Kaiser Permanente

1650 Los Gamos Drive

Medical Office Building Project

Draft Environmental Impact Report

TECHNICAL APPENDICES

Prepared by
LAK Associates, LLC
for

The City of San Rafael
Community Development Department

March 2018

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Kaiser Permanente

1650 Los Gamos Drive

Medical Office Building and Parking Structure

DRAFT ENVIRONMENTAL IMPACT REPORT

TECHNICAL APPENDICES

APPENDIX A:	**NOTICE OF PREPARATION**
APPENDIX B:	**INITIAL STUDY**
APPENDIX C:	**AIR QUALITY AND GREENHOUSE GAS ASSESSMENT**
APPENDIX D:	**NOISE**
APPENDIX E:	**FINAL TRAFFIC IMPACT ANALYSIS and TRAFFIC IMPACT ANALYSIS APPENDIX**

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SAN RAFAEL
THE CITY WITH A MISSION

NOTICE OF PREPARATION

Date of Mailing: June 9, 2017

TO:	Office of Planning and Research State Clearinghouse 1400 Tenth Street, Room 212 Sacramento, CA 95814	**FROM:**	Sean Kennings, Contract Planner LAK Associates, LLC City of San Rafael Community Development Department Attn: Sean Kennings, Contract Planner 1400 Fifth Ave San Rafael, CA 94901
	Responsible and Trustee Agencies, Utility Providers, Organizations, Neighboring Property Owners, Neighboring Occupants, and Interested Parties		

SUBJECT: NOTICE OF PREPARATION (NOP) OF AN ENVIRONMENTAL IMPACT REPORT (EIR)

The City of San Rafael will be the lead agency and will prepare an environmental impact report (EIR) for a project that proposes: a) the conversion of an existing office building to medical office uses, and b) a new three-level parking garage at 1650 Los Gamos Drive at the intersection of Los Gamos and Lucas Valley Road in San Rafael, CA. This Notice of Preparation (NOP) is sent pursuant to Section 15082 of the California Environmental Quality Act (CEQA) Guidelines to announce the initiation of the EIR process and to solicit comments from responsible and trustee agencies, utility providers, organizations, neighboring property owners, and interested parties concerning the scope of issues to be addressed in the EIR. Refer to the Probable Environmental Effects listed below to determine whether your concerns have already been identified. Please focus your comments on the project's potential environmental impacts and recommendations for methods to avoid, reduce or otherwise mitigate those impacts. If you are a governmental agency with discretionary authority over initial or subsequent aspects of this project, describe that authority and provide comments regarding potential environmental effects that are germane to your agency's area of responsibility.

Project Name:
Kaiser Permanente 1650 Los Gamos Drive Medical Office Building

Location:
1650 Los Gamos Drive, San Rafael, Marin County, California, APNs: 165-220-12 and 165-220-13.

Property Description:

The subject property is approximately 11.1 acres in size located in north San Rafael. The subject property consists of two separate parcels bisected by Los Gamos Drive. APN 165-220-13 is an 189,907 square foot parcel previously developed with an existing 146,832 square foot office building and associated surface parking on. Across Los Gamos to the west is APN 165-220-12, a 286,428 square foot parcel developed with an approximately 80,000 square foot terraced surface parking lot and landscaping. The remainder of this parcel is characterized by oak woodland.

Project Description:
Kaiser Permanente is proposing a project with three components (collectively defined as "the proposed project"):

- Amendment to the current Planned Development (PD) zoning to add medical office use as an allowable use in the PD and allow the existing 148,000-gross square foot office building, located at 1650 Los Gamos Drive in San Rafael, it to be utilized as a medical office building (MOB).

- The construction of an up-to 511-space parking structure on the existing surface parking lot located to the west of 1650 Los Gamos Drive that will primarily serve the Kaiser Permanente employees working at the MOB (parking structure).

- Continued use of the 42 existing parking spaces located adjacent to 1650 Los Gamos Drive, on the 1600 Los Gamos Drive property. Kaiser Permanente has legal access to the use of those parking spaces through an easement and is not proposing any changes to the parking spaces.

Both 1650 and 1600 Los Gamos Drive were originally developed pursuant to a single PD District, which permits 1650 Los Gamos Drive to be constructed with up to 150,000 square feet of office uses and 1600 Los Gamos Drive to be constructed with up to 340,000 square feet of office uses.

To provide adequate parking for the use of the MOB at 1650 Los Gamos Drive, Kaiser Permanente is proposing to construct a new up-to 511-space parking structure on the site of the existing surface parking lot to the west of the existing building.

Discretionary approvals or permits needed to construct and operate the Project will include: 1) an amendment to the existing PD District for the site to (i) allow medical office uses at 1650 Los Gamos Drive in addition to existing office uses, and to (ii) separate the PD District from 1600 Los Gamos Drive, except for the surface parking area covered by an easement; 2) a Master Use Permit Amendment; 3) a Major Design Review Permit; and 4) a Sign Program.

Additional approvals may be required from the County of Marin and the California Department of Transportation (Caltrans), as responsible agencies, to allow for any project mitigations identified within their jurisdictional boundaries. Approvals from the Las Gallinas Valley Sanitary District (LGVSD) will also be required to relocate the sanitary sewer line. Other responsible agencies and additional approvals may be identified through the environmental review process.

Environmental Issues:

The proposed project would result in significant adverse impacts upon traffic and circulation due to the proposed requirement of a major intersection improvement. In addition, because traffic impacts are unknown, the proposed project could also result in significant adverse impacts upon Air Quality, Greenhouse Gas Emissions, Land Use and Planning, Noise, and Traffic and Transportation. These project impacts are unknown at this time and therefore cannot be mitigated to a less-than-significant level. An Environmental Impact Report (EIR) shall be prepared.

Initial Study: An Initial Study has been prepared on the project, which identified "Potentially Significant Impacts" listed above. Bound copies of the project's Initial Study are available to review, during operating hours, at the City of San Rafael Public Library (1100 E Street) and the City of San Rafael Community Development Department (1400 Fifth Avenue, 3rd Fl.). In addition, an electronic copy is available on the City's web site at https://www.cityofsanrafael.org/kaiser-losgamos/. CD-format copies of the Initial Study are also available to purchase at the Community Development Department.

Scoping: The City invites written comments on the scope of the EIR and alternatives that should be considered. Due to the time limits mandated by state law, your response must be sent or hand-delivered at the earliest possible date, **but no later than 30 days from the date of this notice**. Written comments should be mailed/hand-delivered to the mailing address/physical location noted above by **5 p.m. on Monday, July 10, 2017.** Comments may also be sent by email to sean@lakassociates.com with the heading "1650 Los Gamos: Kaiser Medical Office Building" in the subject line.

The City will also hold a public scoping meeting before the City of San Rafael Planning Commission to receive oral comments on **Tuesday, June 27, 2017, at 7:00 p.m.** in the San Rafael City Council Chambers, 1400 Fifth Avenue, San Rafael, CA.

Comments should focus on identifying specific environmental impacts to be evaluated during the EIR process and suggesting project modifications or alternatives that would be less environmentally damaging while achieving similar project objectives. Scoping comments should focus on issues and alternatives to be studied, not on expressing a preference for a particular alternative.

For More Information: For additional information on the project or if you wish to be placed on a mailing list to receive further information as the project progresses, please contact Sean Kennings, Contract Planner, at (415) 533-2111, sean@lakassociates.com or the mailing address above.

Date: June 9, 2017 Signature: ______________________
Name/Title: Paul Jensen, *Community Development Director*

Reference: California Code of Regulations, Title 14, (State CEQA Guidelines) Sections 15082(A), 15103, 15375

Sign Language and interpretation and assistive listening devices may be requested by calling (415) 485-3085 (voice) or (415) 485-3198 (TDD) at least 72 hours in advance. Copies of documents are available in accessible formats upon request.

Public transportation to City Hall is available through Golden Gate Transit, Line 22 or 23. Para-transit is available by calling Whistlestop Wheels at (415) 454-0964.

To allow individuals with environmental illness or multiple chemical sensitivity to attend the meeting/hearing, individuals are requested to refrain from wearing scented products.

STATE OF CALIFORNIA

GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH

STATE CLEARINGHOUSE AND PLANNING UNIT

EDMUND G. BROWN JR.
GOVERNOR

KEN ALEX
DIRECTOR

Notice of Preparation

June 9, 2017

To: Reviewing Agencies

Re: Kaiser Permanente: 1650 Los Gamos Drive Medical Office Building
SCH# 2017062019

Attached for your review and comment is the Notice of Preparation (NOP) for the Kaiser Permanente: 1650 Los Gamos Drive Medical Office Building draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

Sean Kennings
City of San Rafael
P.O. Box 15160
1400 Fifth Avenue
San Rafael, CA 94915-1560

with a copy to the State Clearinghouse in the Office of Planning and Research. Please refer to the SCH number noted above in all correspondence concerning this project.

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Scott Morgan
Director, State Clearinghouse

RECEIVED
JUN 13 2017
PLANNING

Attachments
cc: Lead Agency

Exhibit B

Document Details Report
State Clearinghouse Data Base

SCH#	2017062019
Project Title	Kaiser Permanente: 1650 Los Gamos Drive Medical Office Building
Lead Agency	San Rafael, City of

Type	NOP Notice of Preparation
Description	The proposed project includes an amendment to the current Planned Development (PD) zoning to add medical office use as an allowable use in the PD and allow the existing 148,000 gross sq. ft. office building, located at 1650 Los Gamos Drive in San Rafael, it to be utilized as a medical office building. The construction of an up-to 511-space parking structure on the existing surface parking lot located to the west of 1650 Los GAmos Drive that will primarily serve the Kaiser Permanente employees working at the medical office building (parking structure). Continued use of the 42 existing parking spaces located adjacent to the 1650 Los Gamos Drive, on the 1600 Los Gamos Drive property. Kaiser Permanente has legal access to the use of those parking spaces Potential mitigation measures include signalization and upgrades to an unsignalized intersection.

Lead Agency Contact

Name	Sean Kennings		
Agency	City of San Rafael		
Phone	415-533-2111	*Fax*	
email			
Address	P.O. Box 15160 1400 Fifth Avenue		
City	San Rafael	*State* CA	*Zip* 94915-1560

Project Location

County	Marin						
City	San Rafael						
Region							
Cross Streets	Los Gamos Drive and Lucas Valley Road						
Lat / Long	38° 01' 16" N / 122° 32' 29" W						
Parcel No.	165-220-12, 165-220-13						
Township	2N	*Range*	6W	*Section*	4	*Base*	MD

Proximity to:

Highways	US 101
Airports	Norht San Rafael Airport
Railways	SMART
Waterways	Las Galinas Creek
Schools	
Land Use	General Office / PD 1590 / Office 15-32 units/acre

Project Issues	Aesthetic/Visual; Air Quality; Archaeologic-Historic; Biological Resources; Geologic/Seismic; Noise; Public Services; Recreation/Parks; Soil Erosion/Compaction/Grading; Toxic/Hazardous; Traffic/Circulation; Water Quality; Landuse

Reviewing Agencies	Resources Agency; Department of Parks and Recreation; Department of Water Resources; Department of Fish and Wildlife, Region 3; Native American Heritage Commission; Public Utilities Commission; Caltrans, Division of Aeronautics; California Highway Patrol; Caltrans, District 4; Regional Water Quality Control Board, Region 2

Date Received 06/09/2017 *Start of Review* 06/09/2017 *End of Review* 07/10/2017

Exhibit B

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

Exhibit B

Appendix C

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

SCH # 2017062019

Project Title: Kaiser Permanente: 1650 Los Gamos Drive Medical Office Building

Lead Agency: City of San Rafael — Contact Person: Sean Kennings
Mailing Address: PO Box 15160 — Phone: (415) 533-2111
City: San Rafael — Zip: 94915-1560 — County: Marin

Project Location: County: Marin — City/Nearest Community: San Rafeal
Cross Streets: Los Gamos Drive and Lucas Valley Road — Zip Code: 94901
Longitude/Latitude (degrees, minutes and seconds): 38 ° 01 ′ 16 ″ N / 122 ° 32 ′ 29 ″ W Total Acres: 11.1
Assessor's Parcel No.: 165-220-12,165-220-13 — Section: 4 — Twp.: 2N — Range: 6W — Base: Mt. Diablo
Within 2 Miles: State Hwy #: US 101 — Waterways: Las Galinas Creek
Airports: North San Rafael Airport — Railways: SMART — Schools:

