the Draft EIR. Please see Response to Comment H-30. The comment also implies that a SWPPP is needed. Please see Response to Comment H-29.

In addition, this comment asserts that bio-retention and sand infiltration facilities cannot be designed for the site. As discussed in Impact 3.7-3, the project soils were found to provide extremely slow infiltration rates during the infiltration analysis and retention basins cannot be designed for infiltration. The intent of this statement is that infiltration provided by existing conditions cannot be a solution to reduce surface water flow. The proposed bio-retention and sand filtration facilities are water quality structures and are incorporated into the project design. They are located on the project site as shown in Figure 2-11 in the Draft EIR. These structures allow surface water to be captured and then water is discharged to a pipe that conveys the treated surface water to the proposed underground retention basins and ultimately to one of the three existing concrete culverts that convey stormwater under and to the west side of the I-15. The bio-retention and sand filtration facilities are not stormwater retention facilities, but they are water quality structures.

Response to Comment H-32. This comment asserts that a WQMP for the project is not available for the public to review. The WQMP was provided in the Draft EIR Appendix F-2. Please see Response to Comment H-30.

Response to Comment H-33. This comment refers to the WQMP and SWPPP comments provided in Comments 29 through 32. Please see Response to Comment 29 through 32 regarding the WQMP and SWPPP.

Response to Comment H-34. This comment asserts that the project site is in an area intermixed with wildlands. The project site is currently designated by the City as a Very High Fire Hazard Severity Zone due to the brush that is located on the project site. The implementation of the proposed project would remove the existing brush and alter the fire hazard severity zone because the brush would be removed. The project site is surrounded by development, and proposed residences would not be intermixed with wildlands. As stated in Impact 3.8-4, the project site

does not fall within a fire hazard area under the fire Hazard Severity Zones in a State Responsibility Area. Please also see Response to Comment G-1 and G-2, above.

Response to Comment H-35. This comment asserts that the proposed General Plan amendment would render the General Plan internally inconsistent. Amendments to General Plans do not automatically render General Plans internally inconsistent, and the comment does not explain what internal inconsistencies it believes would occur. A General Plan consistency analysis was provided as part of the Draft EIR, and can be found within each Regulatory Framework discussion in each subsection in Section 3 of the Draft EIR. This analysis determined that the project was consistent with all relevant General Plan goals and policies. See also Response to Comment H-36, below.

Response to Comment H-36. This comment asserts that additional General Plan Land Use policies are applicable to the proposed project, and the proposed project is not consistent with these General Plan Land Use policies. Following is a discussion of each referenced policy that was not discussed in the Draft EIR.

Policy LU 3.1 – This policy refers to accommodating land use development in accordance with the patterns and distribution of use and density depicted on the General Plan Land Use Maps and the Area Plan Land Use Maps in accordance with the concepts listed in this policy. Some of these concepts include providing a balanced mixed of land uses and assist in promoting the development of infill and underutilized parcels.

The project is consistent with this policy because the project includes the concepts of a balanced mixed of land uses (residential and commercial) and promoting development of infill parcels. The project is not required to include each concept listed within Policy LU 3.1 to show consistency with the policy. Not every concept identified in this policy is relevant to every proposed project within the City. Please note that the implementation of Mitigation Measure AQ-1 includes the provision of bus passenger benches and shelters at any approved transit location within the project site.

Policy LU 6.1 – This policy states that land uses are required to develop in accordance with the General Plan to ensure compatibility and minimize impacts. The purpose of this policy is to ensure compatibility and minimization of impacts. The proposed project would be consistent with this policy because the project includes setbacks and the proposed townhouse uses would be compatible with the existing single-family uses. The land use compatibility discussion is provided on pages 3.9-15 and 3.9-16 of the Draft EIR.

Policy LU 7.1 – This policy includes accommodation of development that provides for a balance of land uses that maintains and enhances fiscal viability, economic diversity, and environmental integrity. The project would be consistent with this policy because the provision of commercial uses on the project site would enhance the fiscal viability within the City.

Policy LU 7.2 – This policy includes promoting and marketing the development of a variety of stable employment and business uses that provide a diversity of employment opportunities. The project is consistent with this policy because the proposed commercial uses provide employment

opportunities (approximately 237 employees) primarily for the region's existing employment stock while only a relatively small number of new employees would come from outside the region as discussed in Section 3.11.3 of the Draft EIR.

Policy LU 7.3 – This policy includes promoting the development of focused employment centers rather than inefficient strip commercial development. The proposed commercial uses on the project site are not considered strip commercial because each of the commercial uses on the western portion of the project site do not have their own individual parking area and individual access to the adjacent roadway (i.e., Westpark Street). The proposed commercial uses have parking areas that can be shared, and these uses have shared entrances and exits to Westpark Street. Therefore, the proposed project would be consistent with this policy.

Policy LU 7.6 – This policy identifies the provision of practical incentives for business developments and avoidance of disincentives. This policy is not applicable to the proposed project..

Policy LU 7.10 – This policy states that job centers are located so that they have convenient access to the County's multimodal transportation facilities. The project is considered consistent with this policy because the proposed project includes employment opportunities, and the project site is located in close proximity to multiple modes of transportation such as nearby streets, I-15 freeway, pedestrian facilities, and a bus route.

Policy LU 7.12 – This policy states that the relationship and ratio between jobs and housing be improved so that residents have the opportunity to live and work in the County. The project would be consistent with this policy because the project includes a mix of residential and commercial land uses. The development of the existing vacant site would improve the ratio of jobs and housing within the City of Wildomar and provide both residential and employment opportunities in the City.

Policy LU 9.1 – This policy includes the contribution of a fair share toward infrastructure and public facilities such as policy and fire. As stated in the comment, the project applicant will be required to provide a development impact fee for police and fire services. The comment also asked about providing a fair share toward transit or a transit stop; however, provision of such is not necessary for consistency with this policy. Although a fair share for transit facilities is not required by the City, Mitigation Measure AQ-1 requires the applicant to provide bus passenger benches and shelters at any approved transit locations within the project site. The proposed project would be consistent with this policy.

Policy LU 9.2 – This policy identifies a requirement of a fiscal impact analysis for specific plans and major development proposals so as not to have a negative fiscal impact on the City. The City has not requested a fiscal impact analysis be prepared for the project because the project is not a specific plan and is not considered a major development proposal. The inclusion of commercial uses within the proposed project increases taxable revenue to the City to offset potential costs associated with the provision of public services. Furthermore, economic impacts to the City are not issues of concern under CEQA.

Policy LU 10.1 – This policy includes the provision of sufficient commercial and industrial development opportunities in order to increase local employment levels and thereby minimize long-distance commuting. Because the proposed project includes a mixed-use development, the proposed commercial uses would increase local employment levels, and the inclusion of the mixed use commercial and residential uses would minimize long-distance commuting. The proposed project would be consistent with this policy.

Policy LU 10.2 – This policy includes a discussion of ensuring adequate separation between pollution producing activities and sensitive receptors, such as hospitals, residences, and schools. As discussed in Impact 3.2-3 in the Draft EIR, the project would not expose sensitive receptors to substantial pollutant concentrations. The proposed project would be consistent with this policy.

Policy LU 10.4 – This policy includes the provision of options to the automobile in communities, such as transit, bicycle and pedestrian trails to help improve air quality. As described in Section 2.4.4 of the Draft EIR, the project includes the provision of sidewalks on both sides of the majority of the project streets, provision of pedestrian and biking linkages between residential and commercial uses, and provision of biking and walking access between uses. In addition, Mitigation Measure AQ-3 requires the provision of secure bicycle racks. The proposed project would be consistent with Policy LU 10.4.

Policy LU 12.1 – This policy identifies the provision of land use arrangements that reduce reliance on the automobile and improve opportunities for pedestrian, bicycle, and transit use in order to minimize congestion and air pollution. The proposed project is consistent with this policy because the mixed uses proposed as part of the proposed project would provide opportunities to reduce automobile trips between the proposed residential areas and the proposed commercial areas. In addition, due to the location of the project site near an interchange, the project could attract pass-by automobile trips that could reduce overall daily trips in the project vicinity.

Policy LU 12.3 – This policy refers to locating transit stations in community centers and at places of public, employment, entertainment, recreation, and residential concentrations. The proposed project would be consistent with this policy because the project includes Mitigation Measure AQ-1 that requires bus passenger benches and shelters at any approved transit location on the project site.

Policy LU 13.8 – This policy includes avoidance of blocking public views by solid walls. The residential uses located east and north of the project site are located higher in elevation compared to the project site. There are views from the residences to the west and are of the scenic Santa Ana Mountains. These views of the Santa Ana Mountains would not be impeded by the construction of the 6-foot tubular steel fence with pilasters proposed along the I-15 freeway right-of-way because the viewpoints are higher in elevation and viewers can see through the fence. In addition, motorists along the I-15 freeway can see onto the project site. Therefore, the proposed project would not block public views, and the project would be consistent with this policy (see page 3.1-4 in Section 3.1, Aesthetics, of the Draft EIR).

Summary

As described above, the proposed project would be consistent with each of the applicable policies identified in the comment.

Response to Comment H-37. This comment stated that payment of MSHCP and SKR HCP fees and the mitigation measures for the burrowing owl and riparian/riverine habitat would not reduce potential impacts to less than significant. The comment stated that trapping and release of SKR by a qualified biologist should be conducted. Please see Response to Comments H-10 and H-23 regarding adequacy of the payment of fees and implementation of the mitigation measures to reduce potential impacts to the habitat conservation plans to less than significant.

Response to Comment H-38. This comment expressed a concern that the standards established in Chapter 9.48 (Noise Regulation) of the City of Wildomar Municipal Code should be the standards that are applied for potential impacts in accordance with CEQA. However, Section 9.48.010 (Intent) states that Chapter 9.48 is intended to establish City-wide standards regulating noise and is not intended to establish thresholds of significance for the purpose of any analysis required by the California Environmental Quality Act and no such thresholds are established. The City of Wildomar Municipal Code does not need to be amended because the Code clearly states the intent of the standards.

Response to Comment H-39. This comment also asserts that Section 9.48.040 provides a threshold of significance for CEQA. Please see Response to Comment H-38. This comment also expresses a disagreement with the use of worker safety standards as a noise threshold. This noise threshold is for construction activities. As discussed on pages 3.10-19 and 3.10-20, the construction noise standard of 85 dBA was based on a review of standards used by other agencies since the City has not adopted its own construction noise thresholds.

Response to Comment H-40. This comment stated that multiple pieces of construction equipment should be assumed to operate concurrently to determine the noise level. First, the noise level threshold is 85 dBA during the daily construction activities. The threshold was based on noise exposure to workers over a given time period to ensure worker safety. Therefore, it is appropriate that the noise threshold is based on a specific period of time (i.e., 8 hours), and thus the threshold is 85 dBA Leq.

Construction activities could include multiple pieces of equipment; however, within 50 feet of a resident, it is reasonable to assume that multiple spices of equipment will not be working in the immediate vicinity of one of the noise-sensitive receptors (residences) during the entire day. The analysis in the Draft EIR assumes the noisiest piece of equipment would be operating adjacent to a specific residence over a specific time period such as 8 hours. This assumption is considered worst-case since the same piece of equipment would not be operating at the same location for an extended period of time. The piece of equipment such as a grader may travel adjacent to the residence and then pass the residence while another piece of equipment may subsequently pass by the residence. The worst-case noise level would not be constant at the adjacent resident.

Response to Comment H-41. This comment asserts that the sound attenuation proposed for the recreational area and the restaurants on the project site would not be adequate to reduce noise levels to 65 dBA CNEL and 70 dBA CNEL, respectively. The comment included documentation from the Federal Highway Administration regarding soundwalls and sound attenuation and asserted that a greater length of soundwall would be required to adequately attenuate noise levels at the proposed recreational area and the restaurant. The proposed sound attenuation would surround the onsite uses while the commenter's referenced information proposed sound attenuation that only extends along a roadway and does not surround the uses. Therefore, a greater length of sound attenuation (i.e., wall) would be needed due to sound traveling around the end of the walls. Sound traveling around the end of walls does not occur when, as here, the proposed sound attenuation measures surround the use.

Response to Comment H-42. This comment disagrees with the Draft EIR finding that the project would not result in a substantial temporary or periodic increase in ambient noise levels. Please see Response to Comment H-40.

Response to Comment H-43. This comment expressed a concern that Impact 3.11-1 determined that there would be no significant impact because anticipated housing constitutes only three percent of the population growth anticipated for the City between 2012 and 2035. The comment also states that in addition to population growth, the proposed project would exacerbate the City's jobs/housing imbalance by removing a land use designation that allows for office uses and replace it with a mixed use development. As discussed in Impact 3.11-1, the project would not induce a substantial population growth in the project area. The project would provide a mixed use of commercial and residential that would increase the number of jobs and residents within the City on a site that is undeveloped. The project would not exacerbate an existing jobs/housing imbalance because the project would provide employment opportunities for residents within the City as well as the project vicinity. Please also see Response to Comment H-4, above.

Response to Comment H-44. This comment expressed a concern that the City has a deficit of about 98 acres of parkland based on a 3 acres of parkland per 1,000 residents ratio and that the City should require the dedication of parkland for the project because the City cannot prove that the payment of park fees are going to the creation of additional parkland. As stated on page 3.12-5 of the Draft EIR, there is a deficit of about 98 acres of parkland based on a ratio of 3 acre of parkland per 1,000 residents. A deficit of parkland existed within the City of Wildomar prior to the incorporation of the City in 2008. New development cannot be required to remedy existing deficiencies in parkland. As development has occurred, the City has collected Park Acquisition impact fees for parkland acquisition and Park Improvement impact fees for parkland improvements. The City of Wildomar requires applicants of residential development to dedicate 3 acres of parkland per 1,000 residents or in lieu dedication or pay a fee to mitigate the impacts of property development or improvements. The dedication of parkland is not the only alternative to reduce potential park impacts. The payment of the fees described above would also offset potential project park impacts.

Response to Comment H-45. This comment expressed a concern that the Riverside Transit Agency (RTA) is conducting a Comprehensive Operational Analysis and future bus service was

not known. The comment also requested a fair share toward transit improvements. Based on a review of the RTA website, a Final Report of the RTA Comprehensive Operational Analysis was prepared in January 2015. Based on a review of the report located at http://www.riversidetransit.com/images/stories/DOWNLOADS/PUBLICATIONS/COMPREHENSIVE_OPERATIONAL_ANALYSIS/Final%20Report%20-%20Jan%202015.pdf, Figure 33 illustrates that RTA Route 23 would continue to be located along Clinton Keith Road between Inland Valley Road and I-15 which is near the project site. Although a fair share for transit facilities is not required by the City, and would not feasibly reduce any significant impacts identified in the Draft EIR, Mitigation Measure AQ-1 does require the applicant to provide bus passenger benches and shelters at any RTA approved transit location within the project site. Please also see Response to Comment H-5, above.

Response to Comment H-46. This comment requested information regarding the pass-by reduction of 20 percent that was taken for shopping center trips. As discussed in Appendix I-1 of the Draft EIR, pass-by trips are not new trips but those that are already on the roadway system but are anticipated to pass-by the project on their way to a primary destination. The Institute of Transportation Engineers (ITE) Manual indicates that an average of 34 percent of shopping center trips are comprised of pass-by trips during the PM peak hour. However, for the purposes of the traffic study for the proposed project, a lower reduction of 20 percent in trips was used to ensure a conservatively high estimate of project traffic.

Response to Comment H-47. This comment expressed a concern that the cumulative projects that were included in the traffic analysis did not include projects within other cities. The traffic analysis included two separate cumulative analyses. One of the analyses addressed short-term cumulative impacts. This analysis included the proposed project and the list of projects in Table 4-1 as well as added an ambient growth which could account for additional traffic from other projects (i.e., projects within other cities) not listed on Table 4-1. This short-term evaluation included a worst-case assumption that all of the projects that are listed would generate traffic by 2017. This analysis adequately addressed worst-case short-term cumulative traffic volumes for 2017. The second analysis was a long-term cumulative evaluation. This evaluation included traffic volumes derived from the Riverside County Transportation and Analysis Model (RivTAM). The traffic volumes in the model are derived from growth projections throughout the County. This long-term evaluation adequately evaluated traffic impacts for 2035.

Response to Comment H-48. This comment states that projects listed as cumulative projects on Table 4-1 would detract from employment opportunities within the City. Three of the four cumulative projects listed are mixed use projects that would provide employment opportunities within the City of Wildomar on land that is currently vacant. The fourth project is an apartment complex that would result in nominal employment. The implementation of these cumulative projects would not be considered as detracting from existing employment opportunities. Future opportunities may be altered; however, as development occurs within cities, General Plans and land use development are reviewed to determine if revised directions toward the mix of land uses are desired. Moreover, the list provided does not include pending and approved projects in the City that will increase job opportunities that do not include residential components, including the

Rancon Medical and Education Center, Wal-Mart, Wildomar Square, the Cornerstone Church preschool and administrative building, and the Mt. San Jacinto Community College campus.

Response to Comment H-49. This comment expressed a concern regarding the need to calculate the increase of NOx emissions by cumulative projects. Please see Response to Comment H-8 regarding the cumulative analysis conducted for the proposed project.

Response to Comment H-50. This comment states that the risks of fire would be reduced because the projects would produce greater access to sites that are undeveloped. Page 4-15 of the Draft EIR states that the proposed project and cumulative projects are not expected to expose people or structures to wildland fires because these projects are not located in areas designated as wildland fire areas. Therefore, potential impacts would be less than significant.

SECTION 4
Errata

The following provides the corrections and additions to the sections of the Draft EIR. The corrections and additions are organized by page number. Additional text is shown in underline, and deleted text is shown in ~~strikethrough~~ format.

Page ES-1

The first sentence in the second paragraph on page ES-1 of the Draft EIR is revised as follows:

> The project applicant proposes to develop a one~~two~~-phase mixed-use residential and commercial project.

Page ES-7

The level of significance after mitigation in Table ES-1 did not accurately summarize the finding of Impact 3.2-5 on page 3.2-20 in Section 3.2, Air Quality of the Draft EIR. Therefore, the level of significance after mitigation for Impact 3.2-5 on page ES-7 of the Draft EIR is revised as follows:

> ~~Less than significant.~~ Significant and unavoidable for NOx emissions.

Page ES-16

Consistent with the revision identified below for Page 3.10-35, the mitigation measure column for Impact 3.10-3 on page ES-7 of the Draft EIR is revised as follows:

> ~~No mitigation measures are reasonable to implement because noise levels would remain less than the City's exterior noise level standard for residential uses of 65 dBA CNEL.~~
>
> **NOI-7:** The project applicant shall seek permission from the applicable homeowner's association to extend the height of the existing block wall located along the backyards of the four existing residential properties along the north side of Catt Road. With the homeowner's association's permission, the applicant shall extend the wall by an additional 0.5-foot.

Page ES-26

Consistent with the revision identified below for Page 4-18, the mitigation measure column for the third row under Noise on page ES-26 of the Draft EIR is revised as follows:

> ~~No mitigation measures are reasonable to implement because noise levels would remain less than the City's exterior noise level standard for residential uses of 65 dBA CNEL.~~
>
> Implementation of Mitigation Measure NOI-7 is required, if permitted by the homeowner's association who has ownership and control of the existing wall along the north side of Catt Road.

Page 2-22

The second sentence in the first paragraph under Section 2.5 of the Draft EIR is revised as follows:

> The project would be developed in one~~two~~ phase~~s~~.

Page 2-23

Section 2.6, Intended Use of the EIR and Project Approvals, is modified to reflect the reference to the correct regional water quality control board. The ninth bullet on page 2-23 of the Draft EIR is revised as follows:

- ~~Santa Ana~~ San Diego Regional Water Quality Control Board (S~~A~~DRWQCB) – Section 401, NPDES and SWPPP

Page 2-23

Section 2.6, Intended Use of the EIR and Project Approvals, is modified to add the required encroachment permits from Caltrans for the storm drain connections with the concrete headwalls. The following bullet is added after the tenth bullet on page 2-23 of the Draft EIR:

- California Department of Transportation – Encroachment permit for the proposed storm drain connections with the concrete headwalls that are located within the Caltrans right-of-way.

Page 3.2-21

The number of projected residents with the implementation of the proposed project included some inconsistent numbers. Therefore, the second sentence in the second paragraph under Impact 3.2-1 on page 3.2-21 of the Draft EIR is revised as follows:

The project would generate a population of approximately ~~593~~ 630 new residents, which would constitute approximately three percent of the population growth expected in the city between 2008 and 2035.

Page 3.2-21

The number of projected employees with the implementation of the proposed project included some inconsistent numbers. Therefore, the second sentence in the third paragraph under Impact 3.2-1 on page 3.2-21 of the Draft EIR is revised as follows:

The project is anticipated to introduce ~~238~~ 237 new employees to the area (as detailed in Section 3.11, Population and Housing).

Pages 3.3-24 and 3.3-25

To reflect the correct 500-meter required setback during the nesting season, Mitigation Measure BIO-2 on page 3.3-24 and 3.3-25 of the Draft EIR is revised as follows:

BIO-2: If burrowing owls are identified during the 30-day preconstruction survey, the applicant shall take the following actions to offset impacts prior to ground disturbance:

Active nests and paired owls exhibiting breeding activities within the areas scheduled for disturbance or degradation shall be avoided from February 1 through August 31, and a minimum 500-meter~~250-foot (75-meter)~~ buffer shall be provided until fledging has occurred. Following fledging, owls may be passively relocated by a qualified biologist.

If impacts on occupied burrows in the non-nesting period are unavoidable, on-site passive relocation techniques may be used if approved by the CDFW to encourage owls to move to alternative burrows outside of the impact area. However, no occupied burrows shall be disturbed during the nesting season. A qualified biologist must verify through noninvasive methods that the burrow is no longer occupied.

If relocation of the owls is approved for the site by the CDFW, the applicant shall hire a qualified biologist to prepare a plan for relocating the owls to a suitable site. The relocation plan must include all of the following:

- The location of the nest and owls proposed for relocation.
- The location of the proposed relocation site.
- The number of owls involved and the time of year when the relocation is proposed to take place.
- The name and credentials of the biologist who will be retained to supervise the relocation.
- The proposed method of capture and transport for the owls to the new site.

- A description of site preparation at the relocation site (e.g., enhancement of existing burrows, creation of artificial burrows, one-time or long-term vegetation control).
- A description of efforts and funding support proposed to monitor the relocation.

~~If paired owls are present within 160 feet (50 meters) of a temporary project disturbance (e.g., parking areas), active burrows shall be protected with fencing/cones/flagging and monitored by a qualified biologist throughout construction to identify losses from nest abandonment and/or loss of reproductive effort. Any identified loss shall be reported to the CDFW.~~

Page 3.3-27

Mitigation Measure BIO-5 on page 3.3-27 of the Draft EIR is revised as follows and includes a modification that states long-term management of the restoration area shall occur.

BIO-5: Prior to the issuance of a grading permit, the project applicant shall submit a detailed restoration plan that mitigates for the loss of approximately 0.36 acre of jurisdictional waters at a ratio acceptable and approved by the resource agencies (i.e., USACE, RWQCB and CDFW), but no less than 1:1 ratio. The restoration plan shall also be approved by the resource agencies prior to the issuance of a grading permit. The project applicant intends to restore and enhance riverine/riparian habitat on lands owned by the Elsinore Murrieta-Anza Resource Conservation District (EMARCD) located along Clinton Keith Road in Riverside County, or on other lands owned by EMARCD or another conservation district within the watershed if the land along Clinton Keith Road is not available. The restoration and enhancement of habitat is proposed within drainages located on the EMARCD lands to ensure a net gain of riparian/riverine habitat acreage in the region.

A detailed restoration plan will be prepared that will provide a schedule for site preparation and planting. Performance standards will include: (a) increase the canopy cover of native riverine vegetation within the mitigation area by 25 percent with 80 percent survival of planted species after five years following installation, and (b) increase coverage of herbaceous vegetation within the mitigation areas by 25 percent after five years following installation. The restoration plan will also include a maintenance and monitoring schedule for the proposed mitigation. <u>Long-term management of the restoration area shall occur.</u>

Pages 3.4-18 and 3.4-19

After consultation with the Pechanga Tribe, Mitigation Measures CUL-2 through CUL-5 on pages 3.4-18 and 3.4-19 of the Draft EIR are revised as follows:

CUL-2: At least 30 days prior to the issuance of a grading permit, the project applicant shall contact the Pechanga to notify them of grading, excavation, and the monitoring program and to coordinate with the ~~City of Wildomar and~~ the Pechanga to develop a Cultural Resources Treatment and Monitoring Agreement. The agreement shall include, but not be limited to, outlining provisions and requirements for addressing the treatment of cultural resources;

project grading and development scheduling; terms of compensation for the monitors; treatment and final disposition of any cultural resources, sacred sites, and human remains discovered on the site; and establishing on-site monitoring provisions and/or requirements for professional tribal monitors during all ground-disturbing activities. A copy of this signed agreement shall be provided to the Planning Director and Building Official prior to the issuance of the first grading permit.

CUL-3: Prior the issuance of any grading permit, the project archaeologist shall file a pre-grading report with the City to document the proposed methodology for grading activity observation which will be determined in consultation with the Pechanga Tribe. The archaeological monitor and a Pechanga Tribal monitor will have the authority to temporarily halt and redirect grading activities in order to evaluate the significance of any archaeological cultural resources discovered on the project site. Tribal and archaeological monitors shall be allowed to monitor all grading, excavation and groundbreaking activities.

CUL-~~3~~4: If during grading or construction activities cultural resources are discovered on the project site, work shall be halted immediately within 50 feet of the discovery and the resources shall be evaluated by a qualified archaeologist (retained by the applicant) and the Pechanga. Any unanticipated cultural resources that are discovered shall be evaluated and a final report prepared by the qualified archaeologist. The report shall include a list of the resources discovered, documentation of each site/locality, and interpretation of the resources identified, and the method of preservation and/or recovery for identified resources. In the event the significant resources are recovered and if the qualified archaeologist~~,~~ and/or the Pechanga~~, and/or Soboba~~ determines the resources to be historical or unique, avoidance and/or mitigation shall be required pursuant to and consistent with CEQA Guidelines Section 15064.5 and 15126.4, Public Resources Code Section 21083.2, and the Cultural Resources Treatment and Monitoring Agreement required by Mitigation Measure CUL-2.

CUL-4~~5~~: All cultural resources, with the exception of sacred items, burial goods, and human remains, which will be addressed in the Cultural Resources Treatment and Monitoring Agreement required by Mitigation Measure CUL-2, collected during the grading monitoring program and from any previous archaeological studies or excavations on the project site shall be curated according to the current professional repository standards. The collections and associated records shall be transferred, including title, to the Pechanga Tribe's curation facility that meets the standards set forth in 36 Code of Federal Regulations (CFR) Part 79 for federal repositories.

~~**CUL-5**: All sacred sites, should they be encountered within the project site, shall be avoided and preserved as the preferred mitigation, if feasible as determined by a qualified professional in consultation with the Pechanga. To the extent that a sacred site cannot be feasibly preserved in place or left in an undisturbed state, mitigation measures shall be required pursuant to and consistent with Public Resources Code Section 21083.2 and CEQA Guidelines Sections 15064.5 and 15126.4.~~

CUL-6: If inadvertent discoveries of cultural or archaeological resources are made, the project applicant, project archaeologist, and Pechanga Tribe shall assess the significance of the resources and meet and confer regarding the appropriate treatment (i.e., preservation, avoidance. and/or mitigation for the resources). Cultural and archaeological resources are inadvertent discoveries when they were not anticipated to be found during the project's construction activities (e.g. grading, excavation). This may include previously unknown sacred sites and items, midden deposits, artifacts, hearths, bedrock outcrops, human remains and other resources, etc.

Consistent with California Public Resources Code Section 21083.2(b) and Assembly Bill 52 (Chapter 532. Statutes of 2014), avoidance shall be the preferred method of preservation for tribal cultural resources and archaeological resources. If the project applicant, project archaeologist, and Pechanga Tribe cannot agree on the significance of, avoidance of, or mitigation for such resources, then the project applicant and the Pechanga Tribe shall agree on an independent qualified archaeologist who shall make the determination based on the information submitted by the Pechanga Tribe, the religious beliefs, customs, and practices of the Pechanga Tribe, and the provisions of the California Environmental Quality Act regarding tribal cultural and archaeological resources. The decision of the independent qualified archeologist may be challenged by the City, project applicant or the Pechanga Tribe through any appropriate legal means including, but not limited to, a temporary restraining order (TRO) or a Preliminary Injunction. All sacred sites, should they be encountered within the project site, shall be avoided and preserved as the preferred mitigation, if feasible.

Pages 3.4-19

The first paragraph under Impact 3.4-2 on page 3.4-19 of the Draft EIR is revised as follows to correctly identify the depth of ground disturbance to be between four and 15 feet.

The records search conducted by NHM staff indicated that no fossil localities have been previously identified within the project site. However, there are surface exposures of the Pauba Formation on the project site, which is known to contain significant vertebrate fossils. The depth of ground disturbance within the project site is proposed to range between four and 15 feet in depth and has the potential to impact the Pauba Formation. This potential effect on the Pauba Formation could result in significant impacts to unknown paleontological resources.

Pages 3.4-19 and 3.4-20

Based on the renumbering of the mitigation measures in Section 3.4, Mitigation Measures CUL-6, CUL-7, CUL-8 and CUL-9 are revised to CUL-7, CUL-8, CUL-9 and CUL-10, respectively.

CUL-~~6~~7: The project applicant shall retain a qualified paleontologist (in accordance with the Society of Vertebrate Paleontologists) to monitor all initial ground-disturbing activities in native soils or sediments. If the paleontologist, upon observing initial earthwork, determines

there is low potential for discovery, no further action shall be required and the paleontologist shall submit a memo to the City confirming findings of low potential.

If the qualified paleontologist, upon observing initial earthwork, determines there is a moderate to high potential for discovery, a qualified paleontologist or paleontological monitor (retained by the applicant) shall monitor all mass grading and excavation activities. Monitoring will be conducted in areas of grading or excavation in undisturbed formation sediments, as well as where over-excavation of surficial alluvial sediments will encounter these formations in the subsurface. Paleontological monitors shall be equipped to salvage fossils as they are unearthed to avoid construction delays and to remove samples of sediment that are likely to contain the remains of small fossil invertebrates and vertebrates. The monitor must be empowered to temporarily halt or divert equipment to allow removal of abundant or large specimens in a timely manner. Monitoring may be reduced if the potentially fossilferous units are not present in the subsurface, or if present, are determined on exposure and examination by qualified paleontological personnel to have low potential to contain fossil resources.

Should any paleontological resources (i.e., fossils) be uncovered during project construction activities, all work within a 100-foot radius of the discovery site shall be halted or diverted to other areas on the site and the City shall be immediately notified. The qualified paleontologist shall evaluate the finds and recommend appropriate next steps to ensure that the resource is not substantially adversely impacted, including but not limited to avoidance, preservation in place, excavation, documentation, curation, data recovery, or other appropriate measures. Further, ground disturbance shall not resume within a 100-foot radius of the discovery site until an agreement has been reached between the project applicant, the qualified paleontologist, and the City as to the appropriate preservation or mitigation measures to ensure that the resource is not substantially adversely impacted.

CUL ~~7~~8: Any recovered paleontological specimens shall be identified to the lowest taxonomic level possible and prepared for permanent preservation. Screen-washing of sediments to recover small invertebrates and vertebrates shall occur if necessary.

CUL ~~8~~9: Identification and curation of specimens into a professional, accredited public museum repository with a commitment to archival conservation and permanent retrievable storage shall occur at an institutional repository approved by the City of Wildomar. The paleontological program shall include a written repository agreement prior to the initiation of mitigation activities.

CUL-~~9~~10: A final monitoring and mitigation report of findings and significance shall be prepared, including lists of all fossils recovered and necessary maps and graphics to accurately record their original location. The report, when submitted to an accepted by the City of Wildomar, shall signify satisfactory completion of the project program to mitigation impacts to any potential nonrenewable paleontological resources (i.e., fossils) that might have been lost or otherwise adversely affected without such a program in place.

Page 3.4-20

At the end of Impact 3.4-3 on page 3.4-20 of the Draft EIR, the following is added:

Mitigation Measure:

The following mitigation measure is added to reduce a less than significant impact to human remains. The measure is included based on an agreement between the City and the Pechanga Tribe.

CUL-11: If human remains are encountered, consistent with California Health and Safety Code Section 7050.5, no further disturbance shall occur until the Riverside County Coroner has made the necessary findings as to origin of the remains. Further, consistent with California Public Resources Code Section 5097.98(b), human remains shall be left in place and free from disturbance until a final decision as to the treatment and disposition has been made.

If the Riverside County Coroner determines the remains to be Native American, the Native American Heritage Commission shall be contacted within twenty-four (24) hours. The Native American Heritage Commission shall immediately identify the "most likely descendant(s)" and notify them of the discovery. The "most likely descendant(s)" shall make recommendations within forty-eight (48) hours, and engage in consultations with the landowner concerning the treatment of the remains, as provided in Public Resources Code Section 5097.98 and the Agreement described in CUL-2.

Page 3.7-14

The first paragraph under Impact 3.7-1 on page 3.7-14 of the Draft EIR is revised to read:

The project site contains gently rolling hills, with elevations varying from 1,300 to 1,350 feet above mean sea level. In general, soil on slopes tends to be less stable and more susceptible to becoming entrained in stormwater runoff. The project would involve the introduction of structures on a currently undeveloped site. Construction activities such as vegetation removal, grubbing, grading and excavation associated with the proposed project would loosen soil structure and expose bare soil, making it potentially more easily eroded by wind and rain, especially on slopes. ~~However, the project would maximize canopy interception and water conservation by preserving existing native trees and shrubs, thereby minimizing vegetation disturbance and associated erosion potential and sedimentation during construction.~~

Page 3.10-33

The reference to three residences along the north side of Catt Road that could be impacted by the substantial noise increase should be four residences. The third sentence in the third paragraph on page 3.10-33 is revised to read:

There are ~~three~~ ~~four~~ residences along the north side of Catt Road that could be impacted by this noise increase.

Page 3.10-35

Based on further review by City staff, a mitigation measure is recommended to potentially reduce the noise level increase in traffic noise along Catt Road north of Clinton Keith Road. Although the mitigation measure is recommended, the City cannot guarantee the necessary wall improvement along Catt Road would be implemented because the homeowner's association may not allow the extension of the block wall under their ownership and control and permission to extend the wall may be denied. In that event, the increase in noise experienced at the four homes would remain significant.

The top of page 3.10-35 of the Draft EIR is revised to read:

Mitigation Measure~~s~~:

~~No feasible mitigation is available.~~

NOI-7: The project applicant shall seek permission from the applicable homeowner's association to extend the height of the existing block wall located along the backyards of the four existing residential properties along the north side of Catt Road. With the homeowner's association's permission, the applicant shall extend the wall by an additional 0.5-foot.

Significance Determination: Significant and unavoidable. Implementation of NOI-7 would reduce the potential increase in noise level at these four homes to less than 5.0 dBA CNEL (see Attachment 4 of this FEIR). However, because the homeowner's association may not allow extension of the block wall under their ownership and control, permission to extend the wall may be denied. In that event, the increase in noise experienced at these four homes would remain significant. However, no other feasible mitigation measures to reduce the noise, other than improvements to the existing noise wall, exist. Therefore, t~~T~~he roadway noise level increase on the residences on the north side of Catt Road would be considered significant and unavoidable. The onsite noise levels associated with project loading dock activities, mechanical HVAC equipment, trash-pick up and parking lot cleaning activities, and parking lot activities would be less than significant.

Page 3.12-17

The number of projected residents and employees with the implementation of the proposed project included some inconsistent numbers. Therefore, the third sentence in the first paragraph under Impact 3.12-6 on page 3.12-17 of the Draft EIR is revised as follows:

The proposed project will result in the generation of approximately ~~593~~ 630 new residents and approximately ~~238~~ 237 new employees.

Page 4-10

The third and fourth paragraphs under Cultural Resources on page 4-10 of the Draft EIR is revised to read:

> No known fossil localities have been found on the project site. However, exposures of the Pauba Formation that is known to contain significant vertebrate fossils that could be impacted. The Pauba Formation is also located in the project vicinity and could be impacted by cumulative development. This potential cumulative impact to paleontological resources could be significant. Because the proposed project includes the implementation of Mitigation Measures CUL-~~6~~7 through CUL-~~9~~10, the project's contribution to potential cumulative impacts on paleontological resources would be less than cumulatively considerable, and thus less than cumulatively significant.
>
> No known human remains exist on the project site. However, since the project includes excavation, it is possible, but unlikely, that construction activities could impact unknown human remains. The impact on human remains is also a potential for cumulative development. However, since the treatment of human resources is governed by Public Resources Code Section 5097.98 and Health and Safety Code Section 7050.5 and Mitigation Measure CUL-11 was added even though the potential impacts to human remains are less than significant, the potential to impact human remains would be less than cumulatively significant.

Page 4-18

As discussed above, Mitigation Measure NOI-7 has been added to potentially reduce the project's potential increase in noise level at the four existing residences along the north side of Catt Road to less than 5.0 dBA CNEL. This measure will also reduce the cumulative increase in noise along the north side of Catt Road to less than 5.0 dBA CNEL.

> ***Mitigation Measures:***
>
> Implementation of Mitigation Measures NOI-1 through NOI-4 and NOI-6 is required. Although not require because the impact would be less than significant, the implementation of Mitigation Measure NOI-5 would ensure that interior noise levels within the proposed residential units would meet the interior noise standards.
>
> In addition, implementation of Mitigation Measure NOI-7 is required, if permitted by the homeowner's association who has ownership and control of the existing wall along the north side of Catt Road.

Significance after Mitigation: Significant and unavoidable. Implementation of NOI-7 would reduce the potential increase in noise level at these four homes to less than 5.0 dBA CNEL (see Attachment 4 of this FEIR). However, because the homeowner's association may not allow extension of the block wall under their ownership and control, permission to extend the wall may be denied. In that event, the increase in noise experienced at these four homes would remain significant. However, no other feasible mitigation measures to reduce the noise, other than improvements to the existing noise wall, exist. Therefore, t~~T~~he roadway noise level increase on the residences on the north side of Catt Road would be considered significant and unavoidable. ~~for the increase in cumulative traffic noise levels on existing residences along Catt Road, north of Clinton-Keith Road. No feasible measure is available to reduce this potential impact. Furthermore, although the noise level increase is significant, the noise level is below the City 65 dBA CNEL noise standard for residential uses.~~

SECTION 5
Mitigation Monitoring and Reporting Program

CEQA Requirements

Section 15091(d) and Section 15097 of the CEQA Guidelines require a public agency to adopt a program for monitoring or reporting on the changes it has required in the project or conditions of approval to substantially lessen significant environmental effects. This Mitigation Monitoring and Reporting Program (MMRP) summarizes the mitigation commitments identified in the City of Wildomar Westpark Promenade Project (proposed project) Final Environmental Impact Report (EIR) (State Clearinghouse No. 2014021022) which constitutes the Response to Comments and the Draft EIR.

The columns in the MMRP table provide the following information:

- **Mitigation Measure(s):** The action(s) that will be taken to reduce the impact to a less-than-significant level. Mitigation measures are presented in the same order as they occur in the Draft EIR.

- **Responsible for Monitoring:** The agency or private entity responsible for ensuring implementation of the mitigation measure. However, until the mitigation measures are completed, the City of Wildomar, as the CEQA Lead Agency, remains responsible for ensuring that implementation of the mitigation measures occur in accordance with the MMRP (CEQA Guidelines, Section 15097(a)).

- **Monitoring Frequency:** How often the responsible agency or private entity should monitor mitigation measure implementation.

- **Timing of Verification:** The general timing and/or schedule for conducting and verifying each implementing action.

- **Method of Verification:** The appropriate steps to implement and verify compliance with the mitigation measures.

- **Verified Date/Initials:** Where the appropriate agency or private entity will document verification of the implementing action.

MITIGATION MONITORING AND REPORTING PROGRAM

Mitigation Measure	Responsible for Monitoring	Monitoring Frequency	Timing of Verification	Method of Verification	Verified Date/Initials
Air Quality					
AQ-1: The applicant, in coordination with the City, shall cooperate with local transit agencies to determine bus routing in the project area that can accommodate bus stop(s) at the project access points. The project shall provide bus passenger benches and shelters at any approved locations.	City Planning and Building and Safety Departments	Once	Prior to issuance of building permit	City review and coordination with appropriate transit agencies	
AQ-2: The project applicant shall provide preferred parking for low-emitting and fuel efficient vehicles. The number and location of preferred parking spaces must be identified by the project proponent and be approved by the City of Wildomar prior to issuance of building permits.	City Planning and Building and Safety Departments	Once	Prior to issuance of building permit	City review and approval of preferred parking plans	
AQ-3: The project applicant shall provide secure bicycle racks. The number and location of bicycle racks must be identified by the project proponent and be approved by the City of Wildomar prior to issuance of building permits.	City Planning and Building and Safety Departments	Once	Prior to issuance of building permit	City review and approval of number and location of bicycle racks	
Biological Resources					
BIO-1: Per the Burrowing Owl Survey Instructions for the MSHCP and MSHCP Species-Specific Objective 6, preconstruction presence/absence surveys for burrowing owl within suitable habitat areas of the project site, shall be conducted within 30 days prior to disturbance. Take of active nests shall be avoided. Passive relocation (use of one-way doors and collapse of burrows) shall occur when owls are present outside the nesting season. If construction is delayed or suspended for more than 30 days after the survey, the area shall be resurveyed. Surveys shall be completed for occupied burrowing owl burrows within all construction areas and within 500 feet (150 meters) of the project work areas (where possible and appropriate based on habitat). All occupied burrows will be mapped on an aerial photo.	City Planning Department	As needed	30 days prior to the start of ground disturbing activities	Review of pre-construction survey for burrowing owls	

MITIGATION MONITORING AND REPORTING PROGRAM (CONTINUED)

Mitigation Measure	Responsible for Monitoring	Monitoring Frequency	Timing of Verification	Method of Verification	Verified Date/Initials
BIO-2: If burrowing owls are identified during the 30-day preconstruction survey, the applicant shall take the following actions to offset impacts prior to ground disturbance: Active nests and paired owls exhibiting breeding activities within the areas scheduled for disturbance or degradation shall be avoided from February 1 through August 31, and a minimum 500-meter buffer shall be provided until fledging has occurred. Following fledging, owls may be passively relocated by a qualified biologist. If impacts on occupied burrows in the non-nesting period are unavoidable, on-site passive relocation techniques may be used if approved by the CDFW to encourage owls to move to alternative burrows outside of the impact area. However, no occupied burrows shall be disturbed during the nesting season. A qualified biologist must verify through noninvasive methods that the burrow is no longer occupied. If relocation of the owls is approved for the site by the CDFW, the applicant shall hire a qualified biologist to prepare a plan for relocating the owls to a suitable site. The relocation plan must include all of the following: • The location of the nest and owls proposed for relocation. • The location of the proposed relocation site. • The number of owls involved and the time of year when the relocation is proposed to take place. • The name and credentials of the biologist who will be retained to supervise the relocation. • The proposed method of capture and transport for the owls to the new site. • A description of site preparation at the relocation site (e.g., enhancement of existing burrows, creation of artificial burrows, one-time or long-term vegetation control).	City Planning Department	As needed	Prior to the start of ground disturbing activities	Review of relocating plan for burrowing owls and documentation of coordination with CDFW	

MITIGATION MONITORING AND REPORTING PROGRAM (CONTINUED)

Mitigation Measure	Responsible for Monitoring	Monitoring Frequency	Timing of Verification	Method of Verification	Verified Date/Initials
• A description of efforts and funding support proposed to monitor the relocation.					
BIO-3: A qualified biologist shall conduct a preconstruction clearance (trap and release) survey throughout the project site, including a 500-foot buffer (where access is allowed) for coast horned lizard and San Diego black-tailed jackrabbit. If the species are found onsite during the survey, the animals shall be relocated by a qualified biologist. The relocation areas and survey methods shall be developed in consultation with CDFW.	City Planning Department	Once	Prior to the start of ground disturbing activities	Verification of communication with CDFW. Review of pre-construction survey for coast horned lizard and San Diego black-tailed jackrabbit	
BIO-4: Impacts to raptors and migratory birds during nesting activities shall be avoided by implementation of one of the following measures: • All construction, vegetation disturbance, and ground-disturbing activities shall take place outside of the general avian breeding season (February 1-August 30). • If construction, vegetation disturbance, or ground disturbing activities are necessary during the breeding season (February 1-August 30), a focused survey for active nests of raptors and migratory birds and sign of nesting behavior shall be conducted by a qualified, City-approved biologist. The survey shall occur no more than 3 days prior to any construction, vegetation disturbance or ground-disturbing activities. If active nest(s) (with eggs or fledglings) are identified within the project site, they shall not be disturbed until the young have hatched and fledged (matured to a state that they can leave the nest on their own), as determined by the City-approved biologist. A 500-foot construction setback from any active nesting location shall be adhered to in order to avoid disturbance of the nest until the young have fledged or the nest has failed, as determined by a qualified biologist. If no active nests are identified, construction may commence.	City Planning Department	Once	Prior to the start of ground disturbing activities	Review of pre-construction survey for active nests of raptors and migratory birds and sign of nesting behavior	

MITIGATION MONITORING AND REPORTING PROGRAM (CONTINUED)

Mitigation Measure	Responsible for Monitoring	Monitoring Frequency	Timing of Verification	Method of Verification	Verified Date/Initials
BIO-5: Prior to the issuance of a grading permit, the project applicant shall submit a detailed restoration plan that mitigates for the loss of approximately 0.36 acre of jurisdictional waters at a ratio acceptable and approved by the resource agencies (i.e., USACE, RWQCB and CDFW), but no less than 1:1 ratio. The restoration plan shall also be approved by the resource agencies prior to the issuance of a grading permit. The project applicant intends to restore and enhance riverine/riparian habitat on lands owned by the Elsinore Murrieta-Anza Resource Conservation District (EMARCD) located along Clinton Keith Road in Riverside County, or on other lands owned by EMARCD or another conservation district within the watershed if the land along Clinton Keith Road is not available. The restoration and enhancement of habitat is proposed within drainages located on the EMARCD lands to ensure a net gain of riparian/riverine habitat acreage in the region. A detailed restoration plan will be prepared that will provide a schedule for site preparation and planting. Performance standards will include: (a) increase the canopy cover of native riverine vegetation within the mitigation area by 25 percent with 80 percent survival of planted species after five years following installation, and (b) increase coverage of herbaceous vegetation within the mitigation areas by 25 percent after five years following installation. The restoration plan will also include a maintenance and monitoring schedule for the proposed mitigation. Long-term management of the restoration area shall occur.	City Planning Department	Once	Prior to issuance of grading permit.	Review of Restoration Plan	
BIO-6: Prior to the issuance of a grading plan, the project applicant shall provide a plan to the City of Wildomar to demonstrate compliance with the MSHCP Urban/Wildlands Interface Guidelines. This plan shall provide provisions to ensure that indirect impacts to off-site drainage channels and associated riparian/riverine habitats downstream be minimized to the satisfaction of the City of Wildomar.	City Planning Department	Once	Prior to issuance of grading permit.	Review of MSHCP Urban/Wildlands Interface Consistency Plan	

MITIGATION MONITORING AND REPORTING PROGRAM (CONTINUED)

Mitigation Measure	Responsible for Monitoring	Monitoring Frequency	Timing of Verification	Method of Verification	Verified Date/Initials
Cultural Resources					
CUL-1: An archaeological monitor shall be present during all earthmoving activities within the project site. The monitor shall work under the direct supervision of a qualified archaeologist (defined as a cultural resources professional who meets the Secretary of the Interior's Professional Qualifications Standards for archaeology [U.S. Department of the Interior, 2008]). The monitor shall be empowered to temporarily halt or redirect construction work in the vicinity of any find until the qualified archaeologist can evaluate it. In the event of a new find, excavation and treatment of the resource shall be in accordance with Mitigation Measures CUL-3 through CUL-5.	City Planning Director and Building Official	Once	Prior to issuance of grading permit During construction grading and excavation	Proof of retaining an approved cultural resource monitor	
CUL-2: At least 30 days prior to the issuance of a grading permit, the project applicant shall contact both the Pechanga to notify them of grading, excavation, and the monitoring program and to coordinate with the Pechanga to develop a Cultural Resources Treatment and Monitoring Agreement. The agreement shall include, but not be limited to, outlining provisions and requirements for addressing the treatment of cultural resources; project grading and development scheduling; terms of compensation for the monitors; treatment and final disposition of any cultural resources, sacred sites, and human remains discovered on the site; and establishing on-site monitoring provisions and/or requirements for professional tribal monitors during all ground-disturbing activities. A copy of this signed agreement shall be provided to the Planning Director and Building Official prior to the issuance of the first grading permit.	City Planning Department	Once	30 days prior to issuance of grading permit	Proof of Cultural Resources Treatment and Monitoring Agreement	
CUL-3: Prior the issuance of any grading permit, the project archaeologist shall file a pre-grading report with the City to document the proposed methodology for grading activity observation which will be determined in consultation with the Pechanga Tribe. The archaeological monitor and a Pechanga Tribal monitor will have the authority to temporarily halt and redirect grading activities in order to evaluate the significance of any archaeological cultural resources discovered on	City Planning Department	Once	Prior to issuance of grading permit	File a Pre-Grading Report for cultural resources	

MITIGATION MONITORING AND REPORTING PROGRAM (CONTINUED)

Mitigation Measure	Responsible for Monitoring	Monitoring Frequency	Timing of Verification	Method of Verification	Verified Date/Initials
the project site. Tribal and archaeological monitors shall be allowed to monitor all grading, excavation and groundbreaking activities.					
CUL-4: If during grading or construction activities cultural resources are discovered on the project site, work shall be halted immediately within 50 feet of the discovery and the resources shall be evaluated by a qualified archaeologist (retained by the applicant) and the Pechanga. Any unanticipated cultural resources that are discovered shall be evaluated and a final report prepared by the qualified archaeologist. The report shall include a list of the resources discovered, documentation of each site/locality, and interpretation of the resources identified, and the method of preservation and/or recovery for identified resources. In the event the significant resources are recovered and if the qualified archaeologist and/or the Pechanga determines the resources to be historical or unique, avoidance and/or mitigation shall be required pursuant to and consistent with CEQA Guidelines Section 15064.5 and 15126.4, Public Resources Code Section 21083.2, and the Cultural Resources Treatment and Monitoring Agreement required by Mitigation Measure CUL-2.	City Planning Department	During grading and construction	Prior to issuance of grading permit During grading and construction	Consult with project archaeologist and involved tribal representatives as appropriate and file final report	
CUL-5: All cultural resources, with the exception of sacred items, burial goods, and human remains, which will be addressed in the Cultural Resources Treatment and Monitoring Agreement required by Mitigation Measure CUL-2, collected during the grading monitoring program and from any previous archaeological studies or excavations on the project site shall be curated according to the current professional repository standards. The collections and associated records shall be transferred, including title, to the Pechanga Tribe's curation facility that meets the standards set forth in 36 Code of Federal Regulations (CFR) Part 79 for federal repositories.	City Planning Department	During grading and construction	Prior to issuance of grading permit	Consult with project archaeologist and involved tribal representatives as appropriate	

MITIGATION MONITORING AND REPORTING PROGRAM (CONTINUED)

Mitigation Measure	Responsible for Monitoring	Monitoring Frequency	Timing of Verification	Method of Verification	Verified Date/Initials
CUL-6: If inadvertent discoveries of cultural or archaeological resources are made, the project applicant, project archaeologist, and Pechanga Tribe shall assess the significance of the resources and meet and confer regarding the appropriate treatment (i.e., preservation, avoidance, and/or mitigation for the resources). Cultural and archaeological resources are inadvertent discoveries when they were not anticipated to be found during the project's construction activities (e.g. grading, excavation). This may include previously unknown sacred sites and items, midden deposits, artifacts, hearths. bedrock outcrops, human remains and other resources, etc. Consistent with California Public Resources Code Section 21083.2(b) and Assembly Bill 52 (Chapter 532. Statutes of 2014), avoidance shall be the preferred method of preservation for tribal cultural resources and archaeological resources. If the project applicant, project archaeologist, and Pechanga Tribe cannot agree on the significance of, avoidance of, or mitigation for such resources, then the project applicant and the Pechanga Tribe shall agree on an independent qualified archaeologist who shall make the determination based on the information submitted by the Pechanga Tribe, the religious beliefs, customs, and practices of the Pechanga Tribe, and the provisions of the California Environmental Quality Act regarding tribal cultural and archaeological resources. The decision of the independent qualified archeologist may be challenged by the City, project applicant or the Pechanga Tribe through any appropriate legal means including, but not limited to, a temporary restraining order (TRO) or a Preliminary Injunction. All sacred sites, should they be encountered within the project site, shall be avoided and preserved as the preferred mitigation, if feasible.	City Planning Department	During grading and construction	Prior to issuance of grading permit	Consult with project archaeologist and involved tribal representatives as appropriate	
CUL-7: The project applicant shall retain a qualified paleontologist (in accordance with the Society of Vertebrate Paleontologists) to monitor all initial ground-disturbing activities in native soils or sediments. If the paleontologist, upon observing initial earthwork, determines there is	City Planning Department	During grading and construction	Prior to issuance of grading permit	Consult with project paleontologist as appropriate	

MITIGATION MONITORING AND REPORTING PROGRAM (CONTINUED)

Mitigation Measure	Responsible for Monitoring	Monitoring Frequency	Timing of Verification	Method of Verification	Verified Date/Initials
low potential for discovery, no further action shall be required and the paleontologist shall submit a memo to the City confirming findings of low potential. If the qualified paleontologist, upon observing initial earthwork, determines there is a moderate to high potential for discovery, a qualified paleontologist or paleontological monitor (retained by the applicant) shall monitor all mass grading and excavation activities. Monitoring will be conducted in areas of grading or excavation in undisturbed formation sediments, as well as where over-excavation of surficial alluvial sediments will encounter these formations in the subsurface. Paleontological monitors shall be equipped to salvage fossils as they are unearthed to avoid construction delays and to remove samples of sediment that are likely to contain the remains of small fossil invertebrates and vertebrates. The monitor must be empowered to temporarily halt or divert equipment to allow removal of abundant or large specimens in a timely manner. Monitoring may be reduced if the potentially fossilferous units are not present in the subsurface, or if present, are determined on exposure and examination by qualified paleontological personnel to have low potential to contain fossil resources. Should any paleontological resources (i.e., fossils) be uncovered during project construction activities, all work within a 100-foot radius of the discovery site shall be halted or diverted to other areas on the site and the City shall be immediately notified. The qualified paleontologist shall evaluate the finds and recommend appropriate next steps to ensure that the resource is not substantially adversely impacted, including but not limited to avoidance, preservation in place, excavation, documentation, curation, data recovery, or other appropriate measures. Further, ground disturbance shall not resume within a 100-foot radius of the discovery site until an agreement has been reached between the project applicant, the qualified paleontologist, and the City as to the appropriate preservation or mitigation measures to ensure					

MITIGATION MONITORING AND REPORTING PROGRAM (CONTINUED)

Mitigation Measure	Responsible for Monitoring	Monitoring Frequency	Timing of Verification	Method of Verification	Verified Date/Initials
that the resource is not substantially adversely impacted.					
CUL- 8: Any recovered paleontological specimens shall be identified to the lowest taxonomic level possible and prepared for permanent preservation. Screen-washing of sediments to recover small invertebrates and vertebrates shall occur if necessary.	City Planning Department	Ongoing	During grading and excavation construction activities	Consult with project archaeologist and involved tribal representatives as appropriate	
CUL-9: Identification and curation of specimens into a professional, accredited public museum repository with a commitment to archival conservation and permanent retrievable storage shall occur at an institutional repository approved by the City of Wildomar. The paleontological program shall include a written repository agreement prior to the initiation of mitigation activities.	City Planning Department	Ongoing	During grading activities	Consult with project paleontologist and involved tribal representatives as appropriate	
CUL-10: A final monitoring and mitigation report of findings and significance shall be prepared, including lists of all fossils recovered and necessary maps and graphics to accurately record their original location. The report, when submitted to an accepted by the City of Wildomar, shall signify satisfactory completion of the project program to mitigation impacts to any potential nonrenewable paleontological resources (i.e., fossils) that might have been lost or otherwise adversely affected without such a program in place.	City Planning Department	Once	After grading and construction	Review of final monitoring and mitigation report of findings	
CUL-11: If human remains are encountered, consistent with California Health and Safety Code Section 7050.5, no further disturbance shall occur until the Riverside County Coroner has made the necessary findings as to origin of the remains. Further, consistent with California Public Resources Code Section 5097.98(b), human remains shall be left in place and free from disturbance until a final decision as to the treatment and disposition has been made. If the Riverside County Coroner determines the remains to be Native American, the Native American Heritage Commission shall be contacted within twenty-four (24) hours. The Native American Heritage Commission shall	City Planning Department	Ongoing	During grading and excavation construction activities	Consult with project archaeologist and involved tribal representatives as appropriate	

MITIGATION MONITORING AND REPORTING PROGRAM (CONTINUED)

Mitigation Measure	Responsible for Monitoring	Monitoring Frequency	Timing of Verification	Method of Verification	Verified Date/Initials
immediately identify the "most likely descendant(s)" and notify them of the discovery. The "most likely descendant(s)" shall make recommendations within forty-eight (48) hours, and engage in consultations with the landowner concerning the treatment of the remains, as provided in Public Resources Code Section 5097.98 and the Agreement described in CUL-2.					
Noise					
NOI-1: The operator of the northern major retail building shall not allow medium-box truck and semi-trucks to engage in unloading activities during nighttime hours of 10 PM through 7 AM.	City Building Official	Ongoing	During grading and construction activities	Review and approval of business operations.	
NOI-2: Prior to the issuance of a building permit, the project applicant shall submit engineering drawings and acoustical specifications for the project's mechanical HVAC equipment to demonstrate that the equipment design combined with distance separation and parapets or screen walls would be sufficient to ensure that the applicable City of Wildomar's noise standards would not be exceeded at any adjacent off-site residential uses.	City Engineer or Designee	Once	Prior to issuance of building permit	Applicant shall submit for City review and approval, engineering drawings and acoustical specifications for HVAC equipment	
NOI-3: The project applicant shall confine trash pick-up activities at the project site to the hours of 7:00 AM through 10:00 PM, while parking lot sweeping closest to residential uses shall be similarly confined to the hours of 7:00 AM through 10:00 PM.	City Official Designee	Ongoing	As needed	Verification during random compliance visits.	
NOI-4: Prior to the issuance of a building permit for the residential uses within Parcel 3, the project applicant shall include, within building plans, that a 6.5-foot noise wall be constructed around the exterior recreational use patio associated with the community area proposed within Parcel 3.	City Building and Safety Department	Once	Prior to issuance of building permit	Applicant shall submit for City review and approval, building plans	
NOI-5: Prior to the issuance of a building permit, the project applicant shall demonstrate through the preparation of a supplemental acoustical analysis that the interior noise threshold of 45 dBA will be met within proposed residences in Parcels 2 and 3.	City Building and Safety Department	Ongoing	Prior to issuance of building permit	Applicant shall submit for City review and approval, a supplemental acoustical analysis	

MITIGATION MONITORING AND REPORTING PROGRAM (CONTINUED)

Mitigation Measure	Responsible for Monitoring	Monitoring Frequency	Timing of Verification	Method of Verification	Verified Date/Initials
NOI-6: If the project's restaurants propose an outdoor venue, the following design features shall be implemented to ensure compliance with the City of Wildomar noise/land use compatibility standards: • Site outdoor eating areas at a setback distance of 350 feet or greater from the I-15 Freeway centerline to provide a 69 dBA CNEL outdoor noise exposure, or If an outdoor venue were sited at a distance closer than 350 feet from the I-15 Freeway centerline the following measures would achieve necessary exterior noise mitigation: • Orient patios on the east side of the restaurant away from the I-15 Freeway such that the restaurant structure itself would provide needed noise attenuation, or • Construct a five-foot Plexiglas wall to shield the patios from freeway traffic. The Plexiglas wall shall provide a minimum attenuation in noise levels of 5 dBA.	City Building and Safety Department	As needed	Prior to issuance of building permits	Review and approval of building plans	
NOI-7: The project applicant shall seek permission from the applicable homeowner's association to extend the height of the existing block wall located along the backyards of the four existing residential properties along the north side of Catt Road. With the homeowner's association's permission, the applicant shall extend the wall by an additional 0.5-foot.	City Building and Safety Department	Once	Prior to issuance of building permits	Applicant shall submit for City review and approval, building plan for wall extension	
Transportation and Traffic					
TRA-1: The following improvements are required to reduce impacts under the existing plus project conditions on the study area intersections. For each improvement, the project applicant, as directed by the City Engineer, shall either fully fund the improvement, construct the improvement, pay the applicable City Development Fee (DIF) or pay a pro-rated share of the improvement, as identified below. **Catt Road-Arya Road/Clinton Keith Road** • The project applicant, as directed by the	City Engineer or Designee	Once	Prior to issuance of first building permit	Application to City for construction of any improvement	

MITIGATION MONITORING AND REPORTING PROGRAM (CONTINUED)

Mitigation Measure	Responsible for Monitoring	Monitoring Frequency	Timing of Verification	Method of Verification	Verified Date/Initials
City Engineer, shall construct or provide a fair share prior to the approval of a final map for the modification of the northbound striping to provide a dedicated left turn lane and a shared through/right turn lane. • The project applicant, as directed by the City Engineer, shall construct or provide a fair share prior to the approval of a final map for a separate southbound left turn lane. **Inland Valley Drive/Prielipp Road** • The project applicant, as directed by the City Engineer, shall construct prior to the approval of a final map or pay the applicable City Development Impact Fee (DIF) prior to issuance of a building permit for the installation of a traffic signal. • The project applicant, as directed by the City Engineer, shall construct prior to the approval of a final map or pay a fair share prior to issuance of a building permit for the modification of the westbound striping to provide one through lane and one right turn lane. **I-15 Southbound Ramps/Baxter Road** • The project applicant shall provide its fair share toward the funding of the installation of an interim traffic signal. The fair share contribution shall be determined by the City of Wildomar City Engineer. The project applicant shall provide its fair share toward the funding of the addition of an interim separate eastbound right turn lane. The fair share contribution shall be determined by the City of Wildomar City Engineer.					
TRA-2: The following improvements are required to reduce impacts under the existing plus ambient plus project conditions on the study area intersections. For each improvement, the project applicant, as directed by the City Engineer, shall either fully fund the improvement, construct the improvement, pay the applicable City	City Engineer or Designee	Once	Prior to issuance of first building permit	Application to City for construction of any improvement	

MITIGATION MONITORING AND REPORTING PROGRAM (CONTINUED)

Mitigation Measure	Responsible for Monitoring	Monitoring Frequency	Timing of Verification	Method of Verification	Verified Date/Initials
Development Impact Fee (DIF) or pay a pro-rated share of the improvement, as identified below. **Catt Road-Arya Road/Clinton Keith Road** Implementation of Mitigation Measure TRA 1 is required. **Inland Valley Drive/Prielipp Road** Implementation of Mitigation Measure TRA 1 is required. **Monte Vista Drive/Baxter Road** • The project applicant, as directed by the City Engineer, shall construct prior to the approval of a final map or pay the applicable City Development Impact Fee (DIF) prior to issuance of a building permit for the installation of a traffic signal. **I-15 Northbound Ramps/Baxter Road** • The project applicant shall provide its fair share toward the funding of the installation of an interim traffic signal. The fair share contribution shall be determined by the City of Wildomar City Engineer. • The project applicant shall provide its fair share toward the funding of the addition of an interim separate eastbound right turn lane. The fair share contribution shall be determined by the City of Wildomar City Engineer. **I-15 Southbound Ramps/Baxter Road** Implementation of Mitigation Measure TRA-1 is required.					
TRA-3: The following improvements are required to reduce impacts under the existing plus ambient plus project plus cumulative (2017) conditions on the study area intersections. For each improvement, the project applicant, as directed by the City Engineer, shall either fully the improvement, construct the improvement, pay the applicable City Development Impact Fee (DIF) or pay a pro-rated share of the improvement, as	City Engineer or Designee	Once	Prior to issuance of first building permit	Application to City for construction of any improvement	

MITIGATION MONITORING AND REPORTING PROGRAM (CONTINUED)

Mitigation Measure	Responsible for Monitoring	Monitoring Frequency	Timing of Verification	Method of Verification	Verified Date/Initials
identified below. **Hidden Springs Road/Clinton Keith Road** • The project applicant, as directed by the City Engineer, shall construct prior to the approval of a final map or pay a fair share prior to issuance of a building permit for a second southbound left turn lane. **Catt Road-Arya Road/Clinton Keith Road** Implementation of Mitigation Measure TRA 1 is required. **Inland Valley Drive/Clinton Keith Road** The project applicant, as directed by the City Engineer, shall construct prior to the approval of a final map or pay the applicable City Development Impact Fee (DIF) for a second westbound through lane. **Inland Valley Drive/Prielipp Road** Implementation of Mitigation Measure TRA 1 is required. **Monte Vista Drive/Baxter Road** Implementation of Mitigation Measure TRA 2 is required. **I-15 Northbound Ramps/Baxter Road** Implementation of Mitigation Measure TRA 2 is required. **I-15 Southbound Ramps/Baxter Road** Implementation of Mitigation Measure TRA 1 is required. **Northbound I-15 south of Clinton Keith Road** No feasible mitigation is available.					
TRA-4: The following improvements would mitigate the deficient intersections to operate at an acceptable level of service. The following improvements are required to reduce impacts	City Engineer or Designee	Once	Prior to issuance of first building permit	Application to City for construction of any improvement	

MITIGATION MONITORING AND REPORTING PROGRAM (CONTINUED)

Mitigation Measure	Responsible for Monitoring	Monitoring Frequency	Timing of Verification	Method of Verification	Verified Date/Initials
under the Horizon Year (2035) with Project conditions on the study area intersections. For each improvement, the project applicant, as directed by the City Engineer, shall either fully fund the improvement, construct the improvement, pay the applicable City Development Fee (DIF) or pay a pro-rated share of the improvement, as identified below. **Palomar Street/Clinton Keith Road** • The project applicant, as directed by the City Engineer, shall construct prior to the approval of a final map or pay a fair share prior to issuance of a building permit for a second southbound left turn lane. • The project applicant, as directed by the City Engineer, shall construct prior to the approval of a final map or pay a fair share prior to issuance of a building permit for a separate eastbound right turn lane. • The project applicant, as directed by the City Engineer, shall construct prior to the approval of a final map or pay a fair share prior to issuance of a building permit for the modification to the traffic signal to provide a westbound right turn overlap phase. **Hidden Springs Road/Clinton Keith Road** Implementation of Mitigation Measure TRA-3 is required. • The project applicant, as directed by the City Engineer, shall construct prior to the approval of a final map or pay the applicable City Development Impact Fee (DIF) prior to issuance of a building permit for the modification of the traffic signal to provide a westbound right turn overlap phase. **Catt Road-Arya Road / Clinton Keith Road** Implementation of Mitigation Measure TRA-1 is required.					

MITIGATION MONITORING AND REPORTING PROGRAM (CONTINUED)

Mitigation Measure	Responsible for Monitoring	Monitoring Frequency	Timing of Verification	Method of Verification	Verified Date/Initials
Inland Valley Drive/Clinton Keith Road Implementation of Mitigation Measure TRA-3 is required. • The project applicant, as directed by the City Engineer, shall construct prior to the approval of a final map or pay the applicable City Development Impact Fee (DIF) prior to issuance of a building permit for the modification of the northbound striping to provide one left turn lane and one shared left/right turn lane. **Inland Valley Drive/Prielipp Road** Implementation of Mitigation Measure TRA-1 is required. **Monte Vista Drive/Baxter Road** Implementation of Mitigation Measure TRA-2 is required. **I-15 Northbound Ramps/Baxter Road** Implementation of Mitigation Measure TRA-1 is required. **I-15 Southbound Ramps/Baxter Road** Implementation of Mitigation Measure TRA-1 is required. **Northbound and Southbound I-15 mainline north and south of Clinton Keith Road** No feasible mitigation is available.					
TRA-5: Prior to the issuance of a grading permit, the project applicant shall prepare and obtain City approval of a traffic management plan (TMP) to minimize potential impacts during construction. Included among the provisions, the project's contractor will coordinate with the City of Wildomar, Riverside County, and local police, fire, and emergency medical service providers regarding construction scheduling and any other practical measures to maintain adequate access to properties and response times. The TMP may also limit construction activity during typical	City Planning Department	Once	Prior to issuance of grading permit	City review and approval of Traffic Management Plan	

MITIGATION MONITORING AND REPORTING PROGRAM (CONTINUED)

Mitigation Measure	Responsible for Monitoring	Monitoring Frequency	Timing of Verification	Method of Verification	Verified Date/Initials
weekday morning and evening peak traffic hours that would adversely affect traffic flow along Clinton Keith Road. The TMP shall include contact information for the general public who may have questions concerning the project and access of their property. Two-way traffic flow through the construction zone shall be maintained throughout the construction period.					

ATTACHMENT 1

Traffic Impact Analysis Appendices A–V

APPENDIX A

SCOPING AGREEMENT

SCOPING AGREEMENT FOR TRAFFIC IMPACT STUDY

This letter acknowledges the City of Wildomar Transportation Department requirements for the traffic impact analysis of the following project.

Case No.
Related Cases -
SP No. **n/a**
EIR No. **n/a**
GPA No. **n/a**
CZ No. **n/a**
Project Name: **Westpark Promenade**
Project Address: **Between Depasquale Rd. & Clinton Keith Road, east of the I-15 Freeway**
Project Description: **191 Multi-Family Residential Units; 16,000 SF High Turnover Restaurant; 17,354 SF Shopping Center and 85,000 sf supermarket**

	Consultant	Developer
Name:	**Trames Solutions, Inc.**	Mr. James C. Kieckhafer
Address:	**Scott Sato**	Golden Eagle Multi-Family Properties, LLC.
	100 E. San Marcos Blvd., Ste. 400	6201 Oak Canyon, Suite 250
	San Marcos, CA 92069	Irvine, CA 92618
Phone No:	**(949) 244-2436**	
Date:	**1/6/2015**	

A. Trip Generation Source: ITE 9th Edition **(See Tables 1 & 2)**

Proposed Land Use: **Mixed Use** Previous Land Use: **Vacant**
Existing Zoning: **CPS** Proposed Zoning: **Mixed Use**

	In	Out	Total	In	Out	Total
AM Trips	**313**	**275**	**588**			**-**
PM Trips	**644**	**567**	**1,211**			**-**

Internal Trip Allowance **YES** (**5** % Trip Discount)
Pass-By Trip Allowance **YES** (**15** % Trip Discount)

B. Trip Geographic Distribution: (See attached exhibit for detailed assignment). **See Figure C**
N _____ S _____ E _____ W _____

C. Background Traffic
Project Build-out Year **2017** Annual Ambient Growth Rate: **2.0** %

Other projects to be analyzed: **To be provided by the City of Wildomar**
Model/Forecast methodology:

D. Study Intersections: (NOTE: Subject to revision after other projects, trip generation and distribution are determined, or comments form other agencies). **See Figure A**

1 **Palomar Rd. (NS)/Clinton Keith Rd. (EW)**
2 **Hidden Springs Dr. (NS)/Clinton Keith Rd. (EW)**
3 **I-15 SB Ramps (NS)/Clinton Keith Rd. (EW)**
4 **I-15 NB Ramps (NS)/Clinton Keith Rd. (EW)**
5 **Catt Rd. (NS)/Clinton Keith Rd. (EW)**
6 **George Av. (NS)/Clinton Keith Rd. (EW)**
7 **Inland Valley Dr. (NS)/Clinton Keith Rd. (EW)**
8 **Smith Ranch Rd. (NS)/Clinton Keith Rd. (EW)**
9 **Copper Craft Dr. (NS)/Clinton Keith Rd. (EW)**
10 **Catt Rd. (NS)/Depasquale Rd. (EW)**
11 **George Ave. (NS)/Depasquale Rd. (EW)**
12 **Grand Ave. (NS)/Clinton Keith Rd. (EW)**
13 **George Ave. (NS)/La Estrella St. (EW)**
14 **Inland Valley Dr. (NS)/Prielipp Rd. (EW)**
15 **Nutmeg St. (NS)/Prielipp Rd. (EW)**
16 **Monte Vista Dr. (NS)/Baxter Rd. (EW)**
17 **I-15 SB Ramps (NS)/Baxter Rd. (EW)**
18 **I-15 NB Ramps (NS)/Baxter Rd. (EW)**
19
20

E. Study Roadway Segments:

1 Catt Rd., N. of Clinton Keith Rd.
2 De Pasquale Rd, W. of George Ave.
3 Clinton Keith Rd., W. of Catt Rd.
4 Clinton Keith Rd., E. of Catt Rd.

F. Other Jurisdictional Impacts

Is this project within a City's Sphere of influence or one mile radius of City boundaries? **NO**

If so, name of City jurisdiction: _____

G. Site Plan **See Figure B**

H. Specific issues to be addressed in the Study (in addition to the standard analysis described in the Guideline) (To be filled out by Transportation Department)

Existing
Existing+Ambient Growth+Project
Existing+Ambient Growth+Project +Cumulative

Caltrans Analysis at the I-15/Clinton Keith Ramps and I-15 Freeway analysis both north and south of Clinton Keith

Recommended by:

Scott Sato

1/6/2015

Consultant's Representative Date

Approved By:

1/6/15

City of Wildomar ~~Transportation Department~~ ~~Department Traffic Staff~~ Assist. City Mgr. Public Works Dir. / City Eng. Date

TRIP GENERATION RATES[1]

LAND USE	ITE CODE	QUANTITY[2]	PEAK HOUR TRIP RATES						DAILY
			AM			PM			
			IN	OUT	TOTAL	IN	OUT	TOTAL	
Residential Condo/Townhouse	230	191 DU	0.07	0.37	0.44	0.35	0.17	0.52	5.81
High Turnover (Sit-Down) Resta	932	16 TSF	5.95	4.86	10.81	5.91	3.94	9.85	127.15
Supermarket	850	85 TSF	2.11	1.29	3.40	4.83	4.65	9.48	102.24
Shopping Center	820	17.354 TSF	1.91	1.17	3.08	5.13	5.55	10.68	125.36

[1] Source: ITE (Institute of Transportation Engineers) Trip Generation Manual, 9th Edition, 2012.

[2] DU = Dwelling Units; TSF = Thousand Square Feet

TRIP GENERATION SUMMARY

LAND USE	QUANTITY[1]	PEAK HOUR						DAILY
		AM			PM			
		IN	OUT	TOTAL	IN	OUT	TOTAL	
Residential Condo/Townhouse	191 DU	13	71	84	67	32	99	1,110
High Turnover (Sit-Down) Restaurant	16 TSF	95	78	173	95	63	158	2,034
Supermarket	85 TSF	179	110	289	411	395	806	8,690
Shopping Center	17.354 TSF	33	20	53	89	96	185	2,175
Pass by and Internal Capture (20%) Reduction		(7)	(4)	(11)	(18)	(19)	(37)	(435)
Retail Subtotal		26	16	42	71	77	148	1,740
TOTAL		**313**	**275**	**588**	**644**	**567**	**1,211**	**13,574**

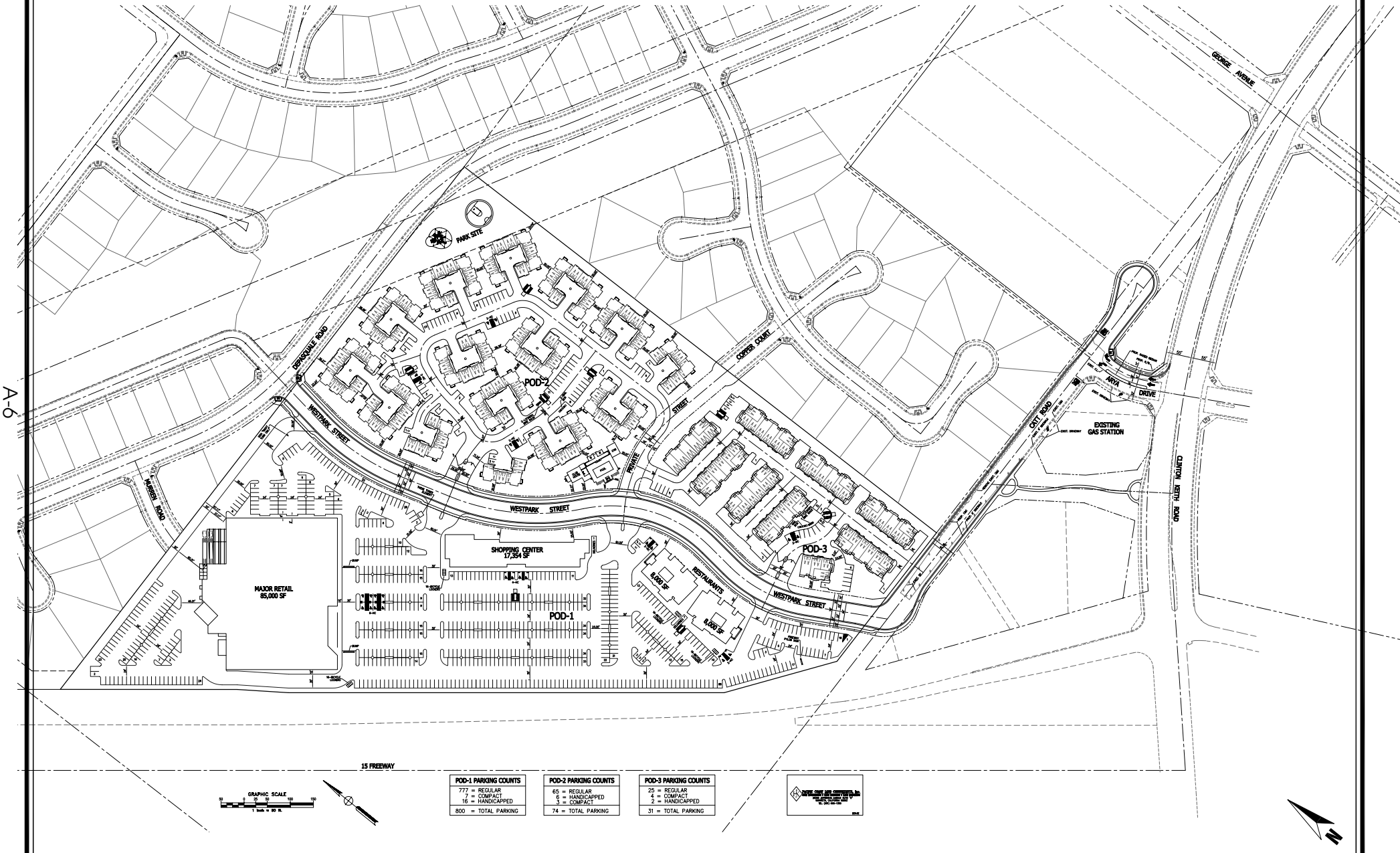
[1] DU = Dwelling Units; TSF = Thousand Square Feet

FIGURE A
STUDY AREA

Westpark Promenade Traffic Impact Analysis
City of Wildomar, CA (0201-0002:scope_02.dwg)

TRAMES SOLUTIONS INC.

FIGURE B
SITE PLAN



POD-1 PARKING COUNTS
777 = REGULAR
7 = COMPACT
16 = HANDICAPPED
800 = TOTAL PARKING

POD-2 PARKING COUNTS
65 = REGULAR
6 = HANDICAPPED
3 = COMPACT
74 = TOTAL PARKING

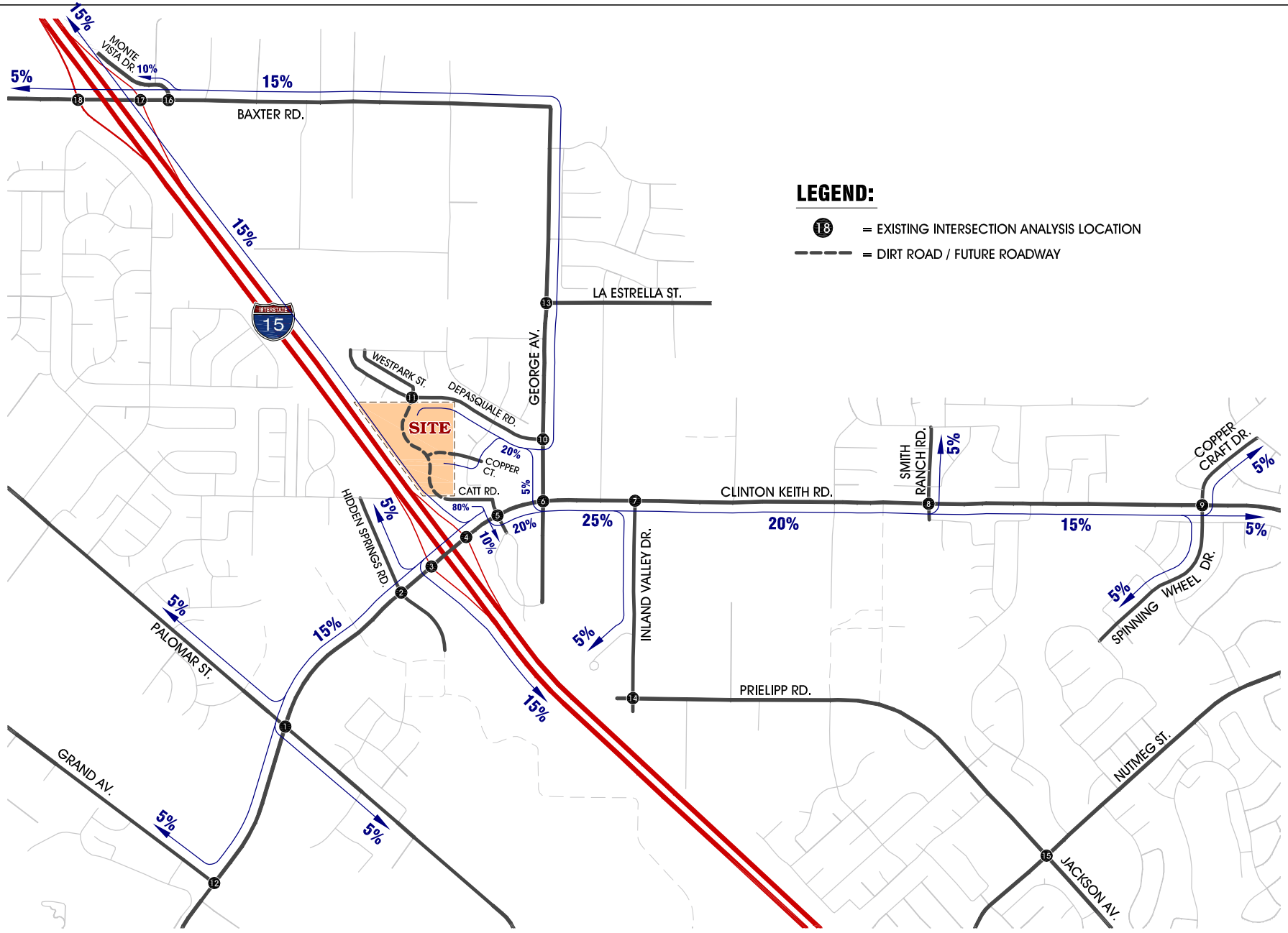
POD-3 PARKING COUNTS
25 = REGULAR
4 = COMPACT
2 = HANDICAPPED
31 = TOTAL PARKING

Westpark Promenade Traffic Impact Analysis
City of Wildomar, CA (0201-0002:scope_02.dwg)

TRAMES SOLUTIONS INC.

(C:\TRAMES\0201-0002\ACAD\Scope\Scope_02.dwg)

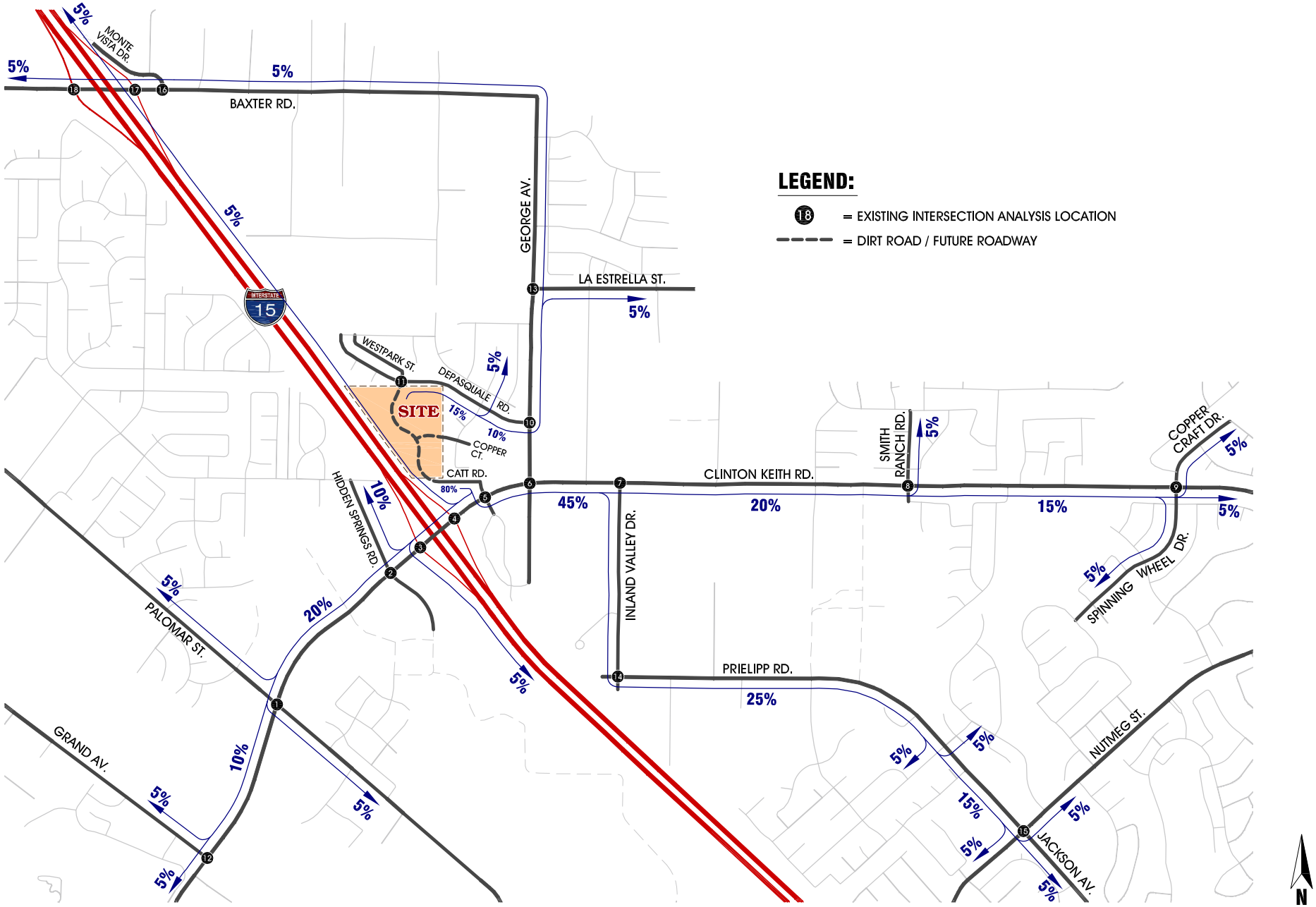
FIGURE C
PROJECT (RESIDENTIAL) TRIP DISTRIBUTION



Westpark Promenade Traffic Impact Analysis
City of Wildomar, CA (0201-0002:scope_02.dwg)

TRAMES SOLUTIONS INC.

FIGURE D
PROJECT (SUPERMARKET) TRIP DISTRIBUTION



Westpark Promenade Traffic Impact Analysis
City of Wildomar, CA (0201-0002:scope_02.dwg)

TRAMES SOLUTIONS INC.

Residential Condominium/Townhouse
(230)

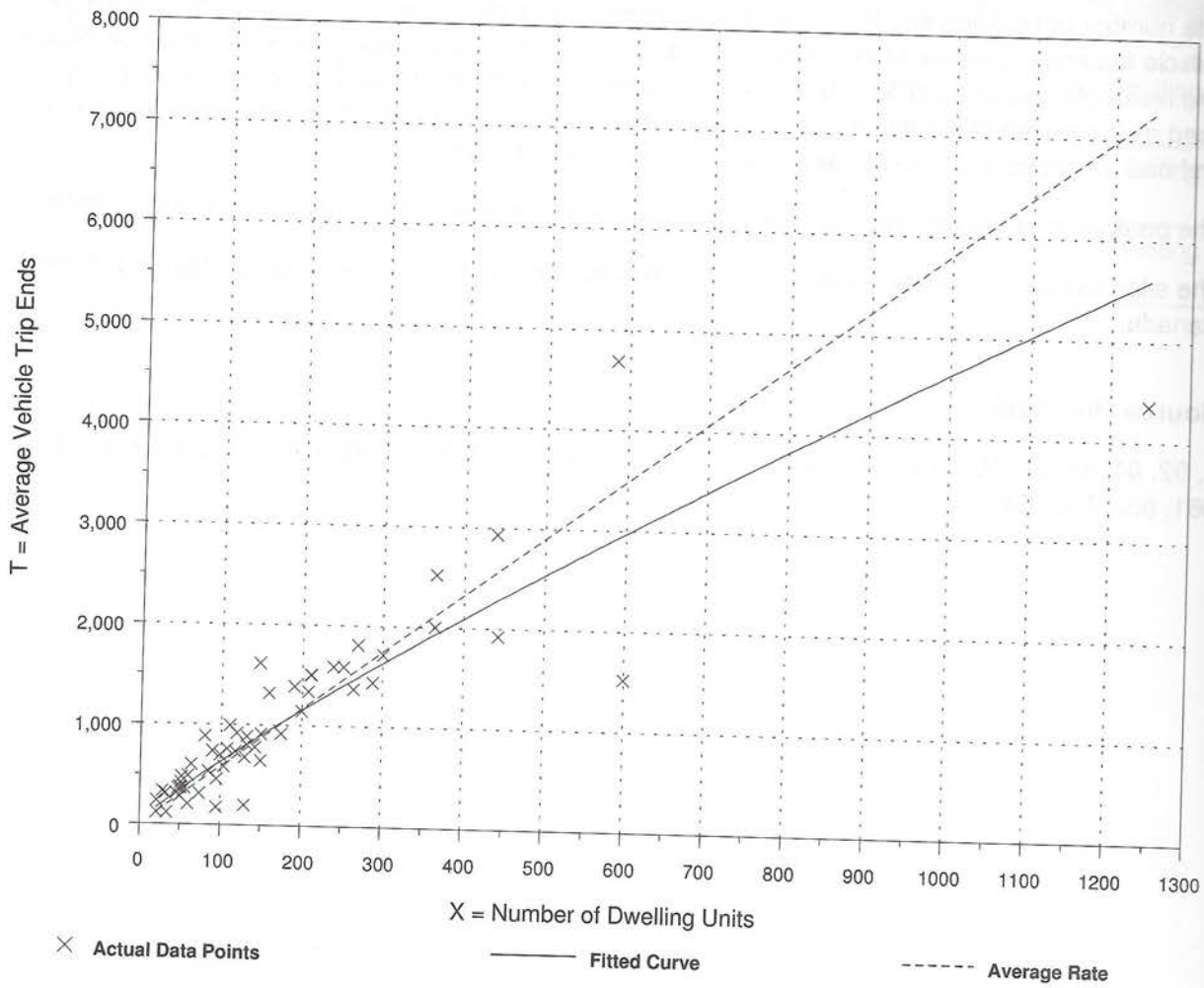
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Number of Studies: 56
Avg. Number of Dwelling Units: 179
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
5.81	1.53 - 11.79	3.11

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.87 Ln(X) + 2.46

R^2 = 0.80

Residential Condominium/Townhouse
(230)

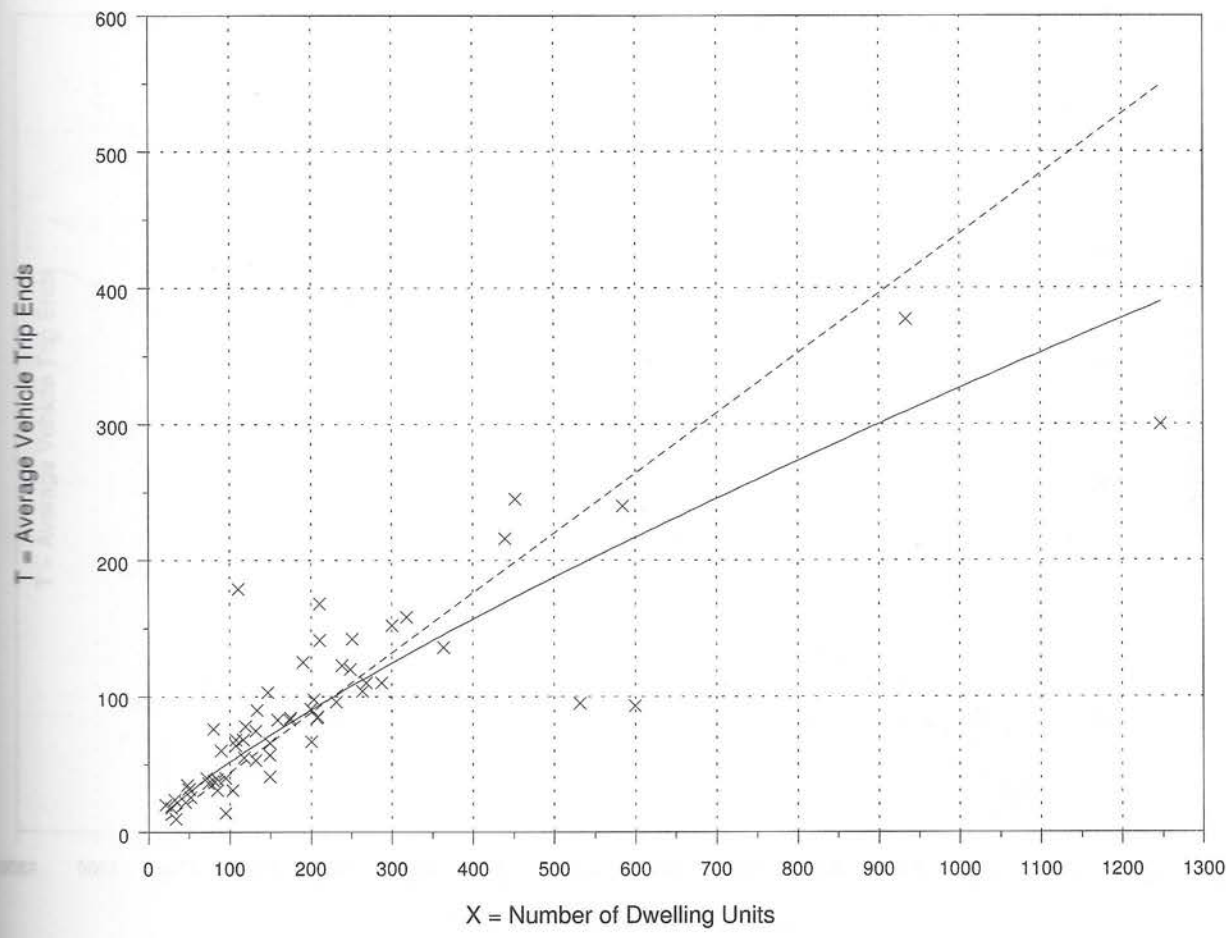
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Number of Studies: 59
Avg. Number of Dwelling Units: 213
Directional Distribution: 17% entering, 83% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.44	0.15 - 1.61	0.69

Data Plot and Equation



× Actual Data Points ——— Fitted Curve - - - - - - Average Rate

Fitted Curve Equation: Ln(T) = 0.80 Ln(X) + 0.26 **R^2 = 0.76**

Residential Condominium/Townhouse
(230)

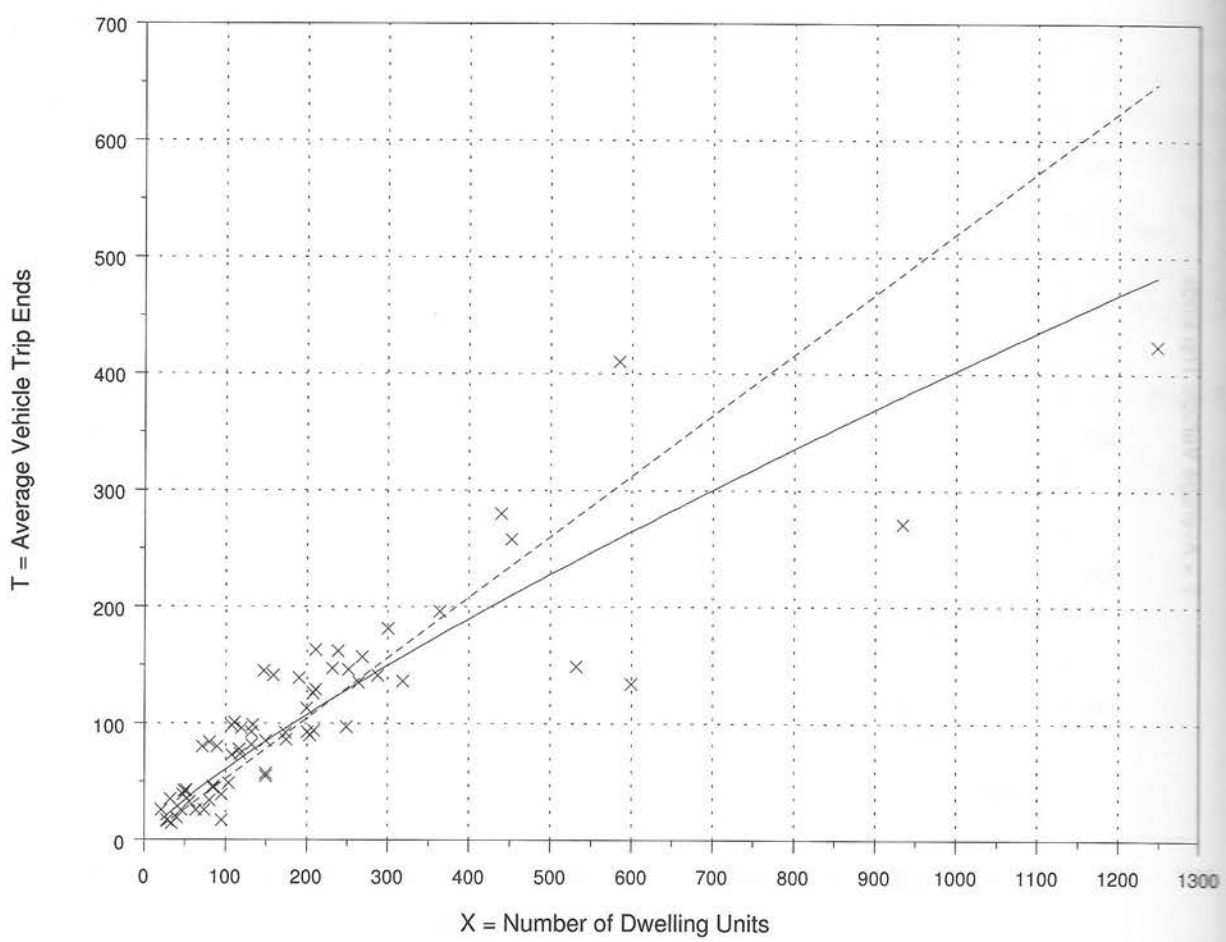
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 62
Avg. Number of Dwelling Units: 205
Directional Distribution: 67% entering, 33% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.52	0.18 - 1.24	0.75

Data Plot and Equation



× Actual Data Points ——— Fitted Curve ------ Average Rate

Fitted Curve Equation: Ln(T) = 0.82 Ln(X) + 0.32 **R^2 = 0.80**

High-Turnover (Sit-Down) Restaurant
(932)

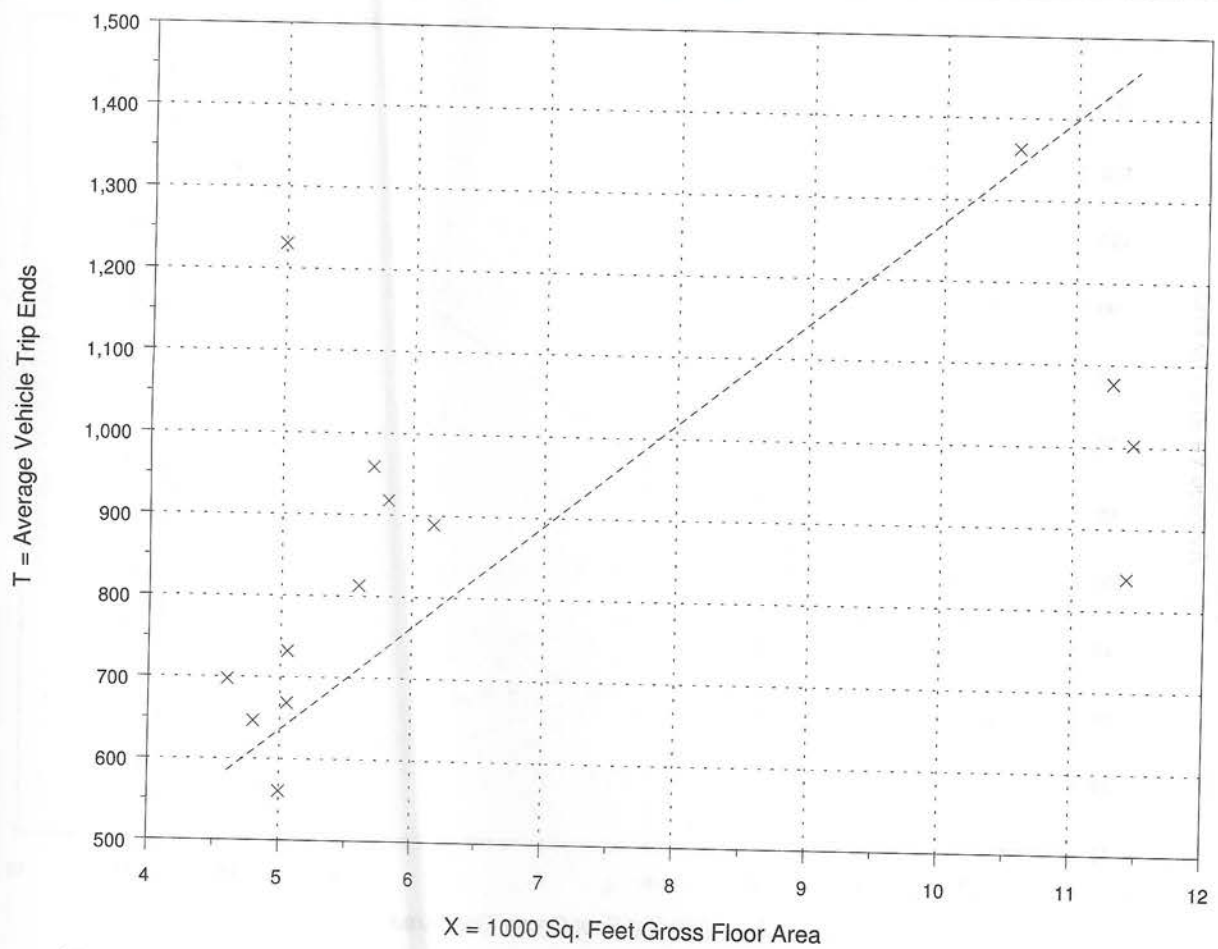
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday

Number of Studies: 14
Average 1000 Sq. Feet GFA: 7
Directional Distribution: 50% entering, 50% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
127.15	73.51 - 246.00	41.77

Data Plot and Equation



× Actual Data Points

------ Average Rate

Fitted Curve Equation: Not given

R^2 = ****

High-Turnover (Sit-Down) Restaurant
(932)

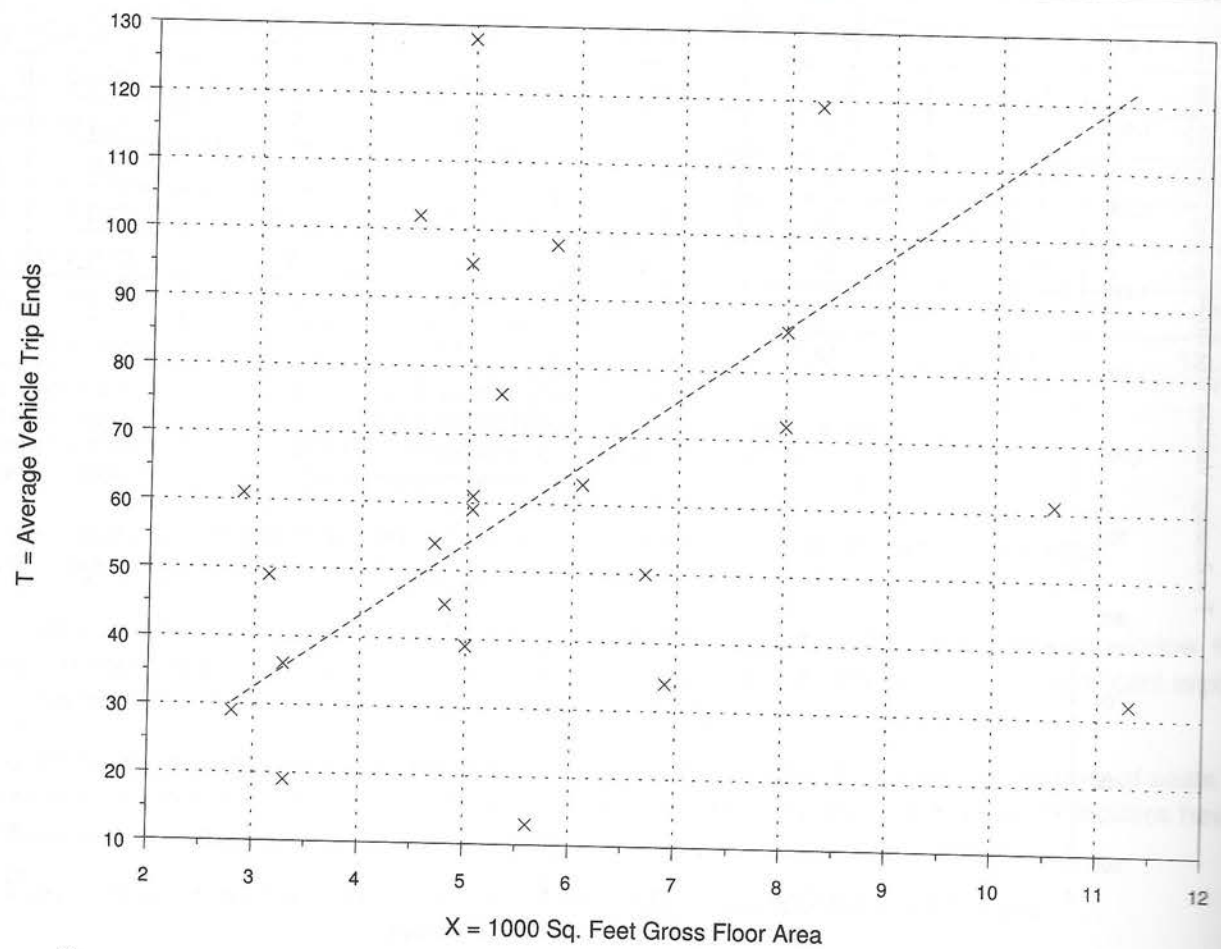
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Number of Studies: 24
Average 1000 Sq. Feet GFA: 6
Directional Distribution: 55% entering, 45% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
10.81	2.32 - 25.60	6.59

Data Plot and Equation



Fitted Curve Equation: Not given

R^2 = ****

High-Turnover (Sit-Down) Restaurant
(932)

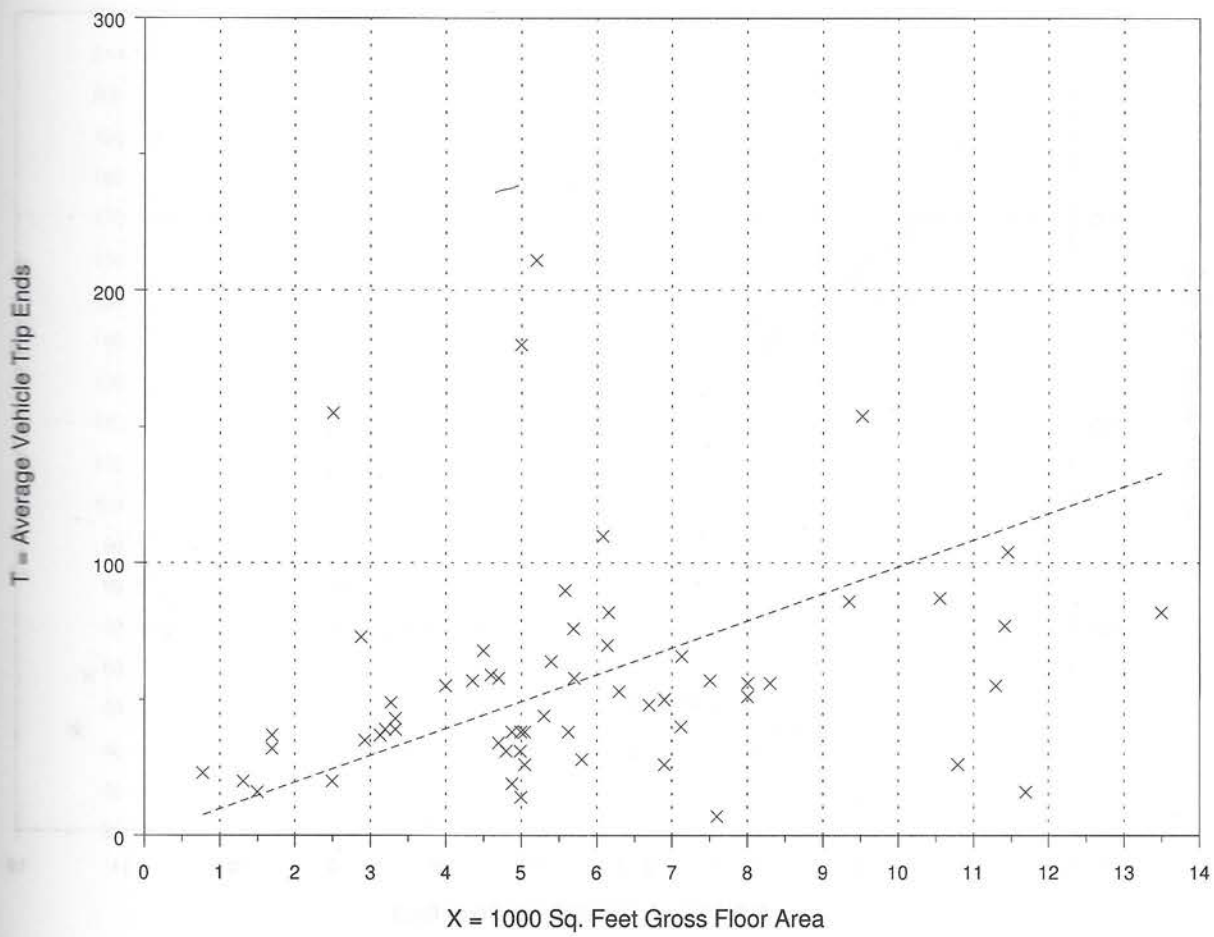
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 60
Average 1000 Sq. Feet GFA: 6
Directional Distribution: 60% entering, 40% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
9.85	0.92 - 62.00	8.54

Data Plot and Equation



× Actual Data Points

------ Average Rate

Fitted Curve Equation: Not given

R^2 = ****

Supermarket
(850)

Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday

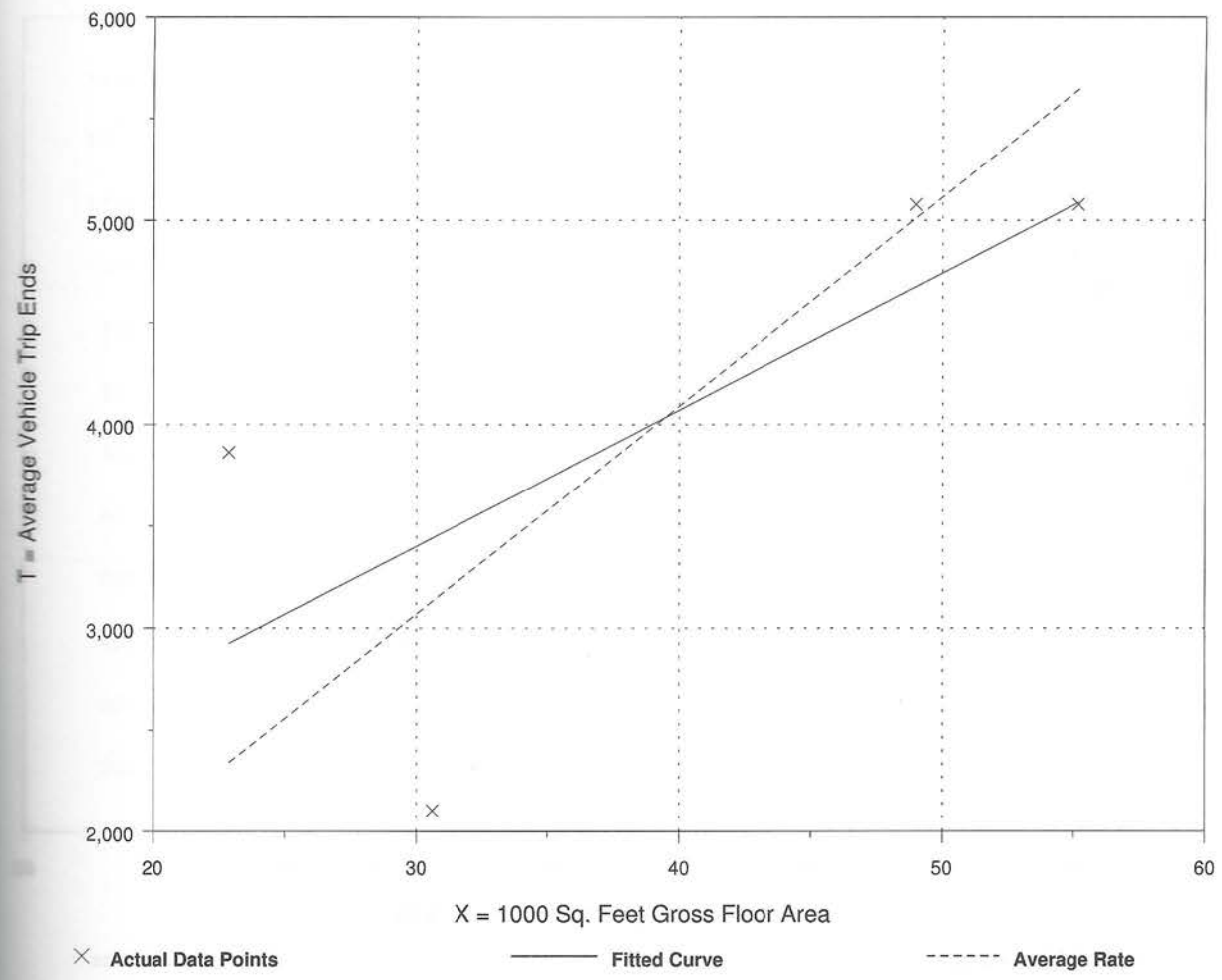
Number of Studies: 4
Average 1000 Sq. Feet GFA: 39
Directional Distribution: 50% entering, 50% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
102.24	68.65 - 168.88	31.73

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: T = 66.95(X) + 1391.56 $R^2 = 0.52$

Supermarket
(850)

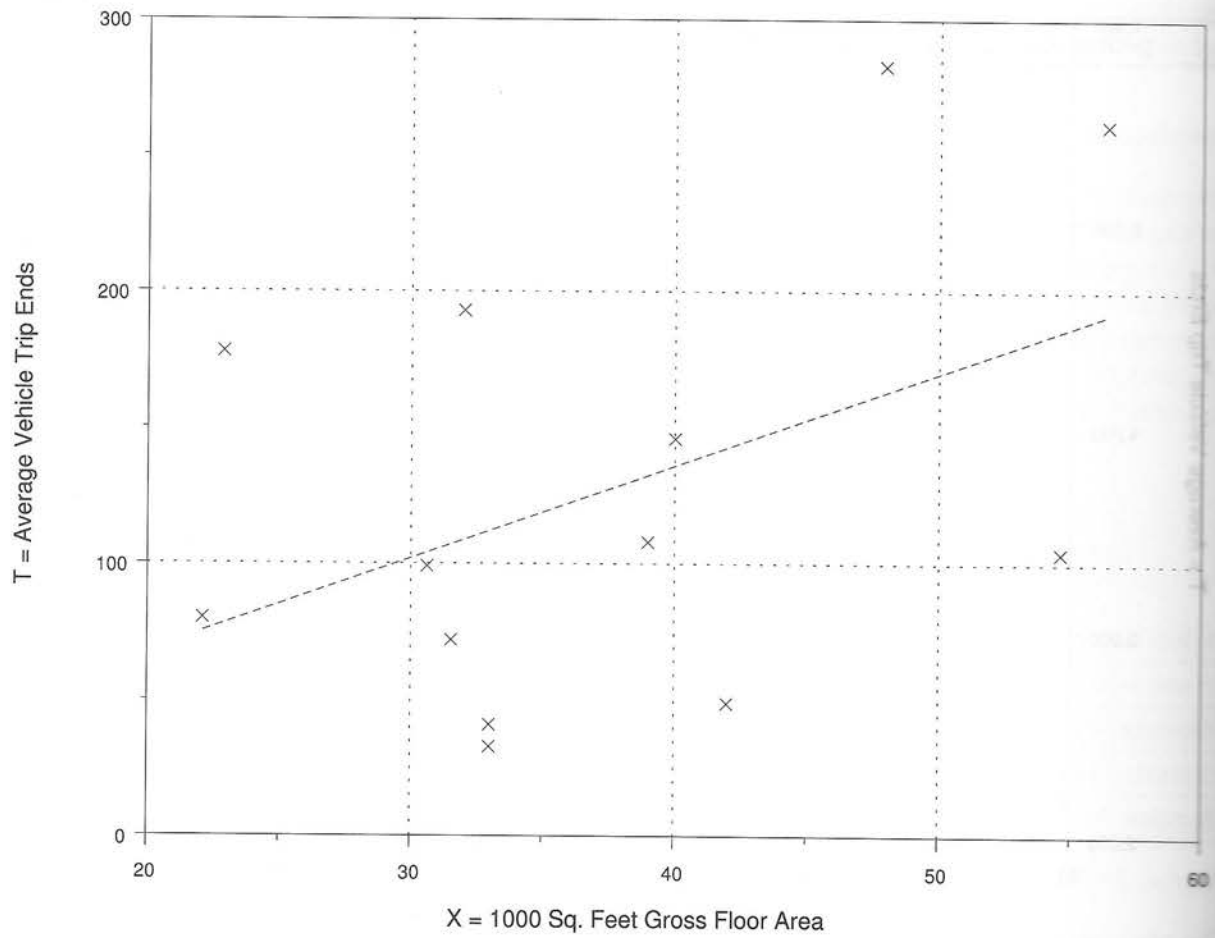
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Number of Studies: 13
Average 1000 Sq. Feet GFA: 37
Directional Distribution: 62% entering, 38% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
3.40	1.00 - 7.78	2.64

Data Plot and Equation



× **Actual Data Points**

------ **Average Rate**

Fitted Curve Equation: Not given

R^2 = ****

Supermarket
(850)

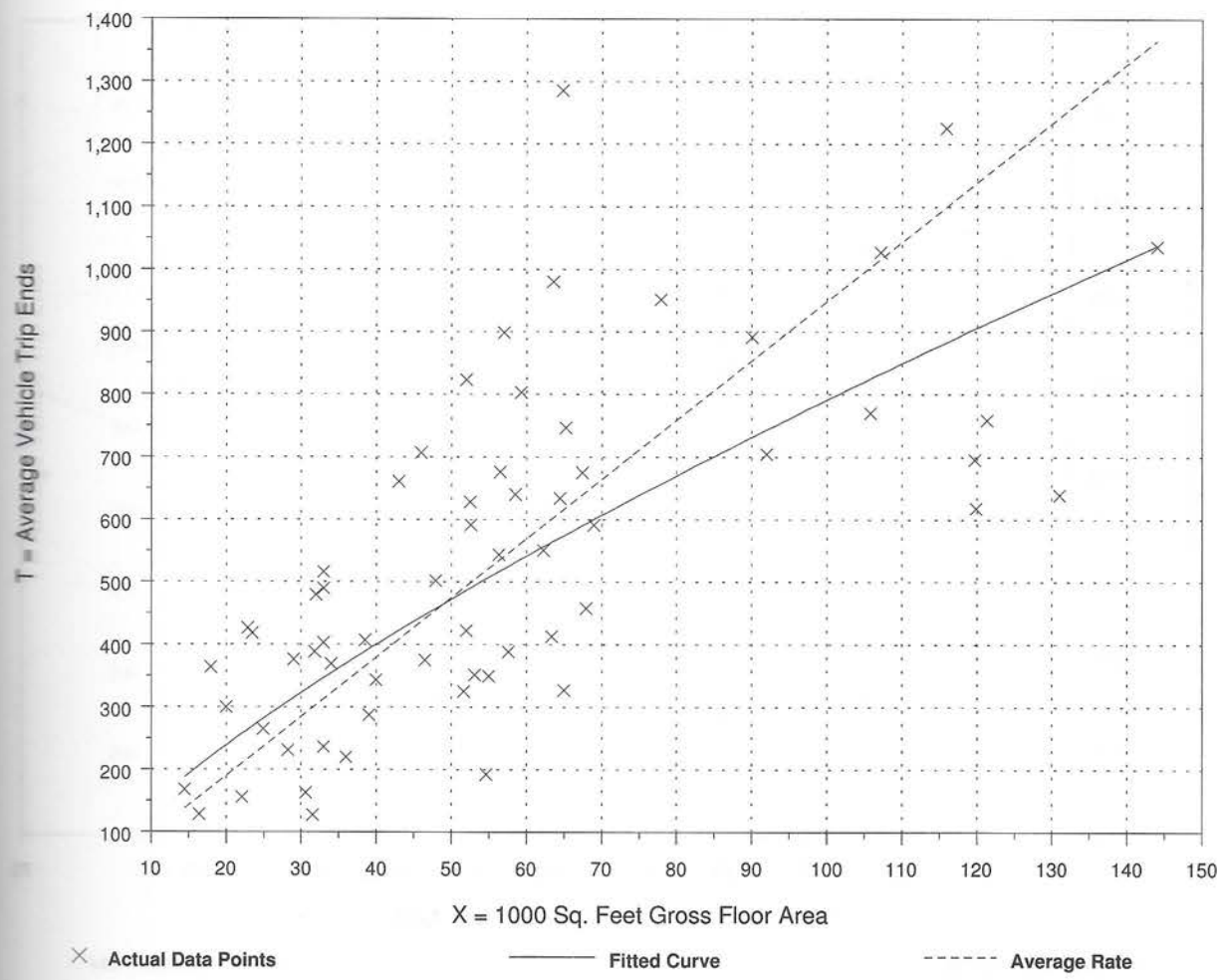
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 62
Average 1000 Sq. Feet GFA: 56
Directional Distribution: 51% entering, 49% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
9.48	3.53 - 20.29	4.81

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.74 Ln(X) + 3.25 $R^2 = 0.52$

Shopping Center
(820)

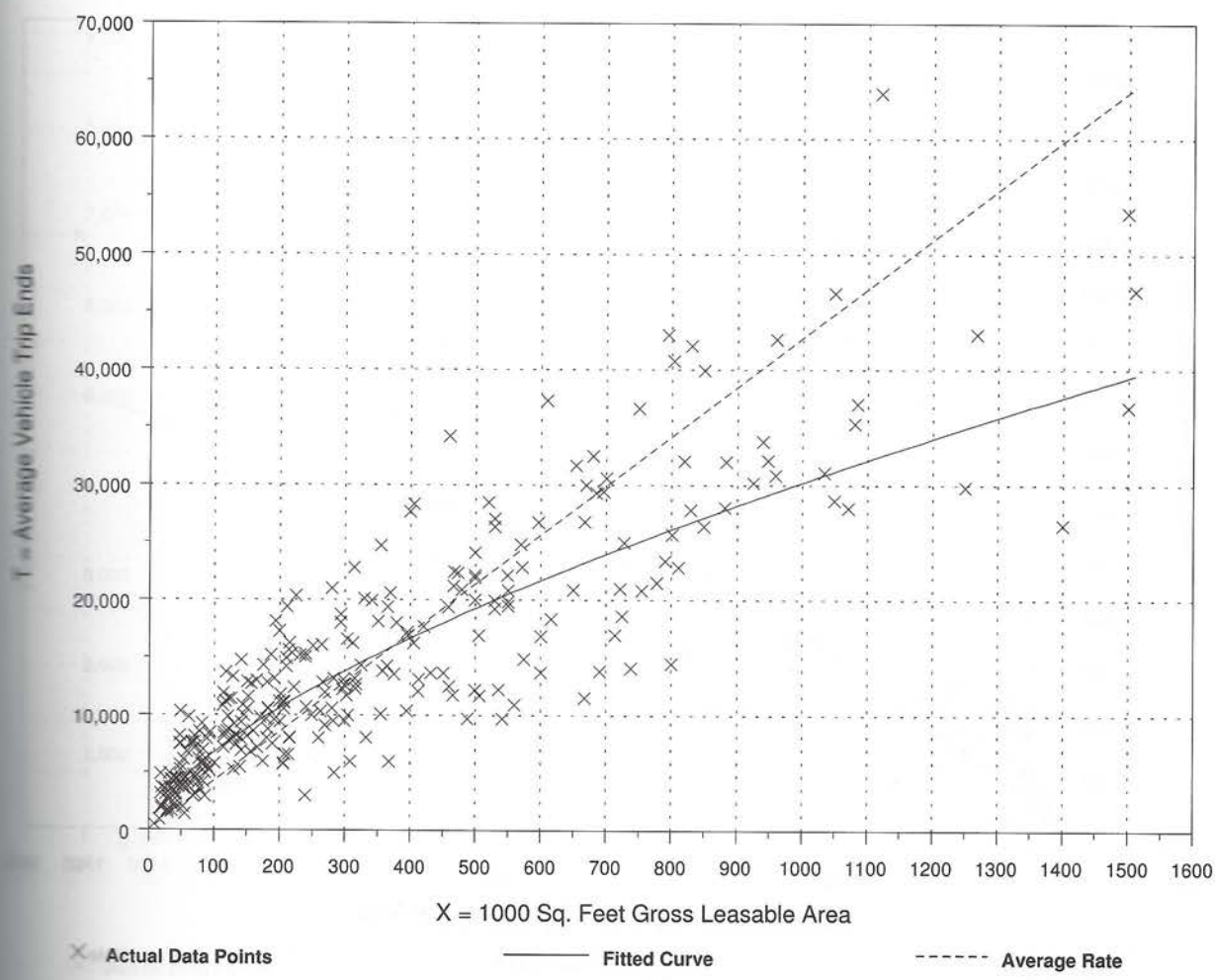
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Leasable Area
On a: Weekday

Number of Studies: 302
Average 1000 Sq. Feet GLA: 331
Directional Distribution: 50% entering, 50% exiting

Trip Generation per 1000 Sq. Feet Gross Leasable Area

Average Rate	Range of Rates	Standard Deviation
42.70	12.50 - 270.89	21.25

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.65 Ln(X) + 5.83 $R^2 = 0.79$

Shopping Center
(820)

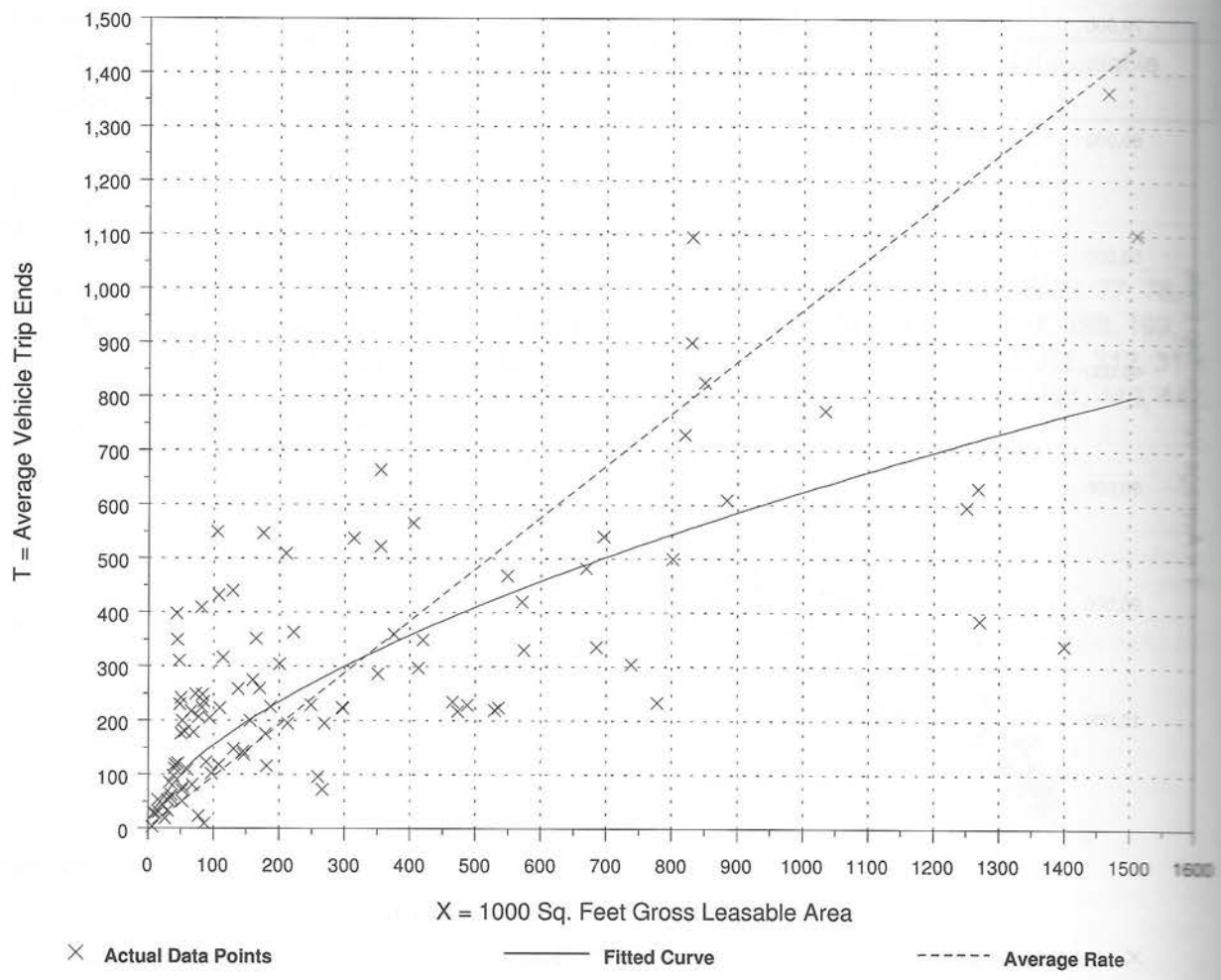
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Leasable Area
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Number of Studies: 104
Average 1000 Sq. Feet GLA: 310
Directional Distribution: 62% entering, 38% exiting

Trip Generation per 1000 Sq. Feet Gross Leasable Area

Average Rate	Range of Rates	Standard Deviation
0.96	0.10 - 9.05	1.31

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.61 Ln(X) + 2.24 $R^2 = 0.56$

Shopping Center
(820)

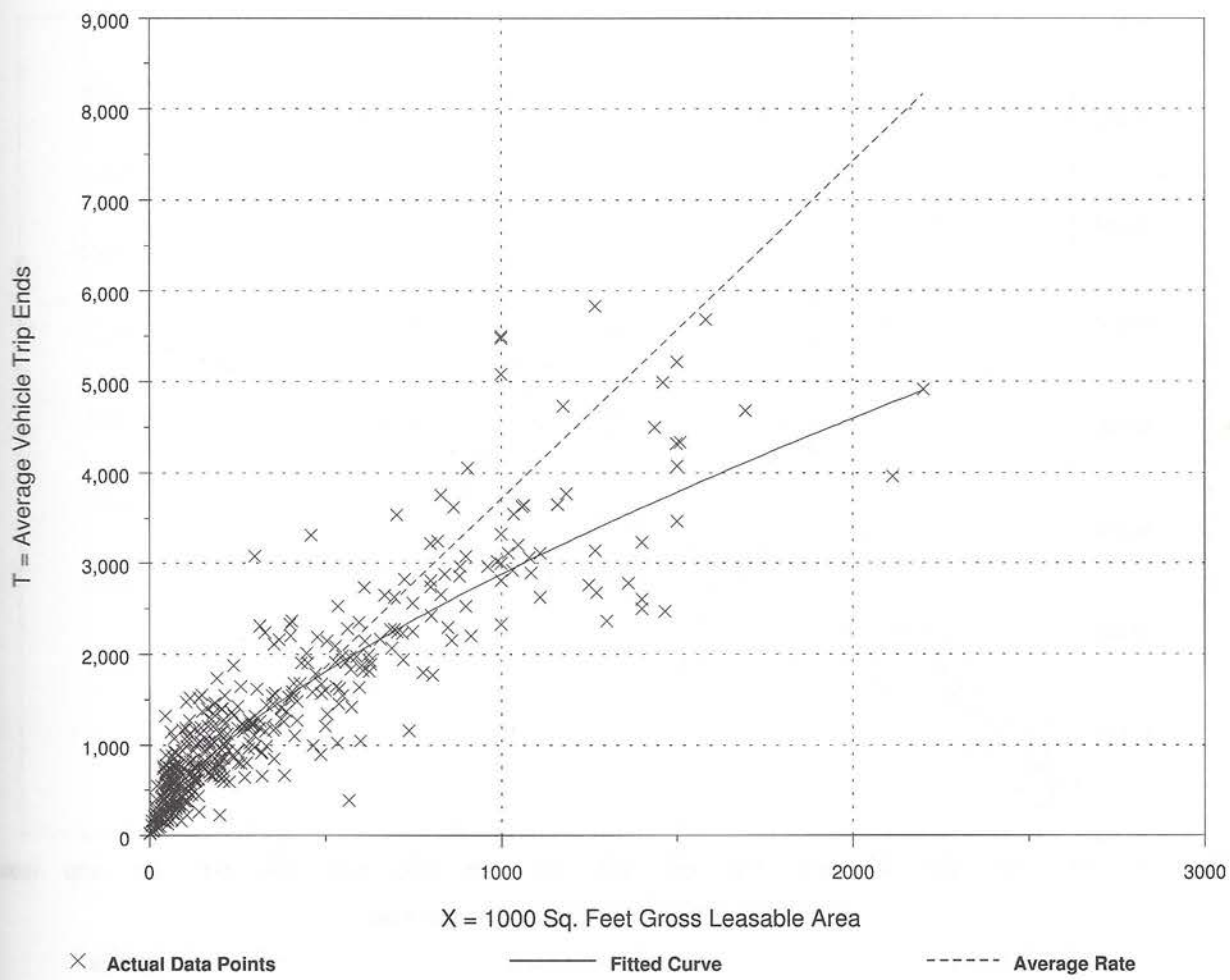
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Leasable Area
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 426
Average 1000 Sq. Feet GLA: 376
Directional Distribution: 48% entering, 52% exiting

Trip Generation per 1000 Sq. Feet Gross Leasable Area

Average Rate	Range of Rates	Standard Deviation
3.71	0.68 - 29.27	2.74

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.67 Ln(X) + 3.31 $R^2 = 0.81$

APPENDIX B

TRAFFIC COUNT WORKSHEETS AND FREEWAY VOLUMES

Counts Unlimited Inc.
PO Box 1178
Corona, CA 92878
951-268-6268

City of Murrieta
N/S: Clinton Keith Road
E/W: Palomar Street
Weather: Sunny

File Name : MURCKPAAM
Site Code : 00000052
Start Date : 5/29/2014
Page No : 1

Groups Printed- Total Volume

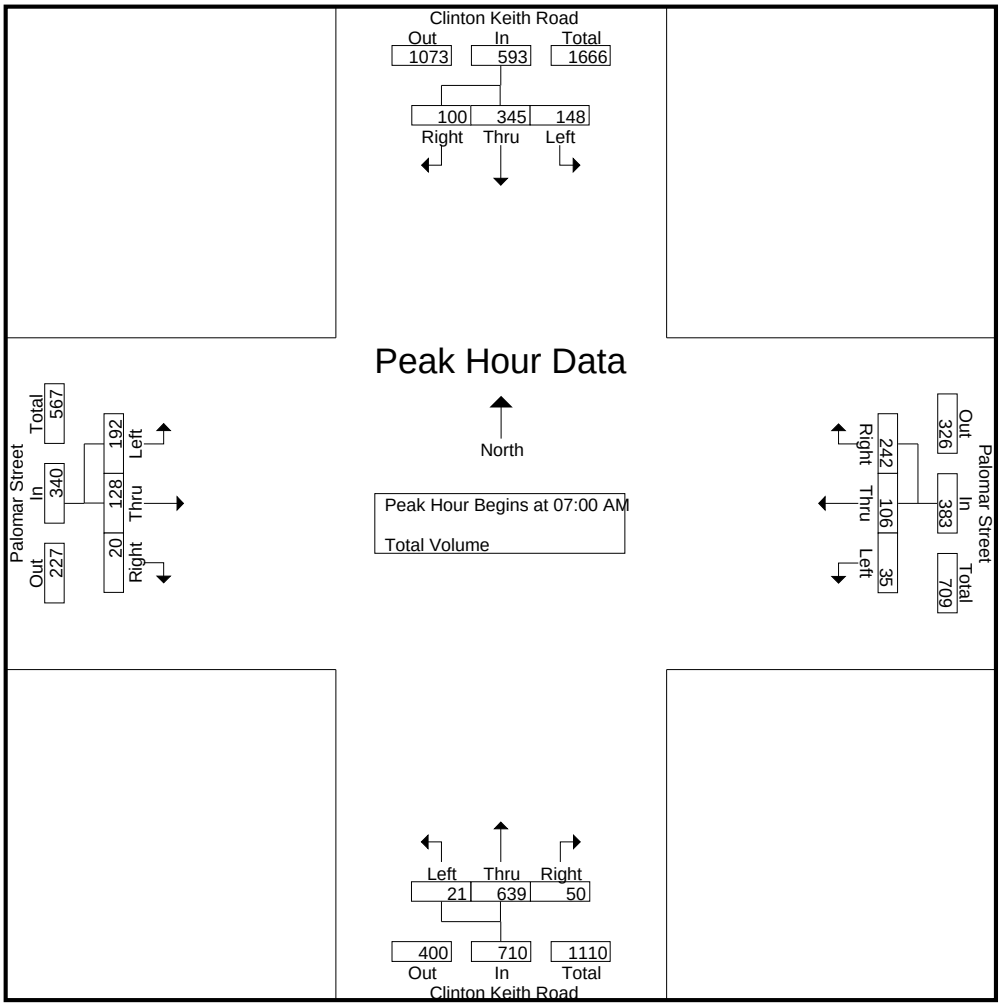
	Clinton Keith Road Southbound				Palomar Street Westbound				Clinton Keith Road Northbound				Palomar Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	45	85	32	162	5	25	44	74	2	170	15	187	30	47	6	83	506
07:15 AM	28	80	22	130	8	29	82	119	7	158	9	174	54	24	4	82	505
07:30 AM	32	75	21	128	9	30	66	105	6	177	13	196	59	27	1	87	516
07:45 AM	43	105	25	173	13	22	50	85	6	134	13	153	49	30	9	88	499
Total	148	345	100	593	35	106	242	383	21	639	50	710	192	128	20	340	2026
08:00 AM	32	93	27	152	9	19	46	74	4	147	10	161	56	23	7	86	473
08:15 AM	38	95	25	158	12	10	55	77	11	142	15	168	27	22	10	59	462
08:30 AM	33	70	27	130	12	14	52	78	12	171	21	204	33	24	7	64	476
08:45 AM	23	84	13	120	11	25	74	110	4	135	14	153	22	29	7	58	441
Total	126	342	92	560	44	68	227	339	31	595	60	686	138	98	31	267	1852
Grand Total	274	687	192	1153	79	174	469	722	52	1234	110	1396	330	226	51	607	3878
Apprch %	23.8	59.6	16.7		10.9	24.1	65		3.7	88.4	7.9		54.4	37.2	8.4		
Total %	7.1	17.7	5	29.7	2	4.5	12.1	18.6	1.3	31.8	2.8	36	8.5	5.8	1.3	15.7	

	Clinton Keith Road Southbound				Palomar Street Westbound				Clinton Keith Road Northbound				Palomar Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	**45**	85	**32**	162	5	25	44	74	2	170	**15**	187	30	**47**	6	83	506
07:15 AM	28	80	22	130	8	29	**82**	**119**	**7**	158	9	174	54	24	4	82	505
07:30 AM	32	75	21	128	9	**30**	66	105	6	**177**	13	**196**	**59**	27	1	87	**516**
07:45 AM	43	**105**	25	**173**	**13**	22	50	85	6	134	13	153	49	30	**9**	**88**	499
Total Volume	148	345	100	593	35	106	242	383	21	639	50	710	192	128	20	340	2026
% App. Total	25	58.2	16.9		9.1	27.7	63.2		3	90	7		56.5	37.6	5.9		
PHF	.822	.821	.781	.857	.673	.883	.738	.805	.750	.903	.833	.906	.814	.681	.556	.966	.982

Counts Unlimited Inc.
PO Box 1178
Corona, CA 92878
951-268-6268

City of Murrieta
N/S: Clinton Keith Road
E/W: Palomar Street
Weather: Sunny

File Name : MURCKPAAM
Site Code : 00000052
Start Date : 5/29/2014
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:45 AM				07:00 AM				07:00 AM				07:15 AM			
+0 mins.	**43**	**105**	25	**173**	5	25	44	74	2	170	**15**	187	54	24	4	82
+15 mins.	32	93	**27**	152	8	29	**82**	**119**	**7**	158	9	174	**59**	27	1	87
+30 mins.	38	95	25	158	9	**30**	66	105	6	**177**	13	**196**	49	**30**	**9**	**88**
+45 mins.	33	70	27	130	**13**	22	50	85	6	134	13	153	56	23	7	86
Total Volume	146	363	104	613	35	106	242	383	21	639	50	710	218	104	21	343
% App. Total	23.8	59.2	17		9.1	27.7	63.2		3	90	7		63.6	30.3	6.1	
PHF	.849	.864	.963	.886	.673	.883	.738	.805	.750	.903	.833	.906	.924	.867	.583	.974

Counts Unlimited Inc.
PO Box 1178
Corona, CA 92878
951-268-6268

City of Murrieta
N/S: Clinton Keith Road
E/W: Palomar Street
Weather: Sunny

File Name : MURCKPAPM
Site Code : 00000052
Start Date : 5/29/2014
Page No : 1

Groups Printed- Total Volume

	Clinton Keith Road Southbound				Palomar Street Westbound				Clinton Keith Road Northbound				Palomar Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	63	150	40	253	18	36	49	103	6	104	30	140	37	25	11	73	569
04:15 PM	68	130	23	221	26	65	36	127	11	118	19	148	35	24	5	64	560
04:30 PM	66	115	23	204	20	65	38	123	4	110	19	133	34	24	8	66	526
04:45 PM	49	88	32	169	19	33	34	86	13	112	14	139	41	29	5	75	469
Total	246	483	118	847	83	199	157	439	34	444	82	560	147	102	29	278	2124
05:00 PM	63	121	24	208	12	46	28	86	4	123	16	143	33	28	3	64	501
05:15 PM	73	125	45	243	23	51	45	119	11	108	22	141	30	27	9	66	569
05:30 PM	59	119	33	211	20	40	38	98	10	116	24	150	34	24	9	67	526
05:45 PM	81	142	36	259	22	38	43	103	9	94	13	116	38	23	13	74	552
Total	276	507	138	921	77	175	154	406	34	441	75	550	135	102	34	271	2148
06:00 PM	61	129	46	236	21	45	43	109	7	98	10	115	26	22	9	57	517
06:15 PM	48	138	29	215	17	45	41	103	2	114	14	130	25	14	4	43	491
06:30 PM	57	118	29	204	16	35	33	84	16	96	10	122	27	23	10	60	470
06:45 PM	48	132	16	196	8	28	34	70	2	102	8	112	26	18	3	47	425
Total	214	517	120	851	62	153	151	366	27	410	42	479	104	77	26	207	1903
Grand Total	736	1507	376	2619	222	527	462	1211	95	1295	199	1589	386	281	89	756	6175
Apprch %	28.1	57.5	14.4		18.3	43.5	38.2		6	81.5	12.5		51.1	37.2	11.8		
Total %	11.9	24.4	6.1	42.4	3.6	8.5	7.5	19.6	1.5	21	3.2	25.7	6.3	4.6	1.4	12.2	

	Clinton Keith Road Southbound				Palomar Street Westbound				Clinton Keith Road Northbound				Palomar Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:15 PM																	
05:15 PM	73	125	45	243	**23**	**51**	**45**	**119**	**11**	108	22	141	30	**27**	9	66	**569**
05:30 PM	59	119	33	211	20	40	38	98	10	**116**	**24**	**150**	34	24	9	67	526
05:45 PM	**81**	**142**	36	**259**	22	38	43	103	9	94	13	116	**38**	23	**13**	**74**	552
06:00 PM	61	129	**46**	236	21	45	43	109	7	98	10	115	26	22	9	57	517
Total Volume	274	515	160	949	86	174	169	429	37	416	69	522	128	96	40	264	2164
% App. Total	28.9	54.3	16.9		20	40.6	39.4		7.1	79.7	13.2		48.5	36.4	15.2		
PHF	.846	.907	.870	.916	.935	.853	.939	.901	.841	.897	.719	.870	.842	.889	.769	.892	.951

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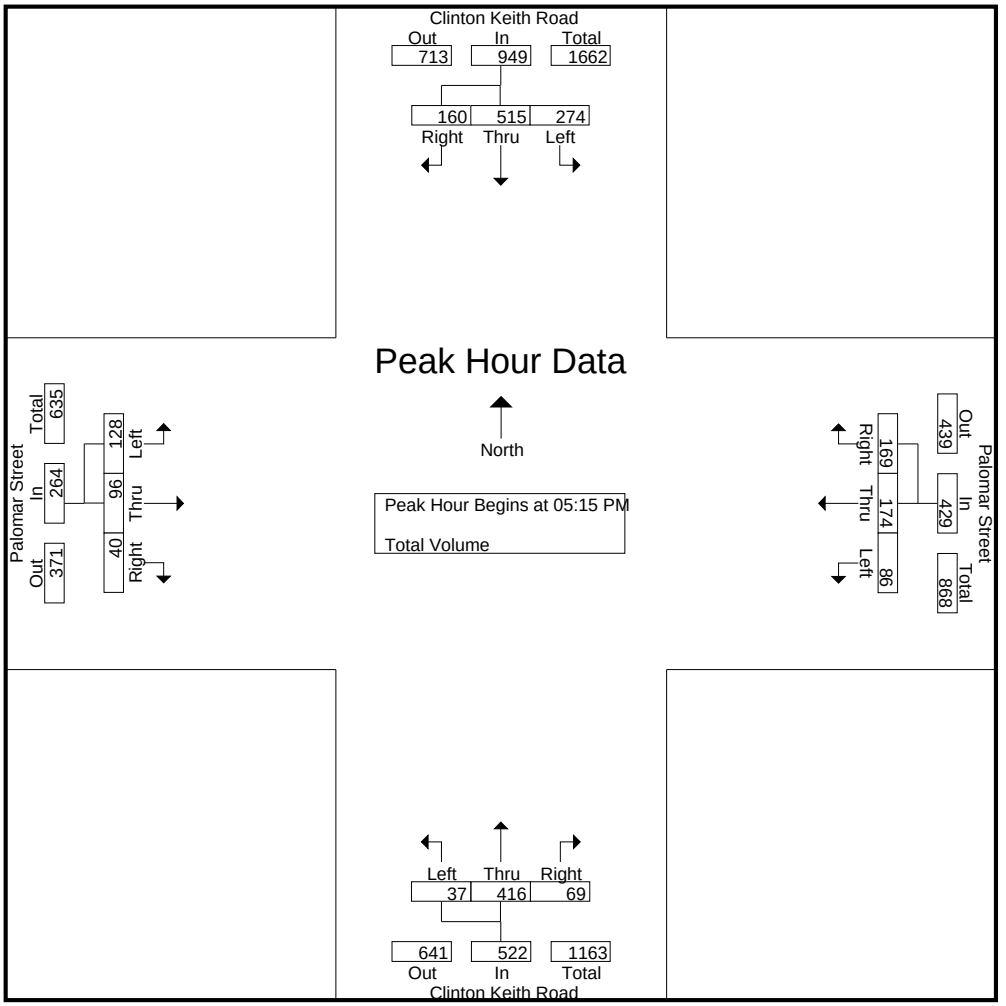
City of Murrieta
N/S: Clinton Keith Road
E/W: Palomar Street
Weather: Sunny

File Name : MURCKPAPM
Site Code : 00000052
Start Date : 5/29/2014
Page No : 2



Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	05:15 PM				04:00 PM				04:45 PM				04:00 PM			
+0 mins.	73	125	45	243	18	36	**49**	103	**13**	112	14	139	37	25	**11**	73
+15 mins.	59	119	33	211	**26**	**65**	36	**127**	4	**123**	16	143	35	24	5	64
+30 mins.	**81**	**142**	36	**259**	20	65	38	123	11	108	22	141	34	24	8	66
+45 mins.	61	129	**46**	236	19	33	34	86	10	116	**24**	**150**	**41**	**29**	5	**75**
Total Volume	274	515	160	949	83	199	157	439	38	459	76	573	147	102	29	278
% App. Total	28.9	54.3	16.9		18.9	45.3	35.8		6.6	80.1	13.3		52.9	36.7	10.4	
PHF	.846	.907	.870	.916	.798	.765	.801	.864	.731	.933	.792	.955	.896	.879	.659	.927

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City of Murrieta
N/S: Hidden Springs Road
E/W: Clinton Keith Road
Weather: Sunny

File Name : MURHSCKAM
Site Code : 00000061
Start Date : 5/29/2014
Page No : 1

Groups Printed- Total Volume

	Hidden Springs Road Southbound				Clinton Keith Road Westbound				Hidden Springs Road Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	65	8	20	93	7	148	42	197	12	2	13	27	13	204	0	217	534
07:15 AM	74	8	15	97	10	121	40	171	12	2	17	31	13	267	1	281	580
07:30 AM	88	5	14	107	11	150	54	215	15	3	19	37	16	219	2	237	596
07:45 AM	92	12	26	130	19	179	67	265	14	5	25	44	17	222	1	240	679
Total	319	33	75	427	47	598	203	848	53	12	74	139	59	912	4	975	2389
08:00 AM	68	6	13	87	15	137	40	192	15	2	22	39	16	210	1	227	545
08:15 AM	71	7	16	94	16	149	44	209	18	4	20	42	21	214	0	235	580
08:30 AM	55	5	14	74	12	124	45	181	15	1	15	31	19	223	1	243	529
08:45 AM	66	3	21	90	19	109	42	170	9	4	14	27	9	205	0	214	501
Total	260	21	64	345	62	519	171	752	57	11	71	139	65	852	2	919	2155
Grand Total	579	54	139	772	109	1117	374	1600	110	23	145	278	124	1764	6	1894	4544
Apprch %	75	7	18		6.8	69.8	23.4		39.6	8.3	52.2		6.5	93.1	0.3		
Total %	12.7	1.2	3.1	17	2.4	24.6	8.2	35.2	2.4	0.5	3.2	6.1	2.7	38.8	0.1	41.7	

	Hidden Springs Road Southbound				Clinton Keith Road Westbound				Hidden Springs Road Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	74	8	15	97	10	121	40	171	12	2	17	31	13	**267**	1	**281**	580
07:30 AM	88	5	14	107	11	150	54	215	**15**	3	19	37	16	219	**2**	237	596
07:45 AM	**92**	**12**	**26**	**130**	**19**	**179**	**67**	**265**	14	**5**	**25**	**44**	**17**	222	1	240	**679**
08:00 AM	68	6	13	87	15	137	40	192	15	2	22	39	16	210	1	227	545
Total Volume	322	31	68	421	55	587	201	843	56	12	83	151	62	918	5	985	2400
% App. Total	76.5	7.4	16.2		6.5	69.6	23.8		37.1	7.9	55		6.3	93.2	0.5		
PHF	.875	.646	.654	.810	.724	.820	.750	.795	.933	.600	.830	.858	.912	.860	.625	.876	.884

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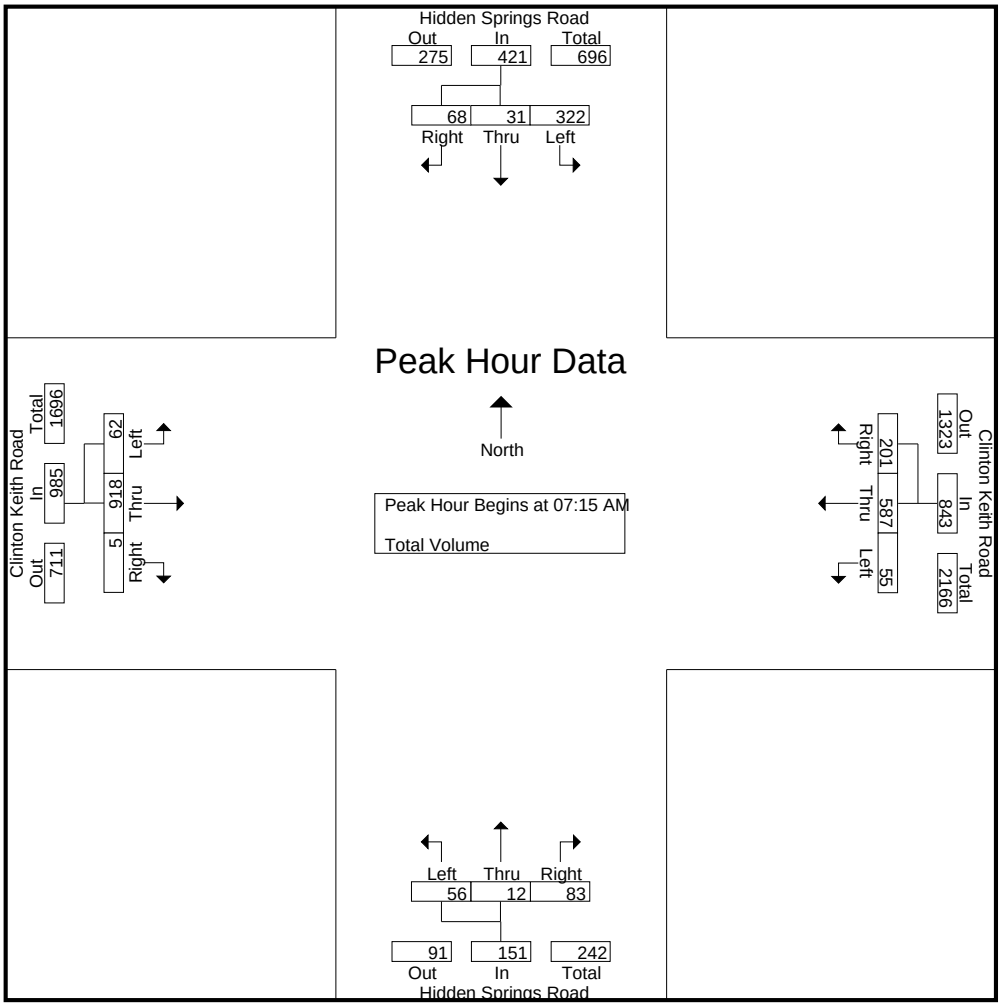
City of Murrieta
N/S: Hidden Springs Road
E/W: Clinton Keith Road
Weather: Sunny

File Name : MURHSCKAM
Site Code : 00000061
Start Date : 5/29/2014
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00 AM				07:30 AM				07:30 AM				07:15 AM			
+0 mins.	65	8	20	93	11	150	54	215	15	3	19	37	13	**267**	1	**281**
+15 mins.	74	8	15	97	**19**	**179**	**67**	**265**	14	**5**	**25**	**44**	16	219	**2**	237
+30 mins.	88	5	14	107	15	137	40	192	15	2	22	39	**17**	222	1	240
+45 mins.	**92**	**12**	**26**	**130**	16	149	44	209	**18**	4	20	42	16	210	1	227
Total Volume	319	33	75	427	61	615	205	881	62	14	86	162	62	918	5	985
% App. Total	74.7	7.7	17.6		6.9	69.8	23.3		38.3	8.6	53.1		6.3	93.2	0.5	
PHF	.867	.688	.721	.821	.803	.859	.765	.831	.861	.700	.860	.920	.912	.860	.625	.876

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City of Murrieta
N/S: Hidden Springs Road
E/W: Clinton Keith Road
Weather: Sunny

File Name : MURHSCKPM
Site Code : 00000061
Start Date : 5/29/2014
Page No : 1

Groups Printed- Total Volume

	Hidden Springs Road Southbound				Clinton Keith Road Westbound				Hidden Springs Road Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	76	8	34	118	30	237	109	376	17	8	15	40	38	191	1	230	764
04:15 PM	74	3	32	109	13	190	111	314	22	3	22	47	32	156	1	189	659
04:30 PM	70	3	40	113	18	164	115	297	9	3	9	21	14	196	0	210	641
04:45 PM	90	5	20	115	17	163	123	303	9	3	19	31	23	155	3	181	630
Total	310	19	126	455	78	754	458	1290	57	17	65	139	107	698	5	810	2694
05:00 PM	86	3	30	119	21	182	125	328	10	2	19	31	40	151	3	194	672
05:15 PM	73	2	42	117	16	215	111	342	19	2	11	32	39	171	3	213	704
05:30 PM	76	4	39	119	14	196	115	325	11	3	23	37	43	159	1	203	684
05:45 PM	70	4	40	114	10	198	112	320	12	4	7	23	34	166	1	201	658
Total	305	13	151	469	61	791	463	1315	52	11	60	123	156	647	8	811	2718
06:00 PM	63	3	31	97	8	202	107	317	12	5	16	33	16	164	0	180	627
06:15 PM	68	9	30	107	15	160	85	260	11	0	9	20	21	150	3	174	561
06:30 PM	68	5	27	100	8	174	97	279	12	2	13	27	34	168	2	204	610
06:45 PM	81	5	26	112	8	160	109	277	10	1	12	23	18	146	1	165	577
Total	280	22	114	416	39	696	398	1133	45	8	50	103	89	628	6	723	2375
Grand Total	895	54	391	1340	178	2241	1319	3738	154	36	175	365	352	1973	19	2344	7787
Apprch %	66.8	4	29.2		4.8	60	35.3		42.2	9.9	47.9		15	84.2	0.8		
Total %	11.5	0.7	5	17.2	2.3	28.8	16.9	48	2	0.5	2.2	4.7	4.5	25.3	0.2	30.1	

	Hidden Springs Road Southbound				Clinton Keith Road Westbound				Hidden Springs Road Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	**86**	3	30	**119**	**21**	182	**125**	328	10	2	19	31	40	151	**3**	194	672
05:15 PM	73	2	**42**	117	16	**215**	111	**342**	**19**	2	11	32	39	**171**	3	**213**	**704**
05:30 PM	76	**4**	39	119	14	196	115	325	11	3	**23**	**37**	**43**	159	1	203	684
05:45 PM	70	4	40	114	10	198	112	320	12	**4**	7	23	34	166	1	201	658
Total Volume	305	13	151	469	61	791	463	1315	52	11	60	123	156	647	8	811	2718
% App. Total	65	2.8	32.2		4.6	60.2	35.2		42.3	8.9	48.8		19.2	79.8	1		
PHF	.887	.813	.899	.985	.726	.920	.926	.961	.684	.688	.652	.831	.907	.946	.667	.952	.965

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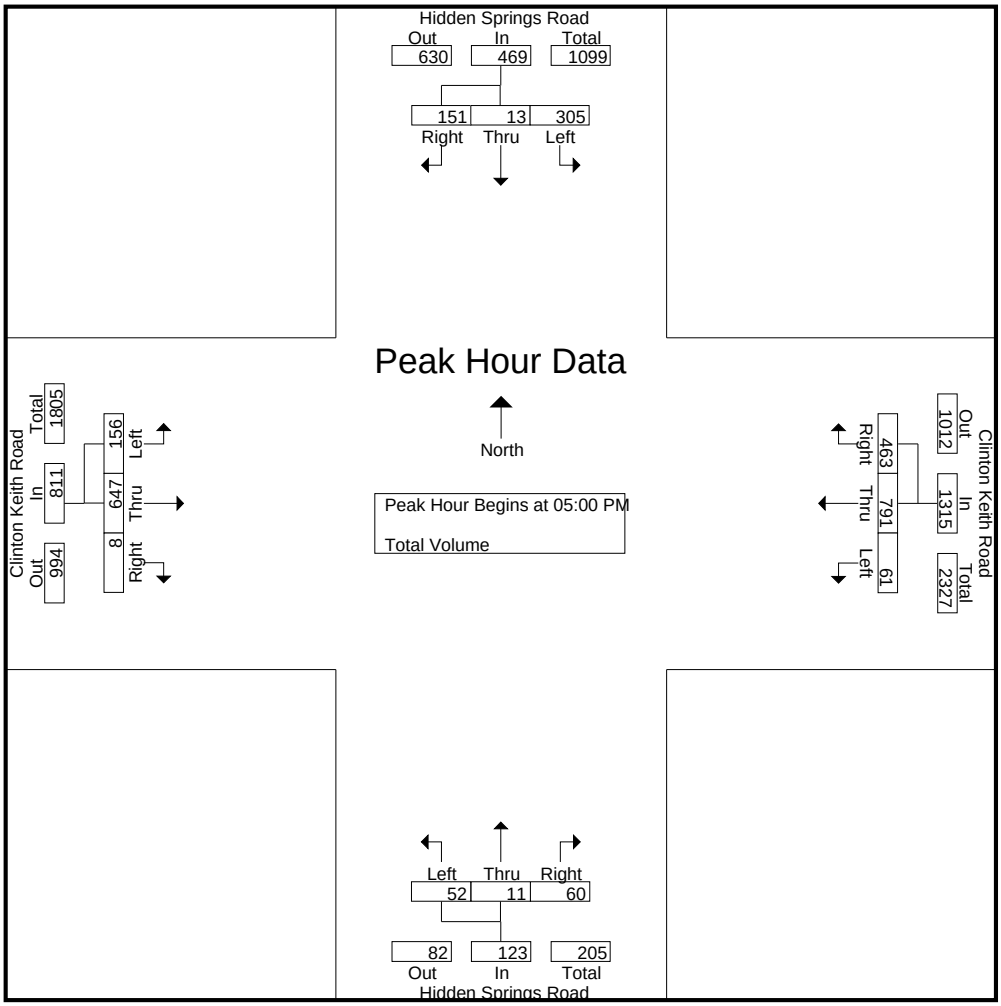
City of Murrieta
N/S: Hidden Springs Road
E/W: Clinton Keith Road
Weather: Sunny

File Name : MURHSCKPM
Site Code : 00000061
Start Date : 5/29/2014
Page No : 2



Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:45 PM				05:00 PM				04:00 PM				05:00 PM			
+0 mins.	**90**	**5**	20	115	**21**	182	**125**	328	17	**8**	15	40	40	151	**3**	194
+15 mins.	86	3	30	**119**	16	**215**	111	**342**	**22**	3	**22**	**47**	39	**171**	3	**213**
+30 mins.	73	2	**42**	117	14	196	115	325	9	3	9	21	**43**	159	1	203
+45 mins.	76	4	39	119	10	198	112	320	9	3	19	31	34	166	1	201
Total Volume	325	14	131	470	61	791	463	1315	57	17	65	139	156	647	8	811
% App. Total	69.1	3	27.9		4.6	60.2	35.2		41	12.2	46.8		19.2	79.8	1	
PHF	.903	.700	.780	.987	.726	.920	.926	.961	.648	.531	.739	.739	.907	.946	.667	.952

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City of Murrieta
N/S: I-15 Southbound Ramps
E/W: Clinton Keith Road
Weather: Sunny

File Name : MUR15SCKAM
Site Code : 00000051
Start Date : 5/29/2014
Page No : 1

Groups Printed- Total Volume

	I-15 Southbound Off Ramp Southbound				Clinton Keith Road Westbound				I-15 Southbound OnRamp Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	53	6	67	126	45	116	0	161	0	0	0	0	0	146	109	255	542
07:15 AM	76	0	61	137	55	121	0	176	0	0	0	0	0	199	174	373	686
07:30 AM	100	0	82	182	65	129	0	194	0	0	0	0	0	181	198	379	755
07:45 AM	111	0	97	208	53	165	0	218	0	0	0	0	0	177	202	379	805
Total	340	6	307	653	218	531	0	749	0	0	0	0	0	703	683	1386	2788
08:00 AM	90	0	71	161	74	124	0	198	0	0	0	0	0	158	150	308	667
08:15 AM	82	0	56	138	54	137	0	191	0	0	0	0	0	151	144	295	624
08:30 AM	58	0	56	114	67	127	0	194	0	0	0	0	0	150	150	300	608
08:45 AM	87	0	62	149	59	129	0	188	0	0	0	0	0	143	164	307	644
Total	317	0	245	562	254	517	0	771	0	0	0	0	0	602	608	1210	2543
Grand Total	657	6	552	1215	472	1048	0	1520	0	0	0	0	0	1305	1291	2596	5331
Apprch %	54.1	0.5	45.4		31.1	68.9	0		0	0	0		0	50.3	49.7		
Total %	12.3	0.1	10.4	22.8	8.9	19.7	0	28.5	0	0	0	0	0	24.5	24.2	48.7	

	I-15 Southbound Off Ramp Southbound				Clinton Keith Road Westbound				I-15 Southbound OnRamp Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	76	0	61	137	55	121	0	176	0	0	0	0	0	**199**	174	373	686
07:30 AM	100	0	82	182	65	129	0	194	0	0	0	0	0	181	198	**379**	755
07:45 AM	**111**	0	**97**	**208**	53	**165**	0	**218**	0	0	0	0	0	177	**202**	379	**805**
08:00 AM	90	0	71	161	**74**	124	0	198	0	0	0	0	0	158	150	308	667
Total Volume	377	0	311	688	247	539	0	786	0	0	0	0	0	715	724	1439	2913
% App. Total	54.8	0	45.2		31.4	68.6	0		0	0	0		0	49.7	50.3		
PHF	.849	.000	.802	.827	.834	.817	.000	.901	.000	.000	.000	.000	.000	.898	.896	.949	.905

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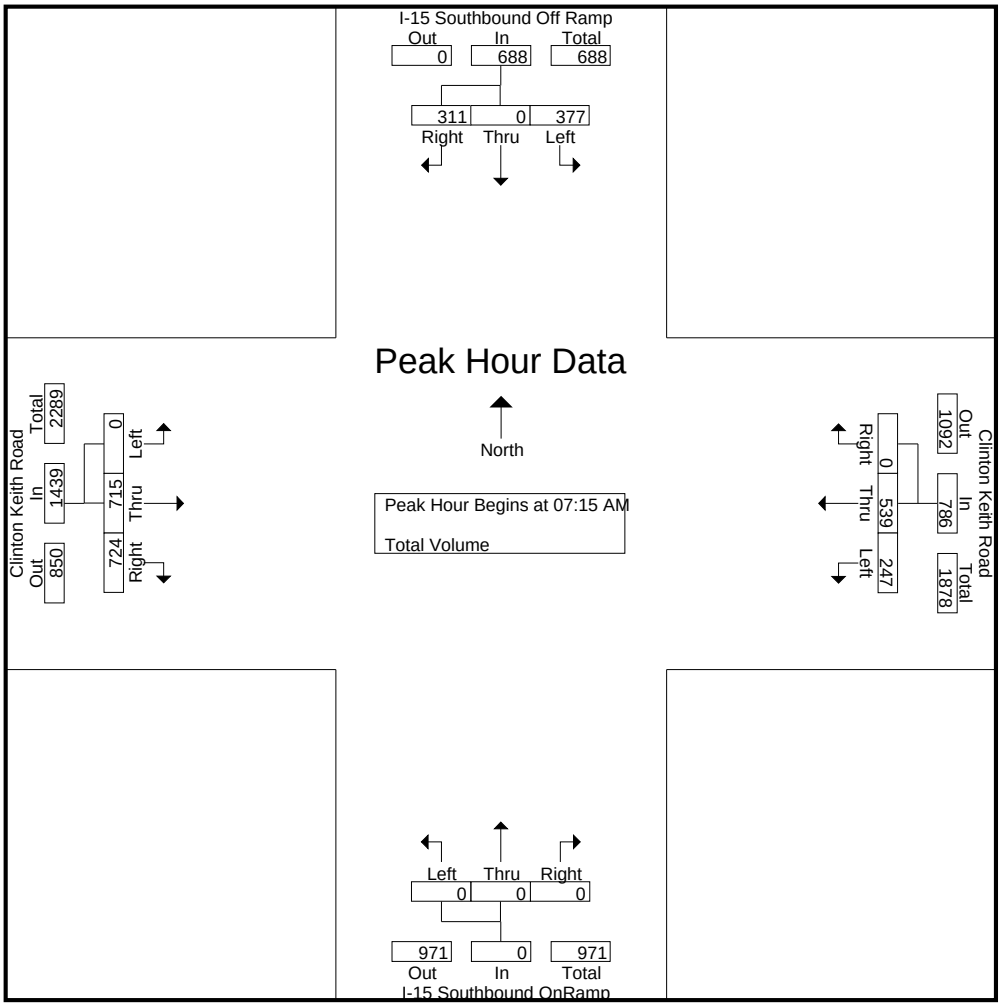
City of Murrieta
N/S: I-15 Southbound Ramps
E/W: Clinton Keith Road
Weather: Sunny

File Name : MUR15SCKAM
Site Code : 00000051
Start Date : 5/29/2014
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30 AM				07:30 AM				07:00 AM				07:15 AM			
+0 mins.	100	0	82	182	65	129	0	194	0	0	0	0	0	**199**	174	373
+15 mins.	**111**	0	**97**	**208**	53	**165**	0	**218**	0	0	0	0	0	181	198	**379**
+30 mins.	90	0	71	161	**74**	124	0	198	0	0	0	0	0	177	**202**	379
+45 mins.	82	0	56	138	54	137	0	191	0	0	0	0	0	158	150	308
Total Volume	383	0	306	689	246	555	0	801	0	0	0	0	0	715	724	1439
% App. Total	55.6	0	44.4		30.7	69.3	0		0	0	0		0	49.7	50.3	
PHF	.863	.000	.789	.828	.831	.841	.000	.919	.000	.000	.000	.000	.000	.898	.896	.949

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City of Murrieta
N/S: I-15 Southbound Ramps
E/W: Clinton Keith Road
Weather: Sunny

File Name : MUR15SCKPM
Site Code : 00000051
Start Date : 5/29/2014
Page No : 1

Groups Printed- Total Volume

	I-15 Southbound Off Ramp Southbound				Clinton Keith Road Westbound				I-15 Southbound On Ramp Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	94	2	104	200	65	256	0	321	0	0	0	0	0	164	98	262	783
04:15 PM	98	0	86	184	76	201	0	277	0	0	0	0	0	143	109	252	713
04:30 PM	88	1	81	170	74	215	0	289	0	0	0	0	0	153	117	270	729
04:45 PM	105	6	79	190	53	215	0	268	0	0	0	0	0	155	91	246	704
Total	385	9	350	744	268	887	0	1155	0	0	0	0	0	615	415	1030	2929
05:00 PM	107	1	100	208	66	217	0	283	0	0	0	0	0	151	101	252	743
05:15 PM	100	0	80	180	61	248	0	309	0	0	0	0	0	131	111	242	731
05:30 PM	102	0	107	209	55	230	0	285	0	0	0	0	0	164	89	253	747
05:45 PM	122	0	105	227	64	221	0	285	0	0	0	0	0	141	93	234	746
Total	431	1	392	824	246	916	0	1162	0	0	0	0	0	587	394	981	2967
06:00 PM	102	0	107	209	59	202	0	261	0	0	0	0	0	144	87	231	701
06:15 PM	114	1	81	196	56	191	0	247	0	0	0	0	0	131	78	209	652
06:30 PM	93	0	70	163	35	192	4	231	0	0	0	0	0	162	95	257	651
06:45 PM	110	1	78	189	37	206	0	243	0	0	0	0	0	136	108	244	676
Total	419	2	336	757	187	791	4	982	0	0	0	0	0	573	368	941	2680
Grand Total	1235	12	1078	2325	701	2594	4	3299	0	0	0	0	0	1775	1177	2952	8576
Apprch %	53.1	0.5	46.4		21.2	78.6	0.1		0	0	0		0	60.1	39.9		
Total %	14.4	0.1	12.6	27.1	8.2	30.2	0	38.5	0	0	0	0	0	20.7	13.7	34.4	

	I-15 Southbound Off Ramp Southbound				Clinton Keith Road Westbound				I-15 Southbound On Ramp Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	107	**1**	100	208	**66**	217	0	283	0	0	0	0	0	151	101	252	743
05:15 PM	100	0	80	180	61	**248**	0	**309**	0	0	0	0	0	131	**111**	242	731
05:30 PM	102	0	**107**	209	55	230	0	285	0	0	0	0	0	**164**	89	**253**	**747**
05:45 PM	**122**	0	105	**227**	64	221	0	285	0	0	0	0	0	141	93	234	746
Total Volume	431	1	392	824	246	916	0	1162	0	0	0	0	0	587	394	981	2967
% App. Total	52.3	0.1	47.6		21.2	78.8	0		0	0	0		0	59.8	40.2		
PHF	.883	.250	.916	.907	.932	.923	.000	.940	.000	.000	.000	.000	.000	.895	.887	.969	.993

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City of Murrieta
N/S: I-15 Southbound Ramps
E/W: Clinton Keith Road
Weather: Sunny

File Name : MUR15SCKPM
Site Code : 00000051
Start Date : 5/29/2014
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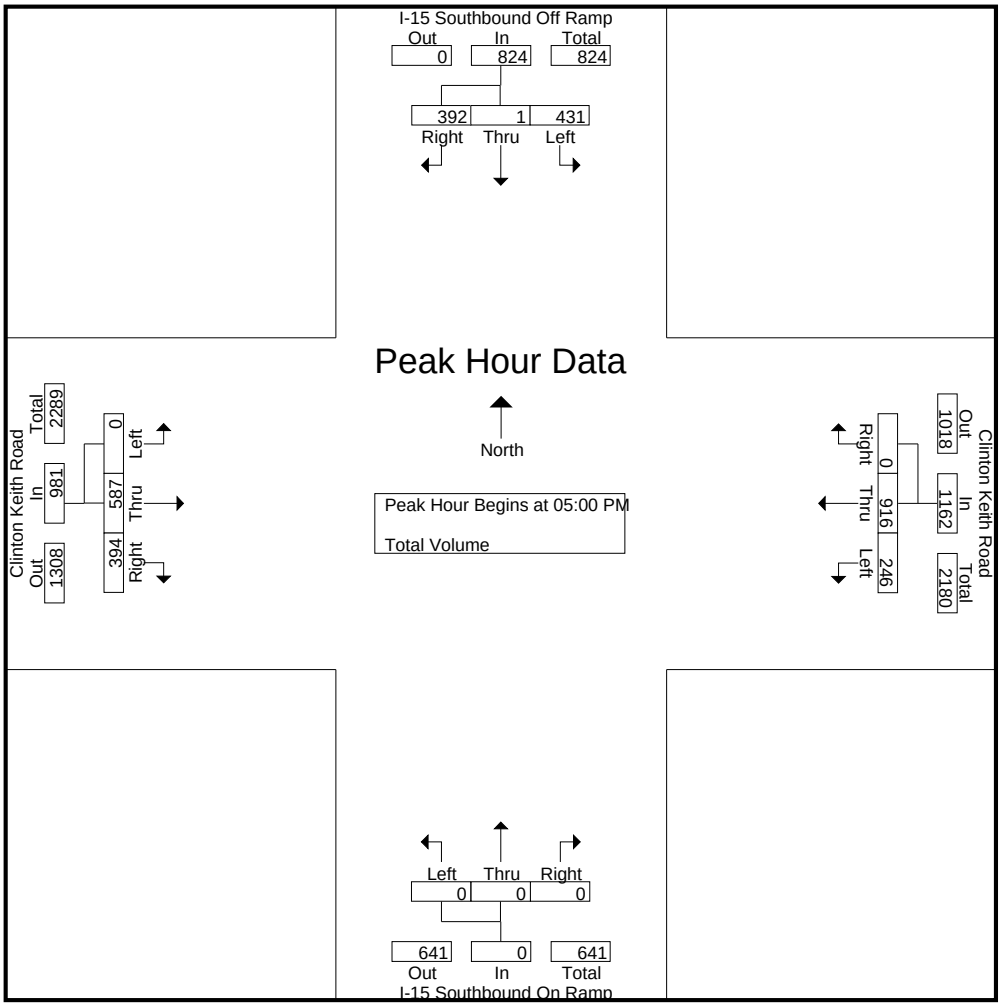

Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	05:30 PM				05:00 PM				04:00 PM				04:00 PM			
+0 mins.	102	0	**107**	209	**66**	217	0	283	0	0	0	0	0	**164**	98	262
+15 mins.	**122**	0	105	**227**	61	**248**	0	**309**	0	0	0	0	0	143	109	252
+30 mins.	102	0	107	209	55	230	0	285	0	0	0	0	0	153	**117**	**270**
+45 mins.	114	**1**	81	196	64	221	0	285	0	0	0	0	0	155	91	246
Total Volume	440	1	400	841	246	916	0	1162	0	0	0	0	0	615	415	1030
% App. Total	52.3	0.1	47.6		21.2	78.8	0		0	0	0		0	59.7	40.3	
PHF	.902	.250	.935	.926	.932	.923	.000	.940	.000	.000	.000	.000	.000	.938	.887	.954

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City of Murrieta
N/S: I-15 Northbound Ramps
E/W: Clinton Keith Road
Weather: Sunny

File Name : MUR15NCKAM
Site Code : 00000053
Start Date : 5/29/2014
Page No : 1

Groups Printed- Total Volume

	I-15 Northbound On Ramp Southbound				Clinton Keith Road Westbound				I-15 Northbound Off Ramp Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	0	0	0	0	0	130	106	236	44	0	42	86	78	143	0	221	543
07:15 AM	0	0	0	0	0	132	130	262	53	0	37	90	92	157	0	249	601
07:30 AM	0	0	0	0	0	148	110	258	43	0	55	98	73	202	0	275	631
07:45 AM	0	0	0	0	0	156	98	254	79	0	56	135	67	230	0	297	686
Total	0	0	0	0	0	566	444	1010	219	0	190	409	310	732	0	1042	2461
08:00 AM	0	0	0	0	0	142	105	247	53	0	48	101	73	177	0	250	598
08:15 AM	0	0	0	0	0	145	98	243	58	0	58	116	60	178	0	238	597
08:30 AM	0	0	0	0	0	128	95	223	58	0	64	122	81	139	0	220	565
08:45 AM	0	0	0	0	0	113	103	216	80	0	68	148	67	168	0	235	599
Total	0	0	0	0	0	528	401	929	249	0	238	487	281	662	0	943	2359
Grand Total	0	0	0	0	0	1094	845	1939	468	0	428	896	591	1394	0	1985	4820
Apprch %	0	0	0		0	56.4	43.6		52.2	0	47.8		29.8	70.2	0		
Total %	0	0	0	0	0	22.7	17.5	40.2	9.7	0	8.9	18.6	12.3	28.9	0	41.2	

	I-15 Northbound On Ramp Southbound				Clinton Keith Road Westbound				I-15 Northbound Off Ramp Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	0	0	0	0	0	132	**130**	**262**	53	0	37	90	**92**	157	0	249	601
07:30 AM	0	0	0	0	0	148	110	258	43	0	55	98	73	202	0	275	631
07:45 AM	0	0	0	0	0	**156**	98	254	**79**	0	**56**	**135**	67	**230**	0	**297**	**686**
08:00 AM	0	0	0	0	0	142	105	247	53	0	48	101	73	177	0	250	598
Total Volume	0	0	0	0	0	578	443	1021	228	0	196	424	305	766	0	1071	2516
% App. Total	0	0	0		0	56.6	43.4		53.8	0	46.2		28.5	71.5	0		
PHF	.000	.000	.000	.000	.000	.926	.852	.974	.722	.000	.875	.785	.829	.833	.000	.902	.917

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City of Murrieta
N/S: I-15 Northbound Ramps
E/W: Clinton Keith Road
Weather: Sunny

File Name : MUR15NCKAM
Site Code : 00000053
Start Date : 5/29/2014
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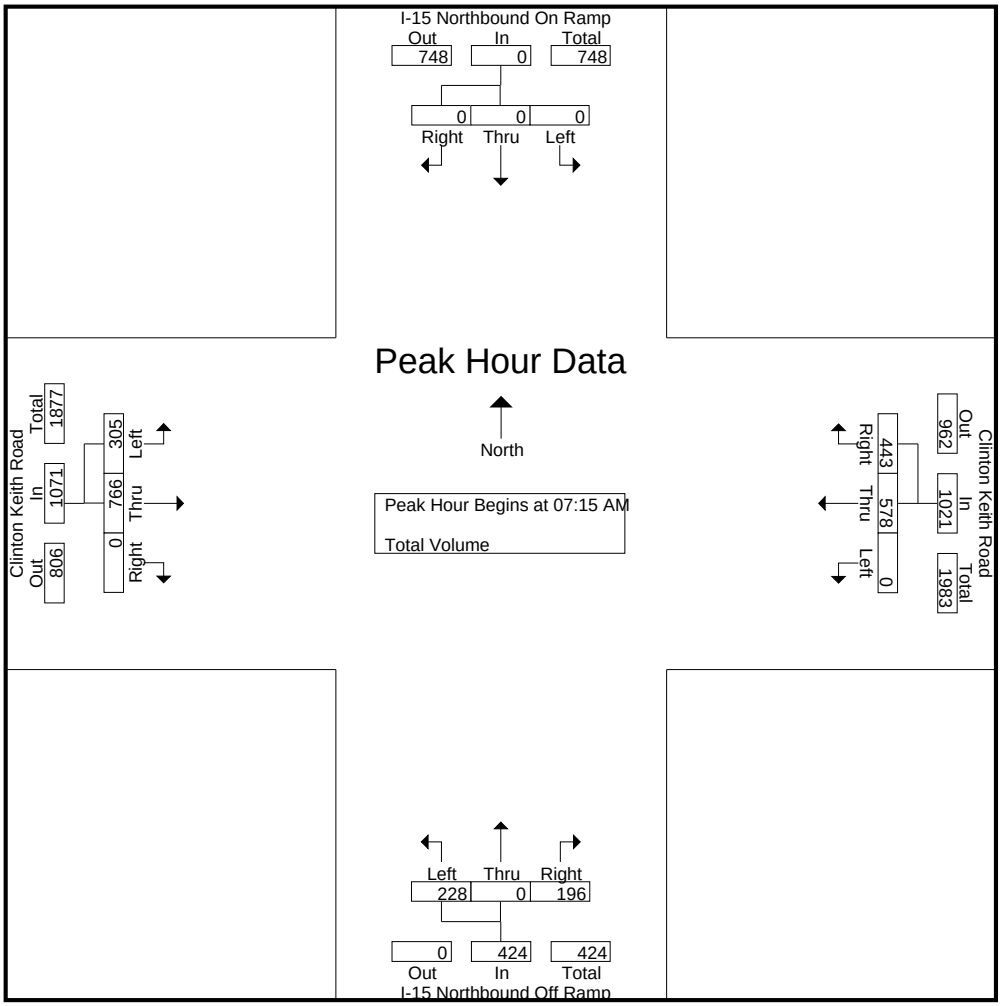

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00 AM				07:15 AM				08:00 AM				07:15 AM			
+0 mins.	0	0	0	0	0	132	**130**	**262**	53	0	48	101	**92**	157	0	249
+15 mins.	0	0	0	0	0	148	110	258	58	0	58	116	73	202	0	275
+30 mins.	0	0	0	0	0	**156**	98	254	58	0	64	122	67	**230**	0	**297**
+45 mins.	0	0	0	0	0	142	105	247	**80**	0	**68**	**148**	73	177	0	250
Total Volume	0	0	0	0	0	578	443	1021	249	0	238	487	305	766	0	1071
% App. Total	0	0	0		0	56.6	43.4		51.1	0	48.9		28.5	71.5	0	
PHF	.000	.000	.000	.000	.000	.926	.852	.974	.778	.000	.875	.823	.829	.833	.000	.902