Document Type:

CEQA: [X] NOP [ ] Early Cons [ ] Neg Dec [ ] Mit Neg Dec [ ] Draft EIR [ ] Supplement/Subsequent EIR (Prior SCH No.) ______ Other: ______
NEPA: [ ] NOI [ ] EA [ ] Draft EIS [ ] FONSI
Other: [ ] Joint Document [ ] Final Document [ ] Other: ______

Governor's Office of Planning & Research
JUN 09 2017
STATE CLEARINGHOUSE

Local Action Type:

[ ] General Plan Update [ ] General Plan Amendment [ ] General Plan Element [ ] Community Plan
[ ] Specific Plan [ ] Master Plan [ ] Planned Unit Development [ ] Site Plan
[X] Rezone [ ] Prezone [X] Use Permit [ ] Land Division (Subdivision, etc.)
[ ] Annexation [ ] Redevelopment [ ] Coastal Permit [ ] Other: ______

Development Type:

[ ] Residential: Units ______ Acres ______
[X] Office: Sq.ft. 150,000 Acres 11.1 Employees 315
[ ] Commercial: Sq.ft. ______ Acres ______ Employees ______
[ ] Industrial: Sq.ft. ______ Acres ______ Employees ______
[ ] Educational: ______
[ ] Recreational: ______
[ ] Water Facilities: Type ______ MGD ______
[ ] Transportation: Type ______
[ ] Mining: Mineral ______
[ ] Power: Type ______ MW ______
[ ] Waste Treatment: Type ______ MGD ______
[ ] Hazardous Waste: Type ______
[X] Other: three story parking structure

Project Issues Discussed in Document:

[X] Aesthetic/Visual [ ] Agricultural Land [X] Air Quality [X] Archeological/Historical [X] Biological Resources [ ] Coastal Zone [ ] Drainage/Absorption [ ] Economic/Jobs
[ ] Fiscal [ ] Flood Plain/Flooding [ ] Forest Land/Fire Hazard [X] Geologic/Seismic [ ] Minerals [X] Noise [ ] Population/Housing Balance [X] Public Services/Facilities
[X] Recreation/Parks [ ] Schools/Universities [ ] Septic Systems [ ] Sewer Capacity [X] Soil Erosion/Compaction/Grading [ ] Solid Waste [X] Toxic/Hazardous [X] Traffic/Circulation
[ ] Vegetation [X] Water Quality [ ] Water Supply/Groundwater [ ] Wetland/Riparian [ ] Growth Inducement [X] Land Use [ ] Cumulative Effects [ ] Other: ______

Present Land Use/Zoning/General Plan Designation:

General Office / PD 1590 / Office (O) 15-32 units/acre

Project Description: *(please use a separate page if necessary)*

The proposed project includes an amendment to the current Planned Development (PD) zoning to add medical office use as an allowable use in the PD and allow the existing 148,000-gross square foot office building, located at 1650 Los Gamos Drive in San Rafael, it to be utilized as a medical office building (MOB). The construction of an up-to 511-space parking structure on the existing surface parking lot located to the west of 1650 Los Gamos Drive that will primarily serve the Kaiser Permanente employees working at the MOB (parking structure). Continued use of the 42 existing parking spaces located adjacent to 1650 Los Gamos Drive, on the 1600 Los Gamos Drive property. Kaiser Permanente has legal access to the use of those parking spaces Potential mitigation measures include signalization and upgrades to an unsignalized intersection.

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

Exhibit B

SB

NOP Distribution List

County: Marin

SCH# 2017062019

Resources Agency

- Resources Agency
  Nadell Gayou
- Dept. of Boating & Waterways
  Denise Peterson
- California Coastal Commission
  Elizabeth A. Fuchs
- Colorado River Board
  Lisa Johansen
- Dept. of Conservation
  Crina Chan
- Cal Fire
  Dan Foster
- Central Valley Flood Protection Board
  James Herota
- Office of Historic Preservation
  Ron Parsons
- Dept of Parks & Recreation
  Environmental Stewardship Section
- S.F. Bay Conservation & Dev't. Comm.
  Steve Goldbeck
- Dept. of Water Resources
  Resources Agency
  Nadell Gayou

Fish and Game

- Depart. of Fish & Wildlife
  Scott Flint
  Environmental Services Division
- Fish & Wildlife Region 1
  Curt Babcock
- Fish & Wildlife Region 1E
  Laurie Harnsberger
- Fish & Wildlife Region 2
  Jeff Drongesen
- Fish & Wildlife Region 3
  Craig Weightman
- Fish & Wildlife Region 4
  Julie Vance
- Fish & Wildlife Region 5
  Leslie Newton-Reed
  Habitat Conservation Program
- Fish & Wildlife Region 6
  Tiffany Ellis
  Habitat Conservation Program
- Fish & Wildlife Region 6 I/M
  Heidi Calvert
  Inyo/Mono, Habitat Conservation Program
- Dept. of Fish & Wildlife M
  William Paznokas
  Marine Region

Other Departments

- California Department of Education
  Lesley Taylor
- OES (Office of Emergency Services)
  Monique Wilber
- Food & Agriculture
  Sandra Schubert
  Dept. of Food and Agriculture
- Dept. of General Services
  Cathy Buck
  Environmental Services Section
- Housing & Comm. Dev.
  CEQA Coordinator
  Housing Policy Division

Independent Commissions, Boards

- Delta Protection Commission
  Erik Vink
- Delta Stewardship Council
  Kevan Samsam
- California Energy Commission
  Eric Knight
- Native American Heritage Comm.
  Debbie Treadway
- Public Utilities Commission
  Supervisor
- Santa Monica Bay Restoration
  Guangyu Wang
- State Lands Commission
  Jennifer Deleong
- Tahoe Regional Planning Agency (TRPA)
  Cherry Jacques

Cal State Transportation Agency CalSTA

- Caltrans - Division of Aeronautics
  Philip Crimmins
- Caltrans – Planning
  HQ LD-IGR
  Christian Bushong
- California Highway Patrol
  Suzann Ikeuchi
  Office of Special Projects

Dept. of Transportation

- Caltrans, District 1
  Rex Jackman
- Caltrans, District 2
  Marcelino Gonzalez
- Caltrans, District 3
  Eric Federicks – South
  Susan Zanchi - North
- Caltrans, District 4
  Patricia Maurice
- Caltrans, District 5
  Larry Newland
- Caltrans, District 6
  Michael Navarro
- Caltrans, District 7
  Dianna Watson
- Caltrans, District 8
  Mark Roberts
- Caltrans, District 9
  Gayle Rosander
- Caltrans, District 10
  Tom Dumas
- Caltrans, District 11
  Jacob Armstrong
- Caltrans, District 12
  Maureen El Harake

Cal EPA

Air Resources Board

- Airport & Freight
  Jack Wursten
  - Transportation Projects
    Nesamani Kalandiyur
  - Industrial/Energy Projects
    Mike Tollstrup
- California Department of Resources, Recycling & Recovery
  Sue O'Leary
- State Water Resources Control Board
  Regional Programs Unit
  Division of Financial Assistance
- State Water Resources Control Board
  Cindy Forbes – Asst Deputy
  Division of Drinking Water
- State Water Resources Control Board
  Div. Drinking Water #________
- State Water Resources Control Board
  Student Intern, 401 Water Quality Certification Unit
  Division of Water Quality
- State Water Resouces Control Board
  Phil Crader
  Division of Water Rights
- Dept. of Toxic Substances Control
  CEQA Tracking Center
- Department of Pesticide Regulation
  CEQA Coordinator

Regional Water Quality Control Board (RWQCB)

- RWQCB 1
  Cathleen Hudson
  North Coast Region (1)
- RWQCB 2
  Environmental Document Coordinator
  San Francisco Bay Region (2)
- RWQCB 3
  Central Coast Region (3)
- RWQCB 4
  Teresa Rodgers
  Los Angeles Region (4)
- RWQCB 5S
  Central Valley Region (5)
  - RWQCB 5F
    Central Valley Region (5)
    Fresno Branch Office
  - RWQCB 5R
    Central Valley Region (5)
    Redding Branch Office
- RWQCB 6
  Lahontan Region (6)
  - RWQCB 6V
    Lahontan Region (6)
    Victorville Branch Office
- RWQCB 7
  Colorado River Basin Region (7)
- RWQCB 8
  Santa Ana Region (8)
- RWQCB 9
  San Diego Region (9)

- Other ________________
  ____
  ____
- ________________
  Conservancy

Last Updated 4/28/17

Exhibit B

Exhibit B

Gmail by Google

Exhibit C

Sean Kennings <sean@lakassociates.com>

Re: 1650 Los Gamos: Kaiser Medical Office Building

1 message

Alex Kugelman [redacted] Tue, Jun 20, 2017 at 12:17 PM
To: Sean Kennings <sean@lakassociates.com>

Sean,

Thanks for your time today. Again, I am the property owner at 56 Salvador Way, San Rafael, 94903. Our property borders the property for the proposed parking garage project. This e-mail outlines the items we discussed. Please include them as appropriate in the report. Further, please add me to any contact/mail list for future correspondence. Finally, please advise when I can access the Design Review Package on the city's website or please e-mail me a copy. Thanks!

- **Redwood Trees.** I am concerned that construction will effect the Redwood and other established trees on the western and southern borders of the existing garage. Those trees shield the view of existing parking lot and Hwy 101. I understand that there are plans to protect those trees. I'd like to make sure that there are plans for suitable replacements if any of these trees are killed removed.
- **Path.** Neighborhood residents access Los Gamos, Lucas Valley via a dirt path at the end of Salvador Way. The path leads to the existing parking lot and also wraps around the west and southern borders. Path network provides access to YMCA, public transportation (Including Hwy 101 bus pad). I'd like to know how construction will restrict access/use and garage will permanently alter use.
- **Security.** Open space to west of parking lot has been subject to loitering and alcohol use. Further, it is my understanding that Kaiser's business hours may extend into the evening or night. This could mean increased traffic during sleeping hours. I'd be interested in knowing owner's security measures for this area to prevent unreasonable noise, activity.
- **Structure Height.** I understand structure to be appx. 10' higher than highest parking level. I'm concerned that any exposed area or light poles will not be cosmetically pleasing.

Again, I appreciate your help. I'm sorry that I will miss Tuesday's meeting.

Best,
Alex
[redacted]

On Tue, Jun 20, 2017 at 10:59 AM, Sean Kennings <sean@lakassociates.com> wrote:

> Hello Alex –
>
> I am at the City offices today – you may call me via my cell phone below.
>
> Sean
>
> **Sean Kennings**
>
> planning consultant
>
> **LAK Associates, LLC**
> PO Box 7043
>
> Corte Madera, CA 94976

Exhibit C

Exhibit C

cell: (415) 533-2111

sean@lakassociates.com

www.lakassociates.com/home

From: Alex Kugelman [redacted]
Sent: Tuesday, June 20, 2017 9:30 AM
To: sean@lakassociates.com
Subject: 1650 Los Gamos: Kaiser Medical Office Building

Sean-

I live at 56 Salvador Way, which borders the proposed parking garage project. I had a few questions and wanted to get some more information. I'm reviewing the website. I was wondering if we could schedule a time to chat by telephone? Thanks!

Best,

Alex

Exhibit C

KAISER PERMANENTE MEDICAL OFFICE BUILDING

1650 Los Gamos, San Rafael, CA
Assessor's Parcel Numbers: 011-256-12, 011-256-13

Initial Study and Notice of Preparation (NOP) of an Environmental Impact Report (EIR)

Lead Agency:

City of San Rafael
Community Development Department
1400 Fifth Avenue (P.O. Box 151560)
San Rafael, CA 94915-1560

Contact: Sean Kennings – LAK Associates

June 9, 2017

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DATE: June 9, 2017

TO: Public Agencies, Organizations and Interested Parties

FROM: Sean Kennings, LAK Associates - Contract Planner for City of San Rafael

SUBJECT: **NOTICE OF PUBLIC REVIEW AND INTENT TO PREPARE AN ENVIRONMENTAL IMPACT REPORT**

Pursuant to the State of California Public Resources Code and the "Guidelines for Implementation of the California Environmental Quality Act of 1970" as amended to date, this is to advise you that the Department of Community Development of the City of San Rafael has prepared an Initial Study on the following project:

Project Name:

Kaiser Permanente 1650 Los Gamos Drive Medical Office Building

Location:

1650 Los Gamos Drive, San Rafael, Marin County, California, APNs: 165-220-12 and 165-220-13.

Property Description:

The subject property is approximately 11.1 acres in size located in north San Rafael. The subject property consists of two separate parcels bisected by Los Gamos Drive. APN 165-220-13 is a 178,160-square foot parcel previously developed with an existing approximately 148,000 square foot office building and associated surface parking. Across Los Gamos to the west is APN 165-220-12, a 305,791-square foot parcel developed with an approximately 80,000 square foot terraced surface parking lot and landscaping. The remainder of this parcel is characterized by oak woodland.

Project Description:

Kaiser Permanente is proposing a project with three components (collectively defined as "the proposed project"):

- Amendment to the current Planned Development (PD) zoning to add medical office use as an allowable use in the PD and allow the existing 148,000-gross square foot office building, located at 1650 Los Gamos Drive in San Rafael, it to be utilized as a medical office building ("MOB").

- The construction of an up-to 511-space parking structure on the existing surface parking lot located to the west of 1650 Los Gamos Drive that will primarily serve the Kaiser Permanente employees working at the MOB ("parking structure").

- Continued use of the 42 existing parking spaces located adjacent to 1650 Los Gamos Drive, on the 1600 Los Gamos Drive property. Kaiser Permanente has legal access to the use of those parking spaces through an easement and is not proposing any changes to the parking spaces.

Both 1650 and 1600 Los Gamos Drive were originally developed pursuant to a single PD District, which permits 1650 Los Gamos Drive to be constructed with up to 150,000 square feet of office uses and 1600 Los Gamos Drive to be constructed with up to 340,000 square feet of office uses.

To provide adequate parking for the use of the MOB at 1650 Los Gamos Drive, Kaiser Permanente is proposing to construct a new up-to 511-space parking structure on the site of the existing surface parking lot to the west of the existing building.

Discretionary approvals or permits needed to construct and operate the Project will include: 1) an amendment to the existing PD District for the site to (i) allow medical office uses at 1650 Los Gamos Drive in addition to existing office uses, and to (ii) separate the PD District from 1600 Los Gamos Drive, except for the surface parking area covered by an easement; 2) a Master Use Permit Amendment; 3) a Major Design Review Permit; and 4) a Sign Program.

Additional approvals may be required from the County of Marin and the California Department of Transportation (Caltrans), as responsible agencies, to allow for any project mitigations identified within their jurisdictional boundaries. Approvals from the Las Gallinas Valley Sanitary District will also be required to relocate the sanitary sewer line. Other responsible agencies and additional approvals may be identified through the environmental review process.

Environmental Issues:

The proposed project would result in significant adverse impacts upon traffic and circulation due to the proposed requirement of a major intersection improvement. In addition, because a comprehensive analysis of potential environmental impacts has not yet been undertaken, the proposed project could potentially result in impacts to Air Quality, Greenhouse Gas Emissions, Land Use and Planning, Noise, and Traffic and Transportation. These thresholds will be further discussed in an Environmental Impact Report (EIR) and mitigations will be identified, analyzed and implemented to the extent feasible to reduce potential environmental impacts to less than significant levels.

The Initial Study document has been prepared in consultation with local, and state responsible and trustee agencies and in accordance with Section 15063 of the California Environmental Quality Act (CEQA).

A thirty-day (30-day) public review period shall commence on **June 9, 2017**. Written comments must be sent to the City of San Rafael, Community Development Department, Planning Division, 1400 Fifth Avenue, San Rafael CA 94901 **by July 10, 2017**. The City of San Rafael Planning Commission will hold a public hearing soliciting comments on the scope of issues to be addressed and alternatives that should be considered in the EIR on **June 27, 2017, 7:00 PM in the San Rafael City Council Chambers at City Hall (address listed above). Correspondence and comments can be delivered to Sean Kennings, project planner, phone: (415) 533-2111, email: sean@lakassociates.com.**

SUMMARY OF IMPACTS AND MITIGATION MEASURES

Summary of Impacts and Mitigation Measures **: Kaiser Permanente: 1650 Los Gamos Medical Office Building**			
Environmental Impacts	**Level of Significance Without Mitigation**	**Mitigation Measures**	**Level of Significance with Mitigation**
Potentially Significant: Less Than Significant Without Mitigation: Less than Significant:	(PS) (LTSWM) (LTS)		(PS) (LTSWM) (LTS)
I. Aesthetics			
I (d). Would the project: Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	PS	**MM AES-1:** Prior to the issuance of any building permits, the Project applicant shall submit to the satisfaction of the Community Development Department Director, Project building plans that include a photometric lighting study demonstrating that outdoor lighting fixtures meet the requirements of the California Energy Code (known as Part 6, Title 24 of the California Code of Regulations).	LTS
III. Air Quality			
III (a): Would the project: Conflict with or obstruct implementation of the applicable air quality plan?	PS	As the full analysis of traffic related impacts is still unknown, air quality as it relates to project generated traffic is also unknown. Based upon this initial review, preparation of an Environmental Impact Report is required. The EIR will analysis of potential traffic mitigation measures and as a result potential temporary and cumulative mitigation measures necessary to reduce potential air quality impacts to less than significant levels. The EIR would also address project alternatives to analyze this potentially significant adverse impact.	PS
III (b): Would the project: Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	PS	This Initial Study provides a preliminary analysis to identify the impacts of the project upon Air Quality considerations. Based upon this initial review, preparation of an Environmental Impact Report is required. The EIR will	PS

Environmental Impacts	Level of Significance Without Mitigation	Mitigation Measures	Level of Significance with Mitigation
		include analysis of potential traffic mitigation measures as well as potential temporary and cumulative mitigation measures necessary to reduce potential air quality impacts to less than significant levels. The EIR would also address project alternatives to analyze this potentially significant adverse impact.	
III (c): Would the project: Result in a cumulatively considerable net increase any criteria pollutant 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)?	PS	This Initial Study provides a preliminary analysis to identify the impacts of the project upon Air Quality considerations. Based upon this initial review, preparation of an Environmental Impact Report is required. The EIR will provide analysis of potential traffic impacts and mitigation measures as well as potential cumulative impacts and subsequent mitigation measures necessary to reduce potential impacts to less than significant levels will also be evaluated. The EIR would also address project alternatives to analyze this potentially significant adverse impact.	PS
III (d): Would the project: Expose sensitive receptors to substantial pollutant concentrations?	PS	Because construction methods have not been fully evaluated, preparation of an Environmental Impact Report is required. The EIR will provide analysis of potential traffic and construction impacts and mitigation measures as well as potential cumulative impacts and subsequent mitigation measures necessary to reduce potential impacts to less than significant levels will also be evaluated. The EIR would also address project alternatives to analyze this potentially significant adverse impact.	PS
IV. Biological Resources			
IV (d): Would the project:	PS	**MM BIO-1:** Prior to issuance of a grading or building	LTS

Summary of Impacts and Mitigation Measures : Kaiser Permanente: 1650 Los Gamos Medical Office Building			
Environmental Impacts	**Level of Significance Without Mitigation**	**Mitigation Measures**	**Level of Significance with Mitigation**
Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?		permit, the project sponsor shall conduct a preconstruction nesting bird and bat survey. Preconstruction surveys shall include the following: 1) Perform any vegetation trimming and/or removal outside of the bird nesting season (Sept. 1 – Feb. 14); 2) Provide a worker environmental awareness training for construction personnel; 3) Perform preconstruction surveys for nesting migratory birds by a qualified biologist no more than 72 hours prior to the start of construction for activities occurring during the breeding season (February 15 to August 31); and 4) If work is to occur within 300 feet of active raptor nests or 50 feet of active passerine nests, non-disturbance buffers will be established at a distance sufficient to minimize disturbance.	
V. Cultural Resources			
V (b): Would the project: Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	PS	**MM CULT-1: Protect Archaeological Resources Identified during Construction**: The project sponsor shall ensure that construction crews stop all work within 100 feet of the discovery until a qualified archaeologist can assess the previously unrecorded discovery and provide recommendations. Resources could include subsurface historic features such as artifact-filled privies, wells, and refuse pits, and artifact deposits, along with concentrations of adobe, stone, or concrete walls or foundations, and concentrations of ceramic, glass, or metal materials. Native	LTS

Environmental Impacts	Level of Significance Without Mitigation	Mitigation Measures	Level of Significance with Mitigation
		American archaeological materials could include obsidian and chert flaked stone tools (such as projectile and dart points), midden (culturally derived darkened soil containing heat-affected rock, artifacts, animal bones, and/or shellfish remains), and/or groundstone implements (such as mortars and pestles).	
V (d): Would the project: Disturb any human remains, including those interred outside of dedicated cemeteries?	PS	**MM CULT-2: Protect Human Remains Identified During Construction**: The Project proponent shall treat any human remains and associated or unassociated funerary objects discovered during soil-disturbing activities according to applicable State laws. Such treatment includes work stoppage and immediate notification of the Marin County Coroner and qualified archaeologist, and in the event that the Coroner's determination that the human remains are Native American, notification of NAHC according to the requirements in PRC Section 5097.98. NAHC would appoint a Most Likely Descendant (MLD). A qualified archaeologist, Project proponent, County of Marin, and MLD shall make all reasonable efforts to develop an agreement for the treatment, with appropriate dignity, of any human remains and associated or unassociated funerary objects (CEQA Guidelines Section 15064.5[d]). The agreement would take into consideration the appropriate excavation, removal, recordation, analysis, custodianship, and final disposition of the human remains and associated or unassociated funerary objects. The PRC allows 48 hours to reach agreement on these matters.	LTS
VII. Greenhouse Gases			

Summary of Impacts and Mitigation Measures : Kaiser Permanente: 1650 Los Gamos Medical Office Building			
Environmental Impacts	**Level of Significance Without Mitigation**	**Mitigation Measures**	**Level of Significance with Mitigation**
VII (a): Would the project: Generate greenhouse gas ("GHG") emissions, either directly or indirectly, that may have a significant impact on the environment?	PS	The project applicant has submitted a Traffic Impact Analysis of the proposed project that will be evaluated pursuant to CEQA and the City of San Rafael standards and regulations. As such, impacts related to increased traffic trips would be addressed in the project EIR. This Initial Study provides a preliminary analysis to identify the impacts of the project upon Greenhouse Gas Emissions considerations. The EIR will provide analysis of potential traffic, construction, and operational impacts and develop potential temporary and cumulative mitigation measures necessary to reduce potential GHG impacts to less than significant levels through compliance with the implementing Ordinances and the San Rafael CCAP. The EIR would also address project alternatives to analyze this potentially significant adverse impact.	PS
VII (b): Would the project: Conflict with an applicable plan, policy or regulation for the purpose of reducing the emissions of greenhouse gases?	PS	The project applicant has submitted a Traffic Impact Analysis of the proposed project that will be evaluated pursuant to CEQA and the City of San Rafael standards and regulations. As such, impacts related to increased traffic trips would be addressed in the project EIR. This Initial Study provides a preliminary analysis to identify the impacts of the project upon Greenhouse Gas Emissions considerations. The EIR will provide analysis of potential traffic, construction, and operational impacts and develop potential temporary and cumulative mitigation measures necessary to reduce potential GHG impacts to less than significant levels through compliance with the implementing Ordinances and the San Rafael CCAP. The EIR would also address project alternatives to analyze this potentially	PS

Environmental Impacts	Level of Significance Without Mitigation	Mitigation Measures	Level of Significance with Mitigation
		significant adverse impact.	
IX. HYDROLOGY AND WATER QUALITY			
IX (a): Would the project: Violate any water quality standards or waste discharge requirements?	PS	**MM HYDRO-1:** Prior to grading activities, the project applicant shall prepare a Stormwater Pollution Prevention Plan (SWPPP) in accordance with the requirements of the statewide Construction General Permit. The SWPPP shall be prepared by a Qualified SWPPP Developer (QSD). The SWPPP shall include the minimum Best Management Practices (BMPs) required for the identified risk level. The SWPPP shall be designed to address the following objectives: (1) All pollutants and their sources, including sources of sediment associated with construction, construction site erosion, and all other activities associated with construction activity are controlled; (2) Where not otherwise required to be under a Regional Water Quality Control Board permit, all non-stormwater discharges are identified and either eliminated, controlled, or treated; (3) Site BMPs are effective and result in the reduction or elimination of pollutants in stormwater discharges and authorized non-stormwater discharges from construction activity; and (4) Stabilization BMPs installed to reduce or eliminate pollutants after construction are completed. (5) BMP implementation shall be consistent with the BMP requirements in the most recent version of the California Stormwater Quality Association Stormwater Best	LTS