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City of Murrieta
N/S: I-15 Northbound Ramps
E/W: Clinton Keith Road
Weather: Sunny

File Name : MUR15NCKPM
Site Code : 00000051
Start Date : 5/29/2014
Page No : 1

Groups Printed- Total Volume

	Northbound On Ramp Southbound				Clinton Keith Road Westbound				Northbound Off Ramp Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	0	0	0	0	0	175	110	285	149	0	82	231	77	181	0	258	774
04:15 PM	0	0	0	0	0	158	106	264	121	0	89	210	57	194	0	251	725
04:30 PM	0	0	0	0	0	168	96	264	134	0	94	228	61	177	0	238	730
04:45 PM	0	0	0	0	0	148	105	253	121	0	95	216	76	205	0	281	750
Total	0	0	0	0	0	649	417	1066	525	0	360	885	271	757	0	1028	2979
05:00 PM	0	0	0	0	0	164	118	282	133	0	70	203	64	192	0	256	741
05:15 PM	0	0	0	0	0	175	108	283	128	0	90	218	59	181	0	240	741
05:30 PM	0	0	0	0	0	154	107	261	134	0	88	222	60	203	0	263	746
05:45 PM	0	0	0	0	0	131	96	227	126	0	72	198	55	205	0	260	685
Total	0	0	0	0	0	624	429	1053	521	0	320	841	238	781	0	1019	2913
06:00 PM	0	0	0	0	0	134	86	220	100	0	95	195	45	192	0	237	652
06:15 PM	0	0	0	0	0	119	96	215	147	0	80	227	61	185	0	246	688
06:30 PM	0	0	0	0	0	119	100	219	127	0	86	213	49	182	0	231	663
06:45 PM	0	0	0	0	0	123	82	205	120	0	92	212	51	181	0	232	649
Total	0	0	0	0	0	495	364	859	494	0	353	847	206	740	0	946	2652
Grand Total	0	0	0	0	0	1768	1210	2978	1540	0	1033	2573	715	2278	0	2993	8544
Apprch %	0	0	0		0	59.4	40.6		59.9	0	40.1		23.9	76.1	0		
Total %	0	0	0	0	0	20.7	14.2	34.9	18	0	12.1	30.1	8.4	26.7	0	35	

	Northbound On Ramp Southbound				Clinton Keith Road Westbound				Northbound Off Ramp Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	0	0	0	0	0	**175**	**110**	**285**	**149**	0	82	**231**	**77**	181	0	258	**774**
04:15 PM	0	0	0	0	0	158	106	264	121	0	89	210	57	194	0	251	725
04:30 PM	0	0	0	0	0	168	96	264	134	0	94	228	61	177	0	238	730
04:45 PM	0	0	0	0	0	148	105	253	121	0	**95**	216	76	**205**	0	**281**	750
Total Volume	0	0	0	0	0	649	417	1066	525	0	360	885	271	757	0	1028	2979
% App. Total	0	0	0		0	60.9	39.1		59.3	0	40.7		26.4	73.6	0		
PHF	.000	.000	.000	.000	.000	.927	.948	.935	.881	.000	.947	.958	.880	.923	.000	.915	.962

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City of Murrieta
N/S: I-15 Northbound Ramps
E/W: Clinton Keith Road
Weather: Sunny

File Name : MUR15NCKPM
Site Code : 00000051
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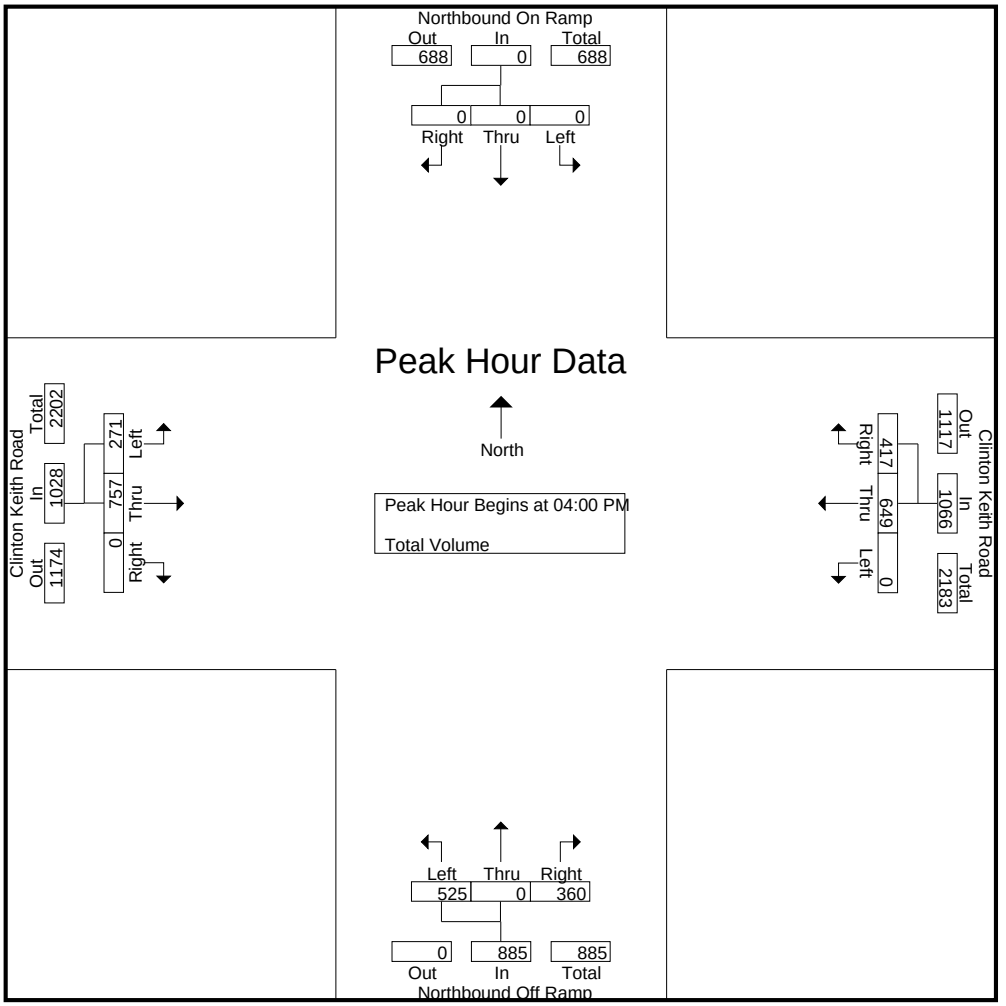

Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:00 PM				04:30 PM				04:00 PM				04:45 PM			
+0 mins.	0	0	0	0	0	168	96	264	**149**	0	82	**231**	**76**	**205**	0	**281**
+15 mins.	0	0	0	0	0	148	105	253	121	0	89	210	64	192	0	256
+30 mins.	0	0	0	0	0	164	**118**	282	134	0	94	228	59	181	0	240
+45 mins.	0	0	0	0	0	**175**	108	**283**	121	0	**95**	216	60	203	0	263
Total Volume	0	0	0	0	0	655	427	1082	525	0	360	885	259	781	0	1040
% App. Total	0	0	0		0	60.5	39.5		59.3	0	40.7		24.9	75.1	0	
PHF	.000	.000	.000	.000	.000	.936	.905	.956	.881	.000	.947	.958	.852	.952	.000	.925

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City of Murrieta
N/S: Catt Road
E/W: Clinton Keith Road
Weather: Sunny

File Name : MURCACKAM
Site Code : 00000051
Start Date : 5/29/2014
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Groups Printed- Total Volume

	Arya Southbound				Clinton Keith Road Westbound				Catt Road Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	3	1	15	19	20	190	22	232	33	0	9	42	12	133	36	181	474
07:15 AM	8	0	20	28	24	183	24	231	56	1	9	66	13	139	48	200	525
07:30 AM	4	2	15	21	39	191	13	243	48	0	8	56	13	200	50	263	583
07:45 AM	8	0	11	19	22	174	23	219	64	1	12	77	9	197	63	269	584
Total	23	3	61	87	105	738	82	925	201	2	38	241	47	669	197	913	2166
08:00 AM	12	1	15	28	18	170	12	200	52	2	15	69	16	150	55	221	518
08:15 AM	1	2	11	14	17	162	16	195	51	0	10	61	11	173	43	227	497
08:30 AM	1	0	15	16	21	149	12	182	56	0	12	68	9	140	38	187	453
08:45 AM	4	2	13	19	22	138	11	171	51	0	12	63	12	174	38	224	477
Total	18	5	54	77	78	619	51	748	210	2	49	261	48	637	174	859	1945
Grand Total	41	8	115	164	183	1357	133	1673	411	4	87	502	95	1306	371	1772	4111
Apprch %	25	4.9	70.1		10.9	81.1	7.9		81.9	0.8	17.3		5.4	73.7	20.9		
Total %	1	0.2	2.8	4	4.5	33	3.2	40.7	10	0.1	2.1	12.2	2.3	31.8	9	43.1	

	Arya Southbound				Clinton Keith Road Westbound				Catt Road Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	8	0	**20**	**28**	24	183	**24**	231	56	1	9	66	13	139	48	200	525
07:30 AM	4	**2**	15	21	**39**	**191**	13	**243**	48	0	8	56	13	**200**	50	263	583
07:45 AM	8	0	11	19	22	174	23	219	**64**	1	12	**77**	9	197	**63**	**269**	**584**
08:00 AM	**12**	1	15	28	18	170	12	200	52	**2**	**15**	69	**16**	150	55	221	518
Total Volume	32	3	61	96	103	718	72	893	220	4	44	268	51	686	216	953	2210
% App. Total	33.3	3.1	63.5		11.5	80.4	8.1		82.1	1.5	16.4		5.4	72	22.7		
PHF	.667	.375	.763	.857	.660	.940	.750	.919	.859	.500	.733	.870	.797	.858	.857	.886	.946

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City of Murrieta
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File Name : MURCACKAM
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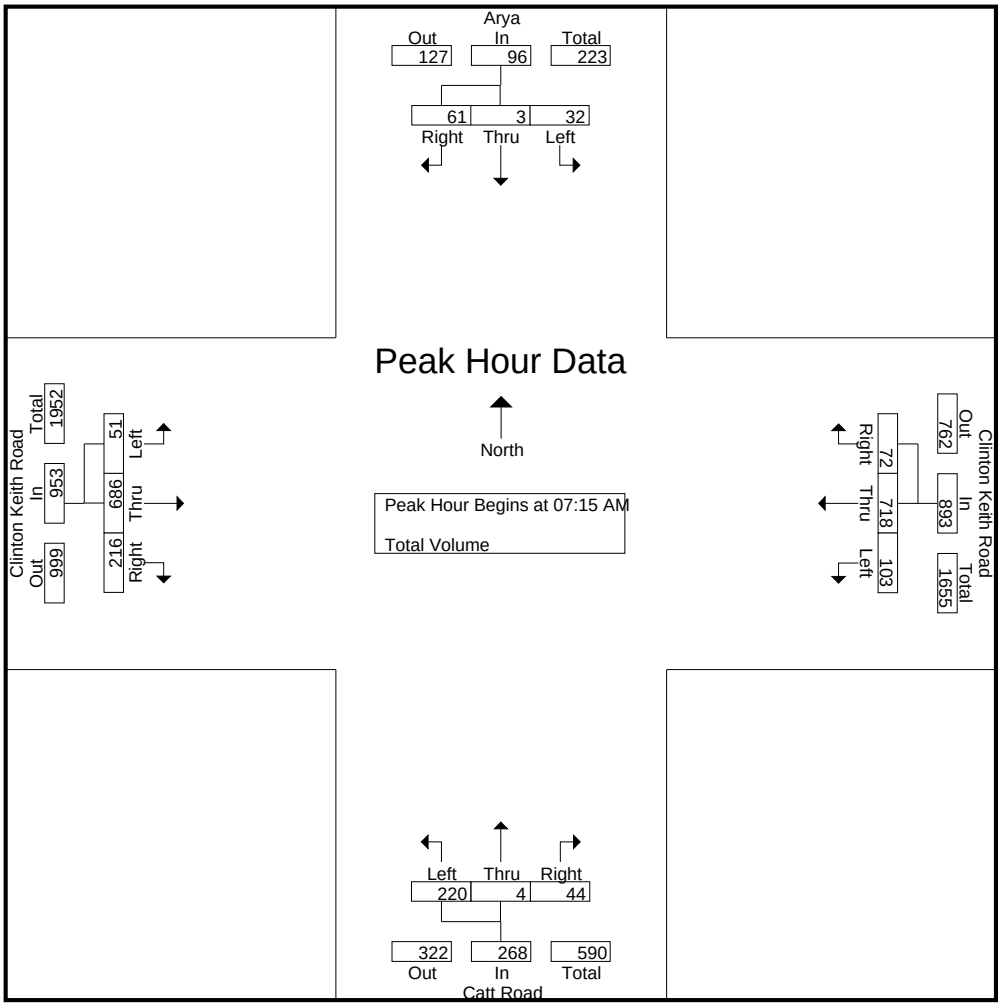

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:15 AM				07:00 AM				07:45 AM				07:30 AM			
+0 mins.	8	0	**20**	**28**	20	190	22	232	**64**	1	12	**77**	13	**200**	50	263
+15 mins.	4	**2**	15	21	24	183	**24**	231	52	**2**	**15**	69	9	197	**63**	**269**
+30 mins.	8	0	11	19	**39**	**191**	13	**243**	51	0	10	61	**16**	150	55	221
+45 mins.	**12**	1	15	28	22	174	23	219	56	0	12	68	11	173	43	227
Total Volume	32	3	61	96	105	738	82	925	223	3	49	275	49	720	211	980
% App. Total	33.3	3.1	63.5		11.4	79.8	8.9		81.1	1.1	17.8		5	73.5	21.5	
PHF	.667	.375	.763	.857	.673	.966	.854	.952	.871	.375	.817	.893	.766	.900	.837	.911

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City of Murrieta
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File Name : MURCACKPM
Site Code : 00000051
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Groups Printed- Total Volume

	Arya Southbound				Clinton Keith Road Westbound				Catt Road Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	6	2	10	18	12	178	6	196	84	4	18	106	11	179	49	239	559
04:15 PM	7	3	15	25	21	172	13	206	69	1	20	90	14	181	54	249	570
04:30 PM	6	1	12	19	16	173	8	197	64	2	15	81	19	186	60	265	562
04:45 PM	7	3	17	27	19	172	18	209	69	0	23	92	20	214	64	298	626
Total	26	9	54	89	68	695	45	808	286	7	76	369	64	760	227	1051	2317
05:00 PM	8	2	9	19	15	197	9	221	65	2	11	78	15	196	57	268	586
05:15 PM	13	1	13	27	18	195	9	222	66	4	18	88	10	187	52	249	586
05:30 PM	3	1	11	15	18	180	10	208	61	2	10	73	9	199	63	271	567
05:45 PM	9	2	12	23	13	153	11	177	70	0	24	94	9	199	73	281	575
Total	33	6	45	84	64	725	39	828	262	8	63	333	43	781	245	1069	2314
06:00 PM	7	0	10	17	11	158	11	180	55	2	18	75	15	194	58	267	539
06:15 PM	9	1	16	26	26	128	9	163	67	3	19	89	15	192	47	254	532
06:30 PM	5	2	14	21	13	134	12	159	62	2	17	81	17	200	73	290	551
06:45 PM	9	0	10	19	20	116	5	141	60	1	20	81	11	197	54	262	503
Total	30	3	50	83	70	536	37	643	244	8	74	326	58	783	232	1073	2125
Grand Total	89	18	149	256	202	1956	121	2279	792	23	213	1028	165	2324	704	3193	6756
Apprch %	34.8	7	58.2		8.9	85.8	5.3		77	2.2	20.7		5.2	72.8	22		
Total %	1.3	0.3	2.2	3.8	3	29	1.8	33.7	11.7	0.3	3.2	15.2	2.4	34.4	10.4	47.3	

	Arya Southbound				Clinton Keith Road Westbound				Catt Road Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	7	**3**	**17**	**27**	**19**	172	**18**	209	**69**	0	**23**	**92**	**20**	**214**	**64**	**298**	**626**
05:00 PM	8	2	9	19	15	**197**	9	221	65	2	11	78	15	196	57	268	586
05:15 PM	**13**	1	13	27	18	195	9	**222**	66	**4**	18	88	10	187	52	249	586
05:30 PM	3	1	11	15	18	180	10	208	61	2	10	73	9	199	63	271	567
Total Volume	31	7	50	88	70	744	46	860	261	8	62	331	54	796	236	1086	2365
% App. Total	35.2	8	56.8		8.1	86.5	5.3		78.9	2.4	18.7		5	73.3	21.7		
PHF	.596	.583	.735	.815	.921	.944	.639	.968	.946	.500	.674	.899	.675	.930	.922	.911	.944

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City of Murrieta
N/S: Catt Road
E/W: Clinton Keith Road
Weather: Sunny

File Name : MURCACKPM
Site Code : 00000051
Start Date : 5/29/2014
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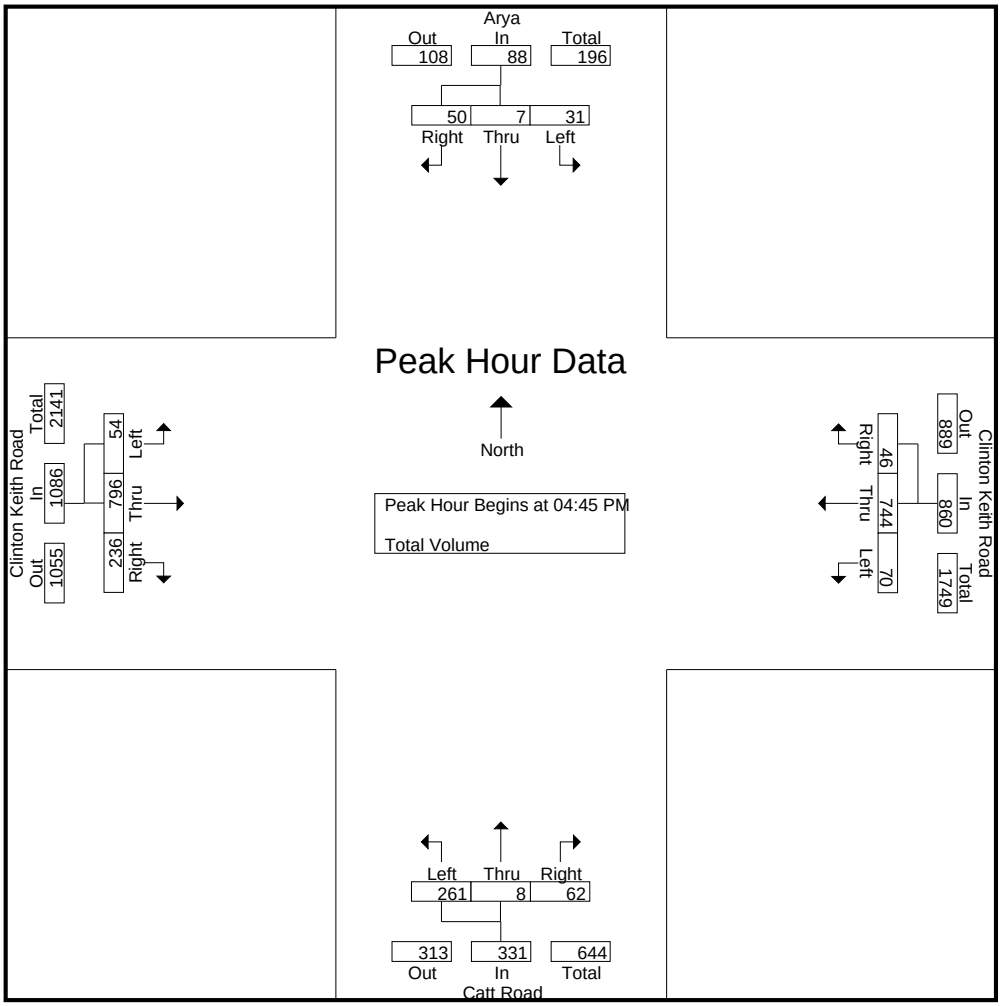

Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:30 PM				04:45 PM				04:00 PM				05:45 PM			
+0 mins.	6	1	12	19	**19**	172	**18**	209	**84**	**4**	18	**106**	9	199	**73**	281
+15 mins.	7	**3**	**17**	**27**	15	**197**	9	221	69	1	20	90	15	194	58	267
+30 mins.	8	2	9	19	18	195	9	**222**	64	2	15	81	15	192	47	254
+45 mins.	**13**	1	13	27	18	180	10	208	69	0	**23**	92	**17**	**200**	73	**290**
Total Volume	34	7	51	92	70	744	46	860	286	7	76	369	56	785	251	1092
% App. Total	37	7.6	55.4		8.1	86.5	5.3		77.5	1.9	20.6		5.1	71.9	23	
PHF	.654	.583	.750	.852	.921	.944	.639	.968	.851	.438	.826	.870	.824	.981	.860	.941

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City of Murrieta
N/S: George Avenue
E/W: Clinton Keith Road
Weather: Sunny

File Name : MURGECKAM
Site Code : 00000098
Start Date : 5/29/2014
Page No : 1

Groups Printed- Total Volume

	George Avenue Southbound				Clinton Keith Road Westbound				George Avenue Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	14	4	37	55	8	206	14	228	1	1	2	4	12	135	4	151	438
07:15 AM	12	2	38	52	14	188	9	211	2	2	5	9	29	140	3	172	444
07:30 AM	15	12	39	66	14	201	11	226	2	10	6	18	44	182	4	230	540
07:45 AM	24	10	47	81	15	161	22	198	3	3	16	22	48	196	3	247	548
Total	65	28	161	254	51	756	56	863	8	16	29	53	133	653	14	800	1970
08:00 AM	21	10	35	66	18	168	11	197	3	1	8	12	21	175	2	198	473
08:15 AM	23	5	25	53	17	165	6	188	3	6	8	17	6	186	2	194	452
08:30 AM	10	6	23	39	12	156	6	174	4	1	12	17	16	138	6	160	390
08:45 AM	8	4	22	34	16	165	6	187	3	1	17	21	22	158	2	182	424
Total	62	25	105	192	63	654	29	746	13	9	45	67	65	657	12	734	1739
Grand Total	127	53	266	446	114	1410	85	1609	21	25	74	120	198	1310	26	1534	3709
Apprch %	28.5	11.9	59.6		7.1	87.6	5.3		17.5	20.8	61.7		12.9	85.4	1.7		
Total %	3.4	1.4	7.2	12	3.1	38	2.3	43.4	0.6	0.7	2	3.2	5.3	35.3	0.7	41.4	

	George Avenue Southbound				Clinton Keith Road Westbound				George Avenue Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30 AM																	
07:30 AM	15	**12**	39	66	14	**201**	11	**226**	2	**10**	6	18	44	182	**4**	230	540
07:45 AM	**24**	10	**47**	**81**	15	161	**22**	198	**3**	3	**16**	**22**	**48**	**196**	3	**247**	**548**
08:00 AM	21	10	35	66	**18**	168	11	197	3	1	8	12	21	175	2	198	473
08:15 AM	23	5	25	53	17	165	6	188	3	6	8	17	6	186	2	194	452
Total Volume	83	37	146	266	64	695	50	809	11	20	38	69	119	739	11	869	2013
% App. Total	31.2	13.9	54.9		7.9	85.9	6.2		15.9	29	55.1		13.7	85	1.3		
PHF	.865	.771	.777	.821	.889	.864	.568	.895	.917	.500	.594	.784	.620	.943	.688	.880	.918

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City of Murrieta
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File Name : MURGECKAM
Site Code : 00000098
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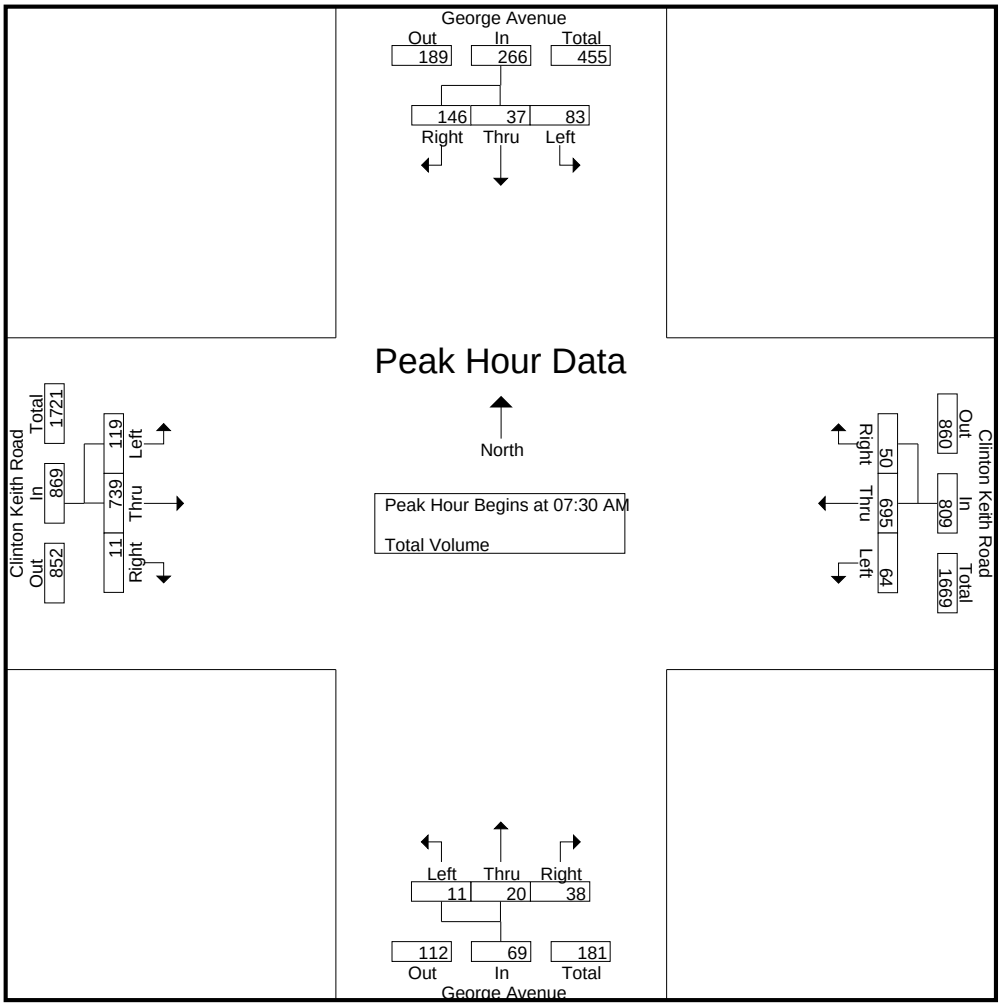

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30 AM				07:00 AM				07:30 AM				07:30 AM			
+0 mins.	15	**12**	39	66	8	**206**	14	**228**	2	**10**	6	18	44	182	**4**	230
+15 mins.	**24**	10	**47**	**81**	14	188	9	211	**3**	3	**16**	**22**	**48**	**196**	3	**247**
+30 mins.	21	10	35	66	14	201	11	226	3	1	8	12	21	175	2	198
+45 mins.	23	5	25	53	**15**	161	**22**	198	3	6	8	17	6	186	2	194
Total Volume	83	37	146	266	51	756	56	863	11	20	38	69	119	739	11	869
% App. Total	31.2	13.9	54.9		5.9	87.6	6.5		15.9	29	55.1		13.7	85	1.3	
PHF	.865	.771	.777	.821	.850	.917	.636	.946	.917	.500	.594	.784	.620	.943	.688	.880

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City of Murrieta
N/S: George Avenue
E/W: Clinton Keith Road
Weather: Sunny

File Name : MURGECKPM
Site Code : 00000098
Start Date : 5/29/2014
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Groups Printed- Total Volume

	George Avenue Southbound				Clinton Keith Road Westbound				George Avenue Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	10	4	26	40	20	170	12	202	4	4	31	39	27	180	0	207	488
04:15 PM	10	2	21	33	30	187	8	225	5	6	23	34	30	194	0	224	516
04:30 PM	11	6	18	35	15	183	9	207	6	6	22	34	27	187	0	214	490
04:45 PM	8	10	22	40	22	174	4	200	0	5	21	26	31	211	4	246	512
Total	39	22	87	148	87	714	33	834	15	21	97	133	115	772	4	891	2006
05:00 PM	15	10	14	39	17	181	10	208	3	6	36	45	28	183	1	212	504
05:15 PM	11	4	14	29	16	204	13	233	6	9	26	41	21	180	3	204	507
05:30 PM	14	5	21	40	25	194	11	230	5	8	30	43	19	183	3	205	518
05:45 PM	10	10	26	46	18	151	14	183	8	10	18	36	28	223	2	253	518
Total	50	29	75	154	76	730	48	854	22	33	110	165	96	769	9	874	2047
06:00 PM	9	6	18	33	20	171	8	199	6	6	20	32	37	186	2	225	489
06:15 PM	9	7	21	37	19	132	6	157	4	9	28	41	26	200	2	228	463
06:30 PM	7	4	16	27	19	150	10	179	3	7	16	26	38	185	1	224	456
06:45 PM	11	9	11	31	12	129	8	149	1	11	19	31	34	184	2	220	431
Total	36	26	66	128	70	582	32	684	14	33	83	130	135	755	7	897	1839
Grand Total	125	77	228	430	233	2026	113	2372	51	87	290	428	346	2296	20	2662	5892
Apprch %	29.1	17.9	53		9.8	85.4	4.8		11.9	20.3	67.8		13	86.3	0.8		
Total %	2.1	1.3	3.9	7.3	4	34.4	1.9	40.3	0.9	1.5	4.9	7.3	5.9	39	0.3	45.2	

	George Avenue Southbound				Clinton Keith Road Westbound				George Avenue Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	**15**	**10**	14	39	17	181	10	208	3	6	**36**	**45**	**28**	183	1	212	504
05:15 PM	11	4	14	29	16	**204**	13	**233**	6	9	26	41	21	180	**3**	204	507
05:30 PM	14	5	21	40	**25**	194	11	230	5	8	30	43	19	183	3	205	**518**
05:45 PM	10	10	**26**	**46**	18	151	**14**	183	**8**	**10**	18	36	28	**223**	2	**253**	518
Total Volume	50	29	75	154	76	730	48	854	22	33	110	165	96	769	9	874	2047
% App. Total	32.5	18.8	48.7		8.9	85.5	5.6		13.3	20	66.7		11	88	1		
PHF	.833	.725	.721	.837	.760	.895	.857	.916	.688	.825	.764	.917	.857	.862	.750	.864	.988

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City of Murrieta
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File Name : MURGECKPM
Site Code : 00000098
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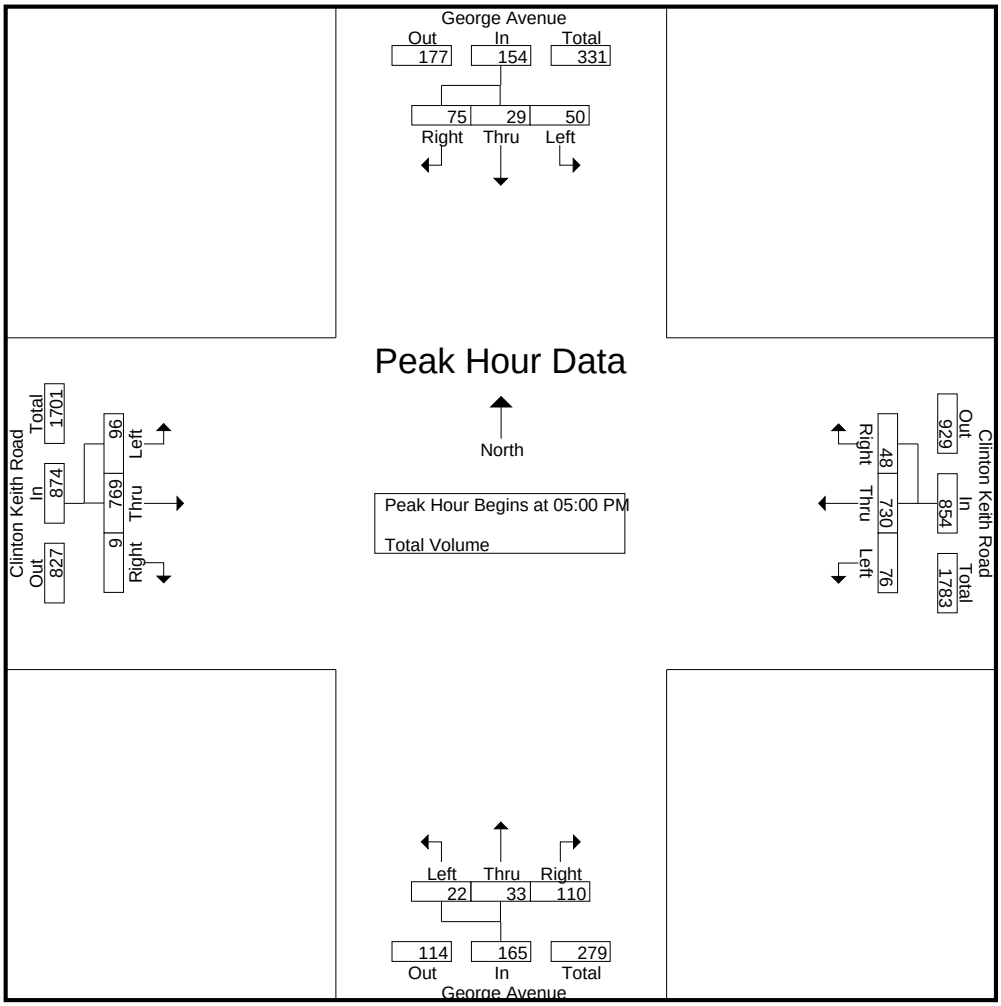

Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	05:30 PM				04:45 PM				05:00 PM				05:45 PM			
+0 mins.	**14**	5	21	40	22	174	4	200	3	6	**36**	**45**	28	**223**	**2**	**253**
+15 mins.	10	**10**	**26**	**46**	17	181	10	208	6	9	26	41	37	186	2	225
+30 mins.	9	6	18	33	16	**204**	**13**	**233**	5	8	30	43	26	200	2	228
+45 mins.	9	7	21	37	**25**	194	11	230	**8**	**10**	18	36	**38**	185	1	224
Total Volume	42	28	86	156	80	753	38	871	22	33	110	165	129	794	7	930
% App. Total	26.9	17.9	55.1		9.2	86.5	4.4		13.3	20	66.7		13.9	85.4	0.8	
PHF	.750	.700	.827	.848	.800	.923	.731	.935	.688	.825	.764	.917	.849	.890	.875	.919

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City of Murrieta
N/S: Inland Valley Drive
E/W: Clinton Keith Road
Weather: Sunny

File Name : MURIVCKAM
Site Code : 00000051
Start Date : 5/29/2014
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Groups Printed- Total Volume

	Clinton Keith Road Westbound			Inland Valley Drive Northbound			Clinton Keith Road Eastbound			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
07:00 AM	13	155	168	56	5	61	90	55	145	374
07:15 AM	12	163	175	46	5	51	87	70	157	383
07:30 AM	16	162	178	68	12	80	101	81	182	440
07:45 AM	35	145	180	58	2	60	125	93	218	458
Total	76	625	701	228	24	252	403	299	702	1655
08:00 AM	29	118	147	58	13	71	114	83	197	415
08:15 AM	29	142	171	49	10	59	97	115	212	442
08:30 AM	38	117	155	62	13	75	66	93	159	389
08:45 AM	22	110	132	59	15	74	85	117	202	408
Total	118	487	605	228	51	279	362	408	770	1654
Grand Total	194	1112	1306	456	75	531	765	707	1472	3309
Apprch %	14.9	85.1		85.9	14.1		52	48		
Total %	5.9	33.6	39.5	13.8	2.3	16	23.1	21.4	44.5	

	Clinton Keith Road Westbound			Inland Valley Drive Northbound			Clinton Keith Road Eastbound			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30 AM										
07:30 AM	16	**162**	178	**68**	12	**80**	101	81	182	440
07:45 AM	**35**	145	**180**	58	2	60	**125**	93	**218**	**458**
08:00 AM	29	118	147	58	**13**	71	114	83	197	415
08:15 AM	29	142	171	49	10	59	97	**115**	212	442
Total Volume	109	567	676	233	37	270	437	372	809	1755
% App. Total	16.1	83.9		86.3	13.7		54	46		
PHF	.779	.875	.939	.857	.712	.844	.874	.809	.928	.958

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City of Murrieta
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File Name : MURIVCKAM
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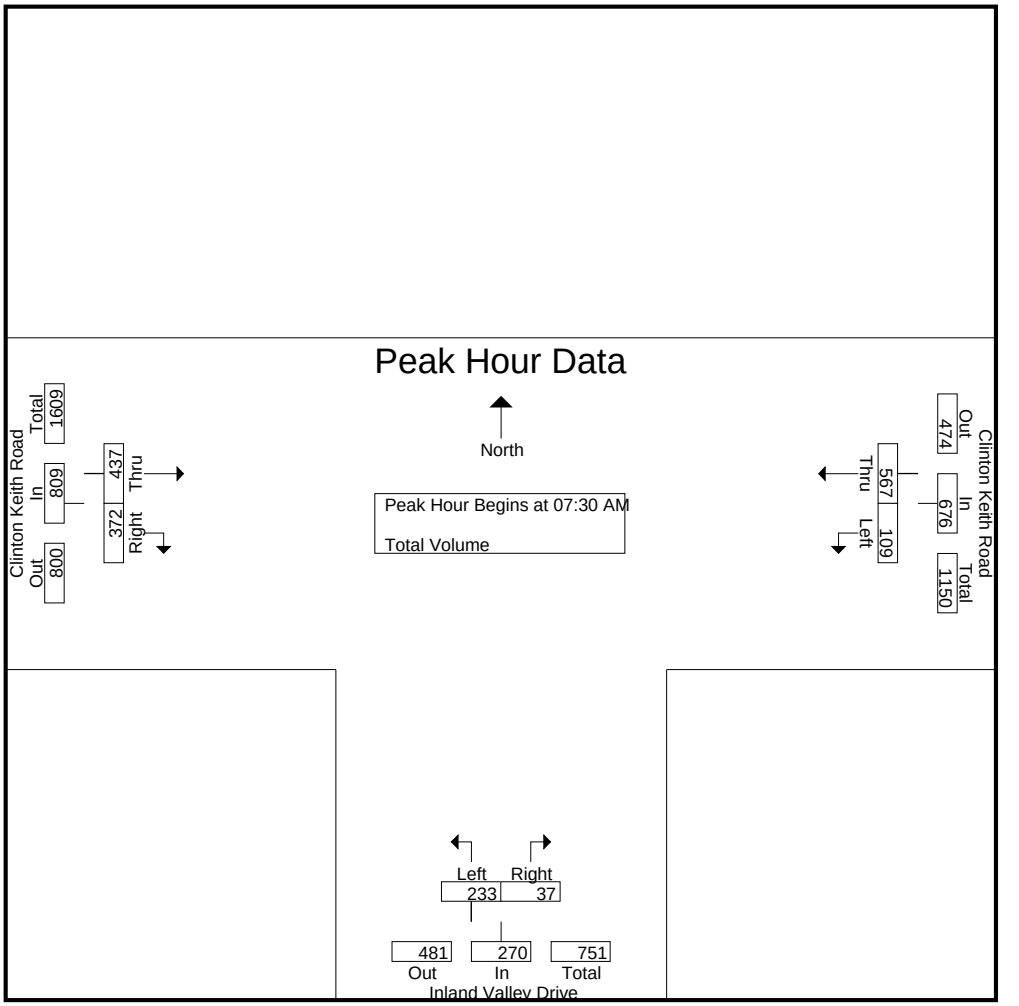

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00 AM			08:00 AM			07:30 AM		
+0 mins.	13	155	168	58	13	71	101	81	182
+15 mins.	12	**163**	175	49	10	59	**125**	93	**218**
+30 mins.	16	162	178	**62**	13	**75**	114	83	197
+45 mins.	**35**	145	**180**	59	**15**	74	97	**115**	212
Total Volume	76	625	701	228	51	279	437	372	809
% App. Total	10.8	89.2		81.7	18.3		54	46	
PHF	.543	.959	.974	.919	.850	.930	.874	.809	.928

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City of Murrieta
N/S: Inland Valley Drive
E/W: Clinton Keith Road
Weather: Sunny

File Name : MURIVCKPM
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Start Date : 5/29/2014
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Groups Printed- Total Volume

	Clinton Keith Road Westbound			Inland Valley Drive Northbound			Clinton Keith Road Eastbound			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
04:00 PM	16	104	120	108	23	131	144	80	224	475
04:15 PM	16	122	138	113	18	131	140	77	217	486
04:30 PM	17	102	119	102	26	128	129	89	218	465
04:45 PM	17	121	138	94	31	125	153	83	236	499
Total	66	449	515	417	98	515	566	329	895	1925
05:00 PM	8	119	127	107	30	137	143	85	228	492
05:15 PM	20	134	154	101	21	122	125	89	214	490
05:30 PM	14	129	143	86	25	111	133	84	217	471
05:45 PM	12	113	125	77	11	88	143	93	236	449
Total	54	495	549	371	87	458	544	351	895	1902
06:00 PM	15	102	117	76	11	87	159	77	236	440
06:15 PM	11	94	105	73	12	85	151	81	232	422
06:30 PM	14	106	120	80	20	100	126	81	207	427
06:45 PM	15	98	113	56	9	65	144	69	213	391
Total	55	400	455	285	52	337	580	308	888	1680
Grand Total	175	1344	1519	1073	237	1310	1690	988	2678	5507
Apprch %	11.5	88.5		81.9	18.1		63.1	36.9		
Total %	3.2	24.4	27.6	19.5	4.3	23.8	30.7	17.9	48.6	

	Clinton Keith Road Westbound			Inland Valley Drive Northbound			Clinton Keith Road Eastbound			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:45 PM										
04:45 PM	17	121	138	94	**31**	125	**153**	83	**236**	**499**
05:00 PM	8	119	127	**107**	30	**137**	143	85	228	492
05:15 PM	**20**	**134**	**154**	101	21	122	125	**89**	214	490
05:30 PM	14	129	143	86	25	111	133	84	217	471
Total Volume	59	503	562	388	107	495	554	341	895	1952
% App. Total	10.5	89.5		78.4	21.6		61.9	38.1		
PHF	.738	.938	.912	.907	.863	.903	.905	.958	.948	.978

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City of Murrieta
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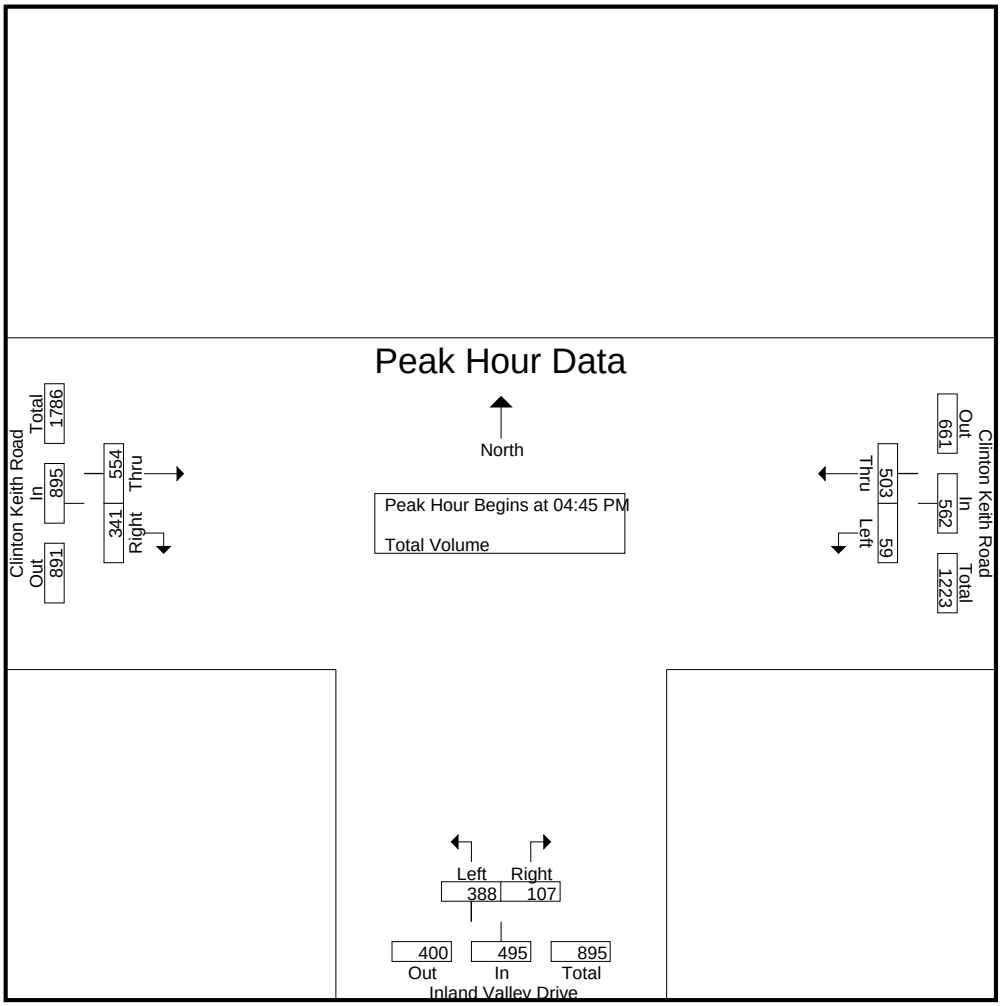

Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:45 PM			04:15 PM			05:30 PM		
+0 mins.	17	121	138	**113**	18	131	133	84	217
+15 mins.	8	119	127	102	26	128	143	**93**	**236**
+30 mins.	**20**	**134**	**154**	94	**31**	125	**159**	77	236
+45 mins.	14	129	143	107	30	**137**	151	81	232
Total Volume	59	503	562	416	105	521	586	335	921
% App. Total	10.5	89.5		79.8	20.2		63.6	36.4	
PHF	.738	.938	.912	.920	.847	.951	.921	.901	.976

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City of Murrieta
N/S: Smith Ranch Road
E/W: Clinton Keith Road
Weather: Sunny

File Name : MURSRCKAM
Site Code : 00000051
Start Date : 5/29/2014
Page No : 1

Groups Printed- Total Volume

	Smith Ranch Road Southbound				Clinton Keith Road Westbound				Smith Ranch Road Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	10	0	14	24	1	147	6	154	7	0	2	9	1	86	2	89	276
07:15 AM	11	0	23	34	3	132	3	138	6	1	0	7	3	89	2	94	273
07:30 AM	9	0	12	21	2	141	10	153	11	0	2	13	5	97	2	104	291
07:45 AM	13	0	12	25	3	137	3	143	14	0	0	14	4	110	5	119	301
Total	43	0	61	104	9	557	22	588	38	1	4	43	13	382	11	406	1141
08:00 AM	13	0	15	28	3	125	3	131	5	0	3	8	5	127	3	135	302
08:15 AM	3	0	13	16	4	156	8	168	4	0	2	6	5	107	5	117	307
08:30 AM	14	0	4	18	3	116	8	127	11	0	1	12	5	68	0	73	230
08:45 AM	11	0	11	22	2	123	7	132	8	0	0	8	9	77	6	92	254
Total	41	0	43	84	12	520	26	558	28	0	6	34	24	379	14	417	1093
Grand Total	84	0	104	188	21	1077	48	1146	66	1	10	77	37	761	25	823	2234
Apprch %	44.7	0	55.3		1.8	94	4.2		85.7	1.3	13		4.5	92.5	3		
Total %	3.8	0	4.7	8.4	0.9	48.2	2.1	51.3	3	0	0.4	3.4	1.7	34.1	1.1	36.8	

	Smith Ranch Road Southbound				Clinton Keith Road Westbound				Smith Ranch Road Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30 AM																	
07:30 AM	9	0	12	21	2	141	**10**	153	11	0	2	13	**5**	97	2	104	291
07:45 AM	**13**	0	12	25	3	137	3	143	**14**	0	0	**14**	4	110	**5**	119	301
08:00 AM	13	0	**15**	**28**	3	125	3	131	5	0	**3**	8	5	**127**	3	**135**	302
08:15 AM	3	0	13	16	**4**	**156**	8	**168**	4	0	2	6	5	107	5	117	**307**
Total Volume	38	0	52	90	12	559	24	595	34	0	7	41	19	441	15	475	1201
% App. Total	42.2	0	57.8		2	93.9	4		82.9	0	17.1		4	92.8	3.2		
PHF	.731	.000	.867	.804	.750	.896	.600	.885	.607	.000	.583	.732	.950	.868	.750	.880	.978

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City of Murrieta
N/S: Smith Ranch Road
E/W: Clinton Keith Road
Weather: Sunny

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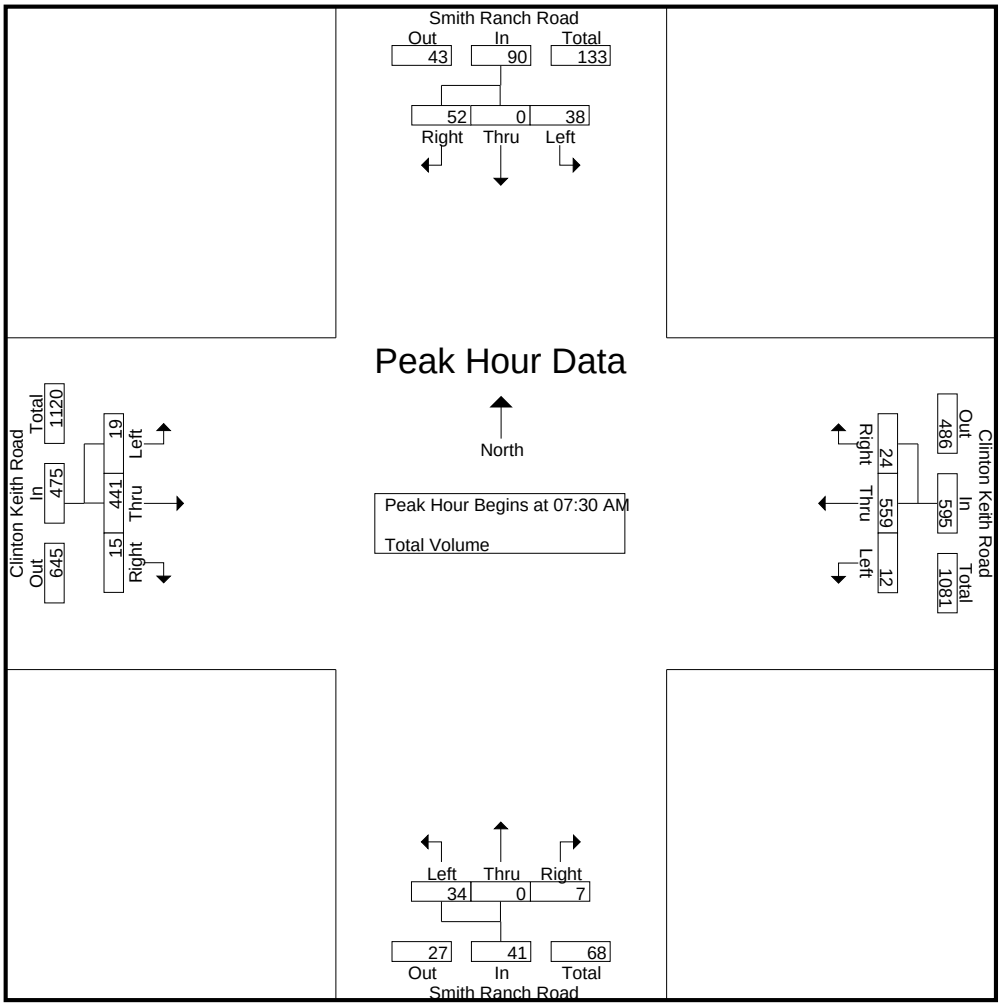

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:15 AM				07:30 AM				07:00 AM				07:30 AM			
+0 mins.	11	0	**23**	**34**	2	141	**10**	153	7	0	**2**	9	**5**	97	2	104
+15 mins.	9	0	12	21	3	137	3	143	6	**1**	0	7	4	110	**5**	119
+30 mins.	**13**	0	12	25	3	125	3	131	11	0	2	13	5	**127**	3	**135**
+45 mins.	13	0	15	28	**4**	**156**	8	**168**	**14**	0	0	**14**	5	107	5	117
Total Volume	46	0	62	108	12	559	24	595	38	1	4	43	19	441	15	475
% App. Total	42.6	0	57.4		2	93.9	4		88.4	2.3	9.3		4	92.8	3.2	
PHF	.885	.000	.674	.794	.750	.896	.600	.885	.679	.250	.500	.768	.950	.868	.750	.880

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City of Murrieta
N/S: Smith Ranch Road
E/W: Clinton Keith Road
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Groups Printed- Total Volume

	Smith Ranch Road Southbound				Clinton Keith Road Westbound				Smith Ranch Road Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	6	1	3	10	4	107	15	126	5	0	0	5	15	120	11	146	287
04:15 PM	4	0	11	15	2	105	10	117	6	0	3	9	17	122	6	145	286
04:30 PM	11	1	10	22	5	97	6	108	9	0	1	10	17	125	6	148	288
04:45 PM	11	2	11	24	2	103	7	112	9	0	0	9	17	122	10	149	294
Total	32	4	35	71	13	412	38	463	29	0	4	33	66	489	33	588	1155
05:00 PM	9	0	5	14	6	111	14	131	8	0	2	10	15	146	4	165	320
05:15 PM	7	1	10	18	2	144	6	152	6	0	1	7	13	129	3	145	322
05:30 PM	6	0	13	19	5	121	11	137	7	0	0	7	12	134	3	149	312
05:45 PM	6	0	9	15	5	91	10	106	6	0	0	6	11	132	7	150	277
Total	28	1	37	66	18	467	41	526	27	0	3	30	51	541	17	609	1231
06:00 PM	13	0	3	16	4	116	11	131	4	0	1	5	12	131	3	146	298
06:15 PM	5	2	5	12	5	81	5	91	7	0	4	11	11	130	7	148	262
06:30 PM	8	0	6	14	1	104	9	114	2	0	1	3	15	117	2	134	265
06:45 PM	5	0	7	12	3	86	10	99	5	0	0	5	11	133	5	149	265
Total	31	2	21	54	13	387	35	435	18	0	6	24	49	511	17	577	1090
Grand Total	91	7	93	191	44	1266	114	1424	74	0	13	87	166	1541	67	1774	3476
Apprch %	47.6	3.7	48.7		3.1	88.9	8		85.1	0	14.9		9.4	86.9	3.8		
Total %	2.6	0.2	2.7	5.5	1.3	36.4	3.3	41	2.1	0	0.4	2.5	4.8	44.3	1.9	51	

	Smith Ranch Road Southbound				Clinton Keith Road Westbound				Smith Ranch Road Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	**11**	**2**	11	**24**	2	103	7	112	**9**	0	0	9	**17**	122	**10**	149	294
05:00 PM	9	0	5	14	**6**	111	**14**	131	8	0	**2**	**10**	15	**146**	4	**165**	320
05:15 PM	7	1	10	18	2	**144**	6	**152**	6	0	1	7	13	129	3	145	**322**
05:30 PM	6	0	**13**	19	5	121	11	137	7	0	0	7	12	134	3	149	312
Total Volume	33	3	39	75	15	479	38	532	30	0	3	33	57	531	20	608	1248
% App. Total	44	4	52		2.8	90	7.1		90.9	0	9.1		9.4	87.3	3.3		
PHF	.750	.375	.750	.781	.625	.832	.679	.875	.833	.000	.375	.825	.838	.909	.500	.921	.969

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City of Murrieta
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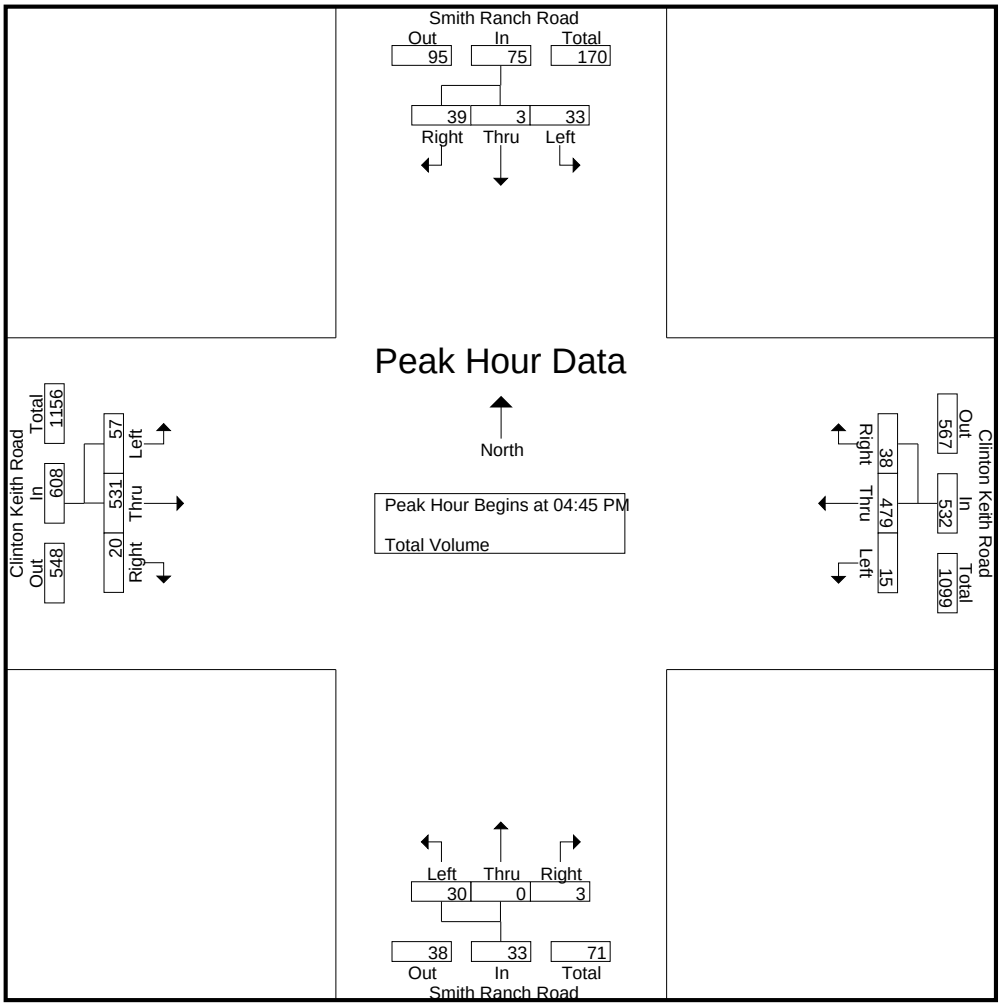

Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:30 PM				04:45 PM				04:15 PM				05:00 PM			
+0 mins.	**11**	1	10	22	2	103	7	112	6	0	**3**	9	**15**	**146**	4	**165**
+15 mins.	11	**2**	**11**	**24**	**6**	111	**14**	131	**9**	0	1	**10**	13	129	3	145
+30 mins.	9	0	5	14	2	**144**	6	**152**	9	0	0	9	12	134	3	149
+45 mins.	7	1	10	18	5	121	11	137	8	0	2	10	11	132	**7**	150
Total Volume	38	4	36	78	15	479	38	532	32	0	6	38	51	541	17	609
% App. Total	48.7	5.1	46.2		2.8	90	7.1		84.2	0	15.8		8.4	88.8	2.8	
PHF	.864	.500	.818	.813	.625	.832	.679	.875	.889	.000	.500	.950	.850	.926	.607	.923

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City of Murrieta
N/S: Copper Craft Drive
E/W: Clinton Keith Road
Weather: Sunny

File Name : MURCCCKAM
Site Code : 00000051
Start Date : 5/29/2014
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Groups Printed- Total Volume

	Copper Craft Drive Southbound				Clinton Keith Road Westbound				Copper Craft Drive Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	6	3	8	17	4	130	0	134	14	1	5	20	3	104	3	110	281
07:15 AM	5	1	7	13	1	130	1	132	7	0	6	13	7	102	1	110	268
07:30 AM	4	2	16	22	3	139	1	143	10	0	3	13	0	118	1	119	297
07:45 AM	4	0	10	14	2	131	4	137	5	0	9	14	4	117	8	129	294
Total	19	6	41	66	10	530	6	546	36	1	23	60	14	441	13	468	1140
08:00 AM	7	2	6	15	3	115	1	119	10	0	15	25	5	137	3	145	304
08:15 AM	4	1	4	9	3	144	1	148	8	0	7	15	4	118	6	128	300
08:30 AM	4	1	2	7	4	129	4	137	3	3	1	7	1	87	4	92	243
08:45 AM	8	0	6	14	1	124	4	129	5	0	6	11	3	95	0	98	252
Total	23	4	18	45	11	512	10	533	26	3	29	58	13	437	13	463	1099
Grand Total	42	10	59	111	21	1042	16	1079	62	4	52	118	27	878	26	931	2239
Apprch %	37.8	9	53.2		1.9	96.6	1.5		52.5	3.4	44.1		2.9	94.3	2.8		
Total %	1.9	0.4	2.6	5	0.9	46.5	0.7	48.2	2.8	0.2	2.3	5.3	1.2	39.2	1.2	41.6	

	Copper Craft Drive Southbound				Clinton Keith Road Westbound				Copper Craft Drive Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30 AM																	
07:30 AM	4	**2**	**16**	**22**	**3**	139	1	143	**10**	0	3	13	0	118	1	119	297
07:45 AM	4	0	10	14	2	131	**4**	137	5	0	9	14	4	117	**8**	129	294
08:00 AM	**7**	2	6	15	3	115	1	119	10	0	**15**	**25**	**5**	**137**	3	**145**	**304**
08:15 AM	4	1	4	9	3	**144**	1	**148**	8	0	7	15	4	118	6	128	300
Total Volume	19	5	36	60	11	529	7	547	33	0	34	67	13	490	18	521	1195
% App. Total	31.7	8.3	60		2	96.7	1.3		49.3	0	50.7		2.5	94	3.5		
PHF	.679	.625	.563	.682	.917	.918	.438	.924	.825	.000	.567	.670	.650	.894	.563	.898	.983

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City of Murrieta
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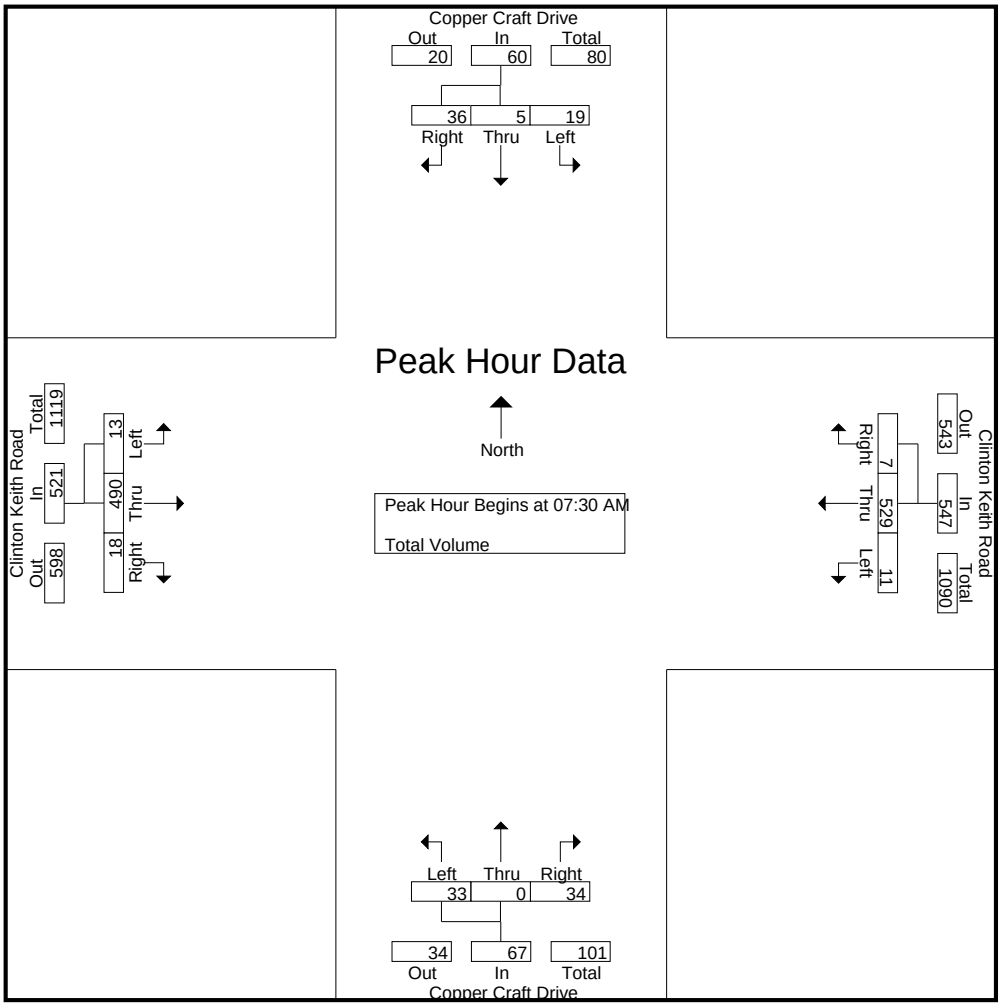

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00 AM				07:30 AM				07:30 AM				07:30 AM			
+0 mins.	**6**	**3**	8	17	**3**	139	1	143	**10**	0	3	13	0	118	1	119
+15 mins.	5	1	7	13	2	131	**4**	137	5	0	9	14	4	117	**8**	129
+30 mins.	4	2	**16**	**22**	3	115	1	119	10	0	**15**	**25**	**5**	**137**	3	**145**
+45 mins.	4	0	10	14	3	**144**	1	**148**	8	0	7	15	4	118	6	128
Total Volume	19	6	41	66	11	529	7	547	33	0	34	67	13	490	18	521
% App. Total	28.8	9.1	62.1		2	96.7	1.3		49.3	0	50.7		2.5	94	3.5	
PHF	.792	.500	.641	.750	.917	.918	.438	.924	.825	.000	.567	.670	.650	.894	.563	.898

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City of Murrieta
N/S: Copper Craft Drive
E/W: Clinton Keith Road
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Groups Printed- Total Volume

	Copper Craft Drive Southbound				Clinton Keith Road Westbound				Copper Craft Drive Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	6	0	3	9	5	122	8	135	5	0	7	12	8	138	8	154	310
04:15 PM	4	0	6	10	4	141	3	148	3	1	2	6	10	127	7	144	308
04:30 PM	1	1	3	5	5	127	6	138	2	0	12	14	7	133	2	142	299
04:45 PM	6	0	3	9	3	101	3	107	3	2	8	13	5	128	4	137	266
Total	17	1	15	33	17	491	20	528	13	3	29	45	30	526	21	577	1183
05:00 PM	1	0	7	8	6	128	3	137	4	1	4	9	5	135	8	148	302
05:15 PM	1	0	5	6	10	90	4	104	8	0	4	12	7	119	9	135	257
05:30 PM	3	1	4	8	4	104	4	112	5	2	1	8	6	115	7	128	256
05:45 PM	4	1	1	6	5	95	2	102	3	1	4	8	10	115	11	136	252
Total	9	2	17	28	25	417	13	455	20	4	13	37	28	484	35	547	1067
06:00 PM	5	0	4	9	6	115	5	126	4	0	2	6	6	119	7	132	273
06:15 PM	4	2	5	11	3	103	5	111	3	0	4	7	6	128	6	140	269
06:30 PM	4	0	4	8	6	102	2	110	5	1	3	9	11	111	7	129	256
06:45 PM	5	1	6	12	6	106	7	119	2	1	6	9	4	127	6	137	277
Total	18	3	19	40	21	426	19	466	14	2	15	31	27	485	26	538	1075
Grand Total	44	6	51	101	63	1334	52	1449	47	9	57	113	85	1495	82	1662	3325
Apprch %	43.6	5.9	50.5		4.3	92.1	3.6		41.6	8	50.4		5.1	90	4.9		
Total %	1.3	0.2	1.5	3	1.9	40.1	1.6	43.6	1.4	0.3	1.7	3.4	2.6	45	2.5	50	

	Copper Craft Drive Southbound				Clinton Keith Road Westbound				Copper Craft Drive Northbound				Clinton Keith Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	**6**	0	3	9	**5**	122	**8**	135	**5**	0	7	12	8	**138**	**8**	**154**	**310**
04:15 PM	4	0	**6**	**10**	4	**141**	3	**148**	3	1	2	6	**10**	127	7	144	308
04:30 PM	1	**1**	3	5	5	127	6	138	2	0	**12**	**14**	7	133	2	142	299
04:45 PM	6	0	3	9	3	101	3	107	3	**2**	8	13	5	128	4	137	266
Total Volume	17	1	15	33	17	491	20	528	13	3	29	45	30	526	21	577	1183
% App. Total	51.5	3	45.5		3.2	93	3.8		28.9	6.7	64.4		5.2	91.2	3.6		
PHF	.708	.250	.625	.825	.850	.871	.625	.892	.650	.375	.604	.804	.750	.953	.656	.937	.954

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City of Murrieta
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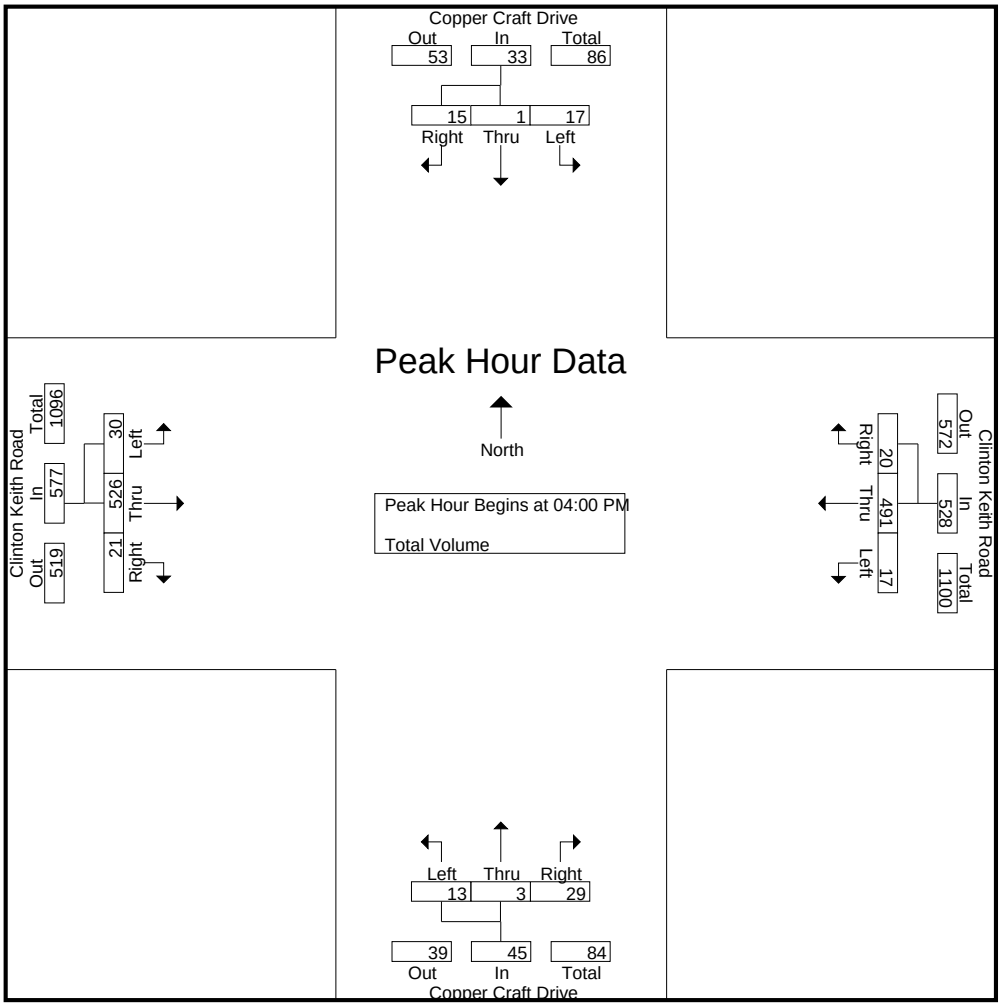

Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	06:00 PM				04:15 PM				04:30 PM				04:00 PM			
+0 mins.	**5**	0	4	9	4	**141**	3	**148**	2	0	**12**	**14**	8	**138**	**8**	**154**
+15 mins.	4	**2**	5	11	5	127	**6**	138	3	**2**	8	13	**10**	127	7	144
+30 mins.	4	0	4	8	3	101	3	107	4	1	4	9	7	133	2	142
+45 mins.	5	1	**6**	**12**	**6**	128	3	137	**8**	0	4	12	5	128	4	137
Total Volume	18	3	19	40	18	497	15	530	17	3	28	48	30	526	21	577
% App. Total	45	7.5	47.5		3.4	93.8	2.8		35.4	6.2	58.3		5.2	91.2	3.6	
PHF	.900	.375	.792	.833	.750	.881	.625	.895	.531	.375	.583	.857	.750	.953	.656	.937

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City of Murrieta
N/S: George Avenue
E/W: Depasquale Road
Weather: Sunny

File Name : MURGEDPAM
Site Code : 00000098
Start Date : 5/29/2014
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Groups Printed- Total Volume

	George Avenue Southbound			George Avenue Northbound			Depasquale Road Eastbound			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
07:00 AM	34	1	35	3	15	18	2	21	23	76
07:15 AM	36	0	36	7	29	36	0	16	16	88
07:30 AM	63	1	64	9	48	57	4	7	11	132
07:45 AM	87	5	92	12	42	54	7	13	20	166
Total	220	7	227	31	134	165	13	57	70	462
08:00 AM	48	0	48	7	22	29	0	12	12	89
08:15 AM	47	0	47	5	9	14	1	7	8	69
08:30 AM	28	0	28	7	13	20	1	9	10	58
08:45 AM	23	1	24	6	19	25	2	12	14	63
Total	146	1	147	25	63	88	4	40	44	279
Grand Total	366	8	374	56	197	253	17	97	114	741
Apprch %	97.9	2.1		22.1	77.9		14.9	85.1		
Total %	49.4	1.1	50.5	7.6	26.6	34.1	2.3	13.1	15.4	

	George Avenue Southbound			George Avenue Northbound			Depasquale Road Eastbound			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:15 AM										
07:15 AM	36	0	36	7	29	36	0	**16**	16	88
07:30 AM	63	1	64	9	**48**	**57**	4	7	11	132
07:45 AM	**87**	**5**	**92**	**12**	42	54	**7**	13	**20**	**166**
08:00 AM	48	0	48	7	22	29	0	12	12	89
Total Volume	234	6	240	35	141	176	11	48	59	475
% App. Total	97.5	2.5		19.9	80.1		18.6	81.4		
PHF	.672	.300	.652	.729	.734	.772	.393	.750	.738	.715

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City of Murrieta
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Start Date : 5/29/2014
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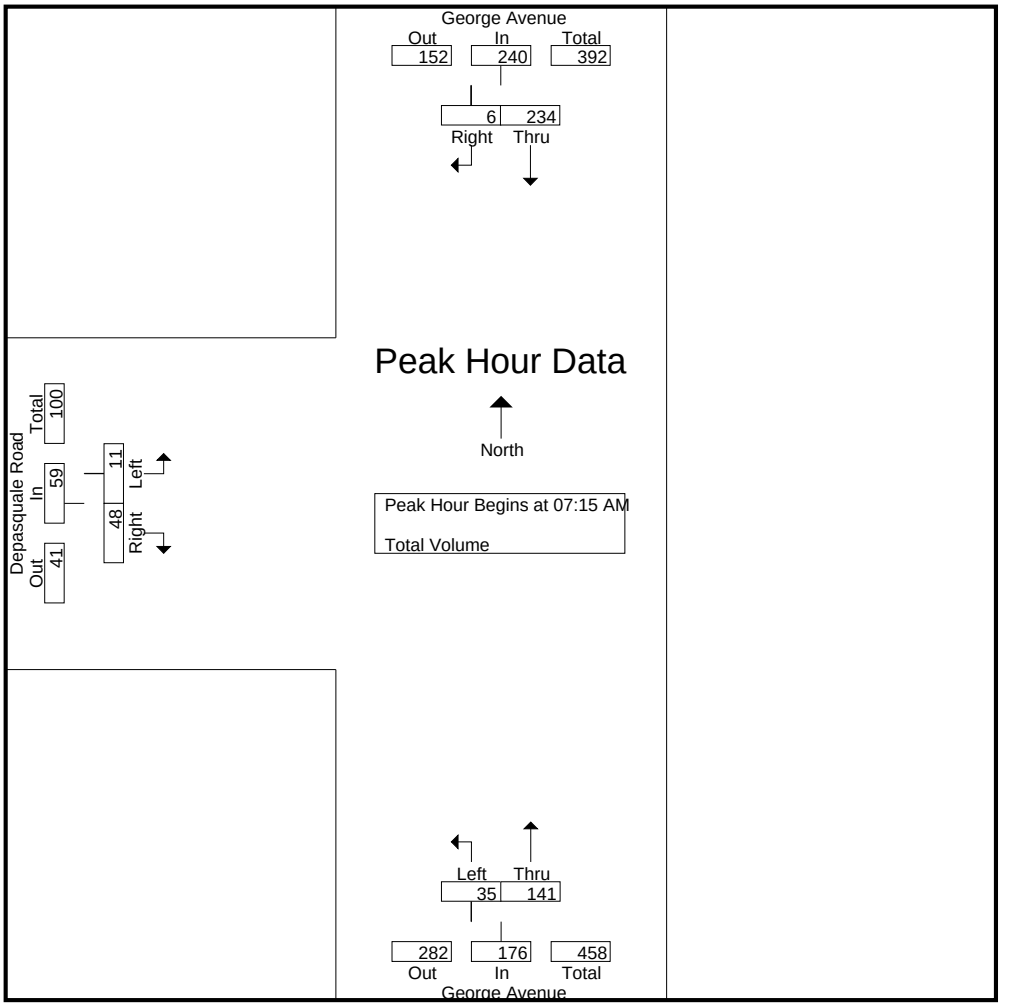

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30 AM			07:15 AM			07:00 AM		
+0 mins.	63	1	64	7	29	36	2	**21**	**23**
+15 mins.	**87**	**5**	**92**	9	**48**	**57**	0	16	16
+30 mins.	48	0	48	**12**	42	54	4	7	11
+45 mins.	47	0	47	7	22	29	**7**	13	20
Total Volume	245	6	251	35	141	176	13	57	70
% App. Total	97.6	2.4		19.9	80.1		18.6	81.4	
PHF	.704	.300	.682	.729	.734	.772	.464	.679	.761

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City of Murrieta
N/S: George Avenue
E/W: Depasquale Road
Weather: Sunny

File Name : MURGEDPPM
Site Code : 00000098
Start Date : 5/29/2014
Page No : 1

Groups Printed- Total Volume

	George Avenue Southbound			George Avenue Northbound			Depasquale Road Eastbound			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
04:00 PM	25	0	25	15	28	43	0	11	11	79
04:15 PM	27	1	28	11	27	38	0	6	6	72
04:30 PM	29	0	29	12	26	38	0	7	7	74
04:45 PM	29	1	30	8	31	39	0	7	7	76
Total	110	2	112	46	112	158	0	31	31	301
05:00 PM	38	2	40	10	34	44	0	6	6	90
05:15 PM	26	0	26	10	31	41	1	9	10	77
05:30 PM	27	0	27	13	25	38	0	13	13	78
05:45 PM	41	1	42	10	40	50	0	11	11	103
Total	132	3	135	43	130	173	1	39	40	348
06:00 PM	30	0	30	12	39	51	0	4	4	85
06:15 PM	28	2	30	13	28	41	0	6	6	77
06:30 PM	20	1	21	13	44	57	0	8	8	86
06:45 PM	22	2	24	13	37	50	0	6	6	80
Total	100	5	105	51	148	199	0	24	24	328
Grand Total	342	10	352	140	390	530	1	94	95	977
Apprch %	97.2	2.8		26.4	73.6		1.1	98.9		
Total %	35	1	36	14.3	39.9	54.2	0.1	9.6	9.7	

	George Avenue Southbound			George Avenue Northbound			Depasquale Road Eastbound			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 05:45 PM										
05:45 PM	**41**	1	**42**	10	40	50	0	**11**	**11**	**103**
06:00 PM	30	0	30	12	39	51	0	4	4	85
06:15 PM	28	**2**	30	**13**	28	41	0	6	6	77
06:30 PM	20	1	21	13	**44**	**57**	0	8	8	86
Total Volume	119	4	123	48	151	199	0	29	29	351
% App. Total	96.7	3.3		24.1	75.9		0	100		
PHF	.726	.500	.732	.923	.858	.873	.000	.659	.659	.852

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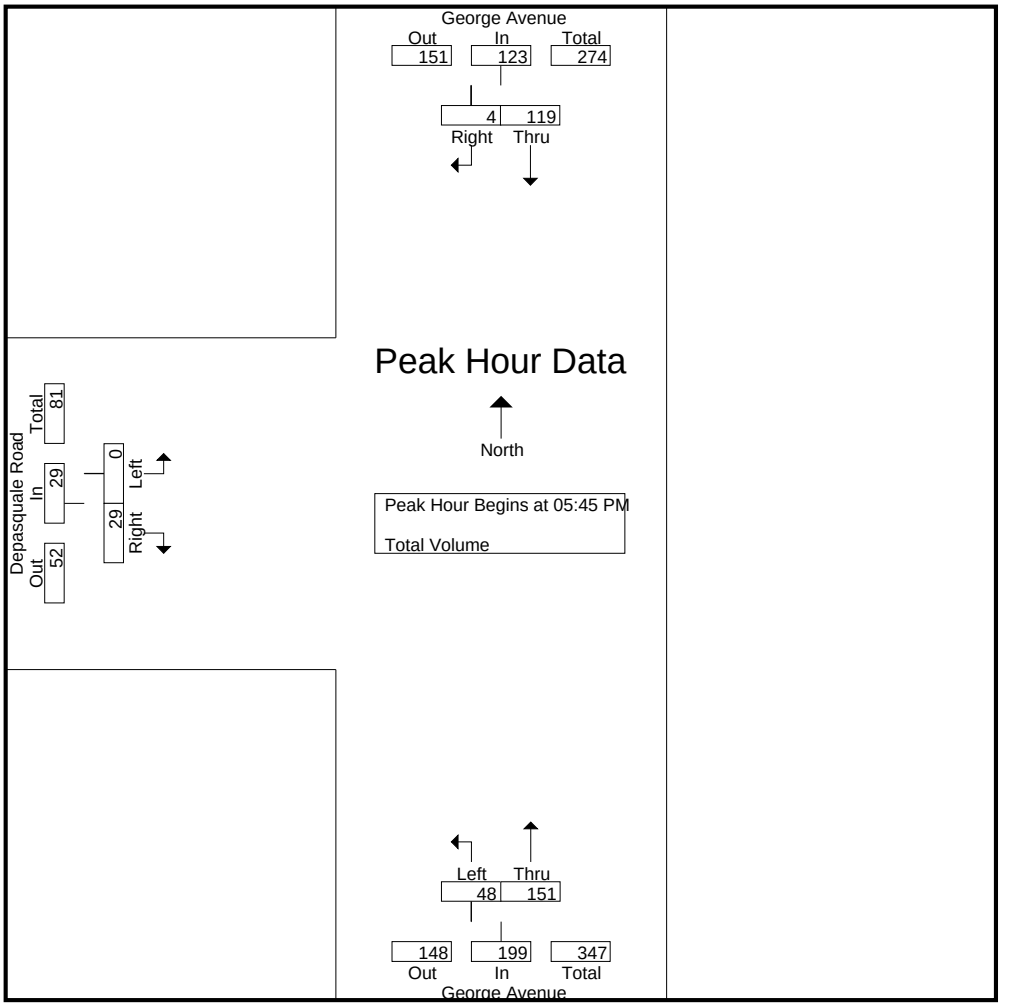
City of Murrieta
N/S: George Avenue
E/W: Depasquale Road
Weather: Sunny

File Name : MURGEDPPM
Site Code : 00000098
Start Date : 5/29/2014
Page No : 2



Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	05:00 PM			05:45 PM			05:00 PM		
+0 mins.	38	**2**	40	10	40	50	0	6	6
+15 mins.	26	0	26	12	39	51	**1**	9	10
+30 mins.	27	0	27	**13**	28	41	0	**13**	**13**
+45 mins.	**41**	1	**42**	13	**44**	**57**	0	11	11
Total Volume	132	3	135	48	151	199	1	39	40
% App. Total	97.8	2.2		24.1	75.9		2.5	97.5	
PHF	.805	.375	.804	.923	.858	.873	.250	.750	.769

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City of Murrieta
N/S: Westpark Street
E/W: Depasquale Road
Weather: Sunny

File Name : MURWPDPAM
Site Code : 00000111
Start Date : 5/29/2014
Page No : 1

Groups Printed- Total Volume

	Westpark Street Southbound			Depasquale Road Westbound			Depasquale Road Eastbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
07:00 AM	3	0	3	1	0	1	0	1	1	5
07:15 AM	0	0	0	1	0	1	0	2	2	3
07:30 AM	2	0	2	1	3	4	0	2	2	8
07:45 AM	1	0	1	3	2	5	0	2	2	8
Total	6	0	6	6	5	11	0	7	7	24
08:00 AM	1	0	1	2	0	2	0	1	1	4
08:15 AM	2	0	2	1	1	2	0	1	1	5
08:30 AM	0	0	0	0	1	1	0	2	2	3
08:45 AM	2	0	2	1	0	1	0	0	0	3
Total	5	0	5	4	2	6	0	4	4	15
Grand Total	11	0	11	10	7	17	0	11	11	39
Apprch %	100	0		58.8	41.2		0	100		
Total %	28.2	0	28.2	25.6	17.9	43.6	0	28.2	28.2	

	Westpark Street Southbound			Depasquale Road Westbound			Depasquale Road Eastbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30 AM										
07:30 AM	**2**	0	**2**	1	**3**	4	0	**2**	**2**	**8**
07:45 AM	1	0	1	**3**	2	**5**	0	2	2	8
08:00 AM	1	0	1	2	0	2	0	1	1	4
08:15 AM	2	0	2	1	1	2	0	1	1	5
Total Volume	6	0	6	7	6	13	0	6	6	25
% App. Total	100	0		53.8	46.2		0	100		
PHF	.750	.000	.750	.583	.500	.650	.000	.750	.750	.781

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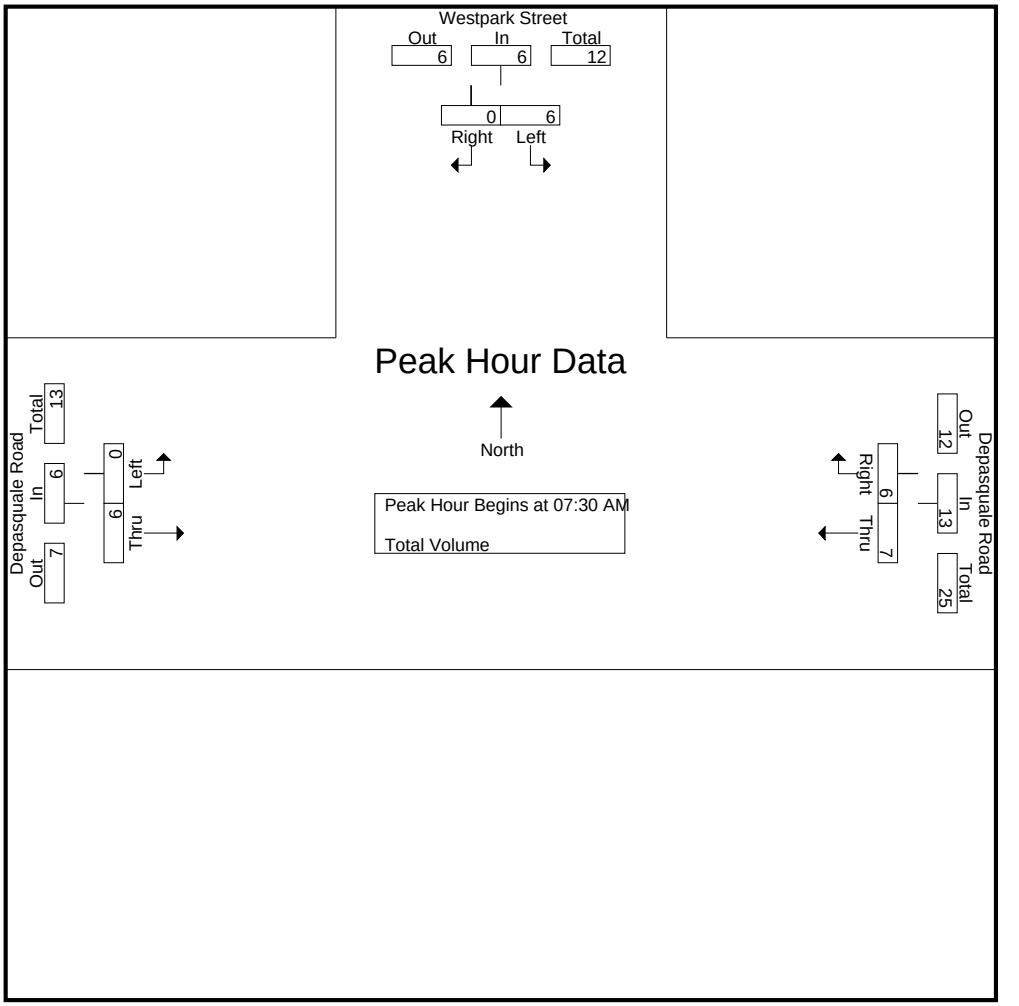
City of Murrieta
N/S: Westpark Street
E/W: Depasquale Road
Weather: Sunny

File Name : MURWPDPAM
Site Code : 00000111
Start Date : 5/29/2014
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00 AM			07:30 AM			07:00 AM		
+0 mins.	**3**	0	**3**	1	**3**	4	0	1	1
+15 mins.	0	0	0	**3**	2	**5**	0	**2**	**2**
+30 mins.	2	0	2	2	0	2	0	2	2
+45 mins.	1	0	1	1	1	2	0	2	2
Total Volume	6	0	6	7	6	13	0	7	7
% App. Total	100	0		53.8	46.2		0	100	
PHF	.500	.000	.500	.583	.500	.650	.000	.875	.875

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City of Murrieta
N/S: Westpark Street
E/W: Depasquale Road
Weather: Sunny

File Name : MURWPDPPM
Site Code : 00000111
Start Date : 5/29/2014
Page No : 1

Groups Printed- Total Volume

	Westpark Street Southbound			Depasquale Road Westbound			Depasquale Road Eastbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
04:00 PM	0	0	0	4	1	5	0	0	0	5
04:15 PM	1	0	1	3	0	3	0	3	3	7
04:30 PM	1	0	1	0	1	1	0	0	0	2
04:45 PM	1	0	1	1	1	2	0	0	0	3
Total	3	0	3	8	3	11	0	3	3	17
05:00 PM	1	0	1	5	1	6	0	0	0	7
05:15 PM	0	0	0	0	1	1	0	3	3	4
05:30 PM	1	0	1	0	2	2	0	0	0	3
05:45 PM	2	0	2	2	3	5	0	1	1	8
Total	4	0	4	7	7	14	0	4	4	22
06:00 PM	0	0	0	0	0	0	0	0	0	0
06:15 PM	0	0	0	0	0	0	0	0	0	0
06:30 PM	0	0	0	0	0	0	0	0	0	0
06:45 PM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
Grand Total	7	0	7	15	10	25	0	7	7	39
Apprch %	100	0		60	40		0	100		
Total %	17.9	0	17.9	38.5	25.6	64.1	0	17.9	17.9	

	Westpark Street Southbound			Depasquale Road Westbound			Depasquale Road Eastbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 05:00 PM										
05:00 PM	1	0	1	**5**	1	**6**	0	0	0	7
05:15 PM	0	0	0	0	1	1	0	**3**	**3**	4
05:30 PM	1	0	1	0	2	2	0	0	0	3
05:45 PM	**2**	0	**2**	2	**3**	5	0	1	1	**8**
Total Volume	4	0	4	7	7	14	0	4	4	22
% App. Total	100	0		50	50		0	100		
PHF	.500	.000	.500	.350	.583	.583	.000	.333	.333	.688

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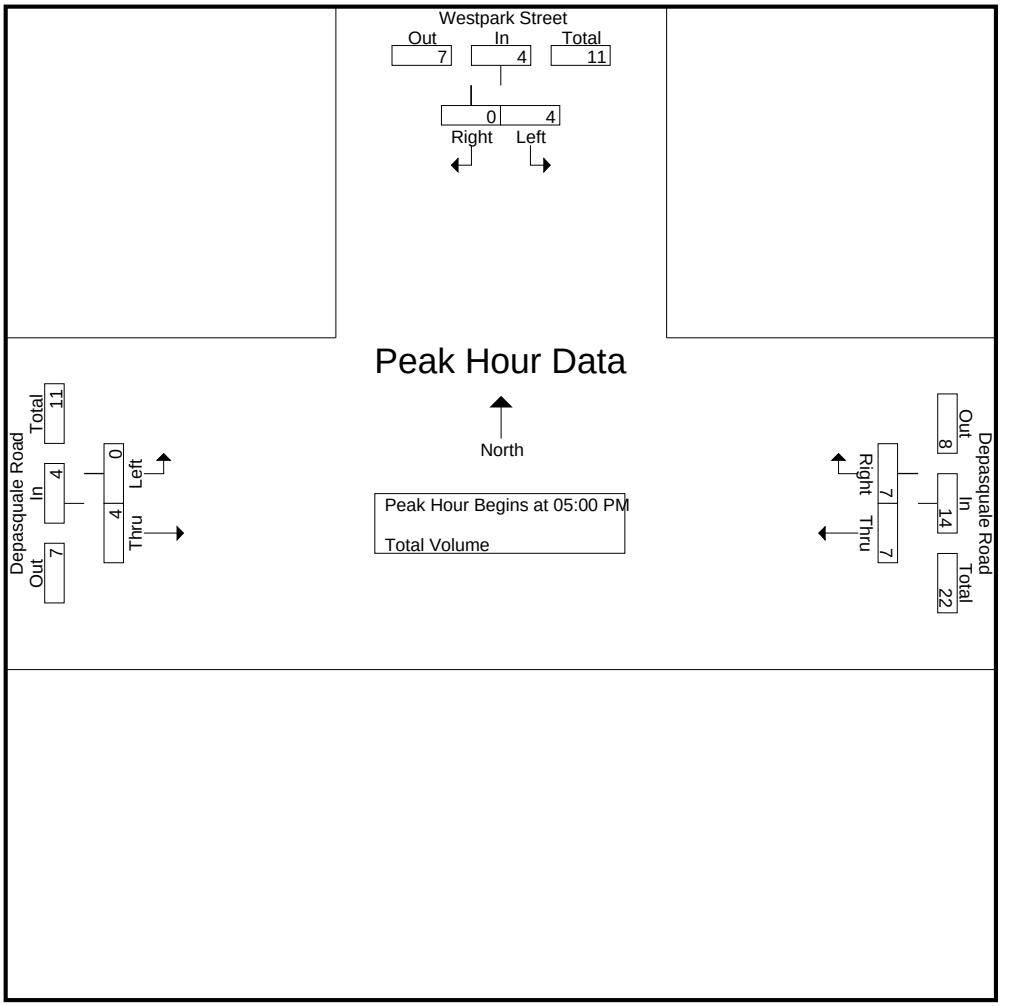
City of Murrieta
N/S: Westpark Street
E/W: Depasquale Road
Weather: Sunny

File Name : MURWPDPPM
Site Code : 00000111
Start Date : 5/29/2014
Page No : 2



Peak Hour Analysis From 04:00 PM to 06:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:15 PM			05:00 PM			05:00 PM		
+0 mins.	**1**	0	**1**	**5**	1	**6**	0	0	0
+15 mins.	1	0	1	0	1	1	0	**3**	**3**
+30 mins.	1	0	1	0	2	2	0	0	0
+45 mins.	1	0	1	2	**3**	5	0	1	1
Total Volume	4	0	4	7	7	14	0	4	4
% App. Total	100	0		50	50		0	100	
PHF	1.000	.000	1.000	.350	.583	.583	.000	.333	.333

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City of Murrieta
N/S: Grand Avenue
E/W: Clinton Keith Road
Weather: Clear

File Name : MURGRCKAM
Site Code : 20115020
Start Date : 1/14/2015
Page No : 1

Groups Printed- Total Volume

	Grand Avenue Southbound			Clinton Keith Road Westbound			Clinton Keith Road Eastbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
07:00 AM	37	13	50	62	34	96	15	130	145	291
07:15 AM	53	7	60	58	15	73	8	144	152	285
07:30 AM	38	7	45	85	21	106	12	155	167	318
07:45 AM	53	9	62	68	22	90	8	116	124	276
Total	181	36	217	273	92	365	43	545	588	1170
08:00 AM	44	13	57	105	16	121	14	151	165	343
08:15 AM	36	15	51	91	23	114	14	170	184	349
08:30 AM	39	9	48	84	24	108	10	153	163	319
08:45 AM	42	10	52	78	18	96	10	132	142	290
Total	161	47	208	358	81	439	48	606	654	1301
Grand Total	342	83	425	631	173	804	91	1151	1242	2471
Apprch %	80.5	19.5		78.5	21.5		7.3	92.7		
Total %	13.8	3.4	17.2	25.5	7	32.5	3.7	46.6	50.3	

	Grand Avenue Southbound			Clinton Keith Road Westbound			Clinton Keith Road Eastbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 08:00 AM										
08:00 AM	44	13	57	105	16	121	14	151	165	343
08:15 AM	36	15	51	91	23	114	14	170	184	349
08:30 AM	39	9	48	84	24	108	10	153	163	319
08:45 AM	42	10	52	78	18	96	10	132	142	290
Total Volume	161	47	208	358	81	439	48	606	654	1301
% App. Total	77.4	22.6		81.5	18.5		7.3	92.7		
PHF	.915	.783	.912	.852	.844	.907	.857	.891	.889	.932

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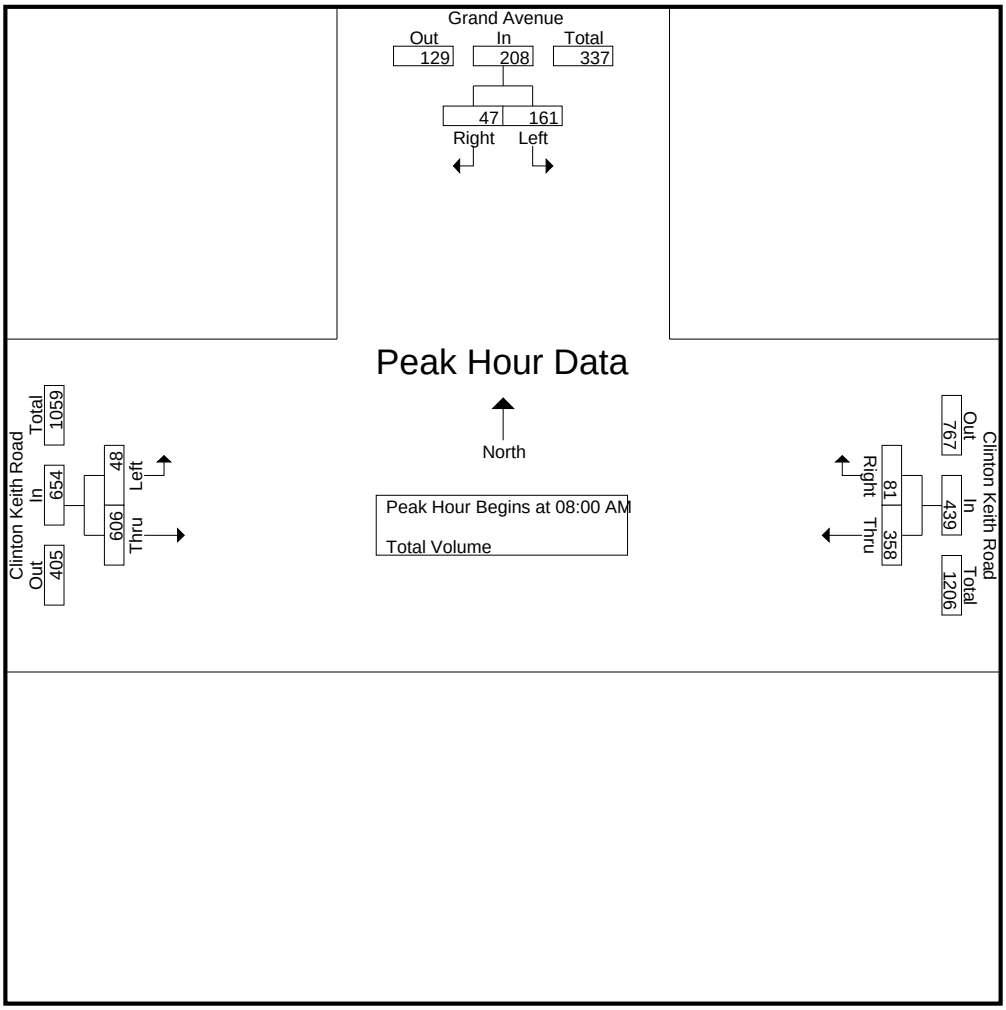
City of Murrieta
N/S: Grand Avenue
E/W: Clinton Keith Road
Weather: Clear

File Name : MURGRCKAM
Site Code : 20115020
Start Date : 1/14/2015
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:15 AM			08:00 AM			08:00 AM		
+0 mins.	53	7	60	105	16	121	14	151	165
+15 mins.	38	7	45	91	23	114	14	170	184
+30 mins.	53	9	62	84	24	108	10	153	163
+45 mins.	44	13	57	78	18	96	10	132	142
Total Volume	188	36	224	358	81	439	48	606	654
% App. Total	83.9	16.1		81.5	18.5		7.3	92.7	
PHF	.887	.692	.903	.852	.844	.907	.857	.891	.889

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City of Murrieta
N/S: Grand Avenue
E/W: Clinton Keith Road
Weather: Clear

File Name : MURGRCKPM
Site Code : 20115020
Start Date : 1/14/2015
Page No : 1

Groups Printed- Total Volume

	Grand Avenue Southbound			Clinton Keith Road Westbound			Clinton Keith Road Eastbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
04:00 PM	34	11	45	144	25	169	18	116	134	348
04:15 PM	34	18	52	134	28	162	13	124	137	351
04:30 PM	59	10	69	101	25	126	15	119	134	329
04:45 PM	43	9	52	131	36	167	14	115	129	348
Total	170	48	218	510	114	624	60	474	534	1376
05:00 PM	33	12	45	131	28	159	15	124	139	343
05:15 PM	47	18	65	116	39	155	13	113	126	346
05:30 PM	46	9	55	143	39	182	8	123	131	368
05:45 PM	38	13	51	141	32	173	4	112	116	340
Total	164	52	216	531	138	669	40	472	512	1397
Grand Total	334	100	434	1041	252	1293	100	946	1046	2773
Apprch %	77	23		80.5	19.5		9.6	90.4		
Total %	12	3.6	15.7	37.5	9.1	46.6	3.6	34.1	37.7	

	Grand Avenue Southbound			Clinton Keith Road Westbound			Clinton Keith Road Eastbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:45 PM										
04:45 PM	43	9	52	131	36	167	14	115	129	348
05:00 PM	33	12	45	131	28	159	15	124	139	343
05:15 PM	47	18	65	116	39	155	13	113	126	346
05:30 PM	46	9	55	143	39	182	8	123	131	368
Total Volume	169	48	217	521	142	663	50	475	525	1405
% App. Total	77.9	22.1		78.6	21.4		9.5	90.5		
PHF	.899	.667	.835	.911	.910	.911	.833	.958	.944	.954

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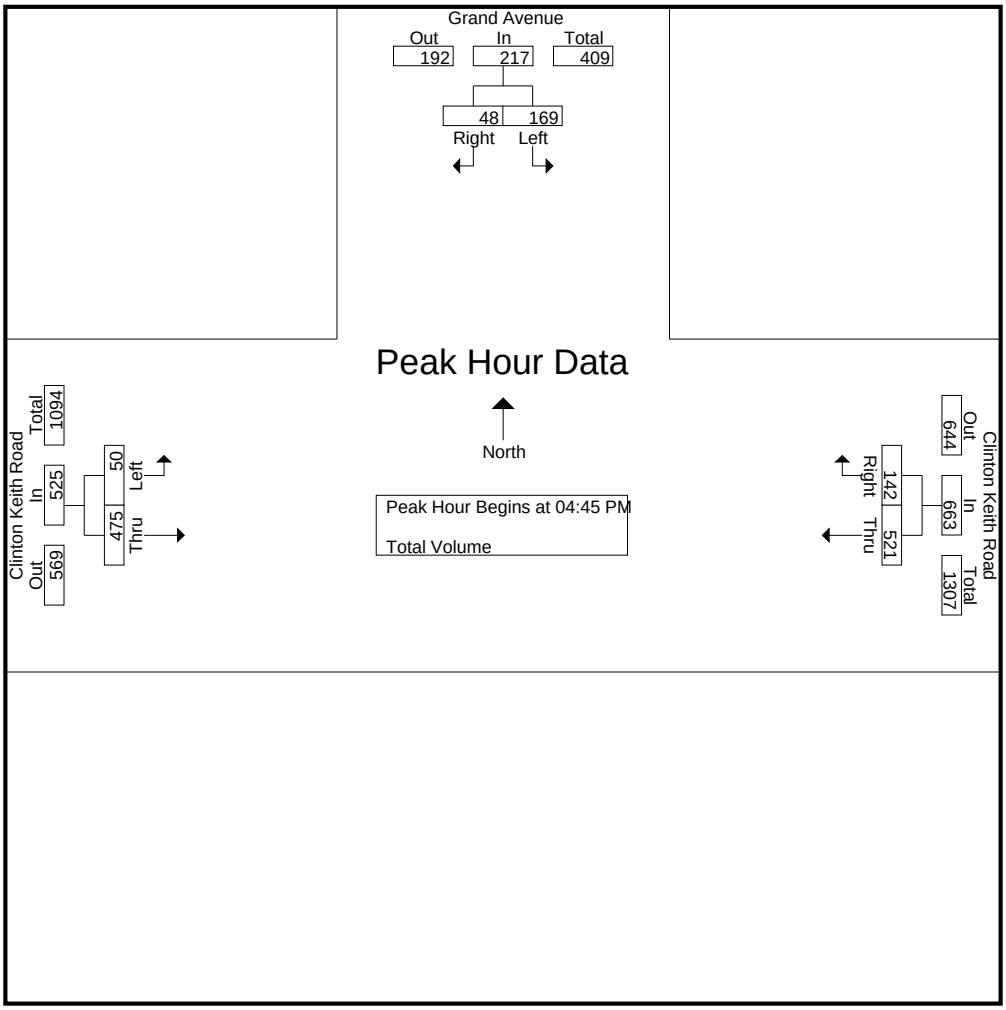
City of Murrieta
N/S: Grand Avenue
E/W: Clinton Keith Road
Weather: Clear

File Name : MURGRCKPM
Site Code : 20115020
Start Date : 1/14/2015
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:30 PM			05:00 PM			04:15 PM		
+0 mins.	59	10	69	131	28	159	13	124	137
+15 mins.	43	9	52	116	39	155	15	119	134
+30 mins.	33	12	45	143	39	182	14	115	129
+45 mins.	47	18	65	141	32	173	15	124	139
Total Volume	182	49	231	531	138	669	57	482	539
% App. Total	78.8	21.2		79.4	20.6		10.6	89.4	
PHF	.771	.681	.837	.928	.885	.919	.950	.972	.969

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City of Murrieta
N/S: George Avenue
E/W: La Estrella Street
Weather: Clear

File Name : MURGELEAM
Site Code : 20115020
Start Date : 1/14/2015
Page No : 1

Groups Printed- Total Volume

	George Avenue Southbound				La Estrella Street Westbound				George Avenue Northbound				La Estrella Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	0	0	0	0	3	20	0	23	9	1	10	20	2	9	3	14	57
07:15 AM	0	0	0	0	4	14	3	21	10	5	9	24	4	30	4	38	83
07:30 AM	2	2	3	7	13	65	8	86	5	6	12	23	13	37	5	55	171
07:45 AM	4	10	39	53	15	72	7	94	5	7	23	35	29	23	4	56	238
Total	6	12	42	60	35	171	18	224	29	19	54	102	48	99	16	163	549
08:00 AM	5	1	1	7	7	45	0	52	4	1	8	13	1	18	0	19	91
08:15 AM	0	0	0	0	3	29	0	32	11	2	5	18	0	13	0	13	63
08:30 AM	1	0	0	1	0	29	0	29	7	0	1	8	1	15	4	20	58
08:45 AM	1	0	0	1	3	16	0	19	6	0	5	11	0	19	3	22	53
Total	7	1	1	9	13	119	0	132	28	3	19	50	2	65	7	74	265
Grand Total	13	13	43	69	48	290	18	356	57	22	73	152	50	164	23	237	814
Apprch %	18.8	18.8	62.3		13.5	81.5	5.1		37.5	14.5	48		21.1	69.2	9.7		
Total %	1.6	1.6	5.3	8.5	5.9	35.6	2.2	43.7	7	2.7	9	18.7	6.1	20.1	2.8	29.1	

	George Avenue Southbound				La Estrella Street Westbound				George Avenue Northbound				La Estrella Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	0	0	0	0	4	14	3	21	10	5	9	24	4	30	4	38	83
07:30 AM	2	2	3	7	13	65	8	86	5	6	12	23	13	37	5	55	171
07:45 AM	4	10	39	53	15	72	7	94	5	7	23	35	29	23	4	56	238
08:00 AM	5	1	1	7	7	45	0	52	4	1	8	13	1	18	0	19	91
Total Volume	11	13	43	67	39	196	18	253	24	19	52	95	47	108	13	168	583
% App. Total	16.4	19.4	64.2		15.4	77.5	7.1		25.3	20	54.7		28	64.3	7.7		
PHF	.550	.325	.276	.316	.650	.681	.563	.673	.600	.679	.565	.679	.405	.730	.650	.750	.612

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City of Murrieta
N/S: George Avenue
E/W: La Estrella Street
Weather: Clear

File Name : MURGELEAM
Site Code : 20115020
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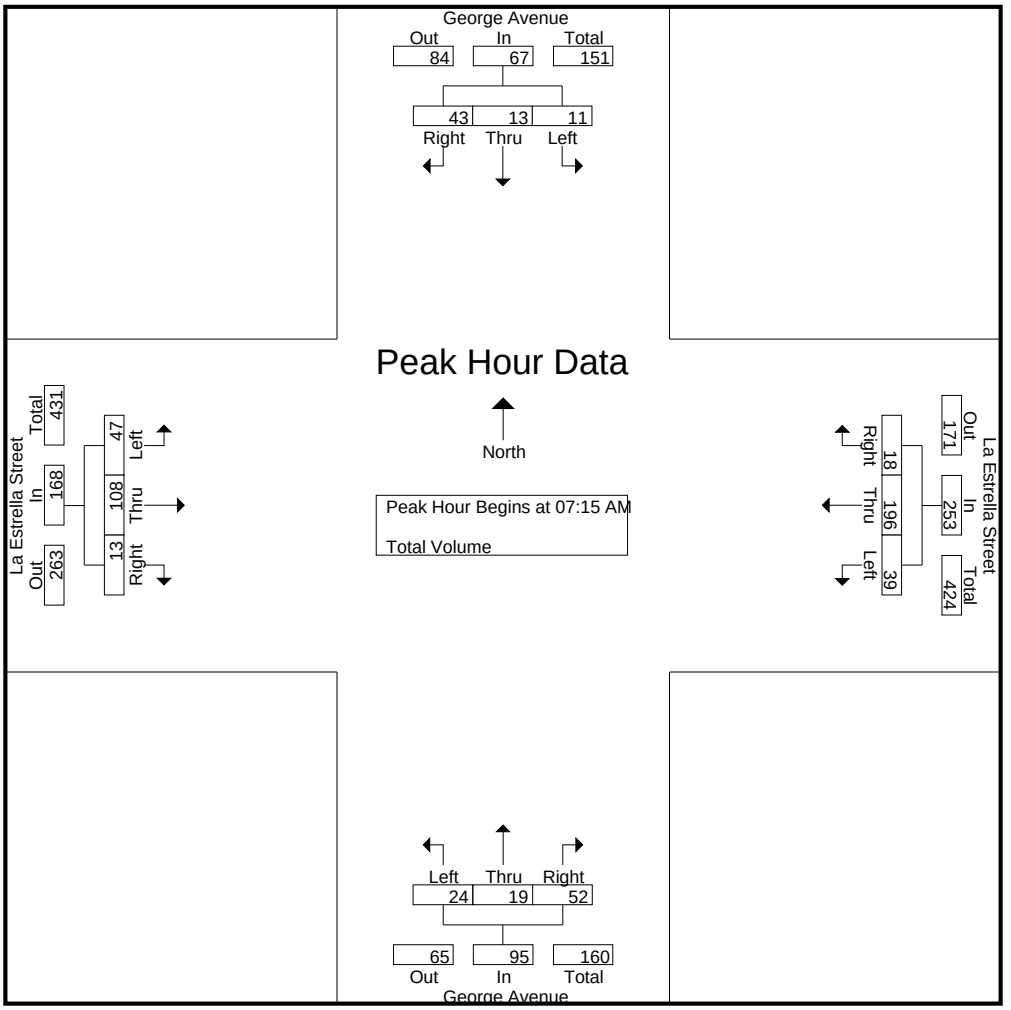

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:15 AM				07:30 AM				07:00 AM				07:15 AM			
+0 mins.	0	0	0	0	13	65	8	86	9	1	10	20	4	30	4	38
+15 mins.	2	2	3	7	15	72	7	94	10	5	9	24	13	37	5	55
+30 mins.	4	10	39	53	7	45	0	52	5	6	12	23	29	23	4	56
+45 mins.	5	1	1	7	3	29	0	32	5	7	23	35	1	18	0	19
Total Volume	11	13	43	67	38	211	15	264	29	19	54	102	47	108	13	168
% App. Total	16.4	19.4	64.2		14.4	79.9	5.7		28.4	18.6	52.9		28	64.3	7.7	
PHF	.550	.325	.276	.316	.633	.733	.469	.702	.725	.679	.587	.729	.405	.730	.650	.750

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City of Murrieta
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E/W: La Estrella Street
Weather: Clear

File Name : MURGELEPM
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Groups Printed- Total Volume

	George Avenue Southbound				La Estrella Street Westbound				George Avenue Northbound				La Estrella Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	0	0	0	0	7	21	1	29	5	0	2	7	0	22	5	27	63
04:15 PM	1	0	0	1	7	16	0	23	8	0	5	13	0	30	5	35	72
04:30 PM	0	0	0	0	8	20	1	29	6	0	2	8	0	33	5	38	75
04:45 PM	0	0	0	0	9	22	0	31	5	0	8	13	0	20	8	28	72
Total	1	0	0	1	31	79	2	112	24	0	17	41	0	105	23	128	282
05:00 PM	1	0	0	1	8	25	0	33	4	0	5	9	0	26	6	32	75
05:15 PM	0	0	0	0	7	24	0	31	5	0	5	10	0	27	7	34	75
05:30 PM	0	0	0	0	9	26	0	35	6	0	4	10	0	27	6	33	78
05:45 PM	0	0	1	1	3	22	0	25	4	1	3	8	0	26	8	34	68
Total	1	0	1	2	27	97	0	124	19	1	17	37	0	106	27	133	296
Grand Total	2	0	1	3	58	176	2	236	43	1	34	78	0	211	50	261	578
Apprch %	66.7	0	33.3		24.6	74.6	0.8		55.1	1.3	43.6		0	80.8	19.2		
Total %	0.3	0	0.2	0.5	10	30.4	0.3	40.8	7.4	0.2	5.9	13.5	0	36.5	8.7	45.2	

	George Avenue Southbound				La Estrella Street Westbound				George Avenue Northbound				La Estrella Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	0	0	0	0	9	22	0	31	5	0	8	13	0	20	8	28	72
05:00 PM	1	0	0	1	8	25	0	33	4	0	5	9	0	26	6	32	75
05:15 PM	0	0	0	0	7	24	0	31	5	0	5	10	0	27	7	34	75
05:30 PM	0	0	0	0	9	26	0	35	6	0	4	10	0	27	6	33	78
Total Volume	1	0	0	1	33	97	0	130	20	0	22	42	0	100	27	127	300
% App. Total	100	0	0		25.4	74.6	0		47.6	0	52.4		0	78.7	21.3		
PHF	.250	.000	.000	.250	.917	.933	.000	.929	.833	.000	.688	.808	.000	.926	.844	.934	.962

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File Name : MURGELEPM
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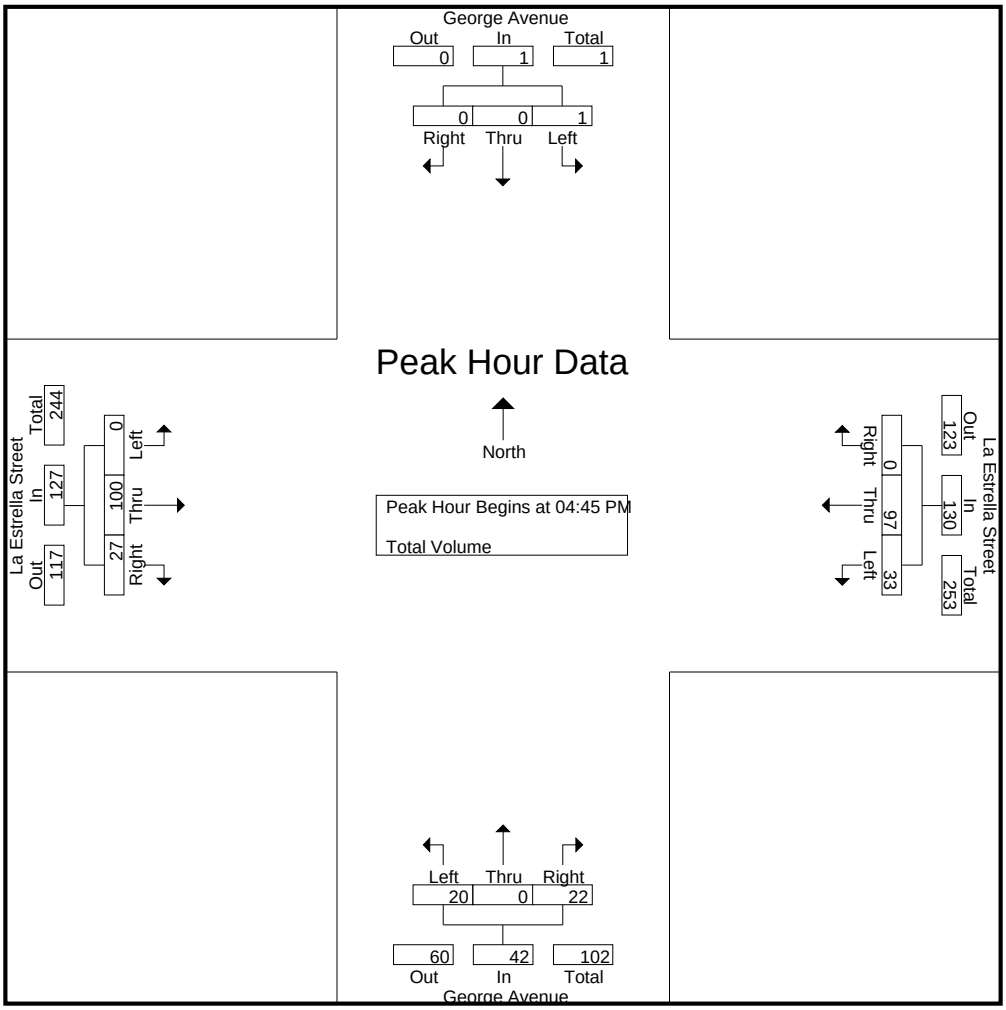

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:15 PM				04:45 PM				04:15 PM				04:15 PM			
+0 mins.	1	0	0	1	9	22	0	31	8	0	5	13	0	30	5	35
+15 mins.	0	0	0	0	8	25	0	33	6	0	2	8	0	33	5	38
+30 mins.	0	0	0	0	7	24	0	31	5	0	8	13	0	20	8	28
+45 mins.	1	0	0	1	9	26	0	35	4	0	5	9	0	26	6	32
Total Volume	2	0	0	2	33	97	0	130	23	0	20	43	0	109	24	133
% App. Total	100	0	0		25.4	74.6	0		53.5	0	46.5		0	82	18	
PHF	.500	.000	.000	.500	.917	.933	.000	.929	.719	.000	.625	.827	.000	.826	.750	.875

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City of Murrieta
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E/W: Prielipp Road
Weather: Clear

File Name : MURIVPRAM
Site Code : 20115020
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Groups Printed- Total Volume

	Inland Valley Drive Southbound				Prielipp Road Westbound				Inland Valley Drive Northbound				Prielipp Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	28	0	6	34	0	3	56	59	0	0	0	0	5	1	0	6	99
07:15 AM	37	0	10	47	0	2	48	50	0	0	0	0	3	3	0	6	103
07:30 AM	40	0	7	47	0	3	52	55	0	0	0	0	5	2	0	7	109
07:45 AM	48	0	13	61	0	3	54	57	0	0	0	0	5	2	0	7	125
Total	153	0	36	189	0	11	210	221	0	0	0	0	18	8	0	26	436
08:00 AM	53	0	10	63	0	6	62	68	0	0	0	0	3	3	0	6	137
08:15 AM	66	0	9	75	1	4	40	45	0	0	0	0	3	2	0	5	125
08:30 AM	39	0	10	49	0	3	53	56	0	0	0	0	5	1	0	6	111
08:45 AM	43	0	10	53	0	3	54	57	0	0	0	0	3	5	0	8	118
Total	201	0	39	240	1	16	209	226	0	0	0	0	14	11	0	25	491
Grand Total	354	0	75	429	1	27	419	447	0	0	0	0	32	19	0	51	927
Apprch %	82.5	0	17.5		0.2	6	93.7		0	0	0		62.7	37.3	0		
Total %	38.2	0	8.1	46.3	0.1	2.9	45.2	48.2	0	0	0	0	3.5	2	0	5.5	

	Inland Valley Drive Southbound				Prielipp Road Westbound				Inland Valley Drive Northbound				Prielipp Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45 AM																	
07:45 AM	48	0	13	61	0	3	54	57	0	0	0	0	5	2	0	7	125
08:00 AM	53	0	10	63	0	6	62	68	0	0	0	0	3	3	0	6	137
08:15 AM	66	0	9	75	1	4	40	45	0	0	0	0	3	2	0	5	125
08:30 AM	39	0	10	49	0	3	53	56	0	0	0	0	5	1	0	6	111
Total Volume	206	0	42	248	1	16	209	226	0	0	0	0	16	8	0	24	498
% App. Total	83.1	0	16.9		0.4	7.1	92.5		0	0	0		66.7	33.3	0		
PHF	.780	.000	.808	.827	.250	.667	.843	.831	.000	.000	.000	.000	.800	.667	.000	.857	.909

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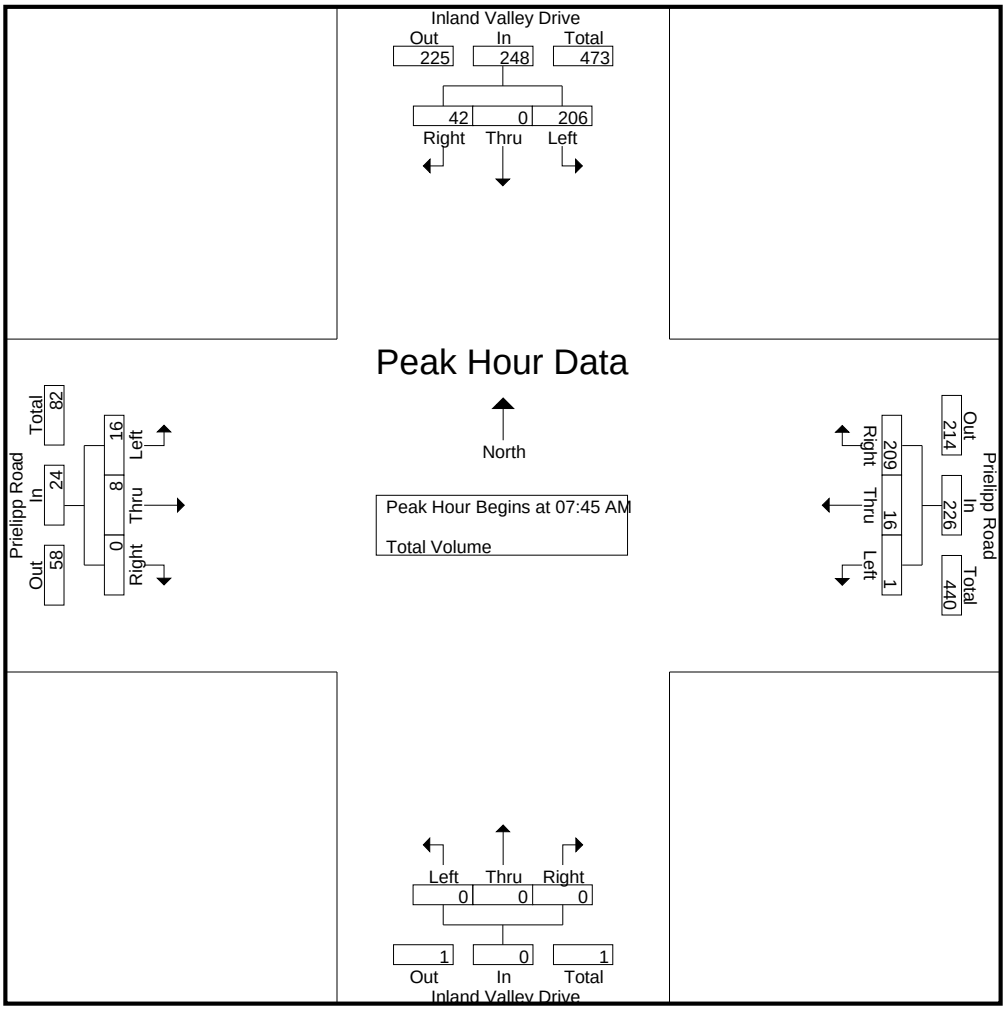

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:45 AM				07:15 AM				07:00 AM				07:00 AM			
+0 mins.	48	0	13	61	0	2	48	50	0	0	0	0	5	1	0	6
+15 mins.	53	0	10	63	0	3	52	55	0	0	0	0	3	3	0	6
+30 mins.	66	0	9	75	0	3	54	57	0	0	0	0	5	2	0	7
+45 mins.	39	0	10	49	0	6	62	68	0	0	0	0	5	2	0	7
Total Volume	206	0	42	248	0	14	216	230	0	0	0	0	18	8	0	26
% App. Total	83.1	0	16.9		0	6.1	93.9		0	0	0		69.2	30.8	0	
PHF	.780	.000	.808	.827	.000	.583	.871	.846	.000	.000	.000	.000	.900	.667	.000	.929

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City of Murrieta
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Groups Printed- Total Volume

	Inland Valley Drive Southbound				Prielipp Road Westbound				Inland Valley Drive Northbound				Prielipp Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	58	0	1	59	0	1	61	62	0	0	0	0	7	3	0	10	131
04:15 PM	70	0	0	70	0	1	76	77	0	0	0	0	4	3	0	7	154
04:30 PM	63	0	3	66	0	0	72	72	0	0	0	0	9	4	0	13	151
04:45 PM	78	0	2	80	0	2	64	66	0	0	0	0	11	0	0	11	157
Total	269	0	6	275	0	4	273	277	0	0	0	0	31	10	0	41	593
05:00 PM	81	0	0	81	1	1	104	106	0	0	0	0	6	5	0	11	198
05:15 PM	74	0	3	77	1	0	62	63	0	0	0	0	4	4	0	8	148
05:30 PM	69	0	2	71	0	1	88	89	0	0	0	0	5	2	0	7	167
05:45 PM	68	0	1	69	0	5	47	52	0	0	0	0	3	1	0	4	125
Total	292	0	6	298	2	7	301	310	0	0	0	0	18	12	0	30	638
Grand Total	561	0	12	573	2	11	574	587	0	0	0	0	49	22	0	71	1231
Apprch %	97.9	0	2.1		0.3	1.9	97.8		0	0	0		69	31	0		
Total %	45.6	0	1	46.5	0.2	0.9	46.6	47.7	0	0	0	0	4	1.8	0	5.8	

	Inland Valley Drive Southbound				Prielipp Road Westbound				Inland Valley Drive Northbound				Prielipp Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	78	0	2	80	0	2	64	66	0	0	0	0	11	0	0	11	157
05:00 PM	81	0	0	81	1	1	104	106	0	0	0	0	6	5	0	11	198
05:15 PM	74	0	3	77	1	0	62	63	0	0	0	0	4	4	0	8	148
05:30 PM	69	0	2	71	0	1	88	89	0	0	0	0	5	2	0	7	167
Total Volume	302	0	7	309	2	4	318	324	0	0	0	0	26	11	0	37	670
% App. Total	97.7	0	2.3		0.6	1.2	98.1		0	0	0		70.3	29.7	0		
PHF	.932	.000	.583	.954	.500	.500	.764	.764	.000	.000	.000	.000	.591	.550	.000	.841	.846

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City of Murrieta
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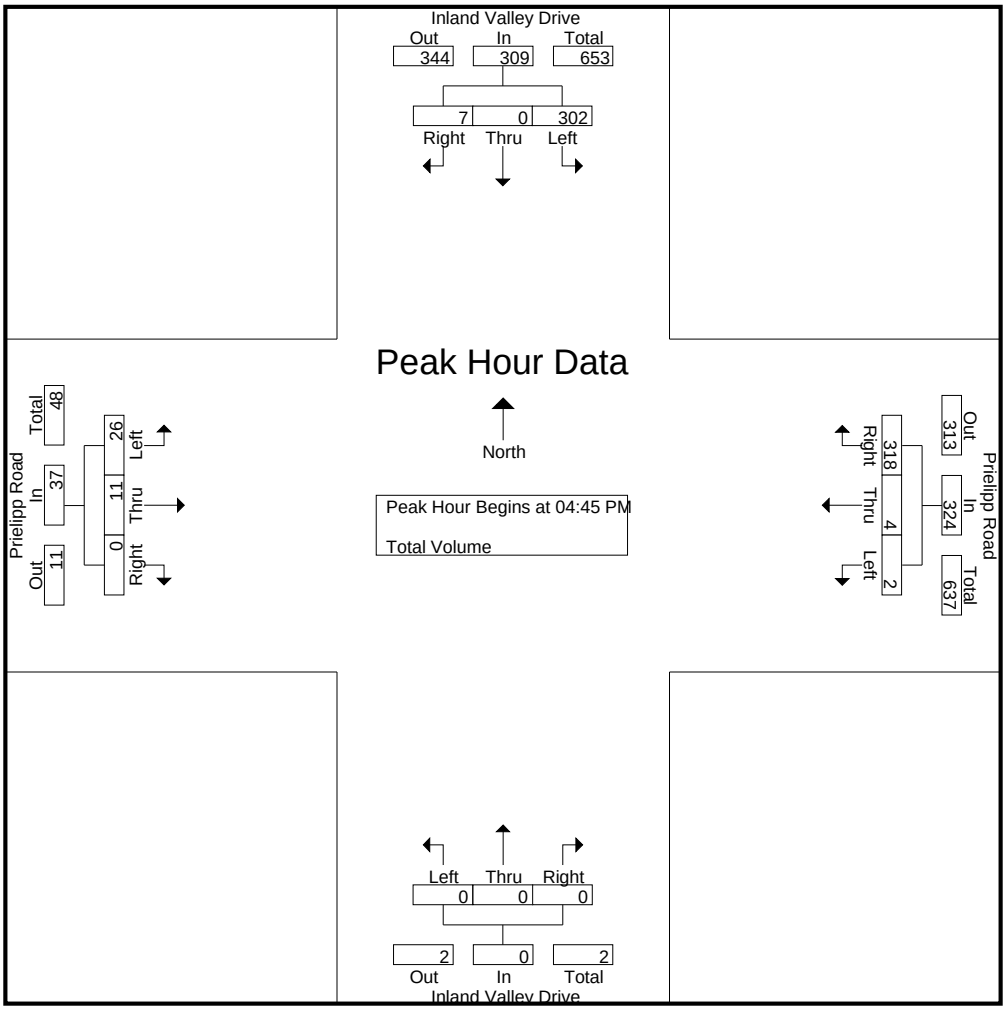

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:45 PM				04:45 PM				04:00 PM				04:30 PM			
+0 mins.	78	0	2	80	0	2	64	66	0	0	0	0	9	4	0	13
+15 mins.	81	0	0	81	1	1	104	106	0	0	0	0	11	0	0	11
+30 mins.	74	0	3	77	1	0	62	63	0	0	0	0	6	5	0	11
+45 mins.	69	0	2	71	0	1	88	89	0	0	0	0	4	4	0	8
Total Volume	302	0	7	309	2	4	318	324	0	0	0	0	30	13	0	43
% App. Total	97.7	0	2.3		0.6	1.2	98.1		0	0	0		69.8	30.2	0	
PHF	.932	.000	.583	.954	.500	.500	.764	.764	.000	.000	.000	.000	.682	.650	.000	.827

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City of Murrieta
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File Name : MURNUPRAM
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Groups Printed- Total Volume

	Nutmeg Street Southbound				Jackson Avenue Westbound				Nutmeg Street Northbound				Prielipp Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	25	125	10	160	9	9	16	34	7	69	20	96	11	22	19	52	342
07:15 AM	64	64	14	142	10	18	16	44	17	88	28	133	12	47	19	78	397
07:30 AM	59	41	16	116	11	22	23	56	14	79	36	129	6	43	6	55	356
07:45 AM	55	52	10	117	16	26	34	76	9	63	39	111	24	48	3	75	379
Total	203	282	50	535	46	75	89	210	47	299	123	469	53	160	47	260	1474
08:00 AM	46	70	22	138	19	29	22	70	5	70	29	104	43	49	10	102	414
08:15 AM	38	123	32	193	29	30	20	79	9	63	28	100	13	37	14	64	436
08:30 AM	35	70	17	122	16	31	18	65	16	70	21	107	9	48	9	66	360
08:45 AM	29	45	6	80	10	28	22	60	14	56	26	96	8	29	6	43	279
Total	148	308	77	533	74	118	82	274	44	259	104	407	73	163	39	275	1489
Grand Total	351	590	127	1068	120	193	171	484	91	558	227	876	126	323	86	535	2963
Apprch %	32.9	55.2	11.9		24.8	39.9	35.3		10.4	63.7	25.9		23.6	60.4	16.1		
Total %	11.8	19.9	4.3	36	4	6.5	5.8	16.3	3.1	18.8	7.7	29.6	4.3	10.9	2.9	18.1	

	Nutmeg Street Southbound				Jackson Avenue Westbound				Nutmeg Street Northbound				Prielipp Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45 AM																	
07:45 AM	55	52	10	117	16	26	34	76	9	63	39	111	24	48	3	75	379
08:00 AM	46	70	22	138	19	29	22	70	5	70	29	104	43	49	10	102	414
08:15 AM	38	123	32	193	29	30	20	79	9	63	28	100	13	37	14	64	436
08:30 AM	35	70	17	122	16	31	18	65	16	70	21	107	9	48	9	66	360
Total Volume	174	315	81	570	80	116	94	290	39	266	117	422	89	182	36	307	1589
% App. Total	30.5	55.3	14.2		27.6	40	32.4		9.2	63	27.7		29	59.3	11.7		
PHF	.791	.640	.633	.738	.690	.935	.691	.918	.609	.950	.750	.950	.517	.929	.643	.752	.911

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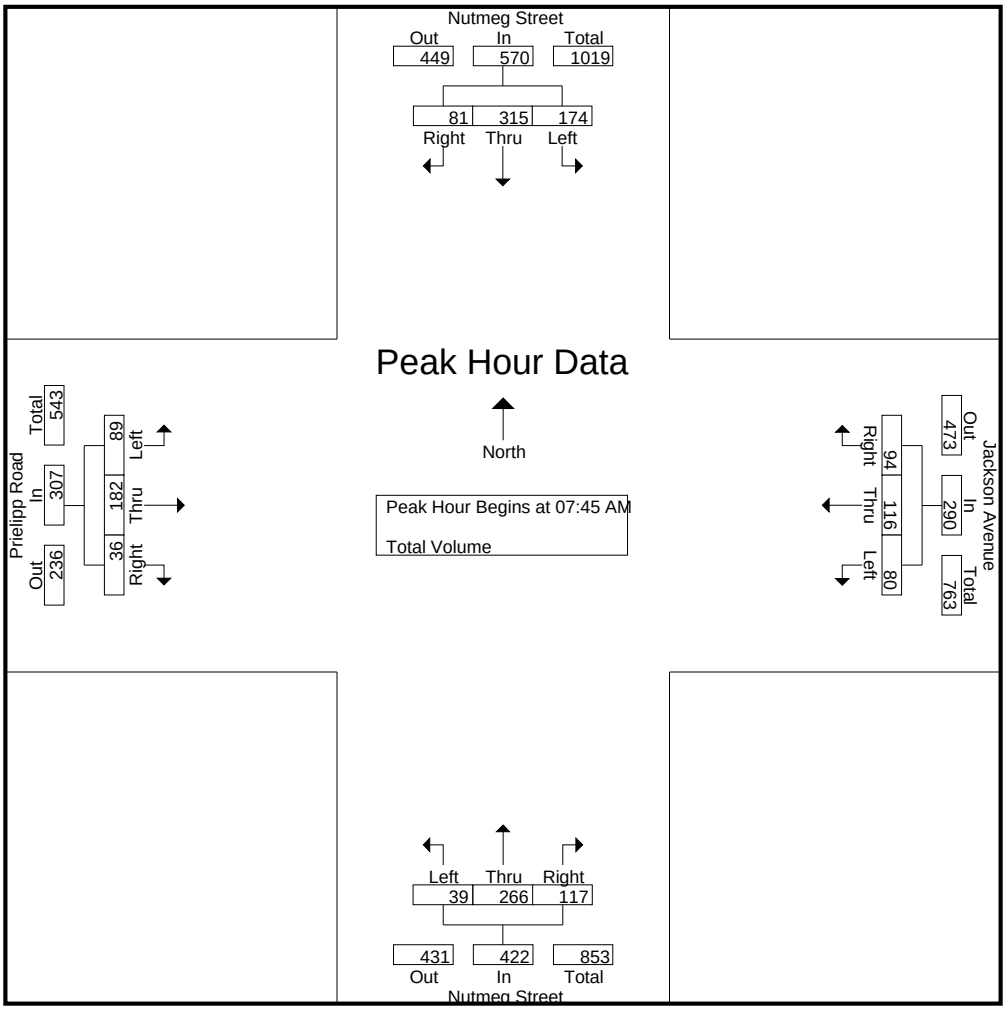

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:45 AM				07:45 AM				07:15 AM				07:15 AM			
+0 mins.	55	52	10	117	16	26	34	76	17	88	28	133	12	47	19	78
+15 mins.	46	70	22	138	19	29	22	70	14	79	36	129	6	43	6	55
+30 mins.	38	123	32	193	29	30	20	79	9	63	39	111	24	48	3	75
+45 mins.	35	70	17	122	16	31	18	65	5	70	29	104	43	49	10	102
Total Volume	174	315	81	570	80	116	94	290	45	300	132	477	85	187	38	310
% App. Total	30.5	55.3	14.2		27.6	40	32.4		9.4	62.9	27.7		27.4	60.3	12.3	
PHF	.791	.640	.633	.738	.690	.935	.691	.918	.662	.852	.846	.897	.494	.954	.500	.760

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City of Murrieta
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Groups Printed- Total Volume

	Nutmeg Street Southbound				Jackson Avenue Westbound				Nutmeg Street Northbound				Prielipp Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	41	51	13	105	25	48	51	124	8	50	20	78	27	38	14	79	386
04:15 PM	25	51	15	91	19	52	50	121	11	63	23	97	18	37	19	74	383
04:30 PM	28	54	11	93	24	33	36	93	19	46	21	86	24	45	20	89	361
04:45 PM	33	61	17	111	33	39	39	111	13	38	17	68	22	42	14	78	368
Total	127	217	56	400	101	172	176	449	51	197	81	329	91	162	67	320	1498
05:00 PM	31	55	8	94	37	46	44	127	19	52	22	93	31	61	16	108	422
05:15 PM	33	56	21	110	23	59	55	137	14	60	22	96	18	44	11	73	416
05:30 PM	38	50	14	102	33	53	61	147	15	63	20	98	33	58	7	98	445
05:45 PM	36	50	13	99	32	50	54	136	9	43	12	64	19	41	17	77	376
Total	138	211	56	405	125	208	214	547	57	218	76	351	101	204	51	356	1659
Grand Total	265	428	112	805	226	380	390	996	108	415	157	680	192	366	118	676	3157
Apprch %	32.9	53.2	13.9		22.7	38.2	39.2		15.9	61	23.1		28.4	54.1	17.5		
Total %	8.4	13.6	3.5	25.5	7.2	12	12.4	31.5	3.4	13.1	5	21.5	6.1	11.6	3.7	21.4	

	Nutmeg Street Southbound				Jackson Avenue Westbound				Nutmeg Street Northbound				Prielipp Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	31	55	8	94	37	46	44	127	19	52	22	93	31	61	16	108	422
05:15 PM	33	56	21	110	23	59	55	137	14	60	22	96	18	44	11	73	416
05:30 PM	38	50	14	102	33	53	61	147	15	63	20	98	33	58	7	98	445
05:45 PM	36	50	13	99	32	50	54	136	9	43	12	64	19	41	17	77	376
Total Volume	138	211	56	405	125	208	214	547	57	218	76	351	101	204	51	356	1659
% App. Total	34.1	52.1	13.8		22.9	38	39.1		16.2	62.1	21.7		28.4	57.3	14.3		
PHF	.908	.942	.667	.920	.845	.881	.877	.930	.750	.865	.864	.895	.765	.836	.750	.824	.932

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City of Murrieta
N/S: Nutmeg Street
E/W: Prielipp Road
Weather: Clear

File Name : MURNUPRPM
Site Code : 20115020
Start Date : 1/14/2015
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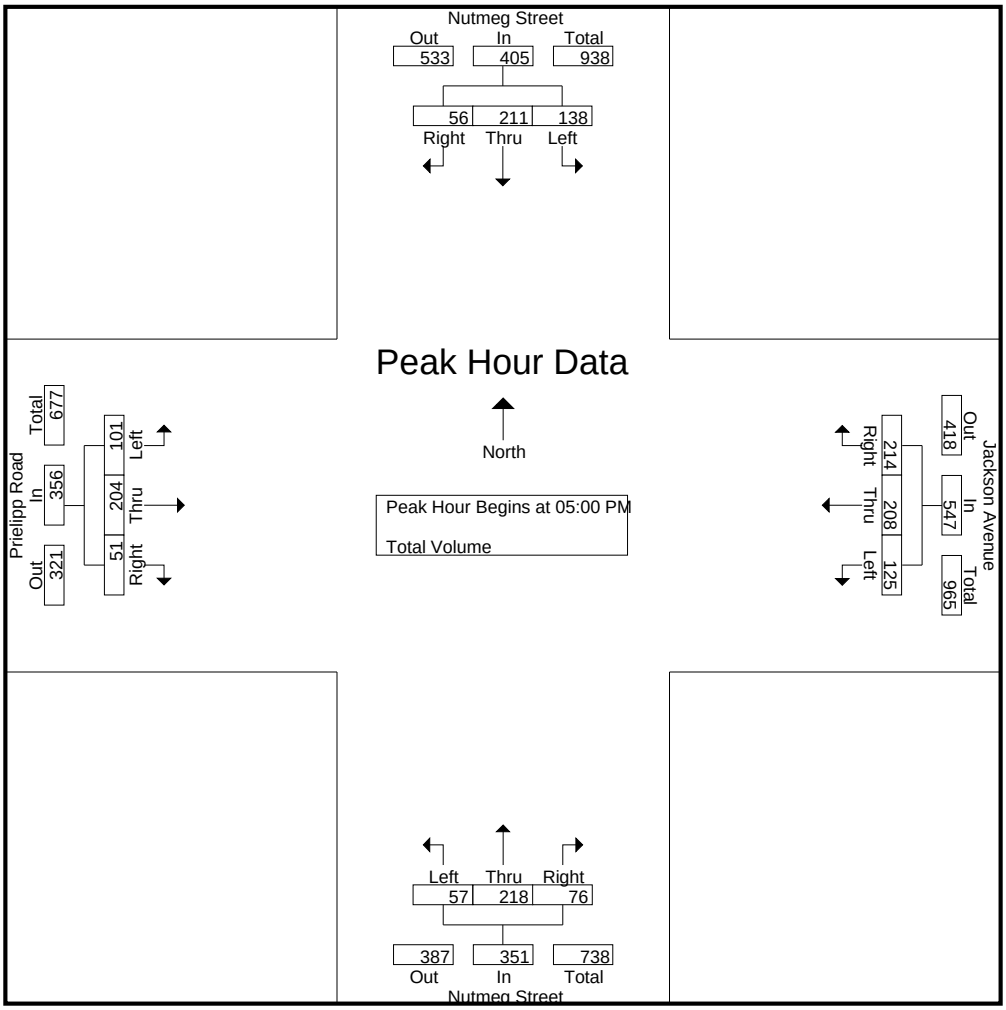

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:45 PM				05:00 PM				04:45 PM				04:45 PM			
+0 mins.	33	61	17	111	37	46	44	127	13	38	17	68	22	42	14	78
+15 mins.	31	55	8	94	23	59	55	137	19	52	22	93	31	61	16	108
+30 mins.	33	56	21	110	33	53	61	147	14	60	22	96	18	44	11	73
+45 mins.	38	50	14	102	32	50	54	136	15	63	20	98	33	58	7	98
Total Volume	135	222	60	417	125	208	214	547	61	213	81	355	104	205	48	357
% App. Total	32.4	53.2	14.4		22.9	38	39.1		17.2	60	22.8		29.1	57.4	13.4	
PHF	.888	.910	.714	.939	.845	.881	.877	.930	.803	.845	.920	.906	.788	.840	.750	.826

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City of Murrieta
N/S: Monte Vista Drive
E/W: Baxter Road
Weather: Clear

File Name : MURMVBAAM
Site Code : 20115020
Start Date : 1/14/2015
Page No : 1

Groups Printed- Total Volume

	Monte Vista Drive Southbound			Baxter Road Westbound			Baxter Road Eastbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
07:00 AM	6	43	49	33	3	36	11	9	20	105
07:15 AM	14	75	89	29	9	38	22	37	59	186
07:30 AM	40	89	129	42	13	55	51	57	108	292
07:45 AM	58	109	167	50	23	73	25	46	71	311
Total	118	316	434	154	48	202	109	149	258	894
08:00 AM	12	54	66	51	14	65	14	19	33	164
08:15 AM	5	28	33	19	6	25	16	10	26	84
08:30 AM	5	22	27	12	5	17	16	5	21	65
08:45 AM	5	21	26	19	2	21	22	16	38	85
Total	27	125	152	101	27	128	68	50	118	398
Grand Total	145	441	586	255	75	330	177	199	376	1292
Apprch %	24.7	75.3		77.3	22.7		47.1	52.9		
Total %	11.2	34.1	45.4	19.7	5.8	25.5	13.7	15.4	29.1	

	Monte Vista Drive Southbound			Baxter Road Westbound			Baxter Road Eastbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:15 AM										
07:15 AM	14	75	89	29	9	38	22	37	59	186
07:30 AM	40	89	129	42	13	55	51	57	108	292
07:45 AM	58	109	167	50	23	73	25	46	71	311
08:00 AM	12	54	66	51	14	65	14	19	33	164
Total Volume	124	327	451	172	59	231	112	159	271	953
% App. Total	27.5	72.5		74.5	25.5		41.3	58.7		
PHF	.534	.750	.675	.843	.641	.791	.549	.697	.627	.766

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City of Murrieta
N/S: Monte Vista Drive
E/W: Baxter Road
Weather: Clear

File Name : MURMVBAAM
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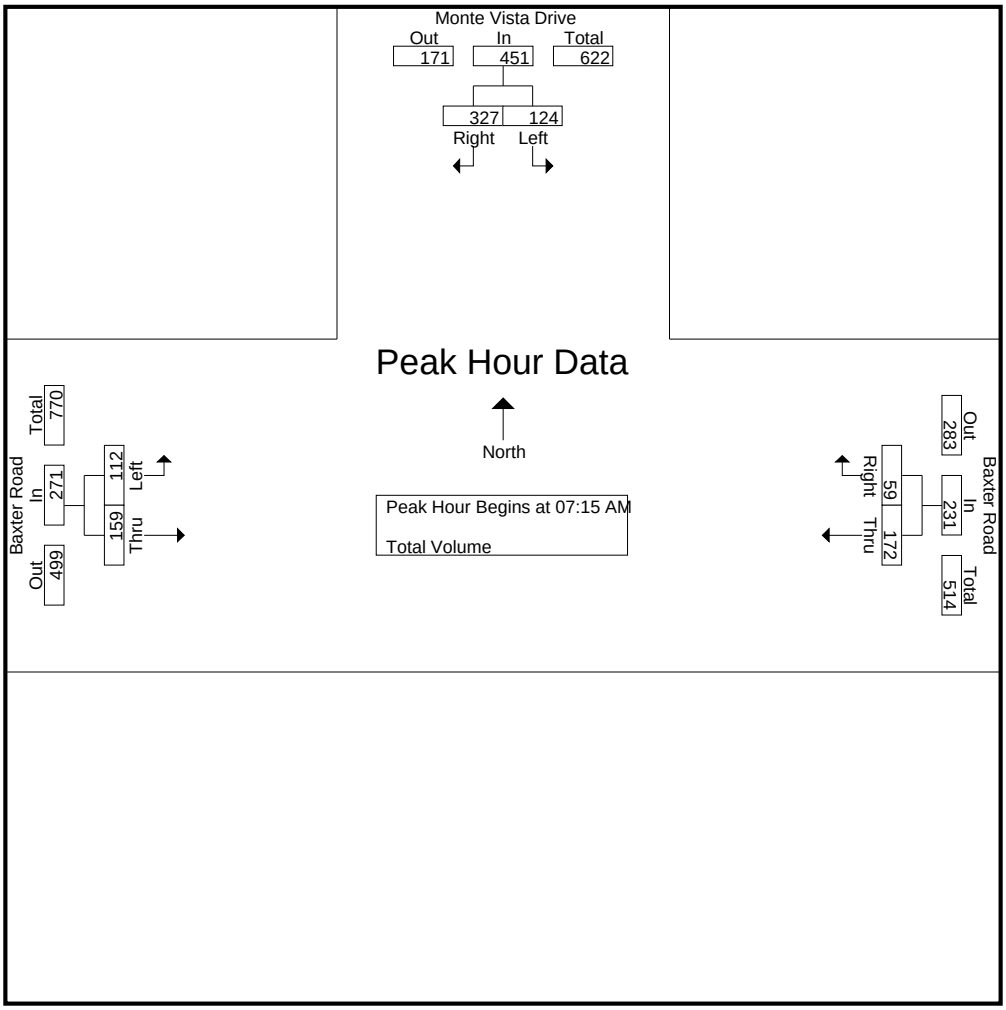

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:15 AM			07:15 AM			07:15 AM		
+0 mins.	14	75	89	29	9	38	22	37	59
+15 mins.	40	89	129	42	13	55	51	57	108
+30 mins.	58	109	167	50	23	73	25	46	71
+45 mins.	12	54	66	51	14	65	14	19	33
Total Volume	124	327	451	172	59	231	112	159	271
% App. Total	27.5	72.5		74.5	25.5		41.3	58.7	
PHF	.534	.750	.675	.843	.641	.791	.549	.697	.627

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City of Murrieta
N/S: Monte Vista Drive
E/W: Baxter Road
Weather: Clear

File Name : MURMVBAPM
Site Code : 20115020
Start Date : 1/14/2015
Page No : 1

Groups Printed- Total Volume

	Monte Vista Drive Southbound			Baxter Road Westbound			Baxter Road Eastbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
04:00 PM	11	29	40	17	4	21	13	27	40	101
04:15 PM	8	18	26	24	4	28	16	17	33	87
04:30 PM	8	23	31	24	7	31	22	15	37	99
04:45 PM	7	19	26	15	6	21	16	28	44	91
Total	34	89	123	80	21	101	67	87	154	378
05:00 PM	3	36	39	14	8	22	17	27	44	105
05:15 PM	10	19	29	18	6	24	28	30	58	111
05:30 PM	7	31	38	21	6	27	17	29	46	111
05:45 PM	2	14	16	22	5	27	16	29	45	88
Total	22	100	122	75	25	100	78	115	193	415
Grand Total	56	189	245	155	46	201	145	202	347	793
Apprch %	22.9	77.1		77.1	22.9		41.8	58.2		
Total %	7.1	23.8	30.9	19.5	5.8	25.3	18.3	25.5	43.8	

	Monte Vista Drive Southbound			Baxter Road Westbound			Baxter Road Eastbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:45 PM										
04:45 PM	7	19	26	15	6	21	16	28	44	91
05:00 PM	3	36	39	14	8	22	17	27	44	105
05:15 PM	10	19	29	18	6	24	28	30	58	111
05:30 PM	7	31	38	21	6	27	17	29	46	111
Total Volume	27	105	132	68	26	94	78	114	192	418
% App. Total	20.5	79.5		72.3	27.7		40.6	59.4		
PHF	.675	.729	.846	.810	.813	.870	.696	.950	.828	.941

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City of Murrieta
N/S: Monte Vista Drive
E/W: Baxter Road
Weather: Clear

File Name : MURMVBAPM
Site Code : 20115020
Start Date : 1/14/2015
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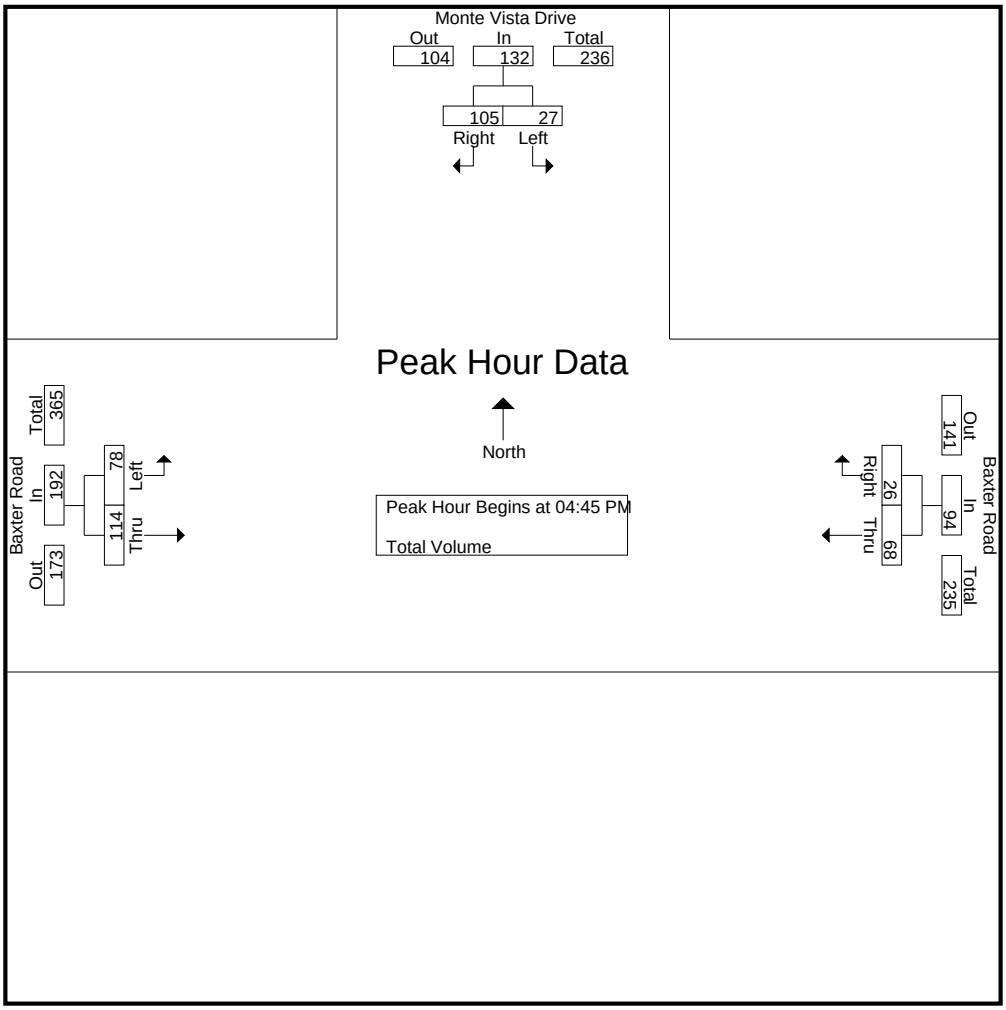

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:45 PM			04:15 PM			05:00 PM		
+0 mins.	7	19	26	24	4	28	17	27	44
+15 mins.	3	36	39	24	7	31	28	30	58
+30 mins.	10	19	29	15	6	21	17	29	46
+45 mins.	7	31	38	14	8	22	16	29	45
Total Volume	27	105	132	77	25	102	78	115	193
% App. Total	20.5	79.5		75.5	24.5		40.4	59.6	
PHF	.675	.729	.846	.802	.781	.823	.696	.958	.832

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City of Murrieta
N/S: I-15 Northbound On / Off Ramps
E/W: Baxter Road
Weather: Clear

File Name : MUR15NBAAM
Site Code : 20115020
Start Date : 1/14/2015
Page No : 1

Groups Printed- Total Volume

	I-15 Northbound On Ramp Southbound				Baxter Road Westbound				I-15 Northbound Off Ramp Northbound				Baxter Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	0	0	0	0	0	64	18	82	46	0	6	52	64	20	0	84	218
07:15 AM	0	0	0	0	0	77	27	104	39	0	11	50	63	47	0	110	264
07:30 AM	0	0	0	0	0	90	40	130	45	1	28	74	65	75	0	140	344
07:45 AM	0	0	0	0	0	114	42	156	45	0	6	51	69	61	0	130	337
Total	0	0	0	0	0	345	127	472	175	1	51	227	261	203	0	464	1163
08:00 AM	0	0	0	0	0	64	36	100	26	0	6	32	52	25	0	77	209
08:15 AM	0	0	0	0	0	40	8	48	32	2	8	42	41	19	0	60	150
08:30 AM	0	0	0	0	0	30	2	32	23	0	13	36	43	10	0	53	121
08:45 AM	0	0	0	0	0	29	11	40	28	1	14	43	31	23	0	54	137
Total	0	0	0	0	0	163	57	220	109	3	41	153	167	77	0	244	617
Grand Total	0	0	0	0	0	508	184	692	284	4	92	380	428	280	0	708	1780
Apprch %	0	0	0		0	73.4	26.6		74.7	1.1	24.2		60.5	39.5	0		
Total %	0	0	0	0	0	28.5	10.3	38.9	16	0.2	5.2	21.3	24	15.7	0	39.8	

	I-15 Northbound On Ramp Southbound				Baxter Road Westbound				I-15 Northbound Off Ramp Northbound				Baxter Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	0	0	0	0	0	64	18	82	46	0	6	52	64	20	0	84	218
07:15 AM	0	0	0	0	0	77	27	104	39	0	11	50	63	47	0	110	264
07:30 AM	0	0	0	0	0	90	40	130	45	1	28	74	65	75	0	140	344
07:45 AM	0	0	0	0	0	114	42	156	45	0	6	51	69	61	0	130	337
Total Volume	0	0	0	0	0	345	127	472	175	1	51	227	261	203	0	464	1163
% App. Total	0	0	0		0	73.1	26.9		77.1	0.4	22.5		56.2	43.8	0		
PHF	.000	.000	.000	.000	.000	.757	.756	.756	.951	.250	.455	.767	.946	.677	.000	.829	.845

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City of Murrieta
N/S: I-15 Northbound On / Off Ramps
E/W: Baxter Road
Weather: Clear

File Name : MUR15NBAAM
Site Code : 20115020
Start Date : 1/14/2015
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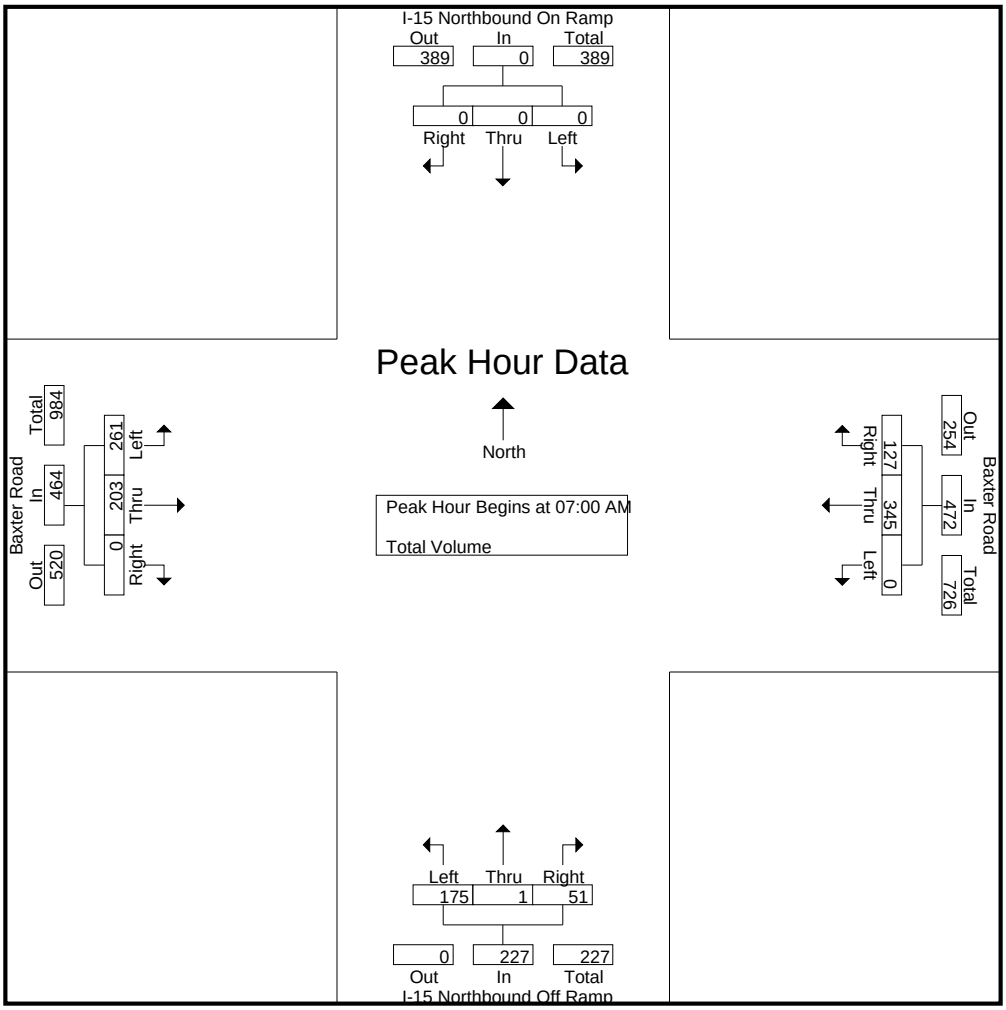

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00 AM				07:15 AM				07:00 AM				07:00 AM			
+0 mins.	0	0	0	0	0	77	27	104	46	0	6	52	64	20	0	84
+15 mins.	0	0	0	0	0	90	40	130	39	0	11	50	63	47	0	110
+30 mins.	0	0	0	0	0	114	42	156	45	1	28	74	65	75	0	140
+45 mins.	0	0	0	0	0	64	36	100	45	0	6	51	69	61	0	130
Total Volume	0	0	0	0	0	345	145	490	175	1	51	227	261	203	0	464
% App. Total	0	0	0		0	70.4	29.6		77.1	0.4	22.5		56.2	43.8	0	
PHF	.000	.000	.000	.000	.000	.757	.863	.785	.951	.250	.455	.767	.946	.677	.000	.829

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City of Murrieta
N/S: I-15 Northbound On / Off Ramps
E/W: Baxter Road
Weather: Clear

File Name : MUR15NBAPM
Site Code : 20115020
Start Date : 1/14/2015
Page No : 1

Groups Printed- Total Volume

	I-15 Northbound On Ramp Southbound				Baxter Road Westbound				I-15 Northbound Off Ramp Northbound				Baxter Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	0	0	0	0	0	39	7	46	76	0	10	86	38	30	0	68	200
04:15 PM	0	0	0	0	0	27	15	42	87	2	10	99	23	20	0	43	184
04:30 PM	0	0	0	0	0	34	12	46	96	0	11	107	33	25	0	58	211
04:45 PM	0	0	0	0	0	27	10	37	106	3	14	123	39	34	0	73	233
Total	0	0	0	0	0	127	44	171	365	5	45	415	133	109	0	242	828
05:00 PM	0	0	0	0	0	28	22	50	87	0	9	96	29	32	0	61	207
05:15 PM	0	0	0	0	0	25	10	35	101	0	19	120	39	43	0	82	237
05:30 PM	0	0	0	0	0	31	21	52	87	1	8	96	41	36	0	77	225
05:45 PM	0	0	0	0	0	25	11	36	75	0	10	85	20	33	0	53	174
Total	0	0	0	0	0	109	64	173	350	1	46	397	129	144	0	273	843
Grand Total	0	0	0	0	0	236	108	344	715	6	91	812	262	253	0	515	1671
Apprch %	0	0	0		0	68.6	31.4		88.1	0.7	11.2		50.9	49.1	0		
Total %	0	0	0	0	0	14.1	6.5	20.6	42.8	0.4	5.4	48.6	15.7	15.1	0	30.8	

	I-15 Northbound On Ramp Southbound				Baxter Road Westbound				I-15 Northbound Off Ramp Northbound				Baxter Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	0	0	0	0	0	27	10	37	106	3	14	123	39	34	0	73	233
05:00 PM	0	0	0	0	0	28	22	50	87	0	9	96	29	32	0	61	207
05:15 PM	0	0	0	0	0	25	10	35	101	0	19	120	39	43	0	82	237
05:30 PM	0	0	0	0	0	31	21	52	87	1	8	96	41	36	0	77	225
Total Volume	0	0	0	0	0	111	63	174	381	4	50	435	148	145	0	293	902
% App. Total	0	0	0		0	63.8	36.2		87.6	0.9	11.5		50.5	49.5	0		
PHF	.000	.000	.000	.000	.000	.895	.716	.837	.899	.333	.658	.884	.902	.843	.000	.893	.951

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City of Murrieta
N/S: I-15 Northbound On / Off Ramps
E/W: Baxter Road
Weather: Clear

File Name : MUR15NBAPM
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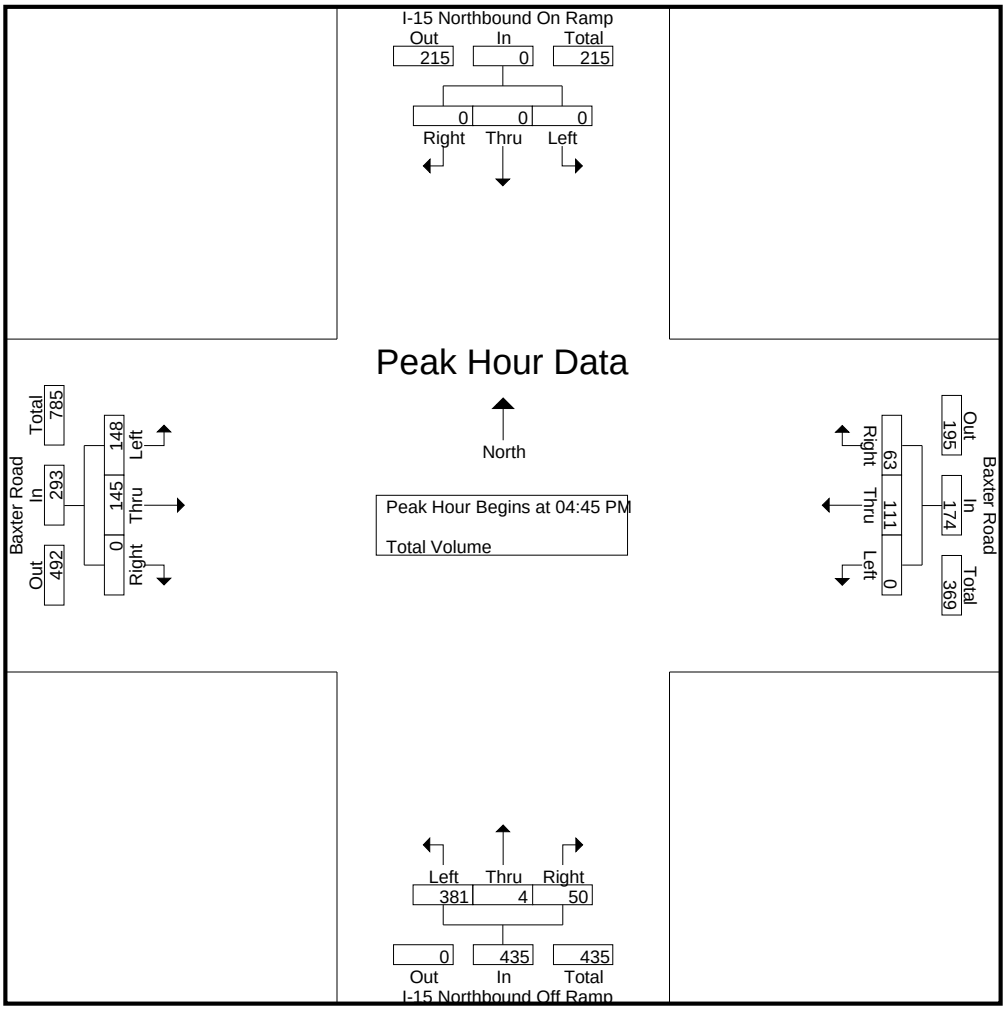

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:00 PM				04:15 PM				04:30 PM				04:45 PM			
+0 mins.	0	0	0	0	0	27	15	42	96	0	11	107	39	34	0	73
+15 mins.	0	0	0	0	0	34	12	46	106	3	14	123	29	32	0	61
+30 mins.	0	0	0	0	0	27	10	37	87	0	9	96	39	43	0	82
+45 mins.	0	0	0	0	0	28	22	50	101	0	19	120	41	36	0	77
Total Volume	0	0	0	0	0	116	59	175	390	3	53	446	148	145	0	293
% App. Total	0	0	0		0	66.3	33.7		87.4	0.7	11.9		50.5	49.5	0	
PHF	.000	.000	.000	.000	.000	.853	.670	.875	.920	.250	.697	.907	.902	.843	.000	.893

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City of Murrieta
N/S: I-15 Southbound On / Off Ramps
E/W: Baxter Road
Weather: Clear

File Name : MUR15SBAAM
Site Code : 20115020
Start Date : 1/14/2015
Page No : 1

Groups Printed- Total Volume

	I-15 Southbound Off Ramp Southbound				Baxter Road Westbound				I-15 Southbound On Ramp Northbound				Baxter Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	7	0	42	49	28	71	0	99	0	0	0	0	0	73	82	155	303
07:15 AM	16	1	34	51	49	74	0	123	0	0	0	0	0	99	91	190	364
07:30 AM	31	1	32	64	68	63	0	131	0	0	0	0	0	104	126	230	425
07:45 AM	28	0	46	74	80	79	0	159	0	0	0	0	0	105	107	212	445
Total	82	2	154	238	225	287	0	512	0	0	0	0	0	381	406	787	1537
08:00 AM	12	0	23	35	42	61	0	103	0	0	0	0	0	70	105	175	313
08:15 AM	6	0	31	37	27	43	0	70	0	0	0	0	0	50	82	132	239
08:30 AM	3	0	29	32	25	34	0	59	0	0	0	0	0	58	111	169	260
08:45 AM	11	0	17	28	18	36	0	54	0	0	0	0	0	39	70	109	191
Total	32	0	100	132	112	174	0	286	0	0	0	0	0	217	368	585	1003
Grand Total	114	2	254	370	337	461	0	798	0	0	0	0	0	598	774	1372	2540
Apprch %	30.8	0.5	68.6		42.2	57.8	0		0	0	0		0	43.6	56.4		
Total %	4.5	0.1	10	14.6	13.3	18.1	0	31.4	0	0	0	0	0	23.5	30.5	54	

	I-15 Southbound Off Ramp Southbound				Baxter Road Westbound				I-15 Southbound On Ramp Northbound				Baxter Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	16	1	34	51	49	74	0	123	0	0	0	0	0	99	91	190	364
07:30 AM	31	1	32	64	68	63	0	131	0	0	0	0	0	104	126	230	425
07:45 AM	28	0	46	74	80	79	0	159	0	0	0	0	0	105	107	212	445
08:00 AM	12	0	23	35	42	61	0	103	0	0	0	0	0	70	105	175	313
Total Volume	87	2	135	224	239	277	0	516	0	0	0	0	0	378	429	807	1547
% App. Total	38.8	0.9	60.3		46.3	53.7	0		0	0	0		0	46.8	53.2		
PHF	.702	.500	.734	.757	.747	.877	.000	.811	.000	.000	.000	.000	.000	.900	.851	.877	.869

Counts Unlimited, Inc.
PO Box 1178
Corona, CA 92878
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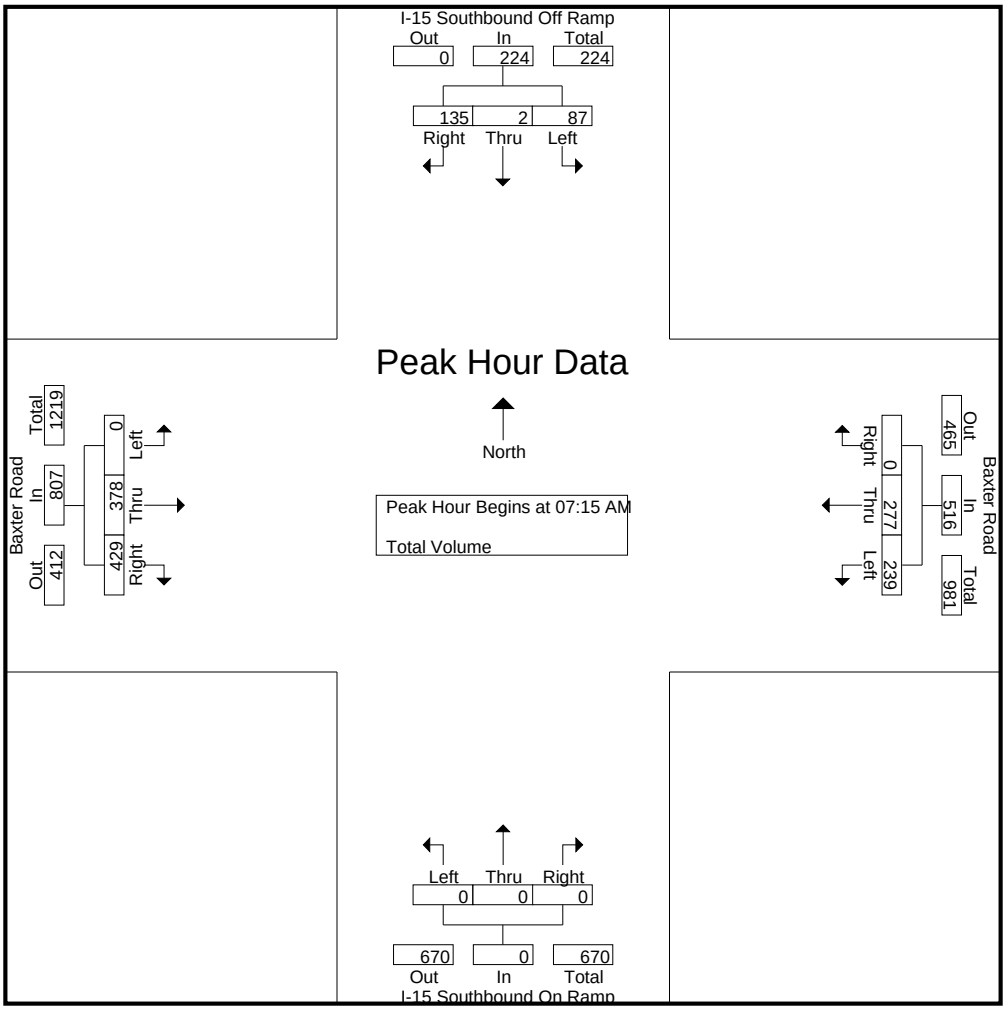
City of Murrieta
N/S: I-15 Southbound On / Off Ramps
E/W: Baxter Road
Weather: Clear

File Name : MUR15SBAAM
Site Code : 20115020
Start Date : 1/14/2015
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00 AM				07:15 AM				07:00 AM				07:15 AM			
+0 mins.	7	0	42	49	49	74	0	123	0	0	0	0	0	99	91	190
+15 mins.	16	1	34	51	68	63	0	131	0	0	0	0	0	104	126	230
+30 mins.	31	1	32	64	80	79	0	159	0	0	0	0	0	105	107	212
+45 mins.	28	0	46	74	42	61	0	103	0	0	0	0	0	70	105	175
Total Volume	82	2	154	238	239	277	0	516	0	0	0	0	0	378	429	807
% App. Total	34.5	0.8	64.7		46.3	53.7	0		0	0	0		0	46.8	53.2	
PHF	.661	.500	.837	.804	.747	.877	.000	.811	.000	.000	.000	.000	.000	.900	.851	.877

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City of Murrieta
N/S: I-15 Southbound On / Off Ramps
E/W: Baxter Road
Weather: Clear

File Name : MUR15SBAPM
Site Code : 20115020
Start Date : 1/14/2015
Page No : 1

Groups Printed- Total Volume

	I-15 Southbound Off Ramp Southbound				Baxter Road Westbound				I-15 Southbound On Ramp Northbound				Baxter Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	17	1	42	60	20	103	0	123	0	0	0	0	0	48	70	118	301
04:15 PM	7	0	41	48	6	105	0	111	0	0	0	0	0	39	78	117	276
04:30 PM	12	1	39	52	11	111	0	122	0	0	0	0	0	45	95	140	314
04:45 PM	16	1	44	61	10	119	0	129	0	0	0	0	0	59	73	132	322
Total	52	3	166	221	47	438	0	485	0	0	0	0	0	191	316	507	1213
05:00 PM	14	0	43	57	16	102	0	118	0	0	0	0	0	47	82	129	304
05:15 PM	16	0	45	61	13	114	0	127	0	0	0	0	0	61	64	125	313
05:30 PM	17	1	37	55	15	107	0	122	0	0	0	0	0	59	67	126	303
05:45 PM	16	0	43	59	10	92	0	102	0	0	0	0	0	38	64	102	263
Total	63	1	168	232	54	415	0	469	0	0	0	0	0	205	277	482	1183
Grand Total	115	4	334	453	101	853	0	954	0	0	0	0	0	396	593	989	2396
Apprch %	25.4	0.9	73.7		10.6	89.4	0		0	0	0		0	40	60		
Total %	4.8	0.2	13.9	18.9	4.2	35.6	0	39.8	0	0	0	0	0	16.5	24.7	41.3	

	I-15 Southbound Off Ramp Southbound				Baxter Road Westbound				I-15 Southbound On Ramp Northbound				Baxter Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	12	1	39	52	11	111	0	122	0	0	0	0	0	45	95	140	314
04:45 PM	16	1	44	61	10	119	0	129	0	0	0	0	0	59	73	132	322
05:00 PM	14	0	43	57	16	102	0	118	0	0	0	0	0	47	82	129	304
05:15 PM	16	0	45	61	13	114	0	127	0	0	0	0	0	61	64	125	313
Total Volume	58	2	171	231	50	446	0	496	0	0	0	0	0	212	314	526	1253
% App. Total	25.1	0.9	74		10.1	89.9	0		0	0	0		0	40.3	59.7		
PHF	.906	.500	.950	.947	.781	.937	.000	.961	.000	.000	.000	.000	.000	.869	.826	.939	.973

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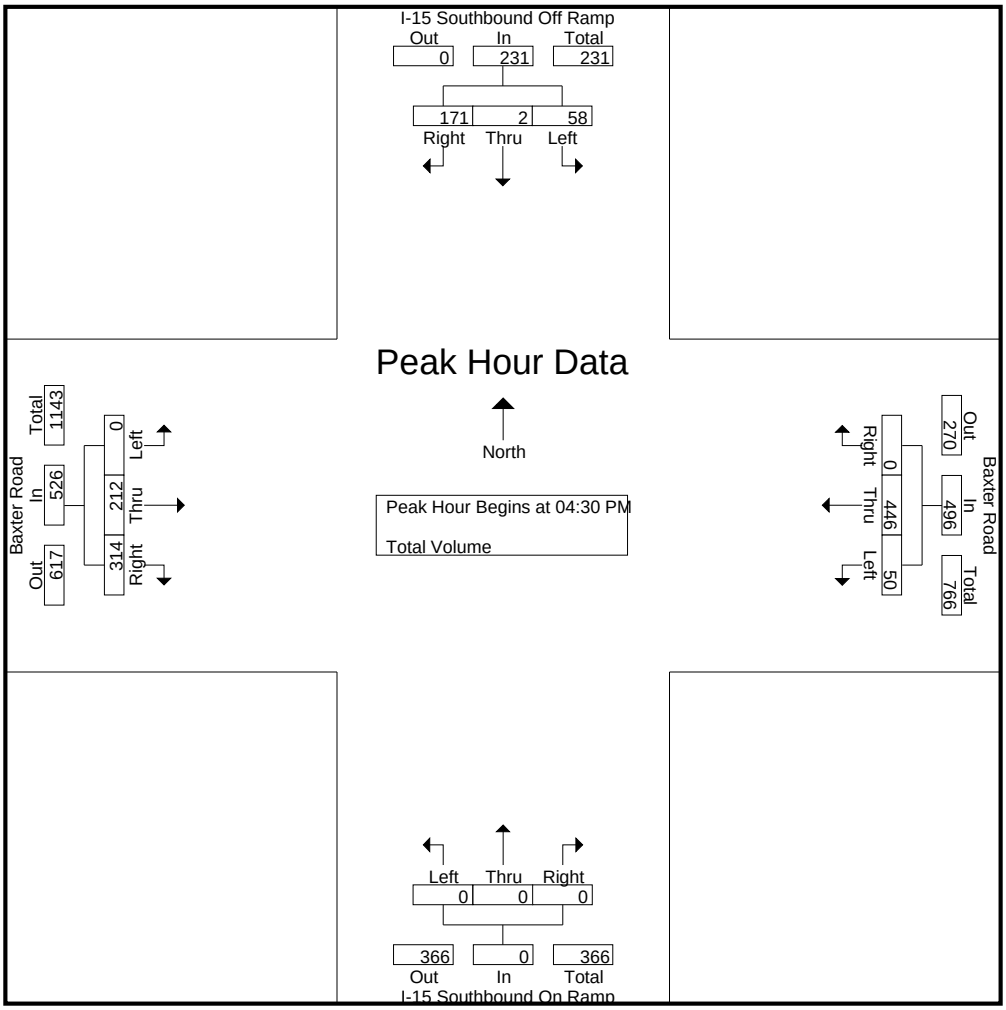
City of Murrieta
N/S: I-15 Southbound On / Off Ramps
E/W: Baxter Road
Weather: Clear

File Name : MUR15SBAPM
Site Code : 20115020
Start Date : 1/14/2015
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:45 PM				04:30 PM				04:00 PM				04:30 PM			
+0 mins.	16	1	44	61	11	111	0	122	0	0	0	0	0	45	95	140
+15 mins.	14	0	43	57	10	119	0	129	0	0	0	0	0	59	73	132
+30 mins.	16	0	45	61	16	102	0	118	0	0	0	0	0	47	82	129
+45 mins.	17	1	37	55	13	114	0	127	0	0	0	0	0	61	64	125
Total Volume	63	2	169	234	50	446	0	496	0	0	0	0	0	212	314	526
% App. Total	26.9	0.9	72.2		10.1	89.9	0		0	0	0		0	40.3	59.7	
PHF	.926	.500	.939	.959	.781	.937	.000	.961	.000	.000	.000	.000	.000	.869	.826	.939

Counts Unlimited, Inc

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City of Murrieta
Arya Road
N/ Clinton Keith Road
24 Hour Directional Volume Count

MUR001
Site Code: 201-15030

Start Time	22-Jan-15 Thu	Northbound Morning	Northbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Southbound Morning	Southbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		0	4			0	11				
12:15		0	**11**			0	17				
12:30		0	**0**			1	6				
12:45		1	**1**	1	16	0	13	1	47	2	63
01:00		0	**8**			0	9				
01:15		3	1			0	12				
01:30		2	4			1	14				
01:45		1	2	6	15	3	19	4	54	10	69
02:00		1	2			2	13				
02:15		0	4			1	11				
02:30		1	4			2	9				
02:45		0	2	2	12	0	12	5	45	7	57
03:00		0	4			1	**11**				
03:15		0	2			1	**20**				
03:30		1	3			1	**13**				
03:45		1	6	2	15	2	**19**	5	63	7	78
04:00		0	3			0	10				
04:15		0	3			6	16				
04:30		4	2			8	8				
04:45		4	5	8	13	3	14	17	48	25	61
05:00		2	7			14	12				
05:15		3	6			9	11				
05:30		1	0			8	8				
05:45		2	3	8	16	6	9	37	40	45	56
06:00		1	6			15	15				
06:15		**3**	0			14	4				
06:30		**10**	4			16	8				
06:45		**2**	2	16	12	**13**	8	58	35	74	47
07:00		**3**	1			**13**	9				
07:15		2	2			**18**	9				
07:30		2	4			**22**	4				
07:45		3	1	10	8	10	6	63	28	73	36
08:00		3	0			16	8				
08:15		7	3			10	6				
08:30		4	0			8	4				
08:45		2	2	16	5	13	4	47	22	63	27
09:00		5	3			12	8				
09:15		2	2			10	5				
09:30		2	0			13	0				
09:45		1	2	10	7	7	3	42	16	52	23
10:00		6	0			11	0				
10:15		4	0			7	1				
10:30		3	0			9	1				
10:45		3	0	16	0	10	3	37	5	53	5
11:00		3	0			4	1				
11:15		9	0			7	3				
11:30		3	0			9	2				
11:45		0	0	15	0	8	1	28	7	43	7
Total		110	119	110	119	344	410	344	410	454	529
Combined Total		229		229		754		754		983	
AM Peak	-	06:15	-	-	-	06:45	-	-	-	-	-
Vol.	-	18	-	-	-	66	-	-	-	-	-
P.H.F.		0.450				0.750					
PM Peak	-	-	00:15	-	-	-	03:00	-	-	-	-
Vol.	-	-	20	-	-	-	63	-	-	-	-
P.H.F.			0.455				0.788				
Percentage		48.0%	52.0%			45.6%	54.4%				
ADT/AADT		ADT 983		AADT 983							

Counts Unlimited, Inc

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City of Murrieta
Clinton Keith Road
E/ Arya Road
24 Hour Directional Volume Count

MUR004
Site Code: 201-15030

Start Time	22-Jan-15 Thu	Eastbound Morning	Eastbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Westbound Morning	Westbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		26	176			13	190				
12:15		20	181			19	199				
12:30		22	172			11	195				
12:45		12	169	80	698	9	188	52	772	132	1470
01:00		17	188			11	171				
01:15		12	196			12	174				
01:30		17	193			16	177				
01:45		4	194	50	771	7	233	46	755	96	1526
02:00		17	238			9	193				
02:15		7	215			7	181				
02:30		6	212			11	234				
02:45		12	227	42	892	14	226	41	834	83	1726
03:00		8	234			23	199				
03:15		15	236			26	224				
03:30		9	213			27	236				
03:45		11	232	43	915	46	229	122	888	165	1803
04:00		6	**241**			43	229				
04:15		9	**272**			60	228				
04:30		14	**264**			75	**230**				
04:45		31	**237**	60	1014	94	**217**	272	904	332	1918
05:00		28	227			93	**267**				
05:15		32	249			105	**243**				
05:30		40	258			130	220				
05:45		80	238	180	972	132	212	460	942	640	1914
06:00		47	232			159	169				
06:15		74	233			156	178				
06:30		99	232			181	141				
06:45		150	217	370	914	217	142	713	630	1083	1544
07:00		136	207			203	141				
07:15		145	184			233	116				
07:30		**184**	162			**259**	155				
07:45		**189**	161	654	714	**251**	108	946	520	1600	1234
08:00		**181**	158			**228**	113				
08:15		**190**	130			**234**	115				
08:30		182	159			201	106				
08:45		182	126	735	573	190	78	853	412	1588	985
09:00		170	119			155	75				
09:15		141	120			182	83				
09:30		148	111			186	65				
09:45		178	82	637	432	180	58	703	281	1340	713
10:00		143	75			157	47				
10:15		137	51			194	46				
10:30		160	60			174	48				
10:45		174	36	614	222	178	37	703	178	1317	400
11:00		160	46			154	29				
11:15		139	41			196	17				
11:30		166	33			201	25				
11:45		156	38	621	158	195	21	746	92	1367	250
Total		4086	8275	4086	8275	5657	7208	5657	7208	9743	15483
Combined Total		12361		12361		12865		12865		25226	
AM Peak	-	07:30	-	-	-	07:30	-	-	-	-	-
Vol.	-	744	-	-	-	972	-	-	-	-	-
P.H.F.		0.979				0.938					
PM Peak	-	-	04:00	-	-	-	04:30	-	-	-	-
Vol.	-	-	1014	-	-	-	957	-	-	-	-
P.H.F.			0.932				0.896				
Percentage		33.1%	66.9%			44.0%	56.0%				
ADT/AADT		ADT 25,226		AADT 25,226							

Counts Unlimited, Inc

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City of Murrieta
Clinton Keith Road
W/ Arya Road
24 Hour Directional Volume Count

MUR003
Site Code: 201-15030

Start Time	22-Jan-15 Thu	Eastbound Morning	Eastbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Westbound Morning	Westbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		28	214			17	218				
12:15		25	222			25	260				
12:30		23	235			14	253				
12:45		14	241	90	912	14	223	70	954	160	1866
01:00		15	249			10	231				
01:15		15	238			15	249				
01:30		23	224			21	227				
01:45		6	277	59	988	6	287	52	994	111	1982
02:00		13	269			7	252				
02:15		7	276			13	244				
02:30		7	264			9	274				
02:45		12	284	39	1093	15	269	44	1039	83	2132
03:00		10	304			24	263				
03:15		14	291			29	273				
03:30		9	279			29	296				
03:45		18	324	51	1198	46	278	128	1110	179	2308
04:00		15	298			44	279				
04:15		25	331			63	298				
04:30		23	326			83	289				
04:45		50	298	113	1253	99	270	289	1136	402	2389
05:00		54	287			111	**310**				
05:15		55	**383**			131	**291**				
05:30		59	**320**			147	**302**				
05:45		98	**307**	266	1297	149	**279**	538	1182	804	2479
06:00		86	**306**			173	233				
06:15		111	310			198	232				
06:30		123	242			190	218				
06:45		191	269	511	1127	248	191	809	874	1320	2001
07:00		164	266			221	184				
07:15		209	210			**276**	197				
07:30		230	193			**266**	178				
07:45		232	187	835	856	**266**	160	1029	719	1864	1575
08:00		**250**	162			**283**	151				
08:15		**251**	156			268	154				
08:30		**244**	182			245	132				
08:45		**234**	135	979	635	236	113	1032	550	2011	1185
09:00		231	138			190	122				
09:15		194	145			235	107				
09:30		194	109			241	95				
09:45		235	102	854	494	236	75	902	399	1756	893
10:00		193	92			218	75				
10:15		188	54			238	53				
10:30		216	71			231	58				
10:45		222	38	819	255	228	48	915	234	1734	489
11:00		188	44			210	45				
11:15		192	46			242	27				
11:30		204	35			225	32				
11:45		211	41	795	166	245	26	922	130	1717	296
Total		5411	10274	5411	10274	6730	9321	6730	9321	12141	19595
Combined Total		15685		15685		16051		16051		31736	
AM Peak	-	08:00	-	-	-	07:15	-	-	-	-	-
Vol.	-	979	-	-	-	1091	-	-	-	-	-
P.H.F.		0.975				0.964					
PM Peak	-	-	05:15	-	-	-	05:00	-	-	-	-
Vol.	-	-	1316	-	-	-	1182	-	-	-	-
P.H.F.			0.859				0.953				
Percentage		34.5%	65.5%			41.9%	58.1%				
ADT/AADT		ADT 31,736		AADT 31,736							

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City of Murrieta
De Pasquale Road
W/ George Avenue
24 Hour Directional Volume Count

MUR002
Site Code: 201-15030

Start Time	22-Jan-15 Thu	Eastbound Morning	Eastbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Westbound Morning	Westbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		0	3			0	7				
12:15		1	7			1	8				
12:30		0	12			0	5				
12:45		0	6	1	28	1	11	2	31	3	59
01:00		0	6			0	9				
01:15		0	5			0	13				
01:30		1	8			1	1				
01:45		0	9	1	28	1	9	2	32	3	60
02:00		0	8			2	8				
02:15		1	**16**			1	9				
02:30		2	**9**			0	10				
02:45		0	**13**	3	46	0	10	3	37	6	83
03:00		0	**10**			0	12				
03:15		0	10			0	11				
03:30		0	9			1	17				
03:45		0	8	0	37	0	13	1	53	1	90
04:00		0	9			1	10				
04:15		1	13			0	12				
04:30		9	7			0	**19**				
04:45		6	10	16	39	2	**13**	3	54	19	93
05:00		10	2			1	**15**				
05:15		5	5			0	**16**				
05:30		10	12			0	10				
05:45		4	4	29	23	2	18	3	59	32	82
06:00		13	15			1	8				
06:15		4	9			1	16				
06:30		15	4			1	14				
06:45		10	5	42	33	2	17	5	55	47	88
07:00		**23**	7			4	13				
07:15		**13**	4			7	11				
07:30		**12**	4			6	8				
07:45		**19**	3	67	18	7	7	24	39	91	57
08:00		13	9			1	12				
08:15		4	5			1	8				
08:30		7	5			4	7				
08:45		11	4	35	23	5	6	11	33	46	56
09:00		10	2			3	8				
09:15		10	1			7	7				
09:30		12	3			4	4				
09:45		4	2	36	8	8	5	22	24	58	32
10:00		9	3			2	3				
10:15		7	2			**10**	6				
10:30		10	1			**6**	2				
10:45		5	1	31	7	**7**	3	25	14	56	21
11:00		5	0			**12**	2				
11:15		9	0			7	1				
11:30		14	2			5	0				
11:45		11	1	39	3	10	2	34	5	73	8
Total		300	293	300	293	135	436	135	436	435	729
Combined Total		593		593		571		571		1164	
AM Peak	-	07:00	-	-	-	10:15	-	-	-	-	-
Vol.	-	67	-	-	-	35	-	-	-	-	-
P.H.F.		0.728				0.729					
PM Peak	-	-	02:15	-	-	-	04:30	-	-	-	-
Vol.	-	-	48	-	-	-	63	-	-	-	-
P.H.F.			0.750				0.829				
Percentage		50.6%	49.4%			23.6%	76.4%				
ADT/AADT		ADT 1,164		AADT 1,164							

Caltrans Performance Measurement System (PeMS)
Freeway Mainline Volumes

I-15 Southbound, North of Clinton Keith Road

DAILY				Data Quality	
Time	5/27/2014	5/28/2014	5/29/2014	# Lane Points	% Observed
0:00	572	548	566	108	100.0
1:00	317	373	335	108	100.0
2:00	261	303	281	108	100.0
3:00	376	403	388	108	100.0
4:00	1041	1023	950	108	100.0
5:00	2318	2308	2226	108	100.0
6:00	3196	3279	3063	108	100.0
7:00	4280	4313	4404	108	100.0
8:00	4147	4090	3977	108	100.0
9:00	3501	3608	3443	108	100.0
10:00	3346	3138	3322	108	100.0
11:00	3335	3266	3250	108	100.0
12:00	3099	3276	3373	108	100.0
13:00	3191	3399	3450	108	100.0
14:00	3939	3731	4225	108	92.0
15:00	3879	3849	4056	108	100.0
16:00	3656	4005	3647	108	100.0
17:00	3828	3842	3724	108	100.0
18:00	3383	3468	3518	108	100.0
19:00	2581	2580	2813	108	100.0
20:00	2020	2302	2553	108	100.0
21:00	1611	1738	2094	108	100.0
22:00	1184	1379	1625	108	100.0
23:00	837	927	989	108	100.0
Total	59,898	61,148	62,272	2,592	99.7

Daily Peak	62,272	5/29/2014

PEAK HOUR				Data Quality	
Time	Minimum	Mean	Maximum	# Lane Points	% Observed
7:00	4280	4332.33	4404	108	100.0
8:00	3977	4071.33	4147	108	100.0
9:00	3443	3517.33	3608	108	100.0
16:00	3647	3769.33	4005	108	100.0
17:00	3724	3798	3842	108	100.0
18:00	3383	3456.33	3518	108	100.0

AM Peak	4,404	7:00
PM Peak	4,005	16:00

I-15 Northbound, South of Clinton Keith Road

DAILY				Data Quality	
Time	5/27/2014	5/28/2014	5/29/2014	# Lane Points	% Observed
0:00	753	558	664	108	100.0
1:00	493	389	447	108	100.0
2:00	488	366	414	108	100.0
3:00	723	593	648	108	100.0
4:00	1541	1280	1323	108	100.0
5:00	1928	1829	1726	108	100.0
6:00	2588	2500	2532	108	100.0
7:00	2902	2932	2884	108	100.0
8:00	2939	3007	3052	108	100.0
9:00	3359	3190	3220	108	100.0
10:00	3337	3175	3281	108	100.0
11:00	3279	3270	3434	108	100.0
12:00	3565	3346	3495	108	100.0
13:00	3669	3599	3808	108	100.0
14:00	3736	3972	3940	108	92.0
15:00	4589	4708	4730	108	100.0
16:00	4843	4835	4744	108	100.0
17:00	5035	5002	4903	108	100.0
18:00	3704	3889	4247	108	100.0
19:00	2699	2714	2952	108	100.0
20:00	2275	2364	2471	108	100.0
21:00	1826	1969	2118	108	100.0
22:00	1330	1383	1520	108	100.0
23:00	823	1007	928	108	100.0
Total	62,424	61,877	63,481	2,592	99.7

Daily Peak	63,481	5/29/2014

PEAK HOUR				Data Quality	
Time	Minimum	Mean	Maximum	# Lane Points	% Observed
7:00	2884	2906	2932	108	100.0
8:00	2939	2999.33	3052	108	100.0
9:00	3190	3256.33	3359	108	100.0
16:00	4744	4807.33	4843	108	100.0
17:00	4903	4980	5035	108	100.0
18:00	3704	3946.67	4247	108	100.0

AM Peak	3,359	9:00
PM Peak	5,035	17:00

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FREEWAY TO RAMP AM PEAK HOUR VOLUMES

I-15 Southbound								
Location	Existing (2013) Raw	Project Total	E+P Total	Cumulative Total	EAP (2017) Total	EAPC (2017) Total	2035 NP Total	2035 WP Total
N of Clinton Keith	4,404	17	4,421	234	4,685	4,919	5,394	5,411
Off-Ramp	688	17	705	88	747	835	1,412	1,429
Between	3,716	0	3,716	146	3,939	4,085	3,982	3,982
On-Ramp	991	21	1,012	189	1,071	1,260	1,367	1,388
S of Clinton Keith	4,707	21	4,728	335	5,010	5,345	5,349	5,370
I-15 Northbound								
Location	Existing (2013) Raw	Project Total	E+P Total	Cumulative Total	EAP (2017) Total	EAPC (2017) Total	2035 NP Total	2035 WP Total
S of Clinton Keith	3,359	17	3,376	225	3,578	3,803	7,607	7,624
Off-Ramp	424	17	441	112	467	579	836	853
Between	2,935	0	2,935	113	3,112	3,225	6,771	6,771
On-Ramp	769	21	790	117	836	954	1,483	1,504
N of Clinton Keith	3,704	21	3,725	230	3,948	4,178	8,254	8,275

Note: Freeway Mainline Truck %: 8.7 - Based on 2012 Annual Average Daily Truck Traffic (Source: Caltrans)

XX = PeMS Data for Week of May 27-29, 2013 (consistent with daily count data).
XX = Flow Conserved Volumes.
XX = 2035 Model data
XX = Volume adjusted (minimum EAPC growth - 10%)

FREEWAY TO RAMP PM PEAK HOUR VOLUMES

I-15 Southbound								
Location	Existing (2013) Raw	Project Total	E+P Total	Cumulative Total	EAP (2017) Total	EAPC (2017) Total	2035 NP Total	2035 WP Total
N of Clinton Keith	4,005	39	4,044	398	4,284	4,682	8,487	8,526
Off-Ramp	824	39	863	181	913	1,094	1,508	1,547
Between	3,181	0	3,181	217	3,372	3,589	6,979	6,979
On-Ramp	667	32	699	212	739	951	1,016	1,048
S of Clinton Keith	3,848	32	3,880	429	4,111	4,540	7,995	8,027
I-15 Northbound								
Location	Existing (2013) Raw	Project Total	E+P Total	Cumulative Total	EAP (2017) Total	EAPC (2017) Total	2035 NP Total	2035 WP Total
S of Clinton Keith	5,035	39	5,074	498	5,376	5,874	6,422	6,461
Off-Ramp	885	39	924	261	978	1,239	1,332	1,371
Between	4,150	0	4,150	237	4,399	4,636	5,090	5,090
On-Ramp	688	32	720	165	761	926	1,482	1,514
N of Clinton Keith	4,838	32	4,870	402	5,160	5,562	6,572	6,604

Note: Freeway Mainline Truck %: 8.7 - Based on 2012 Annual Average Daily Truck Traffic (Source: Caltrans)

XX = PeMS Data for Week of May 27-29, 2013 (consistent with daily count data).
XX = Flow Conserved Volumes.
XX = 2035 Model data
XX = Volume adjusted (minimum EAPC growth - 10%)

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APPENDIX C

EXISTING (2014) CONDITIONS
INTERSECTION ANALYSIS CALCULATION WORKSHEETS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	192	128	20	35	106	242	21	639	50	148	345	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3469		1770	3539	1583	1770	3539	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3469		1770	3539	1583	1770	3539	1583	1770	1863	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	196	131	20	36	108	247	21	652	51	151	352	102
RTOR Reduction (vph)	0	14	0	0	0	188	0	0	36	0	0	62
Lane Group Flow (vph)	196	137	0	36	108	59	21	652	15	151	352	40
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	11.3	20.7		2.0	11.4	11.4	0.8	19.2	19.2	7.1	25.5	25.5
Effective Green, g (s)	11.3	20.7		2.0	11.4	11.4	0.8	19.2	19.2	7.1	25.5	25.5
Actuated g/C Ratio	0.17	0.32		0.03	0.18	0.18	0.01	0.30	0.30	0.11	0.39	0.39
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	307	1104		54	620	277	21	1045	467	193	730	621
v/s Ratio Prot	c0.11	0.04		0.02	0.03		0.01	c0.18		c0.09	0.19	
v/s Ratio Perm						c0.04			0.01			0.03
v/c Ratio	0.64	0.12		0.67	0.17	0.21	1.00	0.62	0.03	0.78	0.48	0.06
Uniform Delay, d1	25.0	15.7		31.2	22.8	23.0	32.1	19.8	16.3	28.2	14.8	12.3
Progression Factor	0.89	0.76		0.81	0.39	0.51	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.2	0.2		25.1	0.6	1.6	196.4	2.8	0.1	18.4	2.3	0.2
Delay (s)	26.3	12.1		50.3	9.5	13.4	228.5	22.6	16.4	46.6	17.1	12.5
Level of Service	C	B		D	A	B	F	C	B	D	B	B
Approach Delay (s)		20.2			15.8			28.1			23.7	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	23.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	62	1034	5	55	594	201	56	12	83	322	31	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1694		1770	1671	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.87		0.66	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1498		1223	1671	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	70	1175	6	62	675	228	64	14	94	366	35	77
RTOR Reduction (vph)	0	0	4	0	0	139	0	59	0	0	49	0
Lane Group Flow (vph)	70	1175	2	62	675	89	0	113	0	366	63	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	3.6	26.6	26.6	2.4	25.4	25.4		24.0		24.0	24.0	
Effective Green, g (s)	3.6	26.6	26.6	2.4	25.4	25.4		24.0		24.0	24.0	
Actuated g/C Ratio	0.06	0.41	0.41	0.04	0.39	0.39		0.37		0.37	0.37	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	98	1448	647	65	1382	618		553		451	616	
v/s Ratio Prot	0.04	c0.33		0.04	c0.19						0.04	
v/s Ratio Perm			0.00			0.06		0.08		c0.30		
v/c Ratio	0.71	0.81	0.00	0.95	0.49	0.14		0.20		0.81	0.10	
Uniform Delay, d1	30.2	17.0	11.4	31.2	14.9	12.8		14.0		18.5	13.4	
Progression Factor	1.05	0.87	1.00	0.70	0.63	0.23		1.00		1.00	1.00	
Incremental Delay, d2	21.7	5.0	0.0	93.7	1.2	0.5		0.8		14.7	0.3	
Delay (s)	53.4	19.8	11.4	115.6	10.6	3.4		14.8		33.1	13.8	
Level of Service	D	B	B	F	B	A		B		C	B	
Approach Delay (s)		21.7			15.7			14.8			28.6	
Approach LOS		C			B			B			C	

Intersection Summary			
HCM 2000 Control Delay	20.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	715	724	267	539	0	0	0	0	377	0	311
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.91					0.95	0.95	0.88
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		5085	1583	3433	5085					1681	1681	2787
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		5085	1583	3433	5085					1681	1681	2787
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	794	804	297	599	0	0	0	0	419	0	346
RTOR Reduction (vph)	0	0	410	0	0	0	0	0	0	0	0	261
Lane Group Flow (vph)	0	794	394	297	599	0	0	0	0	209	210	85
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		29.0	29.0	8.0	41.0					16.0	16.0	16.0
Effective Green, g (s)		29.0	29.0	8.0	41.0					16.0	16.0	16.0
Actuated g/C Ratio		0.45	0.45	0.12	0.63					0.25	0.25	0.25
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		2268	706	422	3207					413	413	686
v/s Ratio Prot		0.16		c0.09	0.12							
v/s Ratio Perm			c0.25							0.12	0.12	0.03
v/c Ratio		0.35	0.56	0.70	0.19					0.51	0.51	0.12
Uniform Delay, d1		11.8	13.3	27.4	5.0					21.1	21.1	19.1
Progression Factor		0.46	0.69	1.04	0.55					1.00	1.00	1.00
Incremental Delay, d2		0.3	2.0	5.1	0.1					4.4	4.4	0.4
Delay (s)		5.7	11.3	33.5	2.9					25.5	25.5	19.4
Level of Service		A	B	C	A					C	C	B
Approach Delay (s)		8.5			13.0			0.0			22.8	
Approach LOS		A			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	13.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	72.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	326	766	0	0	578	443	228	0	196	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.91			0.91	1.00	0.95	0.91	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.94	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.97	1.00			
Satd. Flow (prot)	3433	5085			5085	1583	1681	1543	1504			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.97	1.00			
Satd. Flow (perm)	3433	5085			5085	1583	1681	1543	1504			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	354	833	0	0	628	482	248	0	213	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	289	0	63	111	0	0	0
Lane Group Flow (vph)	354	833	0	0	628	193	159	92	36	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	11.0	41.0			26.0	26.0	16.0	16.0	16.0			
Effective Green, g (s)	11.0	41.0			26.0	26.0	16.0	16.0	16.0			
Actuated g/C Ratio	0.17	0.63			0.40	0.40	0.25	0.25	0.25			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	580	3207			2034	633	413	379	370			
v/s Ratio Prot	c0.10	0.16			c0.12							
v/s Ratio Perm						0.12	c0.09	0.06	0.02			
v/c Ratio	0.61	0.26			0.31	0.30	0.38	0.24	0.10			
Uniform Delay, d1	25.0	5.3			13.3	13.3	20.4	19.6	18.9			
Progression Factor	0.70	0.31			0.80	3.13	1.00	1.00	1.00			
Incremental Delay, d2	1.8	0.2			0.4	1.2	2.7	1.5	0.5			
Delay (s)	19.2	1.8			11.1	42.9	23.1	21.1	19.5			
Level of Service	B	A			B	D	C	C	B			
Approach Delay (s)		7.0			24.9			21.3			0.0	
Approach LOS		A			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	16.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	72.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	51	686	216	103	718	72	242	4	44	32	3	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	0.99			1.00	0.85		0.91	
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00		0.98	
Satd. Flow (prot)	1770	4903		1770	5016			1775	1583		1675	
Flt Permitted	0.95	1.00		0.95	1.00			0.71	1.00		0.85	
Satd. Flow (perm)	1770	4903		1770	5016			1315	1583		1448	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	54	722	227	108	756	76	255	4	46	34	3	64
RTOR Reduction (vph)	0	77	0	0	13	0	0	0	34	0	47	0
Lane Group Flow (vph)	54	872	0	108	819	0	0	259	12	0	54	0
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	5.1	28.0		8.0	30.9			17.0	17.0		17.0	
Effective Green, g (s)	5.1	28.0		8.0	30.9			17.0	17.0		17.0	
Actuated g/C Ratio	0.08	0.43		0.12	0.48			0.26	0.26		0.26	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	138	2112		217	2384			343	414		378	
v/s Ratio Prot	0.03	c0.18		c0.06	0.16							
v/s Ratio Perm								c0.20	0.01		0.04	
v/c Ratio	0.39	0.41		0.50	0.34			0.76	0.03		0.14	
Uniform Delay, d1	28.5	12.8		26.6	10.7			22.1	17.9		18.4	
Progression Factor	0.94	0.59		0.55	0.27			1.00	1.00		1.00	
Incremental Delay, d2	1.8	0.6		1.6	0.4			9.1	0.0		0.2	
Delay (s)	28.5	8.1		16.4	3.3			31.2	17.9		18.6	
Level of Service	C	A		B	A			C	B		B	
Approach Delay (s)		9.2			4.8			29.2			18.6	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM 2000 Control Delay	10.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	54.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	119	739	11	64	695	50	36	20	38	83	37	162
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5074		1770	3539	1583	1770	1681		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.73	1.00		0.72	1.00	1.00
Satd. Flow (perm)	1770	5074		1770	3539	1583	1362	1681		1334	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	129	803	12	70	755	54	39	22	41	90	40	176
RTOR Reduction (vph)	0	2	0	0	0	32	0	30	0	0	0	130
Lane Group Flow (vph)	129	813	0	70	755	22	39	33	0	90	40	46
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases						6	8			4		4
Actuated Green, G (s)	9.6	32.4		3.6	26.4	26.4	17.0	17.0		17.0	17.0	17.0
Effective Green, g (s)	9.6	32.4		3.6	26.4	26.4	17.0	17.0		17.0	17.0	17.0
Actuated g/C Ratio	0.15	0.50		0.06	0.41	0.41	0.26	0.26		0.26	0.26	0.26
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	261	2529		98	1437	642	356	439		348	487	414
v/s Ratio Prot	c0.07	0.16		0.04	c0.21			0.02			0.02	
v/s Ratio Perm						0.01	0.03			c0.07		0.03
v/c Ratio	0.49	0.32		0.71	0.53	0.03	0.11	0.07		0.26	0.08	0.11
Uniform Delay, d1	25.5	9.7		30.2	14.6	11.6	18.2	18.1		19.0	18.1	18.3
Progression Factor	0.66	0.31		1.06	0.88	0.86	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.4	0.3		19.7	1.2	0.1	0.6	0.3		1.8	0.3	0.5
Delay (s)	18.3	3.3		51.7	14.1	10.1	18.9	18.4		20.8	18.4	18.8
Level of Service	B	A		D	B	B	B	B		C	B	B
Approach Delay (s)		5.4			16.9			18.6			19.3	
Approach LOS		A			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	12.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	47.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	0	437	372	109	567	242	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.95	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)		3539	1583	1770	1863	1770	1583
Flt Permitted		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)		3539	1583	1770	1863	1770	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	455	388	114	591	252	39
RTOR Reduction (vph)	0	0	197	0	0	0	31
Lane Group Flow (vph)	0	455	191	114	591	252	8
Turn Type	Prot	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	5	2		1	6	8	
Permitted Phases			2				8
Actuated Green, G (s)		32.0	32.0	7.2	43.2	13.8	13.8
Effective Green, g (s)		32.0	32.0	7.2	43.2	13.8	13.8
Actuated g/C Ratio		0.49	0.49	0.11	0.66	0.21	0.21
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1742	779	196	1238	375	336
v/s Ratio Prot		0.13		0.06	c0.32	c0.14	
v/s Ratio Perm			0.12				0.01
v/c Ratio		0.26	0.25	0.58	0.48	0.67	0.02
Uniform Delay, d1		9.6	9.5	27.5	5.4	23.5	20.3
Progression Factor		0.37	0.61	0.83	0.60	1.00	1.00
Incremental Delay, d2		0.4	0.7	4.3	1.3	4.7	0.0
Delay (s)		3.9	6.5	27.2	4.5	28.2	20.3
Level of Service		A	A	C	A	C	C
Approach Delay (s)		5.1			8.2	27.2	
Approach LOS		A			A	C	

Intersection Summary			
HCM 2000 Control Delay	9.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	19	441	15	12	559	24	34	0	7	38	0	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0		4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00		1.00	1.00		1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00		0.85	1.00		0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95		1.00
Satd. Flow (prot)	1770	3539	1583	1770	3518		1770		1583	1770		1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95		1.00
Satd. Flow (perm)	1770	3539	1583	1770	3518		1770		1583	1770		1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	19	450	15	12	570	24	35	0	7	39	0	53
RTOR Reduction (vph)	0	0	6	0	3	0	0	0	7	0	0	50
Lane Group Flow (vph)	19	450	9	12	591	0	35	0	0	39	0	3
Turn Type	Prot	NA	Perm	Prot	NA		Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	0.8	40.3	40.3	1.4	40.9		4.0		2.9	4.4		3.3
Effective Green, g (s)	0.8	40.3	40.3	1.4	40.9		4.0		2.9	4.4		3.3
Actuated g/C Ratio	0.01	0.62	0.62	0.02	0.63		0.06		0.04	0.07		0.05
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0		3.0
Lane Grp Cap (vph)	21	2194	981	38	2213		108		70	119		80
v/s Ratio Prot	c0.01	0.13		0.01	c0.17		c0.02			c0.02		
v/s Ratio Perm			0.01						0.00			0.00
v/c Ratio	0.90	0.21	0.01	0.32	0.27		0.32		0.00	0.33		0.03
Uniform Delay, d1	32.1	5.4	4.7	31.3	5.4		29.2		29.7	28.9		29.3
Progression Factor	0.56	0.12	1.00	1.14	0.57		1.00		1.00	1.00		1.00
Incremental Delay, d2	149.6	0.2	0.0	4.7	0.3		1.7		0.0	1.6		0.2
Delay (s)	167.7	0.8	4.7	40.5	3.3		31.0		29.7	30.5		29.5
Level of Service	F	A	A	D	A		C		C	C		C
Approach Delay (s)		7.5			4.1			30.7			29.9	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay	8.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	32.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	13	490	18	11	529	7	33	0	34	19	5	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00		0.98	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1770	1583		1684	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00		0.88	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1774	1583		1510	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	13	500	18	11	540	7	34	0	35	19	5	37
RTOR Reduction (vph)	0	0	5	0	0	2	0	0	32	0	34	0
Lane Group Flow (vph)	13	500	13	11	540	5	0	34	3	0	27	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8		8	4		
Actuated Green, G (s)	1.2	46.6	46.6	1.4	46.8	46.8		5.0	5.0		5.0	
Effective Green, g (s)	1.2	46.6	46.6	1.4	46.8	46.8		5.0	5.0		5.0	
Actuated g/C Ratio	0.02	0.72	0.72	0.02	0.72	0.72		0.08	0.08		0.08	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	32	2537	1134	38	2548	1139		136	121		116	
v/s Ratio Prot	0.01	c0.14		0.01	c0.15							
v/s Ratio Perm			0.01			0.00		c0.02	0.00		0.02	
v/c Ratio	0.41	0.20	0.01	0.29	0.21	0.00		0.25	0.02		0.23	
Uniform Delay, d1	31.5	3.0	2.6	31.3	3.0	2.6		28.2	27.7		28.2	
Progression Factor	0.64	0.33	1.00	1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	8.2	0.2	0.0	4.2	0.2	0.0		1.0	0.1		1.0	
Delay (s)	28.4	1.2	2.6	35.5	3.2	2.6		29.2	27.8		29.2	
Level of Service	C	A	A	D	A	A		C	C		C	
Approach Delay (s)		1.9			3.8			28.5			29.2	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay	5.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.22		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	31.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	11	48	35	154	234	6
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.72	0.72	0.72	0.72	0.72	0.72
Hourly flow rate (vph)	15	67	49	214	325	8
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				816		
pX, platoon unblocked						
vC, conflicting volume	640	329	333			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	640	329	333			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	91	96			
cM capacity (veh/h)	422	712	1226			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	82	262	333
Volume Left	15	49	0
Volume Right	67	0	8
cSH	631	1226	1700
Volume to Capacity	0.13	0.04	0.20
Queue Length 95th (ft)	11	3	0
Control Delay (s)	11.6	1.8	0.0
Lane LOS	B	A	
Approach Delay (s)	11.6	1.8	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	36.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	6	7	6	6	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78
Hourly flow rate (vph)	0	8	9	8	8	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	17				21	13
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	17				21	13
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	1601				996	1068

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	8	17	8
Volume Left	0	0	8
Volume Right	0	8	0
cSH	1601	1700	996
Volume to Capacity	0.00	0.01	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.0	0.0	8.6
Lane LOS			A
Approach Delay (s)	0.0	0.0	8.6
Approach LOS			A

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	48	606	358	81	161	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	3539	3441		1770	1583
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	3539	3441		1770	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	52	652	385	87	173	51
RTOR Reduction (vph)	0	0	21	0	0	42
Lane Group Flow (vph)	52	652	451	0	173	9
Turn Type	Prot	NA	NA		Prot	Perm
Protected Phases	5	2	6		7	
Permitted Phases						4
Actuated Green, G (s)	6.0	45.4	35.4		11.6	11.6
Effective Green, g (s)	6.0	45.4	35.4		11.6	11.6
Actuated g/C Ratio	0.09	0.70	0.54		0.18	0.18
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	163	2471	1874		315	282
v/s Ratio Prot	0.03	c0.18	0.13		c0.10	
v/s Ratio Perm						0.01
v/c Ratio	0.32	0.26	0.24		0.55	0.03
Uniform Delay, d1	27.6	3.6	7.8		24.3	22.1
Progression Factor	1.00	1.00	0.77		1.00	1.00
Incremental Delay, d2	1.1	0.3	0.3		2.0	0.0
Delay (s)	28.7	3.9	6.2		26.3	22.1
Level of Service	C	A	A		C	C
Approach Delay (s)		5.7	6.2		25.3	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	9.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	34.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Westpark Promenade Traffic Impact Analysis (#0201-0002)
Existing Conditions
AM Peak Hour

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Base Volume Alternative)

Intersection #13 George Av. / La Estrella St.

Cycle (sec):	100	Critical Vol./Cap.(X):	0.592
Loss Time (sec):	0	Average Delay (sec/veh):	12.4
Optimal Cycle:	0	Level Of Service:	B

Approach:	North Bound			South Bound			East Bound			West Bound		
Movement:	L -	T -	R	L -	T -	R	L -	T -	R	L -	T -	R
Control:	Stop Sign			Stop Sign			Stop Sign			Stop Sign		
Rights:	Include			Include			Include			Include		
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	1 0	0 1	0	1 0	1 0	1	0 0	1! 0	0	0 0	1! 0	0
Volume Module:												
Base Vol:	24	19	52	11	13	43	47	108	13	39	196	18
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Initial Bse:	24	19	52	11	13	43	47	108	13	39	196	18
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHF Adj:	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61
PHF Volume:	39	31	85	18	21	70	77	176	21	64	320	29
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0
Reduced Vol:	39	31	85	18	21	70	77	176	21	64	320	29
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FinalVolume:	39	31	85	18	21	70	77	176	21	64	320	29
Saturation Flow Module:												
Adjustment:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lanes:	1.00	0.27	0.73	1.00	1.00	1.00	0.28	0.64	0.08	0.15	0.78	0.07
Final Sat.:	486	151	413	474	508	564	185	426	51	108	541	50
Capacity Analysis Module:												
Vol/Sat:	0.08	0.21	0.21	0.04	0.04	0.12	0.41	0.41	0.41	0.59	0.59	0.59
Crit Moves:		****				****	****				****	
Delay/Veh:	10.1	9.8	9.8	9.9	9.4	9.1	11.6	11.6	11.6	14.6	14.6	14.6
Delay Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AdjDel/Veh:	10.1	9.8	9.8	9.9	9.4	9.1	11.6	11.6	11.6	14.6	14.6	14.6
LOS by Move:	B	A	A	A	A	A	B	B	B	B	B	B
ApproachDel:		9.9			9.3			11.6			14.6	
Delay Adj:		1.00			1.00			1.00			1.00	
ApprAdjDel:		9.9			9.3			11.6			14.6	
LOS by Appr:		A			A			B			B	
AllWayAvgQ:	0.1	0.2	0.2	0.0	0.0	0.1	0.6	0.6	0.6	1.3	1.3	1.3

Note: Queue reported is the number of cars per lane.

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	16	8	0	1	16	209	9	0	0	206	0	42
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	18	9	0	1	18	230	10	0	0	226	0	46

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total (vph)	22	4	10	238	10	226	46
Volume Left (vph)	18	0	1	0	10	226	0
Volume Right (vph)	0	0	0	230	0	0	46
Hadj (s)	0.43	0.03	0.09	-0.64	0.23	0.53	-0.67
Departure Headway (s)	6.0	5.6	5.4	4.7	5.8	5.7	4.5
Degree Utilization, x	0.04	0.01	0.01	0.31	0.02	0.36	0.06
Capacity (veh/h)	563	604	629	735	588	607	759
Control Delay (s)	8.0	7.4	7.3	8.6	8.8	10.6	6.6
Approach Delay (s)	7.9		8.5		8.8	9.9	
Approach LOS	A		A		A	A	

Intersection Summary			
Delay	9.2		
Level of Service	A		
Intersection Capacity Utilization	31.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	89	182	36	80	116	94	48	266	117	174	315	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.95		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3451		1770	1863	1583	1770	3377		1770	3431	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3451		1770	1863	1583	1770	3377		1770	3431	
Peak-hour factor, PHF	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Adj. Flow (vph)	116	236	47	104	151	122	62	345	152	226	409	105
RTOR Reduction (vph)	0	27	0	0	0	94	0	74	0	0	31	0
Lane Group Flow (vph)	116	256	0	104	151	28	62	423	0	226	483	0
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	4.8	14.7		4.8	14.7	14.7	3.6	18.0		11.5	25.9	
Effective Green, g (s)	4.8	14.7		4.8	14.7	14.7	3.6	18.0		11.5	25.9	
Actuated g/C Ratio	0.07	0.23		0.07	0.23	0.23	0.06	0.28		0.18	0.40	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	130	780		130	421	358	98	935		313	1367	
v/s Ratio Prot	c0.07	0.07		0.06	c0.08		0.04	c0.13		c0.13	0.14	
v/s Ratio Perm						0.02						
v/c Ratio	0.89	0.33		0.80	0.36	0.08	0.63	0.45		0.72	0.35	
Uniform Delay, d1	29.8	21.0		29.6	21.2	19.8	30.1	19.4		25.2	13.7	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	47.7	1.1		28.6	2.4	0.4	12.6	1.6		8.0	0.7	
Delay (s)	77.5	22.1		58.2	23.6	20.2	42.6	21.0		33.2	14.4	
Level of Service	E	C		E	C	C	D	C		C	B	
Approach Delay (s)		38.2			32.0			23.4			20.2	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	26.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	45.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	112	159	172	59	124	327
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	123	175	189	65	136	359
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	254				642	221
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	254				642	221
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	91				66	56
cM capacity (veh/h)	1311				397	818

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	298	254	496
Volume Left	123	0	136
Volume Right	0	65	359
cSH	1311	1700	633
Volume to Capacity	0.09	0.15	0.78
Queue Length 95th (ft)	8	0	188
Control Delay (s)	3.8	0.0	28.0
Lane LOS	A		D
Approach Delay (s)	3.8	0.0	28.0
Approach LOS			D

Intersection Summary			
Average Delay	14.4		
Intersection Capacity Utilization	64.2%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	261	204	0	0	345	154	175	1	67	0	0	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	307	240	0	0	406	181	206	1	79	0	0	0

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2
Volume Total (vph)	307	240	587	207	79
Volume Left (vph)	307	0	0	206	0
Volume Right (vph)	0	0	181	0	79
Hadj (s)	0.53	0.03	-0.15	0.53	-0.67
Departure Headway (s)	6.9	6.4	6.2	7.9	6.7
Degree Utilization, x	0.59	0.43	1.0	0.45	0.15
Capacity (veh/h)	511	552	577	438	524
Control Delay (s)	18.2	12.9	64.7	16.0	9.6
Approach Delay (s)	15.9		64.7	14.2	
Approach LOS	C		F	B	

Intersection Summary			
Delay	35.8		
Level of Service	E		
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	378	429	239	281	0	0	0	0	87	2	135
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	0	434	493	275	323	0	0	0	0	100	2	155

Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	928	275	323	102	155
Volume Left (vph)	0	275	0	100	0
Volume Right (vph)	493	0	0	0	155
Hadj (s)	-0.28	0.53	0.03	0.52	-0.67
Departure Headway (s)	5.9	6.7	6.2	7.9	6.7
Degree Utilization, x	1.0	0.51	0.56	0.22	0.29
Capacity (veh/h)	604	531	574	444	522
Control Delay (s)	255.6	15.3	15.5	11.9	11.2
Approach Delay (s)	255.6	15.4		11.5	
Approach LOS	F	C		B	

Intersection Summary			
Delay	139.8		
Level of Service	F		
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	128	96	40	86	174	169	37	416	69	274	515	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt	1.00	0.96		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3383		1770	3539	1583	1770	3539	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3383		1770	3539	1583	1770	3539	1583	1770	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	135	101	42	91	183	178	39	438	73	288	542	168
RTOR Reduction (vph)	0	32	0	0	0	141	0	0	55	0	0	96
Lane Group Flow (vph)	135	111	0	91	183	37	39	438	18	288	542	72
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	6.0	14.8		4.8	13.6	13.6	1.6	16.0	16.0	13.4	27.8	27.8
Effective Green, g (s)	6.0	14.8		4.8	13.6	13.6	1.6	16.0	16.0	13.4	27.8	27.8
Actuated g/C Ratio	0.09	0.23		0.07	0.21	0.21	0.02	0.25	0.25	0.21	0.43	0.43
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	163	770		130	740	331	43	871	389	364	796	677
v/s Ratio Prot	c0.08	0.03		c0.05	c0.05		0.02	0.12		c0.16	c0.29	
v/s Ratio Perm						0.02			0.01			0.05
v/c Ratio	0.83	0.14		0.70	0.25	0.11	0.91	0.50	0.05	0.79	0.68	0.11
Uniform Delay, d1	29.0	20.0		29.4	21.4	20.8	31.6	21.1	18.7	24.5	15.0	11.2
Progression Factor	1.04	0.70		0.46	0.32	0.12	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	27.5	0.4		12.2	0.6	0.5	100.7	2.1	0.2	11.2	4.7	0.3
Delay (s)	57.7	14.4		25.8	7.5	3.0	132.3	23.1	18.9	35.6	19.7	11.5
Level of Service	E	B		C	A	A	F	C	B	D	B	B
Approach Delay (s)		35.4			9.4			30.3			22.9	
Approach LOS		D			A			C			C	

Intersection Summary			
HCM 2000 Control Delay	23.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	55.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	156	647	8	61	791	463	52	11	60	305	13	151
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1704		1770	1605	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.84		0.71	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1460		1315	1605	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	161	667	8	63	815	477	54	11	62	314	13	156
RTOR Reduction (vph)	0	0	5	0	0	335	0	40	0	0	102	0
Lane Group Flow (vph)	161	667	3	63	815	142	0	87	0	314	67	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	10.9	26.7	26.7	3.6	19.4	19.4		22.7		22.7	22.7	
Effective Green, g (s)	10.9	26.7	26.7	3.6	19.4	19.4		22.7		22.7	22.7	
Actuated g/C Ratio	0.17	0.41	0.41	0.06	0.30	0.30		0.35		0.35	0.35	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	296	1453	650	98	1056	472		509		459	560	
v/s Ratio Prot	c0.09	c0.19		0.04	c0.23						0.04	
v/s Ratio Perm			0.00			0.09		0.06		c0.24		
v/c Ratio	0.54	0.46	0.01	0.64	0.77	0.30		0.17		0.68	0.12	
Uniform Delay, d1	24.8	13.9	11.3	30.1	20.8	17.6		14.6		18.1	14.4	
Progression Factor	0.82	0.59	1.00	0.91	0.78	1.20		1.00		1.00	1.00	
Incremental Delay, d2	1.9	1.0	0.0	13.0	5.3	1.6		0.7		8.0	0.4	
Delay (s)	22.3	9.3	11.3	40.5	21.5	22.6		15.4		26.1	14.8	
Level of Service	C	A	B	D	C	C		B		C	B	
Approach Delay (s)		11.8			22.7			15.4			22.2	
Approach LOS		B			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	19.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	597	415	251	923	0	0	0	0	431	1	392
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.91					0.95	0.95	0.88
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		5085	1583	3433	5085					1681	1686	2787
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		5085	1583	3433	5085					1681	1686	2787
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	0	603	419	254	932	0	0	0	0	435	1	396
RTOR Reduction (vph)	0	0	251	0	0	0	0	0	0	0	0	179
Lane Group Flow (vph)	0	603	168	254	932	0	0	0	0	217	219	217
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		26.0	26.0	9.0	39.0					18.0	18.0	18.0
Effective Green, g (s)		26.0	26.0	9.0	39.0					18.0	18.0	18.0
Actuated g/C Ratio		0.40	0.40	0.14	0.60					0.28	0.28	0.28
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		2034	633	475	3051					465	466	771
v/s Ratio Prot		0.12		c0.07	c0.18							
v/s Ratio Perm			0.11							0.13	0.13	0.08
v/c Ratio		0.30	0.26	0.53	0.31					0.47	0.47	0.28
Uniform Delay, d1		13.3	13.1	26.1	6.4					19.5	19.5	18.4
Progression Factor		0.54	0.53	0.87	0.50					1.00	1.00	1.00
Incremental Delay, d2		0.3	0.9	1.0	0.2					3.3	3.4	0.9
Delay (s)		7.5	7.9	23.7	3.4					22.9	22.9	19.3
Level of Service		A	A	C	A					C	C	B
Approach Delay (s)		7.7			7.8			0.0			21.2	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	271	757	0	0	649	417	525	0	360	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.91			0.91	1.00	0.95	0.91	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.96	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.97	1.00			
Satd. Flow (prot)	3433	5085			5085	1583	1681	1568	1504			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.97	1.00			
Satd. Flow (perm)	3433	5085			5085	1583	1681	1568	1504			
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	282	789	0	0	676	434	547	0	375	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	283	0	57	114	0	0	0
Lane Group Flow (vph)	282	789	0	0	676	151	323	253	175	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	9.4	36.0			22.6	22.6	21.0	21.0	21.0			
Effective Green, g (s)	9.4	36.0			22.6	22.6	21.0	21.0	21.0			
Actuated g/C Ratio	0.14	0.55			0.35	0.35	0.32	0.32	0.32			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	496	2816			1768	550	543	506	485			
v/s Ratio Prot	c0.08	0.16			c0.13							
v/s Ratio Perm						0.10	c0.19	0.16	0.12			
v/c Ratio	0.57	0.28			0.38	0.27	0.59	0.50	0.36			
Uniform Delay, d1	25.9	7.7			15.9	15.3	18.4	17.8	16.9			
Progression Factor	0.83	1.06			0.64	0.56	1.00	1.00	1.00			
Incremental Delay, d2	1.4	0.2			0.6	1.1	4.7	3.5	2.1			
Delay (s)	22.8	8.4			10.8	9.7	23.2	21.3	18.9			
Level of Service	C	A			B	A	C	C	B			
Approach Delay (s)		12.2			10.4			21.2			0.0	
Approach LOS		B			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	54	796	236	70	744	46	272	8	62	31	7	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	
Frt	1.00	0.97		1.00	0.99			1.00	0.85		0.92	
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00		0.98	
Satd. Flow (prot)	1770	4911		1770	5041			1777	1583		1689	
Flt Permitted	0.95	1.00		0.95	1.00			0.72	1.00		0.84	
Satd. Flow (perm)	1770	4911		1770	5041			1344	1583		1440	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	57	847	251	74	791	49	289	9	66	33	7	53
RTOR Reduction (vph)	0	71	0	0	8	0	0	0	48	0	38	0
Lane Group Flow (vph)	57	1027	0	74	832	0	0	298	18	0	55	0
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	5.2	30.7		4.2	29.7			18.1	18.1		18.1	
Effective Green, g (s)	5.2	30.7		4.2	29.7			18.1	18.1		18.1	
Actuated g/C Ratio	0.08	0.47		0.06	0.46			0.28	0.28		0.28	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	141	2319		114	2303			374	440		400	
v/s Ratio Prot	0.03	c0.21		c0.04	0.17							
v/s Ratio Perm								c0.22	0.01		0.04	
v/c Ratio	0.40	0.44		0.65	0.36			0.80	0.04		0.14	
Uniform Delay, d1	28.4	11.4		29.7	11.5			21.7	17.1		17.6	
Progression Factor	1.20	0.59		0.55	0.24			1.00	1.00		1.00	
Incremental Delay, d2	1.8	0.6		11.2	0.4			11.2	0.0		0.2	
Delay (s)	35.9	7.3		27.4	3.2			32.9	17.2		17.7	
Level of Service	D	A		C	A			C	B		B	
Approach Delay (s)		8.8			5.1			30.1			17.7	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM 2000 Control Delay	10.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	96	769	9	76	730	70	55	33	110	50	29	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.88		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5077		1770	3539	1583	1770	1647		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.74	1.00		0.66	1.00	1.00
Satd. Flow (perm)	1770	5077		1770	3539	1583	1375	1647		1226	1863	1583
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	97	777	9	77	737	71	56	33	111	51	29	76
RTOR Reduction (vph)	0	2	0	0	0	41	0	82	0	0	0	56
Lane Group Flow (vph)	97	784	0	77	737	30	56	62	0	51	29	20
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases						6	8			4		4
Actuated Green, G (s)	8.8	29.8		6.2	27.2	27.2	17.0	17.0		17.0	17.0	17.0
Effective Green, g (s)	8.8	29.8		6.2	27.2	27.2	17.0	17.0		17.0	17.0	17.0
Actuated g/C Ratio	0.14	0.46		0.10	0.42	0.42	0.26	0.26		0.26	0.26	0.26
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	239	2327		168	1480	662	359	430		320	487	414
v/s Ratio Prot	0.05	c0.15		0.04	c0.21			0.04			0.02	
v/s Ratio Perm						0.02	0.04			c0.04		0.01
v/c Ratio	0.41	0.34		0.46	0.50	0.04	0.16	0.14		0.16	0.06	0.05
Uniform Delay, d1	25.7	11.3		27.8	13.9	11.2	18.5	18.4		18.5	18.0	17.9
Progression Factor	0.45	0.21		0.98	0.94	1.04	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.4		1.7	1.0	0.1	0.9	0.7		1.1	0.2	0.2
Delay (s)	12.7	2.8		28.9	14.1	11.8	19.4	19.1		19.6	18.2	18.2
Level of Service	B	A		C	B	B	B	B		B	B	B
Approach Delay (s)		3.8			15.2			19.2			18.6	
Approach LOS		A			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	11.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	50.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	0	554	341	59	503	388	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.95	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)		3539	1583	1770	1863	1770	1583
Flt Permitted		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)		3539	1583	1770	1863	1770	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	0	565	348	60	513	396	109
RTOR Reduction (vph)	0	0	183	0	0	0	78
Lane Group Flow (vph)	0	565	165	60	513	396	31
Turn Type	Prot	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	5	2		1	6	8	
Permitted Phases			2				8
Actuated Green, G (s)		30.8	30.8	3.6	38.4	18.6	18.6
Effective Green, g (s)		30.8	30.8	3.6	38.4	18.6	18.6
Actuated g/C Ratio		0.47	0.47	0.06	0.59	0.29	0.29
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1676	750	98	1100	506	452
v/s Ratio Prot		0.16		0.03	c0.28	c0.22	
v/s Ratio Perm			0.10				0.02
v/c Ratio		0.34	0.22	0.61	0.47	0.78	0.07
Uniform Delay, d1		10.7	10.0	30.0	7.5	21.3	16.9
Progression Factor		0.41	0.55	0.73	0.44	1.00	1.00
Incremental Delay, d2		0.5	0.7	10.7	1.4	7.7	0.1
Delay (s)		4.9	6.1	32.7	4.7	29.1	17.0
Level of Service		A	A	C	A	C	B
Approach Delay (s)		5.4			7.6	26.5	
Approach LOS		A			A	C	

Intersection Summary			
HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	57	531	20	15	479	38	30	0	3	33	3	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00		1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00		0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3500		1770		1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3500		1770		1583	1770	1863	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	59	547	21	15	494	39	31	0	3	34	3	40
RTOR Reduction (vph)	0	0	8	0	6	0	0	0	3	0	0	38
Lane Group Flow (vph)	59	547	13	15	527	0	31	0	0	34	3	2
Turn Type	Prot	NA	Perm	Prot	NA		Prot		Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	5.2	40.1	40.1	1.5	36.4		3.9		2.2	5.2	3.5	3.5
Effective Green, g (s)	5.2	40.1	40.1	1.5	36.4		3.9		2.2	5.2	3.5	3.5
Actuated g/C Ratio	0.08	0.62	0.62	0.02	0.56		0.06		0.03	0.08	0.05	0.05
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	141	2183	976	40	1960		106		53	141	100	85
v/s Ratio Prot	c0.03	0.15		0.01	c0.15		0.02			c0.02	c0.00	
v/s Ratio Perm			0.01						0.00			0.00
v/c Ratio	0.42	0.25	0.01	0.38	0.27		0.29		0.00	0.24	0.03	0.03
Uniform Delay, d1	28.5	5.6	4.8	31.3	7.4		29.2		30.3	28.0	29.1	29.1
Progression Factor	0.50	0.21	1.00	0.95	0.46		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	0.3	0.0	5.8	0.3		1.5		0.0	0.9	0.1	0.1
Delay (s)	16.2	1.4	4.8	35.6	3.8		30.8		30.4	28.9	29.3	29.3
Level of Service	B	A	A	D	A		C		C	C	C	C
Approach Delay (s)		2.9			4.6			30.7			29.1	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay	6.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.27		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	36.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	526	21	17	491	20	13	3	29	17	1	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.97	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1789	1583		1704	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.83	1.00		0.83	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1544	1583		1449	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	554	22	18	517	21	14	3	31	18	1	16
RTOR Reduction (vph)	0	0	6	0	0	7	0	0	29	0	15	0
Lane Group Flow (vph)	32	554	16	18	517	14	0	17	2	0	20	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8		8	4		
Actuated Green, G (s)	4.4	47.1	47.1	1.5	44.2	44.2		4.4	4.4		4.4	
Effective Green, g (s)	4.4	47.1	47.1	1.5	44.2	44.2		4.4	4.4		4.4	
Actuated g/C Ratio	0.07	0.72	0.72	0.02	0.68	0.68		0.07	0.07		0.07	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	119	2564	1147	40	2406	1076		104	107		98	
v/s Ratio Prot	0.02	c0.16		c0.01	c0.15							
v/s Ratio Perm			0.01			0.01		0.01	0.00		c0.01	
v/c Ratio	0.27	0.22	0.01	0.45	0.21	0.01		0.16	0.02		0.20	
Uniform Delay, d1	28.8	2.9	2.5	31.3	3.9	3.4		28.6	28.3		28.6	
Progression Factor	0.51	0.23	1.00	1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	1.2	0.2	0.0	7.9	0.2	0.0		0.7	0.1		1.0	
Delay (s)	15.8	0.9	2.5	39.2	4.1	3.4		29.3	28.4		29.7	
Level of Service	B	A	A	D	A	A		C	C		C	
Approach Delay (s)		1.7			5.2			28.7			29.7	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay	5.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.22		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	36.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	29	48	151	125	4
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	0	34	56	178	147	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				816		
pX, platoon unblocked						
vC, conflicting volume	440	149	152			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	440	149	152			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	96	96			
cM capacity (veh/h)	552	897	1429			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	34	234	152
Volume Left	0	56	0
Volume Right	34	0	5
cSH	897	1429	1700
Volume to Capacity	0.04	0.04	0.09
Queue Length 95th (ft)	3	3	0
Control Delay (s)	9.2	2.1	0.0
Lane LOS	A	A	
Approach Delay (s)	9.2	2.1	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	30.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	4	7	7	4	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.69	0.69	0.69	0.69	0.69	0.69
Hourly flow rate (vph)	0	6	10	10	6	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	20				21	15
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	20				21	15
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	1596				996	1064

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	6	20	6
Volume Left	0	0	6
Volume Right	0	10	0
cSH	1596	1700	996
Volume to Capacity	0.00	0.01	0.01
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.0	8.6
Lane LOS			A
Approach Delay (s)	0.0	0.0	8.6
Approach LOS			A

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	50	475	521	142	169	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	3539	3426		1770	1583
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	3539	3426		1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	500	548	149	178	51
RTOR Reduction (vph)	0	0	28	0	0	42
Lane Group Flow (vph)	53	500	669	0	178	9
Turn Type	Prot	NA	NA		Prot	Perm
Protected Phases	5	2	6		7	
Permitted Phases						4
Actuated Green, G (s)	5.1	45.3	36.2		11.7	11.7
Effective Green, g (s)	5.1	45.3	36.2		11.7	11.7
Actuated g/C Ratio	0.08	0.70	0.56		0.18	0.18
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	138	2466	1908		318	284
v/s Ratio Prot	c0.03	0.14	c0.20		c0.10	
v/s Ratio Perm						0.01
v/c Ratio	0.38	0.20	0.35		0.56	0.03
Uniform Delay, d1	28.5	3.5	7.9		24.3	22.0
Progression Factor	1.00	1.00	0.73		1.00	1.00
Incremental Delay, d2	1.8	0.2	0.5		2.1	0.0
Delay (s)	30.2	3.7	6.3		26.4	22.0
Level of Service	C	A	A		C	C
Approach Delay (s)		6.2	6.3		25.5	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	9.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	41.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Westpark Promenade Traffic Impact Analysis (#0201-0002)
Existing Conditions
PM Peak Hour

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Base Volume Alternative)

Intersection #13 George Av. / La Estrella St.

Cycle (sec):	100	Critical Vol./Cap.(X):	0.159
Loss Time (sec):	0	Average Delay (sec/veh):	7.8
Optimal Cycle:	0	Level Of Service:	A

Approach:	North Bound			South Bound			East Bound			West Bound		
Movement:	L	T	R	L	T	R	L	T	R	L	T	R
Control:	Stop Sign			Stop Sign			Stop Sign			Stop Sign		
Rights:	Include			Include			Include			Include		
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	1 0 0 1 0			1 0 1 0 1			0 0 0 1 0			0 1 0 0 0		
Volume Module:												
Base Vol:	20	0	22	1	0	0	0	100	27	33	97	0
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Initial Bse:	20	0	22	1	0	0	0	100	27	33	97	0
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHF Adj:	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
PHF Volume:	21	0	23	1	0	0	0	104	28	34	101	0
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0
Reduced Vol:	21	0	23	1	0	0	0	104	28	34	101	0
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FinalVolume:	21	0	23	1	0	0	0	104	28	34	101	0
Saturation Flow Module:												
Adjustment:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lanes:	1.00	0.00	1.00	1.00	1.00	1.00	0.00	0.79	0.21	0.25	0.75	0.00
Final Sat.:	622	0	786	616	673	774	0	697	188	216	634	0
Capacity Analysis Module:												
Vol/Sat:	0.03	xxxx	0.03	0.00	0.00	0.00	xxxx	0.15	0.15	0.16	0.16	xxxx
Crit Moves:	****			****					****	****		
Delay/Veh:	8.4	0.0	7.2	8.3	0.0	0.0	0.0	7.7	7.7	8.0	8.0	0.0
Delay Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AdjDel/Veh:	8.4	0.0	7.2	8.3	0.0	0.0	0.0	7.7	7.7	8.0	8.0	0.0
LOS by Move:	A	*	A	A	*	*	*	A	A	A	A	*
ApproachDel:	7.8			8.3			7.7			8.0		
Delay Adj:	1.00			1.00			1.00			1.00		
ApprAdjDel:	7.8			8.3			7.7			8.0		
LOS by Appr:	A			A			A			A		
AllWayAvgQ:	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.2

Note: Queue reported is the number of cars per lane.

Traffix 8.0.0715 (c) 2008 Dowling Assoc. Licensed to Trames Solutions

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	26	11	0	2	4	318	0	0	0	302	0	7
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	31	13	0	2	5	374	0	0	0	355	0	8

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total (vph)	37	6	5	376	0	355	8
Volume Left (vph)	31	0	2	0	0	355	0
Volume Right (vph)	0	0	0	374	0	0	8
Hadj (s)	0.45	0.03	0.28	-0.66	0.00	0.53	-0.67
Departure Headway (s)	6.7	6.2	6.0	5.1	6.2	6.1	4.9
Degree Utilization, x	0.07	0.01	0.01	0.53	0.00	0.60	0.01
Capacity (veh/h)	497	528	562	682	537	569	689
Control Delay (s)	8.9	8.1	7.9	12.5	9.2	16.8	6.8
Approach Delay (s)	8.8		12.5		0.0	16.5	
Approach LOS	A		B		A	C	

Intersection Summary			
Delay	14.2		
Level of Service	B		
Intersection Capacity Utilization	40.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	101	204	51	125	208	214	57	218	76	138	211	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.96		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3433		1770	1863	1583	1770	3402		1770	3427	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3433		1770	1863	1583	1770	3402		1770	3427	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	107	217	54	133	221	228	61	232	81	147	224	60
RTOR Reduction (vph)	0	34	0	0	0	172	0	50	0	0	34	0
Lane Group Flow (vph)	107	237	0	133	221	56	61	263	0	147	250	0
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	6.4	16.0		6.4	16.0	16.0	3.6	19.4		7.2	23.0	
Effective Green, g (s)	6.4	16.0		6.4	16.0	16.0	3.6	19.4		7.2	23.0	
Actuated g/C Ratio	0.10	0.25		0.10	0.25	0.25	0.06	0.30		0.11	0.35	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	174	845		174	458	389	98	1015		196	1212	
v/s Ratio Prot	0.06	0.07		c0.08	c0.12		c0.03	c0.08		c0.08	0.07	
v/s Ratio Perm						0.04						
v/c Ratio	0.61	0.28		0.76	0.48	0.14	0.62	0.26		0.75	0.21	
Uniform Delay, d1	28.1	19.8		28.6	21.0	19.1	30.0	17.3		28.0	14.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	6.3	0.8		17.9	3.6	0.8	11.7	0.6		14.8	0.4	
Delay (s)	34.4	20.7		46.5	24.6	19.9	41.7	18.0		42.9	15.0	
Level of Service	C	C		D	C	B	D	B		D	B	
Approach Delay (s)		24.6			27.8			21.8			24.5	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	25.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	46.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	78	117	69	26	27	105
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	84	126	74	28	29	113
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	102				382	88
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	102				382	88
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				95	88
cM capacity (veh/h)	1490				586	970

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	210	102	142
Volume Left	84	0	29
Volume Right	0	28	113
cSH	1490	1700	855
Volume to Capacity	0.06	0.06	0.17
Queue Length 95th (ft)	4	0	15
Control Delay (s)	3.3	0.0	10.0
Lane LOS	A		B
Approach Delay (s)	3.3	0.0	10.0
Approach LOS			B

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	31.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	148	145	0	0	111	63	385	4	50	0	0	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	156	153	0	0	117	66	405	4	53	0	0	0

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2
Volume Total (vph)	156	153	183	409	53
Volume Left (vph)	156	0	0	405	0
Volume Right (vph)	0	0	66	0	53
Hadj (s)	0.53	0.03	-0.18	0.53	-0.67
Departure Headway (s)	6.9	6.4	6.3	6.5	5.3
Degree Utilization, x	0.30	0.27	0.32	0.74	0.08
Capacity (veh/h)	496	534	533	540	652
Control Delay (s)	11.6	10.5	12.3	24.5	7.5
Approach Delay (s)	11.1		12.3	22.6	
Approach LOS	B		B	C	

Intersection Summary			
Delay	16.9		
Level of Service	C		
Intersection Capacity Utilization	49.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	235	314	50	446	0	0	0	0	58	2	171
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	242	324	52	460	0	0	0	0	60	2	176

Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	566	52	460	62	176
Volume Left (vph)	0	52	0	60	0
Volume Right (vph)	324	0	0	0	176
Hadj (s)	-0.31	0.53	0.03	0.52	-0.67
Departure Headway (s)	5.8	6.6	6.1	7.8	6.6
Degree Utilization, x	0.91	0.09	0.78	0.13	0.33
Capacity (veh/h)	615	528	575	442	518
Control Delay (s)	40.9	9.1	26.2	10.9	11.6
Approach Delay (s)	40.9	24.5		11.4	
Approach LOS	E	C		B	

Intersection Summary			
Delay	29.2		
Level of Service	D		
Intersection Capacity Utilization	49.4%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX D

EXISTING (2014) CONDITIONS
FREEWAY RAMP ANALYSIS WORKSHEETS

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	Existing (2014)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	4404
Ramp Volume, V_R	688
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4404	0.92	Level	9	0	0.957	1.00	5002
Ramp	688	0.92	Level	2	0	0.990	1.00	755
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 2666 pc/h
V_3 or V_{av34} 2336 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2858 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5002	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4247	Exhibit 13-8	7050	No
V_R	755	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2666	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 20.7 (pc/mi/ln)
LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.496 (Exhibit 13-12)
S_R= 53.6 mph (Exhibit 13-12)
S_0= 66.8 mph (Exhibit 13-12)
S = 58.6 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	Existing (2014)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A	300	☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3716	V_D =	veh/h
		Ramp Volume, V_R	991		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3716	0.92	Level	9	0	0.957	1.00	4221
Ramp	991	0.92	Level	2	0	0.990	1.00	1088
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2343 pc/h

V_3 or V_{av34} 1878 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2412 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5309	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3500	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 26.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.387 (Exibit 13-11)

S_R= 56.1 mph (Exhibit 13-11)

S_0= 60.3 mph (Exhibit 13-11)

S = 57.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	Existing (2014)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	3359
Ramp Volume, V_R	424
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3359	0.92	Level	9	0	0.957	1.00	3815
Ramp	424	0.92	Level	2	0	0.990	1.00	465
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 1972 pc/h
V_3 or V_{av34} 1843 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2180 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3815	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	3350	Exhibit 13-8	7050	No
V_R	465	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1972	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 14.9 (pc/mi/ln)
LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.470 (Exhibit 13-12)
S_R= 54.2 mph (Exhibit 13-12)
S_0= 68.8 mph (Exhibit 13-12)
S = 59.6 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	Existing (2014)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A	300	☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	2935	V_D =	veh/h
		Ramp Volume, V_R	769		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2935	0.92	Level	9	0	0.957	1.00	3334
Ramp	769	0.92	Level	2	0	0.990	1.00	844
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 1850 pc/h

V_3 or V_{av34} 1484 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 1905 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4178	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2749	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 20.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.319 (Exibit 13-11)

S_R= 57.7 mph (Exhibit 13-11)

S_0= 61.7 mph (Exhibit 13-11)

S = 59.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	Existing (2014)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	4404
Ramp Volume, V_R	824
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4404	0.92	Level	9	0	0.957	1.00	5002
Ramp	824	0.92	Level	2	0	0.990	1.00	905
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 2749 pc/h
V_3 or V_{av34} 2253 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2858 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5002	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4097	Exhibit 13-8	7050	No
V_R	905	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2749	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 20.7 (pc/mi/ln)
LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.509 (Exhibit 13-12)
S_R= 53.3 mph (Exhibit 13-12)
S_0= 66.8 mph (Exhibit 13-12)
S = 58.4 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	Existing (2014)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3181	
	Ramp Volume, V_R: 667	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3181	0.92	Level	9	0	0.957	1.00	3613
Ramp	667	0.92	Level	2	0	0.990	1.00	732
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2005 pc/h

V_3 or V_{av34} 1608 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 2064 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4345	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2796	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 21.3 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.322 (Exibit 13-11)

S_R= 57.6 mph (Exhibit 13-11)

S_0= 61.2 mph (Exhibit 13-11)

S = 58.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	Existing (2014)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	5035
Ramp Volume, V_R	885
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5035	0.92	Level	9	0	0.957	1.00	5719
Ramp	885	0.92	Level	2	0	0.990	1.00	972
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 3108 pc/h
V_3 or V_{av34} 2611 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 3268 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5719	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4747	Exhibit 13-8	7050	No
V_R	972	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3108	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 24.3 (pc/mi/ln)
LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.515 (Exhibit 13-12)
S_R= 53.1 mph (Exhibit 13-12)
S_0= 65.6 mph (Exhibit 13-12)
S = 57.9 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	Existing (2014)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D	V_D = veh/h
	Freeway Volume, V_F: 4150	
	Ramp Volume, V_R: 688	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4150	0.92	Level	9	0	0.957	1.00	4714
Ramp	688	0.92	Level	2	0	0.990	1.00	755
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2616 pc/h

V_3 or V_{av34} 2098 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 2693 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5469	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3448	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 26.4 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.381 (Exibit 13-11)

S_R= 56.2 mph (Exhibit 13-11)

S_0= 59.5 mph (Exhibit 13-11)

S = 57.4 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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APPENDIX E

EXISTING (2014) CONDITIONS
BASIC FREEWAY SEGMENT ANALYSIS WORKSHEETS

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*Existing Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4404*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1667*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*67.5*	mph	S	mph
D = v_p / S	*24.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*Existing Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4707*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1782*	pc/h/ln
S	*66.1*	mph
D = v_p / S	*27.0*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*Existing Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3359*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1272*	pc/h/ln
S	*69.9*	mph
D = v_p / S	*18.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*Existing Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3704*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1402*	pc/h/ln
S	*69.5*	mph
D = v_p / S	*20.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4005*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1516*	pc/h/ln
S	*68.8*	mph
D = v_p / S	*22.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3848*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1457*	pc/h/ln
S	*69.2*	mph
D = v_p / S	*21.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5035*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1906*	pc/h/ln
S	*64.2*	mph
D = v_p / S	*29.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4838*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1832*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*65.4*	mph	S	mph
D = v_p / S	*28.0*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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APPENDIX F

TRAFFIC SIGNAL WARRANTS

Figure 4C-3. Warrant 3, Peak Hour

EXISTING CONDITIONS (AM Peak Hour)

Major Street Name = **George Avenue**

Total of Both Approaches (VPH) = **429**

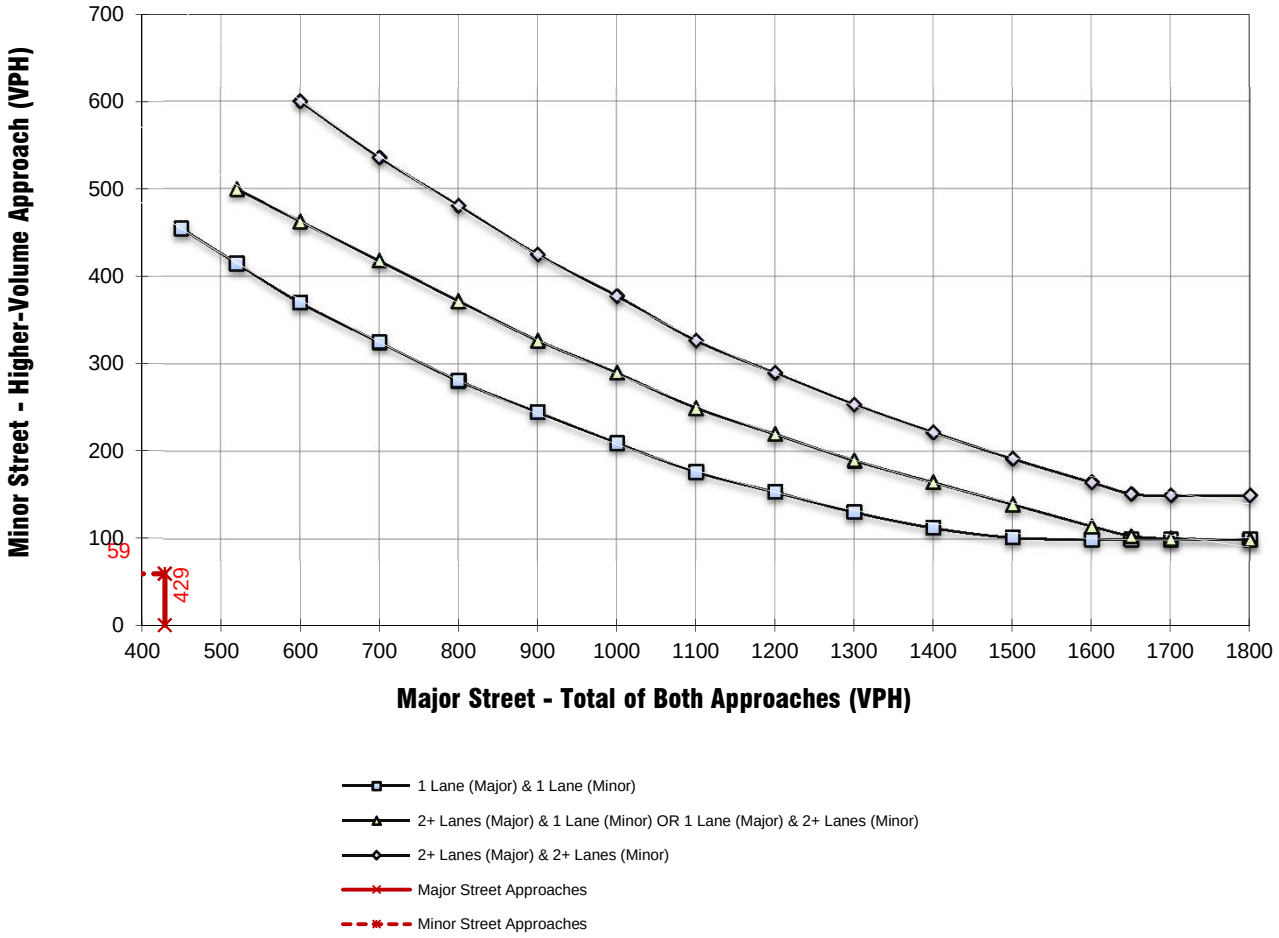
Number of Approach Lanes Major Street = **1**

Minor Street Name = **Depasquale Road**

High Volume Approach (VPH) = **59**

Number of Approach Lanes Minor Street = **1**

SIGNAL WARRANT NOT SATISFIED



** NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

California MUTCD 2012 Edition
C:\TRAMES\0201-0002\Warrants\Existing\10 AM\Fig 4C-3 (Urban Peak)

Figure 4C-3. Warrant 3, Peak Hour

EXISTING CONDITIONS (PM Peak Hour)

Major Street Name = **George Avenue**

Total of Both Approaches (VPH) = **328**

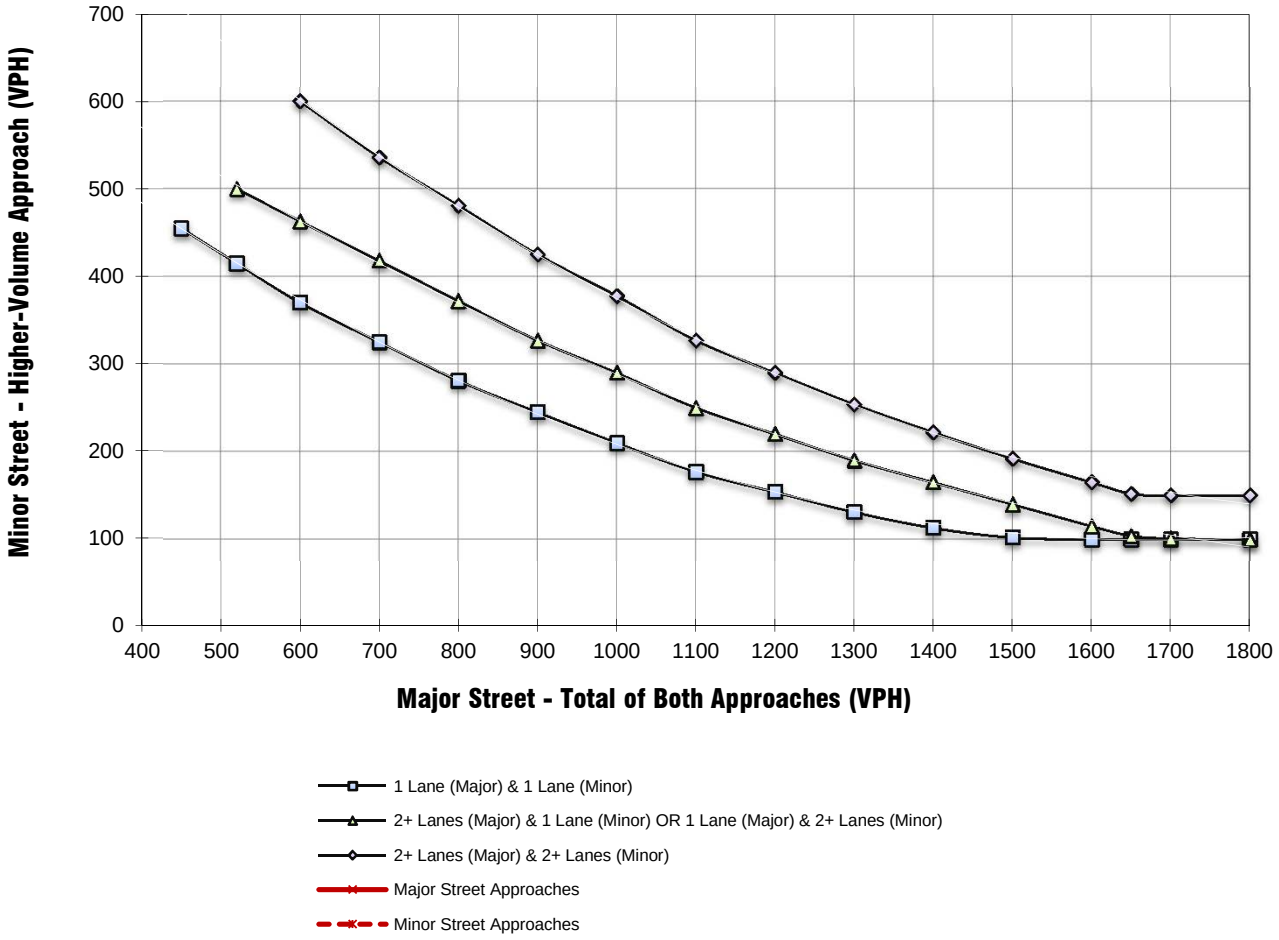
Number of Approach Lanes Major Street = **1**

Minor Street Name = **Depasquale Road**

High Volume Approach (VPH) = **29**

Number of Approach Lanes Minor Street = **1**

SIGNAL WARRANT NOT SATISFIED



** NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Figure 4C-3. Warrant 3, Peak Hour

EXISTING CONDITIONS (AM Peak Hour)

Major Street Name = **La Estrella Street**

Total of Both Approaches (VPH) = **421**

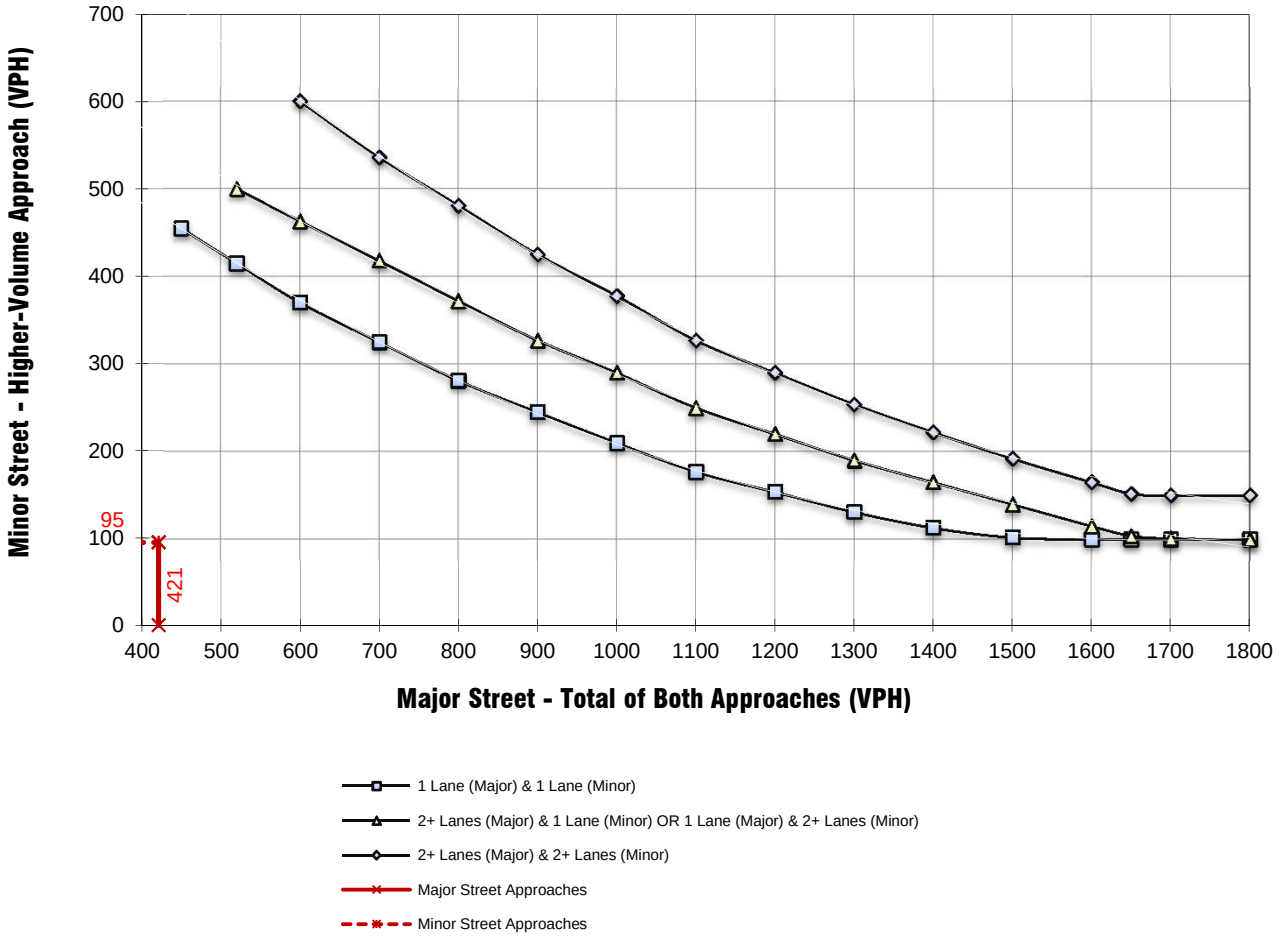
Number of Approach Lanes Major Street = **1**

Minor Street Name = **George Avenue**

High Volume Approach (VPH) = **95**

Number of Approach Lanes Minor Street = **1**

SIGNAL WARRANT NOT SATISFIED



** NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Figure 4C-3. Warrant 3, Peak Hour

EXISTING CONDITIONS (PM Peak Hour)

Major Street Name = **La Estrella Street**

Total of Both Approaches (VPH) = **257**

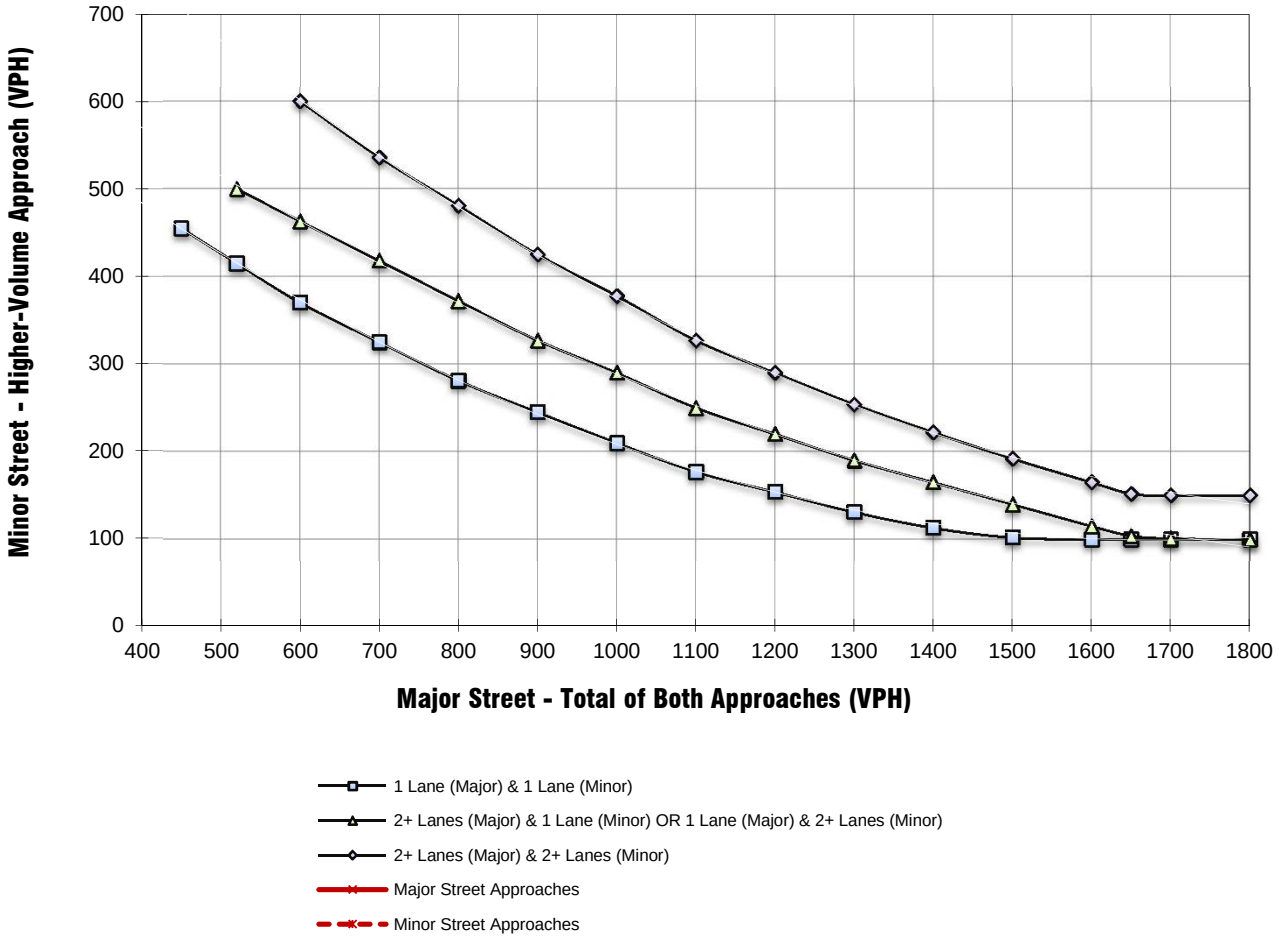
Number of Approach Lanes Major Street = **1**

Minor Street Name = **George Avenue**

High Volume Approach (VPH) = **42**

Number of Approach Lanes Minor Street = **1**

SIGNAL WARRANT NOT SATISFIED



** NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

California MUTCD 2012 Edition
C:\TRAMES\0201-0002\Warrants\Existing\13 PM\Fig 4C-3 (Urban Peak)

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

EXISTING CONDITIONS (AM Peak Hour)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)

Major Street Name = **Inland Valley Drive**

Total of Both Approaches (VPH) = **257**

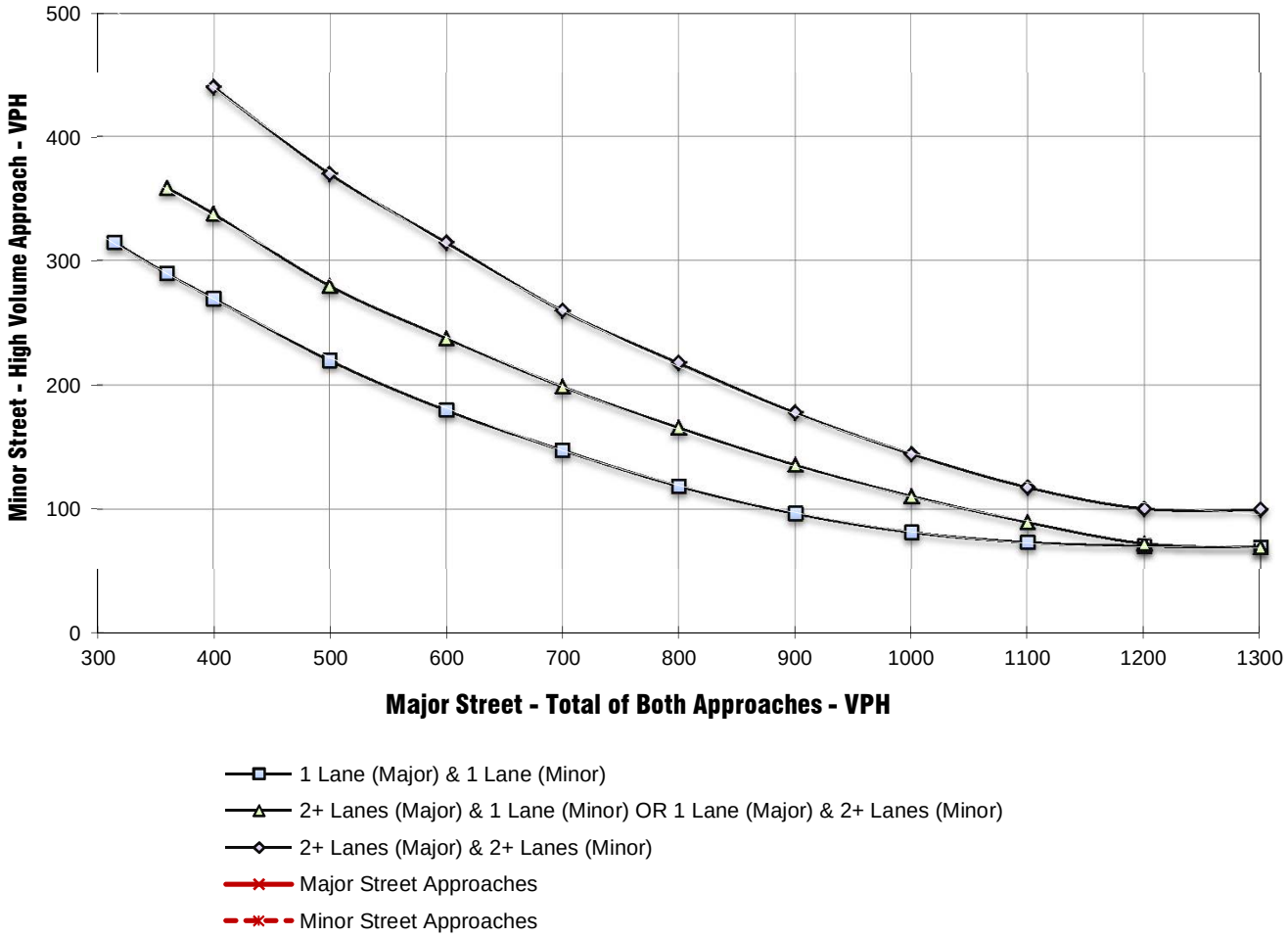
Number of Approach Lanes Major Street = **1**

Minor Street Name = **Prielipp Road**

High Volume Approach (VPH) = **226**

Number of Approach Lanes Minor Street = **1**

SIGNAL WARRANT NOT SATISFIED



** NOTE:
100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

EXISTING CONDITIONS (PM Peak Hour)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)

Major Street Name = **Prielipp Road**

Total of Both Approaches (VPH) = **361**

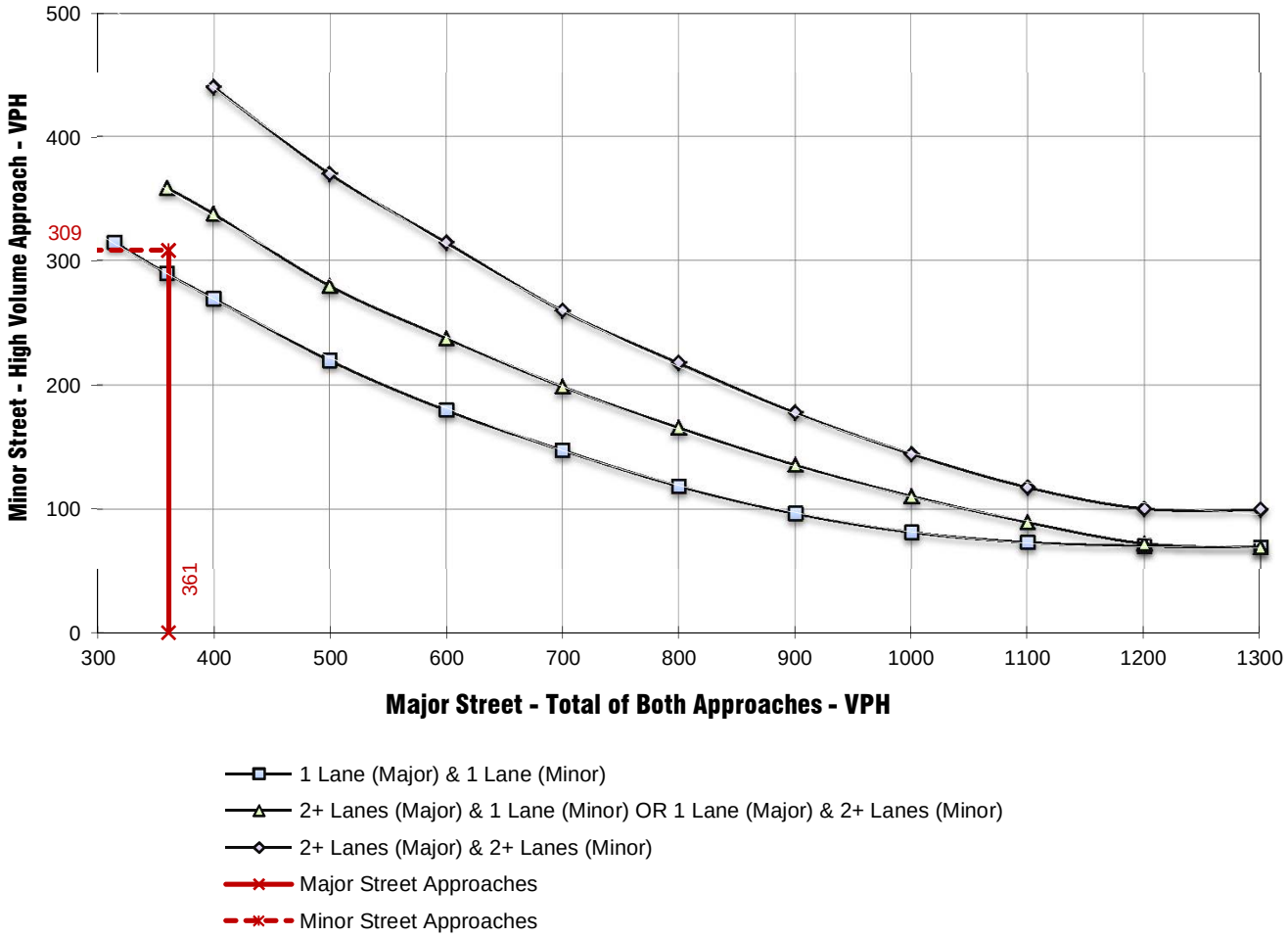
Number of Approach Lanes Major Street = **1**

Minor Street Name = **Inland Valley Drive**

High Volume Approach (VPH) = **309**

Number of Approach Lanes Minor Street = **1**

WARRANTED FOR A SIGNAL



** NOTE:
100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

EXISTING CONDITIONS (AM Peak Hour)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)

Major Street Name = **Baxter Road**

Total of Both Approaches (VPH) = **502**

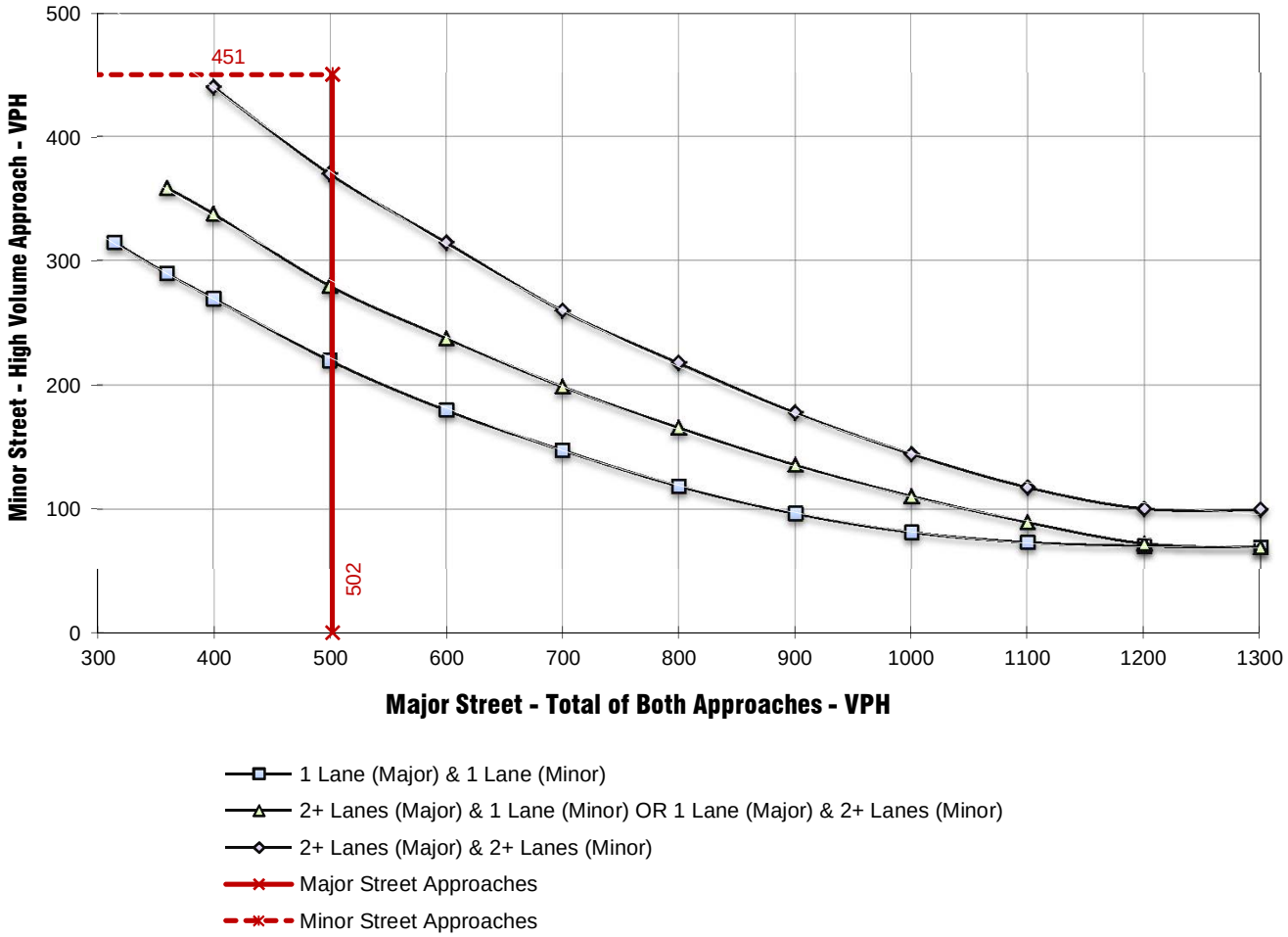
Number of Approach Lanes Major Street = **1**

Minor Street Name = **Monte Vista Drive**

High Volume Approach (VPH) = **451**

Number of Approach Lanes Minor Street = **1**

WARRANTED FOR A SIGNAL



** NOTE:
100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

EXISTING CONDITIONS (PM Peak Hour)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)

Major Street Name = **Baxter Road**

Total of Both Approaches (VPH) = **290**

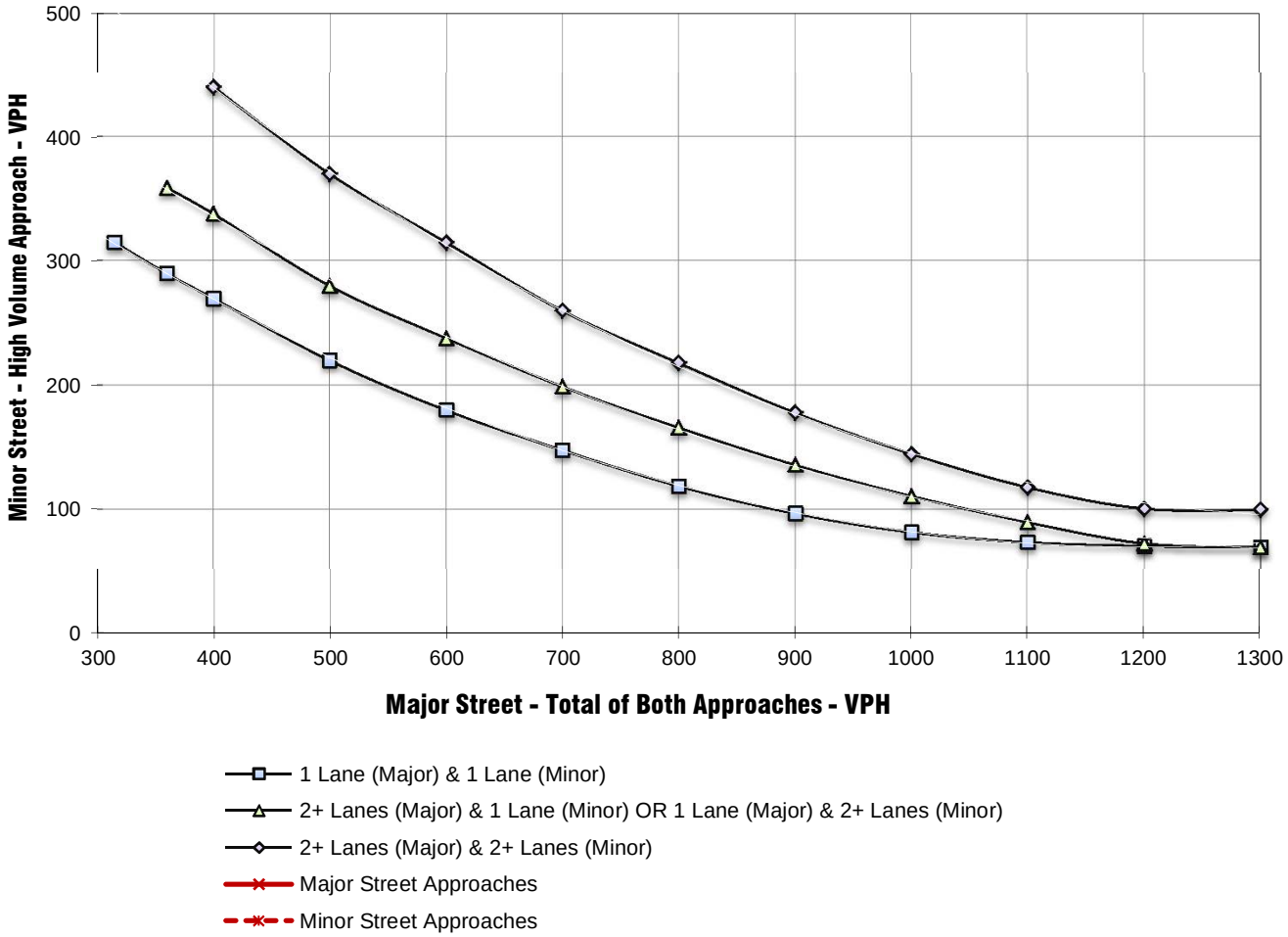
Number of Approach Lanes Major Street = **1**

Minor Street Name = **Monte Vista Drive**

High Volume Approach (VPH) = **132**

Number of Approach Lanes Minor Street = **1**

SIGNAL WARRANT NOT SATISFIED



** NOTE:
100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

EXISTING CONDITIONS (AM Peak Hour)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)

Major Street Name = **Baxter Road**

Total of Both Approaches (VPH) = **964**

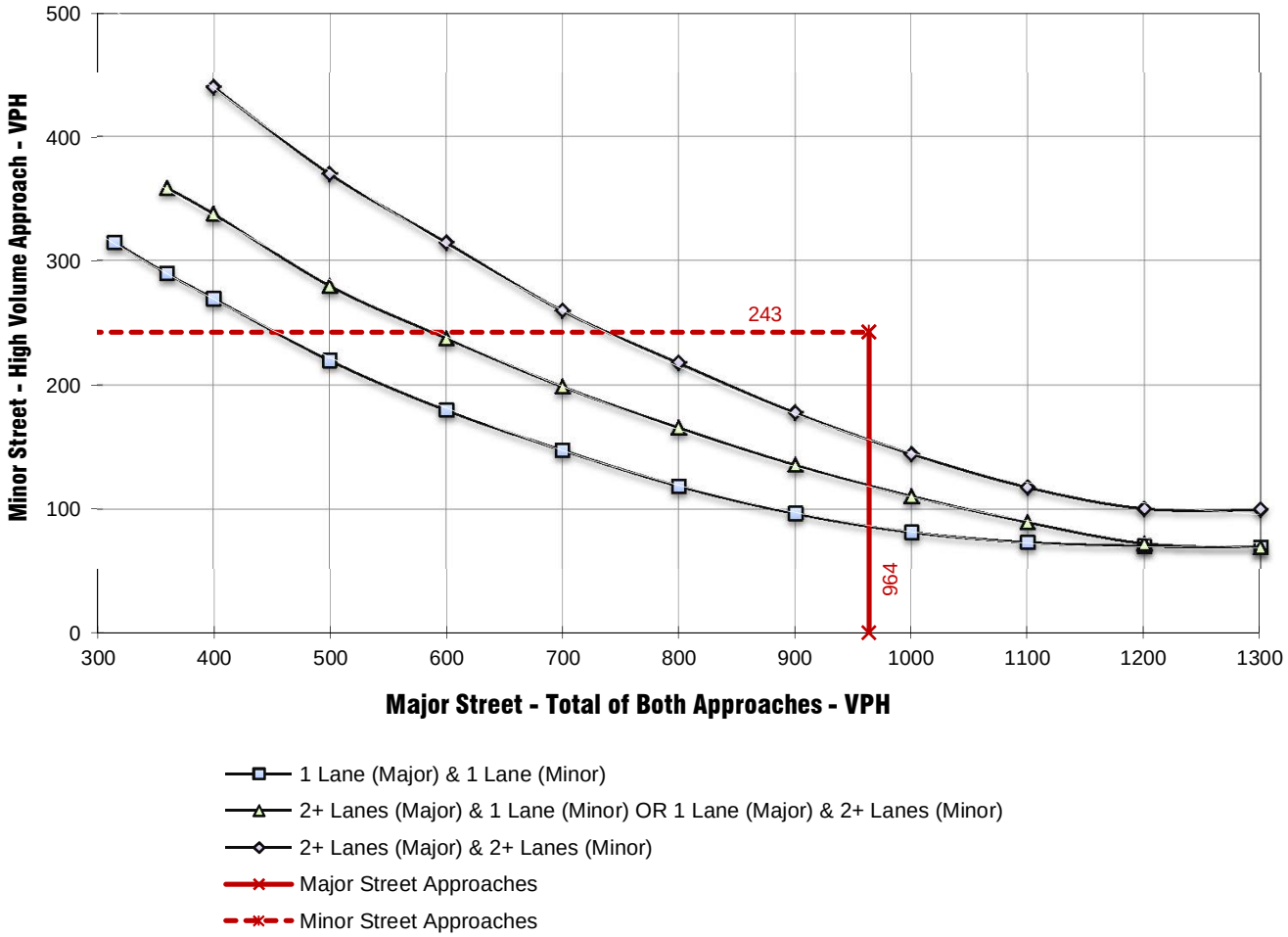
Number of Approach Lanes Major Street = **1**

Minor Street Name = **I-15 NB Ramps**

High Volume Approach (VPH) = **243**

Number of Approach Lanes Minor Street = **1**

WARRANTED FOR A SIGNAL



** NOTE:
100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

EXISTING CONDITIONS (PM Peak Hour)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)

Major Street Name = **Baxter Road**

Total of Both Approaches (VPH) = **467**

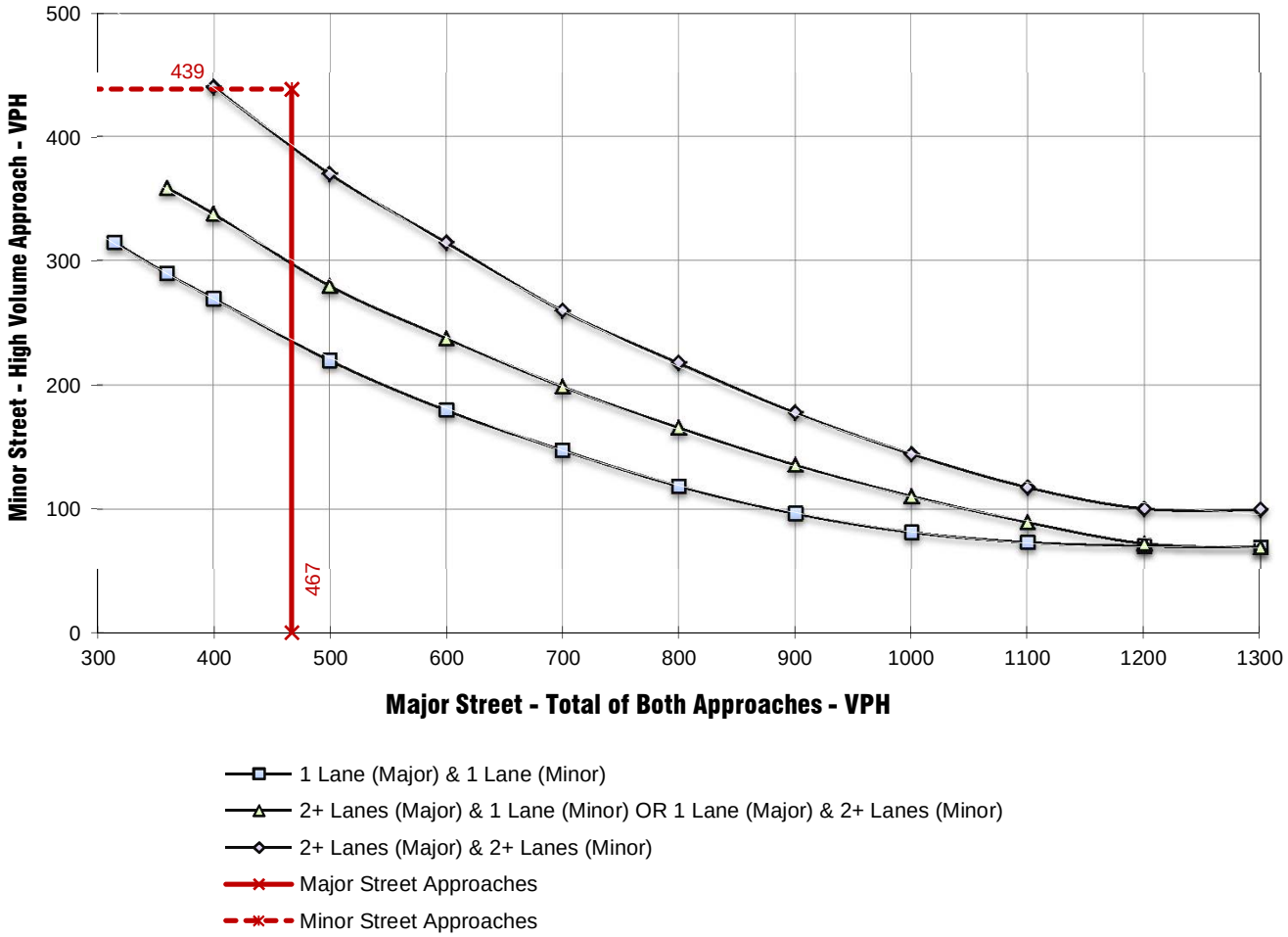
Number of Approach Lanes Major Street = **1**

Minor Street Name = **I-15 NB Ramps**

High Volume Approach (VPH) = **439**

Number of Approach Lanes Minor Street = **1**

WARRANTED FOR A SIGNAL



** NOTE:
100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

EXISTING CONDITIONS (AM Peak Hour)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)

Major Street Name = **Baxter Road**

Total of Both Approaches (VPH) = **1,327**

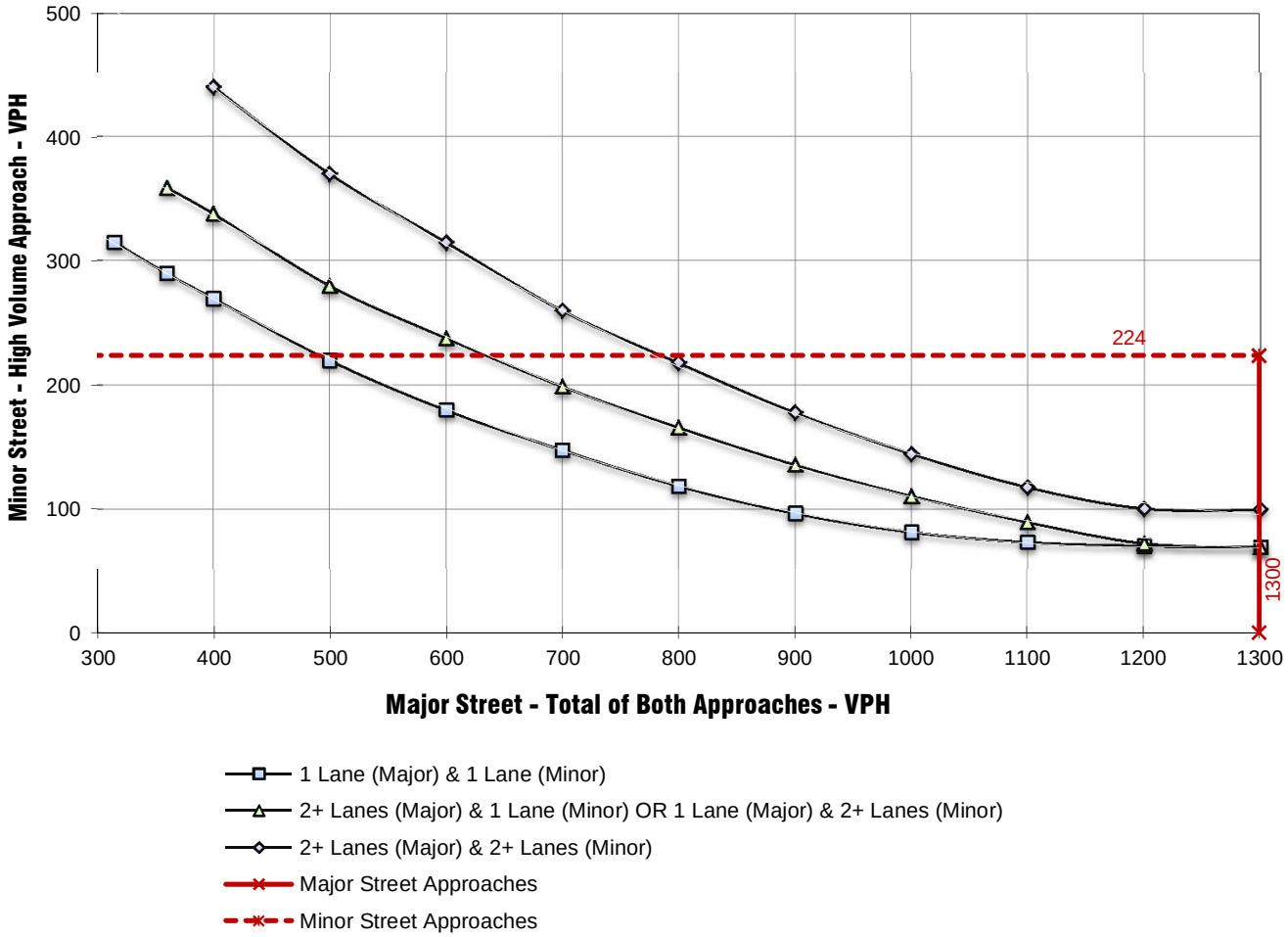
Number of Approach Lanes Major Street = **1**

Minor Street Name = **I-15 SB Ramps**

High Volume Approach (VPH) = **224**

Number of Approach Lanes Minor Street = **1**

WARRANTED FOR A SIGNAL



** NOTE:
100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

EXISTING CONDITIONS (PM Peak Hour)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)

Major Street Name = **Baxter Road**

Total of Both Approaches (VPH) = **1,045**

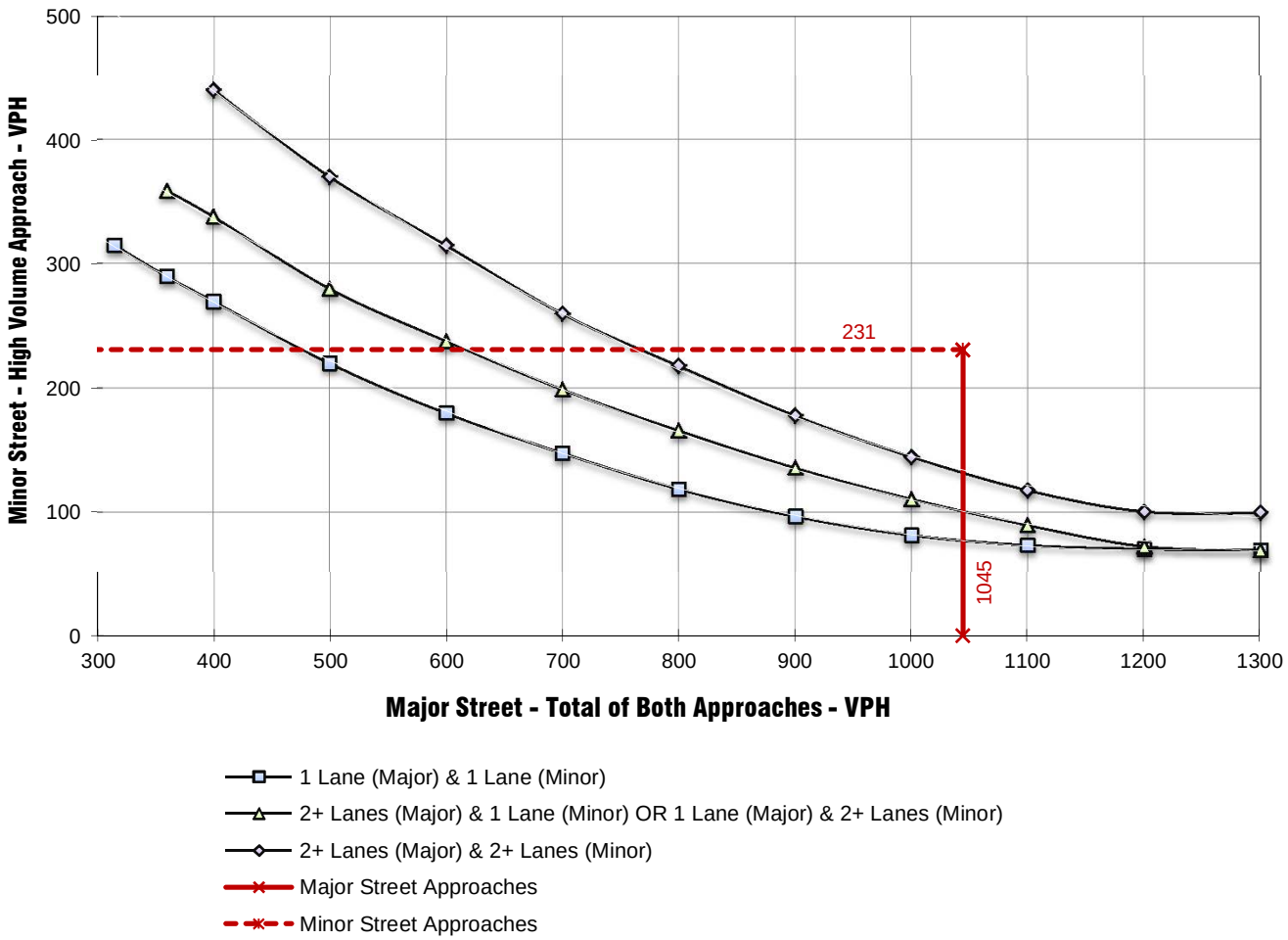
Number of Approach Lanes Major Street = **1**

Minor Street Name = **I-15 SB Ramps**

High Volume Approach (VPH) = **231**

Number of Approach Lanes Minor Street = **1**

WARRANTED FOR A SIGNAL



** NOTE:
100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Figure 4C-3. Warrant 3, Peak Hour

E+A+P+C CONDITIONS (AM Peak Hour)

Major Street Name = **George Avenue**

Total of Both Approaches (VPH) = **518**

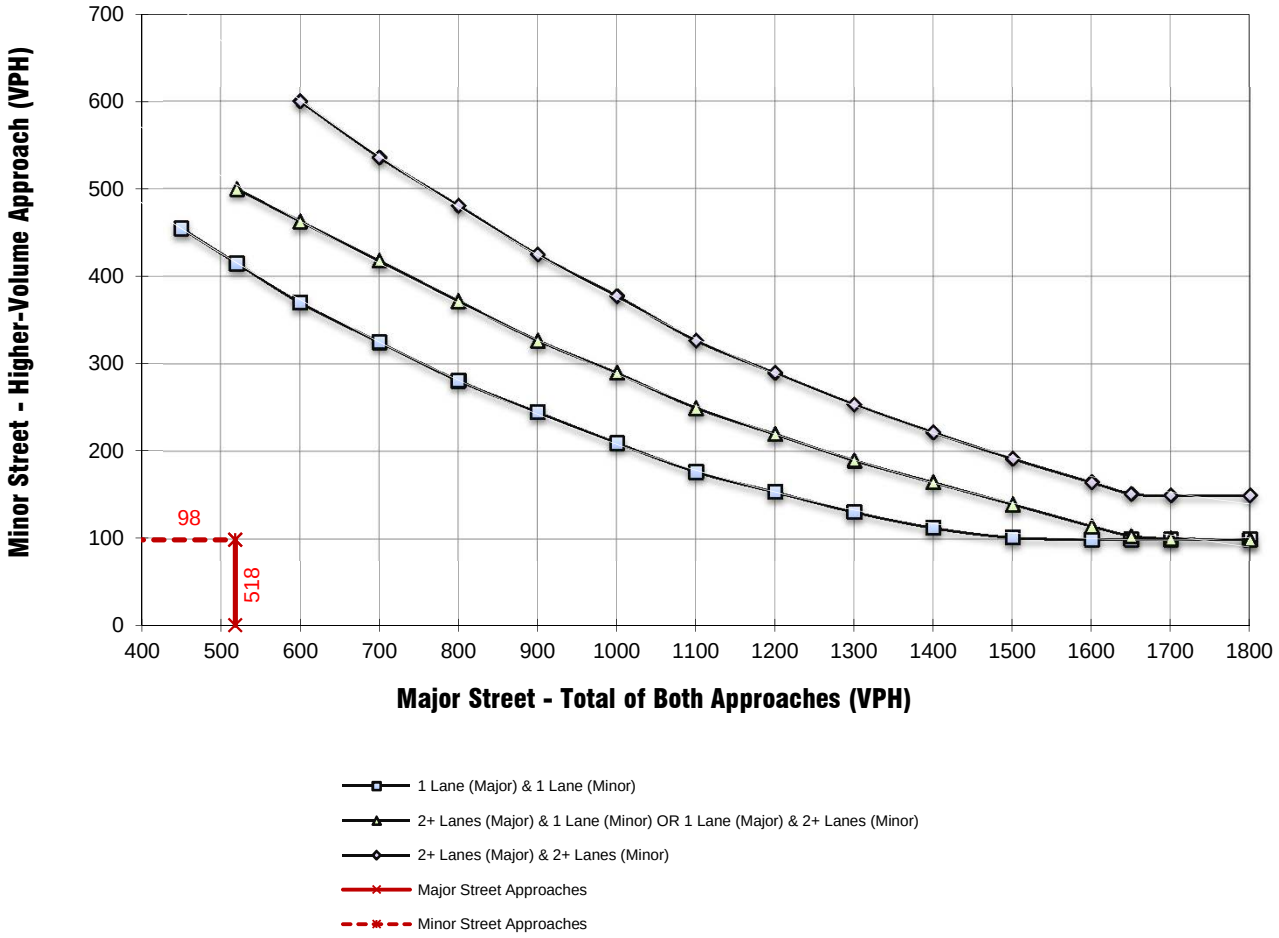
Number of Approach Lanes Major Street = **1**

Minor Street Name = **Depasquale Road**

High Volume Approach (VPH) = **98**

Number of Approach Lanes Minor Street = **1**

SIGNAL WARRANT NOT SATISFIED



** NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Figure 4C-3. Warrant 3, Peak Hour

E+A+P+C CONDITIONS (PM Peak Hour)

Major Street Name = **George Avenue**

Total of Both Approaches (VPH) = **460**

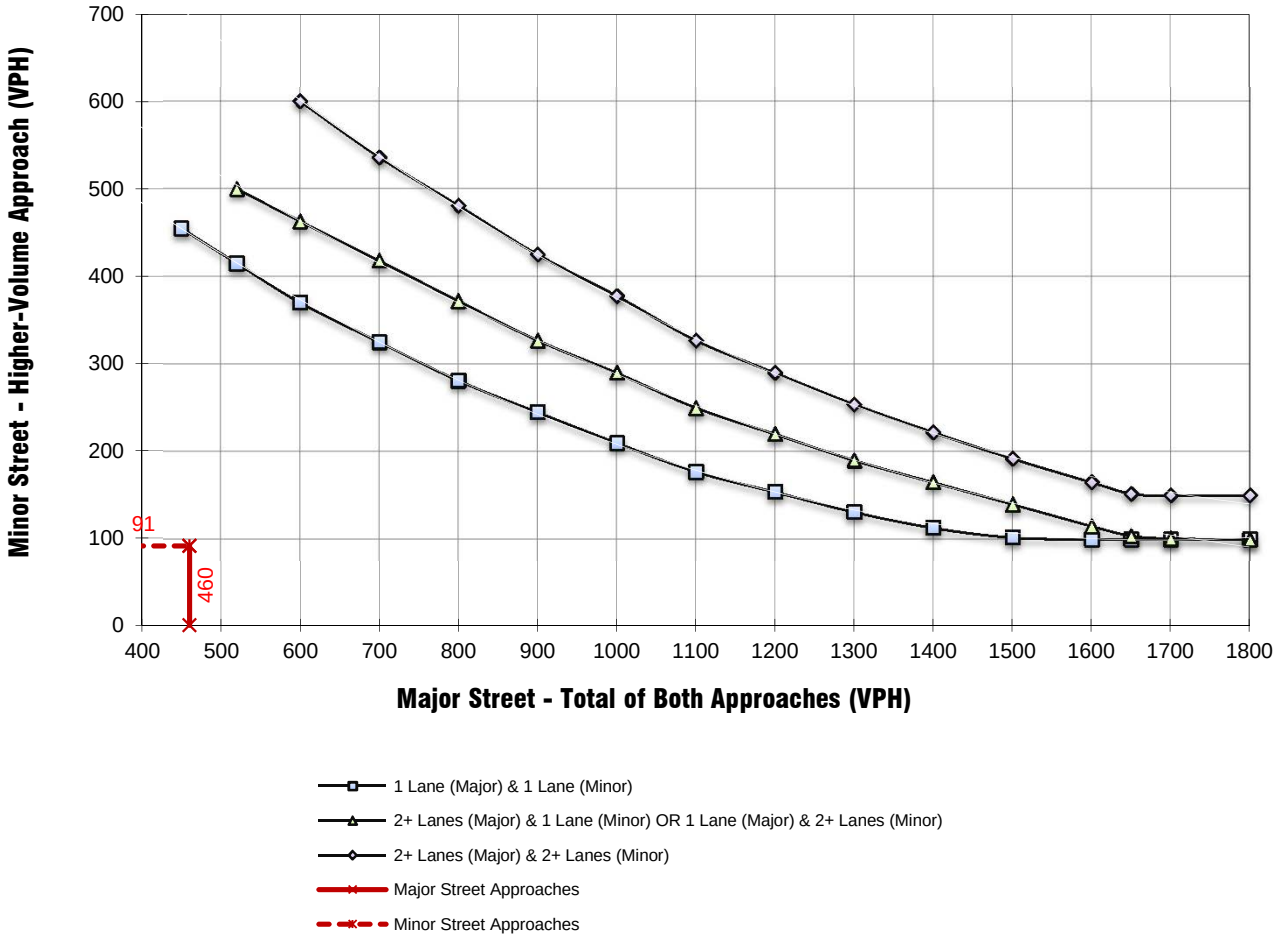
Number of Approach Lanes Major Street = **1**

Minor Street Name = **Depasquale Road**

High Volume Approach (VPH) = **91**

Number of Approach Lanes Minor Street = **1**

SIGNAL WARRANT NOT SATISFIED



** NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Figure 4C-3. Warrant 3, Peak Hour

E+A+P+C CONDITIONS (AM Peak Hour)

Major Street Name = **La Estrella Street**

Total of Both Approaches (VPH) = **462**

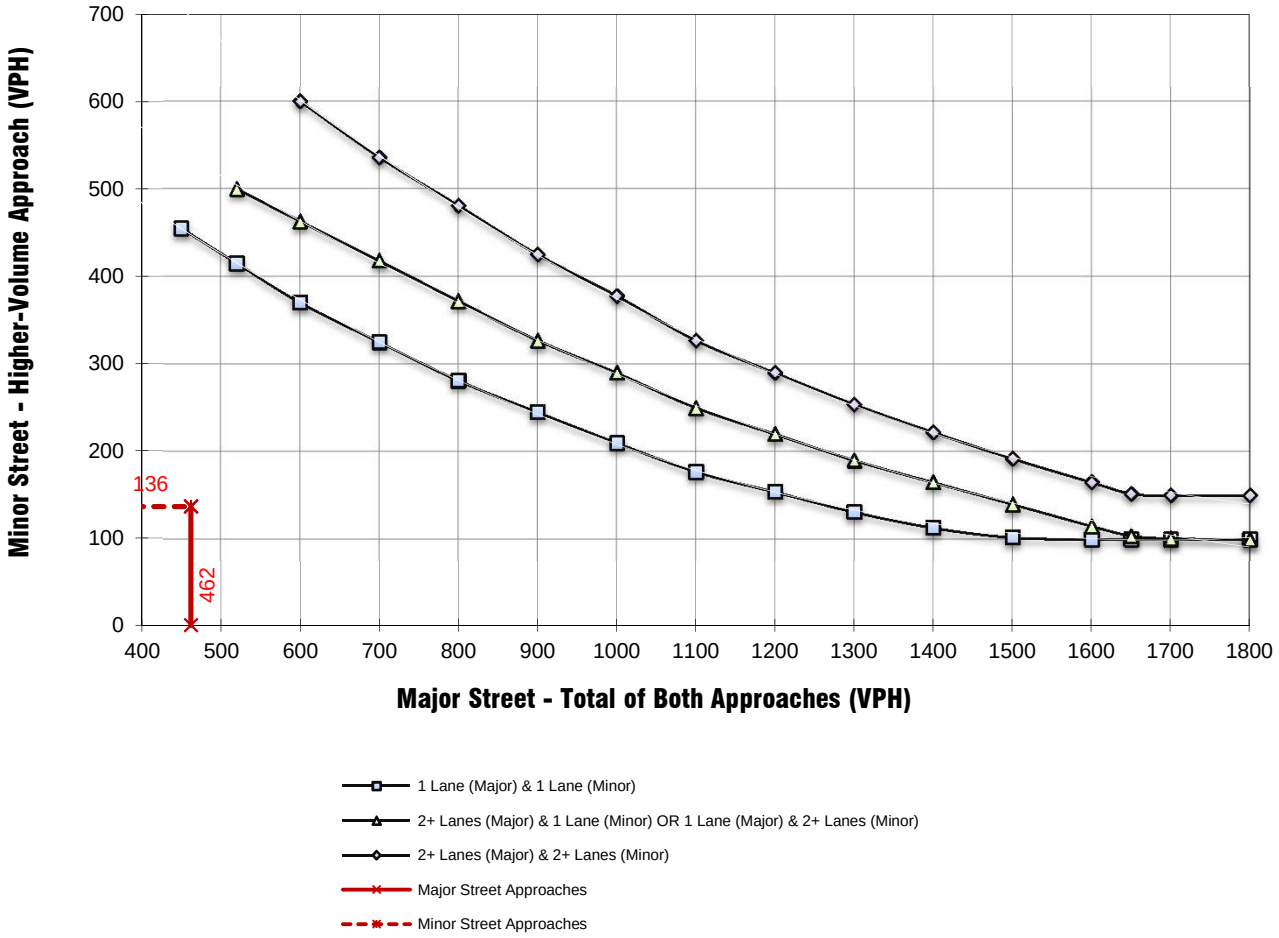
Number of Approach Lanes Major Street = **1**

Minor Street Name = **George Avenue**

High Volume Approach (VPH) = **136**

Number of Approach Lanes Minor Street = **1**

SIGNAL WARRANT NOT SATISFIED



** NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

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Figure 4C-3. Warrant 3, Peak Hour

E+A+P+C CONDITIONS (PM Peak Hour)

Major Street Name = **La Estrella Street**

Total of Both Approaches (VPH) = **304**

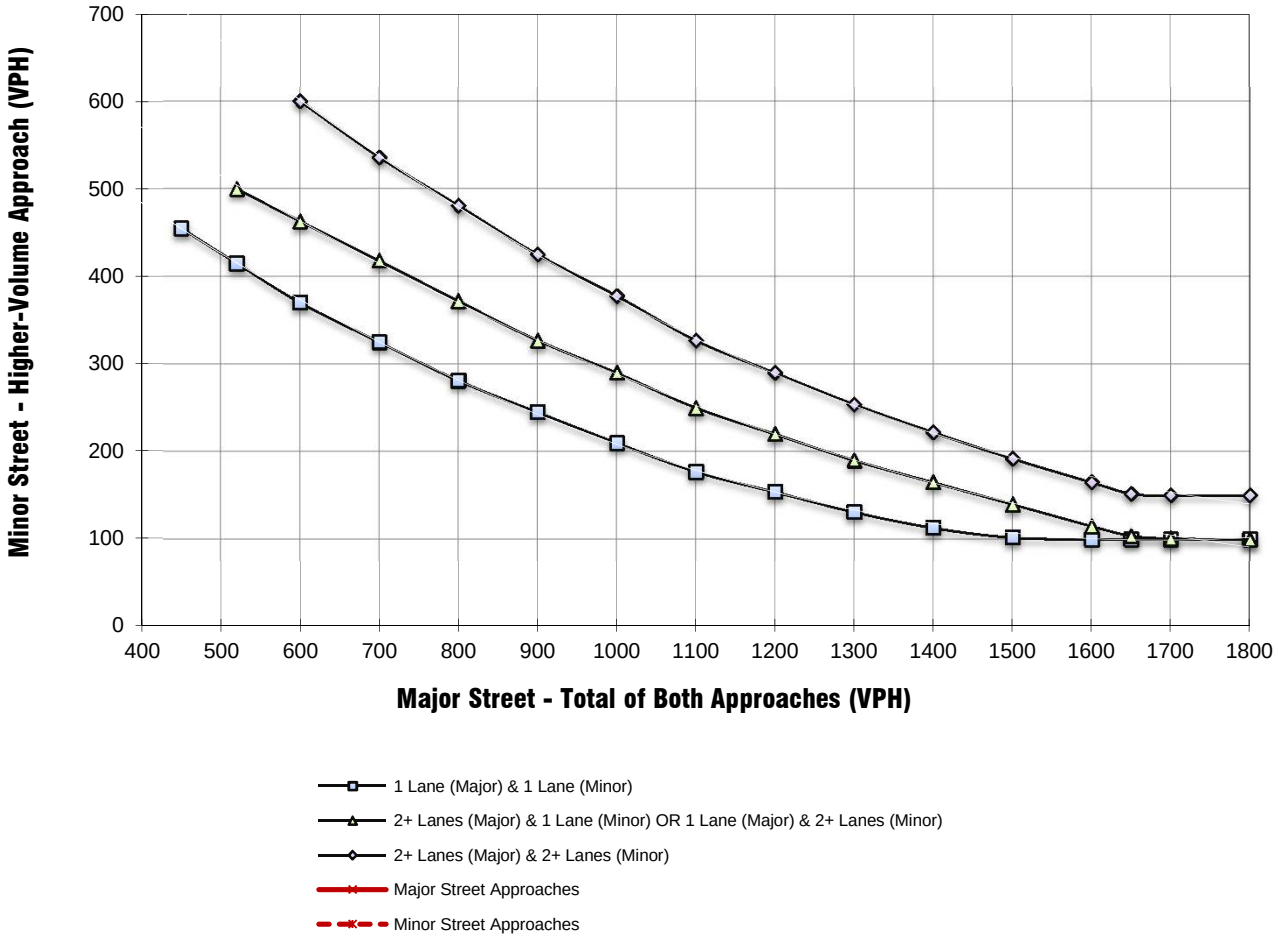
Number of Approach Lanes Major Street = **1**

Minor Street Name = **George Avenue**

High Volume Approach (VPH) = **107**

Number of Approach Lanes Minor Street = **1**

SIGNAL WARRANT NOT SATISFIED



** NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Figure 4C-103 (CA). Traffic Signal Warrants Worksheet
(Average Traffic Estimate Form)

EXISTING PLUS AMBIENT PLUS PROJECT PLUS CUMULATIVE CONDITIONS

Jurisdiction: City of Wildomar
Major Street: Depasquale Road
Minor Street: Westpark St. - Catt Rd.

Critical Approach Speed (Major) 35 mph
Critical Approach Speed (Minor) 35 mph

Major Street Approach Lanes = 1 lane
Minor Street Approach Lanes = 1 lane

Major Street Future ADT = 1,250 vpd
Minor Street Future ADT = 1,050 vpd

Speed limit or critical speed on major street traffic > 64 km/h (40 mph); ..... [ ]

or URBAN (U)

In built up area of isolated community of < 10,000 population ..... [ ]

(Based on Estimated Average Daily Traffic - See Note)

URBAN	RURAL	Minimum Requirements EADT			
XX					
CONDITION A - Minimum Vehicular Volume					
Satisfied	Not Satisfied	Vehicles Per Day on Major Street (Total of Both Approaches)		Vehicles Per Day on Higher-Volume Minor Street Approach (One Direction Only)	
	XX				
Number of lanes for moving traffic on each approach					
Major Street	Minor Street	Urban	Rural	Urban	Rural
1 1,250	*1* 1,050	8,000	5,600	2,400	1,680
2 +	*1*	9,600	6,720	2,400	1,680
2 +	*2* +	9,600	6,720	3,200	2,240
1	*2* +	8,000	5,600	3,200	2,240
CONDITION B - Interruption of Continuous Traffic					
Satisfied	Not Satisfied	Vehicles Per Day on Major Street (Total of Both Approaches)		Vehicles Per Day on Higher-Volume Minor Street Approach (One Direction Only)	
	XX				
Number of lanes for moving traffic on each approach					
Major Street	Minor Street	Urban	Rural	Urban	Rural
1 1,250	*1* 1,050	12,000	8,400	1,200	850
2 +	*1*	14,400	10,080	1,200	850
2 +	*2* +	14,400	10,080	1,600	1,120
1	*2* +	12,000	8,400	1,600	1,120
Combination of CONDITIONS A + B					
Satisfied	Not Satisfied				
	XX	2 CONDITIONS 80%		2 CONDITIONS 80%	
No one condition satisfied, but following conditions fulfilled 80% of more	A / B				
	16% / 10%				

Note: To be used only for NEW INTERSECTIONS or other locations where it is not reasonable to count actual traffic volumes.

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

California MUTCD (FHWA's MUTCD 2012, as amended for use in California)
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Figure 4C-103 (CA). Traffic Signal Warrants Worksheet
(Average Traffic Estimate Form)

2035 WITH PROJECT CONDITIONS

Jurisdiction: City of Wildomar
Major Street: Depasquale Road
Minor Street: Westpark St. - Catt Rd.

Critical Approach Speed (Major) 35 mph
Critical Approach Speed (Minor) 35 mph

Major Street Approach Lanes = 1 lane
Minor Street Approach Lanes = 1 lane

Major Street Future ADT = 1,400 vpd
Minor Street Future ADT = 1,050 vpd

Speed limit or critical speed on major street traffic > 64 km/h (40 mph); ..... [ ]

or

In built up area of isolated community of < 10,000 population ..... [ ]

URBAN (U)

(Based on Estimated Average Daily Traffic - See Note)

URBAN	RURAL	Minimum Requirements EADT			
XX					
CONDITION A - Minimum Vehicular Volume		Vehicles Per Day on Major Street (Total of Both Approaches)		Vehicles Per Day on Higher-Volume Minor Street Approach (One Direction Only)	
Satisfied	Not Satisfied				
	XX				
Number of lanes for moving traffic on each approach					
Major Street	Minor Street	Urban	Rural	Urban	Rural
1 1,400	*1* 1,050	8,000	5,600	2,400	1,680
2 +	*1*	9,600	6,720	2,400	1,680
2 +	*2* +	9,600	6,720	3,200	2,240
1	*2* +	8,000	5,600	3,200	2,240
CONDITION B - Interruption of Continuous Traffic		Vehicles Per Day on Major Street (Total of Both Approaches)		Vehicles Per Day on Higher-Volume Minor Street Approach (One Direction Only)	
Satisfied	Not Satisfied				
	XX				
Number of lanes for moving traffic on each approach					
Major Street	Minor Street	Urban	Rural	Urban	Rural
1 1,400	*1* 1,050	12,000	8,400	1,200	850
2 +	*1*	14,400	10,080	1,200	850
2 +	*2* +	14,400	10,080	1,600	1,120
1	*2* +	12,000	8,400	1,600	1,120
Combination of CONDITIONS A + B					
Satisfied	Not Satisfied				
	XX	2 CONDITIONS		2 CONDITIONS	
No one condition satisfied, but following conditions fulfilled 80% of more	A / B	80%		80%	
	18% / 12%				

Note: To be used only for NEW INTERSECTIONS or other locations where it is not reasonable to count actual traffic volumes.

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

California MUTCD (FHWA's MUTCD 2012, as amended for use in California)
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APPENDIX G

CUMULATIVE DEVELOPMENT PROJECTS
TRIP DISTRIBUTION PATTERNS

FIGURE 1
TAZ 1a TRIP DISTRIBUTION

Westpark Promenade Traffic Impact Analysis
City of Wildomar, CA (0201-0002:05.dwg)

TRAMES SOLUTIONS INC.

(C:\TRAMES\0201-0002\ACAD\05.dwg)

FIGURE 2
TAZ 1b and 1c TRIP DISTRIBUTION

Westpark Promenade Traffic Impact Analysis
City of Wildomar, CA (0201-0002:05.dwg)

TRAMES SOLUTIONS INC.

(C:\TRAMES\0201-0002\ACAD\05.dwg)

FIGURE 3
TAZ 1d TRIP DISTRIBUTION

Westpark Promenade Traffic Impact Analysis
City of Wildomar, CA (0201-0002:05.dwg)

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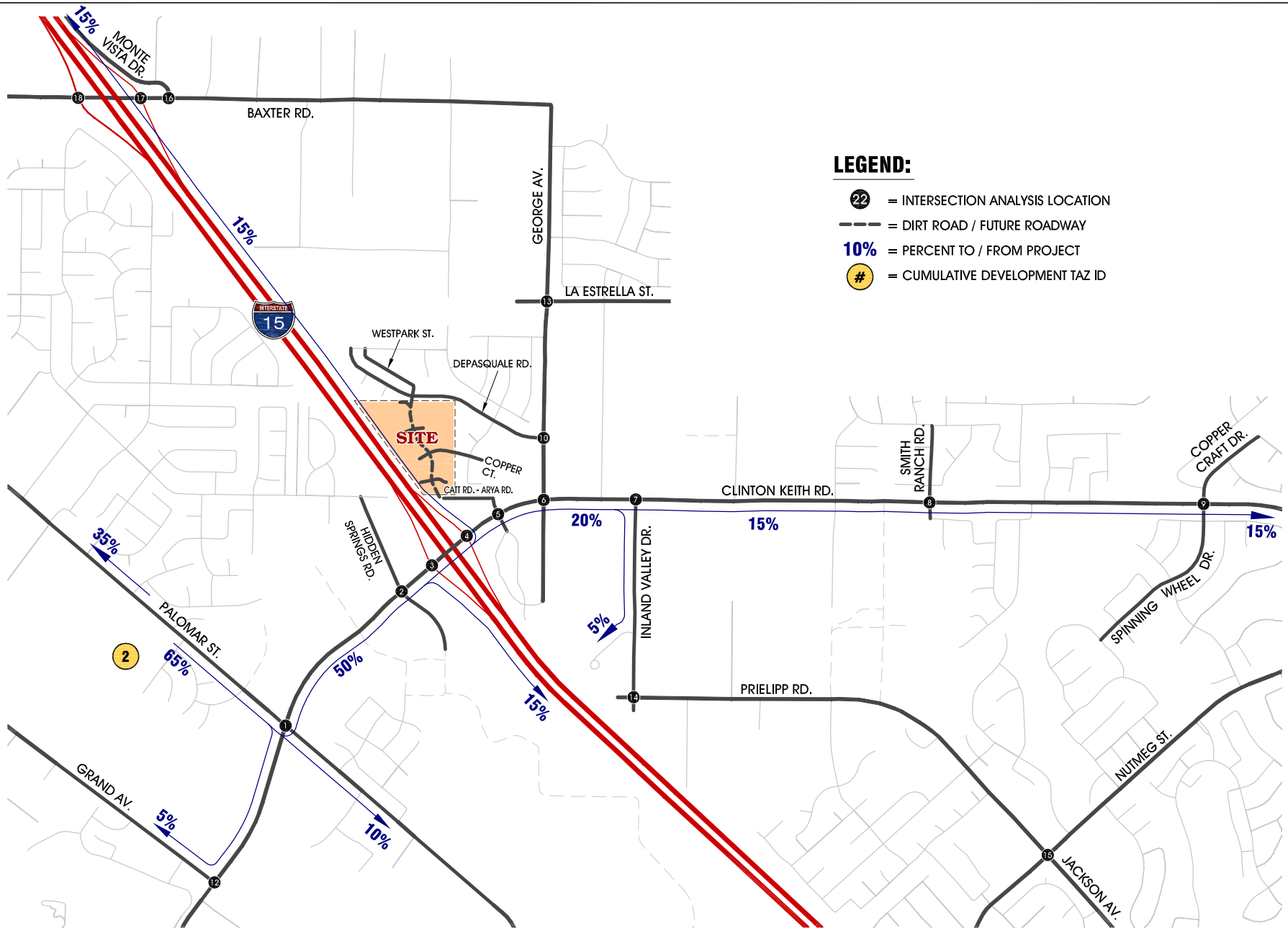
FIGURE 4
TAZ 2 TRIP DISTRIBUTION



Westpark Promenade Traffic Impact Analysis
City of Wildomar, CA (0201-0002:05.dwg)

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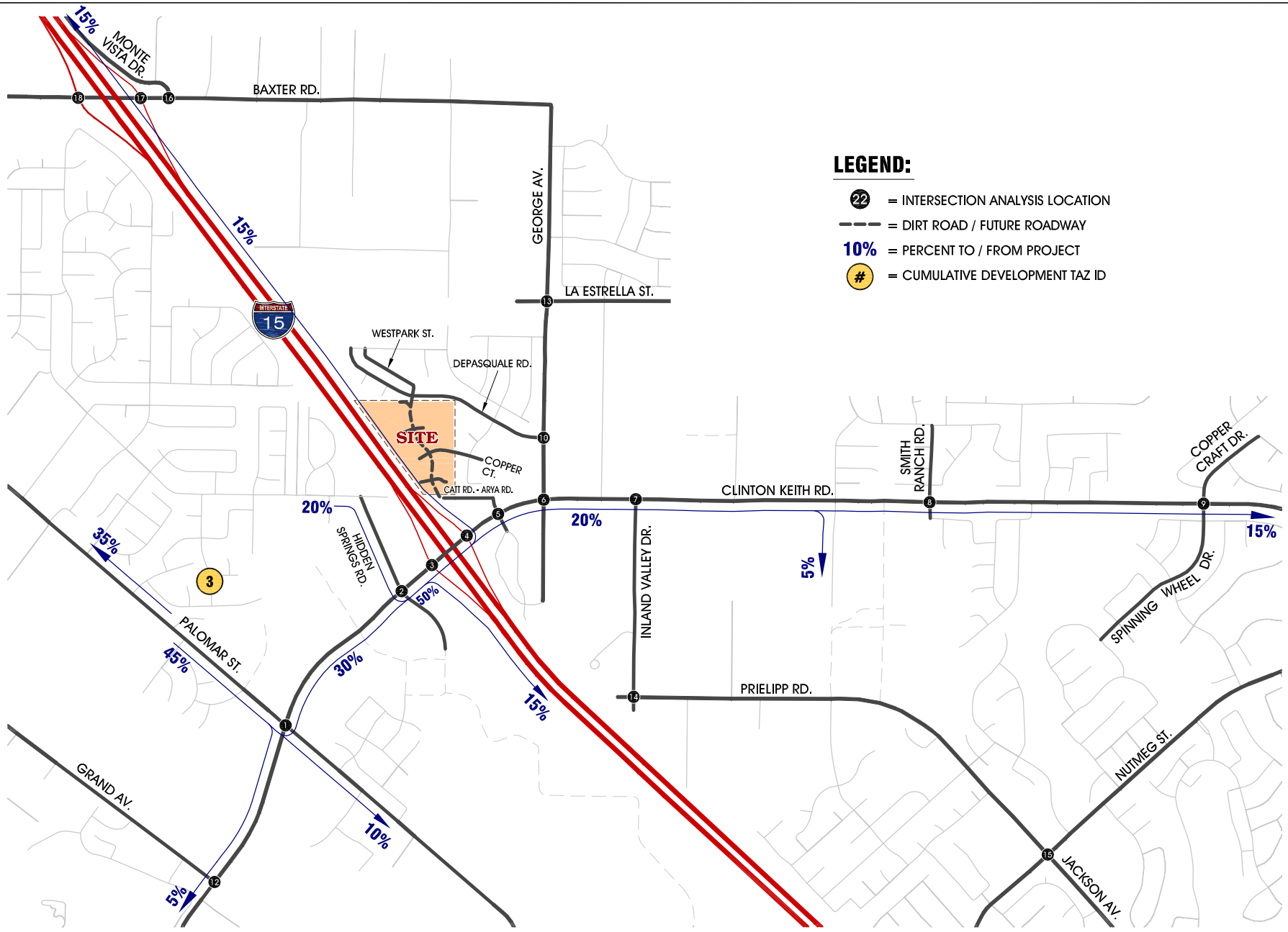
FIGURE 5
TAZ 3 TRIP DISTRIBUTION



Westpark Promenade Traffic Impact Analysis
City of Wildomar, CA (0201-0002:05.dwg)

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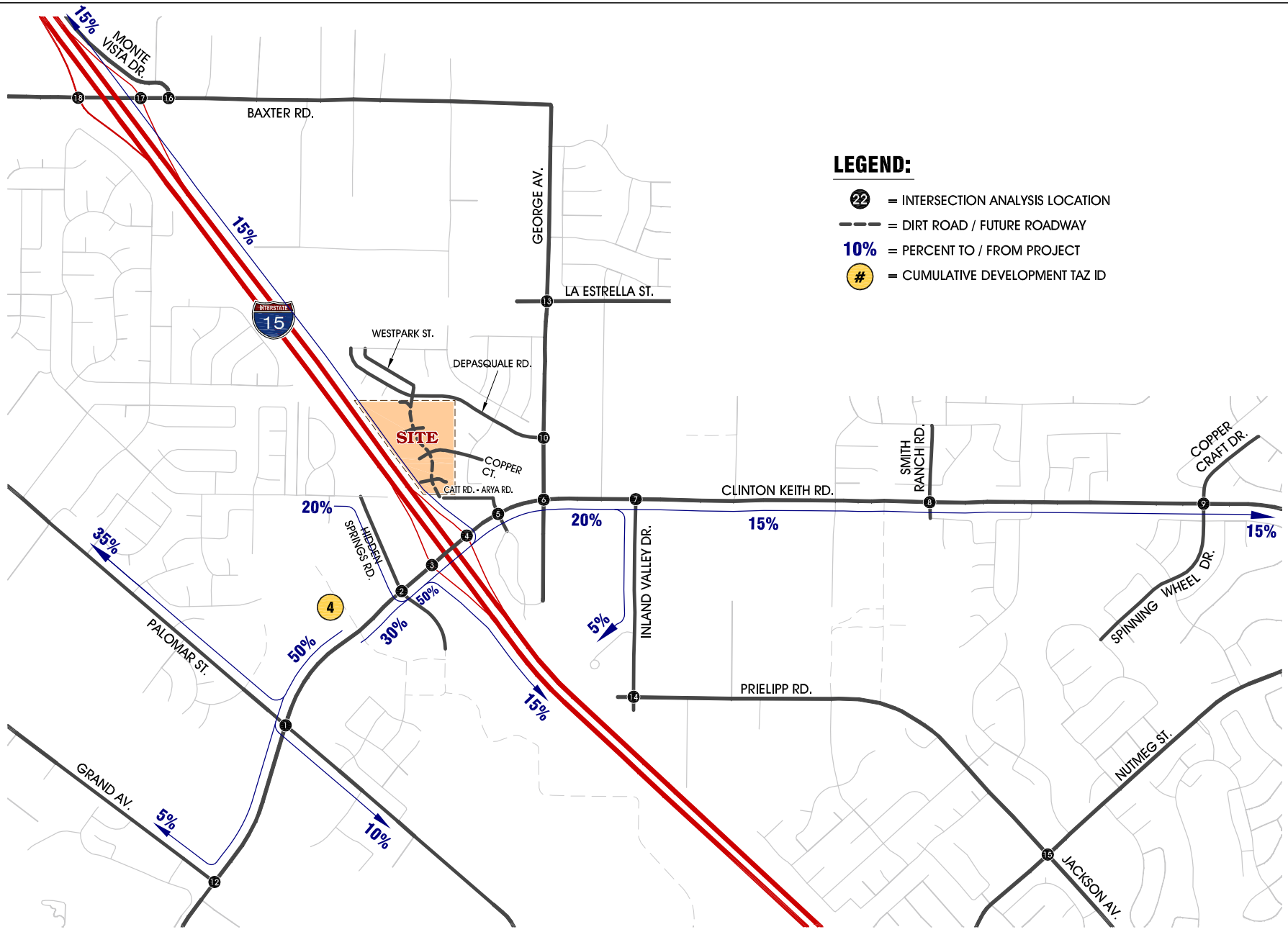
FIGURE 6
TAZ 4 TRIP DISTRIBUTION



Westpark Promenade Traffic Impact Analysis
City of Wildomar, CA (0201-0002:05.dwg)

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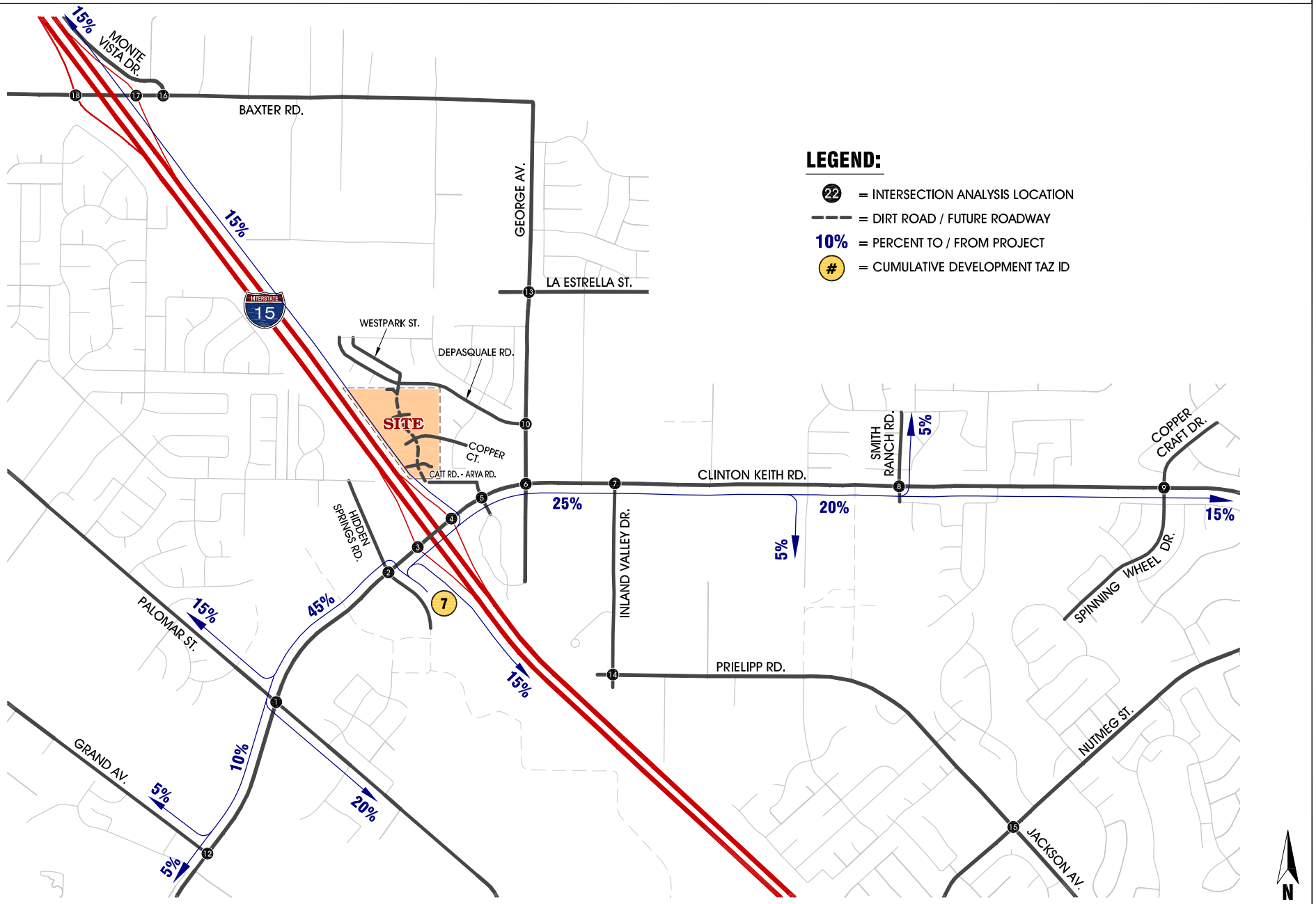
FIGURE 9
TAZ 7 TRIP DISTRIBUTION



Westpark Promenade Traffic Impact Analysis
City of Wildomar, CA (0201-0002:05.dwg)

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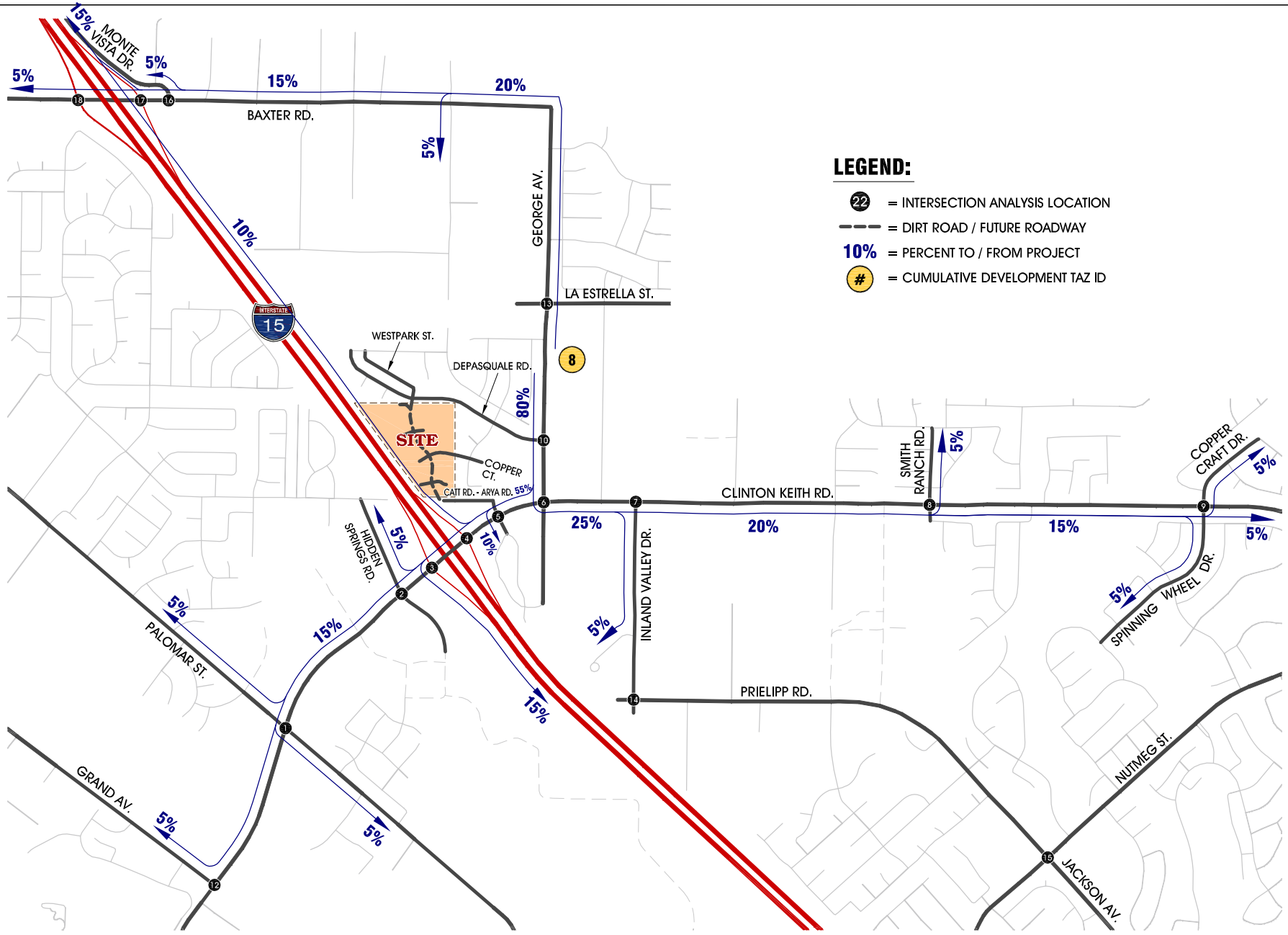
FIGURE 10
TAZ 8 TRIP DISTRIBUTION



Westpark Promenade Traffic Impact Analysis
City of Wildomar, CA (0201-0002:05.dwg)

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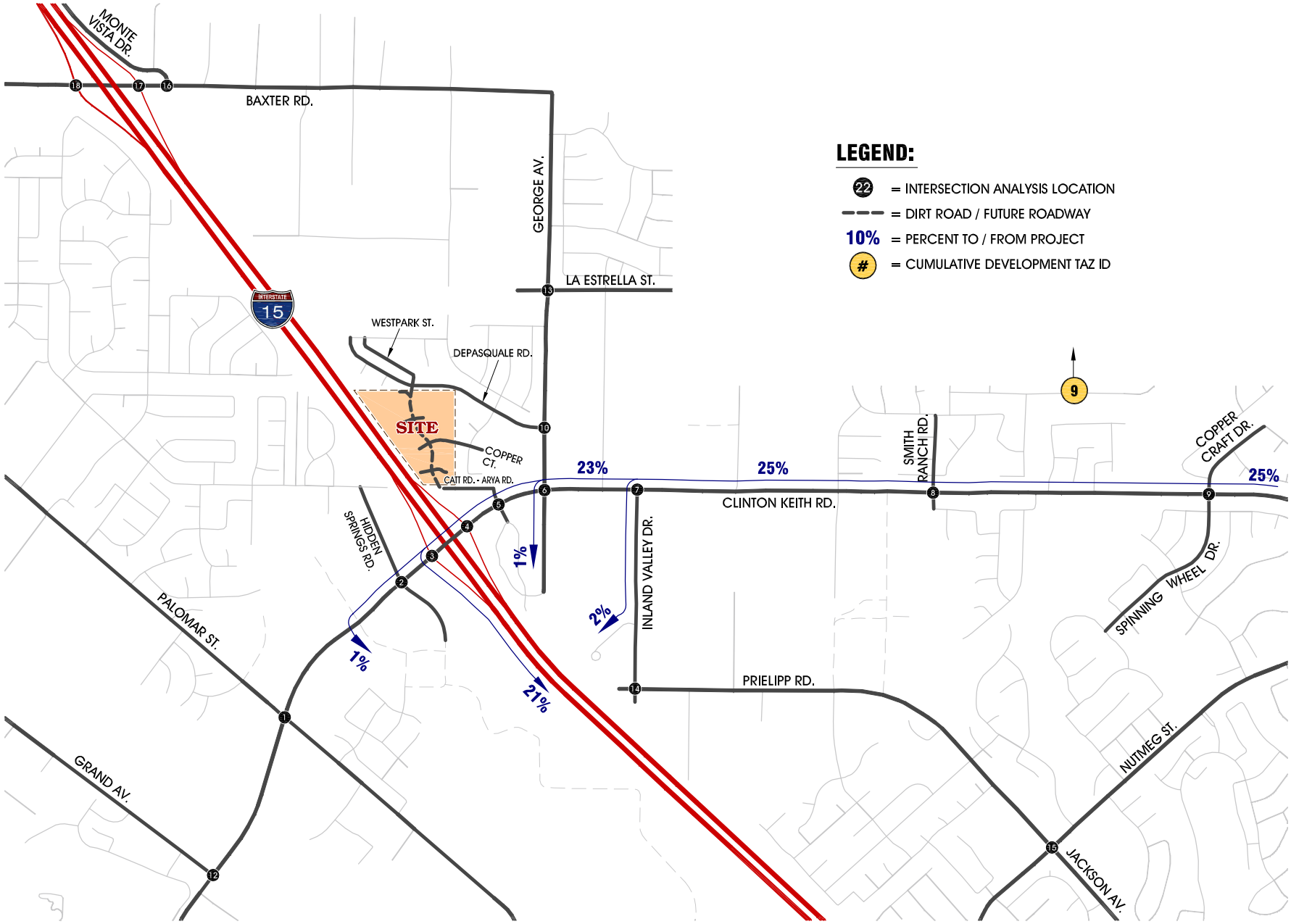
FIGURE 11
TAZ 9 TRIP DISTRIBUTION



Westpark Promenade Traffic Impact Analysis
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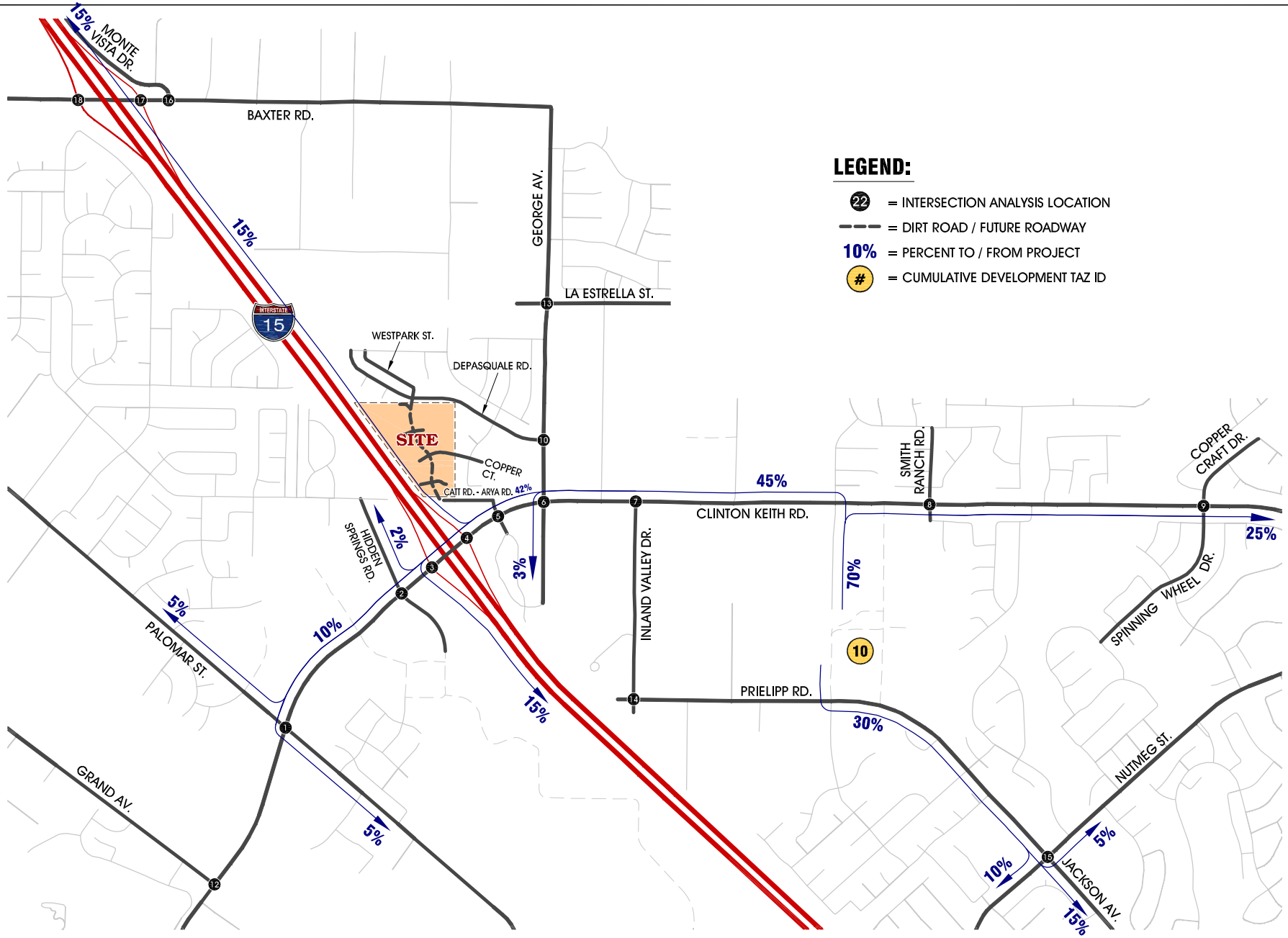
FIGURE 12
TAZ 10 TRIP DISTRIBUTION



Westpark Promenade Traffic Impact Analysis
City of Wildomar, CA (0201-0002:05.dwg)

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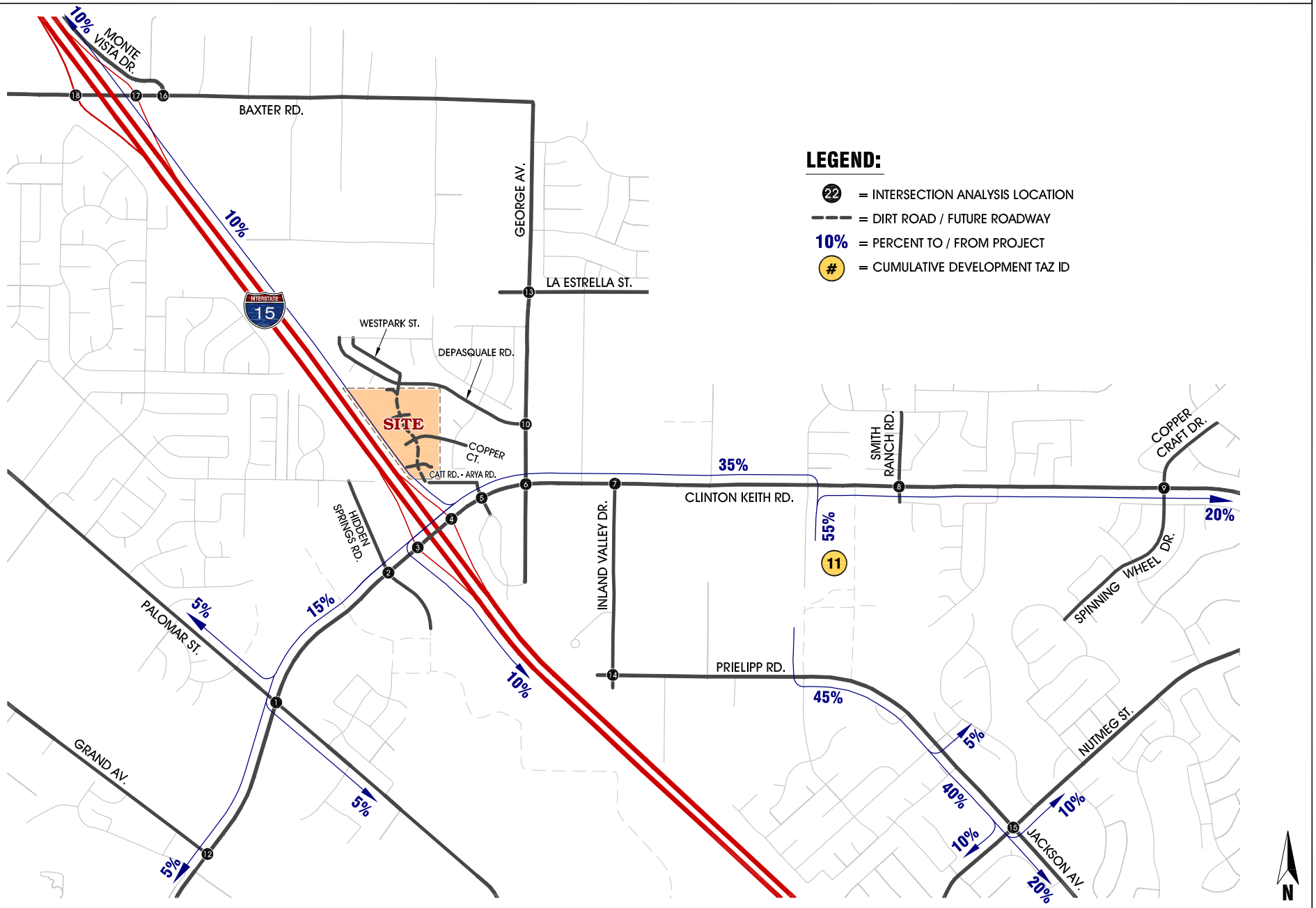
FIGURE 13
TAZ 11 TRIP DISTRIBUTION



Westpark Promenade Traffic Impact Analysis
City of Wildomar, CA (0201-0002:05.dwg)

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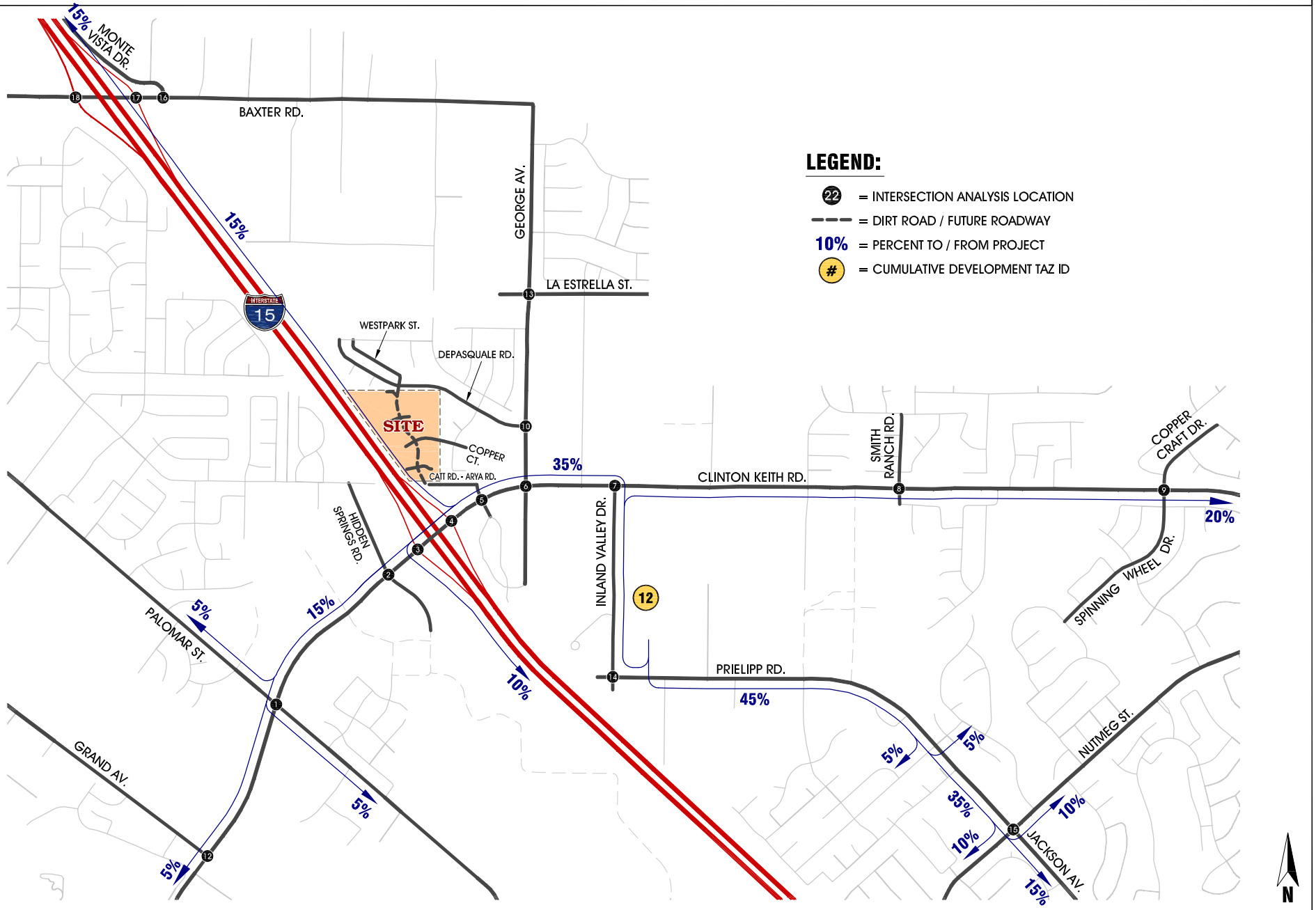
FIGURE 14
TAZ 12 TRIP DISTRIBUTION



Westpark Promenade Traffic Impact Analysis
City of Wildomar, CA (0201-0002:05.dwg)

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APPENDIX H

EXISTING PLUS PROJECT
INTERSECTION ANALYSIS CALCULATION WORKSHEETS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	192	159	20	49	130	256	21	639	66	164	345	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3481		1770	3539	1583	1770	3539	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3481		1770	3539	1583	1770	3539	1583	1770	1863	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	196	162	20	50	133	261	21	652	67	167	352	102
RTOR Reduction (vph)	0	12	0	0	0	210	0	0	50	0	0	60
Lane Group Flow (vph)	196	170	0	50	133	51	21	652	17	167	352	42
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	14.2	26.1		3.6	15.5	15.5	1.6	20.5	20.5	13.8	32.7	32.7
Effective Green, g (s)	14.2	26.1		3.6	15.5	15.5	1.6	20.5	20.5	13.8	32.7	32.7
Actuated g/C Ratio	0.18	0.33		0.05	0.19	0.19	0.02	0.26	0.26	0.17	0.41	0.41
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	314	1135		79	685	306	35	906	405	305	761	647
v/s Ratio Prot	c0.11	0.05		0.03	c0.04		0.01	c0.18		c0.09	0.19	
v/s Ratio Perm						0.03			0.01			0.03
v/c Ratio	0.62	0.15		0.63	0.19	0.17	0.60	0.72	0.04	0.55	0.46	0.06
Uniform Delay, d1	30.4	19.1		37.6	27.0	26.9	38.9	27.1	22.4	30.2	17.2	14.4
Progression Factor	0.90	0.77		0.82	0.29	0.14	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.7	0.3		13.7	0.6	1.0	24.7	4.9	0.2	2.0	2.0	0.2
Delay (s)	31.3	14.9		44.6	8.4	4.9	63.6	32.0	22.6	32.3	19.3	14.6
Level of Service	C	B		D	A	A	E	C	C	C	B	B
Approach Delay (s)		23.4			10.4			32.1			22.0	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	23.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	54.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	62	1096	5	55	645	225	56	12	83	353	31	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1694		1770	1671	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.87		0.64	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1496		1200	1671	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	70	1245	6	62	733	256	64	14	94	401	35	77
RTOR Reduction (vph)	0	0	4	0	0	161	0	54	0	0	46	0
Lane Group Flow (vph)	70	1245	2	62	733	95	0	118	0	401	66	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	6.4	32.8	32.8	3.2	29.6	29.6		32.0		32.0	32.0	
Effective Green, g (s)	6.4	32.8	32.8	3.2	29.6	29.6		32.0		32.0	32.0	
Actuated g/C Ratio	0.08	0.41	0.41	0.04	0.37	0.37		0.40		0.40	0.40	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	141	1450	649	70	1309	585		598		480	668	
v/s Ratio Prot	0.04	c0.35		c0.04	0.21						0.04	
v/s Ratio Perm			0.00			0.06		0.08		c0.33		
v/c Ratio	0.50	0.86	0.00	0.89	0.56	0.16		0.20		0.84	0.10	
Uniform Delay, d1	35.3	21.5	13.9	38.2	20.0	16.9		15.6		21.6	15.0	
Progression Factor	0.92	0.88	1.00	1.14	0.79	0.72		1.00		1.00	1.00	
Incremental Delay, d2	2.7	6.8	0.0	67.9	1.7	0.6		0.7		15.7	0.3	
Delay (s)	35.1	25.6	14.0	111.7	17.6	12.8		16.4		37.3	15.3	
Level of Service	D	C	B	F	B	B		B		D	B	
Approach Delay (s)		26.1			22.0			16.4			32.5	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	25.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	808	724	288	614	0	0	0	0	394	0	311
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.91					0.95	0.95	0.88
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		5085	1583	3433	5085					1681	1681	2787
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		5085	1583	3433	5085					1681	1681	2787
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	898	804	320	682	0	0	0	0	438	0	346
RTOR Reduction (vph)	0	0	341	0	0	0	0	0	0	0	0	272
Lane Group Flow (vph)	0	898	463	320	682	0	0	0	0	219	219	74
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		41.0	41.0	10.0	55.0					17.0	17.0	17.0
Effective Green, g (s)		41.0	41.0	10.0	55.0					17.0	17.0	17.0
Actuated g/C Ratio		0.51	0.51	0.12	0.69					0.21	0.21	0.21
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		2606	811	429	3495					357	357	592
v/s Ratio Prot		0.18		c0.09	0.13							
v/s Ratio Perm			c0.29							c0.13	0.13	0.03
v/c Ratio		0.34	0.57	0.75	0.20					0.61	0.61	0.12
Uniform Delay, d1		11.5	13.4	33.8	4.5					28.5	28.5	25.5
Progression Factor		0.64	2.39	0.51	0.26					1.00	1.00	1.00
Incremental Delay, d2		0.2	1.6	6.6	0.1					7.7	7.7	0.4
Delay (s)		7.6	33.8	24.0	1.3					36.2	36.2	25.9
Level of Service		A	C	C	A					D	D	C
Approach Delay (s)		20.0			8.5			0.0			31.7	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	19.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	74.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	326	876	0	0	674	464	228	0	213	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.91			0.91	1.00	0.95	0.91	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.93	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.98	1.00			
Satd. Flow (prot)	3433	5085			5085	1583	1681	1531	1504			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.98	1.00			
Satd. Flow (perm)	3433	5085			5085	1583	1681	1531	1504			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	354	952	0	0	733	504	248	0	232	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	272	0	53	119	0	0	0
Lane Group Flow (vph)	354	952	0	0	733	232	166	108	34	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	13.2	54.0			36.8	36.8	18.0	18.0	18.0			
Effective Green, g (s)	13.2	54.0			36.8	36.8	18.0	18.0	18.0			
Actuated g/C Ratio	0.16	0.68			0.46	0.46	0.22	0.22	0.22			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	566	3432			2339	728	378	344	338			
v/s Ratio Prot	c0.10	0.19			0.14							
v/s Ratio Perm						c0.15	c0.10	0.07	0.02			
v/c Ratio	0.63	0.28			0.31	0.32	0.44	0.31	0.10			
Uniform Delay, d1	31.1	5.2			13.6	13.7	26.7	25.9	24.6			
Progression Factor	0.65	0.80			0.93	1.56	1.00	1.00	1.00			
Incremental Delay, d2	2.0	0.2			0.3	0.9	3.7	2.4	0.6			
Delay (s)	22.2	4.3			13.0	22.3	30.3	28.2	25.2			
Level of Service	C	A			B	C	C	C	C			
Approach Delay (s)		9.2			16.8			28.0			0.0	
Approach LOS		A			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	15.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	74.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	181	683	216	103	716	212	242	5	44	141	10	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	0.97			1.00	0.85		0.93	
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00		0.98	
Satd. Flow (prot)	1770	4902		1770	4911			1776	1583		1690	
Flt Permitted	0.95	1.00		0.95	1.00			0.48	1.00		0.61	
Satd. Flow (perm)	1770	4902		1770	4911			903	1583		1061	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	191	719	227	108	754	223	255	5	46	148	11	189
RTOR Reduction (vph)	0	61	0	0	60	0	0	0	31	0	60	0
Lane Group Flow (vph)	191	885	0	108	917	0	0	260	15	0	288	0
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	15.0	33.8		7.7	26.5			26.5	26.5		26.5	
Effective Green, g (s)	15.0	33.8		7.7	26.5			26.5	26.5		26.5	
Actuated g/C Ratio	0.19	0.42		0.10	0.33			0.33	0.33		0.33	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	331	2071		170	1626			299	524		351	
v/s Ratio Prot	c0.11	0.18		0.06	c0.19							
v/s Ratio Perm								c0.29	0.01		0.27	
v/c Ratio	0.58	0.43		0.64	0.56			0.87	0.03		0.82	
Uniform Delay, d1	29.6	16.3		34.8	22.0			25.1	18.1		24.6	
Progression Factor	0.74	0.33		0.84	0.48			1.00	1.00		1.00	
Incremental Delay, d2	2.4	0.6		6.8	1.3			22.5	0.0		14.3	
Delay (s)	24.3	6.0		36.1	11.7			47.6	18.1		38.9	
Level of Service	C	A		D	B			D	B		D	
Approach Delay (s)		9.1			14.2			43.2			38.9	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	18.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	181	683	216	103	716	212	242	5	44	141	10	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.97		1.00	0.86		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	4902		1770	4911		1770	1611		1770	1599	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	4902		1770	4911		1770	1611		1770	1599	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	191	719	227	108	754	223	255	5	46	148	11	189
RTOR Reduction (vph)	0	59	0	0	58	0	0	44	0	0	167	0
Lane Group Flow (vph)	191	887	0	108	919	0	255	7	0	148	33	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	15.0	32.7		7.7	25.4		14.2	4.3		19.3	9.4	
Effective Green, g (s)	15.0	32.7		7.7	25.4		14.2	4.3		19.3	9.4	
Actuated g/C Ratio	0.19	0.41		0.10	0.32		0.18	0.05		0.24	0.12	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	331	2003		170	1559		314	86		427	187	
v/s Ratio Prot	c0.11	0.18		0.06	c0.19		c0.14	0.00		c0.08	0.02	
v/s Ratio Perm												
v/c Ratio	0.58	0.44		0.64	0.59		0.81	0.09		0.35	0.18	
Uniform Delay, d1	29.6	17.1		34.8	22.9		31.6	36.0		25.1	31.8	
Progression Factor	0.71	0.63		0.73	0.60		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.4	0.7		6.7	1.4		14.7	0.4		0.5	0.5	
Delay (s)	23.5	11.5		32.2	15.2		46.3	36.4		25.6	32.3	
Level of Service	C	B		C	B		D	D		C	C	
Approach Delay (s)		13.5			16.9			44.7			29.4	
Approach LOS		B			B			D			C	

Intersection Summary			
HCM 2000 Control Delay	20.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	119	845	11	64	833	51	36	20	38	87	37	162
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5075		1770	3539	1583	1770	1681		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.73	1.00		0.72	1.00	1.00
Satd. Flow (perm)	1770	5075		1770	3539	1583	1362	1681		1334	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	129	918	12	70	905	55	39	22	41	95	40	176
RTOR Reduction (vph)	0	1	0	0	0	28	0	32	0	0	0	136
Lane Group Flow (vph)	129	929	0	70	905	27	39	31	0	95	40	40
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases						6	8			4		4
Actuated Green, G (s)	11.2	42.9		7.1	38.8	38.8	18.0	18.0		18.0	18.0	18.0
Effective Green, g (s)	11.2	42.9		7.1	38.8	38.8	18.0	18.0		18.0	18.0	18.0
Actuated g/C Ratio	0.14	0.54		0.09	0.48	0.48	0.22	0.22		0.22	0.22	0.22
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	247	2721		157	1716	767	306	378		300	419	356
v/s Ratio Prot	c0.07	0.18		0.04	c0.26			0.02			0.02	
v/s Ratio Perm						0.02	0.03			c0.07		0.03
v/c Ratio	0.52	0.34		0.45	0.53	0.03	0.13	0.08		0.32	0.10	0.11
Uniform Delay, d1	31.9	10.5		34.6	14.3	10.8	24.7	24.5		25.9	24.6	24.6
Progression Factor	0.56	0.39		0.91	0.93	0.99	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.9	0.3		1.7	1.0	0.1	0.9	0.4		2.8	0.5	0.6
Delay (s)	19.8	4.4		33.3	14.2	10.7	25.6	24.9		28.6	25.0	25.3
Level of Service	B	A		C	B	B	C	C		C	C	C
Approach Delay (s)		6.3			15.3			25.2			26.3	
Approach LOS		A			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	13.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	51.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	0	492	427	109	630	318	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.95	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)		3539	1583	1770	1863	1770	1583
Flt Permitted		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)		3539	1583	1770	1863	1770	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	512	445	114	656	331	39
RTOR Reduction (vph)	0	0	223	0	0	0	30
Lane Group Flow (vph)	0	512	223	114	656	331	9
Turn Type	Prot	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	5	2		1	6	8	
Permitted Phases			2				8
Actuated Green, G (s)		40.0	40.0	8.8	52.8	19.2	19.2
Effective Green, g (s)		40.0	40.0	8.8	52.8	19.2	19.2
Actuated g/C Ratio		0.50	0.50	0.11	0.66	0.24	0.24
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1769	791	194	1229	424	379
v/s Ratio Prot		0.14		0.06	c0.35	c0.19	
v/s Ratio Perm			0.14				0.01
v/c Ratio		0.29	0.28	0.59	0.53	0.78	0.02
Uniform Delay, d1		11.7	11.6	33.9	7.1	28.4	23.2
Progression Factor		0.47	1.06	0.81	0.52	1.00	1.00
Incremental Delay, d2		0.4	0.9	4.4	1.6	9.0	0.0
Delay (s)		5.9	13.2	31.8	5.3	37.5	23.3
Level of Service		A	B	C	A	D	C
Approach Delay (s)		9.3			9.2	36.0	
Approach LOS		A			A	D	

Intersection Summary			
HCM 2000 Control Delay	14.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	482	15	12	606	24	34	0	7	38	0	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0		4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00		1.00	1.00		1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00		0.85	1.00		0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95		1.00
Satd. Flow (prot)	1770	3539	1583	1770	3519		1770		1583	1770		1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95		1.00
Satd. Flow (perm)	1770	3539	1583	1770	3519		1770		1583	1770		1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	34	492	15	12	618	24	35	0	7	39	0	69
RTOR Reduction (vph)	0	0	5	0	2	0	0	0	7	0	0	64
Lane Group Flow (vph)	34	492	10	12	640	0	35	0	0	39	0	5
Turn Type	Prot	NA	Perm	Prot	NA		Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	4.8	52.4	52.4	1.2	48.8		4.2		2.2	8.2		6.2
Effective Green, g (s)	4.8	52.4	52.4	1.2	48.8		4.2		2.2	8.2		6.2
Actuated g/C Ratio	0.06	0.65	0.65	0.01	0.61		0.05		0.03	0.10		0.08
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0		3.0
Lane Grp Cap (vph)	106	2318	1036	26	2146		92		43	181		122
v/s Ratio Prot	c0.02	0.14		0.01	c0.18		c0.02			0.02		
v/s Ratio Perm			0.01						0.00			c0.00
v/c Ratio	0.32	0.21	0.01	0.46	0.30		0.38		0.00	0.22		0.04
Uniform Delay, d1	36.0	5.5	4.8	39.1	7.4		36.6		37.8	32.9		34.2
Progression Factor	1.06	0.12	1.00	0.81	0.70		1.00		1.00	1.00		1.00
Incremental Delay, d2	1.7	0.2	0.0	12.3	0.4		2.6		0.0	0.6		0.1
Delay (s)	40.1	0.9	4.8	43.8	5.6		39.3		37.9	33.5		34.3
Level of Service	D	A	A	D	A		D		D	C		C
Approach Delay (s)		3.4			6.3			39.0			34.0	
Approach LOS		A			A			D			C	

Intersection Summary			
HCM 2000 Control Delay	8.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	39.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	27	504	32	11	545	7	49	0	34	19	5	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00		0.99	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1770	1583		1669	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.73	1.00		0.91	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1360	1583		1529	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	28	514	33	11	556	7	50	0	35	19	5	53
RTOR Reduction (vph)	0	0	8	0	0	2	0	0	32	0	48	0
Lane Group Flow (vph)	28	514	25	11	556	5	0	50	3	0	29	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8		8	4		
Actuated Green, G (s)	5.1	59.4	59.4	1.4	55.7	55.7		7.2	7.2		7.2	
Effective Green, g (s)	5.1	59.4	59.4	1.4	55.7	55.7		7.2	7.2		7.2	
Actuated g/C Ratio	0.06	0.74	0.74	0.02	0.70	0.70		0.09	0.09		0.09	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	112	2627	1175	30	2464	1102		122	142		137	
v/s Ratio Prot	0.02	c0.15		0.01	c0.16							
v/s Ratio Perm			0.02			0.00		c0.04	0.00		0.02	
v/c Ratio	0.25	0.20	0.02	0.37	0.23	0.00		0.41	0.02		0.21	
Uniform Delay, d1	35.6	3.1	2.7	38.9	4.4	3.7		34.4	33.2		33.8	
Progression Factor	0.55	0.19	0.02	1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	1.2	0.2	0.0	7.4	0.2	0.0		2.2	0.1		0.8	
Delay (s)	20.8	0.8	0.1	46.3	4.6	3.7		36.6	33.3		34.5	
Level of Service	C	A	A	D	A	A		D	C		C	
Approach Delay (s)		1.7			5.4			35.2			34.5	
Approach LOS		A			A			D			C	

Intersection Summary			
HCM 2000 Control Delay	7.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.25		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	39.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	42	52	36	154	234	38
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.72	0.72	0.72	0.72	0.72	0.72
Hourly flow rate (vph)	58	72	50	214	325	53
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				816		
pX, platoon unblocked						
vC, conflicting volume	665	351	378			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	665	351	378			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	86	90	96			
cM capacity (veh/h)	407	692	1181			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	131	264	378
Volume Left	58	50	0
Volume Right	72	0	53
cSH	527	1181	1700
Volume to Capacity	0.25	0.04	0.22
Queue Length 95th (ft)	24	3	0
Control Delay (s)	14.1	1.9	0.0
Lane LOS	B	A	
Approach Delay (s)	14.1	1.9	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	40.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	6	0	48	7	6	0	0	45	6	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Hourly flow rate (vph)	0	8	0	62	9	8	0	0	58	8	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	17			8			144	147	8	201	144	13
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	17			8			144	147	8	201	144	13
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			96			100	100	95	99	100	100
cM capacity (veh/h)	1601			1613			802	716	1074	696	719	1068

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	8	78	58	8
Volume Left	0	62	0	8
Volume Right	0	8	58	0
cSH	1601	1613	1074	696
Volume to Capacity	0.00	0.04	0.05	0.01
Queue Length 95th (ft)	0	3	4	1
Control Delay (s)	0.0	5.8	8.5	10.2
Lane LOS		A	A	B
Approach Delay (s)	0.0	5.8	8.5	10.2
Approach LOS			A	B

Intersection Summary			
Average Delay	6.8		
Intersection Capacity Utilization	21.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	48	621	368	95	177	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	3539	3430		1770	1583
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	3539	3430		1770	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	52	668	396	102	190	51
RTOR Reduction (vph)	0	0	19	0	0	42
Lane Group Flow (vph)	52	668	479	0	190	9
Turn Type	Prot	NA	NA		Prot	Perm
Protected Phases	5	2	6		7	
Permitted Phases						4
Actuated Green, G (s)	6.6	58.1	47.5		13.9	13.9
Effective Green, g (s)	6.6	58.1	47.5		13.9	13.9
Actuated g/C Ratio	0.08	0.73	0.59		0.17	0.17
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	146	2570	2036		307	275
v/s Ratio Prot	0.03	c0.19	0.14		c0.11	
v/s Ratio Perm						0.01
v/c Ratio	0.36	0.26	0.24		0.62	0.03
Uniform Delay, d1	34.7	3.7	7.7		30.6	27.5
Progression Factor	1.00	1.00	0.75		1.00	1.00
Incremental Delay, d2	1.5	0.2	0.3		3.7	0.0
Delay (s)	36.2	3.9	6.0		34.3	27.5
Level of Service	D	A	A		C	C
Approach Delay (s)		6.3	6.0		32.9	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	10.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	36.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Westpark Promenade Traffic Impact Analysis (#0201-0002)
E+P Conditions
AM Peak Hour

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Future Volume Alternative)

Intersection #13 George Av. / La Estrella St.