Summary of Impacts and Mitigation Measures : Kaiser Permanente: 1650 Los Gamos Medical Office Building			
Environmental Impacts	**Level of Significance Without Mitigation**	**Mitigation Measures**	**Level of Significance with Mitigation**
		Management Handbook-Construction or the Caltrans Stormwater Quality Handbook Construction Site BMPs Manual.	
IX (a): Would the project: Violate any water quality standards or waste discharge requirements?	PS	**MM HYDRO-2**: Prior to a certificate of occupancy, the project applicant shall verify that operational stormwater quality control measures that comply with the requirements of the current Phase II Small MS4 Permit have been implemented. Responsibilities include but are not limited to: 1) Designing BMPs into project features and operations to reduce potential impacts to surface water quality and to manage changes in the timing and quantity of runoff associated with operation of the project. These features shall be included in the design-level drainage plan and final development drawings. 2) The proposed project shall incorporate site design measures and Low Impact Development design standards, including minimizing disturbed areas and impervious surfaces, infiltration, harvesting, evapotranspiration, and/or bio-treatment of stormwater runoff. 3) The project applicant shall establish an Operation and Maintenance Plan. This plan shall specify a regular inspection schedule of stormwater treatment facilities in accordance with the requirements of the Phase II Small MS4 Permit. 4) Funding for long-term maintenance of all BMPs shall be specified.	LTS

Summary of Impacts and Mitigation Measures **: Kaiser Permanente: 1650 Los Gamos Medical Office Building**			
Environmental Impacts	**Level of Significance Without Mitigation**	**Mitigation Measures**	**Level of Significance with Mitigation**
IX (b): Would the project: Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner, which would result in substantial erosion or siltation on- or off-site?	PS	**Implementation of MM HYDRO-1**	LTS
IX (f): Would the project: Otherwise substantially degrade water quality?	PS	**Implementation of MM HYDRO-1**	LTS
X. Land Use and Planning			
X (b): Would the project: 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, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	PS	The proposed project has not been evaluated for consistency with the policies in the General Plan Climate Change Action Plan (CCAP), which seek to limit GHG emissions and implement regional air quality goals. This Initial Study provides a preliminary analysis to identify the impacts of the project upon Greenhouse Gas Emissions considerations. As such, impacts related to increased traffic trips would be addressed in the project EIR. The EIR will provide analysis of potential traffic, construction, and operational impacts and develop potential temporary and cumulative mitigation measures necessary to reduce potential GHG impacts to less than significant levels through compliance with the implementing Ordinances and the San Rafael CCAP. Therefore, the proposed project would need to be further evaluated to ensure there is no conflict with an applicable land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect.	PS
XII. Noise			
XII (a): Would the project: Exposure of persons to or generation of noise levels	PS	The project applicant has submitted a Traffic Impact Analysis of the proposed project that will be evaluated	PS

Summary of Impacts and Mitigation Measures : Kaiser Permanente: 1650 Los Gamos Medical Office Building			
Environmental Impacts	**Level of Significance Without Mitigation**	**Mitigation Measures**	**Level of Significance with Mitigation**
in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?		pursuant to CEQA and the City of San Rafael standards and regulations. As such, impacts related to increased traffic trips would be addressed in the project EIR. This Initial Study provides a preliminary analysis to identify the impacts of the project upon Noise considerations. Based upon this initial review, preparation of an Environmental Impact Report is required. The EIR will provide analysis of potential traffic, construction, and operational impacts and as a result potential temporary and cumulative mitigation measures necessary to reduce potential Noise impacts to less than significant levels. The EIR would also address project alternatives to analyze this potentially significant adverse impact.	
XII (b): Would the project: Exposure of persons to or generation of excessive ground borne vibration or ground borne noise levels?	PS	Evaluation of the construction activities has not been determined to involve excessive ground borne vibration or ground borne noise levels. This Initial Study provides a preliminary analysis to identify the impacts of the project upon Noise considerations including impacts related to construction activities. Based upon this initial review, preparation of an Environmental Impact Report is required. The EIR will provide analysis of potential construction impacts and as a result evaluate potential mitigation measures necessary to reduce potential construction Noise impacts to less than significant levels. The EIR would also address project alternatives to analyze this potentially significant adverse impact.	PS
XII (c): Would the project: A substantial permanent increase in ambient noise	PS	Evaluation of the long term operational activities of the proposed project has not yet been determined and therefore	PS

Summary of Impacts and Mitigation Measures : Kaiser Permanente: 1650 Los Gamos Medical Office Building			
Environmental Impacts	**Level of Significance Without Mitigation**	**Mitigation Measures**	**Level of Significance with Mitigation**
levels in the project vicinity above levels existing without the project?		it is unknown if the project would result in substantial permanent increase in ambient noise levels in the project vicinity. However, this Initial Study provides a preliminary analysis to identify the impacts of the project upon Noise considerations including impacts related to ambient noise levels. Based upon this initial review, preparation of an Environmental Impact Report is required. The EIR will provide analysis of potential construction impacts and as a result evaluate potential mitigation measures necessary to reduce potential construction Noise impacts to less than significant levels. The EIR would also address project alternatives to analyze this potentially significant adverse impact.	
XII (d): Would the project: A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	PS	See Response XII (a) and (b) above. Discussion of temporary construction noise impacts and ongoing traffic impacts and potential recommended mitigation measures related to the proposed project would be addressed in a project EIR.	PS
XVI. Traffic and Transportation			
XVI (a): Would the project: Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant component of the circulation system, including but not limited to intersections, streets, highways, and freeways, pedestrian and bicycle paths, and mass	PS	Although the TIA provides potential mitigation measures to reduce the project's impacts, several traffic impacts have been identified that would remain significant and unavoidable. This Initial Study provides a preliminary analysis to identify the impacts of the project upon Traffic and Transportation considerations. Based upon this initial review, preparation of an Environmental Impact Report is required. The EIR will provide analysis of potential traffic impacts and potential cumulative impacts and mitigation	PS

Summary of Impacts and Mitigation Measures **: Kaiser Permanente: 1650 Los Gamos Medical Office Building**			
Environmental Impacts	**Level of Significance Without Mitigation**	**Mitigation Measures**	**Level of Significance with Mitigation**
transit)?		measures necessary to reduce potential impacts to less than significant levels. The EIR would also address project alternatives to analyze this potentially significant adverse impact.	
XVI (b): Would the project: Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	PS	As the TIA will be further evaluated by the City of San Rafael, potential conflicts with applicable congestion management programs, including, but not limited to level of service standards and travel demand measures have not yet been identified and could remain significant and unavoidable. Based upon this initial review, preparation of an Environmental Impact Report is required. The EIR will provide analysis of potential traffic impacts and potential cumulative impacts and mitigation measures necessary to reduce potential impacts to less than significant levels. The EIR would also address project alternatives to analyze this potentially significant adverse impact.	PS
XVI (d): Would the project: Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	PS	The project traffic study was evaluated by the City of San Rafael Department of Public Works for traffic and circulation compliance with City standards including potential conflicts to site distances and found them to be acceptable. However, the full analysis of proposed project improvements, including the proposed signalized intersection at Los Gamos Drive and Lucas Valley Road have not yet been evaluated. This Initial Study provides a preliminary analysis to identify the impacts of the project upon Traffic and Transportation considerations. Based upon this initial review, preparation of an Environmental Impact Report is required. The EIR will provide analysis of	PS

Summary of Impacts and Mitigation Measures : Kaiser Permanente: 1650 Los Gamos Medical Office Building			
Environmental Impacts	**Level of Significance Without Mitigation**	**Mitigation Measures**	**Level of Significance with Mitigation**
		potential traffic impacts and mitigation measures necessary to reduce potential impacts to less than significant levels will also be evaluated. The EIR would also address project alternatives to analyze this potentially significant adverse impact.	
XVI (f): Would the project: Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	PS	This Initial Study provides a preliminary analysis to identify the impacts of the project upon Traffic and Transportation considerations. Based upon this initial review, preparation of an Environmental Impact Report is required. The EIR will provide analysis of potential traffic impacts and mitigation measures necessary to reduce potential impacts to less than significant levels will also be evaluated. The EIR would also address project alternatives to analyze this potentially significant adverse impact.	PS
XVII. Tribal Cultural Resources			
XVIII. Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is Geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is: (a) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or	PS	**MM TRIBAL-1:** Implementation of the unanticipated discovery measures outlined in Section V(b) and (d) above, address the potential discovery of previously unknown resources within the project area. If significant tribal cultural resources are identified onsite, all work would stop immediately within 50 feet of the resource(s) and the project applicant would comply with all relevant State and City policies and procedures prescribed under PRC Section 21074.	LTS

Summary of Impacts and Mitigation Measures **: Kaiser Permanente: 1650 Los Gamos Medical Office Building**			
Environmental Impacts	**Level of Significance Without Mitigation**	**Mitigation Measures**	**Level of Significance with Mitigation**
(b) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in Subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.			

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ENVIRONMENTAL CHECKLIST

1. Project Title	Kaiser Permanente 1650 Los Gamos Drive Medical Office Building
2. Lead Agency Name & Address	City of San Rafael Community Development Department Planning Division 1400 Fifth Avenue San Rafael, California 94901
3. Contact Person & Phone Number	Sean Kennings, LAK Associates Phone: (415) 533-2111 Email: sean@lakassociates.com
4. Project Location	The site is located in the City of San Rafael, Marin County, California at 1650 Los Gamos Drive, Assessor's Parcel Nos. 165-220-12 & 165-220-13. (Refer to Exhibit A, "Vicinity Map").
5. Project Sponsor's Name & Address	Project Sponsor: Kaiser Foundation Health Plan Real Estate Department 1950 Franklin Street – 12th Floor Oakland, CA 94612
6. General Plan Designation	Office – 15-32 units/acres
7. Zoning	Planned Development District (PD 1590)

8. Description of Project

Environmental Setting and Background

The applicant, Kaiser Foundation Hospitals (Kaiser Permanente), proposes a medical office building project at 1650 Los Gamos Drive in the City of San Rafael, California. The project site is located in the North San Rafael Commercial Center district just west of Highway 101 at the intersection of Lucas Valley Road and Los Gamos Drive. An existing building at 1650 Los Gamos Drive is surrounded by several existing surface parking lots. There is also an office building owned by Marin County to the south of the project site, at 1600 Los Gamos Drive. The project site is located in a mixed-use office/commercial area and is separated approximately 250' from the nearest residential structure by an open space hillside.

The project site includes three corresponding parcels, two of which (1650 Los Gamos Drive and an adjacent surface parking lot) are owned by Kaiser Permanente and the third (1600 Los Gamos Drive) is owned by Marin County. Together, these parcels comprise the "project site" and are more fully described as follows:

- An existing building at 1650 Los Gamos Drive (Assessor Parcel Number's [APN] 165-220-13), includes a three-story, approximately 148,000 square foot office building and associated surface parking on approximately 4.02 acres.
- An approximately 7.02-acre parcel located to the west of 1650 Los Gamos Drive, on the west side of Los Gamos Drive (APN 165-220-12). The parcel currently consists of a surface parking lot and

vegetative hillside, and abuts an undeveloped hillside slope, with a single-family subdivision above. There is also an existing sanitary sewer line running through the parcel.

- The surface parking site at 1600 Los Gamos Drive (APN: 165-220-11), a portion of which Kaiser holds a parking easement (to allow the use of 42 parking spaces for 1650 Los Gamos Drive.

Project Description
Kaiser Permanente is proposing a project with three components:

- Amendment to the current Planned Development (PD) zoning to add medical office use as an allowable use in the PD and allow the existing 148,000-gross square foot office building, located at 1650 Los Gamos Drive in San Rafael, it to be utilized as a medical office building (MOB).

- The construction of an up-to 511-space parking structure on the existing surface parking lot located to the west of 1650 Los Gamos Drive that will primarily serve the Kaiser Permanente employees working at the MOB (parking structure).

- Continued use of the 42 existing parking spaces located adjacent to 1650 Los Gamos Drive, on the 1600 Los Gamos Drive property. Kaiser Permanente has legal access to the use of those parking spaces through an easement and is not proposing any changes to the parking spaces.

Both 1650 and 1600 Los Gamos Drive were originally developed pursuant to a single PD District, which permits 1650 Los Gamos Drive to be constructed with up to 150,000 square feet of office uses and 1600 Los Gamos Drive to be constructed with up to 340,000 square feet of office uses.

To provide adequate parking for the use of the MOB at 1650 Los Gamos Drive, Kaiser Permanente is proposing to construct a new up-to 511-space parking structure on the site of the existing surface parking lot to the west of the existing building.

Discretionary approvals or permits needed to construct and operate the Project will include: 1) an amendment to the existing PD District for the site to (i) allow medical office uses at 1650 Los Gamos Drive in addition to existing office uses, and to (ii) separate the PD District from 1600 Los Gamos Drive, except for the surface parking area covered by an easement; 2) a Master Use Permit Amendment; 3) a Major Design Review Permit; and 4) a Sign Program.

Additional approvals may be required from the County of Marin and the California Department of Transportation (Caltrans), as responsible agencies, to allow for any project mitigations identified within their jurisdictional boundaries. Approvals from the Las Gallinas Valley Sanitary District will also be required to relocate the sanitary sewer line. Other responsible agencies and additional approvals may be identified through the environmental review process.

At full buildout, the MOB would contain approximately 70 provider offices anticipated to provide the following services:

- Member Services
- Health Education
- Internal Medicine
- Pediatrics
- OB/GYN
- Endocrinology
- Rheumatology
- Dermatology
- Eye Services
- Physical Therapy
- Imaging
- Pharmacy
- Laboratory

Other services, such as an urgent care clinic, may also be included in the MOB, and the mix of services will change over time to reflect the changes needs of the local membership base. There would be approximately 315 employees working at 1650 Los Gamos Drive at full buildout. Many of these employees, about 77%, or 245, would be relocated from existing Kaiser Permanente facilities throughout Marin County. Approximately 70%, or 170, of these relocated Marin employees would be relocated from the Kaiser Permanente Medical Center at 99 Montecillo Road, San Rafael.

The proposed project will not increase the footprint, height or massing of the existing office building. The medical office uses will be contained within the existing building and no substantial exterior changes are proposed to the MOB. The only proposed exterior changes to the existing building at 1650 Los Gamos Drive are minor improvements to the landscaping and new signage to identify the facility and to provide a brand identity.

For purposes of this environmental review, the proposed reuse of the existing building is assumed to have up to 150,000 square feet of medical office space, which is the maximum amount allowed for development under the existing PD zoning.

Draft Traffic Impact Analysis

The project applicant contracted the services of Fehr & Peers to prepare a Draft Transportation Impact Analysis (DTIA) for the proposed project. The DTIA analyzes the transportation impacts associated with the applicant's proposal to add medical office as an allowed use at the existing 1650 Los Gamos Drive office building. Although not considered an environmental impact, the DTIA also included a parking analysis consistent with the City of San Rafael parking requirements. Fehr & Peers determined that the proposed project is an infill development because it does not require new construction on undeveloped land, as the existing office building will not be expanded and the proposed parking structure will be located on the existing parking lot. At the time Fehr & Peers collected data for the DTIA, the existing office building was approximately 34% occupied. However, historically, the office building has been close to 100% occupied over the majority of its existence from 1979 to the late 2000's.

Potential Intersection Improvement

The DTIA identifies a potential intersection improvement for the Lucas Valley Road/Los Gamos Drive interchange. This potential improvement includes signalization of the intersection, providing multiple through and turns lanes, and crosswalks and sidewalks for pedestrians. This intersection improvement is consistent with planned improvements for this intersection identified in the San Rafael General Plan 2020 Policy C-7. The potential intersection improvement in included as Figure 3 below.

Access, Circulation and Parking

There are a total of 455 existing parking spaces allocated to the project site consisting of:

- 204 spaces surrounding the building at 1650 Los Gamos Drive
- 209 spaces on the existing surface parking lot on the west side of Los Gamos Drive
- 42 spaces located on the adjacent 1600 Los Gamos Drive property, which are legally allocated to 1650 Los Gamos Drive through an easement

The overall project site currently provides approximately 3.1 parking spaces to 1,000 square feet of office space (a parking ratio of 3.1:1,000), consistent with the City's municipal code provisions in place at the time the building was originally constructed and in line with the PD District parameters currently in place. To meet current City parking requirements for medical office uses, Kaiser Permanente is required to provide additional parking, as discussed below.

The existing building is served by 455 existing parking spaces. The current City municipal code requires a parking ratio of 4.4 parking spaces per 1,000 square feet of office space for medical uses, which would result in a shortfall of approximately 203 parking spaces once the entire building is utilized as medical office. As a result, Kaiser Permanente needs to provide at least 203 additional parking spaces to meet the City's minimum requirements. In addition, based on its experience, Kaiser Permanente's preferred parking ratio is 5:1,000 (or about 285 additional parking spaces), since many of its members are unable to take public transit due to the health issues for which they are visiting the facility.

To provide adequate parking for the use of the MOB at 1650 Los Gamos Drive, Kaiser Permanente is proposing to construct a new approximately 511-space parking structure on the surface parking lot to the west of the existing building. At 511 parking spaces, the new parking structure would provide a net increase of 302 parking spaces above the current 209 surface spaces. After completion of the parking structure, including the 246 parking spaces that would remain around the MOB, the proposed project would result in a total of 757 parking spaces, meeting the Kaiser Permanente standard. Sheet A-110 of the Design Review Package depicts the potential location of a future parking facility. Kaiser Permanente is still studying the ideal size of the parking structure, but it would not exceed 511 parking spaces and would not provide less than the City required parking minimum of 203 parking spaces.

Parking Structure Design

The proposed parking structure will be partially buried into the hillside and screened by a stand of existing mature trees. The trees will provide a back drop to the parking structure, which also buffers it from surrounding properties. The design of the proposed parking structure is based on a very efficient, straight-forward approach with concrete as the main structural component. There will are railings at each level along the east and north sides of the facility that provide a very open and light architecture. The proposed parking structure will have an enclosed elevator and stair element at the southeast corner adjacent to the existing cross walk. The elevator/stair element will be clad in a material that will provide texture that softens and blends well with the concrete structure. Use of the same cladding at the upper portion of the northeast corner will help define the vehicular entry/exit and wraps the stairs at this end to relate to the elevator/stair element at the opposite end. The proposed parking structure will be fully sprinklered and outfitted with fire extinguishers/cabinets per current codes and ordinances. Fire access will also be provided by fire lanes on both the north and south side of the parking structure, and from Los Gamos Drive. The parking structure will have LED lighting throughout and will be fully accessible per ADA requirements.

Vehicular access will be provided from Los Gamos Drive. The three existing driveways on the east side of Los Gamos Drive will continue to provide primary access to the existing building. The proposed parking structure would be accessed by a single driveway on the west side of Los Gamos Drive, with fire lanes located on both the north and south side of the structure. Kaiser Permanente has requested that the City allow it to stripe "Keep Clear" lane markings in front of the parking structure driveway to permit vehicles turning in and out of the driveway when traffic along Los Gamos Drive is in queue.

Pedestrians will access the project site from the sidewalks on both sides of Los Gamos Drive, connecting to sidewalks along Lucas Valley Road, as well as connecting to the bus pad/stop at the Highway 101 ramp interchange.

Bicyclists will access the project site from the existing Class II bike lane on Lucas Valley Road. The Project will also provide approximately 64 on-site bicycle parking spaces (34 at the MOB, 30 at the parking structure) to encourage bicycle usage.

Transportation Demand Management Program

The San Rafael Medical Center operates an existing transportation demand management program (San Rafael Kaiser Permanente TDM) to increase the use of alternative modes of transportation by employees. Currently, the San Rafael Kaiser Permanente TDM includes the Kaiser Permanente facilities at: 99 Montecillo Road, 820 Las Gallinas, 111 Smith Ranch Road, 100 Smith Ranch Road, 7200 Redwood Blvd., 1033 3rd Street, 3900 Lakeville Hwy, and 97 San Marin Drive. The 1650 Los Gamos Drive MOB would be integrated in the existing program.

The San Rafael Kaiser Permanente TDM will include the following services for Kaiser Permanente employees working at the facilities listed above:

- Transportation manager to oversee the San Rafael Kaiser Permanente TDM
- Commuter subsidy for transit or vanpool use
- Pre-tax community spending accounts
- Guaranteed Ride Home program
- Carpool Matching (provided through 511.org)
- Vanpool Matching
- Internal website that provides information on San Rafael Kaiser Permanente TDM and alternative modes of transportation

The proposed project's MOB will also provide on-site bicycle parking, as well as dedicated parking for carpool/vanpools and electric charging stations for electric vehicles to comply with San Rafael regulatory requirements.

<u>Drainage and Grading</u>

The development of the proposed parking structure will require excavation to partially bury the rear of the structure and with the goal of minimizing the impact to the existing trees. With the current design, approximately 15,000 cubic feet of excavation is required for construction of the proposed parking structure. This 15,000 cubic feet of material would be removed and disposed of off-site. The proposed parking structure will have a concrete retaining wall system integrated with the overall structural system. Retaining walls with be primarily on the south, west and north sides. The water retention/planter area on the east side will utilize concrete retainage.

A 6-inch public sanitary sewer main, operated and maintained by the Las Gallinas Valley Sanitary District ("LGVSD"), runs along a 10-foot easement through the site of the proposed parking structure. This pipe will be re-routed around west and north side of the proposed parking structure footprint.

<u>Proposed Landscaping and Associated Improvements</u>

The parking structure is proposed to be located within the footprint of an existing parking lot to reduce the limits of disturbance. The majority of trees proposed for removal are mature landscaping trees located within this footprint, though many of the larger trees around the perimeter of the existing parking lot would be retained by keeping project construction and grading out of the critical root zones of these trees. Approximately 61 trees are proposed to be removed and 31 new trees would be planted around the perimeter of the parking structure as replacement. The existing and proposed perimeter trees will provide screening of the new parking structure and provide habitat for local species. The design also integrates terraced planter walls that collect and treat stormwater in native planting beds. The terraces transition the grade change from street level to the parking structure.

<u>Planning Applications</u>

In addition to this Initial Study (IS17-001), the 1650 Los Gamos Drive project would require a number of discretionary permits, including the following:

> *Environmental and Design Review (ED17-001)* - The project requires an Environmental and Design Review Permit because it is proposing a new three-story parking structure. The project is subject to the

review criteria for Environmental and Design Review Permits pursuant to San Rafael Municipal Code Section 14.25.050, which provide guidelines for all aspects of project design, including site design, architecture, materials and colors, walls, fences and screening, exterior lighting, signs and landscape design.

Use Permit (UP17-005) - The project includes a request for approval of a use permit to allow medical office, pursuant to Section 14.07.020 of the San Rafael Municipal Code.

Zoning Change (ZC17-001) The project includes a request for PD amendment or zoning change to allow medical office uses in the existing PD ordinance, pursuant to Section 14.07.150 of the San Rafael Municipal Code. This action will create a new PD ordinance specific to 1650 Los Gamos Drive property

Signage Program (SP17-002) - The Project includes a request for approval of a signage master plan for the site.

Existing PD and Amendment Consistency

In conjunction with this project, the City of San Rafael will initiate a concurrent amendment to the existing PD 1590 district, removing references to the building, parking or description of the 1650 Los Gamos site. No other changes to the land use allowance for the County's property at 1600 Los GAmos are proposed This action to amend PD 1590 for 1600 Los Gamos Dr will ensure that prior references to 1650 Los Gamos in the newly created district are separate and apart from the uses and standards attributed to the PD specific to the 1600 Los Gamos Drive property. This action will remove reference to 1650 Los Gamos Drive in PD 1590, and like the zoning change for the proposed project, would therefore create a new PD for the 1600 Los Gamos Drive parcel.