Cycle (sec):	100	Critical Vol./Cap.(X):	0.666
Loss Time (sec):	0	Average Delay (sec/veh):	14.0
Optimal Cycle:	0	Level Of Service:	B

Approach:	North Bound			South Bound			East Bound			West Bound		
Movement:	L -	T -	R	L -	T -	R	L -	T -	R	L -	T -	R
Control:	Stop Sign			Stop Sign			Stop Sign			Stop Sign		
Rights:	Include			Include			Include			Include		
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	1 0	0 1	0	1 0	1 0	1	0 0	1! 0	0	0 0	1! 0	0
Volume Module:												
Base Vol:	24	19	52	11	13	43	47	108	13	39	196	18
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Initial Bse:	24	19	52	11	13	43	47	108	13	39	196	18
Added Vol:	0	21	10	0	17	0	0	0	0	15	0	0
PasserByVol:	0	0	0	0	0	0	0	0	0	0	0	0
Initial Fut:	24	40	62	11	30	43	47	108	13	54	196	18
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHF Adj:	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61
PHF Volume:	39	65	101	18	49	70	77	176	21	88	320	29
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0
Reduced Vol:	39	65	101	18	49	70	77	176	21	88	320	29
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FinalVolume:	39	65	101	18	49	70	77	176	21	88	320	29
Saturation Flow Module:												
Adjustment:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lanes:	1.00	0.39	0.61	1.00	1.00	1.00	0.28	0.64	0.08	0.20	0.73	0.07
Final Sat.:	474	212	328	455	485	537	173	396	48	133	481	44
Capacity Analysis Module:												
Vol/Sat:	0.08	0.31	0.31	0.04	0.10	0.13	0.45	0.45	0.45	0.67	0.67	0.67
Crit Moves:		****				****	****					****
Delay/Veh:	10.3	11.2	11.2	10.1	10.0	9.5	12.6	12.6	12.6	17.6	17.6	17.6
Delay Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AdjDel/Veh:	10.3	11.2	11.2	10.1	10.0	9.5	12.6	12.6	12.6	17.6	17.6	17.6
LOS by Move:	B	B	B	B	B	A	B	B	B	C	C	C
ApproachDel:	11.1			9.8			12.6			17.6		
Delay Adj:	1.00			1.00			1.00			1.00		
ApprAdjDel:	11.1			9.8			12.6			17.6		
LOS by Appr:	B			A			B			C		
AllWayAvgQ:	0.1	0.4	0.4	0.0	0.1	0.1	0.7	0.7	0.7	1.7	1.7	1.7

Note: Queue reported is the number of cars per lane.

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	16	8	0	1	16	284	9	0	0	257	0	42
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	18	9	0	1	18	312	10	0	0	282	0	46

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total (vph)	22	4	10	321	10	282	46
Volume Left (vph)	18	0	1	0	10	282	0
Volume Right (vph)	0	0	0	312	0	0	46
Hadj (s)	0.43	0.03	0.09	-0.65	0.23	0.53	-0.67
Departure Headway (s)	6.3	5.9	5.6	4.9	6.1	5.9	4.7
Degree Utilization, x	0.04	0.01	0.02	0.43	0.02	0.46	0.06
Capacity (veh/h)	528	564	605	708	547	584	719
Control Delay (s)	8.4	7.7	7.5	10.4	9.2	12.7	6.8
Approach Delay (s)	8.2		10.3		9.2	11.9	
Approach LOS	A		B		A	B	

Intersection Summary			
Delay	11.0		
Level of Service	B		
Intersection Capacity Utilization	33.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	16	8	0	1	16	284	9	0	0	257	0	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0		4.0		4.0		4.0
Lane Util. Factor		0.95			1.00	1.00		1.00		1.00		1.00
Frt		1.00			1.00	0.85		1.00		1.00		0.85
Flt Protected		0.97			1.00	1.00		0.95		0.95		1.00
Satd. Flow (prot)		3425			1858	1583		1770		1770		1583
Flt Permitted		0.82			0.99	1.00		0.95		0.95		1.00
Satd. Flow (perm)		2897			1841	1583		1770		1770		1583
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	18	9	0	1	18	312	10	0	0	282	0	46
RTOR Reduction (vph)	0	0	0	0	0	279	0	0	0	0	0	9
Lane Group Flow (vph)	0	27	0	0	19	33	0	10	0	282	0	37
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Prot		Perm
Protected Phases		4			8			2		1		
Permitted Phases	4			8		8	2					6
Actuated Green, G (s)		8.5			8.5	8.5		41.5		18.0		63.5
Effective Green, g (s)		8.5			8.5	8.5		41.5		18.0		63.5
Actuated g/C Ratio		0.11			0.11	0.11		0.52		0.22		0.79
Clearance Time (s)		4.0			4.0	4.0		4.0		4.0		4.0
Vehicle Extension (s)		3.0			3.0	3.0		3.0		3.0		3.0
Lane Grp Cap (vph)		307			195	168		918		398		1256
v/s Ratio Prot										c0.16		
v/s Ratio Perm		0.01			0.01	c0.02		0.01				c0.02
v/c Ratio		0.09			0.10	0.20		0.01		0.71		0.03
Uniform Delay, d1		32.3			32.3	32.6		9.3		28.6		1.7
Progression Factor		1.00			1.00	1.00		1.00		0.72		1.43
Incremental Delay, d2		0.1			0.2	0.6		0.0		5.2		0.0
Delay (s)		32.4			32.5	33.2		9.3		25.7		2.5
Level of Service		C			C	C		A		C		A
Approach Delay (s)		32.4			33.2			9.3			22.5	
Approach LOS		C			C			A			C	

Intersection Summary			
HCM 2000 Control Delay	27.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.23		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	34.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	99	192	46	80	131	94	63	266	117	174	315	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.95		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3436		1770	1863	1583	1770	3377		1770	3415	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3436		1770	1863	1583	1770	3377		1770	3415	
Peak-hour factor, PHF	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Adj. Flow (vph)	129	249	60	104	170	122	82	345	152	226	409	125
RTOR Reduction (vph)	0	32	0	0	0	92	0	75	0	0	42	0
Lane Group Flow (vph)	129	277	0	104	170	30	82	422	0	226	492	0
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	6.0	17.4		4.8	16.2	16.2	5.6	16.9		9.9	21.2	
Effective Green, g (s)	6.0	17.4		4.8	16.2	16.2	5.6	16.9		9.9	21.2	
Actuated g/C Ratio	0.09	0.27		0.07	0.25	0.25	0.09	0.26		0.15	0.33	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	163	919		130	464	394	152	878		269	1113	
v/s Ratio Prot	c0.07	0.08		0.06	c0.09		0.05	c0.12		c0.13	c0.14	
v/s Ratio Perm						0.02						
v/c Ratio	0.79	0.30		0.80	0.37	0.08	0.54	0.48		0.84	0.44	
Uniform Delay, d1	28.9	19.0		29.6	20.2	18.7	28.5	20.3		26.8	17.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	22.5	0.8		28.6	2.2	0.4	3.7	1.9		20.4	1.3	
Delay (s)	51.4	19.8		58.2	22.4	19.1	32.1	22.2		47.2	18.5	
Level of Service	D	B		E	C	B	C	C		D	B	
Approach Delay (s)		29.1			30.8			23.6			27.0	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	27.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	112	175	186	66	125	327
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	123	192	204	73	137	359
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	277				679	241
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	277				679	241
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	90				64	55
cM capacity (veh/h)	1286				377	798

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	315	277	497
Volume Left	123	0	137
Volume Right	0	73	359
cSH	1286	1700	610
Volume to Capacity	0.10	0.16	0.81
Queue Length 95th (ft)	8	0	207
Control Delay (s)	3.7	0.0	31.6
Lane LOS	A		D
Approach Delay (s)	3.7	0.0	31.6
Approach LOS			D

Intersection Summary			
Average Delay	15.5		
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	261	220	0	0	359	154	175	1	67	0	0	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	307	259	0	0	422	181	206	1	79	0	0	0

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2
Volume Total (vph)	307	259	604	207	79
Volume Left (vph)	307	0	0	206	0
Volume Right (vph)	0	0	181	0	79
Hadj (s)	0.53	0.03	-0.15	0.53	-0.67
Departure Headway (s)	6.9	6.4	6.2	7.9	6.7
Degree Utilization, x	0.59	0.46	1.0	0.45	0.15
Capacity (veh/h)	511	553	568	437	522
Control Delay (s)	18.2	13.6	73.2	16.1	9.6
Approach Delay (s)	16.1		73.2	14.3	
Approach LOS	C		F	B	

Intersection Summary			
Delay	39.4		
Level of Service	E		
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	261	220	0	0	359	154	175	1	67	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0			4.0	4.0			
Lane Util. Factor	1.00	1.00			1.00			1.00	1.00			
Frt	1.00	1.00			0.96			1.00	0.85			
Flt Protected	0.95	1.00			1.00			0.95	1.00			
Satd. Flow (prot)	1770	1863			1787			1774	1583			
Flt Permitted	0.95	1.00			1.00			0.95	1.00			
Satd. Flow (perm)	1770	1863			1787			1774	1583			
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	307	259	0	0	422	181	206	1	79	0	0	0
RTOR Reduction (vph)	0	0	0	0	17	0	0	0	52	0	0	0
Lane Group Flow (vph)	307	259	0	0	586	0	0	207	27	0	0	0
Turn Type	Prot	NA			NA		Split	NA	Perm			
Protected Phases	5	2			6		8	8				
Permitted Phases									8			
Actuated Green, G (s)	18.2	61.0			38.8			16.0	16.0			
Effective Green, g (s)	18.2	61.0			38.8			16.0	16.0			
Actuated g/C Ratio	0.21	0.72			0.46			0.19	0.19			
Clearance Time (s)	4.0	4.0			4.0			4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0			
Lane Grp Cap (vph)	378	1336			815			333	297			
v/s Ratio Prot	c0.17	0.14			c0.33			c0.12				
v/s Ratio Perm									0.02			
v/c Ratio	0.81	0.19			0.72			0.62	0.09			
Uniform Delay, d1	31.8	3.9			18.7			31.7	28.5			
Progression Factor	0.70	0.54			1.00			1.00	1.00			
Incremental Delay, d2	11.3	0.3			5.4			8.5	0.6			
Delay (s)	33.4	2.4			24.1			40.2	29.1			
Level of Service	C	A			C			D	C			
Approach Delay (s)		19.2			24.1			37.1			0.0	
Approach LOS		B			C			D			A	

Intersection Summary			
HCM 2000 Control Delay	24.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	394	429	239	295	0	0	0	0	87	2	135
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	0	453	493	275	339	0	0	0	0	100	2	155

Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	946	275	339	102	155
Volume Left (vph)	0	275	0	100	0
Volume Right (vph)	493	0	0	0	155
Hadj (s)	-0.28	0.53	0.03	0.52	-0.67
Departure Headway (s)	5.9	6.7	6.2	7.9	6.7
Degree Utilization, x	1.0	0.51	0.58	0.22	0.29
Capacity (veh/h)	608	530	574	443	520
Control Delay (s)	271.3	15.3	16.3	12.0	11.2
Approach Delay (s)	271.3	15.8		11.5	
Approach LOS	F	C		B	

Intersection Summary			
Delay	148.2		
Level of Service	F		
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	394	429	239	295	0	0	0	0	87	2	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0						4.0	4.0
Lane Util. Factor		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		1863	1583	1770	1863						1776	1583
Flt Permitted		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (perm)		1863	1583	1770	1863						1776	1583
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	0	453	493	275	339	0	0	0	0	100	2	155
RTOR Reduction (vph)	0	0	211	0	0	0	0	0	0	0	0	126
Lane Group Flow (vph)	0	453	282	275	339	0	0	0	0	0	102	29
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2		1	6					4	4	
Permitted Phases			2									4
Actuated Green, G (s)		39.2	39.2	17.8	61.0						16.0	16.0
Effective Green, g (s)		39.2	39.2	17.8	61.0						16.0	16.0
Actuated g/C Ratio		0.46	0.46	0.21	0.72						0.19	0.19
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		859	730	370	1336						334	297
v/s Ratio Prot		c0.24		c0.16	0.18						c0.06	
v/s Ratio Perm			0.18									0.02
v/c Ratio		0.53	0.39	0.74	0.25						0.31	0.10
Uniform Delay, d1		16.3	15.0	31.5	4.1						29.7	28.5
Progression Factor		1.00	1.00	0.89	0.25						1.00	1.00
Incremental Delay, d2		2.3	1.5	5.7	0.3						2.4	0.7
Delay (s)		18.6	16.6	33.8	1.3						32.1	29.2
Level of Service		B	B	C	A						C	C
Approach Delay (s)		17.5			15.9			0.0			30.3	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	18.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	4	10	18	18	10	7	26	241	3	1	199	6
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	11	20	20	11	8	28	262	3	1	216	7
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						2						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1183				
pX, platoon unblocked												
vC, conflicting volume	551	543	220	567	545	264	223			265		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	551	543	220	567	545	264	223			265		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	98	98	95	98	99	98			100		
cM capacity (veh/h)	425	437	820	409	436	775	1346			1299		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	35	38	293	224
Volume Left	4	20	28	1
Volume Right	20	8	3	7
cSH	590	523	1346	1299
Volume to Capacity	0.06	0.07	0.02	0.00
Queue Length 95th (ft)	5	6	2	0
Control Delay (s)	11.5	13.4	0.9	0.0
Lane LOS	B	B	A	A
Approach Delay (s)	11.5	13.4	0.9	0.0
Approach LOS	B	B		

Intersection Summary				
Average Delay		2.0		
Intersection Capacity Utilization		40.6%	ICU Level of Service	A
Analysis Period (min)		15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	6	10	68	0	10	0	99	153	0	0	138	9
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	11	74	0	11	0	108	166	0	0	150	10
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	542	536	155	579	541	166	160			166		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	542	536	155	579	541	166	160			166		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	97	92	100	97	100	92			100		
cM capacity (veh/h)	417	417	891	361	414	878	1419			1412		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	91	11	274	160
Volume Left	7	0	108	0
Volume Right	74	0	0	10
cSH	1101	414	1419	1412
Volume to Capacity	0.08	0.03	0.08	0.00
Queue Length 95th (ft)	7	2	6	0
Control Delay (s)	10.3	13.9	3.4	0.0
Lane LOS	B	B	A	
Approach Delay (s)	10.3	13.9	3.4	0.0
Approach LOS	B	B		

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	37.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	10	82	39	10	7	135	17	7	1	26	30
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	11	89	42	11	8	147	18	8	1	28	33
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	376	366	45	412	379	22	61			26		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	376	366	45	412	379	22	61			26		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	98	91	91	98	99	90			100		
cM capacity (veh/h)	526	508	1025	458	500	1055	1542			1588		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	122	42	18	173	62
Volume Left	22	42	0	147	1
Volume Right	89	0	8	8	33
cSH	1400	458	638	1542	1588
Volume to Capacity	0.09	0.09	0.03	0.10	0.00
Queue Length 95th (ft)	7	8	2	8	0
Control Delay (s)	9.8	13.7	10.8	6.5	0.1
Lane LOS	A	B	B	A	A
Approach Delay (s)	9.8	12.8		6.5	0.1
Approach LOS	A	B			

Intersection Summary			
Average Delay	7.5		
Intersection Capacity Utilization	31.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	10	0	45	48	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	11	0	49	52	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	101	52	52			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	101	52	52			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	100			
cM capacity (veh/h)	897	1015	1554			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	11	49	52
Volume Left	0	0	0
Volume Right	11	0	0
cSH	1015	1700	1700
Volume to Capacity	0.01	0.03	0.03
Queue Length 95th (ft)	1	0	0
Control Delay (s)	8.6	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.6	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	128	157	40	114	229	197	37	416	101	306	515	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3432		1770	3539	1583	1770	3539	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3432		1770	3539	1583	1770	3539	1583	1770	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	135	165	42	120	241	207	39	438	106	322	542	168
RTOR Reduction (vph)	0	22	0	0	0	164	0	0	85	0	0	69
Lane Group Flow (vph)	135	185	0	120	241	43	39	438	21	322	542	99
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	12.8	20.4		14.0	21.6	21.6	3.6	21.0	21.0	33.6	51.0	51.0
Effective Green, g (s)	12.8	20.4		14.0	21.6	21.6	3.6	21.0	21.0	33.6	51.0	51.0
Actuated g/C Ratio	0.12	0.19		0.13	0.21	0.21	0.03	0.20	0.20	0.32	0.49	0.49
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	215	666		236	728	325	60	707	316	566	904	768
v/s Ratio Prot	c0.08	c0.05		c0.07	0.07		0.02	c0.12		0.18	c0.29	
v/s Ratio Perm						0.03			0.01			0.06
v/c Ratio	0.63	0.28		0.51	0.33	0.13	0.65	0.62	0.07	0.57	0.60	0.13
Uniform Delay, d1	43.8	36.0		42.3	35.5	34.0	50.1	38.4	34.1	29.7	19.6	14.8
Progression Factor	0.80	0.78		0.54	0.43	1.23	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.5	1.0		1.3	0.9	0.6	22.4	4.0	0.4	1.3	2.9	0.3
Delay (s)	40.6	29.2		24.0	16.3	42.4	72.5	42.4	34.5	31.0	22.5	15.2
Level of Service	D	C		C	B	D	E	D	C	C	C	B
Approach Delay (s)		33.7			27.4			43.0			24.0	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	30.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	156	772	8	61	903	518	52	11	60	366	13	151
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1704		1770	1605	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.83		0.67	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1449		1255	1605	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	161	796	8	63	931	534	54	11	62	377	13	156
RTOR Reduction (vph)	0	0	5	0	0	342	0	33	0	0	94	0
Lane Group Flow (vph)	161	796	3	63	931	192	0	94	0	377	75	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	13.3	43.8	43.8	7.2	37.7	37.7		42.0		42.0	42.0	
Effective Green, g (s)	13.3	43.8	43.8	7.2	37.7	37.7		42.0		42.0	42.0	
Actuated g/C Ratio	0.13	0.42	0.42	0.07	0.36	0.36		0.40		0.40	0.40	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	224	1476	660	121	1270	568		579		502	642	
v/s Ratio Prot	c0.09	0.22		0.04	c0.26						0.05	
v/s Ratio Perm			0.00			0.12		0.06		c0.30		
v/c Ratio	0.72	0.54	0.01	0.52	0.73	0.34		0.16		0.75	0.12	
Uniform Delay, d1	44.1	23.0	17.9	47.2	29.3	24.5		20.2		27.0	19.8	
Progression Factor	0.77	0.91	1.00	0.86	0.78	0.61		1.00		1.00	1.00	
Incremental Delay, d2	10.3	1.4	0.0	3.8	3.6	1.5		0.6		9.9	0.4	
Delay (s)	44.2	22.3	17.9	44.4	26.5	16.4		20.8		36.9	20.2	
Level of Service	D	C	B	D	C	B		C		D	C	
Approach Delay (s)		25.9			23.7			20.8			31.8	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	25.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	783	415	283	1090	0	0	0	0	470	1	392
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.91					0.95	0.95	0.88
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		5085	1583	3433	5085					1681	1686	2787
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		5085	1583	3433	5085					1681	1686	2787
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	0	791	419	286	1101	0	0	0	0	475	1	396
RTOR Reduction (vph)	0	0	247	0	0	0	0	0	0	0	0	127
Lane Group Flow (vph)	0	791	172	286	1101	0	0	0	0	237	239	269
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		43.0	43.0	18.0	65.0					32.0	32.0	32.0
Effective Green, g (s)		43.0	43.0	18.0	65.0					32.0	32.0	32.0
Actuated g/C Ratio		0.41	0.41	0.17	0.62					0.30	0.30	0.30
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		2082	648	588	3147					512	513	849
v/s Ratio Prot		c0.16		c0.08	0.22							
v/s Ratio Perm			0.11							0.14	0.14	0.10
v/c Ratio		0.38	0.26	0.49	0.35					0.46	0.47	0.32
Uniform Delay, d1		21.7	20.5	39.3	9.7					29.5	29.6	28.1
Progression Factor		0.55	0.46	0.90	0.61					1.00	1.00	1.00
Incremental Delay, d2		0.4	0.8	0.6	0.3					3.0	3.0	1.0
Delay (s)		12.5	10.3	35.9	6.2					32.5	32.6	29.1
Level of Service		B	B	D	A					C	C	C
Approach Delay (s)		11.7			12.3			0.0			31.0	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	16.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	271	982	0	0	847	449	525	0	399	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.91			0.91	1.00	0.95	0.91	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.95	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.97	1.00			
Satd. Flow (prot)	3433	5085			5085	1583	1681	1556	1504			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.97	1.00			
Satd. Flow (perm)	3433	5085			5085	1583	1681	1556	1504			
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	282	1023	0	0	882	468	547	0	416	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	294	0	33	62	0	0	0
Lane Group Flow (vph)	282	1023	0	0	882	174	334	292	242	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	16.0	59.0			39.0	39.0	38.0	38.0	38.0			
Effective Green, g (s)	16.0	59.0			39.0	39.0	38.0	38.0	38.0			
Actuated g/C Ratio	0.15	0.56			0.37	0.37	0.36	0.36	0.36			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	523	2857			1888	587	608	563	544			
v/s Ratio Prot	c0.08	0.20			c0.17							
v/s Ratio Perm						0.11	c0.20	0.19	0.16			
v/c Ratio	0.54	0.36			0.47	0.30	0.55	0.52	0.45			
Uniform Delay, d1	41.1	12.6			25.1	23.3	26.7	26.3	25.5			
Progression Factor	1.03	0.69			0.47	0.27	1.00	1.00	1.00			
Incremental Delay, d2	1.0	0.3			0.2	0.3	3.5	3.4	2.6			
Delay (s)	43.5	9.0			12.0	6.6	30.2	29.7	28.1			
Level of Service	D	A			B	A	C	C	C			
Approach Delay (s)		16.4			10.2			29.4			0.0	
Approach LOS		B			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	17.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	326	788	236	70	738	325	272	15	62	286	10	286
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	
Frt	1.00	0.97		1.00	0.95			1.00	0.85		0.93	
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00		0.98	
Satd. Flow (prot)	1770	4909		1770	4852			1778	1583		1698	
Flt Permitted	0.95	1.00		0.95	1.00			0.44	1.00		0.60	
Satd. Flow (perm)	1770	4909		1770	4852			812	1583		1051	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	347	838	251	74	785	346	289	16	66	304	11	304
RTOR Reduction (vph)	0	50	0	0	77	0	0	0	33	0	33	0
Lane Group Flow (vph)	347	1039	0	74	1054	0	0	305	33	0	586	0
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	19.8	33.8		7.2	21.2			52.0	52.0		52.0	
Effective Green, g (s)	19.8	33.8		7.2	21.2			52.0	52.0		52.0	
Actuated g/C Ratio	0.19	0.32		0.07	0.20			0.50	0.50		0.50	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	333	1580		121	979			402	783		520	
v/s Ratio Prot	c0.20	0.21		0.04	c0.22							
v/s Ratio Perm								0.38	0.02		c0.56	
v/c Ratio	1.04	0.66		0.61	1.08			0.76	0.04		1.13	
Uniform Delay, d1	42.6	30.6		47.5	41.9			21.4	13.7		26.5	
Progression Factor	0.65	0.45		0.72	0.76			1.00	1.00		1.00	
Incremental Delay, d2	59.0	2.0		8.1	50.7			8.0	0.0		79.0	
Delay (s)	86.7	15.8		42.5	82.5			29.4	13.7		105.5	
Level of Service	F	B		D	F			C	B		F	
Approach Delay (s)		33.0			80.1			26.6			105.5	
Approach LOS		C			F			C			F	

Intersection Summary			
HCM 2000 Control Delay	60.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	90.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	326	788	236	70	738	325	272	15	62	286	10	286
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.95		1.00	0.88		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	4909		1770	4852		1770	1638		1770	1593	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	4909		1770	4852		1770	1638		1770	1593	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	347	838	251	74	785	346	289	16	66	304	11	304
RTOR Reduction (vph)	0	44	0	0	68	0	0	62	0	0	272	0
Lane Group Flow (vph)	347	1045	0	74	1063	0	289	20	0	304	43	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	24.1	50.4		7.6	33.9		19.8	6.2		24.8	11.2	
Effective Green, g (s)	24.1	50.4		7.6	33.9		19.8	6.2		24.8	11.2	
Actuated g/C Ratio	0.23	0.48		0.07	0.32		0.19	0.06		0.24	0.11	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	406	2356		128	1566		333	96		418	169	
v/s Ratio Prot	c0.20	0.21		0.04	c0.22		c0.16	0.01		c0.17	0.03	
v/s Ratio Perm												
v/c Ratio	0.85	0.44		0.58	0.68		0.87	0.21		0.73	0.26	
Uniform Delay, d1	38.8	18.0		47.1	30.8		41.3	47.1		37.0	43.1	
Progression Factor	0.74	0.46		0.77	0.59		1.00	1.00		1.00	1.00	
Incremental Delay, d2	15.0	0.6		5.6	2.2		20.5	1.1		6.2	0.8	
Delay (s)	43.9	8.8		42.0	20.4		61.8	48.1		43.2	43.9	
Level of Service	D	A		D	C		E	D		D	D	
Approach Delay (s)		17.3			21.7			58.8			43.5	
Approach LOS		B			C			E			D	

Intersection Summary			
HCM 2000 Control Delay	27.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	86.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	96	1016	9	76	1003	73	55	33	110	52	29	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.88		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5079		1770	3539	1583	1770	1647		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.74	1.00		0.55	1.00	1.00
Satd. Flow (perm)	1770	5079		1770	3539	1583	1375	1647		1029	1863	1583
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	97	1026	9	77	1013	74	56	33	111	53	29	76
RTOR Reduction (vph)	0	1	0	0	0	32	0	90	0	0	0	62
Lane Group Flow (vph)	97	1034	0	77	1013	42	56	54	0	53	29	14
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases						6	8			4		4
Actuated Green, G (s)	12.8	64.3		8.7	60.2	60.2	20.0	20.0		20.0	20.0	20.0
Effective Green, g (s)	12.8	64.3		8.7	60.2	60.2	20.0	20.0		20.0	20.0	20.0
Actuated g/C Ratio	0.12	0.61		0.08	0.57	0.57	0.19	0.19		0.19	0.19	0.19
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	215	3110		146	2029	907	261	313		196	354	301
v/s Ratio Prot	c0.05	0.20		0.04	c0.29			0.03			0.02	
v/s Ratio Perm						0.03	0.04			c0.05		0.01
v/c Ratio	0.45	0.33		0.53	0.50	0.05	0.21	0.17		0.27	0.08	0.05
Uniform Delay, d1	42.8	9.9		46.2	13.4	9.8	35.9	35.6		36.3	35.0	34.7
Progression Factor	0.71	0.40		1.00	0.85	0.79	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.2		2.5	0.6	0.1	1.9	1.2		3.4	0.5	0.3
Delay (s)	31.3	4.2		48.6	12.1	7.9	37.7	36.8		39.6	35.4	35.0
Level of Service	C	A		D	B	A	D	D		D	D	D
Approach Delay (s)		6.5			14.2			37.0			36.6	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	14.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	58.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	0	667	476	59	632	536	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.95	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)		3539	1583	1770	1863	1770	1583
Flt Permitted		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)		3539	1583	1770	1863	1770	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	0	681	486	60	645	547	109
RTOR Reduction (vph)	0	0	260	0	0	0	66
Lane Group Flow (vph)	0	681	226	60	645	547	43
Turn Type	Prot	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	5	2		1	6	8	
Permitted Phases			2				8
Actuated Green, G (s)		48.9	48.9	7.2	60.1	36.9	36.9
Effective Green, g (s)		48.9	48.9	7.2	60.1	36.9	36.9
Actuated g/C Ratio		0.47	0.47	0.07	0.57	0.35	0.35
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1648	737	121	1066	622	556
v/s Ratio Prot		0.19		0.03	c0.35	c0.31	
v/s Ratio Perm			0.14				0.03
v/c Ratio		0.41	0.31	0.50	0.61	0.88	0.08
Uniform Delay, d1		18.6	17.5	47.2	14.7	32.0	22.7
Progression Factor		0.44	0.31	0.71	0.58	1.00	1.00
Incremental Delay, d2		0.7	1.0	3.1	2.5	13.4	0.1
Delay (s)		9.0	6.4	36.7	11.0	45.4	22.8
Level of Service		A	A	D	B	D	C
Approach Delay (s)		7.9			13.2	41.6	
Approach LOS		A			B	D	

Intersection Summary			
HCM 2000 Control Delay	18.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	85	616	20	15	576	38	30	0	3	33	3	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00		1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00		0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3507		1770		1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3507		1770		1583	1770	1863	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	88	635	21	15	594	39	31	0	3	34	3	73
RTOR Reduction (vph)	0	0	6	0	3	0	0	0	3	0	0	70
Lane Group Flow (vph)	88	635	15	15	630	0	31	0	0	34	3	3
Turn Type	Prot	NA	Perm	Prot	NA		Prot		Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	12.3	75.3	75.3	2.4	65.4		6.6		2.2	9.1	4.7	4.7
Effective Green, g (s)	12.3	75.3	75.3	2.4	65.4		6.6		2.2	9.1	4.7	4.7
Actuated g/C Ratio	0.12	0.72	0.72	0.02	0.62		0.06		0.02	0.09	0.04	0.04
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	207	2537	1135	40	2184		111		33	153	83	70
v/s Ratio Prot	c0.05	0.18		0.01	c0.18		0.02			c0.02	0.00	
v/s Ratio Perm			0.01						0.00			c0.00
v/c Ratio	0.43	0.25	0.01	0.38	0.29		0.28		0.00	0.22	0.04	0.05
Uniform Delay, d1	43.1	5.1	4.2	50.6	9.1		46.9		50.3	44.7	48.0	48.0
Progression Factor	0.55	0.29	1.00	0.97	0.50		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.2	0.0	5.7	0.3		1.4		0.0	0.7	0.2	0.3
Delay (s)	25.0	1.7	4.3	55.0	4.8		48.3		50.3	45.4	48.2	48.3
Level of Service	C	A	A	D	A		D		D	D	D	D
Approach Delay (s)		4.5			6.0			48.5			47.4	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	9.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	40.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	58	554	49	17	523	20	45	3	29	17	1	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.99	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1779	1583		1660	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.66	1.00		0.90	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1235	1583		1515	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	61	583	52	18	551	21	47	3	31	18	1	49
RTOR Reduction (vph)	0	0	11	0	0	7	0	0	29	0	45	0
Lane Group Flow (vph)	61	583	41	18	551	14	0	50	2	0	23	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8		8	4		
Actuated Green, G (s)	16.8	81.8	81.8	3.1	68.1	68.1		8.1	8.1		8.1	
Effective Green, g (s)	16.8	81.8	81.8	3.1	68.1	68.1		8.1	8.1		8.1	
Actuated g/C Ratio	0.16	0.78	0.78	0.03	0.65	0.65		0.08	0.08		0.08	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	283	2757	1233	52	2295	1026		95	122		116	
v/s Ratio Prot	0.03	c0.16		0.01	c0.16							
v/s Ratio Perm			0.03			0.01		c0.04	0.00		0.02	
v/c Ratio	0.22	0.21	0.03	0.35	0.24	0.01		0.53	0.02		0.20	
Uniform Delay, d1	38.4	3.1	2.6	50.0	7.7	6.5		46.6	44.8		45.4	
Progression Factor	0.73	1.04	1.20	1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	0.4	0.2	0.0	4.0	0.2	0.0		5.2	0.1		0.8	
Delay (s)	28.4	3.4	3.2	53.9	7.9	6.6		51.8	44.8		46.2	
Level of Service	C	A	A	D	A	A		D	D		D	
Approach Delay (s)		5.6			9.3			49.1			46.2	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	11.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.27		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	39.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	58	31	51	151	125	72
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	68	36	60	178	147	85
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				816		
pX, platoon unblocked						
vC, conflicting volume	487	189	232			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	487	189	232			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	87	96	96			
cM capacity (veh/h)	515	852	1336			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	105	238	232
Volume Left	68	60	0
Volume Right	36	0	85
cSH	598	1336	1700
Volume to Capacity	0.18	0.04	0.14
Queue Length 95th (ft)	16	4	0
Control Delay (s)	12.3	2.3	0.0
Lane LOS	B	A	
Approach Delay (s)	12.3	2.3	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	36.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	4	0	100	7	7	0	0	87	4	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Hourly flow rate (vph)	0	6	0	145	10	10	0	0	126	6	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	20			6			311	316	6	437	311	15
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	20			6			311	316	6	437	311	15
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			91			100	100	88	99	100	100
cM capacity (veh/h)	1596			1615			598	546	1077	436	550	1064

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	6	165	126	6
Volume Left	0	145	0	6
Volume Right	0	10	126	0
cSH	1596	1615	1077	436
Volume to Capacity	0.00	0.09	0.12	0.01
Queue Length 95th (ft)	0	7	10	1
Control Delay (s)	0.0	6.6	8.8	13.4
Lane LOS		A	A	B
Approach Delay (s)	0.0	6.6	8.8	13.4
Approach LOS			A	B

Intersection Summary			
Average Delay	7.5		
Intersection Capacity Utilization	25.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	50	504	548	170	201	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.96		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	3539	3414		1770	1583
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	3539	3414		1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	531	577	179	212	51
RTOR Reduction (vph)	0	0	20	0	0	42
Lane Group Flow (vph)	53	531	736	0	212	9
Turn Type	Prot	NA	NA		Prot	Perm
Protected Phases	5	2	6		7	
Permitted Phases						4
Actuated Green, G (s)	10.4	79.1	64.7		17.9	17.9
Effective Green, g (s)	10.4	79.1	64.7		17.9	17.9
Actuated g/C Ratio	0.10	0.75	0.62		0.17	0.17
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	175	2666	2103		301	269
v/s Ratio Prot	c0.03	0.15	c0.22		c0.12	
v/s Ratio Perm						0.01
v/c Ratio	0.30	0.20	0.35		0.70	0.03
Uniform Delay, d1	43.9	3.8	9.9		41.1	36.3
Progression Factor	1.00	1.00	0.59		1.00	1.00
Incremental Delay, d2	1.0	0.2	0.5		7.3	0.0
Delay (s)	44.9	3.9	6.3		48.3	36.4
Level of Service	D	A	A		D	D
Approach Delay (s)		7.6	6.3		46.0	
Approach LOS		A	A		D	

Intersection Summary			
HCM 2000 Control Delay	13.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Westpark Promenade Traffic Impact Analysis (#0201-0002)
E+P Conditions
PM Peak Hour

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Future Volume Alternative)

Intersection #13 George Av. / La Estrella St.

Cycle (sec):	100	Critical Vol./Cap.(X):	0.212
Loss Time (sec):	0	Average Delay (sec/veh):	8.3
Optimal Cycle:	0	Level Of Service:	A

Approach:	North Bound			South Bound			East Bound			West Bound		
Movement:	L	T	R	L	T	R	L	T	R	L	T	R
Control:	Stop Sign			Stop Sign			Stop Sign			Stop Sign		
Rights:	Include			Include			Include			Include		
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	1 0 0 1 0			1 0 1 0 1			0 0 0 1 0			0 1 0 0 0		
Volume Module:												
Base Vol:	20	0	22	1	0	0	0	100	27	33	97	0
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Initial Bse:	20	0	22	1	0	0	0	100	27	33	97	0
Added Vol:	0	32	27	0	39	0	0	0	0	29	0	0
PasserByVol:	0	0	0	0	0	0	0	0	0	0	0	0
Initial Fut:	20	32	49	1	39	0	0	100	27	62	97	0
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHF Adj:	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
PHF Volume:	21	33	51	1	41	0	0	104	28	64	101	0
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0
Reduced Vol:	21	33	51	1	41	0	0	104	28	64	101	0
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FinalVolume:	21	33	51	1	41	0	0	104	28	64	101	0
Saturation Flow Module:												
Adjustment:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lanes:	1.00	0.40	0.60	1.00	1.00	1.00	0.00	0.79	0.21	0.39	0.61	0.00
Final Sat.:	605	283	434	595	649	743	0	635	172	305	476	0
Capacity Analysis Module:												
Vol/Sat:	0.03	0.12	0.12	0.00	0.06	0.00	xxxx	0.16	0.16	0.21	0.21	xxxx
Crit Moves:		****			****				****	****		
Delay/Veh:	8.6	8.1	8.1	8.5	8.3	0.0	0.0	8.1	8.1	8.6	8.6	0.0
Delay Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AdjDel/Veh:	8.6	8.1	8.1	8.5	8.3	0.0	0.0	8.1	8.1	8.6	8.6	0.0
LOS by Move:	A	A	A	A	A	*	*	A	A	A	A	*
ApproachDel:	8.2			8.3			8.1			8.6		
Delay Adj:	1.00			1.00			1.00			1.00		
ApprAdjDel:	8.2			8.3			8.1			8.6		
LOS by Appr:	A			A			A			A		
AllWayAvgQ:	0.0	0.1	0.1	0.0	0.1	0.0	0.2	0.2	0.2	0.3	0.3	0.3

Note: Queue reported is the number of cars per lane.

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	26	11	0	2	4	462	0	0	0	436	0	7
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	31	13	0	2	5	544	0	0	0	513	0	8

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total (vph)	37	6	5	546	0	513	8
Volume Left (vph)	31	0	2	0	0	513	0
Volume Right (vph)	0	0	0	544	0	0	8
Hadj (s)	0.45	0.03	0.28	-0.66	0.00	0.53	-0.67
Departure Headway (s)	7.9	7.5	6.8	5.8	7.4	6.7	5.6
Degree Utilization, x	0.08	0.01	0.01	0.88	0.00	0.96	0.01
Capacity (veh/h)	444	468	523	602	469	530	618
Control Delay (s)	10.4	9.4	8.6	35.9	10.4	54.5	7.4
Approach Delay (s)	10.3		35.7		0.0	53.7	
Approach LOS	B		E		A	F	

Intersection Summary			
Delay	43.1		
Level of Service	E		
Intersection Capacity Utilization	52.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	26	11	0	2	4	462	0	0	0	436	0	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0				4.0		4.0
Lane Util. Factor		0.95			1.00	1.00				1.00		1.00
Frt		1.00			1.00	0.85				1.00		0.85
Flt Protected		0.97			0.99	1.00				0.95		1.00
Satd. Flow (prot)		3419			1837	1583				1770		1583
Flt Permitted		0.80			0.95	1.00				0.95		1.00
Satd. Flow (perm)		2833			1761	1583				1770		1583
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	31	13	0	2	5	544	0	0	0	513	0	8
RTOR Reduction (vph)	0	0	0	0	0	485	0	0	0	0	0	1
Lane Group Flow (vph)	0	44	0	0	7	59	0	0	0	513	0	7
Turn Type	Perm	NA		Perm	NA	Perm				Prot		Perm
Protected Phases		4			8			2		1		
Permitted Phases	4			8		8	2					6
Actuated Green, G (s)		11.4			11.4	11.4				36.4		85.6
Effective Green, g (s)		11.4			11.4	11.4				36.4		85.6
Actuated g/C Ratio		0.11			0.11	0.11				0.35		0.82
Clearance Time (s)		4.0			4.0	4.0				4.0		4.0
Vehicle Extension (s)		3.0			3.0	3.0				3.0		3.0
Lane Grp Cap (vph)		307			191	171				613		1290
v/s Ratio Prot										c0.29		
v/s Ratio Perm		0.02			0.00	c0.04						c0.00
v/c Ratio		0.14			0.04	0.35				0.84		0.01
Uniform Delay, d1		42.4			41.9	43.3				31.6		1.8
Progression Factor		1.00			1.00	1.00				0.74		0.14
Incremental Delay, d2		0.2			0.1	1.2				8.7		0.0
Delay (s)		42.6			42.0	44.6				32.1		0.3
Level of Service		D			D	D				C		A
Approach Delay (s)		42.6			44.5			0.0			31.6	
Approach LOS		D			D			A			C	

Intersection Summary			
HCM 2000 Control Delay	38.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	38.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	128	231	78	125	237	214	86	218	76	138	211	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.96		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3405		1770	1863	1583	1770	3402		1770	3387	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3405		1770	1863	1583	1770	3402		1770	3387	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	136	246	83	133	252	228	91	232	81	147	224	90
RTOR Reduction (vph)	0	50	0	0	0	169	0	51	0	0	63	0
Lane Group Flow (vph)	136	279	0	133	252	59	91	262	0	147	251	0
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	6.4	16.8		6.4	16.8	16.8	6.4	18.6		7.2	19.4	
Effective Green, g (s)	6.4	16.8		6.4	16.8	16.8	6.4	18.6		7.2	19.4	
Actuated g/C Ratio	0.10	0.26		0.10	0.26	0.26	0.10	0.29		0.11	0.30	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	174	880		174	481	409	174	973		196	1010	
v/s Ratio Prot	c0.08	0.08		0.08	c0.14		c0.05	0.08		c0.08	c0.07	
v/s Ratio Perm						0.04						
v/c Ratio	0.78	0.32		0.76	0.52	0.14	0.52	0.27		0.75	0.25	
Uniform Delay, d1	28.6	19.5		28.6	20.7	18.6	27.8	17.9		28.0	17.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	20.0	0.9		17.9	4.0	0.7	2.8	0.7		14.8	0.6	
Delay (s)	48.7	20.4		46.5	24.7	19.3	30.7	18.6		42.9	17.9	
Level of Service	D	C		D	C	B	C	B		D	B	
Approach Delay (s)		28.7			27.4			21.3			25.8	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	26.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	49.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	78	149	97	29	34	105
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	84	160	104	31	37	113
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	135				448	120
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	135				448	120
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				93	88
cM capacity (veh/h)	1449				536	932

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	244	135	149
Volume Left	84	0	37
Volume Right	0	31	113
cSH	1449	1700	789
Volume to Capacity	0.06	0.08	0.19
Queue Length 95th (ft)	5	0	17
Control Delay (s)	2.9	0.0	10.6
Lane LOS	A		B
Approach Delay (s)	2.9	0.0	10.6
Approach LOS			B

Intersection Summary			
Average Delay	4.4		
Intersection Capacity Utilization	37.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	148	177	0	0	139	63	385	4	50	0	0	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	156	186	0	0	146	66	405	4	53	0	0	0

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2
Volume Total (vph)	156	186	213	409	53
Volume Left (vph)	156	0	0	405	0
Volume Right (vph)	0	0	66	0	53
Hadj (s)	0.53	0.03	-0.15	0.53	-0.67
Departure Headway (s)	7.0	6.5	6.5	6.7	5.5
Degree Utilization, x	0.30	0.34	0.38	0.76	0.08
Capacity (veh/h)	489	527	526	525	630
Control Delay (s)	11.8	11.5	13.4	26.6	7.8
Approach Delay (s)	11.7		13.4	24.5	
Approach LOS	B		B	C	

Intersection Summary			
Delay	17.9		
Level of Service	C		
Intersection Capacity Utilization	50.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	148	177	0	0	139	63	385	4	50	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0			4.0	4.0			
Lane Util. Factor	1.00	1.00			1.00			1.00	1.00			
Frt	1.00	1.00			0.96			1.00	0.85			
Flt Protected	0.95	1.00			1.00			0.95	1.00			
Satd. Flow (prot)	1770	1863			1784			1775	1583			
Flt Permitted	0.95	1.00			1.00			0.95	1.00			
Satd. Flow (perm)	1770	1863			1784			1775	1583			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	156	186	0	0	146	66	405	4	53	0	0	0
RTOR Reduction (vph)	0	0	0	0	23	0	0	0	33	0	0	0
Lane Group Flow (vph)	156	186	0	0	189	0	0	409	20	0	0	0
Turn Type	Prot	NA			NA		Split	NA	Perm			
Protected Phases	5	2			6		8	8				
Permitted Phases									8			
Actuated Green, G (s)	8.8	33.0			20.2			24.0	24.0			
Effective Green, g (s)	8.8	33.0			20.2			24.0	24.0			
Actuated g/C Ratio	0.14	0.51			0.31			0.37	0.37			
Clearance Time (s)	4.0	4.0			4.0			4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0			
Lane Grp Cap (vph)	239	945			554			655	584			
v/s Ratio Prot	c0.09	0.10			c0.11			c0.23				
v/s Ratio Perm									0.01			
v/c Ratio	0.65	0.20			0.34			0.62	0.03			
Uniform Delay, d1	26.7	8.8			17.3			16.8	13.1			
Progression Factor	0.69	0.44			1.00			1.00	1.00			
Incremental Delay, d2	6.1	0.5			1.7			4.5	0.1			
Delay (s)	24.4	4.3			18.9			21.3	13.2			
Level of Service	C	A			B			C	B			
Approach Delay (s)		13.5			18.9			20.3			0.0	
Approach LOS		B			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	17.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	50.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	267	314	50	474	0	0	0	0	58	2	171
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	275	324	52	489	0	0	0	0	60	2	176

Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	599	52	489	62	176
Volume Left (vph)	0	52	0	60	0
Volume Right (vph)	324	0	0	0	176
Hadj (s)	-0.29	0.53	0.03	0.52	-0.67
Departure Headway (s)	5.9	6.7	6.2	8.0	6.8
Degree Utilization, x	0.98	0.10	0.84	0.14	0.33
Capacity (veh/h)	609	531	573	439	515
Control Delay (s)	54.6	9.2	32.3	11.1	12.0
Approach Delay (s)	54.6	30.1		11.7	
Approach LOS	F	D		B	

Intersection Summary			
Delay	37.6		
Level of Service	E		
Intersection Capacity Utilization	50.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	267	314	50	474	0	0	0	0	58	2	171
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0						4.0	4.0
Lane Util. Factor		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		1863	1583	1770	1863						1777	1583
Flt Permitted		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (perm)		1863	1583	1770	1863						1777	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	275	324	52	489	0	0	0	0	60	2	176
RTOR Reduction (vph)	0	0	178	0	0	0	0	0	0	0	0	125
Lane Group Flow (vph)	0	275	146	52	489	0	0	0	0	0	62	51
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2		1	6					4	4	
Permitted Phases			2									4
Actuated Green, G (s)		29.3	29.3	4.7	38.0						19.0	19.0
Effective Green, g (s)		29.3	29.3	4.7	38.0						19.0	19.0
Actuated g/C Ratio		0.45	0.45	0.07	0.58						0.29	0.29
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		839	713	127	1089						519	462
v/s Ratio Prot		0.15		0.03	c0.26						c0.03	
v/s Ratio Perm			0.09									0.03
v/c Ratio		0.33	0.20	0.41	0.45						0.12	0.11
Uniform Delay, d1		11.5	10.8	28.8	7.6						16.9	16.8
Progression Factor		1.00	1.00	1.29	0.21						1.00	1.00
Incremental Delay, d2		1.0	0.6	1.8	1.1						0.5	0.5
Delay (s)		12.5	11.5	39.1	2.8						17.3	17.3
Level of Service		B	B	D	A						B	B
Approach Delay (s)		12.0			6.3			0.0			17.3	
Approach LOS		B			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	10.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	50.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	11	10	47	8	10	3	50	491	17	7	440	12
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	12	11	51	9	11	3	54	534	18	8	478	13
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						2						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1183				
pX, platoon unblocked												
vC, conflicting volume	1159	1161	485	1208	1158	543	491			552		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1159	1161	485	1208	1158	543	491			552		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	94	91	93	94	99	95			99		
cM capacity (veh/h)	157	184	582	133	185	540	1072			1018		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	74	23	607	499
Volume Left	12	9	54	8
Volume Right	51	3	18	13
cSH	331	189	1072	1018
Volume to Capacity	0.22	0.12	0.05	0.01
Queue Length 95th (ft)	21	10	4	1
Control Delay (s)	19.0	27.6	1.3	0.2
Lane LOS	C	D	A	A
Approach Delay (s)	19.0	27.6	1.3	0.2
Approach LOS	C	D		

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	73.7%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	16	10	181	0	10	0	195	310	0	0	277	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	11	197	0	11	0	212	337	0	0	301	18
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1077	1071	310	1175	1080	337	320			337		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1077	1071	310	1175	1080	337	320			337		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	94	73	100	94	100	83			100		
cM capacity (veh/h)	163	183	730	102	181	705	1240			1222		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	225	11	549	320
Volume Left	17	0	212	0
Volume Right	197	0	0	18
cSH	835	181	1240	1222
Volume to Capacity	0.27	0.06	0.17	0.00
Queue Length 95th (ft)	27	5	15	0
Control Delay (s)	14.1	26.2	4.4	0.0
Lane LOS	B	D	A	
Approach Delay (s)	14.1	26.2	4.4	0.0
Approach LOS	B	D		

Intersection Summary			
Average Delay	5.3		
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	54	10	214	18	10	3	260	30	37	7	62	58
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	59	11	233	20	11	3	283	33	40	8	67	63
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	741	752	99	854	764	53	130			73		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	741	752	99	854	764	53	130			73		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	78	96	76	89	96	100	81			100		
cM capacity (veh/h)	272	272	957	174	268	1015	1455			1527		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	302	20	14	355	138
Volume Left	59	20	0	283	8
Volume Right	233	0	3	40	63
cSH	1182	174	323	1455	1527
Volume to Capacity	0.26	0.11	0.04	0.19	0.00
Queue Length 95th (ft)	26	9	3	18	0
Control Delay (s)	12.9	28.4	16.7	6.8	0.4
Lane LOS	B	D	C	A	A
Approach Delay (s)	12.9	23.5		6.8	0.4
Approach LOS	B	C			

Intersection Summary			
Average Delay	8.6		
Intersection Capacity Utilization	41.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	27	0	87	100	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	29	0	95	109	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	203	109	109			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	203	109	109			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	97	100			
cM capacity (veh/h)	785	945	1482			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	29	95	109
Volume Left	0	0	0
Volume Right	29	0	0
cSH	945	1700	1700
Volume to Capacity	0.03	0.06	0.06
Queue Length 95th (ft)	2	0	0
Control Delay (s)	8.9	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.9	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	15.3%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX I

EXISTING PLUS PROJECT
FREEWAY RAMP ANALYSIS WORKSHEETS

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	Existing + Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	4421
Ramp Volume, V_R	705
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4421	0.92	Level	9	0	0.957	1.00	5022
Ramp	705	0.92	Level	2	0	0.990	1.00	774
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 2686 pc/h

V_3 or V_{av34} 2336 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2869 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5022	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4248	Exhibit 13-8	7050	No
V_R	774	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2686	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 20.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.498 (Exhibit 13-12)

S_R= 53.6 mph (Exhibit 13-12)

S_0= 66.8 mph (Exhibit 13-12)

S = 58.5 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	Existing + Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D	V_D = veh/h
	Freeway Volume, V_F: 3716	
	Ramp Volume, V_R: 1012	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3716	0.92	Level	9	0	0.957	1.00	4221
Ramp	1012	0.92	Level	2	0	0.990	1.00	1111
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2343 pc/h

V_3 or V_{av34} 1878 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 2412 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5332	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3523	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 26.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.390 (Exibit 13-11)

S_R= 56.0 mph (Exhibit 13-11)

S_0= 60.3 mph (Exhibit 13-11)

S = 57.4 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	Existing + Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	3376
Ramp Volume, V_R	441
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3376	0.92	Level	9	0	0.957	1.00	3835
Ramp	441	0.92	Level	2	0	0.990	1.00	484
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 1992 pc/h
V_3 or V_{av34} 1843 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2191 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3835	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	3351	Exhibit 13-8	7050	No
V_R	484	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1992	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 15.0 (pc/mi/ln)
LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.472 (Exhibit 13-12)
S_R= 54.2 mph (Exhibit 13-12)
S_0= 68.8 mph (Exhibit 13-12)
S = 59.6 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	Existing + Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2935	
	Ramp Volume, V_R: 790	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2935	0.92	Level	9	0	0.957	1.00	3334
Ramp	790	0.92	Level	2	0	0.990	1.00	867
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 1850 pc/h

V_3 or V_{av34} 1484 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 1905 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4201	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2772	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 21.1 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.320 (Exibit 13-11)

S_R= 57.6 mph (Exhibit 13-11)

S_0= 61.7 mph (Exhibit 13-11)

S = 58.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	Existing + Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	4044
Ramp Volume, V_R	863
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4044	0.92	Level	9	0	0.957	1.00	4593
Ramp	863	0.92	Level	2	0	0.990	1.00	947
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 2588 pc/h

V_3 or V_{av34} 2005 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2624 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4593	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	3646	Exhibit 13-8	7050	No
V_R	947	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2588	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 18.7 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.513 (Exhibit 13-12)

S_R= 53.2 mph (Exhibit 13-12)

S_0= 67.5 mph (Exhibit 13-12)

S = 58.5 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	Existing + Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3181	
	Ramp Volume, V_R: 699	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3181	0.92	Level	9	0	0.957	1.00	3613
Ramp	699	0.92	Level	2	0	0.990	1.00	767
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2005 pc/h

V_3 or V_{av34} 1608 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 2064 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4380	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2831	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 21.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.324 (Exibit 13-11)

S_R= 57.5 mph (Exhibit 13-11)

S_0= 61.2 mph (Exhibit 13-11)

S = 58.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	Existing + Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	5074
Ramp Volume, V_R	924
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5074	0.92	Level	9	0	0.957	1.00	5763
Ramp	924	0.92	Level	2	0	0.990	1.00	1014
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 3151 pc/h
V_3 or V_{av34} 2612 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 3293 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5763	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4749	Exhibit 13-8	7050	No
V_R	1014	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3151	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 24.5 (pc/mi/ln)
LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.519 (Exhibit 13-12)
S_R= 53.1 mph (Exhibit 13-12)
S_0= 65.6 mph (Exhibit 13-12)
S = 57.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	Existing + Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 4150	
	Ramp Volume, V_R: 720	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4150	0.92	Level	9	0	0.957	1.00	4714
Ramp	720	0.92	Level	2	0	0.990	1.00	790
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2616 pc/h

V_3 or V_{av34} 2098 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 2693 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5504	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3483	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 26.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.385 (Exibit 13-11)

S_R= 56.1 mph (Exhibit 13-11)

S_0= 59.5 mph (Exhibit 13-11)

S = 57.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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APPENDIX J

EXISTING PLUS PROJECT
BASIC FREEWAY SEGMENT ANALYSIS WORKSHEETS

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*Existing + Project Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4421*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1674*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*67.4*	mph	S	mph
D = v_p / S	*24.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*Existing + Project Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4728*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1790*	pc/h/ln
S	*66.0*	mph
D = v_p / S	*27.1*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*Existing + Project Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3376*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1278*	pc/h/ln
S	*69.9*	mph
D = v_p / S	*18.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*Existing + Project Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3725*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1410*	pc/h/ln
S	*69.5*	mph
D = v_p / S	*20.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing + Project Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4404*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1667*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*67.5*	mph	S	mph
D = v_p / S	*24.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing + Project Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3880*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1469*	pc/h/ln
S	*69.2*	mph
D = v_p / S	*21.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing + Project Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5074*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1921*	pc/h/ln
S	*64.0*	mph
D = v_p / S	*30.0*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing + Project Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4870*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1844*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*65.2*	mph	S	mph
D = v_p / S	*28.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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APPENDIX K

EXISTING PLUS AMBIENT PLUS PROJECT
INTERSECTION ANALYSIS CALCULATION WORKSHEETS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	204	167	21	51	136	271	22	677	69	173	366	106
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3481		1770	3539	1583	1770	3539	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3481		1770	3539	1583	1770	3539	1583	1770	1863	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	208	170	21	52	139	277	22	691	70	177	373	108
RTOR Reduction (vph)	0	12	0	0	0	226	0	0	51	0	0	63
Lane Group Flow (vph)	208	179	0	52	139	51	22	691	19	177	373	45
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	14.4	25.6		3.6	14.8	14.8	1.6	21.2	21.2	13.6	33.2	33.2
Effective Green, g (s)	14.4	25.6		3.6	14.8	14.8	1.6	21.2	21.2	13.6	33.2	33.2
Actuated g/C Ratio	0.18	0.32		0.05	0.19	0.19	0.02	0.26	0.26	0.17	0.42	0.42
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	318	1113		79	654	292	35	937	419	300	773	656
v/s Ratio Prot	c0.12	0.05		0.03	c0.04		0.01	c0.20		c0.10	0.20	
v/s Ratio Perm						0.03			0.01			0.03
v/c Ratio	0.65	0.16		0.66	0.21	0.18	0.63	0.74	0.04	0.59	0.48	0.07
Uniform Delay, d1	30.5	19.5		37.6	27.7	27.5	38.9	26.9	21.9	30.6	17.1	14.1
Progression Factor	0.90	0.77		0.83	0.27	0.24	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.6	0.3		15.9	0.6	1.1	30.3	5.2	0.2	3.0	2.2	0.2
Delay (s)	32.0	15.2		47.3	8.1	7.7	69.3	32.0	22.1	33.6	19.3	14.3
Level of Service	C	B		D	A	A	E	C	C	C	B	B
Approach Delay (s)		24.0			12.2			32.2			22.3	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	23.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	56.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	66	1158	5	58	681	237	59	13	88	372	33	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1693		1770	1672	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.86		0.63	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1489		1177	1672	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	75	1316	6	66	774	269	67	15	100	423	38	82
RTOR Reduction (vph)	0	0	3	0	0	169	0	55	0	0	50	0
Lane Group Flow (vph)	75	1316	3	66	774	100	0	127	0	423	70	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	7.2	33.8	33.8	3.2	29.8	29.8		31.0		31.0	31.0	
Effective Green, g (s)	7.2	33.8	33.8	3.2	29.8	29.8		31.0		31.0	31.0	
Actuated g/C Ratio	0.09	0.42	0.42	0.04	0.37	0.37		0.39		0.39	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	159	1495	668	70	1318	589		576		456	647	
v/s Ratio Prot	0.04	c0.37		c0.04	0.22						0.04	
v/s Ratio Perm			0.00			0.06		0.09		c0.36		
v/c Ratio	0.47	0.88	0.00	0.94	0.59	0.17		0.22		0.93	0.11	
Uniform Delay, d1	34.6	21.2	13.4	38.3	20.2	16.8		16.4		23.4	15.7	
Progression Factor	0.91	0.87	1.00	0.99	0.88	1.10		1.00		1.00	1.00	
Incremental Delay, d2	2.2	7.7	0.0	86.1	1.9	0.6		0.9		27.5	0.3	
Delay (s)	33.8	26.1	13.4	124.2	19.6	19.1		17.3		50.9	16.0	
Level of Service	C	C	B	F	B	B		B		D	B	
Approach Delay (s)		26.5			25.7			17.3			43.2	
Approach LOS		C			C			B			D	

Intersection Summary			
HCM 2000 Control Delay	28.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	851	767	304	646	0	0	0	0	417	0	330
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.91					0.95	0.95	0.88
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		5085	1583	3433	5085					1681	1681	2787
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		5085	1583	3433	5085					1681	1681	2787
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	946	852	338	718	0	0	0	0	463	0	367
RTOR Reduction (vph)	0	0	339	0	0	0	0	0	0	0	0	289
Lane Group Flow (vph)	0	946	513	338	718	0	0	0	0	231	232	78
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		40.0	40.0	11.0	55.0					17.0	17.0	17.0
Effective Green, g (s)		40.0	40.0	11.0	55.0					17.0	17.0	17.0
Actuated g/C Ratio		0.50	0.50	0.14	0.69					0.21	0.21	0.21
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		2542	791	472	3495					357	357	592
v/s Ratio Prot		0.19		c0.10	0.14							
v/s Ratio Perm			c0.32							0.14	0.14	0.03
v/c Ratio		0.37	0.65	0.72	0.21					0.65	0.65	0.13
Uniform Delay, d1		12.3	14.8	33.0	4.5					28.8	28.8	25.5
Progression Factor		0.61	1.44	0.56	0.43					1.00	1.00	1.00
Incremental Delay, d2		0.2	2.1	4.9	0.1					8.8	8.9	0.5
Delay (s)		7.7	23.4	23.5	2.1					37.5	37.6	26.0
Level of Service		A	C	C	A					D	D	C
Approach Delay (s)		15.1			8.9			0.0			32.5	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	17.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	346	922	0	0	709	491	242	0	225	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.91			0.91	1.00	0.95	0.91	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.93	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.98	1.00			
Satd. Flow (prot)	3433	5085			5085	1583	1681	1532	1504			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.98	1.00			
Satd. Flow (perm)	3433	5085			5085	1583	1681	1532	1504			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	376	1002	0	0	771	534	263	0	245	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	291	0	53	120	0	0	0
Lane Group Flow (vph)	376	1002	0	0	771	243	176	117	42	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	13.6	54.0			36.4	36.4	18.0	18.0	18.0			
Effective Green, g (s)	13.6	54.0			36.4	36.4	18.0	18.0	18.0			
Actuated g/C Ratio	0.17	0.68			0.45	0.45	0.22	0.22	0.22			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	583	3432			2313	720	378	344	338			
v/s Ratio Prot	c0.11	0.20			0.15							
v/s Ratio Perm						c0.15	c0.10	0.08	0.03			
v/c Ratio	0.64	0.29			0.33	0.34	0.47	0.34	0.12			
Uniform Delay, d1	30.9	5.3			14.0	14.0	26.8	26.0	24.7			
Progression Factor	0.68	0.79			0.75	1.04	1.00	1.00	1.00			
Incremental Delay, d2	2.2	0.2			0.3	1.0	4.1	2.7	0.8			
Delay (s)	23.3	4.3			10.8	15.6	30.9	28.7	25.5			
Level of Service	C	A			B	B	C	C	C			
Approach Delay (s)		9.5			12.8			28.4			0.0	
Approach LOS		A			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	13.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	184	724	229	109	759	216	257	5	47	143	10	184
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	0.97			1.00	0.85		0.93	
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00		0.98	
Satd. Flow (prot)	1770	4902		1770	4917			1776	1583		1690	
Flt Permitted	0.95	1.00		0.95	1.00			0.48	1.00		0.60	
Satd. Flow (perm)	1770	4902		1770	4917			898	1583		1036	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	194	762	241	115	799	227	271	5	49	151	11	194
RTOR Reduction (vph)	0	63	0	0	59	0	0	0	32	0	58	0
Lane Group Flow (vph)	194	940	0	115	967	0	0	276	17	0	298	0
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	14.8	32.4		8.3	25.9			27.3	27.3		27.3	
Effective Green, g (s)	14.8	32.4		8.3	25.9			27.3	27.3		27.3	
Actuated g/C Ratio	0.19	0.40		0.10	0.32			0.34	0.34		0.34	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	327	1985		183	1591			306	540		353	
v/s Ratio Prot	c0.11	0.19		0.06	c0.20							
v/s Ratio Perm								c0.31	0.01		0.29	
v/c Ratio	0.59	0.47		0.63	0.61			0.90	0.03		0.84	
Uniform Delay, d1	29.8	17.5		34.4	22.8			25.1	17.5		24.4	
Progression Factor	0.77	0.36		0.79	0.44			1.00	1.00		1.00	
Incremental Delay, d2	2.8	0.8		5.6	1.5			27.9	0.0		16.6	
Delay (s)	25.8	7.2		32.9	11.4			52.9	17.6		41.0	
Level of Service	C	A		C	B			D	B		D	
Approach Delay (s)		10.2			13.6			47.6			41.0	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	19.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	184	724	229	109	759	216	257	5	47	143	10	184
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.97		1.00	0.86		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	4902		1770	4917		1770	1609		1770	1598	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	4902		1770	4917		1770	1609		1770	1598	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	194	762	241	115	799	227	271	5	49	151	11	194
RTOR Reduction (vph)	0	59	0	0	56	0	0	46	0	0	171	0
Lane Group Flow (vph)	194	944	0	115	970	0	271	8	0	151	34	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	14.9	31.6		8.3	25.0		14.7	4.3		19.8	9.4	
Effective Green, g (s)	14.9	31.6		8.3	25.0		14.7	4.3		19.8	9.4	
Actuated g/C Ratio	0.19	0.40		0.10	0.31		0.18	0.05		0.25	0.12	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	329	1936		183	1536		325	86		438	187	
v/s Ratio Prot	c0.11	c0.19		0.06	c0.20		c0.15	0.00		c0.09	0.02	
v/s Ratio Perm												
v/c Ratio	0.59	0.49		0.63	0.63		0.83	0.09		0.34	0.18	
Uniform Delay, d1	29.8	18.1		34.4	23.6		31.5	36.0		24.8	31.8	
Progression Factor	0.72	0.64		0.75	0.56		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.6	0.9		5.6	1.7		16.6	0.4		0.5	0.5	
Delay (s)	24.1	12.4		31.3	14.9		48.0	36.4		25.2	32.3	
Level of Service	C	B		C	B		D	D		C	C	
Approach Delay (s)		14.3			16.6			46.1			29.3	
Approach LOS		B			B			D			C	

Intersection Summary			
HCM 2000 Control Delay	20.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	69.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	126	889	12	68	875	54	38	21	40	92	39	172
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5075		1770	3539	1583	1770	1681		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.73	1.00		0.71	1.00	1.00
Satd. Flow (perm)	1770	5075		1770	3539	1583	1359	1681		1330	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	137	966	13	74	951	59	41	23	43	100	42	187
RTOR Reduction (vph)	0	1	0	0	0	33	0	33	0	0	0	145
Lane Group Flow (vph)	137	978	0	74	951	26	41	33	0	100	42	42
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases						6	8			4		4
Actuated Green, G (s)	14.8	43.2		6.8	35.2	35.2	18.0	18.0		18.0	18.0	18.0
Effective Green, g (s)	14.8	43.2		6.8	35.2	35.2	18.0	18.0		18.0	18.0	18.0
Actuated g/C Ratio	0.19	0.54		0.08	0.44	0.44	0.22	0.22		0.22	0.22	0.22
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	327	2740		150	1557	696	305	378		299	419	356
v/s Ratio Prot	c0.08	0.19		0.04	c0.27			0.02			0.02	
v/s Ratio Perm						0.02	0.03			c0.08		0.03
v/c Ratio	0.42	0.36		0.49	0.61	0.04	0.13	0.09		0.33	0.10	0.12
Uniform Delay, d1	28.8	10.5		35.0	17.2	12.8	24.8	24.5		26.0	24.6	24.7
Progression Factor	0.58	0.35		0.93	0.94	0.87	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.8	0.3		2.1	1.5	0.1	0.9	0.5		3.0	0.5	0.7
Delay (s)	17.5	4.0		34.6	17.6	11.2	25.7	25.0		29.0	25.1	25.4
Level of Service	B	A		C	B	B	C	C		C	C	C
Approach Delay (s)		5.6			18.4			25.2			26.4	
Approach LOS		A			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	14.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	52.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	0	518	449	116	664	333	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.95	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)		3539	1583	1770	1863	1770	1583
Flt Permitted		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)		3539	1583	1770	1863	1770	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	540	468	121	692	347	41
RTOR Reduction (vph)	0	0	242	0	0	0	31
Lane Group Flow (vph)	0	540	226	121	692	347	10
Turn Type	Prot	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	5	2		1	6	8	
Permitted Phases			2				8
Actuated Green, G (s)		38.7	38.7	9.6	52.3	19.7	19.7
Effective Green, g (s)		38.7	38.7	9.6	52.3	19.7	19.7
Actuated g/C Ratio		0.48	0.48	0.12	0.65	0.25	0.25
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1711	765	212	1217	435	389
v/s Ratio Prot		0.15		0.07	c0.37	c0.20	
v/s Ratio Perm			0.14				0.01
v/c Ratio		0.32	0.30	0.57	0.57	0.80	0.03
Uniform Delay, d1		12.6	12.4	33.3	7.6	28.3	22.9
Progression Factor		0.49	1.33	0.81	0.51	1.00	1.00
Incremental Delay, d2		0.5	0.9	3.6	1.9	9.8	0.0
Delay (s)		6.6	17.5	30.6	5.8	38.1	22.9
Level of Service		A	B	C	A	D	C
Approach Delay (s)		11.7			9.5	36.5	
Approach LOS		B			A	D	

Intersection Summary			
HCM 2000 Control Delay	15.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	34	508	16	13	640	25	36	0	7	40	0	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0		4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00		1.00	1.00		1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00		0.85	1.00		0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95		1.00
Satd. Flow (prot)	1770	3539	1583	1770	3519		1770		1583	1770		1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95		1.00
Satd. Flow (perm)	1770	3539	1583	1770	3519		1770		1583	1770		1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	35	518	16	13	653	26	37	0	7	41	0	72
RTOR Reduction (vph)	0	0	5	0	2	0	0	0	7	0	0	67
Lane Group Flow (vph)	35	518	11	13	677	0	37	0	0	41	0	5
Turn Type	Prot	NA	Perm	Prot	NA		Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	4.8	52.6	52.6	0.8	48.6		4.6		2.2	8.4		6.0
Effective Green, g (s)	4.8	52.6	52.6	0.8	48.6		4.6		2.2	8.4		6.0
Actuated g/C Ratio	0.06	0.66	0.66	0.01	0.61		0.06		0.03	0.11		0.08
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0		3.0
Lane Grp Cap (vph)	106	2326	1040	17	2137		101		43	185		118
v/s Ratio Prot	c0.02	0.15		0.01	c0.19		c0.02			0.02		
v/s Ratio Perm			0.01						0.00			c0.00
v/c Ratio	0.33	0.22	0.01	0.76	0.32		0.37		0.00	0.22		0.05
Uniform Delay, d1	36.1	5.5	4.7	39.5	7.6		36.3		37.8	32.8		34.3
Progression Factor	1.06	0.11	1.00	0.83	0.69		1.00		1.00	1.00		1.00
Incremental Delay, d2	1.8	0.2	0.0	106.0	0.4		2.2		0.0	0.6		0.2
Delay (s)	40.0	0.8	4.7	138.9	5.7		38.5		37.9	33.4		34.5
Level of Service	D	A	A	F	A		D		D	C		C
Approach Delay (s)		3.4			8.2			38.4			34.1	
Approach LOS		A			A			D			C	

Intersection Summary			
HCM 2000 Control Delay	9.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	40.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	28	533	33	12	577	7	51	0	36	20	5	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00		0.99	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1770	1583		1669	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.71	1.00		0.90	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1332	1583		1527	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	29	544	34	12	589	7	52	0	37	20	5	55
RTOR Reduction (vph)	0	0	9	0	0	2	0	0	34	0	50	0
Lane Group Flow (vph)	29	544	25	12	589	5	0	52	3	0	30	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8		8	4		
Actuated Green, G (s)	4.8	59.1	59.1	1.5	55.8	55.8		7.4	7.4		7.4	
Effective Green, g (s)	4.8	59.1	59.1	1.5	55.8	55.8		7.4	7.4		7.4	
Actuated g/C Ratio	0.06	0.74	0.74	0.02	0.70	0.70		0.09	0.09		0.09	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	106	2614	1169	33	2468	1104		123	146		141	
v/s Ratio Prot	0.02	c0.15		0.01	c0.17							
v/s Ratio Perm			0.02			0.00		c0.04	0.00		0.02	
v/c Ratio	0.27	0.21	0.02	0.36	0.24	0.00		0.42	0.02		0.21	
Uniform Delay, d1	35.9	3.2	2.8	38.8	4.4	3.7		34.3	33.0		33.6	
Progression Factor	0.53	0.19	0.00	1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	1.4	0.2	0.0	6.7	0.2	0.0		2.3	0.1		0.8	
Delay (s)	20.3	0.8	0.0	45.5	4.6	3.7		36.6	33.1		34.4	
Level of Service	C	A	A	D	A	A		D	C		C	
Approach Delay (s)		1.7			5.4			35.1			34.4	
Approach LOS		A			A			D			C	

Intersection Summary			
HCM 2000 Control Delay	7.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	40.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	43	55	38	163	248	38
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.72	0.72	0.72	0.72	0.72	0.72
Hourly flow rate (vph)	60	76	53	226	344	53
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				816		
pX, platoon unblocked						
vC, conflicting volume	703	371	397			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	703	371	397			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	85	89	95			
cM capacity (veh/h)	386	675	1161			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	136	279	397
Volume Left	60	53	0
Volume Right	76	0	53
cSH	508	1161	1700
Volume to Capacity	0.27	0.05	0.23
Queue Length 95th (ft)	27	4	0
Control Delay (s)	14.7	1.9	0.0
Lane LOS	B	A	
Approach Delay (s)	14.7	1.9	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	41.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	6	0	48	7	6	0	0	45	6	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Hourly flow rate (vph)	0	8	0	62	9	8	0	0	58	8	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	17			8			144	147	8	201	144	13
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	17			8			144	147	8	201	144	13
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			96			100	100	95	99	100	100
cM capacity (veh/h)	1601			1613			802	716	1074	696	719	1068

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	8	78	58	8
Volume Left	0	62	0	8
Volume Right	0	8	58	0
cSH	1601	1613	1074	696
Volume to Capacity	0.00	0.04	0.05	0.01
Queue Length 95th (ft)	0	3	4	1
Control Delay (s)	0.0	5.8	8.5	10.2
Lane LOS		A	A	B
Approach Delay (s)	0.0	5.8	8.5	10.2
Approach LOS			A	B

Intersection Summary			
Average Delay	6.8		
Intersection Capacity Utilization	21.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	51	657	389	100	187	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	3539	3430		1770	1583
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	3539	3430		1770	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	55	706	418	108	201	54
RTOR Reduction (vph)	0	0	19	0	0	44
Lane Group Flow (vph)	55	706	507	0	201	10
Turn Type	Prot	NA	NA		Prot	Perm
Protected Phases	5	2	6		7	
Permitted Phases						4
Actuated Green, G (s)	6.0	57.6	47.6		14.4	14.4
Effective Green, g (s)	6.0	57.6	47.6		14.4	14.4
Actuated g/C Ratio	0.08	0.72	0.60		0.18	0.18
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	132	2548	2040		318	284
v/s Ratio Prot	c0.03	c0.20	0.15		c0.11	
v/s Ratio Perm						0.01
v/c Ratio	0.42	0.28	0.25		0.63	0.03
Uniform Delay, d1	35.3	3.9	7.7		30.3	27.1
Progression Factor	1.00	1.00	0.77		1.00	1.00
Incremental Delay, d2	2.1	0.3	0.3		4.1	0.0
Delay (s)	37.5	4.2	6.2		34.4	27.1
Level of Service	D	A	A		C	C
Approach Delay (s)		6.6	6.2		32.9	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	10.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	37.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Westpark Promenade Traffic Impact Analysis (#0201-0002)
Existing + Ambient + Project Conditions
AM Peak Hour

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Future Volume Alternative)

Intersection #13 George Av. / La Estrella St.

Cycle (sec):	100	Critical Vol./Cap.(X):	0.715
Loss Time (sec):	0	Average Delay (sec/veh):	15.3
Optimal Cycle:	0	Level Of Service:	C

Approach:	North Bound			South Bound			East Bound			West Bound		
Movement:	L -	T -	R	L -	T -	R	L -	T -	R	L -	T -	R
Control:	Stop Sign			Stop Sign			Stop Sign			Stop Sign		
Rights:	Include			Include			Include			Include		
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	1 0	0 1	0	1 0	1 0	1	0 0	1! 0	0	0 0	1! 0	0
Volume Module:												
Base Vol:	24	19	52	11	13	43	47	108	13	39	196	18
Growth Adj:	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Initial Bse:	25	20	55	12	14	46	50	114	14	41	208	19
Added Vol:	0	21	10	0	17	0	0	0	0	15	0	0
PasserByVol:	0	0	0	0	0	0	0	0	0	0	0	0
Initial Fut:	25	41	65	12	31	46	50	114	14	56	208	19
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHF Adj:	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61
PHF Volume:	42	67	106	19	50	74	81	187	23	92	339	31
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0
Reduced Vol:	42	67	106	19	50	74	81	187	23	92	339	31
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FinalVolume:	42	67	106	19	50	74	81	187	23	92	339	31
Saturation Flow Module:												
Adjustment:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lanes:	1.00	0.39	0.61	1.00	1.00	1.00	0.28	0.64	0.08	0.20	0.73	0.07
Final Sat.:	463	204	322	442	472	519	169	388	47	129	475	44
Capacity Analysis Module:												
Vol/Sat:	0.09	0.33	0.33	0.04	0.11	0.14	0.48	0.48	0.48	0.71	0.71	0.71
Crit Moves:			****			****		****			****	
Delay/Veh:	10.6	11.7	11.7	10.3	10.3	9.7	13.4	13.4	13.4	20.0	20.0	20.0
Delay Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AdjDel/Veh:	10.6	11.7	11.7	10.3	10.3	9.7	13.4	13.4	13.4	20.0	20.0	20.0
LOS by Move:	B	B	B	B	B	A	B	B	B	C	C	C
ApproachDel:	11.5			10.0			13.4			20.0		
Delay Adj:	1.00			1.00			1.00			1.00		
ApprAdjDel:	11.5			10.0			13.4			20.0		
LOS by Appr:	B			B			B			C		
AllWayAvgQ:	0.1	0.4	0.4	0.0	0.1	0.1	0.8	0.8	0.8	2.1	2.1	2.1

Note: Queue reported is the number of cars per lane.

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	17	8	0	1	17	297	10	0	0	269	0	45
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	19	9	0	1	19	326	11	0	0	296	0	49

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total (vph)	23	4	10	336	11	296	49
Volume Left (vph)	19	0	1	0	11	296	0
Volume Right (vph)	0	0	0	326	0	0	49
Hadj (s)	0.44	0.03	0.09	-0.65	0.23	0.53	-0.67
Departure Headway (s)	6.4	6.0	5.7	4.9	6.2	6.0	4.8
Degree Utilization, x	0.04	0.01	0.02	0.46	0.02	0.49	0.07
Capacity (veh/h)	520	554	598	700	539	580	711
Control Delay (s)	8.5	7.8	7.6	10.9	9.3	13.4	6.9
Approach Delay (s)	8.4		10.8		9.3	12.5	
Approach LOS	A		B		A	B	

Intersection Summary			
Delay	11.5		
Level of Service	B		
Intersection Capacity Utilization	35.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	17	8	0	1	17	297	10	0	0	269	0	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0		4.0		4.0		4.0
Lane Util. Factor		0.95			1.00	1.00		1.00		1.00		1.00
Frt		1.00			1.00	0.85		1.00		1.00		0.85
Flt Protected		0.97			1.00	1.00		0.95		0.95		1.00
Satd. Flow (prot)		3423			1858	1583		1770		1770		1583
Flt Permitted		0.82			0.99	1.00		0.95		0.95		1.00
Satd. Flow (perm)		2886			1842	1583		1770		1770		1583
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	19	9	0	1	19	326	11	0	0	296	0	49
RTOR Reduction (vph)	0	0	0	0	0	291	0	0	0	0	0	10
Lane Group Flow (vph)	0	28	0	0	20	35	0	11	0	296	0	39
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Prot		Perm
Protected Phases		4			8			2		1		
Permitted Phases	4			8		8	2					6
Actuated Green, G (s)		8.6			8.6	8.6		40.8		18.6		63.4
Effective Green, g (s)		8.6			8.6	8.6		40.8		18.6		63.4
Actuated g/C Ratio		0.11			0.11	0.11		0.51		0.23		0.79
Clearance Time (s)		4.0			4.0	4.0		4.0		4.0		4.0
Vehicle Extension (s)		3.0			3.0	3.0		3.0		3.0		3.0
Lane Grp Cap (vph)		310			198	170		902		411		1254
v/s Ratio Prot										c0.17		
v/s Ratio Perm		0.01			0.01	c0.02		0.01				c0.02
v/c Ratio		0.09			0.10	0.21		0.01		0.72		0.03
Uniform Delay, d1		32.2			32.2	32.6		9.7		28.3		1.8
Progression Factor		1.00			1.00	1.00		1.00		0.72		1.64
Incremental Delay, d2		0.1			0.2	0.6		0.0		5.5		0.0
Delay (s)		32.3			32.4	33.2		9.7		25.8		2.9
Level of Service		C			C	C		A		C		A
Approach Delay (s)		32.3			33.1			9.7			22.6	
Approach LOS		C			C			A			C	

Intersection Summary			
HCM 2000 Control Delay	27.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.24		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	35.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	104	203	48	85	138	100	66	282	124	184	334	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.95		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3438		1770	1863	1583	1770	3377		1770	3416	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3438		1770	1863	1583	1770	3377		1770	3416	
Peak-hour factor, PHF	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Adj. Flow (vph)	135	264	62	110	179	130	86	366	161	239	434	131
RTOR Reduction (vph)	0	31	0	0	0	100	0	75	0	0	42	0
Lane Group Flow (vph)	135	295	0	110	179	30	86	452	0	239	523	0
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	6.0	16.4		4.8	15.2	15.2	6.4	17.1		10.7	21.4	
Effective Green, g (s)	6.0	16.4		4.8	15.2	15.2	6.4	17.1		10.7	21.4	
Actuated g/C Ratio	0.09	0.25		0.07	0.23	0.23	0.10	0.26		0.16	0.33	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	163	867		130	435	370	174	888		291	1124	
v/s Ratio Prot	c0.08	0.09		0.06	c0.10		0.05	c0.13		c0.14	c0.15	
v/s Ratio Perm						0.02						
v/c Ratio	0.83	0.34		0.85	0.41	0.08	0.49	0.51		0.82	0.47	
Uniform Delay, d1	29.0	19.9		29.7	21.1	19.5	27.8	20.4		26.2	17.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	27.9	1.1		36.9	2.9	0.4	2.2	2.1		16.8	1.4	
Delay (s)	56.9	20.9		66.7	24.0	19.9	30.0	22.5		43.0	18.7	
Level of Service	E	C		E	C	B	C	C		D	B	
Approach Delay (s)		31.5			33.9			23.5			25.9	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	27.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	48.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	119	185	196	70	132	347
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	131	203	215	77	145	381
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	292				719	254
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	292				719	254
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	90				59	51
cM capacity (veh/h)	1269				355	785

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	334	292	526
Volume Left	131	0	145
Volume Right	0	77	381
cSH	1269	1700	588
Volume to Capacity	0.10	0.17	0.89
Queue Length 95th (ft)	9	0	268
Control Delay (s)	3.8	0.0	42.5
Lane LOS	A		E
Approach Delay (s)	3.8	0.0	42.5
Approach LOS			E

Intersection Summary			
Average Delay	20.5		
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	119	185	196	70	132	347
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00		1.00	
Frt		1.00	0.96		0.90	
Flt Protected		0.98	1.00		0.99	
Satd. Flow (prot)		1827	1796		1658	
Flt Permitted		0.71	1.00		0.99	
Satd. Flow (perm)		1331	1796		1658	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	131	203	215	77	145	381
RTOR Reduction (vph)	0	0	15	0	111	0
Lane Group Flow (vph)	0	334	277	0	415	0
Turn Type	Perm	NA	NA		Perm	
Protected Phases		2	6			
Permitted Phases	2				4	
Actuated Green, G (s)		38.0	38.0		39.0	
Effective Green, g (s)		38.0	38.0		39.0	
Actuated g/C Ratio		0.45	0.45		0.46	
Clearance Time (s)		4.0	4.0		4.0	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		595	802		760	
v/s Ratio Prot			0.15			
v/s Ratio Perm		c0.25			c0.25	
v/c Ratio		0.56	0.35		0.55	
Uniform Delay, d1		17.3	15.4		16.6	
Progression Factor		0.61	1.00		1.00	
Incremental Delay, d2		3.8	1.2		2.8	
Delay (s)		14.3	16.5		19.4	
Level of Service		B	B		B	
Approach Delay (s)		14.3	16.5		19.4	
Approach LOS		B	B		B	

Intersection Summary			
HCM 2000 Control Delay	17.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	277	232	0	0	380	163	186	1	71	0	0	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	326	273	0	0	447	192	219	1	84	0	0	0

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2
Volume Total (vph)	326	273	639	220	84
Volume Left (vph)	326	0	0	219	0
Volume Right (vph)	0	0	192	0	84
Hadj (s)	0.53	0.03	-0.15	0.53	-0.67
Departure Headway (s)	7.0	6.5	6.3	7.9	6.7
Degree Utilization, x	0.63	0.49	1.0	0.48	0.16
Capacity (veh/h)	506	546	572	436	519
Control Delay (s)	20.1	14.4	99.1	17.0	9.8
Approach Delay (s)	17.5		99.1	15.0	
Approach LOS	C		F	B	

Intersection Summary			
Delay	50.8		
Level of Service	F		
Intersection Capacity Utilization	79.0%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	277	232	0	0	380	163	186	1	71	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.96		1.00	0.85				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1770	1863			1787		1770	1587				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	1770	1863			1787		1770	1587				
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	326	273	0	0	447	192	219	1	84	0	0	0
RTOR Reduction (vph)	0	0	0	0	18	0	0	68	0	0	0	0
Lane Group Flow (vph)	326	273	0	0	621	0	219	17	0	0	0	0
Turn Type	Prot	NA			NA		Split	NA				
Protected Phases	5	2			6		8	8				
Permitted Phases												
Actuated Green, G (s)	18.6	61.0			38.4		16.0	16.0				
Effective Green, g (s)	18.6	61.0			38.4		16.0	16.0				
Actuated g/C Ratio	0.22	0.72			0.45		0.19	0.19				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	387	1336			807		333	298				
v/s Ratio Prot	c0.18	0.15			c0.35		c0.12	0.01				
v/s Ratio Perm												
v/c Ratio	0.84	0.20			0.77		0.66	0.06				
Uniform Delay, d1	31.8	4.0			19.6		32.0	28.3				
Progression Factor	0.71	0.45			0.87		1.00	1.00				
Incremental Delay, d2	13.5	0.3			6.3		9.8	0.4				
Delay (s)	36.2	2.1			23.4		41.7	28.7				
Level of Service	D	A			C		D	C				
Approach Delay (s)		20.7			23.4			38.1			0.0	
Approach LOS		C			C			D			A	

Intersection Summary			
HCM 2000 Control Delay	25.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	417	455	253	312	0	0	0	0	92	2	143
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	0	479	523	291	359	0	0	0	0	106	2	164

Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	1002	291	359	108	164
Volume Left (vph)	0	291	0	106	0
Volume Right (vph)	523	0	0	0	164
Hadj (s)	-0.28	0.53	0.03	0.52	-0.67
Departure Headway (s)	6.0	6.8	6.3	7.9	6.8
Degree Utilization, x	1.0	0.55	0.62	0.24	0.31
Capacity (veh/h)	606	526	559	441	517
Control Delay (s)	322.8	16.4	17.9	12.2	11.6
Approach Delay (s)	322.8	17.2		11.8	
Approach LOS	F	C		B	

Intersection Summary			
Delay	175.7		
Level of Service	F		
Intersection Capacity Utilization	79.0%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	417	455	253	312	0	0	0	0	92	2	143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0						4.0	4.0
Lane Util. Factor		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		1863	1583	1770	1863						1776	1583
Flt Permitted		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (perm)		1863	1583	1770	1863						1776	1583
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	0	479	523	291	359	0	0	0	0	106	2	164
RTOR Reduction (vph)	0	0	211	0	0	0	0	0	0	0	0	133
Lane Group Flow (vph)	0	479	312	291	359	0	0	0	0	0	108	31
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2		1	6					4	4	
Permitted Phases			2									4
Actuated Green, G (s)		38.5	38.5	18.5	61.0						16.0	16.0
Effective Green, g (s)		38.5	38.5	18.5	61.0						16.0	16.0
Actuated g/C Ratio		0.45	0.45	0.22	0.72						0.19	0.19
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		843	717	385	1336						334	297
v/s Ratio Prot		c0.26		c0.16	0.19						c0.06	
v/s Ratio Perm			0.20									0.02
v/c Ratio		0.57	0.44	0.76	0.27						0.32	0.10
Uniform Delay, d1		17.1	15.8	31.1	4.2						29.8	28.6
Progression Factor		1.00	1.00	0.92	0.21						1.00	1.00
Incremental Delay, d2		2.8	1.9	5.5	0.3						2.6	0.7
Delay (s)		19.9	17.8	34.2	1.2						32.4	29.3
Level of Service		B	B	C	A						C	C
Approach Delay (s)		18.8			16.0			0.0			30.5	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	19.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	4	10	18	18	10	7	26	241	3	1	199	6
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	11	20	20	11	8	28	262	3	1	216	7
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						2						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1183				
pX, platoon unblocked												
vC, conflicting volume	551	543	220	567	545	264	223			265		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	551	543	220	567	545	264	223			265		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	98	98	95	98	99	98			100		
cM capacity (veh/h)	425	437	820	409	436	775	1346			1299		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	35	38	293	224
Volume Left	4	20	28	1
Volume Right	20	8	3	7
cSH	590	523	1346	1299
Volume to Capacity	0.06	0.07	0.02	0.00
Queue Length 95th (ft)	5	6	2	0
Control Delay (s)	11.5	13.4	0.9	0.0
Lane LOS	B	B	A	A
Approach Delay (s)	11.5	13.4	0.9	0.0
Approach LOS	B	B		

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	40.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	6	10	68	0	10	0	99	153	0	0	138	9
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	11	74	0	11	0	108	166	0	0	150	10
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	542	536	155	579	541	166	160			166		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	542	536	155	579	541	166	160			166		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	97	92	100	97	100	92			100		
cM capacity (veh/h)	417	417	891	361	414	878	1419			1412		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	91	11	274	160
Volume Left	7	0	108	0
Volume Right	74	0	0	10
cSH	1101	414	1419	1412
Volume to Capacity	0.08	0.03	0.08	0.00
Queue Length 95th (ft)	7	2	6	0
Control Delay (s)	10.3	13.9	3.4	0.0
Lane LOS	B	B	A	
Approach Delay (s)	10.3	13.9	3.4	0.0
Approach LOS	B	B		

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	37.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	10	82	39	10	7	135	17	7	1	26	30
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	11	89	42	11	8	147	18	8	1	28	33
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	376	366	45	412	379	22	61			26		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	376	366	45	412	379	22	61			26		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	98	91	91	98	99	90			100		
cM capacity (veh/h)	526	508	1025	458	500	1055	1542			1588		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	122	42	18	173	62
Volume Left	22	42	0	147	1
Volume Right	89	0	8	8	33
cSH	1400	458	638	1542	1588
Volume to Capacity	0.09	0.09	0.03	0.10	0.00
Queue Length 95th (ft)	7	8	2	8	0
Control Delay (s)	9.8	13.7	10.8	6.5	0.1
Lane LOS	A	B	B	A	A
Approach Delay (s)	9.8	12.8		6.5	0.1
Approach LOS	A	B			

Intersection Summary			
Average Delay	7.5		
Intersection Capacity Utilization	31.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	10	0	45	48	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	11	0	49	52	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	101	52	52			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	101	52	52			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	100			
cM capacity (veh/h)	897	1015	1554			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	11	49	52
Volume Left	0	0	0
Volume Right	11	0	0
cSH	1015	1700	1700
Volume to Capacity	0.01	0.03	0.03
Queue Length 95th (ft)	1	0	0
Control Delay (s)	8.6	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.6	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	136	163	42	119	239	207	39	441	105	322	546	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3431		1770	3539	1583	1770	3539	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3431		1770	3539	1583	1770	3539	1583	1770	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	143	172	44	125	252	218	41	464	111	339	575	179
RTOR Reduction (vph)	0	22	0	0	0	174	0	0	88	0	0	69
Lane Group Flow (vph)	143	194	0	125	252	44	41	464	23	339	575	110
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	13.1	20.4		14.0	21.3	21.3	3.6	22.0	22.0	32.6	51.0	51.0
Effective Green, g (s)	13.1	20.4		14.0	21.3	21.3	3.6	22.0	22.0	32.6	51.0	51.0
Actuated g/C Ratio	0.12	0.19		0.13	0.20	0.20	0.03	0.21	0.21	0.31	0.49	0.49
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	220	666		236	717	321	60	741	331	549	904	768
v/s Ratio Prot	c0.08	c0.06		c0.07	0.07		0.02	c0.13		0.19	c0.31	
v/s Ratio Perm						0.03			0.01			0.07
v/c Ratio	0.65	0.29		0.53	0.35	0.14	0.68	0.63	0.07	0.62	0.64	0.14
Uniform Delay, d1	43.8	36.1		42.4	35.9	34.3	50.1	37.8	33.3	30.9	20.1	14.9
Progression Factor	0.80	0.79		0.53	0.44	1.36	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.6	1.1		1.5	1.0	0.6	27.6	4.0	0.4	2.1	3.4	0.4
Delay (s)	41.6	29.5		24.2	16.6	47.3	77.7	41.7	33.7	33.0	23.5	15.3
Level of Service	D	C		C	B	D	E	D	C	C	C	B
Approach Delay (s)		34.3			29.5			42.7			25.1	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	31.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	165	811	8	65	950	546	55	12	64	384	14	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1704		1770	1605	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.83		0.67	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1441		1242	1605	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	170	836	8	67	979	563	57	12	66	396	14	165
RTOR Reduction (vph)	0	0	5	0	0	365	0	33	0	0	97	0
Lane Group Flow (vph)	170	836	3	67	979	198	0	102	0	396	82	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	13.1	42.8	42.8	7.2	36.9	36.9		43.0		43.0	43.0	
Effective Green, g (s)	13.1	42.8	42.8	7.2	36.9	36.9		43.0		43.0	43.0	
Actuated g/C Ratio	0.12	0.41	0.41	0.07	0.35	0.35		0.41		0.41	0.41	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	220	1442	645	121	1243	556		590		508	657	
v/s Ratio Prot	c0.10	0.24		0.04	c0.28						0.05	
v/s Ratio Perm			0.00			0.12		0.07		c0.32		
v/c Ratio	0.77	0.58	0.01	0.55	0.79	0.36		0.17		0.78	0.12	
Uniform Delay, d1	44.5	24.1	18.5	47.3	30.5	25.2		19.7		26.9	19.3	
Progression Factor	0.83	0.87	1.00	0.83	0.75	0.59		1.00		1.00	1.00	
Incremental Delay, d2	15.0	1.7	0.0	5.1	4.8	1.7		0.6		11.3	0.4	
Delay (s)	51.8	22.6	18.5	44.3	27.6	16.6		20.3		38.1	19.7	
Level of Service	D	C	B	D	C	B		C		D	B	
Approach Delay (s)		27.5			24.5			20.3			32.4	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	26.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	819	440	298	1145	0	0	0	0	496	1	416
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.91					0.95	0.95	0.88
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		5085	1583	3433	5085					1681	1686	2787
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		5085	1583	3433	5085					1681	1686	2787
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	0	827	444	301	1157	0	0	0	0	501	1	420
RTOR Reduction (vph)	0	0	262	0	0	0	0	0	0	0	0	118
Lane Group Flow (vph)	0	827	182	301	1157	0	0	0	0	250	252	302
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		43.0	43.0	19.0	66.0					31.0	31.0	31.0
Effective Green, g (s)		43.0	43.0	19.0	66.0					31.0	31.0	31.0
Actuated g/C Ratio		0.41	0.41	0.18	0.63					0.30	0.30	0.30
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		2082	648	621	3196					496	497	822
v/s Ratio Prot		c0.16		c0.09	0.23							
v/s Ratio Perm			0.11							0.15	0.15	0.11
v/c Ratio		0.40	0.28	0.48	0.36					0.50	0.51	0.37
Uniform Delay, d1		21.9	20.7	38.6	9.4					30.6	30.7	29.3
Progression Factor		0.56	0.37	0.92	0.62					1.00	1.00	1.00
Incremental Delay, d2		0.4	0.9	0.5	0.3					3.6	3.7	1.3
Delay (s)		12.6	8.5	36.1	6.1					34.3	34.3	30.5
Level of Service		B	A	D	A					C	C	C
Approach Delay (s)		11.2			12.3			0.0			32.6	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	17.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	287	1027	0	0	886	474	557	0	421	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.91			0.91	1.00	0.95	0.91	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.95	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.97	1.00			
Satd. Flow (prot)	3433	5085			5085	1583	1681	1556	1504			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.97	1.00			
Satd. Flow (perm)	3433	5085			5085	1583	1681	1556	1504			
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	299	1070	0	0	923	494	580	0	439	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	320	0	33	52	0	0	0
Lane Group Flow (vph)	299	1070	0	0	923	174	354	312	268	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	17.0	58.0			37.0	37.0	39.0	39.0	39.0			
Effective Green, g (s)	17.0	58.0			37.0	37.0	39.0	39.0	39.0			
Actuated g/C Ratio	0.16	0.55			0.35	0.35	0.37	0.37	0.37			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	555	2808			1791	557	624	577	558			
v/s Ratio Prot	c0.09	0.21			c0.18							
v/s Ratio Perm						0.11	c0.21	0.20	0.18			
v/c Ratio	0.54	0.38			0.52	0.31	0.57	0.54	0.48			
Uniform Delay, d1	40.4	13.3			26.9	24.7	26.3	26.0	25.2			
Progression Factor	1.02	0.67			0.48	0.22	1.00	1.00	1.00			
Incremental Delay, d2	0.9	0.4			0.1	0.1	3.7	3.6	2.9			
Delay (s)	42.2	9.3			12.9	5.6	30.0	29.6	28.2			
Level of Service	D	A			B	A	C	C	C			
Approach Delay (s)		16.5			10.3			29.3			0.0	
Approach LOS		B			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	17.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	329	836	250	74	783	328	288	15	66	288	10	289
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	
Frt	1.00	0.97		1.00	0.96			1.00	0.85		0.93	
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00		0.98	
Satd. Flow (prot)	1770	4910		1770	4860			1778	1583		1697	
Flt Permitted	0.95	1.00		0.95	1.00			0.43	1.00		0.59	
Satd. Flow (perm)	1770	4910		1770	4860			808	1583		1023	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	350	889	266	79	833	349	306	16	70	306	11	307
RTOR Reduction (vph)	0	50	0	0	73	0	0	0	35	0	33	0
Lane Group Flow (vph)	350	1105	0	79	1109	0	0	322	35	0	591	0
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	18.8	35.4		5.6	22.2			52.0	52.0		52.0	
Effective Green, g (s)	18.8	35.4		5.6	22.2			52.0	52.0		52.0	
Actuated g/C Ratio	0.18	0.34		0.05	0.21			0.50	0.50		0.50	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	316	1655		94	1027			400	783		506	
v/s Ratio Prot	c0.20	0.22		0.04	c0.23							
v/s Ratio Perm								0.40	0.02		c0.58	
v/c Ratio	1.11	0.67		0.84	1.08			0.81	0.04		1.17	
Uniform Delay, d1	43.1	29.8		49.3	41.4			22.2	13.7		26.5	
Progression Factor	0.62	0.46		0.72	0.74			1.00	1.00		1.00	
Incremental Delay, d2	80.8	2.0		42.0	51.0			11.2	0.0		95.0	
Delay (s)	107.6	15.6		77.7	81.5			33.4	13.7		121.5	
Level of Service	F	B		E	F			C	B		F	
Approach Delay (s)		37.0			81.3			29.9			121.5	
Approach LOS		D			F			C			F	

Intersection Summary			
HCM 2000 Control Delay	65.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	91.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	329	836	250	74	783	328	288	15	66	288	10	289
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.96		1.00	0.88		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	4910		1770	4860		1770	1635		1770	1593	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	4910		1770	4860		1770	1635		1770	1593	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	350	889	266	79	833	349	306	16	70	306	11	307
RTOR Reduction (vph)	0	45	0	0	65	0	0	66	0	0	276	0
Lane Group Flow (vph)	350	1110	0	79	1117	0	306	20	0	306	42	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	24.3	50.0		7.7	33.4		20.8	6.3		25.0	10.5	
Effective Green, g (s)	24.3	50.0		7.7	33.4		20.8	6.3		25.0	10.5	
Actuated g/C Ratio	0.23	0.48		0.07	0.32		0.20	0.06		0.24	0.10	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	409	2338		129	1545		350	98		421	159	
v/s Ratio Prot	c0.20	0.23		0.04	c0.23		c0.17	0.01		c0.17	0.03	
v/s Ratio Perm												
v/c Ratio	0.86	0.47		0.61	0.72		0.87	0.21		0.73	0.26	
Uniform Delay, d1	38.7	18.6		47.2	31.7		40.8	47.0		36.9	43.7	
Progression Factor	0.74	0.45		0.78	0.59		1.00	1.00		1.00	1.00	
Incremental Delay, d2	14.9	0.6		7.4	2.6		20.7	1.0		6.2	0.9	
Delay (s)	43.5	9.0		44.0	21.2		61.6	48.0		43.0	44.6	
Level of Service	D	A		D	C		E	D		D	D	
Approach Delay (s)		17.0			22.6			58.6			43.8	
Approach LOS		B			C			E			D	

Intersection Summary			
HCM 2000 Control Delay	27.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	88.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	102	1062	10	81	1047	77	58	35	117	55	31	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.88		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5078		1770	3539	1583	1770	1647		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.74	1.00		0.53	1.00	1.00
Satd. Flow (perm)	1770	5078		1770	3539	1583	1373	1647		990	1863	1583
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	103	1073	10	82	1058	78	59	35	118	56	31	81
RTOR Reduction (vph)	0	1	0	0	0	36	0	96	0	0	0	66
Lane Group Flow (vph)	103	1082	0	82	1058	42	59	57	0	56	31	15
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases						6	8			4		4
Actuated Green, G (s)	16.8	64.1		8.9	56.2	56.2	20.0	20.0		20.0	20.0	20.0
Effective Green, g (s)	16.8	64.1		8.9	56.2	56.2	20.0	20.0		20.0	20.0	20.0
Actuated g/C Ratio	0.16	0.61		0.08	0.54	0.54	0.19	0.19		0.19	0.19	0.19
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	283	3099		150	1894	847	261	313		188	354	301
v/s Ratio Prot	0.06	c0.21		0.05	c0.30			0.03			0.02	
v/s Ratio Perm						0.03	0.04			c0.06		0.01
v/c Ratio	0.36	0.35		0.55	0.56	0.05	0.23	0.18		0.30	0.09	0.05
Uniform Delay, d1	39.3	10.1		46.1	16.2	11.6	36.0	35.7		36.5	35.0	34.7
Progression Factor	0.66	0.37		0.97	0.90	0.81	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.5	0.2		2.8	0.8	0.1	2.0	1.3		4.0	0.5	0.3
Delay (s)	26.4	3.9		47.5	15.3	9.5	38.0	36.9		40.5	35.5	35.1
Level of Service	C	A		D	B	A	D	D		D	D	D
Approach Delay (s)		5.9			17.1			37.2			36.9	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	15.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	60.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	0	700	496	63	662	559	113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.95	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)		3539	1583	1770	1863	1770	1583
Flt Permitted		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)		3539	1583	1770	1863	1770	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	0	714	506	64	676	570	115
RTOR Reduction (vph)	0	0	275	0	0	0	67
Lane Group Flow (vph)	0	714	231	64	676	570	48
Turn Type	Prot	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	5	2		1	6	8	
Permitted Phases			2				8
Actuated Green, G (s)		48.0	48.0	7.2	59.2	37.8	37.8
Effective Green, g (s)		48.0	48.0	7.2	59.2	37.8	37.8
Actuated g/C Ratio		0.46	0.46	0.07	0.56	0.36	0.36
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1617	723	121	1050	637	569
v/s Ratio Prot		0.20		0.04	c0.36	c0.32	
v/s Ratio Perm			0.15				0.03
v/c Ratio		0.44	0.32	0.53	0.64	0.89	0.09
Uniform Delay, d1		19.4	18.1	47.3	15.7	31.7	22.2
Progression Factor		0.48	0.55	0.71	0.57	1.00	1.00
Incremental Delay, d2		0.8	1.1	4.0	3.0	15.0	0.1
Delay (s)		10.1	11.1	37.4	12.0	46.8	22.2
Level of Service		B	B	D	B	D	C
Approach Delay (s)		10.5			14.2	42.6	
Approach LOS		B			B	D	

Intersection Summary			
HCM 2000 Control Delay	19.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	88	648	21	16	605	40	32	0	3	35	3	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00		1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00		0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3506		1770		1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3506		1770		1583	1770	1863	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	91	668	22	16	624	41	33	0	3	36	3	75
RTOR Reduction (vph)	0	0	6	0	3	0	0	0	3	0	0	72
Lane Group Flow (vph)	91	668	16	16	662	0	33	0	0	36	3	3
Turn Type	Prot	NA	Perm	Prot	NA		Prot		Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	12.7	75.2	75.2	2.4	64.9		6.7		2.2	9.2	4.7	4.7
Effective Green, g (s)	12.7	75.2	75.2	2.4	64.9		6.7		2.2	9.2	4.7	4.7
Actuated g/C Ratio	0.12	0.72	0.72	0.02	0.62		0.06		0.02	0.09	0.04	0.04
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	214	2534	1133	40	2167		112		33	155	83	70
v/s Ratio Prot	c0.05	0.19		0.01	c0.19		0.02			c0.02	0.00	
v/s Ratio Perm			0.01						0.00			c0.00
v/c Ratio	0.43	0.26	0.01	0.40	0.31		0.29		0.00	0.23	0.04	0.05
Uniform Delay, d1	42.8	5.2	4.3	50.6	9.4		46.9		50.3	44.6	48.0	48.0
Progression Factor	0.53	0.33	1.00	0.97	0.51		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.2	0.0	6.3	0.4		1.5		0.0	0.8	0.2	0.3
Delay (s)	24.0	2.0	4.3	55.7	5.1		48.4		50.3	45.4	48.2	48.3
Level of Service	C	A	A	E	A		D		D	D	D	D
Approach Delay (s)		4.6			6.3			48.5			47.4	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	9.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	41.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	586	50	18	552	21	46	3	31	18	1	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.99	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1779	1583		1660	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.65	1.00		0.90	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1205	1583		1512	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	63	617	53	19	581	22	48	3	33	19	1	51
RTOR Reduction (vph)	0	0	12	0	0	8	0	0	30	0	47	0
Lane Group Flow (vph)	63	617	41	19	581	14	0	51	3	0	24	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8		8	4		
Actuated Green, G (s)	16.8	81.7	81.7	3.1	68.0	68.0		8.2	8.2		8.2	
Effective Green, g (s)	16.8	81.7	81.7	3.1	68.0	68.0		8.2	8.2		8.2	
Actuated g/C Ratio	0.16	0.78	0.78	0.03	0.65	0.65		0.08	0.08		0.08	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	283	2753	1231	52	2291	1025		94	123		118	
v/s Ratio Prot	0.04	c0.17		0.01	c0.16							
v/s Ratio Perm			0.03			0.01		c0.04	0.00		0.02	
v/c Ratio	0.22	0.22	0.03	0.37	0.25	0.01		0.54	0.02		0.20	
Uniform Delay, d1	38.4	3.1	2.7	50.0	7.8	6.6		46.6	44.7		45.3	
Progression Factor	0.69	0.95	1.01	1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	0.4	0.2	0.0	4.3	0.3	0.0		6.3	0.1		0.9	
Delay (s)	26.8	3.2	2.7	54.3	8.1	6.6		52.9	44.8		46.2	
Level of Service	C	A	A	D	A	A		D	D		D	
Approach Delay (s)		5.2			9.4			49.7			46.2	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	11.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	40.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	58	33	54	160	133	72
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	68	39	64	188	156	85
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				816		
pX, platoon unblocked						
vC, conflicting volume	514	199	241			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	514	199	241			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	86	95	95			
cM capacity (veh/h)	495	842	1325			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	107	252	241
Volume Left	68	64	0
Volume Right	39	0	85
cSH	582	1325	1700
Volume to Capacity	0.18	0.05	0.14
Queue Length 95th (ft)	17	4	0
Control Delay (s)	12.6	2.3	0.0
Lane LOS	B	A	
Approach Delay (s)	12.6	2.3	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	4	0	100	7	7	0	0	87	4	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Hourly flow rate (vph)	0	6	0	145	10	10	0	0	126	6	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	20			6			311	316	6	437	311	15
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	20			6			311	316	6	437	311	15
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			91			100	100	88	99	100	100
cM capacity (veh/h)	1596			1615			598	546	1077	436	550	1064

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	6	165	126	6
Volume Left	0	145	0	6
Volume Right	0	10	126	0
cSH	1596	1615	1077	436
Volume to Capacity	0.00	0.09	0.12	0.01
Queue Length 95th (ft)	0	7	10	1
Control Delay (s)	0.0	6.6	8.8	13.4
Lane LOS		A	A	B
Approach Delay (s)	0.0	6.6	8.8	13.4
Approach LOS			A	B

Intersection Summary			
Average Delay	7.5		
Intersection Capacity Utilization	25.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	53	533	579	179	211	51
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.96		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	3539	3414		1770	1583
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	3539	3414		1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	56	561	609	188	222	54
RTOR Reduction (vph)	0	0	20	0	0	44
Lane Group Flow (vph)	56	561	777	0	222	10
Turn Type	Prot	NA	NA		Prot	Perm
Protected Phases	5	2	6		7	
Permitted Phases						4
Actuated Green, G (s)	10.4	78.5	64.1		18.5	18.5
Effective Green, g (s)	10.4	78.5	64.1		18.5	18.5
Actuated g/C Ratio	0.10	0.75	0.61		0.18	0.18
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	175	2645	2084		311	278
v/s Ratio Prot	c0.03	0.16	c0.23		c0.13	
v/s Ratio Perm						0.01
v/c Ratio	0.32	0.21	0.37		0.71	0.03
Uniform Delay, d1	44.0	4.0	10.3		40.8	35.8
Progression Factor	1.00	1.00	0.59		1.00	1.00
Incremental Delay, d2	1.1	0.2	0.5		7.6	0.1
Delay (s)	45.1	4.2	6.6		48.3	35.9
Level of Service	D	A	A		D	D
Approach Delay (s)		7.9	6.6		45.9	
Approach LOS		A	A		D	

Intersection Summary			
HCM 2000 Control Delay	13.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	46.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Westpark Promenade Traffic Impact Analysis (#0201-0002)
Existing + Ambient + Project Conditions
PM Peak Hour

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Future Volume Alternative)

Intersection #13 George Av. / La Estrella St.

Cycle (sec):	100	Critical Vol./Cap.(X):	0.223
Loss Time (sec):	0	Average Delay (sec/veh):	8.4
Optimal Cycle:	0	Level Of Service:	A

Approach:	North Bound			South Bound			East Bound			West Bound		
Movement:	L -	T -	R	L -	T -	R	L -	T -	R	L -	T -	R
Control:	Stop Sign			Stop Sign			Stop Sign			Stop Sign		
Rights:	Include			Include			Include			Include		
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	1 0 0 1 0			1 0 1 0 1			0 0 0 1 0			0 1 0 0 0		
Volume Module:												
Base Vol:	20	0	22	1	0	0	0	100	27	33	97	0
Growth Adj:	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Initial Bse:	21	0	23	1	0	0	0	106	29	35	103	0
Added Vol:	0	32	27	0	39	0	0	0	0	29	0	0
PasserByVol:	0	0	0	0	0	0	0	0	0	0	0	0
Initial Fut:	21	32	50	1	39	0	0	106	29	64	103	0
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHF Adj:	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
PHF Volume:	22	33	52	1	41	0	0	110	30	67	107	0
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0
Reduced Vol:	22	33	52	1	41	0	0	110	30	67	107	0
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FinalVolume:	22	33	52	1	41	0	0	110	30	67	107	0
Saturation Flow Module:												
Adjustment:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lanes:	1.00	0.39	0.61	1.00	1.00	1.00	0.00	0.79	0.21	0.38	0.62	0.00
Final Sat.:	601	276	434	590	643	733	0	633	171	298	479	0
Capacity Analysis Module:												
Vol/Sat:	0.04	0.12	0.12	0.00	0.06	0.00	xxxx	0.17	0.17	0.22	0.22	xxxx
Crit Moves:		****			****			****			****	
Delay/Veh:	8.6	8.1	8.1	8.5	8.3	0.0	0.0	8.2	8.2	8.7	8.7	0.0
Delay Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AdjDel/Veh:	8.6	8.1	8.1	8.5	8.3	0.0	0.0	8.2	8.2	8.7	8.7	0.0
LOS by Move:	A	A	A	A	A	*	*	A	A	A	A	*
ApproachDel:	8.2			8.3			8.2			8.7		
Delay Adj:	1.00			1.00			1.00			1.00		
ApprAdjDel:	8.2			8.3			8.2			8.7		
LOS by Appr:	A			A			A			A		
AllWayAvgQ:	0.0	0.1	0.1	0.0	0.1	0.0	0.2	0.2	0.2	0.3	0.3	0.3

Note: Queue reported is the number of cars per lane.

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	28	12	0	2	4	481	0	0	0	454	0	7
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	33	14	0	2	5	566	0	0	0	534	0	8

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total (vph)	40	7	5	568	0	534	8
Volume Left (vph)	33	0	2	0	0	534	0
Volume Right (vph)	0	0	0	566	0	0	8
Hadj (s)	0.45	0.03	0.28	-0.66	0.00	0.53	-0.67
Departure Headway (s)	7.9	7.5	6.7	5.8	7.5	6.8	5.6
Degree Utilization, x	0.09	0.01	0.01	0.92	0.00	1.0	0.01
Capacity (veh/h)	444	468	522	607	467	515	612
Control Delay (s)	10.4	9.4	8.6	41.2	10.5	67.0	7.5
Approach Delay (s)	10.3		40.9		0.0	66.1	
Approach LOS	B		E		A	F	

Intersection Summary			
Delay	51.4		
Level of Service	F		
Intersection Capacity Utilization	54.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	28	12	0	2	4	481	0	0	0	454	0	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0				4.0		4.0
Lane Util. Factor		0.95			1.00	1.00				1.00		1.00
Frt		1.00			1.00	0.85				1.00		0.85
Flt Protected		0.97			0.99	1.00				0.95		1.00
Satd. Flow (prot)		3419			1837	1583				1770		1583
Flt Permitted		0.80			0.94	1.00				0.95		1.00
Satd. Flow (perm)		2848			1755	1583				1770		1583
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	33	14	0	2	5	566	0	0	0	534	0	8
RTOR Reduction (vph)	0	0	0	0	0	494	0	0	0	0	0	2
Lane Group Flow (vph)	0	47	0	0	7	72	0	0	0	534	0	6
Turn Type	Perm	NA		Perm	NA	Perm				Prot		Perm
Protected Phases		4			8			2		1		
Permitted Phases	4			8		8	2					6
Actuated Green, G (s)		10.2			10.2	10.2				28.1		61.8
Effective Green, g (s)		10.2			10.2	10.2				28.1		61.8
Actuated g/C Ratio		0.13			0.13	0.13				0.35		0.77
Clearance Time (s)		4.0			4.0	4.0				4.0		4.0
Vehicle Extension (s)		3.0			3.0	3.0				3.0		3.0
Lane Grp Cap (vph)		363			223	201				621		1222
v/s Ratio Prot										c0.30		
v/s Ratio Perm		0.02			0.00	c0.05						c0.00
v/c Ratio		0.13			0.03	0.36				0.86		0.01
Uniform Delay, d1		31.0			30.6	31.9				24.1		2.1
Progression Factor		1.00			1.00	1.00				1.00		1.00
Incremental Delay, d2		0.2			0.1	1.1				11.4		0.0
Delay (s)		31.1			30.6	33.0				35.6		2.1
Level of Service		C			C	C				D		A
Approach Delay (s)		31.1			33.0			0.0			35.1	
Approach LOS		C			C			A			D	

Intersection Summary			
HCM 2000 Control Delay	33.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	40.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	134	243	81	133	249	227	89	231	81	146	224	88
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.96		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3407		1770	1863	1583	1770	3402		1770	3389	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3407		1770	1863	1583	1770	3402		1770	3389	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	143	259	86	141	265	241	95	246	86	155	238	94
RTOR Reduction (vph)	0	49	0	0	0	175	0	53	0	0	61	0
Lane Group Flow (vph)	143	296	0	141	265	66	95	279	0	155	271	0
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	6.4	17.8		6.4	17.8	17.8	6.4	16.9		7.9	18.4	
Effective Green, g (s)	6.4	17.8		6.4	17.8	17.8	6.4	16.9		7.9	18.4	
Actuated g/C Ratio	0.10	0.27		0.10	0.27	0.27	0.10	0.26		0.12	0.28	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	174	932		174	510	433	174	884		215	959	
v/s Ratio Prot	c0.08	0.09		0.08	c0.14		c0.05	0.08		c0.09	c0.08	
v/s Ratio Perm						0.04						
v/c Ratio	0.82	0.32		0.81	0.52	0.15	0.55	0.32		0.72	0.28	
Uniform Delay, d1	28.7	18.8		28.7	20.0	17.9	27.9	19.4		27.5	18.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	25.7	0.9		24.0	3.8	0.7	3.5	0.9		11.3	0.7	
Delay (s)	54.5	19.7		52.7	23.7	18.6	31.4	20.3		38.8	18.9	
Level of Service	D	B		D	C	B	C	C		D	B	
Approach Delay (s)		29.9			28.1			22.8			25.2	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	26.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	50.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	83	156	101	31	36	111
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	89	168	109	33	39	119
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	142				472	125
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	142				472	125
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				93	87
cM capacity (veh/h)	1441				517	925

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	257	142	158
Volume Left	89	0	39
Volume Right	0	33	119
cSH	1441	1700	775
Volume to Capacity	0.06	0.08	0.20
Queue Length 95th (ft)	5	0	19
Control Delay (s)	3.0	0.0	10.8
Lane LOS	A		B
Approach Delay (s)	3.0	0.0	10.8
Approach LOS			B

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	38.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	83	156	101	31	36	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00		1.00	
Frt		1.00	0.97		0.90	
Flt Protected		0.98	1.00		0.99	
Satd. Flow (prot)		1831	1804		1653	
Flt Permitted		0.86	1.00		0.99	
Satd. Flow (perm)		1606	1804		1653	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	89	168	109	33	39	119
RTOR Reduction (vph)	0	0	16	0	77	0
Lane Group Flow (vph)	0	257	126	0	81	0
Turn Type	Perm	NA	NA		Perm	
Protected Phases		2	6			
Permitted Phases	2				4	
Actuated Green, G (s)		34.0	34.0		23.0	
Effective Green, g (s)		34.0	34.0		23.0	
Actuated g/C Ratio		0.52	0.52		0.35	
Clearance Time (s)		4.0	4.0		4.0	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		840	943		584	
v/s Ratio Prot			0.07			
v/s Ratio Perm		c0.16			c0.05	
v/c Ratio		0.31	0.13		0.14	
Uniform Delay, d1		8.8	7.9		14.3	
Progression Factor		0.36	1.00		1.00	
Incremental Delay, d2		0.9	0.3		0.5	
Delay (s)		4.1	8.2		14.8	
Level of Service		A	A		B	
Approach Delay (s)		4.1	8.2		14.8	
Approach LOS		A	A		B	

Intersection Summary			
HCM 2000 Control Delay	8.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.24		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	38.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	157	186	0	0	146	67	408	4	53	0	0	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	165	196	0	0	154	71	429	4	56	0	0	0

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2
Volume Total (vph)	165	196	224	434	56
Volume Left (vph)	165	0	0	429	0
Volume Right (vph)	0	0	71	0	56
Hadj (s)	0.53	0.03	-0.15	0.53	-0.67
Departure Headway (s)	7.2	6.6	6.6	6.8	5.6
Degree Utilization, x	0.33	0.36	0.41	0.82	0.09
Capacity (veh/h)	478	515	514	520	620
Control Delay (s)	12.4	12.2	14.2	32.4	7.9
Approach Delay (s)	12.3		14.2	29.6	
Approach LOS	B		B	D	

Intersection Summary			
Delay	20.6		
Level of Service	C		
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	157	186	0	0	146	67	408	4	53	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.96		1.00	0.86				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1770	1863			1783		1770	1602				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	1770	1863			1783		1770	1602				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	165	196	0	0	154	71	429	4	56	0	0	0
RTOR Reduction (vph)	0	0	0	0	24	0	0	34	0	0	0	0
Lane Group Flow (vph)	165	196	0	0	201	0	429	26	0	0	0	0
Turn Type	Prot	NA			NA		Split	NA				
Protected Phases	5	2			6		8	8				
Permitted Phases												
Actuated Green, G (s)	8.9	32.0			19.1		25.0	25.0				
Effective Green, g (s)	8.9	32.0			19.1		25.0	25.0				
Actuated g/C Ratio	0.14	0.49			0.29		0.38	0.38				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	242	917			523		680	616				
v/s Ratio Prot	c0.09	0.11			c0.11		c0.24	0.02				
v/s Ratio Perm												
v/c Ratio	0.68	0.21			0.38		0.63	0.04				
Uniform Delay, d1	26.7	9.4			18.3		16.3	12.5				
Progression Factor	0.68	0.42			0.95		1.00	1.00				
Incremental Delay, d2	7.5	0.5			2.1		4.4	0.1				
Delay (s)	25.8	4.4			19.5		20.7	12.6				
Level of Service	C	A			B		C	B				
Approach Delay (s)		14.2			19.5			19.7			0.0	
Approach LOS		B			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	17.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	53.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	281	333	53	501	0	0	0	0	61	2	181
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	290	343	55	516	0	0	0	0	63	2	187

Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	633	55	516	65	187
Volume Left (vph)	0	55	0	63	0
Volume Right (vph)	343	0	0	0	187
Hadj (s)	-0.29	0.53	0.03	0.52	-0.67
Departure Headway (s)	6.0	6.7	6.2	8.0	6.8
Degree Utilization, x	1.0	0.10	0.89	0.14	0.35
Capacity (veh/h)	599	528	577	439	515
Control Delay (s)	74.4	9.2	38.3	11.1	12.2
Approach Delay (s)	74.4	35.5		11.9	
Approach LOS	F	E		B	

Intersection Summary			
Delay	48.3		
Level of Service	E		
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	281	333	53	501	0	0	0	0	61	2	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0						4.0	4.0
Lane Util. Factor		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		1863	1583	1770	1863						1777	1583
Flt Permitted		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (perm)		1863	1583	1770	1863						1777	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	290	343	55	516	0	0	0	0	63	2	187
RTOR Reduction (vph)	0	0	188	0	0	0	0	0	0	0	0	132
Lane Group Flow (vph)	0	290	155	55	516	0	0	0	0	0	65	55
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2		1	6					4	4	
Permitted Phases			2									4
Actuated Green, G (s)		29.3	29.3	4.7	38.0						19.0	19.0
Effective Green, g (s)		29.3	29.3	4.7	38.0						19.0	19.0
Actuated g/C Ratio		0.45	0.45	0.07	0.58						0.29	0.29
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		839	713	127	1089						519	462
v/s Ratio Prot		0.16		0.03	c0.28						c0.04	
v/s Ratio Perm			0.10									0.03
v/c Ratio		0.35	0.22	0.43	0.47						0.13	0.12
Uniform Delay, d1		11.6	10.9	28.9	7.8						16.9	16.9
Progression Factor		1.00	1.00	1.30	0.21						1.00	1.00
Incremental Delay, d2		1.1	0.7	2.0	1.2						0.5	0.5
Delay (s)		12.7	11.6	39.6	2.9						17.4	17.4
Level of Service		B	B	D	A						B	B
Approach Delay (s)		12.1			6.4			0.0			17.4	
Approach LOS		B			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	10.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	53.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	11	10	47	8	10	3	50	491	17	7	440	12
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	12	11	51	9	11	3	54	534	18	8	478	13
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						2						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1183				
pX, platoon unblocked												
vC, conflicting volume	1159	1161	485	1208	1158	543	491			552		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1159	1161	485	1208	1158	543	491			552		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	94	91	93	94	99	95			99		
cM capacity (veh/h)	157	184	582	133	185	540	1072			1018		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	74	23	607	499
Volume Left	12	9	54	8
Volume Right	51	3	18	13
cSH	331	189	1072	1018
Volume to Capacity	0.22	0.12	0.05	0.01
Queue Length 95th (ft)	21	10	4	1
Control Delay (s)	19.0	27.6	1.3	0.2
Lane LOS	C	D	A	A
Approach Delay (s)	19.0	27.6	1.3	0.2
Approach LOS	C	D		

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	73.7%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	16	10	181	0	10	0	195	310	0	0	277	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	11	197	0	11	0	212	337	0	0	301	18
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1077	1071	310	1175	1080	337	320			337		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1077	1071	310	1175	1080	337	320			337		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	94	73	100	94	100	83			100		
cM capacity (veh/h)	163	183	730	102	181	705	1240			1222		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	225	11	549	320
Volume Left	17	0	212	0
Volume Right	197	0	0	18
cSH	835	181	1240	1222
Volume to Capacity	0.27	0.06	0.17	0.00
Queue Length 95th (ft)	27	5	15	0
Control Delay (s)	14.1	26.2	4.4	0.0
Lane LOS	B	D	A	
Approach Delay (s)	14.1	26.2	4.4	0.0
Approach LOS	B	D		

Intersection Summary			
Average Delay	5.3		
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	54	10	214	18	10	3	260	30	37	7	62	58
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	59	11	233	20	11	3	283	33	40	8	67	63
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	741	752	99	854	764	53	130			73		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	741	752	99	854	764	53	130			73		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	78	96	76	89	96	100	81			100		
cM capacity (veh/h)	272	272	957	174	268	1015	1455			1527		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	302	20	14	355	138
Volume Left	59	20	0	283	8
Volume Right	233	0	3	40	63
cSH	1182	174	323	1455	1527
Volume to Capacity	0.26	0.11	0.04	0.19	0.00
Queue Length 95th (ft)	26	9	3	18	0
Control Delay (s)	12.9	28.4	16.7	6.8	0.4
Lane LOS	B	D	C	A	A
Approach Delay (s)	12.9	23.5		6.8	0.4
Approach LOS	B	C			

Intersection Summary			
Average Delay	8.6		
Intersection Capacity Utilization	41.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	27	0	87	100	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	29	0	95	109	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	203	109	109			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	203	109	109			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	97	100			
cM capacity (veh/h)	785	945	1482			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	29	95	109
Volume Left	0	0	0
Volume Right	29	0	0
cSH	945	1700	1700
Volume to Capacity	0.03	0.06	0.06
Queue Length 95th (ft)	2	0	0
Control Delay (s)	8.9	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.9	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	15.3%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX L

EXISTING PLUS AMBIENT PLUS PROJECT
FREEWAY RAMP ANALYSIS WORKSHEETS

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	EAP (2017)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	4685
Ramp Volume, V_R	747
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4685	0.92	Level	9	0	0.957	1.00	5322
Ramp	747	0.92	Level	2	0	0.990	1.00	820
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 2846 pc/h

V_3 or V_{av34} 2476 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 3041 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5322	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4502	Exhibit 13-8	7050	No
V_R	820	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2846	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 22.3 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.502 (Exhibit 13-12)

S_R= 53.5 mph (Exhibit 13-12)

S_0= 66.3 mph (Exhibit 13-12)

S = 58.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	EAP (2017)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A	300	☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3939	V_D =	veh/h
		Ramp Volume, V_R	1071		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3939	0.92	Level	9	0	0.957	1.00	4474
Ramp	1071	0.92	Level	2	0	0.990	1.00	1176
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2483 pc/h

V_3 or V_{av34} 1991 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 2556 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5650	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3732	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.4 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.421 (Exibit 13-11)

S_R= 55.3 mph (Exhibit 13-11)

S_0= 59.9 mph (Exhibit 13-11)

S = 56.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	EAP (2017)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	3578
Ramp Volume, V_R	467
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3578	0.92	Level	9	0	0.957	1.00	4064
Ramp	467	0.92	Level	2	0	0.990	1.00	513
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 2111 pc/h
V_3 or V_{av34} 1953 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2322 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4064	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	3551	Exhibit 13-8	7050	No
V_R	513	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2111	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 16.1 (pc/mi/ln)
LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.474 (Exhibit 13-12)
S_R= 54.1 mph (Exhibit 13-12)
S_0= 68.4 mph (Exhibit 13-12)
S = 59.4 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	EAP (2017)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A	300	☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3112	V_D =	veh/h
		Ramp Volume, V_R	836		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3112	0.92	Level	9	0	0.957	1.00	3535
Ramp	836	0.92	Level	2	0	0.990	1.00	918
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 1962 pc/h

V_3 or V_{av34} 1573 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 2020 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4453	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2938	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 22.3 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.332 (Exibit 13-11)

S_R= 57.4 mph (Exhibit 13-11)

S_0= 61.3 mph (Exhibit 13-11)

S = 58.7 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	EAP (2017)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	4284
Ramp Volume, V_R	913
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4284	0.92	Level	9	0	0.957	1.00	4866
Ramp	913	0.92	Level	2	0	0.990	1.00	1002
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 2741 pc/h

V_3 or V_{av34} 2125 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2780 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4866	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	3864	Exhibit 13-8	7050	No
V_R	1002	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2741	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 20.1 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.518 (Exhibit 13-12)

S_R= 53.1 mph (Exhibit 13-12)

S_0= 67.1 mph (Exhibit 13-12)

S = 58.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	EAP (2017)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A	300	☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3372	V_D =	veh/h
		Ramp Volume, V_R	739		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3372	0.92	Level	9	0	0.957	1.00	3830
Ramp	739	0.92	Level	2	0	0.990	1.00	811
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2126 pc/h

V_3 or V_{av34} 1704 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2188 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4641	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2999	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 22.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.336 (Exibit 13-11)

S_R= 57.3 mph (Exhibit 13-11)

S_0= 60.9 mph (Exhibit 13-11)

S = 58.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	EAP (2017)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	5376
Ramp Volume, V_R	978
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5376	0.92	Level	9	0	0.957	1.00	6106
Ramp	978	0.92	Level	2	0	0.990	1.00	1074
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 3338 pc/h

V_3 or V_{av34} 2768 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3489 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6106	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	5032	Exhibit 13-8	7050	No
V_R	1074	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3338	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 26.2 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.525 (Exhibit 13-12)

S_R= 52.9 mph (Exhibit 13-12)

S_0= 65.0 mph (Exhibit 13-12)

S = 57.5 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	EAP (2017)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 4399	
	Ramp Volume, V_R: 761	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4399	0.92	Level	9	0	0.957	1.00	4997
Ramp	761	0.92	Level	2	0	0.990	1.00	835
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2773 pc/h

V_3 or V_{av34} 2224 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2855 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5832	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3690	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.2 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.414 (Exibit 13-11)

S_R= 55.5 mph (Exhibit 13-11)

S_0= 59.1 mph (Exhibit 13-11)

S = 56.7 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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APPENDIX M

EXISTING PLUS AMBIENT PLUS PROJECT
BASIC FREEWAY SEGMENT ANALYSIS WORKSHEETS

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*EAP Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4685*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1774*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*66.2*	mph	S	mph
D = v_p / S	*26.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*EAP Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5010*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1897*	pc/h/ln
S	*64.4*	mph
D = v_p / S	*29.5*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*EAP Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3578*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1355*	pc/h/ln
S	*69.7*	mph
D = v_p / S	*19.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*EAP Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3948*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1495*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*69.0*	mph	S	mph
D = v_p / S	*21.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*EAP Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4284*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1622*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*67.9*	mph	S	mph
D = v_p / S	*23.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*EAP Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4111*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1557*	pc/h/ln
S	*68.5*	mph
D = v_p / S	*22.7*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
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f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*EAP Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5376*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2035*	pc/h/ln
S	*61.9*	mph
D = v_p / S	*32.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*EAP Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5160*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1954*	pc/h/ln
S	*63.4*	mph
D = v_p / S	*30.8*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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APPENDIX N

EXISTING PLUS AMBIENT PLUS PROJECT PLUS CUMULATIVE INTERSECTION ANALYSIS CALCULATION WORKSHEETS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	220	223	27	94	164	376	24	682	116	334	382	119
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3481		1770	3539	1583	1770	3539	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3481		1770	3539	1583	1770	3539	1583	1770	1863	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	224	228	28	96	167	384	24	696	118	341	390	121
RTOR Reduction (vph)	0	12	0	0	0	307	0	0	93	0	0	69
Lane Group Flow (vph)	224	244	0	96	167	77	24	696	25	341	390	52
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	11.8	20.6		7.2	16.0	16.0	2.0	17.0	17.0	19.2	34.2	34.2
Effective Green, g (s)	11.8	20.6		7.2	16.0	16.0	2.0	17.0	17.0	19.2	34.2	34.2
Actuated g/C Ratio	0.15	0.26		0.09	0.20	0.20	0.02	0.21	0.21	0.24	0.43	0.43
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	261	896		159	707	316	44	752	336	424	796	676
v/s Ratio Prot	c0.13	c0.07		0.05	0.05		0.01	c0.20		c0.19	0.21	
v/s Ratio Perm						0.05			0.02			0.03
v/c Ratio	0.86	0.27		0.60	0.24	0.24	0.55	0.93	0.07	0.80	0.49	0.08
Uniform Delay, d1	33.3	23.7		35.0	26.9	26.9	38.6	30.9	25.2	28.6	16.6	13.6
Progression Factor	0.96	0.79		0.89	0.41	1.47	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	22.6	0.7		5.3	0.7	1.5	13.1	19.0	0.4	10.6	2.2	0.2
Delay (s)	54.5	19.5		36.6	11.6	41.1	51.7	49.9	25.6	39.2	18.7	13.8
Level of Service	D	B		D	B	D	D	D	C	D	B	B
Approach Delay (s)		35.9			32.8			46.5			26.2	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	35.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	66	1362	32	92	816	278	76	13	108	410	33	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1692		1770	1672	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.85		0.59	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1462		1104	1672	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	75	1548	36	105	927	316	86	15	123	466	38	82
RTOR Reduction (vph)	0	0	21	0	0	185	0	55	0	0	51	0
Lane Group Flow (vph)	75	1548	15	105	927	131	0	169	0	466	69	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	4.8	33.0	33.0	5.0	33.2	33.2		30.0		30.0	30.0	
Effective Green, g (s)	4.8	33.0	33.0	5.0	33.2	33.2		30.0		30.0	30.0	
Actuated g/C Ratio	0.06	0.41	0.41	0.06	0.42	0.42		0.38		0.38	0.38	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	106	1459	652	110	1468	656		548		414	627	
v/s Ratio Prot	0.04	c0.44		c0.06	0.26						0.04	
v/s Ratio Perm			0.01			0.08		0.12		c0.42		
v/c Ratio	0.71	1.06	0.02	0.95	0.63	0.20		0.31		1.13	0.11	
Uniform Delay, d1	36.9	23.5	13.9	37.4	18.6	14.9		17.7		25.0	16.3	
Progression Factor	0.86	0.78	0.05	0.82	0.78	1.37		1.00		1.00	1.00	
Incremental Delay, d2	19.1	41.4	0.1	69.3	2.0	0.7		1.5		83.0	0.4	
Delay (s)	50.7	59.9	0.8	100.0	16.4	21.1		19.1		108.0	16.6	
Level of Service	D	E	A	F	B	C		B		F	B	
Approach Delay (s)		58.2			24.0			19.1			89.3	
Approach LOS		E			C			B			F	

Intersection Summary			
HCM 2000 Control Delay	48.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	90.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	66	1362	32	92	816	278	76	13	108	410	33	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1692		3433	1672	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1692		3433	1672	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	75	1548	36	105	927	316	86	15	123	466	38	82
RTOR Reduction (vph)	0	0	19	0	0	167	0	42	0	0	70	0
Lane Group Flow (vph)	75	1548	17	105	927	149	0	182	0	466	50	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2			6						
Actuated Green, G (s)	7.6	49.2	49.2	7.8	49.4	49.4		16.0		16.0	16.0	
Effective Green, g (s)	7.6	49.2	49.2	7.8	49.4	49.4		16.0		16.0	16.0	
Actuated g/C Ratio	0.07	0.47	0.47	0.07	0.47	0.47		0.15		0.15	0.15	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	128	1658	741	131	1665	744		257		523	254	
v/s Ratio Prot	0.04	c0.44		c0.06	0.26			c0.11		c0.14	0.03	
v/s Ratio Perm			0.01			0.09						
v/c Ratio	0.59	0.93	0.02	0.80	0.56	0.20		0.71		0.89	0.20	
Uniform Delay, d1	47.2	26.4	15.0	47.8	19.9	16.2		42.3		43.6	38.9	
Progression Factor	1.01	0.79	1.00	0.78	0.55	0.21		1.00		1.00	1.00	
Incremental Delay, d2	6.6	11.0	0.1	27.8	1.3	0.6		15.3		20.0	1.7	
Delay (s)	54.1	32.0	15.0	65.0	12.4	4.0		57.6		63.6	40.6	
Level of Service	D	C	B	E	B	A		E		E	D	
Approach Delay (s)		32.6			14.5			57.6			58.9	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	31.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1052	829	431	811	0	0	0	0	461	0	374
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.91					0.95	0.95	0.88
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		5085	1583	3433	5085					1681	1681	2787
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		5085	1583	3433	5085					1681	1681	2787
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1169	921	479	901	0	0	0	0	512	0	416
RTOR Reduction (vph)	0	0	312	0	0	0	0	0	0	0	0	285
Lane Group Flow (vph)	0	1169	609	479	901	0	0	0	0	256	256	131
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		38.0	38.0	14.0	56.0					16.0	16.0	16.0
Effective Green, g (s)		38.0	38.0	14.0	56.0					16.0	16.0	16.0
Actuated g/C Ratio		0.48	0.48	0.18	0.70					0.20	0.20	0.20
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		2415	751	600	3559					336	336	557
v/s Ratio Prot		0.23		c0.14	0.18							
v/s Ratio Perm			c0.38							c0.15	0.15	0.05
v/c Ratio		0.48	0.81	0.80	0.25					0.76	0.76	0.24
Uniform Delay, d1		14.3	17.9	31.6	4.4					30.2	30.2	26.9
Progression Factor		0.54	0.45	0.61	0.66					1.00	1.00	1.00
Incremental Delay, d2		0.1	0.9	6.6	0.2					15.0	15.0	1.0
Delay (s)		7.9	9.0	26.0	3.0					45.2	45.2	27.9
Level of Service		A	A	C	A					D	D	C
Approach Delay (s)		8.3			11.0			0.0			37.4	
Approach LOS		A			B			A			D	

Intersection Summary			
HCM 2000 Control Delay	15.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	408	1105	0	0	957	546	286	0	293	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.91			0.91	1.00	0.95	0.91	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.92	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.98	1.00			
Satd. Flow (prot)	3433	5085			5085	1583	1681	1519	1504			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.98	1.00			
Satd. Flow (perm)	3433	5085			5085	1583	1681	1519	1504			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	443	1201	0	0	1040	593	311	0	318	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	337	0	57	75	0	0	0
Lane Group Flow (vph)	443	1201	0	0	1040	256	218	154	125	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	14.5	53.0			34.5	34.5	19.0	19.0	19.0			
Effective Green, g (s)	14.5	53.0			34.5	34.5	19.0	19.0	19.0			
Actuated g/C Ratio	0.18	0.66			0.43	0.43	0.24	0.24	0.24			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	622	3368			2192	682	399	360	357			
v/s Ratio Prot	c0.13	0.24			c0.20							
v/s Ratio Perm						0.16	c0.13	0.10	0.08			
v/c Ratio	0.71	0.36			0.47	0.37	0.55	0.43	0.35			
Uniform Delay, d1	30.8	6.0			16.3	15.4	26.7	25.9	25.4			
Progression Factor	0.89	0.49			0.51	0.37	1.00	1.00	1.00			
Incremental Delay, d2	3.2	0.2			0.4	0.9	5.3	3.7	2.7			
Delay (s)	30.7	3.2			8.7	6.6	32.0	29.6	28.0			
Level of Service	C	A			A	A	C	C	C			
Approach Delay (s)		10.6			7.9			29.9			0.0	
Approach LOS		B			A			C			A	

Intersection Summary			
HCM 2000 Control Delay	12.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	184	976	229	120	1062	216	257	5	52	143	10	184
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	
Frt	1.00	0.97		1.00	0.97			1.00	0.85		0.93	
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00		0.98	
Satd. Flow (prot)	1770	4940		1770	4957			1776	1583		1690	
Flt Permitted	0.95	1.00		0.95	1.00			0.48	1.00		0.59	
Satd. Flow (perm)	1770	4940		1770	4957			896	1583		1022	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	194	1027	241	126	1118	227	271	5	55	151	11	194
RTOR Reduction (vph)	0	44	0	0	36	0	0	0	37	0	57	0
Lane Group Flow (vph)	194	1224	0	126	1309	0	0	276	18	0	299	0
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	15.2	33.4		7.8	26.0			26.8	26.8		26.8	
Effective Green, g (s)	15.2	33.4		7.8	26.0			26.8	26.8		26.8	
Actuated g/C Ratio	0.19	0.42		0.10	0.32			0.34	0.34		0.34	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	336	2062		172	1611			300	530		342	
v/s Ratio Prot	c0.11	c0.25		0.07	c0.26							
v/s Ratio Perm								c0.31	0.01		0.29	
v/c Ratio	0.58	0.59		0.73	0.81			0.92	0.03		0.88	
Uniform Delay, d1	29.5	18.0		35.1	24.8			25.6	17.9		25.0	
Progression Factor	0.73	0.62		0.86	0.47			1.00	1.00		1.00	
Incremental Delay, d2	2.3	1.2		11.0	3.4			31.9	0.0		21.3	
Delay (s)	23.7	12.5		41.3	15.0			57.5	17.9		46.3	
Level of Service	C	B		D	B			E	B		D	
Approach Delay (s)		13.9			17.3			50.9			46.3	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	21.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	184	976	229	120	1062	216	257	5	52	143	10	184
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.97		1.00	0.86		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	4940		1770	4957		1770	1607		1770	1598	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	4940		1770	4957		1770	1607		1770	1598	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	194	1027	241	126	1118	227	271	5	55	151	11	194
RTOR Reduction (vph)	0	31	0	0	25	0	0	52	0	0	177	0
Lane Group Flow (vph)	194	1237	0	126	1320	0	271	8	0	151	28	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	15.5	48.8		11.5	44.8		19.7	5.7		23.0	9.0	
Effective Green, g (s)	15.5	48.8		11.5	44.8		19.7	5.7		23.0	9.0	
Actuated g/C Ratio	0.15	0.46		0.11	0.43		0.19	0.05		0.22	0.09	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	261	2295		193	2114		332	87		387	136	
v/s Ratio Prot	c0.11	0.25		0.07	c0.27		c0.15	0.00		c0.09	0.02	
v/s Ratio Perm												
v/c Ratio	0.74	0.54		0.65	0.62		0.82	0.09		0.39	0.20	
Uniform Delay, d1	42.8	20.1		44.8	23.5		40.9	47.2		35.0	44.7	
Progression Factor	0.86	0.81		0.68	0.57		1.00	1.00		1.00	1.00	
Incremental Delay, d2	10.3	0.9		6.1	1.1		14.3	0.5		0.7	0.7	
Delay (s)	47.1	17.1		36.8	14.5		55.2	47.6		35.7	45.4	
Level of Service	D	B		D	B		E	D		D	D	
Approach Delay (s)		21.1			16.4			53.8			41.3	
Approach LOS		C			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	24.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	132	1140	12	71	1173	57	38	21	41	99	39	188
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5077		1770	3539	1583	1770	1678		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.73	1.00		0.71	1.00	1.00
Satd. Flow (perm)	1770	5077		1770	3539	1583	1359	1678		1328	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	143	1239	13	77	1275	62	41	23	45	108	42	204
RTOR Reduction (vph)	0	1	0	0	0	32	0	36	0	0	0	163
Lane Group Flow (vph)	143	1251	0	77	1275	30	41	32	0	108	42	41
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases						6	8			4		4
Actuated Green, G (s)	13.8	45.1		6.9	38.2	38.2	16.0	16.0		16.0	16.0	16.0
Effective Green, g (s)	13.8	45.1		6.9	38.2	38.2	16.0	16.0		16.0	16.0	16.0
Actuated g/C Ratio	0.17	0.56		0.09	0.48	0.48	0.20	0.20		0.20	0.20	0.20
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	305	2862		152	1689	755	271	335		265	372	316
v/s Ratio Prot	0.08	c0.25		0.04	c0.36			0.02			0.02	
v/s Ratio Perm						0.02	0.03			c0.08		0.03
v/c Ratio	0.47	0.44		0.51	0.75	0.04	0.15	0.10		0.41	0.11	0.13
Uniform Delay, d1	29.8	10.1		34.9	17.1	11.1	26.4	26.1		27.9	26.2	26.3
Progression Factor	0.54	0.40		1.04	0.85	0.86	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.4		1.6	1.9	0.1	1.2	0.6		4.6	0.6	0.8
Delay (s)	17.2	4.4		37.8	16.4	9.6	27.6	26.7		32.5	26.8	27.1
Level of Service	B	A		D	B	A	C	C		C	C	C
Approach Delay (s)		5.7			17.3			27.0			28.7	
Approach LOS		A			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	13.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	0	736	490	137	950	350	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.95	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)		3539	1583	1770	1863	1770	1583
Flt Permitted		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)		3539	1583	1770	1863	1770	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	767	510	143	990	365	47
RTOR Reduction (vph)	0	0	273	0	0	0	37
Lane Group Flow (vph)	0	767	237	143	990	365	10
Turn Type	Prot	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	5	2		1	6	8	
Permitted Phases			2				8
Actuated Green, G (s)		37.2	37.2	13.0	54.2	17.8	17.8
Effective Green, g (s)		37.2	37.2	13.0	54.2	17.8	17.8
Actuated g/C Ratio		0.47	0.47	0.16	0.68	0.22	0.22
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1645	736	287	1262	393	352
v/s Ratio Prot		0.22		0.08	c0.53	c0.21	
v/s Ratio Perm			0.15				0.01
v/c Ratio		0.47	0.32	0.50	0.78	0.93	0.03
Uniform Delay, d1		14.6	13.5	30.5	8.9	30.5	24.3
Progression Factor		0.36	0.86	0.85	0.61	1.00	1.00
Incremental Delay, d2		0.9	1.1	1.3	4.8	27.9	0.0
Delay (s)		6.2	12.7	27.2	10.2	58.3	24.4
Level of Service		A	B	C	B	E	C
Approach Delay (s)		8.8			12.3	54.5	
Approach LOS		A			B	D	

Intersection Summary			
HCM 2000 Control Delay	16.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	0	736	490	137	950	350	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.95	1.00	1.00	0.95	1.00	1.00
Frt		1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)		3539	1583	1770	3539	1770	1583
Flt Permitted		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)		3539	1583	1770	3539	1770	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	767	510	143	990	365	47
RTOR Reduction (vph)	0	0	245	0	0	0	35
Lane Group Flow (vph)	0	767	265	143	990	365	12
Turn Type	Prot	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	5	2		1	6	8	
Permitted Phases			2				8
Actuated Green, G (s)		52.3	52.3	13.8	70.1	26.9	26.9
Effective Green, g (s)		52.3	52.3	13.8	70.1	26.9	26.9
Actuated g/C Ratio		0.50	0.50	0.13	0.67	0.26	0.26
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1762	788	232	2362	453	405
v/s Ratio Prot		c0.22		c0.08	0.28	c0.21	
v/s Ratio Perm			0.17				0.01
v/c Ratio		0.44	0.34	0.62	0.42	0.81	0.03
Uniform Delay, d1		16.9	15.9	43.1	8.1	36.6	29.3
Progression Factor		0.64	0.55	0.77	0.79	1.00	1.00
Incremental Delay, d2		0.7	1.1	4.7	0.5	10.1	0.0
Delay (s)		11.5	9.9	38.0	6.9	46.7	29.3
Level of Service		B	A	D	A	D	C
Approach Delay (s)		10.9			10.8	44.7	
Approach LOS		B			B	D	

Intersection Summary			
HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	37	693	16	13	849	25	36	0	7	40	0	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0		4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00		1.00	1.00		1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00		0.85	1.00		0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95		1.00
Satd. Flow (prot)	1770	3539	1583	1770	3524		1770		1583	1770		1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95		1.00
Satd. Flow (perm)	1770	3539	1583	1770	3524		1770		1583	1770		1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	38	707	16	13	866	26	37	0	7	41	0	77
RTOR Reduction (vph)	0	0	5	0	2	0	0	0	7	0	0	71
Lane Group Flow (vph)	38	707	11	13	890	0	37	0	0	41	0	6
Turn Type	Prot	NA	Perm	Prot	NA		Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	4.9	53.6	53.6	0.8	49.5		3.6		2.2	7.4		6.0
Effective Green, g (s)	4.9	53.6	53.6	0.8	49.5		3.6		2.2	7.4		6.0
Actuated g/C Ratio	0.06	0.67	0.67	0.01	0.62		0.05		0.03	0.09		0.08
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0		3.0
Lane Grp Cap (vph)	108	2371	1060	17	2180		79		43	163		118
v/s Ratio Prot	0.02	c0.20		0.01	c0.25		c0.02			0.02		
v/s Ratio Perm			0.01						0.00			c0.00
v/c Ratio	0.35	0.30	0.01	0.76	0.41		0.47		0.00	0.25		0.05
Uniform Delay, d1	36.0	5.4	4.4	39.5	7.8		37.3		37.8	33.7		34.4
Progression Factor	1.17	0.09	1.00	0.83	0.66		1.00		1.00	1.00		1.00
Incremental Delay, d2	1.8	0.3	0.0	105.0	0.6		4.3		0.0	0.8		0.2
Delay (s)	44.0	0.8	4.4	137.7	5.7		41.6		37.9	34.5		34.5
Level of Service	D	A	A	F	A		D		D	C		C
Approach Delay (s)		3.0			7.6			41.0			34.5	
Approach LOS		A			A			D			C	

Intersection Summary			
HCM 2000 Control Delay	8.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	46.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	29	715	34	12	785	7	52	0	36	20	5	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00		0.99	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1770	1583		1668	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.71	1.00		0.91	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1323	1583		1529	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	30	730	35	12	801	7	53	0	37	20	5	56
RTOR Reduction (vph)	0	0	9	0	0	2	0	0	34	0	51	0
Lane Group Flow (vph)	30	730	26	12	801	5	0	53	3	0	30	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8		8	4		
Actuated Green, G (s)	4.5	59.0	59.0	1.5	56.0	56.0		7.5	7.5		7.5	
Effective Green, g (s)	4.5	59.0	59.0	1.5	56.0	56.0		7.5	7.5		7.5	
Actuated g/C Ratio	0.06	0.74	0.74	0.02	0.70	0.70		0.09	0.09		0.09	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	99	2610	1167	33	2477	1108		124	148		143	
v/s Ratio Prot	0.02	c0.21		0.01	c0.23							
v/s Ratio Perm			0.02			0.00		c0.04	0.00		0.02	
v/c Ratio	0.30	0.28	0.02	0.36	0.32	0.00		0.43	0.02		0.21	
Uniform Delay, d1	36.2	3.5	2.8	38.8	4.7	3.6		34.2	32.9		33.5	
Progression Factor	0.50	0.33	0.01	1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	1.7	0.3	0.0	6.7	0.3	0.0		2.4	0.1		0.7	
Delay (s)	19.8	1.4	0.1	45.5	5.0	3.6		36.6	33.0		34.3	
Level of Service	B	A	A	D	A	A		D	C		C	
Approach Delay (s)		2.0			5.6			35.1			34.3	
Approach LOS		A			A			D			C	

Intersection Summary			
HCM 2000 Control Delay	6.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	42.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	43	55	38	171	271	38
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.72	0.72	0.72	0.72	0.72	0.72
Hourly flow rate (vph)	60	76	53	238	376	53
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				816		
pX, platoon unblocked						
vC, conflicting volume	746	403	429			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	746	403	429			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	84	88	95			
cM capacity (veh/h)	363	648	1130			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	136	290	429
Volume Left	60	53	0
Volume Right	76	0	53
cSH	482	1130	1700
Volume to Capacity	0.28	0.05	0.25
Queue Length 95th (ft)	29	4	0
Control Delay (s)	15.4	1.9	0.0
Lane LOS	C	A	
Approach Delay (s)	15.4	1.9	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	43.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	6	0	48	7	6	0	0	45	6	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Hourly flow rate (vph)	0	8	0	62	9	8	0	0	58	8	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	17			8			144	147	8	201	144	13
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	17			8			144	147	8	201	144	13
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			96			100	100	95	99	100	100
cM capacity (veh/h)	1601			1613			802	716	1074	696	719	1068

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	8	78	58	8
Volume Left	0	62	0	8
Volume Right	0	8	58	0
cSH	1601	1613	1074	696
Volume to Capacity	0.00	0.04	0.05	0.01
Queue Length 95th (ft)	0	3	4	1
Control Delay (s)	0.0	5.8	8.5	10.2
Lane LOS		A	A	B
Approach Delay (s)	0.0	5.8	8.5	10.2
Approach LOS			A	B

Intersection Summary			
Average Delay	6.8		
Intersection Capacity Utilization	21.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	57	721	414	118	201	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	3539	3421		1770	1583
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	3539	3421		1770	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	61	775	445	127	216	56
RTOR Reduction (vph)	0	0	23	0	0	45
Lane Group Flow (vph)	61	775	549	0	216	11
Turn Type	Prot	NA	NA		Prot	Perm
Protected Phases	5	2	6		7	
Permitted Phases						4
Actuated Green, G (s)	6.6	56.9	46.3		15.1	15.1
Effective Green, g (s)	6.6	56.9	46.3		15.1	15.1
Actuated g/C Ratio	0.08	0.71	0.58		0.19	0.19
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	146	2517	1979		334	298
v/s Ratio Prot	0.03	c0.22	0.16		c0.12	
v/s Ratio Perm						0.01
v/c Ratio	0.42	0.31	0.28		0.65	0.04
Uniform Delay, d1	34.9	4.3	8.5		30.0	26.5
Progression Factor	1.00	1.00	0.70		1.00	1.00
Incremental Delay, d2	1.9	0.3	0.3		4.3	0.0
Delay (s)	36.8	4.6	6.2		34.3	26.6
Level of Service	D	A	A		C	C
Approach Delay (s)		6.9	6.2		32.7	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	10.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	39.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Westpark Promenade Traffic Impact Analysis (#0201-0002)
Existing + Ambient + Project + Cumulative (2017) Conditions
AM Peak Hour

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Future Volume Alternative)

Intersection #13 George Av. / La Estrella St.

Cycle (sec):	100	Critical Vol./Cap.(X):	0.720
Loss Time (sec):	0	Average Delay (sec/veh):	15.6
Optimal Cycle:	0	Level Of Service:	C

Approach:	North Bound			South Bound			East Bound			West Bound		
Movement:	L - T - R			L - T - R			L - T - R			L - T - R		
Control:	Stop Sign			Stop Sign			Stop Sign			Stop Sign		
Rights:	Include			Include			Include			Include		
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	1 0 0 1 0			1 0 1 0 1			0 0 1! 0 0			0 0 1! 0 0		
Volume Module:												
Base Vol:	24	19	52	11	13	43	47	108	13	39	196	18
Growth Adj:	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Initial Bse:	25	20	55	12	14	46	50	114	14	41	208	19
Added Vol:	1	25	10	0	18	0	0	0	1	15	0	0
PasserByVol:	0	0	0	0	0	0	0	0	0	0	0	0
Initial Fut:	26	45	65	12	32	46	50	114	15	56	208	19
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHF Adj:	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61
PHF Volume:	43	74	106	19	52	74	81	187	24	92	339	31
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0
Reduced Vol:	43	74	106	19	52	74	81	187	24	92	339	31
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FinalVolume:	43	74	106	19	52	74	81	187	24	92	339	31
Saturation Flow Module:												
Adjustment:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lanes:	1.00	0.41	0.59	1.00	1.00	1.00	0.28	0.64	0.08	0.20	0.73	0.07
Final Sat.:	462	214	309	440	468	515	166	382	49	128	472	43
Capacity Analysis Module:												
Vol/Sat:	0.09	0.34	0.34	0.04	0.11	0.14	0.49	0.49	0.49	0.72	0.72	0.72
Crit Moves:		****				****		****			****	
Delay/Veh:	10.6	11.9	11.9	10.4	10.3	9.8	13.6	13.6	13.6	20.4	20.4	20.4
Delay Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AdjDel/Veh:	10.6	11.9	11.9	10.4	10.3	9.8	13.6	13.6	13.6	20.4	20.4	20.4
LOS by Move:	B	B	B	B	B	A	B	B	B	C	C	C
ApproachDel:	11.6			10.1			13.6			20.4		
Delay Adj:	1.00			1.00			1.00			1.00		
ApprAdjDel:	11.6			10.1			13.6			20.4		
LOS by Appr:	B			B			B			C		
AllWayAvgQ:	0.1	0.4	0.4	0.0	0.1	0.1	0.8	0.8	0.8	2.1	2.1	2.1

Note: Queue reported is the number of cars per lane.