9. Surrounding land uses and setting: Briefly describe the project's surroundings:

The project site is located in North San Rafael, immediately west of US Highway 101 and south of the intersection of Lucas Valley Road and Los Gamos Drive.

10. Other Public Agencies Whose Approval Is Required

[e.g., Permits, Financing Approval, or Participation Agreement.]

The following additional public agencies will review and comment upon the project plans and Initial Study:

- Regional Water Quality Control Board (RWQCB)
- Marin Municipal Water District
- Las Gallinas Valley Sanitary District CalTrans
- Marin County Community Development Agency – Department of Public Works

11. Have California Native American tribes traditionally and culturally affiliated with the project area requested consultation pursuant to Public Resources Code section 21080.3.1? If so, has consultation begun?

Garcia and Associates ("GANDA") sent a letter to the Graton Rancheria of Federated Indians on April 28, 2017 to formally begin the consultation process. The Tribe responded via email on May 17, 2017 requesting updated consultation.

EXHIBITS

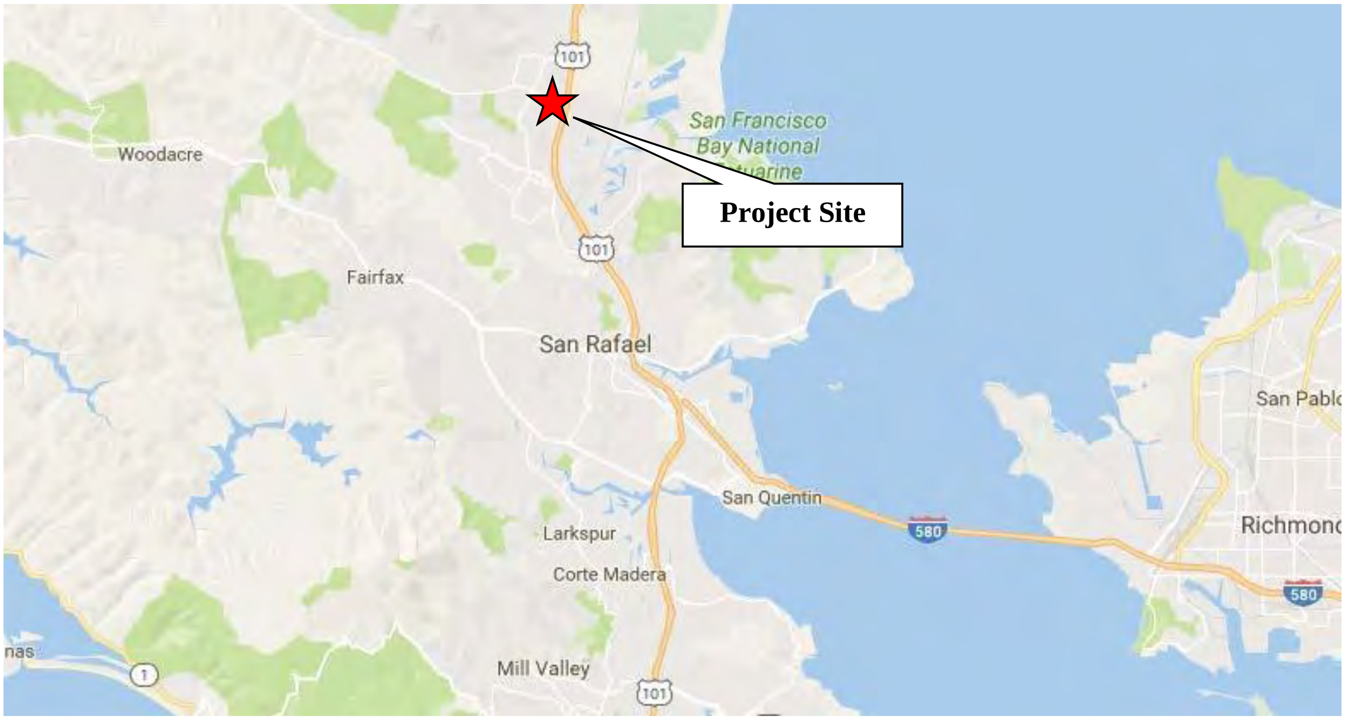

Figure 1: Vicinity Map

Figure 2: Project Site

Figure 3: Site Plan

Figure 4: Parking Structure Perspective

Note: Conceptual illustration not to scale.
Source: BKF, Kaiser Permanente (2017)

Figure 5: Potential Intersection Improvement

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

☐	Aesthetics	☐	Agriculture Resources	☒	Air Quality
☐	Biological Resources	☐	Cultural Resources	☐	Geology /Soils
☒	Greenhouse Gas Emissions	☐	Hazards & Hazardous Materials	☐	Hydrology / Water Quality
☒	Land Use / Planning	☐	Mineral Resources	☒	Noise
☐	Population / Housing	☐	Public Services	☐	Recreation
☒	Transportation / Traffic	☐	Tribal Cultural Resources	☐	Utilities / Service Systems
☒	Mandatory Finding of Significance				

DETERMINATION

On the basis of this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☒ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an EARLIER EIR or NEGATIVE DECLARATION pursuant to applicable legal standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

__________________________________ __________________________
Signature Date

Sean Kennings,
Contract Planner - LAK Associates

EVALUATION OF ENVIRONMENTAL IMPACTS

Evaluation of the Project environmental impacts is prepared as follows:

A brief explanation is provided for all answers except for "No Impact" answers that are adequately supported by the information sources cited in the parentheses following each question below. Answers take into account the whole action involved, including off-site, on-site, cumulative, project-level, direct and indirect, construction and operational impacts. A "No Impact" answer is adequately supported by referenced information sources that show the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone; the project involves a minor zoning text amendments that would not lead to or allow new construction, grading or other physical alterations to the environment). A "No Impact" answer is explained where it is based on project-specific factor as well as general standards (e.g., the project will not expose sensitive receptors to pollutants, based on a project specific screening analysis).

A "Potentially Significant Impact" is appropriate where there is substantial evidence that an effect may be significant. A final determination of one or more Potentially Significant Impacts shall require preparation of an EIR.

A Negative Declaration or Mitigated Negative Declaration shall be prepared for the project if it results in a less than significant impact determination based on the analysis, discussion, source reference materials and/or mitigation measures identified herein (to minimize impacts or reduce impacts from a "Potentially Significant" level). Any mitigation measures shall be described and briefly explain how they reduce the effect to a less than significant level.

Mitigation measures or discussion from earlier analysis may be used where, pursuant to tiering, program EIR or other CEQA process, an effect has been adequately analyzed in an earlier environmental document. Section 15063(c)(3)(D). In this case, the Initial Study below includes a brief discussion of the earlier analysis used, impacts that were previously addressed, and mitigation measures that were incorporated or refined. Supporting information sources are attached and cited in the discussion below.

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
I. AESTHETICS				
Would the project:				
a. Have a substantial adverse effect on a scenic vista?	☐	☐	☐	☒

Discussion:

No Impact: No scenic vistas have been identified in the General Plan at or in the immediate vicinity of this site. The 1650 Los Gamos Drive MOB would be considered an urban infill development project located in the North San Rafael Commercial Center area. The project would involve converting an existing office building to medical office uses and replacing an existing terraced surface parking lot with a three-story parking structure to satisfy parking requirements for the new use. The project would be generally consistent with existing zoning standards and General Plan land use designations. There would be no impact.

(Sources: 1, 3)

	Potentially Significant Impact	*Less-Than-Significant With Mitigation Incorporation*	*Less-Than-Significant Impact*	*No Impact*
b. Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒

Discussion:
No Impact: The project site is located approximately 500 feet west of US 101 Highway at the Lucas Valley Road/Los Gamos Drive intersection in the North San Rafael Commercial Center District. The segment of US 101 is not a designated state scenic highway. Proposed project improvements would occur within footprints of existing disturbance. Although the construction of the parking structure would require removal of existing landscaping trees, this would not be considered an impact to scenic resources. Several mature redwood trees beyond the surface parking lot would be retained as part of the proposed project. As such, because the project is not located within a state scenic highway and would not be substantially damaging scenic resources, there would be no impact.

(Sources: 1, 3)

c. Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☒	☐

Discussion:
Less Than Significant Impact: The proposed project would require the construction of a three-story parking structure on the western parcel (165-220-12) to accommodate the parking spaces required to convert the existing building to medical office uses. Construction of the structure would require the removal of 61existing ornamental trees. Although these trees are primarily mature parking lot landscaping trees, these 61 trees are not considered to have "significant" status per the San Rafael Municipal Code. A total of 31 trees are proposed as replacement as part of the project.

To accommodate the three-story parking structure, excavation will be required to reduce the mass and scale of the parking structure by lowering the profile and burying a portion of the garage into the hillside. Although the parking structure would not project over ridgelines or block views to cause potentially significant impacts on visual resources, the proposed project would represent a new sizable development footprint in an area currently screened by mature landscaping vegetation proposed to be removed. However, the proposed parking structure has been designed to retain mature redwood trees that ring the perimeter of the existing surface parking lot. These mature redwoods create an effective visual screen of the project to the homes in the Mont San Rafael neighborhood above (and west/southwest of) the site. Furthermore, because the proposed parking garage is located in an area formerly developed with surface parking and does not extend outside the existing areas of disturbance; the retention of mature screening vegetation will greatly reduce the potential for visual degradation. The project application includes a photo-simulation from two vantage points within the vicinity of the project: 1.) View from Los Gamos Drive; 2.) View from Salvatore Way. These before and after images are included below:

PHOTOSIMULATION 1: View from Los Gamos looking southwest from Lucas Valley Road intersection prior to (above) and including (below) proposed parking structure

PHOTOSIMULATION 2: View from Salvador Way looking northeast

	Potentially Significant Impact	*Less-Than-Significant With Mitigation Incorporation*	*Less-Than-Significant Impact*	*No Impact*

Although the proposed parking structure can be seen from Los Gamos Drive, the remaining mature vegetation surrounding the structure would reduce visual impacts to views beyond the site. Similarly, the retention of mature trees and landscaping would screen the structure from public vantage points above the site. The proposed project would also require and Environmental and Design Review Permit and consistency with current City of San Rafael General Plan policies and non-residential design guidelines. In addition, the project will be reviewed by the Design Review Board and Planning Commission to evaluate the project's compatibility and harmony with existing development, preservation of existing trees and natural landforms, quality of building materials, and how landscaping would be maintained over time. For these reasons, the impact is considered less than significant and no mitigation is required.

(Sources: 1, 3, 12)

d. Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☒	☐	☐

Discussion:

Less Than Significant Impact with Mitigation Incorporation: The proposed project would include full occupancy of the existing office building with medical office uses. It is anticipated that medical office usage will include after-hours and potentially weekend activity. The project would occupy the entirety of the building, as compared with the current vacancy of the existing building uses. However, historical patterns of use for 1650 Los Gamos would be similar to the full occupancy for the proposed medical office use. Therefore, the proposed usage of the building would not be introducing a new source of light and glare or affect nighttime views.

The proposed project would require the development of a three-story Parking structure on the parcel across Los Gamos Drive. This would result in the introduction of new sources of interior and exterior lighting, as well as landscape and signage lighting. No new exterior building lighting is proposed for the existing building; however, security lighting for the new parking structure, pedestrian walkways and perimeter security lighting would be included. Although typical LED light standards are noted on the plans, all site lighting would be designed to meet the City of San Rafael minimum illumination standards for safety at all exterior doorways, parking areas and ground level walkways. Specific lighting design would be subject to Design Review Board review and approval and standard City conditions of approval. The following mitigation measure is included to ensure that lighting fixtures that meet building codes specifications area included within the project's building plans:

MM AES-1: Prior to the issuance of any building permits, the project applicant shall submit to the satisfaction of the Community Development Department Director, project building plans that include a photometric lighting study demonstrating that outdoor lighting fixtures meet the requirements of the California Energy Code (known as Part 6, Title 24 of the California Code of Regulations).

With the incorporation of Mitigation Measure AES-1, the impact would be considered less than significant and no further mitigation is required.

(Sources: 3, 4)

	Potentially Significant Impact	*Less-Than-Significant With Mitigation Incorporation*	*Less-Than-Significant Impact*	*No Impact*

II. AGRICULTURE AND FOREST RESOURCES

Would the project: {In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland.} In determining whether impacts to a forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy assessment Project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resource Board.