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	17	8	0	1	17	297	10	0	0	269	0	45
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	19	9	0	1	19	326	11	0	0	296	0	49

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total (vph)	23	4	10	336	11	296	49
Volume Left (vph)	19	0	1	0	11	296	0
Volume Right (vph)	0	0	0	326	0	0	49
Hadj (s)	0.44	0.03	0.09	-0.65	0.23	0.53	-0.67
Departure Headway (s)	6.4	6.0	5.7	4.9	6.2	6.0	4.8
Degree Utilization, x	0.04	0.01	0.02	0.46	0.02	0.49	0.07
Capacity (veh/h)	520	554	598	700	539	580	711
Control Delay (s)	8.5	7.8	7.6	10.9	9.3	13.4	6.9
Approach Delay (s)	8.4		10.8		9.3	12.5	
Approach LOS	A		B		A	B	

Intersection Summary			
Delay	11.5		
Level of Service	B		
Intersection Capacity Utilization	35.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	17	8	0	1	17	297	10	0	0	269	0	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0		4.0		4.0		4.0
Lane Util. Factor		0.95			1.00	1.00		1.00		1.00		1.00
Frt		1.00			1.00	0.85		1.00		1.00		0.85
Flt Protected		0.97			1.00	1.00		0.95		0.95		1.00
Satd. Flow (prot)		3423			1858	1583		1770		1770		1583
Flt Permitted		0.81			0.99	1.00		0.95		0.95		1.00
Satd. Flow (perm)		2870			1842	1583		1770		1770		1583
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	19	9	0	1	19	326	11	0	0	296	0	49
RTOR Reduction (vph)	0	0	0	0	0	295	0	0	0	0	0	9
Lane Group Flow (vph)	0	28	0	0	20	31	0	11	0	296	0	40
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Prot		Perm
Protected Phases		4			8			2		1		
Permitted Phases	4			8		8	2					6
Actuated Green, G (s)		8.9			8.9	8.9		52.7		21.4		78.1
Effective Green, g (s)		8.9			8.9	8.9		52.7		21.4		78.1
Actuated g/C Ratio		0.09			0.09	0.09		0.55		0.23		0.82
Clearance Time (s)		4.0			4.0	4.0		4.0		4.0		4.0
Vehicle Extension (s)		3.0			3.0	3.0		3.0		3.0		3.0
Lane Grp Cap (vph)		268			172	148		981		398		1301
v/s Ratio Prot										c0.17		
v/s Ratio Perm		0.01			0.01	c0.02		0.01				c0.03
v/c Ratio		0.10			0.12	0.21		0.01		0.74		0.03
Uniform Delay, d1		39.4			39.4	39.8		9.5		34.2		1.5
Progression Factor		1.00			1.00	1.00		1.00		1.00		1.00
Incremental Delay, d2		0.2			0.3	0.7		0.0		7.4		0.0
Delay (s)		39.6			39.7	40.5		9.5		41.6		1.6
Level of Service		D			D	D		A		D		A
Approach Delay (s)		39.6			40.4			9.5			35.9	
Approach LOS		D			D			A			D	

Intersection Summary			
HCM 2000 Control Delay	37.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.23		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	35.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	129	266	87	85	203	100	103	282	124	184	334	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.95		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3408		1770	1863	1583	1770	3377		1770	3389	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3408		1770	1863	1583	1770	3377		1770	3389	
Peak-hour factor, PHF	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Adj. Flow (vph)	168	345	113	110	264	130	134	366	161	239	434	171
RTOR Reduction (vph)	0	49	0	0	0	98	0	76	0	0	61	0
Lane Group Flow (vph)	168	409	0	110	264	32	134	451	0	239	544	0
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	7.0	18.4		4.8	16.2	16.2	5.6	16.8		9.0	20.2	
Effective Green, g (s)	7.0	18.4		4.8	16.2	16.2	5.6	16.8		9.0	20.2	
Actuated g/C Ratio	0.11	0.28		0.07	0.25	0.25	0.09	0.26		0.14	0.31	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	190	964		130	464	394	152	872		245	1053	
v/s Ratio Prot	c0.09	0.12		0.06	c0.14		c0.08	0.13		c0.14	c0.16	
v/s Ratio Perm						0.02						
v/c Ratio	0.88	0.42		0.85	0.57	0.08	0.88	0.52		0.98	0.52	
Uniform Delay, d1	28.6	19.0		29.7	21.3	18.7	29.4	20.6		27.9	18.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	35.0	1.4		36.9	5.0	0.4	40.5	2.2		50.2	1.8	
Delay (s)	63.6	20.4		66.7	26.3	19.1	69.9	22.8		78.1	20.2	
Level of Service	E	C		E	C	B	E	C		E	C	
Approach Delay (s)		32.0			33.3			32.4			36.6	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	33.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	167	186	199	75	136	387
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	184	204	219	82	149	425
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	301				831	260
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	301				831	260
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	85				48	45
cM capacity (veh/h)	1260				290	779

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	388	301	575
Volume Left	184	0	149
Volume Right	0	82	425
cSH	1260	1700	541
Volume to Capacity	0.15	0.18	1.06
Queue Length 95th (ft)	13	0	423
Control Delay (s)	4.7	0.0	83.5
Lane LOS	A		F
Approach Delay (s)	4.7	0.0	83.5
Approach LOS			F

Intersection Summary			
Average Delay	39.4		
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	167	186	199	75	136	387
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00		1.00	
Frt		1.00	0.96		0.90	
Flt Protected		0.98	1.00		0.99	
Satd. Flow (prot)		1820	1794		1655	
Flt Permitted		0.65	1.00		0.99	
Satd. Flow (perm)		1204	1794		1655	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	184	204	219	82	149	425
RTOR Reduction (vph)	0	0	16	0	121	0
Lane Group Flow (vph)	0	388	285	0	453	0
Turn Type	Perm	NA	NA		Perm	
Protected Phases		2	6			
Permitted Phases	2				4	
Actuated Green, G (s)		42.0	42.0		35.0	
Effective Green, g (s)		42.0	42.0		35.0	
Actuated g/C Ratio		0.49	0.49		0.41	
Clearance Time (s)		4.0	4.0		4.0	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		594	886		681	
v/s Ratio Prot			0.16			
v/s Ratio Perm		c0.32			c0.27	
v/c Ratio		0.65	0.32		0.67	
Uniform Delay, d1		16.1	12.9		20.3	
Progression Factor		0.57	1.00		1.00	
Incremental Delay, d2		5.4	1.0		5.1	
Delay (s)		14.6	13.9		25.4	
Level of Service		B	B		C	
Approach Delay (s)		14.6	13.9		25.4	
Approach LOS		B	B		C	

Intersection Summary			
HCM 2000 Control Delay	19.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	309	270	0	0	411	174	207	1	82	0	0	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	364	318	0	0	484	205	244	1	96	0	0	0

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2
Volume Total (vph)	364	318	688	245	96
Volume Left (vph)	364	0	0	244	0
Volume Right (vph)	0	0	205	0	96
Hadj (s)	0.53	0.03	-0.14	0.53	-0.67
Departure Headway (s)	7.2	6.7	6.5	8.0	6.8
Degree Utilization, x	0.72	0.59	1.0	0.55	0.18
Capacity (veh/h)	495	524	556	432	513
Control Delay (s)	25.6	17.6	149.0	19.1	10.2
Approach Delay (s)	21.8		149.0	16.6	
Approach LOS	C		F	C	

Intersection Summary			
Delay	72.0		
Level of Service	F		
Intersection Capacity Utilization	85.2%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	309	270	0	0	411	174	207	1	82	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.96		1.00	0.85				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1770	1863			1788		1770	1586				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	1770	1863			1788		1770	1586				
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	364	318	0	0	484	205	244	1	96	0	0	0
RTOR Reduction (vph)	0	0	0	0	18	0	0	78	0	0	0	0
Lane Group Flow (vph)	364	318	0	0	671	0	244	19	0	0	0	0
Turn Type	Prot	NA			NA		Split	NA				
Protected Phases	5	2			6		8	8				
Permitted Phases												
Actuated Green, G (s)	20.0	61.0			37.0		16.0	16.0				
Effective Green, g (s)	20.0	61.0			37.0		16.0	16.0				
Actuated g/C Ratio	0.24	0.72			0.44		0.19	0.19				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	416	1336			778		333	298				
v/s Ratio Prot	c0.21	0.17			c0.38		c0.14	0.01				
v/s Ratio Perm												
v/c Ratio	0.88	0.24			0.86		0.73	0.06				
Uniform Delay, d1	31.3	4.1			21.7		32.5	28.3				
Progression Factor	0.70	0.41			0.91		1.00	1.00				
Incremental Delay, d2	15.4	0.3			10.5		13.3	0.4				
Delay (s)	37.4	2.0			30.4		45.8	28.8				
Level of Service	D	A			C		D	C				
Approach Delay (s)		20.9			30.4			41.0			0.0	
Approach LOS		C			C			D			A	

Intersection Summary			
HCM 2000 Control Delay	28.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	476	487	263	355	0	0	0	0	103	2	164
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	0	547	560	302	408	0	0	0	0	118	2	189

Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	1107	302	408	121	189
Volume Left (vph)	0	302	0	118	0
Volume Right (vph)	560	0	0	0	189
Hadj (s)	-0.27	0.53	0.03	0.52	-0.67
Departure Headway (s)	6.2	6.9	6.4	8.0	6.8
Degree Utilization, x	1.0	0.58	0.73	0.27	0.36
Capacity (veh/h)	585	515	550	437	513
Control Delay (s)	425.8	17.8	23.3	12.7	12.4
Approach Delay (s)	425.8	21.0		12.5	
Approach LOS	F	C		B	

Intersection Summary			
Delay	230.5		
Level of Service	F		
Intersection Capacity Utilization	85.2%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	476	487	263	355	0	0	0	0	103	2	164
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0						4.0	4.0
Lane Util. Factor		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		1863	1583	1770	1863						1775	1583
Flt Permitted		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (perm)		1863	1583	1770	1863						1775	1583
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	0	547	560	302	408	0	0	0	0	118	2	189
RTOR Reduction (vph)	0	0	202	0	0	0	0	0	0	0	0	153
Lane Group Flow (vph)	0	547	358	302	408	0	0	0	0	0	120	36
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2		1	6					4	4	
Permitted Phases			2									4
Actuated Green, G (s)		38.4	38.4	18.6	61.0						16.0	16.0
Effective Green, g (s)		38.4	38.4	18.6	61.0						16.0	16.0
Actuated g/C Ratio		0.45	0.45	0.22	0.72						0.19	0.19
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		841	715	387	1336						334	297
v/s Ratio Prot		c0.29		c0.17	0.22						c0.07	
v/s Ratio Perm			0.23									0.02
v/c Ratio		0.65	0.50	0.78	0.31						0.36	0.12
Uniform Delay, d1		18.1	16.5	31.3	4.3						30.0	28.7
Progression Factor		1.00	1.00	1.00	0.14						1.00	1.00
Incremental Delay, d2		3.9	2.5	5.5	0.3						3.0	0.8
Delay (s)		22.0	19.0	36.7	0.9						33.0	29.5
Level of Service		C	B	D	A						C	C
Approach Delay (s)		20.5			16.2			0.0			30.9	
Approach LOS		C			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	20.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	4	10	18	18	10	7	26	241	3	1	199	6
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	11	20	20	11	8	28	262	3	1	216	7
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						2						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1183				
pX, platoon unblocked												
vC, conflicting volume	551	543	220	567	545	264	223			265		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	551	543	220	567	545	264	223			265		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	98	98	95	98	99	98			100		
cM capacity (veh/h)	425	437	820	409	436	775	1346			1299		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	35	38	293	224
Volume Left	4	20	28	1
Volume Right	20	8	3	7
cSH	590	523	1346	1299
Volume to Capacity	0.06	0.07	0.02	0.00
Queue Length 95th (ft)	5	6	2	0
Control Delay (s)	11.5	13.4	0.9	0.0
Lane LOS	B	B	A	A
Approach Delay (s)	11.5	13.4	0.9	0.0
Approach LOS	B	B		

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	40.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	6	10	68	0	10	0	99	153	0	0	138	9
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	11	74	0	11	0	108	166	0	0	150	10
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	542	536	155	579	541	166	160			166		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	542	536	155	579	541	166	160			166		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	97	92	100	97	100	92			100		
cM capacity (veh/h)	417	417	891	361	414	878	1419			1412		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	91	11	274	160
Volume Left	7	0	108	0
Volume Right	74	0	0	10
cSH	1101	414	1419	1412
Volume to Capacity	0.08	0.03	0.08	0.00
Queue Length 95th (ft)	7	2	6	0
Control Delay (s)	10.3	13.9	3.4	0.0
Lane LOS	B	B	A	
Approach Delay (s)	10.3	13.9	3.4	0.0
Approach LOS	B	B		

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	37.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	10	82	39	10	7	135	17	7	1	26	30
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	11	89	42	11	8	147	18	8	1	28	33
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	376	366	45	412	379	22	61			26		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	376	366	45	412	379	22	61			26		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	98	91	91	98	99	90			100		
cM capacity (veh/h)	526	508	1025	458	500	1055	1542			1588		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	122	42	18	173	62
Volume Left	22	42	0	147	1
Volume Right	89	0	8	8	33
cSH	1400	458	638	1542	1588
Volume to Capacity	0.09	0.09	0.03	0.10	0.00
Queue Length 95th (ft)	7	8	2	8	0
Control Delay (s)	9.8	13.7	10.8	6.5	0.1
Lane LOS	A	B	B	A	A
Approach Delay (s)	9.8	12.8		6.5	0.1
Approach LOS	A	B			

Intersection Summary			
Average Delay	7.5		
Intersection Capacity Utilization	31.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	10	0	45	48	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	11	0	49	52	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	101	52	52			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	101	52	52			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	100			
cM capacity (veh/h)	897	1015	1554			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	11	49	52
Volume Left	0	0	0
Volume Right	11	0	0
cSH	1015	1700	1700
Volume to Capacity	0.01	0.03	0.03
Queue Length 95th (ft)	1	0	0
Control Delay (s)	8.6	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.6	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	154	225	46	215	322	450	45	460	196	524	557	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3450		1770	3539	1583	1770	3539	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3450		1770	3539	1583	1770	3539	1583	1770	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	162	237	48	226	339	474	47	484	206	552	586	200
RTOR Reduction (vph)	0	16	0	0	0	380	0	0	173	0	0	49
Lane Group Flow (vph)	162	269	0	226	339	94	47	484	33	552	586	151
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	12.4	16.2		17.0	20.8	20.8	5.6	17.0	17.0	38.8	50.2	50.2
Effective Green, g (s)	12.4	16.2		17.0	20.8	20.8	5.6	17.0	17.0	38.8	50.2	50.2
Actuated g/C Ratio	0.12	0.15		0.16	0.20	0.20	0.05	0.16	0.16	0.37	0.48	0.48
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	209	532		286	701	313	94	572	256	654	890	756
v/s Ratio Prot	c0.09	0.08		c0.13	c0.10		0.03	c0.14		c0.31	0.31	
v/s Ratio Perm						0.06			0.02			0.10
v/c Ratio	0.78	0.51		0.79	0.48	0.30	0.50	0.85	0.13	0.84	0.66	0.20
Uniform Delay, d1	44.9	40.7		42.3	37.3	35.9	48.3	42.7	37.7	30.3	20.9	15.8
Progression Factor	0.80	0.79		0.69	0.64	3.81	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	15.8	3.3		6.4	1.0	1.1	4.1	14.3	1.1	9.7	3.8	0.6
Delay (s)	51.7	35.5		35.6	24.8	137.7	52.5	57.1	38.7	40.1	24.7	16.4
Level of Service	D	D		D	C	F	D	E	D	D	C	B
Approach Delay (s)		41.4			78.6			51.6			29.8	
Approach LOS		D			E			D			C	

Intersection Summary			
HCM 2000 Control Delay	50.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	165	1039	85	160	1232	613	139	12	167	452	14	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1693		1770	1605	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.77		0.54	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1328		1002	1605	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	170	1071	88	165	1270	632	143	12	172	466	14	165
RTOR Reduction (vph)	0	0	34	0	0	357	0	38	0	0	93	0
Lane Group Flow (vph)	170	1071	54	165	1270	275	0	289	0	466	86	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	10.0	37.0	37.0	10.0	37.0	37.0		46.0		46.0	46.0	
Effective Green, g (s)	10.0	37.0	37.0	10.0	37.0	37.0		46.0		46.0	46.0	
Actuated g/C Ratio	0.10	0.35	0.35	0.10	0.35	0.35		0.44		0.44	0.44	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	168	1247	557	168	1247	557		581		438	703	
v/s Ratio Prot	c0.10	0.30		0.09	c0.36						0.05	
v/s Ratio Perm			0.03			0.17		0.22		c0.47		
v/c Ratio	1.01	0.86	0.10	0.98	1.02	0.49		0.50		1.06	0.12	
Uniform Delay, d1	47.5	31.6	22.8	47.4	34.0	26.7		21.2		29.5	17.5	
Progression Factor	0.90	0.67	0.36	0.77	0.68	0.36		1.00		1.00	1.00	
Incremental Delay, d2	67.7	6.9	0.3	59.7	28.7	2.8		3.0		61.0	0.4	
Delay (s)	110.2	28.2	8.6	96.4	51.7	12.4		24.2		90.5	17.9	
Level of Service	F	C	A	F	D	B		C		F	B	
Approach Delay (s)		37.4			43.2			24.2			70.4	
Approach LOS		D			D			C			E	

Intersection Summary			
HCM 2000 Control Delay	44.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	100.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	165	1039	85	160	1232	613	139	12	167	452	14	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1693		3433	1605	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1693		3433	1605	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	170	1071	88	165	1270	632	143	12	172	466	14	165
RTOR Reduction (vph)	0	0	56	0	0	386	0	42	0	0	137	0
Lane Group Flow (vph)	170	1071	32	165	1270	246	0	285	0	466	42	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2			6						
Actuated Green, G (s)	10.0	35.0	35.0	12.0	37.0	37.0		16.0		16.0	16.0	
Effective Green, g (s)	10.0	35.0	35.0	12.0	37.0	37.0		16.0		16.0	16.0	
Actuated g/C Ratio	0.11	0.37	0.37	0.13	0.39	0.39		0.17		0.17	0.17	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	186	1303	583	223	1378	616		285		578	270	
v/s Ratio Prot	0.10	c0.30		0.09	c0.36			c0.17		c0.14	0.03	
v/s Ratio Perm			0.02			0.16						
v/c Ratio	0.91	0.82	0.06	0.74	0.92	0.40		1.00		0.81	0.15	
Uniform Delay, d1	42.1	27.2	19.3	40.0	27.6	21.0		39.5		38.0	33.7	
Progression Factor	0.97	0.56	0.17	0.66	0.49	0.41		1.00		1.00	1.00	
Incremental Delay, d2	38.0	5.1	0.2	10.8	10.4	1.7		52.9		11.5	1.2	
Delay (s)	79.0	20.5	3.5	37.1	24.0	10.2		92.4		49.5	34.9	
Level of Service	E	C	A	D	C	B		F		D	C	
Approach Delay (s)		26.8			20.8			92.4			45.4	
Approach LOS		C			C			F			D	

Intersection Summary			
HCM 2000 Control Delay	31.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	88.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1125	532	418	1484	0	0	0	0	572	1	521
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.91					0.95	0.95	0.88
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		5085	1583	3433	5085					1681	1686	2787
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		5085	1583	3433	5085					1681	1686	2787
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	0	1136	537	422	1499	0	0	0	0	578	1	526
RTOR Reduction (vph)	0	0	332	0	0	0	0	0	0	0	0	51
Lane Group Flow (vph)	0	1136	205	422	1499	0	0	0	0	289	290	475
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		40.0	40.0	21.0	65.0					32.0	32.0	32.0
Effective Green, g (s)		40.0	40.0	21.0	65.0					32.0	32.0	32.0
Actuated g/C Ratio		0.38	0.38	0.20	0.62					0.30	0.30	0.30
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1937	603	686	3147					512	513	849
v/s Ratio Prot		c0.22		c0.12	0.29							
v/s Ratio Perm			0.13							0.17	0.17	0.17
v/c Ratio		0.59	0.34	0.62	0.48					0.56	0.57	0.56
Uniform Delay, d1		25.9	23.1	38.3	10.8					30.6	30.7	30.6
Progression Factor		0.47	0.20	0.93	0.62					1.00	1.00	1.00
Incremental Delay, d2		0.6	0.7	1.1	0.3					4.5	4.5	2.7
Delay (s)		12.8	5.4	36.6	7.0					35.1	35.1	33.2
Level of Service		B	A	D	A					D	D	C
Approach Delay (s)		10.4			13.5			0.0			34.2	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	17.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	379	1317	0	0	1240	547	662	0	577	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.91			0.91	1.00	0.95	0.91	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.93	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.97	1.00			
Satd. Flow (prot)	3433	5085			5085	1583	1681	1540	1504			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.97	1.00			
Satd. Flow (perm)	3433	5085			5085	1583	1681	1540	1504			
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	395	1372	0	0	1292	570	690	0	601	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	385	0	32	32	0	0	0
Lane Group Flow (vph)	395	1372	0	0	1292	185	448	402	377	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	18.0	56.0			34.0	34.0	41.0	41.0	41.0			
Effective Green, g (s)	18.0	56.0			34.0	34.0	41.0	41.0	41.0			
Actuated g/C Ratio	0.17	0.53			0.32	0.32	0.39	0.39	0.39			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	588	2712			1646	512	656	601	587			
v/s Ratio Prot	c0.12	0.27			c0.25							
v/s Ratio Perm						0.12	c0.27	0.26	0.25			
v/c Ratio	0.67	0.51			0.78	0.36	0.68	0.67	0.64			
Uniform Delay, d1	40.7	15.7			32.2	27.2	26.6	26.4	26.0			
Progression Factor	0.78	0.43			0.35	0.12	1.00	1.00	1.00			
Incremental Delay, d2	2.5	0.6			0.4	0.2	5.7	5.8	5.3			
Delay (s)	34.2	7.3			11.5	3.4	32.3	32.2	31.4			
Level of Service	C	A			B	A	C	C	C			
Approach Delay (s)		13.3			9.0			32.0			0.0	
Approach LOS		B			A			C			A	

Intersection Summary			
HCM 2000 Control Delay	16.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	329	1282	250	83	1210	328	288	15	80	288	10	289
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	
Frt	1.00	0.98		1.00	0.97			1.00	0.85		0.93	
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00		0.98	
Satd. Flow (prot)	1770	4961		1770	4923			1778	1583		1697	
Flt Permitted	0.95	1.00		0.95	1.00			0.44	1.00		0.56	
Satd. Flow (perm)	1770	4961		1770	4923			828	1583		966	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	350	1364	266	88	1287	349	306	16	85	306	11	307
RTOR Reduction (vph)	0	27	0	0	46	0	0	0	48	0	33	0
Lane Group Flow (vph)	350	1603	0	88	1590	0	0	322	37	0	591	0
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	17.0	41.0		6.0	30.0			46.0	46.0		46.0	
Effective Green, g (s)	17.0	41.0		6.0	30.0			46.0	46.0		46.0	
Actuated g/C Ratio	0.16	0.39		0.06	0.29			0.44	0.44		0.44	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	286	1937		101	1406			362	693		423	
v/s Ratio Prot	c0.20	0.32		0.05	c0.32							
v/s Ratio Perm								0.39	0.02		c0.61	
v/c Ratio	1.22	0.83		0.87	1.13			0.89	0.05		1.40	
Uniform Delay, d1	44.0	28.8		49.1	37.5			27.2	17.0		29.5	
Progression Factor	0.78	0.71		0.74	0.72			1.00	1.00		1.00	
Incremental Delay, d2	124.2	3.6		42.3	66.3			22.3	0.0		192.5	
Delay (s)	158.4	24.1		78.5	93.4			49.5	17.0		222.0	
Level of Service	F	C		E	F			D	B		F	
Approach Delay (s)		47.9			92.7			42.7			222.0	
Approach LOS		D			F			D			F	

Intersection Summary			
HCM 2000 Control Delay	86.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.28		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	99.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	329	1282	250	83	1210	328	288	15	80	288	10	289
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.97		1.00	0.87		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	4961		1770	4923		1770	1628		1770	1593	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	4961		1770	4923		1770	1628		1770	1593	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	350	1364	266	88	1287	349	306	16	85	306	11	307
RTOR Reduction (vph)	0	27	0	0	47	0	0	78	0	0	276	0
Lane Group Flow (vph)	350	1603	0	88	1589	0	306	23	0	306	42	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	18.8	45.7		7.7	34.6		16.0	7.7		17.9	9.6	
Effective Green, g (s)	18.8	45.7		7.7	34.6		16.0	7.7		17.9	9.6	
Actuated g/C Ratio	0.20	0.48		0.08	0.36		0.17	0.08		0.19	0.10	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	350	2386		143	1793		298	131		333	160	
v/s Ratio Prot	c0.20	0.32		0.05	c0.32		c0.17	0.01		0.17	c0.03	
v/s Ratio Perm												
v/c Ratio	1.00	0.67		0.62	0.89		1.03	0.17		0.92	0.26	
Uniform Delay, d1	38.1	18.9		42.2	28.4		39.5	40.7		37.8	39.4	
Progression Factor	0.79	0.68		0.89	0.52		1.00	1.00		1.00	1.00	
Incremental Delay, d2	44.1	1.3		5.9	5.4		59.2	0.6		29.2	0.9	
Delay (s)	74.1	14.1		43.4	20.0		98.7	41.3		67.0	40.3	
Level of Service	E	B		D	C		F	D		E	D	
Approach Delay (s)		24.7			21.2			84.5			53.4	
Approach LOS		C			C			F			D	

Intersection Summary			
HCM 2000 Control Delay	32.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	96.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	120	1504	10	83	1473	85	58	35	121	60	31	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.88		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5080		1770	3539	1583	1770	1646		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.74	1.00		0.49	1.00	1.00
Satd. Flow (perm)	1770	5080		1770	3539	1583	1373	1646		907	1863	1583
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	121	1519	10	84	1488	86	59	35	122	61	31	91
RTOR Reduction (vph)	0	1	0	0	0	36	0	102	0	0	0	76
Lane Group Flow (vph)	121	1528	0	84	1488	50	59	55	0	61	31	15
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases						6	8			4		4
Actuated Green, G (s)	14.8	68.3		7.7	61.2	61.2	17.0	17.0		17.0	17.0	17.0
Effective Green, g (s)	14.8	68.3		7.7	61.2	61.2	17.0	17.0		17.0	17.0	17.0
Actuated g/C Ratio	0.14	0.65		0.07	0.58	0.58	0.16	0.16		0.16	0.16	0.16
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	249	3304		129	2062	922	222	266		146	301	256
v/s Ratio Prot	0.07	c0.30		0.05	c0.42			0.03			0.02	
v/s Ratio Perm						0.03	0.04			c0.07		0.01
v/c Ratio	0.49	0.46		0.65	0.72	0.05	0.27	0.21		0.42	0.10	0.06
Uniform Delay, d1	41.6	9.2		47.3	15.8	9.4	38.5	38.1		39.6	37.5	37.2
Progression Factor	0.60	0.22		1.00	0.95	0.86	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	0.2		1.1	0.2	0.0	2.9	1.7		8.6	0.7	0.4
Delay (s)	25.7	2.2		48.5	15.2	8.2	41.4	39.9		48.1	38.2	37.7
Level of Service	C	A		D	B	A	D	D		D	D	D
Approach Delay (s)		4.0			16.5			40.3			41.2	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	13.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	0	1119	528	75	1041	617	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.95	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)		3539	1583	1770	1863	1770	1583
Flt Permitted		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)		3539	1583	1770	1863	1770	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	0	1142	539	77	1062	630	143
RTOR Reduction (vph)	0	0	208	0	0	0	70
Lane Group Flow (vph)	0	1142	331	77	1062	630	73
Turn Type	Prot	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	5	2		1	6	8	
Permitted Phases			2				8
Actuated Green, G (s)		51.0	51.0	8.0	63.0	34.0	34.0
Effective Green, g (s)		51.0	51.0	8.0	63.0	34.0	34.0
Actuated g/C Ratio		0.49	0.49	0.08	0.60	0.32	0.32
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1718	768	134	1117	573	512
v/s Ratio Prot		0.32		0.04	c0.57	c0.36	
v/s Ratio Perm			0.21				0.05
v/c Ratio		0.66	0.43	0.57	0.95	1.10	0.14
Uniform Delay, d1		20.5	17.6	46.9	19.6	35.5	25.2
Progression Factor		0.31	0.23	0.73	0.67	1.00	1.00
Incremental Delay, d2		1.9	1.6	5.6	16.8	67.7	0.1
Delay (s)		8.2	5.7	39.7	30.0	103.2	25.3
Level of Service		A	A	D	C	F	C
Approach Delay (s)		7.4			30.6	88.8	
Approach LOS		A			C	F	

Intersection Summary			
HCM 2000 Control Delay	32.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	0	1119	528	75	1041	617	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.95	1.00	1.00	0.95	1.00	1.00
Frt		1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)		3539	1583	1770	3539	1770	1583
Flt Permitted		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)		3539	1583	1770	3539	1770	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	0	1142	539	77	1062	630	143
RTOR Reduction (vph)	0	0	222	0	0	0	76
Lane Group Flow (vph)	0	1142	317	77	1062	630	67
Turn Type	Prot	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	5	2		1	6	8	
Permitted Phases			2				8
Actuated Green, G (s)		40.9	40.9	4.8	49.7	37.3	37.3
Effective Green, g (s)		40.9	40.9	4.8	49.7	37.3	37.3
Actuated g/C Ratio		0.43	0.43	0.05	0.52	0.39	0.39
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1523	681	89	1851	694	621
v/s Ratio Prot		c0.32		0.04	c0.30	c0.36	
v/s Ratio Perm			0.20				0.04
v/c Ratio		0.75	0.47	0.87	0.57	0.91	0.11
Uniform Delay, d1		22.7	19.3	44.8	15.4	27.2	18.3
Progression Factor		0.32	0.29	0.99	1.07	0.91	0.86
Incremental Delay, d2		3.1	2.0	51.8	1.2	14.2	0.1
Delay (s)		10.4	7.6	96.1	17.8	39.0	15.8
Level of Service		B	A	F	B	D	B
Approach Delay (s)		9.5			23.1	34.7	
Approach LOS		A			C	C	

Intersection Summary			
HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	98	966	21	16	897	40	32	0	3	35	3	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00		1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00		0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3517		1770		1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3517		1770		1583	1770	1863	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	101	996	22	16	925	41	33	0	3	36	3	86
RTOR Reduction (vph)	0	0	6	0	2	0	0	0	3	0	0	82
Lane Group Flow (vph)	101	996	16	16	964	0	33	0	0	36	3	4
Turn Type	Prot	NA	Perm	Prot	NA		Prot		Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	13.6	75.9	75.9	1.6	63.9		6.7		2.2	9.3	4.8	4.8
Effective Green, g (s)	13.6	75.9	75.9	1.6	63.9		6.7		2.2	9.3	4.8	4.8
Actuated g/C Ratio	0.13	0.72	0.72	0.02	0.61		0.06		0.02	0.09	0.05	0.05
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	229	2558	1144	26	2140		112		33	156	85	72
v/s Ratio Prot	c0.06	0.28		0.01	c0.27		0.02			c0.02	0.00	
v/s Ratio Perm			0.01						0.00			c0.00
v/c Ratio	0.44	0.39	0.01	0.62	0.45		0.29		0.00	0.23	0.04	0.05
Uniform Delay, d1	42.2	5.6	4.1	51.4	11.1		46.9		50.3	44.5	47.9	47.9
Progression Factor	0.53	0.41	1.00	0.86	0.55		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	0.4	0.0	35.0	0.7		1.5		0.0	0.8	0.2	0.3
Delay (s)	23.3	2.7	4.1	79.3	6.8		48.4		50.3	45.3	48.1	48.2
Level of Service	C	A	A	E	A		D		D	D	D	D
Approach Delay (s)		4.6			8.0			48.5			47.4	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	9.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	50.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	61	902	51	18	841	21	48	3	31	18	1	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00		0.99	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1779	1583		1659	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.64	1.00		0.90	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1187	1583		1516	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	64	949	54	19	885	22	51	3	33	19	1	53
RTOR Reduction (vph)	0	0	12	0	0	7	0	0	30	0	49	0
Lane Group Flow (vph)	64	949	42	19	885	15	0	54	3	0	24	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8		8	4		
Actuated Green, G (s)	13.6	81.4	81.4	3.1	70.9	70.9		8.5	8.5		8.5	
Effective Green, g (s)	13.6	81.4	81.4	3.1	70.9	70.9		8.5	8.5		8.5	
Actuated g/C Ratio	0.13	0.78	0.78	0.03	0.68	0.68		0.08	0.08		0.08	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	229	2743	1227	52	2389	1068		96	128		122	
v/s Ratio Prot	0.04	c0.27		0.01	c0.25							
v/s Ratio Perm			0.03			0.01		c0.05	0.00		0.02	
v/c Ratio	0.28	0.35	0.03	0.37	0.37	0.01		0.56	0.02		0.20	
Uniform Delay, d1	41.3	3.6	2.7	50.0	7.4	5.6		46.5	44.4		45.1	
Progression Factor	0.66	0.71	0.60	1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	0.6	0.3	0.0	4.3	0.4	0.0		7.3	0.1		0.8	
Delay (s)	27.7	2.9	1.7	54.3	7.8	5.6		53.8	44.5		45.9	
Level of Service	C	A	A	D	A	A		D	D		D	
Approach Delay (s)		4.3			8.7			50.3			45.9	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	9.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	58	33	54	186	148	72
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	68	39	64	219	174	85
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				816		
pX, platoon unblocked						
vC, conflicting volume	562	216	259			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	562	216	259			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	85	95	95			
cM capacity (veh/h)	464	823	1306			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	107	282	259
Volume Left	68	64	0
Volume Right	39	0	85
cSH	551	1306	1700
Volume to Capacity	0.19	0.05	0.15
Queue Length 95th (ft)	18	4	0
Control Delay (s)	13.1	2.1	0.0
Lane LOS	B	A	
Approach Delay (s)	13.1	2.1	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	40.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	4	0	100	7	7	0	0	87	4	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Hourly flow rate (vph)	0	6	0	145	10	10	0	0	126	6	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	20			6			311	316	6	437	311	15
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	20			6			311	316	6	437	311	15
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			91			100	100	88	99	100	100
cM capacity (veh/h)	1596			1615			598	546	1077	436	550	1064

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	6	165	126	6
Volume Left	0	145	0	6
Volume Right	0	10	126	0
cSH	1596	1615	1077	436
Volume to Capacity	0.00	0.09	0.12	0.01
Queue Length 95th (ft)	0	7	10	1
Control Delay (s)	0.0	6.6	8.8	13.4
Lane LOS		A	A	B
Approach Delay (s)	0.0	6.6	8.8	13.4
Approach LOS			A	B

Intersection Summary			
Average Delay	7.5		
Intersection Capacity Utilization	25.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	57	585	659	208	243	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.96		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	3539	3412		1770	1583
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	3539	3412		1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	60	616	694	219	256	61
RTOR Reduction (vph)	0	0	22	0	0	49
Lane Group Flow (vph)	60	616	891	0	256	12
Turn Type	Prot	NA	NA		Prot	Perm
Protected Phases	5	2	6		7	
Permitted Phases						4
Actuated Green, G (s)	8.8	76.5	63.7		20.5	20.5
Effective Green, g (s)	8.8	76.5	63.7		20.5	20.5
Actuated g/C Ratio	0.08	0.73	0.61		0.20	0.20
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	148	2578	2069		345	309
v/s Ratio Prot	c0.03	0.17	c0.26		c0.14	
v/s Ratio Perm						0.01
v/c Ratio	0.41	0.24	0.43		0.74	0.04
Uniform Delay, d1	45.6	4.7	11.0		39.8	34.3
Progression Factor	1.00	1.00	0.57		1.00	1.00
Incremental Delay, d2	1.8	0.2	0.6		8.3	0.1
Delay (s)	47.4	4.9	6.9		48.1	34.3
Level of Service	D	A	A		D	C
Approach Delay (s)		8.7	6.9		45.5	
Approach LOS		A	A		D	

Intersection Summary			
HCM 2000 Control Delay	13.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Westpark Promenade Traffic Impact Analysis (#0201-0002)
Existing + Ambient + Project + Cumulative (2017) Conditions
PM Peak Hour

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Future Volume Alternative)

Intersection #13 George Av. / La Estrella St.

Cycle (sec):	100	Critical Vol./Cap.(X):	0.225
Loss Time (sec):	0	Average Delay (sec/veh):	8.5
Optimal Cycle:	0	Level Of Service:	A

Approach:	North Bound			South Bound			East Bound			West Bound		
Movement:	L -	T -	R	L -	T -	R	L -	T -	R	L -	T -	R
Control:	Stop Sign			Stop Sign			Stop Sign			Stop Sign		
Rights:	Include			Include			Include			Include		
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	1 0 0 1 0			1 0 1 0 1			0 0 0 1 0			0 1 0 0 0		
Volume Module:												
Base Vol:	20	0	22	1	0	0	0	100	27	33	97	0
Growth Adj:	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Initial Bse:	21	0	23	1	0	0	0	106	29	35	103	0
Added Vol:	1	34	27	0	44	0	0	0	2	29	0	0
PasserByVol:	0	0	0	0	0	0	0	0	0	0	0	0
Initial Fut:	22	34	50	1	44	0	0	106	31	64	103	0
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHF Adj:	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
PHF Volume:	23	35	52	1	46	0	0	110	32	67	107	0
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0
Reduced Vol:	23	35	52	1	46	0	0	110	32	67	107	0
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FinalVolume:	23	35	52	1	46	0	0	110	32	67	107	0
Saturation Flow Module:												
Adjustment:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lanes:	1.00	0.40	0.60	1.00	1.00	1.00	0.00	0.78	0.22	0.38	0.62	0.00
Final Sat.:	598	285	422	589	641	731	0	620	179	296	476	0
Capacity Analysis Module:												
Vol/Sat:	0.04	0.12	0.12	0.00	0.07	0.00	xxxx	0.18	0.18	0.22	0.22	xxxx
Crit Moves:		****			****			****			****	
Delay/Veh:	8.7	8.2	8.2	8.5	8.4	0.0	0.0	8.3	8.3	8.8	8.8	0.0
Delay Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AdjDel/Veh:	8.7	8.2	8.2	8.5	8.4	0.0	0.0	8.3	8.3	8.8	8.8	0.0
LOS by Move:	A	A	A	A	A	*	*	A	A	A	A	*
ApproachDel:	8.3			8.4			8.3			8.8		
Delay Adj:	1.00			1.00			1.00			1.00		
ApprAdjDel:	8.3			8.4			8.3			8.8		
LOS by Appr:	A			A			A			A		
AllWayAvgQ:	0.0	0.1	0.1	0.0	0.1	0.0	0.2	0.2	0.2	0.3	0.3	0.3

Note: Queue reported is the number of cars per lane.

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	28	12	0	2	4	481	0	0	0	454	0	7
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	33	14	0	2	5	566	0	0	0	534	0	8

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total (vph)	40	7	5	568	0	534	8
Volume Left (vph)	33	0	2	0	0	534	0
Volume Right (vph)	0	0	0	566	0	0	8
Hadj (s)	0.45	0.03	0.28	-0.66	0.00	0.53	-0.67
Departure Headway (s)	7.9	7.5	6.7	5.8	7.5	6.8	5.6
Degree Utilization, x	0.09	0.01	0.01	0.92	0.00	1.0	0.01
Capacity (veh/h)	444	468	522	607	467	515	612
Control Delay (s)	10.4	9.4	8.6	41.2	10.5	67.0	7.5
Approach Delay (s)	10.3		40.9		0.0	66.1	
Approach LOS	B		E		A	F	

Intersection Summary			
Delay	51.4		
Level of Service	F		
Intersection Capacity Utilization	54.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	28	12	0	2	4	481	0	0	0	454	0	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0				4.0		4.0
Lane Util. Factor		0.95			1.00	1.00				1.00		1.00
Frt		1.00			1.00	0.85				1.00		0.85
Flt Protected		0.97			0.99	1.00				0.95		1.00
Satd. Flow (prot)		3419			1837	1583				1770		1583
Flt Permitted		0.80			0.95	1.00				0.95		1.00
Satd. Flow (perm)		2839			1761	1583				1770		1583
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	33	14	0	2	5	566	0	0	0	534	0	8
RTOR Reduction (vph)	0	0	0	0	0	499	0	0	0	0	0	2
Lane Group Flow (vph)	0	47	0	0	7	67	0	0	0	534	0	6
Turn Type	Perm	NA		Perm	NA	Perm				Prot		Perm
Protected Phases		4			8			2		1		
Permitted Phases	4			8		8	2					6
Actuated Green, G (s)		11.3			11.3	11.3				33.8		75.7
Effective Green, g (s)		11.3			11.3	11.3				33.8		75.7
Actuated g/C Ratio		0.12			0.12	0.12				0.36		0.80
Clearance Time (s)		4.0			4.0	4.0				4.0		4.0
Vehicle Extension (s)		3.0			3.0	3.0				3.0		3.0
Lane Grp Cap (vph)		337			209	188				629		1261
v/s Ratio Prot										c0.30		
v/s Ratio Perm		0.02			0.00	c0.04						c0.00
v/c Ratio		0.14			0.03	0.36				0.85		0.01
Uniform Delay, d1		37.5			37.0	38.5				28.2		2.0
Progression Factor		1.00			1.00	1.00				0.52		0.11
Incremental Delay, d2		0.2			0.1	1.2				8.5		0.0
Delay (s)		37.7			37.1	39.7				23.3		0.2
Level of Service		D			D	D				C		A
Approach Delay (s)		37.7			39.7			0.0			23.0	
Approach LOS		D			D			A			C	

Intersection Summary			
HCM 2000 Control Delay	31.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	40.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	180	342	139	133	340	227	144	231	81	146	224	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.96		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3386		1770	1863	1583	1770	3402		1770	3348	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3386		1770	1863	1583	1770	3402		1770	3348	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	191	364	148	141	362	241	153	246	86	155	238	134
RTOR Reduction (vph)	0	66	0	0	0	178	0	54	0	0	101	0
Lane Group Flow (vph)	191	446	0	141	362	63	153	278	0	155	271	0
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	8.9	19.6		6.4	17.1	17.1	7.0	16.0		7.0	16.0	
Effective Green, g (s)	8.9	19.6		6.4	17.1	17.1	7.0	16.0		7.0	16.0	
Actuated g/C Ratio	0.14	0.30		0.10	0.26	0.26	0.11	0.25		0.11	0.25	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	242	1021		174	490	416	190	837		190	824	
v/s Ratio Prot	c0.11	0.13		0.08	c0.19		c0.09	0.08		c0.09	c0.08	
v/s Ratio Perm						0.04						
v/c Ratio	0.79	0.44		0.81	0.74	0.15	0.81	0.33		0.82	0.33	
Uniform Delay, d1	27.1	18.3		28.7	21.9	18.4	28.3	20.1		28.4	20.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	15.6	1.4		24.0	9.6	0.8	21.4	1.1		22.9	1.1	
Delay (s)	42.7	19.6		52.7	31.5	19.2	49.7	21.2		51.3	21.2	
Level of Service	D	B		D	C	B	D	C		D	C	
Approach Delay (s)		25.9			31.5			30.2			30.0	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	29.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	137	159	103	35	41	171
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	147	171	111	38	44	184
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	148				595	130
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	148				595	130
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	90				89	80
cM capacity (veh/h)	1433				419	920

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	318	148	228
Volume Left	147	0	44
Volume Right	0	38	184
cSH	1433	1700	747
Volume to Capacity	0.10	0.09	0.31
Queue Length 95th (ft)	9	0	32
Control Delay (s)	4.1	0.0	11.9
Lane LOS	A		B
Approach Delay (s)	4.1	0.0	11.9
Approach LOS			B

Intersection Summary			
Average Delay	5.8		
Intersection Capacity Utilization	46.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	137	159	103	35	41	171
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00		1.00	
Frt		1.00	0.97		0.89	
Flt Protected		0.98	1.00		0.99	
Satd. Flow (prot)		1821	1799		1644	
Flt Permitted		0.80	1.00		0.99	
Satd. Flow (perm)		1491	1799		1644	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	147	171	111	38	44	184
RTOR Reduction (vph)	0	0	17	0	125	0
Lane Group Flow (vph)	0	318	132	0	103	0
Turn Type	Perm	NA	NA		Perm	
Protected Phases		2	6			
Permitted Phases	2				4	
Actuated Green, G (s)		36.0	36.0		21.0	
Effective Green, g (s)		36.0	36.0		21.0	
Actuated g/C Ratio		0.55	0.55		0.32	
Clearance Time (s)		4.0	4.0		4.0	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		825	996		531	
v/s Ratio Prot			0.07			
v/s Ratio Perm		c0.21			c0.06	
v/c Ratio		0.39	0.13		0.19	
Uniform Delay, d1		8.2	7.0		15.9	
Progression Factor		0.30	1.00		1.00	
Incremental Delay, d2		1.3	0.3		0.8	
Delay (s)		3.8	7.3		16.7	
Level of Service		A	A		B	
Approach Delay (s)		3.8	7.3		16.7	
Approach LOS		A	A		B	

Intersection Summary			
HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	206	233	0	0	196	79	463	4	63	0	0	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	217	245	0	0	206	83	487	4	66	0	0	0

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2
Volume Total (vph)	217	245	289	492	66
Volume Left (vph)	217	0	0	487	0
Volume Right (vph)	0	0	83	0	66
Hadj (s)	0.53	0.03	-0.14	0.53	-0.67
Departure Headway (s)	7.6	7.1	7.1	7.3	6.1
Degree Utilization, x	0.46	0.49	0.57	1.0	0.11
Capacity (veh/h)	465	499	504	492	575
Control Delay (s)	15.8	15.5	18.9	67.1	8.7
Approach Delay (s)	15.6		18.9	60.1	
Approach LOS	C		C	F	

Intersection Summary			
Delay	35.3		
Level of Service	E		
Intersection Capacity Utilization	62.4%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	206	233	0	0	196	79	463	4	63	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.96		1.00	0.86				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1770	1863			1791		1770	1599				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	1770	1863			1791		1770	1599				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	217	245	0	0	206	83	487	4	66	0	0	0
RTOR Reduction (vph)	0	0	0	0	22	0	0	42	0	0	0	0
Lane Group Flow (vph)	217	245	0	0	267	0	487	28	0	0	0	0
Turn Type	Prot	NA			NA		Split	NA				
Protected Phases	5	2			6		8	8				
Permitted Phases												
Actuated Green, G (s)	12.0	33.0			17.0		24.0	24.0				
Effective Green, g (s)	12.0	33.0			17.0		24.0	24.0				
Actuated g/C Ratio	0.18	0.51			0.26		0.37	0.37				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	326	945			468		653	590				
v/s Ratio Prot	c0.12	0.13			c0.15		c0.28	0.02				
v/s Ratio Perm												
v/c Ratio	0.67	0.26			0.57		0.75	0.05				
Uniform Delay, d1	24.6	9.1			20.8		17.8	13.2				
Progression Factor	0.78	0.39			0.87		1.00	1.00				
Incremental Delay, d2	4.8	0.6			4.9		7.6	0.2				
Delay (s)	24.1	4.1			23.0		25.4	13.3				
Level of Service	C	A			C		C	B				
Approach Delay (s)		13.5			23.0			23.9			0.0	
Approach LOS		B			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	20.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	365	382	64	595	0	0	0	0	72	2	236
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	376	394	66	613	0	0	0	0	74	2	243

Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	770	66	613	76	243
Volume Left (vph)	0	66	0	74	0
Volume Right (vph)	394	0	0	0	243
Hadj (s)	-0.27	0.53	0.03	0.52	-0.67
Departure Headway (s)	6.3	7.0	6.5	8.1	6.9
Degree Utilization, x	1.0	0.13	1.0	0.17	0.47
Capacity (veh/h)	563	506	568	438	515
Control Delay (s)	185.6	9.8	93.6	11.6	14.7
Approach Delay (s)	185.6	85.4		13.9	
Approach LOS	F	F		B	

Intersection Summary			
Delay	116.1		
Level of Service	F		
Intersection Capacity Utilization	62.4%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	365	382	64	595	0	0	0	0	72	2	236
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0						4.0	4.0
Lane Util. Factor		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		1863	1583	1770	1863						1776	1583
Flt Permitted		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (perm)		1863	1583	1770	1863						1776	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	376	394	66	613	0	0	0	0	74	2	243
RTOR Reduction (vph)	0	0	204	0	0	0	0	0	0	0	0	176
Lane Group Flow (vph)	0	376	190	66	613	0	0	0	0	0	76	67
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2		1	6					4	4	
Permitted Phases			2									4
Actuated Green, G (s)		31.4	31.4	3.6	39.0						18.0	18.0
Effective Green, g (s)		31.4	31.4	3.6	39.0						18.0	18.0
Actuated g/C Ratio		0.48	0.48	0.06	0.60						0.28	0.28
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		899	764	98	1117						491	438
v/s Ratio Prot		0.20		0.04	c0.33						c0.04	
v/s Ratio Perm			0.12									0.04
v/c Ratio		0.42	0.25	0.67	0.55						0.15	0.15
Uniform Delay, d1		10.9	9.9	30.1	7.8						17.8	17.7
Progression Factor		1.00	1.00	0.79	0.32						1.00	1.00
Incremental Delay, d2		1.4	0.8	12.1	1.4						0.7	0.7
Delay (s)		12.3	10.7	36.0	3.8						18.4	18.5
Level of Service		B	B	D	A						B	B
Approach Delay (s)		11.5			7.0			0.0			18.5	
Approach LOS		B			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	11.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	11	10	47	8	10	3	50	491	17	7	440	12
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	12	11	51	9	11	3	54	534	18	8	478	13
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						2						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1183				
pX, platoon unblocked												
vC, conflicting volume	1159	1161	485	1208	1158	543	491			552		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1159	1161	485	1208	1158	543	491			552		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	94	91	93	94	99	95			99		
cM capacity (veh/h)	157	184	582	133	185	540	1072			1018		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	74	23	607	499
Volume Left	12	9	54	8
Volume Right	51	3	18	13
cSH	331	189	1072	1018
Volume to Capacity	0.22	0.12	0.05	0.01
Queue Length 95th (ft)	21	10	4	1
Control Delay (s)	19.0	27.6	1.3	0.2
Lane LOS	C	D	A	A
Approach Delay (s)	19.0	27.6	1.3	0.2
Approach LOS	C	D		

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	73.7%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	16	10	181	0	10	0	195	310	0	0	277	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	11	197	0	11	0	212	337	0	0	301	18
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1077	1071	310	1175	1080	337	320			337		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1077	1071	310	1175	1080	337	320			337		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	94	73	100	94	100	83			100		
cM capacity (veh/h)	163	183	730	102	181	705	1240			1222		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	225	11	549	320
Volume Left	17	0	212	0
Volume Right	197	0	0	18
cSH	835	181	1240	1222
Volume to Capacity	0.27	0.06	0.17	0.00
Queue Length 95th (ft)	27	5	15	0
Control Delay (s)	14.1	26.2	4.4	0.0
Lane LOS	B	D	A	
Approach Delay (s)	14.1	26.2	4.4	0.0
Approach LOS	B	D		

Intersection Summary			
Average Delay	5.3		
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	54	10	214	18	10	3	260	30	37	7	62	58
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	59	11	233	20	11	3	283	33	40	8	67	63
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	741	752	99	854	764	53	130			73		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	741	752	99	854	764	53	130			73		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	78	96	76	89	96	100	81			100		
cM capacity (veh/h)	272	272	957	174	268	1015	1455			1527		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	302	20	14	355	138
Volume Left	59	20	0	283	8
Volume Right	233	0	3	40	63
cSH	1182	174	323	1455	1527
Volume to Capacity	0.26	0.11	0.04	0.19	0.00
Queue Length 95th (ft)	26	9	3	18	0
Control Delay (s)	12.9	28.4	16.7	6.8	0.4
Lane LOS	B	D	C	A	A
Approach Delay (s)	12.9	23.5		6.8	0.4
Approach LOS	B	C			

Intersection Summary			
Average Delay	8.6		
Intersection Capacity Utilization	41.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	27	0	87	100	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	29	0	95	109	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	203	109	109			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	203	109	109			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	97	100			
cM capacity (veh/h)	785	945	1482			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	29	95	109
Volume Left	0	0	0
Volume Right	29	0	0
cSH	945	1700	1700
Volume to Capacity	0.03	0.06	0.06
Queue Length 95th (ft)	2	0	0
Control Delay (s)	8.9	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.9	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	15.3%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX O

EXISTING PLUS AMBIENT PLUS PROJECT PLUS CUMULATIVE FREEWAY RAMP ANALYSIS WORKSHEETS

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	EAPC (2017)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	4919
Ramp Volume, V_R	835
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4919	0.92	Level	9	0	0.957	1.00	5587
Ramp	835	0.92	Level	2	0	0.990	1.00	917
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 3018 pc/h

V_3 or V_{av34} 2569 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3192 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5587	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4670	Exhibit 13-8	7050	No
V_R	917	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3018	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 23.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.511 (Exhibit 13-12)

S_R= 53.3 mph (Exhibit 13-12)

S_0= 65.9 mph (Exhibit 13-12)

S = 58.0 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	EAPC (2017)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes ☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A	300	☑ No ☐ Off
L_{up} =	ft	Deceleration Lane Length L_D		L_{down} = ft
V_u =	veh/h	Freeway Volume, V_F	4085	V_D = veh/h
		Ramp Volume, V_R	1260	
		Freeway Free-Flow Speed, S_{FF}	65.0	
		Ramp Free-Flow Speed, S_{FR}	35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4085	0.92	Level	9	0	0.957	1.00	4640
Ramp	1260	0.92	Level	2	0	0.990	1.00	1383
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2575 pc/h

V_3 or V_{av34} 2065 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 2651 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6023	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4034	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 30.7 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.478 (Exibit 13-11)

S_R= 54.0 mph (Exhibit 13-11)

S_0= 59.6 mph (Exhibit 13-11)

S = 55.7 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	EAPC (2017)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	3803
Ramp Volume, V_R	579
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3803	0.92	Level	9	0	0.957	1.00	4320
Ramp	579	0.92	Level	2	0	0.990	1.00	636
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 2294 pc/h
V_3 or V_{av34} 2026 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No
If Yes, V_{12a} = 2468 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4320	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	3684	Exhibit 13-8	7050	No
V_R	636	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2294	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 17.4 (pc/mi/ln)
LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.485 (Exhibit 13-12)
S_R= 53.8 mph (Exhibit 13-12)
S_0= 68.0 mph (Exhibit 13-12)
S = 59.1 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	EAPC (2017)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A	300	☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3225	V_D =	veh/h
		Ramp Volume, V_R	954		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3225	0.92	Level	9	0	0.957	1.00	3663
Ramp	954	0.92	Level	2	0	0.990	1.00	1047
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2033 pc/h

V_3 or V_{av34} 1630 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 2093 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4710	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3140	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 23.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.348 (Exibit 13-11)

S_R= 57.0 mph (Exhibit 13-11)

S_0= 61.1 mph (Exhibit 13-11)

S = 58.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	EAPC (2017)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	300	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	4682	V_D =	veh/h
		Ramp Volume, V_R	1094		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4682	0.92	Level	9	0	0.957	1.00	5318
Ramp	1094	0.92	Level	2	0	0.990	1.00	1201
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 3054 pc/h

V_3 or V_{av34} 2264 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5318	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4117	Exhibit 13-8	7050	No
V_R	1201	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3054	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 22.4 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.536 (Exhibit 13-12)

S_R= 52.7 mph (Exhibit 13-12)

S_0= 66.4 mph (Exhibit 13-12)

S = 57.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	EAPC (2017)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D	V_D = veh/h
	Freeway Volume, V_F: 3589	
	Ramp Volume, V_R: 951	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3589	0.92	Level	9	0	0.957	1.00	4077
Ramp	951	0.92	Level	2	0	0.990	1.00	1044
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2263 pc/h

V_3 or V_{av34} 1814 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 2329 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5121	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3373	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 25.7 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.372 (Exibit 13-11)

S_R= 56.4 mph (Exhibit 13-11)

S_0= 60.5 mph (Exhibit 13-11)

S = 57.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	EAPC (2017)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	5874
Ramp Volume, V_R	1239
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5874	0.92	Level	9	0	0.957	1.00	6672
Ramp	1239	0.92	Level	2	0	0.990	1.00	1360
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 3750 pc/h

V_3 or V_{av34} 2922 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3972 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6672	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	5312	Exhibit 13-8	7050	No
V_R	1360	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3750	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.550 (Exhibit 13-12)

S_R= 52.3 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 56.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	EAPC (2017)

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 4636	
	Ramp Volume, V_R: 926	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4636	0.92	Level	9	0	0.957	1.00	5266
Ramp	926	0.92	Level	2	0	0.990	1.00	1017
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2923 pc/h

V_3 or V_{av34} 2343 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 3009 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6283	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4026	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 30.8 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.477 (Exibit 13-11)

S_R= 54.0 mph (Exhibit 13-11)

S_0= 58.7 mph (Exhibit 13-11)

S = 55.6 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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APPENDIX P

EXISTING PLUS AMBIENT PLUS PROJECT PLUS CUMULATIVE BASIC FREEWAY SEGMENT ANALYSIS WORKSHEETS

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*EAPC Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4919*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1862*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*64.9*	mph	S	mph
D = v_p / S	*28.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*EAPC Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5345*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2024*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*62.1*	mph	S	mph
D = v_p / S	*32.6*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*EAPC Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3803*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1440*	pc/h/ln
S	*69.3*	mph
D = v_p / S	*20.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*EAPC w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3803*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1080*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*15.4*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*EAPC Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4178*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1582*	pc/h/ln
S	*68.3*	mph
D = v_p / S	*23.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*EAPC Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4682*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1773*	pc/h/ln
S	*66.2*	mph
D = v_p / S	*26.8*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*EAPC Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4540*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1719*	pc/h/ln
S	*66.9*	mph
D = v_p / S	*25.7*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*EAPC Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5874*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2224*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*57.8*	mph	S	mph
D = v_p / S	*38.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*EAPC w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5874*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1668*	pc/h/ln
S	*67.5*	mph
D = v_p / S	*24.7*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*EAPC Conditions*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5562*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2106*	pc/h/ln
S	*60.5*	mph
D = v_p / S	*34.8*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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APPENDIX Q

HORIZON YEAR (2035) WITHOUT PROJECT
INTERSECTION ANALYSIS CALCULATION WORKSHEETS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	242	654	76	324	694	494	46	750	182	352	420	131
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3484		1770	3539	1583	1770	3539	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3484		1770	3539	1583	1770	3539	1583	1770	1863	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	247	667	78	331	708	504	47	765	186	359	429	134
RTOR Reduction (vph)	0	9	0	0	0	289	0	0	144	0	0	58
Lane Group Flow (vph)	247	736	0	331	708	215	47	765	42	359	429	76
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	17.0	23.2		20.0	26.2	26.2	5.6	23.8	23.8	22.0	40.2	40.2
Effective Green, g (s)	17.0	23.2		20.0	26.2	26.2	5.6	23.8	23.8	22.0	40.2	40.2
Actuated g/C Ratio	0.16	0.22		0.19	0.25	0.25	0.05	0.23	0.23	0.21	0.38	0.38
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	286	769		337	883	394	94	802	358	370	713	606
v/s Ratio Prot	0.14	c0.21		c0.19	0.20		0.03	c0.22		c0.20	0.23	
v/s Ratio Perm						0.14			0.03			0.05
v/c Ratio	0.86	0.96		0.98	0.80	0.55	0.50	0.95	0.12	0.97	0.60	0.13
Uniform Delay, d1	42.9	40.4		42.3	37.0	34.2	48.3	40.1	32.3	41.2	26.0	21.0
Progression Factor	1.04	0.92		0.87	0.43	1.07	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	21.9	23.0		28.9	3.7	2.5	4.1	22.3	0.7	38.8	3.7	0.4
Delay (s)	66.6	60.3		65.9	19.6	39.3	52.5	62.4	32.9	79.9	29.7	21.4
Level of Service	E	E		E	B	D	D	E	C	E	C	C
Approach Delay (s)		61.9			36.0			56.4			48.1	
Approach LOS		E			D			E			D	

Intersection Summary			
HCM 2000 Control Delay	48.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	92.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	242	654	76	324	694	494	46	750	182	352	420	131
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	1770	3539	1583	3433	1863	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	247	667	78	331	708	504	47	765	186	359	429	134
RTOR Reduction (vph)	0	0	59	0	0	44	0	0	138	0	0	86
Lane Group Flow (vph)	247	667	19	331	708	460	47	765	48	359	429	48
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6	7	3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	17.2	25.2	25.2	22.2	30.2	44.6	4.0	27.2	27.2	14.4	37.6	37.6
Effective Green, g (s)	17.2	25.2	25.2	22.2	30.2	44.6	4.0	27.2	27.2	14.4	37.6	37.6
Actuated g/C Ratio	0.16	0.24	0.24	0.21	0.29	0.42	0.04	0.26	0.26	0.14	0.36	0.36
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	289	849	379	374	1017	672	67	916	410	470	667	566
v/s Ratio Prot	0.14	c0.19		c0.19	c0.20	0.09	0.03	c0.22		c0.10	0.23	
v/s Ratio Perm			0.01			0.20			0.03			0.03
v/c Ratio	0.85	0.79	0.05	0.89	0.70	0.68	0.70	0.84	0.12	0.76	0.64	0.08
Uniform Delay, d1	42.7	37.4	30.7	40.2	33.3	24.5	49.9	36.8	29.7	43.7	28.1	22.3
Progression Factor	1.05	0.91	1.00	1.10	0.56	1.74	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	20.4	7.0	0.2	12.5	2.1	1.5	28.2	8.9	0.6	7.2	4.7	0.3
Delay (s)	65.2	41.0	30.9	56.7	20.6	44.1	78.1	45.7	30.3	50.9	32.8	22.6
Level of Service	E	D	C	E	C	D	E	D	C	D	C	C
Approach Delay (s)		46.2			36.0			44.3			38.4	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	40.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	80.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	73	1482	36	102	1394	282	84	15	119	420	37	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1693		1770	1671	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.84		0.57	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1445		1066	1671	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	1611	39	111	1515	307	91	16	129	457	40	87
RTOR Reduction (vph)	0	0	22	0	0	145	0	41	0	0	54	0
Lane Group Flow (vph)	79	1611	17	111	1515	162	0	195	0	457	73	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	5.0	46.0	46.0	7.0	48.0	48.0		40.0		40.0	40.0	
Effective Green, g (s)	5.0	46.0	46.0	7.0	48.0	48.0		40.0		40.0	40.0	
Actuated g/C Ratio	0.05	0.44	0.44	0.07	0.46	0.46		0.38		0.38	0.38	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	84	1550	693	118	1617	723		550		406	636	
v/s Ratio Prot	0.04	c0.46		0.06	c0.43						0.04	
v/s Ratio Perm			0.01			0.10		0.13		c0.43		
v/c Ratio	0.94	1.04	0.02	0.94	0.94	0.22		0.35		1.13	0.12	
Uniform Delay, d1	49.9	29.5	16.8	48.8	27.1	17.2		23.3		32.5	21.0	
Progression Factor	1.10	0.63	0.66	0.70	0.46	0.41		1.00		1.00	1.00	
Incremental Delay, d2	68.9	31.5	0.1	59.0	10.5	0.6		1.8		83.4	0.4	
Delay (s)	123.6	50.2	11.1	93.2	22.8	7.7		25.0		115.9	21.4	
Level of Service	F	D	B	F	C	A		C		F	C	
Approach Delay (s)		52.7			24.4			25.0			95.4	
Approach LOS		D			C			C			F	

Intersection Summary			
HCM 2000 Control Delay	44.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	73	1482	36	102	1394	282	84	15	119	420	37	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1693		3433	1671	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1693		3433	1671	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	1611	39	111	1515	307	91	16	129	457	40	87
RTOR Reduction (vph)	0	0	20	0	0	108	0	42	0	0	74	0
Lane Group Flow (vph)	79	1611	19	111	1515	199	0	194	0	457	53	0
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Split	NA		Split	NA	
Protected Phases	5	2		1	6	4	8	8		4	4	
Permitted Phases			2			6						
Actuated Green, G (s)	5.0	50.0	50.0	7.0	52.0	68.0		16.0		16.0	16.0	
Effective Green, g (s)	5.0	50.0	50.0	7.0	52.0	68.0		16.0		16.0	16.0	
Actuated g/C Ratio	0.05	0.48	0.48	0.07	0.50	0.65		0.15		0.15	0.15	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	84	1685	753	118	1752	1085		257		523	254	
v/s Ratio Prot	0.04	c0.46		0.06	c0.43	0.03		c0.11		c0.13	0.03	
v/s Ratio Perm			0.01			0.10						
v/c Ratio	0.94	0.96	0.02	0.94	0.86	0.18		0.76		0.87	0.21	
Uniform Delay, d1	49.9	26.4	14.6	48.8	23.4	7.4		42.6		43.5	39.0	
Progression Factor	1.04	0.59	1.00	0.77	0.52	1.75		1.00		1.00	1.00	
Incremental Delay, d2	73.0	12.6	0.1	59.0	5.2	0.3		18.6		18.1	1.9	
Delay (s)	125.1	28.3	14.6	96.6	17.4	13.3		61.3		61.6	40.8	
Level of Service	F	C	B	F	B	B		E		E	D	
Approach Delay (s)		32.4			21.3			61.3			57.1	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	32.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	83.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1109	912	454	1156	0	0	0	0	789	1	622
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.91					0.95	0.95	0.88
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		5085	1583	3433	5085					1681	1686	2787
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		5085	1583	3433	5085					1681	1686	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1205	991	493	1257	0	0	0	0	858	1	676
RTOR Reduction (vph)	0	0	382	0	0	0	0	0	0	0	0	105
Lane Group Flow (vph)	0	1205	609	493	1257	0	0	0	0	429	430	571
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		48.0	48.0	16.0	68.0					29.0	29.0	29.0
Effective Green, g (s)		48.0	48.0	16.0	68.0					29.0	29.0	29.0
Actuated g/C Ratio		0.46	0.46	0.15	0.65					0.28	0.28	0.28
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		2324	723	523	3293					464	465	769
v/s Ratio Prot		0.24		c0.14	0.25							
v/s Ratio Perm			c0.38							c0.26	0.26	0.20
v/c Ratio		0.52	0.84	0.94	0.38					0.92	0.92	0.74
Uniform Delay, d1		20.3	25.2	44.0	8.7					36.9	36.9	34.6
Progression Factor		0.37	0.38	1.17	0.80					1.00	1.00	1.00
Incremental Delay, d2		0.1	1.2	20.3	0.2					26.6	26.6	6.4
Delay (s)		7.7	10.6	71.9	7.2					63.6	63.6	41.0
Level of Service		A	B	E	A					E	E	D
Approach Delay (s)		9.0			25.4			0.0			53.6	
Approach LOS		A			C			A			D	

Intersection Summary			
HCM 2000 Control Delay	26.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	101.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	792	1106	0	0	1094	682	516	9	311	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.91			0.91	1.00	0.95	0.91	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.97	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.96	1.00			
Satd. Flow (prot)	3433	5085			5085	1583	1681	1588	1504			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.96	1.00			
Satd. Flow (perm)	3433	5085			5085	1583	1681	1588	1504			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	861	1202	0	0	1189	741	561	10	338	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	306	0	7	82	0	0	0
Lane Group Flow (vph)	861	1202	0	0	1189	435	314	304	202	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	30.0	72.0			38.0	38.0	25.0	25.0	25.0			
Effective Green, g (s)	30.0	72.0			38.0	38.0	25.0	25.0	25.0			
Actuated g/C Ratio	0.29	0.69			0.36	0.36	0.24	0.24	0.24			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	980	3486			1840	572	400	378	358			
v/s Ratio Prot	c0.25	0.24			0.23							
v/s Ratio Perm						c0.27	0.19	0.19	0.13			
v/c Ratio	0.88	0.34			0.65	0.76	0.79	0.80	0.57			
Uniform Delay, d1	35.8	6.8			27.9	29.5	37.5	37.7	35.2			
Progression Factor	0.85	0.25			0.73	0.86	1.00	1.00	1.00			
Incremental Delay, d2	6.7	0.2			1.4	7.4	14.3	16.5	6.3			
Delay (s)	36.9	1.9			21.8	32.7	51.8	54.2	41.6			
Level of Service	D	A			C	C	D	D	D			
Approach Delay (s)		16.5			26.0			49.4			0.0	
Approach LOS		B			C			D			A	

Intersection Summary			
HCM 2000 Control Delay	26.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	101.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	73	1077	252	138	1409	98	283	5	58	49	4	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	
Frt	1.00	0.97		1.00	0.99			1.00	0.85		0.92	
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00		0.98	
Satd. Flow (prot)	1770	4941		1770	5036			1775	1583		1679	
Flt Permitted	0.95	1.00		0.95	1.00			0.60	1.00		0.70	
Satd. Flow (perm)	1770	4941		1770	5036			1122	1583		1204	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	77	1134	265	145	1483	103	298	5	61	52	4	88
RTOR Reduction (vph)	0	34	0	0	6	0	0	0	42	0	58	0
Lane Group Flow (vph)	77	1365	0	145	1580	0	0	303	19	0	86	0
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	8.7	44.1		16.9	52.3			32.0	32.0		32.0	
Effective Green, g (s)	8.7	44.1		16.9	52.3			32.0	32.0		32.0	
Actuated g/C Ratio	0.08	0.42		0.16	0.50			0.30	0.30		0.30	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	146	2075		284	2508			341	482		366	
v/s Ratio Prot	0.04	c0.28		0.08	c0.31							
v/s Ratio Perm								c0.27	0.01		0.07	
v/c Ratio	0.53	0.66		0.51	0.63			0.89	0.04		0.23	
Uniform Delay, d1	46.2	24.4		40.3	19.3			34.8	25.7		27.3	
Progression Factor	1.11	0.95		0.66	0.41			1.00	1.00		1.00	
Incremental Delay, d2	3.2	1.5		1.1	0.8			23.2	0.0		0.3	
Delay (s)	54.5	24.8		27.8	8.8			58.0	25.7		27.7	
Level of Service	D	C		C	A			E	C		C	
Approach Delay (s)		26.4			10.4			52.6			27.7	
Approach LOS		C			B			D			C	

Intersection Summary			
HCM 2000 Control Delay	21.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	146	1153	14	79	1390	62	42	24	46	105	43	213
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5076		1770	3539	1583	1770	1679		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.73	1.00		0.71	1.00	1.00
Satd. Flow (perm)	1770	5076		1770	3539	1583	1353	1679		1318	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	159	1253	15	86	1511	67	46	26	50	114	47	232
RTOR Reduction (vph)	0	1	0	0	0	29	0	42	0	0	0	197
Lane Group Flow (vph)	159	1267	0	86	1511	38	46	34	0	114	47	35
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases						6	8			4		4
Actuated Green, G (s)	17.8	68.8		8.2	59.2	59.2	16.0	16.0		16.0	16.0	16.0
Effective Green, g (s)	17.8	68.8		8.2	59.2	59.2	16.0	16.0		16.0	16.0	16.0
Actuated g/C Ratio	0.17	0.66		0.08	0.56	0.56	0.15	0.15		0.15	0.15	0.15
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	300	3325		138	1995	892	206	255		200	283	241
v/s Ratio Prot	c0.09	0.25		0.05	c0.43			0.02			0.03	
v/s Ratio Perm						0.02	0.03			c0.09		0.02
v/c Ratio	0.53	0.38		0.62	0.76	0.04	0.22	0.13		0.57	0.17	0.15
Uniform Delay, d1	39.8	8.3		46.9	17.4	10.2	39.0	38.5		41.3	38.7	38.6
Progression Factor	0.82	0.22		0.98	0.99	1.02	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.5	0.3		0.8	0.3	0.0	2.5	1.1		11.3	1.3	1.3
Delay (s)	34.3	2.1		46.8	17.5	10.5	41.5	39.6		52.6	40.0	39.9
Level of Service	C	A		D	B	B	D	D		D	D	D
Approach Delay (s)		5.7			18.7			40.3			43.6	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	17.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	0	1049	484	151	1409	309	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.95	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)		3539	1583	1770	1863	1770	1583
Flt Permitted		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)		3539	1583	1770	1863	1770	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	1093	504	157	1468	322	52
RTOR Reduction (vph)	0	0	210	0	0	0	44
Lane Group Flow (vph)	0	1093	294	157	1468	322	8
Turn Type	Prot	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	5	2		1	6	8	
Permitted Phases			2				8
Actuated Green, G (s)		60.0	60.0	17.0	81.0	16.0	16.0
Effective Green, g (s)		60.0	60.0	17.0	81.0	16.0	16.0
Actuated g/C Ratio		0.57	0.57	0.16	0.77	0.15	0.15
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		2022	904	286	1437	269	241
v/s Ratio Prot		0.31		0.09	c0.79	c0.18	
v/s Ratio Perm			0.19				0.01
v/c Ratio		0.54	0.32	0.55	1.02	1.20	0.03
Uniform Delay, d1		14.0	11.8	40.5	12.0	44.5	37.9
Progression Factor		0.46	0.27	0.85	0.65	1.00	1.00
Incremental Delay, d2		1.0	0.9	2.1	29.2	119.0	0.1
Delay (s)		7.5	4.1	36.4	37.0	163.5	38.0
Level of Service		A	A	D	D	F	D
Approach Delay (s)		6.4			36.9	146.0	
Approach LOS		A			D	F	

Intersection Summary			
HCM 2000 Control Delay	34.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	104.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	0	1049	484	151	1409	309	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95	0.97	
Frt		1.00	0.85	1.00	1.00	0.98	
Flt Protected		1.00	1.00	0.95	1.00	0.96	
Satd. Flow (prot)		3539	1583	1770	3539	3392	
Flt Permitted		1.00	1.00	0.95	1.00	0.96	
Satd. Flow (perm)		3539	1583	1770	3539	3392	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	1093	504	157	1468	322	52
RTOR Reduction (vph)	0	0	195	0	0	14	0
Lane Group Flow (vph)	0	1093	309	157	1468	360	0
Turn Type	Prot	NA	Perm	Prot	NA	Prot	
Protected Phases	5	2		1	6	8	
Permitted Phases			2				
Actuated Green, G (s)		57.8	57.8	19.0	80.8	16.2	
Effective Green, g (s)		57.8	57.8	19.0	80.8	16.2	
Actuated g/C Ratio		0.55	0.55	0.18	0.77	0.15	
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		1948	871	320	2723	523	
v/s Ratio Prot		c0.31		0.09	c0.41	c0.11	
v/s Ratio Perm			0.20				
v/c Ratio		0.56	0.36	0.49	0.54	0.69	
Uniform Delay, d1		15.3	13.2	38.7	4.8	42.0	
Progression Factor		0.31	0.07	0.82	0.74	1.00	
Incremental Delay, d2		1.1	1.1	1.2	0.8	3.8	
Delay (s)		5.9	2.0	32.9	4.3	45.8	
Level of Service		A	A	C	A	D	
Approach Delay (s)		4.7			7.0	45.8	
Approach LOS		A			A	D	

Intersection Summary			
HCM 2000 Control Delay	10.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	27	721	18	15	887	28	40	5	8	44	5	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3523		1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3523		1770	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	28	736	18	15	905	29	41	5	8	45	5	68
RTOR Reduction (vph)	0	0	5	0	1	0	0	0	8	0	0	65
Lane Group Flow (vph)	28	736	13	15	933	0	41	5	0	45	5	3
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	6.2	74.8	74.8	3.0	71.6		6.4	3.8	3.8	7.4	4.8	4.8
Effective Green, g (s)	6.2	74.8	74.8	3.0	71.6		6.4	3.8	3.8	7.4	4.8	4.8
Actuated g/C Ratio	0.06	0.71	0.71	0.03	0.68		0.06	0.04	0.04	0.07	0.05	0.05
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	104	2521	1127	50	2402		107	67	57	124	85	72
v/s Ratio Prot	0.02	c0.21		0.01	c0.26		c0.02	0.00		c0.03	0.00	
v/s Ratio Perm			0.01						0.00			0.00
v/c Ratio	0.27	0.29	0.01	0.30	0.39		0.38	0.07	0.01	0.36	0.06	0.04
Uniform Delay, d1	47.2	5.5	4.4	50.0	7.2		47.4	48.9	48.8	46.6	47.9	47.9
Progression Factor	0.52	0.18	1.00	1.24	0.64		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.3	0.0	3.1	0.4		2.3	0.5	0.0	1.8	0.3	0.2
Delay (s)	26.0	1.3	4.4	65.2	5.0		49.7	49.4	48.8	48.4	48.2	48.2
Level of Service	C	A	A	E	A		D	D	D	D	D	D
Approach Delay (s)		2.2			6.0			49.5			48.2	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	8.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	42.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	927	24	56	1144	20	42	23	81	64	6	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00		0.98	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1804	1583		1699	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.67	1.00		0.82	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1239	1583		1424	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	36	946	24	57	1167	20	43	23	83	65	6	69
RTOR Reduction (vph)	0	0	7	0	0	6	0	0	73	0	38	0
Lane Group Flow (vph)	36	946	17	57	1167	14	0	66	10	0	102	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8		8	4		
Actuated Green, G (s)	4.8	72.9	72.9	7.6	75.7	75.7		12.5	12.5		12.5	
Effective Green, g (s)	4.8	72.9	72.9	7.6	75.7	75.7		12.5	12.5		12.5	
Actuated g/C Ratio	0.05	0.69	0.69	0.07	0.72	0.72		0.12	0.12		0.12	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	80	2457	1099	128	2551	1141		147	188		169	
v/s Ratio Prot	0.02	c0.27		0.03	c0.33							
v/s Ratio Perm			0.01			0.01		0.05	0.01		c0.07	
v/c Ratio	0.45	0.39	0.02	0.45	0.46	0.01		0.45	0.05		0.60	
Uniform Delay, d1	48.8	6.7	5.0	46.7	6.1	4.1		43.0	41.0		43.9	
Progression Factor	0.75	0.77	1.31	1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	3.9	0.5	0.0	2.5	0.6	0.0		2.2	0.1		6.0	
Delay (s)	40.7	5.6	6.5	49.1	6.7	4.1		45.2	41.1		49.9	
Level of Service	D	A	A	D	A	A		D	D		D	
Approach Delay (s)		6.9			8.6			42.9			49.9	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	12.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	17	57	41	188	298	10
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.72	0.72	0.72	0.72	0.72	0.72
Hourly flow rate (vph)	24	79	57	261	414	14
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				816		
pX, platoon unblocked						
vC, conflicting volume	796	421	428			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	796	421	428			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	93	87	95			
cM capacity (veh/h)	338	633	1132			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	103	318	428
Volume Left	24	57	0
Volume Right	79	0	14
cSH	527	1132	1700
Volume to Capacity	0.19	0.05	0.25
Queue Length 95th (ft)	18	4	0
Control Delay (s)	13.5	1.9	0.0
Lane LOS	B	A	
Approach Delay (s)	13.5	1.9	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	42.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	7	8	7	7	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78
Hourly flow rate (vph)	6	9	10	9	9	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	19				37	15
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	19				37	15
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	99
cM capacity (veh/h)	1597				972	1065

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	15	19	15
Volume Left	6	0	9
Volume Right	0	9	6
cSH	1597	1700	1009
Volume to Capacity	0.00	0.01	0.02
Queue Length 95th (ft)	0	0	1
Control Delay (s)	3.0	0.0	8.6
Lane LOS	A		A
Approach Delay (s)	3.0	0.0	8.6
Approach LOS			A

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	14.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	63	778	445	116	205	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	3539	3429		1770	1583
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	3539	3429		1770	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	68	837	478	125	220	62
RTOR Reduction (vph)	0	0	15	0	0	51
Lane Group Flow (vph)	68	837	588	0	220	11
Turn Type	Prot	NA	NA		Prot	Perm
Protected Phases	5	2	6		7	
Permitted Phases						4
Actuated Green, G (s)	12.0	78.5	62.5		18.5	18.5
Effective Green, g (s)	12.0	78.5	62.5		18.5	18.5
Actuated g/C Ratio	0.11	0.75	0.60		0.18	0.18
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	202	2645	2041		311	278
v/s Ratio Prot	0.04	c0.24	0.17		c0.12	
v/s Ratio Perm						0.01
v/c Ratio	0.34	0.32	0.29		0.71	0.04
Uniform Delay, d1	42.8	4.4	10.4		40.7	35.9
Progression Factor	1.00	1.00	0.28		1.00	1.00
Incremental Delay, d2	1.0	0.3	0.3		7.2	0.1
Delay (s)	43.8	4.7	3.2		47.9	35.9
Level of Service	D	A	A		D	D
Approach Delay (s)		7.6	3.2		45.2	
Approach LOS		A	A		D	

Intersection Summary			
HCM 2000 Control Delay	12.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	40.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Westpark Promenade Traffic Impact Analysis (#0201-0002)
2035 Without Project Conditions
AM Peak Hour

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Base Volume Alternative)

Intersection #13 George Av. / La Estrella St.

Cycle (sec):	100	Critical Vol./Cap.(X):	0.806
Loss Time (sec):	0	Average Delay (sec/veh):	19.2
Optimal Cycle:	0	Level Of Service:	C

Approach:	North Bound			South Bound			East Bound			West Bound		
Movement:	L	T	R	L	T	R	L	T	R	L	T	R
Control:	Stop Sign			Stop Sign			Stop Sign			Stop Sign		
Rights:	Include			Include			Include			Include		
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	1 0 0 1 0			1 0 1 0 1			0 0 1! 0 0			0 0 1! 0 0		
Volume Module:												
Base Vol:	58	125	62	65	224	51	55	126	42	73	229	120
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Initial Bse:	58	125	62	65	224	51	55	126	42	73	229	120
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHF Adj:	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
PHF Volume:	63	136	67	71	243	55	60	137	46	79	249	130
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0
Reduced Vol:	63	136	67	71	243	55	60	137	46	79	249	130
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FinalVolume:	63	136	67	71	243	55	60	137	46	79	249	130
Saturation Flow Module:												
Adjustment:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lanes:	1.00	0.67	0.33	1.00	1.00	1.00	0.25	0.56	0.19	0.17	0.55	0.28
Final Sat.:	428	313	155	446	476	523	123	282	94	98	309	162
Capacity Analysis Module:												
Vol/Sat:	0.15	0.43	0.43	0.16	0.51	0.11	0.49	0.49	0.49	0.81	0.81	0.81
Crit Moves:			****		****			****			****	
Delay/Veh:	11.8	14.5	14.5	11.7	16.4	9.9	15.1	15.1	15.1	28.3	28.3	28.3
Delay Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AdjDel/Veh:	11.8	14.5	14.5	11.7	16.4	9.9	15.1	15.1	15.1	28.3	28.3	28.3
LOS by Move:	B	B	B	B	C	A	C	C	C	D	D	D
ApproachDel:	13.8			14.5			15.1			28.3		
Delay Adj:	1.00			1.00			1.00			1.00		
ApprAdjDel:	13.8			14.5			15.1			28.3		
LOS by Appr:	B			B			C			D		
AllWayAvgQ:	0.1	0.6	0.6	0.2	0.9	0.1	0.8	0.8	0.8	3.0	3.0	3.0

Note: Queue reported is the number of cars per lane.

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	19	9	1	2	19	252	11	1	1	245	0	50
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	21	10	1	2	21	274	12	1	1	266	0	54

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total (vph)	26	6	13	284	14	266	54
Volume Left (vph)	21	0	2	0	12	266	0
Volume Right (vph)	0	1	0	274	1	0	54
Hadj (s)	0.44	-0.09	0.12	-0.64	0.16	0.53	-0.67
Departure Headway (s)	6.2	5.7	5.6	4.9	5.9	5.9	4.7
Degree Utilization, x	0.04	0.01	0.02	0.38	0.02	0.43	0.07
Capacity (veh/h)	536	585	604	709	566	591	731
Control Delay (s)	8.3	7.5	7.5	9.6	9.0	12.0	6.8
Approach Delay (s)	8.2		9.5		9.0	11.2	
Approach LOS	A		A		A	B	

Intersection Summary			
Delay	10.2		
Level of Service	B		
Intersection Capacity Utilization	37.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	132	283	86	94	209	110	99	310	137	203	368	131
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.95		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3416		1770	1863	1583	1770	3376		1770	3400	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3416		1770	1863	1583	1770	3376		1770	3400	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	143	308	93	102	227	120	108	337	149	221	400	142
RTOR Reduction (vph)	0	47	0	0	0	91	0	84	0	0	57	0
Lane Group Flow (vph)	143	354	0	102	227	29	108	402	0	221	485	0
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	5.8	16.2		4.0	14.4	14.4	4.8	16.0		7.8	19.0	
Effective Green, g (s)	5.8	16.2		4.0	14.4	14.4	4.8	16.0		7.8	19.0	
Actuated g/C Ratio	0.10	0.27		0.07	0.24	0.24	0.08	0.27		0.13	0.32	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	171	922		118	447	379	141	900		230	1076	
v/s Ratio Prot	c0.08	0.10		0.06	c0.12		0.06	0.12		c0.12	c0.14	
v/s Ratio Perm						0.02						
v/c Ratio	0.84	0.38		0.86	0.51	0.08	0.77	0.45		0.96	0.45	
Uniform Delay, d1	26.6	17.8		27.7	19.7	17.6	27.0	18.3		25.9	16.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	28.3	1.2		43.9	4.1	0.4	21.6	1.6		48.2	1.4	
Delay (s)	54.9	19.1		71.6	23.8	18.0	48.7	19.9		74.1	17.7	
Level of Service	D	B		E	C	B	D	B		E	B	
Approach Delay (s)		28.5			33.1			25.2			34.0	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	30.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	55.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	184	189	209	76	149	426
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	200	205	227	83	162	463
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	310				874	268
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	310				874	268
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	84				40	40
cM capacity (veh/h)	1251				269	770

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	405	310	625
Volume Left	200	0	162
Volume Right	0	83	463
cSH	1251	1700	519
Volume to Capacity	0.16	0.18	1.20
Queue Length 95th (ft)	14	0	582
Control Delay (s)	4.9	0.0	134.1
Lane LOS	A		F
Approach Delay (s)	4.9	0.0	134.1
Approach LOS			F

Intersection Summary			
Average Delay	64.0		
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	184	189	209	76	149	426
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00		1.00	
Frt		1.00	0.96		0.90	
Flt Protected		0.98	1.00		0.99	
Satd. Flow (prot)		1818	1795		1655	
Flt Permitted		0.61	1.00		0.99	
Satd. Flow (perm)		1145	1795		1655	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	200	205	227	83	162	463
RTOR Reduction (vph)	0	0	15	0	114	0
Lane Group Flow (vph)	0	405	296	0	511	0
Turn Type	Perm	NA	NA		Perm	
Protected Phases		2	6			
Permitted Phases	2				4	
Actuated Green, G (s)		45.0	45.0		37.0	
Effective Green, g (s)		45.0	45.0		37.0	
Actuated g/C Ratio		0.50	0.50		0.41	
Clearance Time (s)		4.0	4.0		4.0	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		572	897		680	
v/s Ratio Prot			0.16			
v/s Ratio Perm		c0.35			c0.31	
v/c Ratio		0.71	0.33		0.75	
Uniform Delay, d1		17.4	13.5		22.6	
Progression Factor		0.35	1.00		1.00	
Incremental Delay, d2		7.1	1.0		7.5	
Delay (s)		13.1	14.5		30.1	
Level of Service		B	B		C	
Approach Delay (s)		13.1	14.5		30.1	
Approach LOS		B	B		C	

Intersection Summary			
HCM 2000 Control Delay	21.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	343	281	0	0	439	196	407	2	92	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	373	305	0	0	477	213	442	2	100	0	0	0

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2
Volume Total (vph)	373	305	690	445	100
Volume Left (vph)	373	0	0	442	0
Volume Right (vph)	0	0	213	0	100
Hadj (s)	0.53	0.03	-0.15	0.53	-0.67
Departure Headway (s)	8.1	7.6	7.3	8.1	6.9
Degree Utilization, x	0.84	0.65	1.0	1.0	0.19
Capacity (veh/h)	437	461	504	445	511
Control Delay (s)	40.4	22.4	213.2	71.5	10.4
Approach Delay (s)	32.3		213.2	60.3	
Approach LOS	D		F	F	

Intersection Summary			
Delay	105.5		
Level of Service	F		
Intersection Capacity Utilization	92.1%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	343	281	0	0	439	196	407	2	92	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.96		1.00	0.85				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1770	1863			1785		1770	1589				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	1770	1863			1785		1770	1589				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	373	305	0	0	477	213	442	2	100	0	0	0
RTOR Reduction (vph)	0	0	0	0	18	0	0	74	0	0	0	0
Lane Group Flow (vph)	373	305	0	0	672	0	442	28	0	0	0	0
Turn Type	Prot	NA			NA		Split	NA				
Protected Phases	5	2			6		8	8				
Permitted Phases												
Actuated Green, G (s)	20.0	59.0			35.0		23.0	23.0				
Effective Green, g (s)	20.0	59.0			35.0		23.0	23.0				
Actuated g/C Ratio	0.22	0.66			0.39		0.26	0.26				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	393	1221			694		452	406				
v/s Ratio Prot	c0.21	0.16			c0.38		c0.25	0.02				
v/s Ratio Perm												
v/c Ratio	0.95	0.25			0.97		0.98	0.07				
Uniform Delay, d1	34.5	6.4			27.0		33.2	25.4				
Progression Factor	1.16	0.58			1.08		1.00	1.00				
Incremental Delay, d2	28.2	0.4			23.2		37.2	0.3				
Delay (s)	68.2	4.1			52.3		70.4	25.7				
Level of Service	E	A			D		E	C				
Approach Delay (s)		39.4			52.3			62.0			0.0	
Approach LOS		D			D			E			A	

Intersection Summary			
HCM 2000 Control Delay	50.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	510	536	290	556	0	0	0	0	114	1	181
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	554	583	315	604	0	0	0	0	124	1	197

Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	1137	315	604	125	197
Volume Left (vph)	0	315	0	124	0
Volume Right (vph)	583	0	0	0	197
Hadj (s)	-0.27	0.53	0.03	0.53	-0.67
Departure Headway (s)	6.3	7.0	6.5	8.2	7.0
Degree Utilization, x	1.0	0.61	1.0	0.29	0.38
Capacity (veh/h)	578	502	567	432	506
Control Delay (s)	463.5	19.2	88.1	13.3	13.1
Approach Delay (s)	463.5	64.5		13.2	
Approach LOS	F	F		B	

Intersection Summary			
Delay	248.3		
Level of Service	F		
Intersection Capacity Utilization	92.1%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	510	536	290	556	0	0	0	0	114	1	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0						4.0	4.0
Lane Util. Factor		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		1863	1583	1770	1863						1775	1583
Flt Permitted		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (perm)		1863	1583	1770	1863						1775	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	554	583	315	604	0	0	0	0	124	1	197
RTOR Reduction (vph)	0	0	193	0	0	0	0	0	0	0	0	172
Lane Group Flow (vph)	0	554	390	315	604	0	0	0	0	0	125	25
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2		1	6					4	4	
Permitted Phases			2									4
Actuated Green, G (s)		42.4	42.4	24.0	70.4						11.6	11.6
Effective Green, g (s)		42.4	42.4	24.0	70.4						11.6	11.6
Actuated g/C Ratio		0.47	0.47	0.27	0.78						0.13	0.13
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		877	745	472	1457						228	204
v/s Ratio Prot		c0.30		c0.18	0.32						c0.07	
v/s Ratio Perm			0.25									0.02
v/c Ratio		0.63	0.52	0.67	0.41						0.55	0.12
Uniform Delay, d1		17.9	16.7	29.4	3.2						36.7	34.7
Progression Factor		1.00	1.00	0.90	0.07						1.00	1.00
Incremental Delay, d2		3.4	2.6	1.0	0.2						2.7	0.3
Delay (s)		21.4	19.3	27.4	0.5						39.4	35.0
Level of Service		C	B	C	A						D	C
Approach Delay (s)		20.3			9.7			0.0			36.7	
Approach LOS		C			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	18.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	170	582	77	424	944	539	64	506	313	545	613	209
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3477		1770	3539	1583	1770	3539	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3477		1770	3539	1583	1770	3539	1583	1770	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	179	613	81	446	994	567	67	533	329	574	645	220
RTOR Reduction (vph)	0	9	0	0	0	254	0	0	283	0	0	73
Lane Group Flow (vph)	179	685	0	446	994	313	67	533	46	574	645	147
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	12.0	20.2		27.0	35.2	35.2	4.8	16.0	16.0	35.8	47.0	47.0
Effective Green, g (s)	12.0	20.2		27.0	35.2	35.2	4.8	16.0	16.0	35.8	47.0	47.0
Actuated g/C Ratio	0.10	0.18		0.23	0.31	0.31	0.04	0.14	0.14	0.31	0.41	0.41
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	184	610		415	1083	484	73	492	220	551	761	646
v/s Ratio Prot	0.10	c0.20		c0.25	0.28		0.04	c0.15		c0.32	0.35	
v/s Ratio Perm						0.20			0.03			0.09
v/c Ratio	0.97	1.12		1.07	0.92	0.65	0.92	1.08	0.21	1.04	0.85	0.23
Uniform Delay, d1	51.3	47.4		44.0	38.5	34.5	54.9	49.5	43.9	39.6	30.8	22.2
Progression Factor	0.96	1.02		0.50	0.44	0.11	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	57.0	74.6		58.0	9.9	4.5	76.7	65.0	2.1	49.6	11.3	0.8
Delay (s)	106.3	122.8		80.2	26.7	8.1	131.6	114.5	46.0	89.2	42.1	23.0
Level of Service	F	F		F	C	A	F	F	D	F	D	C
Approach Delay (s)		119.4			33.3			91.5			58.0	
Approach LOS		F			C			F			E	

Intersection Summary			
HCM 2000 Control Delay	64.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	99.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	170	582	77	424	944	539	64	506	313	545	613	209
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	1770	3539	1583	3433	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	179	613	81	446	994	567	67	533	329	574	645	220
RTOR Reduction (vph)	0	0	64	0	0	35	0	0	264	0	0	80
Lane Group Flow (vph)	179	613	17	446	994	532	67	533	65	574	645	140
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6	7	3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	14.0	24.0	24.0	30.0	40.0	62.4	5.0	22.6	22.6	22.4	40.0	40.0
Effective Green, g (s)	14.0	24.0	24.0	30.0	40.0	62.4	5.0	22.6	22.6	22.4	40.0	40.0
Actuated g/C Ratio	0.12	0.21	0.21	0.26	0.35	0.54	0.04	0.20	0.20	0.19	0.35	0.35
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	215	738	330	461	1230	858	76	695	311	668	648	550
v/s Ratio Prot	0.10	0.17		c0.25	c0.28	0.12	0.04	0.15		c0.17	c0.35	
v/s Ratio Perm			0.01			0.22			0.04			0.09
v/c Ratio	0.83	0.83	0.05	0.97	0.81	0.62	0.88	0.77	0.21	0.86	1.00	0.25
Uniform Delay, d1	49.4	43.6	36.4	42.0	34.0	18.1	54.7	43.7	38.7	44.8	37.4	26.8
Progression Factor	1.17	0.98	1.00	0.82	0.46	0.42	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	22.5	10.2	0.3	26.6	4.1	1.0	64.5	7.9	1.5	10.7	34.2	1.1
Delay (s)	80.4	52.9	36.7	61.1	19.6	8.6	119.2	51.6	40.2	55.5	71.7	27.9
Level of Service	F	D	D	E	B	A	F	D	D	E	E	C
Approach Delay (s)		57.0			25.7			52.5			58.5	
Approach LOS		E			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	44.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	88.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	182	1232	94	176	1245	619	153	14	184	436	16	176
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1694		1770	1606	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.72		0.52	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1244		966	1606	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	188	1270	97	181	1284	638	158	14	190	449	16	181
RTOR Reduction (vph)	0	0	30	0	0	325	0	34	0	0	102	0
Lane Group Flow (vph)	188	1270	67	181	1284	313	0	328	0	449	95	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	12.0	41.0	41.0	12.0	41.0	41.0		50.0		50.0	50.0	
Effective Green, g (s)	12.0	41.0	41.0	12.0	41.0	41.0		50.0		50.0	50.0	
Actuated g/C Ratio	0.10	0.36	0.36	0.10	0.36	0.36		0.43		0.43	0.43	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	184	1261	564	184	1261	564		540		420	698	
v/s Ratio Prot	c0.11	0.36		0.10	c0.36						0.06	
v/s Ratio Perm			0.04			0.20		0.26		c0.46		
v/c Ratio	1.02	1.01	0.12	0.98	1.02	0.56		0.61		1.07	0.14	
Uniform Delay, d1	51.5	37.0	24.9	51.4	37.0	29.7		24.9		32.5	19.5	
Progression Factor	1.21	1.43	1.77	0.91	0.78	0.90		1.00		1.00	1.00	
Incremental Delay, d2	42.6	15.9	0.1	56.6	28.2	3.4		5.0		63.5	0.4	
Delay (s)	105.1	68.7	44.1	103.4	57.0	30.2		29.9		96.0	19.9	
Level of Service	F	E	D	F	E	C		C		F	B	
Approach Delay (s)		71.6			52.9			29.9			72.8	
Approach LOS		E			D			C			E	

Intersection Summary			
HCM 2000 Control Delay	60.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	182	1232	94	176	1245	619	153	14	184	436	16	176
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1694		3433	1606	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1694		3433	1606	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	188	1270	97	181	1284	638	158	14	190	449	16	181
RTOR Reduction (vph)	0	0	51	0	0	298	0	35	0	0	156	0
Lane Group Flow (vph)	188	1270	46	181	1284	340	0	327	0	449	41	0
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Split	NA		Split	NA	
Protected Phases	5	2		1	6	4	8	8		4	4	
Permitted Phases			2			6						
Actuated Green, G (s)	13.8	46.0	46.0	13.0	45.2	61.2		24.0		16.0	16.0	
Effective Green, g (s)	13.8	46.0	46.0	13.0	45.2	61.2		24.0		16.0	16.0	
Actuated g/C Ratio	0.12	0.40	0.40	0.11	0.39	0.53		0.21		0.14	0.14	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	212	1415	633	200	1390	897		353		477	223	
v/s Ratio Prot	0.11	c0.36		0.10	c0.36	0.05		c0.19		c0.13	0.03	
v/s Ratio Perm			0.03			0.16						
v/c Ratio	0.89	0.90	0.07	0.91	0.92	0.38		0.93		0.94	0.18	
Uniform Delay, d1	49.8	32.3	21.3	50.4	33.3	15.8		44.6		49.0	43.7	
Progression Factor	0.89	1.06	1.54	0.60	0.39	1.02		1.00		1.00	1.00	
Incremental Delay, d2	23.3	6.2	0.1	34.4	10.4	1.1		32.5		28.9	1.8	
Delay (s)	67.8	40.4	32.9	64.4	23.3	17.1		77.1		77.9	45.6	
Level of Service	E	D	C	E	C	B		E		E	D	
Approach Delay (s)		43.2			24.9			77.1			68.1	
Approach LOS		D			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	41.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1266	586	428	1466	0	0	0	0	932	2	574
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.91					0.95	0.95	0.88
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		5085	1583	3433	5085					1681	1686	2787
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		5085	1583	3433	5085					1681	1686	2787
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	0	1279	592	432	1481	0	0	0	0	941	2	580
RTOR Reduction (vph)	0	0	356	0	0	0	0	0	0	0	0	29
Lane Group Flow (vph)	0	1279	236	432	1481	0	0	0	0	470	473	551
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		38.0	38.0	20.0	62.0					45.0	45.0	45.0
Effective Green, g (s)		38.0	38.0	20.0	62.0					45.0	45.0	45.0
Actuated g/C Ratio		0.33	0.33	0.17	0.54					0.39	0.39	0.39
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1680	523	597	2741					657	659	1090
v/s Ratio Prot		c0.25		c0.13	0.29							
v/s Ratio Perm			0.15							0.28	0.28	0.20
v/c Ratio		0.76	0.45	0.72	0.54					0.72	0.72	0.51
Uniform Delay, d1		34.4	30.3	44.9	17.2					29.6	29.6	26.6
Progression Factor		0.49	0.08	0.72	0.33					1.00	1.00	1.00
Incremental Delay, d2		0.9	0.7	2.4	0.4					6.6	6.6	1.7
Delay (s)		17.6	3.2	34.8	6.2					36.1	36.2	28.2
Level of Service		B	A	C	A					D	D	C
Approach Delay (s)		13.0			12.6			0.0			33.2	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	18.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	101.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	781	1417	0	0	1166	694	729	7	596	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.91			0.91	1.00	0.95	0.91	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.94	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.97	1.00			
Satd. Flow (prot)	3433	5085			5085	1583	1681	1551	1504			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.97	1.00			
Satd. Flow (perm)	3433	5085			5085	1583	1681	1551	1504			
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	814	1476	0	0	1215	723	759	7	621	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	412	0	19	31	0	0	0
Lane Group Flow (vph)	814	1476	0	0	1215	311	478	449	410	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	29.9	69.0			35.1	35.1	38.0	38.0	38.0			
Effective Green, g (s)	29.9	69.0			35.1	35.1	38.0	38.0	38.0			
Actuated g/C Ratio	0.26	0.60			0.31	0.31	0.33	0.33	0.33			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	892	3051			1552	483	555	512	496			
v/s Ratio Prot	c0.24	0.29			c0.24							
v/s Ratio Perm						0.20	0.28	0.29	0.27			
v/c Ratio	0.91	0.48			0.78	0.64	0.86	0.88	0.83			
Uniform Delay, d1	41.3	13.0			36.5	34.5	36.0	36.3	35.5			
Progression Factor	1.12	1.47			0.61	1.42	1.00	1.00	1.00			
Incremental Delay, d2	9.8	0.4			2.8	4.5	16.0	18.6	14.5			
Delay (s)	56.1	19.4			25.1	53.5	52.1	54.9	50.0			
Level of Service	E	B			C	D	D	D	D			
Approach Delay (s)		32.4			35.7			52.4			0.0	
Approach LOS		C			D			D			A	

Intersection Summary			
HCM 2000 Control Delay	38.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	101.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	1418	275	128	1461	82	317	10	88	62	8	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	
Frt	1.00	0.98		1.00	0.99			1.00	0.85		0.93	
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00		0.98	
Satd. Flow (prot)	1770	4961		1770	5045			1777	1583		1693	
Flt Permitted	0.95	1.00		0.95	1.00			0.60	1.00		0.61	
Satd. Flow (perm)	1770	4961		1770	5045			1111	1583		1050	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	96	1509	293	136	1554	87	337	11	94	66	9	87
RTOR Reduction (vph)	0	23	0	0	4	0	0	0	56	0	39	0
Lane Group Flow (vph)	96	1779	0	136	1637	0	0	348	38	0	123	0
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	11.5	51.8		12.0	52.3			39.2	39.2		39.2	
Effective Green, g (s)	11.5	51.8		12.0	52.3			39.2	39.2		39.2	
Actuated g/C Ratio	0.10	0.45		0.10	0.45			0.34	0.34		0.34	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	177	2234		184	2294			378	539		357	
v/s Ratio Prot	0.05	c0.36		0.08	c0.32							
v/s Ratio Perm								c0.31	0.02		0.12	
v/c Ratio	0.54	0.80		0.74	0.71			0.92	0.07		0.34	
Uniform Delay, d1	49.2	27.1		50.0	25.3			36.4	25.6		28.3	
Progression Factor	1.22	0.65		0.70	0.46			1.00	1.00		1.00	
Incremental Delay, d2	2.7	2.5		10.9	1.4			27.3	0.1		0.6	
Delay (s)	62.8	20.0		45.9	13.0			63.7	25.7		28.9	
Level of Service	E	C		D	B			E	C		C	
Approach Delay (s)		22.2			15.5			55.6			28.9	
Approach LOS		C			B			E			C	

Intersection Summary			
HCM 2000 Control Delay	23.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	132	1572	11	112	1469	91	64	41	134	94	51	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.88		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5080		1770	3539	1583	1770	1648		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.72	1.00		0.48	1.00	1.00
Satd. Flow (perm)	1770	5080		1770	3539	1583	1347	1648		891	1863	1583
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	133	1588	11	113	1484	92	65	41	135	95	52	139
RTOR Reduction (vph)	0	0	0	0	0	39	0	103	0	0	0	111
Lane Group Flow (vph)	133	1599	0	113	1484	53	65	73	0	95	52	28
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases						6	8			4		4
Actuated Green, G (s)	16.0	68.2		11.8	64.0	64.0	23.0	23.0		23.0	23.0	23.0
Effective Green, g (s)	16.0	68.2		11.8	64.0	64.0	23.0	23.0		23.0	23.0	23.0
Actuated g/C Ratio	0.14	0.59		0.10	0.56	0.56	0.20	0.20		0.20	0.20	0.20
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	246	3012		181	1969	880	269	329		178	372	316
v/s Ratio Prot	0.08	c0.31		0.06	c0.42			0.04			0.03	
v/s Ratio Perm						0.03	0.05			c0.11		0.02
v/c Ratio	0.54	0.53		0.62	0.75	0.06	0.24	0.22		0.53	0.14	0.09
Uniform Delay, d1	46.1	13.9		49.5	19.5	11.7	38.7	38.5		41.2	37.9	37.5
Progression Factor	0.74	0.18		0.96	1.09	1.22	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.7	0.5		0.6	0.3	0.0	2.1	1.5		11.0	0.8	0.5
Delay (s)	35.6	2.9		48.1	21.6	14.3	40.8	40.1		52.2	38.6	38.0
Level of Service	D	A		D	C	B	D	D		D	D	D
Approach Delay (s)		5.5			22.9			40.3			42.8	
Approach LOS		A			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	17.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	0	1554	446	117	1365	531	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.95	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)		3539	1583	1770	1863	1770	1583
Flt Permitted		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)		3539	1583	1770	1863	1770	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	0	1586	455	119	1393	542	189
RTOR Reduction (vph)	0	0	119	0	0	0	98
Lane Group Flow (vph)	0	1586	336	119	1393	542	91
Turn Type	Prot	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	5	2		1	6	8	
Permitted Phases			2				8
Actuated Green, G (s)		63.0	63.0	11.0	78.0	29.0	29.0
Effective Green, g (s)		63.0	63.0	11.0	78.0	29.0	29.0
Actuated g/C Ratio		0.55	0.55	0.10	0.68	0.25	0.25
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1938	867	169	1263	446	399
v/s Ratio Prot		0.45		0.07	c0.75	c0.31	
v/s Ratio Perm			0.21				0.06
v/c Ratio		0.82	0.39	0.70	1.10	1.22	0.23
Uniform Delay, d1		21.3	14.9	50.4	18.5	43.0	34.1
Progression Factor		0.23	0.05	0.82	0.56	1.00	1.00
Incremental Delay, d2		3.6	1.2	12.3	58.2	115.9	0.3
Delay (s)		8.5	1.9	53.7	68.5	158.9	34.4
Level of Service		A	A	D	E	F	C
Approach Delay (s)		7.0			67.4	126.7	
Approach LOS		A			E	F	

Intersection Summary			
HCM 2000 Control Delay	48.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	114.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	0	1554	446	117	1365	531	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95	0.97	
Frt		1.00	0.85	1.00	1.00	0.96	
Flt Protected		1.00	1.00	0.95	1.00	0.96	
Satd. Flow (prot)		3539	1583	1770	3539	3349	
Flt Permitted		1.00	1.00	0.95	1.00	0.96	
Satd. Flow (perm)		3539	1583	1770	3539	3349	
Peak-hour factor, PHF	0.96	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	0	1586	455	119	1393	542	189
RTOR Reduction (vph)	0	0	116	0	0	32	0
Lane Group Flow (vph)	0	1586	339	119	1393	699	0
Turn Type	Prot	NA	Perm	Prot	NA	Prot	
Protected Phases	5	2		1	6	8	
Permitted Phases			2				
Actuated Green, G (s)		62.7	62.7	13.0	79.7	27.3	
Effective Green, g (s)		62.7	62.7	13.0	79.7	27.3	
Actuated g/C Ratio		0.55	0.55	0.11	0.69	0.24	
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		1929	863	200	2452	795	
v/s Ratio Prot		c0.45		0.07	c0.39	c0.21	
v/s Ratio Perm			0.21				
v/c Ratio		0.82	0.39	0.59	0.57	0.88	
Uniform Delay, d1		21.6	15.1	48.5	8.9	42.3	
Progression Factor		0.24	0.05	0.80	0.41	1.00	
Incremental Delay, d2		3.7	1.2	4.6	0.9	10.9	
Delay (s)		8.9	2.0	43.3	4.6	53.1	
Level of Service		A	A	D	A	D	
Approach Delay (s)		7.4			7.7	53.1	
Approach LOS		A			A	D	

Intersection Summary			
HCM 2000 Control Delay	15.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	978	24	18	890	44	36	5	4	39	4	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3514		1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3514		1770	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	82	1008	25	19	918	45	37	5	4	40	4	62
RTOR Reduction (vph)	0	0	7	0	2	0	0	0	4	0	0	59
Lane Group Flow (vph)	82	1008	18	19	961	0	37	5	0	40	4	3
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	14.4	83.9	83.9	3.2	72.7		7.1	2.4	2.4	9.5	4.8	4.8
Effective Green, g (s)	14.4	83.9	83.9	3.2	72.7		7.1	2.4	2.4	9.5	4.8	4.8
Actuated g/C Ratio	0.13	0.73	0.73	0.03	0.63		0.06	0.02	0.02	0.08	0.04	0.04
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	221	2581	1154	49	2221		109	38	33	146	77	66
v/s Ratio Prot	0.05	c0.28		0.01	c0.27		0.02	c0.00		c0.02	0.00	
v/s Ratio Perm			0.01						0.00			0.00
v/c Ratio	0.37	0.39	0.02	0.39	0.43		0.34	0.13	0.00	0.27	0.05	0.04
Uniform Delay, d1	46.1	5.9	4.3	54.9	10.7		51.7	55.3	55.1	49.5	52.9	52.9
Progression Factor	0.55	0.12	1.00	1.27	0.72		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.3	0.0	4.5	0.6		1.9	1.6	0.0	1.0	0.3	0.2
Delay (s)	26.3	1.0	4.3	74.2	8.3		53.6	56.8	55.2	50.5	53.2	53.1
Level of Service	C	A	A	E	A		D	E	E	D	D	D
Approach Delay (s)		2.9			9.5			54.1			52.2	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	9.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	63	1373	29	41	1173	72	21	11	88	46	2	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00		0.97	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1804	1583		1725	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.81	1.00		0.78	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1510	1583		1395	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	66	1445	31	43	1235	76	22	12	93	48	2	24
RTOR Reduction (vph)	0	0	8	0	0	19	0	0	85	0	16	0
Lane Group Flow (vph)	66	1445	23	43	1235	57	0	34	8	0	58	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8		8	4		
Actuated Green, G (s)	8.8	85.9	85.9	7.1	84.2	84.2		10.0	10.0		10.0	
Effective Green, g (s)	8.8	85.9	85.9	7.1	84.2	84.2		10.0	10.0		10.0	
Actuated g/C Ratio	0.08	0.75	0.75	0.06	0.73	0.73		0.09	0.09		0.09	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	135	2643	1182	109	2591	1159		131	137		121	
v/s Ratio Prot	0.04	c0.41		0.02	c0.35							
v/s Ratio Perm			0.01			0.04		0.02	0.01		c0.04	
v/c Ratio	0.49	0.55	0.02	0.39	0.48	0.05		0.26	0.06		0.48	
Uniform Delay, d1	50.9	6.2	3.7	51.9	6.3	4.3		49.0	48.2		50.0	
Progression Factor	0.74	0.33	0.03	1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	2.7	0.8	0.0	2.3	0.6	0.1		1.1	0.2		2.9	
Delay (s)	40.6	2.9	0.1	54.2	7.0	4.4		50.1	48.4		52.9	
Level of Service	D	A	A	D	A	A		D	D		D	
Approach Delay (s)		4.4			8.3			48.8			52.9	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	9.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	6	35	57	205	163	12
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	7	41	67	241	192	14
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				816		
pX, platoon unblocked						
vC, conflicting volume	574	199	206			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	574	199	206			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	95	95			
cM capacity (veh/h)	457	842	1365			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	48	308	206
Volume Left	7	67	0
Volume Right	41	0	14
cSH	750	1365	1700
Volume to Capacity	0.06	0.05	0.12
Queue Length 95th (ft)	5	4	0
Control Delay (s)	10.1	2.0	0.0
Lane LOS	B	A	
Approach Delay (s)	10.1	2.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	36.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	5	8	8	5	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.69	0.69	0.69	0.69	0.69	0.69
Hourly flow rate (vph)	7	7	12	12	7	7
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	23				39	17
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	23				39	17
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	99
cM capacity (veh/h)	1592				968	1061

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	14	23	14
Volume Left	7	0	7
Volume Right	0	12	7
cSH	1592	1700	1013
Volume to Capacity	0.00	0.01	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	3.7	0.0	8.6
Lane LOS	A		A
Approach Delay (s)	3.7	0.0	8.6
Approach LOS			A

Intersection Summary			
Average Delay	3.4		
Intersection Capacity Utilization	14.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	63	615	698	201	236	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	3539	3420		1770	1583
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	3539	3420		1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	66	647	735	212	248	67
RTOR Reduction (vph)	0	0	16	0	0	54
Lane Group Flow (vph)	66	647	931	0	248	13
Turn Type	Prot	NA	NA		Prot	Perm
Protected Phases	5	2	6		7	
Permitted Phases						4
Actuated Green, G (s)	8.4	85.5	73.1		21.5	21.5
Effective Green, g (s)	8.4	85.5	73.1		21.5	21.5
Actuated g/C Ratio	0.07	0.74	0.64		0.19	0.19
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	129	2631	2173		330	295
v/s Ratio Prot	c0.04	0.18	c0.27		c0.14	
v/s Ratio Perm						0.01
v/c Ratio	0.51	0.25	0.43		0.75	0.04
Uniform Delay, d1	51.3	4.6	10.5		44.2	38.3
Progression Factor	1.00	1.00	0.17		1.00	1.00
Incremental Delay, d2	3.4	0.2	0.4		9.3	0.1
Delay (s)	54.7	4.9	2.1		53.5	38.4
Level of Service	D	A	A		D	D
Approach Delay (s)		9.5	2.1		50.3	
Approach LOS		A	A		D	

Intersection Summary			
HCM 2000 Control Delay	12.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	52.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Westpark Promenade Traffic Impact Analysis (#0201-0002)
2035 Without Project Conditions
PM Peak Hour

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Base Volume Alternative)

Intersection #13 George Av. / La Estrella St.

Cycle (sec): 100 | Critical Vol./Cap.(X): 0.309
Loss Time (sec): 0 | Average Delay (sec/veh): 10.1
Optimal Cycle: 0 | Level Of Service: B

Approach:	North Bound			South Bound			East Bound			West Bound		
Movement:	L -	T -	R	L -	T -	R	L -	T -	R	L -	T -	R
Control:	Stop Sign			Stop Sign			Stop Sign			Stop Sign		
Rights:	Include			Include			Include			Include		
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	1 0	0 1	0	1 0	1 0	1	0 0	1! 0	0	0 0	1! 0	0
Volume Module:												
Base Vol:	25	139	49	131	176	1	10	117	35	42	0	67
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Initial Bse:	25	139	49	131	176	1	10	117	35	42	0	67
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHF Adj:	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
PHF Volume:	26	145	51	136	183	1	10	122	36	44	0	70
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0
Reduced Vol:	26	145	51	136	183	1	10	122	36	44	0	70
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FinalVolume:	26	145	51	136	183	1	10	122	36	44	0	70
Saturation Flow Module:												
Adjustment:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lanes:	1.00	0.74	0.26	1.00	1.00	1.00	0.06	0.72	0.22	0.39	0.00	0.61
Final Sat.:	565	469	165	582	634	721	39	459	137	245	0	391
Capacity Analysis Module:												
Vol/Sat:	0.05	0.31	0.31	0.23	0.29	0.00	0.27	0.27	0.27	0.18	xxxx	0.18
Crit Moves:		****			****			****			****	
Delay/Veh:	9.1	10.4	10.4	10.4	10.3	7.5	10.0	10.0	10.0	9.2	0.0	9.2
Delay Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AdjDel/Veh:	9.1	10.4	10.4	10.4	10.3	7.5	10.0	10.0	10.0	9.2	0.0	9.2
LOS by Move:	A	B	B	B	B	A	B	B	B	A	*	A
ApproachDel:		10.2			10.3			10.0			9.2	
Delay Adj:		1.00			1.00			1.00			1.00	
ApprAdjDel:		10.2			10.3			10.0			9.2	
LOS by Appr:		B			B			B			A	
AllWayAvgQ:	0.0	0.4	0.4	0.3	0.4	0.0	0.3	0.3	0.3	0.2	0.2	0.2

Note: Queue reported is the number of cars per lane.

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	31	14	1	3	5	385	1	1	1	365	0	8
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	34	15	1	3	5	418	1	1	1	397	0	9

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total (vph)	41	9	6	421	3	397	9
Volume Left (vph)	34	0	3	0	1	397	0
Volume Right (vph)	0	1	0	418	1	0	9
Hadj (s)	0.44	-0.05	0.31	-0.66	-0.10	0.53	-0.67
Departure Headway (s)	6.9	6.4	6.2	5.3	6.4	6.3	5.1
Degree Utilization, x	0.08	0.02	0.01	0.62	0.01	0.69	0.01
Capacity (veh/h)	477	510	544	662	503	555	666
Control Delay (s)	9.3	8.3	8.1	15.2	9.4	21.1	7.0
Approach Delay (s)	9.1		15.1		9.4	20.8	
Approach LOS	A		C		A	C	

Intersection Summary			
Delay	17.3		
Level of Service	C		
Intersection Capacity Utilization	53.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	171	349	126	147	345	250	130	254	90	161	247	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.96		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3398		1770	1863	1583	1770	3400		1770	3376	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3398		1770	1863	1583	1770	3400		1770	3376	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	182	371	134	156	367	266	138	270	96	171	263	117
RTOR Reduction (vph)	0	56	0	0	0	196	0	55	0	0	78	0
Lane Group Flow (vph)	182	449	0	156	367	70	138	311	0	171	302	0
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	8.0	17.1		7.9	17.0	17.0	7.0	16.0		8.0	17.0	
Effective Green, g (s)	8.0	17.1		7.9	17.0	17.0	7.0	16.0		8.0	17.0	
Actuated g/C Ratio	0.12	0.26		0.12	0.26	0.26	0.11	0.25		0.12	0.26	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	217	893		215	487	414	190	836		217	882	
v/s Ratio Prot	c0.10	0.13		0.09	c0.20		c0.08	0.09		c0.10	c0.09	
v/s Ratio Perm						0.04						
v/c Ratio	0.84	0.50		0.73	0.75	0.17	0.73	0.37		0.79	0.34	
Uniform Delay, d1	27.9	20.3		27.5	22.1	18.5	28.1	20.3		27.7	19.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	23.7	2.0		11.5	10.3	0.9	12.9	1.3		17.1	1.1	
Delay (s)	51.5	22.4		39.0	32.4	19.4	41.0	21.6		44.7	20.5	
Level of Service	D	C		D	C	B	D	C		D	C	
Approach Delay (s)		30.1			29.3			26.9			28.0	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	28.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	151	177	87	36	39	188
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	162	190	94	39	42	202
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	132				628	113
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	132				628	113
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	89				89	78
cM capacity (veh/h)	1453				397	940

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	353	132	244
Volume Left	162	0	42
Volume Right	0	39	202
cSH	1453	1700	761
Volume to Capacity	0.11	0.08	0.32
Queue Length 95th (ft)	9	0	35
Control Delay (s)	4.1	0.0	11.9
Lane LOS	A		B
Approach Delay (s)	4.1	0.0	11.9
Approach LOS			B

Intersection Summary			
Average Delay	6.0		
Intersection Capacity Utilization	48.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	151	177	87	36	39	188
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00		1.00	
Frt		1.00	0.96		0.89	
Flt Protected		0.98	1.00		0.99	
Satd. Flow (prot)		1821	1789		1640	
Flt Permitted		0.80	1.00		0.99	
Satd. Flow (perm)		1496	1789		1640	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	162	190	94	39	42	202
RTOR Reduction (vph)	0	0	17	0	139	0
Lane Group Flow (vph)	0	352	116	0	105	0
Turn Type	Perm	NA	NA		Perm	
Protected Phases		2	6			
Permitted Phases	2				4	
Actuated Green, G (s)		40.0	40.0		22.0	
Effective Green, g (s)		40.0	40.0		22.0	
Actuated g/C Ratio		0.57	0.57		0.31	
Clearance Time (s)		4.0	4.0		4.0	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		854	1022		515	
v/s Ratio Prot			0.07			
v/s Ratio Perm		c0.24			c0.06	
v/c Ratio		0.41	0.11		0.20	
Uniform Delay, d1		8.4	6.9		17.6	
Progression Factor		0.45	1.00		1.00	
Incremental Delay, d2		1.4	0.2		0.9	
Delay (s)		5.3	7.1		18.5	
Level of Service		A	A		B	
Approach Delay (s)		5.3	7.1		18.5	
Approach LOS		A	A		B	

Intersection Summary			
HCM 2000 Control Delay	10.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	48.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	256	225	0	0	188	87	535	5	103	0	0	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	269	237	0	0	198	92	563	5	108	0	0	0

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2
Volume Total (vph)	269	237	289	568	108
Volume Left (vph)	269	0	0	563	0
Volume Right (vph)	0	0	92	0	108
Hadj (s)	0.53	0.03	-0.16	0.53	-0.67
Departure Headway (s)	7.7	7.2	7.1	7.4	6.2
Degree Utilization, x	0.57	0.47	0.57	1.0	0.19
Capacity (veh/h)	464	496	501	489	566
Control Delay (s)	19.3	15.2	19.1	122.8	9.5
Approach Delay (s)	17.4		19.1	104.7	
Approach LOS	C		C	F	

Intersection Summary			
Delay	57.8		
Level of Service	F		
Intersection Capacity Utilization	69.3%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	256	225	0	0	188	87	535	5	103	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.96		1.00	0.86				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1770	1863			1783		1770	1596				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	1770	1863			1783		1770	1596				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	269	237	0	0	198	92	563	5	108	0	0	0
RTOR Reduction (vph)	0	0	0	0	24	0	0	66	0	0	0	0
Lane Group Flow (vph)	269	237	0	0	266	0	563	47	0	0	0	0
Turn Type	Prot	NA			NA		Split	NA				
Protected Phases	5	2			6		8	8				
Permitted Phases												
Actuated Green, G (s)	14.0	35.0			17.0		27.0	27.0				
Effective Green, g (s)	14.0	35.0			17.0		27.0	27.0				
Actuated g/C Ratio	0.20	0.50			0.24		0.39	0.39				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	354	931			433		682	615				
v/s Ratio Prot	c0.15	0.13			c0.15		c0.32	0.03				
v/s Ratio Perm												
v/c Ratio	0.76	0.25			0.61		0.83	0.08				
Uniform Delay, d1	26.4	10.0			23.6		19.4	13.6				
Progression Factor	0.88	0.59			0.89		1.00	1.00				
Incremental Delay, d2	8.8	0.6			6.2		11.0	0.2				
Delay (s)	32.1	6.5			27.2		30.3	13.8				
Level of Service	C	A			C		C	B				
Approach Delay (s)		20.1			27.2			27.6			0.0	
Approach LOS		C			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	24.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	373	448	71	652	0	0	0	0	108	3	351
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	385	462	73	672	0	0	0	0	111	3	362

Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	846	73	672	114	362
Volume Left (vph)	0	73	0	111	0
Volume Right (vph)	462	0	0	0	362
Hadj (s)	-0.29	0.53	0.03	0.52	-0.67
Departure Headway (s)	6.8	7.6	7.1	8.1	6.9
Degree Utilization, x	1.0	0.15	1.0	0.26	0.70
Capacity (veh/h)	546	467	519	438	509
Control Delay (s)	291.9	10.7	177.6	12.7	23.2
Approach Delay (s)	291.9	161.2		20.6	
Approach LOS	F	F		C	

Intersection Summary			
Delay	182.3		
Level of Service	F		
Intersection Capacity Utilization	69.3%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	373	448	71	652	0	0	0	0	108	3	351
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0						4.0	4.0
Lane Util. Factor		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		1863	1583	1770	1863						1776	1583
Flt Permitted		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (perm)		1863	1583	1770	1863						1776	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	385	462	73	672	0	0	0	0	111	3	362
RTOR Reduction (vph)	0	0	201	0	0	0	0	0	0	0	0	199
Lane Group Flow (vph)	0	385	261	73	672	0	0	0	0	0	114	163
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2		1	6					4	4	
Permitted Phases			2									4
Actuated Green, G (s)		39.6	39.6	5.6	49.2						12.8	12.8
Effective Green, g (s)		39.6	39.6	5.6	49.2						12.8	12.8
Actuated g/C Ratio		0.57	0.57	0.08	0.70						0.18	0.18
Clearance Time (s)		4.0	4.0	4.0	4.0						4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		1053	895	141	1309						324	289
v/s Ratio Prot		0.21		0.04	c0.36						0.06	
v/s Ratio Perm			0.17									c0.10
v/c Ratio		0.37	0.29	0.52	0.51						0.35	0.56
Uniform Delay, d1		8.3	7.9	30.9	4.8						25.0	26.1
Progression Factor		1.00	1.00	0.90	0.38						1.00	1.00
Incremental Delay, d2		1.0	0.8	1.9	0.9						0.7	2.5
Delay (s)		9.3	8.7	29.8	2.7						25.6	28.6
Level of Service		A	A	C	A						C	C
Approach Delay (s)		9.0			5.3			0.0			27.9	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	12.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX R

HORIZON YEAR (2035) WITHOUT PROJECT
FREEWAY RAMP ANALYSIS WORKSHEETS

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035 Without Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	300	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	5394	V_D =	veh/h
		Ramp Volume, V_R	1412		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5394	0.92	Level	9	0	0.957	1.00	6127
Ramp	1412	0.92	Level	2	0	0.990	1.00	1550
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 3610 pc/h

V_3 or V_{av34} 2517 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6127	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4577	Exhibit 13-8	7050	No
V_R	1550	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3610	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 27.2 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.567 (Exhibit 13-12)

S_R= 51.9 mph (Exhibit 13-12)

S_0= 65.4 mph (Exhibit 13-12)

S = 56.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035NP w/ Improvements

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	5	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	300	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	5394	V_D =	veh/h
		Ramp Volume, V_R	1412		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5394	0.92	Level	9	0	0.957	1.00	6127
Ramp	1412	0.92	Level	2	0	0.990	1.00	1550
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 2501 pc/h

V_3 or V_{av34} 1353 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5208	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	3658	Exhibit 13-8	9400	No
V_R	1550	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2501	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 17.7 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.567 (Exhibit 13-12)

S_R= 51.9 mph (Exhibit 13-12)

S_0= 69.9 mph (Exhibit 13-12)

S = 60.0 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035 Without Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3982	
	Ramp Volume, V_R: 1367	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3982	0.92	Level	9	0	0.957	1.00	4523
Ramp	1367	0.92	Level	2	0	0.990	1.00	1501
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2510 pc/h

V_3 or V_{av34} 2013 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 2584 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6024	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4085	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 31.0 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.490 (Exibit 13-11)

S_R= 53.7 mph (Exhibit 13-11)

S_0= 59.8 mph (Exhibit 13-11)

S = 55.6 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035NP w/ Improvements

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3982	
	Ramp Volume, V_R: 1367	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3982	0.92	Level	9	0	0.957	1.00	4523
Ramp	1367	0.92	Level	2	0	0.990	1.00	1501
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.209 using Equation (Exhibit 13-6)

V_{12} = 945 pc/h

V_3 or V_{av34} 1789 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 1809 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6024	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3310	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 25.0 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.365 (Exibit 13-11)

S_R= 56.6 mph (Exhibit 13-11)

S_0= 61.9 mph (Exhibit 13-11)

S = 58.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035 Without Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	7607
Ramp Volume, V_R	836
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7607	0.92	Level	9	0	0.957	1.00	8641
Ramp	836	0.92	Level	2	0	0.990	1.00	918
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 4393 pc/h
V_3 or V_{av34} 4248 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 5941 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8641	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	7723	Exhibit 13-8	7050	Yes
V_R	918	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4393	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 47.2 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.511 (Exhibit 13-12)
S_R= 53.3 mph (Exhibit 13-12)
S_0= 64.7 mph (Exhibit 13-12)
S = 56.4 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035NP w/ Improvements

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	4
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	7607
Ramp Volume, V_R	836
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7607	0.92	Level	9	0	0.957	1.00	8641
Ramp	836	0.92	Level	2	0	0.990	1.00	918
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 2926 pc/h

V_3 or V_{av34} 2857 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3456 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8641	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	7723	Exhibit 13-8	9400	No
V_R	918	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2926	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 25.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.511 (Exhibit 13-12)

S_R= 53.3 mph (Exhibit 13-12)

S_0= 65.1 mph (Exhibit 13-12)

S = 59.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035 Without Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 6771	
	Ramp Volume, V_R: 1483	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6771	0.92	Level	9	0	0.957	1.00	7691
Ramp	1483	0.92	Level	2	0	0.990	1.00	1628
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 4269 pc/h

V_3 or V_{av34} 3422 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 4991 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9319	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	6619	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 50.7 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 3.180 (Exibit 13-11)

S_R= -8.1 mph (Exhibit 13-11)

S_0= 56.1 mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035NP w/ Improvements

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	5	Downstream Adj Ramp
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes ☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A	300	☑ No ☐ Off
L_{up} =	ft	Deceleration Lane Length L_D		L_{down} = ft
V_u =	veh/h	Freeway Volume, V_F	6771	V_D = veh/h
		Ramp Volume, V_R	1483	
		Freeway Free-Flow Speed, S_{FF}	65.0	
		Ramp Free-Flow Speed, S_{FR}	35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6771	0.92	Level	9	0	0.957	1.00	7691
Ramp	1483	0.92	Level	2	0	0.990	1.00	1628
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.209 using Equation (Exhibit 13-6)

V_{12} = 1150 pc/h

V_3 or V_{av34} 2175 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 2200 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7128	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3828	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.9 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.437 (Exibit 13-11)

S_R= 54.9 mph (Exhibit 13-11)

S_0= 60.9 mph (Exhibit 13-11)

S = 57.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	2035 Without Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	8487
Ramp Volume, V_R	1508
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8487	0.92	Level	9	0	0.957	1.00	9640
Ramp	1508	0.92	Level	2	0	0.990	1.00	1656
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 5249 pc/h

V_3 or V_{av34} 4391 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 6940 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	9640	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	7984	Exhibit 13-8	7050	Yes
V_R	1656	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5249	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 55.8 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.577 (Exhibit 13-12)

S_R= 51.7 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 54.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	2035NP w/ Improvements

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	5	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	300	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	8487	V_D =	veh/h
		Ramp Volume, V_R	1508		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8487	0.92	Level	9	0	0.957	1.00	9640
Ramp	1508	0.92	Level	2	0	0.990	1.00	1656
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 3231 pc/h

V_3 or V_{av34} 2240 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7712	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	6056	Exhibit 13-8	9400	No
V_R	1656	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3231	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 23.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.577 (Exhibit 13-12)

S_R= 51.7 mph (Exhibit 13-12)

S_0= 66.5 mph (Exhibit 13-12)

S = 59.4 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	2035 Without Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D	V_D = veh/h
	Freeway Volume, V_F: 6979	
	Ramp Volume, V_R: 1016	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6979	0.92	Level	9	0	0.957	1.00	7927
Ramp	1016	0.92	Level	2	0	0.990	1.00	1115
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 4399 pc/h

V_3 or V_{av34} 3528 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 5227 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9042	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	6342	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 48.8 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 2.473 (Exibit 13-11)

S_R= 8.1 mph (Exhibit 13-11)

S_0= 56.1 mph (Exhibit 13-11)

S = 10.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	2035NP w/ Improvements

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 6979	
	Ramp Volume, V_R: 1016	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6979	0.92	Level	9	0	0.957	1.00	7927
Ramp	1016	0.92	Level	2	0	0.990	1.00	1115
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.209 using Equation (Exhibit 13-6)

V_{12} = 1657 pc/h

V_3 or V_{av34} 3135 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 3170 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9042	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4285	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 32.7 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.541 (Exibit 13-11)

S_R= 52.6 mph (Exhibit 13-11)

S_0= 58.0 mph (Exhibit 13-11)

S = 55.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035 Without Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	6422
Ramp Volume, V_R	1332
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6422	0.92	Level	9	0	0.957	1.00	7295
Ramp	1332	0.92	Level	2	0	0.990	1.00	1462
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 4087 pc/h
V_3 or V_{av34} 3208 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 4595 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7295	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	5833	Exhibit 13-8	7050	No
V_R	1462	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4087	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.7 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.560 (Exhibit 13-12)
S_R= 52.1 mph (Exhibit 13-12)
S_0= 64.7 mph (Exhibit 13-12)
S = 56.2 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035NP w/ Improvements

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	300	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	6422	V_D =	veh/h
		Ramp Volume, V_R	1332		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6422	0.92	Level	9	0	0.957	1.00	7295
Ramp	1332	0.92	Level	2	0	0.990	1.00	1462
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 2979 pc/h

V_3 or V_{av34} 2158 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7295	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	5833	Exhibit 13-8	9400	No
V_R	1462	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2979	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 21.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.560 (Exhibit 13-12)

S_R= 52.1 mph (Exhibit 13-12)

S_0= 66.8 mph (Exhibit 13-12)

S = 59.9 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	2035 Without Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 5090	
	Ramp Volume, V_R: 1482	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5090	0.92	Level	9	0	0.957	1.00	5782
Ramp	1482	0.92	Level	2	0	0.990	1.00	1627
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 3209 pc/h

V_3 or V_{av34} 2573 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 3304 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7409	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4931	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 37.5 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 0.798 (Exibit 13-11)

S_R= 46.6 mph (Exhibit 13-11)

S_0= 57.4 mph (Exhibit 13-11)

S = 49.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	2035NP w/ Improvements

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 5	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 5090	
	Ramp Volume, V_R: 1482	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5090	0.92	Level	9	0	0.957	1.00	5782
Ramp	1482	0.92	Level	2	0	0.990	1.00	1627
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.209 using Equation (Exhibit 13-6)

V_{12} = 919 pc/h

V_3 or V_{av34} 1738 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 1758 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6022	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3385	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 25.5 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.373 (Exibit 13-11)

S_R= 56.4 mph (Exhibit 13-11)

S_0= 62.1 mph (Exhibit 13-11)

S = 58.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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APPENDIX S

HORIZON YEAR (2035) WITHOUT PROJECT
BASIC FREEWAY SEGMENT ANALYSIS WORKSHEETS

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2035 Without Project*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5394*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2042*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*61.8*	mph	S	mph
D = v_p / S	*33.1*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2035NP w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5394*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*5*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1225*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*17.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2035 Without Project*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5349*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2025*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*62.1*	mph	S	mph
D = v_p / S	*32.6*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2035NP w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5349*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*5*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1215*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*17.4*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2035 Without Project*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7607*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2880*	pc/h/ln
S	*37.3*	mph
D = v_p / S	*77.3*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2035NP w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7607*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*5*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1728*	pc/h/ln
S	*66.8*	mph
D = v_p / S	*25.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2035 Without Project*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8254*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*3125*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*27.0*	mph	S	mph
D = v_p / S	*115.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*F*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2035NP w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8254*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*5*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1875*	pc/h/ln
S	*64.7*	mph
D = v_p / S	*29.0*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2035 Without Project*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8487*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*3213*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*23.0*	mph	S	mph
D = v_p / S	*139.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*F*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2035NP w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8487*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*5*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1928*	pc/h/ln
S	*63.9*	mph
D = v_p / S	*30.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2035 Without Project*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7995*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*3027*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*31.3*	mph	S	mph
D = v_p / S	*96.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*F*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2035NP w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7995*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*5*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1816*	pc/h/ln
S	*65.6*	mph
D = v_p / S	*27.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2035 Without Project*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6422*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2432*	pc/h/ln
S	*52.4*	mph
D = v_p / S	*46.4*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2035NP w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6422*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*5*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1459*	pc/h/ln
S	*69.2*	mph
D = v_p / S	*21.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2035 Without Project*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6572*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2488*	pc/h/ln
S	*50.8*	mph
D = v_p / S	*49.0*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2035NP w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6572*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*5*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1493*	pc/h/ln
S	*69.0*	mph
D = v_p / S	*21.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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APPENDIX T

HORIZON YEAR (2035) WITH PROJECT
INTERSECTION ANALYSIS CALCULATION WORKSHEETS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	242	685	76	338	718	508	46	750	198	368	420	131
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3486		1770	3539	1583	1770	3539	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3486		1770	3539	1583	1770	3539	1583	1770	1863	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	247	699	78	345	733	518	47	765	202	376	429	134
RTOR Reduction (vph)	0	8	0	0	0	290	0	0	160	0	0	84
Lane Group Flow (vph)	247	769	0	345	733	228	47	765	42	376	429	50
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	17.0	24.2		20.0	27.2	27.2	5.6	22.0	22.0	22.8	39.2	39.2
Effective Green, g (s)	17.0	24.2		20.0	27.2	27.2	5.6	22.0	22.0	22.8	39.2	39.2
Actuated g/C Ratio	0.16	0.23		0.19	0.26	0.26	0.05	0.21	0.21	0.22	0.37	0.37
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	286	803		337	916	410	94	741	331	384	695	590
v/s Ratio Prot	0.14	c0.22		c0.19	c0.21		0.03	c0.22		c0.21	0.23	
v/s Ratio Perm						0.14			0.03			0.03
v/c Ratio	0.86	0.96		1.02	0.80	0.56	0.50	1.03	0.13	0.98	0.62	0.08
Uniform Delay, d1	42.9	39.9		42.5	36.4	33.7	48.3	41.5	33.7	40.9	26.8	21.3
Progression Factor	0.94	0.92		0.71	0.43	0.62	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	21.8	22.2		36.3	2.9	2.1	4.1	41.7	0.8	39.9	4.1	0.3
Delay (s)	62.2	59.0		66.4	18.5	23.0	52.5	83.2	34.5	80.8	30.9	21.6
Level of Service	E	E		E	B	C	D	F	C	F	C	C
Approach Delay (s)		59.7			30.3			72.0			49.5	
Approach LOS		E			C			E			D	

Intersection Summary			
HCM 2000 Control Delay	50.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	94.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	73	1544	36	102	1445	306	84	15	119	451	37	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1693		1770	1671	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.84		0.57	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1446		1071	1671	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	1678	39	111	1571	333	91	16	129	490	40	87
RTOR Reduction (vph)	0	0	22	0	0	152	0	41	0	0	53	0
Lane Group Flow (vph)	79	1678	17	111	1571	181	0	195	0	490	74	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	5.0	47.0	47.0	5.0	47.0	47.0		41.0		41.0	41.0	
Effective Green, g (s)	5.0	47.0	47.0	5.0	47.0	47.0		41.0		41.0	41.0	
Actuated g/C Ratio	0.05	0.45	0.45	0.05	0.45	0.45		0.39		0.39	0.39	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	84	1584	708	84	1584	708		564		418	652	
v/s Ratio Prot	0.04	c0.47		c0.06	0.44						0.04	
v/s Ratio Perm			0.01			0.11		0.13		c0.46		
v/c Ratio	0.94	1.06	0.02	1.32	0.99	0.26		0.34		1.17	0.11	
Uniform Delay, d1	49.9	29.0	16.2	50.0	28.8	18.1		22.5		32.0	20.4	
Progression Factor	0.82	0.67	0.78	0.68	0.32	0.23		1.00		1.00	1.00	
Incremental Delay, d2	67.9	37.9	0.1	199.4	19.1	0.7		1.7		100.2	0.4	
Delay (s)	108.7	57.4	12.7	233.6	28.3	5.0		24.2		132.2	20.8	
Level of Service	F	E	B	F	C	A		C		F	C	
Approach Delay (s)		58.7			35.7			24.2			109.3	
Approach LOS		E			D			C			F	

Intersection Summary			
HCM 2000 Control Delay	53.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	99.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1202	912	475	1231	0	0	0	0	806	1	622
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.91					0.95	0.95	0.88
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		5085	1583	3433	5085					1681	1686	2787
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		5085	1583	3433	5085					1681	1686	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1307	991	516	1338	0	0	0	0	876	1	676
RTOR Reduction (vph)	0	0	392	0	0	0	0	0	0	0	0	84
Lane Group Flow (vph)	0	1307	599	516	1338	0	0	0	0	438	439	592
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		46.0	46.0	17.0	67.0					30.0	30.0	30.0
Effective Green, g (s)		46.0	46.0	17.0	67.0					30.0	30.0	30.0
Actuated g/C Ratio		0.44	0.44	0.16	0.64					0.29	0.29	0.29
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		2227	693	555	3244					480	481	796
v/s Ratio Prot		0.26		c0.15	0.26							
v/s Ratio Perm			c0.38							c0.26	0.26	0.21
v/c Ratio		0.59	0.86	0.93	0.41					0.91	0.91	0.74
Uniform Delay, d1		22.3	26.7	43.4	9.3					36.2	36.2	34.0
Progression Factor		0.56	0.41	1.18	0.87					1.00	1.00	1.00
Incremental Delay, d2		0.1	1.5	16.3	0.3					24.2	24.2	6.2
Delay (s)		12.5	12.3	67.7	8.4					60.4	60.4	40.3
Level of Service		B	B	E	A					E	E	D
Approach Delay (s)		12.4			24.9			0.0			51.7	
Approach LOS		B			C			A			D	

Intersection Summary			
HCM 2000 Control Delay	27.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	792	1216	0	0	1190	703	516	9	328	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.91			0.91	1.00	0.95	0.91	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.97	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.96	1.00			
Satd. Flow (prot)	3433	5085			5085	1583	1681	1581	1504			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.96	1.00			
Satd. Flow (perm)	3433	5085			5085	1583	1681	1581	1504			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	861	1322	0	0	1293	764	561	10	357	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	306	0	9	64	0	0	0
Lane Group Flow (vph)	861	1322	0	0	1293	458	320	310	225	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	30.0	72.0			38.0	38.0	25.0	25.0	25.0			
Effective Green, g (s)	30.0	72.0			38.0	38.0	25.0	25.0	25.0			
Actuated g/C Ratio	0.29	0.69			0.36	0.36	0.24	0.24	0.24			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	980	3486			1840	572	400	376	358			
v/s Ratio Prot	c0.25	0.26			0.25							
v/s Ratio Perm						c0.29	0.19	0.20	0.15			
v/c Ratio	0.88	0.38			0.70	0.80	0.80	0.82	0.63			
Uniform Delay, d1	35.8	7.0			28.7	30.1	37.6	37.9	35.8			
Progression Factor	0.79	0.20			0.40	0.34	1.00	1.00	1.00			
Incremental Delay, d2	6.4	0.2			0.9	4.6	15.4	18.2	8.1			
Delay (s)	34.8	1.6			12.3	14.9	53.0	56.1	44.0			
Level of Service	C	A			B	B	D	E	D			
Approach Delay (s)		14.7			13.3			51.3			0.0	
Approach LOS		B			B			D			A	

Intersection Summary			
HCM 2000 Control Delay	20.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	203	1074	252	138	1407	238	283	6	58	158	11	203
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	
Frt	1.00	0.97		1.00	0.98			1.00	0.85		0.93	
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00		0.98	
Satd. Flow (prot)	1770	4940		1770	4975			1776	1583		1690	
Flt Permitted	0.95	1.00		0.95	1.00			0.47	1.00		0.56	
Satd. Flow (perm)	1770	4940		1770	4975			873	1583		961	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	214	1131	265	145	1481	251	298	6	61	166	12	214
RTOR Reduction (vph)	0	37	0	0	22	0	0	0	34	0	41	0
Lane Group Flow (vph)	214	1359	0	145	1710	0	0	304	27	0	351	0
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	15.3	39.0		14.3	38.0			39.7	39.7		39.7	
Effective Green, g (s)	15.3	39.0		14.3	38.0			39.7	39.7		39.7	
Actuated g/C Ratio	0.15	0.37		0.14	0.36			0.38	0.38		0.38	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	257	1834		241	1800			330	598		363	
v/s Ratio Prot	c0.12	0.28		0.08	c0.34							
v/s Ratio Perm								0.35	0.02		c0.37	
v/c Ratio	0.83	0.74		0.60	0.95			0.92	0.04		0.97	
Uniform Delay, d1	43.6	28.6		42.7	32.6			31.2	20.7		32.0	
Progression Factor	0.88	0.97		0.94	0.48			1.00	1.00		1.00	
Incremental Delay, d2	18.5	2.5		2.6	8.6			30.1	0.0		38.1	
Delay (s)	56.9	30.4		42.7	24.2			61.2	20.7		70.1	
Level of Service	E	C		D	C			E	C		E	
Approach Delay (s)		33.9			25.6			54.5			70.1	
Approach LOS		C			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	35.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	146	1259	14	79	1528	63	42	24	46	109	43	213
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5077		1770	3539	1583	1770	1679		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.73	1.00		0.71	1.00	1.00
Satd. Flow (perm)	1770	5077		1770	3539	1583	1353	1679		1318	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	159	1368	15	86	1661	68	46	26	50	118	47	232
RTOR Reduction (vph)	0	1	0	0	0	29	0	42	0	0	0	197
Lane Group Flow (vph)	159	1382	0	86	1661	39	46	34	0	118	47	35
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases						6	8			4		4
Actuated Green, G (s)	16.8	68.8		8.2	60.2	60.2	16.0	16.0		16.0	16.0	16.0
Effective Green, g (s)	16.8	68.8		8.2	60.2	60.2	16.0	16.0		16.0	16.0	16.0
Actuated g/C Ratio	0.16	0.66		0.08	0.57	0.57	0.15	0.15		0.15	0.15	0.15
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	283	3326		138	2029	907	206	255		200	283	241
v/s Ratio Prot	c0.09	0.27		0.05	c0.47			0.02			0.03	
v/s Ratio Perm						0.02	0.03			c0.09		0.02
v/c Ratio	0.56	0.42		0.62	0.82	0.04	0.22	0.13		0.59	0.17	0.15
Uniform Delay, d1	40.7	8.6		46.9	18.0	9.8	39.0	38.5		41.4	38.7	38.6
Progression Factor	0.54	0.20		1.02	1.03	0.97	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.9	0.3		0.8	0.4	0.0	2.5	1.1		12.2	1.3	1.3
Delay (s)	24.0	2.0		48.5	18.9	9.6	41.5	39.6		53.6	40.0	39.9
Level of Service	C	A		D	B	A	D	D		D	D	D
Approach Delay (s)		4.3			19.9			40.3			44.0	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	16.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	0	1104	539	151	1472	385	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.95	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)		3539	1583	1770	1863	1770	1583
Flt Permitted		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)		3539	1583	1770	1863	1770	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	1150	561	157	1533	401	52
RTOR Reduction (vph)	0	0	223	0	0	0	40
Lane Group Flow (vph)	0	1150	338	157	1533	401	12
Turn Type	Prot	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	5	2		1	6	8	
Permitted Phases			2				8
Actuated Green, G (s)		56.0	56.0	17.0	77.0	20.0	20.0
Effective Green, g (s)		56.0	56.0	17.0	77.0	20.0	20.0
Actuated g/C Ratio		0.53	0.53	0.16	0.73	0.19	0.19
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1887	844	286	1366	337	301
v/s Ratio Prot		0.32		0.09	c0.82	c0.23	
v/s Ratio Perm			0.21				0.01
v/c Ratio		0.61	0.40	0.55	1.12	1.19	0.04
Uniform Delay, d1		16.9	14.5	40.5	14.0	42.5	34.7
Progression Factor		0.41	0.40	0.83	0.69	1.00	1.00
Incremental Delay, d2		1.4	1.3	2.1	65.1	111.2	0.1
Delay (s)		8.3	7.1	35.5	74.7	153.7	34.7
Level of Service		A	A	D	E	F	C
Approach Delay (s)		7.9			71.1	140.0	
Approach LOS		A			E	F	

Intersection Summary			
HCM 2000 Control Delay	51.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	112.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	41	762	18	15	934	28	40	5	8	44	5	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3524		1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3524		1770	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	42	778	18	15	953	29	41	5	8	45	5	85
RTOR Reduction (vph)	0	0	5	0	1	0	0	0	8	0	0	80
Lane Group Flow (vph)	42	778	13	15	981	0	41	5	0	45	5	5
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	6.2	74.9	74.9	3.0	71.7		5.2	3.7	3.7	7.4	5.9	5.9
Effective Green, g (s)	6.2	74.9	74.9	3.0	71.7		5.2	3.7	3.7	7.4	5.9	5.9
Actuated g/C Ratio	0.06	0.71	0.71	0.03	0.68		0.05	0.04	0.04	0.07	0.06	0.06
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	104	2524	1129	50	2406		87	65	55	124	104	88
v/s Ratio Prot	0.02	c0.22		0.01	c0.28		c0.02	0.00		0.03	0.00	
v/s Ratio Perm			0.01						0.00			c0.00
v/c Ratio	0.40	0.31	0.01	0.30	0.41		0.47	0.08	0.01	0.36	0.05	0.05
Uniform Delay, d1	47.6	5.5	4.3	50.0	7.3		48.6	49.0	48.9	46.6	46.9	46.9
Progression Factor	0.62	0.24	1.00	1.25	0.60		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.1	0.3	0.0	3.0	0.5		4.0	0.5	0.0	1.8	0.2	0.3
Delay (s)	31.7	1.6	4.4	65.6	4.8		52.6	49.5	48.9	48.4	47.1	47.2
Level of Service	C	A	A	E	A		D	D	D	D	D	D
Approach Delay (s)		3.2			5.7			51.7			47.6	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	8.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	49	941	38	56	1160	20	58	23	81	64	6	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00		0.98	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1798	1583		1690	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.57	1.00		0.80	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1065	1583		1387	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	50	960	39	57	1184	20	59	23	83	65	6	86
RTOR Reduction (vph)	0	0	12	0	0	6	0	0	73	0	46	0
Lane Group Flow (vph)	50	960	27	57	1184	14	0	82	10	0	111	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8		8	4		
Actuated Green, G (s)	7.2	72.3	72.3	7.6	72.7	72.7		13.1	13.1		13.1	
Effective Green, g (s)	7.2	72.3	72.3	7.6	72.7	72.7		13.1	13.1		13.1	
Actuated g/C Ratio	0.07	0.69	0.69	0.07	0.69	0.69		0.12	0.12		0.12	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	121	2436	1090	128	2450	1096		132	197		173	
v/s Ratio Prot	0.03	c0.27		0.03	c0.33							
v/s Ratio Perm			0.02			0.01		0.08	0.01		c0.08	
v/c Ratio	0.41	0.39	0.02	0.45	0.48	0.01		0.62	0.05		0.64	
Uniform Delay, d1	46.9	7.0	5.2	46.7	7.5	5.0		43.6	40.5		43.7	
Progression Factor	0.67	0.54	0.23	1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	2.3	0.5	0.0	2.5	0.7	0.0		8.8	0.1		7.5	
Delay (s)	33.9	4.3	1.3	49.1	8.2	5.0		52.4	40.6		51.2	
Level of Service	C	A	A	D	A	A		D	D		D	
Approach Delay (s)		5.6			10.0			46.4			51.2	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	13.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	48	61	42	188	298	42
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.72	0.72	0.72	0.72	0.72	0.72
Hourly flow rate (vph)	67	85	58	261	414	58
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				816		
pX, platoon unblocked						
vC, conflicting volume	821	443	472			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	821	443	472			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	80	86	95			
cM capacity (veh/h)	326	615	1090			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	151	319	472
Volume Left	67	58	0
Volume Right	85	0	58
cSH	442	1090	1700
Volume to Capacity	0.34	0.05	0.28
Queue Length 95th (ft)	38	4	0
Control Delay (s)	17.3	2.0	0.0
Lane LOS	C	A	
Approach Delay (s)	17.3	2.0	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	7	5	48	8	7	5	10	45	7	10	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Hourly flow rate (vph)	6	9	6	62	10	9	6	13	58	9	13	6
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	19			15			176	167	12	227	166	15
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	19			15			176	167	12	227	166	15
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			96			99	98	95	99	98	99
cM capacity (veh/h)	1597			1602			746	695	1068	657	696	1065

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	22	81	77	28
Volume Left	6	62	6	9
Volume Right	6	9	58	6
cSH	1597	1602	949	740
Volume to Capacity	0.00	0.04	0.08	0.04
Queue Length 95th (ft)	0	3	7	3
Control Delay (s)	2.2	5.7	9.1	10.1
Lane LOS	A	A	A	B
Approach Delay (s)	2.2	5.7	9.1	10.1
Approach LOS			A	B

Intersection Summary			
Average Delay	7.2		
Intersection Capacity Utilization	18.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	63	793	455	130	221	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	3539	3421		1770	1583
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	3539	3421		1770	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	68	853	489	140	238	62
RTOR Reduction (vph)	0	0	16	0	0	50
Lane Group Flow (vph)	68	853	613	0	238	12
Turn Type	Prot	NA	NA		Prot	Perm
Protected Phases	5	2	6		7	
Permitted Phases						4
Actuated Green, G (s)	8.2	77.5	65.3		19.5	19.5
Effective Green, g (s)	8.2	77.5	65.3		19.5	19.5
Actuated g/C Ratio	0.08	0.74	0.62		0.19	0.19
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	138	2612	2127		328	293
v/s Ratio Prot	c0.04	c0.24	0.18		c0.13	
v/s Ratio Perm						0.01
v/c Ratio	0.49	0.33	0.29		0.73	0.04
Uniform Delay, d1	46.4	4.7	9.1		40.2	35.1
Progression Factor	1.00	1.00	0.13		1.00	1.00
Incremental Delay, d2	2.8	0.3	0.3		7.8	0.1
Delay (s)	49.2	5.1	1.4		48.0	35.1
Level of Service	D	A	A		D	D
Approach Delay (s)		8.3	1.4		45.3	
Approach LOS		A	A		D	

Intersection Summary			
HCM 2000 Control Delay	12.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	42.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Westpark Promenade Traffic Impact Analysis (#0201-0002)
2035 With Project Conditions
AM Peak Hour

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Future Volume Alternative)

Intersection #13 George Av. / La Estrella St.

Cycle (sec):	100	Critical Vol./Cap.(X):	0.864
Loss Time (sec):	0	Average Delay (sec/veh):	22.6
Optimal Cycle:	0	Level Of Service:	C

Approach:	North Bound			South Bound			East Bound			West Bound		
Movement:	L - T - R			L - T - R			L - T - R			L - T - R		
Control:	Stop Sign			Stop Sign			Stop Sign			Stop Sign		
Rights:	Include			Include			Include			Include		
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	1 0 0 1 0			1 0 1 0 1			0 0 1! 0 0			0 0 1! 0 0		
Volume Module:												
Base Vol:	58	125	62	65	224	51	55	126	42	73	229	120
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Initial Bse:	58	125	62	65	224	51	55	126	42	73	229	120
Added Vol:	0	21	10	0	17	0	0	0	0	15	0	0
PasserByVol:	0	0	0	0	0	0	0	0	0	0	0	0
Initial Fut:	58	146	72	65	241	51	55	126	42	88	229	120
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHF Adj:	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
PHF Volume:	63	159	78	71	262	55	60	137	46	96	249	130
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0
Reduced Vol:	63	159	78	71	262	55	60	137	46	96	249	130
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FinalVolume:	63	159	78	71	262	55	60	137	46	96	249	130
Saturation Flow Module:												
Adjustment:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lanes:	1.00	0.67	0.33	1.00	1.00	1.00	0.25	0.56	0.19	0.20	0.53	0.27
Final Sat.:	419	307	152	433	462	506	116	267	89	111	288	151
Capacity Analysis Module:												
Vol/Sat:	0.15	0.52	0.52	0.16	0.57	0.11	0.51	0.51	0.51	0.86	0.86	0.86
Crit Moves:		****			****			****			****	
Delay/Veh:	12.1	16.6	16.6	12.0	18.4	10.2	16.2	16.2	16.2	35.5	35.5	35.5
Delay Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AdjDel/Veh:	12.1	16.6	16.6	12.0	18.4	10.2	16.2	16.2	16.2	35.5	35.5	35.5
LOS by Move:	B	C	C	B	C	B	C	C	C	E	E	E
ApproachDel:		15.7			16.1			16.2			35.5	
Delay Adj:		1.00			1.00			1.00			1.00	
ApprAdjDel:		15.7			16.1			16.2			35.5	
LOS by Appr:		C			C			C			E	
AllWayAvgQ:	0.2	0.8	0.8	0.2	1.1	0.1	0.8	0.8	0.8	4.0	4.0	4.0

Note: Queue reported is the number of cars per lane.

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	19	9	1	2	19	327	11	1	1	296	0	50
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	21	10	1	2	21	355	12	1	1	322	0	54

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total (vph)	26	6	13	366	14	322	54
Volume Left (vph)	21	0	2	0	12	322	0
Volume Right (vph)	0	1	0	355	1	0	54
Hadj (s)	0.44	-0.09	0.12	-0.65	0.16	0.53	-0.67
Departure Headway (s)	6.6	6.1	5.8	5.1	6.3	6.1	4.9
Degree Utilization, x	0.05	0.01	0.02	0.52	0.02	0.54	0.07
Capacity (veh/h)	503	545	582	684	527	569	694
Control Delay (s)	8.7	7.9	7.8	12.1	9.4	14.9	7.1
Approach Delay (s)	8.6		12.0		9.4	13.8	
Approach LOS	A		B		A	B	

Intersection Summary			
Delay	12.7		
Level of Service	B		
Intersection Capacity Utilization	41.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	142	293	96	94	224	110	114	310	137	203	368	146
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.95		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3408		1770	1863	1583	1770	3376		1770	3388	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3408		1770	1863	1583	1770	3376		1770	3388	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	154	318	104	102	243	120	124	337	149	221	400	159
RTOR Reduction (vph)	0	53	0	0	0	90	0	82	0	0	67	0
Lane Group Flow (vph)	154	369	0	102	243	30	124	404	0	221	492	0
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	5.0	16.2		4.0	15.2	15.2	5.6	16.8		7.0	18.2	
Effective Green, g (s)	5.0	16.2		4.0	15.2	15.2	5.6	16.8		7.0	18.2	
Actuated g/C Ratio	0.08	0.27		0.07	0.25	0.25	0.09	0.28		0.12	0.30	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	147	920		118	471	401	165	945		206	1027	
v/s Ratio Prot	c0.09	0.11		0.06	c0.13		0.07	0.12		c0.12	c0.15	
v/s Ratio Perm						0.02						
v/c Ratio	1.05	0.40		0.86	0.52	0.08	0.75	0.43		1.07	0.48	
Uniform Delay, d1	27.5	17.9		27.7	19.2	17.1	26.5	17.7		26.5	17.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	87.4	1.3		43.9	4.0	0.4	17.4	1.4		83.4	1.6	
Delay (s)	114.9	19.2		71.6	23.2	17.4	43.9	19.1		109.9	18.6	
Level of Service	F	B		E	C	B	D	B		F	B	
Approach Delay (s)		44.8			32.4			24.1			44.5	
Approach LOS		D			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	37.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	184	205	223	83	150	426
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	200	223	242	90	163	463
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	333				910	288
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	333				910	288
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	84				36	38
cM capacity (veh/h)	1227				255	752

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	423	333	626
Volume Left	200	0	163
Volume Right	0	90	463
cSH	1227	1700	499
Volume to Capacity	0.16	0.20	1.26
Queue Length 95th (ft)	15	0	631
Control Delay (s)	4.9	0.0	155.6
Lane LOS	A		F
Approach Delay (s)	4.9	0.0	155.6
Approach LOS			F

Intersection Summary			
Average Delay	72.0		
Intersection Capacity Utilization	82.3%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	343	297	0	0	453	196	407	2	92	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	373	323	0	0	492	213	442	2	100	0	0	0

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2
Volume Total (vph)	373	323	705	445	100
Volume Left (vph)	373	0	0	442	0
Volume Right (vph)	0	0	213	0	100
Hadj (s)	0.53	0.03	-0.15	0.53	-0.67
Departure Headway (s)	8.1	7.6	7.3	8.1	7.0
Degree Utilization, x	0.84	0.68	1.0	1.0	0.19
Capacity (veh/h)	437	462	505	445	510
Control Delay (s)	40.4	24.5	227.2	72.0	10.4
Approach Delay (s)	33.0		227.2	60.7	
Approach LOS	D		F	F	

Intersection Summary			
Delay	111.1		
Level of Service	F		
Intersection Capacity Utilization	92.9%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	526	536	290	570	0	0	0	0	114	1	181
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	572	583	315	620	0	0	0	0	124	1	197

Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	1154	315	620	125	197
Volume Left (vph)	0	315	0	124	0
Volume Right (vph)	583	0	0	0	197
Hadj (s)	-0.27	0.53	0.03	0.53	-0.67
Departure Headway (s)	6.3	7.0	6.5	8.2	7.0
Degree Utilization, x	1.0	0.61	1.0	0.29	0.38
Capacity (veh/h)	578	502	559	432	506
Control Delay (s)	477.9	19.2	97.4	13.3	13.1
Approach Delay (s)	477.9	71.0		13.2	
Approach LOS	F	F		B	

Intersection Summary			
Delay	258.1		
Level of Service	F		
Intersection Capacity Utilization	92.9%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	4	10	18	18	10	7	26	256	3	1	214	6
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	11	20	20	11	8	28	278	3	1	233	7
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						2						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1183				
pX, platoon unblocked												
vC, conflicting volume	584	576	236	599	578	280	239			282		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	584	576	236	599	578	280	239			282		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	97	98	95	97	99	98			100		
cM capacity (veh/h)	404	418	803	388	418	759	1328			1281		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	35	38	310	240
Volume Left	4	20	28	1
Volume Right	20	8	3	7
cSH	569	499	1328	1281
Volume to Capacity	0.06	0.08	0.02	0.00
Queue Length 95th (ft)	5	6	2	0
Control Delay (s)	11.7	13.8	0.9	0.0
Lane LOS	B	B	A	A
Approach Delay (s)	11.7	13.8	0.9	0.0
Approach LOS	B	B		

Intersection Summary				
Average Delay		2.0		
Intersection Capacity Utilization		42.2%	ICU Level of Service	A
Analysis Period (min)		15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	6	10	68	0	10	0	99	168	0	0	153	9
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	11	74	0	11	0	108	183	0	0	166	10
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	574	569	171	611	574	183	176			183		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	574	569	171	611	574	183	176			183		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	97	92	100	97	100	92			100		
cM capacity (veh/h)	396	399	873	342	396	860	1400			1392		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	91	11	290	176
Volume Left	7	0	108	0
Volume Right	74	0	0	10
cSH	1078	396	1400	1392
Volume to Capacity	0.08	0.03	0.08	0.00
Queue Length 95th (ft)	7	2	6	0
Control Delay (s)	10.5	14.3	3.3	0.0
Lane LOS	B	B	A	
Approach Delay (s)	10.5	14.3	3.3	0.0
Approach LOS	B	B		

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	38.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	10	82	39	10	7	135	32	7	1	41	30
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	11	89	42	11	8	147	35	8	1	45	33
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	408	399	61	445	411	39	77			42		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	408	399	61	445	411	39	77			42		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	98	91	90	98	99	90			100		
cM capacity (veh/h)	500	487	1004	434	479	1033	1521			1567		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	122	42	18	189	78
Volume Left	22	42	0	147	1
Volume Right	89	0	8	8	33
cSH	1372	434	615	1521	1567
Volume to Capacity	0.09	0.10	0.03	0.10	0.00
Queue Length 95th (ft)	7	8	2	8	0
Control Delay (s)	10.0	14.2	11.0	6.1	0.1
Lane LOS	A	B	B	A	A
Approach Delay (s)	10.0	13.2		6.1	0.1
Approach LOS	A	B			

Intersection Summary			
Average Delay	7.1		
Intersection Capacity Utilization	31.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	10	0	60	63	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	11	0	65	68	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	134	68	68			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	134	68	68			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	100			
cM capacity (veh/h)	860	995	1533			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	11	65	68
Volume Left	0	0	0
Volume Right	11	0	0
cSH	995	1700	1700
Volume to Capacity	0.01	0.04	0.04
Queue Length 95th (ft)	1	0	0
Control Delay (s)	8.7	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.7	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	170	643	77	452	999	567	64	506	345	577	613	209
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3482		1770	3539	1583	1770	3539	1583	1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3482		1770	3539	1583	1770	3539	1583	1770	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	179	677	81	476	1052	597	67	533	363	607	645	220
RTOR Reduction (vph)	0	8	0	0	0	250	0	0	312	0	0	76
Lane Group Flow (vph)	179	750	0	476	1052	347	67	533	51	607	645	144
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	12.0	24.0		26.0	38.0	38.0	5.0	16.0	16.0	33.0	44.0	44.0
Effective Green, g (s)	12.0	24.0		26.0	38.0	38.0	5.0	16.0	16.0	33.0	44.0	44.0
Actuated g/C Ratio	0.10	0.21		0.23	0.33	0.33	0.04	0.14	0.14	0.29	0.38	0.38
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	184	726		400	1169	523	76	492	220	507	712	605
v/s Ratio Prot	0.10	c0.22		c0.27	0.30		0.04	c0.15		c0.34	0.35	
v/s Ratio Perm						0.22			0.03			0.09
v/c Ratio	0.97	1.03		1.19	0.90	0.66	0.88	1.08	0.23	1.20	0.91	0.24
Uniform Delay, d1	51.3	45.5		44.5	36.7	33.0	54.7	49.5	44.0	41.0	33.5	24.1
Progression Factor	0.89	0.86		0.79	0.46	0.13	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	56.7	41.5		100.4	7.4	4.1	64.5	65.0	2.4	106.7	17.3	0.9
Delay (s)	102.3	80.7		135.6	24.2	8.4	119.2	114.5	46.4	147.7	50.8	25.0
Level of Service	F	F		F	C	A	F	F	D	F	D	C
Approach Delay (s)		84.8			44.7			89.1			86.9	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM 2000 Control Delay	70.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	104.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	182	1357	94	176	1357	674	153	14	184	497	16	176
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1694		1770	1606	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.72		0.52	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1244		966	1606	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	188	1399	97	181	1399	695	158	14	190	512	16	181
RTOR Reduction (vph)	0	0	29	0	0	325	0	34	0	0	102	0
Lane Group Flow (vph)	188	1399	68	181	1399	370	0	328	0	512	95	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	10.0	44.0	44.0	9.0	43.0	43.0		50.0		50.0	50.0	
Effective Green, g (s)	10.0	44.0	44.0	9.0	43.0	43.0		50.0		50.0	50.0	
Actuated g/C Ratio	0.09	0.38	0.38	0.08	0.37	0.37		0.43		0.43	0.43	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	153	1354	605	138	1323	591		540		420	698	
v/s Ratio Prot	c0.11	c0.40		0.10	c0.40						0.06	
v/s Ratio Perm			0.04			0.23		0.26		c0.53		
v/c Ratio	1.23	1.03	0.11	1.31	1.06	0.63		0.61		1.22	0.14	
Uniform Delay, d1	52.5	35.5	22.9	53.0	36.0	29.4		24.9		32.5	19.5	
Progression Factor	1.07	0.86	1.04	0.69	0.54	0.32		1.00		1.00	1.00	
Incremental Delay, d2	116.3	21.8	0.1	176.6	39.5	4.2		5.0		118.4	0.4	
Delay (s)	172.3	52.2	23.9	213.4	59.1	13.5		29.9		150.9	19.9	
Level of Service	F	D	C	F	E	B		C		F	B	
Approach Delay (s)		63.9			57.5			29.9			114.5	
Approach LOS		E			E			C			F	

Intersection Summary			
HCM 2000 Control Delay	65.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	109.0%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1452	586	460	1633	0	0	0	0	971	2	574
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.91					0.95	0.95	0.88
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		5085	1583	3433	5085					1681	1686	2787
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		5085	1583	3433	5085					1681	1686	2787
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	0	1467	592	465	1649	0	0	0	0	981	2	580
RTOR Reduction (vph)	0	0	310	0	0	0	0	0	0	0	0	29
Lane Group Flow (vph)	0	1467	282	465	1649	0	0	0	0	490	493	551
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		40.0	40.0	20.0	64.0					43.0	43.0	43.0
Effective Green, g (s)		40.0	40.0	20.0	64.0					43.0	43.0	43.0
Actuated g/C Ratio		0.35	0.35	0.17	0.56					0.37	0.37	0.37
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1768	550	597	2829					628	630	1042
v/s Ratio Prot		c0.29		c0.14	0.32							
v/s Ratio Perm			0.18							0.29	0.29	0.20
v/c Ratio		0.83	0.51	0.78	0.58					0.78	0.78	0.53
Uniform Delay, d1		34.4	29.8	45.4	16.7					31.8	31.9	28.1
Progression Factor		0.61	0.16	0.89	0.51					1.00	1.00	1.00
Incremental Delay, d2		0.4	0.3	2.8	0.4					9.3	9.4	1.9
Delay (s)		21.6	5.0	43.2	9.0					41.1	41.2	30.0
Level of Service		C	A	D	A					D	D	C
Approach Delay (s)		16.8			16.5			0.0			37.0	
Approach LOS		B			B			A			D	

Intersection Summary			
HCM 2000 Control Delay	22.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	104.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	781	1642	0	0	1364	726	729	7	635	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.91			0.91	1.00	0.95	0.91	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.93	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.97	1.00			
Satd. Flow (prot)	3433	5085			5085	1583	1681	1542	1504			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.97	1.00			
Satd. Flow (perm)	3433	5085			5085	1583	1681	1542	1504			
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	814	1710	0	0	1421	756	759	7	661	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	418	0	15	31	0	0	0
Lane Group Flow (vph)	814	1710	0	0	1421	338	493	470	418	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	29.0	69.0			36.0	36.0	38.0	38.0	38.0			
Effective Green, g (s)	29.0	69.0			36.0	36.0	38.0	38.0	38.0			
Actuated g/C Ratio	0.25	0.60			0.31	0.31	0.33	0.33	0.33			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	865	3051			1591	495	555	509	496			
v/s Ratio Prot	c0.24	0.34			c0.28							
v/s Ratio Perm						0.21	0.29	0.30	0.28			
v/c Ratio	0.94	0.56			0.89	0.68	0.89	0.92	0.84			
Uniform Delay, d1	42.2	13.9			37.7	34.5	36.5	37.1	35.7			
Progression Factor	0.90	0.59			0.33	0.48	1.00	1.00	1.00			
Incremental Delay, d2	12.2	0.4			0.8	0.7	18.8	24.7	15.8			
Delay (s)	50.1	8.6			13.3	17.3	55.3	61.8	51.5			
Level of Service	D	A			B	B	E	E	D			
Approach Delay (s)		22.0			14.7			56.3			0.0	
Approach LOS		C			B			E			A	

Intersection Summary			
HCM 2000 Control Delay	27.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	104.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	362	1410	275	128	1455	361	317	17	88	317	11	318
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	
Frt	1.00	0.98		1.00	0.97			1.00	0.85		0.93	
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00		0.98	
Satd. Flow (prot)	1770	4961		1770	4934			1778	1583		1697	
Flt Permitted	0.95	1.00		0.95	1.00			0.43	1.00		0.52	
Satd. Flow (perm)	1770	4961		1770	4934			810	1583		902	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	385	1500	293	136	1548	384	337	18	94	337	12	338
RTOR Reduction (vph)	0	25	0	0	37	0	0	0	47	0	30	0
Lane Group Flow (vph)	385	1768	0	136	1895	0	0	355	47	0	657	0
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		
Actuated Green, G (s)	19.0	43.0		9.0	33.0			51.0	51.0		51.0	
Effective Green, g (s)	19.0	43.0		9.0	33.0			51.0	51.0		51.0	
Actuated g/C Ratio	0.17	0.37		0.08	0.29			0.44	0.44		0.44	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	292	1854		138	1415			359	702		400	
v/s Ratio Prot	c0.22	0.36		0.08	c0.38							
v/s Ratio Perm								0.44	0.03		c0.73	
v/c Ratio	1.32	0.95		0.99	1.34			0.99	0.07		1.64	
Uniform Delay, d1	48.0	35.0		52.9	41.0			31.7	18.4		32.0	
Progression Factor	0.75	0.85		0.72	0.80			1.00	1.00		1.00	
Incremental Delay, d2	160.6	10.2		57.0	155.8			44.0	0.0		300.1	
Delay (s)	196.8	39.8		95.3	188.5			75.8	18.4		332.1	
Level of Service	F	D		F	F			E	B		F	
Approach Delay (s)		67.6			182.3			63.7			332.1	
Approach LOS		E			F			E			F	

Intersection Summary			
HCM 2000 Control Delay	145.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.48		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	110.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	132	1819	11	112	1742	94	64	41	134	96	51	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.88		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5081		1770	3539	1583	1770	1648		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.72	1.00		0.47	1.00	1.00
Satd. Flow (perm)	1770	5081		1770	3539	1583	1347	1648		883	1863	1583
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	133	1837	11	113	1760	95	65	41	135	97	52	139
RTOR Reduction (vph)	0	0	0	0	0	34	0	101	0	0	0	112
Lane Group Flow (vph)	133	1848	0	113	1760	61	65	75	0	97	52	27
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases						6	8			4		4
Actuated Green, G (s)	12.4	68.0		12.4	68.0	68.0	22.6	22.6		22.6	22.6	22.6
Effective Green, g (s)	12.4	68.0		12.4	68.0	68.0	22.6	22.6		22.6	22.6	22.6
Actuated g/C Ratio	0.11	0.59		0.11	0.59	0.59	0.20	0.20		0.20	0.20	0.20
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	190	3004		190	2092	936	264	323		173	366	311
v/s Ratio Prot	c0.08	0.36		0.06	c0.50			0.05			0.03	
v/s Ratio Perm						0.04	0.05			c0.11		0.02
v/c Ratio	0.70	0.62		0.59	0.84	0.07	0.25	0.23		0.56	0.14	0.09
Uniform Delay, d1	49.5	15.1		48.9	19.1	10.0	39.0	38.9		41.7	38.2	37.8
Progression Factor	0.77	0.34		1.01	1.08	1.21	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.1		0.5	0.4	0.0	2.2	1.7		12.5	0.8	0.6
Delay (s)	39.3	5.2		49.8	21.0	12.1	41.2	40.6		54.2	39.0	38.3
Level of Service	D	A		D	C	B	D	D		D	D	D
Approach Delay (s)		7.5			22.2			40.7			43.8	
Approach LOS		A			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	18.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	0	1667	581	117	1494	679	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.95	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)		3539	1583	1770	1863	1770	1583
Flt Permitted		1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)		3539	1583	1770	1863	1770	1583
Peak-hour factor, PHF	0.96	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	0	1701	593	119	1524	693	189
RTOR Reduction (vph)	0	0	145	0	0	0	77
Lane Group Flow (vph)	0	1701	448	119	1524	693	112
Turn Type	Prot	NA	Perm	Prot	NA	Prot	Perm
Protected Phases	5	2		1	6	8	
Permitted Phases			2				8
Actuated Green, G (s)		62.0	62.0	8.0	74.0	33.0	33.0
Effective Green, g (s)		62.0	62.0	8.0	74.0	33.0	33.0
Actuated g/C Ratio		0.54	0.54	0.07	0.64	0.29	0.29
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		1907	853	123	1198	507	454
v/s Ratio Prot		0.48		0.07	c0.82	c0.39	
v/s Ratio Perm			0.28				0.07
v/c Ratio		0.89	0.53	0.97	1.27	1.37	0.25
Uniform Delay, d1		23.5	17.0	53.4	20.5	41.0	31.5
Progression Factor		0.28	0.14	0.80	0.52	1.00	1.00
Incremental Delay, d2		5.9	2.0	68.8	128.9	177.4	0.3
Delay (s)		12.5	4.3	111.4	139.5	218.4	31.7
Level of Service		B	A	F	F	F	C
Approach Delay (s)		10.4			137.4	178.4	
Approach LOS		B			F	F	

Intersection Summary			
HCM 2000 Control Delay	84.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.35		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	129.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	108	1063	24	18	987	44	36	5	4	39	4	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3517		1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3517		1770	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	111	1096	25	19	1018	45	37	5	4	40	4	95
RTOR Reduction (vph)	0	0	7	0	2	0	0	0	4	0	0	90
Lane Group Flow (vph)	111	1096	18	19	1061	0	37	5	0	40	4	5
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	19.4	82.5	82.5	3.2	66.3		7.0	3.5	3.5	9.8	6.3	6.3
Effective Green, g (s)	19.4	82.5	82.5	3.2	66.3		7.0	3.5	3.5	9.8	6.3	6.3
Actuated g/C Ratio	0.17	0.72	0.72	0.03	0.58		0.06	0.03	0.03	0.09	0.05	0.05
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	298	2538	1135	49	2027		107	56	48	150	102	86
v/s Ratio Prot	0.06	c0.31		0.01	c0.30		0.02	c0.00		c0.02	0.00	
v/s Ratio Perm			0.01						0.00			0.00
v/c Ratio	0.37	0.43	0.02	0.39	0.52		0.35	0.09	0.00	0.27	0.04	0.06
Uniform Delay, d1	42.4	6.7	4.6	54.9	14.8		51.8	54.2	54.1	49.2	51.5	51.5
Progression Factor	0.59	0.13	1.00	1.30	0.61		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.3	0.0	4.4	0.8		1.9	0.7	0.0	1.0	0.2	0.3
Delay (s)	25.2	1.2	4.7	75.9	9.9		53.7	54.9	54.1	50.2	51.6	51.8
Level of Service	C	A	A	E	A		D	D	D	D	D	D
Approach Delay (s)		3.4			11.1			53.9			51.4	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	10.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	91	1401	57	41	1205	72	53	11	88	46	2	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.98	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1789	1583		1690	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.60	1.00		0.82	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1116	1583		1416	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	96	1475	60	43	1268	76	56	12	93	48	2	58
RTOR Reduction (vph)	0	0	13	0	0	21	0	0	84	0	40	0
Lane Group Flow (vph)	96	1475	47	43	1268	55	0	68	9	0	68	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8		8	4		
Actuated Green, G (s)	14.7	84.6	84.6	7.1	77.0	77.0		11.3	11.3		11.3	
Effective Green, g (s)	14.7	84.6	84.6	7.1	77.0	77.0		11.3	11.3		11.3	
Actuated g/C Ratio	0.13	0.74	0.74	0.06	0.67	0.67		0.10	0.10		0.10	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	226	2603	1164	109	2369	1059		109	155		139	
v/s Ratio Prot	0.05	c0.42		0.02	c0.36							
v/s Ratio Perm			0.03			0.03		c0.06	0.01		0.05	
v/c Ratio	0.42	0.57	0.04	0.39	0.54	0.05		0.62	0.06		0.49	
Uniform Delay, d1	46.3	6.9	4.1	51.9	9.8	6.5		49.8	47.0		49.1	
Progression Factor	0.70	0.29	0.05	1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	1.3	0.9	0.1	2.3	0.9	0.1		10.6	0.2		2.7	
Delay (s)	33.8	2.9	0.3	54.2	10.7	6.6		60.4	47.2		51.8	
Level of Service	C	A	A	D	B	A		E	D		D	
Approach Delay (s)		4.6			11.8			52.8			51.8	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	11.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	64	37	60	205	163	80
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	75	44	71	241	192	94
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				816		
pX, platoon unblocked						
vC, conflicting volume	621	239	286			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	621	239	286			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	82	95	94			
cM capacity (veh/h)	426	800	1276			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	119	312	286
Volume Left	75	71	0
Volume Right	44	0	94
cSH	514	1276	1700
Volume to Capacity	0.23	0.06	0.17
Queue Length 95th (ft)	22	4	0
Control Delay (s)	14.1	2.2	0.0
Lane LOS	B	A	
Approach Delay (s)	14.1	2.2	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	43.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	5	5	100	8	8	5	10	87	5	10	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Hourly flow rate (vph)	7	7	7	145	12	12	7	14	126	7	14	7
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	23			14			347	338	11	466	336	17
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	23			14			347	338	11	466	336	17
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			91			99	97	88	98	97	99
cM capacity (veh/h)	1592			1604			548	528	1070	406	529	1061

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	22	168	148	29
Volume Left	7	145	7	7
Volume Right	7	12	126	7
cSH	1592	1604	933	557
Volume to Capacity	0.00	0.09	0.16	0.05
Queue Length 95th (ft)	0	7	14	4
Control Delay (s)	2.4	6.5	9.6	11.8
Lane LOS	A	A	A	B
Approach Delay (s)	2.4	6.5	9.6	11.8
Approach LOS			A	B

Intersection Summary			
Average Delay	7.9		
Intersection Capacity Utilization	26.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	63	644	725	229	268	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.96		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	3539	3412		1770	1583
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	3539	3412		1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	66	678	763	241	282	67
RTOR Reduction (vph)	0	0	20	0	0	53
Lane Group Flow (vph)	66	678	984	0	282	14
Turn Type	Prot	NA	NA		Prot	Perm
Protected Phases	5	2	6		7	
Permitted Phases						4
Actuated Green, G (s)	8.4	83.3	70.9		23.7	23.7
Effective Green, g (s)	8.4	83.3	70.9		23.7	23.7
Actuated g/C Ratio	0.07	0.72	0.62		0.21	0.21
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	129	2563	2103		364	326
v/s Ratio Prot	c0.04	0.19	c0.29		c0.16	
v/s Ratio Perm						0.01
v/c Ratio	0.51	0.26	0.47		0.77	0.04
Uniform Delay, d1	51.3	5.4	11.9		43.1	36.6
Progression Factor	1.00	1.00	0.15		1.00	1.00
Incremental Delay, d2	3.4	0.3	0.4		9.9	0.1
Delay (s)	54.7	5.7	2.2		53.0	36.6
Level of Service	D	A	A		D	D
Approach Delay (s)		10.0	2.2		49.9	
Approach LOS		B	A		D	

Intersection Summary			
HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	55.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Westpark Promenade Traffic Impact Analysis (#0201-0002)
2035 With Project Conditions
AM Peak Hour

Level Of Service Computation Report
2000 HCM 4-Way Stop Method (Future Volume Alternative)

Intersection #13 George Av. / La Estrella St.

Cycle (sec):	100	Critical Vol./Cap.(X):	0.418
Loss Time (sec):	0	Average Delay (sec/veh):	11.1
Optimal Cycle:	0	Level Of Service:	B

Approach:	North Bound			South Bound			East Bound			West Bound		
Movement:	L -	T -	R	L -	T -	R	L -	T -	R	L -	T -	R
Control:	Stop Sign			Stop Sign			Stop Sign			Stop Sign		
Rights:	Include			Include			Include			Include		
Min. Green:	0	0	0	0	0	0	0	0	0	0	0	0
Lanes:	1 0	0 1	0	1 0	1 0	1	0 0	1! 0	0	0 0	1! 0	0
Volume Module:												
Base Vol:	25	139	49	131	176	1	10	117	35	42	0	67
Growth Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Initial Bse:	25	139	49	131	176	1	10	117	35	42	0	67
Added Vol:	0	32	27	0	39	0	0	0	0	29	0	0
PasserByVol:	0	0	0	0	0	0	0	0	0	0	0	0
Initial Fut:	25	171	76	131	215	1	10	117	35	71	0	67
User Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PHF Adj:	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
PHF Volume:	26	178	79	136	224	1	10	122	36	74	0	70
Reduct Vol:	0	0	0	0	0	0	0	0	0	0	0	0
Reduced Vol:	26	178	79	136	224	1	10	122	36	74	0	70
PCE Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MLF Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FinalVolume:	26	178	79	136	224	1	10	122	36	74	0	70
Saturation Flow Module:												
Adjustment:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lanes:	1.00	0.69	0.31	1.00	1.00	1.00	0.06	0.72	0.22	0.51	0.00	0.49
Final Sat.:	547	426	189	561	608	688	36	426	128	303	0	285
Capacity Analysis Module:												
Vol/Sat:	0.05	0.42	0.42	0.24	0.37	0.00	0.29	0.29	0.29	0.24	xxxx	0.24
Crit Moves:			****		****			****		****		
Delay/Veh:	9.3	12.0	12.0	10.8	11.5	7.7	10.6	10.6	10.6	10.2	0.0	10.2
Delay Adj:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AdjDel/Veh:	9.3	12.0	12.0	10.8	11.5	7.7	10.6	10.6	10.6	10.2	0.0	10.2
LOS by Move:	A	B	B	B	B	A	B	B	B	B	*	B
ApproachDel:	11.8			11.2			10.6			10.2		
Delay Adj:	1.00			1.00			1.00			1.00		
ApprAdjDel:	11.8			11.2			10.6			10.2		
LOS by Appr:	B			B			B			B		
AllWayAvgQ:	0.0	0.6	0.6	0.3	0.5	0.0	0.3	0.3	0.3	0.3	0.3	0.3

Note: Queue reported is the number of cars per lane.

Traffix 8.0.0715 (c) 2008 Dowling Assoc. Licensed to Trames Solutions

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	31	14	1	3	5	529	1	1	1	499	0	8
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	34	15	1	3	5	575	1	1	1	542	0	9

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total (vph)	41	9	6	578	3	542	9
Volume Left (vph)	34	0	3	0	1	542	0
Volume Right (vph)	0	1	0	575	1	0	9
Hadj (s)	0.44	-0.05	0.31	-0.66	-0.10	0.53	-0.67
Departure Headway (s)	7.9	7.4	6.8	5.8	7.5	6.9	5.7
Degree Utilization, x	0.09	0.02	0.01	0.93	0.01	1.0	0.01
Capacity (veh/h)	444	473	519	608	459	512	610
Control Delay (s)	10.4	9.3	8.7	44.4	10.5	74.6	7.6
Approach Delay (s)	10.3		44.0		10.5	73.6	
Approach LOS	B		E		B	F	

Intersection Summary			
Delay	56.2		
Level of Service	F		
Intersection Capacity Utilization	65.1%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	198	376	153	147	374	250	159	254	90	161	247	139
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.96		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3386		1770	1863	1583	1770	3400		1770	3348	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3386		1770	1863	1583	1770	3400		1770	3348	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	211	400	163	156	398	266	169	270	96	171	263	148
RTOR Reduction (vph)	0	68	0	0	0	196	0	55	0	0	112	0
Lane Group Flow (vph)	211	495	0	156	398	70	169	311	0	171	299	0
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	9.0	18.1		7.9	17.0	17.0	7.0	16.0		7.0	16.0	
Effective Green, g (s)	9.0	18.1		7.9	17.0	17.0	7.0	16.0		7.0	16.0	
Actuated g/C Ratio	0.14	0.28		0.12	0.26	0.26	0.11	0.25		0.11	0.25	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	245	942		215	487	414	190	836		190	824	
v/s Ratio Prot	c0.12	0.15		0.09	c0.21		0.10	c0.09		c0.10	0.09	
v/s Ratio Perm						0.04						
v/c Ratio	0.86	0.53		0.73	0.82	0.17	0.89	0.37		0.90	0.36	
Uniform Delay, d1	27.4	19.8		27.5	22.5	18.5	28.6	20.3		28.7	20.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	25.2	2.1		11.5	14.1	0.9	35.8	1.3		38.6	1.2	
Delay (s)	52.6	21.9		39.0	36.6	19.4	64.4	21.6		67.2	21.5	
Level of Service	D	C		D	D	B	E	C		E	C	
Approach Delay (s)		30.3			31.5			35.1			35.0	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	32.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	151	209	115	39	46	188
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	162	225	124	42	49	202
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	166				694	145
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	166				694	145
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	89				86	78
cM capacity (veh/h)	1413				362	903

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	387	166	252
Volume Left	162	0	49
Volume Right	0	42	202
cSH	1413	1700	698
Volume to Capacity	0.11	0.10	0.36
Queue Length 95th (ft)	10	0	41
Control Delay (s)	3.9	0.0	13.0
Lane LOS	A		B
Approach Delay (s)	3.9	0.0	13.0
Approach LOS			B

Intersection Summary			
Average Delay	6.0		
Intersection Capacity Utilization	51.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	256	257	0	0	216	87	535	5	103	0	0	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	269	271	0	0	227	92	563	5	108	0	0	0

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2
Volume Total (vph)	269	271	319	568	108
Volume Left (vph)	269	0	0	563	0
Volume Right (vph)	0	0	92	0	108
Hadj (s)	0.53	0.03	-0.14	0.53	-0.67
Departure Headway (s)	7.7	7.2	7.2	7.6	6.4
Degree Utilization, x	0.58	0.54	0.63	1.0	0.19
Capacity (veh/h)	460	492	498	479	553
Control Delay (s)	19.7	17.4	21.7	132.7	9.7
Approach Delay (s)	18.5		21.7	113.0	
Approach LOS	C		C	F	

Intersection Summary			
Delay	60.8		
Level of Service	F		
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	405	448	71	680	0	0	0	0	108	3	351
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	418	462	73	701	0	0	0	0	111	3	362

Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	879	73	701	114	362
Volume Left (vph)	0	73	0	111	0
Volume Right (vph)	462	0	0	0	362
Hadj (s)	-0.28	0.53	0.03	0.52	-0.67
Departure Headway (s)	6.8	7.6	7.1	8.1	6.9
Degree Utilization, x	1.0	0.15	1.0	0.26	0.70
Capacity (veh/h)	535	467	521	438	509
Control Delay (s)	320.2	10.7	201.0	12.7	23.2
Approach Delay (s)	320.2	183.0		20.6	
Approach LOS	F	F		C	

Intersection Summary			
Delay	203.3		
Level of Service	F		
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	11	10	47	8	10	3	50	506	17	7	455	12
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	12	11	51	9	11	3	54	550	18	8	495	13
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						2						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1183				
pX, platoon unblocked												
vC, conflicting volume	1191	1193	501	1241	1191	559	508			568		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1191	1193	501	1241	1191	559	508			568		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	94	91	93	94	99	95			99		
cM capacity (veh/h)	149	176	570	126	176	528	1057			1004		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	74	23	623	515
Volume Left	12	9	54	8
Volume Right	51	3	18	13
cSH	319	180	1057	1004
Volume to Capacity	0.23	0.13	0.05	0.01
Queue Length 95th (ft)	22	11	4	1
Control Delay (s)	19.7	28.9	1.4	0.2
Lane LOS	C	D	A	A
Approach Delay (s)	19.7	28.9	1.4	0.2
Approach LOS	C	D		

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	16	10	181	0	10	0	195	325	0	0	292	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	11	197	0	11	0	212	353	0	0	317	18
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1109	1104	327	1208	1113	353	336			353		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1109	1104	327	1208	1113	353	336			353		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	94	72	100	94	100	83			100		
cM capacity (veh/h)	154	175	715	96	172	690	1223			1205		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	225	11	565	336
Volume Left	17	0	212	0
Volume Right	197	0	0	18
cSH	817	172	1223	1205
Volume to Capacity	0.28	0.06	0.17	0.00
Queue Length 95th (ft)	28	5	16	0
Control Delay (s)	14.4	27.3	4.4	0.0
Lane LOS	B	D	A	
Approach Delay (s)	14.4	27.3	4.4	0.0
Approach LOS	B	D		

Intersection Summary			
Average Delay	5.3		
Intersection Capacity Utilization	62.4%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	54	10	214	18	10	3	260	45	37	7	77	58
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	59	11	233	20	11	3	283	49	40	8	84	63
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	773	785	115	886	796	69	147			89		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	773	785	115	886	796	69	147			89		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	77	96	75	88	96	100	80			99		
cM capacity (veh/h)	258	259	937	163	255	994	1435			1506		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	302	20	14	372	154
Volume Left	59	20	0	283	8
Volume Right	233	0	3	40	63
cSH	1121	163	308	1435	1506
Volume to Capacity	0.27	0.12	0.05	0.20	0.01
Queue Length 95th (ft)	27	10	4	18	0
Control Delay (s)	13.3	30.0	17.2	6.6	0.4
Lane LOS	B	D	C	A	A
Approach Delay (s)	13.3	24.7		6.6	0.4
Approach LOS	B	C			

Intersection Summary			
Average Delay	8.5		
Intersection Capacity Utilization	47.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	27	0	102	115	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	29	0	111	125	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	236	125	125			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	236	125	125			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	97	100			
cM capacity (veh/h)	752	926	1462			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	29	111	125
Volume Left	0	0	0
Volume Right	29	0	0
cSH	926	1700	1700
Volume to Capacity	0.03	0.07	0.07
Queue Length 95th (ft)	2	0	0
Control Delay (s)	9.0	0.0	0.0
Lane LOS	A		
Approach Delay (s)	9.0	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	16.1%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX U

HORIZON YEAR (2035) WITH PROJECT
FREEWAY RAMP ANALYSIS WORKSHEETS

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035 With Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	300	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	5411	V_D =	veh/h
		Ramp Volume, V_R	1429		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5411	0.92	Level	9	0	0.957	1.00	6146
Ramp	1429	0.92	Level	2	0	0.990	1.00	1569
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 3629 pc/h

V_3 or V_{av34} 2517 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6146	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4577	Exhibit 13-8	7050	No
V_R	1569	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3629	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 27.4 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.569 (Exhibit 13-12)

S_R= 51.9 mph (Exhibit 13-12)

S_0= 65.4 mph (Exhibit 13-12)

S = 56.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035WP w/ Improvements

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	5	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	300	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	5411	V_D =	veh/h
		Ramp Volume, V_R	1429		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5411	0.92	Level	9	0	0.957	1.00	6146
Ramp	1429	0.92	Level	2	0	0.990	1.00	1569
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 2520 pc/h

V_3 or V_{av34} 1352 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5225	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	3656	Exhibit 13-8	9400	No
V_R	1569	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2520	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 17.8 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.569 (Exhibit 13-12)

S_R= 51.9 mph (Exhibit 13-12)

S_0= 69.9 mph (Exhibit 13-12)

S = 59.9 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035 With Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3982	
	Ramp Volume, V_R: 1388	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3982	0.92	Level	9	0	0.957	1.00	4523
Ramp	1388	0.92	Level	2	0	0.990	1.00	1524
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2510 pc/h

V_3 or V_{av34} 2013 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 2584 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6047	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4108	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 31.2 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.495 (Exibit 13-11)

S_R= 53.6 mph (Exhibit 13-11)

S_0= 59.8 mph (Exhibit 13-11)

S = 55.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035WP w/ Improvements

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3982	
	Ramp Volume, V_R: 1388	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3982	0.92	Level	9	0	0.957	1.00	4523
Ramp	1388	0.92	Level	2	0	0.990	1.00	1524
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.209 using Equation (Exhibit 13-6)

V_{12} = 945 pc/h

V_3 or V_{av34} 1789 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 1809 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6047	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3333	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 25.1 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.367 (Exibit 13-11)

S_R= 56.6 mph (Exhibit 13-11)

S_0= 61.9 mph (Exhibit 13-11)

S = 58.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035 With Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	7624
Ramp Volume, V_R	853
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7624	0.92	Level	9	0	0.957	1.00	8660
Ramp	853	0.92	Level	2	0	0.990	1.00	936
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 4412 pc/h

V_3 or V_{av34} 4248 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 5960 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8660	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	7724	Exhibit 13-8	7050	Yes
V_R	936	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4412	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 47.4 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.512 (Exhibit 13-12)

S_R= 53.2 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 56.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035WP w/ Improvements

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	4
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	7624
Ramp Volume, V_R	853
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7624	0.92	Level	9	0	0.957	1.00	8660
Ramp	853	0.92	Level	2	0	0.990	1.00	936
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 2944 pc/h

V_3 or V_{av34} 2858 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3464 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8660	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	7724	Exhibit 13-8	9400	No
V_R	936	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2944	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 25.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.512 (Exhibit 13-12)

S_R= 53.2 mph (Exhibit 13-12)

S_0= 65.1 mph (Exhibit 13-12)

S = 59.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035 With Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 6771	
	Ramp Volume, V_R: 1504	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6771	0.92	Level	9	0	0.957	1.00	7691
Ramp	1504	0.92	Level	2	0	0.990	1.00	1651
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 4269 pc/h

V_3 or V_{av34} 3422 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 4991 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9342	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	6642	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 50.9 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 3.248 (Exibit 13-11)

S_R= -9.7 mph (Exhibit 13-11)

S_0= 56.1 mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035WP w/ Improvements

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 5	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 6771	
	Ramp Volume, V_R: 1504	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6771	0.92	Level	9	0	0.957	1.00	7691
Ramp	1504	0.92	Level	2	0	0.990	1.00	1651
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.209 using Equation (Exhibit 13-6)

V_{12} = 1150 pc/h

V_3 or V_{av34} 2175 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 2200 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7151	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3851	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 29.1 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.441 (Exibit 13-11)

S_R= 54.8 mph (Exhibit 13-11)

S_0= 60.9 mph (Exhibit 13-11)

S = 57.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	2035 With Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	8526
Ramp Volume, V_R	1547
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8526	0.92	Level	9	0	0.957	1.00	9684
Ramp	1547	0.92	Level	2	0	0.990	1.00	1698
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 5292 pc/h

V_3 or V_{av34} 4392 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 6984 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	9684	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	7986	Exhibit 13-8	7050	Yes
V_R	1698	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5292	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 56.2 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.581 (Exhibit 13-12)

S_R= 51.6 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 54.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	2035WP w/ Improvements

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 5	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 300	V_D = veh/h
	Freeway Volume, V_F: 8526	
	Ramp Volume, V_R: 1547	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8526	0.92	Level	9	0	0.957	1.00	9684
Ramp	1547	0.92	Level	2	0	0.990	1.00	1698
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 3271 pc/h

V_3 or V_{av34} 2238 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7748	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	6050	Exhibit 13-8	9400	No
V_R	1698	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3271	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 24.3 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.581 (Exhibit 13-12)

S_R= 51.6 mph (Exhibit 13-12)

S_0= 66.5 mph (Exhibit 13-12)

S = 59.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	2035 With Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D	V_D = veh/h
	Freeway Volume, V_F: 6979	
	Ramp Volume, V_R: 1048	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6979	0.92	Level	9	0	0.957	1.00	7927
Ramp	1048	0.92	Level	2	0	0.990	1.00	1151
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 4399 pc/h

V_3 or V_{av34} 3528 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 5227 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9078	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	6378	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 49.1 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 2.554 (Exibit 13-11)

S_R= 6.3 mph (Exhibit 13-11)

S_0= 56.1 mph (Exhibit 13-11)

S = 8.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 SB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	2035WP w/ Improvements

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 6979	
	Ramp Volume, V_R: 1048	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6979	0.92	Level	9	0	0.957	1.00	7927
Ramp	1048	0.92	Level	2	0	0.990	1.00	1151
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.209 using Equation (Exhibit 13-6)

V_{12} = 1657 pc/h

V_3 or V_{av34} 3135 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 3170 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9078	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4321	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 33.0 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.552 (Exibit 13-11)

S_R= 52.3 mph (Exhibit 13-11)

S_0= 58.0 mph (Exhibit 13-11)

S = 55.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035 With Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	6461
Ramp Volume, V_R	1371
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6461	0.92	Level	9	0	0.957	1.00	7339
Ramp	1371	0.92	Level	2	0	0.990	1.00	1505
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 4130 pc/h

V_3 or V_{av34} 3209 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 4639 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7339	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	5834	Exhibit 13-8	7050	No
V_R	1505	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4130	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 36.0 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.563 (Exhibit 13-12)

S_R= 52.0 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 56.1 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-5 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith Off-Ramp
Date Performed	7/25/14	Jurisdiction	Caltrans
Analysis Time Period	AM Peak Hour	Analysis Year	2035WP w/ Improvements

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	300	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	6461	V_D =	veh/h
		Ramp Volume, V_R	1371		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6461	0.92	Level	9	0	0.957	1.00	7339
Ramp	1371	0.92	Level	2	0	0.990	1.00	1505
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 3022 pc/h

V_3 or V_{av34} 2158 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7339	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	5834	Exhibit 13-8	9400	No
V_R	1505	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3022	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 22.1 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.563 (Exhibit 13-12)

S_R= 52.0 mph (Exhibit 13-12)

S_0= 66.8 mph (Exhibit 13-12)

S = 59.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	2035 With Project

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 5090	
	Ramp Volume, V_R: 1514	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5090	0.92	Level		0	1.000	1.00	5533
Ramp	1514	0.92	Level	2	0	0.990	1.00	1662
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 3071 pc/h

V_3 or V_{av34} 2462 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 3161 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7195	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4823	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 36.7 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 0.743 (Exibit 13-11)

S_R= 47.9 mph (Exhibit 13-11)

S_0= 58.0 mph (Exhibit 13-11)

S = 50.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-15 NB
Agency or Company	Trames Solutions, Inc.	Junction	Clinton Keith On-Ramp
Date Performed	8/3/2014	Jurisdiction	Caltrans
Analysis Time Period	PM Peak Hour	Analysis Year	2035WP w/ Improvements

Project Description Westpark Promenade Traffic Impact Analysis

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 5	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 5090	
	Ramp Volume, V_R: 1514	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5090	0.92	Level	9	0	0.957	1.00	5782
Ramp	1514	0.92	Level	2	0	0.990	1.00	1662
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.209 using Equation (Exhibit 13-6)

V_{12} = 919 pc/h

V_3 or V_{av34} 1738 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 1758 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6057	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3420	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 25.7 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.377 (Exibit 13-11)

S_R= 56.3 mph (Exhibit 13-11)

S_0= 62.1 mph (Exhibit 13-11)

S = 58.7 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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APPENDIX V

HORIZON YEAR (2035) WITH PROJECT
BASIC FREEWAY SEGMENT ANALYSIS WORKSHEETS

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2035 With Project*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5411*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2049*	pc/h/ln
S	*61.6*	mph
D = v_p / S	*33.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2035WP w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5411*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*5*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1229*	pc/h/ln	Design LOS	
S	*70.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*17.6*	pc/mi/ln	S	mph
LOS	*B*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2035 With Project*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5370*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2033*	pc/h/ln
S	*62.0*	mph
D = v_p / S	*32.8*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2035WP w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5370*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*5*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1220*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*17.4*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2035 With Project*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7624*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2887*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*37.0*	mph	S	mph
D = v_p / S	*78.1*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*F*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2035WP w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7624*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*5*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1732*	pc/h/ln
S	*66.7*	mph
D = v_p / S	*26.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2035 With Project*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8275*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*3133*	pc/h/ln
S	*26.7*	mph
D = v_p / S	*117.5*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2035WP w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8275*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*5*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1880*	pc/h/ln
S	*64.6*	mph
D = v_p / S	*29.1*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2035 With Project*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8526*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*3228*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*22.3*	mph	S	mph
D = v_p / S	*144.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*F*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2035WP w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8526*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*5*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1937*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*63.7*	mph	S	mph
D = v_p / S	*30.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2035 With Project*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8027*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*3039*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*30.8*	mph	S	mph
D = v_p / S	*98.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*F*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 SB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2035WP w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8027*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*5*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1824*	pc/h/ln
S	*65.5*	mph
D = v_p / S	*27.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2035 With Project*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6461*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2446*	pc/h/ln
S	*52.0*	mph
D = v_p / S	*47.0*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*South of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2035WP w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6461*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*5*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1468*	pc/h/ln
S	*69.2*	mph
D = v_p / S	*21.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2035 With Project*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6604*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2500*	pc/h/ln	Design LOS	
S	*50.4*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*49.6*	pc/mi/ln	S	mph
LOS	*F*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-15 NB*
Agency or Company	*Trames Solutions, Inc.*	From/To	*North of Clinton Keith Road*
Date Performed	*03/02/2015*	Jurisdiction	*Caltrans*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2035WP w/ Improvements*

Project Description *Westpark Promenade Traffic Impact Analysis*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6604*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*5*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1500*	pc/h/ln
S	*69.0*	mph
D = v_p / S	*21.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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ATTACHMENT 2

Focused Plant Surveys

RCA Associates LLC

15555 Main Street, #D4-235
Hesperia, California 92345
(760) 956-9212 fax (760) 244-0791
rca123@aol.com
www.rcaassociatesllc.com

August 30, 2016

Mr. Michael E. Houlihan, AICP
Principal Associate
ESA – Environmental Science Associates
2121 Alton Parkway, Suite 100
Irvine, CA 92606

Re: Westpark Promenade Project: Focused Plant Surveys
RCA#2013-41B

Dear Mr. Houlihan:

As requested by the project proponent, biologists from our firm conducted focused surveys on the Westpark Promenade property to determine the presence or absence of two special status species, including the round-leaved filaree (*California macrophylla*) and smooth tarplant (*Centromadia pingens ssp. Laevis*). The surveys were conducted on August 26, 2016 by Randy Arnold (Senior Biologist) and Patricia Moore (Senior Botanist). Comprehensive biological surveys were previously conducted on the site in February 2013 and May 2013 during which the vegetative communities present on the site were evaluated and a comprehensive plant list was prepared. The property is approximately 26-acres (gross) in size and is located in the City of Wildomar, California, Riverside County, northeast of the intersection of Interstate 15 and Clinton Keith Road (Sections 1 & 36, Township 7 South, Range 4 West) (Figures 1, 2, 3 & 4, Appendix A).