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
a. Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b. Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c. Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 511104(g))?	☐	☐	☐	☒
d. Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☒
e. Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or	☐	☐	☐	☒

conversion of forest land to non-forest use?

Discussion:
No Impact: The project site is located in north San Rafael and is zoned for office development under the current Planned Development (PD 1509) Zoning designation. The site is presently developed with commercial uses and parking areas and is not prime farmland. There are no Williamson Act contracts associated with the subject property, nor is the property zoned for agricultural uses. The proposed project would require the removal of some existing on-site mature trees, but these are not designated as forest land or timberland zoned Timberland Production. There would be no impact.

(Sources: 1, 2, 3)

III. AIR QUALITY

Would the project:	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
a. Conflict with or obstruct implementation of the applicable air quality plan?	☒	☐	☐	☐

Discussion:
Potentially Significant Impact. The project site is in Marin County, which is located within the San Francisco Bay Area Air Basin (SFBAAB). The Bay Area Air Quality Management District (BAAQMD) is responsible for assuring that the Federal and California Ambient Air Quality Standards are attained and maintained in the SFBAAB. The SFBAAB exceeds the state air quality standards for ozone and particulate matter (PM10 and PM2.5). The area is designated nonattainment for national standards of 8-hour ozone, 24-hour PM2.5, and state standards for 24-hour and annual PM10, and annual PM2.5.

The 2010 Clean Air Plan, the regional air quality management plan for the SFBAAB, accounts for projections of population growth provided by the Association of Bay Area Governments (ABAG) and vehicle miles traveled provided by the Metropolitan Transportation Commission (MTC), and it identifies strategies to bring regional emissions into compliance with federal and state air quality standards. BAAQMD encourages local jurisdictions to include General Plan policies or elements that, when implemented, would improve air quality. Although air quality elements are not mandated, general plans are required to be consistent with any air quality policies and programs that exist within that jurisdiction.

For projects, the determination of a significant cumulative air quality impact should be based on the consistency of the project with the Bay Area's most recently adopted Clean Air Plan. A project would be consistent with the 2010 Clean Air Plan if the project would not exceed the growth assumptions in the plan. The primary method of determining consistency with the 2010 Clean Air Plan growth assumptions is consistency with the General Plan land use designations and zoning ordinance zoning designations for the site. If the General Plan growth forecast was adopted prior to the adoption of the 2010 Clean Air Plan, then it can be safely assumed that the 2010 Clean Air Plan incorporates the growth forecast from the General Plan.

The Clean Air Plan assumptions for projected air emissions and pollutants in San Rafael are based on the land use and development projection assumptions in the San Rafael General Plan 2020 (General Plan). The adopted General Plan land use designation for the project site is Office, which permits general, administrative, and medical office uses. As such, the proposed project would not significantly affect regional vehicle miles traveled pursuant to the CEQA Guidelines (Section 15206) because of its consistency with adopted land use plans in the

City of San Rafael. In addition, the proposed project would not have the potential to exceed the level of population or housing foreseen in regional planning efforts.

In 2011, the City of San Rafael adopted a new Sustainability Element for General Plan 2020 that contains a Climate Change Action Plan (CCAP). The CCAP includes goals to achieve greenhouse gas (GHG) level reduction by 2025 and 2050 that exceed the State's goals under AB 32. Because the proposed development project would be consistent with the General Plan land use designation, no analysis of GHG emissions is required under the provisions of the CCAP, provided the project is consistent with the City's "Greenhouse Gas Reduction Strategy Compliance Checklist", which lists all the individual City Ordinances that help implement the City's Sustainability Element goals.

This Initial Study provides a preliminary analysis to identify the impacts of the project upon air quality considerations. Because a comprehensive analysis of traffic-related impacts has not yet been undertaken, the proposed project may potentially result in air quality impacts. Based upon this potential for significant impacts, preparation of an Environmental Impact Report (EIR) is required to further evaluate the project. This threshold will be discussed in the EIR for the proposed project. The EIR will analyze potential traffic mitigation measures, as well as potential temporary and cumulative mitigation measures appropriate to reduce potential air quality impacts to less than significant levels.

(Sources: 1, 3, 4, 18)

b. Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☒	☐	☐	☐

Discussion:
Potentially Significant Impact. See discussion in III (a) above.

(Sources: 1,3, 4)

c. Result in a cumulatively considerable net increase any criteria pollutant 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)?	☒	☐	☐	☐

Discussion:
Potentially Significant Impact. See discussion in III (a) above.

(Sources: 1, 3, 4)

d. Expose sensitive receptors to substantial pollutant concentrations?	☒	☐	☐	☐

Discussion:

Potentially Significant Impact: Sensitive receptors are defined as facilities or land uses that include members of the population that are particularly sensitive to the effects of air pollutants, such as children, the elderly, and people with illnesses. Examples of these sensitive receptors are residences, schools, hospitals, and daycare centers. CARB has identified the following groups of individuals as the most likely to be affected by air pollution: the elderly over 65, children under 14, athletes, and persons with cardiovascular and chronic respiratory diseases such as asthma, emphysema, and bronchitis. Bright Horizons daycare center and the private Fusion Academy school are located approximately 200 feet from the project site at 1600 Los Gamos Drive. The Mont Marin/San Rafael Park residential neighborhood is located 250 feet west of the proposed parking garage.

Localized Carbon Monoxide Hotspots

The SFBAAB is designated as attainment for carbon monoxide (CO). Emissions and ambient concentrations of CO have decreased dramatically in the SFBAAB with the introduction of the catalytic converter in 1975. No exceedances of the CAAQS or NAAQS for CO have been recorded at nearby monitoring stations since 1991. As a result, the BAAQMD screening criteria notes that CO impacts may be determined to be less than significant if a project is consistent with the applicable congestion management plan (CMP) and would not increase traffic volumes at local intersections to more than 24,000 vehicles per hour for locations in heavily urban areas, where "urban canyons" formed by buildings tend to reduce air circulation. Based on the scope of the proposed project (reuse of an existing approximately 148,000 square-foot building from general office to medical office use), traffic would increase along surrounding roadways during long-term operational activities. New net daily trips could be generated as a result of the project, which could lead to CO-related effects. However, according to the DTIA for the proposed project, the entire project would generate approximately 5,400 net new daily trips. Therefore, the project would could generate a significant number of vehicle trips and effects related to CO concentrations would be analyzed in a full EIR. As such, this threshold will be discussed in the EIR for the proposed project.

parking structure Hotspots

Carbon monoxide concentrations are a function of vehicle idling time, meteorological conditions, and traffic flow. Therefore, parking structures tend to be of concern regarding CO hotspots, as they are enclosed spaces with frequent cars operating in cold start mode. Approximately 511 parking spaces would be constructed within the proposed parking structure. The proposed project would be required to comply with the ventilation requirements of the International Mechanical Code (Section 403.5 [Public Garages]), which requires that mechanical ventilation systems for public garages operate automatically upon detection of a concentration of carbon monoxide of 25 ppm by approved detection devices. The 25-ppm trigger is the maximum allowable concentration for continuous exposure in any eight-hour period according to the American Conference of Governmental Industrial Hygienists. The proposed design of the parking structure includes three full levels of parking with open ends. As such, the parking structure would most likely not require mechanical ventilation. Impacts in regards to parking structure CO hotspots would be considered less than significant.

Risk and Health Hazards

According to Section 39655 of the California Health and Safety Code, a toxic air contaminant (TAC) is "an air pollutant which may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health". In addition, substances that have been listed as Federal hazardous air pollutants (HAPs) pursuant to Section 7412 of Title 42 of the United States Code are TACs under the State's air toxics program pursuant to Section 39657 (b) of the California Health and Safety Code. TACs can cause various cancers, depending on the particular chemicals, their type, and duration of exposure. Additionally, some of the TACs may cause other health effects over the short or long term. TACs of particular concern for posing health risks in California are acetaldehyde, benzene, 1-3 butadiene, carbon tetrachloride, hexavalent chromium, para-dichlorobenzene, formaldehyde, methylene chloride, perchlorethylene, and diesel particulate matter.

The proposed medical office building would not generate TACs that would pose a possible risk to off-site uses. Any possible TAC impacts would result solely from construction. Combustion emissions from construction equipment would be generated during project construction and could expose sensitive receptors to diesel particulate matter (DPM) and other TACs. DPM exhaust emissions for project construction from off-road heavy equipment were calculated using CalEEMod.

The BAAQMD's Recommended Methods for Screening and Modeling Local Risks and Hazards (May 2011) was used to complete this screening-level health risk assessment. The BAAQMD recommends a two-tiered approach for screening-level health risk assessments: a screening-level dispersion model is initially applied to project emissions using generally over-predictive assumptions and if the predicted health risk is not within acceptable levels, then a more sophisticated dispersion modeling is necessary.

A screening-level individual cancer analysis was conducted to determine the maximum PM2.5 concentration from diesel exhaust. This concentration was combined with the DPM exposure unit risk factor to calculate the inhalation cancer risk from project-related construction activities at the closest sensitive receptor. The EPA AERSCREEN air dispersion model was used to evaluate concentrations of DPM and PM2.5 from diesel exhaust. The AERSCREEN model was developed to provide an easy to use method of obtaining pollutant concentration estimates and is a single source Gaussian plume model, which provides a maximum one-hour ground-level concentration.

Because construction methods have not been fully evaluated, the proposed project may potentially result in air quality impacts. This threshold will be discussed in the EIR for the proposed project. The EIR will analyze potential traffic and construction mitigation measures, as well as potential temporary and cumulative mitigation measures appropriate to reduce potential air quality impacts to less than significant levels.

(Sources: 1, 2, 3, 4, 5, 18)

e. Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☒

Discussion:

No Impact. The proposed medical office use would be consistent with surrounding uses and long-term operation of the building would not create objectionable odors. There would be no impact.

(Sources: 1, 2, 3)

IV. BIOLOGICAL RESOURCES

Would the project:

a. Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by	☐	☐	☐	☒

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
the California Department of Fish and Game or U.S. Fish and Wildlife Service?				

Discussion:

No Impact. The project site consists of two parcels totaling approximately 11-acres separated by Los Gamos Drive. The 4.09-acre eastern parcel is fully developed with an office building, surface parking lots and landscaped areas. The 7.02-acre western parcel is partially developed with surface parking lot, sidewalks and landscaped areas. The undeveloped areas of this parcel include hillsides with slopes up to 50 percent. Vegetation on the slopes consists of oak woodland with some open grassland patches. Dense riparian vegetation occurs along an unnamed creek that runs along the northeast edge of the property. This is an intermittent creek that drains to Gallinas Creek on the east side of Highway 101, which drains to San Pablo Bay.

Garcia and Associates (GANDA) conducted a biological site assessment and determined that there are no sensitive or special status species adjacent to the proposed project site. GANDA completed the background review and site visit for the proposed project on March 14, 2016. The background review included querying the California Natural Diversity Database (CNDDB; Figure 2); for records of special status species; requesting a species list from the Sacramento Office of the United States Fish and Wildlife Service (USFWS) generated using their Information, Planning, and Conservation System (IPaC); querying the California Native Plant Society (CNPS) Inventory of Rare and Endangered Plants list for the Novato 7.5 minute quadrangle map and reviewing the National Wetlands Inventory. Although several special status species were identified during this search, no occurrences were located on the property and no suitable habitat was identified in the proposed project footprint that could support any of these species or sensitive habitat types. Although some mature landscaping trees would be removed as part of the proposed project, these trees do not constitute suitable contiguous vegetation that would support special status species. As proposed, the Project would not include development or construction outside the limits of existing disturbance or impervious surfaces. For these reasons, there would be no impact and no mitigation would be required.

(Sources: 1, 3, 4, 10)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
b. Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?	☐	☐	☒	☐

Discussion:

Less Than Significant Impact: An unnamed creek runs along the northeast edge of the 1650 Los Gamos Drive property. This intermittent creek drains to Gallinas Creek on the east side of Highway 101, which drains to San Pablo Bay. The creek is culverted within the neighborhoods north of the property, but is open, then culverted, and then open again in the area within the proposed project site. The creek has a natural substrate bottom in the areas which are daylighted and is in relatively good condition. GANDA conducted a survey on March 14, 2016 following a week of rain, and the creek was flowing. The creek was estimated to be approximately 20 feet wide at the Ordinary High Water Mark (OHWM) at the culvert leading under Los Gamos Drive (see attached GANDA Photos 1 and 2).