Existing Conditions

Most of the site has been disturbed due to past human activities and currently supports a disturbed grassland community. Plant diversity throughout the site is relatively low and numerous invasive plant species were indentified which are typical of disturbed habitats. The most common dominant perennials throughout the site included elderberry (*Sambucus*

Mexicana) and buckwheat (*Eriogonum* sp.), and several olive trees (*Olea europea*) are also present in the northwest corner of the site. Common annuals included snakeweed (*Gutierrezia sorothrae*), fiddleneck (*Amsinckia tessellata*), plantain (*Plantago erecta*), croton (*Croton californica*), and coyote melon (*Cucurbita foetidissima*). A few other plants were also noted in the small mesic area along the eastern portion of the site and included narrowleaf goldenbush (*Haplopappus linearifolius*), lotus (*Lotus purshianus*), Pacific willow (*Salix lasiandra*), cattails (*Typha latifolia*), mugwort (*Artemisia douglasiana*), broom baccharis (*Baccharis sarothroides*), brickelbush (*Brickella californica*), and salt cedar (*Tamarix rammissima*). Annuals observed in the mesic habitat included pearly everlasting (*Gnaphalium californicum*), phacelia (*Phacelia distans*), and centaurem (*Centaurea squarrrosa*).

According to the California Natural Diversity Data Base (CNDDB, 2016), no special status plant species have been documented in the immediate area surrounding the property; however, as mentioned above, the round-leaved filaree and smooth tarplant could potentially occur on the site. Both species are found in native grassland communities and given the presence of a disturbed grassland community on the property, it was deemed necessary to conduct focused surveys for the two species. Information on the two species is provided below.

Smooth Tarplant (*Centromadia pungens*) & Round-Leaved Filaree (*California macrophylla)*

Background Information: These species are typically found in native grasslands in interior dry valleys and foothills, primarily below 1000 feet elevation. Both species are relatively rare with low population levels throughout California, and both are classified as List 1B.1 plants by CNPS. The site supports a disturbed grassland community which provides marginal habitat for the species; however, given the presence of these two plants in the general region it was deemed necessary to conduct focused surveys to determine the potential presence of these two plants on the property.

Methodologies: Parallel transects were walked throughout the property on August 26, 2016 during which biologists evaluated the vegetation and identified all of the plant species. The centerline of the transects varied from about 10 to 15 meters in order to account for differences in the terrain, vegetation density, and ground surface visibility, and to provide total coverage

of the site. In addition, transects were walked at a pace that allowed the biologists to fully identify all of the plants.

Results

No smooth tarplant or round-leaved filaree plants were identified during the focused surveys conducted on August 26, 2016. In addition, the site is not expected to support populations of these two species given the disturbed conditions present throughout the property, and the fact that there are only a few documented populations of the two plants in the general region. No additional surveys are recommended at the present time.

If you have any questions or would like to discuss the survey results presented in this report, please contact me at (760) 956-9212 or via email at rca123@aol.com.

Sincerely,

Randall C. Arnold, Jr.
Principal & Senior Biologist

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APPENDIX A

Figures

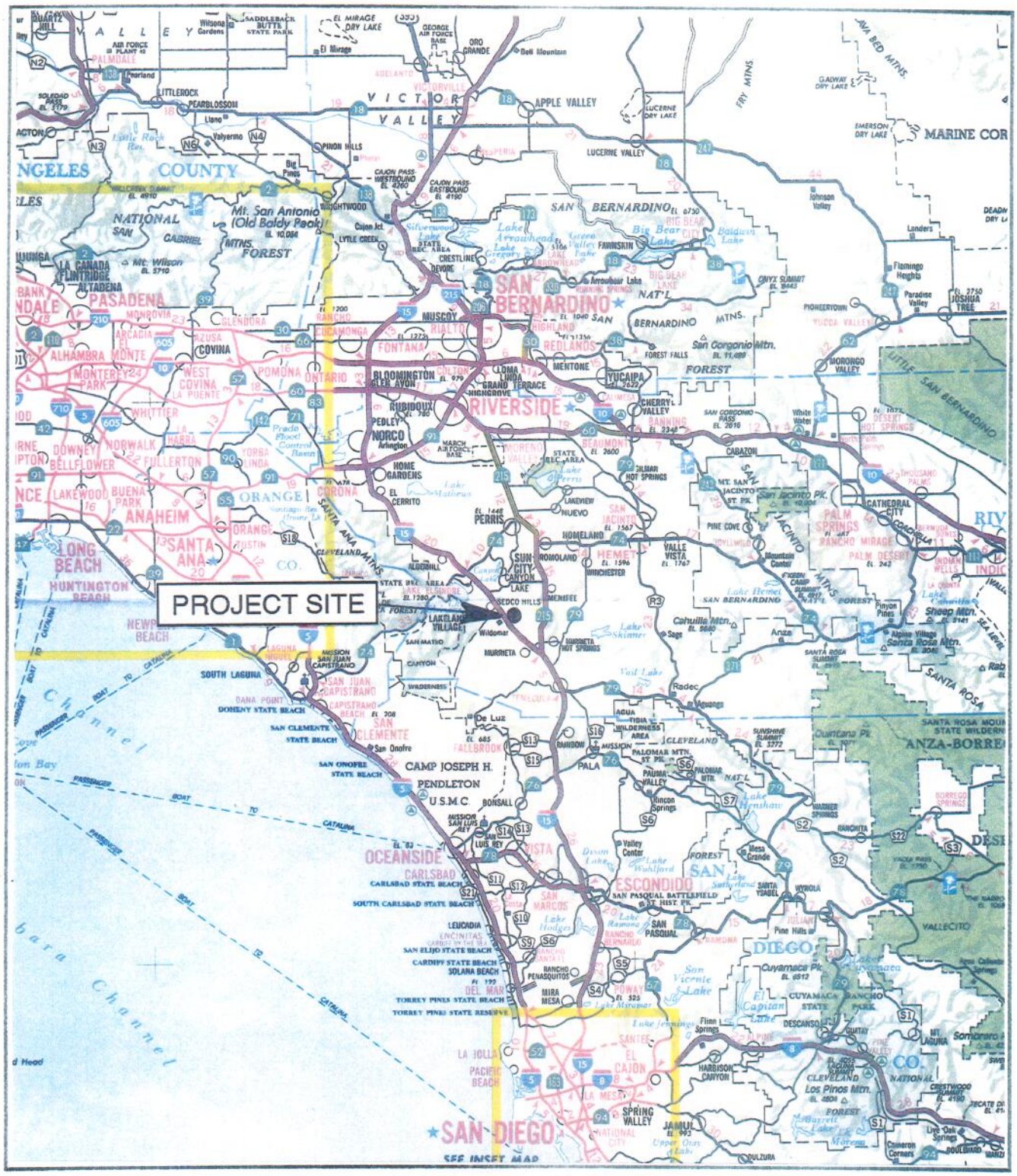


FIGURE 1
VICINITY MAP
(Westpark Promenade, Wildomar, CA)
(Source: ACSC Map Source, 2013)

N

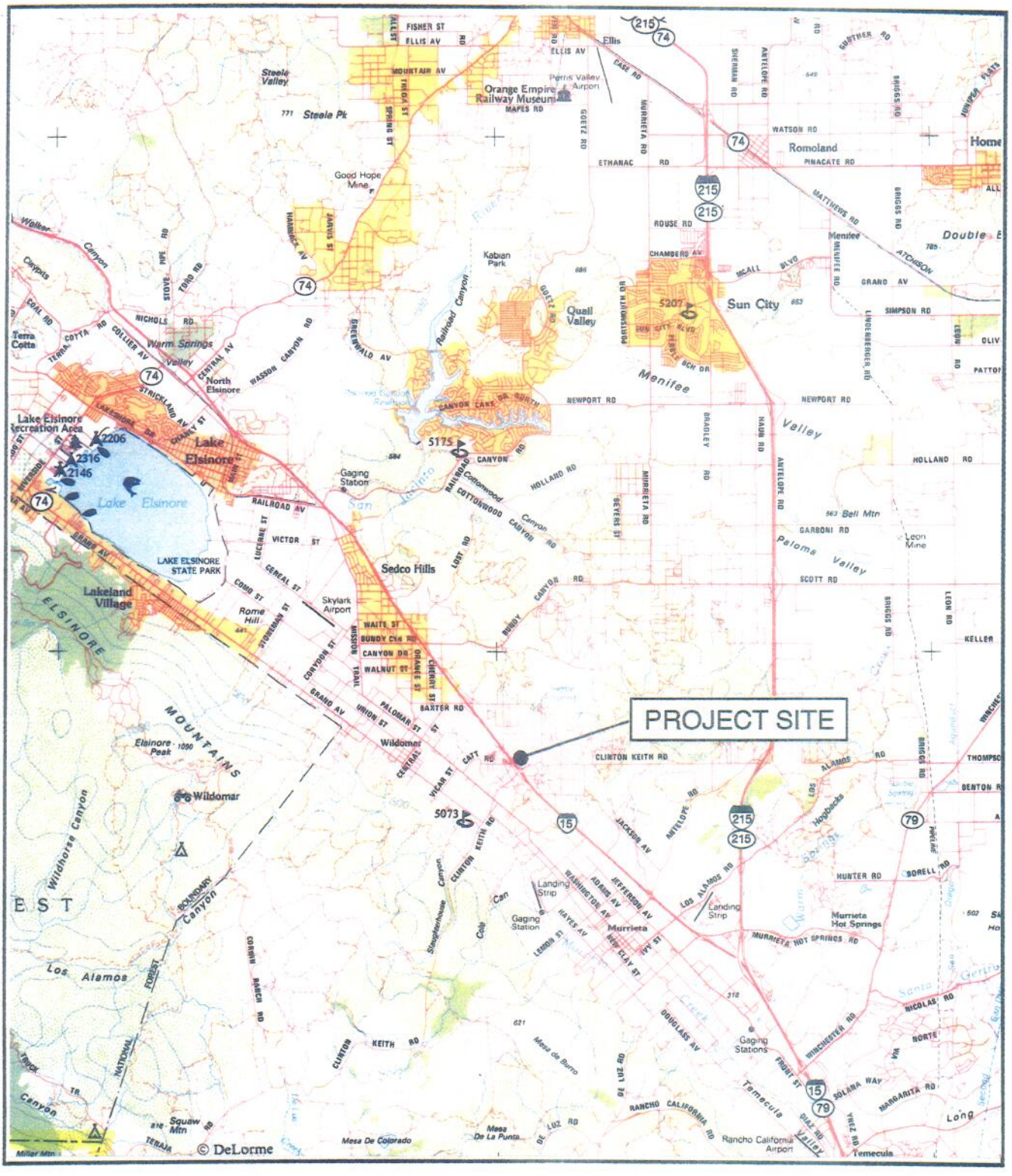
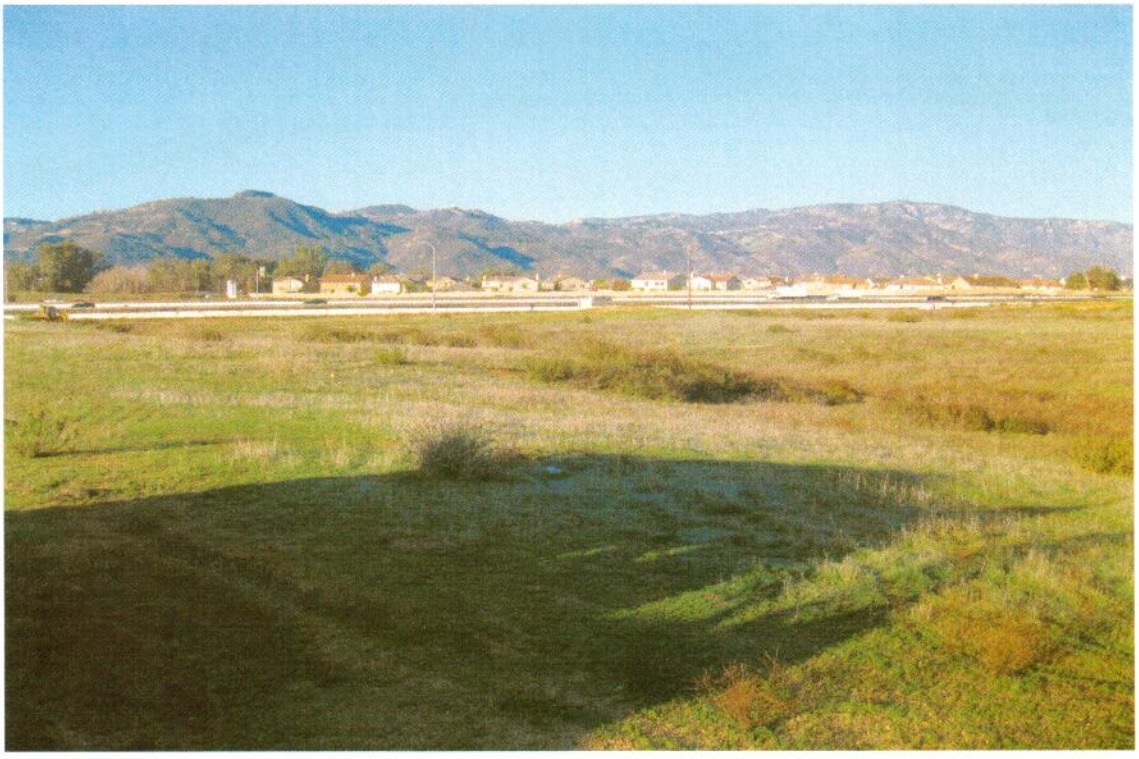


FIGURE 2
PROPERTY LOCATION
(Westpark Promenade, Wildomar, CA)
(Source: DeLorme Maps, 2013)

CENTER OF PROPERTY LOOKING EAST

CENTER OF PROPERTY LOOKING NORTH

FIGURE 3
SITE PHOTOGRAPHS
(WESTPARK PROMENADE, WILDOMAR, CA)



CENTER OF PROPERTY LOOKING WEST

CENTER OF PROPERTY LOOKING SOUTH

FIGURE 3, cont.
SITE PHOTOGRAPHS
(WESTPARK PROMENADE, WILDOMAR, CA)

FIGURE 4
AERIAL VIEW OF SITE
(WESTPARK PROMENADE, WILDOMAR, CA)

ATTACHMENT 3

Attachments to the Blum Collins LLP Letter H

BLUM | COLLINS LLP

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June 20, 2016

Matthew C. Bassi, Planning Director
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Wildomar, CA 92595
mbassi@cityofwildomar.org

Via Email & U.S. Mail

Re: *Comments on Westpark Promenade DEIR*

Dear Mr. Bassi and the City of Wildomar:

Under the California Environmental Quality Act ("CEQA"), this letter is to serve you with comments on behalf of the SoCal Environmental Justice Alliance ("SEJA") regarding the Westpark Promenade ("the Project") Draft Environmental Impact Report ("DEIR"), State Clearinghouse Number 2014021022. Our comments appear mostly in the order in which matters come up in the DEIR.

Chapter 1 – Introduction

You indicate there were two scoping meetings on the Project and that you provided attendees the opportunity to submit written comments on the Project but none were received. You could have provided for transcription of oral comments.

Chapter 2 – Project Description

At 2-5 your Project Objectives appear narrowly defined to require development of only this Project.

Chapter 3 – Environmental Impact Analysis

3.2 Air Quality. You cite to General Plan Policies AQ 2.1 ("land use planning efforts shall assure that sensitive receptors are separated and protected from polluting point sources to the greatest extent possible,") and 2.2 ("Require site plan designs to protect people and land uses sensitive to air pollution through the use of barriers and/or distance from emission sources when possible") and assert the Project is consistent with them.

The Policies are inconsistent with placing residential uses roughly adjacent to the I-15 freeway.

Impact 3.2-1 The Project would not conflict with or obstruct implementation of an Air Quality Management Plan. You assert that projects that are consistent with regional population, housing and employment forecasts are consistent with the South Coast Air Quality Management District ("SCAQMD") Air Quality Management Plan ("AQMP"), and you claim that because the population growth that is attributable to the Project fits within the projections for Wildomar as a whole, the Project is consistent. It doesn't work this way. Growth should be accounted for according to consistency with a General Plan. Here your Project contradicts the General Plan and requires a General Plan amendment to allow housing on a site designated for office use. This will lead to air quality impacts because residents will more than likely have to commute further to work because of the change in planned uses.

Impact 3.2-2 The Project would violate an air quality standard or contribute substantially to an existing or projected air quality violation. You concede here that operational emissions would exceed thresholds for NO_x by 40%, and you impose several mitigation measures but you concede these measures will not reduce impacts to less than significant levels. Measure AQ-1 is that the applicant will consult with transit agencies and provide bus stops at project access points as directed. CEQA requires you to impose all feasible mitigation measures when an impact is not mitigated to less than significant levels. The applicant for the Baxter Village project is providing fair share payments toward transit service to that community, and this is a feasible mitigation measure you have not imposed here.

Impact 3.2-3 The Project would not expose sensitive receptors to substantial pollutant concentrations. Regarding construction emissions you claim that SCAQMD has not adopted a methodology for analyzing construction emissions of diesel particulate matter ("DPM") "and has not recommended that health risk assessments be completed." We believe you have understated exposures of sensitive receptors to PM_{10} and $PM_{2.5}$ because the closest receptors are closer than 82 feet away. And regarding Toxic Air Contaminants ("TACs"), you could still model acute effects from exposure. Both construction and operational emissions on nearby residents could and should have been modeled. You could use the same exposure calculations with shorter timeframes.

Concerning operational emissions you concede that the maximum predicted cancer risk from the Project is 9.6 in one million using the California Office of Environmental Health Hazard Assessment's ("OEHHA's") methodology. With rounding, this is 10 in a million and you should have found this impact to be significant. And you concede you did not calculate into this number the exposure of residents to additional TAC emissions from loading and unloading activity from trucks at the four bays adjacent to the major retail building.

Impact 3.2-5 The Project would result in a cumulatively considerable net increase of criteria pollutants for which the Project region is non-attainment under an applicable

federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors). You concede that the Project will lead to significant impacts regarding NO_x, but you refuse to calculate cumulative impacts for other pollutants based on SCAQMD guidance. We disagree with this approach and believe it is not based on substantial evidence. Your approach is contrary to the very definition of what a cumulative impact is. Public Resources Code § 20183(b)(2) defines cumulative impacts to mean "that the incremental effects of an individual project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects." In other words, inherent in a cumulative impacts analysis is whether an impact is significant when *combined* with the effects of other past, present, and future projects. This is borne out by the Guidelines. Guidelines § 15130(a)(1) provides "As defined in Section 15355, a cumulative impact consists of an impact which is created *as a result of the combination* of the project evaluated in the EIR together with other projects causing related impacts." (emphasis supplied). Guidelines § 15064(h)(1) provides:

> When assessing whether a cumulative effect requires an EIR, the lead agency shall consider whether the cumulative impact is significant and whether the effects of the project are cumulatively considerable. An EIR must be prepared *if the cumulative impact may be significant and the project's incremental effect, though individually limited, is cumulatively considerable. "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.*

Guidelines § 15064(h)(1) (emphasis supplied).

Guidelines § 15065(a)(3) requires a mandatory finding of significance when "The project has possible environmental effects that are individually limited but cumulatively considerable," and provides the same definition of "cumulatively considerable."

Finally, Guidelines § 15355 defines cumulative impacts and states:

> *"Cumulative impacts" refer to two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts.*
> (a) The individual effects may be changes resulting from a single project or a number of separate projects.
> (b) The cumulative impact from several projects is the change in the environment which results from the *incremental impact* of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. *Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time.*

Guidelines § 15355 (emphasis supplied). *See also* Gordon & Herson, "Demystifying CEQA's Cumulative Impact Analysis Requirements: Guidance for Defensible EIR Evaluation," *Cal. Env't'l L. Reporter,* 379, 381 (Sept. 2011) (Vol. 2011, Issue 9) ("Critically, a proposed project's incremental effects may be 'cumulatively considerable' even when its individual effects are limited. (citations). *In other words, CEQA does not excuse an EIR from evaluating cumulative impacts simply because the project-specific analysis determined its impacts would be 'less than significant.'*" In short, your cumulative impacts analysis is wholly without a basis in substantial evidence and represents a failure to proceed by law.

In addition, you should *assess* the cumulative emissions of NO_x, rather than merely stating that they are cumulatively significant.

3.3 Biological Resources. You state regarding special status plant species that the round-leaved filaree and the smooth tarplant – both California Native Plant Society ("CNPS") 1.B.1 species – have the potential to occur on the site but they were not surveyed for given recent drought conditions. *See* Appendix C (reflecting that by 2013 no focused surveys were done for plant species on site due to ongoing drought conditions: "CDFW has indicated . . . that conducting focused surveys during the current drought conditions would not provide any useable data on the presence or absence of any sensitive plants given the fact that plants would be unlikely to germinate and be detectable"). Despite this you assert there are no significant impacts to them because you didn't find them when you didn't survey, and "any loss of individuals plants of this species would not threaten to eliminate or reduce the viability of a population or restrict the range of the plant species." This conclusion is directly contrary to CNPS's listing of them as 1.B.1, indicating the plant species is threatened within 80% of its range. You could have surveyed for these species this year after the rains, but apparently you did not.

Concerning special status wildlife, you did not conduct focused surveys for the Stephens kangaroo rat ("SKR"), the black-tailed jackrabbit or the coast horned lizard. Regarding the SKR Appendix C specifically states that SKR "may also occur on the site given the presence of suitable habitat, however live-trapping surveys were not conducted as part of the field investigations. *Consequently the presence of the species [or its absence] cannot be definitively determined at the present time.*" You note that critical habitat for the coastal California gnatcatcher ("CAGN") is 1200 feet from the site but you provide no map of this habitat and state in a conclusory fashion there is no potential for the species to occur on site even as a stopover.

At 3.3-12 you concede the site could provide "dispersal" habitat for the western spadefoot toad, but you did not survey for it. There could be a significant impact to the toad because of the Project regardless of whether the site provides breeding habitat, and you haven't provided mitigation measures for the toad.

At 3.3-20 in your General Plan consistency analysis you claim the Project follows Policy OS 5.5 (new development will preserve and enhance existing native riparian habitat and prevent obstruction of natural watercourses) even though you are obstructing two

watercourses. You say implementation of mitigation measure ("MM") BIO-5 would provide for offsite restoration and enhancement at a ratio approved by the resource agencies even though (1) the mitigation and its extent has not been determined yet, (2) the General Plan Policy does not intend such a result, and (3) the mitigation is not planned for any location, and will not necessarily be of equivalent habitat values. Similarly, General Plan Policy OS 6.3 states the City should consider wetlands for use as natural water treatment areas that will result in the improvement of water quality. You claim the Project is "consistent" because of MM BIO-5. It's not. Clearly the Policy is aimed at preserving the habitat.

Impact 3.3-1 The Project would not have a substantial adverse effect on any special-status, sensitive, or candidate plant species. You assert as noted above that the smooth tarplant and round-leaved filaree will not be affected because you did not observe them onsite. However you also did not look for them. An individual loss of this species would be significant as noted above.

Impact 3.3-2 The Project has the potential to impact sensitive wildlife species. You say there is no substantial impact to the SKR which you did not survey for onsite because of the payment of fees for the SKR Habitat Conservation Plan ("HCP"). However, individual impacts to SKR can be significant, and you have done nothing about this.

You also say there will be *no* impacts to the nine species you say have a low potential to occur because (1) they weren't seen, even though they weren't looked for in any systematic way, and (2) they are not expected on the site due to "low quality" habitat conditions – even though habitat for the Quino checkerspot butterfly, for example, is only "open habitat." We disagree with your assessment. Impacts are potentially significant absent focused surveys negating the presence of these species immediately prior to ground disturbance.

Regarding your MM's, BIO-1 provides for preconstruction surveys within 30 days of site disturbance for the burrowing owl. Per the California Department of Fish & Wildlife ("CDFW") Burrowing Owl Mitigation Staff Report, this survey should occur within 14 days. *See* Attachment A. BIO-2 provides if burrowing owl are found, active nests will be avoided from February 1 to August 31, and a minimum 250 foot (75 meter) buffer will be provided until fledging has occurred. This is contrary to the required setback distance of 500 meters as recommended in the Staff Report, *see* Attachment A at 9. The Report allows for reduced setbacks but only in the presence of a "broad-scale, long-term, scientifically-rigorous monitoring program," Report at 10, which you do not provide for. You do not provide for qualified biologist monitoring of nesting in most of MM'S BIO-1 and -2. BIO-2 also provides that if paired owls are present within 160 feet of a temporary project disturbance, active burrows will be protected with fencing or flagging and monitored by a qualified biologist throughout the construction to identify losses from nest abandonment. This runs contrary to your earlier stated condition of 75 meters – which again, is insufficient under the Staff Report.

BIO-3 provides for a preconstruction survey and trapping and release of the coast horned lizard and San Diego black-tailed jackrabbit. Do the same for the SKR. And specify a time prior to construction for these surveys – other guidance suggests a maximum of 14 days.

Impact 3.3-3 The Project has the potential to impact raptors and migratory birds during nesting activities. You have proposed MM BIO-4, requiring either all construction outside of the avian nesting season – which you define as February 1 to August 30 – or, if there is construction, vegetation or ground disturbance during this breeding season, a focused survey will be conducted by a qualified City-approved biologist, and nests will not be disturbed until young have fledged from the nest, with a 500 foot setback. However, you have not defined the nesting season properly; it begins in early January for raptors and lasts through at least September 15 and beyond that for passerine species according to CDFW. We have included Attachments B-1 through -3 regarding nesting habits of different birds.

Impact 3.3-4 The Project would not impact critical habitat or sensitive natural communities. You claim there are no sensitive natural communities or critical habitat on site. However, critical habitat is apparently close to the Project site for the CAGN and increased urbanization in the vicinity can affect the species, an impact you did not address.

Impact 3.3-5 The Project has the potential to impact jurisdictional waters including wetlands and riparian habitat. You agree that the grading of two drainage channels is a significant impact but you claim this impact will be mitigated to less than significant levels by MM BIO-5, which requires the applicant to submit a detailed restoration plan to mitigate for loss of 0.36 acres of jurisdictional waters at a ratio approved by the resource agencies but no less than 1:1. The mitigation measure should delineate the monitoring responsibilities and the applicant or the District should be responsible for checking the status of the restoration annually. The mitigation should provide for maintenance responsibilities *in perpetuity*, which is something the applicant cannot manage. The impact is not less than significant.

Impact 3.3-6 The Project would not interfere substantially with the movement of any native resident or migratory . . . wildlife species or with established native resident or migratory wildlife corridors . . . As we've noted, you previously have conceded critical habitat for the CAGN is 1200 feet away. Given this fact your assertions that the proposed Project "is not expected to have an adverse effect on wildlife movements in the area" requires further explanation as it does not seem credible. We dispute your conclusion there is no significant impact.

Impact 3.3-8 The Project could conflict with a HCP. Here you concede the Project could impact riparian/riverine habitat and the burrowing owl, protected under the Western Riverside County MSHCP, and the SKR, covered under the SKR HCP. You assert that payment of the mitigation fee regarding the SKR would reduce impacts to that species to less than significant but not regarding the riparian and riverine habitat or the burrowing

owl. We fail to see the distinction, especially since you are not proposing to catch and release the SKR that may be onsite. You rely on MM BIO-6 to reduce impacts to less than significant regarding the riparian/riverine habitat. First this has nothing to do with the burrowing owl and the loss of its habitat. Second, you are acknowledging there is an urban/wildlife interface, which undercuts your analysis under Impact 3.3-6 above. Third, you fail to discuss what the Guidelines require. This does not comply with CEQA which is meant to ensure the public reviews the environmental impacts of the Project.

3.4 Cultural and Paleontological Resources. MM CUL-3 refers at first to just the Pechanga and later to both the Pechanga and the Soboba. If the Soboba are also involved they should be kept informed.

Impact 3.4-2 Implementation of the Project may adversely affect paleontological resources. You indicate that the Project will disturb ground from "4 to 15 in depth." We later figured out this was feet rather than inches but it is not clear from this part of the DEIR. MM CUL-6 calls for review by a qualified paleontological monitor but your General Plan requires assessment by a paleontologist.

3.5 Geology, Soils and Seismicity. You indicate the nearest "active" fault is the Elsinore Fault approximately 1.9 miles away, but then you concede there is another one nearly at the Project site, and that the fault zone for this fault – the Glen Ivy fault – passes through the Project site. This is a potential significant impact, and General Plan Policy S.2-1 provides that "lifelines" be designed to resist without failure their crossing of a fault should fault rupture occur, and requires trenching studies and analysis.

Impact 3.5-1 The Project would not expose persons or structures to potential substantial adverse effects, including risk of loss, injury or death involving rupture of a known earthquake fault . . . You acknowledge that in 2007, the Working Group on Earthquake Probabilities indicated there was a 97% chance of an earthquake of 6.7 or greater in Southern California over the next 30 years, and that the Elsinore Fault is one of those considered capable of producing significant groundshaking. You fail to address the Glen Ivy fault zone which runs through the property. You assert there would be no significant impact based on construction of the site with shallow foundations with post tensioned slabs. This is not enough under the General Plan, implicitly.

3.6 Greenhouse Gas Emissions and Climate Change. You adopt a 3,000 $MTCO_2e$ threshold based on a SCAQMD working group proposal. You've amortized your construction emissions over 30 years which we think is contrary to the mandates of AB 32 and Executive Order B-30-15, because they call for reductions in the near- and mid-term.

Because you have concluded that your GHG emissions are significant, both under impacts 3.6-1 and -2, you must adopt all feasible mitigation measures. You could have but failed to adopt rooftop solar in the Project or at least in a part of it. Your failure to do so is not based on substantial evidence.

3.7 Hydrology and Water Quality. *Impact 3.7-1 The proposed Project would not violate any water quality standards or waste discharge requirements.* As to construction the DEIR states that the Project "would maximize canopy interception and water conservation by preserving existing native trees and shrubs thereby minimizing vegetation disturbance and associated pollution potential and sedimentation during construction." You have previously indicated that you intend to replace the olive trees onsite. We don't find your assertions believable.

You saw a SWPPP "would be prepared." Why hasn't it been prepared already and provided with the DEIR? You say the BMPs "could include" a long list of items. This means nothing. The final BMPs and the SWPPP should have been provided to the public with the DEIR.

Regarding operation, you state that structural BMPs "would include" several items. You could have provided but did not provide the Water Quality Management Plan with the DEIR. Without these documents we have no assurance that impacts will be modified to less than significant levels.

Impact 3.7-3 The Project would not substantially alter the existing drainage pattern of the site or area, including through alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation offsite. You concede here you will alter the existing drainage pattern and place impervious structures on the site. You again rely on the SWPPP and the WQMP but you have not provided them. You say here that "treatment control BMPs would include treatment of first flush flows in bio retention and sand infiltration facilities." This is directly contrary to what you asserted previously, that the site is already impervious and that such structures cannot be designed for the site.

You assert that the Final WQMP "will demonstrate that BMPs will retain the incremental increase of runoff from a two-year storm event, ten-year storm event, or the BMP Design Volume, whichever is greater," and that therefore impacts regarding alteration of drainage patterns will be less than significant. Since you have not provided the WQMP the public is left to trust you. CEQA does not provide for this.

Impact 3.7-5 The Project would not substantially degrade water quality. Please see our earlier discussion regarding the WQMP and SWPPP.

3.8 Hazards and Hazardous Materials. *Impact 3.8-4 The proposed Project would not expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.* The Project site is undeveloped and near other undeveloped parcels. It qualifies as "where residences are intermixed with wildlands." You concede that the Project site is within a Very High Fire Hazard Severity Zone (VHFHS Zone) under Wildomar's authority. You claim the Project would minimize this risk through hardscapes. This is not enough to prevent wildfire, as the Fort McMurray fire in Canada makes clear.

3.9 Land Use and Planning. You claim in *Impact 3.9-1* that *The proposed Project would not conflict with any applicable land use plan, policy or regulation of an agency with jurisdiction over the Project (including but not limited to the general plan [or] zoning ordinance) adopted for the purpose of avoiding or mitigation an environmental effect*, that the Project would be consistent with the General Plan. This is only because you are amending it, and even then you are rendering the General Plan internally inconsistent. The City has engaged in this "spot zoning" repeatedly, as we will demonstrate briefly. First, though, here are some of the General Plan Policies which you are contradicting with the present Project:

Policy	**Consistency**	**Discussion**
LU 3.1 Accommodate land use development in accordance with the patterns and distribution of land use and density depicted on the General Plan Land Use Maps and the Area Plan Land Use Maps in accordance with the following concepts . . . (f) In new towns, accommodate compact, transit-adaptive infrastructure (based on modified standards that take into account transit system facilities or street network).	Inconsistent.	The present Project does not plan for transit and the nearest stop is not adjacent to the Project and it is uncertain whether that stop will remain as the transit agency is reviewing its service plans. The Project contradicts the Land Use Maps which have to be amended to allow the Project to move forward.
LU 6.1 Require land uses to develop in accordance with the General Plan and area plans to ensure compatibility and minimize impacts.	Inconsistent.	The General Plan is being amended to allow this Project to develop.
LU 7.1 Accommodate the development of a balance of land uses that maintain and enhance the County's fiscal viability, economic diversity, and environmental integrity.	Inconsistent.	The original designation of the land was Commercial Office (CO) – a designation the City and County sorely need. The present Project removes this designation to allow for more housing and retail, leading to a greater jobs/housing imbalance and lower wage jobs that will not sustain the residents of the complex or most surrounding communities.
LU 7.2 Promote and market the development of a variety of stable employment and business	Inconsistent.	The General Plan Amendment detracts from this Policy by taking away potential job

uses that provide a diversity of employment opportunities.		diversity within the City.
LU 7.3 Promote the development of focused employment centers rather than inefficient strip commercial development.	Inconsistent.	The General Plan Amendment is directly contrary to this Policy.
LU 7.6 Create practical incentives for business developments and avoid disincentives.	Inconsistent.	The General Plan Amendment is a disincentive to a proposed business development on the site.
LU 7.10 Locate job centers so they have convenient access to the County's multimodal transportation facilities.	Inconsistent.	The Project is not located next to transit and the nearest stop is under review.
LU 7.12 Improve the relationship and ratio between jobs and housing so that residents have an opportunity to live and work in the County.	Inconsistent.	The Project accomplishes the opposite of this Policy.
LU 9.1 Require new development to contribute their fair share to fund infrastructure and public facilities such as police and fire facilities.	Inconsistent.	While the developer is funding police and fire facilities, there is no mention of payment of a fair share fee toward transit or a transit stop.
LU 9.2 Require a fiscal impact analysis for specific plans and major development proposals so as not to have a negative fiscal impact on the [City].	Inconsistent.	The Project completed no fiscal impact analysis and it may well have a negative impact on the City and County due to the jobs/housing imbalance it exacerbates.
LU 10.1 Provide sufficient commercial and industrial development opportunities in order to increase local employment levels and thereby minimize long-distance commuting.	Inconsistent.	The purchasers of the units will not be taking jobs in the retail development as they cannot sustain their mortgages with that employment.
LU 10.2 Ensure adequate separation between pollution producing activities and sensitive emission receptors, such as hospitals, residences, and schools.	Inconsistent.	The residential uses are 300 feet away from the I-15 freeway. This is contrary to the California Air Resources Board's Air Quality and Land Use Handbook, included as Attachment C.
LU 10.4 Provide options to the	Inconsistent.	The Project does not provide for

automobile in communities, such as transit, bicycle and pedestrian trails, to help improve air quality.		transit. The applicant should pay its fair share toward a new stop.
LU 12.1 Provide land use arrangements that reduce reliance on the automobile and improve opportunities for pedestrian, bicycle, and transit use in order to minimize congestion and air pollution.	Inconsistent.	Same.
LU 12.3 Locate transit stations in community centers and at places of public, employment, entertainment, recreation, and residential concentrations.	Inconsistent.	Same.
LU 13.8 Avoid the blocking of public views by solid walls.	Inconsistent.	The masonry walls will block residential views of surrounding scenery.

For the reasons above we dispute your determination of no significant impact.

Impact 3.9-2 The Project would conflict with an HCP. You concede the Project could conflict with the MSHCP and the SKR HCP but claim that the payment of fees toward the SKR HCP and the mitigations regarding the burrowing owl and riparian/riverine habitat will reduce this to less than significant. We disagree for the reasons stated earlier. There should be trapping and release of any SKR by a qualified biologist.

3.10 Noise and Vibration. You assert first that the General Plan controls over the Municipal Code. We disagree. The most stringent rule applies and section 9.48.040 of the Code states the present rule. If it is inaccurate it should be amended. What is codified governs.

You later assert that Wildomar does not have a standard for noise based on Code section 9.48.010(I). We disagree. Section 9.48.040 provides a threshold. We disagree with your use of worker noise safety standards as a threshold for human annoyance. The two are very different things. You also claim that the thresholds are "safe for adjacent residents who are typically farther from the noise source," but this is irrelevant as you have calculate noise *at the receptors.*

Next, you have "calculated" noise levels by simply taking the noisiest piece of equipment and applying a "usage factor" to it to get an L_{eq} level at 50 feet. You should be calculating the noise levels of the pieces of equipment that will be used concurrently. Also using L_{eq} does not reflect the significance of this extremely disturbing sound to neighboring residents. And in setting out your threshold of 85 dBA you did not indicate that it was L_{eq}.

Concerning operational impacts you concede that there would be a greater than 65 dBA CNEL impact on the outdoor residential community area and the restaurants with patios. You impose MM's NOI-4 (a sound wall of 6. 5feet around the recreational use patio in the residential area) and NOI-6 (constructing a 5-foot Plexiglas wall to attenuate noise which will provide a minimum of 5 dBA attenuation). In both cases we doubt that the proposed walls will provide the planned-for attenuation. Attachment D is a Federal Highway Administration analysis indicating that attenuation of 10 dBA requires a wall 15 feet high and eight times the length from the receptor to the noise source. While a wall shorter than that may provide 5 dBA attenuation, it must have sufficient length. We don't believe your MM's are supported by substantial evidence.

Impact 3.10-4 The Project would not result in a substantial temporary or periodic increase in ambient noise levels in the Project vicinity greater than levels existing without the Project. We disagree with this conclusion as to construction noise for the reasons stated above.

3.11 Population and Housing. You say there will be no significant impact because the anticipated housing constitutes only three percent of the population growth anticipated for the City between 2012 and 2035. However, the population growth is in addition to that anticipated in your General Plan because the site is designated for office uses and it will exacerbate the City's jobs/housing imbalance.

3.12 Public Services. By 2012 Wildomar's population was estimated at 32,719 which at 3 acres of parkland per 1,000 residents meant you should have 98 acres of parks. Wildomar has only 15 acres of parks. Clearly the City's Quimby fees, though assessed, will not create additional parkland, and the City cannot prove that the payment of the fees is going toward this essential public service. Therefore Wildomar should require the dedication of parkland for this Project. You assert that "payment of the impact fees would offset any increased deterioration of existing parks," but this is not the standard. The City should create new parks to keep up with its increasing number of residents.

3.14 Transportation and Traffic. You estimate that the nearest transit stop is ¼ mile from the Project site, though you don't identify it, and you subsequently concede that the Riverside Transit Agency is conducting a Comprehensive Operational Analysis and therefore "no information can be provided regarding future bus service in the project area at this time." The developer can pay its fair share toward transit improvements, as did the developer of the Baxter Village development further up the I-15.

At page 3.14-12 you have taken a pass-by reduction of 20% for shopping center trips. On what basis did you reach the conclusion that this number would be accurate?

Impact 3.14-3 Ambient growth, project-generated trips and cumulative projects would result in an increase in existing traffic that would conflict with an applicable plan, ordinance or policy establishing measures of effectiveness (i.e. level of service standards) for the performance of the circulation system. Your cumulative projects list only

includes projects in Wildomar. We don't dispute you have a significant impact but we believe you have underestimated it.

Chapter 4 – Cumulative Impacts

We wish to note that these projects on your cumulative projects list also detract from employment opportunities within the City and lead to a cumulative jobs/housing imbalance contrary to the stated goals of your General Plan:

- Project 14 – Villa Sienna Apartment Project – zone change from IP (industrial park) to R-3 (general residential)
- Project 15 – Grove Park Mixed Use Project – General Plan Amendment from Business Park to Commercial Retail
- Project 16 – Baxter Village Mixed Use – Change of zone from C-P-S (scenic highway commercial) to R-3 and R-4
- Project 17 – Horizons/Strata Mixed Use Project – General Plan Amendment from Business Park to Commercial Retail and High Density Residential

Regarding cumulative impacts to air quality we dispute your use of SCAQMD's "methodology" for the reasons stated above, and you have not calculated the increased emissions of NO_x from the cumulative projects, much less indicated whether you are using the list method or summary of projections method.

Regarding cumulative impacts on hazards, you assert the risks of fire would be reduced because the projects would produce greater access to sites that are undeveloped. The projects are in an extremely high fire hazard area. Your analysis and conclusion are not based on substantial evidence.

Thank you for the opportunity to comment on this Project. We look forward to your responses. Please notify us of the availability of a Final Environmental Impact Report when it becomes available at collins@blumcollins.com and bentley@blumcollins.com. Thank you.

Sincerely,

Craig M. Collins

attachments: A-D

Attachment A

Staff Report on Burrowing Owl Mitigation

State of California

Natural Resources Agency

Department of Fish and Game

March 7, 2012[1]

[1] This document replaces the Department of Fish and Game 1995 Staff Report On Burrowing Owl Mitigation.

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INTRODUCTION AND PURPOSE

Maintaining California's rich biological diversity is dependent on the conservation of species and their habitats. The California Department of Fish and Game (Department) has designated certain species as "species of special concern" when their population viability and survival is adversely affected by risk factors such as precipitous declines or other vulnerability factors (Shuford and Gardali 2008). Preliminary analyses of regional patterns for breeding populations of burrowing owls (*Athene cunicularia*) have detected declines both locally in their central and southern coastal breeding areas, and statewide where the species has experienced modest breeding range retraction (Gervais et al. 2008). In California, threat factors affecting burrowing owl populations include habitat loss, degradation and modification, and eradication of ground squirrels resulting in a loss of suitable burrows required by burrowing owls for nesting, protection from predators, and shelter (See Appendix A).

The Department recognized the need for a comprehensive conservation and mitigation strategy for burrowing owls, and in 1995 directed staff to prepare a report describing mitigation and survey recommendations. This report, "1995 Staff Report on Burrowing Owl Mitigation," (Staff Report) (CDFG 1995), contained Department-recommended burrowing owl and burrow survey techniques and mitigation measures intended to offset the loss of habitat and slow or reverse further decline of this species. Notwithstanding these measures, over the past 15+ years, burrowing owls have continued to decline in portions of their range (DeSante et al. 2007, Wilkerson and Siegel, 2010). The Department has determined that reversing declining population and range trends for burrowing owls will require implementation of more effective conservation actions, and evaluating the efficacy of the Department's existing recommended avoidance, minimization and mitigation approaches for burrowing owls.

The Department has identified three main actions that together will facilitate a more viable, coordinated, and concerted approach to conservation and mitigation for burrowing owls in California. These include:

1. Incorporating burrowing owl comprehensive conservation strategies into landscape-based planning efforts such as Natural Community Conservation Plans (NCCPs) and multi-species Habitat Conservation Plans (HCPs) that specifically address burrowing owls.
2. Developing and implementing a statewide conservation strategy (Burkett and Johnson, 2007) and local or regional conservation strategies for burrowing owls, including the development and implementation of a statewide burrowing owl survey and monitoring plan.
3. Developing more rigorous burrowing owl survey methods, working to improve the adequacy of impacts assessments; developing clear and effective avoidance and minimization measures; and developing mitigation measures to ensure impacts to the species are effectively addressed at the project, local, and/or regional level (the focus of this document).

This Report sets forth the Department's recommendations for implementing the third approach identified above by revising the 1995 Staff Report, drawing from the most relevant and current knowledge and expertise, and incorporating the best scientific information

available pertaining to the species. It is designed to provide a compilation of the best available science for Department staff, biologists, planners, land managers, California Environmental Quality Act (CEQA) lead agencies, and the public to consider when assessing impacts of projects or other activities on burrowing owls.

This revised Staff Report takes into account the California Burrowing Owl Consortium's Survey Protocol and Mitigation Guidelines (CBOC 1993, 1997) and supersedes the survey, avoidance, minimization and mitigation recommendations in the 1995 Staff Report. Based on experiences gained from implementing the 1995 Staff Report, the Department believes revising that report is warranted. This document also includes general conservation goals and principles for developing mitigation measures for burrowing owls.

DEPARTMENT ROLE AND LEGAL AUTHORITIES

The mission of the Department is to manage California's diverse fish, wildlife and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. The Department has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitats necessary to maintain biologically sustainable populations of those species (Fish and Game Code (FGC) §1802). The Department, as trustee agency pursuant to CEQA (See CEQA Guidelines, §15386), has jurisdiction by law over natural resources, including fish and wildlife, affected by a project, as that term is defined in Section 21065 of the Public Resources Code. The Department exercises this authority by reviewing and commenting on environmental documents and making recommendations to avoid, minimize, and mitigate potential negative impacts to those resources held in trust for the people of California.

Field surveys designed to detect the presence of a particular species, habitat element, or natural community are one of the tools that can assist biologists in determining whether a species or habitat may be significantly impacted by land use changes or disturbance. The Department reviews field survey data as well as site-specific and regional information to evaluate whether a project's impacts may be significant. This document compiles the best available science for conducting habitat assessments and surveys, and includes considerations for developing measures to avoid impacts or mitigate unavoidable impacts.

CEQA

CEQA requires public agencies in California to analyze and disclose potential environmental impacts associated with a project that the agency will carry out, fund, or approve. Any potentially significant impact must be mitigated to the extent feasible. Project-specific CEQA mitigation is important for burrowing owls because most populations exist on privately owned parcels that, when proposed for development or other types of modification, may be subject to the environmental review requirements of CEQA.

Take

Take of individual burrowing owls and their nests is defined by FGC section 86, and prohibited by sections 3503, 3503.5 and 3513. Take is defined in FGC Section 86 as "hunt, pursue, catch, capture or kill, or attempt to hunt, pursue, catch, capture or kill."

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) implements various treaties and conventions between the United States and Canada, Japan, Mexico, and Russia for the protection of migratory birds, including the burrowing owl (50 C.F.R. § 10). The MBTA protects migratory bird nests from possession, sale, purchase, barter, transport, import and export, and collection. The other prohibitions of the MBTA - capture, pursue, hunt, and kill - are inapplicable to nests. The regulatory definition of take, as defined in Title 50 C.F.R. part 10.12, means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to hunt, shoot, wound, kill, trap, capture, or collect. Only the verb "collect" applies to nests. It is illegal to collect, possess, and by any means transfer possession of any migratory bird nest. The MBTA prohibits the destruction of a nest when it contains birds or eggs, and no possession shall occur during the destruction (see Fish and Wildlife Service, Migratory Bird Permit Memorandum, April 15, 2003). Certain exceptions to this prohibition are included in 50 C.F.R. section 21. Pursuant to Fish & Game Code section 3513, the Department enforces the Migratory Bird Treaty Act consistent with rules and regulations adopted by the Secretary of the Interior under provisions of the Migratory Treaty Act.

Regional Conservation Plans

Regional multiple species conservation plans offer long-term assurances for conservation of covered species at a landscape scale, in exchange for biologically appropriate levels of incidental take and/or habitat loss as defined in the approved plan. California's NCCP Act (FGC §2800 et seq.) governs such plans at the state level, and was designed to conserve species, natural communities, ecosystems, and ecological processes across a jurisdiction or a collection of jurisdictions. Complementary federal HCPs are governed by the Endangered Species Act (7 U.S.C. § 136, 16 U.S.C.§ 1531 et seq.) (ESA). Regional conservation plans (and certain other landscape-level conservation and management plans), may provide conservation for unlisted as well as listed species. Because the geographic scope of NCCPs and HCPs may span many hundreds of thousands of acres, these planning tools have the potential to play a significant role in conservation of burrowing owls, and grasslands and other habitats.

Fish and Game Commission Policies

There are a number of Fish and Game Commission policies (see FGC §2008) that can be applied to burrowing owl conservation. These include policies on: Raptors, Cooperation, Endangered and Threatened Species, Land Use Planning, Management and Utilization of Fish and Wildlife on Federal Lands, Management and Utilization of Fish and Wildlife on Private Lands, and Research.

GUIDING PRINCIPLES FOR CONSERVATION

Unless otherwise provided in a statewide, local, or regional conservation strategy, surveying and evaluating impacts to burrowing owls, as well as developing and implementing avoidance, minimization, and mitigation and conservation measures incorporate the following principles. These principles are a summary of Department staff expert opinion and were used to guide the preparation of this document.

1. Use the Precautionary Principle (Noss et al.1997), by which the alternative of increased conservation is deliberately chosen in order to buffer against incomplete knowledge of burrowing owl ecology and uncertainty about the consequences to burrowing owls of potential impacts, including those that are cumulative.
2. Employ basic conservation biology tenets and population-level approaches when determining what constitutes appropriate avoidance, minimization, and mitigation for impacts. Include mitigation effectiveness monitoring and reporting, and use an adaptive management loop to modify measures based on results.
3. Protect and conserve owls in wild, semi-natural, and agricultural habitats (conserve is defined at FGC §1802).
4. Protect and conserve natural nest burrows (or burrow surrogates) previously used by burrowing owls and sufficient foraging habitat and protect auxiliary "satellite" burrows that contribute to burrowing owl survivorship and natural behavior of owls.

CONSERVATION GOALS FOR THE BURROWING OWL IN CALIFORNIA

It is Department staff expert opinion that the following goals guide and contribute to the short and long-term conservation of burrowing owls in California:

1. Maintain size and distribution of extant burrowing owl populations (allowing for natural population fluctuations).
2. Increase geographic distribution of burrowing owls into formerly occupied historical range where burrowing owl habitat still exists, or where it can be created or enhanced, and where the reason for its local disappearance is no longer of concern.
3. Increase size of existing populations where possible and appropriate (for example, considering basic ecological principles such as carrying capacity, predator-prey relationships, and inter-specific relationships with other species at risk).
4. Protect and restore self-sustaining ecosystems or natural communities which can support burrowing owls at a landscape scale, and which will require minimal long-term management.
5. Minimize or prevent unnatural causes of burrowing owl population declines (e.g., nest burrow destruction, chemical control of rodent hosts and prey).
6. Augment/restore natural dynamics of burrowing owl populations including movement and genetic exchange among populations, such that the species does not require future listing and protection under the California Endangered Species Act (CESA) and/or the federal Endangered Species Act (ESA).
7. Engage stakeholders, including ranchers; farmers; military; tribes; local, state, and federal agencies; non-governmental organizations; and scientific research and education communities involved in burrowing owl protection and habitat management.

ACTIVITIES WITH THE POTENTIAL TO TAKE OR IMPACT BURROWING OWLS

The following activities are examples of activities that have the potential to take burrowing owls, their nests or eggs, or destroy or degrade burrowing owl habitat: grading, disking, cultivation, earthmoving, burrow blockage, heavy equipment compacting and crushing burrow tunnels, levee maintenance, flooding, burning and mowing (if burrows are impacted), and operating wind turbine collisions (collectively hereafter referred to as "projects" or "activities"

whether carried out pursuant to CEQA or not). In addition, the following activities may have impacts to burrowing owl populations: eradication of host burrowers; changes in vegetation management (i.e. grazing); use of pesticides and rodenticides; destruction, conversion or degradation of nesting, foraging, over-wintering or other habitats; destruction of natural burrows and burrow surrogates; and disturbance which may result in harassment of owls at occupied burrows.

PROJECT IMPACT EVALUATIONS

The following three progressive steps are effective in evaluating whether projects will result in impacts to burrowing owls. The information gained from these steps will inform any subsequent avoidance, minimization and mitigation measures. The steps for project impact evaluations are: 1) habitat assessment, 2) surveys, and 3) impact assessment. Habitat assessments are conducted to evaluate the likelihood that a site supports burrowing owl. Burrowing owl surveys provide information needed to determine the potential effects of proposed projects and activities on burrowing owls, and to avoid take in accordance with FGC sections 86, 3503, and 3503.5. Impact assessments evaluate the extent to which burrowing owls and their habitat may be impacted, directly or indirectly, on and within a reasonable distance of a proposed CEQA project activity or non-CEQA project. These three site evaluation steps are discussed in detail below.

Biologist Qualifications

The current scientific literature indicates that only individuals meeting the following minimum qualifications should perform burrowing owl habitat assessments, surveys, and impact assessments:

1. Familiarity with the species and its local ecology;
2. Experience conducting habitat assessments and non-breeding and breeding season surveys, or experience with these surveys conducted under the direction of an experienced surveyor;
3. Familiarity with the appropriate state and federal statutes related to burrowing owls, scientific research, and conservation;
4. Experience with analyzing impacts of development on burrowing owls and their habitat.

Habitat Assessment Data Collection and Reporting

A habitat assessment is the first step in the evaluation process and will assist investigators in determining whether or not occupancy surveys are needed. Refer to Appendix B for a definition of burrowing owl habitat. Compile the detailed information described in Appendix C when conducting project scoping, conducting a habitat assessment site visit and preparing a habitat assessment report.

Surveys

Burrowing owl surveys are the second step of the evaluation process and the best available scientific literature recommends that they be conducted whenever burrowing owl habitat or sign (see Appendix B) is encountered on or adjacent to (within 150 meters) a project site

(Thomsen 1971, Martin 1973). Occupancy of burrowing owl habitat is confirmed at a site when at least one burrowing owl, or its sign at or near a burrow entrance, is observed within the last three years (Rich 1984). Burrowing owls are more detectable during the breeding season with detection probabilities being highest during the nestling stage (Conway et al. 2008). In California, the burrowing owl breeding season extends from 1 February to 31 August (Haug et al. 1993, Thompsen 1971) with some variances by geographic location and climatic conditions. Several researchers suggest three or more survey visits during daylight hours (Haug and Diduik 1993, CBOC 1997, Conway and Simon 2003) and recommend each visit occur at least three weeks apart during the peak of the breeding season, commonly accepted in California as between 15 April and 15 July (CBOC 1997). Conway and Simon (2003) and Conway et al. (2008) recommended conducting surveys during the day when most burrowing owls in a local area are in the laying and incubation period (so as not to miss early breeding attempts), during the nesting period, and in the late nestling period when most owls are spending time above ground.

Non-breeding season (1 September to 31 January) surveys may provide information on burrowing owl occupancy, but do not substitute for breeding season surveys because results are typically inconclusive. Burrowing owls are more difficult to detect during the non-breeding season and their seasonal residency status is difficult to ascertain. Burrowing owls detected during non-breeding season surveys may be year-round residents, young from the previous breeding season, pre-breeding territorial adults, winter residents, dispersing juveniles, migrants, transients or new colonizers. In addition, the numbers of owls and their pattern of distribution may differ during winter and breeding seasons. However, on rare occasions, non-breeding season surveys may be warranted (i.e., if the site is believed to be a wintering site only based on negative breeding season results). Refer to Appendix D for information on breeding season and non-breeding season survey methodologies.

Survey Reports

Adequate information about burrowing owls present in and adjacent to an area that will be disturbed by a project or activity will enable the Department, reviewing agencies and the public to effectively assess potential impacts and will guide the development of avoidance, minimization, and mitigation measures. The survey report includes but is not limited to a description of the proposed project or proposed activity, including the proposed project start and end dates, as well as a description of disturbances or other activities occurring on-site or nearby. Refer to Appendix D for details included in a survey report.

Impact Assessment

The third step in the evaluation process is the impact assessment. When surveys confirm occupied burrowing owl habitat in or adjoining the project area, there are a number of ways to assess a project's potential significant impacts to burrowing owls and their habitat. Richardson and Miller (1997) recommended monitoring raptor behavior prior to developing management recommendations and buffers to determine the extent to which individuals have been sensitized to human disturbance. Monitoring results will also provide detail necessary for developing site-specific measures. Postovit and Postovit (1987) recommended an analytical approach to mitigation planning: define the problem (impact), set goals (to guide mitigation development), evaluate and select mitigation methods, and monitor the results.

Define the problem. The impact assessment evaluates all factors that could affect burrowing owls. Postovit and Postovit (1987) recommend evaluating the following in assessing impacts to raptors and planning mitigation: type and extent of disturbance, duration and timing of disturbance, visibility of disturbance, sensitivity and ability to habituate, and influence of environmental factors. They suggest identifying and addressing all potential direct and indirect impacts to burrowing owls, regardless of whether or not the impacts will occur during the breeding season. Several examples are given for each impact category below; however, examples are not intended to be used exclusively.

Type and extent of the disturbance. The impact assessment describes the nature (source) and extent (scale) of potential project impacts on occupied, satellite and unoccupied burrows including acreage to be lost (temporary or permanent), fragmentation/edge being created, increased distance to other nesting and foraging habitat, and habitat degradation. Discuss any project activities that impact either breeding and/or non-breeding habitat which could affect owl home range size and spatial configuration, negatively affect onsite and offsite burrowing owl presence, increase energetic costs, lower reproductive success, increase vulnerability to predation, and/or decrease the chance of procuring a mate.

Duration and timing of the impact. The impact assessment describes the amount of time the burrowing owl habitat will be unavailable to burrowing owls (temporary or permanent) on the site and the effect of that loss on essential behaviors or life history requirements of burrowing owls, the overlap of project activities with breeding and/or non-breeding seasons (timing of nesting and/or non-breeding activities may vary with latitude and climatic conditions, which should be considered with the timeline of the project or activity), and any variance of the project activities in intensity, scale and proximity relative to burrowing owl occurrences.

Visibility and sensitivity. Some individual burrowing owls or pairs are more sensitive than others to specific stimuli and may habituate to ongoing visual or audible disturbance. Site-specific monitoring may provide clues to the burrowing owl's sensitivities. This type of assessment addresses the sensitivity of burrowing owls within their nesting area to humans on foot, and vehicular traffic. Other variables are whether the site is primarily in a rural versus urban setting, and whether any prior disturbance (e.g., human development or recreation) is known at the site.

Environmental factors. The impact assessment discusses any environmental factors that could be influenced or changed by the proposed activities including nest site availability, predators, prey availability, burrowing mammal presence and abundance, and threats from other extrinsic factors such as human disturbance, urban interface, feral animals, invasive species, disease or pesticides.

Significance of impacts. The impact assessment evaluates the potential loss of nesting burrows, satellite burrows, foraging habitat, dispersal and migration habitat, wintering habitat, and habitat linkages, including habitat supporting prey and host burrowers and other essential habitat attributes. This assessment determines if impacts to the species will result in significant impacts to the species locally, regionally and range-wide per CEQA Guidelines §15382 and Appendix G. The significance of the impact to habitat depends on the extent of habitat disturbed and length of time the habitat is unavailable (for example: minor – several days, medium – several weeks to months, high - breeding season affecting juvenile survival,

or over winter affecting adult survival).

Cumulative effects. The cumulative effects assessment evaluates two consequences: 1) the project's proportional share of reasonably foreseeable impacts on burrowing owls and habitat caused by the project or in combination with other projects and local influences having impacts on burrowing owls and habitat, and 2) the effects on the regional owl population resulting from the project's impacts to burrowing owls and habitat.

Mitigation goals. Establishing goals will assist in planning mitigation and selecting measures that function at a desired level. Goals also provide a standard by which to measure mitigation success. Unless specifically provided for through other FGC Sections or through specific regulations, take, possession or destruction of individual burrowing owls, their nests and eggs is prohibited under FGC sections 3503, 3503.5 and 3513. Therefore, a required goal for all project activities is to avoid take of burrowing owls. Under CEQA, goals would consist of measures that would avoid, minimize and mitigate impacts to a less than significant level. For individual projects, mitigation must be roughly proportional to the level of impacts, including cumulative impacts, in accordance with the provisions of CEQA (CEQA Guidelines, §§ 15126.4(a)(4)(B), 15064, 15065, and 16355). In order for mitigation measures to be effective, they must be specific, enforceable, and feasible actions that will improve environmental conditions. As set forth in more detail in Appendix A, the current scientific literature supports the conclusion that mitigation for permanent habitat loss necessitates replacement with an equivalent or greater habitat area for breeding, foraging, wintering, dispersal, presence of burrows, burrow surrogates, presence of fossorial mammal dens, well drained soils, and abundant and available prey within close proximity to the burrow.

MITIGATION METHODS

The current scientific literature indicates that any site-specific avoidance or mitigation measures developed should incorporate the best practices presented below or other practices confirmed by experts and the Department. The Department is available to assist in the development of site-specific avoidance and mitigation measures.

Avoiding. A primary goal is to design and implement projects to seasonally and spatially avoid negative impacts and disturbances that could result in take of burrowing owls, nests, or eggs. Other avoidance measures may include but not be limited to:

- Avoid disturbing occupied burrows during the nesting period, from 1 February through 31 August.
- Avoid impacting burrows occupied during the non-breeding season by migratory or non-migratory resident burrowing owls.
- Avoid direct destruction of burrows through chaining (dragging a heavy chain over an area to remove shrubs), disking, cultivation, and urban, industrial, or agricultural development.
- Develop and implement a worker awareness program to increase the on-site worker's recognition of and commitment to burrowing owl protection.
- Place visible markers near burrows to ensure that farm equipment and other machinery does not collapse burrows.
- Do not fumigate, use treated bait or other means of poisoning nuisance animals in areas where burrowing owls are known or suspected to occur (e.g., sites observed with nesting

owls, designated use areas).

- Restrict the use of treated grain to poison mammals to the months of January and February.

Take avoidance (pre-construction) surveys. Take avoidance surveys are intended to detect the presence of burrowing owls on a project site at a fixed period in time and inform necessary take avoidance actions. Take avoidance surveys may detect changes in owl presence such as colonizing owls that have recently moved onto the site, migrating owls, resident burrowing owls changing burrow use, or young of the year that are still present and have not dispersed. Refer to Appendix D for take avoidance survey methodology.

Site surveillance. Burrowing owls may attempt to colonize or re-colonize an area that will be impacted; thus, the current scientific literature indicates a need for ongoing surveillance at the project site during project activities is recommended. The surveillance frequency/effort should be sufficient to detect burrowing owls if they return. Subsequent to their new occupancy or return to the site, take avoidance measures should assure with a high degree of certainty that take of owls will not occur.

Minimizing. If burrowing owls and their habitat can be protected in place on or adjacent to a project site, the use of buffer zones, visual screens or other measures while project activities are occurring can minimize disturbance impacts. Conduct site-specific monitoring to inform development of buffers (see Visibility and sensitivity above). The following general guidelines for implementing buffers should be adjusted to address site-specific conditions using the impact assessment approach described above. The CEQA lead agency and/or project proponent is encouraged to consult with the Department and other burrowing owl experts for assistance in developing site-specific buffer zones and visual screens.

Buffers. Holroyd et al. (2001) identified a need to standardize management and disturbance mitigation guidelines. For instance, guidelines for mitigating impacts by petroleum industries on burrowing owls and other prairie species (Scobie and Faminow, 2000) may be used as a template for future mitigation guidelines (Holroyd et al. 2001). Scobie and Faminow (2000) developed guidelines for activities around occupied burrowing owl nests recommending buffers around low, medium, and high disturbance activities, respectively (see below).

Recommended restricted activity dates and setback distances by level of disturbance for burrowing owls (Scobie and Faminow 2000).

Location	Time of Year	Level of Disturbance		
		Low	Med	High
Nesting sites	April 1-Aug 15	200 m*	500 m	500 m
Nesting sites	Aug 16-Oct 15	200 m	200 m	500 m
Nesting sites	Oct 16-Mar 31	50 m	100 m	500 m

* meters (m)

Based on existing vegetation, human development, and land uses in an area, resource managers may decide to allow human development or resource extraction closer to these area/sites than recommended above. However, if it is decided to allow activities closer than

the setback distances recommended, a broad-scale, long-term, scientifically-rigorous monitoring program ensures that burrowing owls are not detrimentally affected by alternative approaches.

Other minimization measures include eliminating actions that reduce burrowing owl forage and burrowing surrogates (e.g. ground squirrel), or introduce/facilitate burrowing owl predators. Actions that could influence these factors include reducing livestock grazing rates and/or changing the timing or duration of grazing or vegetation management that could result in less suitable habitat.

Burrow exclusion and closure. Burrow exclusion is a technique of installing one-way doors in burrow openings during the non-breeding season to temporarily exclude burrowing owls, or permanently exclude burrowing owls and close burrows after verifying burrows are empty by site monitoring and scoping. Exclusion in and of itself is not a take avoidance, minimization or mitigation method. Eviction of burrowing owls is a potentially significant impact under CEQA.

The long-term demographic consequences of these techniques have not been thoroughly evaluated, and the fate of evicted or excluded burrowing owls has not been systematically studied. Because burrowing owls are dependent on burrows at all times of the year for survival and/or reproduction, evicting them from nesting, roosting, and satellite burrows may lead to indirect impacts or take. Temporary or permanent closure of burrows may result in significant loss of burrows and habitat for reproduction and other life history requirements. Depending on the proximity and availability of alternate habitat, loss of access to burrows will likely result in varying levels of increased stress on burrowing owls and could depress reproduction, increase predation, increase energetic costs, and introduce risks posed by having to find and compete for available burrows. Therefore, exclusion and burrow closure are not recommended where they can be avoided. The current scientific literature indicates consideration of all possible avoidance and minimization measures before temporary or permanent exclusion and closure of burrows is implemented, in order to avoid take.

The results of a study by Trulio (1995) in California showed that burrowing owls passively displaced from their burrows were quickly attracted to adjacent artificial burrows at five of six passive relocation sites. The successful sites were all within 75 meters (m) of the destroyed burrow, a distance generally within a pair's territory. This researcher discouraged using passive relocation to artificial burrows as a mitigation measure for lost burrows without protection of adjacent foraging habitat. The study results indicated artificial burrows were used by evicted burrowing owls when they were approximately 50-100 m from the natural burrow (Thomsen 1971, Haug and Oliphant 1990). Locating artificial or natural burrows more than 100 m from the eviction burrow may greatly reduce the chances that new burrows will be used. Ideally, exclusion and burrow closure is employed only where there are adjacent natural burrows and non-impacted, sufficient habitat for burrowing owls to occupy with permanent protection mechanisms in place. Any new burrowing owl colonizing the project site after the CEQA document has been adopted may constitute changed circumstances that should be addressed in a re-circulated CEQA document.

The current scientific literature indicates that burrow exclusion should only be conducted by qualified biologists (meeting the Biologist's Qualifications above) during the non-breeding

season, before breeding behavior is exhibited and after the burrow is confirmed empty by site surveillance and/or scoping. The literature also indicates that when temporary or permanent burrow exclusion and/or burrow closure is implemented, burrowing owls should not be excluded from burrows unless or until:

- A Burrowing Owl Exclusion Plan (see Appendix E) is developed and approved by the applicable local DFG office;
- Permanent loss of occupied burrow(s) and habitat is mitigated in accordance with the Mitigating Impacts sections below. Temporary exclusion is mitigated in accordance with the item #1 under Mitigating Impacts below.
- Site monitoring is conducted prior to, during, and after exclusion of burrowing owls from their burrows sufficient to ensure take is avoided. Conduct daily monitoring for one week to confirm young of the year have fledged if the exclusion will occur immediately after the end of the breeding season.
- Excluded burrowing owls are documented using artificial or natural burrows on an adjoining mitigation site (if able to confirm by band re-sight).

Translocation (Active relocation offsite >100 meters). At this time, there is little published information regarding the efficacy of translocating burrowing owls, and additional research is needed to determine subsequent survival and breeding success (Klute et al. 2003, Holroyd et al. 2001). Study results for translocation in Florida implied that hatching success may be decreased for populations of burrowing owls that undergo translocation (Nixon 2006). At this time, the Department is unable to authorize the capture and relocation of burrowing owls except within the context of scientific research (FGC §1002) or a NCCP conservation strategy.

Mitigating impacts. Habitat loss and degradation from rapid urbanization of farmland in the core areas of the Central and Imperial valleys is the greatest of many threats to burrowing owls in California (Shuford and Gardali, 2008). At a minimum, if burrowing owls have been documented to occupy burrows (see Definitions, Appendix B) at the project site in recent years, the current scientific literature supports the conclusion that the site should be considered occupied and mitigation should be required by the CEQA lead agency to address project-specific significant and cumulative impacts. Other site-specific and regionally significant and cumulative impacts may warrant mitigation. The current scientific literature indicates the following to be best practices. If these best practices cannot be implemented, the lead agency or lead investigator may consult with the Department to develop effective mitigation alternatives. The Department is also available to assist in the identification of suitable mitigation lands.

1. Where habitat will be temporarily disturbed, restore the disturbed area to pre-project condition including decompacting soil and revegetating. Permanent habitat protection may be warranted if there is the potential that the temporary impacts may render a nesting site (nesting burrow and satellite burrows) unsustainable or unavailable depending on the time frame, resulting in reduced survival or abandonment. For the latter potential impact, see the permanent impact measures below.
2. Mitigate for permanent impacts to nesting, occupied and satellite burrows and/or burrowing owl habitat such that the habitat acreage, number of burrows and burrowing owls impacted are replaced based on the information provided in Appendix A. Note: A

minimum habitat replacement recommendation is not provided here as it has been shown to serve as a default, replacing any site-specific analysis and discounting the wide variation in natal area, home range, foraging area, and other factors influencing burrowing owls and burrowing owl population persistence in a particular area.

3. Mitigate for permanent impacts to nesting, occupied and satellite burrows and burrowing owl habitat with (a) permanent conservation of similar vegetation communities (grassland, scrublands, desert, urban, and agriculture) to provide for burrowing owl nesting, foraging, wintering, and dispersal (i.e., during breeding and non-breeding seasons) comparable to or better than that of the impact area, and (b) sufficiently large acreage, and presence of fossorial mammals. The mitigation lands may require habitat enhancements including enhancement or expansion of burrows for breeding, shelter and dispersal opportunity, and removal or control of population stressors. If the mitigation lands are located adjacent to the impacted burrow site, ensure the nearest neighbor artificial or natural burrow clusters are at least within 210 meters (Fisher et al. 2007).
4. Permanently protect mitigation land through a conservation easement deeded to a non-profit conservation organization or public agency with a conservation mission, for the purpose of conserving burrowing owl habitat and prohibiting activities incompatible with burrowing owl use. If the project is located within the service area of a Department-approved burrowing owl conservation bank, the project proponent may purchase available burrowing owl conservation bank credits.
5. Develop and implement a mitigation land management plan to address long-term ecological sustainability and maintenance of the site for burrowing owls (see Management Plan and Artificial Burrow sections below, if applicable).
6. Fund the maintenance and management of mitigation land through the establishment of a long-term funding mechanism such as an endowment.
7. Habitat should not be altered or destroyed, and burrowing owls should not be excluded from burrows, until mitigation lands have been legally secured, are managed for the benefit of burrowing owls according to Department-approved management, monitoring and reporting plans, and the endowment or other long-term funding mechanism is in place or security is provided until these measures are completed.
8. Mitigation lands should be on, adjacent or proximate to the impact site where possible and where habitat is sufficient to support burrowing owls present.
9. Where there is insufficient habitat on, adjacent to, or near project sites where burrowing owls will be excluded, acquire mitigation lands with burrowing owl habitat away from the project site. The selection of mitigation lands should then focus on consolidating and enlarging conservation areas located outside of urban and planned growth areas, within foraging distance of other conserved lands. If mitigation lands are not available adjacent to other conserved lands, increase the mitigation land acreage requirement to ensure a selected site is of sufficient size. Offsite mitigation may not adequately offset the biological and habitat values impacted on a one to one basis. Consult with the Department when determining offsite mitigation acreages.
10. Evaluate and select suitable mitigation lands based on a comparison of the habitat attributes of the impacted and conserved lands, including but not limited to: type and structure of habitat being impacted or conserved; density of burrowing owls in impacted and conserved habitat; and significance of impacted or conserved habitat to the species range-wide. Mitigate for the highest quality burrowing owl habitat impacted first and foremost when identifying mitigation lands, even if a mitigation site is located outside of

a lead agency's jurisdictional boundary, particularly if the lead agency is a city or special district.

11. Select mitigation lands taking into account the potential human and wildlife conflicts or incompatibility, including but not limited to, human foot and vehicle traffic, and predation by cats, loose dogs and urban-adapted wildlife, and incompatible species management (i.e., snowy plover).
12. Where a burrowing owl population appears to be highly adapted to heavily altered habitats such as golf courses, airports, athletic fields, and business complexes, permanently protecting the land, augmenting the site with artificial burrows, and enhancing and maintaining those areas may enhance sustainability of the burrowing owl population onsite. Maintenance includes keeping lands grazed or mowed with weed-eaters or push mowers, free from trees and shrubs, and preventing excessive human and human-related disturbance (e.g., walking, jogging, off-road activity, dog-walking) and loose and feral pets (chasing and, presumably, preying upon owls) that make the environment uninhabitable for burrowing owls (Wesemann and Rowe 1985, Millsap and Bear 2000, Lincer and Bloom 2007). Items 4, 5 and 6 also still apply to this mitigation approach.
13. If there are no other feasible mitigation options available and a lead agency is willing to establish and oversee a Burrowing Owl Mitigation and Conservation Fund that funds on a competitive basis acquisition and permanent habitat conservation, the project proponent may participate in the lead agency's program.

Artificial burrows. Artificial burrows have been used to replace natural burrows either temporarily or long-term and their long-term success is unclear. Artificial burrows may be an effective addition to in-perpetuity habitat mitigation if they are augmenting natural burrows, the burrows are regularly maintained (i.e., no less than annual, with biennial maintenance recommended), and surrounding habitat patches are carefully maintained. There may be some circumstances, for example at airports, where squirrels will not be allowed to persist and create a dynamic burrow system, where artificial burrows may provide some support to an owl population.

Many variables may contribute to the successful use of artificial burrows by burrowing owls, including pre-existence of burrowing owls in the area, availability of food, predators, surrounding vegetation and proximity, number of natural burrows in proximity, type of materials used to build the burrow, size of the burrow and entrance, direction in which the burrow entrance is facing, slope of the entrance, number of burrow entrances per burrow, depth of the burrow, type and height of perches, and annual maintenance needs (Belthoff and King 2002, Smith et al. 2005, Barclay et al. 2011). Refer to Barclay (2008) and (2011) and to Johnson et al. 2010 (unpublished report) for guidance on installing artificial burrows including recommendations for placement, installation and maintenance.

Any long-term reliance on artificial burrows as natural burrow replacements must include semi-annual to annual cleaning and maintenance and/or replacement (Barclay et al. 2011, Smith and Conway 2005, Alexander et al. 2005) as an ongoing management practice. Alexander et al. (2005), in a study of the use of artificial burrows found that all of 20 artificial burrows needed some annual cleaning and maintenance. Burrows were either excavated by predators, blocked by soil or vegetation, or experienced substrate erosion forming a space beneath the tubing that prevented nestlings from re-entering the burrow.

Mitigation lands management plan. Develop a Mitigation Lands Management Plan for projects that require off-site or on-site mitigation habitat protection to ensure compliance with and effectiveness of identified management actions for the mitigation lands. A suggested outline and related vegetation management goals and monitoring success criteria can be found in Appendix E.

Mitigation Monitoring and Reporting

Verify the compliance with required mitigation measures, the accuracy of predictions, and ensure the effectiveness of all mitigation measures for burrowing owls by conducting follow-up monitoring, and implementing midcourse corrections, if necessary, to protect burrowing owls. Refer to CEQA Guidelines Section 15097 and the CEQA Guidelines for additional guidance on mitigation, monitoring and reporting. Monitoring is qualitatively different from site surveillance; monitoring normally has a specific purpose and its outputs and outcomes will usually allow a comparison with some baseline condition of the site before the mitigation (including avoidance and minimization) was undertaken. Ideally, monitoring should be based on the Before-After Control-Impact (BACI) principle (McDonald et al. 2000) that requires knowledge of the pre-mitigation state to provide a reference point for the state and change in state after the project and mitigation have been implemented.

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Appendix A. Burrowing Owl Natural History and Threats

Diet

Burrowing owl diet includes arthropods, small rodents, birds, amphibians, reptiles, and carrion (Haug et al. 1993).

Breeding

In California, the breeding season for the burrowing owl typically occurs between 1 February and 31 August although breeding in December has been documented (Thompson 1971, Gervais et al. 2008); breeding behavior includes nest site selection by the male, pair formation, copulation, egg laying, hatching, fledging, and post-fledging care of young by the parents. The peak of the breeding season occurs between 15 April and 15 July and is the period when most burrowing owls have active nests (eggs or young). The incubation period lasts 29 days (Coulombe 1971) and young fledge after 44 days (Haug et al. 1993). Note that the timing of nesting activities may vary with latitude and climatic conditions. Burrowing owls may change burrows several times during the breeding season, starting when nestlings are about three weeks old (Haug et al. 1993).

Dispersal

The following discussion is an excerpt from Gervais et al (2008):

> "The burrowing owl is often considered a sedentary species (e.g., Thomsen 1971). A large proportion of adults show strong fidelity to their nest site from year to year, especially where resident, as in Florida (74% for females, 83% for males; Millsap and Bear 1997). In California, nest-site fidelity rates were 32%–50% in a large grassland and 57% in an agricultural environment (Ronan 2002, Catlin 2004, Catlin et al. 2005). Differences in these rates among sites may reflect differences in nest predation rates (Catlin 2004, Catlin et al. 2005). Despite the high nest fidelity rates, dispersal distances may be considerable for both juveniles (natal dispersal) and adults (postbreeding dispersal), but this also varied with location (Catlin 2004, Rosier et al. 2006). Distances of 53 km to roughly 150 km have been observed in California for adult and natal dispersal, respectively (D. K. Rosenberg and J. A. Gervais, unpublished data), despite the difficulty in detecting movements beyond the immediate study area (Koenig et al. 1996)."

Habitat

The burrowing owl is a small, long-legged, ground-dwelling bird species, well-adapted to open, relatively flat expanses. In California, preferred habitat is generally typified by short, sparse vegetation with few shrubs, level to gentle topography and well-drained soils (Haug et al. 1993). Grassland, shrub steppe, and desert are naturally occurring habitat types used by the species. In addition, burrowing owls may occur in some agricultural areas, ruderal grassy fields, vacant lots and pastures if the vegetation structure is suitable and there are useable burrows and foraging habitat in proximity (Gervais et al 2008). Unique amongst North

American raptors, the burrowing owl requires underground burrows or other cavities for nesting during the breeding season and for roosting and cover, year round. Burrows used by the owls are usually dug by other species termed host burrowers. In California, California ground squirrel (*Spermophilus beecheyi*) and round-tailed ground squirrel (*Citellus tereticaudus*) burrows are frequently used by burrowing owls but they may use dens or holes dug by other fossorial species including badger (*Taxidea taxus*), coyote (*Canis latrans*), and fox (e.g., San Joaquin kit fox, *Vulpes macrotis mutica*; Ronan 2002). In some instances, owls have been known to excavate their own burrows (Thompson 1971, Barclay 2007). Natural rock cavities, debris piles, culverts, and pipes also are used for nesting and roosting (Rosenberg et al. 1998). Burrowing owls have been documented using artificial burrows for nesting and cover (Smith and Belthoff, 2003).

Foraging habitat. Foraging habitat is essential to burrowing owls. The following discussion is an excerpt from Gervais et al. (2008):

> "Useful as a rough guide to evaluating project impacts and appropriate mitigation for burrowing owls, adult male burrowing owls home ranges have been documented (calculated by minimum convex polygon) to comprise anywhere from 280 acres in intensively irrigated agroecosystems in Imperial Valley (Rosenberg and Haley 2004) to 450 acres in mixed agricultural lands at Lemoore Naval Air Station, CA (Gervais et al. 2003), to 600 acres in pasture in Saskatchewan, Canada (Haug and Oliphant 1990). But owl home ranges may be much larger, perhaps by an order of magnitude, in non-irrigated grasslands such as at Carrizo Plain, California (Gervais et al. 2008), based on telemetry studies and distribution of nests. Foraging occurs primarily within 600 m of their nests (within approximately 300 acres, based on a circle with a 600 m radius) during the breeding season."

Importance of burrows and adjacent habitat. Burrows and the associated surrounding habitat are essential ecological requisites for burrowing owls throughout the year and especially during the breeding season. During the non-breeding season, burrowing owls remain closely associated with burrows, as they continue to use them as refuge from predators, shelter from weather and roost sites. Resident populations will remain near the previous season's nest burrow at least some of the time (Coulombe 1971, Thomsen 1971, Botelho 1996, LaFever et al. 2008).

In a study by Lutz and Plumpton (1999) adult males and females nested in formerly used sites at similar rates (75% and 63%, respectively) (Lutz and Plumpton 1999). Burrow fidelity has been reported in some areas; however, more frequently, burrowing owls reuse traditional nesting areas without necessarily using the same burrow (Haug et al. 1993, Dechant et al. 1999). Burrow and nest sites are re-used at a higher rate if the burrowing owl has reproduced successfully during the previous year (Haug et al. 1993) and if the number of burrows isn't limiting nesting opportunity.

Burrowing owls may use "satellite" or non-nesting burrows, moving young at 10-14 days, presumably to reduce risk of predation (Desmond and Savidge 1998) and possibly to avoid nest parasites (Dechant et al. 1999). Successful nests in Nebraska had more active satellite burrows within 75 m of the nest burrow than unsuccessful nests (Desmond and Savidge

1999). Several studies have documented the number of satellite burrows used by young and adult burrowing owls during the breeding season as between one and 11 burrows with an average use of approximately five burrows (Thompsen 1984, Haug 1985, Haug and Oliphant 1990). Supporting the notion of selecting for nest sites near potential satellite burrows, Ronan (2002) found burrowing owl families would move away from a nest site if their satellite burrows were experimentally removed through blocking their entrance.

Habitat adjacent to burrows has been documented to be important to burrowing owls. Gervais et al. (2003) found that home range sizes of male burrowing owls during the nesting season were highly variable within but not between years. Their results also suggested that owls concentrate foraging efforts within 600 meters of the nest burrow, as was observed in Canada (Haug and Oliphant 1990) and southern California (Rosenberg and Haley 2004). James et al. (1997), reported habitat modification factors causing local burrowing owl declines included habitat fragmentation and loss of connectivity.

In conclusion, the best available science indicates that essential habitat for the burrowing owl in California must include suitable year-round habitat, primarily for breeding, foraging, wintering and dispersal habitat consisting of short or sparse vegetation (at least at some time of year), presence of burrows, burrow surrogates or presence of fossorial mammal dens, well-drained soils, and abundant and available prey within close proximity to the burrow.

Threats to Burrowing Owls in California

Habitat loss. Habitat loss, degradation, and fragmentation are the greatest threats to burrowing owls in California. According to DeSante et al. (2007), “the vast majority of burrowing owls [now] occur in the wide, flat lowland valleys and basins of the Imperial Valley and Great Central Valley [where] for the most part,...the highest rates of residential and commercial development in California are occurring.” Habitat loss from the State’s long history of urbanization in coastal counties has already resulted in either extirpation or drastic reduction of burrowing owl populations there (Gervais et al. 2008). Further, loss of agricultural and other open lands (such as grazed landscapes) also negatively affect owl populations. Because of their need for open habitat with low vegetation, burrowing owls are unlikely to persist in agricultural lands dominated by vineyards and orchards (Gervais et al. 2008).

Control of burrowing rodents. According to Klute et al. (2003), the elimination of burrowing rodents through control programs is a primary factor in the recent and historical decline of burrowing owl populations nationwide. In California, ground squirrel burrows are most often used by burrowing owls for nesting and cover; thus, ground squirrel control programs may affect owl numbers in local areas by eliminating a necessary resource.

Direct mortality. Burrowing owls suffer direct losses from a number of sources. Vehicle collisions are a significant source of mortality especially in the urban interface and where owls nest alongside roads (Haug et al. 1993, Gervais et al. 2008). Road and ditch maintenance, modification of water conveyance structures (Imperial Valley) and discing to control weeds in fallow fields may destroy burrows (Rosenberg and Haley 2004, Catlin and Rosenberg 2006) which may trap or crush owls. Wind turbines at Altamont Pass Wind Resource Area are known to cause direct burrowing owl mortality (Thelander et al. 2003). Exposure to

pesticides may pose a threat to the species but is poorly understood (Klute et al. 2003, Gervais et al. 2008).

Appendix B. Definitions

Some key terms that appear in this document are defined below.

Adjacent habitat means burrowing owl habitat that abuts the area where habitat and burrows will be impacted and rendered non-suitable for occupancy.

Breeding (nesting) season begins as early as 1 February and continues through 31 August (Thomsen 1971, Zarn 1974). The timing of breeding activities may vary with latitude and climatic conditions. The breeding season includes pairing, egg-laying and incubation, and nestling and fledging stages.

Burrow exclusion is a technique of installing one-way doors in burrow openings during the non-breeding season to temporarily exclude burrowing owls or permanently exclude burrowing owls and excavate and close burrows after confirming burrows are empty.

Burrowing owl habitat generally includes, but is not limited to, short or sparse vegetation (at least at some time of year), presence of burrows, burrow surrogates or presence of fossorial mammal dens, well-drained soils, and abundant and available prey.

Burrow surrogates include culverts, piles of concrete rubble, piles of soil, burrows created along soft banks of ditches and canals, pipes, and similar structures.

Civil twilight - Morning civil twilight begins when the geometric center of the sun is 6 degrees below the horizon (civil dawn) and ends at sunrise. Evening civil twilight begins at sunset and ends when the geometric center of the sun reaches 6 degrees below the horizon (civil dusk). During this period there is enough light from the sun that artificial sources of light may not be needed to carry on outdoor activities. This concept is sometimes enshrined in laws, for example, when drivers of automobiles must turn on their headlights (called lighting-up time in the UK); when pilots may exercise the rights to fly aircraft. Civil twilight can also be described as the limit at which twilight illumination is sufficient, under clear weather conditions, for terrestrial objects to be clearly distinguished; at the beginning of morning civil twilight, or end of evening civil twilight, the horizon is clearly defined and the brightest stars are visible under clear atmospheric conditions.

Conservation for burrowing owls may include but may not be limited to protecting remaining breeding pairs or providing for population expansion, protecting and enhancing breeding and essential habitat, and amending or augmenting land use plans to stabilize populations and other specific actions to avoid the need to list the species pursuant to California or federal Endangered Species Acts.

Contiguous means connected together so as to form an uninterrupted expanse in space.

Essential habitat includes nesting, foraging, wintering, and dispersal habitat.

Foraging habitat is habitat within the estimated home range of an occupied burrow, supports suitable prey base, and allows for effective hunting.

Host burrowers include ground squirrels, badgers, foxes, coyotes, gophers etc.

Locally significant species is a species that is not rare from a statewide perspective but is rare or uncommon in a local context such as within a county or region (CEQA §15125 (c)) or is so designated in local or regional plans, policies, or ordinances (CEQA Guidelines, Appendix G). Examples include a species at the outer limits of its known range or occurring in a unique habitat type.

Non-breeding season is the period of time when nesting activity is not occurring, generally September 1 through January 31, but may vary with latitude and climatic conditions.

Occupied site or occupancy means a site that is assumed occupied if at least one burrowing owl has been observed occupying a burrow within the last three years (Rich 1984). Occupancy of suitable burrowing owl habitat may also be indicated by owl sign including its molted feathers, cast pellets, prey remains, eggshell fragments, or excrement at or near a burrow entrance or perch site.

Other impacting activities may include but may not be limited to agricultural practices, vegetation management and fire control, pest management, conversion of habitat from rangeland or natural lands to more intensive agricultural uses that could result in “take”. These impacting activities may not meet the definition of a project under CEQA.

Passive relocation is a technique of installing one-way doors in burrow openings to temporarily or permanently evict burrowing owls and prevent burrow re-occupation.

Peak of the breeding season is between 15 April and 15 July.

Sign includes its tracks, molted feathers, cast pellets (defined as 1-2” long brown to black regurgitated pellets consisting of non-digestible portions of the owls’ diet, such as fur, bones, claws, beetle elytra, or feathers), prey remains, egg shell fragments, owl white wash, nest burrow decoration materials (e.g., paper, foil, plastic items, livestock or other animal manure, etc.), possible owl perches, or other items.

Appendix C. Habitat Assessment and Reporting Details

Habitat Assessment Data Collection and Reporting

Current scientific literature indicates that it would be most effective to gather the data in the manner described below when conducting project scoping, conducting a habitat assessment site visit and preparing a habitat assessment report:

1. Conduct at least one visit covering the entire potential project/activity area including areas that will be directly or indirectly impacted by the project. Survey adjoining areas within 150 m (Thomsen 1971, Martin 1973), or more where direct or indirect effects could potentially extend offsite. If lawful access cannot be achieved to adjacent areas, surveys can be performed with a spotting scope or other methods.
2. Prior to the site visit, compile relevant biological information for the site and surrounding area to provide a local and regional context.
3. Check all available sources for burrowing owl occurrence information regionally prior to a field inspection. The CNDDB and BIOS (see References cited) may be consulted for known occurrences of burrowing owls. Other sources of information include, but are not limited to, the Proceedings of the California Burrowing Owl Symposium (Barclay et al. 2007), county bird atlas projects, Breeding Bird Survey records, eBIRD (http://ebird.org), Gervais et al. (2008), local reports or experts, museum records, and other site-specific relevant information.
4. Identify vegetation and habitat types potentially supporting burrowing owls in the project area and vicinity.
5. Record and report on the following information:
   a. A full description of the proposed project, including but not limited to, expected work periods, daily work schedules, equipment used, activities performed (such as drilling, construction, excavation, etc.) and whether the expected activities will vary in location or intensity over the project's timeline;
   b. A regional setting map, showing the general project location relative to major roads and other recognizable features;
   c. A detailed map (preferably a USGS topo 7.5' quad base map) of the site and proposed project, including the footprint of proposed land and/or vegetation-altering activities, base map source, identifying topography, landscape features, a north arrow, bar scale, and legend;
   d. A written description of the biological setting, including location (Section, Township, Range, baseline and meridian), acreage, topography, soils, geographic and hydrologic characteristics, land use and management history on and adjoining the site (i.e., whether it is urban, semi-urban or rural; whether there is any evidence of past or current livestock grazing, mowing, disking, or other vegetation management activities);
   e. An analysis of any relevant, historical information concerning burrowing owl use or occupancy (breeding, foraging, over-wintering) on site or in the assessment area;
   f. Vegetation type and structure (using Sawyer et al. 2009), vegetation height, habitat types and features in the surrounding area plus a reasonably sized (as supported with logical justification) assessment area; (Note: use caution in discounting habitat based on grass height as it can be a temporary condition variable by season and conditions (such as current grazing regime) or may be distributed as a mosaic).

g. The presence of burrowing owl individuals or pairs or sign (see Appendix B);
h. The presence of suitable burrows and/or burrow surrogates (>11 cm in diameter (height and width) and >150 cm in depth) (Johnson et al. 2010), regardless of a lack of any burrowing owl sign and/or burrow surrogates; and burrowing owls and/or their sign that have recently or historically (within the last 3 years) been identified on or adjacent to the site.

Appendix D. Breeding and Non-breeding Season Surveys and Reports

Current scientific literature indicates that it is most effective to conduct breeding and non-breeding season surveys and report in the manner that follows:

Breeding Season Surveys

Number of visits and timing. Conduct 4 survey visits: 1) at least one site visit between 15 February and 15 April, and 2) a minimum of three survey visits, at least three weeks apart, between 15 April and 15 July, with at least one visit after 15 June. Note: many burrowing owl migrants are still present in southwestern California during mid-March, therefore, exercise caution in assuming breeding occupancy early in the breeding season.

Survey method. Rosenberg et al. (2007) confirmed walking line transects were most effective in smaller habitat patches. Conduct surveys in all portions of the project site that were identified in the Habitat Assessment and fit the description of habitat in Appendix A. Conduct surveys by walking straight-line transects spaced 7 m to 20 m apart, adjusting for vegetation height and density (Rosenberg et al. 2007). At the start of each transect and, at least, every 100 m, scan the entire visible project area for burrowing owls using binoculars. During walking surveys, record all potential burrows used by burrowing owls as determined by the presence of one or more burrowing owls, pellets, prey remains, whitewash, or decoration. Some burrowing owls may be detected by their calls, so observers should also listen for burrowing owls while conducting the survey.

Care should be taken to minimize disturbance near occupied burrows during all seasons and not to “flush” burrowing owls especially if predators are present to reduce any potential for needless energy expenditure or burrowing owl mortality. Burrowing owls may flush if approached by pedestrians within 50 m (Conway et al. 2003). If raptors or other predators are present that may suppress burrowing owl activity, return at another time or later date for a follow-up survey.

Check all burrowing owls detected for bands and/or color bands and report band combinations to the Bird Banding Laboratory (BBL). Some site-specific variations to survey methods discussed below may be developed in coordination with species experts and Department staff.

Weather conditions. Poor weather may affect the surveyor’s ability to detect burrowing owls, therefore, avoid conducting surveys when wind speed is >20 km/hr, and there is precipitation or dense fog. Surveys have greater detection probability if conducted when ambient temperatures are >20º C, <12 km/hr winds, and cloud cover is <75% (Conway et al. 2008).

Time of day. Daily timing of surveys varies according to the literature, latitude, and survey method. However, surveys between morning civil twilight and 10:00 AM and two hours before sunset until evening civil twilight provide the highest detection probabilities (Barclay pers. comm. 2012, Conway et al. 2008).

Alternate methods. If the project site is large enough to warrant an alternate method, consult current literature for generally accepted survey methods and consult with the Department on the proposed survey approach.

Additional breeding season site visits. Additional breeding season site visits may be necessary, especially if non-breeding season exclusion methods are contemplated. Detailed information, such as approximate home ranges of each individual or of family units, as well as foraging areas as related to the proposed project, will be important to document for evaluating impacts, planning avoidance measure implementation and for mitigation measure performance monitoring.

Adverse conditions may prevent investigators from determining presence or occupancy. Disease, predation, drought, high rainfall or site disturbance may preclude presence of burrowing owls in any given year. Any such conditions should be identified and discussed in the survey report. Visits to the site in more than one year may increase the likelihood of detection. Also, visits to adjacent known occupied habitat may help determine appropriate survey timing.

Given the high site fidelity shown by burrowing owls (see Appendix A, Importance of burrows), conducting surveys over several years may be necessary when project activities are ongoing, occur annually, or start and stop seasonally. (See Negative surveys).

Non-breeding Season Surveys

If conducting non-breeding season surveys, follow the methods described above for breeding season surveys, but conduct at least four (4) visits, spread evenly, throughout the non-breeding season. Burrowing owl experts and local Department staff are available to assist with interpreting results.

Negative Surveys

Adverse conditions may prevent investigators from documenting presence or occupancy. Disease, predation, drought, high rainfall or site disturbance may preclude presence of burrowing owl in any given year. Discuss such conditions in the Survey Report. Visits to the site in more than one year increase the likelihood of detection and failure to locate burrowing owls during one field season does not constitute evidence that the site is no longer occupied, particularly if adverse conditions influenced the survey results. Visits to other nearby known occupied sites can affirm whether the survey timing is appropriate.

Take Avoidance Surveys

Field experience from 1995 to present supports the conclusion that it would be effective to complete an initial take avoidance survey no less than 14 days prior to initiating ground disturbance activities using the recommended methods described in the Detection Surveys section above. Implementation of avoidance and minimization measures would be triggered by positive owl presence on the site where project activities will occur. The development of avoidance and minimization approaches would be informed by monitoring the burrowing owls.

Burrowing owls may re-colonize a site after only a few days. Time lapses between project activities trigger subsequent take avoidance surveys including but not limited to a final survey conducted within 24 hours prior to ground disturbance.

Survey Reports

Report on the survey methods used and results including the information described in the Summary Report and include the reports within the CEQA documentation:

1. Date, start and end time of surveys including weather conditions (ambient temperature, wind speed, percent cloud cover, precipitation and visibility);
2. Name(s) of surveyor(s) and qualifications;
3. A discussion of how the timing of the survey affected the comprehensiveness and detection probability;
4. A description of survey methods used including transect spacing, point count dispersal and duration, and any calls used;
5. A description and justification of the area surveyed relative to the project area;
6. A description that includes: number of owls or nesting pairs at each location (by nestlings, juveniles, adults, and those of an unknown age), number of burrows being used by owls, and burrowing owl sign at burrows. Include a description of individual markers, such as bands (numbers and colors), transmitters, or unique natural identifying features. If any owls are banded, request documentation from the BBL and bander to report on the details regarding the known history of the banded burrowing owl(s) (age, sex, origins, whether it was previously relocated) and provide with the report if available;
7. A description of the behavior of burrowing owls during the surveys, including feeding, resting, courtship, alarm, territorial defense, and those indicative of parents or juveniles;
8. A list of possible burrowing owl predators present and documentation of any evidence of predation of owls;
9. A detailed map (1:24,000 or closer to show details) showing locations of all burrowing owls, potential burrows, occupied burrows, areas of concentrated burrows, and burrowing owl sign. Locations documented by use of global positioning system (GPS) coordinates must include the datum in which they were collected. The map should include a title, north arrow, bar scale and legend;
10. Signed field forms, photos, etc., as appendices to the field survey report;
11. Recent color photographs of the proposed project or activity site; and
12. Original CNDDB Field Survey Forms should be sent directly to the Department's CNDDB office, and copies should be included in the environmental document as an appendix. (http://www.dfg.ca.gov/bdb/html/cnddb.html).

Appendix E. Example Components for Burrowing Owl Artificial Burrow and Exclusion Plans

Whereas the Department does not recommend exclusion and burrow closure, current scientific literature and experience from 1995 to present, indicate that the following example components for burrowing owl artificial burrow and exclusion plans, combined with consultation with the Department to further develop these plans, would be effective.

Artificial Burrow Location

If a burrow is confirmed occupied on-site, artificial burrow locations should be appropriately located and their use should be documented taking into consideration:

1. A brief description of the project and project site pre-construction;
2. The mitigation measures that will be implemented;
3. Potential conflicting site uses or encumbrances;
4. A comparison of the occupied burrow site(s) and the artificial burrow site(s) (e.g., vegetation, habitat types, fossorial species use in the area, and other features);
5. Artificial burrow(s) proximity to the project activities, roads and drainages;
6. Artificial burrow(s) proximity to other burrows and entrance exposure;
7. Photographs of the site of the occupied burrow(s) and the artificial burrows;
8. Map of the project area that identifies the burrow(s) to be excluded as well as the proposed sites for the artificial burrows;
9. A brief description of the artificial burrow design;
10. Description of the monitoring that will take place during and after project implementation including information that will be provided in a monitoring report.
11. A description of the frequency and type of burrow maintenance.

Exclusion Plan

An Exclusion Plan addresses the following including but not limited to:

1. Confirm by site surveillance that the burrow(s) is empty of burrowing owls and other species preceding burrow scoping;
2. Type of scope and appropriate timing of scoping to avoid impacts;
3. Occupancy factors to look for and what will guide determination of vacancy and excavation timing (one-way doors should be left in place 48 hours to ensure burrowing owls have left the burrow before excavation, visited twice daily and monitored for evidence that owls are inside and can't escape i.e., look for sign immediately inside the door).
4. How the burrow(s) will be excavated. Excavation using hand tools with refilling to prevent reoccupation is preferable whenever possible (may include using piping to stabilize the burrow to prevent collapsing until the entire burrow has been excavated and it can be determined that no owls reside inside the burrow);
5. Removal of other potential owl burrow surrogates or refugia on site;
6. Photographing the excavation and closure of the burrow to demonstrate success and sufficiency;

7. Monitoring of the site to evaluate success and, if needed, to implement remedial measures to prevent subsequent owl use to avoid take;
8. How the impacted site will continually be made inhospitable to burrowing owls and fossorial mammals (e.g., by allowing vegetation to grow tall, heavy disking, or immediate and continuous grading) until development is complete.

Appendix F. Mitigation Management Plan and Vegetation Management Goals

Mitigation Management Plan

A mitigation site management plan will help ensure the appropriate implementation and maintenance for the mitigation site and persistence of the burrowing owls on the site. For an example to review, refer to Rosenberg et al. (2009). The current scientific literature and field experience from 1995 to present indicate that an effective management plan includes the following:

1. Mitigation objectives;
2. Site selection factors (including a comparison of the attributes of the impacted and conserved lands) and baseline assessment;
3. Enhancement of the conserved lands (enhancement of reproductive capacity, enhancement of breeding areas and dispersal opportunities, and removal or control of population stressors);
4. Site protection method and prohibited uses;
5. Site manager roles and responsibilities;
6. Habitat management goals and objectives:
    a. Vegetation management goals,
        i. Vegetation management tools:
            1. Grazing
            2. Mowing
            3. Burning
            4. Other
    b. Management of ground squirrels and other fossorial mammals,
    c. Semi-annual and annual artificial burrow cleaning and maintenance,
    d. Non-natives control – weeds and wildlife,
    e. Trash removal;
7. Financial assurances:
    a. Property analysis record or other financial analysis to determine long-term management funding,
    b. Funding schedule;
8. Performance standards and success criteria;
9. Monitoring, surveys and adaptive management;
10. Maps;
11. Annual reports.

Vegetation Management Goals

- Manage vegetation height and density (especially in immediate proximity to burrows). Suitable vegetation structure varies across sites and vegetation types, but should generally be at the average effective vegetation height of 4.7 cm (Green and Anthony 1989) and <13 cm average effective vegetation height (MacCracken et al. 1985*a)*.
- Employ experimental prescribed fires (controlled, at a small scale) to manage vegetation structure;

- Vegetation reduction or ground disturbance timing, extent, and configuration should avoid take. While local ordinances may require fire prevention through vegetation management, activities like disking, mowing, and grading during the breeding season can result in take of burrowing owls and collapse of burrows, causing nest destruction. Consult the take avoidance surveys section above for pre-management avoidance survey recommendations;
- Promote natural prey distribution and abundance, especially in proximity to occupied burrows; and
- Promote self-sustaining populations of host burrowers by limiting or prohibiting lethal rodent control measures and by ensuring food availability for host burrowers through vegetation management.

Refer to Rosenberg et al. (2009) for a good discussion of managing grasslands for burrowing owls.

Mitigation Site Success Criteria

In order to evaluate the success of mitigation and management strategies for burrowing owls, monitoring is required that is specific to the burrowing owl management plan. Given limited resources, Barclay et al. (2011) suggests managers focus on accurately estimating annual adult owl populations rather than devoting time to estimating reproduction, which shows high annual variation and is difficult to accurately estimate. Therefore, the key objective will be to determine accurately the number of adult burrowing owls and pairs, and if the numbers are maintained. A frequency of 5-10 years for surveys to estimate population size may suffice if there are no changes in the management of the nesting and foraging habitat of the owls.

Effective monitoring and evaluation of off-site and on-site mitigation management success for burrowing owls includes (Barclay, pers. comm.):

- Site tenacity;
- Number of adult owls present and reproducing;
- Colonization by burrowing owls from elsewhere (by band re-sight);
- Evidence and causes of mortality;
- Changes in distribution; and
- Trends in stressors.

Attachment C

AIR QUALITY AND LAND USE HANDBOOK: A COMMUNITY HEALTH PERSPECTIVE

April 2005

California Environmental Protection Agency
California Air Resources Board

Air Agency Contacts

Federal-

U.S. EPA, Region 9
Phone: (866)-EPA-WEST
Website: www.epa.gov/region09
Email: r9.info@epa.gov

-State-

California Air Resources Board
Phone: (916) 322-2990 (public info)
(800) 363-7664 (public info)
(800) 952-5588 (complaints)
(866)-397-5462 (env. justice)
Website: www.arb.ca.gov
Email: helpline@arb.ca.gov

-Local-

Amador County APCD
Phone: (209) 257-0112
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E-Mail: jharris@amadorapcd.org

Antelope Valley AQMD
Phone: (661) 723-8070
Complaint Line: (888) 732-8070
Website: www.avaqmd.ca.gov
E-Mail: bbanks@avaqmd.ca.gov

Bay Area AQMD
Phone: (415) 749-5000
Complaint Line: (800) 334-6367
Website: www.baaqmd.gov
E-Mail: webmaster@baaqmd.gov

Butte County AQMD
Phone: (530) 891-2882
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Calaveras County APCD
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Colusa County APCD
Phone: (530) 458-0590
Website: www.colusanet.com/apcd
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El Dorado County AQMD
Phone: (530) 621-6662
Website:
www.co.el-dorado.ca.us/emd/apcd
E-Mail: mcctaggart@co.el-dorado.ca.us

Feather River AQMD
Phone: (530) 634-7659
Website: www.fraqmd.org
E-Mail: fraqmd@fraqmd.org

Glenn County APCD
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http://www.countyofglenn.net/air_pollution_control
E-Mail: ktokunaga@countyofglenn.net

Great Basin Unified APCD
Phone: (760) 872-8211
Website: www.gbuapcd.org
E-Mail: gb1@greatbasinapcd.org

Imperial County APCD
Phone: (760) 482-4606
E-Mail: reyesromero@imperialcounty.net

Kern County APCD
Phone: (661) 862-5250
Website: www.kernair.org
E-Mail: kcapcd@co.kern.ca.us

Lake County AQMD
Phone: (707) 263-7000
Website: www.lcaqmd.net
E-Mail: bobr@pacific.net

Lassen County APCD
Phone: (530) 251-8110
E-Mail: lassenag@psln.com

Mariposa County APCD
Phone: (209) 966-2220
E-Mail: air@mariposacounty.org

Mendocino County AQMD
Phone: (707) 463-4354
Website:
www.co.mendocino.ca.us/aqmd
E-Mail:
mcaqmd@co.mendocino.ca.us

Modoc County APCD
Phone: (530) 233-6419
E-Mail: modapcd@hdo.net

Mojave Desert AQMD
Phone: (760) 245-1661
(800) 635-4617
Website: www.mdaqmd.ca.gov

Monterey Bay Unified APCD
Phone: (831) 647-9411
(800) 253-6028 (Complaints)
Website: www.mbuapcd.org
E-Mail: dquetin@mbuapcd.org

North Coast Unified AQMD
Phone: (707) 443-3093
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E-Mail: lawrence@ncuaqmd.org

Northern Sierra AQMD
Phone: (530) 274-9360
Website: www.myairdistrict.com
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Northern Sonoma County APCD
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To My Local Government Colleagues....

I am pleased to introduce this informational guide to air quality and land use issues focused on community health. As a former county supervisor, I know from experience the complexity of local land use decisions. There are multiple factors to consider and balance. This document provides important public health information that we hope will be considered along with housing needs, economic development priorities, and other quality of life issues.

An important focus of this document is prevention. We hope the air quality information provided will help inform decision-makers about the benefits of avoiding certain siting situations. The overarching goal is to avoid placing people in harm's way. Recent studies have shown that public exposure to air pollution can be substantially elevated near freeways and certain other facilities. What is encouraging is that the health risk is greatly reduced with distance. For that reason, we have provided some general recommendations aimed at keeping appropriate distances between sources of air pollution and land uses such as residences.

Land use decisions are a local government responsibility. The Air Resources Board's role is advisory and these recommendations do not establish regulatory standards of any kind. However, we hope that the information in this document will be seriously considered by local elected officials and land use agencies. We also hope that this document will promote enhanced communication between land use agencies and local air pollution control agencies. We developed this document in close coordination with the California Air Pollution Control Officers Association with that goal in mind.

I hope you find this document both informative and useful.

Barbara Riordan

Mrs. Barbara Riordan
Interim Chairman
California Air Resources Board

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Acknowledgments

The ARB staff would like to acknowledge the exceptional contributions made to this document by members of the ARB Environmental Justice Stakeholders Group. Since 2001, ARB staff has consistently relied on this group to provide critical and constructive input on implementing the specifics of ARB's environmental justice policies and actions. The Stakeholders Group is convened by the ARB, and comprised of representatives from local land use and air agencies, community interest groups, environmental justice organizations, academia, and business. Their assistance and suggestions throughout the development of this Handbook have been invaluable.

Executive Summary

The Air Resources Board's (ARB) primary goal in developing this document is to provide information that will help keep California's children and other vulnerable populations out of harm's way with respect to nearby sources of air pollution. Recent air pollution studies have shown an association between respiratory and other non-cancer health effects and proximity to high traffic roadways. Other studies have shown that diesel exhaust and other cancer-causing chemicals emitted from cars and trucks are responsible for much of the overall cancer risk from airborne toxics in California. Also, ARB community health risk assessments and regulatory programs have produced important air quality information about certain types of facilities that should be considered when siting new residences, schools, day care centers, playgrounds, and medical facilities (i.e., sensitive land uses). Sensitive land uses deserve special attention because children, pregnant women, the elderly, and those with existing health problems are especially vulnerable to the non-cancer effects of air pollution. There is also substantial evidence that children are more sensitive to cancer-causing chemicals.

Focusing attention on these siting situations is an important preventative action. ARB and local air districts have comprehensive efforts underway to address new and existing air pollution sources under their respective jurisdictions. The issue of siting is a local government function. As more data on the connection between proximity and health risk from air pollution become available, it is essential that air agencies share what we know with land use agencies. We hope this document will serve that purpose.

The first section provides ARB recommendations regarding the siting of new sensitive land uses near freeways, distribution centers, rail yards, ports, refineries, chrome plating facilities, dry cleaners, and gasoline dispensing facilities. This list consists of the air pollution sources that we have evaluated from the standpoint of the proximity issue. It is based on available information and reflects ARB's primary areas of jurisdiction – mobile sources and toxic air contaminants. A key air pollutant common to many of these sources is particulate matter from diesel engines. Diesel particulate matter (diesel PM) is a carcinogen identified by ARB as a toxic air contaminant and contributes to particulate pollution statewide.

Reducing diesel particulate emissions is one of ARB's highest public health priorities and the focus of a comprehensive statewide control program that is reducing diesel PM emissions each year. ARB's long-term goal is to reduce diesel PM emissions 85% by 2020. However, cleaning up diesel engines will take time as new engine standards phase in and programs to accelerate fleet turnover or retrofit existing engines are implemented. Also, these efforts are reducing diesel particulate emissions on a statewide basis, but do not yet capture every site where diesel vehicles and engines may congregate. Because living or going to school too close to such air pollution sources may increase both cancer and non-cancer health risks, we are recommending that proximity be considered in the siting of new sensitive land uses.

There are also other key toxic air contaminants associated with specific types of facilities. Most of these are subject to stringent state and local air district regulations. However, what we know today indicates that keeping new homes and other sensitive land uses from siting too close to such facilities would provide additional health protection. Chrome platers are a prime example of facilities that should not be located near vulnerable communities because of the cancer health risks from exposure to the toxic material used during their operations.

In addition to source specific recommendations, we also encourage land use agencies to use their planning processes to ensure the appropriate separation of industrial facilities and sensitive land uses. While we provide some suggestions, how to best achieve that goal is a local issue. In the development of these guidelines, we received valuable input from local government about the spectrum of issues that must be considered in the land use planning process. This includes addressing housing and transportation needs, the benefits of urban infill, community economic development priorities, and other quality of life issues. All of these factors are important considerations. The recommendations in the Handbook need to be balanced with other State and local policies.

Our purpose with this document is to highlight the potential health impacts associated with proximity to air pollution sources so planners explicitly consider this issue in planning processes. We believe that with careful evaluation, infill development, mixed use, higher density, transit-oriented development, and other concepts that benefit regional air quality can be compatible with protecting the health of individuals at the neighborhood level. One suggestion for achieving this goal is more communication between air agencies and land use planners. Local air districts are an important resource that should be consulted regarding sources of air pollution in their jurisdictions. ARB staff will also continue to provide updated technical information as it becomes available.

Our recommendations are as specific as possible given the nature of the available data. In some cases, like refineries, we suggest that the siting of new sensitive land uses should be avoided immediately downwind. However, we leave definition of the size of this area to local agencies based on facility specific considerations. Also, project design that would reduce air pollution exposure may be part of the picture and we encourage consultation with air agencies on this subject.

In developing the recommendations, our first consideration was the adequacy of the data available for an air pollution source category. Using that data, we assessed whether we could reasonably characterize the relative exposure and health risk from a proximity standpoint. That screening provided the list of air pollution sources that we were able to address with specific recommendations. We also considered the practical implications of making hard and fast recommendations where the potential impact area is large, emissions will be reduced with time, and air agencies are in the process of looking at options for additional emission control. In the end, we tailored our recommendations to minimize the highest exposures for each source category independently. Due to the large variability in relative risk in the source categories, we chose not to apply

a uniform, quantified risk threshold as is typically done in air quality permitting programs. Instead, because these guidelines are not regulatory or binding on local agencies, we took a more qualitative approach in developing the distance-based recommendations.

Where possible, we recommend a minimum separation between a new sensitive land use and known air pollution risks. In other cases, we acknowledge that the existing health risk is too high in a relatively large area, that air agencies are working to reduce that risk, and that in the meantime, we recommend keeping new sensitive land uses out of the highest exposure areas. However, it is critical to note that our implied identification of the high exposure areas for these sources does not mean that the risk in the remaining impact area is insignificant. Rather, we hope this document will bring further attention to the potential health risk throughout the impact area and help garner support for our ongoing efforts to reduce health risk associated with air pollution sources. Areas downwind of major ports, rail yards, and other inter-modal transportation facilities are prime examples.

We developed these recommendations as a means to share important public health information. The underlying data are publicly available and referenced in this document. We also describe our rationale and the factors considered in developing each recommendation, including data limitations and uncertainties. These recommendations are advisory and should not be interpreted as defined "buffer zones." We recognize the opportunity for more detailed site-specific analyses always exists, and that there is no "one size fits all" solution to land use planning.

As California continues to grow, we collectively have the opportunity to use all the information at hand to avoid siting scenarios that may pose a health risk. As part of ARB's focus on communities and children's health, we encourage land use agencies to apply these recommendations and work more closely with air agencies. We also hope that this document will help educate a wider audience about the value of preventative action to reduce environmental exposures to air pollution.

1. ARB Recommendations on Siting New Sensitive Land Uses

Protecting California's communities and our children from the health effects of air pollution is one of the most fundamental goals of state and local air pollution control programs. Our focus on children reflects their special vulnerability to the health impacts of air pollution. Other vulnerable populations include the elderly, pregnant women, and those with serious health problems affected by air pollution. With this document, we hope to more effectively engage local land use agencies as partners in our efforts to reduce health risk from air pollution in all California communities.

Later sections emphasize the need to strengthen the connection between air quality and land use in both planning and permitting processes. Because the siting process for many, but not all air pollution sources involves permitting by local air districts, there is an opportunity for interagency coordination where the proposed location might pose a problem. To enhance the evaluation process from a land use perspective, section 4 includes recommended project related questions to help screen for potential proximity related issues.

Unlike industrial and other stationary sources of air pollution, the siting of new homes or day care centers does not require an air quality permit. Because these situations fall outside the air quality permitting process, it is especially important that land use agencies be aware of potential air pollution impacts.

The following recommendations address the issue of siting "sensitive land uses" near specific sources of air pollution; namely:

- High traffic freeways and roads
- Distribution centers
- Rail yards
- Ports
- Refineries
- Chrome plating facilities
- Dry cleaners
- Large gas dispensing facilities

The recommendations for each category include a summary of key information and guidance on what to avoid from a public health perspective.

Sensitive individuals refer to those segments of the population most susceptible to poor air quality (i.e., children, the elderly, and those with pre-existing serious health problems affected by air quality). Land uses where sensitive individuals are most likely to spend time include schools and schoolyards, parks and playgrounds, daycare centers, nursing homes, hospitals, and residential communities (sensitive sites or sensitive land uses).

We are characterizing sensitive land uses as simply as we can by using the example of residences, schools, day care centers, playgrounds, and medical facilities. However, a variety of facilities are encompassed. For example, residences can include houses, apartments, and senior living complexes. Medical facilities can include hospitals, convalescent homes, and health clinics. Playgrounds could be play areas associated with parks or community centers.

In developing these recommendations, ARB first considered the adequacy of the data available for each air pollution source category. We assessed whether we could generally characterize the relative exposure and health risk from a proximity standpoint. The documented non-cancer health risks include triggering of asthma attacks, heart attacks, and increases in daily mortality and hospitalization for heart and respiratory diseases. These health impacts are well documented in epidemiological studies, but less easy to quantify from a particular air pollution source. Therefore, the cancer health impacts are used in this document to provide a picture of relative risk. This screening process provided the list of source categories we were able to address with specific recommendations. In evaluating the available information, we also considered the practical implications of making hard and fast recommendations where the potential impact area is large, emissions will be reduced with time, and air agencies are in the process of looking at options for additional emission control. Due to the large variability in relative risk between the source categories, we chose not to apply a uniform, quantified risk threshold as is typically done in regulatory programs. Therefore, in the end, we tailored our recommendations to minimize the highest exposures for each source category independently. Additionally, because this guidance is not regulatory or binding on local agencies, we took a more qualitative approach to developing distance based recommendations.

Where possible, we recommend a minimum separation between new sensitive land uses and existing sources. However, this is not always possible, particularly where there is an elevated health risk over large geographical areas. Areas downwind of ports and rail yards are prime examples. In such cases, we recommend doing everything possible to avoid locating sensitive receptors within the highest risk zones. Concurrently, air agencies and others will be working to reduce the overall risk through controls and measures within their scope of authority.

The recommendations were developed from the standpoint of siting new sensitive land uses. Project-specific data for new and existing air pollution sources are available as part of the air quality permitting process. Where such information is available, it should be used. Our recommendations are designed to fill a gap where information about existing facilities may not be readily available. These recommendations are only guidelines and are not designed to substitute for more specific information if it exists.

A summary of our recommendations is shown in Table 1-1. The basis and references[1] supporting each of these recommendations, including health studies, air quality modeling and monitoring studies is discussed below beginning with freeways and summarized in Table 1-2. As new information becomes available, it will be included on ARB's community health web page.

[1]Detailed information on these references are available on ARB's website at: http://www.ARB.ca.gov/ch/landuse.htm.

Table 1-1

Recommendations on Siting New Sensitive Land Uses Such As Residences, Schools, Daycare Centers, Playgrounds, or Medical Facilities*

Source Category	Advisory Recommendations
Freeways and High-Traffic Roads	• Avoid siting new sensitive land uses within 500 feet of a freeway, urban roads with 100,000 vehicles/day, or rural roads with 50,000 vehicles/day.
Distribution Centers	• Avoid siting new sensitive land uses within 1,000 feet of a distribution center (that accommodates more than 100 trucks per day, more than 40 trucks with operating transport refrigeration units (TRUs) per day, or where TRU unit operations exceed 300 hours per week). • Take into account the configuration of existing distribution centers and avoid locating residences and other new sensitive land uses near entry and exit points.
Rail Yards	• Avoid siting new sensitive land uses within 1,000 feet of a major service and maintenance rail yard. • Within one mile of a rail yard, consider possible siting limitations and mitigation approaches.
Ports	• Avoid siting of new sensitive land uses immediately downwind of ports in the most heavily impacted zones. Consult local air districts or the ARB on the status of pending analyses of health risks.
Refineries	• Avoid siting new sensitive land uses immediately downwind of petroleum refineries. Consult with local air districts and other local agencies to determine an appropriate separation.
Chrome Platers	• Avoid siting new sensitive land uses within 1,000 feet of a chrome plater.
Dry Cleaners Using Perchloro-ethylene	• Avoid siting new sensitive land uses within 300 feet of any dry cleaning operation. For operations with two or more machines, provide 500 feet. For operations with 3 or more machines, consult with the local air district. • Do not site new sensitive land uses in the same building with perc dry cleaning operations.
Gasoline Dispensing Facilities	• Avoid siting new sensitive land uses within 300 feet of a large gas station (defined as a facility with a throughput of 3.6 million gallons per year or greater). A 50 foot separation is recommended for typical gas dispensing facilities.

*Notes:

- These recommendations are advisory. Land use agencies have to balance other considerations, including housing and transportation needs, economic development priorities, and other quality of life issues.

- Recommendations are based primarily on data showing that the air pollution exposures addressed here (i.e., localized) can be reduced as much as 80% with the recommended separation.
- The relative risk for these categories varies greatly (see Table 1-2). To determine the actual risk near a particular facility, a site-specific analysis would be required. Risk from diesel PM will decrease over time as cleaner technology phases in.
- These recommendations are designed to fill a gap where information about existing facilities may not be readily available and are not designed to substitute for more specific information if it exists. The recommended distances take into account other factors in addition to available health risk data (see individual category descriptions).
- Site-specific project design improvements may help reduce air pollution exposures and should also be considered when siting new sensitive land uses.
- This table does not imply that mixed residential and commercial development in general is incompatible. Rather it focuses on known problems like dry cleaners using perchloroethylene that can be addressed with reasonable preventative actions.
- A summary of the basis for the distance recommendations can be found in Table 1-2.

Table 1-2

Summary of Basis for Advisory Recommendations

Source Category	Range of Relative Cancer Risk[1,2]	Summary of Basis for Advisory Recommendations
Freeways and High-Traffic Roads	300 – 1,700	• In traffic-related studies, the additional non-cancer health risk attributable to proximity was seen within 1,000 feet and was strongest within 300 feet. California freeway studies show about a 70% drop off in particulate pollution levels at 500 feet.
Distribution Centers[3]	Up to 500	• Because ARB regulations will restrict truck idling at distribution centers, transport refrigeration unit (TRU) operations are the largest onsite diesel PM emission source followed by truck travel in and out of distribution centers. • Based on ARB and South Coast District emissions and modeling analyses, we estimate an 80 percent drop-off in pollutant concentrations at approximately 1,000 feet from a distribution center.
Rail Yards	Up to 500	• The air quality modeling conducted for the Roseville Rail Yard Study predicted the highest impact is within 1,000 feet of the Yard, and is associated with service and maintenance activities. The next highest impact is between a half to one mile of the Yard, depending on wind direction and intensity.
Ports	Studies underway	• ARB will evaluate the impacts of ports and develop a new comprehensive plan that will describe the steps needed to reduce public health impacts from port and rail activities in California. In the interim, a general advisory is appropriate based on the magnitude of diesel PM emissions associated with ports.
Refineries	Under 10	• Risk assessments conducted at California refineries show risks from air toxics to be under 10 chances of cancer per million.[4] • Distance recommendations were based on the amount and potentially hazardous nature of many of the pollutants released as part of the refinery process, particularly during non-routine emissions releases.
Chrome Platers	10-100	• ARB modeling and monitoring studies show localized risk of hexavalent chromium diminishing significantly at 300 feet. There are data limitations in both the modeling and monitoring studies. These include variability of plating activities and uncertainty of emissions such as fugitive dust. Hexavalent chromium is one of the most potent toxic air contaminants. Considering these factors, a distance of 1,000 feet was used as a precautionary measure.
Dry Cleaners Using Perchloro-ethylene (perc)	15-150	• Local air district studies indicate that individual cancer risk can be reduced by as much as 75 percent by establishing a 300 foot separation between a sensitive land use and a one-machine perc dry cleaning operation. For larger operations (2 machines or more), a separation of 500 feet can reduce risk by over 85 percent.

Source Category	Range of Relative Cancer Risk[1,2]	Summary of Basis for Advisory Recommendations
Gasoline Dispensing Facilities (GDF)[5]	Typical GDF: Less than 10 Large GDF: Between Less than 10 and 120	• Based on the CAPCOA Gasoline Service Station Industry-wide Risk Assessment Guidelines, most typical GDFs (less than 3.6 million gallons per year) have a risk of less than 10 at 50 feet under urban air dispersion conditions. Over the last few years, there has been a growing number of extremely large GDFs with sales over 3.6 and as high as 19 million gallons per year. Under rural air dispersion conditions, these large GDFs can pose a larger risk at a greater distance.

[1]For cancer health effects, risk is expressed as an estimate of the increased chances of getting cancer due to facility emissions over a 70-year lifetime. This increase in risk is expressed as chances in a million (e.g., 10 chances in a million).

[2]The estimated cancer risks are a function of the proximity to the specific category and were calculated independent of the regional health risk from air pollution. For example, the estimated regional cancer risk from air toxics in the Los Angeles region (South Coast Air Basin) is approximately 1,000 in a million.

[3]Analysis based on refrigerator trucks.

[4]Although risk assessments performed by refineries indicate they represent a low cancer risk, there is limited data on non-cancer effects of pollutants that are emitted from these facilities. Refineries are also a source of non-routine emissions and odors.

[5]A typical GDF in California dispenses under 3.6 million gallons of gasoline per year. The cancer risk for this size facility is likely to be less than 10 in a million at the fence line under urban air dispersion conditions.

A large GDF has fuel throughputs that can range from 3.6 to 19 million gallons of gasoline per year. The upper end of the risk range (i.e., 120 in a million) represents a hypothetical worst case scenario for an extremely large GDF under rural air dispersion conditions.

Freeways and High Traffic Roads

Air pollution studies indicate that living close to high traffic and the associated emissions may lead to adverse health effects beyond those associated with regional air pollution in urban areas. Many of these epidemiological studies have focused on children. A number of studies identify an association between adverse non-cancer health effects and living or attending school near heavily traveled roadways (see findings below). These studies have reported associations between residential proximity to high traffic roadways and a variety of respiratory symptoms, asthma exacerbations, and decreases in lung function in children.

One such study that found an association between traffic and respiratory symptoms in children was conducted in the San Francisco Bay Area. Measurements of traffic-related pollutants showed concentrations within 300 meters (approximately 1,000 feet) downwind of freeways were higher than regional values. Most other studies have assessed exposure based on proximity factors such as distance to freeways or traffic density.

These studies linking traffic emissions with health impacts build on a wealth of data on the adverse health effects of ambient air pollution. The data on the effects of proximity to traffic-related emissions provides additional information that can be used in land use siting and regulatory actions by air agencies. The key observation in these studies is that close proximity increases both exposure and the potential for adverse health effects. Other effects associated with traffic emissions include premature death in elderly individuals with heart disease.

Key Health Findings

- Reduced lung function in children was associated with traffic density, especially trucks, within 1,000 feet and the association was strongest within 300 feet. (Brunekreef, 1997)
- Increased asthma hospitalizations were associated with living within 650 feet of heavy traffic and heavy truck volume. (Lin, 2000)
- Asthma symptoms increased with proximity to roadways and the risk was greatest within 300 feet. (Venn, 2001)
- Asthma and bronchitis symptoms in children were associated with proximity to high traffic in a San Francisco Bay Area community with good overall regional air quality. (Kim, 2004)
- A San Diego study found increased medical visits in children living within 550 feet of heavy traffic. (English, 1999)

In these and other proximity studies, the distance from the roadway and truck traffic densities were key factors affecting the strength of the association with adverse health effects. In the above health studies, the association of traffic-related emissions with adverse health effects was seen within 1,000 feet and was

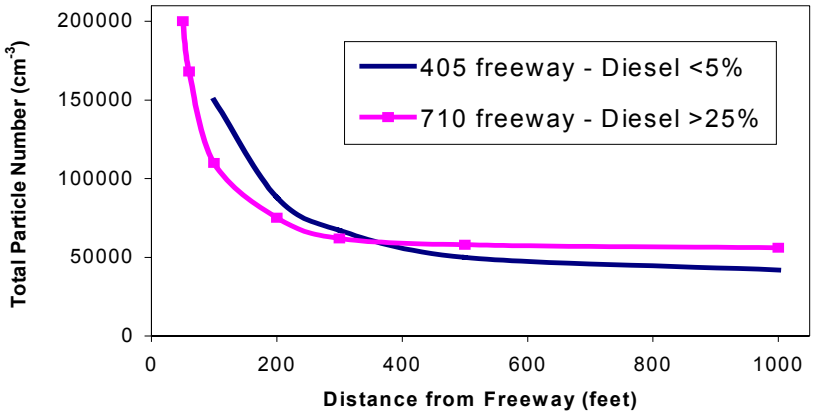
strongest within 300 feet. This demonstrates that the adverse effects diminished with distance.

In addition to the respiratory health effects in children, proximity to freeways increases potential cancer risk and contributes to total particulate matter exposure. There are three carcinogenic toxic air contaminants that constitute the majority of the known health risk from motor vehicle traffic – diesel particulate matter (diesel PM) from trucks, and benzene and 1,3-butadiene from passenger vehicles. On a typical urban freeway (truck traffic of 10,000-20,000/day), diesel PM represents about 70 percent of the potential cancer risk from the vehicle traffic. Diesel particulate emissions are also of special concern because health studies show an association between particulate matter and premature mortality in those with existing cardiovascular disease.

Distance Related Findings

A southern California study (Zhu, 2002) showed measured concentrations of vehicle-related pollutants, including ultra-fine particles, decreased dramatically within approximately 300 feet of the 710 and 405 freeways. Another study looked at the validity of using distance from a roadway as a measure of exposure

Figure 1-1
Decrease In Concentration of Freeway Diesel PM Emissions With Distance



to traffic related air pollution (Knape, 1999). This study showed that concentrations of traffic related pollutants declined with distance from the road, primarily in the first 500 feet.

These findings are consistent with air quality modeling and risk analyses done by ARB staff that show an estimated range of potential cancer risk that decreases with distance from freeways. The estimated risk varies with the local meteorology, including wind pattern. As an example, at 300 feet downwind from a freeway (Interstate 80) with truck traffic of 10,000 trucks per day, the potential cancer risk was as high as 100 in one million (ARB Roseville Rail Yard Study). The cancer health risk at 300 feet on the upwind side of the freeway was much

less. The risk at that distance for other freeways will vary based on local conditions – it may be higher or lower. However, in all these analyses the relative exposure and health risk dropped substantially within the first 300 feet. This phenomenon is illustrated in Figure 1-1.

State law restricts the siting of new schools within 500 feet of a freeway, urban roadways with 100,000 vehicles/day, or rural roadways with 50,000 vehicles with some exceptions.[2] However, no such requirements apply to the siting of residences, day care centers, playgrounds, or medical facilities. The available data show that exposure is greatly reduced at approximately 300 feet. In the traffic-related studies the additional health risk attributable to the proximity effect was strongest within 1,000 feet.

The combination of the children's health studies and the distance related findings suggests that it is important to avoid exposing children to elevated air pollution levels immediately downwind of freeways and high traffic roadways. These studies suggest a substantial benefit to a 500-foot separation.

The impact of traffic emissions is on a gradient that at some point becomes indistinguishable from the regional air pollution problem. As air agencies work to reduce the underlying regional health risk from diesel PM and other pollutants, the impact of proximity will also be reduced. In the meantime, as a preventative measure, we hope to avoid exposing more children and other vulnerable individuals to the highest concentrations of traffic-related emissions.

Recommendation

- Avoid siting new sensitive land uses within 500 feet of a freeway, urban roads with 100,000 vehicles/day, or rural roads with 50,000 vehicles/day.

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[2] Section 17213 of the California Education Code and section 21151.8 of the California Public Resources Code. See also Appendix E for a description of special processes that apply to school siting.

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Distribution Centers

Distribution centers or warehouses are facilities that serve as a distribution point for the transfer of goods. Such facilities include cold storage warehouses, goods transfer facilities, and inter-modal facilities such as ports. These operations involve trucks, trailers, shipping containers, and other equipment with diesel engines. A distribution center can be comprised of multiple centers or warehouses within an area. The size can range from several to hundreds of acres, involving a number of different transfer operations and long waiting periods. A distribution center can accommodate hundreds of diesel trucks a day that deliver, load, and/or unload goods up to seven days a week. To the extent that these trucks are transporting perishable goods, they are equipped with diesel-powered transport refrigeration units (TRUs) or TRU generator sets.

The activities associated with delivering, storing, and loading freight produces diesel PM emissions. Although TRUs have relatively small diesel-powered engines, in the normal course of business, their emissions can pose a significant health risk to those nearby. In addition to onsite emissions, truck travel in and out of distribution centers contributes to the local pollution impact.

ARB is working to reduce diesel PM emissions through regulations, financial incentives, and enforcement programs. In 2004, ARB adopted two airborne toxic control measures that will reduce diesel PM emissions associated with distribution centers. The first will limit nonessential (or unnecessary) idling of diesel-fueled commercial vehicles, including those entering from other states or countries. This statewide measure, effective in 2005, prohibits idling of a vehicle more than five minutes at any one location.[3] The elimination of unnecessary idling will reduce the localized impacts caused by diesel PM and other air toxics

[3] For further information on the Anti-Idling ATCM, please click on: http://www.arb.ca.gov/toxics/idling/outreach/factsheet.pdf

in diesel vehicle exhaust. This should be a very effective new strategy for reducing diesel PM emissions at distribution centers as well as other locations.

The second measure requires that TRUs operating in California become cleaner over time. The measure establishes in-use performance standards for existing TRU engines that operate in California, including out-of-state TRUs. The requirements are phased-in beginning in 2008, and extend to 2019.[4]

ARB also operates a smoke inspection program for heavy-duty diesel trucks that focuses on reducing truck emissions in California communities. Areas with large numbers of distribution centers are a high priority.

Key Health Findings

Diesel PM has been identified by ARB as a toxic air contaminant and represents 70 percent of the known potential cancer risk from air toxics in California. Diesel PM is an important contributor to particulate matter air pollution. Particulate matter exposure is associated with premature mortality and health effects such as asthma exacerbation and hospitalization due to aggravating heart and lung disease.

Distance Related Findings

Although distribution centers are located throughout the state, they are usually clustered near transportation corridors, and are often located in or near population centers. Diesel PM emissions from associated delivery truck traffic and TRUs at these facilities may result in elevated diesel PM concentrations in neighborhoods surrounding those sites. Because ARB regulations will restrict truck idling at distribution centers, the largest continuing onsite diesel PM emission source is the operation of TRUs. Truck travel in and out of distribution centers also contributes to localized exposures, but specific travel patterns and truck volumes would be needed to identify the exact locations of the highest concentrations.

As part of the development of ARB's regulation for TRUs, ARB staff performed air quality modeling to estimate exposure and the associated potential cancer risk of onsite TRUs for a typical distribution center. For an individual person, cancer risk estimates for air pollution are commonly expressed as a probability of developing cancer from a lifetime (i.e., 70 years) of exposure. These risks were calculated independent of regional risk. For example, the estimated regional cancer risk from air toxics in the Los Angeles region (South Coast Air Basin) is approximately 1,000 additional cancer cases per one million population.

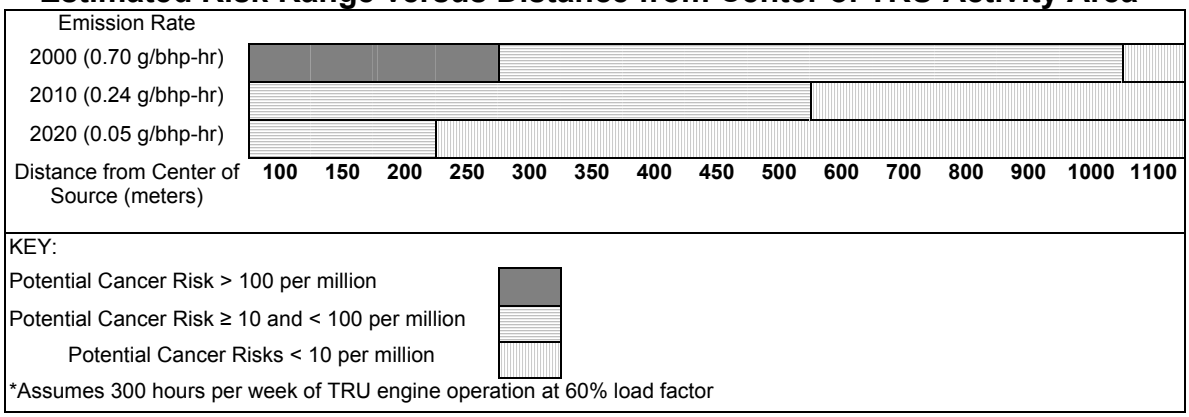
[4] For further information on the Transport Refrigeration Unit ATCM, please click on: http://www.arb.ca.gov/diesel/documents/trufaq.pdf

The diesel PM emissions from a facility are dependent on the size (horsepower), age, and number of engines, emission rates, the number of hours the truck engines and/or TRUs operate, distance, and meteorological conditions at the site. This assessment assumes a total on-site operating time for all TRUs of 300 hours per week. This would be the equivalent of 40 TRU-equipped trucks a day, each loading or unloading on-site for one hour, 12 hours a day and seven days a week.

As shown in Figure 1-2 below, at this estimated level of activity and assuming a current fleet diesel PM emission rate, the potential cancer risk would be over 100 in a million at 800 feet from the center of the TRU activity. The estimated potential cancer risk would be in the 10 to 100 per million range between 800 to 3,300 feet and fall off to less than 10 per million at approximately 3,600 feet. However with the implementation of ARB's regulation on TRUs, the risk will be significantly reduced.[5] We have not conducted a risk assessment for distribution centers based on truck traffic alone, but on an emissions basis, we would expect similar risks for a facility with truck volumes in the range of 100 per day.

Figure 1-2

Estimated Risk Range versus Distance from Center of TRU Activity Area*

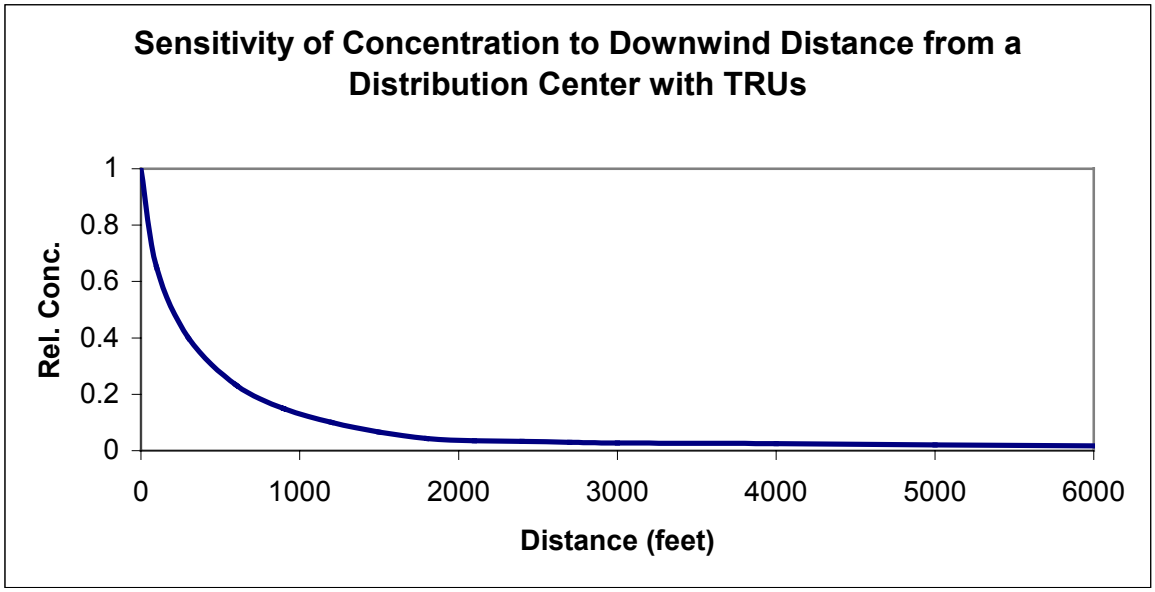


The estimated potential cancer risk level in Figure 1-2 is based on a number of assumptions that may not reflect actual conditions for a specific site. For example, increasing or decreasing the hours of diesel engine operations would change the potential risk levels. Meteorological and other facility specific parameters can also impact the results. Therefore, the results presented here are not directly applicable to any particular facility or operation. Rather, this information is intended to provide an indication as to the potential relative levels of risk that may be observed from operations at distribution centers. As shown in Figure 1-2, the estimated risk levels will decrease over time as lower-emitting diesel engines are used.

[5] These risk values assume an exposure duration of 70 years for a nearby resident and uses the methodology specified in the 2003 OEHHA health risk assessment guidelines.

Another air modeling analysis, performed by the South Coast Air Quality Management District (South Coast AQMD), evaluated the impact of diesel PM emissions from distribution center operations in the community of Mira Loma in southern California. Based on dispersion of diesel PM emissions from a large distribution center, Figure 1-3 shows the relative pollution concentrations at varying distances downwind. As Figure 1-3 shows, there is about an 80 percent drop off in concentration at approximately 1,000 feet.

Figure 1-3
Decrease In Relative Concentration of Risk
With Distance



Both the ARB and the South Coast AQMD analyses indicate that providing a separation of 1,000 feet would substantially reduce diesel PM concentrations and public exposure downwind of a distribution center. While these analyses do not provide specific risk estimates for distribution centers, they provide an indication of the range of risk and the benefits of providing a separation. ARB recommends a separation of 1,000 feet based on the combination of risk analysis done for TRUs and the decrease in exposure predicted with the South Coast AQMD modeling. However, ARB staff plans to provide further information on distribution centers as we collect more data and implement the TRU control measure.

Taking into account the configuration of distribution centers can also reduce population exposure and risk. For example, locating new sensitive land uses away from the main entry and exit points helps to reduce cancer risk and other health impacts.

Recommendations

- Avoid siting new sensitive land uses within 1,000 feet of a distribution center (that accommodates more than 100 trucks per day, more than 40 trucks with operating TRUs per day, or where TRU unit operations exceed 300 hours per week).

- Take into account the configuration of existing distribution centers and avoid locating residences and other new sensitive land uses near entry and exit points.

References

- *Airborne Toxic Control Measure To Limit Diesel-Fueled Commercial Motor Vehicle Idling.* ARB (August 20, 2004). Rule effectiveness date awaiting submittal of regulation to the Office of Administration Law. http://www.arb.ca.gov/regact/idling/idling.htm

- *Revised Staff Report: Initial Statement of Reasons for Proposed Rulemaking. Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units (TRU) and TRU Generator Sets, and Facilities Where TRUs Operate.* ARB (October 28, 2003). http://www.arb.ca.gov/regact/trude03/revisor.doc

- *Health Risk Assessment Guidance for Analyzing Cancer Risks from Mobile Source Diesel Idling Emissions for CEQA Air Quality Analysis.* SCAQMD (August 2003) http://www.aqmd.gov/ceqa/handbook/diesel_analysis.doc

- *"Mira Loma Study: Analysis of the Impact of Diesel Particulate Emissions from Warehouse/Distribution Center Operations",* PowerPoint presentation. SCAQMD (July 31, 2002)

Rail Yards

Rail yards are a major source of diesel particulate air pollution. They are usually located near inter-modal facilities, which attract heavy truck traffic, and are often sited in mixed industrial and residential areas. ARB, working with the Placer County air district and Union Pacific Railroad, recently completed a study[6] of the Roseville Rail Yard (Yard) in northern California that focused on the health risk from diesel particulate. A comprehensive emissions analysis and air quality modeling were conducted to characterize the estimated potential cancer risk associated with the facility.

[6] To review the study, please click on: http://www.arb.ca.gov/diesel/documents/rrstudy.htm

The Yard encompasses about 950 acres on a one-quarter mile wide by four-mile long strip of land that parallels Interstate 80. It is surrounded by commercial, industrial, and residential properties. The Yard is one of the largest service and maintenance rail yards in the West with over 30,000 locomotives visiting annually.

Using data provided by Union Pacific Railroad, the ARB determined the number and type of locomotives visiting the Yard annually and what those locomotives were doing - moving, idling, or undergoing maintenance testing. Union Pacific provided the annual, monthly, daily, and hourly locomotive activity in the yard including locomotive movements; routes for arrival, departure, and through trains; and locomotive service and testing. This information was used to estimate the emissions of particulate matter from the locomotives, which was then used to model the potential impacts on the surrounding community.

The key findings of the study are:

- Diesel PM emissions in 2000 from locomotive operations at the Roseville Yard were estimated at about 25 tons per year.

- Of the total diesel PM in the Yard, moving locomotives accounted for about 50 percent, idling locomotives about 45 percent, and locomotive testing about five percent.

- Air quality modeling predicts potential cancer risks greater than 500 in a million (based on 70 years of exposure) in a 10-40 acre area immediately adjacent to the Yard's maintenance operations.

- The risk assessment also showed elevated cancer risk impacting a larger area covering about a 10 by 10 mile area around the Yard.

The elevated concentrations of diesel PM found in the study contribute to an increased risk of cancer and premature death due to cardiovascular disease, and non-cancer health effects such as asthma and other respiratory illnesses. The magnitude of the risk, the general location, and the size of the impacted area depended on the meteorological data used to characterize conditions at the Yard, the dispersion characteristics, and exposure assumptions. In addition to these variables, the nature of locomotive activity will influence a risk characterization at a particular rail yard. For these reasons, the quantified risk estimates in the Roseville Rail Yard Study cannot be directly applied to other rail yards. However, the study does indicate the health risk due to diesel PM from rail yards needs to be addressed. ARB, in conjunction with the U.S. Environmental Protection Agency (U.S. EPA), and local air districts, is working with the rail industry to identify and implement short term, mid-term and long-term mitigation strategies. ARB also intends to conduct a second rail study in southern California to increase its understanding of rail yard operations and the associated public health impacts.

Key Health Findings

Diesel PM has been identified by ARB as a toxic air contaminant and represents 70 percent of the known potential cancer risk from air toxics in California. Diesel PM is an important contributor to particulate matter air pollution. Particulate matter exposure is associated with premature mortality and health effects such as asthma exacerbation and hospitalization due to aggravating heart and lung disease.

Distance Related Findings

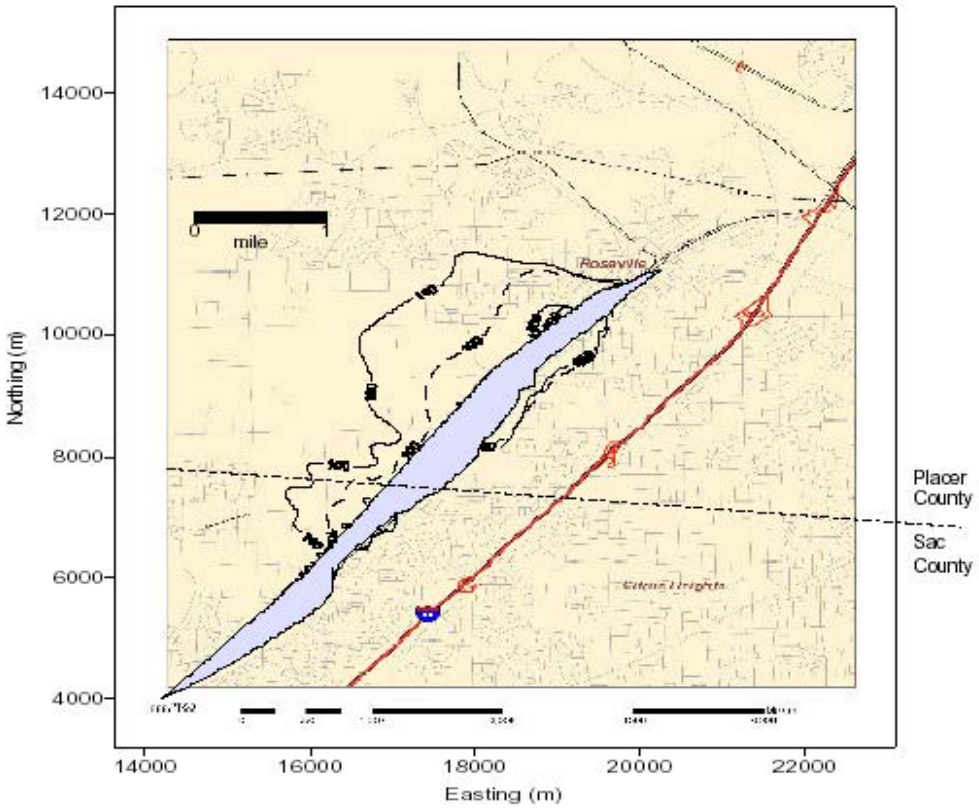
Two sets of meteorological data were used in the Roseville study because of technical limitations in the data. The size of the impact area was highly dependent on the meteorological data set used. The predicted highest impact area ranged from 10 - 40 acres with the two different meteorological data sets. This area, with risks estimated above 500 in a million, is adjacent to an area that includes a maintenance shop (see Figure 1-4). The high concentration of diesel PM emissions is due to the number of locomotives and nature of activities in this area, particularly idling locomotives.

The area of highest impact is within 1,000 feet of the Yard. The next highest impact zone as defined in the report had a predicted risk between 500 and 100 in one million and extends out between a half to one mile in some spots, depending on which meteorological conditions were assumed. The impact areas are irregular in shape making it difficult to generalize about the impact of distance at a particular location. However, the Roseville Rail Yard Study clearly indicates that the localized health risk is high, the impact area is large, and mitigation of the locomotive diesel PM emissions is needed.

For facilities like rail yards and ports, the potential impact area is so large that the real solution is to substantially reduce facility emissions. However, land use planners can avoid encroaching upon existing rail facilities and those scheduled for expansion. We also recommend that while air agencies tackle this problem, land use planners try not to add new sensitive individuals into the highest exposure areas. Finally, we recommend that land use agencies consider the potential health impacts of rail yards in their planning and permitting processes. Additional limitations and mitigation may be feasible to further reduce exposure on a site-specific basis.

Figure 1-4

Estimated Cancer Risk from the Yard
(100 and 500 in a million risk isopleths)



Notes: 100/Million Contours: Solid Line – Roseville Met Data; Dashed Line-McClellan Met Data, Urban Dispersion Coefficients, 80th Percentile Breathing Rate, All Locomotives' Activities (23 TPY), 70-Year Exposure

Recommendation

- Avoid siting new sensitive land uses within 1,000 feet of a major service and maintenance rail yard[7].
- Within one mile of a rail yard, consider possible siting limitations and mitigation approaches.

References

- *Roseville Rail Yard Study.* ARB (2004)

[7] The rail yard risk analysis was conducted for the Union Pacific rail yard in Roseville, California. This rail yard is one of the largest in the state. There are other rail yards in California with comparable levels of activity that should be considered "major" for purposes of this Handbook.

Ports

Air pollution from maritime port activities is a growing concern for regional air quality as well as air quality in nearby communities. The primary air pollutant associated with port operations is directly emitted diesel particulate. Port-related activities also result in emissions that form ozone and secondary particulate in the atmosphere. The emission sources associated with ports include diesel engine-powered ocean-going ships, harbor craft, cargo handling equipment, trucks, and locomotives. The size and concentration of these diesel engines makes ports one of the biggest sources of diesel PM in the state. For that reason, ARB has made it a top priority to reduce diesel PM emissions at the ports, in surrounding communities, and throughout California.

International, national, state, and local government collaboration is critical to reducing port emissions based on both legal and practical considerations. For example, the International Maritime Organization (IMO) and the U.S. EPA establish emission standards for ocean-going vessels and U.S.-flagged harbor craft, respectively. ARB is pursuing further federal actions to tighten these standards. In addition, ARB and local air districts are reducing emissions from ports through a variety of approaches. These include: incentive programs to fund cleaner engines, enhanced enforcement of smoke emissions from ships and trucks, use of dockside electricity instead of diesel engines, cleaner fuels for ships, harbor craft, locomotives, and reduced engine idling. The two ATCMs that limit truck idling and reduce emissions from TRUs (discussed under “Distribution Centers”) also apply to ports.

ARB is also developing several other regulations that will reduce port-related emissions. One rule would require ocean-going ships to use a cleaner marine diesel fuel to power auxiliary engines while in California coastal waters and at dock. Ships that frequently visit California ports would also be required to further reduce their emissions. ARB has adopted a rule that would require harbor craft to use the same cleaner diesel fuel used by on-road trucks in California. In 2005, ARB will consider a rule that would require additional controls for in-use harbor craft, such as the use of add-on emission controls and accelerated turnover of older engines.

Key Health Findings

Port activities are a major source of diesel PM. Diesel PM has been identified by ARB as a toxic air contaminant and represents 70 percent of the known potential cancer risk from air toxics in California. Diesel PM is an important contributor to particulate matter air pollution. Particulate matter exposure is associated with premature mortality and health effects such as asthma exacerbation and hospitalization due to aggravating heart and lung disease.

Distance Related Findings

The Ports of Los Angeles and Long Beach provide an example of the emissions impact of port operations. A comprehensive emissions inventory was completed in June 2004. These ports combined are one of the world's largest and busiest seaports. Located in San Pedro Bay, about 20 miles south of downtown Los Angeles, the port complex occupies approximately 16 square miles of land and water. Port activities include five source categories that produce diesel emissions. These are ocean-going vessels, harbor craft, cargo handling equipment, railroad locomotives, and heavy-duty trucks.

The baseline emission inventory provides emission estimates for all major air pollutants. This analysis focuses on diesel PM from in-port activity because these emissions have the most potential health impact on the areas adjacent to the port. Ocean vessels are the largest overall source of diesel PM related to the ports, but these emissions occur primarily outside of the port in coastal waters, making the impact more regional in nature.

The overall in-port emission inventory for diesel particulate for the ports of Los Angeles and Long Beach is estimated to be 550 tons per year. The emissions fall in the following major categories: ocean-going vessels (17%), harbor craft (25%), cargo handling (47%), railroad locomotive (3%), and heavy duty vehicles (8%). In addition to in-port emissions, ship, rail, and trucking activities also contribute to regional emissions and increase emissions in nearby neighborhoods. Off-port emissions associated with related ship, rail, and trucking activities contribute an additional 680 tons per year of diesel particulate at the Port of Los Angeles alone.

To put this in perspective, the diesel PM emissions estimated for the Roseville Yard in ARB's 2004 study are 25 tons per year. The potential cancer risk associated with these emissions is 100 in one million at a distance of one mile, or one half mile, depending on the data set used. This rail yard covers one and a half square miles. The Los Angeles and Long Beach ports have combined diesel PM emissions of 550 tons per year emitted from a facility that covers a much larger area - 16 miles. The ports have about twice the emission density of the rail yard - 34 tons per year per square mile compared to 16 tons per year per square mile. However, while this general comparison is illustrative of the overall size of the complex, a detailed air quality modeling analysis would be needed to assess the potential health impact on specific downwind areas near the ports.

ARB is in the process of evaluating the various port-related emission sources from the standpoint of existing emissions, growth forecasts, new control options, regional air quality impacts, and localized health risk. A number of public processes - both state and local - are underway to address various aspects of these issues. Until more of these analyses are complete, there is little basis for recommending a specific separation between new sensitive land uses and ports.

For example, the type of data we have showing the relationship between air pollutant concentrations and distance from freeways is not yet available.

Also, the complexity of the port facilities makes a site-specific analysis critical. Ports are a concentration of multiple emission sources with differing dispersion and other characteristics. In the case of the Roseville rail yard, we found a high, very localized impact associated with a particular activity, service and maintenance. By contrast, the location, size, and nature of impact areas can be expected to vary substantially for different port activities. For instance, ground level emissions from dockside activities would behave differently from ship stack level emissions.

Nonetheless, on an emissions basis alone, we expect locations downwind of ports to be substantially impacted. For that reason, we recommend that land use agencies track the current assessment efforts, and consider limitations on the siting of new sensitive land uses in areas immediately downwind of ports.

Recommendations

Avoid siting new sensitive land uses immediately downwind of ports in the most heavily impacted zones. Consult local air districts or the ARB on the status of pending analyses of health risks.

References

- *Roseville Rail Yard Study.* ARB (2004)
- Final Draft, "*Port-Wide Baseline Air Emissions Inventory."* Port of Los Angeles (June 2004)
- Final Draft, "*2002 Baseline Air Emissions Inventory."* Port of Long Beach (February 2004)

Petroleum Refineries

A petroleum refinery is a complex facility where crude oil is converted into petroleum products (primarily gasoline, diesel fuel, and jet fuel), which are then transported through a system of pipelines and storage tanks for final distribution by delivery truck to fueling facilities throughout the state. In California, most crude oil is delivered either by ship from Alaska or foreign sources, or is delivered via pipeline from oil production fields within the state. The crude oil then undergoes many complex chemical and physical reactions, which include distillation, catalytic cracking, reforming, and finishing. These refining processes have the potential to emit air contaminants, and are subject to extensive emission controls by district regulations.

As a result of these regulations covering the production, marketing, and use of gasoline and other oil by-products, California has seen significant regional air quality benefits both in terms of cleaner fuels and cleaner operating facilities. In

the 1990s, California refineries underwent significant modifications and modernization to produce cleaner fuels in response to changes in state law. Nevertheless, while residual emissions are small when compared to the total emissions controlled from these major sources, refineries are so large that even small amounts of fugitive, uncontrollable emissions and associated odors from the operations, can be significant. This is particularly the case for communities that may be directly downwind of the refinery. Odors can cause health symptoms such as nausea and headache. Also, because of the size, complexity, and vast numbers of refinery processes onsite, the occasional refinery upset or malfunction can potentially result in acute or short-term health effects to exposed individuals.

Key Health Findings

Petroleum refineries are large single sources of emissions. For volatile organic compounds (VOCs), eight of the ten largest stationary sources in California are petroleum refineries. For oxides of nitrogen (NOx), four of the ten largest stationary sources in California are petroleum refineries. Both of these compounds react in the presence of sunlight to form ozone. Ozone impacts lung function by irritating and damaging the respiratory system. Petroleum refineries are also large stationary sources of both particulate matter under 10 microns in size (PM_{10}) and particulate matter under 2.5 microns in size ($PM_{2.5}$). Exposure to particulate matter aggravates a number of respiratory illnesses, including asthma, and is associated with premature mortality in people with existing cardiac and respiratory disease. Both long-term and short-term exposure can have adverse health impacts. Finer particles pose an increased health risk because they can deposit deep in the lung and contain substances that are particularly harmful to human health. NOx are also significant contributors to the secondary formation of $PM_{2.5}$.

Petroleum refineries also emit a variety of toxic air pollutants. These air toxics vary by facility and process operation but may include: acetaldehyde, arsenic, antimony, benzene, beryllium, 1,3-butadiene, cadmium compounds, carbonyl sulfide, carbon disulfide, chlorine, dibenzofurans, diesel particulate matter, formaldehyde, hexane, hydrogen chloride, lead compounds, mercury compounds, nickel compounds, phenol, 2,3,7,8 tetrachlorodibenzo-p-dioxin, toluene, and xylenes (mixed) among others. The potential health effects associated with these air toxics can include cancer, respiratory irritation, and damage to the central nervous system, depending on exposure levels.

Distance Related Findings

Health risk assessments for petroleum refineries have shown risks from toxic air pollutants that have quantifiable health risk values to be around 10 potential cancer cases per million. Routine air monitoring and several air monitoring studies conducted in the San Francisco Bay Area (Crockett) and the South Coast Air Basin (Wilmington) have not identified significant health risks specifically

associated with refineries. However, these studies did not measure diesel PM as no accepted method currently exists, and there are many toxic air pollutants that do not have quantifiable health risk values.

In 2002, ARB published a report on the results of the state and local air district air monitoring done near oil refineries. The purpose of this evaluation was to try to determine how refinery-related emissions might impact nearby communities. This inventory of air monitoring activities included 10 ambient air monitoring stations located near refineries in Crockett and four stations near refineries in Wilmington. These monitoring results did not identify significant increased health risks associated with the petroleum refineries. In 2002-2003, ARB conducted additional monitoring studies in communities downwind of refineries in Crockett and Wilmington. These monitoring results also did not indicate significant increased health risks from the petroleum refineries.

Consequently, there are no air quality modeling or air monitoring data that provides a quantifiable basis for recommending a specific separation between refineries and new sensitive land uses. However, in view of the amount and potentially hazardous nature of many of the pollutants released as part of the refinery process, we believe the siting of new sensitive land uses immediately downwind should be avoided. Land use agencies should consult with the local air district when considering how to define an appropriate separation for refineries within their jurisdiction.

Recommendations

- Avoid siting new sensitive land uses immediately downwind of petroleum refineries. Consult with local air districts and other local agencies to determine an appropriate separation.

References

- *Review of Current Ambient Air Monitoring Activities Related to California Bay Area and South Coast Refineries. ARB (March 2002)* http://www.arb.ca.gov/aaqm/qmosqual/special/mldrefinery.pdf
- *Community Air Quality Monitoring: Special Studies – Crockett. ARB (September 2004)* http://www.arb.ca.gov/ch/communities/studies/crockett/crockett.htm
- *Wilmington Study - Air Monitoring Results. ARB (2003)* http://www.arb.ca.gov/ch/communities/studies/wilmington/wilmington.htm

Chrome Plating Operations

Chrome plating operations rely on the use of the toxic metal hexavalent chromium, and have been subject to ARB and local air district control programs for many years. Regulation of chrome plating operations has reduced statewide emissions substantially. However, due to the nature of chrome plating

operations and the highly toxic nature of hexavalent chromium, the remaining health risk to nearby residents is a continuing concern.

Chrome plating operations convert hexavalent chromium in solution to a chromium metal layer by electroplating, and are categorized based upon the thickness of the chromium metal layer applied. In “decorative plating”, a layer of nickel is first plated over a metal substrate. Following this step, a thin layer of chromium is deposited over the nickel layer to provide a decorative and protective finish, for example, on faucets and automotive wheels. “Hard chrome plating” is a process in which a thicker layer of chromium metal is deposited directly on metal substrates such as engine parts, industrial machinery, and tools to provide greater protection against corrosion and wear.

Hexavalent chromium is emitted into the air when an electric current is applied to the plating bath. Emissions are dependent upon the amount of electroplating done per year and the control requirements. A unit of production referred to as an ampere-hour represents the amount of electroplating produced. Small facilities have an annual production rate of 100,000 – 500,000 ampere-hours, while medium-size facilities may have a production rate of 500,000 to about 3 million ampere-hours. The remaining larger facilities have a range of production rates that can be as high as 80 million ampere-hours.

The control requirements, which reduce emissions from the plating tanks, vary according to the size and type of the operation. Facilities either install add-on pollution control equipment, such as filters and scrubbers, or in-tank controls, such as fume suppressants and polyballs. With this combination of controls, the overall hexavalent chromium emissions have been reduced by over 90 percent. Larger facilities typically have better controls that can achieve efficiencies greater than 99 percent. However, even with stringent controls, the lack of maintenance and good housekeeping practices can lead to problems. And, since the material itself is inherently dangerous, any lapse in compliance poses a significant risk to nearby residents.

A 2002 ARB study in the San Diego community of Barrio Logan measured unexpectedly high concentrations of hexavalent chromium near chrome platers. The facilities were located in a mixed-use area with residences nearby. The study found that fugitive dust laden with hexavalent chromium was an important source of emissions that likely contributed to the elevated cancer risk. Largely as a result of this study, ARB is in the process of updating the current requirements to further reduce the emissions from these facilities.

In December 2004, the ARB adopted an ATCM to reduce emissions of hexavalent chromium and nickel from thermal spraying operations through the installation of best available control technology. The ATCM requires all existing facilities to comply with its requirements by January 1, 2006. New and modified thermal spraying operations must comply upon initial startup. An existing thermal spraying facility may be exempt from the minimum control efficiency

requirements of the ATCM if it is located at least 1,640 feet from the nearest sensitive receptor and emits no more than 0.5 pound per year of hexavalent chromium.[8]

Key Health Findings

Hexavalent chromium is one of the most toxic air pollutants regulated by the State of California. Hexavalent chromium is a carcinogen and has been identified in worker health studies as causing lung cancer. Exposure to even very low levels of hexavalent chromium should be avoided.

The California Office of Environmental Health Hazard Assessment has found that: 1) many epidemiological studies show a strong association between hexavalent chromium exposure in the work place and respiratory cancer; and 2) all short-term assays reported show that hexavalent chromium compounds can cause damage to human DNA.

Hexavalent chromium when inhaled over a period of many years can cause a variety of non-cancer health effects. These health effects include damage to the nose, blood disorders, lung disease, and kidney damage. The non-cancer health impacts occur with exposures considerably higher than exposures causing significant cancer risks. It is less likely that the public would be exposed to hexavalent chromium at levels high enough to cause these non-cancer health effects. Non-cancer health effects, unlike cancer health effects, have a threshold or exposure level below which non-cancer health effects would not be expected.

Distance Related Findings

ARB's 2002 Barrio Logan Study measured concentrations of hexavalent chromium in the air near two chrome plating facilities. The study was conducted from December 2001 to May 2002. There were two chrome platers on the street - one decorative and one hard plater. The purpose of the study was to better understand the near source impact of hexavalent chromium emissions. Air monitors were placed at residences next to the platers and at varying distances down the street. The monitors were moved periodically to look at the spatial distribution of the impact. Source testing and facility inspections identified one of the facilities as the likely source.

The first two weeks of monitoring results showed unexpectedly high levels of hexavalent chromium at a number of the monitoring sites. The high concentrations were intermittent. The concentrations ranged from 1 to 22 ng/m3 compared to the statewide average of 0.1 ng/m3. If these levels were to continue for 70 years, the potential cancer risk would be 150 in one million. The highest value was found at an air monitor behind a house adjacent to one of the

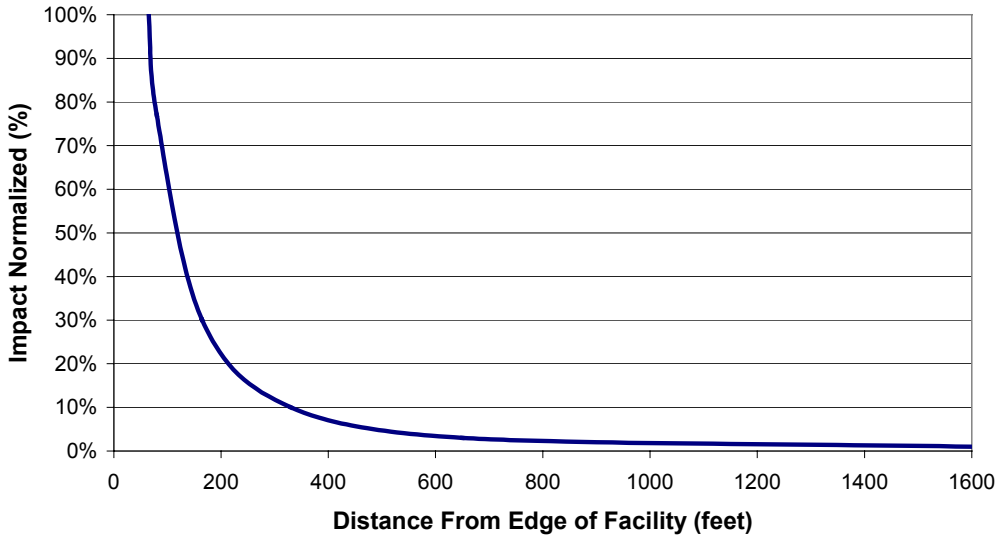
[8] For further information on the ATCM, please refer to: http://www.arb.ca.gov/regact/thermspr/thermalspr.htm

plating facilities–approximately 30 feet from the back entrance. Lower, but significant concentrations were found at an ambient air monitor 250 feet away.

The monitoring covered a period when the facility was not operating its plating tank. During this period, one of the highest concentrations was measured at an adjacent house. It appears that chromium-laden dust was responsible for high concentrations at this location since there was no plating activity at the time. Dust samples from the facility were tested and found to contain high levels of hexavalent chromium. On the day the highest concentration was measured at the house next door, a monitor 350 feet away from the plater's entrance showed very little impact. Similar proximity effects are shown in ARB modeling studies.

Figure 1-5 shows how the relative health risk varies as a function of distance from a chrome plater. This analysis is based on a medium-sized chrome plater with an annual production rate of 3 million ampere-hours. As shown in Figure 1- 5, the potential health risk drops off rapidly, with over 90 percent reduction in risk within 300 feet. This modeling was done in 2003 as part of a review of ARB's current air toxic control measure for chrome platers and is based on data from a recent ARB survey of chrome platers in California. The emission

Figure 1-5
Risk vs. Distance From Chrome Plater
(Based on plating tank emissions)



rates are only for plating operations. Because there are insufficient data available to directly quantify the impacts, the analysis does not include fugitive emissions, which the Barrio Logan analysis indicated could be significant.

Both the ARB Barrio Logan monitoring results and ARB's 2003 modeling analysis suggests that the localized emissions impact of a chrome plater diminishes significantly at 300 feet. However, in developing our recommendation, we also considered the following factors:

- some chrome platers will have higher volumes of plating activity,
- potential dust impacts were not modeled,
- we have only one monitoring study looking at the impact of distance, and,
- hexavalent chromium is one of the most potent toxic air contaminants ARB has identified.

Given these limitations in the analysis, we recommend a separation of 1,000 feet as a precautionary measure. For large chrome platers, site specific information should be obtained from the local air district.

Recommendation

- Avoid siting new sensitive land uses within 1,000 feet of a chrome plater.

References

- *Ambient Air Monitoring for Hexavalent Chromium and Metals in Barrio Logan: May 2001 through May 2002.* ARB, Monitoring and Laboratory Division (October 14, 2003)
- *Draft Barrio Logan Report.* ARB, Planning and Technical Support Division (November 2004)
- *Proposed Amendments to the Hexavalent Chromium Control Measure for Decorative and Hard Chrome Plating and Chromic Acid Anodizing Facilities.* ARB (April 1998)
- Murchison, Linda; Suer, Carolyn; Cook, Jeff. *"Neighborhood Scale Monitoring in Barrio Logan," (*AWMA Annual Conference Proceedings, June 2003)

Dry Cleaners Using Perchloroethylene (Perc Dry Cleaners)

Perchloroethylene (perc) is the solvent most commonly used by the dry cleaning industry to clean clothes or other materials. The ARB and other public health agencies have identified perc as a potential cancer-causing compound. Perc persists in the atmosphere long enough to contribute to both regional air pollution and localized exposures. Perc dry cleaners are the major source of perc emissions in California.

Since 1990, the statewide concentrations and health risk from exposure to perc has dropped over 70 percent. This is due to a number of regulatory requirements on perc dry cleaners and other sources, including degreasing operations, brake cleaners, and adhesives. ARB adopted an Airborne Toxic Control Measure (ATCM) for Perc Emissions from Dry Cleaning Operations in 1993. ARB has also prohibited the use of perc in aerosol adhesives and automotive brake cleaners.

Perc dry cleaners statewide are required to comply with ARB and local air district regulations to reduce emissions. However, even with these controls, some emissions continue to occur. Air quality studies indicate that there is still the potential for significant risks even near well-controlled dry cleaners. The South Coast AQMD has adopted a rule requiring that all new dry cleaners use alternatives to perc and that existing dry cleaners phase out the use of perc by December 2020. Over time, transition to non-toxic alternatives should occur. However, while perc continues to be used, a preventative approach should be taken to siting of new sensitive land uses.

Key Health Findings

Inhalation of perc may result in both cancer and non-cancer health effects. An assessment by California's Office of Environmental Health Hazard Assessment (OEHHA) concluded that perc is a potential human carcinogen and can cause non-cancer health effects. In addition to the potential cancer risk, the effects of long-term exposure include dizziness, impaired judgment and perception, and damage to the liver and kidneys. Workers have shown signs of liver toxicity following chronic exposure to perc, as well as kidney dysfunction and neurological effects. Non-cancer health effects occur with higher exposure levels than those associated with significant cancer risks. The public is more likely to be exposed to perchloroethylene at levels causing significant cancer risks than to levels causing non-cancer health effects. Non-cancer health effects, unlike cancer health effects, have a threshold or exposure level below which non-cancer health effects would not be expected. The ARB formally identified perc as a toxic air contaminant in October 1991.

One study has determined that inhalation of perc is the predominant route of exposure to infants living in apartments co-located in the same building with a business operating perc dry cleaning equipment. Results of air sampling within co-residential buildings indicate that dry cleaners can cause a wide range of exposures depending on the type and maintenance of the equipment. For example, a well-maintained state-of-the-art system may have risks in the range of 10 in one million, whereas a badly maintained machine with major leaks can have potential cancer risks of thousands in one million.

The California Air Pollution Control Officers Association (CAPCOA) is developing Industry-wide Risk Assessment Guidelines for Perchloroethylene Dry Cleaners which, when published, will provide detailed information on public health risk from exposure to emissions from this source.

Distance Related Findings

Risk created by perc dry cleaning is dependent on the amount of perc emissions, the type of dry cleaning equipment, proximity to the source, and how the emissions are released and dispersed (e.g., type of ventilation system, stack parameters, and local meteorology). Dry cleaners are often located near

residential areas, and near shopping centers, schools, day-care centers, and restaurants.

The vast majority of dry cleaners in California have one dry cleaning machine per facility. The South Coast AQMD estimates that an average well-controlled dry cleaner uses about 30 to 160 gallons of cleaning solvent per year, with an average of about 100 gallons. Based on these estimates, the South Coast AQMD estimates a potential cancer risk between 25 to 140 in one million at residential locations 75 feet or less from the dry cleaner, with an average of about 80 in one million. The estimate could be as high as 270 in one million for older machines.

CAPCOA's draft industry-wide risk assessment of perc dry cleaning operations indicates that the potential cancer risk for many dry cleaners may be in excess of potential cancer risk levels adopted by the local air districts. The draft document also indicates that, in general, the public's exposure can be reduced by at least 75 percent, by providing a separation distance of about 300 feet from the operation. This assessment is based on a single machine with perc use of about 100 gallons per year. At these distances, the potential cancer risk would be less than 10 potential cases per million for most scenarios.

The risk would be proportionately higher for large, industrial size, dry cleaners. These facilities typically have two or more machines and use 200 gallons or more per year of perc. Therefore, separation distances need to be greater for large dry cleaners. At a distance of 500 feet, the remaining risk for a large plant can be reduced by over 85 percent.

In California, a small number of dry cleaners that are co-located (sharing a common wall, floor, or ceiling) with a residence have the potential to expose the inhabitants of the residence to high levels of perc. However, while special requirements have been imposed on these existing facilities, the potential for exposure still exists. Avoiding these siting situations in the future is an important preventative measure.

Local air districts are a source of information regarding specific dry cleaning operations—particularly for large industrial operations with multiple machines. The 300 foot separation recommended below reflects the most common situation – a dry cleaner with only one machine. While we recommend 500 feet when there are two or more machines, site specific information should be obtained from the local air district for some very large industrial operations. Factors that can impact the risk include the number and type of machines, controls used, source configuration, building dimensions, terrain, and meteorological data.

Recommendation

- Avoid siting new sensitive land uses within 300 feet of any dry cleaning operation. For operations with two or more machines provide 500 feet. For operations with 3 or more machines, consult with the local air district.

- Do not site new sensitive land uses in the same building with perc dry cleaning operations.

References

- *Proposed Amended Rule 1421 – Control of Perchloroethylene Emissions from Dry Cleaning Systems,* Final Staff Report. South Coast AQMD. (October 2002)
- *Air Toxic Control Measure for Emissions of Perchloroethylene from Dry Cleaning Operations.* ARB (1994) (http://www.arb.ca.gov/toxics/atcm/percatcm.htm)
- *"An Assessment of Tetrachloroethylene in Human Breast Milk"*, Judith Schreiber, New York State Department of Health – Bureau of Toxic Substance Assessment, Journal of Exposure Analysis and Environmental Epidemiology, Vol.2, Suppl.2, pp. 15-26, 1992.
- Draft *Air Toxics "Hot Spots" Program Perchloroethylene Dry Cleaner Industry-wide Risk Assessment Guidelines.* (CAPCOA (November 2002)
- *Final Environmental Assessment for Proposed Amended Rule 1421 – Control of Perchloroethylene Emissions from Dry Cleaning Systems.* South Coast AQMD. (October 18, 2002)

Gasoline Dispensing Facilities

Refueling at gasoline dispensing facilities releases benzene into the air. Benzene is a potent carcinogen and is one of the highest risk air pollutants regulated by ARB. Motor vehicles and motor vehicle-related activity account for over 90 percent of benzene emissions in California. While gasoline-dispensing facilities account for a small part of total benzene emissions, near source exposures for large facilities can be significant.

Since 1990, benzene in the air has been reduced by over 75 percent statewide, primarily due to the implementation of emissions controls on motor vehicle vapor recovery equipment at gas stations, and a reduction in benzene levels in gasoline. However, benzene levels are still significant. In urban areas, average benzene exposure is equivalent to about 50 in one million.

Gasoline dispensing facilities tend to be located in areas close to residential and shopping areas. Benzene emissions from the largest gas stations may result in near source health risk beyond the regional background and district health risk thresholds. The emergence of very high gasoline throughput at large retail or

wholesale outlets makes this a concern as these types of outlets are projected to account for an increasing market share in the next few years.

Key Health Findings

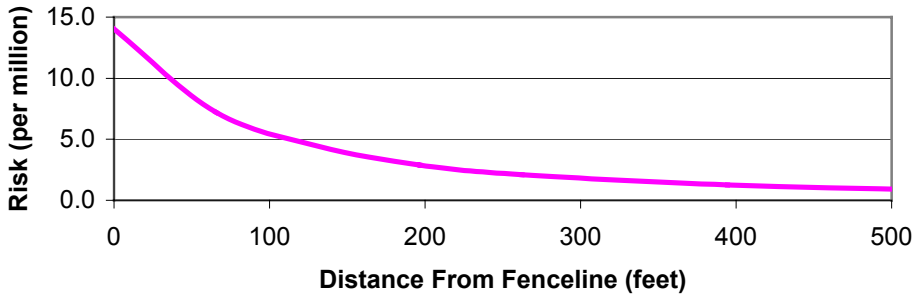
Benzene is a human carcinogen identified by ARB as a toxic air contaminant. Benzene also can cause non-cancer health effects above a certain level of exposure. Brief inhalation exposure to high concentrations can cause central nervous system depression. Acute effects include central nervous system symptoms of nausea, tremors, drowsiness, dizziness, headache, intoxication, and unconsciousness. It is unlikely that the public would be exposed to levels of benzene from gasoline dispensing facilities high enough to cause these non-cancer health effects.

Distance Related Findings

A well-maintained vapor recovery system can decrease emissions of benzene by more than 90% compared with an uncontrolled facility. Almost all facilities have emission control systems. Air quality modeling of the health risks from gasoline dispensing facilities indicate that the impact from the facilities decreases rapidly as the distance from the facility increases.

Statistics reported in the ARB's staff reports on Enhanced Vapor Recovery released in 2000 and 2002, indicated that almost 96 percent of the gasoline dispensing facilities had a throughput less than 2.4 million gallons per year. The remaining four percent, or approximately 450 facilities, had throughputs exceeding 2.4 million gallons per year. For these stations, the average gasoline throughput was 3.6 million gallons per year.

Figure 1-6
Gasoline Dispensing Facility Health Risk
for 3,600,000 gal/yr throughput



As shown in Figure 1-6, the risk levels for a gasoline dispensing facility with a throughput of 3.6 million gallons per year is about 10 in one million at a distance of 50 feet from the fenceline. However, as the throughput increases, the potential risk increases.

As mentioned above, air pollution levels in the immediate vicinity of large gasoline dispensing facilities may be higher than the surrounding area (although tailpipe emissions from motor vehicles dominates the health impacts). Very large gasoline dispensing facilities located at large wholesale and discount centers may dispense nine million gallons of gasoline per year or more. At nine million gallons, the potential risk could be around 25 in one million at 50 feet, dropping to about five in one million at 300 feet. Some facilities have throughputs as high as 19 million gallons.

Recommendation

- Avoid siting new sensitive land uses within 300 feet of a large gasoline dispensing facility (defined as a facility with a throughput of 3.6 million gallons per year or greater). A 50 foot separation is recommended for typical gas dispensing facilities.

References

- *Gasoline Service Station Industry-wide Risk Assessment Guidelines.* California Air Pollution Control Officers Association (December 1997 and revised November 1, 2001)
- *Staff Report on Enhanced Vapor Recovery.* ARB (February 4, 2000)
- *The California Almanac of Emissions and Air Quality.* ARB (2004)
- *Staff Report on Enhanced Vapor Recovery Technology Review.* ARB (October 2002)

Other Facility Types that Emit Air Pollutants of Concern

In addition to source specific recommendations, Table 1-3 includes a list of other industrial sources that could pose a significant health risk to nearby sensitive individuals depending on a number of factors. These factors include the amount of pollutant emitted and its toxicity, the distance to nearby individuals, and the type of emission controls in place. Since these types of facilities are subject to air permits from local air districts, facility specific information should be obtained where there are questions about siting a sensitive land use close to an industrial facility.

Potential Sources of Odor and Dust Complaints

Odors and dust from commercial activities are the most common sources of air pollution complaints and concerns from the public. Land use planning and permitting processes should consider the potential impacts of odor and dust on surrounding land uses, and provide for adequate separation between odor and dust sources. As with other types of air pollution, a number of factors need to be considered when determining an adequate distance or mitigation to avoid odor or

Table 1-3 – Examples of Other Facility Types That Emit[1] Air Pollutants of Concern

Categories	Facility Type	Air Pollutants of Concern
Commercial		
	Autobody Shops	Metals, Solvents
	Furniture Repair	Solvents[2], Methylene Chloride
	Film Processing Services	Solvents, Perchloroethylene
	Distribution Centers	Diesel Particulate Matter
	Printing Shops	Solvents
	Diesel Engines	Diesel Particulate Matter
Industrial		
	Construction	Particulate Matter, Asbestos
	Manufacturers	Solvents, Metals
	Metal Platers, Welders, Metal Spray (flame spray) Operations	Hexavalent Chromium, Nickel, Metals
	Chemical Producers	Solvents, Metals
	Furniture Manufacturers	Solvents
	Shipbuilding and Repair	Hexavalent chromium and other metals, Solvents
	Rock Quarries and Cement Manufacturers	Particulate Matter, Asbestos
	Hazardous Waste Incinerators	Dioxin, Solvents, Metals
	Power Plants	Benzene, Formaldehyde, Particulate Matter
	Research and Development Facilities	Solvents, Metals, etc.
Public		
	Landfills	Benzene, Vinyl Chloride, Diesel Particulate Matter
	Waste Water Treatment Plants	Hydrogen Sulfide
	Medical Waste Incinerators	Dioxin, Benzene, PAH, PCBs, 1,3-Butadiene
	Recycling, Garbage Transfer Stations	Diesel Particulate Matter
	Municipal Incinerators	Dioxin, Benzene, PAH, PCBs, 1,3-Butadiene
Transportation		
	Truck Stops	Diesel Particulate Matter
Agricultural Operations		
	Farming Operations	Diesel Particulate Matter, VOCs, NOx, PM10, CO, SOx, Pesticides
	Livestock and Dairy Operations	Ammonia, VOCs, PM10

[1]Not all facilities will emit pollutants of concern due to process changes or chemical substitution. Consult the local air district regarding specific facilities.
[2]Some solvents may emit toxic air pollutants, but not all solvents are toxic air contaminants.

dust complaints in a specific situation. Local air districts should be consulted for advice when these siting situations arise.

Table 1-4 lists some of the most common sources of odor complaints received by local air districts. Complaints about odors are the responsibility of local air districts and are covered under state law. The types of facilities that can cause odor complaints are varied and can range from small commercial facilities to large industrial facilities, and may include waste disposal and recycling operations. Odors can cause health symptoms such as nausea and headache. Facilities with odors may also be sources of toxic air pollutants (See Table 1-3). Some common sources of odors emitted by facilities are sulfur compounds, organic solvents, and the decomposition/digestion of biological materials. Because of the subjective nature of an individual's sensitivity to a particular type of odor, there is no specific rule for assigning appropriate separations from odor sources. Under the right meteorological conditions, some odors may still be offensive several miles from the source.

Table 1-4
Sources of Odor Complaints

- Sewage Treatment Plants
- Landfills
- Recycling Facilities
- Waste Transfer Stations
- Petroleum Refineries
- Biomass Operations
- Autobody Shops
- Coating Operations
- Fiberglass Manufacturing
- Foundries
- Rendering Plants
- Livestock Operations

Sources of dust are also common sources of air pollution-related complaints. Operations that can result in dust problems are rock crushing, gravel production, stone quarrying, and mining operations. A common source of complaints is the dust and noise associated with blasting that may be part of these operations. Besides the health impacts of dust as particulate matter, thick dust also impairs visibility, aesthetic values, and can soil homes and automobiles. Local air districts typically have rules for regulating dust sources in their jurisdictions, but dust sources can still be a concern. Therefore, separation of these facilities from residential and other new sensitive land uses should be considered.

In some areas of California, asbestos occurs naturally in stone deposits. Asbestos is a potent carcinogenic substance when inhaled. Asbestos-containing dust may be a public health concern in areas where asbestos-containing rock is mined, crushed, processed, or used. Situations where asbestos-containing gravel has been used in road paving materials are also a source of asbestos exposure to the general public. Planners are advised to consult with local air pollution agencies in areas where asbestos-containing gravel or stone products are produced or used.

2. Handbook Development

ARB and local air districts share responsibility for improving statewide air quality. As a result of California's air pollution control programs, air quality has improved and health risk has been reduced statewide. However, state and federal air quality standards are still exceeded in many areas of California and the statewide health risk posed by toxic air contaminants (air toxics) remains too high. Also, some communities experience higher pollution exposures than others - making localized impacts, as well regional or statewide impacts, an important consideration. It is for this reason that this Handbook has been produced - to promote better, more informed decision-making by local land use agencies that will improve air quality and public health in their communities.

Land use policies and practices, including planning, zoning, and siting activities, can play a critical role in air quality and public health at the local level. For instance, even with the best available control technology, some projects that are sited very close to homes, schools, and other public places can result in elevated air pollution exposures. The reverse is also true – siting a new school or home too close to an existing source of air pollution can pose a public health risk. The ARB recommendations in section 1 address this issue.

> *This Handbook is an informational document that we hope will strengthen the relationship between air quality and land use agencies. It highlights the need for land use agencies to address the potential for new projects to result in localized health risk or contribute to cumulative impacts where air pollution sources are concentrated.*

Avoiding these incompatible land uses is a key to reducing localized air pollution exposures that can result in adverse health impacts, especially to sensitive individuals.

Individual siting decisions that result in incompatible land uses are often the result of locating "sensitive" land uses next to polluting sources. These decisions can be of even greater concern when existing air pollution exposures in a community are considered. In general terms, this is often referred to as the issue of "cumulative impacts." ARB is working with local air districts to better define these situations and to make information about existing air pollution levels (e.g., from local businesses, motor vehicles, and other areawide sources) more readily available to land use agencies.

In December 2001, the ARB adopted "Policies and Actions for Environmental Justice" (Policies). These Policies were developed in coordination with a group of stakeholders, representing local government agencies, community interest

groups, environmental justice organizations, academia, and business (Environmental Justice Stakeholders Group).

The Policies included a commitment to work with land use planners, transportation agencies, and local air districts to develop ways to identify, consider, and reduce cumulative air pollution emissions, exposure, and health risks associated with land use planning and decision-making. Developed under the auspices of the ARB's Environmental Justice Stakeholders Group, this Handbook is a first step in meeting that commitment.

ARB has produced this Handbook to help achieve several objectives:

- Provide recommendations on situations to avoid when siting new residences, schools, day care centers, playgrounds, and medical-related facilities (sensitive sites or sensitive land uses);

- Identify approaches that land use agencies can use to prevent or reduce potential air pollution impacts associated with general plan policies, new land use development, siting, and permitting decisions;

- Improve and facilitate access to air quality data and evaluation tools for use in the land use decision-making process;

- Encourage stronger collaboration between land use agencies and local air districts to reduce community exposure to source-specific and cumulative air pollution impacts; and

- Emphasize community outreach approaches that promote active public involvement in the air quality/land use decision-making process.

This Handbook builds upon California's 2003 General Plan Guidelines. These Guidelines, developed by the Governor's Office of Planning and Research (OPR), explain the land use planning process and applicable legal requirements. This Handbook also builds upon a 1997 ARB report, "The Land Use-Air Quality Linkage" ("Linkage Report").[9] The Linkage Report was an outgrowth of the California Clean Air Act which, among other things, called upon local air districts to focus particular attention on reducing emissions from sources that indirectly cause air pollution by attracting vehicle trips. Such indirect sources include, but are not limited to, shopping centers, schools and universities, employment centers, warehousing, airport hubs, medical offices, and sports arenas. The Linkage Report summarizes data as of 1997 on the relationships between land use, transportation, and air quality, and highlights strategies that can help to reduce the use of single occupancy automobile use. Such strategies

[9] To access this report, please refer to ARB's website or click on: http://www.arb.ca.gov/ch/programs/link97.pdf

complement ARB regulatory programs that continue to reduce motor vehicle emissions.

In this Handbook, we identify types of air quality-related information that we recommend land use agencies consider in the land use decision-making processes such as the development of regional, general, and community plans; zoning ordinances; environmental reviews; project siting; and permit issuance. The Handbook provides recommendations on the siting of new sensitive land uses based on current analyses. It also contains information on approaches and methodologies for evaluating new projects from an air pollution perspective.

The Handbook looks at air quality issues associated with emissions from industrial, commercial, and mobile sources of air pollution. Mobile sources continue to be the largest overall contributors to the state's air pollution problems, representing the greatest air pollution health risk to most Californians. Based on current health risk information for air toxics, the most serious pollutants on a statewide basis are diesel PM, benzene, and 1,3-butadiene, all of which are primarily emitted by motor vehicles. From a state perspective, ARB continues to pursue new strategies to further reduce motor vehicle-related emissions in order to meet air quality standards and reduce air toxics risk.

While mobile sources are the largest overall contributors to the state's air pollution problems, industrial and commercial sources can also pose a health risk, particularly to people near the source. For this reason, the issue of incompatible land uses is an important focus of this document.

Handbook Audience

Even though the primary users of the Handbook will likely be agencies responsible for air quality and land use planning, we hope the ideas and technical issues presented in this Handbook will also be useful for:

- public and community organizations and community residents;
- federal, state and regional agencies that fund, review, regulate, oversee, or otherwise influence environmental policies and programs affected by land use policies; and
- private developers.

3. Key Community Focused Issues Land Use Agencies Should Consider

Two key air quality issues that land use agencies should consider in their planning, zoning, and permitting processes are:

1) **Incompatible Land Uses.** Localized air pollution impacts from incompatible land use can occur when polluting sources, such as a heavily trafficked roadway, warehousing facilities, or industrial or commercial facilities, are located near a land use where sensitive individuals are found such as a school, hospital, or homes.

2) **Cumulative Impacts.** Cumulative air pollution impacts can occur from a concentration of multiple sources that individually comply with air pollution control requirements or fall below risk thresholds, but in the aggregate may pose a public health risk to exposed individuals. These sources can be heavy or light-industrial operations, commercial facilities such as autobody shops, large gas dispensing facilities, dry cleaners, and chrome platers, and freeways or other nearby busy transportation corridors.

Incompatible Land Uses

Land use policies and practices can worsen air pollution exposure and adversely affect public health by mixing incompatible land uses. Examples include locating new sensitive land uses, such as housing or schools, next to small metal plating facilities that use a highly toxic form of chromium, or very near large industrial facilities or freeways. Based on recent monitoring and health-based studies, we now know that air quality impacts from incompatible land uses can contribute to increased risk of illness, missed work and school, a lower quality of life, and higher costs for public health and pollution control.[10]

Avoiding incompatible land uses can be a challenge in the context of mixed-use industrial and residential zoning. For a variety of reasons, government agencies and housing advocates have encouraged the proximity of affordable housing to employment centers, shopping areas, and transportation corridors, partially as a means to reduce vehicle trips and their associated emissions. Generally speaking, typical distances in mixed-use communities between businesses and industries and other land uses such as homes and schools, should be adequate to avoid health risks. However, generalizations do not always hold as we addressed in section 1 of this Handbook.

In terms of siting air pollution sources, the proposed location of a project is a major factor in determining whether it will result in localized air quality impacts. Often, the problem can be avoided by providing an adequate distance or setback

[10] For more information, the reader should refer to ARB's website on community health: http://www.arb.ca.gov/ch/ch.htm

between a source of emissions and nearby sensitive land uses. Sometimes, suggesting project design changes or mitigation measures in the project review phase can also reduce or avoid potential impacts. This underscores the importance of addressing potential incompatible land uses as early as possible in the project review process, ideally in the general plan itself.

Cumulative Air Pollution Impacts

The broad concept of cumulative air pollution impacts reflects the combination of regional air pollution levels and any localized impacts. Many factors contribute to air pollution levels experienced in any location. These include urban background air pollution, historic land use patterns, the prevalence of freeways and other transportation corridors, the concentration of industrial and commercial businesses, and local meteorology and terrain.

When considering the potential air quality impacts of polluting sources on individuals, project location and the concentration of emissions from air pollution sources need to be considered in the land use decision-making process. In section 4, the Handbook offers a series of questions that helps land use agencies determine if a project should undergo a more careful analysis. This holds true regardless of whether the project being sited is a polluting source or a sensitive land use project.

Large industrial areas are not the only land uses that may result in public health concerns in mixed-use communities. Cumulative air pollution impacts can also occur if land uses do not adequately provide setbacks or otherwise protect sensitive individuals from potential air pollution impacts associated with nearby light industrial sources. This can occur with activities such as truck idling and traffic congestion, or from indirect sources such as warehousing facilities that are located in a community or neighborhood.

In October 2004, Cal/EPA published its Environmental Justice Action Plan. In February 2005, the Cal/EPA Interagency Working Group approved a working definition of “cumulative impacts” for purposes of initially guiding the pilot projects that are being conducted pursuant to that plan. Cal/EPA is now in the process of developing a Cumulative Impacts Assessment Guidance document. Cal/EPA will revisit the working definition of “cumulative impacts” as the Agency develops that guidance. The following is the working definition:

> *“Cumulative impacts means exposures, public health or environmental effects from the combined emissions and discharges, in a geographic area, including environmental pollution from all sources, whether single or multi-media, routinely, accidentally, or otherwise released. Impacts will take into account sensitive populations and socio-economic factors, where applicable, and to the extent data are available.”*

4. Mechanisms for Integrating Localized Air Quality Concerns Into Land Use Processes

Land use agencies should use each of their existing planning, zoning, and permitting authorities to address the potential health risk associated with new projects. Land use-specific mechanisms can go a long way toward addressing both localized and cumulative impacts from new air pollution sources that are not otherwise addressed by environmental regulations. Likewise, close collaboration and communication between land use agencies and local air districts in both the planning and project approval stages can further reduce these impacts. Local agency partnerships can also result in early identification of potential impacts from proposed activities that might otherwise escape environmental review. When this happens, pollution problems can be prevented or reduced before projects are approved, when it is less complex and expensive to mitigate.

The land use entitlement process requires a series of planning decisions. At the highest level, the General Plan sets the policies and direction for the jurisdiction, and includes a number of mandatory elements dealing with issues such as housing, circulation, and health hazards. Zoning is the primary tool for implementing land use policies. Specific or community plans created in conjunction with a specific project also perform many of the same functions as a zoning ordinance. Zoning can be modified by means of variances and conditional use permits. The latter are frequently used to insure compatibility between otherwise conflicting land uses. Finally, new development usually requires the approval of a parcel or tract map before grading and building permits can be issued. These parcel or tract maps must be consistent with the applicable General Plan, zoning and other standards.

Land use agencies can use their planning authority to separate industrial and residential land uses, or to require mitigation where separation is not feasible. By separating incompatible land uses, land use agencies can prevent or reduce both localized and cumulative air pollution impacts without denying what might otherwise be a desirable project.[11] For instance:

- a dry cleaner could open a storefront operation in a community with actual cleaning operations performed at a remote location away from residential areas;
- gas dispensing facilities with lower fuel throughput could be sited in mixed-use areas;
- enhanced building ventilation or filtering systems in schools or senior care centers can reduce ambient air from nearby busy arterials; or
- landscaping and regular watering can be used to reduce fugitive dust at a building construction site near a school yard.

[11] It should be noted that such actions should also be considered as part of the General Plan or Plan element process.

The following general and specific land use approaches can help to reduce potential adverse air pollution impacts that projects may have on public health.

General Plans

The primary purpose of planning, and the source of government authority to engage in planning, is to protect public health, safety, and welfare. In its most basic sense, a local government General Plan expresses the community's development goals and embodies public policy relative to the distribution of future land uses, forming the basis for most land use decisions. Therefore, the most effective mechanism for dealing with the central land use concept of compatibility and its relationship to cumulative air pollution impacts is the General Plan. Well before projects are proposed within a jurisdiction, the General Plan sets the stage for where projects can be sited, and their compatibility with comprehensive community goals, objectives, and policies.

In 2003, OPR revised its General Plan Guidelines, highlighting the importance of incorporating sustainable development and environmental justice policies in the planning process. The OPR General Plan Guidelines provides an effective and long-term approach to reduce cumulative air pollution impacts at the earliest planning stages. In light of these important additions to the Guidelines, land use agencies should consider updating their General Plans or Plan elements to address these revisions.

The General Plan and related Plan elements can be used to avoid incompatible land uses by incorporating air quality considerations into these documents. For instance, a General Plan safety element with an air quality component could be used to incorporate policies or objectives that are intended to protect the public from the potential for facility breakdowns that may result in a dangerous release of air toxics. Likewise, an air quality component to the transportation circulation element of the General Plan could include policies or standards to prevent or reduce local exposure to diesel exhaust from trucks and other vehicles. For instance, the transportation circulation element could encourage the construction of alternative routes away from residential areas for heavy-duty diesel trucks. By considering the relationship between air quality and transportation, the circulation element could also include air quality policies to prevent or reduce trips and travel, and thus vehicle emissions. Policies in the land use element of the General Plan could identify areas appropriate for future industrial, commercial, and residential uses. Such policies could also introduce design and distance parameters that reduce emissions, exposure, and risk from industrial and some commercial land uses (e.g., dry cleaners) that are in close proximity to residential areas or schools.

Land use agencies should also consider updating or creating an air quality element in the jurisdiction's General Plan. In the air quality element, local decision-makers could develop long-term, effective plans and policies to address

air quality issues, including cumulative impacts. The air quality element can also provide a general reference guide that informs local land use planners about regional and community level air quality, regulatory air pollution control requirements and guidelines, and references emissions and pollution source data bases and assessment and modeling tools. As is further described in Appendix C of the Handbook, new assessment tools that ARB is developing can be included into the air quality element by reference. For instance, ARB's statewide risk maps could be referenced in the air quality element as a resource that could be consulted by developers or land use agencies

Zoning

The purpose of "zoning" is to separate different land uses. Zoning ordinances establish development controls to ensure that private development takes place within a given area in a manner in which:

- All uses are compatible (e.g., an industrial plant is not permitted in a residential area);
- Common development standards are used (e.g., all homes in a given area are set back the same minimum distance from the street); and,
- Each development does not unreasonably impose a burden upon its neighbors (e.g., parking is required on site so as not to create neighborhood parking problems).

To do this, use districts called "zones" are established and standards are developed for these zones. The four basic zones are residential, commercial, industrial and institutional.

Land use agencies may wish to consider how zoning ordinances, particularly those for mixed-use areas, can be used to avoid exacerbating poor land use practices of the past or contributing to localized and cumulative air pollution impacts in the community.

Sometimes, especially in mixed-use zones, there is a potential for certain categories of existing businesses or industrial operations to result in cumulative air pollution impacts to new development projects. For example:

- An assisted living project is proposed for a mixed-use zone adjacent to an existing chrome plating facility, or several dry cleaners;
- Multiple industrial sources regulated by a local air district are located directly upwind of a new apartment complex;
- A new housing development is sited in a mixed-use zone that is downwind or adjacent to a distribution center that attracts diesel-fueled delivery trucks and TRUs; or
- A new housing development or sensitive land use is sited without adequate setbacks from an existing major transportation corridor or rail yard.

As part of the public process for making zoning changes, local land use agencies could work with community planning groups, local businesses, and community residents to determine how best to address existing incompatible land uses.

Land Use Permitting Processes

■ Questions to Consider When Reviewing New Projects

Very often, just knowing what questions to ask can yield critical information about the potential air pollution impacts of proposed projects – both from the perspective of a specific project as well as in the nature of existing air pollution sources in the same impact area. Available land use information can reveal the proximity of air pollution sources to sensitive individuals, the potential for incompatible land uses, and the location and nature of nearby air pollution sources. Air quality data, available from the ARB and local air districts, can provide information about the types and amounts of air pollution emitted in an area, regional air quality concentrations, and health risk estimates for specific sources.

General Plans and zoning maps are an excellent starting point in reviewing project proposals for their potential air pollution impacts. These documents contain information about existing or proposed land uses for a specific location as well as the surrounding area. Often, just looking at a map of the proposed location for a facility and its surrounding area will help to identify a potential adjacent incompatible land use.

The following pages are a “pull-out” list of questions to consider along with cross-references to pertinent information in the Handbook. These questions are intended to assist land use agencies in evaluating potential air quality-related concerns associated with new project proposals.

The first group of questions contains project-related queries designed to help identify the potential for localized project impacts, particularly associated with incompatible land uses. The second group of questions focuses on the issue of potential cumulative impacts by including questions about existing emissions and air quality in the community, and community feedback. Depending on the answers to these questions, a land use agency may decide a more detailed review of the proposal is warranted.

The California Department of Education has already developed a detailed process for school siting which is outlined in Appendix E. However, school districts may also find this section helpful when evaluating the most appropriate site for new schools in their area. At a minimum, using these questions may encourage school districts to engage throughout their siting process with land use agencies and local air districts. The combined expertise of these entities can be useful in devising relevant design standards and mitigation measures that can

reduce exposure to cumulative emissions, exposure, and health risk to students and school workers.

As indicated throughout the Handbook, we strongly encourage land use agencies to consult early and often with local air districts. Local air districts have the expertise, many of the analytical tools, and a working knowledge of the sources they regulate. It is also critical to fully involve the public and businesses that could be affected by the siting decision. The questions provided in the chart below do not imply any particular action should be taken by land use agencies. Rather the questions are intended to improve the assessment process and facilitate informed decision-making.

- **Project-Related Questions**

This section includes project-related questions that, in conjunction with the questions in the next section, can be used to tailor the project evaluation. These questions are designed to help identify the potential for incompatible land uses from localized project impacts.

Questions to Consider When Reviewing New Projects

Project-Related Questions	Cross-Reference to Relevant Handbook Sections
1. Is the proposed project: ▲ A business or commercial license renewal ▲ A new or modified commercial project ▲ A new or modified industrial project ▲ A new or modified public facility project ▲ A new or modified transportation project ▲ A housing or other development in which sensitive individuals may live or play	See Appendix A for typical land use classifications and associated project categories that could emit air pollutants.
2. Does the proposed project: ▲ Conform to the zoning designation? ▲ Require a variance to the zoning designation? ▲ Include plans to expand operations over the life of the business such that additional emissions may increase the pollution burden in the community (e.g., from additional truck operations, new industrial operations or process lines, increased hours of operation, build-out to the property line, etc.)?	See Appendix F for a general explanation of land use processes. In addition, Section 3 contains a discussion of how land use planning, zoning, and permitting practices can result in incompatible land uses or cumulative air pollution impacts.
3. Has the local air district provided comments or information to assist in the analysis?	See Section 5 and Appendix C for a description of air quality-related tools that the ARB and local air districts use to provide information on potential air pollution impacts.
4. Have public meetings been scheduled with the affected community to solicit their involvement in the decision-making process for the proposed project?	See Section 7 for a discussion of public participation, information and outreach tools.
5. If the proposed project will be subject to local air district regulations: ▲ Has the project received a permit from the local air district? ▲ Would it comply with applicable local air district requirements? ▲ Is the local air district contemplating new regulations that would reduce emissions from the source over time? ▲ Will potential emissions from the project	See Appendix C for a description of local air district programs.

Project-Related Questions	Cross-Reference to Relevant Handbook Sections
trigger the local air district's new source review for criteria pollutants or air toxics emissions? ▲ Is the local air district expected to ask the proposed project to perform a risk assessment? ▲ Is there sufficient new information or public concern to call for a more thorough environmental analysis of the proposed project? ▲ Are there plans to expand operations over time? ▲ Are there land-use based air quality significance thresholds or design standards that could be applied to this project in addition to applicable air district requirements?	
6. If the proposed project will release air pollution emissions, either directly or indirectly, but is not regulated by the local air district: ▲ Is the local air district informed of the project? ▲ Does the local air district believe that there could be potential air pollution impacts associated with this project category because of the proximity of the project to sensitive individuals? ▲ If the project is one in which individuals live or play (e.g., a home, playground, convalescent home, etc.), does the local air district believe that the project's proximity to nearby sources could pose potential air pollution impacts? ▲ Are there indirect emissions that could be associated with the project (e.g., truck traffic or idling, transport refrigeration unit operations, stationary diesel engine operations, etc.) that will be in close proximity to sensitive individuals? ▲ Will the proposed project increase or serve as a magnet for diesel traffic? ▲ Are there land-use based air quality significance thresholds or design standards that could be applied to this project in addition to applicable air district requirements? ▲ Is there sufficient new information or public concern to call for a more thorough environmental analysis of the proposed project? ▲ Should the site approval process include identification and mitigation of potential	See Section 1 for recommendations on situations to avoid when siting projects where sensitive individuals would be located (sensitive sites).

Project-Related Questions	Cross-Reference to Relevant Handbook Sections
direct or indirect emissions associated with the potential project?	
7. Does the local air district or land use agency have pertinent information on the source, such as: ▲ Available permit and enforcement data, including for the owner or operator of the proposed source that may have other sources in the State. ▲ Proximity of the proposed project to sensitive individuals. ▲ Number of potentially exposed individuals from the proposed project. ▲ Potential for the proposed project to expose sensitive individuals to odor or other air pollution nuisances. ▲ Meteorology or the prevailing wind patterns between the proposed project and the nearest receptor, or between the proposed sensitive receptor project and sources that could pose a localized or cumulative air pollution impact.	See Appendix C for a description of local air district programs. See Appendix B for a listing of useful information that land use agencies should have on hand or have accessible when reviewing proposed projects for potential air pollution impacts. Also, do not hesitate to contact your local air district regarding answers to any of these questions that might not be available at the land use agency. See Section 1 for recommendations on situations to avoid when siting projects where sensitive individuals would be located (sensitive sites).
8. Based upon the project application, its location, and the nature of the source, could the proposed project: ▲ Be a polluting source that is located in proximity to, or otherwise upwind, of a location where sensitive individuals live or play? ▲ Attract sensitive individuals and be located in proximity to or otherwise downwind, of a source or multiple sources of pollution, including polluting facilities or transportation-related sources that contribute emissions either directly or indirectly? ▲ Result in health risk to the surrounding community?	See Section 3 for a discussion of what is an incompatible land use and the potential cumulative air pollution impacts. See Section 1 for recommendations on situations to avoid when siting projects where sensitive individuals would be located (sensitive sites).
9. If a CEQA categorical exemption is proposed, were the following questions considered: ▲ Is the project site environmentally sensitive as defined by the project's location? (A project that is ordinarily insignificant in its impact on the environment may in a particularly sensitive environment be significant.) ▲ Would the project and successive future projects of the same type in the approximate location potentially result in cumulative impacts? ▲ Are there "unusual circumstances" creating the possibility of significant effects?	See CEQA Guidelines section 15300, and Public Resources Code, section 21084. See Section 1 for recommendations on situations to avoid when siting projects where sensitive individuals would be located (sensitive sites). See also Section 5 and Appendix C for a description of air quality-related tools that the ARB and local air districts use to provide information on potential air pollution impacts.

- **Questions Related to Cumulative Impact Assessment**

The following questions can be used to provide the decision-maker with a better understanding of the potential for cumulative air pollution impacts to an affected community. Answers to these questions will help to determine if new projects or activities warrant a more detailed review. It may also help to see potential environmental concerns from the perspective of the affected community. Additionally, responses can provide local decision-makers with information with which to assess the best policy options for addressing neighborhood-scale air pollution concerns.

The questions below can be used to identify whether existing tools and procedures are adequate to address land use-related air pollution issues. This process can also be used to pinpoint project characteristics that may have the greatest impact on community-level emissions, exposure, and risk. Such elements can include: the compliance record of existing sources including those owned or operated by the project proponent; the concentration of emissions from polluting sources within the approximate area of sensitive sites; transportation circulation in proximity to the proposed project; compatibility with the General Plan and General Plan elements; etc.

The local air district can provide useful assistance in the collection and evaluation of air quality-related information for some of the questions and should be consulted early in the process.

Questions Related to Cumulative Impact Assessment

Technical Questions	Cross-Reference to Relevant Handbook Sections
1. Is the community home to industrial facilities?	See Appendix A for typical land use classifications and associated project categories that could emit air pollutants.
2. Do one or more major freeways or high-traffic volume surface streets cut through the community?	See transportation circulation element of your general plan. See also Appendix B for useful information that land use agencies should have on hand or have accessible when reviewing proposed projects for potential air pollution impacts. See Section 1 for recommendations on situations to avoid when siting projects where sensitive individuals would be located (sensitive sites).
3. Is the area classified for mixed-use zoning?	See your general plan and zoning ordinances.
4. Is there an available list of air pollution sources in the community?	Contact your local air district.
5. Has a walk-through of the community been conducted to gather the following information:	See Appendix B for a listing of useful information that land use agencies

Technical Questions	Cross-Reference to Relevant Handbook Sections
▲ Corroborate available information on land use activities in the area (e.g., businesses, housing developments, sensitive individuals, etc.)? ▲ Determine the proximity of existing and anticipated future projects to residential areas or sensitive individuals? ▲ Determine the concentration of emission sources (including anticipated future projects) to residential areas or sensitive individuals?	should have on hand or have accessible when reviewing proposed projects for potential air pollution impacts. Also contact your local air district.
6. Has the local air district been contacted to obtain information on sources in the community?	See Section 7 for a discussion of public participation, information and outreach tools.
7. What categories of commercial establishments are currently located in the area and does the local air district have these sources on file as being regulated or permitted?	See Appendix A for typical land use classifications and associated project categories that could emit air pollutants. Also contact your local air district.
8. What categories of indirect sources such as distribution centers or warehouses are currently located in the area?	See Appendix A for typical land use classifications and associated project categories that emit air pollutants.
9. What air quality monitoring data are available?	Contact your local air district.
10. Have any risk assessments been performed on emission sources in the area?	Contact your local air district.
11. Does the land use agency have the capability of applying a GIS spatial mapping tool that can overlay zoning, sub-development information, and other neighborhood characteristics, with air pollution and transportation data?	See Appendix B for a listing of useful information that land use agencies should have on hand or have accessible when reviewing proposed projects for potential air pollution impacts. Also contact your local air district for tools that can be used to supplement available land use agency tools.
12. Based on available information, is it possible to determine if the affected community or neighborhood experiences elevated health risk due to a concentration of air pollution sources in close proximity, and if not, can the necessary information be obtained?	Contact your local air district. Also see Section 1 for recommendations on situations to avoid when siting projects where sensitive individuals would be located (sensitive sites).
13. Does the community have a history of chronic complaints about air quality?	See Section 7 for a discussion of public participation, information and outreach tools. Also contact your local air district.
14. Is the affected community included in the public participation process for the agency's decision?	See Section 7 for a discussion of public participation, information and outreach tools.
15. Have community leaders or groups been contacted about any pre-existing or chronic community air quality concerns?	See Section 7 for a discussion of public participation, information and outreach tools. Also contact your local air district.

- **Mitigation Approaches**

In addition to considering the suitability of the project location, opportunities for mitigation of air pollution impacts should be considered. Sometimes, a land use agency may find that selection of a different project location to avoid a health risk is not feasible. When that happens, land use agencies should consider design improvements or other strategies that would reduce the risk. Such strategies could include performance or design standards, consultation with local air districts and other agencies on appropriate actions that these agencies should, or plan to, undertake, and consultation and outreach in the affected community. Potential mitigation measures should be feasible, cost-effective solutions within the available resources and authority of implementing agencies to enforce.[12]

- **Conditional Use Permits and Performance Standards**

Some types of land uses are only allowed upon approval of a conditional use permit (also called a CUP or special use permit). A conditional use permit does not re-zone the land but specifies conditions under which a particular land use will be permitted. Such land uses could be those with potentially significant environmental impacts. Local zoning ordinances specify the uses for which a conditional use permit is required, the zones they may be allowed in, and public hearing procedures. The conditional use permit imposes special requirements to ensure that the use will not be detrimental to its surroundings.

In the context of land use planning, performance standards are requirements imposed on projects or project categories through conditional use permits to ensure compliance with general plan policies and local ordinances. These standards could apply to such project categories as distribution centers, very large gas dispensing facilities, autobody shops, dry cleaners, and metal platers. Land use agencies may wish to consider adding land use-based performance standards to zoning ordinances in existing mixed-use communities for certain air pollution project categories. Such standards would provide certainty and equitable treatment to all projects of a similar nature, and reserve the more resource intensive conditional or special use permits to projects that require a more detailed analysis. In developing project design or performance standards, land use agencies should consult with the local air district. Early and regular consultation can avoid duplication or inconsistency with local air district control requirements when considering the site-specific design and operation of a project.

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[12] A land use agency has the authority to condition or deny a project based upon information collected and evaluated through the land use decision-making process. However, any denial would need to be based upon identifiable, generally applicable, articulated standards set forth in the local government's General Plan and zoning codes. One way of averting this is to conduct early and regular outreach to the community and the local air district so that community and environmental concerns can be addressed and accommodated into the project proposal.

Examples of land use-based air quality-specific performance standards include the following:

- Placing a process vent away from the direction of the local playground that is nearby or increasing the stack height so that emissions are dispersed to reduce the emissions impact on surrounding homes or schools.
- Setbacks between the project fence line and the population center.
- Limiting the hours of operation of a facility to avoid excess emissions exposure or foul odors to nearby individuals.
- An ordinance that requires fleet operators to use cleaner vehicles before project approval (if a new business), or when expanding the fleet (if an existing business); and
- Providing alternate routes for truck operations that discourage detours into residential neighborhoods.

Outreach to Other Agencies

When questions arise regarding the air quality impacts of projects, including potential cumulative impacts, land use agencies should consult the local air district. Land use agencies should also consider the following suggestions to avoid creating new incompatible land uses:

- Consult with the local air district to help determine if emissions from a particular project will adversely impact sensitive individuals in the area, if existing or future effective regulations or permit requirements will affect the proposed project or other sources in the vicinity of the proposed project, or if additional inspections should be required.
- Check with ARB for new information and modeling tools that can help evaluate projects seeking to site within your jurisdiction.
- Become familiar with ARB's Land Use-Air Quality Linkage Report to determine whether approaches and evaluation tools contained in the Report can be used to reduce transportation-related impacts on communities.
- Contact and collaborate with other state agencies that play a role in the land use decision-making process, e.g., the State Department of Education, the California Energy Commission, and Caltrans. These agencies have information on mitigation measures and mapping tools that could be useful in addressing local problems.

- **Information Clearinghouse**

  - Land use agencies can refer to the ARB statewide electronic information clearinghouse for information on what measures other jurisdictions are using to address comparable issues or sources.[13]

[13] This information can be accessed from ARB's website by going to: http://www.arb.ca.gov/ch/clearinghouse.htm

The next section addresses available air quality assessment tools that land use agencies can use to evaluate the potential for localized or cumulative impacts in their communities.

5. Available Tools to Evaluate Cumulative Air Pollution Emissions and Risk

Until recently, California has traditionally approached air pollution control from the perspective of assessing whether the pollution was regional, category-specific, or from new or existing sources. This methodology has been generally effective in reducing statewide and regional air pollution impacts and risk levels. However, such an incremental, category-by-category, source-by-source approach may not always address community health impacts from multiple sources - including mobile, industrial, and commercial facilities.

As a result of air toxics and children's health concerns over the past several years, ARB and local air districts have begun to develop new tools to evaluate and inform the public about cumulative air pollution impacts at the community level. One aspect of ARB's programs now underway is to consolidate and make accessible air toxics emissions and monitoring data by region, using modeling tools and other analytical techniques to take a preliminary look at emissions, exposure, and health risk in communities.

ARB has developed multiple tools to assist local air districts perform assessments of cumulative emissions, exposure, and risk on a neighborhood scale. These tools include:

- Regional risk maps that show trends in potential cancer risk from toxic air pollutants in southern and central California between 1990 and 2010. These maps are based on the U.S. EPA's ASPEN model. These maps provide an estimate of background levels of toxic air pollutant risk but are not detailed enough to assess individual neighborhoods or facilities.[14]

- The Community Health Air Pollution Information System (CHAPIS) is a user-friendly, Internet-based system for displaying information on emissions from sources of air pollution in an easy to use mapping format. CHAPIS contains information on air pollution emissions from selected large facilities and small businesses that emit criteria and toxic air pollutants. It also contains information on air pollution emissions from motor vehicles. When released in 2004, CHAPIS did not contain information on every source of air pollution or every air pollutant. However, ARB continues to work with local air districts to include all of the largest air pollution sources and those with the highest documented air pollution risk. Additional facilities will be added to CHAPIS as more data become available.[15]

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[14] For further information on these maps, please visit ARB's website at: http://www.arb.ca.gov/toxics/cti/hlthrisk/hlthrisk.htm

[15] For further information on CHAPIS, please click on: http://www.arb.ca.gov/ch/chapis1/chapis1.htm

- The Hot Spots Analysis and Reporting Program (HARP) is a software database package that evaluates emissions from one or more facilities to determine the overall health risk posed by the facility(-ies) on the surrounding community. Proper use of HARP ensures that the risk assessment meets the latest risk assessment guidelines published by the State Office of Environmental Health Hazard Assessment (OEHHA). HARP is designed with air quality professionals in mind and is available from the ARB.

- The Urban Emissions Model (URBEMIS) is a computer program that can be used to estimate emissions associated with land development projects in California such as residential neighborhoods, shopping centers, office buildings, and construction projects. URBEMIS uses emission factors available from the ARB to estimate vehicle emissions associated with new land uses.

Local air districts, and others can use these tools to assess a new project, or plan revision. For example, these tools can be used to:

- Identify if there are multiple sources of air pollution in the community;
- Identify the major sources of air pollution in the area under consideration;
- Identify the background potential cancer risk from toxic air pollution in the area under consideration;
- Estimate the risk from a new facility and how it adds to the overall risk from other nearby facilities; and
- Provide information to decision-makers and key stakeholders on whether there may be significant issues related to cumulative emissions, exposure, and health risk due to a permitting or land use decision.

If an air agency wishes to perform a cumulative air pollution impact analysis using any of these tools, it should consult with the ARB and/or the local air district to obtain information or assistance on the data inputs and procedures necessary to operate the program. In addition, land use agencies could consult with local air districts to determine the availability of land use and air pollution data for entry into an electronic Geographical Information System (GIS) format. GIS is an easier mapping tool than the more sophisticated models described in Appendix C. GIS mapping makes it possible to superimpose land use with air pollution information so that the spatial relationship between air pollution sources, sensitive receptors, and air quality can be visually represented. Appendix C provides a general description of the impact assessment process and micro-scale, or community level modeling tools that are available to evaluate potential cumulative air pollution impacts. Modeling protocols will be accessible on ARB's website as they become available. The ARB will also provide land use agencies and local air districts with statewide regional modeling results and information regarding micro-scale modeling.

6. ARB Programs to Reduce Air Pollution in Communities

ARB's regulatory programs reduce air pollutant emissions through statewide strategies that improve public health in all California communities. ARB's overall program addresses motor vehicles, consumer products, air toxics, air-quality planning, research, education, enforcement, and air monitoring. Community health and environmental justice concerns are a consideration in all these programs. ARB's programs are statewide but recognize that extra efforts may be needed in some communities due to historical mixed land-use patterns, limited participation in public processes in the past, and a greater concentration of air pollution sources in some communities.

ARB's strategies are intended to result in better air quality and reduced health risk to residents throughout California. The ARB's priority is to prevent or reduce the public's exposure to air pollution, including from toxic air contaminants that pose the greatest risk, particularly to infants and children who are more vulnerable to air pollution.

In October 2003, ARB updated its statewide control strategy to reduce emissions from source categories within its regulatory authority. A primary focus of the strategy is to achieve federal and state air quality standards for ozone and particulate matter throughout California, and to reduce health risk from diesel PM. Along with local air districts, ARB will continue to address air toxics emissions from regulated sources (see Table 6-1 for a summary of ARB activities). As indicated earlier, ARB will also provide analytical tools and information to land use agencies and local air districts to help assess and mitigate cumulative air pollution impacts.

The ARB will continue to consider the adoption of or revisions to needed air toxics control measures as part of the state's ongoing air toxics assessment program.[16]

As part of its effort to reduce particulate matter and air toxics emissions from diesel PM, the ARB has developed a Diesel Risk Reduction Program[17] that lays out several strategies in a three-pronged approach to reduce emissions and their associated risk:

- Stringent emission standards for all new diesel-fueled engines;
- Aggressive reductions from in-use engines; and
- Low sulfur fuel that will reduce PM and still provide the quality of diesel fuel needed to control diesel PM.

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[16] For continuing information and updates on state measures, the reader can refer to ARB's website at http://www.arb.ca.gov/toxics/toxics.htm.

[17] For a comprehensive description of the program, please refer to ARB's website at http://www.arbB.ca.gov/diesel/dieselrrp.htm.

Table 6-1
ARB ACTIONS TO ADDRESS
CUMULATIVE AIR POLLUTION IMPACTS IN COMMUNITIES

Information Collection

- Improve emission inventories, air monitoring data, and analysis tools that can help to identify areas with high cumulative air pollution impacts
- Conduct studies in coordination with OEHHA on the potential for cancer and non-cancer health effects from air pollutants emitted by specific source categories
- Establish web-based clearinghouse for local land use strategies

Emission Reduction Approaches (2004-2006)*

- Through a public process, consider development and/or amendment of regulations and related guidance to reduce emissions, exposure, and health risk at a statewide and local level for the following sources:
  - Diesel PM sources such as stationary diesel engines, transport refrigeration units, portable diesel engines, on-road public fleets, off-road public fleets, heavy-duty diesel truck idling, harbor craft vessels, waste haulers
  - Other air toxics sources, such as formaldehyde in composite wood products, hexavalent chromium for chrome plating and chromic acid anodizing, thermal spraying, and perchloroethylene dry cleaning
- Develop technical information for the following:*
  - Distribution centers
  - Modeling tools such as HARP and CHAPIS
- Adopt rules and pollution prevention initiatives within legal authority to reduce emissions from mobile sources and fuels, and consumer products
- Develop and maintain Air Quality Handbook as a tool for use by land use agencies and local air districts to address cumulative air pollution impacts

Other Approaches

- Establish guidelines for use of statewide incentive funding for high priority mobile source emission reduction projects

*Because ARB will continue to review the need to adopt or revise statewide measures, the information contained in this chart will be updated on an ongoing basis.

A number of ARB's diesel risk reduction strategies have been adopted. These include measures to reduce emissions from refuse haulers, urban buses, transport refrigeration units, stationary and portable diesel engines, and idling trucks and school buses. These sources are all important from a community perspective.[18]

[18] The reader can refer to ARB's website for information on its mobile source-related programs at: http://www.arb.ca.gov/msprog/msprog.htm, as well as regulations adopted and under consideration as part of the Diesel Risk Reduction Program at: http://www.arb.ca.gov/diesel/dieselrrp.htm

The ARB will continue to evaluate the health effects of air pollutants while implementing programs with local air districts to reduce air pollution in all California communities.

Local air districts also have ambitious programs to reduce criteria pollutants and air toxics from regulated sources in their region. Many of these programs also benefit air quality in local communities as well as in the broader region. For more information on what is being done in your area to reduce cumulative air pollution impacts through air pollution control programs, you should contact your local air district.[19]

[19] Local air district contacts can be found on the inside cover to this Handbook.

7. Ways to Enhance Meaningful Public Participation

Community involvement is an important part of the land use process. The public is entitled to the best possible information about the air they breathe and what is being done to prevent or reduce unhealthful air pollution in their communities. In particular, information on how land use decisions can affect air pollution and public health should be made accessible to all communities, including low-income and minority communities.

Effective community participation consistently relies on a two-way flow of information – from public agencies to community members about opportunities, constraints, and impacts, and from community members back to public officials about needs, priorities, and preferences. The outreach process needed to build understanding and local neighborhood involvement requires data, methodologies, and formats tailored to the needs of the specific community. More importantly, it requires the strong collaboration of local government agencies that review and approve projects and land uses to improve the physical and environmental surroundings of the local community.

Many land use agencies, especially those in major metropolitan areas, are familiar with, and have a long-established public review process. Nevertheless, public outreach can often be improved. Active public involvement requires engaging the public in ways that do not require their previous interest in or knowledge of the land use or air pollution control requirements, and a commitment to taking action where appropriate to address the concerns that are raised.

- **Direct Community Outreach**

In conjunction with local air districts, land use agencies should consider designing an outreach program for community groups, other stakeholders, and local government agency staffs that address the problem of cumulative air pollution impacts, and the public and government role in reducing them. Such a program could consider analytical tools that assist in the preparation and presentation of information in a way that supports sensible decision-making and public involvement. Table 7-1 contains some general outreach approaches that might be considered.

Table 7-1
Public Participation Approaches

- Staff and community leadership awareness training on environmental justice programs and community-based issues
- Surveys to identify the website information needs of interested community-based organizations and other stakeholders
- Information materials on local land use and air district authorities
- Community-based councils to facilitate and invite resident participation in the planning process
- Neighborhood CEQA scoping sessions that allows for community input prior to technical analysis
- Public information materials on siting issues are under review including materials written for the affected community, and in different media that widens accessibility
- Public meetings
- Identify other opportunities to include community-based organizations in the process

To improve outreach, local land use agencies should consider the following activities:

- Hold meetings in communities affected by agency programs, policies, and projects at times and in places that encourage public participation, such as evenings and weekends at centrally located community meeting rooms, libraries, and schools.
- Assess the need for and provide translation services at public meetings.
- Hold community meetings to update residents on the results of any special air monitoring programs conducted in their neighborhood.
- Hold community meetings to discuss and evaluate the various options to address cumulative impacts in their community.
- In coordination with local air districts, make staff available to attend meetings of community organizations and neighborhood groups to listen to and, where appropriate, act upon community concerns.
- Establish a specific contact person for environmental justice issues.
- Increase student and community awareness of local government land use activities and policies through outreach opportunities.
- Make air quality and land use information available to communities in an easily understood and useful format, including fact sheets, mailings, brochures, public service announcements, and web pages, in English and other languages.
- On the local government web-site, dedicate a page or section to what the land use program is doing regarding environmental justice and cumulative environmental impacts, and, as applicable, activities conducted with local air districts such as neighborhood air monitoring studies, pollution prevention, air pollution sources in neighborhoods, and risk reduction.

- Allow, encourage, and promote community access to land use activities, including public meetings, General Plan or Community Plan updates, zoning changes, special studies, CEQA reviews, variances, etc.
- Distribute information in multiple languages, as needed, on how to contact the land use agency or local air district to obtain information and assistance regarding environmental justice programs, including how to participate in public processes.
- Create and distribute a simple, easy-to-read, and understandable public participation handbook, which may be based on the "Public Participation Guidebook" developed by ARB.

- **Other Opportunities for Meaningful Public Outreach**

  - Community-Based Planning Committees

  Neighborhood-based or community planning advisory councils could be established to invite and facilitate direct resident participation into the planning process. With the right training and technical assistance, such councils can provide valuable input and a forum for the review of proposed amendments to plans, zone changes, land use permits, and suggestions as to how best to prevent or reduce cumulative air pollution impacts in their community.

  - Regional Partnerships

  Consider creating regional coalitions of key growth-related organizations from both the private and public sectors, with corporations, communities, other jurisdictions, and government agencies. Such partnerships could facilitate agreement on common goals and win-win solutions tailored specifically for the region. With this kind of dialogue, shared vision, and collaboration, barriers can be overcome and locally acceptable sustainable solutions implemented. Over the long term, such strategies will help to bring about clean air in communities as well as regionally.

LAND USE CLASSIFICATIONS AND ASSOCIATED FACILITY CATEGORIES THAT COULD EMIT AIR POLLUTANTS

(1) Land Use Classifications – by Activity[i]	(2) Facility or Project Examples	(3) Key Pollutants[ii,iii]	(4) Air Pollution Permits[iv]
COMMERCIAL/ LIGHT INDUSTRIAL: SHOPPING, BUSINESS, AND COMMERCIAL			
▲ Primarily retail shops and stores, office, commercial activities, and light industrial or small business	Dry cleaners; drive-through restaurants; gas dispensing facilities; auto body shops; metal plating shops; photographic processing shops; textiles; apparel and furniture upholstery; leather and leather products; appliance repair shops; mechanical assembly cleaning; printing shops	VOCs, air toxics, including diesel PM, NOx, CO, SOx	Limited; Rules for applicable equipment
▲ Goods storage or handling activities, characterized by loading and unloading goods at warehouses, large storage structures, movement of goods, shipping, and trucking.	Warehousing; freight-forwarding centers; drop-off and loading areas; distribution centers	VOCs, air toxics, including diesel PM, NOx, CO, SOx	No[v]
LIGHT INDUSTRIAL: RESEARCH AND DEVELOPMENT			
▲ Medical waste at research hospitals and labs	Incineration; surgical and medical instrument manufacturers, pharmaceutical manufacturing, biotech research facilities	Air toxics, NOx, CO, SOx	Yes
▲ Electronics, electrical apparatus, components, and accessories	Computer manufacturer; integrated circuit board manufacturer; semi-conductor production	Air toxics, VOCs	Yes
▲ College or university lab or research center	Medical waste incinerators; lab chemicals handling, storage and disposal	Air toxics, NOx, CO, SOx, PM10	Yes
▲ Research and development labs	Satellite manufacturer; fiber-optics manufacturer; defense contractors; space research and technology; new vehicle and fuel testing labs	Air toxics, VOCs	Yes
▲ Commercial testing labs	Consumer products; chemical handling, storage and disposal	Air toxics, VOCs	Yes

(1) Land Use Classifications – by Activity[i]	(2) Facility or Project Examples	(3) Key Pollutants[ii,iii]	(4) Air Pollution Permits[iv]
INDUSTRIAL: NON-ENERGY-RELATED			
▲ Assembly plants, manufacturing facilities, industrial machinery	Adhesives; chemical; textiles; apparel and furniture upholstery; clay, glass, and stone products production; asphalt materials; cement manufacturers, wood products; paperboard containers and boxes; metal plating; metal and canned food product fabrication; auto manufacturing; food processing; printing and publishing; drug, vitamins, and pharmaceuticals; dyes; paints; pesticides; photographic chemicals; polish and wax; consumer products; metal and mineral smelters and foundries; fiberboard; floor tile and cover; wood and metal furniture and fixtures; leather and leather products; general industrial and metalworking machinery; musical instruments; office supplies; rubber products and plastics production; saw mills; solvent recycling; shingle and siding; surface coatings	VOCs, air toxics, including diesel PM, NOx, PM, CO, SOx	Yes
INDUSTRIAL: ENERGY AND UTILITIES			
▲ Water and sewer operations	Pumping stations; air vents; treatment	VOCs, air toxics, NOx, CO, SOx, PM10	Yes
▲ Power generation and distribution	Power plant boilers and heaters; portable diesel engines; gas turbine engines	NOx, diesel PM, NOx, CO, SOx, PM10, VOCs	Yes
▲ Refinery operations	Refinery boilers and heaters; coke cracking units; valves and flanges; flares	VOCs, air toxics, including diesel PM, NOx, CO, SOx, PM10	Yes
▲ Oil and gas extraction	Oil recovery systems; uncovered wells	NOx, diesel PM, VOCs, CO, SOx, PM10	Yes
▲ Gasoline storage, transmission, and marketing	Above and below ground storage tanks; floating roof tanks; tank farms; pipelines	VOCs, air toxics, including diesel PM, NOx, CO, SOx, PM10	Yes
▲ Solid and hazardous waste treatment, storage, and disposal activities.	Landfills; methane digester systems; process recycling facility for concrete and asphalt materials	VOCs, air toxics, NOx, CO, SOx, PM10	Yes
CONSTRUCTION (NON-TRANSPORTATION)			
	Building construction; demolition sites	PM (re-entrained road dust), asbestos, diesel PM, NOx, CO, SOx, PM10, VOCs	Limited; state and federal off-road equipment standards

(1) Land Use Classifications – by Activity[i]	(2) Facility or Project Examples	(3) Key Pollutants[ii,iii]	(4) Air Pollution Permits[iv]
DEFENSE			
	Ordnance and explosives demolition; range and testing activities; chemical production; degreasing; surface coatings; vehicle refueling; vehicle and engine operations and maintenance	VOCs, air toxics, including diesel PM, NOx, CO, SOx, PM10	Limited; prescribed burning; equipment and solvent rules
TRANSPORTATION			
▲ Vehicular movement	Residential area circulation systems; parking and idling at parking structures; drive-through establishments; car washes; special events; schools; shopping malls, etc.	VOCs, NOx, PM (re-entrained road dust) air toxics e.g., benzene, diesel PM, formaldehyde, acetaldehyde, 1,3 butadiene, CO, SOx, PM10	No
▲ Road construction and surfacing	Street paving and repair; new highway construction and expansion	VOCs, air toxics, including diesel PM, NOx, CO, SOx, PM10	No
▲ Trains	Railroads; switch yards; maintenance yards	VOCs, NOx, CO, SOx, PM10, air toxics, including diesel PM	Limited; Applicable state and federal MV standards, and possible equipment rules
▲ Marine and port activities	Recreational sailing; commercial marine operations; hotelling operations; loading and un-loading; servicing; shipping operations; port or marina expansion; truck idling		
▲ Aircraft	Takeoff, landing, and taxiing; aircraft maintenance; ground support activities		
▲ Mass transit and school buses	Bus repair and maintenance		
NATURAL RESOURCES			
▲ Farming operations	Agricultural burning; diesel operated engines and heaters; small food processors; pesticide application; agricultural off-road equipment	Diesel PM, VOCs, NOx, PM10, CO, SOx, pesticides	Limited[vi]; Agricultural burning requirements, applicable state and federal mobile source standards; pesticide rules
▲ Livestock and dairy operations	Dairies and feed lots	Ammonia, VOCs, PM10	Yes[vii]
▲ Logging	Off-road equipment e.g., diesel fueled chippers, brush hackers, etc.	Diesel PM, NOx, CO, SOx, PM10, VOCs	Limited; Applicable state/federal mobile source standards
▲ Mining operations	Quarrying or stone cutting; mining; drilling or dredging	PM10, CO, SOx, VOCs, NOx, and asbestos in some geographical areas	Applicable equipment rules and dust controls

(1) Land Use Classifications – by Activity[i]	(2) Facility or Project Examples	(3) Key Pollutants[ii,iii]	(4) Air Pollution Permits[iv]
RESIDENTIAL			
Housing	Housing developments; retirement developments; affordable housing	Fireplace emissions (PM10, NOx, VOCs, CO, air toxics); Water heater combustion (NOx, VOCs, CO)	No[vii]
ACADEMIC AND INSTITUTIONAL			
▲ Schools, including school-related recreational activities	Schools; school yards; vocational training labs/classrooms such as auto repair/painting and aviation mechanics	Air toxics	Yes/No[viii]
▲ Medical waste	Incineration	Air toxics, NOx, CO, PM10	Yes
▲ Clinics, hospitals, convalescent homes		Air toxics	Yes

[i] These classifications were adapted from the American Planning Association's "Land Based Classification Standards." The Standards provide a consistent model for classifying land uses based on their characteristics. The model classifies land uses by refining traditional categories into multiple dimensions, such as activities, functions, building types, site development character, and ownership constraints. Each dimension has its own set of categories and subcategories. These multiple dimensions allow users to have precise control over land-use classifications. For more information, the reader should refer to the Association's website at http://www.planning.org/LBCS/GeneralInfo/.

[ii] This column includes key criteria pollutants and air toxic contaminants that are most typically associated with the identified source categories.

Additional information on specific air toxics that are attributed to facility categories can be found in ARB's Emission Inventory Criteria and Guidelines Report for the Air Toxics Hot Spots Program (May 15, 1997). This information can be viewed at ARB's web site at http://www.arb.ca.gov/ab2588/final96/guide96.pdf.

Criteria air pollutants are those air pollutants for which acceptable levels of exposure can be determined and for which an ambient air quality standard has been set. Criteria pollutants include ozone (formed by the reaction of volatile organic compounds and nitrogen oxides in the presence of sunlight), particulate matter, nitrogen dioxide, sulfur dioxide, carbon monoxide, and lead.

Volatile organic compounds (VOCs) combine with nitrogen oxides to form ozone, as well as particulate matter. VOC emissions result primarily from incomplete fuel combustion and the evaporation of chemical solvents and fuels. On-road mobile sources are the largest contributors to statewide VOC emissions. Stationary sources of VOC emissions include processes that use solvents (such as dry-cleaning, degreasing, and coating operations) and petroleum-related processes (such as petroleum refining, gasoline marketing and dispensing, and oil and gas extraction). Areawide VOC sources include consumer products, pesticides, aerosols and paints, asphalt paving and roofing, and other evaporative emissions.

Nitrogen oxides (NOx) are a group of gaseous compounds of nitrogen and oxygen, many of which contribute to the formation of ozone and particulate matter. Most NOx emissions are produced by the combustion of fuels. Mobile sources make up about 80 percent of the total statewide NOx emissions. Mobile sources include on-road vehicles and trucks, aircraft, trains, ships, recreational boats, industrial and construction equipment, farm

equipment, off-road recreational vehicles, and other equipment. Stationary sources of NOx include both internal and external combustion processes in industries such as manufacturing, food processing, electric utilities, and petroleum refining. Areawide source, which include residential fuel combustion, waste burning, and fires, contribute only a small portion of the total statewide NOx emissions, but depending on the community, may contribute to a cumulative air pollution impact.

Particulate matter (PM) refers to particles small enough to be breathed into the lungs (under 10 microns in size). It is not a single substance, but a mixture of a number of highly diverse types of particles and liquid droplets. It can be formed directly, primarily as dust from vehicle travel on paved and unpaved roads, agricultural operations, construction and demolition.

Carbon monoxide (CO) is a colorless and odorless gas that is directly emitted as a by-product of combustion. The highest concentrations are generally associated with cold stagnant weather conditions that occur during winter. CO problems tend to be localized.

An Air Toxic Contaminant (air toxic) is defined as an air pollutant that may cause or contribute to an increase in mortality or in serous illness, or which may pose a present or potential hazard to human health. Similar to criteria pollutants, air toxics are emitted from stationary, areawide, and mobile sources. They contribute to elevated regional and localized risks near industrial and commercial facilities and busy roadways. The ten compounds that pose the greatest statewide risk are: acetaldehyde; benzene; 1,3-butadiene; carbon tetrachloride; diesel particulate matter (diesel PM); formaldehyde; hexavalent chromium; methylene chloride; para-dichlorobenzene; and perchloroethylene. The risk from diesel PM is by far the largest, representing about 70 percent of the known statewide cancer risk from outdoor air toxics. The exhaust from diesel-fueled engines is a complex mixture of gases, vapors, and particles, many of which are known human carcinogens. Diesel PM is emitted from both mobile and stationary sources. In California, on-road diesel-fueled vehicles contribute about 26 percent of statewide diesel PM emissions, with an additional 72 percent attributed to other mobile sources such as construction and mining equipment, agricultural equipment, and other equipment. Stationary engines in shipyards, warehouses, heavy equipment repair yards, and oil and gas production operations contribute about two percent of statewide emissions. However, when this number is disaggregated to a sub-regional scale such as neighborhoods, the risk factor can be far greater.

[iii] The level of pollution emitted is a major determinant of the significance of the impact.

[iv] Indicates whether facility activities listed in column 4 are generally subject to local air district permits to operate. This does not include regulated products such as solvents and degreasers that may be used by sources that may not require an operating permit per se, e.g., a gas station or dry cleaner.

[v] Generally speaking, warehousing or distribution centers are not subject to local air district permits. However, depending on the district, motor vehicle fleet rules may apply to trucks or off-road vehicles operated and maintained by the facility operator. Additionally, emergency generators or internal combustion engines operated on the site may require an operating permit.

[vi] Authorized by recent legislation SB700.

[vii] Local air districts do not require permits for woodburning fireplaces inside private homes. However, some local air districts and land use agencies do have rules or ordinances that require new housing developments or home re-sales to install U.S. EPA –certified stoves. Some local air districts also ban residential woodburning during weather inversions that concentrate smoke in residential areas. Likewise, home water heaters are not subject to permits; however, new heaters could be subject to emission limits that are imposed by federal or local agency regulations.

[viii] Technical training schools that conduct activities normally permitted by a local air district could be subject to an air permit.

LAND USE-BASED REFERENCE TOOLS TO EVALUATE NEW PROJECTS FOR POTENTIAL AIR POLLUTION IMPACTS

Land use agencies generally have a variety of tools and approaches at hand, or accessible from local air districts that can be useful in performing an analysis of potential air pollution impacts associated with new projects. These tools and approaches include:

- Base map of the city or county planning area and terrain elevations.
- General Plan designations of land use (existing and proposed).
- Zoning maps.
- Land use maps that identify existing land uses, including the location of facilities that are permitted or otherwise regulated by the local air district. Land use agencies should consult with their local air district for information on regulated facilities.
- Demographic data, e.g., population location and density, distribution of population by income, distribution of population by ethnicity, and distribution of population by age. The use of population data is a normal part of the planning process. However, from an air quality perspective, socioeconomic data is useful to identify potential community health and environmental justice issues.
- Emissions, monitoring, and risk-based maps created by the ARB or local air districts that show air pollution-related health risk by community across the state.
- Location of public facilities that enhance community quality of life, including parks, community centers, and open space.
- Location of industrial and commercial facilities and other land uses that use hazardous materials, or emit air pollutants. These include chemical storage facilities, hazardous waste disposal sites, dry cleaners, large gas dispensing facilities, auto body shops, and metal plating and finishing shops.
- Location of sources or facility types that result in diesel on-road and off-road emissions, e.g., stationary diesel power generators, forklifts, cranes, construction equipment, on-road vehicle idling, and operation of transportation refrigeration units. Distribution centers, marine terminals and ports, rail yards, large industrial facilities, and facilities that handle bulk goods are all examples of complex facilities where these types of emission sources are frequently concentrated.[1] Very large facilities, such as ports, marine terminals, and airports, could be analyzed regardless of proximity to a receptor if they are within the modeling area.
- Location and zoning designations for existing and proposed schools, buildings, or outdoor areas where sensitive individuals may live or play.
- Location and density of existing and proposed residential development.
- Zoning requirements, property setbacks, traffic flow requirements, and idling restrictions for trucks, trains, yard hostlers[2], construction equipment, or school buses.
- Traffic counts (including diesel truck traffic counts), within a community to validate or augment existing regional motor vehicle trip and speed data.

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[1] The ARB is currently evaluating the types of facilities that may act as complex point sources and developing methods to identify them.

[2] Yard hostler means a tractor less than 300 horsepower that is used to transfer semi-truck or tractor-trailer containers in and around storage, transfer, or distribution yards or areas and is often equipped with a hydraulic lifting fifth wheel for connection to trailer containers.

ARB AND LOCAL AIR DISTRICT INFORMATION AND TOOLS CONCERNING CUMULATIVE AIR POLLUTION IMPACTS

It is the ARB's policy to support research and data collection activities toward the goal of reducing cumulative air pollution impacts. These efforts include updating and improving the air toxics emissions inventory, performing special air monitoring studies in specific communities, and conducting a more complete assessment of non-cancer health effects associated with air toxics and criteria pollutants.[1] This information is important because it helps us better understand links between air pollution and the health of sensitive individuals -- children, the elderly, and those with pre-existing serious health problems affected by air quality.

ARB is working with CAPCOA and OEHHA to improve air pollutant data and evaluation tools to determine when and where cumulative air pollution impacts may be a problem. The following provides additional information on this effort.

How are emissions assessed?

Detailed information about the sources of air pollution in an area is collected and maintained by local air districts and the ARB in what is called an emission inventory. Emission inventories contain information about the nature of the business, the location, type and amount of air pollution emitted, the air pollution-producing processes, the type of air pollution control equipment, operating hours, and seasonal variations in activity. Local districts collect emission inventory data for most stationary source categories.

Local air districts collect air pollution emission information directly from facilities and businesses that are required to obtain an air pollution operating permit. Local air districts use this information to compile an emission inventory for areas within their jurisdiction. The ARB compiles a statewide emission inventory based on the information collected by the ARB and local air districts. Local air districts provide most of the stationary source emission data, and ARB provides mobile source emissions as well as some areawide emission sources such as consumer products and paints. ARB is also developing map-based tools that will display information on air pollution sources.

Criteria pollutant data have been collected since the early 1970's, and toxic pollutant inventories began to be developed in the mid-1980's.

[1] A criteria pollutant is any air pollutant for which EPA has established a National Ambient Air Quality Standard or for which California has established a State Ambient Air Quality Standard, including: carbon monoxide, lead, nitrogen oxides, ozone, particulates and sulfur oxides. Criteria pollutants are measured in each of California's air basins to determine whether the area meets or does not meet specific federal or state air quality standards. Air toxics or air toxic contaminants are listed pollutants recognized by California or EPA as posing a potential risk to health.

How is the toxic emission inventory developed?

Emissions data for toxic air pollutants is a high priority for communities because of concerns about potential health effects. Most of ARB's air toxics data is collected through the toxic "Hot Spots" program. Local air districts collect emissions data from industrial and commercial facilities. Facilities that exceed health-based thresholds are required to report their air toxics emissions as part of the toxic "Hot Spots" program and update their emissions data every four years. Facilities are required to report their air toxics emissions data if there is an increase that would trigger the reporting threshold of the hotspots program. Air toxics emissions from motor vehicles and consumer products are estimated by the ARB. These estimates are generally regional in nature, reflecting traffic and population.

The ARB also maintains chemical speciation profiles that can be used to estimate toxics emissions when no toxic emissions data is available.

What additional toxic emissions information is needed?

In order to assess cumulative air pollution impacts, updated information from individual facilities is needed. Even for sources where emissions data are available, additional information such as the location of emissions release points is often needed to better model cumulative impacts. In terms of motor vehicles, emissions data are currently based on traffic models that only contain major roads and freeways. Local traffic data are needed so that traffic emissions can be more accurately assigned to specific streets and roads. Local information is also needed for off-road emission sources, such as ships, trains, and construction equipment. In addition, hourly maximum emissions data are needed for assessing acute air pollution impacts.

What work is underway?

ARB is working with CAPCOA to improve toxic emissions data, developing a community health air pollution information system to improve access to emission information, conducting neighborhood assessment studies to better understand toxic emission sources, and conducting surveys of sources of toxic pollutants.

How is air pollution monitored?

While emissions data identify how much air pollution is going into the air, the state's air quality monitoring network measures air pollutant levels in outdoor air. The statewide air monitoring network is primarily designed to measure regional exposure to air pollutants, and consists of more than 250 air monitoring sites.

The air toxics monitoring network consists of approximately 20 permanent sites. These sites are supplemented by special monitoring studies conducted by ARB and local air districts. These sites measure approximately sixty toxic air pollutants. Diesel PM, which is the major driver of urban air toxic risk, is not monitored directly. Ten of the

60 toxic pollutants, not including diesel, account for most of the remaining potential cancer risk in California urban areas.

What additional monitoring has been done?

Recently, additional monitoring has been done to look at air quality at the community level. ARB's community monitoring was conducted in six communities located throughout the state. Most sites were in low-income, minority communities located near major sources of air pollution, such as refineries or freeways. The monitoring took place for a year or more in each community, and included measurements of both criteria and toxic pollutants.

What is being learned from community monitoring?

In some cases, the ARB or local air districts have performed air quality monitoring or modeling studies covering a particular region of the state. When available, these studies can give information about regional air pollution exposures.

The preliminary results of ARB's community monitoring are providing insights into air pollution at the community level. Urban background levels are a major contributor to the overall risk from air toxics in urban areas, and this urban background tends to mask the differences between communities. When localized elevated air pollutant levels were measured, they were usually associated with local ground-level sources of toxic pollutants. The most common source of this type was busy streets and freeways. The impact these ground-level sources had on local air quality decreased rapidly with distance from the source. Pollutant levels usually returned to urban background levels within a few hundred meters of the source.

These results indicate that tools to assess cumulative impacts must be able to account for both localized, near-source impacts, as well as regional background air pollution. The tools that ARB is developing for this purpose are air quality models.

How can air quality modeling be used?

While air monitoring can directly measure cumulative exposure to air pollution, it is limited because all locations cannot be monitored. To address this, air quality modeling provides the capability to estimate exposure when air monitoring is not feasible. Air quality modeling can be refined to assess local exposure, identify locations of potential hot spots, and identify the relative contribution of emission sources to exposure at specific locations. The ARB has used this type of information to develop regional cumulative risk maps that estimate the cumulative cancer air pollution risk for most of California. While these maps only show one air pollution-related health risk, it does provide a useful starting point.

What is needed for community modeling?

Air quality models have been developed to assess near-source impacts, but they have very exacting data requirements. These near-source models estimate the impact of local sources, but do not routinely include the contribution from regional air pollution background. To estimate cumulative air pollution exposure at a neighborhood scale, a modeling approach needs to combine features of both micro-scale and regional models.

In addition, improved methods are needed to assess near-source impacts under light and variable wind conditions, when high local concentrations are more likely to occur. A method for modeling long-term exposure to air pollutants near freeways and other high traffic areas is also needed.

What modeling work has ARB developed?

A key component of ARB's Community Health Program is the Neighborhood Assessment Program (NAP). As described later in this section, the NAP studies are being conducted to better understand pollution impacts at the community level. Through two such studies conducted in Barrio Logan (San Diego) and Wilmington (Los Angeles), ARB is refining community-level modeling methodologies. Regional air toxics modeling is also being performed to better understand regional air pollution background levels.

In a parallel effort, ARB is developing modeling protocols for estimating cumulative emissions, exposure, and risk from air pollution. The protocols will cover modeling approaches and uncertainties, procedures for running the models, the development of statewide risk maps, and methods for estimating health risks. The protocols are subject to an extensive peer review process prior to release.

How are air pollution impacts on community health assessed?

On a statewide basis, ARB's toxic air contaminant program identifies and reduces public exposure to air toxics. The focus of the program has been on reducing potential cancer risk, because monitoring results show potential urban cancer risk levels are too high. ARB has also looked for potential non-cancer risks based on health reference levels provided by OEHHA. On a regional basis, the pollutants measured in ARB's toxic monitoring network are generally below the OEHHA non-cancer reference exposure levels.

As part of its community health program, the ARB is looking at potential cancer and non-cancer risk. This could include chronic or acute health effects. If the assessment work shows elevated exposures on a localized basis, ARB will work with OEHHA to assess the health impacts.

What tools has ARB developed to assess cumulative air pollution impacts?

ARB has developed the following tools and reports to assist land use agencies and local air districts assess and reduce cumulative emissions, exposure, and risk on a neighborhood scale.

Statewide Risk Maps

ARB has produced regional risk maps that show the statewide trends for Southern and Central California in estimated potential cancer risk from air toxics between 1990 and 2010.[2] These maps will supplement U.S. EPA's ASPEN model and are available on the ARB's Internet site. These maps are best used to obtain an estimate of the regional background air pollution health risk and are not detailed enough to estimate the exact risk at a specific location.

ARB also has maps that focus in more detail on smaller areas that fall within the Southern and Central California regions for these same modeled years. The finest visual resolution available in the maps on this web site is two by two kilometers. These maps are not detailed enough to assess individual neighborhoods or facilities.

Community Health Air Pollution Information System (CHAPIS)

CHAPIS is an Internet-based procedure for displaying information on emissions from sources of air pollution in an easy to use mapping format. CHAPIS uses Geographical Information System (GIS) software to deliver interactive maps over the Internet. CHAPIS relies on emission estimates reported to the ARB's emission inventory database - California Emissions Inventory Development and Reporting System, or CEIDARS.

Through CHAPIS, air district staff can quickly and easily identify pollutant sources and emissions within a specified area. CHAPIS contains information on air pollution emissions from selected large facilities and small businesses that emit criteria and toxic air pollutants. It also contains information on air pollution emissions from motor vehicle and areawide emissions. CHAPIS does not contain information on every source of air pollution or every air pollutant. It is a major long-term objective of CHAPIS to include all of the largest air pollution sources and those with the highest documented air pollution risk. CHAPIS will be updated on a periodic basis and additional facilities will be added to CHAPIS as more data becomes available.

CHAPIS is being developed in stages to assure data quality. The initial release of CHAPIS will include facilities emitting 10 or more tons per year of nitrogen oxides, sulfur dioxide, carbon monoxide, PM10, or reactive organic gases; air toxics from refineries and power plants of 50 megawatts or more; and facilities that conducted health risk

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[2]ARB maintains state trends and local potential cancer risk maps that show statewide trends in potential inhalable cancer risk from air toxics between 1990 and 2010. This information can be viewed at ARB's web site at http://www.arb.ca.gov/toxics/cti/hlthrisk/hlthrisk.htm)

assessments under the California Air Toxics "Hot Spots" Information and Assessment Program.[3]

CHAPIS can be used to identify the emission contributions from mobile, area, and point sources on that community.

"Hot Spots" Analysis and Reporting Program (HARP)

HARP[4] is a software package available from the ARB and is designed with air quality professionals in mind. It models emissions and release data from one or more facilities to estimate the potential health risk posed by the selected facilities on the neighboring community. HARP uses the latest risk assessment guidelines published by OEHHA.

With HARP, a user can perform the following tasks:

- Create and manage facility databases;
- Perform air dispersion modeling;
- Conduct health risk analyses;
- Output data reports; and
- Output results to GIS mapping software.

HARP can model downwind concentrations of air toxics based on the calculated emissions dispersion at a single facility. HARP also has the capability of assessing the risk from multiple facilities, and for multiple locations of concern near those facilities. While HARP has the capability to assess multiple source impacts, there had been limited application of the multiple facility assessment function in the field at the time of HARP's debut in 2003. HARP can also evaluate multi-pathway, non-inhalation health risk resulting from air pollution exposure, including skin and soil exposure, and ingestion of meat and vegetables contaminated with air toxics, and other toxics that have accumulated in a mother's breast milk.

Neighborhood Assessment Program (NAP)

The NAP[5] has been a key component of ARB's Community Health Program. It includes the development of tools that can be used to perform assessments of cumulative air pollution impacts on a neighborhood scale. The NAP studies have been done to better understand how air pollution affects individuals at the neighborhood level. Thus far, ARB has conducted neighborhood scale assessments in Barrio Logan and Wilmington.

As part of these studies, ARB is collecting data and developing a modeling protocol that can be used to conduct cumulative air pollution impact assessments. Initially these

[3] California Health & Safety Code section 44300, et seq.
[4] More detailed information can be found on ARB's website at: http://www.arb.ca.gov/toxics/harp/harp.htm
[5] For more information on the Program, please refer to: http://www.arb.ca.gov/ch/programs/nap/nap.htm

assessments will focus on cumulative inhalation cancer health risk and chronic non-cancer impacts. The major challenge is developing modeling methods that can combine both regional and localized air pollution impacts, and identifying the critical data necessary to support these models. The objective is to develop methods and tools from these studies that can ultimately be applied to other areas of the state. In addition, the ARB plans to use these methods to replace the ASPEN regional risk maps currently posted on the ARB Internet site.

Urban Emissions Model (URBEMIS)

URBEMIS[6] is a computer program that can be used to estimate emissions associated with land development projects in California such as residential neighborhoods, shopping centers, office buildings, and construction projects. URBEMIS uses emission factors available from the ARB to estimate vehicle emissions associated with new land uses. URBEMIS estimates sulfur dioxide emissions from motor vehicles in addition to reactive organic gases, nitrogen oxides, carbon monoxide, and PM10.

Land-Use Air Quality Linkage Report[7]

This report summarizes data currently available on the relationships between land use, transportation and air quality. It also highlights strategies that can help to reduce the use of the private automobile. It also briefly summarizes two ARB-funded research projects. The first project analyzes the travel patterns of residents living in five higher density, mixed use neighborhoods in California, and compares them to travel in more auto-oriented areas. The second study correlates the relationship between travel behavior and community characteristics, such as density, mixed land uses, transit service, and accessibility for pedestrians.

[6] For more information on this model, please refer to ARB's website at http://www.arb.ca.gov/html/soft.htm.
[7] To access this report, please refer to ARB's website or click on: http://www.arb.ca.gov/ch/programs/link97.pdf

LAND USE AND AIR QUALITY AGENCY ROLES IN THE LAND USE PROCESS

A wide variety of federal, state, and local government agencies are responsible for regulatory, planning, and siting decisions that can have an impact on air pollution. They include local land use agencies, regional councils of government, school districts, local air districts, ARB, the California Department of Transportation (Caltrans), and the Governor's Office of Planning and Research (OPR) to name a few. This Section will focus on the roles and responsibilities of local and state agencies. The role of school districts will be discussed in Appendix E.

Local Land Use Agencies

Under the State Constitution, land use agencies have the primary authority to plan and control land use.[1] Each of California's incorporated cities and counties are required to adopt a comprehensive, long-term General Plan.[2]

The General Plan's long-term goals are implemented through zoning ordinances. These are local laws adopted by counties and cities that describe for specific areas the kinds of development that will be allowed within their boundaries.

Land use agencies are also the lead for doing environmental assessments under CEQA for new projects that may pose a significant environmental impact, or for new or revised General Plans.

Local Agency Formation Commissions (LAFCOs)

Operating in each of California's 58 counties, LAFCOs are composed of local elected officials and public members who are responsible for coordinating changes in local governmental boundaries, conducting special studies that review ways to reorganize, simplify, and streamline governmental structures, and preparing a sphere of influence for each city and special district within each county. Each Commission's efforts are directed toward seeing that local government services are provided efficiently and economically while agricultural and open-space lands are protected. LAFCO decisions strive to balance the competing needs in California for efficient services, affordable housing, economic opportunity, and conservation of natural resources.

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[1] The legal basis for planning and land use regulation is the "police power" of the city or county to protect the public's health, safety and welfare. The California Constitution gives cities and counties the power to make and enforce all local police, sanitary and other ordinances and regulations not in conflict with general laws. State law reference: California Constitution, Article XI §7.

[2] OPR General Plan Guidelines, 2003: http://www.opr.ca.gov/planning/PDFs/General_Plan_Guidelines_2003.pdf

Councils of Government (COG)

COGs are organizations composed of local counties and cities that serve as a focus for the development of sound regional planning, including plans for transportation, growth management, hazardous waste management, and air quality. They can also function as the metropolitan planning organization for coordinating the region's transportation programs. COGs also prepare regional housing need allocations for updates of General Plan housing elements.

Local Air Districts

Under state law, air pollution control districts or air quality management districts (local air districts) are the local government agencies responsible for improving air quality and are generally the first point of contact for resolving local air pollution issues or complaints. There are 35 local air districts in California[3] that have authority and primary responsibility for regional clean air planning. Local air districts regulate stationary sources of air pollutants within their jurisdiction including but not limited to industrial and commercial facilities, power plants, construction activities, outdoor burning, and other non-mobile sources of air pollution. Some local air districts also regulate public and private motor vehicle fleet operators such as public bus systems, private shuttle and taxi services, and commercial truck depots.

- **Regional Clean Air Plans**

Local air districts are responsible for the development and adoption of clean air plans that protect the public from the harmful effects of air pollution. These plans incorporate strategies that are necessary to attain ambient air quality standards. Also included in these regional air plans are ARB and local district measures to reduce statewide emissions from mobile sources, consumer products, and industrial sources.

- **Facility-Specific Considerations**

Permitting. In addition to the planning function, local air districts adopt and enforce regulations, issue permits, and evaluate the potential environmental impacts of projects.

Pollution is regulated through permits and technology-based rules that limit emissions from operating units within a facility or set standards that vehicle fleet operators must meet. Permits to construct and permits to operate contain very specific requirements and conditions that tell each regulated source what it must do to limit its air pollution in compliance with local air district rules, regulations, and state law. Prior to receiving a permit, new facilities must go through a New Source Review (NSR) process that establishes air pollution control requirements for the facility. Permit conditions are typically contained in the permit to operate and specify requirements that businesses must follow; these may include limits on the amount of pollution that can be emitted, the

[3] Contact information for local air districts in California is listed in the front of this Handbook.

type of pollution control equipment that must be installed and maintained, and various record-keeping requirements.

Local air districts also notify the public about new permit applications for major new facilities, or major modifications to existing facilities that seek to locate within 1,000 feet of a school.

Local air districts can also regulate other types of sources to reduce emissions. These include regulations to reduce emissions from the following sources:

- hazardous materials in products used by industry such as paints, solvents, and de-greasers;
- agricultural and residential burning;
- leaking gasoline nozzles at service stations;
- public fleet vehicles such as sanitation trucks and school buses; and
- fugitive or uncontrolled dust at construction sites.

However, while emissions from industrial and commercial sources are typically subject to the permit authority of the local air district, sensitive sites such as a day care center, convalescent home, or playground are not ordinarily subject to an air permit. Local air district permits address the air pollutant emissions of a project but not its location.

Under the state's air toxics program, local air districts regulate air toxic emissions by adopting ARB air toxic control measures, or more stringent district-specific requirements, and by requiring individual facilities to perform a health risk assessment if emissions at the source exceed district-specific health risk thresholds[4], [5] (See the section on ARB programs for a more detailed summary of this program).

One approach by which local air districts regulate air toxics emissions is through the "Hot Spots" program.[6] The risk assessments submitted by the facilities under this

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[4] Cal/EPA's Office of Environmental Health Hazard Assessment has published "A Guide to Health Risk Assessment" for lay people involved in environmental health issues, including policymakers, businesspeople, members of community groups, and others with an interest in the potential health effects of toxic chemicals. To access this information, please refer to http://www.oehha.ca.gov/pdf/HRSguide2001.pdf

[5] Section 44306 of the California Health & Safety Code defines a health risk assessment as a detailed comprehensive analysis that a polluting facility uses to evaluate and predict the dispersion of hazardous substances in the environment and the potential for exposure of human populations, and to assess and quantify both the individual and population-wide health risks associated with those levels of exposure.

[6] AB-2588 (the Air Toxics "Hot Spots" Information and Assessment Act) requires local air districts to prioritize facilities by high, intermediate, and low priority categories to determine which must perform a health risk assessment. Each district is responsible for establishing the prioritization score threshold at which facilities are required to prepare a health risk assessment. In establishing priorities for each facility, local air districts must consider the potency, toxicity, quantity, and volume of hazardous materials released from the facility, the proximity of the facility to potential receptors, and any other factors that the district determines may indicate that the facility may pose a significant risk. All facilities within the highest category must prepare a health risk assessment. In addition, each district may require facilities in the intermediate and low priority categories to also submit a health risk assessment.

Table D-1
Local Sources of Air Pollution, Responsible Agencies, and Associated Regulatory Programs

Source	Examples	Primary Agency	Applicable Regulations
Large Stationary	Refineries, power plants, chemical facilities, certain manufacturing plants	Local air districts	Operating permit rules Air Toxics "Hot Spots" Law (AB 2588) Local district rules Air Toxic Control Measures (ATCMs)* New Source Review rules Title V permit rules
Small Stationary	Dry cleaners, auto body shops, welders, chrome plating facilities, service stations, certain manufacturing plants	Local air districts	Operating permit conditions, Air Toxics "Hot Spots" Law (AB 2588) Local district rules ATCMs* New Source Review rules
Mobile (non-fleet)	Cars, trucks, buses	ARB	Emission standards Cleaner-burning fuels (e.g., unleaded gasoline, low-sulfur diesel) Inspection and repair programs (e.g., Smog Check)
Mobile Equipment	Construction equipment	ARB, U.S. EPA	ARB rules U.S. EPA rules
Mobile (fleet)	Truck depots, school buses, taxi services	Local air districts, ARB	Local air district rules ARB urban bus fleet rule
Areawide	Paints and consumer products such as hair spray and spray paint	Local air district, ARB	ARB rules Local air district rules

*ARB adopts ATCMs, but local air districts have the responsibility to implement and enforce these measures or more stringent ones.

program are reviewed by OEHHA and approved by the local air district. Risk assessments are available by contacting the local air district.

Enforcement. Local air districts also take enforcement action to ensure compliance with air quality requirements. They enforce air toxic control measures, agricultural and residential burning programs, gasoline vapor control regulations, laws that prohibit air pollution nuisances, visible emission limits, and many other requirements designed to

clean the air. Local districts use a variety of enforcement tools to ensure compliance. These include notices of violation, monetary penalties, and abatement orders. Under some circumstances, a permit may be revoked.

- **Environmental Review**

As required by the California Environmental Quality Act (CEQA), local air districts also review and comment on proposed land use plans and development projects that can have a significant effect on the environment or public health.[7]

California Air Resources Board

The ARB is the air pollution control agency at the state level that is responsible for the preparation of air plans required by state and federal law. In this regard, it coordinates the activities of all local air districts to ensure all statutory requirements are met and to reduce air pollution emissions for sources under its jurisdiction.

Motor vehicles are the single largest emissions source category under ARB's jurisdiction as well as the largest overall emissions source statewide. ARB also regulates emissions from other mobile equipment and engines as well as emissions from consumer products such as hair sprays, perfumes, cleaners, and aerosol paints.

Air Toxics Program

Under state law, the ARB has a critical role to play in the identification, prioritization, and control of air toxic emissions. The ARB statewide comprehensive air toxics program was established in the early 1980's. The Toxic Air Contaminant Identification and Control Act of 1983 (AB 1807, Tanner 1983) created California's program to reduce exposure to air toxics.[8] The Air Toxics "Hot Spots" Information and Assessment Act (Hot Spots program) supplements the AB 1807 program, by requiring a statewide air toxics inventory, notification of people exposed to a significant health risk, and facility plans to reduce these risks.

Under AB 1807, the ARB is required to use certain criteria to prioritize the identification and control of air toxics. In selecting substances for review, the ARB must consider criteria relating to emissions, exposure, and health risk, as well as persistence in the atmosphere, and ambient concentrations in the community. AB 1807 also requires the ARB to use available information gathered from the Hot Spots program when prioritizing compounds.

The ARB identifies pollutants as toxic air contaminants and adopts statewide air toxic control measures (ATCMs). Once ARB adopts an ATCM, local air districts must

[7] Section 4 of this Handbook contains more information on the CEQA process.
[8] For a general background on California's air toxics program, the reader should refer to ARB's website at http://www.arb.ca.gov/toxics/tac/appendxb.htm.

implement the measure, or adopt and implement district-specific measures that are at least as stringent as the state standard. Taken in the aggregate, these ARB programs will continue to further reduce emissions, exposure, and health risk statewide.

With regard to the land use decision-making process, ARB, in conjunction with local air districts, plays an advisory role by providing technical information on land use-related air issues.

Other Agencies

Governor's Office of Planning and Research (OPR)

In addition to serving as the Governor's advisor on land use planning, research, and liaison with local government, OPR develops and implements the state's policy on land use planning and coordinates the state's environmental justice programs. OPR updated its General Plan Guidelines in 2003 to highlight the importance of sustainable development and environmental justice policies in the planning process. OPR also advises project proponents and government agencies on CEQA provisions and operates the State Clearinghouse for environmental and federal grant documents.

California Department of Housing and Community Development

The Department of Housing and Community Development (HCD) administers a variety of state laws, programs and policies to preserve and expand housing opportunities, including the development of affordable housing. All local jurisdictions must update their housing elements according to a staggered statutory schedule, and are subject to certification by HCD. In their housing elements, cities and counties are required to include a land inventory which identifies and zones sites for future residential development to accommodate a mix of housing types, and to remove barriers to the development of housing.

An objective of state housing element law is to increase the overall supply and affordability of housing. Other fundamental goals include conserving existing affordable housing, improving the condition of the existing housing stock, removing regulatory barriers to housing production, expanding equal housing opportunities, and addressing the special housing needs of the state's most vulnerable residents (frail elderly, disabled, large families with children, farmworkers, and the homeless).

Transportation Agencies

Transportation agencies can also influence mobile source-related emissions in the land use decision-making process. Local transportation agencies work with land use agencies to develop a transportation (circulation) element for the General Plan. These local government agencies then work with other transportation-related agencies, such as the Congestion Management Agency (CMA), Metropolitan Planning Organization

(MPO), Regional Transportation Planning Agency (RTPA), and Caltrans to develop long and short range transportation plans and projects.

Caltrans is the agency responsible for setting state transportation goals and for state transportation planning, design, construction, operations and maintenance activities. Caltrans is also responsible for delivering California's multibillion-dollar state Transportation Improvement Program, a list of transportation projects that are approved for funding by the California Transportation Commission in a 4-year cycle.

When safety hazards or traffic circulation problems are identified in the existing road system, or when land use changes are proposed such as a new residential subdivision, shopping mall or manufacturing center, Caltrans and/or the local transportation agency ensure the projects meet applicable state, regional, and local goals and objectives.

Caltrans also evaluates transportation-related projects for regional air quality impacts, from the perspective of travel-related emissions as well as road congestion and increases in road capacity (new lanes).

California Energy Commission (CEC)

The CEC is the state's CEQA lead agency for permitting large thermal power plants (50 megawatts or greater). The CEC works closely with local air districts and other federal, state and local agencies to ensure compliance with applicable laws, ordinances, regulations and standards in the permitting, construction, operation and closure of such plants. The CEC uses an open and public review process that provides communities with outreach and multiple opportunities to participate and be heard. In addition to its comprehensive environmental impact and engineering design assessment process, the CEC also conducts an environmental justice evaluation. This evaluation involves an initial demographic screening to determine if a qualifying minority or low-income population exists in the vicinity of the proposed project. If such a population is present, staff considers possible environmental justice impacts including from associated project emissions in its technical assessments.[9]

Department of Pesticides Regulation (DPR)

Pesticides are industrial chemicals produced specifically for their toxicity to a target pest. They must be released into the environment to do their job. Therefore, regulation of pesticides focuses on using toxicity and other information to ensure that when pesticides are used according to their label directions, potential for harm to people and the environment is minimized. DPR imposes strict controls on use, beginning before pesticide products can be sold in California, with an extensive scientific program to ensure they can be used safely. DPR and county enforcement staff tracks the use of pesticides to ensure that pesticides are used properly. DPR collects periodic

[9] See California Energy Commission, "Environmental Performance Report," July 2001 at http://www.energy.ca.gov/reports/2001-11-20_700-01-001.PDF

measurements of any remaining amounts of pesticides in water, air, and on fresh produce. If unsafe levels are found, DPR requires changes in how pesticides are used, to reduce the possibility of harm. If this cannot be done - that is, if a pesticide cannot be used safely - use of the pesticide will be banned in California.[10]

Federal Agencies

Federal agencies have permit authority over activities on federal lands and certain resources, which have been the subject of congressional legislation, such as air, water quality, wildlife, and navigable waters. The U.S. Environmental Protection Agency generally oversees implementation of the federal Clean Air Act, and has broad authority for regulating certain activities such as mobile sources, air toxics sources, the disposal of toxic wastes, and the use of pesticides. The responsibility for implementing some federal regulatory programs such as those for air and water quality and toxics is delegated by management to specific state and local agencies. Although federal agencies are not subject to CEQA they must follow their own environmental process established under the National Environmental Policy Act (NEPA).

[10] For more information, the reader is encouraged to visit the Department of Pesticide Regulation web site at www.cdpr.ca.gov/docs/empm/pubs/tacmenu.htm.

SPECIAL PROCESSES THAT APPLY TO SCHOOL SITING

The California Education Code and the California Public Resources Code place primary authority for siting public schools with the local school district, which is the 'lead agency' for purposes of CEQA. The California Education Code requires public school districts to notify the local planning agency about siting a new public school or expanding an existing school. The planning agency then reports back to the school district regarding a project's conformity with the adopted General Plan. However, school districts can overrule local zoning and land use designations for schools if they follow specified procedures. In addition, all school districts must evaluate new school sites using site selection standards established in Section 14010 of Title 5 of the California Code of Regulations. Districts seeking state funding for school site acquisition must also obtain site approval from the California Department of Education.

Before making a final decision on a school site acquisition, a school district must comply with CEQA and evaluate the proposed site acquisition/new school project for air emissions and health risks by preparing and certifying an environmental impact report or negative declaration. Both the California Education Code section 17213 and the California Public Resources Code section 21151.8 require school districts to consult with administering agencies and local air districts when preparing the environmental assessment. Such consultation is required to identify both permitted and non-permitted "facilities" that might significantly affect health at the new site. These facilities include, but are not limited to, freeways and other busy traffic corridors, large agricultural operations, and rail yards that are within one-quarter mile of the proposed school site, and that might emit hazardous air emissions, or handle hazardous or acutely hazardous materials, substances, or waste.

As part of the CEQA process and before approving a school site, the school district must make a finding that either it found none of the facilities or significant air pollution sources, or alternatively, if the school district finds that there are such facilities or sources, it must determine either that they pose no significant health risks, or that corrective actions by another governmental entity would be taken so that there would be no actual or potential endangerment to students or school workers.

In addition, if the proposed school site boundary is within 500 feet of the edge of the closest traffic lane of a freeway or traffic corridor that has specified minimum average daily traffic counts, the school district is required to determine through specified risk assessment and air dispersion modeling that neither short-term nor long term exposure poses significant heath risks to pupils.

State law changes effective January 1, 2004 (SB352, Escutia 2003, amending Education Code section 17213 and Public Resources Code section 21151.8) also provides for cases in which the school district cannot make either of those two findings and cannot find a suitable alternative site. When this occurs, the school district must adopt a statement of over-riding considerations, as part of an environmental impact

report, that the project should be approved based on the ultimate balancing of the merits.

Some school districts use a standardized assessment process to determine the environmental impacts of a proposed school site. In the assessment process, school districts can use maps and other available information to evaluate risk, including a local air district's database of permitted source emissions. School districts can also perform field surveys and record searches to identify and calculate emissions from non-permitted sources within one-quarter mile radius of a proposed site. Traffic count data and vehicular emissions data can also be obtained from Caltrans for major roadways and freeways in proximity to the proposed site to model potential emissions impacts to students and school employees. This information is available from the local COG, Caltrans, or local cities and counties for non-state maintained roads.

GENERAL PROCESSES USED BY LAND USE AGENCIES TO ADDRESS AIR POLLUTION IMPACTS

There are several separate but related processes for addressing the air pollution impacts of land use projects. One takes place as part of the planning and zoning function. This consists of preparing and implementing goals and policies contained in county or city General Plans, community or area plans, and specific plans governing land uses such as residential, educational, commercial, industrial, and recreational activities. It also includes recommending locations for thoroughfares, parks and other public improvements.

Land use agencies also have a permitting function that includes performing environmental reviews and mitigation when projects may pose a significant environmental impact. They conduct inspections for zoning permits issued, enforce the zoning regulations and issue violations as necessary, issue zoning certificates of compliance, and check compliance when approving certificates of occupancy.

Planning

- **General Plan**[1]

The General Plan is a local government "blueprint" of existing and future anticipated land uses for long-term future development. It is composed of the goals, policies, and general elements upon which land use decisions are based. Because the General Plan is the foundation for all local planning and development, it is an important tool for implementing policies and programs beneficial to air quality. Local governments may choose to adopt a separate air quality element into their General Plan or to integrate air quality-beneficial objectives, policies, and strategies in other elements of the Plan, such as the land use, circulation, conservation, and community design elements.

More information on General Plan elements is contained in Appendix D.

- **Community Plans**

Community or area plans are terms for plans that focus on a particular region or community within the overall general plan area. It refines the policies of the general plan as they apply to a smaller geographic area and is implemented by ordinances and other discretionary actions, such as zoning.

[1] In October 2003, OPR revised its General Plan Guidelines. An entire chapter is now devoted to a discussion of how sustainable development and environmental justice goals can be incorporated into the land use planning process. For further information, the reader is encouraged to obtain a copy of OPR's General Plan Guidelines, or refer to their website at: http://www.opr.ca.gov/planning/PDFs/General_Plan_Guidelines_2003.pdf

- **Specific Plan**

A specific plan is a hybrid that can combine policies with development regulations or zoning requirements. It is often used to address the development requirements for a single project such as urban infill or a planned community. As a result, its emphasis is on concrete standards and development criteria.

- **Zoning**

Zoning is the public regulation of the use of land. It involves the adoption of ordinances that divide a community into various districts or zones. For instance, zoning ordinances designate what projects and activities can be sited in particular locations. Each zone designates allowable uses of land within that zone, such as residential, commercial, or industrial. Zoning ordinances can address building development standards, e.g., minimum lot size, maximum building height, minimum building setback, parking, signage, density, and other allowable uses.

Land Use Permitting

In addition to the planning and zoning function, land use agencies issue building and business permits, and evaluate the potential environmental impacts of projects. To be approved, projects must be located in a designated zone and comply with applicable ordinances and zoning requirements.

Even if a project is sited properly in a designated zone, a land use agency may require a new source to mitigate potential localized environmental impacts to the surrounding community below what would be required by the local air district. In this case, the land use agency could condition the permit by limiting or prescribing allowable uses including operating hour restrictions, building standards and codes, property setbacks between the business property and the street or other structures, vehicle idling restrictions, or traffic diversion.

Land use agencies also evaluate the environmental impacts of proposed land use projects or activities. If a project or activity falls under CEQA, the land use agency requires an environmental review before issuing a permit to determine if there is the potential for a significant impact, and if so, to mitigate the impact or possibly deny the project.

- **Land Use Permitting Process**

In California, the authority to regulate land use is delegated to city and county governments. The local land use planning agency is the local government administrative body that typically provides information and coordinates the review of development project applications. Conditional Use Permits (CUP) typically fall within a land use agency's discretionary authority and therefore are subject to CEQA. CUPs are

intended to provide an opportunity to review the location, design, and manner of development of land uses prior to project approval. A traditional purpose of the CUP is to enable a municipality to control certain uses that could have detrimental environmental effects on the community.

The process for permitting new discretionary projects is quite elaborate, but can be broken down into five fundamental components:

- Project application
- Environmental assessment
- Consultation
- Public comment
- Public hearing and decision

Project Application

The permit process begins when the land use agency receives a project application, with a detailed project description, and support documentation. During this phase, the agency reviews the submitted application for completeness. When the agency deems the application to be complete, the permit process moves into the environmental review phase.

Environmental Assessment

If the project is discretionary and the application is accepted as complete, the project proposal or activity must undergo an environmental clearance process under CEQA and the CEQA Guidelines adopted by the California Resources Agency.[2] The purpose of the CEQA process is to inform decision-makers and the public of the potential significant environmental impacts of a project or activity, to identify measures to minimize or eliminate those impacts to the point they are no longer significant, and to discuss alternatives that will accomplish the project goals and objectives in a less environmentally harmful manner.

What is a "Lead Agency"?

A lead agency is the public agency that has the principal responsibility for carrying out or approving a project that is subject to CEQA. In general, the land use agency is the preferred public agency serving as lead agency because it has jurisdiction over general land uses. The lead agency is responsible for determining the appropriate environmental document, as well as its preparation.

What is a "Responsible Agency"?

A responsible agency is a public agency with discretionary approval authority over a portion of a CEQA project (e.g., projects requiring a permit). As a responsible agency, the agency is available to the lead agency and project proponent for early consultation on a project to apprise them of applicable rules and regulations, potential adverse impacts, alternatives, and mitigation measures, and provide guidance as needed on applicable methodologies or other related issues.

What is a "Commenting Agency"?

A commenting agency is any public agency that comments on a CEQA document, but is neither a lead agency nor a responsible agency. For example, a local air district, as the agency with the responsibility for comprehensive air pollution control, could review and comment on an air quality analysis in a CEQA document for a proposed distribution center, even though the project was not subject to a permit or other pollution control requirements.

[2] Projects and activities that may have a significant adverse impact on the environment are evaluated under CEQA Guidelines set forth in title 14 of the California Code of Regulations, sections 15000 et seq.

To assist the lead agency in determining whether the project or activity may have a significant effect that would require the preparation of an EIR, the land use agency may consider criteria, or thresholds of significance, to assess the potential impacts of the project, including its air quality impacts. The land use agency must consider any credible evidence in addition to the thresholds, however, in determining whether the project or activity may have a significant effect that would trigger the preparation of an EIR.

The screening criteria to determine significance is based on a variety of factors, including local, state, and federal regulations, administrative practices of other public agencies, and commonly accepted professional standards. However, the final determination of significance for individual projects is the responsibility of the lead agency. In the case of land use projects, the lead agency would be the City Council or County Board of Supervisors.

A new land use plan or project can also trigger an environmental assessment under CEQA if, among other things, it will expose sensitive sites such as schools, day care centers, hospitals, retirement homes, convalescence facilities, and residences to substantial pollutant concentrations.[3]

CEQA only applies to "discretionary projects." Discretionary means the public agency must exercise judgment and deliberation when deciding to approve or disapprove a particular project or activity, and may append specific conditions to its approval. Examples of discretionary projects include the issuance of a CUP, re-zoning a property, or widening of a public road. Projects that are not subject to the exercise of agency discretion, and can therefore be approved administratively through the application of set standards are referred to as ministerial projects. CEQA does not apply to ministerial projects.[4] Examples of typical ministerial projects include the issuance of most building permits or a business license.

Once a potential environmental impact associated with a project is identified through an environmental assessment, mitigation must be considered. A land use agency should incorporate mitigation measures that are suggested by the local air district as part of the project review process.

Consultation

Application materials are provided to various departments and agencies that may have an interest in the project (e.g., air pollution, building, police, fire, water agency, Fish and Game, etc.) for consultation and input.

[3] Readers interested in learning more about CEQA should contact OPR or visit their website at http://www.opr.ca.gov/.
[4] See California Public Resources Code section 21080(b)(1).

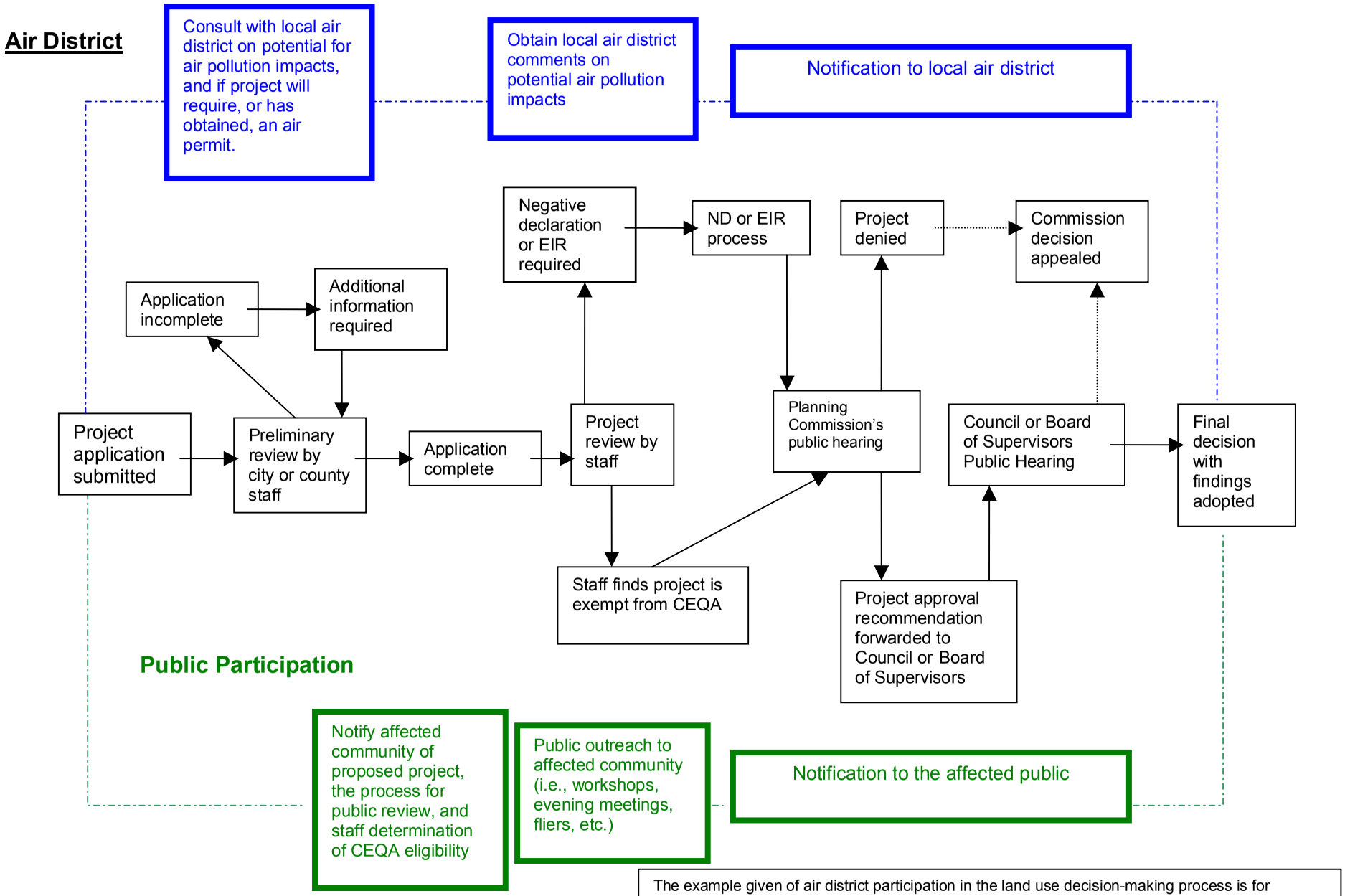
Public Comment

Following the environmental review process, the Planning Commission reviews application along with the staff's report on the project assessment and a public comment period is set and input is solicited.

Public Hearing and Decision

Permit rules vary depending on the particular permit authority in question, but the process generally involves comparing the proposed project with the land use agency standards or policies. The procedure usually leads to a public hearing, which is followed by a written decision by the agency or its designated officer. Typically, a project is approved, denied, or approved subject to specified conditions.

USE PERMIT (DISCRETIONARY ACTION) REVIEW PROCESS*



The example given of air district participation in the land use decision-making process is for illustrative purposes only. In reality, the land use siting process involves the ongoing participation of multiple affected agencies and stakeholders throughout the process.

GLOSSARY OF KEY AIR POLLUTION TERMS

Air Pollution Control Board or Air Quality Management Board: Serves as the governing board for local air districts. It consists of appointed or elected members from the public or private sector. It conducts public hearings to adopt local air pollution regulations.

Air Pollution Control Districts or Air Quality Management Districts (local air district): A county or regional agency with authority to regulate stationary and area sources of air pollution within a given county or region. Governed by a district air pollution control board.

Air Pollution Control Officer (APCO): Head of a local air pollution control or air quality management district.

Air Toxic Control Measures (ATCM): A control measure adopted by the ARB (Health and Safety Code section 39666 et seq.), which reduces emissions of toxic air contaminants.

Ambient Air Quality Standards: An air quality standard defines the maximum amount of a pollutant that can be present in the outdoor air during a specific time period without harming the public's health. Only U.S. EPA and the ARB may establish air quality standards. No other state has this authority. Air quality standards are a measure of clean air. More specifically, an air quality standard establishes the concentration at which a pollutant is known to cause adverse health effects to sensitive groups within the population, such as children and the elderly. Federal standards are referred to as National Ambient Air Quality Standards (NAAQS); state standards are referred to as California ambient air quality standards (CAAQS).

Area-wide Sources: Sources of air pollution that individually emit small amounts of pollution, but together add up to significant quantities of pollution. Examples include consumer products, fireplaces, road dust, and farming operations.

Attainment vs. Nonattainment Area: An attainment area is a geographic area that meets the National Ambient Air Quality Standards for the criteria pollutants and a non-attainment area is a geographic area that doesn't meet the NAAQS for criteria pollutants.

Attainment Plan: Attainment plans lay out measures and strategies to attain one or more air quality standards by a specified date.

California Clean Air Act (CCAA): A California law passed in 1988, which provides the basis for air quality planning and regulation independent of federal regulations. A major element of the Act is the requirement that local air districts in violation of the CAAQS

must prepare attainment plans which identify air quality problems, causes, trends, and actions to be taken to attain and maintain California's air quality standards by the earliest practicable date.

California Environmental Quality Act (CEQA): A California law that sets forth a process for public agencies to make informed decisions on discretionary project approvals. The process helps decision-makers determine whether any potential, significant, adverse environmental impacts are associated with a proposed project and to identify alternatives and mitigation measures that will eliminate or reduce such adverse impacts.[1]

California Health and Safety Code: A compilation of California laws, including state air pollution laws, enacted by the Legislature to protect the health and safety of people in California. Government agencies adopt regulations to implement specific provisions of the California Health and Safety Code.

Clean Air Act (CAA): The federal Clean Air Act was adopted by the United States Congress and sets forth standards, procedures, and requirements to be implemented by the U.S. Environmental Protection Agency (U.S. EPA) to protect air quality in the United States.

Councils of Government (COGs): There are 25 COGs in California made up of city and county elected officials. COGs are regional agencies concerned primarily with transportation planning and housing; they do not directly regulate land use.

Criteria Air Pollutant: An air pollutant for which acceptable levels of exposure can be determined and for which an ambient air quality standard has been set. Examples include ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, and PM10 and PM2.5. The term "criteria air pollutants" derives from the requirement that the U.S. EPA and ARB must describe the characteristics and potential health and welfare effects of these pollutants. The U.S. EPA and ARB periodically review new scientific data and may propose revisions to the standards as a result.

District Hearing Board: Hears local air district permit appeals and issues variances and abatement orders. The local air district board appoints the members of the hearing board.

Emission Inventory: An estimate of the amount of pollutants emitted into the atmosphere from mobile, stationary, area-wide, and natural source categories over a specific period of time such as a day or a year.

Environmental Impact Report (EIR): The public document used by a governmental agency to analyze the significant environmental effects of a proposed project, to identify

[1] To track the submittal of CEQA documents to the State Clearinghouse within the Office of Planning and Research, the reader can refer to CEQAnet at http://www.ceqanet.ca.gov.

alternatives, and to disclose possible ways to reduce or avoid the possible negative environmental impacts.

Environmental Justice: California law defines environmental justice as the fair treatment of people of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies (California Government Code sec.65040.12(c)).

General Plans: A statement of policies developed by local governments, including text and diagrams setting forth objectives, principles, standards, and plan proposals for the future physical development of the city or county.

Hazardous Air Pollutants (HAPs): An air pollutant listed under section 112 (b) of the federal Clean Air Act as particularly hazardous to health. U.S. EPA identifies emission sources of hazardous air pollutants, and emission standards are set accordingly. In California, HAPs are referred to as toxic air contaminants.

Land Use Agency: Local government agency that performs functions associated with the review, approval, and enforcement of general plans and plan elements, zoning, and land use permitting. For purposes of this Handbook, a land use agency is typically a local planning department.

Mobile Source: Sources of air pollution such as automobiles, motorcycles, trucks, off-road vehicles, boats, and airplanes.

National Ambient Air Quality Standard (NAAQS): A limit on the level of an outdoor air pollutant established by the US EPA pursuant to the Clean Air Act. There are two types of NAAQS. Primary standards set limits to protect public health and secondary standards set limits to protect public welfare.

Negative Declaration (ND): When the lead agency (the agency responsible for preparing the EIR or ND) under CEQA, finds that there is no substantial evidence that a project may have a significant environmental effect, the agency will prepare a "negative declaration" instead of an EIR.

New Source Review (NSR): A federal Clean Air Act requirement that state implementation plans must include a permit review process, which applies to the construction and operation of new or modified stationary sources in nonattainment areas. Two major elements of NSR to reduce emissions are best available control technology requirements and emission offsets.

Office of Planning and Research (OPR): OPR is part of the Governor's office. OPR has a variety of functions related to local land-use planning and environmental programs. It provides General Plan Guidelines for city and county planners, and coordinates the state clearinghouse for Environmental Impact Reports.

Ordinance: A law adopted by a City Council or County Board of Supervisors. Ordinances usually amend, repeal or supplement the municipal code; provide zoning specifications; or appropriate money for specific purposes.

Overriding Considerations: A ruling made by the lead agency in the CEQA process when the lead agency finds the importance of the project to the community outweighs potential adverse environmental impacts.

Public Comment: An opportunity for the general public to comment on regulations and other proposals made by government agencies. You can submit written or oral comments at the public meeting or send your written comments to the agency.

Public Hearing: A public hearing is an opportunity to testify on a proposed action by a governing board at a public meeting. The public and the media are welcome to attend the hearing and listen to, or participate in, the proceedings.

Public Notice: A public notice identifies the person, business, or local government seeking approval of a specific course of action (such as a regulation). It describes the activity for which approval is being sought, and describes the location where the proposed activity or public meeting will take place.

Public Nuisance: A public nuisance, for the purposes of air pollution regulations, is defined as a discharge from any source whatsoever of such quantities of air contaminants or other material which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public, or which endanger the comfort, repose, health, or safety of any such persons or the public, or which cause, or have a natural tendency to cause, injury or damage to business or property. (Health and Safety Code section 41700).

Property Setback: In zoning parlance, a setback is the minimum amount of space required between a lot line and a building line.

Risk: For cancer health effects, risk is expressed as an estimate of the increased chances of getting cancer due to facility emissions over a 70-year lifetime. This increase in risk is expressed as chances in a million (e.g.,10 chances in a million).

Sensitive Individuals: Refers to those segments of the population most susceptible to poor air quality (i.e., children, the elderly, and those with pre-existing serious health problems affected by air quality).

Sensitive Sites or Sensitive Land Uses: Land uses where sensitive individuals are most likely to spend time, including schools and schoolyards, parks and playgrounds, day care centers, nursing homes, hospitals, and residential communities.

Setback: An area of land separating one parcel of land from another that acts to soften or mitigate the effects of one land use on the other.

State Implementation Plan (SIP): A plan prepared by state and local agencies and submitted to U.S. EPA describing how each area will attain and maintain national ambient air quality standards. SIPs include the technical information about emission inventories, air quality monitoring, control measures and strategies, and enforcement mechanisms. A SIP is composed of local air quality management plans and state air quality regulations.

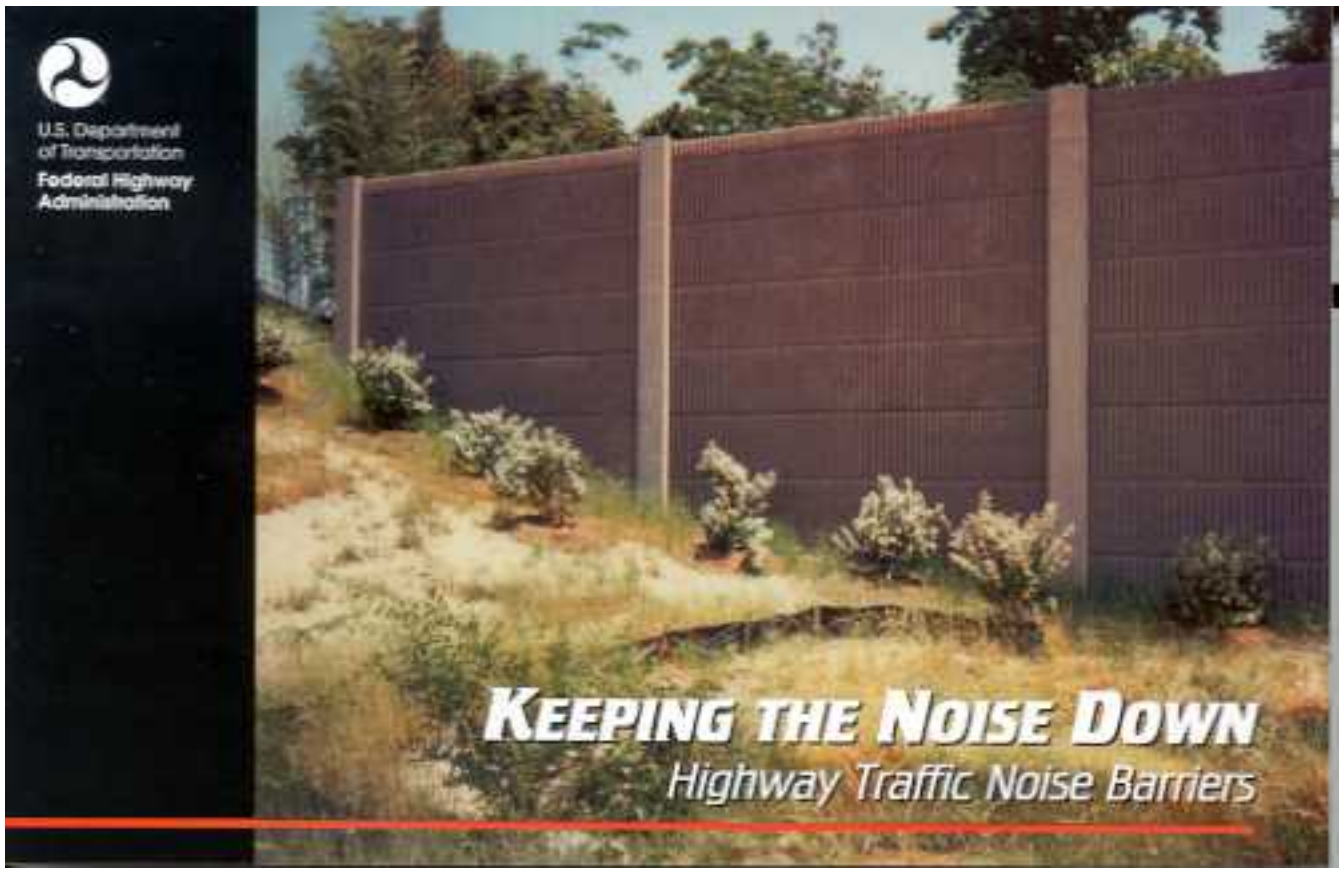
Stationary Sources: Non-mobile sources such as power plants, refineries, and manufacturing facilities.

Toxic Air Contaminant (TAC): An air pollutant, identified in regulation by the ARB, which may cause or contribute to an increase in deaths or in serious illness, or which may pose a present or potential hazard to human health. TACs are considered under a different regulatory process (California Health and Safety Code section 39650 et seq.) than pollutants subject to State Ambient Air Quality Standards. Health effects associated with TACs may occur at extremely low levels. It is often difficult to identify safe levels of exposure, which produce no adverse health effects.

Urban Background: The term is used in this Handbook to represent the ubiquitous, elevated, regional air pollution levels observed in large urban areas in California.

Zoning ordinances: City councils and county boards of supervisors adopts zoning ordinances that set forth land use classifications, divides the county or city into land use zones as delineated on the official zoning, maps, and set enforceable standards for future develop

Noise Barrier Design - Visual Quality



Highway Traffic Noise Barriers at a Glance

Highway traffic noise barriers:

- can reduce the loudness of traffic noise by as much as half;
- do not completely block all traffic noise;
- can be effective, regardless of the material used;
- must be tall and long with no openings;
- are most effective within 61 meters (200 feet) of a highway (usually the first row of homes);
- must be designed to be visually appealing;
- must be designed to preserve aesthetic values and scenic vistas;
- do not increase noise levels perceptibly on the opposite side of a highway; and
- substantially reduce noise levels for people living next to highways.

Keeping the Noise Down

A sound occurs when an ear senses pressure variations or vibrations in the air. Noise is unwanted sound. The brain relates a subjective element to a sound, and an individual reaction is formed. Numerous studies have indicated that the most pervasive sources of noise in our environment today are those associated with transportation. Highway traffic noise tends to be a dominant noise source in our urban, as well as rural, environment.

What are Noise Barriers?

Noise barriers are solid obstructions built between the highway and the homes along a highway. They do not *completely* block all noise they only reduce overall noise levels. Effective noise barriers typically reduce noise levels by 5 to 10 decibels (dB), cutting the loudness of traffic noise by as much as one half. For example, a barrier which achieves a 10-dB reduction can reduce the sound level of a typical tractor trailer pass-by to that of an automobile. Barriers can be formed from earth mounds or "berms" along the road, from high, vertical walls, or from a combination of earth berms and walls. Earth berms have a very natural appearance and are usually attractive. They also reduce noise by approximately 3 dB more than vertical walls of the same height. However, earth berms can require a lot of land to construct, especially if they are very tall. Walls require less space, but they are usually limited to eight meters (25 feet) in height for structural and aesthetic reasons.

When Are Noise Barriers Required?

Noise barriers are not always required at locations where an absolute threshold is met. There is no "number standard" which requires the construction of a noise barrier. Federal requirements for noise barriers may be found in Title 23 of the U.S. Code of Federal Regulations, Part 772, "Procedures for Abatement of Highway Traffic Noise and Construction Noise."

The Federal Highway Administration noise regulations apply only to projects where a State transportation department has requested Federal funding for participation in the improvements. The State transportation department must determine if there will be traffic noise impacts, when a project is proposed for (1) the construction of a highway on new location or (2) the reconstruction of an existing highway to either significantly change the horizontal or vertical alignment or increase the number of through-traffic lanes. If the State transportation department identifies potential impacts, it must implement abatement measures, possibly including the construction of noise barriers, where reasonable and feasible.

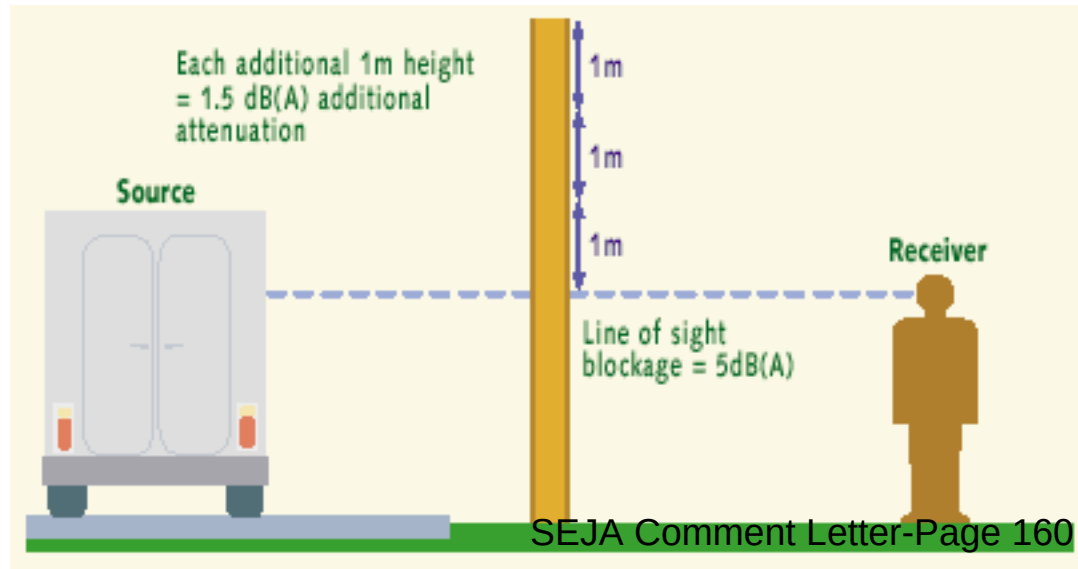
Federal law and Federal Highway Administration regulations do not require State transportation departments to build noise barriers along existing highways where no other highway improvements are planned. They may voluntarily do so, but they are solely responsible for making this decision.

How Is a Noise Barrier Funded?

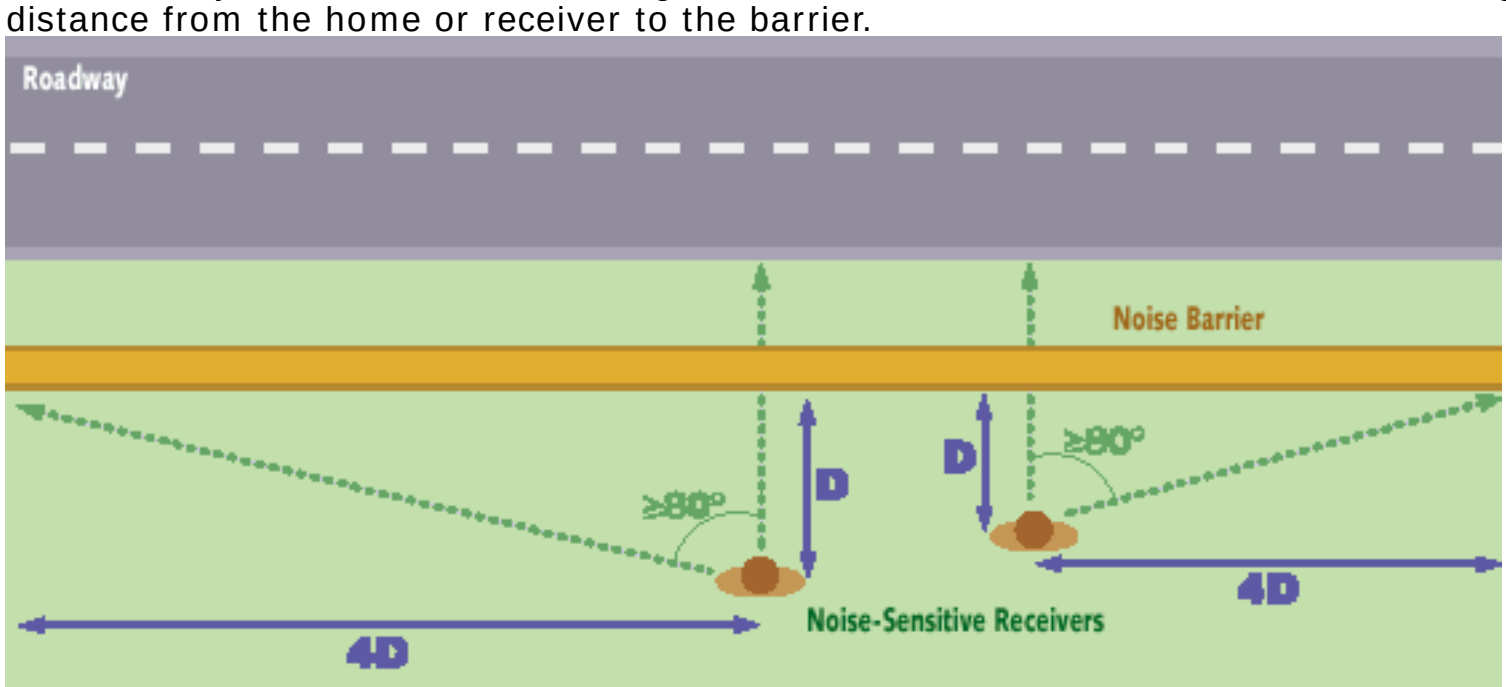
There are no special or separate Federal funds for highway traffic noise abatement. State transportation departments include the costs of noise barriers in their proposed Federal-aid highway projects. The Federal share is the same as that for the highway system on which the project is located. Noise barriers are sometimes constructed without using Federal funds - for example, using only State, local, or private funds. The costs of noise barriers are sometimes shared by governmental agencies and individual homeowners.

How Does a Noise Barrier Work?

Noise barriers reduce the sound which enters a community from a busy highway by either absorbing the sound, transmitting it, reflecting it back across the highway, or forcing it to take a longer path over and around the barrier. A noise barrier must be tall enough and long enough to block the view of a highway from the area that is to be protected, the "receiver." Noise barriers provide very little benefit for homes on a hillside overlooking a highway or for buildings which rise above the barrier. A noise barrier can achieve a 5 dB noise level reduction, when it is tall enough to break the line-of-sight from the highway to the home or receiver. After it breaks the line-of-sight, it can achieve approximately 1.5dB of additional noise level reduction for each meter of barrier height.



To effectively reduce the noise coming around its ends, a barrier should be at least eight times as long as the distance from the home or receiver to the barrier.



Openings in noise barriers for driveway connections or intersecting streets destroy their effectiveness. In some areas, homes are scattered too far apart to permit noise barriers to be built at a reasonable cost. Noise barriers are normally most effective in reducing noise for areas that are within approximately 61meters (200 feet) of a highway (usually the first row of homes).

What Type of Material Is Best for a Noise Barrier?

Noise barriers can be constructed from earth, concrete, masonry, wood, metal, and other materials. To effectively reduce sound transmission through the barrier, the material chosen must be rigid and sufficiently dense (at least 20 kilograms/square meter). All noise barrier material types are equally effective, acoustically, if they have this density.

There are no Federal requirements specifying the materials to be used in the construction of highway traffic noise barriers. Individual State departments of transportation select the materials when building these barriers. The selection is normally made based on factors, such as aesthetics, durability, maintenance, cost, and the desires of the public.

How Do People React to Noise Barriers?

Overall, public reaction to highway noise barriers appears to be positive. However, specific reactions vary widely. Residents adjacent to barriers say that conversations in households are easier, sleeping conditions are better, the environment is more relaxing, windows are opened more often, and yards are used more in the summer. Residents also perceive indirect benefits, such as increased privacy, cleaner air, improved views and a sense of ruralness, and healthier lawns and shrubs.
Negative reactions from residents have included a restriction of view, a feeling of confinement, a loss of air circulation, a loss of sunlight and lighting, and poor maintenance of the barrier. Motorists have sometimes complained of a loss of view or scenic vistas and a feeling of being "walled in" when traveling adjacent to barriers.

Are Residents' Views Considered?

A major consideration in the design of a noise barrier is its visual impact on the surrounding area. A tall barrier near a one-story, single family, detached residential area can have a negative visual effect. One solution to addressing the size relationship in visual quality is to provide staggered horizontal elements to a noise barrier to reduce the visual impact by planting landscaping in the foreground. Native plantings are preferable.

The visual character of noise barriers in relationship to their environmental setting should be carefully considered. In general, it is desirable to locate a noise barrier approximately four times its height from residences and to provide landscaping near the barrier to avoid visual dominance.
Noise barriers should reflect the character of their surroundings as much as possible. It is always desirable to preserve aesthetic views and scenic vistas, to the extent possible.

Are Motorists' Views Considered?

The psychological effect of noise barriers on the passing motorist should be a part of barrier design and construction. Noise barriers in dense, urban settings should be designed differently than barriers in more open suburban or rural areas, and they should be designed to avoid monotony for the motorist. At normal roadway speeds, motorists tend to notice noise barriers overall form, color, and surface texture. A primary objective of noise barrier design should be to avoid a tunnel effect for the motorist. This can be accomplished by varying the forms, materials, and surface treatments.

Graffiti on noise barriers can be a potential problem. One solution is to use materials that can be readily washed or repainted. Landscaping and plantings near barriers can also be used to discourage graffiti, as well as to add visual quality.

Does Construction of a Noise Barrier Increase Noise Levels on the Opposite Side of the Highway?

Residents adjacent to a highway sometimes feel that their noise levels have increased substantially, because of the construction of a noise barrier on the opposite side of the highway. However, field studies have shown that this is not true. If all the noise striking a noise barrier were reflected back to the other side of a highway, the increase would be theoretically limited to 3 dB. In practice, not all of the acoustical energy is reflected back to the other side. Some of the energy goes over the barrier, some is reflected to points other than the homes on the opposite side, some is scattered by ground coverings (for example, grass and shrubs), and some is blocked by the vehicles on the highway. Additionally, some of the reflected energy is lost due to the longer path that it must travel. Measurements made to quantify this reflective increase have never shown an increase of greater than 1-2 dB an increase that is not perceptible to the average human ear.

Does Construction of Noise Barriers on "Both" Sides of a Highway Increase Noise Levels?

Multiple reflections of noise between two parallel plane surfaces, such as noise barriers or retaining walls on both sides of a highway, can theoretically reduce the effectiveness of individual barriers. However, studies of this issue have found no problems associated with this type of reflective noise. Any measured increases in noise levels have been less than can be perceived by normal human hearing, that is, less than 3 dB. Studies have suggested that to avoid a reduction in the performance of parallel reflective noise barriers, the width-to-height ratio of the roadway section to the barriers should be at least 10:1. The width is the distance between the barriers, and the height is the average height of the barriers above the roadway. This means that two parallel barriers 3 meters (10 feet) tall should be at least 30 meters (100 feet) apart to avoid any reduction in effectiveness. These studies have also shown that any reduction in performance can be eliminated through the use of sound absorptive noise barriers.

Can Trees Be Planted to Act as Noise Barriers?

Vegetation, if it is high enough, wide enough, and dense enough that it cannot be seen over or through, can decrease highway traffic noise. A wide strip of trees with very thick undergrowth can lower noise levels. 30 meters of dense vegetation can reduce noise by five decibels. However, it is not feasible to plant enough trees and other vegetation along a highway to achieve such a reduction. Trees and other vegetation can be planted for psychological relief but not to physically lessen noise levels.

In Summary

Most residents near a barrier seem to feel that highway noise barriers effectively reduce traffic noise and that the benefits of barriers far outweigh the disadvantages of barriers. While noise barriers do not eliminate all highway traffic noise, they do reduce it substantially and improve the quality of life for people who live adjacent to busy highways.

For More Information . . .

For more information on Keeping the Noise Down: Highway Traffic Noise Barriers, write to us at our e-mail address: environment@fhwa.dot.gov.
Or send your questions to our mailing address:
Federal Highway Administration (HEPN)
400 Seventh St., SW
Washington, DC 20590

Attachment B-1

Prepared in cooperation with the Bureau of Reclamation and the U.S. Fish and Wildlife Service

A Natural History Summary and Survey Protocol for the Southwestern Willow Flycatcher

Chapter 10 of
Section A, Biological Science
Book 2, Collection of Environmental Data

Techniques and Methods 2A-10

U.S. Department of the Interior
U.S. Geological Survey

Cover: Southwestern Willow Flycatcher. Photograph taken by Susan Sferra, U.S. Fish and Wildlife Service.

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U.S. Department of the Interior
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U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

U.S. Geological Survey, Reston, Virginia: 2010

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Conversion Factors

Multiply	By	To obtain
centimeter (cm)	0.3937	inch (in.)
gram (g)	0.03527	ounce, avoirdupois (oz)
hectare (ha)	2.471	acre
kilometer (km)	0.6214	mile (mi)
meter (m)	3.281	foot (ft)
millimeter (mm)	0.03937	inch (in.)

Abbreviations and Acronyms

GPS	Global Positioning System
NDVI	Normalized Difference Vegetation Index
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

A Natural History Summary and Survey Protocol for the Southwestern Willow Flycatcher

By Mark K. Sogge, U.S. Geological Survey; Darrell Ahlers, Bureau of Reclamation; and Susan J. Sferra, U.S. Fish and Wildlife Service

Background

The Southwestern Willow Flycatcher (*Empidonax traillii extimus*) has been the subject of substantial research, monitoring, and management activity since it was listed as an endangered species in 1995. When proposed for listing in 1993, relatively little was known about the flycatche 's natural history, and there were only 30 known breeding sites supporting an estimated 111 territories rangewide (Sogge and others, 2003a). Since that time, thousands of presence/absences surveys have been conducted throughout the historical range of the flycatche , and many studies of its natural history and ecology have been completed. As a result, the ecology of the flycatcher is much better understood than it was just over a decade ago. In addition, we have learned that the current status of the flycatcher is better than originally thought: as of 2007, the population was estimated at approximately 1,300 territories distributed among approximately 280 breeding sites (Durst and others, 2008a).

Concern about the Southwestern Willow Flycatcher on a rangewide scale was brought to focus by Unitt (1987), who described declines in flycatcher abundance and distribution throughout the Southwest. *E. t. extimus* populations declined during the 20th century, primarily because of habitat loss and modification from activities, such as dam construction and operation, groundwater pumping, water diversions, and flood control. In 1991, the U.S. Fish and Wildlife Service (USFWS) designated the Southwestern Willow Flycatcher as a candidate category 1 species (U.S. Fish and Wildlife Service, 1991). In July 1993, the USFWS proposed to list *E. t. extimus* as an endangered species and to designate critical habitat under the Act (U.S. Fish and Wildlife Service, 1993). A final rule listing *E. t. extimus* as endangered was published in February 1995 (U.S. Fish and Wildlife Service, 1995); critical habitat was designated in 1997 (U.S. Fish and Wildlife Service, 1997). The USFWS Service released a Recovery Plan for the Southwestern Willow Flycatcher in 2002 (U.S. Fish and Wildlife Service, 2002), and re-designated critical habitat in 2005 (U.S. Fish and Wildlife Service, 2005).

In addition to its federal status, the Southwestern Willow Flycatcher is listed as an endangered species or species of concern in Arizona (Arizona Game and Fish Department, 2006), New Mexico (New Mexico Department of Game and Fish, 1996), California (California Department of Fish and Game, 1991), and Utah (Utah Division of Wildlife Resources, 1997).

Sound management and conservation of an endangered species like the Southwestern Willow Flycatcher requires current, detailed information on its abundance and distribution. This requires, among other things, identifying where flycatchers are and are not breeding, and annual monitoring of as many breeding areas as possible. Such efforts require effective, standardized survey protocols and consistent reporting, at both local and regional levels. However, the Willow Flycatcher is a difficult species to identify and survey for. Moreover, inconsistent or ineffective surveys are of limited value, can produce misleading information (including "false positives" and "false negatives"), hinder regional and rangewide analyses, and waste limited resources.

We developed this document to provide a standardized survey protocol and a source of basic ecological and status information on the flycatche . The first section summarizes the current state of knowledge regarding Southwestern Willow Flycatcher natural history, based on a wide array of published and unpublished literature. Emphasis is given to information relevant to flycatcher conservation and management, and to conducting and interpreting surveys. The second section details a standard survey protocol that provides for consistent data collection, reporting, and interpretation. This protocol document builds on and supersedes previous versions, the most recent of which was Sogge and others (1997a). In this update, we incorporate over a decade of new science and survey results, and refine the survey methodology to clarify key points. Further, we update the standard survey data sheets and provide guidelines on how to fill in the requested information. Amidst these revisions, the basic approach of the survey protocol has remained unchanged—multiple surveys at each survey area within the same breeding season, the use of the call-playback technique using flycatcher vocalizations to increase the probability of detection, and verification of species identity through its diagnostic song.

Section 1. Natural History

Breeding Range and Taxonomy

The Willow Flycatcher is a widespread species that breeds across much of the conterminous United States (Sedgwick, 2000). Four subspecies commonly are recognized in North America, with each occupying a distinct breeding range (fig.): *E. t. adastus*, ranging across the northern Rocky Mountains and Great Basin; *E. t. brewsteri*, found west of the Sierra Nevada and Cascade Mountains along the Pacific Slope; *E. t. extimus*, the Southwestern Willow Flycatcher, which breeds across the Southwest; and *E. t. traillii*, ranging east of the northern Rocky Mountains. Although the overall subspecies' ranges are distinct, Sedgwick (2001) and Paxton (2008) noted interbreeding/gradation zones in the boundary area between *E. t. extimus* and *E. t. adastus*.

The breeding range of the Southwestern Willow Flycatcher includes southern California, Arizona, New Mexico, southwestern Colorado, and extreme southern portions of Nevada and Utah: specific range boundaries are delineated in the subspecies' recovery plan (U.S. Fish and Wildlife Service, 2002). Unitt (1987) included western Texas in the subspecies' range, but recent breeding records from western Texas are lacking. Records of probable breeding Southwestern Willow Flycatchers in Mexico are few and restricted to extreme northern Baja California and Sonora (Unitt, 1987; Wilbur, 1987). Although recent data are lacking, the USFWS does include parts of northern Mexico in its description of *E. t. extimus* breeding range (U.S. Fish and Wildlife Service, 2002).

Although they appear very similar to most observers, experienced taxonomist or those using specialized equipment (for example, an electronic colorimeter) can differentiate among the subspecies by subtle differences in color and morphology (for example, Unitt, 1987; Paxton, 2008). Despite the subtle level of differences, the taxonomic status of *E. t. extimus* has been critically reviewed and confirmed multiple times based on morphological, genetic, and song data (Hubbard, 1987; Unitt, 1987; Browning, 1993; Paxton, 2000; Sedgwick, 2001).

The Southwestern Willow Flycatcher was described by Phillips (1948) from a specimen collected along the San Pedro River in southeastern Arizona. The Southwestern Willow Flycatcher generally is paler than other Willow Flycatcher subspecies, although this difference is indistinguishable without considerable experience and training, and study skins as comparative reference material. The southwestern subspecies differs in morphology (primarily wing formula) but not overall size. The plumage and color differences between the Willow Flycatcher subspecies are so subtle that they should not be used to characterize birds observed in the field (Unitt, 1987; Hubbard, 1999; U.S. Fish and Wildlife Service, 2002).

Migration and Winter Range, Habitat, and Ecology

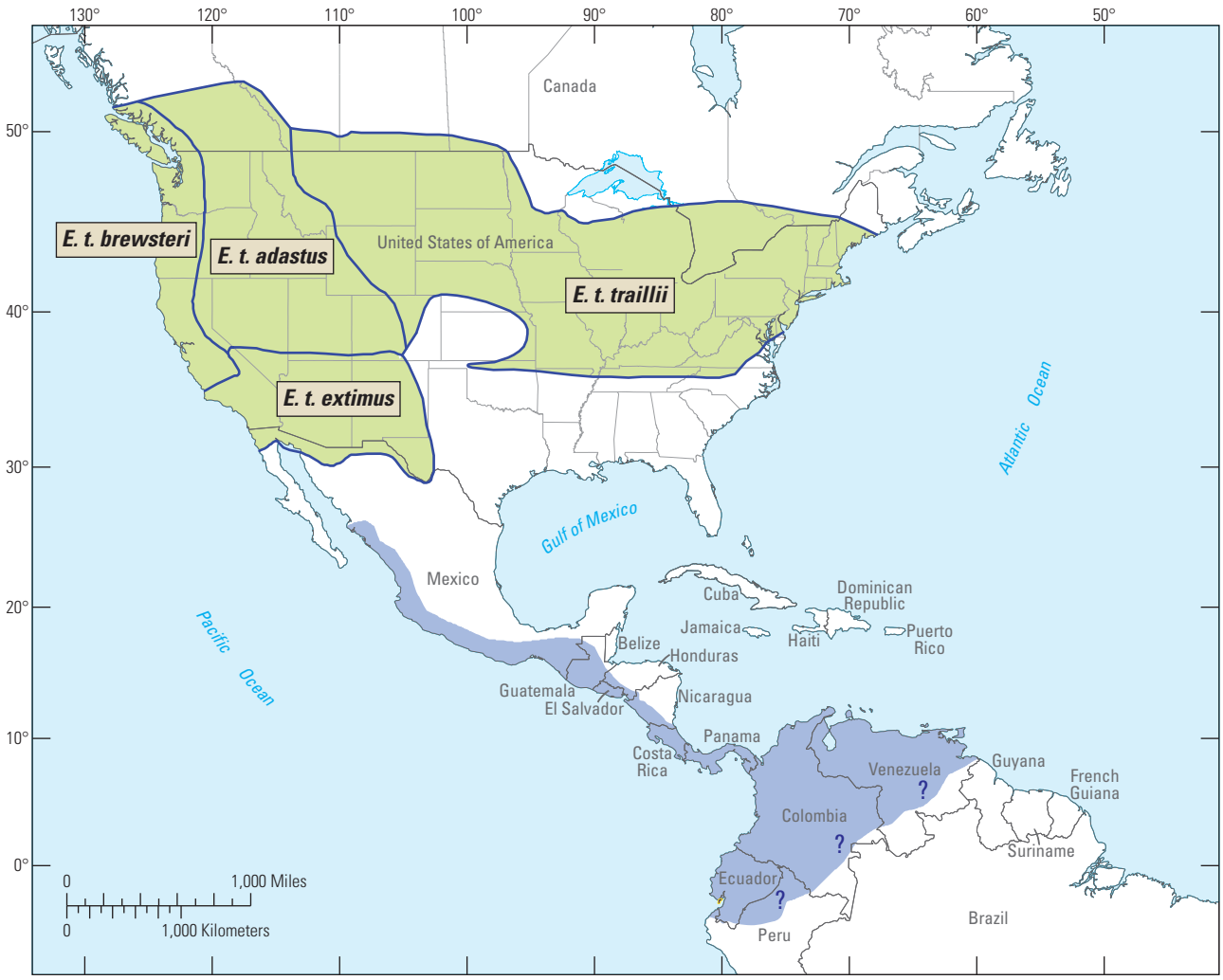
All Willow Flycatcher subspecies breed in North America but winter in the subtropical and tropical regions of southern Mexico, Central America, and northern South America (Sedgwick, 2000; Koronkiewicz, 2002; fig.). Most wintering birds are found in the Pacific slope lowlands in Mexico and Central America, and Caribbean slope lowlands in Mexico and Guatemala.

Because all Willow Flycatcher subspecies look very similar, determining specific wintering sites for the southwestern race has been challenging. However, recent genetic analysis of wintering birds (Paxton, 2008) suggests that the four subspecies occupy finite areas of the wintering grounds, but with overlapping ranges. The Southwestern Willow Flycatcher appears to be largely restricted to the center of the winter range (in the vicinity of Costa Rica), although Paxton (2008) suggests more research is needed to address this question.

On the wintering grounds, flycatchers primarily are found in habitats that have four main components: (1) standing or slow moving water and/or saturated soils, (2) patches or stringers of trees, (3) woody shrubs, and (4) open areas (Koronkiewicz and Whitfield, 1999; Koronkiewicz and Sogge, 2000; Lynn and others, 2003; Nishida and Whitfield, 2007; Schuetz and others, 2007). Based on surveys to date, the presence of water or saturated soils is almost universal, although tree heights and configurations, the presence of woody shrubs, and the amount of open space surrounding winter territories can vary considerably (Schuetz and others, 2007).

Male and female flycatchers hold separate, individual non-breeding territories, and defend those territories throughout the winter by using song, calls, and aggression displays. Fidelity to wintering territories and sites is high, as is survivorship over the wintering period (Koronkiewicz and others, 2006b; Sogge and others, 2007).

Willow Flycatchers travel approximately 1,500–8,000 km each way between wintering and breeding areas. During migration, flycatchers use a wider array of forest and shrub habitats than they do for breeding, although riparian vegetation may still be a preferred migration habitat type (Finch and others, 2000). Migration requires high energy expenditures, exposure to predators, and successful foraging in unfamiliar areas. Therefore, migration is the period of highest mortality within the annual cycle of the flycatcher (Paxton and others, 2007). Willow Flycatchers of all subspecies sing during northward migration, perhaps to establish temporary territories for short-term defense of food resources.



Basemap modified from U.S. Geological Survey and other agency digital data, various scales. Projection Mercator, World Geodetic System1984 datum.

EXPLANATION

Approximate range distribution of the Willow Flycatcher (*Empidonax traillii*)—Adapted from Unitt (1987), Browning (1993), and Paxton (2008)

Breeding range, including boundaries of the Willow Flycatcher subspecies

? Wintering range—Question marks reflect uncertainty of the location of the eastern boundary of the winter range

Figure 1. Approximate ranges of the Willow Flycatcher (*Empidonax traillii*) during breeding and non-breeding seasons.

Southwestern Willow Flycatchers typically arrive on breeding grounds between early May and early June (Ellis and others, 2008; Moore and Ahlers, 2009). Because arrival dates vary annually and geographically, northbound migrant Willow Flycatchers of multiple subspecies pass through areas where Southwestern Willow Flycatchers have already begun nesting. Similarly, southbound migrants in late July and August may occur where Southwestern Willow Flycatchers are still breeding (Unitt, 1987). This can make it challenging for an observer to differentiate local breeders from migrants. Other than timing, we still know relatively little about Southwestern Willow Flycatcher migratory behavior, pathways, or habitat use.

Breeding Habitat

Breeding Southwestern Willow Flycatchers are riparian obligates, typically nesting in relatively dense riparian vegetation where surface water is present or soil moisture is high enough to maintain the appropriate vegetation characteristics (Sogge and Marshall, 2000; U.S. Fish and Wildlife Service, 2002; Ahlers and Moore, 2009). However, hydrological conditions in the Southwest can be highly variable within a season and between years, so water availability at a site may range from flooded to dry over the course of a breeding season or from year to year.

The Southwestern Willow Flycatcher breeds in dense riparian habitats across a wide elevational range, from near sea level in California to more than 2,600 m in Arizona and southwestern Colorado (Durst and others, 2008a). Vegetation characteristics of Southwestern Willow Flycatcher breeding habitat generally include dense tree or shrub cover that is ≥ 3 m tall (with or without a higher overstory layer), dense twig structure, and high levels of live green foliage (Allison and others, 2003); many patches with tall canopy vegetation also include dense midstory vegetation in the 2–5 m range. Beyond these generalities, the flycatcher shows adaptability in habitat selection, as demonstrated by variability in dominant plant species (both native and exotic), size and shape of breeding patch, and canopy height and structure (U.S. Fish and Wildlife Service, 2002).

Southwestern Willow Flycatcher breeding habitat can be quantified and characterized in a number of ways, depending on the level of detail needed and habitat traits of interest. For many sites, detailed floristic composition, plant structure, patch size, and even characteristics such as Normalized Difference Vegetation Index (NDVI) have been described in agency reports and scientific journal articles (Allison and others, 2003; Hatten and Paradzick, 2003; Koronkiewicz and others, 2006a; Hatten and Sogge, 2007; Moore, 2007; Schuetz and Whitfield, 2007; Ellis and others, 2008). For purposes of this survey protocol, we take a relatively simple approach and broadly describe and classify breeding sites based on plant species composition and habitat structure. Clearly, these are not the only important components, but they are conspicuous to human perception and easily observed and recorded. Thus, they have proven useful in conceptualizing, selecting and evaluating suitable survey habitat, and in predicting where breeding flycatchers are likely to be found.

Breeding habitat types commonly used by Southwestern Willow Flycatchers are described below. The general categories are based on the composition of the tree/shrub vegetation at the site—native broadleaf, exotic, and mixed native/exotic. In the field, breeding habitats occur along a continuum of plant species composition (from nearly monotypic to mixed species) and vegetation structure (from simple, single stratum patches to complex, multiple strata patches). The images in figures 2– illustrate some of the variation in flycatcher breeding habitat, and other examples can be found in numerous publications and agency reports, and on the USGS photo gallery web site (http://sbsc.wr.usgs.gov/SBSCgallery/). The intent of the descriptions and photographs is to provide a general guide for identifying suitable habitat in which to conduct surveys.

Native broadleaf.—Southwestern Willow Flycatchers breed across a great elevational range, and the characteristics of their native broadleaf breeding sites varies between high elevation sites and those at low and mid-elevation sites.

High elevation sites (fig.) range from nearly monotypic dense stands of willow to mixed stands of native broadleaf trees and shrubs, 2–7 m in height with no distinct overstory layer; often associated with sedges, rushes, nettles, and other herbaceous wetland plants; usually very dense structure in lower 2 m; live foliage density is high from the ground to the canopy. Vegetation surrounding the patch can range from open meadow, to agricultural lands, to pines or upland shrub.

At low and mid-elevations (fig.), flycatcher breeding sites can be composed of single species (often Goodding's willow (*Salix gooddingii*), *S. exigua*, or other willow species) or mixtures of native broadleaf trees and shrubs including (but not limited to) cottonwood, willows, boxelder (*Acer negundo*), ash (*Fraxinus* spp.), alder (*Alnus* spp.), and buttonbush (*Cephalanthus* spp.), height from 3 to 15 m; characterized by trees of different size classes; often a distinct overstory of cottonwood, willow or other broadleaf tree, with recognizable subcanopy layers and a dense understory of mixed species; exotic/introduced species may be a rare component, particularly in the understory.

Monotypic exotic.—(fig.) Breeding sites also can include nearly monotypic, dense stands of exotics such as saltcedar (*Tamarix* spp.) or Russian olive (*Elaeagnus angustifolia*), 4–10 m in height forming a nearly continuous, closed canopy (with no distinct overstory layer); lower 2 m commonly very difficult to penetrate due to dense branches, however, live foliage density may be relatively low 1–2 m above ground, but increases higher in the canopy; canopy density uniformly high.

Aerial view of Little Colorado River near Greer, Arizona. Photograph by USGS, 1995.

Parkview Fish Hatchery, New Mexico. Photograph by USGS, 2000.

Tierra Azul, New Mexico. Photograph by USGS, 2005.

Little Colorado River near Greer, Arizona. Photograph courtesy of Arizona Game and Fish Department, 1996.

Rio Grande State Wildlife Area, Colorado. Photograph by USGS, 2002.

McIntyre Springs, Colorado. Photograph by USGS, 2002.

Figure 2. Examples of Southwestern Willow Flycatcher breeding habitat in native broadleaf vegetation at high-elevation sites.

Hassayampa River, Arizona. Photograph by USGS, 2003.

Santa Ynez River, California, Photograph by USGS, 1996.

San Luis Rey River, California. Photograph by USGS, 2005.

Kern River, California. Photograph by USGS, 1995.

Bosque del Apache, Rio Grande, New Mexico. Photograph courtesy of Bureau of Reclamation, 2008.

Kern River, California. Photograph by USGS, 1995.

Figure 3. Examples of Southwestern Willow Flycatcher breeding habitat in native broadleaf vegetation at low and mid-elevation sites.

Aerial view of Topock Marsh, Colorado River, Arizona. Photograph by USGS, 1996.

Topock Marsh, Colorado River, Arizona. Photograph by USGS, 1996.

Rio Grande, New Mexico. Photograph by USGS, 2005.

Salt River, Arizona. Photograph courtesy of Bureau of Reclamation, 1996.

Orrilla Verde, Rio Grande, New Mexico. Photograph by USGS, 2006.

Aerial view of Salt River, Arizona. Photograph by USGS, 1996.

Figure 4. Examples of Southwestern Willow Flycatcher breeding habitat in exotic vegetation.

Mixed native/exotic—(fig.) These sites include dense mixtures of native broadleaf trees and shrubs (such as those listed above) mixed with exotic/introduced species, such as saltcedar or Russian olive; exotics are often primarily in the understory, but may be a component of overstory; the native and exotic components may be dispersed throughout the habitat or concentrated as a distinct patch within a larger matrix of habitat; overall, a particular site may be dominated primarily by natives or exotics, or be a more-or-less equal mixture.

Regardless of the plant species composition or height, occupied sites almost always have dense vegetation in the patch interior (fig.). These dense patches are often interspersed with small openings, open water, or shorter/sparser vegetation, creating a mosaic that is not uniformly dense.

Gila River, Arizona. Photograph by USGS, 2002.

Roosevelt Lake, Arizona. Photograph by USGS, 1999.

Verde River River, Arizona. Photograph by USGS, 2002.

Virgin River, Utah. Photograph by USGS, 1997.

Figure 5. Examples of Southwestern Willow Flycatcher breeding habitat in mixed native/exotic vegetation.

Gila River, Arizona. Photograph by USGS, 2002.

Kern River, California. Photograph by USGS, 1999.

Rio Grande, New Mexico. Photograph by USGS, 2007.

Salt River, Arizona. Photograph by USGS, 1999.

Rio Grande, New Mexico. Photograph by USGS, 2007.

Rio Grande, New Mexico. Photograph by USGS, 2005.

Figure 6. Examples of dense vegetation structure within breeding habitats of Southwestern Willow Flycatcher.

Riparian patches used by breeding flycatchers vary in size and shape, ranging from a relatively contiguous stand of uniform vegetation to an irregularly shaped mosaic of dense vegetation with open areas. Southwestern Willow Flycatchers have nested in patches as small as 0.8 ha (for example, in the Grand Canyon) and as large as several hundred hectares (for example, at Roosevelt Lake, Ariz., or Elephant Butte Reservoir, New Mex.). They have only rarely been found nesting in isolated, narrow, linear riparian habitats that are less than 10 m wide, although they will use such linear habitats during migration.

Flycatcher territories and nests typically are adjacent to open water, cienegas, marshy seeps, or saturated soil, and within riparian areas rooted in standing water. However, in the Southwest, hydrological conditions at a site can vary remarkably within a season, between years, and among nearby sites (fig.). Surface water or saturated soil may only be present early in the breeding season (that is, May and part of June), especially in dry years. Similarly, vegetation at a patch may be immersed in standing water during a wet year, but be hundreds of meters from surface water in dry years (Ahlers and Moore, 2009). This is particularly true of reservoir sites, such as the Kern River at Lake Isabella, Calif., Tonto Creek and Salt River at Roosevelt Lake, and the Rio Grande near Elephant Butte Reservoir. Natural or human-caused river channel modifications and altered subsurface flows (fo example, from agricultural runoff), can lead to a total absence of water or visibly saturated soil at a site for several years.

Other potentially important aspects of Southwestern Willow Flycatcher habitat include distribution and isolation of vegetation patches, hydrology, food base (arthropods), parasites, predators, environmental factors (for example temperature, humidity), and interspecific competition (U.S. Fish and Wildlife Service, 2002). Population dynamics

Rio Grande at San Marcial, New Mexico, with dry substrate. Photograph by USGS, 2007.

Rio Grande at San Marcial, New Mexico, with flowing water beneath the territories. Photograph by USGS, 2007.

Tonto Creek inflow to Roosevelt Lake, Arizona, during a dry year. Photograph by USGS, 2004.

Tonto Creek inflow to Roosevelt Lake, Arizona, during high-water year. Photograph by USGS, 2005.

Figure 7. Examples of the variable hydrologic conditions at breeding habitats of Southwestern Willow Flycatcher.

factors, such as demography (for example, survivorship rates, fecundity), distribution of breeding groups across the landscape, flycatcher dispersal patterns, migration routes, the tendency for adults and surviving young to return to their previous year breeding site, and conspecific sociality also influence where flycatchers are found and what habitats the use (U.S. Fish and Wildlife Service, 2002).

It is critically important to recognize that the ultimate measure of habitat suitability is not simply whether or not a site is occupied. Habitat suitability occurs along a gradient from high to poor to unsuitable; the best habitats are those in which flycatcher reproductive success and survivorship result in a stable or growing population. Some occupied habitats may be acting as population sources, while others may be functioning as population sinks (Pulliam, 1988). Therefore, it can take extensive research to determine the quality of any given habitat patch. Furthermore, productivity and survival rates can vary widely among years (Paxton and others, 2007; Ellis and others, 2008; Ahlers and Moore, 2009), so conclusions based on short-term datasets or data extrapolated from one area to another may be erroneous. It also is important to note that not all unoccupied habitat is unsuitable; some sites with suitable habitat may be geographically isolated or newly established, such that they are not yet colonized by breeding flycatchers. There also may simply not be enough flycatchers in a given area to fill all available habitat in particular locations (U.S. Fish and Wildlife Service, 2002). A better understanding of which habitats or sites are sinks or sources can be especially helpful in site conservation and restoration planning.

As described earlier, migrant Willow Flycatchers may occur in riparian habitats that are structurally unsuitable for breeding (for example, too sparse, smaller patch size, etc.), and in non-riparian habitats. Such migration stopover areas, even though not used for breeding, may be critically important resources affecting local and regional flycatcher productivity and survival (U.S. Fish and Wildlife Service, 2002, 2005).

Breeding Chronology and Biology

Unless otherwise noted, the information that follows and upon which the generalized breeding season chronology (fig.) is based comes from Unitt (1987), Whitfield (1990), Maynard (1995), Sogge and others (2003b), Paxton and others (2007), Schuetz and Whitfield (2007), and Ellis and others (2008). Extreme or record dates for any stage of the breeding cycle may vary by 1–2 weeks from the dates presented, depending on the geographic area, extreme weather events, yearly variation and other factors. Higher elevation areas, in particular, have delayed chronology (Ahlers and White, 2000).

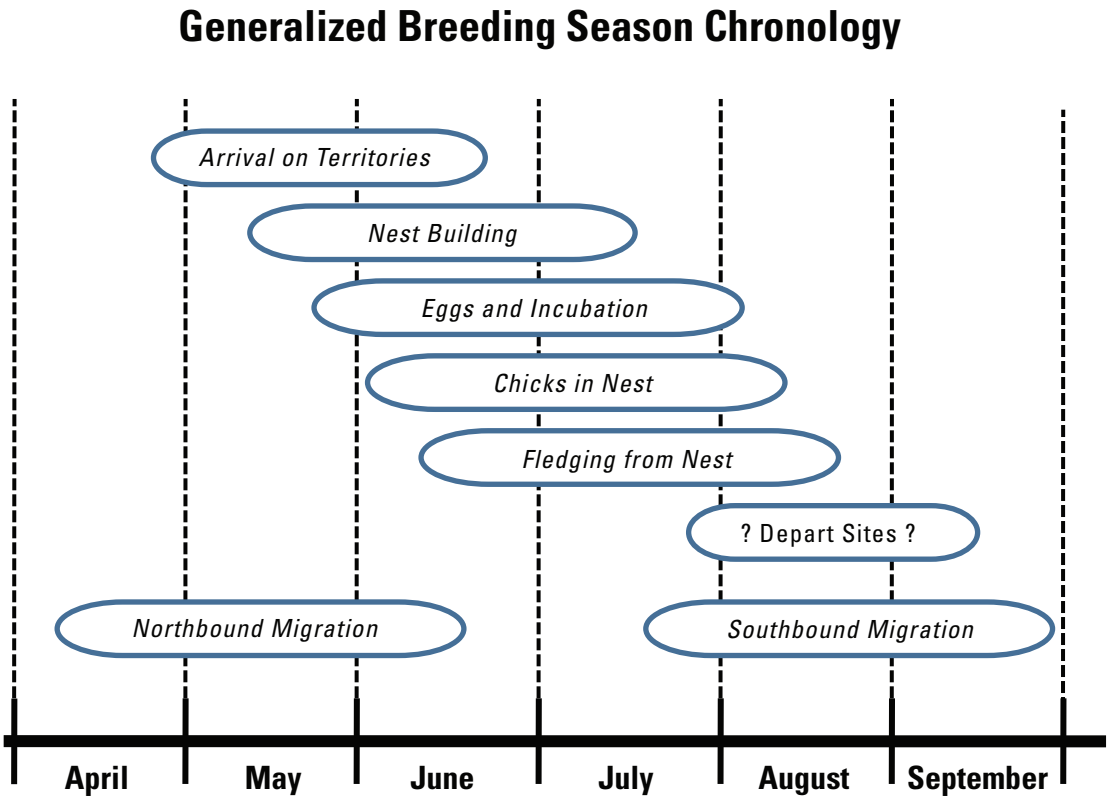


Figure 8. Generalized migration and breeding chronology for the Willow Flycatcher in the Southwest. Extreme or record dates may occur slightly earlier or later than indicated.

Both sexes can breed beginning in their second year. Male Southwestern Willow Flycatchers generally arrive at breeding areas first; older males typically arrive before younger ones. Although females usually arrive a few weeks after males, some older females are present at sites before late-arriving males. Adult flycatchers will sometimes wander extensively through large riparian sites before and after breeding, possibly as a way to evaluate potential breeding habitat (Cardinal and others, 2006).

Males establish and defend their territories through singing and aggressive interactions. Females settle on established territories, and may choose a territory more for its habitat characteristics than for the traits of its territorial male. Territory size tends to be larger when a male first arrives, then gets smaller after a female pairs with the male (Cardinal and others, 2006). Similarly, male song rate is very high early in the season, then declines after pairing (Yard and Brown, 2003). Not all males are successful in attracting mates in a given year, and as a result unpaired territorial males occur at many breeding sites. Unpaired males are usually a small percentage of any local population, but can comprise as much as 15–25 percent of the territories in some populations (Munzer and others, 2005; Ahlers and Moore, 2009).

Although the Willow Flycatcher as a species is considered predominantly monogamous during the breeding season (Sedgwick, 2000), some Southwestern Willow Flycatcher populations have a relatively high degree of polygyny whereby one male can have more than one breeding female in its territory. Polygynous males generally have two females in their territory, but up to four have been recorded (Davidson and Allison, 2003; Pearson and others, 2006). Polygyny rates can vary between sites, and among years at a given site. At some sites, polygynous males have much higher productivity than monogamous males (Paxton and others, 2007).

Nest building within the territory usually begins within a week or two after pair formation. Egg laying begins as early as mid-May, but more often starts in late May to mid-June. Chicks can be present in nests from late May through early August. Young typically fledge from nests from mid-June through mid-August; later fledglings are often products of re-nesting attempts. Breeding adults generally depart from their territories in early to mid-August, but may stay later if they fledged young late in the season. Males that fail to attract or retain mates, and males or pairs that are subject to significant disturbance, such as repeated nest parasitism or predation may leave territories by early July. Fledglings probably leave the breeding areas a week or two after adults, but few details are known.

Southwestern Willow Flycatcher territory size varies widely, probably due to differences in population density, habitat quality (including vegetation density and food availability), and nesting stage. Studies have reported estimated territory sizes ranging from 0.06 to 2.3 ha (Sogge and others, 1995; Whitfield and Enos, 1996; Bureau of Reclamation, 2009). At Roosevelt Lake, Ariz., measurements of home ranges, which include the defended territory and sometimes adjacent use areas, averaged 0.4 ha for actively breeding males; home range can be much larger for pre- and post-breeding males (Paxton and others, 2007). During incubation and nestling phases territory size, or at least the activity centers of pairs, can be very small. Flycatchers may increase their activity area after young are fledged, and use non-riparian habitats adjacent to the breeding area (Cardinal and others, 2006). This variability among sites, individual territories, and over time illustrates the challenge of defining a minimum habitat patch size for breeding flycatchers, or estimating the number of territories based simply on the size of a given breeding site.

At some breeding sites, non-territorial adult “floaters” will be present among the territorial population. Floaters are quieter and less aggressive than territorial adults, and therefore are harder to detect and frequently overlooked. Most floaters are young males, and float for only a single yea . At Roosevelt Lake, floaters typically accounted for 3–8 percent of the known adult population, although the rate was much higher in drought years when habitat quality was lower (Paxton and others, 2007). The presence of floaters in a population may indicate that there is not enough high quality habitat to support all potentially territorial individuals present in a given breeding season.

Nests and Eggs

Historically, 75–80 percent of reported Southwestern Willow Flycatcher nests were placed in willows (Phillips, 1948; Phillips and others, 1964; Hubbard, 1987; Unitt, 1987). Southwestern Willow Flycatchers still commonly place their nests in native plants, but will often build nests in exotics, such as saltcedar and Russian olive (Sogge and Marshall, 2000; Stoleson and Finch, 2003; Durst and others, 2008a). In Arizona, most nests are in saltcedar or willows (Paradzick and Woodward, 2003; McLeod and others, 2007). In a unique situation in San Diego County, Calif., the flycatcher nests in coast live oak (*Quercus agrifolia*) along the San Luis Rey River (Haas, 2003), where oak became the dominant plant species adjacent to the river following willow removal in the 1950s. In another unusual situation, flycatchers in the Cliff-Gila Valley in New Mex. nest in tall boxelder (Stoleson and Finch, 2003). Southwestern Willow Flycatcher nests also have been found in buttonbush, black twinberry (*Lonicera involucrata*), Fremont cottonwood (*Populus fremontii*), alder (*Alnus* spp.), blackberry (*Rubus ursinus*), baccharis (*Baccharis* spp.), and stinging nettle (*Urtica* spp.). Overall, flycatcher nest site selection appears to be driven more by plant structure than by species composition.

Southwestern Willow Flycatchers build open cup nests approximately 8 cm high and 8 cm wide (outside dimensions), exclusive of any dangling material at the bottom. Females build the nest with little or no assistance from the males. Nests typically are placed in the fork of a branch with the nest cup supported by several small-diameter vertical stems. Nest height is highly variable and depends on the available plant structure within the territory; nests have been found from 0.6 m to approximately 20 m above ground. In any given habitat type or nest substrate, nests can be placed wherever suitable twig structure and vegetative cover are present.

Egg laying generally begins from mid-May through mid-June, depending on the geographic area and elevation. Willow Flycatcher eggs are buffy or light tan, approximately 18 mm long and 14 mm wide, with brown markings in a wreath at the blunt end. Clutch size is usually three or four eggs for first nests. Only the female develops a brood patch and incubates the eggs. Incubation lasts 12–13 days from the date the last egg is laid, and all eggs typically hatch within 24–48 hours of each other.

Flycatcher chicks are altricial and weigh only about 1–2 g at hatching, but grow rapidly and are ready to leave the nest at 12–15 days of age (Sedgwick, 2000; Paxton and Owen, 2002). The female provides most or all initial care of the young, although the role of the male increases with the age and size of nestlings. After Willow Flycatchers fledge at 12–15 days of age, they stay close to the nest and each other for 3–5 days, and adults continue feeding the fledged young for approximately 2 weeks. Recently fledged birds may repeatedly return to and leave the nest during this period (Spencer and others, 1996). Both male and female adults feed the fledged young, which give frequent, loud "*peep*" calls.

Southwestern Willow Flycatchers readily re-nest following an unsuccessful nesting attempt, although rarely more than once (Ellis and others, 2008). They also will sometimes nest again (double brood) following a successful nesting attempt, although this is more uncommon than re-nesting and varies between sites and years. From 2002 to 2008 at Elephant Butte Reservoir, approximately 13 percent of the pairs produced two successful nests per year (Ahlers and Moore, 2009). The productivity gains from pairs having successful second nests are important drivers of positive population growth (Paxton and others, 2007; Moore and Ahlers, 2009).

Replacement nests are built in the same territory, either in the same plant or at a distance of as much as 20 m from the previous nest. Reuse of old nests is uncommon, but does occur (Yard and Brown, 1999; Darrell Ahlers, Bureau of Reclamation, unpub. data, 2009). Replacement nest building and egg laying can occur (uncommonly) as late as the end of July or early August. Pairs may attempt a third nest if the second fails. However, clutch size, and therefore potential productivity, decreases with each nest attempt (Whitfield and Strong, 1995; Ellis and others, 2008).

Food and Foraging

The breeding season diet of Southwestern Willow Flycatchers is relatively well documented (DeLay and others, 2002; Drost and others, 2003; Durst, 2004; Wiesenborn and Heydon, 2007; Durst and others, 2008b). Breeding flycatchers are exclusively insectivorous, and consume a wide range of prey taxa ranging in size from small leafhoppers (Homoptera) to large dragonflies (Odonata). Major prey taxa include bugs (Hemiptera), bees and wasps (Hymenoptera), flies (Diptera), and leafhoppers; however, diet can vary widely between years and among different habitat types. There is no known differences in diet by sex, but there are differences between adult and nestling diet in the proportions of some arthropod groups. Differences in the composition of arthropods in flycatcher diet have been documented between native and exotic habitats, and between years within particular breeding sites; however, flycatchers appear able to tolerate substantial variation in relative prey abundance, except in extreme situations such as severe droughts (Durst and others, 2008b).

Willow Flycatchers of all subspecies forage primarily by sallying from a perch to perform aerial hawking and gleaning (Sedgwick, 2000; Durst, 2004). Males and females forage with similar maneuvers, although males may forage higher in the tree canopy than females. Foraging frequently takes place at external edges or internal openings within a habitat patch, or at the top of the upper canopy.

Site Fidelity and Survivorship

Based on studies of banded birds, most adult Southwestern Willow Flycatchers that survive from one year to the next will return to the same river drainage, often in proximity to the same breeding site (U.S. Fish and Wildlife Service, 2002; McLeod and others, 2007; Paxton and others, 2007). However, it is common for individual flycatchers to return to different sites within a breeding area, and even to move between breeding areas, from one year to the next. Some of this movement may be related to breeding success and habitat quality. At Roosevelt Lake, those birds that moved to different sites within a breeding area had on average higher productivity in the year following the move than in the year before the move (Paxton and others, 2007). At Roosevelt Lake and on the San Pedro and Gila Rivers, movement out of breeding patches also increased with the relative age of a patch, which may indicate a preference for younger riparian vegetation structure.

In addition to movements within a breeding site, long-distance movements within and between drainages have been observed (Paxton and others, 2007), at distances up to approximately 450 km. Dispersal of first-year flycatcher is more extensive than adult birds, as typical for most bird species.

Survivorship within the breeding season can be very high, averaging 97 percent at Roosevelt Lake (Paxton and others, 2007). Between-year survivorship of adults can be highly variable, but appears to be similar to that of most small passerine birds studied, with estimates generally ranging from approximately 55 to 65 percent (Stoleson and others, 2000; McLeod and others, 2007; Paxton and others, 2007; Schuetz and Whitfield, 2007). Males and females have similar survivorship rates.

Estimated survivorship of young birds (from hatching to the next breeding season) is highly variable, depending in part on how the estimates are generated (Stoleson and others, 2000). Generally reported as between 15 and 40 percent, juvenile survivorship typically is lower than adult survivorship (Whitfield and Strong, 1995; Stoleson and others, 2000; McLeod and others, 2007). Early fledging young have higher survivorship than those that leave the nest later in the season (Whitfield and Strong, 1995; Paxton and others, 2007). Most flycatchers survive for only 1–2 adult years, and mean life expectancy in Arizona was estimated to be 1.9 years following fledging. Howeve , some individuals live much longer. The maximum reported ages of banded Southwestern Willow Flycatchers are 9–11 years (Sedgwick, 2000; Paxton and others, 2007).

Overall, the Southwestern Willow Flycatcher population appears to persist as one or more widely dispersed metapopulations (Busch and others, 2000; U.S. Fish and Wildlife Service, 2002), with movement of individuals, and thus genetic exchange, occurring across the landscape. However, the amount of movement and interchange is lower among sites that are farther apart or more isolated. Some sites serve as population sources while others may be sinks; some sites will be ephemeral over periods of years or decades. Flycatcher movement and dispersal among sites is important for initial site colonization and subsequent recolonization.

There are few general predictors for the persistence of breeding sites. Relatively large populations, such as the Kern River Preserve, San Pedro River, Elephant Butte Reservoir, and the Gila River have persisted for 10 or more years. However, such large sites can be subject to major changes in population numbers, and even potential extirpation, due to changes in local hydrology, site inundation, drought, etc. (Moore, 2005; Paxton and others, 2007). Although some small populations may be ephemeral and last only a few years (Durst and others, 2008a), others have remained occupied for much longer periods (Kus and others, 2003). Breeding populations also may reappear at unoccupied sites following 1–5 year absences. Suitable flycatcher habitat also can develop—and poor quality habitat can improve—relatively quickly in some sites, under favorable hydrological conditions. For example, at Roosevelt Lake and the San Pedro River (AZ), the age of riparian vegetation when first colonized was as young as 3 years (Paxton and others, 2007). In the same study, flycatchers moved back into older habitat patches when nearby younger, occupied habitat was inundated or scoured away.

Overall, the vegetation and flycatcher occupancy of a habitat patch or river drainage are often dynamic; few if any sites remain static over time. The amount of suitable flycatcher habitat can substantially increase or decrease in just a few years, at local and regional scales. Flycatchers can respond quickly to habitat changes, colonizing new sites if available and abandoning others. Therefore, one cannot assume that local, regional, or rangewide flycatcher population numbers will remain stable over time.

Threats to the Flycatcher and Habitat

The greatest historical factor in the decline of the Southwestern Willow Flycatcher is the extensive loss, fragmentation, and modification of riparian breeding habitat (U.S. Fish and Wildlife Service, 2002). Large-scale losses of southwestern wetlands have occurred, particularly the cottonwood-willow riparian habitats historically used by the Southwestern Willow Flycatcher (Unitt, 1987; General Accounting Office, 1988; Dahl, 1990; State of Arizona, 1990). Changes in the riparian plant community have frequently reduced, degraded, and eliminated nesting habitat for the flycatche , curtailing its distribution and abundance.

Habitat losses and changes have occurred and continue to occur because of urban, recreational, and agricultural development, water diversion and impoundment, channelization, livestock grazing, and replacement of native habitats by introduced plant species (Marshall and Stoleson, 2000; U.S. Fish and Wildlife Service, 2002). Hydrological changes, natural or man-made, can greatly reduce the quality and extent of flycatcher habitat. Although riparian areas are often not considered as fire-prone, several Southwestern Willow Flycatcher breeding sites were destroyed by fire over the past decade (U.S. Fish and Wildlife Service, 2002), and others are at risk to similar catastrophic loss. Fire danger in these riparian systems may be exacerbated by increases in exotic vegetation, such as saltcedar, diversions or reductions of surface water, increased recreational activity, and drawdown of local water tables.

Although the degradation of many river systems and associated riparian habitat is a key cause of their absence, Southwestern Willow Flycatchers do not require free-running rivers or “pristine” riparian habitats. Most of the largest

Southwestern Willow Flycatcher populations in the last decade were found in reservoir drawdown zones, such as at Roosevelt Lake and Elephant Butte Reservoir. Many breeding populations are found on regulated rivers (Graf and others, 2002). In addition, the vegetation at many smaller flycatcher breeding sites is supported by artificial water sources such as irrigation canals, sewage outflo , or agricultural drainages (U.S. Fish and Wildlife Service, 2002). Although rising water levels could be detrimental to breeding flycatchers within a reservoir drawdown zone, reservoir fluctuations can simulate river dynamics with cycles of destruction and establishment of riparian vegetation, depositing rich sediments and flushing salt accumulations in the soil (Paxton and others, 2007). Therefore, managed and manipulated rivers and reservoirs have the potential to play a positive role by providing flycatcher breeding habitat. However, because rivers and reservoirs are not managed solely to create and maintain flycatcher habitat, the persistence of riparian vegetation in these systems—and any flycatchers breeding therein—is not assured

Although the historic degradation and loss of native riparian negatively affected the Southwestern Willow Flycatcher, this species does not show an inherent preference for native vegetation. Instead, breeding habitat selection is based primarily on vegetation structure, density, size, and other stand characteristics, and presence of water or saturated soils (U.S. Fish and Wildlife Service, 2002). In fact, approximately 25 percent of known territories are found in habitat composed of 50 percent or greater exotic vegetative component—primarily saltcedar (Durst and others, 2008a). Saltcedar also can be an important habitat component in sites dominated by native vegetation (U.S. Fish and Wildlife Service, 2002, 2005). Despite suggestions that flycatchers breeding in saltcedar are suffering negative consequences and that removal of saltcedar is therefore a benefit (DeLoach and others, 2000; Dudley and DeLoach, 2004), there is increasing and substantial evidence that this is not the case. For example, Paxton and others (2007) found that flycatchers did not suffer any detectable negative consequences from breeding in saltcedar. This is consistent with the findings of Owen and others (2005) and Sogge and others (2006). Therefore, the rapid or large-scale loss of saltcedar in occupied flycatcher habitats, without rapid replacement of suitable native vegetation, could result in reduction or degradation of flycatcher habitat (U.S. Fish and Wildlife Service, 2002; Sogge and others, 2008).

In evaluating Southwestern Willow Flycatcher use of either native or exotic habitat, it is important to recognize that throughout the Southwest, there are many saltcedar-dominated and native-dominated habitats in which flycatchers do not breed (U.S. Fish and Wildlife Service, 2002; Sogge and others, 2006). Therefore, the use of any riparian patch—native or exotic—as breeding habitat will be site specific and will depend on the spatial, structural, and ecological characteristics of that particular patch and the potential for flycatchers to colonize and maintain populations within it.

Drought can have substantial negative effects on breeding flycatchers and their breeding habitat by reducing riparian vegetation vigor and density, and reducing prey availability (Durst, 2004; Paxton and others, 2007; Bureau of Reclamation, 2009). For example, the extreme drought of 2002 caused near complete reproductive failure of the large flycatcher population at Roosevelt Lake; among approximately 150 breeding territories, only two nests successfully fledged young in that year (Ellis and others, 2008). If future climate change produces more frequent or more sustained droughts, as predicted by many climate change models (for example, Seager and others, 2007), southwestern riparian habitats could be reduced in extent or quality. This scenario would present a challenge to the long-term sustainability of Southwestern Willow Flycatcher populations.

Brood parasitism by the Brown-headed Cowbird (*Molothrus ater*) was initially considered another significant threat to the Southwestern Willow Flycatcher (Whitfield, 1990; Harris, 1991; U.S. Fish and Wildlife Service, 1993, 1995; Whitfield and Strong, 1995; Sferra and others, 1997). Cowbirds lay their eggs in the nest of other species (the “hosts”), which raise the young cowbirds—often at the expense of reduced survivorship of their own young. Southwestern Willow Flycatchers seldom fledge any flycatcher young from nests that are parasitized by cowbirds (Whitfield and Sogge, 1999). Although parasitism negatively impacts some Southwestern Willow Flycatcher populations, especially at small and isolated breeding sites, it is highly variable and no longer considered among the primary rangewide threats to flycatcher conservation (U.S. Fish and Wildlife Service, 2002). Cowbird abundance, and therefore parasitism, tends to be a function of habitat type and quality, and the availability of suitable hosts, not specific to the flycatch . Therefore, large-scale cowbirds control may not always be warranted unless certain impact thresholds are met (U.S. Fish and Wildlife Service, 2002; Rothstein and others, 2003; Siegle and Ahlers, 2004).

Section 2. Survey Protocol

The fundamental principles of the methodology described in this version have remained the same since the original Tibbitts and others (1994) and subsequent Sogge and others (1997a) protocols: the use of vocalization play-back, repeated site visits, and confirmation of flycatcher identity via th species-characteristic song. This newest protocol incorporates guidelines of the 2000 USFWS addendum, and includes changes based on our improved understanding of Willow Flycatcher biology and the significance of potential threats, and the availability of new survey technologies.

Several factors work together to make Southwestern Willow Flycatcher surveys challenging. Difficulties include the flycatche 's physical similarities with other species and subspecies; accessing the dense habitat they occupy; time constraints based on their breeding period; and vocalization patterns. Given these challenges, no methodology can assure 100-percent detection rates. However, the survey protocol described herein has proven to be an effective tool for locating flycatchers, and flycatchers generally are detectable when th protocol is carefully followed. Since 1995, hundreds of sites have been surveyed and thousands of flycatchers detected using the two previous versions of the survey protocol.

The Willow Flycatcher is 1 of 10 regularly occurring *Empidonax* flycatchers found in North America, all of which look very much alike. Like all *Empidonax*, Willow Flycatchers are nondescript in appearance, making them difficult to see in dense breeding habitat. Although the Willow Flycatcher has a characteristic *fitz-be* song that distinguishes it from other birds (including other *Empidonax*), Willow Flycatchers are not equally vocal at all times of the day or during all parts of the breeding season. Because Southwestern Willow Flycatchers are rare and require relatively dense riparian habitat, they may occur only in a small area within a larger riparian system, thus decreasing detectability during general bird surveys. Migrating Willow Flycatchers (of all subspecies) often sing during their migration through the Southwest, and could therefore be confused with local breeders. In addition, Southwestern Willow Flycatchers are in breeding areas for only 3–4 months of the year. Surveys conducted too early or late in the year would fail to find flycatchers even at sites where they bree

These life history characteristics and demographic factors influence how Southwestern Willow Flycatcher surveys should be conducted and form the basis upon which this protocol was developed. This protocol is based on the use of repeated call-playback surveys during pre-determined periods of the breeding season, to confirm presence or to derive a high degree of confidence regarding their absence at a site. Such species-specific survey techniques are necessary to collect reliable presence/absence information for rare species (Bibby and others, 1992).

The primary objective of this protocol is to provide a standardized survey technique to detect Southwestern Willow Flycatchers, determine breeding status, and facilitate consistent and standardized data reporting. The survey technique will, at a minimum, help determine presence or absence of the species in the surveyed habitat for that breeding season. Ultimately, the quality of the survey that is conducted will depend on the preparation, training, and in-the-field diligence of the individual surveyor.

This protocol is designed for use by persons who are non-specialists with *Empidonax* flycatchers or who are not expert birders. However, surveyors must have sufficient knowledge, training, and experience with bird identification and surveys to distinguish the Willow Flycatcher from other non-*Empidonax* species, and be able to recognize the Willow Flycatcher's primary song. A surveyor's dedication and attitude, willingness to work early hours in dense, rugged and wet habitats, and their ability to remain alert and aware of important cues also are important. Surveys conducted improperly or by unqualified, inexperienced, or complacent personnel may lead to inaccurate results and unwarranted conclusions.

Surveys conducted by qualified personnel in a consistent and standardized manner will enable continued monitoring of general population trends at and between sites, and between years. Annual or periodic surveys in cooperation with State and Federal agencies should aid resource managers in gathering basic information on flycatcher status and distribution at various spatial scales. Identifying occupied and unoccupied sites will assist resource managers in assessing potential impacts of proposed projects, avoiding impacts to occupied habitat, identifying suitable habitat characteristics, developing effective restoration management plans, and assessing species recovery.

The earlier versions of this protocol (Tibbitts and others, 1994; Sogge and others, 1997a) were used extensively and successfully for many years. Hundreds of flycatcher surveys conducted throughout the Southwest since 1994 revealed much about the usefulness and application of this survey technique. Three important lessons were: (1) the call-playback technique works and detects flycatchers that would have otherwise been overlooked; (2) multiple surveys at each site are important; and (3) with appropriate effort, general biologists without extensive experience with *Empidonax* can find and verify Willow Flycatcher breeding sites.

This revised protocol is still based on call-playback techniques and detection of singing individuals. However, it includes changes in the timing and number of surveys to increase the probability of detecting flycatchers and to help determine if they are breeders or migrants. It also incorporates the basic premise of the USFWS 2000 addendum to the 1997 protocol by requiring a minimum of five surveys in all "project-related" sites. A detailed description of surveys and

timing is discussed in section, "Timing and Number of Visits." Changes in the survey data sheets make them easier to use and submit, and allow reporting all site visits within a single year on one form. The new survey forms also are formatted such that the data on the respective forms can be easily incorporated into the flycatcher range-wide database

This protocol is intended to determine if a habitat patch contains territorial Southwestern Willow Flycatchers, and is not designed establish the exact distribution and abundance of flycatchers at a site. Determining precise flycatcher number and locations requires many more visits and additional time observing the behavior of individual birds. This survey protocol also does not address issues and techniques associated with nest monitoring or other flycatcher research activities. Those efforts are beyond the scope usually needed for most survey purposes, and require advanced levels of experience and skills to gather useful data and avoid potential negative effects to the flycatche . If nest monitoring is a required component of your study, refer to Rourke and others (1999) for appropriate nest monitoring techniques (available for download at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/reports.asp).

Biologists who are not expert birders or specialists with regard to *Empidonax* flycatchers can e fectively use this protocol. However, users should attend a U.S. Fish and Wildlife Service-approved Southwestern Willow Flycatcher survey training workshop, and have knowledge and experience with bird identification, surveys, and ecology sufficient t effectively apply this protocol.

Permits

Federal endangered species recovery permits are required for surveys in all USFWS regions where the Southwestern Willow Flycatcher breeds (application forms can be downloaded at http://www.fws.gov/forms/3-200-55.pdf). State permits also may be required before you can survey within any of the States throughout the Southwestern Willow Flycatcher's range: be certain to check with the appropriate State wildlife agency in your area. It usually takes several months to receive permits, so apply early to avoid delays in starting your surveys. You also must obtain permission from government agencies and private landowners prior to conducting any surveys on their lands.

Pre-Survey Preparation

The degree of effort invested in pre-survey preparation will have a direct effect on the quality and efficiency of the surveys conducted. Pre-survey preparation is often overlooked, but can prove to be one of the more important aspects in achieving high-quality survey results.

Surveyors should study calls, songs, drawings, photographs, and videos of Willow Flycatchers. Several web sites describe life history requirements, and provide photographs and vocalizations. It is especially critical for surveyors to be familiar with Willow Flycatcher vocalizations before going in the field. Although the *fitz-be* song is the basis of verifying detections using this protocol, Willow Flycatchers use many other vocalizations that are valuable in locating birds and breeding sites. We strongly encourage that all surveyors learn as many vocalizations as possible and refer to the on-line "Willow Flycatcher Vocalizations; a Guide for Surveyors" (available at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/wiflvocl.as). Several commercial bird song recordings include Willow Flycatcher vocalizations, but these recordings typically have only a few vocalizations and the dialects may differ from those heard in the Southwest.

If possible, visit known Willow Flycatcher breeding sites to become familiar with flycatcher appearance, behavio , vocalizations, and habitat. Such visits are usually part of the standardized flycatcher survey workshops. All visits should be coordinated with USFWS, State wildlife agencies, and the property manager/owner, and must avoid disturbance to territorial flycatchers. While visiting these sites, carefully observe the habitat characteristics to develop a mental image of the key features of suitable habitat.

Surveyors must be able to identify, by sight and vocalizations, other species likely to be found in survey areas that may be confused with Southwestern Willow Flycatchers. These include Bell's Vireo (*Vireo bellii*), Western Wood-pewee (*Contopus sordidulus*), young or female Vermillion Flycatchers (*Pyrocephalus rubinus*), and other *Empidonax* flycatchers. At a distance, partial song or call notes of Bell's Vireo, Ash-throated Flycatchers (*Myiarchus cinerascens*) and some swallows can sound considerably like a *fitz-be* . Surveyors also should be able to identify Brown-headed Cowbirds by sight and vocalizations. It is worthwhile to make one or more pre-survey trips to the survey sites or other similar areas to become familiar with the local bird fauna. You might consider obtaining a species list relative to your area and become familiar with those species by site and sound.

Prior to conducting any presence/absence surveys in your respective State or USFWS Region, contact the respective flycatcher coordinators to discuss the proposed survey sites and determine if the sites have been surveyed in prior years. If possible, obtain copies of previous survey forms and maintain consistency with naming conventions and site boundaries. Study the forms to determine if flycatchers have been previously detected in the site, record locations of any previous detections, and read the comments provided by prior surveyors. While surveying, be sure to pay special attention to any patches where flycatchers have previously been detected

Familiarity with the survey site prior to the first surveys is the best way to be prepared for the conditions you will experience. Determine the best access routes to your sites and always have a back-up plan available in the event of unforeseen conditions (for example, locked gates, weather, etc.). Know the local property boundaries and where the potential hazards may be, including deep water, barbed wire fencing, and difficult terrain. Be prepared to work hard and remain focused and diligent in a wide range of physically demanding conditions. At many sites, these include heat, cold, wading through flowing or stagnant wate , muddy or swampy conditions, crawling through dense thickets (often on hands and knees), and exposure to snakes, skunks, and biting insects.

It is imperative that all surveyors exercise the adage "safety first." Be aware of safety hazards and how to avoid them, and do not allow the need to conduct surveys to supersede common sense and safety. Inform your coworkers where you will be surveying and when you anticipate returning. Always take plenty of water and know how to effectively use your equipment, especially compass, Global Positioning System (GPS), and maps.

Equipment

The following equipment is necessary to conduct the surveys:

1. **USGS topographic maps of the area**: A marked copy is required to be attached to survey data sheets submitted at the end of the season. Be sure to always delineate the survey area and clearly mark any flycatcher detections. If the survey area differed between visits; delineate each survey individually.
2. **Standardized survey form**: Always bring more copies than you think you need.
3. **Lightweight audio player**: Be sure the player has adequate volume to carry well; use portable speakers if necessary. Several digital devices, such as CD players and MP3 players, are currently available and can be connected to external amplified speakers for broadcasting the flycatcher vocalizations. Howeve , not all are equally functional or effective in field conditions; durabilit , reliability, and ease of use are particularly important. Talk to experienced surveyors for recommendations on particular models and useful features.
4. **Extra player and batteries**: In the field, dirt, wate , dust, and heat often cause equipment failure, and having backup equipment helps avoid aborting a survey due to equipment loss or failure.
5. **Clipboard and permanent (waterproof) ink pen**: We recommend recording survey results directly on the survey data form, to assure that you collect and record all required data and any field notes of interest
6. **Aerial photographs**: Aerial photographs can significantly improve your surveys by allowing you to accurately target your efforts, thus saving time and energy in the field. Previousl , aerial images were often expensive and difficult to obtain. Howeve , it is now easy to get free or low-cost images from sources, such as Google© Earth. Even moderate resolution images generally are better than none. For higher resolution aerial photographs, check with local planning offices and/or State/Federal land-management agencies for availability. Take color photocopies, not the original aerial photographs, with you in the field. Aerial photographs also are very useful when submitting your survey results but cannot be substituted in lieu of the required topographic map.
7. **Binoculars and bird field guid** : Although this protocol relies primarily on song detections to verify flycatcher presence, good quality binoculars are still a crucial field tool to help distinguish between possible Southwestern Willow Flycatchers and other species. Use a pair with 7–10 power magnification that can provide crisp images in poor lighting conditions. A good field guide also is essential for the same reason.
8. **GPS unit**: A GPS unit is needed for determining survey coordinates and verifying the location of survey plots on topographic maps. All flycatcher detections should be stored as waypoints and coordinates recorded on the survey form. A wide variety of fairly inexpensive GPS units are currently available. Most commercially available units will provide accuracy within 10 m, which is sufficient for navigating and marking locations
9. **Compass**: Surveyors should carry a compass to help them while navigating larger habitat patches. This is an important safety back-up device, because GPS units can fail or lose power. Most GPS units have a feature to provide an accurate bearing to stored waypoints (for example, previous flycatcher detections, your parked vehicle, etc.); however, many units do not accurately display the direction in which the surveyor is traveling slowly through dense vegetation. A compass set to the proper bearing provides a more reliable method to navigate the survey site and relocate previously marked locations.

The following equipment also is recommended:

10. **Camera:** These are very helpful for habitat photographs, especially at sites where flycatchers are found. Small digital cameras are easily portable and relatively inexpensive.
11. **Survey flagging** Used for marking survey sites or areas where flycatcher are detected. Check with the local land owner or management agency before flagging sites. Use flagging conservatively so as to not attract people or predators.
12. **Field vest:** A multi-pocket field vest can be very useful for carrying field equipment and personal items. We recommend muted earth-tone colors.

13. **Cell phone and/or portable radio**: In addition to providing an increased level of safety, cell phones or portable radios may be used by surveyors to assist each other in identifying territories and pairs in dense habitats, or where birds are difficult to hea .

In addition to the necessary equipment mentioned above, personal items, such as food, extra water or electrolyte drink, sunscreen, insect repellent, mosquito net, first-aid kit, whistle, and a light jacket, also should be considered. Being prepared for unforeseen difficulties, and remaining as comfortable as conditions allow while surveying are important factors to conducting thorough and effective surveys.

All survey results (both negative and positive) should be recorded directly on data forms when possible. These data forms have been designed to prompt surveyors to record key information that is crucial to interpretation of survey results and characterization of study sites. Even if no flycatchers are detected or habitat appears unsuitable, this is valuable information and should be recorded. Knowing where flycatchers are not breeding can be as important as knowing where they are; therefore, negative data are important. Standardized data forms are provided in appendix 1, or can be downloaded online. Always check for updated forms prior to each year's surveys.

Willow Flycatcher surveys are targeted at this species and require a great deal of focused effort. Surveyors must be constantly alert and concentrate on detecting a variety of flycatcher cues and responses. Therefore, field work, such as generalized bird surveys (for example, point counts or walking transects) or other distracting tasks, should not be conducted in conjunction with Willow Flycatcher surveys. Avoid bringing pets or additional people who are not needed for the survey. Dress in muted earth-tone colors, and avoid wearing bright clothing.

Willow Flycatcher Identification

The Southwestern Willow Flycatcher is a small bird, approximately 15 cm long and weighing about 11–12 g. Sexes look alike and cannot be distinguished by plumage. The upper parts are brownish-olive; a white throat contrasts with the pale olive breast, and the belly is pale yellow. Two white wing bars are visible (juveniles have buffy wing bars) and the eye ring is faint or absent. The upper mandible is dark and the lower mandible light. The tail is not strongly forked. When perched, the Willow Flycatcher often flicks its tail upward. As a group, the *Empidonax* flycatchers are very difficult to distinguis from one another by appearance. The Willow Flycatcher also looks very similar to several other passerine species you may encounter in the field

Given that Willow Flycatchers look similar to other *Empidonax* flycatchers that may be present at survey sites, the most certain way to verify Willow Flycatchers in the field is by their vocalization. For the purpose of this protocol, identification of Willow Flycatchers cannot be made by sight alone; vocalizations are a critical identification criterion, and specifically the primary song *fitz-be* . Willow Flycatchers have a variety of vocalizations (see Stein, 1963; Sedgwick, 2000), but two are most commonly heard during surveys or in response to call-playback:

1. ***Fitz-bew***. This is the Willow Flycatcher's characteristic primary song. Note that *fitz-bew* are not unique to the southwestern subspecies; all Willow Flycatchers sing this characteristics song. Male Willow Flycatchers may sing almost continuously for hours, with song rates as high as one song every few seconds. Song volume, pitch, and frequency may change as the season progresses. During prolonged singing bouts, *fitz-bew* are often separated by short *britt* notes. *Fitz-bews* are most often given by a male, but studies have shown female Willow Flycatchers also sing, sometimes quite loudly and persistently (although generally less than males). Flycatchers often sing from the top of vegetation, but also will vocalize while perched or moving about in dense vegetation.
2. ***Whitt***. This is a call often used by nesting pairs on their territory, and commonly is heard even during periods when the flycatchers are not singing *fitz-bewin*). The *whitt* call appears to be a contact call between sexes, as well as an alarm call, particularly when responding to disturbance near the nest. *Whitt* calls can be extremely useful for locating Willow Flycatchers later in the season when *fitz-bewin* may be infrequent, but are easily overlooked by inexperienced surveyors. When flycatcher pairs have active nests and particularly once young have hatched, *whitts* may be the most noticeable vocalization. However, many species of birds *whitt*, and a *whitt* is not a diagnostic characteristic for Willow Flycatchers. For example, the "*whitt*" of the Black-headed Grosbeak (*Pheucticus melanocephalus*) and Yellow-breasted Chat (*Icteria virens*) are often confused with that of the flycatche .

The *fitz-be* and *whitt* calls are the primary vocalizations used to locate Willow Flycatchers. However, other less common Willow Flycatcher vocalizations can be very useful in alerting surveyors to the presence of flycatchers. These include twittering vocalizations typically given during interactions between flycatchers and sometimes between flycatchers and other birds, bill snapping, *britt*'s, and *wheeo*'s. Because these sounds can be valuable in locating territories (Shook and others, 2003), they should be studied prior to going in the field. Willow Flycatcher vocalization recordings are available from Federal and State agency contacts and online at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/. Standardized recordings of Southwestern Willow Flycatchers also are available online at http://www.naturesongs.com/tyrrcert.html#tyrr. Specificall , only *fitz-bew* and *britts* should be used for conducting surveys, to provide more robust comparative results among sites and years.

Willow Flycatcher song rates are highest early in the breeding season (late May–early June), and typically decline after eggs hatch. However, in areas with many territorial flycatchers or where an unpaired flycatcher is still tryin to attract a mate, or where re-nesting occurs, singing rates may remain high well into July. Isolated pairs can be much quieter and harder to detect than pairs with adjacent territorial flycatchers. At some sites, pre-dawn singing (0330–0500 hours) appears to continue strongly at least through mid-July (Sogge and others, 1995). Singing rates may increase again later in the season, possibly coinciding with re-nesting attempts (Yard and Brown, 2003). The social dynamics of adjacent territories can strongly influence vocalization rates. A single "*fitz-be* " from one flycatcher may elicit multiple responses from adjacent territories. When these interactions occur, it is a good opportunity to distinguish among territories and provides the surveyor with an estimate of territory numbers in the immediate area.

There are some periods during which Willow Flycatchers do not sing and even the use of call-playback sometimes fails to elicit any response. This can be particularly true late in the breeding season. Early and repeated surveys are the best way to maximize the odds of detecting a singing flycatcher and determining its breeding status.

Timing and Number of Visits

No survey protocol can guarantee that a Southwestern Willow Flycatcher, if present, will be detected on any single visit. However, performing repeated surveys during the early to mid-nesting season increases the likelihood of detecting flycatchers and aids in determining their breeding status. A single survey, or surveys conducted too early or late in the breeding cycle, do not provide definitive data and are of limited value.

For purposes of this survey protocol, we have divided the Southwestern Willow Flycatcher breeding season into three basic survey periods, and specified a minimum number of survey visits for each period (fig.). Although the Sogge and others (1997a) protocol recommended a minimum of one survey in each period, we now recommend a differing number of visits for general surveys versus project-related studies.

General surveys are conducted for the sole purpose of determining whether Willow Flycatchers are present or absent from a respective site, when there is no foreseeable direct or indirect impact to their habitat from a known potential project or change in site management. In such cases, a minimum of one survey visit is required in each of the three survey periods.

Project-related surveys are conducted to determine the presence or absence of Willow Flycatchers within a site when there is a potential or foreseeable impact to their habitat due to a potential project or change in site management. Additional surveys are required for project-related studies in order to derive a greater degree of confidence regarding the presence or absence of Willow Flycatchers.

All successive surveys must be at least 5 days apart; surveys conducted more closely are not considered to be separate surveys. Although a minimum of three or five surveys are required for general and project-related purposes, respectively, if the habitat patches are large, contiguous and extremely dense, additional surveys are strongly encouraged to ensure full coverage of the site.

If you are uncertain whether three general surveys or five project-related surveys are required for your respective study, contact your USFWS flycatcher coordinato . As noted earlier, this survey protocol will help determine if territorial flycatchers are present and their approximate locations; if your project requires fine-scale estimates of flycatcher numbers o distribution at a site, you may need to conduct more intensive efforts that include additional surveys, nest searches, and nest monitoring.

Survey Period 1: May 15–31.—For both general and project-related surveys: a minimum of one survey is required. The timing of this survey is intended to coincide with the period of high singing rates in newly arrived males, which tends to begin in early to mid-May. This is one of the most reliable times to detect flycatchers that have established their territories, so there is substantial value to conducting period 1 surveys even though not all territorial males may yet have arrived. Migrant Willow Flycatchers of multiple subspecies will likely be present and singing during this period. Because both migrant and resident Willow Flycatchers are present during this period, and relatively more abundant then in subsequent surveys, it is an excellent opportunity to hone your survey and detection skills and gain confidence in your abilities. Detections of flycatchers during period 1 also provide insight on areas to pay particular attention to during the next survey period.

Survey Period 2: June 1–24.—For general surveys: a minimum of one survey is required. For project-related surveys, a minimum of two surveys are required. Note that this differs from the minimum of one survey that was recommended in this period under the previous protocol (Sogge and others, 1997a). During this period, the earliest arriving males may already be paired and singing less, but later arriving males should still be singing strongly. Period 2 surveys can provide insight about the status of any flycatchers detected during survey period 1. For example, if a flycatcher is detected during survey period 1 but not survey period 2, the first detection may have been a migrant. Conversel , detecting a flycatcher at the same site during periods 1 and 2 increases the likelihood that the bird is not a migrant, although it does not necessarily confirm it. Survey period 2 also is the earliest time during which you are likely to find nesting activity by resident birds at most sites. Special care should be taken during this period to watch for activity that will verify whether the flycatchers that are present are attempting to breed. A little extra time and diligence should be spent at all locations where flycatchers were detected during survey period 1.

Survey Visit Timing, Numbers, and Detection Interpretation

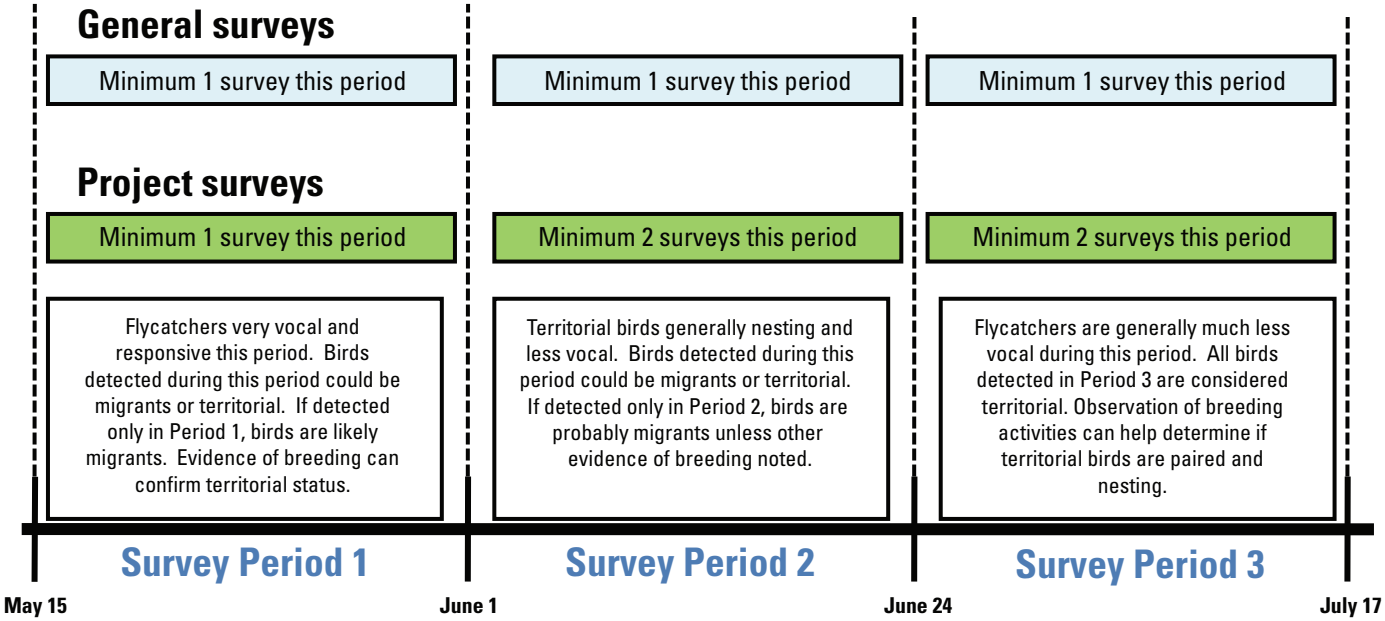


Figure 9. Recommended numbers and timing of visits during each survey period for general surveys and project surveys. General surveys are those conducted when there is no foreseeable direct or indirect impact to their habitat from a known potential project or change in site management. Project-related surveys are conducted when there is a potential or foreseeable impact to their habitat due to a potential project or change in site management.

Survey Period 3: June 25–July 17.—For general surveys, a minimum of one survey is required. For project-related surveys, a minimum of two surveys are required. Virtually all Southwestern Willow Flycatchers should have arrived on their territories by this time. Flycatcher singing rates probably have lessened, and most paired flycatchers will have initiated or even completed their first round of nesting activit . Migrant Willow Flycatchers should no longer be passing through the Southwest; therefore, any flycatchers that you detect are likely to be either territorial or nonbreeding floaters. Surveyors should determine if flycatchers detected during surveys in periods 1 or 2 are still present, and watch closely for nesting activity. Flycatchers that have completed a first nesting attempt may resume vigorous singing during this period. Extra time and diligence should be spent at all locations where flycatchers were detected during survey periods 1 or 2.

At high elevation sites (above 2,000 m), Southwestern Willow Flycatcher arrival and initiation of breeding activities may occur in early June, and possibly later in some years due to weather or migration patterns. Therefore, flycatcher breeding chronology may be delayed by 1 or 2 weeks at such sites, and surveys should be conducted in the latter part of each period.

It may not require multiple surveys to verify Southwestern Willow Flycatcher presence or breeding status. If, for example, Willow Flycatchers are observed carrying nest material during survey periods 1 or 2, this is conclusive verification they are breeders as opposed to migrants, regardless of what is found during period 3. However, it requires a minimum of three surveys for general studies and five surveys for project-related studies to determine with relative confidence that Southwestern Willow Flycatchers probably are not breeding at a site in that year, based on lack of detections.

We strongly encourage additional follow-up surveys to sites where territorial Southwestern Willow Flycatchers are verified or suspected. Extra surveys provide greater confidenc about presence or absence of flycatchers at a site, as well as help in estimating the number of breeding territories or pairs, and determining breeding status and the outcome of breeding efforts. Pre-survey visits the evening before the survey or post-survey follow-up later in the morning can help confirm breeding status when surveyors are not under time constraints. However, avoid returning to a site so often as to damage the habitat, establish or enlarge trails, or cause undue disturbance to the flycatchers

Survey Methods

The survey methods described below fulfill the primary objectives of documenting the presence or absence of Willow Flycatchers, and determining their status as territorial versus migrant. This protocol primarily is a call-playback technique, a proven method for eliciting response from nearby Willow Flycatchers (Seutin, 1987; Craig and others, 1992), both territorial and migrants. The premise of the call-playback technique is to simulate a territorial intrusion by another Willow Flycatcher, which generally will elicit a defensive response by the territorial bird, increasing its detectability. At each site, surveyors should broadcast a series of recorded Willow Flycatcher *fitz-bew* and *britts*, and look and listen for responses. In addition to maximizing the likelihood of detecting nearby flycatchers, this method also allows for positive identification by comparing the responding bird s vocalizations to the known Willow Flycatcher recording.

Documenting Presence/Absence—Begin surveys as soon as there is enough light to safely walk (about 1 hour before sunrise) and end by about 0900–1030 hours, depending on the temperature, wind, rain, background noise, and other environmental factors. Use your best professional judgment whether to conduct surveys that day based on local field conditions. If the detectability of flycatchers i being reduced by environmental factors, surveys planned for that day should be postponed until conditions improve. If observers are camped in or near potential Willow Flycatcher habitat, afternoons and evenings can be spent doing site reconnaissance and planning a survey strategy for the following morning. If camped immediately adjacent to survey sites, surveyors can awaken early and listen for flycatchers singing during the predawn period (0330–0500 hours), when territorial males often sing loudly.

Conduct surveys from within rather than from the perimeter of the sites, while limiting the breaking of vegetation or damaging the habitat. If surveys cannot be conducted from within the habitat, walk along the perimeter and enter the patch at intervals to broadcast the vocalizations and listen for responses. Flycatchers often respond most strongly if the recording is played from within the habitat and territory, rather than from the periphery. In addition, it can be surprisingly difficult to hear singing Willow Flycatchers that are even a short distance away amidst the noise generated by other singing and calling birds, roads, noisy streams, and other extraneous sounds. Therefore, it is preferable to survey from within the habitat, but always move carefully to avoid disturbing habitat or nests. Surveying from the periphery should not be conducted only for the sake of convenience, but is allowable for narrow linear reaches or when absolutely necessary due to safety considerations.

Because flycatchers may be clustered within only a portion of a habitat patch, it is critical to survey all suitable habitat within the patch. Small linear sites may be thoroughly covered by a single transect through the patch. For larger sites, choose a systematic survey path that assures complete patch coverage throughout the length and breadth of the site. This may require multiple straight transects, serpentine, zig-zag, or criss-cross routes. Aerial photographs and previous survey forms are valuable tools to help plan and conduct surveys, and to assure complete coverage. Always move carefully through the habitat to avoid disturbing vegetation or nests.

Initially approach each site and stand quietly for 1–2 minutes or longer, listening for spontaneously singing flycatchers. A period of quiet listening is important because it helps acclimate surveyors to background noises that can be quite loud due to roads, aircraft, machinery, waterways, and other sounds. It also allows surveyors to recognize and shift attention away from the songs and calls of other bird species, letting them focus on listening for flycatchers. Although it happens rarely, some singing Willow Flycatchers will actually stop vocalizing and approach quietly in response to a broadcast song, perhaps in an effort to locate what they perceive as an intruding male. Therefore, playing a recording before listening for singing individuals has at least some potential of reducing detectability.

If you do not hear singing flycatchers during the initial listening period, broadcast the Willow Flycatcher song recording for 10–15 seconds; then listen for approximately 1 minute for a response. Repeat this procedure (including a 10-second quiet pre-broadcast listening period) every 20–30 m throughout each survey site, more often if background noise is loud. The recording should be played at about the volume of natural bird calls, and not so loud as to cause distortion of the broadcast. We recommend that the playback recording include a series of *fitz-bew* interspersed with several *britts*.

Response to the broadcast call could take several forms. Early in the breeding season (approximately May–mid-June), a responding Willow Flycatcher will usually move toward the observer and *fitz-be* or *whitt* from within or at the top of vegetation. Territorial Willow Flycatchers almost always vocalize strongly when a recording is played in their territory early in the season. If there are several flycatchers present in an area, some or all may start singing after hearing the recording or the first responding individual. Flycatchers can often hear the recording from far away but will not usually move outside of their territory, so listen for distant responses. Also, stay alert and listen for flycatchers vocalizing behind you that may not have responded when you were first in their territory. Another common flycatcher response is alarm calls (*whitts*) or interaction twitters from within nearby vegetation, particularly once nesting has begun. Willow Flycatchers will often sing after a period of *whitting* in response to a recording, so surveyors hearing *whitts* should remain in the area and quietly listen for *fitz-bew* for several minutes. Because some flycatchers may initially respond by approaching quietl , particularly during periods 2 and 3, it is critical to watch carefully for responding birds.

If you detect flycatchers that appear particularly agitated, it is possible that you are in close proximity to their nest. Agitated flycatchers may swoop down at the surveyo , snap their beaks, and otherwise appear distressed. Exercise extreme caution so as to not accidently disturb the nest, and move slowly away from the immediate area.

For the purpose of this protocol, detection of a *fitz-be* song is essential to identify a bird as a Willow Flycatcher. Similar appearing species (including other *Empidonax* flycatchers) occur as migrants, and even breeders, at potential Willow Flycatcher sites. A few of these other species may even approach a broadcast Willow Flycatcher song and respond with vocalizations. In order to standardize interpretation of survey results and assure a high degree of confidence in surveys conducted by biologists of varying experience and skill, positive identification must be based on detection of the Willow Flycatcher's most unique characteristic—its song. It is important to remember that the *whitt* call is not unique to Willow Flycatchers, and therefore cannot serve as the basis of a positive identification. Howeve , *whitts* are extremely useful for locating flycatchers and identifying areas needing follow-up visits. Loud, strong *whitting* may indicate a nearby nest, dictating that surveyors exercise extra caution moving through the area.

Whenever a verified or suspected Willow Flycatcher is detected, be careful not to overplay the song recording. Excessive playing could divert the bird from normal breeding activities or attract the attention of predators and brood parasites. Wildlife management agencies may consider overplaying the recording as "harassment" of the flycatche , and this is not needed to verify species identification. Although flycatchers usually sing repeatedly once prompted, even a single *fitz-be* is sufficient for verification. If you hav played a recording several times and a bird has approached but has not *fitz-bewe* , do not continue playing the recording. If a potential Willow Flycatcher responds, approaches or *whitts* but does not sing, it is best to carefully back away and wait quietly. If it is a Willow Flycatcher, it probably will sing within a short time (5–10 minutes). Another option is to return to the same site early the following morning to listen for or attempt to elicit singing again. If you are still uncertain, record the location with your GPS, record comments on the survey form, and follow-up on the detection during subsequent surveys. If possible, request the assistance of an experienced surveyor to determine positive identification

If more habitat remains to be surveyed, continue onward once a flycatcher is detected and verified. In doing so, mov 30–40 m past the current detection before again playing the recording, and try to avoid double-counting flycatchers that have already responded. Willow Flycatchers, particularly unpaired males, may follow the broadcast song for 50 m or more.

Looking For and Recording Color Bands.—Several research projects have involved the capture and banding of Willow Flycatchers at breeding sites across the Southwest. In such projects, flycatchers are banded with one or more small colored leg bands, including a federal numbered band. As a result, surveyors may find colo -banded individuals at their survey sites, and identification and reporting of the band combination can provide important data on flycatcher movements, survivorship, and site fidelit .

To look for bands, move to get a good view of the flycatche 's legs. This may be difficult in dense vegetation, but flycatchers commonly perch on more exposed branches at the edges of their territory or habitat patch. If bands are seen, carefully note the band colors. If there is more than one band on a leg, differentiate the top (farthest up the leg) from the bottom (closest to the foot), and those on the bird's left leg versus the right leg. If you are unsure of the color, do not guess. Instead, record the color as unknown. Incorrect color-band data are worse than incomplete data, so only record colors of which you are certain. The fact that a banded bird was seen, even without being certain of its color combination, is very important information. Record the color-band information on the survey form, and report the sighting to the appropriate State or Federal contact as soon as you return from the survey that day.

Determining the Number of Territories and Pairs.—Accurately determining the number of breeding territories and pairs can be more difficult than determining simple presence or absence. Flycatcher habitat is usually so dense that visual detections are difficult, and seeing more than one bird at a time is often impossible. Flycatchers sing from multiple song perches within their territories, and may be mistaken for more than one flycatche . A flycatcher responding to or following a surveyor playing a recording may move considerable distances in a patch and thus be counted more than once. Territorial male flycatchers often sing strongl , but so do many migrants and some females, particularly in response to call-playback (Seutin, 1987; Unitt, 1987; Sogge and others, 1997b). Rangewide, many territorial male flycatchers are unmated, particularly those in small breeding groups. For these reasons, each singing flycatcher may not represent a territory or a mated pair. Following the established survey protocol and carefully observing flycatcher behavior can help determine if you have detected migrants, territorial birds, breeders, unmated birds, or pairs.

Given sufficient time, e fort and observation, it is usually possible to approximate the number of territories and pairs. First, listen carefully for simultaneously singing flycatchers. Note the general location of each bird—especially concurrently singing individuals—on aerial photographs, map, or a site sketch. Spend some time watching each flycatcher to determine approximate boundaries of its territory, and how it interacts with other flycatchers. If one or more singing

birds stay primarily in mutually exclusive areas, they can be considered as separate territories. To determine if a flycatcher is paired, watch for interactions within a territory. Refer to the section, "Determining Breeding Status" for signs of pairing and breeding activity. Do not report a territorial male as a pair unless you observe one or more of the signs listed below. In some cases, it may be possible only to estimate the number of singing individuals. In other cases, it may take multiple site visits to differentiate territories or pairs.

Determining Breeding Status.—One way to determine if the flycatchers found at a particular site are migrants or territorial is to find out if they are still present during the "non-migrant" period, which generally is from about June 15 to July 20 (Unitt, 1987). A Willow Flycatcher found during this time probably is a territorial bird, although there is a small chance it could be a non-territorial floater (Paxton and others, 2007). If the management question is simply whether the site is a potential breeding area, documenting the presence of a territorial flycatcher during the non-migrant period may meet all survey objectives, and the site may not need to be resurveyed during the remainder of that breeding season.

However, in some cases, surveyors will be interested in knowing not only if territorial Southwestern Willow Flycatchers are present at a site, but also whether breeding or nesting efforts are taking place. Some males maintain territories well into July yet never succeed in attracting a mate, so unpaired males are not uncommon (McLeod and others, 2007; Ellis and others, 2008; Ahlers and Moore, 2009). Thus, an assumption that each singing male represents a breeding pair may not be well founded, especially in small populations. If it is important to determine whether a pair is present and breeding in that territory, move a short distance away from where the bird was sighted, find a good vantage point, and sit or lie quietly to watch for evidence of breeding. Signs of breeding activity include:

a. observation of another unchallenged Willow Flycatcher in the immediate vicinity (indicates possible pair);
b. *whitt* calls between nearby flycatchers (indicates possible pair);
c. interaction twitter calls between nearby flycatchers (indicates possible pair);
d. countersinging or physical aggression against another flycatcher or bird species (suggests territorial defense)
e. physical aggression against cowbirds (suggests nest defense);
f. observation of Willow Flycatchers copulating (verifies attempted breeding);
g. flycatcher carrying nest material (verifies nesting attempt but not nest outcome);
h. flycatcher carrying food or fecal sac (verifies nest wit young, but not nest outcome);
i. locating an active nest (verifies nesting). Recall that general survey permits do not authorize nest searching or monitoring, and see section, "Special Considerations";
j. observation of adult flycatchers feeding fledged youn (verifies successful nesting)

You may be able to detect flycatcher nesting activit , especially once the chicks are being fed. Adults feed chicks at rates of as many as 30 times per hour, and the repeated trips to the nest tree or bush are often quite evident. Be sure to note on the flycatcher survey form any breeding activity that is observed, including detailed descriptions of the number of birds, and specific activities observed. Also note the location of breeding activities on an aerial photograph, map, or sketch of the area.

The number of flycatchers found at a site also can provide a clue as to whether they are migrants or territorial birds. Early season detections of single, isolated Willow Flycatchers often turn out to be migrants. However, discovery of a number of Willow Flycatchers at one site usually leads to verification that at least some of them remain as local breeders. This underscores the importance of completing a thorough survey of each site to be confident of the approximate number of flycatchers present

In some cases, regardless of the time and diligence of your efforts, it will be difficult to determine the actual breeding status of a territorial male. In these instances, use your best professional judgment, or request the assistance of an experienced surveyor or an agency flycatcher coordinator to interpret your observations regarding breeding status.

Reporting Results.—There is little value in conducting formal surveys if the data are not recorded and submitted. Fill in all appropriate information on the Willow Flycatcher survey form while still in the field, and mark the location of detections on a copy of the USGS topographic map. Make a habit of reviewing the form before you leave any site—trying to remember specific information and recording it later can lead to missing and inaccurate data. Note the location of the sighting on an aerial photograph or sketch of the site. Attaching photographs of the habitat also is useful. Whenever a Willow Flycatcher territory or nest site is confirmed, notify the USFWS or appropriate State wildlife agency as soon as you return from the field. The immediate reporting of flycatcher detections or nests may di fer among USFWS regions and States—discuss these reporting procedures with your respective State and USFWS flycatcher coordinators

Complete a survey form (appendix 1) for each site surveyed, whether or not flycatchers are detected. "Negative data" (that is, a lack of detections) are important to document the absence of Willow Flycatchers and help determine what areas have already been surveyed. Make and retain a copy of each survey form, and submit the original or a legible copy. Electronic copies of the survey forms also are acceptable and are available online (http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/). All survey forms must be submitted to the USFWS and the appropriate State wildlife agency by the specified deadline identified in your permits Timely submission of survey data is a permit requirement, and will ensure the information is included in annual statewide and regional reports.

Special Considerations

To avoid adverse impacts to Willow Flycatchers, follow these guidelines when performing all surveys:

1. Obtain all necessary Federal, State, and agency permits and permissions prior to conducting any surveys. Failure to do so leaves you liable for violation of the Endangered Species Act, various State laws, and prosecution for trespass.
2. Do not play the recording more than necessary or needlessly elicit vocal responses once Willow Flycatchers have been located and verified. This may distract territorial birds from caring for eggs or young, or defending their territory. If flycatchers are vocalizing upon arrival at the site, and your objective is to determine their presence or absence at a particular site—there is no need to play the recording. Excessive playing of the recording also may attract the attention of predators or brood parasites. Stop playing the survey recording as soon as you have confirmed the presence of a Willow Flycatcher, and do not play the recording again until you have moved 30–40 m to the next survey location.
3. Proceed cautiously while moving through Willow Flycatcher habitat. Continuously check the area around you to avoid disturbance to nests of Willow Flycatchers and other species. Do not break understory vegetation, even dead branches, to create a path through the surveyed habitat.
4. Do not approach known or suspected nests. Nest searches and monitoring require specific State and Federal permits, have their own specialized methodologies (Rourke and others, 1999), and are not intended to be a part of this survey protocol.
5. If you find yourself close to a known or suspected nest, move away slowly to avoid startling the birds or force-fledging the young. Avoid physical contact with the nest or nest tree, to prevent physical disturbance and leaving a scent. Do not leave the nest area by the same route that you approached. This leaves a “dead end” trail that could guide a potential predator to the nest/nest tree. If nest monitoring is a component of the study, but you are not specifically permitted to monitor the nest, store a waypoint with your GPS, affix flagging to a nearby tre at least 10 m away, and record the compass bearing to the nest on the flagging. Report your findings to an agenc flycatcher coordinator or a biologist who is permitted to monitor nests.
6. If you use flagging to mark an area where flycatchers ar found, use it conservatively and make certain the flagging is not near an active nest. Check with the property owner or land-management agency before flagging to be sure that similar flagging is not being used for other purposes in the area. Unless conducting specific and authorized permitted nest monitoring, flagging should be placed no closer than 10 m to any nest. Keep flagging inconspicuous from general public view to avoid attracting people or animals to an occupied site, and remove it at the end of the breeding season.
7. Watch for and note the presence of potential nest predators, particularly birds, such as Common Ravens (*Corvus corax*), American Crows (*Corvus brachyrhynchos*), jays, and magpies. If such predators are in the immediate vicinity, wait for them to leave before playing the recording.
8. Although cowbird parasitism is no longer considered among the primary threats to flycatcher conservation it remains useful to note high concentrations of cowbirds in the comment section of the survey form. While conducting surveys, avoid broadcasting the flycatcher vocalizations if cowbirds are nearby, especially if you believe you may be close to an active flycatcher territor . The intent of not broadcasting flycatcher vocalizations is to reduce the potential for attracting cowbirds to a flycatcher territory or making flycatcher nests mor detectable to cowbirds.
9. Non-indigenous plants and animals can pose a significant threat to flycatcher habitat and may be unintentionally spread by field personnel, including those conducting flycatcher surveys. Simple avoidance and sanitation measures can help prevent the spread of these organisms to other environments. To avoid being a carrier of non-indigenous plants or animals from one field site to another visually inspect and clean your clothing, gear, and vehicles before moving to a different field site. A detailed description on how to prevent and control the spread of these species is available by visiting the Hazard Analysis and Critical Control Point Planning for Natural Resource Management web site (http://www.haccp-nrm.org). One species of particular interest is the tamarisk leaf-beetle (*Diorhabda* spp.). If you observe defoliation of saltcedar while conducting flycatcher surveys and believe that *Diorhabda* beetles may be responsible, notify your USFWS coordinator immediately. Other non-native species of concern in survey locations are the quagga mussel (*Dreissena rostriformis bugensis*), cheatgrass (*Bromus tectorum*), red brome (*Bromus rubens*), giant salvinia (*Salvinia molesta*), water milfoil (*Myriophyllum spicatum*), parrot’s feather (*M. aquaticum*), and amphibian chytrid fungus (*Batrachochytrium dendrobatidis*).

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Appendix 1. Willow Flycatcher Survey and Detection Form

Always check the U.S. Fish and Wildlife Service Arizona Ecological Services Field Office web site http://www.fws.gov/southwest/es/arizona/) for the most up-to-date version.

Willow Flycatcher (WIFL) Survey and Detection Form (revised April 2010)

Site Name_____ State_____ County _____
USGS Quad Name _____ Elevation _____ (meters)
Creek, River, Wetland, or Lake Name_____
Is copy of USGS map marked with survey area and WIFL sightings attached (as required)? Yes___ No____

Survey Coordinates: Start: E_____ N_____ UTM Datum_____(See instructions)
Stop: E_____ N_____ UTM Zone _____
If survey coordinates changed between visits, enter coordinates for each survey in comments section on back of this page.

***** Fill in additional site information on back of this page *****

Survey # Observer(s) (Full Name)	Date (m/d/y) Survey time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found? Y or N If Yes, number of nests	Comments (e.g., bird behavior; evidence of pairs or breeding; potential threats [livestock, cowbirds, *Diorhabda* spp.]). If *Diorhabda* found, contact USFWS and State WIFL coordinator	GPS Coordinates for WIFL Detections (this is an optional column for documenting individuals, pairs, or groups of birds found on each survey). Include additional sheets if necessary.			
Survey # 1 Observer(s)	Date						# Birds	Sex	UTM E	UTM N
	Start									
	Stop									
	Total hrs ___									
Survey # 2 Observer(s)	Date						# Birds	Sex	UTM E	UTM N
	Start									
	Stop									
	Total hrs ___									
Survey # 3 Observer(s)	Date						# Birds	Sex	UTM E	UTM N
	Start									
	Stop									
	Total hrs ___									
Survey # 4 Observer(s)	Date						# Birds	Sex	UTM E	UTM N
	Start									
	Stop									
	Total hrs ___									
Survey # 5 Observer(s)	Date						# Birds	Sex	UTM E	UTM N
	Start									
	Stop									
	Total hrs ___									
Overall Site Summary Totals do not equal the sum of each column. Include only resident adults. Do not include migrants, nestlings, and fledglings. Be careful not to double count individuals. Total Survey Hrs		Total Adult Residents	Total Pairs	Total Territories	Total Nests	Were any Willow Flycatchers color-banded? Yes___ No ___ If yes, report color combination(s) in the comments section on back of form and report to USFWS.				

Reporting Individual _____ Date Report Completed_____ _____
US Fish and Wildlife Service Permit #_____State Wildlife Agency Permit #_____
Submit form to USFWS and State Wildlife Agency by September 1st. Retain a copy for your records.

Fill in the following information completely. Submit form by September 1st. Retain a copy for your records.

Reporting Individual _____Phone # _____
Affiliation _____ E-mail _____
Site Name_____Date Report Completed _____

Did you verify that this site name is consistent with that used in previous years? Yes ____ No _____ Not Applicable ___
If site name is different, what name(s) was used in the past?_____
If site was surveyed last year, did you survey the same general area this year? Yes ____ No ____ If no, summarize below.
Did you survey the same general area during each visit to this site this year? Yes ____ No ____ If no, summarize below.

Management Authority for Survey Area : Federal____ Municipal/County ____ State ____ Tribal ____ Private ____
Name of Management Entity or Owner (e.g., Tonto National Forest) _____

Length of area surveyed: _____ (meters)

Vegetation Characteristics: Mark the category that best describes the predominant tree/shrub foliar layer at this site (check one):

_____ Native broadleaf plants (entirely or almost entirely, > 90% native, includes high-elevation willow)

_____ Mixed native and exotic plants (mostly native, 50 - 90% native)

_____ Mixed native and exotic plants (mostly exotic, 50 - 90% exotic)

_____ Exotic/introduced plants (entirely or almost entirely, > 90% exotic)

Identify the 2-3 predominant tree/shrub species in order of dominance. Use scientific name.
_____

Average height of canopy (Do not include a range): _____ (meters)

Attach copy of USGS quad/topographical map (REQUIRED) of survey area, outlining survey site and location of WIFL detections.
Attach sketch or aerial photo showing site location, patch shape, survey route, location of any WIFLs or WIFL nests detected.
Attach photos of the interior of the patch, exterior of the patch, and overall site; describe any unique habitat features.

Comments (attach additional sheets if necessary)
_____
_____
_____
_____
_____
_____

Territory Summary Table. Provide the following information for each verified territory at your site.

Territory Number	All Dates Detected	UTM N	UTM E	Pair Confirmed? Y or N	Nest Found? Y or N	Description of How You Confirmed Territory and Breeding Status (e.g., vocalization type, pair interactions, nesting attempts, behavior)

Attach additional sheets if necessary

Appendix 2. Willow Flycatcher Survey Continuation Sheet / Territory Summary Table

Always check the U.S. Fish and Wildlife Service Arizona Ecological Services Field Office web site http://www.fws.gov/southwest/es/arizona/) for the most up-to-date version.

Willow Flycatcher Survey Continuation Sheet
(For reporting additional detections and territories; append to Survey and Detection form)

Reporting Individual _____ Phone # _____
Affiliation _____ E-mail _____
Site Name _____ Date Report Completed _____

Territory Number	All Dates Detected	UTM E	UTM N	Pair Confirmed? Y or N	Nest Found? Y or N	Description of How You Confirmed Territory and Breeding Status (e.g., vocalization type, pair interactions, nesting attempts, behavior)

Comments _____

Appendix 3. Instructions for Completing the Willow Flycatcher Survey and Detection Form and the Survey Continuation Sheet

These instructions are provided as guidance for completing the standard survey form. It is particularly important to provide the correct type and format of information for each field. Complete and submit your survey forms to both the appropriate State Willow Flycatcher coordinator and the U.S. Fish and Wildlife Service (USFWS) by September 1 of the survey year. You also may complete forms digitally (Microsoft© Word or Excel) and submit them via email with attached or embedded topographic maps and photographs.

Page 1 of Survey Form

Site Name. Standardized site names are provided by the flycatcher survey coordinators for each State and should be consistent with the naming of other sites that might be in the area. If the site is new, work with your State or USFWS flycatcher coordinator to determine suitable site names before the beginning of the survey season. If the site was previously surveyed, use the site name from previous years (which can be obtained from the State or USFWS flycatcher coordinator). If you are uncertain if the site was previously surveyed, contact your State or USFWS flycatcher coordinato .

USGS Quad Name. Provide the full quad name, as shown on the appropriate standard 7.5-minute topographic maps.

Creek, River, Wetland, or Lake Name. Give the name of the riparian feature, such as the lake or watercourse, where the survey is being conducted.

Survey Coordinates. Provide the start and end points of the survey, which will indicate the linear, straight-line extent of survey area, based on Universal Transverse Mercator coordinates (UTMs). California surveyors only: provide latitude/longitude geographic coordinates instead of UTMs in the UTM fields and identify them as such. If the start and end points of the survey changed significantly among visits, enter separate coordinates for each survey in the comments section on the back of the survey sheet. Note that we do not need the coordinates for the detailed path taken by the surveyor(s).

Datum. Indicate the datum in which the coordinates are expressed: NAD27, WGS84, or NAD83. The datum can be found in the settings of most GPS units. Note that Arizona prefers NAD27 and New Mexico prefers NAD83.

Zone. Provide the appropriate UTM zone for the site, which is displayed along with the coordinates by most GPS units. Zones for California are 10, 11, or 12. The zone for Arizona is 12. Zones for New Mexico are 12 or 13.

Survey #. Survey 1 – 5. See the protocol for an explanation of the number of required visits for each survey period. **Note:** A survey is defined as a complete protocol-based survey that occurs over no more than 1 day. If a site is so large as to require more than a single day to survey, consider splitting the site into multiple subsites and use separate survey forms for each. Casual site visits, pre-season or supplemental visits, or follow-up visits to check on the status of a territory should not be listed in this column, but should be documented in the Comments section on page 2 or in the survey continuation sheet.

Date. Indicate the date that the survey was conducted, using the format mm/dd/yyyy.

Start and **Stop.** Start and stop time of the survey, given in 24-hour format (e.g., 1600 hours rather than 4:00 p.m.).

Total hours. The duration of time (in hours) spent surveying the site, rounded to the nearest tenth (0.1) hour. For single-observer surveys, or when multiple observers stay together throughout the survey, total the number of hours from survey start to end. If two or more observers surveyed sections of the site concurrently and independently, sum the number of hours each observer spent surveying the site.

Number of Adult WIFLs. The total number of individual adult Willow Flycatchers detected during this particular survey. Do not count nestlings or recently fledged birds.

Number of Pairs. The number of breeding pairs. Do not assume that any bird is paired; designation of birds as paired should be based only on direct evidence of breeding behaviors described in the protocol. If there is strong evidence that the detected bird is unpaired, enter “0”. If it is unknown whether a territorial bird is paired, enter “–”. Note that the estimated number of pairs can change over the course of a season.

Number of Territories. Provide your best estimate of the number of territories, defined as a discrete area defended by a resident single bird or pair. This is usually evidenced by the presence of a singing male, and possibly one or more mates. Note that the estimated number of territories may change over the course of a season.

Nest(s) Found? Yes or No. If yes, indicate the number of nests. Renests are included in this total.

Comments about this survey. Describe bird behavior, evidence of pairs or breeding, evidence of nest building, evidence of nestlings/fledglings, nesting, vocalizations (e.g., interaction twitter calls, *whitts*, *britts*, *wheeos*, *fitz-bew* /countersinging), potential threats (e.g., livestock, cowbirds, saltcedar leaf beetles [*Diorhabda* spp.] etc.). If *Diorhabda* beetles are observed, contact your USFWS and State flycatcher coordinator immediatel . Please be aware that permits are needed for nest monitoring.

GPS Coordinates for WIFL Detections. Provide the number of birds (e.g., unpaired, paired, or groups of birds) and corresponding UTMs. If known, provide the sex of individuals.

Overall Site Summary. For each of these columns, provide your best estimate of the overall total for the season. Do not simply total the numbers in each column. In some cases where consistent numbers were detected on each survey, the overall summary is easy to determine. In cases where numbers varied substantially among the different surveys, use professional judgment and logic to estimate the most likely number of adults, pairs, and territories that were consistently present. Be careful not to double count individuals. Record only territorial adult Southwestern Willow Flycatchers, do not include migrants, nestlings, or fledglings in the overall summary. In complex cases, consult with your State or USFWS flycatcher coordinato .

Total Survey Hours. The sum of all hours spent surveying the site.

Were any WIFLs color-banded? Circle or highlight "Yes" or "No". If yes, report the sighting and color combination (if known) in the comments section on back of form, and contact your USFWS coordinator within 48 hours after returning from the survey. Note that identifying colors of bands is difficult and might require follow-up visits by experienced surveyors.

Reporting Individual. Indicate the full first and last name of the reporting individual.

Date Report Completed. Provide the date the form was completed in mm/dd/yyyy format.

U.S. Fish and Wildlife Service Permit #. List the full number of the required federal permit under which the survey was completed.

State Wildlife Agency Permit #. If a State permit is required by the State in which the survey was completed, provide the full number of the State permit. State permits are required for Arizona and California. State permits are recommended for New Mexico.

Page 2 of Survey Form

Affiliation Provide the full name of the agency or other affiliation (which is usually the employer) of the reporting individual.

Phone Number. Self-explanatory; include the area code.

E-mail. Self-explanatory.

Was this site surveyed in a previous year? Indicate "Yes", "No", or "Unknown."

Did you verify that this site name is consistent with that used in previous years? Indicate "Yes" or "No". This can be determined by checking survey forms from previous years or consulting with agency flycatcher coordinators

If site name is different, what name(s) was used in the past? Enter the full site name that was used in previous years.

If site was surveyed last year, did you survey the same general area this year? Indicate "Yes" or "No". If no, indicate the reason and how the survey varied in the Comments section.

Did you survey the same general area during each visit to this site this year? If no, indicate the reason in the Comments section and delineate the differing route of each survey on the topographical map.

Management Authority for Survey Area. Mark the appropriate management authority.

Name of Management Entity or Owner (e.g., Tonto National Forest). Provide the name of the organization or person(s) responsible for management of the survey site.

Length of area surveyed. Estimate the linear straight-line distance of the length of the area surveyed, in kilometers. This is not an estimate of the total distance walked throughout the survey site. Do not provide a range of distances.

Vegetation Characteristics: Mark only one of the categories that best describes the predominant tree/shrub foliar layer at the site.

Native broadleaf habitat is composed of entirely or almost entirely (i.e., > 90%) native broadleaf plants.

Mostly native habitat is composed of 50–90% native plants with some (i.e., 10–50%) non-native plants.

Mostly exotic habitat is composed of 50–90% non-native plants with some (i.e., 10–50%) native plants.

Exotic/introduced habitat is composed entirely or almost entirely (i.e., > 90%) of non-native plants.

Identify the 2–3 predominant tree/shrub species in order of dominance. Identify by scientific name.

Average height of canopy. Provide the best estimate of the average height of the top of the canopy throughout the patch. Although canopy height can vary, give only a single (not a range) overall height estimate.

Attach the following: (1) copy of USGS quad/topographical map (REQUIRED) of survey area, outlining survey site and location of WIFL detections; (2) sketch or aerial photo showing site location, patch shape, survey route, location of any detected WIFLs or their nests; (3) photos of the interior of the patch, exterior of the patch, and overall site. Describe any unique habitat features in Comments. Include the flycatcher territory number and GPS location. You also may include a compact disc of photographs.

Comments. Include any information that supports estimates of total territory numbers and breeding status. You may provide additional information on bird behavior, banded birds, evidence of pairs or breeding, nesting, potential threats (e.g., livestock, cowbirds, saltcedar leaf beetles [*Diorhabda* spp.] etc.), and changes in survey length and route throughout the season. Attach additional pages or use the continuation sheet if needed.

Table. If Willow Flycatchers are detected, complete the table at the bottom of the form. Identify flycatchers by territory number and include the dates detected, UTMs, whether or not pairs were detected, and whether or not nests were located. Also describe the observation. For example, the surveyor might have observed and heard a bird *fitz-be* from an exposed perch, heard and observed two birds interacting and eliciting a twitter call, heard a bird *fitz-be* while observing another carrying nesting material, heard birds from territory 1 and 2 countersinging, etc. This information provides supporting information for territory and breeding status. Use the continuation sheet if needed.

Appendix 4. Example of a Completed Willow Flycatcher Survey and Detection Form (with map)

Willow Flycatcher (WIFL) Survey and Detection Form (revised April, 2010)

Site Name: **DL-08** State: **New Mexico** County: **Socorro**

USGS Quad Name: **Paraje Well** Elevation: **1,356** (meters)

Creek, River, or Lake Name: **Rio Grande**

Is copy of USGS map marked with survey area and WIFL sightings attached (as required)? ***Yes*** **X** ***No*** ____

Survey Coordinates: Start: E **306,009** N **3,715,506** UTM Datum: **NAD 83** (See instructions)

Stop: E **304,339** N **3,711,922** UTM Zone: **13**

If survey coordinates changed between visits, enter coordinates for each survey in comments section on back of this page.

*****Fill in additional site information on back of this page*****

Survey # Observer(s) (Full Name)	Date (m/d/y) Survey Time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found? Y or N If Yes, number of nests	Comments (e.g., bird behavior; evidence of pairs or breeding;-potential threats [livestock, cowbirds, *Diorhabda* spp.]). If *Diorhabda* found, contact USFWS and State WIFL coordinator.	GPS Coordinates for WIFL Detections (this is an optional column for documenting individuals, pairs, or groups of birds found on each survey). Include additional sheets if necessary.			
Survey # 1	Date:	5	0	5	N	Suitable breeding habitat dispersed throughout site. WIFLs were very vocal, and covering large areas. No obvious signs of pairing were observed. Approximately 10 head of cattle were found within this site.	# Birds	Sex	UTM E	UTM N
Observer(s):	5/24/2009						1	M	305,276	3,714,926
D. Savage	Start:						1	M	305,131	3,714,628
	5:45						1	M	305,191	3,714,778
	Stop:						1	M	305,394	3,715,009
	10:15						1	M	305,084	3,714,732
	Total hrs:									
	4.5									
Survey # 2	Date:	11	4	7	Y (3)	Portions of site are flooded, 1-2 ft deep. Two males found during 1st survey appear unpaired. Three pairs confirmed based on nesting, and another pair suspected based on vocal interactions and nonaggressive behavior with another flycatcher. Two additional territories (1 pair and 1 unpaired male) found during this survey.	# Birds	Sex	UTM E	UTM N
Observer(s):	6/10/2009						1	M	305,276	3,714,926
S. Kennedy	Start:						1	M	305,131	3,714,628
	6:00						2	M/F	305,191	714,778
	Stop:						2	M/F	305,394	3,715,009
	10:15						2	M/F	305,084	3,714,732
	Total hrs:						2	M/F	305,001	3,714,640
	4.3						1	M	305,010	3,714,524
Survey # 3	Date:	12	5	7	Y (4)	Portions of site still flooded. All territories found in Survey 2 are still active. The two males found during Surveys #1 and #2, still believed to be unpaired. All other territories are believed to be paired. Several cows observed in vicinity of active territories.	# Birds	Sex	UTM E	UTM N
Observer(s):	6/21/2009						1	M	305,276	3,714,926
S. Kennedy	Start:						1	M	305,131	3,714,628
	5:30						2	M/F	305,191	3,714,778
	Stop:						2	M/F	305,394	3,715,009
	10:00						2	M/F	305,084	3,714,732
	Total hrs:						2	M/F	305,001	3,714,640
	4.5						2	M/F	305,010	3,714,524
Survey # 4	Date:	12	5	7	Y (4)	Site is no longer flooded, but saturated soils persist throughout most of site. No change in territory numbers or status. All SWFL pairs very quiet - only a few whits and fitz-bews. Light rain over night, vegetation was saturated early in the morning. Lots of mosquitos!	# Birds	Sex	UTM E	UTM N
Observer(s):	7/1/2009						1	M	305,276	3,714,926
D. Moore	Start:						1	M	305,131	3,714,628
	6:00						2	M/F	305,191	3,714,778
	Stop:						2	M/F	305,394	3,715,009
	10:00						2	M/F	305,084	3,714,732
	Total hrs:						2	M/F	305,001	3,714,640
	4.0						2	M/F	305,010	3,714,524
Survey # 5	Date:	11	5	6	Y (4)	Site beginning to dry out, some portions still muddy. One of the unpaired males could not be detected. It was hard to hear SWFLs due to breezy conditions early in the morning.	# Birds	Sex	UTM E	UTM N
Observer(s):	7/10/2009						1	M	305,131	3,714,628
D. Moore	Start:						2	M/F	305,191	3,714,778
	5:30						2	M/F	305,394	3,715,009
	Stop:						2	M/F	305,084	3,714,732
	10:00						2	M/F	305,001	3,714,640
	Total hrs:						2	M/F	305,010	3,714,524
	4.5									
Overall Site Summary Totals do not equal the sum of each column. Include only resident adults. Do not include migrants, nestlings, and fledglings. Be careful not to double count individuals. Total survey hrs: 21.8		Total Adult Residents	Total Pairs	Total Territories	Total Nests	Were any WIFLs color-banded? Yes ____ No **X** If yes, report color combination(s) in the comments section on back of form and report to USFWS.				
		12	5	7	4					

Reporting Individual: **Darrell Ahlers** Date Report Completed: **8/20/2009**

US Fish & Wildlife Service Permit #: **TE819475-2** State Wildlife Agency Permit #: **N/A**

Submit ***form to USFWS and State Wildlife Agency by September 1st. Retain a copy for your records.***

Fill in the following information completely. Submit form by September 1st. Retain a copy for your records.

Reporting Individual **Darrell Ahlers** Phone # **(303) 445-2233**
Affiliation **Bureau of Reclamation** E-mail dahlers@usbr.gov
Site Name **DL-08** Date report Completed **8/20/2009**
Was this site surveyed in a previous year? Yes__x__ No____ Unknown____
Did you verify that this site name is consistent with that used in previous yrs? Yes x No ____ Not Applicable ____
If name is different, what name(s) was used in the past? **Not applicable**
If site was surveyed last year, did you survey the same general area this year? Yes x No ____ If no, summarize below.
Did you survey the same general area during each visit to this site this year? Yes x No ____ If no, summarize below.

Management Authority for Survey Area: Federal X Municipal/County ____ State ____ Tribal ____ Private ____
Name of Management Entity or Owner (e.g., Tonto National Forest) **Bureau of Reclamation**

Length of area surveyed: **2.5** (km)

Vegetation Characteristics: Check (only one) category that best describes the predominant tree/shrub foliar layer at this site:

____ Native broadleaf plants (entirely or almost entirely, > 90% native)

X Mixed native and exotic plants (mostly native, 50 - 90% native)

____ Mixed native and exotic plants (mostly exotic, 50 - 90% exotic)

____ Exotic/introduced plants (entirely or almost entirely, > 90% exotic)

Identify the 2-3 predominant tree/shrub species in order of dominance. Use scientific name.
Salix Gooddingii, Populus spp., Tamarix spp.

Average height of canopy (Do not include a range): **6** (meters)

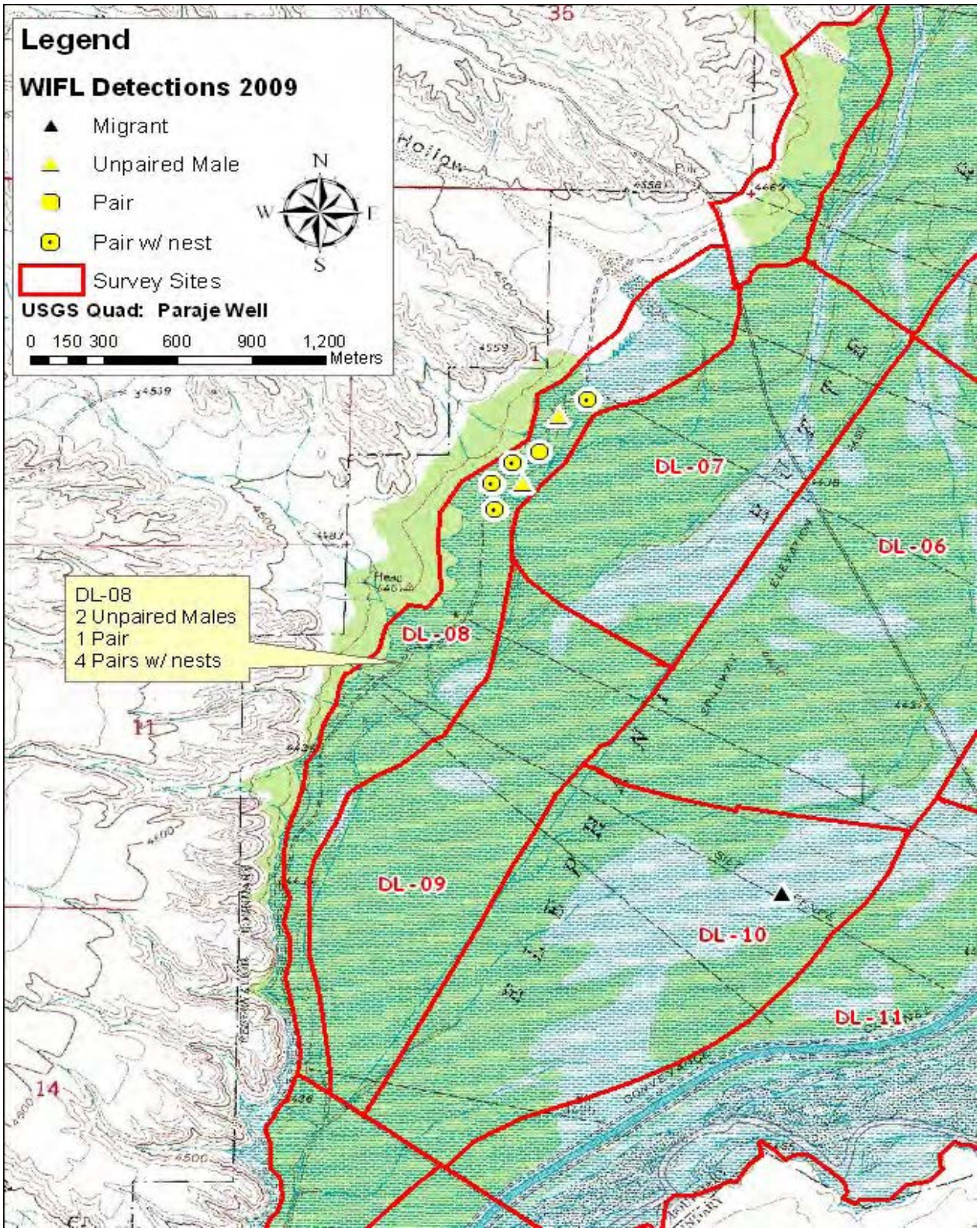
Attach the following: 1) copy of USGS quad/topographical map (REQUIRED) of survey area, outlining survey site and location of WIFL detections;
2) sketch or aerial photo showing site location, patch shape, survey route, location of any detected WIFLs or their nests;
3) photos of the interior of the patch, exterior of the patch, and overall site. Describe any unique habitat features in Comments.

Comments (such as start and end coordinates of survey area if changed among surveys, supplemental visits to sites, unique habitat features. Attach additional sheets if necessary.
Great habitat with saturated or flooded soils throughout most of the site on 1st survey. Site began to dry by the end of the breeding season. SWFL territories are dominated by Gooddings willow, however Tamarix spp. tends to be increasing in density compared to previous years. Site is supported by flows from the Low Flow Conveyance Channel.

Territory Summary Table. Provide the following information for each verified territory at your site.

Territory Number	All Dates Detected	UTM E	UTM N	Pair Confirmed? Y or N	Nest Found? Y or N	Description of How You Confirmed Territory and Breeding Status (e.g., vocalization type, pair interactions, nesting attempts, behavior)
1 (Unpaired male)	5/24, 6/10,6/21,7/1	305,276	3,714,926	N	N	extended presence at site from 5/24 through 7/1, no evidence of pairing
2 (Unpaired male)	5/24, 6/10,6/21,7/1, 7/10	305,131	3,714,628	N	N	extended presence at site from 5/24 through 7/10, no evidence of pairing
3 (Pair)	5/24, 6/10,6/21,7/1, 7/10	305,191	3,714,778	Y	Y	Pair confirmed based on vocalizations and observation of unchallenged WIFL
4 (Pair w/nest)	5/24, 6/10,6/21,7/1, 7/10	305,394	3,715,009	Y	Y	Confirmed breeding status with nest
5 (Pair w/nest)	5/24, 6/10,6/21,7/1, 7/10	305,084	3,714,732	Y	Y	Confirmed breeding status with nest
6 (Pair w/nest)	6/10,6/21,7/1, 7/10	305,001	3,714,640	Y	Y	Confirmed breeding status with nest
7 (Pair w/nest)	6/10,6/21,7/1, 7/10	305,010	3,714,524	Y	N	Confirmed breeding status with nest

Attach additional sheets if necessary


Legend
WIFL Detections 2009
Migrant
Unpaired Male
Pair
Pair w/ nest
Survey Sites
USGS Quad: Paraje Well
0 150 300 600 900 1,200
Meters
N
W
E
S
DL-08
2 Unpaired Males
1 Pair
4 Pairs w/ nests
DL-07
DL-06
DL-08
DL-09
DL-10
DL-11

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For more information concerning the research in this report, contact

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Flagstaff, AZ 86001

SEJA Comment Letter-Page 210

Attachment B-2

Final Report - NCCP/MSCP Raptor Monitoring Project (January 1, 2001 – December 31, 2003)

for

California Department Fish and Game
4949 Viewridge Ave.
San Diego, CA 92123

by

Wildlife Research Institute, Inc.
P.O. Box 2209
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March 31, 2005

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BACKGROUND

The Natural Communities Conservation Planning (NCCP) Raptor Monitoring Project is part of the urgent implementation tasks associated with the Multiple Species Conservation Program (MSCP). The MSCP is the local representation of the State's NCCP Program of which the City of San Diego is a participating member and the lead agency. The County of San Diego is also an active participant (County of San Diego 1997). The city adopted the MSCP on March 18, 1997 and entered into a binding contract on July 16, 1997 with the State of California Department of Fish and Game and the United States Fish and Wildlife Service to implement the MSCP.

Each habitat conservation plan (HCP) requires a monitoring program to determine the efficacy of that plan. The "Biological Monitoring Plan for the Multiple Species Conservation Program" (Ogden 1996) recommended monitoring for certain plant species, coastal sage scrub (Coastal California Gnatcatcher and Cactus Wren), herpetofauna, and grasslands (specifically, using raptors).

THE PROJECT AND ITS OBJECTIVES

Monitoring of raptors is a critical component of the MSCP. This project, specifically, addresses monitoring the raptor species identified as target species for MSCP monitoring with one exception--the Burrowing Owl (BO; *Athene cunicularia hypugaea*). In addition to the Burrowing Owl, the MSCP Biological Monitoring Plan (Ogden, 1996) identified the following raptor species (hereafter referred to as the "target" species) to be monitored: Golden Eagle (GE; *Aquila chrysaetos*), Bald Eagle (BE; *Haliaeetus leucocephalus*), Peregrine Falcon (PF; *Falco peregrinus*), Northern Harrier (NH; *Circus cyaneus*), Ferruginous Hawk (FH; *Buteo regalis*), Swainson's Hawk (SH; *Buteo swainsoni*), and Cooper's Hawk (CH; *Accipiter cooperii*). Prior to the subject work, no comprehensive study had been conducted for any of these species, within the geographical limits of the MSCP.

The Wildlife Research Institute, Inc. (WRI), a non-profit organization, has been working with all MSCP participants to identify appropriate long-term raptor monitoring locations (based on the results of the current WRI raptor surveys), develop a scientifically-based monitoring program (including survey locations and protocols), test the monitoring methods, and identify opportunities for population enhancements.

The original project objectives (taken from the contract's scope of work) are as follows:

- Determine where breeding and wintering individuals (of the target species) are located within the study areas.
- Wherever possible, document the breeding success of active pairs.
- Characterize situations of both successful and less successful or unsuccessful habitat.
- Identify, modify, or create, if necessary, survey raptor monitoring methods, based on scientific principles that would be appropriate to meet the objectives of the MSCP Monitoring Plan.
- Identify management, including research, needs and enhancement opportunities.

THIS REPORT

Constraints. This report covers WRI's raptor surveying activity for the three years of this project (January 1, 2001 through December 31, 2003), focusing on the breeding and wintering seasons. For the record, our work did not, officially, include the BO. Therefore, with few exceptions, surveys were not conducted during what would normally have been the most productive time for this species (i.e., early morning and early evening). Fieldwork was conducted during the daylight hours to maximize chances for seeing the diurnal raptors that were the focus of the contracted scope. Although nocturnal owls can be expected to nest and winter in many of the study sites, they would be expected to often escape observation under this temporal survey regime. However, our methods required documenting any raptor, regardless of whether or not it was a target species and, when a BO or any other owl was observed, it was noted.

A natural phenomenon created a situation that could be considered a constraint. This was the extreme drought that the region experienced for several years (1999-2004). Therefore, 2001 through 2003 may not have been the best of raptor breeding years. Drought clearly plays a significant factor in the density and reproductive success of raptors. This study was conducted during the worst drought for San Diego in over 160 years. This fact should be noted for future researchers and resource managers/planners. This kind of extreme drought has the potential effect of reducing the available prey biomass, which, in turn, can have at least two effects. First, it likely reduces the "attractiveness" of a habitat complex, partly because of low prey densities, and may encourage raptors and other predators to look elsewhere. Second, for those individuals that choose to stay in a less-than-ideal environment, the lack of prey often results in lowered reproductive success or even total nest failure (see Discussion, below). If a nest site is not successful, the birds are more likely to disperse, which leaves the historically active territories apparently, or actually, vacant.

Intent. It is the intent that this, the Final Report, will not only serve to (1) provide data analysis and interpretation but, importantly, it strives to (2) provide an initial baseline of information on many of the breeding and wintering raptors within the MSCP and environs, (3) identify resource management challenges and opportunities, and (4) recommend needed research and management, including what areas should be considered for the MSCP Long-term Raptor Monitoring Program (LRMP).

METHODS

LITERATURE REVIEW, INTERVIEWS, DATA SEARCHES, ETC.

We first contacted other professional biologists, regarding available literature and monitoring programs already in place. We acquired relevant literature, which we did not already have, and met with and/or phone-interviewed members of the outdoor-oriented public as well as key professionals in the San Diego ornithologist community (including Mr. John Oakley, Mr. David Mayer, Mr. Phil Unitt, Dr. Jim Hannan, and others listed in the Acknowledgements section) to inquire about raptor sightings. Using existing published and gray literature, the Natural Communities Data Base, museum collections, raw data from the San Diego County Bird Atlas (then in prep.), MSCP vegetation and sensitive species GIS data, and discussions with knowledgeable experts, a project bibliography, relevant to the MSCP and the target species, was produced (Appendix A).

STUDY SITES

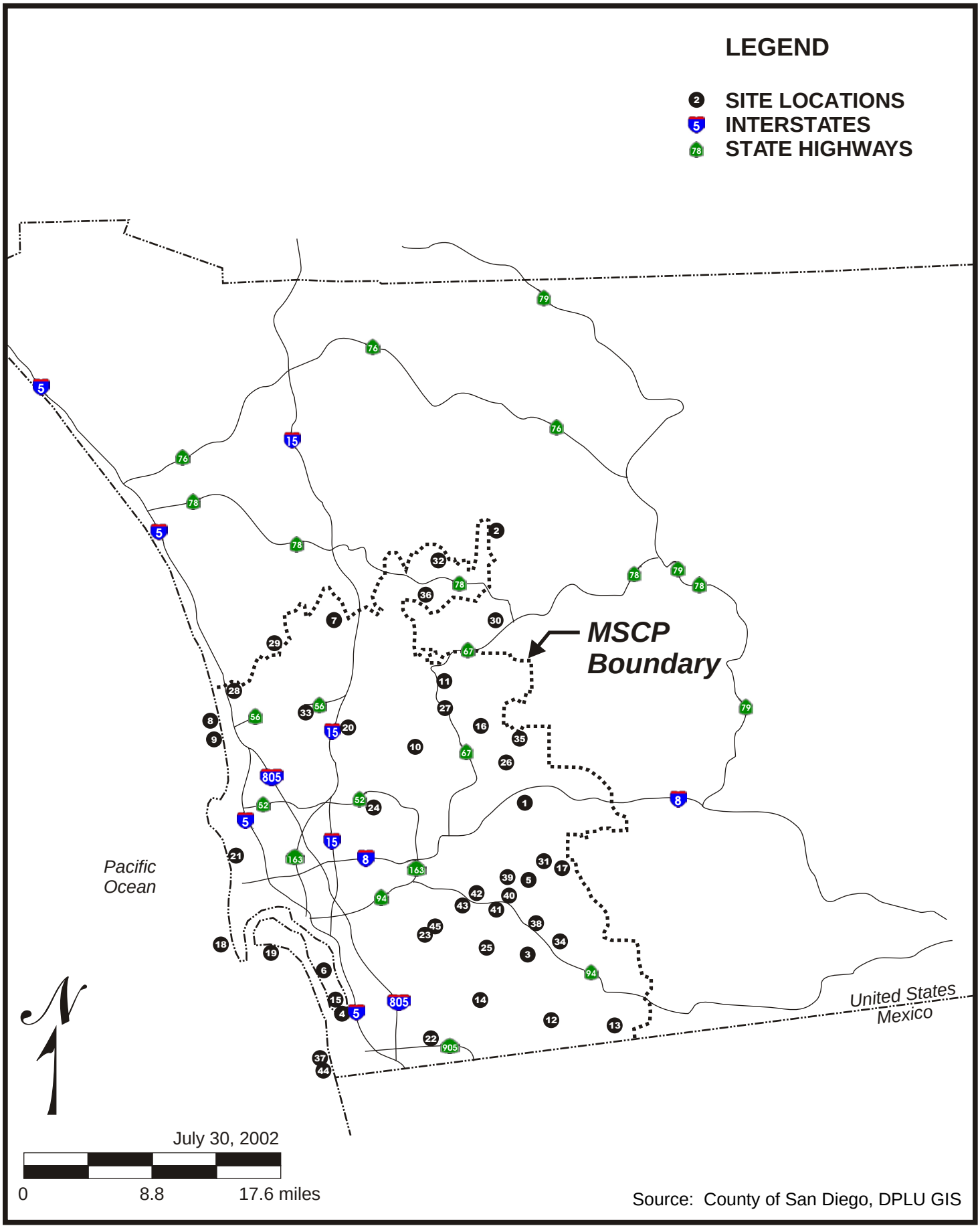
The choice of *study sites* (i.e., those which would be the focus of the 2001-2003 field observations) began with the raptor monitoring locations proposed by the "Biological Monitoring Plan for the Multiple Species Conservation Program" (Ogden 1996). Through consultations with CDFG staff and other knowledgeable biologists, we initially identified 22 sites. After some consolidation and the addition of several sites, including control sites and five sites recently acquired by the state or federal government (numbers 34, and 39 through 43), this number was, ultimately, increased to 45 locations within, and juxtaposed to, the MSCP (hereafter referred to as "study sites"; Figure 1 and Table 1). These became the sites, which were surveyed and considered as *potential* sites, or components of sites, for the Long-term *Monitoring* Plan. The basis for choosing the study sites included that they (1) could be expected to support raptors, (2) were part of an area which was managed by a public or private organization or, alternatively, could serve as a control site over time, (3) were accessible by vehicle and could be safely surveyed with repeatability, (4) contained grassland and/or other relevant habitat which was representative of the MSCP area, and (5) were within or immediately juxtaposed to the MSCP area. We considered all ten sites recommended by the Ogden (1996) report. Of those ten sites, we believe all are covered by one or more of the above 45 locations unless they did not meet the above criteria.

MONITORING SITES

The parameters considered in order to make the recommendations for monitoring sites (i.e., those which would be used in the MSCP Long-term Monitoring Program; LRMP) were discussed at a meeting with representatives of CDFG, USFWS, the City of San Diego and the County of San Diego, on January 27, 2002, at the CDFG San Diego office. It was agreed that the following were important when reviewing each study site as a potential MSCP LRMP site:

- Number of individual raptors documented at a site
- Number of raptor species
- Number of target raptor species
- Diversity of raptors and/or target raptor species
- Number of raptor territories
- Number of crows and/or ravens
- Incidence and/or expectation of management/enforcement problems
- Likely changes in habitat and disturbance over time

In order to identify which sites are the most appropriate for the MSCP LRMP during the breeding season, each site was examined, based on two species diversity parameters (number of total raptors and number of target raptors, both of which were normalized by level of effort) and a third parameter for evenness (Probability of an Interspecific Encounter or PIE; Hurlburt, 1971). The analysis for evenness provided a logical break between the top 19th and 20th sites. All sites were then arranged in descending order for each of these three parameters. If any site came out in the top 19 for any two of the three parameters, it was considered a candidate for the MSCP LRMP. Seventeen sites met this requirement. Each site was reviewed, based on our biological knowledge of that site and how it fit into the geographic distribution of recommended monitoring sites. Finally, juxtaposed sites were combined and sites and site boundaries were adjusted based on historic raptor numbers and improved geographic coverage.



Wildlife Research Institute, Inc.

MSCP RAPTOR STUDY SITE LOCATIONS

Figure 1

Table 1. Raptor Study Sites (2001-2003)

NOTE TO READER: In order to facilitate the reader's access to the following topographic maps, they are listed below alphabetically and by site number.

Number	Name	Name	Number
1	Crestridge	Boden Canyon	2
2	Boden Canyon	Border Fields	44
3	Jamul Ranch	Brown Field Complex	22
4	SDNWR*/Salt Works/Egger Ghio	Crestridge	1
5	McGinty Mountain Complex	Grasslands/Route 67	30
6	San Diego Bay NWR (winter only)	Hollenbeck Canyon	34
7	Lake Hodges	Immenschuh	39
8	Penasquitos Lagoon	Iron Mountain	11
9	Torrey Pines	Jamul Ranch	3
10	Sycamore Canyon	Lake Hodges	7
11	Iron Mountain	Los Montanas (North)	40
12	Otay Mountain	Los Montanas (South)	41
13	Marron Valley	Marron Valley	13
14	Otay Lakes	McGinty Mountain Complex	5
15	SDNWR* Sweetwater Marsh	Miramar Reservoir	20
16	San Vicente	Mission Bay	21
17	Sycuan Peak	Mission Trails	24
18	Point Loma	North Island	19
19	North Island	Otay Lakes	14
20	Miramar Reservoir	Otay Mountain	12
21	Mission Bay	Penasquitos Canyon	33
22	Brown Field Complex	Penasquitos Lagoon	8
23	SDNWR*/San Miguel Mountain	Point Loma	18
24	Mission Trails	Proctor Valley	25
25	Proctor Valley	Rancho San Diego (East)	42
26	San Diego River	Rancho San Diego (West)	43
27	Route 67 South	Rock Mountain	35
28	San Dieguito Lagoon	Rockwood Canyon	32
29	Route S-6 (deleted/safety issue)	Route 67 South	27
30	Grasslands/Route 67	Route 94 (North and South)	38
31	Sloan Canyon	Route S-6	29
32	Rockwood Canyon	San Diego Bay NWR (winter only)	6
33	Penasquitos Canyon	San Diego River	26
34	Hollenbeck Canyon	San Dieguito Lagoon	28
35	Rock Mountain	San Pasqual	36
36	San Pasqual	San Vicente	16
37	SDNWR*Tijuana Slough	SDNWR* Sweetwater Marsh	15
38	Route 94 (North and South)	SDNWR*/Salt Works/Egger Ghio	4
39	Immenschuh	SDNWR*/San Miguel Mountain	23
40	Los Montanas (North)	SDNWR*Tijuana Slough	37
41	Los Montanas (South)	Sloan Canyon	31
42	Rancho San Diego (East)	Sweetwater Reservoir	45
43	Rancho San Diego (West)	Sycamore Canyon	10
44	Border Fields	Sycuan Peak	17
45	Sweetwater Reservoir	Torrey Pines	9

*San Diego National Wildlife Refuge

After completing the above analysis, it became clear that the coastal portions of the MSCP were excluded from the proposed breeding season monitoring because the vast majority and greatest diversity of raptor species breed somewhat inland of the coast. In addition, our data showed that the MSCP area supported a sizable wintering PF population, most of which would be excluded without a coastal component to the MSCP LRMP. Therefore, a winter monitoring route was established that included a good sampling of the coastal wintering raptor habitat that could be driven safely and consistently.

FIELD SURVEYS

By way of clarification, we will be discussing two kinds of raptor searching and documentation. The first is the *survey*—the approach we took to investigate each of the 45 study sites, some of which we are recommending for the MSCP LRMP. This approach utilized several techniques in order to capture a maximum amount of raptor data on sites of considerable environmental variation. The second kind of raptor searching and documentation is the *monitoring protocol*, which will be recommended for MSCP LRMP. This was based on which *survey* techniques were most useful, what has become standardized for raptors, and what will meet the objectives of a monitoring program (discussed below).

Based on a review of the MSCP Biological Monitoring Plan, discussions with the Contract Manager, and our knowledge of survey techniques that are widely accepted, we established guidelines for WRI biologists to follow for the breeding and wintering surveys (WRI 2004, Appendices A and B). As discussed in the Year 1 and 2 reports (WRI 2002, 2004), because of latitude, and the resulting mild climate of the MSCP area, raptor nesting activities can start as early as December and run into August. However, wintering raptors are commonly observed in this region December through February, with some remaining (or migrating through) into mid-March. Therefore, we have, somewhat arbitrarily, called field observations made December through February "winter " survey data. However, "breeding" season data are not limited to a specific timeframe, often overlap with the "winter" observation, and are based on observed behavior (e.g., copulation, nest building, incubation, bringing food to the nest, presence of young).

Table 1 provides a reminder of all the sites that were in the original list of those to be examined. One of the objectives of the 2003 fieldwork was to fill in some data gaps. We had difficulty gaining access to one site (San Diego National Wildlife Refuge/San Miguel Mountain, Site 23) because it involved the use of an access across private property. Table 1 does not reflect surveys that were conducted for the GE or numerous surveys conducted by WRI volunteers and cooperators. During this last year of study, we also continued our coordination with individuals responsible for managing the study sites to keep them appraised of project progress, maintain a point of contact, enlist their input, coordinate access, etc.

Although most of the fieldwork was conducted by vehicle and on foot, as described in WRI (2004, Appendices A and B), some observations, which were focused on the GE, were conducted by helicopter (WRI 2005).

RESULTS

LITERATURE REVIEW

The Project Bibliography has been completed (Appendix A); although, we would welcome any additions from those who review it. This bibliography is not intended to be comprehensive but is intended to provide the reader and local resource manager with important references that relate to: (1) relevant natural history of the target raptors; (2) the presence or distribution of the target raptors within the MSCP, and/or (3) survey or monitoring techniques that could be applied to the target raptor resources by land and wildlife managers within the MSCP. It is arranged by sections for each raptor target species, followed by a section on general raptor literature, with a focus on raptor management.

FIELD SURVEYS

The GE and the PF are addressed separately below because they are unique in both their biological status and their potential for being disturbed. The PF was only recently removed from the listing category and the GE has shown a marked (approximately 50 percent), and well-documented, decline in San Diego County.

Golden Eagle

The GE has been reported on separately (WRI 2005) for a number of reasons relating to resource protection. The detailed site-specific maps are provided in that document so that CDFG has the option of distributing those data separate from the other, less sensitive, raptor data depending on the recipient's need to know.

As an overview, however, after 16 years of consistent monitoring, we estimate that thirty one (31) pairs formerly occupied the San Diego MSCP. Today, fifteen (15) pairs are still active and sixteen (16) pairs have been extirpated. Most of these extirpations occurred in the last 35 years. The fifteen (15) breeding pairs of Golden Eagles remaining in the SD MSCP represent 30 percent of all the breeding Golden Eagles in San Diego County. Seven (7) of the fifteen (15) remaining active pairs within the SD MSCP are in serious jeopardy of being extirpated in the next 5-10 years. Three (3) of the seven (7) pairs predicted to become extirpated may, in fact, already be lost.

The first changes of significance that affected the SD MSCP Golden Eagle population were from intensive agriculture such as avocado and citrus groves. This agriculture replaced cattle grazing and grasslands. Some extirpations were documented to occur in San Diego County in the 1950s and 1960s, after the build-up of military personnel post-WWII, but most disappeared after the 1970s, when major freeways opened land for development that was formerly cattle ranches. Interstate and local freeways made access easy and allowed development to proceed.

Extirpated Golden Eagle territories were primarily located on private land (56 percent). Currently only three (20 percent) of the remaining pairs of Golden Eagles core nesting areas remain on private lands. Twelve (80 percent) of the currently active Golden Eagles within the SD MSCP nest on public land. *This is a significant and valuable opportunity for the future management and survival of Golden Eagles within the SD MSCP.*

In order to properly manage this far-ranging species, specific information about their ecological needs is required, including the limits of the core area around the nest, the primary foraging areas, and the limits of the defendable territory. These are provided in the Golden Eagle report (WRI 2005).

Peregrine Falcon

Breeding Season Results

Of the 12 current and/or historic PF territories known for the county, nine were (and, in five cases, are) located within the MSCP boundaries. Of the five territories located within the MSCP, only one territory is located at one of the study sites (Point Loma, Site 18; see Table 2). The status of that territory and others that we are aware of, within the MSCP, is as follows: Point Loma—active (likely produced young, 2002; was active, 2003); downtown San Diego—active (nest success not known, 2001-2003); La Jolla Cove—active (thought to have produced young, 2002); La Jolla Cliffs—active (nest success not known, 2001-2003); Downtown El Cajon—active (2002) but nest success not known.

Winter Results

A total of 14 PFs were documented during the winter months of 2002 and we believe this was typical for the study period (2001-2003). These were observed at ten study sites (Table 3). One individual was observed at each of nine sites, 2 at one site, and 3 were noted at, or near, another site (Point Loma; site 18). Most birds were observed along the coast or associated with large bodies of water, where shorebirds and other water-associated birds were abundant. Based on other observations, and input from knowledgeable raptor biologists, it is likely that there were roughly 20 PFs wintering in San Diego County during each of the period 2001-2003.

Other Raptors

Breeding Raptors

The raptor breeding season data, by study site, presented in Table 2 and Appendix B provides a picture of what each of the study sites can be expected to support under conditions of average-to-poor precipitation. Maps of all 45 study sites are provided. In cases where no data were collected, or data were combined between two sites, a note on the map provides that explanation. During the period 2001-2003, we examined 44 out of 45 sites (land access was not possible at SDNWR/San Miguel Mountain, Site 23 although we were able to survey a nearby GE nest by helicopter). We documented a total of 15 raptor species and 539 raptor breeding territories (excluding the CR but including 78 stick nests, which we could not positively identify as to raptor species). Of the 539 raptor breeding territories, 96 were target species (all but the BE, SH, and FH, which do not, currently, breed in the MSCP area). Sites varied greatly in their ability to support breeding raptors. Some sites didn't support more than one or two territories, while, others, like the Ramona Grasslands, supported almost 90 territories. Four sites supported no breeding raptors (see those with note "NBR"), while one site (Ramona Grasslands) supported 9 raptor species, including three target species.

The RT was the most commonly documented nesting raptor species, with a total of 177 nests and/or territories located on 34 sites. The next most commonly documented raptor

TABLE 2. Number of Raptor Nests and/or Territories by Site (2001-2003)

		SPECIES**																			Stick	Target	Total	Notes	Site
	SITE	AK	BE	BR	BO	CH	CR	FH	GE	GO	LO	NH	OS	PF	RS	RT	SO	SH	TV	WK	Nest	Spp.	Spp.		No.
1	Crestridge	1				**1**	2								3	2						**1**	9		1
2	Boden Canyon					**2**									2	2						**2**	6		2
3	Jamul Ranch					**2**	2			1					1	13				2	15	**2**	36		3
4	SDNWR*/Salt Works/Egger Ghio																					**0**	0	NBR	4
5	McGinty Mountain Complex					**1**									1	5						**1**	7		5
6	San Diego Bay NWR			1			1									1					2	**0**	5	Note 1	6
7	Lake Hodges	1		2		**2**	1		**1**	2					5	8				1		**3**	23		7
8	Penasquitos Lagoon																					**0**	0	Note 5	8
9	Torrey Pines						6									1						**0**	7	Note 5	9
10	Sycamore Canyon			1							3				1	1	1					**0**	7		10
11	Iron Mountain			2		**4**	1		**1**	1			1		11	13			1	2		**5**	37	Note 2	11
12	Otay Mountain						2		**2**						1	5					1	**2**	11		12
13	Marron Valley						2		**1**							6					10	**1**	19		13
14	Otay Lakes	1				**2**	2			1		**2**				4				1	4	**4**	17		14
15	SDNWR* Sweetwater Marsh											**2**				1						**2**	3	NBR	15
16	San Vicente								**1**				3			2			2			**1**	8		16
17	Sycuan Peak																					**0**	0	NBR	17
18	Point Loma													**1**		1						**1**	2		18
19	North Island				**6**								1			1					1	**6**	9		19
20	Miramar Reservoir					**1**							1			1						**1**	3		20
21	Mission Bay																					**0**	0	NBR	21
22	Brown Field Complex	1			**4**		1					**1**				5					1	**5**	13		22
23	SDNWR*/San Miguel Mountain								**1**													**1**	1	NSC	23
24	Mission Trails					**1**									1	2				1	1	**1**	6		24
25	Proctor Valley	3				**1**										3					1	**1**	8		25
26	San Diego River	1				**3**	1		**1**	1					3	9						**4**	19		26
27	Route 67 South/Iron Mtn #11																					**0**	0	Note 2	27
28	San Dieguito Lagoon											**1**				4				1		**1**	6		28
29	Route S-6																					**0**	0	Note 4	29
30	Grasslands/Route 67	10			**1**	**1**	1		**1**	6					25	41			1	3		**3**	90		30
31	Sloan Canyon						7		**1**						2	4				1	2	**1**	17		31
32	Rockwood Canyon					**1**	1		**1**						1	4						**2**	8		32
33	Penasquitos Canyon	3		2		**7**	1			2		**2**			9	4			1	6		**9**	37		33
34	Hollenbeck Canyon	4				**1**	4					**2**			2	4				1	4	**3**	22		34
35	Rock Mountain						1		**1**						1	2						**1**	5		35
36	San Pasqual	1		4		**2**	2			3					9	16			1	2	7	**2**	47		36
37	SDNWR*Tijuana Slough	1										**2**										**2**	3		37
38	Route 94 (North and South)																					**0**	0	Note 3	38
39	Immenschuh					**1**															1	**1**	2		39
40	Los Montanas (North)														1	1					1	**0**	3		40

TABLE 2. Number of Raptor Nests and/or Territories by Site (2001-2003)

		SPECIES**																			Stick	Target	Total	Notes	Site
	SITE	AK	**BE**	BR	**BO**	**CH**	CR	**FH**	**GE**	GO	LO	**NH**	OS	**PF**	RS	RT	SO	**SH**	TV	WK	Nest	**Spp.**	**Spp.**		**No.**
41	Los Montanas (South)															2						**0**	2		41
42	Rancho San Diego (East)	1				**1**										3				1	5	**1**	11		42
43	Rancho San Diego (West)					**2**									1						8	**2**	11		43
44	Border Fields	1		2		**6**				1		**13**			2	1				2	12	**19**	40		44
45	Sweetwater Reservoir					**5**	3			2					1	5				1	2	**5**	19		45
Total		29	**0**	14	**11**	**47**	41	**0**	**12**	20	3	**25**	6	**1**	83	177	1	**0**	6	25	78	**96**	579		

* San Diego National Wildlife Refuge.
NBR No breeding raptors observed.
NSC No formal raptor surveys conducted (see notes on topo report maps).
(1) Breeding raptors and ravens observed in residential areas to east of study area.
(2) Data for Route 67 South (# 27) and Iron Mountain (#11) were combined. See Iron Mountain (#11)).
(3) The Route 94 transect overlaps other study sites. Data from this transect were assigned to other appropriate sites.
(4) No data collected due to safety and access issues.
(5) Data for Penasquitos Canyon (#8) combined with Torrey Pines (#9). See Torrey Pines (#9).

**Specie

AC American Crow
AK American Kestrel
BE Bald Eagle
BH Black Hawk
BR Barn Owl
BO Burrowing Owl
CH Cooper's Hawk
CR Common Raven
FH Ferruginous Hawk
GE Golden Eagle
GO Great-horned Owl
HH Harris' Hawk
LO Long-eared Owl
MR Merlin
NH Northern Harrier
OS Osprey
PF Peregrine Falcon
PR Prairie Falcon
RS Red-shouldered Hawk
RT Red-tailed Hawk
SO Screech Owl
SS Sharp-shinned Hawk
SH Swainson's Hawk
TV Turkey Vulture
WK White-tailed Kite

Table 3. Number* of raptors observed during the winter (primarily January, February, and December) surveys--2001-2003.

		SPECIES***																						Total	Total	Notes	Site
SITE		AK	BE	BR	BO	CH	CR	FH	GE	GO	LO	MR	NH	OS	PF	PR	RS	RT	SO	SS	SH	TV	WK	Target Spp.	Raptors		No.
1	Crestridge					1	19										3	4				1		1	28		1
2	Boden Canyon					2			2								2	6				3		4	15		2
3	Jamul Ranch	5					6						1					7						1	19		3
4	SDNWR*/Salt Works/Egger Ghio	2				1	2	1				1	4	3	1			4					1	7	20		4
5	McGinty Mountain Complex						2										2	5						0	9		5
6	San Diego Bay NWR	3					1	1					1	1	1									3	8		6
7	Lake Hodges	5		4		3	2		2	2			1	2	1		8	36				2	3	7	71		7
8	Penasquitos Lagoon																							0	0	Note 1	8
9	Torrey Pines						12								2			2						2	16	Note 1	9
10	Sycamore Canyon			2							6						2	2	2					0	14		10
11	Iron Mountain			4		8	2		1	2				2			22	18				2	4	9	65	Note 2	11
12	Otay Mountain	2					18		1				1					5						2	27		12
13	Marron Valley	1				1	14										1	6				1		1	24		13
14	Otay Lakes	5				3	10						2	2	1		1	5				1		6	30		14
15	SDNWR* Sweetwater Marsh	2				1	1					1	3	1				5					1	4	15		15
16	San Vicente																	4					2	0	6		16
17	Sycuan Peak																							0	0	Note 3	17
18	Point Loma	1				1	3								3			3						4	11	Note 4	18
19	North Island	2			3		6							2				3						3	16	Notes 3 & 5	19
20	Miramar Reservoir					2								2				2				2		2	8		20
21	Mission Bay	2					2											2						0	6		21
22	Brown Field Complex	4			3	1	8						4					7					2	8	29		22
23	SDNWR*/San Miguel Mountain																							0	0	NWC	23
24	Mission Trails	1				2	6										3	3				1	2	2	18		24
25	Proctor Valley	3				1	132								1			8						2	145		25
26	San Diego River	5				6	2			2			1	1			7	22					2	7	48		26
27	Route 67 South/Iron Mtn #11																							0	0	Note 2	27
28	San Dieguito Lagoon												2					8					2	2	12		28
29	Route S-6	2																2						0	4	Note 4	29
30	Grasslands/Route 67	7			2	1	3	9	3	6		1		1	1		4	12		1		40		16	91		30
31	Sloan Canyon						5		1								2	1						1	9	Note 3	31
32	Rockwood Canyon					2	2		2									6						4	12		32
33	Penasquitos Canyon	6		4		14	2		4				4	2			18	8				2	12	22	76		33
34	Hollenbeck Canyon	7				1	13		2				3			1	3	5						6	35		34
35	Rock Mountain								3															3	3		35
36	San Pasqual	11		7		2	6		2	6			1		1		16	57		1		3	8	6	121		36
37	SDNWR*Tijuana Slough	3				1	4		1			1	2	1	1			4						5	18		37
38	Route 94 (North and South)																							0	0	Note 6	38
39	Immenschuh					1																		1	1		39
40	Los Montanas (North)																	3						0	3		40
41	Los Montanas (South)						4											3						0	7		41
42	Rancho San Diego (East)	2				3	6											4					1	3	16		42
43	Rancho San Diego (West)						3											1						0	4		43
44	Border Fields	8											6				1	13					3	6	31		44

Table 3. Number* of raptors observed during the winter (primarily January, February, and December) surveys--2001-2003.

45	Sweetwater Reservoir	9	**2**			**3**	38			2		1		1	**1**			5				1	1	**6**	64		45
Total		98	**2**	21	**8**	**61**	334	**11**	**24**	20	6	5	**36**	21	**14**	1	95	291	2	2	**0**	59	44	**156**	1155		

* Numbers refer to maximum number of birds observed.

** San Diego National Wildlife Refuge.

(1) Data for Penasquitos Lagoon (#8) and Torrey Pines (#9) combined. See Torrey Pines (#9).

(2) Data for Route 67 South (# 27) and Iron Mountain (#11) were combined. See Iron Mountain (#11)).

(3) Includes March survey.

(4) Two PFs were observed to the north of this site, near the S.D. Airport.

(5) Seven widely-spaced active burrows suggested that there were at least seven B0s on this study site.

(6) The Route 94 transect overlaps other study sites. Data from this transect were assigned to other appropriate sites.

***Species

AK American Kestrel	CR Common Raven	MR Merlin	RS Red-shouldered Hawk	TV Turkey Vulture
BE Bald Eagle	**FH Ferruginous Hawk**	**NH Northern Harrier**	RT Red-tailed Hawk	WK White-tailed Kite
BR Barn Owl	**GE Golden Eagle**	OS Osprey	SO Screech Owl	
BO Burrowing Owl	GO Great-horned Owl	**PF Peregrine Falcon**	SS Sharp-shinned Hawk	
CH Cooper's Hawk	LO Long-eared Owl	PR Prairie Falcon	**SH Swainson's Hawk**	

nests/territories were those of the RS with 83 and the CH with 47. The CR (a non-raptor, but a species that can have an impact on raptors) was fourth in frequency with 41 nests/territories. The next level of frequency was shared by AK (29), NH (25), WK (25), and GO (20). To a great extent, this frequency distribution is a function of site size, amount of appropriate habitat, and sometimes local conditions on the respective sites.

Of the eight project target species, nesting was documented for five—CH, NH, GE, BO, and, PF. CH nesting was observed at the highest number of study sites, with nests and/or territories documented at 21 sites (48 percent of the 44 sites surveyed). GE was observed nesting at 11 sites (25 percent); while NH was documented at only 8 sites (18 percent) with 13 of the 25 territories found at Border Fields. BO were found nesting at only 3 (7 percent) of the sites and PF at only 1 (0.23 percent) of the sites.

The CH nested, primarily, at those sites that contain healthy riparian habitat; however, this species has become somewhat of a generalist and also nests elsewhere (see Discussion). GEs limited their nesting to sites with sheer cliffs away from human activity and close to nearby grasslands for hunting (see below). The NH and the PF were concentrated primarily along the coast. However, one PF pair attempted nesting in downtown El Cajon and a few scattered NHs were observed nesting at more inland sites. NHs nested in mostly coastal marsh and open field habitat; although we have observed NHs nesting in ruderal areas (J. Oakley, pers. comm.). PFs utilized mostly man-made structures, along the coast, with nearby sources of shorebirds and other prey. Most of BOs, located on the study sites, were found in sandy soil with low grass and open areas (see also WRI 2003, Lincer and Bloom 2003, in prep.). BE and FH winter within the MSCP but are not known to breed there. SHs only pass through during migration, are infrequently documented, and when they are, they are usually not within the MSCP. Some of the SH migrants seen are in the Ramona area and large numbers (over 5,200) have been recently documented migrating along the desert front to the east of the MSCP during the spring (Unitt 2004).

Based on the number of *all* nesting raptor species (plus the CR) and all the sites surveyed during the 2001-2003 breeding seasons, Site 30 (Ramona Grasslands/Route 67) contained the most nests/territories of all sites surveyed. Eighty-nine nests/territories were documented, representing nine raptor species (and 1 CR). The site to show the next highest number of territories was San Pasqual (Site 36) with 47 territories (including two CR and 7 unidentified stick nests that were not duplications of known territories). Border Fields State Park (Site 44) showed the next highest number of territories with 40 territories (including 12 non-duplicative unidentified stick nests).

Site 44 (Border Fields) contained the highest number of *target* species nests/territories of all sites surveyed (19). Penasquitos Canyon (Site 33) supported 9 target species territories while North Island (Site 19) supported 6 and Brown Field Complex (Site 22) and Iron Mountain (Site 11) tied, with both supporting 5 nests of the target raptor species.

Wintering Raptors

A total of 20 raptor species were documented on our study sites during the winter months (January, February, and December) of 2001-2003 (Table 3). Of course, at San Diego's latitude, a number of the resident breeders are actively nesting while many of the wintering birds are still on site. All target raptors, but the SH, were documented during the winter observation period (December-February). Numbers ranged from 0 to 22 individual target raptors per site for a total of 154 individuals for all study sites. Comparable numbers for all raptors (plus the Common Raven) were 0 to 145 as a range. A total of 1,153 wintering individuals were documented (or 819, without the ravens).

The CR was, clearly, the most common wintering bird of those surveyed for. The three most commonly documented wintering raptors were the RT, AK, and RS, with totals of 291, 98, and 95, respectively. Of those sites surveyed in this study, the following held the highest number of wintering individuals (raptors and ravens): Site 25 (Proctor Valley) – 145, Site 36 (San Pasqual) – 121, Site 30 (Ramona Grasslands) – 91 (which included 9-16 FHs; with 20 documented in 2005), Site 33 (Penasquitos Canyon) – 76, and Site 7 (Lake Hodges) – 71.

DISCUSSION

Weather as a Factor

In reviewing any body of data, it is important to consider how typical the sampling period was. So just how "typical" were 2001 through 2003? Drought plays a significant factor in the density and reproductive success of raptors and other predators. During the El Nino of 1998/99, NHs were breeding in areas where they have not bred since and in lower numbers in other locations. The demonstrable impacts of drought on GEs and Prairie Falcons, throughout southern California, were presented by Bittner et al. (2003). This study was conducted during the worst drought for San Diego in 160 years. This should be noted for future researchers.

Management and Enforcement Issues

Table 4 is a summary of management and enforcement issues by site. Clearly, some study sites are substantially impacted, either directly or indirectly, by human activities. Some sites are currently without major impacts. Unfortunately, many of the more diverse and potentially productive sites are the same ones that are experiencing multiple management and enforcement challenges. Of those that are obviously impacted, the following activities are the most common: humans walking or hiking (36 out of 45 sites or 80%) and pets, primarily dogs being allowed to run free, (26 out of 45 sites or 57 %).

Table 4. Management Enforcement Issues Identified by Raptor Study Site

Site No.	Name	Humans Walking/Hiking	Rock Climbing	Off-road Vehicle Use	Pets	Disking, etc. Agricultural Activities	Rodent/Ground Squirrel Poisoning	Construction/Development	Newly-developed Access Road(s)	Other
1	Crestridge	X								
2	Boden Canyon	X		X	X				X	6
3	Jamul Ranch									6?
4	SDNWR*/Salt Works	X								
5	McGinty Mountain Complex			X	X					
6	San Diego Bay NWR	X			X					
7	Lake Hodges	X	X	X	X			X	X	6
8	Penasquitos Lagoon	X			X					
9	Torrey Pines	X			X					7
10	Sycamore Canyon	X		X	X				X	
11	Iron Mountain	X	X	X	X				X	
12	Otay Mountain	?	X	X						1
13	Marron Valley	X	X	X	X					1
14	Otay Lakes	X			?				X	8
15	SDNWR* Sweetwater Marsh	X		X	X					
16	San Vicente	X	X		X				X	
17	Sycuan Peak									
18	Point Loma	X								
19	North Island	X								2
20	Miramar Reservoir	X						X		
21	Mission Bay	X		X	X			X		
22	Brown Field Complex	X		X	X			X		1,3,4
23	SDNWR*/San Miguel Mountain	X		X	X				X	
24	Mission Trails	X	X		X					
25	Proctor Valley	X		X	X		X	X		
26	San Diego River	X	X		X		X			7
27	Route 67 South	X		X				X	X	
28	San Dieguito Lagoon	X				X		X		
29	Route S-6	X						X		
30	Grasslands/Route 67	X	X		X	X	X	X	X	
31	Sloan Canyon	X			X					
32	Rockwood Canyon	X	X					X		
33	Penasquitos Canyon	X		X	X				X	
34	Hollenbeck Canyon									6
35	Rock Mountain	X	X							5
36	San Pasqual	X		X	X	X	X	X		5
37	SDNWR*Tijuana Slough	X		X	X	X	?			

Table 4. Management Enforcement Issues Identified by Raptor Study Site

38	Route 94 (North and South)									
39	Immenschuh									
40	Los Montanas (North)									
41	Los Montanas (South)									
42	Rancho San Diego (East)	X			X					
43	Rancho San Diego (West)	X			X					
44	Border Fields	X			X					1
45	Sweetwater Reservoir									

*San Diego National Wildlife Refuge

(1) Border Patrol and illegal alien activities.
(2) Conflicts with Navy goals and endangered species recovery program.
(3) Potential conflict with future Navy goals at Satellite Surveillance Station.
(4) Heavy predation by Coyotes and Barn owls.
(5) Future threats from proposed trail construction and associated access to rock climbers, ORVs, etc. activities.
(6) Shooting (legal and illegal).
(7) Paragliding.
(8) Cattle grazing.

Management Conflicts

The following are observed management conflicts, which lead to our recommended management and research (see Recommendations):

- As indicated above, human uses [rock-climbing, hiking, jogging, walking dogs (often without leashes), vehicular use, etc.] impact the normal behavior of raptors (and other wildlife).
- In many cases, the size of protected parcels is substantially smaller than that required by a raptor's functional territory, including foraging areas.
- The public/political pressure to create new trails into MSCP preserve lands provides a path for, and encourages, increased disturbance to raptors (and other wildlife).
- The public/political perception that MSCP preserve lands have been created primarily for active, and in some cases, consumptive, recreation, sets up an obvious conflict for managing raptors (and other wildlife).
- The constraint of using fire as a management tool in proximity to human habitation limits habitat management tools.
- Inadequate funding to both acquire important lands and properly manage MSCP lands which are acquired.

Raptor Monitoring

The following is a reiteration of considerations, regarding the MSCP Long-term Raptor Monitoring Program, that were presented previously (WRI 2004) and discussed elsewhere (Lincer and Bittner 2002; Lincer et al. 2003). For further reading, relevant issues are proposed and discussed by Oakley, Thomas, and Fancy (2003).

Sample Design

The ideal sample design should be:

1. Representative of the study area and the issues at hand. (e.g., habitat loss, disturbance, etc.) ;
2. Representative of the habitats of interest and the seasons during which those habitat support the monitored species (e.g., the MSCP not only provides important breeding habitat for numerous raptor but it is also a significant habitat for several wintering raptors, including some that are considered target raptors, like the PF, BE, FH, and BO);
3. Inclusive of all focus species or represent them in some functional way;
4. Sensitive to the objectives of the MSCP monitoring requirements;
5. Sensitive to logistics;
6. Statistically appropriate (which may be compromised by above logistics);
7. Able to predict, and take into consideration, *detectability* (i.e., how counts relate to the actual number of raptors in the sampled area; one approach is to use a "double count" approach). This objective may also be compromised by above logistics.

Questions to be Answered and Objectives to be Met

How will the data be used by the various management entities? When do they need what? An example of a clear monitoring objective would be, "Be able to detect a 25% change in population (individual species or overall raptor group?), in each chosen habitat, in 10 years." This is the approach that is being attempted by NARMS (North American Monitoring Strategy) but some of the best raptor monitoring minds are having a serious challenge addressing these objectives. It is entirely possible that we won't have enough observations for some species to detect a significant change in a timely manner.

Possible Monitoring Approaches

Levels of effort and agency *commitment* are, integrally tied. For instance, the MSCP program could adopt a:

1. Highly rigorous, scientific approach that would be costly but could withstand the most challenging statistical/legal tests, or
2. More practical, less expensive approach that would be more likely to be funded, and therefore carried out, but would stand the chance of being successfully, challenged at some time in the future.

As to *which, and how many, species* should be involved, the program could use a:

1. Multiple species approach, using selective target species only,
2. Multiple species approach, using selective target species, but recording all raptors (and ravens) observed,
3. Single species approach, using a keystone species, like the Golden Eagle or
4. Combination of the above.

Target Species and Other Multiple Species Approaches

A monitoring approach that focuses on one or more so-called “target” species has the appeal of apparent simplicity and the implication that these target species will, somehow, reflect a broader suite of species and be sensitive to whatever perturbations are experienced. Having surveyed raptors for many years, it is apparent that each species often responds to similar impacts differently. Although GOs and RTs might show similar population changes in response to small mammal population changes, and most raptors will show some response to a record-breaking drought, such as we have just experienced, there are likely more differences than similarities between species. Those differences are not only in *degree* but also in *direction*. For instance, GEs and PRs responded to the recent drought to different degrees (Bittner et al. 2003), with the PR being less impacted by presumed small mammal population decreases because it takes a wider range of prey species than the GE, which is heavily dependent on jackrabbit and ground squirrel populations. In addition, some raptors (e.g., GE) are far more negatively responsive to human activity than others (e.g., AKs, RTs, RSs, and some CHs). There are also differences in response, both within and between species, depending on the time of year (e.g., during the

breeding season vs. the wintering season) and where a disturbance occurs (e.g., on the hunting grounds or within the nest territory).

Regarding raptors responding in a different direction, one only needs to recognize that many different raptors require different habitats and, although not many species will persist if usable habitat is replaced with a development (although some CHs and RSs may defy this simplification), a conversion from one habitat/land use to another will often affect different species in different ways. For instance, if an extensive riparian habitat were to be replaced by an agricultural land use, and some hedge rows were to be left/created, we could expect that there would be a decrease in RSs, CHs, and several owl species. But, at the same time, there would likely be an increase in AKs, RTs, and perhaps WKs.

The point to the above exercise is that, if an arbitrary few species are chosen as "target" species, and the other raptors are not monitored, there will be a good chance that only some kinds of impacts will be reflected in the population trends of those raptors monitored. In our opinion, the MSCP Long-term Monitoring Program should include a broad-based approach, which documents all raptors observed and uses observed changes/trends to identify appropriate adaptive management strategies.

Single Species Monitoring Approach

Having sung the praises of a multiple raptor species approach (above), there is at least one raptor species in the western United States that has the ability to reflect regional trends in environmental health. This is the Golden Eagle. The attraction of using the GE, as a regional "miner's canary," is that (1) it requires a reasonably large and intact territory, and (2) there exists, in San Diego County, a unique and relevant historical regional database for this species. The Wildlife Research Institute has a long history of investigating the historical presence of GE in southern California, which includes the MSCP and environs (Bittner and Oakley 1999; WRI 2005). This collection of records has been compiled to reflect past documentation of GE pairs, their nesting success, hunting territories, and numbers of egg and /or young. The WRI database includes both active and extirpated territories beginning with records as early as 1864. WRI became involved in 1987 with the start of the San Diego GE Project (see Discussion in WRI 2005). *This project, in total, represents the longest such study of any eagle population in the Western Hemisphere, and is the second to longest in the world, next to one study in Switzerland.*

Providing this historical information, in conjunction with current trend data, is critical to managing the GE into the future. Only if we understand the extant population (within the context of the historical variation) can we properly evaluate the population and meet the needs of the species under current and future changing environmental and land-use conditions. If this is accomplished, it will reflect the success of the MSCP program.

RECOMMENDATIONS

<u>Long-term MSCP Raptor Monitoring</u>

Long-term monitoring is recommended under three categories: (1) Breeding Season, (2) Winter Season, and (3) Single Species Monitoring Program.

Breeding Season Monitoring Program

Twelve areas are recommended for breeding season portion of a Long-term Raptor Monitoring Program (Figure 2 and Table 5). Each Raptor Monitoring Area (RMA) consists of one to four of the individual raptor study sites that were surveyed during the period 2001-2003, the analysis of which led up to these recommendations. The choices of RMAs were based on a number of biological parameters (e.g., raptor diversity and population parameters, known history of raptor use), logistical considerations (how a monitor would move efficiently through a monitoring area), and a reasonable geographic coverage of the MSCP study area (see Methods). The Breeding Season Monitoring Program should, initially, be conducted every two years and encompass all 12 RMAs each time (i.e., don't conduct different portions of the total every other year). After a maximum of 5 monitoring events (i.e., 10 years), a statistical trend analysis should be conducted to determine if the frequency of every two years is adequate or, perhaps, unnecessarily frequent. Depending on the data, it may make sense to conduct this analysis earlier.

Raptor monitoring for the Breeding Season Monitoring Program should follow the protocol provided in Appendix C. This monitoring should be conducted by qualified raptor biologists with several years of relevant regional experience with the raptors found in the MSCP and proper training in the specific techniques necessary to conduct this monitoring.

Thanks to a grant from the San Diego Foundation, for post- (2003) fire studies, WRI was able to test this monitoring program on seven RMAs, representing varying degrees of being burned:

B. Ramona Grasslands (Control Area)
D. Iron Mountain (Burned)
E. San Diego River (Burned)
F Sloan Canyon (Burned)
H. Proctor Valley (Partially Burned)
I. Rancho Jamul (Partially Burned)
L. Otay Mountain (Burned)

The results of this monitoring effort were reported to the San Diego Natural History Museum (Lincer 2005).

Winter Season Monitoring Program

Because (1) the MSCP provides important wintering grounds for many raptors (some of which are *only* here during the winter), (2) coastal portions of the MSCP are not captured by the above breeding season monitoring approach, and (3) it is important to track at least three raptor species, that are primarily coastal in the MSCP, which have proven to be ideal bioindicators (PF, NH, and Osprey), we recommend conducting a winter monitoring program that focuses on the coastal portions of the MSCP (Figure 3). This, like the Breeding Season Monitoring program, should be conducted every two years (alternating years with the breeding season monitoring would be acceptable). After a maximum of 5 monitoring events (i.e., 10 years), a statistical trend analysis

should be conducted to determine if the frequency of every two years is adequate or, perhaps, unnecessarily frequent. Depending on the data, it may make sense to conduct this analysis earlier.

TABLE 5. Proposed MSCP Areas for Long-term Raptor Monitoring (Breeding Season)

Area	Name	Study Sites* (original number(s)
A	San Pasqual	San Pasqual (36), Lk. Hodges (7), Boden Cyn. (2), Rockwood (32)
B	Ramona Grasslands	Ramona Grasslands (30)
C	Penasquitos Canyon	Penasquitos Canyon (33)
D	Iron Mountain Complex	Iron Mountain**(11), San Vicente (16), Route 67 (27)
E	San Diego River	San Diego River (26)
F	Sloan Canyon	Sloan Canyon (31), McGinty Mtn. North (5), Sycuan Mtn. North (17)
G	Sweetwater River	Sweetwater Reservoir (45), Rcho. S.D. East (42), Rcho. S.D. West (43), San Miguel Mtn. North (23)
H	Proctor Valley	Proctor Valley (25), San Miguel Mtn. South (23), Upper Otay Lk.(14)
I	Rancho Jamul	Jamul Ranch (3), Hollenbeck Canyon (34)
J	Border Fields	Border Fields (44), Tijuana River (part)
K	Brown Field Complex	Brown Field (22), Otay River, Spring Cyn. (part), Dennery Cyn. (part)
L	Otay Mountain	Otay Mountain (12), Marron Valley (13), Lower Otay Lake (14)

* In some cases, only a portion of a study site is included because of access, visibility, or some other reason (see detailed maps, Appendix C, for details).
** Including Monte Vista Ranch.

Raptor monitoring for the Winter Season Monitoring Program should follow the protocol provided in Appendix C. This monitoring should be conducted from a vehicle, following the route depicted by Figure 3, and be conducted by qualified raptor biologists with several years of relevant regional experience with the raptors found in the MSCP.

Single Species Program

For the reasons covered in the Discussion section, we recommend that the GE (breeding season only) be used for the Single Species Program. Because of the dynamic nature of the GE pairs and the use of their territory, including their primary foraging area, these surveys should be conducted *every year* as they have been by WRI's biologists for the last 16 years. GE monitoring should follow the protocol that has been used for the San Diego GE Study for the last 16 years (Bittner and Oakley 1999, WRI 2005). WRI (2005) provides the details of both the breeding history of the GEs in the MSCP and recommendations on monitoring and future research. WRI (2005) is provided as a separate report for the protection and proper management of the GE. As an overview, observations must begin in December and go through June of each year. GEs begin courtship and nest building in December and January. They lay eggs in February and early March, hatch young in late March and April and fledge young in May and June. Therefore, it is essential that monitoring biologists be in the field for critical portions of the entire season (six months) to obtain all the data needed to monitor the GE population properly.

Aerial surveys have been a crucial part of the current study providing new insight into once-difficult areas to investigate potential territories. Patagial tags (and soon radio transmitters) placed on the GE's wings are now also an integral part of the eagle tracking process. Territory

Fig. 2. Prop'd RMAs (breeding)

Contact WRI for maps

integrity is fairly well documented in the San Diego MSCP and is being refined. See MSCP (2005) for more details.

Consistency in Monitoring

If data to be collected for this, or *any* monitoring program, are to have any utility in showing trends, they must be collected in a consistent fashion. As discussed above, the areas and routes to be monitored should be monitored frequently enough to reveal a complete picture of what is breeding and wintering on those respective areas and routes but these data are only a *sampling* of the entire MSCP. Therefore, it is extremely important that monitoring protocol is consistent both between sites/areas and over time (i.e., between years). To do this, a significant effort will have to go into selecting qualified raptor biologists, making sure that they are familiar with the required protocol, geography and species, and ensuring consistency between sites and years.

Other Recommendations

Management Needs and Enhancement Opportunities

- Restriction of inappropriate human activities where they are in conflict with, especially nesting, raptors.
- Apply the lessons learned in the development of the MSCP to the North and East County MSCPs and other HCPs.
- Develop a comprehensive management plan for the dwindling Burrowing Owl population within the MSCP.
- Selectively install artificial burrows, for BOs, and nest boxes for AKs, BRs, and Screech Owls (SOs). Keep in mind that BRs are an effective predator on not only small mammals but also medium size raptors, like the BO.
- Consider the use of grazing and/or fire as appropriate management tools to maintain grasslands, maintain/improve biological diversity, and manage fire fuel loading.

Recommended Research

- Transmitter study to better define the use of MSCP lands by GEs (initial studies in progress).
- Investigate the feasibility of reintroducing SHs into historical sites within the MSCP.
- Investigate the most efficient approaches to captive rearing and hacking BOs into appropriate habitat (either as is or as it can be modified and managed) within the MSCP.
- In order to prioritize the management of raptors that winter within the MSCP, but breed elsewhere (e.g., FH, MR, OS, BE, and some of the WK), determine the natal areas for these birds. If the natal areas have substantial threats, then no amount of MSCP management will have substantial positive impact.
- Document the growing OS population and determine emigration and immigration.
- Document the presence of, and habitat use by, crepuscular (BO) and nocturnal raptors (e.g., BR, SO, GO, Long-eared Owl).
- Document the recovery of raptors after the November 2003 fires and apply findings to future management strategies.

Fig. 3. Prop'd Winter Monit. Areas.

Contact WRI for Maps

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APPENDIX A

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APPENDIX B

BREEDING SEASON RAPTOR NESTS AND TERRITORIES BY SITE (2001-2003)

The following pages reflect raptor breeding territories which were typical of the below study sites for the period 2001-2003. To facilitate the reader's access to the following topographic maps, they are listed below alphabetically and by site number.

Number	Name	Name	Number
1	Crestridge	Boden Canyon	2
2	Boden Canyon	Border Fields	44
3	Jamul Ranch	Brown Field Complex	22
4	SDNWR*/Salt Works/Egger Ghio	Crestridge	1
5	McGinty Mountain Complex	Grasslands/Route 67	30
6	San Diego Bay NWR (winter only)	Hollenbeck Canyon	34
7	Lake Hodges	Immenschuh	39
8	Penasquitos Lagoon	Iron Mountain	11
9	Torrey Pines	Jamul Ranch	3
10	Sycamore Canyon	Lake Hodges	7
11	Iron Mountain	Los Montanas (North)	40
12	Otay Mountain	Los Montanas (South)	41
13	Marron Valley	Marron Valley	13
14	Otay Lakes	McGinty Mountain Complex	5
15	SDNWR* Sweetwater Marsh	Miramar Reservoir	20
16	San Vicente	Mission Bay	21
17	Sycuan Peak	Mission Trails	24
18	Point Loma	North Island	19
19	North Island	Otay Lakes	14
20	Miramar Reservoir	Otay Mountain	12
21	Mission Bay	Penasquitos Canyon	33
22	Brown Field Complex	Penasquitos Lagoon	8
23	SDNWR*/San Miguel Mountain	Point Loma	18
24	Mission Trails	Proctor Valley	25
25	Proctor Valley	Rancho San Diego (East)	42
26	San Diego River	Rancho San Diego (West)	43
27	Route 67 South	Rock Mountain	35
28	San Dieguito Lagoon	Rockwood Canyon	32
29	Route S-6 (deleted/safety issue)	Route 67 South	27
30	Grasslands/Route 67	Route 94 (North and South)	38
31	Sloan Canyon	Route S-6 (deleted/safety issue)	29
32	Rockwood Canyon	San Diego Bay NWR (winter only)	6
33	Penasquitos Canyon	San Diego River	26
34	Hollenbeck Canyon	San Dieguito Lagoon	28
35	Rock Mountain	San Pasqual	36
36	San Pasqual	San Vicente	16
37	SDNWR*Tijuana Slough	SDNWR* Sweetwater Marsh	15
38	Route 94 (North and South)	SDNWR*/Salt Works/Egger Ghio	4
39	Immenschuh	SDNWR*/San Miguel Mountain	23
40	Los Montanas (North)	SDNWR*Tijuana Slough	37
41	Los Montanas (South)	Sloan Canyon	31
42	Rancho San Diego (East)	Sweetwater Reservoir	45
43	Rancho San Diego (West)	Sycamore Canyon	10
44	Border Fields	Sycuan Peak	17
45	Sweetwater Reservoir	Torrey Pines	9

*San Diego National Wildlife Refuge

LEGEND

Symbols

Center of raptor/corvid territory or assumed or documented nest site.

Note: Above symbol without an acronym following it indicates that a stick nest was documented but species was not determinable. If species was known for the nest or territory, the above symbol is followed by the appropriate acronym (see below).

Acronyms for Raptor and Corvid Species

AC	American crow
AK	American kestrel
BE*	**BALD EAGLE**
BH	Black hawk
BR	Barn owl
BO*	**BURROWING OWL**
CH*	**COOPER'S HAWK**
CR	Common raven
FH*	**FERRUGINOUS HAWK**
GE*	**GOLDEN EAGLE**
GO	Great-horned owl
HH	Harris' hawk
LO	Long-eared owl
MR	Merlin
NH*	**NORTHERN HARRIER**
OS	Osprey
PF*	**PEREGRINE FALCON**
PR	Prairie falcon
RS	Red-shouldered hawk
RT	Red-tailed hawk
SE	Short-eared owl
SO	Screech owl
SS	Sharp-shinned hawk
SH*	**SWAINSON'S HAWK**
TV	Turkey vulture
UA	Unidentifiable accipiter
UB	Unidentifiable buteo
UF	Unidentifiable falcon
UR	Unidentifiable raptor
WK	White-tailed kite
WH	White-tailed hawk
ZH	Zone-tailed hawk

* MSCP target species.

APPENDIX C

LONG -TERM RAPTOR MONITORING PROTOCOL

BACKGROUND

The Multiple Species Conservation Program (MSCP) is a comprehensive, long-term habitat conservation plan that addresses the needs of multiple species and the preservation of natural vegetation in San Diego County (County of San Diego 1997). The size and configuration of the preserve network is continually evolving but it may ultimately encompass approximately 172,000 acres. In order to determine if the MSCP or any management area, for that matter, is functioning correctly, a meaningful monitoring plan must be in place. A vast area, such as the MSCP, cannot be comprehensively monitored for any but a few species with very limited and specific habitat requirements. Raptor species will, therefore, be monitored using a reproducible sampling approach. Details of this approach are described below after reminding the reader of the ultimate monitoring objectives.

OBJECTIVES

The overall goal of the MSCP monitoring is to detect changes in habitat quality and population trends in those habitats and species covered by the MSCP (Ogden 1996). Specific objectives, as they relate to raptors, are as follows:

1. Document the protection of target species as specified in subarea plans and implementing agreements.
2. Document changes in preserved populations of covered species.
3. Describe new biological data collected.
4. Evaluate impacts of land uses and construction activities in and adjacent to the preserve.
5. Evaluate management activities and identify enforcement difficulties.

The purpose of this document is to provide guidance for consistency in the approach to surveying for raptors *during the breeding season and during the wintering period*. The below protocol is generic in nature but site-specific details, as to route, viewshed locations, and other important site features, are provided for each Raptor Monitoring Area (RMA) in Appendix C-1.

APPROACH

The following provides methodological details for the professional, with adequate raptor expertise, to conduct the breeding season and wintering period raptor monitoring in a consistent manner. The ability to detect trends (e.g., in raptor numbers, distribution, diversity, etc.) will be extremely important in order that adaptive management decisions be made in a timely manner. If trend analyses are to be interpretable, it is essential that the same locations within the preserve be monitored in a consistent manner. This would best be accomplished if the same individual or team monitored all locations, for all surveys.

ACRONYMS AND DEFINITIONS

Acronyms and definitions are attached (Appendix C-2). Use them consistently in order that there be continuity and clarity in all observations and record keeping.

SPECIES

Although all raptor species will be noted, there are eight MSCP, so-called "target," raptor species: Bald Eagle (BE), Burrowing Owl (BO), Cooper's Hawk (CH), Ferruginous Hawk (FH), Golden Eagle (GE), Northern Harrier (NH), American Peregrine Falcon (PF), and the Swainson's Hawk (SH). Although you will not, necessarily, be searching for the BO at the most desirable time of day (early morning/early evening), any observations of BO or any other raptor species should be documented. Raptors will be the focus of the surveys but any observed sensitive species (regardless of taxa), interesting road kill, unusual biological observation, breeding colony, bird roost site, or other unique resource should also be noted on the WRI "Field Datasheet" (Appendix C-3).

TIMING AND FREQUENCY OF SURVEYS

Although it is common for ornithologists to identify a specific time of year as the "breeding season," it is not possible to specify a timeframe, for our local raptors, that does not overlap with what is considered the wintering period. Because of the latitude of the MSCP, raptors are not restricted to a brief portion of the spring within which to breed. Many of our local raptors start breeding while other wintering and migrating raptors are still in the MSCP study area and environs. Therefore, the time of year that we call the "breeding season" could span December through August but varies considerably by species. Some GEs, for instance, can start nest building as early as December and still have nestlings in that nest as late as June. BOs, on the other hand, can start laying eggs in early April but fledge some young as late as August.

EQUIPMENT/SUPPLIES

Field vehicles should have 4WD capability if terrain requires. Binoculars, a camera, and a spotting scope of sufficient power for raptor observations are required. A magnification of 10X for binoculars and a range of approximately 20-60X for scopes are recommended. A cell phone may be very helpful in some locations, as could a set of "walkie-talkies" if more than one investigator will be in the field at the same time. Bring these survey guidelines, a copy of any authorization letters from resource agencies, any windshield placards (that indicates that you are under contract to conduct these surveys), local and project-generated site maps, and an adequate supply of "Transect Data Sheets" (Appendix C-3). To this, add your standard field equipment and supplies (field guides, hat, water, snacks, etc.). Although observers should be thoroughly familiar with all the local raptors, field guides that should be helpful include the Peterson guide, *Hawks* (Clark and Wheeler 1987) and the accompanying photographic guide (Wheeler and Clark 1999).

WEATHER

Monitoring should be conducted only during certain desirable weather conditions to maximize chances of documenting raptors. Inclement weather (rain, fog, winds greater than 20 mph, etc.) should be avoided. Occasional drizzle and winds up to 20 mph will not normally affect most raptor behavior. Observation in cold or wet weather should be done very carefully or completely discouraged. If an incubating bird is accidentally flushed during surveys, total nest failure could result for that season.

TIME OF DAY

The time of day, during which observations are made, is more important during the breeding season surveys than for the winter surveys (for most raptor species). Monitoring should take place from dawn through 1200, although professional experience may allow for some flexibility. Although BOs are not, necessarily, most active during this timeframe, you may note them and they should be documented as indicated below, as you would any raptor species. Since this is a crepuscular species, however, schedule sites that may support BOs for the early morning and/or early evening, whenever possible, to maximize chances of seeing this crepuscular species.

TWO TYPES OF OBSERVATIONS

Observations will be made two ways: (1) in vehicles, along established routes, and (2) at designated viewshed (i.e., observation) points. In addition, all reliable reports provided by interested individuals and cooperators will be verified and included in the data set but noted as "personal communications" with the appropriate documentation.

Vehicular Transects

Many of the breeding season raptor observations, and all those for the winter period, will be conducted from a vehicle. Therefore, vehicle speed will be an important variable. Speed will vary between road transects, depending on the road conditions, including traffic, and weather. That speed, however, should be consistent (year-to-year) for a particular transect in order that meaningful data comparisons can be made over time. Speed on a busy highway will have to be adequate to safely keep up with traffic. Some highway transects, that were deemed too dangerous, were removed from consideration. On a backcountry road, however, 10 mph may be the right speed. Safety should be the highest priority, and for that reason, an assistant to the driver is recommended to make observations and take notes, especially on busy roads.

Point/View shed Observations

Observation points have been established along some vehicle routes and at other desirable view shed locations for breeding season monitoring (see Appendix C-1). These will be especially important for riparian areas and inaccessible mountainous, and other, areas, where limited vehicle access prevents a reasonable survey of a RMA. At observation points along vehicle routes, a minimum of 10 minutes of actual observation is required. This means allowing whatever time is necessary to stop the vehicle in a safe, repeatable location, get out of the vehicle, and set up equipment (spotting scope, etc.) before starting the formal ten-minute observation (i.e., watching *and* listening). In situations where the observer is driving *through* the relevant habitat, a 5-minute observation period may be adequate. At some viewshed locations (like the top of a mountain), the observation time will be longer (perhaps 30 minutes). The most important issue here is that, once a viewing time period has been established for a particular RMA, it is maintained for consistency each year.

WHAT TO NOTE

All relevant data must be documented (see Transect Data Sheet, Appendix C-3). Sightings for *all* raptors will be documented. Note specific location of the raptor species *the first time it is observed* on each day of observation. Note age, sex, and any unusual plumage (if relevant) and

describe location(s) of any band(s) (metal right or metal left and sequence and numbers of any color bands), transmitter, or patagial wing markers. Avoid duplicate counts by noting unique characteristics of an individual and, when a bird is moving, its direction and relative speed. Record courtship and nesting behavior. If a nest is observed during the "winter" surveys, note its location on the topo map, what species of tree its in, height, size of nest, composition, and whether you consider it active. Indicate the basis for assumed activity (for instance, presence of an adult or pair near the nest, young, recent whitewash or greenery in /around nest).

CONTROL NUMBERING

Each control number for a study site and day of observation will be alphanumeric. For each species observed, the control number will start with the acronym for that species (see Appendix C-2) and be followed by "01." The following control numbers, for that species, will end with 02, 03, etc., in the sequence in which the observations take place. This number is entered on the field data sheet (with all of its associated observations) and on the topo survey map, on which is always placed the survey date and the name(s) of the biologist(s). For instance, if the first observation of the day, at Mission Trails Regional Park, is a RT (Red-tailed Hawk), the control number will be "RT01." The second RT will receive the control number "RT02." If the next observation were a Cooper's Hawk, it would be "CH01." It will simplify records if each Transect Data Sheet and topo map is only used for one day's observation at each site. However, there may be situations (such as when it takes more than one day to adequately survey a site or when it may lead to duplication or confusion later) when it makes sense to enter more than one day's information on the same data sheet/map. It may also be beneficial to have all the breeding data on one map which keeps the picture in front of the observer at all times. This allows the observer to see gaps for certain species and explore areas not previously covered. The most important objective is to make sure the record is clear as to the date of each observation/set of observations and the name of the investigator so that clarification can be sought, if necessary.

Raptor, and other, nests are often less visible later in the breeding season, when deciduous trees have regained their foliage. However, note any stick nests in the area as "SN" followed by the appropriate observation number. Indicate on the data sheet if you know or suspect what species it belongs to and why. When summarizing yearly data, it will be important to determine which nests are alternate nests of the same pair and which represent additional pairs/territories. Do not get close enough to potentially disturb any nests, without approval from the Project Manager (PM) and Management Unit administrator.

Keep careful track of miles driven and times spent during vehicle transects and point location observations. Deduct any miles/time not spent on monitoring. These details are very important in order to allow data to be normalized over both time and distance to properly analyze for trends. There may be situations when you will not be able to track mileage or the miles you track are complicated by circling back through a study area to recheck a nest to confirm nesting, etc. Just keep good records that can be interpreted by someone else.

ENFORCEMENT/MANAGEMENT ISSUES

Note any enforcement or management problems or opportunities. Suggest corrective action or adaptive management, as appropriate, to the PM. Report any significant enforcement problems to the PM as soon as possible, but no later than within 24 hours of the observation.

RECORDS MANAGEMENT

Management of records is extremely important. Two-hole punched field forms and computer-generated project topo maps must be kept in Study Site folders (in a hard plastic or other secure file box provided) unless being copied. Field forms and topo maps must be attached to the inside of the Study Site folders using the two-hole clips at the end of each field day. Unless other provisions are made, field record copying should be done no less frequently than once a week, during the active field season, with copies placed in the appropriate administration project file for security.

THE SURVEYS

Breeding Season

In some management units, where a fulltime knowledgeable biologist is on staff, daily observations may be made, thereby providing greater potential for trend detection. However, the objective of these guidelines is to conduct up to 6 surveys at each of 12 RMAs (Figure C-1) for the breeding season raptor monitoring, where the assemblage of species dictates the actual number of replicates. Many stick nests will be located during the winter when the deciduous trees have lost their leaves. The next best opportunity to survey will often be early in the breeding season (December through April) when the adult raptors are establishing their territories and courting. Note that each species has a chronology for these behaviors. Some (like the GE, RT, and RS) will start breeding-related behaviors in December or January, while others (like the CH) may not display until April. At this time, they are obvious and concentrating their activities around the likely, and alternative, nest sites. In order to adequately characterize the raptor species present throughout the breeding season, the initial surveys at each site should be separated by 10-14 days, if possible. Subsequent surveys should be scheduled based on the raptor species present and where they are in their reproductive cycle. There will be a period, during which one of the adults will be incubating eggs or sheltering young, while the other adult is off hunting. During this time, it will be difficult to document many raptors and fieldwork may not be the best use of your time for that RMA. The next logical time to concentrate on conducting breeding season surveys will be when the young have fledged but are still dependent on the adults for food. At this time, there is a lot of activity and an increased chance of spotting a family unit because of the increased number of individuals per territory and, in some cases, the young will call attention to themselves by begging and/or calling to the parents.

The following times are recommended for the (breeding season) Raptor Monitoring Program:

- Late-December
- Mid-January
- Mid-February
- March
- Mid-April
- Mid-May

There are 12 RMAs that will be surveyed (Table C-1).

TABLE C-1. MSCP Raptor Monitoring Areas (Breeding Season)

Area	Name	Study Sites* (original number(s)
A	San Pasqual	San Pasqual (36), Lk. Hodges (7), Boden Cyn. (2), Rockwood (32)
B	Ramona Grasslands	Ramona Grasslands (30)
C	Penasquitos Canyon	Penasquitos Canyon (33)
D	Iron Mountain Complex	Iron Mountain** (11), San Vicente ((16), Route 67 (27)
E	San Diego River	San Diego River (26)
F	Sloan Canyon	Sloan Canyon (31), McGinty Mtn. North (5), Sycuan Mtn. North (17)
G	Sweetwater River	Sweetwater Reservoir (45), Rcho. S.D. East (42), Rcho. S.D. West (43), San Miguel Mtn. North (23)
H	Proctor Valley	Proctor Valley (25), San Miguel Mtn. South (23), Upper Otay Lk.(14)
I	Rancho Jamul	Jamul Ranch (3), Hollenbeck Canyon (34)
J	Border Fields	Border Fields (44), Tijuana River (part)
K	Brown Field Complex	Brown Field (22), Otay River, Spring Cyn. (part), Dennery Cyn. (part)
L	Otay Mountain	Otay Mountain (12), Marron Valley (13), Lower Otay Lake (14)

* In some cases, only a portion of a study site is included because of access, visibility, or some other reason (see detailed maps, Appendix C-1, for details).
** Including Monte Vista Ranch.

Each study site is followed by a number, which corresponds to the original study site number that was assigned to it (WRI 2002, 2004).

Winter Surveys

In keeping with the timing of many "winter" surveys (e.g., County Bird Atlas), the MSCP winter raptor surveys will occur primarily from *mid-December through February*, with possible changes in response to changes in weather conditions (i.e., global warming, cycles, etc.). This "winter" time period is somewhat arbitrary and we are not suggesting that raptors observed during this period are, necessarily, only birds that have migrated in and are wintering within the MSCP and environs. Similarly, the winter visit by some species may extend before and/or after this timeframe. The FH, for instance, can arrive on its MSCP wintering grounds by mid-September and not leave until mid-March. Many of the birds that you observe will be the same ones that you document during the "breeding season" surveys. The objective is to conduct three (3) vehicle-based surveys, along the coastal route depicted by Figure C-2. In order to adequately characterize the raptor species present throughout the winter season, the three surveys should be conducted according to the following schedule:

- Late December
- Mid-to-late January
- Mid-to-late February

Raptor, and other, nests are often more visible in the winter, when deciduous trees have lost their foliage. Knowledge about nest and breeding pair locations will help the monitor separate wintering birds from resident pairs. When summarizing yearly data, it will also be important to determine which nests are alternate nests of the same pair and which represent additional pairs/territories. Note any raptor nests in the area and/or if any nesting behavior is observed. Do not approach any nests, without approval from the PM and Management Unit administrator.

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APPENDIX C-2
ACRONYMS AND DEFINITIONS

Raptor and Corvid Species

AC	American crow
AK	American kestrel
BE*	**BALD EAGLE**
BH	Black hawk
BR	Barn owl
BO*	**BURROWING OWL**
CH*	**COOPER'S HAWK**
CR	Common raven
FH*	**FERRUGINOUS HAWK**
GE*	**GOLDEN EAGLE**
GO	Great-horned owl
HH	Harris' hawk
LO	Long-eared owl
MR	Merlin
NH*	**NORTHERN HARRIER**
OS	Osprey
PF*	**PEREGRINE FALCON**
PR	Prairie falcon
RS	Red-shouldered hawk
RT	Red-tailed hawk
SE	Short-eared owl
SO	Screech owl
SS	Sharp-shinned hawk
SH*	**SWAINSON'S HAWK**
TV	Turkey vulture
UA	Unidentifiable accipiter
UB	Unidentifiable buteo
UF	Unidentifiable falcon
UR	Unidentifiable raptor
WK	White-tailed kite
WH	White-tailed hawk
ZH	Zone-tailed hawk

* MSCP target species.

Other Abbreviations

AB	Active burrow
Ad	Adult
CDFG	California Department of Fish and Game
CN	Cavity nest
F	Female
HY	Hatching year (when a bird is in its first year; i.e., the same calendar year as hatched).
Imm	Immature (a non-specific term that means "not adult").
M	Male
Mel	Melanistic (black/dark)
Ruf	Rufous/reddish
Sa	Sub adult (plumage that precedes adult plumage and appears much like it but with some characters that are not in adult plumage; used only for species, like the Golden Eagle, that can be distinguished at this age).
SN	Stick nest.
U	Unknown (e.g., unknown species, age, or sex).
USFWS	U.S. Fish and Wildlife Service

APPENDIX C-3

TRANSECT DATA SHEET

Wildlife Research Institute, Inc.					BIOLOGIST(S):
		TIME (24hr)	Start	Finish	(minus time out) = TOTAL TIME:
		TEMP (F):			OTHER WEATHER INFO.:
DATE:	PAGE __OF ___	CLOUD CVR (%):			TRANSECT MILEAGE BEGIN:
TRANSECT NAME & NUMBER:		WIND (mph):			TRANSECT MILEAGE END:
		VISIBILITY (mi):			SUBTRACT MILEAGE:
	#	PRECIP:			TRANSECT TOTAL MILEAGE:

	WAYPOINTS (Start/End Points of Transects, Road Names.etc.)	SPECIES	TIME DURATION	SEX	AGE	PAIR	PERCHING	HUNTING	FEEDING	COURTSHIP	SOARING	NESTING	COMMENTS, MILEAGE, TIME, ETC.
1													
2													
3													
4													
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COMMENTS: (USE REVERSE FOR DRAWINGS OR ADDITIONAL NOTES)

Attachment B-3

LEAST BELL'S VIREO
Vireo bellii pusillus

Author: Michael A. Patten, Department of Biology, University of California, Riverside, California 92521

Management Status: Federal: Endangered
California: Endangered (CDFG, 1998)

General Distribution:

The Least Bell's Vireo is a subspecies of the Bell's Vireo. The Bell's Vireo breeds in the southwestern United States and northwestern Mexico, northward through the Great Plains of the central United States to the southwestern fringe of the Great Lakes (Brown, 1993). This species winters in southern Baja California, on the Pacific slope of mainland Mexico from Sonora south through northern Nicaragua (Brown, 1993), and on the Atlantic slope from Veracruz south to Honduras (AOU, 1998).

Distribution in the West Mojave Planning Area:

The Least Bell's Vireo breeds in southwestern California and adjacent northwestern Baja California (Wilbur, 1980, Garrett and Dunn, 1981); it largely occurs in cismontane southern California, but it does extend into transmontane areas along the western flank of the Anza-Borrego Desert (San Diego County; Unitt, 1984), in the vicinity of Palm Springs (Riverside County; C. McGaugh pers. comm.), at Leona Valley (Los Angeles County; summering, breeding not proven; K.L. Garrett in litt.), and in San Bernardino County at Morongo Valley and along the Mojave River (Patten, 1995; S. J. Myers in litt.). There are breeding records for this subspecies just north of the WMPA in the southern Owens Valley of Inyo County and it regularly breeds just northwest of the WMPA at the South Fork of the Kern River Preserve (Kern County; M.T. Heindel pers. comm.). Elsewhere within the WMPA, the Bell's Vireo is an occasional migrant.

The eastern limit of the range of the Least Bell's Vireo in California is contentious, in that the ranges of the Least Bell's Vireo and the Arizona Bell's Vireo (*V. b. arizonae*) in California are based more on supposition than on direct evidence. It is generally believed that the Arizona Bell's Vireo is confined to the Lower Colorado River Valley, whereas the Least Bell's Vireo occurs in cismontane southern California and on the western edge of the deserts, extending north up the Mojave River into the Owens Valley, and eastward into Death Valley National Park, along the Amargosa River (Inyo County) and at Fort Piute in the East Mojave Desert (Goldwasser, 1978; Goldwasser et al., 1980; Garrett and Dunn, 1981; Regional Environmental Consultants, 1986; Franzreb, 1987a, 1987b, 1989; Brown, 1993; Small, 1994). Considering the biogeography of similarly-distributed cismontane and transmontane species pairs (Grinnell and Miller, 1944; Garrett and Dunn, 1981), such as California (*Callipepla californica*) and Gambel's quail (*C. gambelii*), Nuttall's (*Picoides nuttallii*) and Ladder-backed woodpeckers (*P. scalaris*), and California (*Toxostoma redivivum*) and Crissal thrashers (*T. crissale*), it is probable that Arizona Bell's Vireo is in fact the subspecies occurring in the East Mojave Desert (including Fort Piute and the Amargosa River) northward through Death Valley, and this subspecies may occasionally occur in the extreme eastern portion of the WMPA. Data to support this contention is provided

by the observations that spring birds in Death Valley and at Fort Piute are more brightly-colored (i.e., they have a greener back and yellower flanks), and thus more like *V. b. arizonae*, than are birds along the Mojave River or at Morongo Valley, which are grayer and thus more like *V. b. pusillus* (M.A. Patten pers. obs.). Also, there is a late February specimen of the Arizona Bell's Vireo taken in the Anza-Borrego Desert (Unitt, 1985; Phillips, 1991), showing that this subspecies can occur well west of its described range.

Natural History:

The Bell's Vireo is a conspicuous member of riparian habitats where it occurs because of its lively, complex song. However, given its penchant for dense vegetation, it is far more often heard than seen. Its song belies its rather subtle, drab plumage: this small passerine is basically olive-gray (with emphasis on the latter in *V. b. pusillus*) above with a single faint wingbar, a thick bill, thin but distinct "spectacles," and a long tail that is flipped expressively from side-to-side. In overall plumage and behavior, this species most closely resembles a Gray Vireo (*V. vicinor*), a species with a very different song that occurs in pinyon-juniper and redshank-chaparral associations.

The Least Bell's Vireo and the Arizona Bell's Vireo differ slightly in size and subtlety of color, with the latter being slightly smaller and more brightly colored (Ridgway, 1904; Phillips, 1991). Specimens of Bell's Vireo from eastern California (e.g., Death Valley) were identified as Least Bell's Vireo (Ridgway, 1904; Grinnell, 1923). However, these specimens were taken in spring (Fisher, 1893; Grinnell, 1923), when the plumage of a Bell's Vireo can be quite worn (Unitt, 1985), thus confounding subspecific identification. An examination of specimens at the Natural History Museum of Los Angeles County, the Museum of Vertebrate Zoology, University of California, Berkeley, and elsewhere indicates that evidence for defining the eastern extent of the range of Least Bell's Vireo is weak (M.A. Patten unpubl. data; A.R. Phillips in litt.; N.K. Johnson in litt.). Seven external characters have proven useful in distinguishing these subspecies (Ridgway, 1904; Phillips, 1991): exposed culmen length, wing chord, tail length, rump color, flank color, mantle color, and undertail covert color. These subspecies may also have slight differences in song (L.R. Hays pers. comm.), and they apparently differ in habitat choice (see below).

The Least Bell's Vireo arrives on its breeding grounds in mid-March (Brown, 1993), with males arriving slightly before females (Nolan, 1960; Barlow, 1962). This vireo shows a high degree of nest site tenacity (Greaves, 1987). Most individuals depart by September (Brown, 1993), although some individuals remain on their breeding grounds into late November (Rosenberg et al., 1991). This subspecies winters primarily in Baja California, with occasional individuals remaining through the winter in cismontane southern California (there is also a record for the Sonoran Desert at this season, although the subspecies in not known). Nesting takes place from early April through the end of July, with two broods usually being attempted. Nests are suspended from forks in dense bushes or small trees; over 60 species of plants have been used by Bell's Vireos for nest sites (Brown, 1993), but the Least Bell's Vireo predominantly uses willows (*Salix* spp.). The Bell's Vireo feeds almost exclusively on arthropods, with insects and spiders comprising over 99% of their diet (Brown, 1993).

Habitat Requirements:

The Bell's Vireo occurs in riparian habitats. The Least Bell's Vireo typically breeds in willow riparian forest supporting a dense, shrubby understory of mulefat (*Baccharis salicifolius*) and other mesic species (Goldwasser, 1981; Gray and Greaves, 1984; Franzreb, 1989). Oak woodland with a willow riparian understory is also used in some areas (Gray and Greaves, 1984), and individuals sometimes enter adjacent chaparral, coastal sage scrub, or desert scrub habitats to forage (Brown 1993; L.R. Hays pers. comm.). The Least Bell's Vireo and the Arizona Bell's Vireo probably have different habitat requirements. Least Bell's Vireos in cismontane California occur in riparian forest dominated by willows (Goldwasser, 1981; Gray and Greaves, 1984), whereas Arizona Bell's Vireos tend to occur in riparian woodland dominated by mesquite (*Prosopis* sp.; Rosenberg et al., 1991; Brown, 1993; L.R. Hays pers. comm.; M.A. Patten pers. obs.). Similar habitats are used during the winter months. Although the Arizona Bell's Vireo will use non-native salt cedar (*Tamarix* spp.) in parts of its range (Brown, 1993), the Least Bell's Vireo avoids riparian areas dominated by these plants.

Population Status:

The most recent published population censuses for the Least Bell's Vireo indicated that this subspecies was critically endangered, with a total population estimated to be only a few hundred pairs (Goldwasser, 1978; Goldwasser et al., 1980; Wilbur 1980). Primarily as a result of extensive efforts to restore riparian habitat and to remove Brown-headed Cowbirds (*Molothrus ater*) from breeding areas, populations of the Least Bell's Vireo have increased dramatically at several locations in cismontane southern California (L.R. Hays pers. comm.; Brown, 1993), particularly at the two core population sites of the Santa Margarita River, San Diego County (±400 pairs) and the Prado Basin, Riverside County (±150 pairs). The total population breeding within the WMPA is much smaller, with only a 1-3 pairs at Morongo Valley and 1-2 pairs along the Mojave River (M.A. Patten pers. obs.; S.J. Myers in litt.).

Threats Analysis:

Loss of habitat, combined with increased brood parasite pressure from Brown-headed Cowbirds (Goldwasser, 1978; Beezley and Rieger, 1987), has led to the two breeding subspecies in California, Least Bell's Vireo and Arizona Bell's Vireo, being listed as Endangered by the State of California and, for *V. b. pusillus*, by the federal government (Franzreb, 1989; Franzreb et al., 1992; Salata, 1992; U.S. Fish and Wildlife Service, 1992). Losses of habitat similarly have affected the Bell's Vireo throughout its range (Brown, 1993). Habitat loss within the WMPA probably most often results from flood control efforts (e.g., stream channelization or vegetation clearing along the Mojave River). Conversion of occupied habitat to parks or golf courses is generally less of a problem, if only because it occurs more rarely.

Although Brown-headed Cowbirds are perhaps less prevalent in transmontane sites occupied by this vireo, cowbirds nevertheless can have a huge negative impact on the breeding success of the Least Bell's Vireo (Goldwasser, 1978; Beezley and Rieger, 1987; Clark, 1988), and they have increased dramatically in California in the past century (Laymon, 1987; Rothstein, 1994). Populations of the Least Bell's Vireo have responded dramatically to efforts to remove cowbirds from breeding areas (see above), underscoring the severe impact of brood parasitism. The recent, albeit slow, northwesterly range expansion of the Bronzed Cowbird (*M. aeneus*), could present this vireo with yet another brood parasite (M.A. Patten unpubl. data).

Biological Standards:

Much effort has been expended to maintain minimum viable populations of the Least Bell's Vireo at certain core population sites in cismontane southern California (e.g., the Santa Margarita River, the Prado Basin, and the Santa Ynez drainage in Santa Barbara County). Recovery efforts have generally been extremely successful; prospects for the long-term survival of the Least Bell's Vireo are much better now than they were 15-20 years ago when recovery was initiated (L.R. Hays pers. comm.). However, even historically this vireo has occurred only in low numbers within the WMPA, and in few locations, so management of vireo habitat within its boundary likely will not have a substantial effect on the subspecies as a whole. Nevertheless, conservation and sustainable management of the small breeding populations at Morongo Valley and along the Mojave River could be accomplished through (1) limiting the destruction of riparian habitat in these areas, including less invasive flood control management activities, (2) eradication of non-native salt cedar, giant reed (*Arundo donax*), and Russian olive (*Elaeagnus angustifolius*) from sites occupied by the vireo, with willows and mulefat planted in their place, (3) extensive trapping and removal of Brown-headed Cowbirds from breeding areas, and (4) restoration of riparian habitats, because cowbird parasitism is reduced woodland habitats with lower edge to area ratios (Laymon 1987). An additional measures could be the limiting access of both cattle and humans (hikers and off-highway vehicle users) to prime nesting areas.

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The Policies are inconsistent with placing residential uses roughly adjacent to the I-15 freeway.

Impact 3.2-1 The Project would not conflict with or obstruct implementation of an Air Quality Management Plan. You assert that projects that are consistent with regional population, housing and employment forecasts are consistent with the South Coast Air Quality Management District ("SCAQMD") Air Quality Management Plan ("AQMP"), and you claim that because the population growth that is attributable to the Project fits within the projections for Wildomar as a whole, the Project is consistent. It doesn't work this way. Growth should be accounted for according to consistency with a General Plan. Here your Project contradicts the General Plan and requires a General Plan amendment to allow housing on a site designated for office use. This will lead to air quality impacts because residents will more than likely have to commute further to work because of the change in planned uses.

Impact 3.2-2 The Project would violate an air quality standard or contribute substantially to an existing or projected air quality violation. You concede here that operational emissions would exceed thresholds for NO_x by 40%, and you impose several mitigation measures but you concede these measures will not reduce impacts to less than significant levels. Measure AQ-1 is that the applicant will consult with transit agencies and provide bus stops at project access points as directed. CEQA requires you to impose all feasible mitigation measures when an impact is not mitigated to less than significant levels. The applicant for the Baxter Village project is providing fair share payments toward transit service to that community, and this is a feasible mitigation measure you have not imposed here.

Impact 3.2-3 The Project would not expose sensitive receptors to substantial pollutant concentrations. Regarding construction emissions you claim that SCAQMD has not adopted a methodology for analyzing construction emissions of diesel particulate matter ("DPM") "and has not recommended that health risk assessments be completed." We believe you have understated exposures of sensitive receptors to PM_{10} and $PM_{2.5}$ because the closest receptors are closer than 82 feet away. And regarding Toxic Air Contaminants ("TACs"), you could still model acute effects from exposure. Both construction and operational emissions on nearby residents could and should have been modeled. You could use the same exposure calculations with shorter timeframes.

Concerning operational emissions you concede that the maximum predicted cancer risk from the Project is 9.6 in one million using the California Office of Environmental Health Hazard Assessment's ("OEHHA's") methodology. With rounding, this is 10 in a million and you should have found this impact to be significant. And you concede you did not calculate into this number the exposure of residents to additional TAC emissions from loading and unloading activity from trucks at the four bays adjacent to the major retail building.

Impact 3.2-5 The Project would result in a cumulatively considerable net increase of criteria pollutants for which the Project region is non-attainment under an applicable

federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors). You concede that the Project will lead to significant impacts regarding NO_x, but you refuse to calculate cumulative impacts for other pollutants based on SCAQMD guidance. We disagree with this approach and believe it is not based on substantial evidence. Your approach is contrary to the very definition of what a cumulative impact is. Public Resources Code § 20183(b)(2) defines cumulative impacts to mean "that the incremental effects of an individual project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects." In other words, inherent in a cumulative impacts analysis is whether an impact is significant when *combined* with the effects of other past, present, and future projects. This is borne out by the Guidelines. Guidelines § 15130(a)(1) provides "As defined in Section 15355, a cumulative impact consists of an impact which is created *as a result of the combination* of the project evaluated in the EIR together with other projects causing related impacts." (emphasis supplied). Guidelines § 15064(h)(1) provides:

> When assessing whether a cumulative effect requires an EIR, the lead agency shall consider whether the cumulative impact is significant and whether the effects of the project are cumulatively considerable. An EIR must be prepared *if the cumulative impact may be significant and the project's incremental effect, though individually limited, is cumulatively considerable. "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.*

Guidelines § 15064(h)(1) (emphasis supplied).

Guidelines § 15065(a)(3) requires a mandatory finding of significance when "The project has possible environmental effects that are individually limited but cumulatively considerable," and provides the same definition of "cumulatively considerable."

Finally, Guidelines § 15355 defines cumulative impacts and states:

> *"Cumulative impacts" refer to two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts.*
> (a) The individual effects may be changes resulting from a single project or a number of separate projects.
> (b) The cumulative impact from several projects is the change in the environment which results from the *incremental impact* of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. *Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time.*

Guidelines § 15355 (emphasis supplied). *See also* Gordon & Herson, "Demystifying CEQA's Cumulative Impact Analysis Requirements: Guidance for Defensible EIR Evaluation," *Cal. Env't'l L. Reporter,* 379, 381 (Sept. 2011) (Vol. 2011, Issue 9) ("Critically, a proposed project's incremental effects may be 'cumulatively considerable' even when its individual effects are limited. (citations). *In other words, CEQA does not excuse an EIR from evaluating cumulative impacts simply because the project-specific analysis determined its impacts would be 'less than significant.'*" In short, your cumulative impacts analysis is wholly without a basis in substantial evidence and represents a failure to proceed by law.

In addition, you should *assess* the cumulative emissions of NO_x, rather than merely stating that they are cumulatively significant.

3.3 Biological Resources. You state regarding special status plant species that the round-leaved filaree and the smooth tarplant – both California Native Plant Society ("CNPS") 1.B.1 species – have the potential to occur on the site but they were not surveyed for given recent drought conditions. *See* Appendix C (reflecting that by 2013 no focused surveys were done for plant species on site due to ongoing drought conditions: "CDFW has indicated . . . that conducting focused surveys during the current drought conditions would not provide any useable data on the presence or absence of any sensitive plants given the fact that plants would be unlikely to germinate and be detectable"). Despite this you assert there are no significant impacts to them because you didn't find them when you didn't survey, and "any loss of individuals plants of this species would not threaten to eliminate or reduce the viability of a population or restrict the range of the plant species." This conclusion is directly contrary to CNPS's listing of them as 1.B.1, indicating the plant species is threatened within 80% of its range. You could have surveyed for these species this year after the rains, but apparently you did not.

Concerning special status wildlife, you did not conduct focused surveys for the Stephens kangaroo rat ("SKR"), the black-tailed jackrabbit or the coast horned lizard. Regarding the SKR Appendix C specifically states that SKR "may also occur on the site given the presence of suitable habitat, however live-trapping surveys were not conducted as part of the field investigations. *Consequently the presence of the species [or its absence] cannot be definitively determined at the present time.*" You note that critical habitat for the coastal California gnatcatcher ("CAGN") is 1200 feet from the site but you provide no map of this habitat and state in a conclusory fashion there is no potential for the species to occur on site even as a stopover.

At 3.3-12 you concede the site could provide "dispersal" habitat for the western spadefoot toad, but you did not survey for it. There could be a significant impact to the toad because of the Project regardless of whether the site provides breeding habitat, and you haven't provided mitigation measures for the toad.

At 3.3-20 in your General Plan consistency analysis you claim the Project follows Policy OS 5.5 (new development will preserve and enhance existing native riparian habitat and prevent obstruction of natural watercourses) even though you are obstructing two

watercourses. You say implementation of mitigation measure ("MM") BIO-5 would provide for offsite restoration and enhancement at a ratio approved by the resource agencies even though (1) the mitigation and its extent has not been determined yet, (2) the General Plan Policy does not intend such a result, and (3) the mitigation is not planned for any location, and will not necessarily be of equivalent habitat values. Similarly, General Plan Policy OS 6.3 states the City should consider wetlands for use as natural water treatment areas that will result in the improvement of water quality. You claim the Project is "consistent" because of MM BIO-5. It's not. Clearly the Policy is aimed at preserving the habitat.

Impact 3.3-1 The Project would not have a substantial adverse effect on any special-status, sensitive, or candidate plant species. You assert as noted above that the smooth tarplant and round-leaved filaree will not be affected because you did not observe them onsite. However you also did not look for them. An individual loss of this species would be significant as noted above.

Impact 3.3-2 The Project has the potential to impact sensitive wildlife species. You say there is no substantial impact to the SKR which you did not survey for onsite because of the payment of fees for the SKR Habitat Conservation Plan ("HCP"). However, individual impacts to SKR can be significant, and you have done nothing about this.

You also say there will be *no* impacts to the nine species you say have a low potential to occur because (1) they weren't seen, even though they weren't looked for in any systematic way, and (2) they are not expected on the site due to "low quality" habitat conditions – even though habitat for the Quino checkerspot butterfly, for example, is only "open habitat." We disagree with your assessment. Impacts are potentially significant absent focused surveys negating the presence of these species immediately prior to ground disturbance.

Regarding your MM's, BIO-1 provides for preconstruction surveys within 30 days of site disturbance for the burrowing owl. Per the California Department of Fish & Wildlife ("CDFW") Burrowing Owl Mitigation Staff Report, this survey should occur within 14 days. *See* Attachment A. BIO-2 provides if burrowing owl are found, active nests will be avoided from February 1 to August 31, and a minimum 250 foot (75 meter) buffer will be provided until fledging has occurred. This is contrary to the required setback distance of 500 meters as recommended in the Staff Report, *see* Attachment A at 9. The Report allows for reduced setbacks but only in the presence of a "broad-scale, long-term, scientifically-rigorous monitoring program," Report at 10, which you do not provide for. You do not provide for qualified biologist monitoring of nesting in most of MM'S BIO-1 and -2. BIO-2 also provides that if paired owls are present within 160 feet of a temporary project disturbance, active burrows will be protected with fencing or flagging and monitored by a qualified biologist throughout the construction to identify losses from nest abandonment. This runs contrary to your earlier stated condition of 75 meters – which again, is insufficient under the Staff Report.

BIO-3 provides for a preconstruction survey and trapping and release of the coast horned lizard and San Diego black-tailed jackrabbit. Do the same for the SKR. And specify a time prior to construction for these surveys – other guidance suggests a maximum of 14 days.

Impact 3.3-3 The Project has the potential to impact raptors and migratory birds during nesting activities. You have proposed MM BIO-4, requiring either all construction outside of the avian nesting season – which you define as February 1 to August 30 – or, if there is construction, vegetation or ground disturbance during this breeding season, a focused survey will be conducted by a qualified City-approved biologist, and nests will not be disturbed until young have fledged from the nest, with a 500 foot setback. However, you have not defined the nesting season properly; it begins in early January for raptors and lasts through at least September 15 and beyond that for passerine species according to CDFW. We have included Attachments B-1 through -3 regarding nesting habits of different birds.

Impact 3.3-4 The Project would not impact critical habitat or sensitive natural communities. You claim there are no sensitive natural communities or critical habitat on site. However, critical habitat is apparently close to the Project site for the CAGN and increased urbanization in the vicinity can affect the species, an impact you did not address.

Impact 3.3-5 The Project has the potential to impact jurisdictional waters including wetlands and riparian habitat. You agree that the grading of two drainage channels is a significant impact but you claim this impact will be mitigated to less than significant levels by MM BIO-5, which requires the applicant to submit a detailed restoration plan to mitigate for loss of 0.36 acres of jurisdictional waters at a ratio approved by the resource agencies but no less than 1:1. The mitigation measure should delineate the monitoring responsibilities and the applicant or the District should be responsible for checking the status of the restoration annually. The mitigation should provide for maintenance responsibilities *in perpetuity*, which is something the applicant cannot manage. The impact is not less than significant.

Impact 3.3-6 The Project would not interfere substantially with the movement of any native resident or migratory . . . wildlife species or with established native resident or migratory wildlife corridors . . . As we've noted, you previously have conceded critical habitat for the CAGN is 1200 feet away. Given this fact your assertions that the proposed Project "is not expected to have an adverse effect on wildlife movements in the area" requires further explanation as it does not seem credible. We dispute your conclusion there is no significant impact.

Impact 3.3-8 The Project could conflict with a HCP. Here you concede the Project could impact riparian/riverine habitat and the burrowing owl, protected under the Western Riverside County MSHCP, and the SKR, covered under the SKR HCP. You assert that payment of the mitigation fee regarding the SKR would reduce impacts to that species to less than significant but not regarding the riparian and riverine habitat or the burrowing

owl. We fail to see the distinction, especially since you are not proposing to catch and release the SKR that may be onsite. You rely on MM BIO-6 to reduce impacts to less than significant regarding the riparian/riverine habitat. First this has nothing to do with the burrowing owl and the loss of its habitat. Second, you are acknowledging there is an urban/wildlife interface, which undercuts your analysis under Impact 3.3-6 above. Third, you fail to discuss what the Guidelines require. This does not comply with CEQA which is meant to ensure the public reviews the environmental impacts of the Project.

3.4 Cultural and Paleontological Resources. MM CUL-3 refers at first to just the Pechanga and later to both the Pechanga and the Soboba. If the Soboba are also involved they should be kept informed.

Impact 3.4-2 Implementation of the Project may adversely affect paleontological resources. You indicate that the Project will disturb ground from "4 to 15 in depth." We later figured out this was feet rather than inches but it is not clear from this part of the DEIR. MM CUL-6 calls for review by a qualified paleontological monitor but your General Plan requires assessment by a paleontologist.

3.5 Geology, Soils and Seismicity. You indicate the nearest "active" fault is the Elsinore Fault approximately 1.9 miles away, but then you concede there is another one nearly at the Project site, and that the fault zone for this fault – the Glen Ivy fault – passes through the Project site. This is a potential significant impact, and General Plan Policy S.2-1 provides that "lifelines" be designed to resist without failure their crossing of a fault should fault rupture occur, and requires trenching studies and analysis.

Impact 3.5-1 The Project would not expose persons or structures to potential substantial adverse effects, including risk of loss, injury or death involving rupture of a known earthquake fault . . . You acknowledge that in 2007, the Working Group on Earthquake Probabilities indicated there was a 97% chance of an earthquake of 6.7 or greater in Southern California over the next 30 years, and that the Elsinore Fault is one of those considered capable of producing significant groundshaking. You fail to address the Glen Ivy fault zone which runs through the property. You assert there would be no significant impact based on construction of the site with shallow foundations with post tensioned slabs. This is not enough under the General Plan, implicitly.

3.6 Greenhouse Gas Emissions and Climate Change. You adopt a 3,000 $MTCO_2e$ threshold based on a SCAQMD working group proposal. You've amortized your construction emissions over 30 years which we think is contrary to the mandates of AB 32 and Executive Order B-30-15, because they call for reductions in the near- and mid-term.

Because you have concluded that your GHG emissions are significant, both under impacts 3.6-1 and -2, you must adopt all feasible mitigation measures. You could have but failed to adopt rooftop solar in the Project or at least in a part of it. Your failure to do so is not based on substantial evidence.

3.7 Hydrology and Water Quality. *Impact 3.7-1 The proposed Project would not violate any water quality standards or waste discharge requirements.* As to construction the DEIR states that the Project "would maximize canopy interception and water conservation by preserving existing native trees and shrubs thereby minimizing vegetation disturbance and associated pollution potential and sedimentation during construction." You have previously indicated that you intend to replace the olive trees onsite. We don't find your assertions believable.

You saw a SWPPP "would be prepared." Why hasn't it been prepared already and provided with the DEIR? You say the BMPs "could include" a long list of items. This means nothing. The final BMPs and the SWPPP should have been provided to the public with the DEIR.

Regarding operation, you state that structural BMPs "would include" several items. You could have provided but did not provide the Water Quality Management Plan with the DEIR. Without these documents we have no assurance that impacts will be modified to less than significant levels.

Impact 3.7-3 The Project would not substantially alter the existing drainage pattern of the site or area, including through alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation offsite. You concede here you will alter the existing drainage pattern and place impervious structures on the site. You again rely on the SWPPP and the WQMP but you have not provided them. You say here that "treatment control BMPs would include treatment of first flush flows in bio retention and sand infiltration facilities." This is directly contrary to what you asserted previously, that the site is already impervious and that such structures cannot be designed for the site.

You assert that the Final WQMP "will demonstrate that BMPs will retain the incremental increase of runoff from a two-year storm event, ten-year storm event, or the BMP Design Volume, whichever is greater," and that therefore impacts regarding alteration of drainage patterns will be less than significant. Since you have not provided the WQMP the public is left to trust you. CEQA does not provide for this.

Impact 3.7-5 The Project would not substantially degrade water quality. Please see our earlier discussion regarding the WQMP and SWPPP.

3.8 Hazards and Hazardous Materials. *Impact 3.8-4 The proposed Project would not expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.* The Project site is undeveloped and near other undeveloped parcels. It qualifies as "where residences are intermixed with wildlands." You concede that the Project site is within a Very High Fire Hazard Severity Zone (VHFHS Zone) under Wildomar's authority. You claim the Project would minimize this risk through hardscapes. This is not enough to prevent wildfire, as the Fort McMurray fire in Canada makes clear.

3.9 Land Use and Planning. You claim in *Impact 3.9-1* that *The proposed Project would not conflict with any applicable land use plan, policy or regulation of an agency with jurisdiction over the Project (including but not limited to the general plan [or] zoning ordinance) adopted for the purpose of avoiding or mitigation an environmental effect*, that the Project would be consistent with the General Plan. This is only because you are amending it, and even then you are rendering the General Plan internally inconsistent. The City has engaged in this "spot zoning" repeatedly, as we will demonstrate briefly. First, though, here are some of the General Plan Policies which you are contradicting with the present Project:

Policy	**Consistency**	**Discussion**
LU 3.1 Accommodate land use development in accordance with the patterns and distribution of land use and density depicted on the General Plan Land Use Maps and the Area Plan Land Use Maps in accordance with the following concepts . . . (f) In new towns, accommodate compact, transit-adaptive infrastructure (based on modified standards that take into account transit system facilities or street network).	Inconsistent.	The present Project does not plan for transit and the nearest stop is not adjacent to the Project and it is uncertain whether that stop will remain as the transit agency is reviewing its service plans. The Project contradicts the Land Use Maps which have to be amended to allow the Project to move forward.
LU 6.1 Require land uses to develop in accordance with the General Plan and area plans to ensure compatibility and minimize impacts.	Inconsistent.	The General Plan is being amended to allow this Project to develop.
LU 7.1 Accommodate the development of a balance of land uses that maintain and enhance the County's fiscal viability, economic diversity, and environmental integrity.	Inconsistent.	The original designation of the land was Commercial Office (CO) – a designation the City and County sorely need. The present Project removes this designation to allow for more housing and retail, leading to a greater jobs/housing imbalance and lower wage jobs that will not sustain the residents of the complex or most surrounding communities.
LU 7.2 Promote and market the development of a variety of stable employment and business	Inconsistent.	The General Plan Amendment detracts from this Policy by taking away potential job

uses that provide a diversity of employment opportunities.		diversity within the City.
LU 7.3 Promote the development of focused employment centers rather than inefficient strip commercial development.	Inconsistent.	The General Plan Amendment is directly contrary to this Policy.
LU 7.6 Create practical incentives for business developments and avoid disincentives.	Inconsistent.	The General Plan Amendment is a disincentive to a proposed business development on the site.
LU 7.10 Locate job centers so they have convenient access to the County's multimodal transportation facilities.	Inconsistent.	The Project is not located next to transit and the nearest stop is under review.
LU 7.12 Improve the relationship and ratio between jobs and housing so that residents have an opportunity to live and work in the County.	Inconsistent.	The Project accomplishes the opposite of this Policy.
LU 9.1 Require new development to contribute their fair share to fund infrastructure and public facilities such as police and fire facilities.	Inconsistent.	While the developer is funding police and fire facilities, there is no mention of payment of a fair share fee toward transit or a transit stop.
LU 9.2 Require a fiscal impact analysis for specific plans and major development proposals so as not to have a negative fiscal impact on the [City].	Inconsistent.	The Project completed no fiscal impact analysis and it may well have a negative impact on the City and County due to the jobs/housing imbalance it exacerbates.
LU 10.1 Provide sufficient commercial and industrial development opportunities in order to increase local employment levels and thereby minimize long-distance commuting.	Inconsistent.	The purchasers of the units will not be taking jobs in the retail development as they cannot sustain their mortgages with that employment.
LU 10.2 Ensure adequate separation between pollution producing activities and sensitive emission receptors, such as hospitals, residences, and schools.	Inconsistent.	The residential uses are 300 feet away from the I-15 freeway. This is contrary to the California Air Resources Board's Air Quality and Land Use Handbook, included as Attachment C.
LU 10.4 Provide options to the	Inconsistent.	The Project does not provide for

automobile in communities, such as transit, bicycle and pedestrian trails, to help improve air quality.		transit. The applicant should pay its fair share toward a new stop.
LU 12.1 Provide land use arrangements that reduce reliance on the automobile and improve opportunities for pedestrian, bicycle, and transit use in order to minimize congestion and air pollution.	Inconsistent.	Same.
LU 12.3 Locate transit stations in community centers and at places of public, employment, entertainment, recreation, and residential concentrations.	Inconsistent.	Same.
LU 13.8 Avoid the blocking of public views by solid walls.	Inconsistent.	The masonry walls will block residential views of surrounding scenery.

For the reasons above we dispute your determination of no significant impact.

Impact 3.9-2 The Project would conflict with an HCP. You concede the Project could conflict with the MSHCP and the SKR HCP but claim that the payment of fees toward the SKR HCP and the mitigations regarding the burrowing owl and riparian/riverine habitat will reduce this to less than significant. We disagree for the reasons stated earlier. There should be trapping and release of any SKR by a qualified biologist.

3.10 Noise and Vibration. You assert first that the General Plan controls over the Municipal Code. We disagree. The most stringent rule applies and section 9.48.040 of the Code states the present rule. If it is inaccurate it should be amended. What is codified governs.

You later assert that Wildomar does not have a standard for noise based on Code section 9.48.010(I). We disagree. Section 9.48.040 provides a threshold. We disagree with your use of worker noise safety standards as a threshold for human annoyance. The two are very different things. You also claim that the thresholds are "safe for adjacent residents who are typically farther from the noise source," but this is irrelevant as you have calculate noise *at the receptors.*

Next, you have "calculated" noise levels by simply taking the noisiest piece of equipment and applying a "usage factor" to it to get an L_{eq} level at 50 feet. You should be calculating the noise levels of the pieces of equipment that will be used concurrently. Also using L_{eq} does not reflect the significance of this extremely disturbing sound to neighboring residents. And in setting out your threshold of 85 dBA you did not indicate that it was L_{eq}.

Concerning operational impacts you concede that there would be a greater than 65 dBA CNEL impact on the outdoor residential community area and the restaurants with patios. You impose MM's NOI-4 (a sound wall of 6. 5feet around the recreational use patio in the residential area) and NOI-6 (constructing a 5-foot Plexiglas wall to attenuate noise which will provide a minimum of 5 dBA attenuation). In both cases we doubt that the proposed walls will provide the planned-for attenuation. Attachment D is a Federal Highway Administration analysis indicating that attenuation of 10 dBA requires a wall 15 feet high and eight times the length from the receptor to the noise source. While a wall shorter than that may provide 5 dBA attenuation, it must have sufficient length. We don't believe your MM's are supported by substantial evidence.

Impact 3.10-4 The Project would not result in a substantial temporary or periodic increase in ambient noise levels in the Project vicinity greater than levels existing without the Project. We disagree with this conclusion as to construction noise for the reasons stated above.

3.11 Population and Housing. You say there will be no significant impact because the anticipated housing constitutes only three percent of the population growth anticipated for the City between 2012 and 2035. However, the population growth is in addition to that anticipated in your General Plan because the site is designated for office uses and it will exacerbate the City's jobs/housing imbalance.

3.12 Public Services. By 2012 Wildomar's population was estimated at 32,719 which at 3 acres of parkland per 1,000 residents meant you should have 98 acres of parks. Wildomar has only 15 acres of parks. Clearly the City's Quimby fees, though assessed, will not create additional parkland, and the City cannot prove that the payment of the fees is going toward this essential public service. Therefore Wildomar should require the dedication of parkland for this Project. You assert that "payment of the impact fees would offset any increased deterioration of existing parks," but this is not the standard. The City should create new parks to keep up with its increasing number of residents.

3.14 Transportation and Traffic. You estimate that the nearest transit stop is ¼ mile from the Project site, though you don't identify it, and you subsequently concede that the Riverside Transit Agency is conducting a Comprehensive Operational Analysis and therefore "no information can be provided regarding future bus service in the project area at this time." The developer can pay its fair share toward transit improvements, as did the developer of the Baxter Village development further up the I-15.

At page 3.14-12 you have taken a pass-by reduction of 20% for shopping center trips. On what basis did you reach the conclusion that this number would be accurate?

Impact 3.14-3 Ambient growth, project-generated trips and cumulative projects would result in an increase in existing traffic that would conflict with an applicable plan, ordinance or policy establishing measures of effectiveness (i.e. level of service standards) for the performance of the circulation system. Your cumulative projects list only

includes projects in Wildomar. We don't dispute you have a significant impact but we believe you have underestimated it.

Chapter 4 – Cumulative Impacts

We wish to note that these projects on your cumulative projects list also detract from employment opportunities within the City and lead to a cumulative jobs/housing imbalance contrary to the stated goals of your General Plan:

- Project 14 – Villa Sienna Apartment Project – zone change from IP (industrial park) to R-3 (general residential)
- Project 15 – Grove Park Mixed Use Project – General Plan Amendment from Business Park to Commercial Retail
- Project 16 – Baxter Village Mixed Use – Change of zone from C-P-S (scenic highway commercial) to R-3 and R-4
- Project 17 – Horizons/Strata Mixed Use Project – General Plan Amendment from Business Park to Commercial Retail and High Density Residential

Regarding cumulative impacts to air quality we dispute your use of SCAQMD's "methodology" for the reasons stated above, and you have not calculated the increased emissions of NO_x from the cumulative projects, much less indicated whether you are using the list method or summary of projections method.

Regarding cumulative impacts on hazards, you assert the risks of fire would be reduced because the projects would produce greater access to sites that are undeveloped. The projects are in an extremely high fire hazard area. Your analysis and conclusion are not based on substantial evidence.

Thank you for the opportunity to comment on this Project. We look forward to your responses. Please notify us of the availability of a Final Environmental Impact Report when it becomes available at collins@blumcollins.com and bentley@blumcollins.com. Thank you.

Sincerely,

Craig M. Collins

attachments: A-D

ATTACHMENT 4

Noise Data for Residences Adjacent to Catt Road

Noise Data for Residences Adjacent to Catt Road
Westpark Promenade (September 29, 2016)

Roadway Noise Levels at Residences Along Catt Road --Federal Highway Traffic Noise Model (TNM) Version 2.5
(https://www.fhwa.dot.gov/environment/noise/traffic_noise_model/tnm_v25/)

Based on the cumulative noise analysis provided in Section 4, Cumulative Impacts of the Westpark Promenade Draft EIR prepared in May 2016, cumulative roadway noise levels with project were identified in Table 4-2 on pages 4-19 and 4-20. Catt Road north of Clinton Keith is shown to result in a cumulative increase (existing verses buildout with the project) of 5.9 dBA CNEL. A substantial and significant cumulative noise increase is defined as an increase of 5.0 dB CNEL or greater. Therefore, to reduce noise levels along Catt Road to less than the 5.0 dBA CNEL increase, a noise reduction of greater than 0.9 dBA CNEL (i.e., 5.9 dBA CNEL– 5.0 dBA CNEL) would be required.

An increase in the existing sound barrier (wall) along Catt Road could reduce the cumulative noise increase. Below includes two model runs using the Federal Highway TNM Version 2.5 to determine the increase in the wall height that would be needed to decrease the future noise levels by more than 0.9 dBA CNEL.

Model Run Assumptions – With the Existing 6-Foot High Barrier

Catt Road Roadway Width – 35 Feet
Distance from Center of Catt Road to Existing Sound Barrier (slope and wall) – 37.5 feet
Distance between Barrier and Residential Receiver – 5 feet
Future Average Daily Traffic – 9,200 ADT
Daily Traffic Mix – Auto (97.4%), Medium (1.8%), and Heavy (0.7%)
Height of Barrier – 6 feet (2 feet of slope and 4 feet of wall)
dBA CNEL = 56.1

Model Run Assumptions – With a Future 6.5-Foot High Barrier

Catt Road Roadway Width – 35 Feet
Distance from center of Catt Road to Existing Sound Barrier (slope and wall) – 37.5 feet
Distance between Barrier and Residential Receiver – 5 feet
Future Average Daily Traffic – 9,200 ADT
Daily Traffic Mix – Auto (97.4%), Medium (1.8%), and Heavy (0.7%)
Height of Barrier – 6.5 feet (2 feet of slope and 4.5 feet of wall)
dBA CNEL = 55.1

Conclusion

As shown above, the addition of at least a 0.5 foot of block to the existing 6-foot sound barrier along Catt Road could decrease the future noise levels by more than 0.9 dBA CNEL to reduce the cumulative noise increase along Catt Road to less than 5.0 dBA CNEL.