On the west side of Los Gamos Drive, the creek is lined with riparian vegetation dominated by coast live oak (Quercus agrifolia), valley oak (Quercus lobata), California bay (Umbellularia californica), arroyo willow (Salix lasiolepis) and California buckeye (Aesculus californica). The understory includes poison oak (Toxicodendron diversilobum), California blackberry (Rubus ursinus), vetch (Vicia sp.), English ivy (Hedera helix), Cape ivy (Delairea odorata), French broom (Genista monspessulana), Italian thistle (Carduus pycnocephalus) and soft chess (Avena sp.). On the east side of Los Gamos Road, the creek emerges from an approximately 500-foot long, 36" inch diameter cement culvert that is lined with arroyo willow, Himalayan blackberry (Rubus armeniacus), French broom, English Ivy, and annual grasses. Within the creek bed dense stands of cattails (Typha sp.) were present. The creek was estimated to be approximately 15-20 wide at the OHWM where it emerges from the culvert (see attached GANDA Photos 3 and 4).

The proposed project footprint of disturbance lacks riparian and wetland habitat and does not support any other sensitive natural communities. No work is currently proposed that would modify or impact the channel of the unnamed intermittent tributary to Gallinas Creek. The proposed project site of both buildings and parking lots are serviced by an existing stormwater drainage system managed by the City of San Rafael. Proposed infrastructure and improvements would connect with existing facilities located within the right of way or Los Gamos Drive and would not be dispersed into the intermittent channel.

As proposed, the only physical improvement included in the proposed project would be the construction of the parking structure. However, analysis and discussion in the DTIA provided by Fehr & Peers indicates the need for intersection improvements at Los Gamos Drive and Lucas Valley Road. These improvements include signalization of the intersection, providing multiple through and turns lanes, and crosswalks and sidewalks for pedestrians. The General Plan requires that new projects maintain a minimum 50-foot development-free setback from wetlands, including, but not limited to, paving or structures. However, General Plan Policy CON-6. Creek and Drainageway Setbacks (a) establishes a 25-foot top of creek bank setback for all new development. The proposed improvements, including site development for the parking structure, would be set back approximately 120 feet from the intermittent tributary to Gallinas Creek. Additionally, the preliminary design for the potential intersection indicates that improvements would be located within the existing footprint of disturbance and would not require widening the intersection to the west or northwest.

Implementation of the General Plan Policy CON-6. Creek and Drainageway Setbacks (a) and (b) would establish setbacks for future improvements as a result of the proposed project including the intersection upgrade at Los Gamos Drive and Lucas Valley Road. For these reasons, the impact is considered less than significant and no mitigation is required.

(Sources: 1, 3, 4, 10)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
c. Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☒	☐

Discussion:

Less Than Significant Impact. See discussion in IV (b) above. The project footprint lacks riparian and wetland habitat. The northeastern boundary of the project area has an unnamed intermittent tributary to Gallinas Creek;

however, no work is proposed that would modify or impact this channel. Per the San Rafael General Plan, CON-6. Creek and Drainageway Setbacks, no structures or development is allowed within 25 feet of the top of creek banks. Based on the proposed project design and preliminary recommendation for intersection improvements at Los Gamos Drive and Lucas Valley Road, no structures or development would be located within 25 feet of the unnamed intermittent channel. For these reasons, the impact is considered less than significant and no mitigation is required.

(Sources: 1, 3, 4, 10)

d. Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☒	☐	☐

Discussion:

Less Than Significant Impact with Mitigation Incorporation: See discussion in IV(a) and (b) above. GANDA conducted a biological site assessment of the subject property on March 14, 2016. The proposed project footprint would primarily be kept to the existing developed building and parking lot areas. With implementation of BMPs including erosion control, wildlife exclusion fencing, biological monitoring and protection of sensitive resources, impacts to wildlife species may be avoided. The northeastern boundary of the project area has an unnamed intermittent tributary to Gallinas Creek; however, no work is proposed that would modify or impact this channel. Due to the intermittent nature of this channel, it is not likely to support any native resident fish species. Because the project site is currently developed and the proposed new development is within this developed footprint, no interference with any migratory wildlife corridors or native wildlife nursery sites will occur.

However, the project area, including the landscaped ornamental vegetation and the existing building structure, may support nesting birds and roosting bats. To mitigate impacts to these species, implementation of the following mitigation measure would reduce potential impacts to less than significant levels:

MM BIO-1: Prior to issuance of a grading or building permit, the Project sponsor shall conduct a preconstruction nesting bird and bat survey. Preconstruction surveys shall include the following:

1) Perform any vegetation trimming and/or removal outside of the bird nesting season (Sept. 1 – Feb. 14);
2) Provide a worker environmental awareness training for construction personnel;
3) Perform preconstruction surveys for nesting migratory birds by a qualified biologist no more than 72 hours prior to the start of construction for activities occurring during the breeding season (February 15 to August 31); and
4) If work is to occur within 300 feet of active raptor nests or 50 feet of active passerine nests, non-disturbance buffers will be established at a distance sufficient to minimize disturbance.

(Sources: 1, 3, 4, 10)

e. Conflict with any local policies or ordinances	☐	☐	☒	☐

protecting biological resources, such as a tree preservation policy or ordinance?

Discussion:

Less Than Significant Impact: The project site contains over 300 existing trees, including native oaks and redwoods, and other landscape varietals. Urban Forestry Associates ("UFA") conducted a survey of the project site and identified 274 trees within the planned building envelope for the proposed project that could potentially be impacted by proposed improvements. Of the 274 trees surveyed by UFA, 61 have significance, due to size, and unique character in this locale. The landscape plan (Sheet L-105) indicates an additional 19 trees could be impacted due to their location, resulting in canopy reduction or root zone impacts. UFA provided an arborist report which included recommendations for a Tree Protection Zone (TPZ) to preserve remaining trees on site within the limits of disturbance.

Several mature redwood trees used as screen trees at the west of the parking structure would be retained as part of the proposed project. Furthermore, the balance of the parking structure parcel would remain untouched including mature native and landscaping trees. The proposed project includes 31 replacement trees to the north and east of the proposed parking structure. Although the City's Environmental and Design Review Permit Review Criteria (SRMC Section 14.25.050.G) requires preservation of trees and or equal numbers of replacement trees, revegetating the site with an additional 30 trees would over-burden the available planting areas and increase fire fuel load. As the proposed project is located within a Wildland Urban Interface zone, the proposed replanting plan is consistent with the general requirements of the SRMC. For these reasons, the impact would be considered less than significant and no further mitigation would be required.

(Sources: 2, 3, 10)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
f. Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒

Discussion:

No Impact: There are no Habitat Conservation or Natural Community Conservation Plans within the project area. See discussion above in IV(a). Proposed improvements are specific to the new parking structure and the intersection upgrade at Los Gamos and Lucas Valley Road. Per the biological constraints analysis, no sensitive habitats or species would be impacted by the proposed project. For these reasons, there would be no impact and no mitigation would be required.

(Sources: 1, 3, 4, 10)

V. CULTURAL RESOURCES

Would the project:

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
a. Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☐	☐	☒

	Potentially Significant Impact	*Less-Than-Significant With Mitigation Incorporation*	*Less-Than-Significant Impact*	*No Impact*

Discussion:

No Impact: The proposed project involves amending the current PD zoning to allow medical office uses in the existing building. The existing building was constructed in 1979 and does not meet criteria as defined in CEQA Guidelines Section 15064.5. No physical improvements are proposed to the existing office building, with the exception of updated exterior finishes and branding related to Kaiser Permanente. A new three-story parking structure is proposed to meet current City standards for parking requirements. Modifications to surface parking areas, including new landscaping, would be required for parking upgrades. A signalized intersection would be constructed at Los Gamos and Lucas Valley Road, but would be generally contained to areas of existing site disturbance.

No structures would be modified or removed to facilitate the required parking and circulation improvements. Based on the results of the cultural resources investigation conducted for the proposed project, no cultural resources have been identified within the project area. The existing building, culverts, and drainage system, is associated with the development of the property in the 1980s. Since they are not more than 45 years old, they are not considered cultural resources and there would be no impacts to historical resources as defined in Section15064.5. Therefore, there is no impact and no mitigation is required.

(Sources: 1, 3, 4, 9, 21, 22)

b. Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☒	☐	☐

Discussion:

Less Than Significant Impact with Mitigation Incorporation: According to both the City of San Rafael's adopted Archaeological Sensitivity Map and "PastFinder", a citywide database of parcel-specific archaeological sensitivity reports for development proposals that involve excavation or grading, the parcels that comprise the project site have a sensitivity rating of "low" and no archaeological consultation is recommended prior to initiating a permitted project.

Based upon this preliminary cultural resource investigation, the chance of unknown archaeological resources being uncovered during excavation, grading or construction is remote. However, given the proximity of the site to a creek, an archeological investigation was prepared.

GANDA conducted an archaeological investigation of the subject property and prepared a written report on May 14, 2017. GANDA archaeologist Robin Fies, M.A., conducted a records search for a 0.2-mile radius around the Project Area, at the Northwest Information Center (NWIC) of the California Historical Resources Information System (CHRIS) at Sonoma State University, Rohnert Park (File No. 15-1354). The following sources were consulted during the records search:

1. NWIC base map: USGS 7.5-minute series topographic quadrangle of Novato, California (1980).

2. Survey reports from previous cultural resources investigations and cultural resources site records to identify recorded archaeological sites and built environmental resources (i.e., buildings, structures, and objects) located within a 0.25-mile radius of the APE.

3. California Office of Historic Preservation (OHP) sources, including the California Inventory of Historic Resources (1976), California Archaeological Determinations of Eligibility (2012a), and the Historic Properties Directory (2012b), which combines cultural resources listed as California Points of Historical Interest and California Historical Landmarks and those that are listed in or determined eligible for listing in the National Register of Historic Places (NRHP) or the California Register of Historical Resources (CRHR).

Records Search Results

The records search indicates that two cultural resources investigations have been completed within or directly adjacent to the project area: Chavez 1979 and Darko 2014. Additionally, the records search indicated that eight cultural resources investigations have been completed within a 0.25-mile radius of the project area. The records search did not result in the identification of previously recorded cultural resources in or within a 0.25-mile radius of the project area; however, three prehistoric cultural resources were identified within a 0.5-mile radius of the project area along Miller Creek. None are located within or adjacent to the project area, but rather demonstrate the sensitivity of the area around Miller Creek for prehistoric, Native American resources.

Field Survey Results

Most of the project area is covered by an asphalt parking lot. Areas of natural ground surface were present to the north, west and south of the parking lot. The project area is generally hilly with slopes ranging from 10-30 degrees. The area is grass covered and vegetated in some places with brush, trees, and poison oak. Ground visibility is generally poor, ranging from 0-25 percent, and pockets of exposed soils were examined for artifacts. Las Gallinas Creek runs through the northeastern portion of the project area and through a culvert under Los Gamos Drive. The creek is deeply incised and cuts through hilly areas. The exposed banks within the project area were examined for cultural materials but none were observed. Concrete-lined drainage ditches that feed runoff from Salvador Way up slope down to Las Gallinas Creek and run through the project area. No archaeological materials or sites were observed during the survey.

Based on the results of the cultural resources investigation conducted for the proposed project, no prehistoric or historic-period archaeological resources were identified within the project area.

Although construction of the proposed project would have no impact on known archaeological resources, there is a possibility that previously unidentified archaeological resources and subsurface deposits are present within the project area. If present, excavation, grading, and movement of heavy construction vehicles and equipment could expose, disturb or damage any such previously unrecorded archaeological resources. Because the possibility of encountering archaeological resources during construction cannot be completely discounted, the impact related to the potential disturbance or damage of previously undiscovered archaeological resources, if present, could be significant.

MM CULT-1: Protect Archaeological Resources Identified during Construction: The project sponsor shall ensure that construction crews stop all work within 100 feet of the discovery until a qualified archaeologist can assess the previously unrecorded discovery and provide recommendations. Resources could include subsurface historic features such as artifact-filled privies, wells, and refuse pits, and artifact deposits, along with concentrations of adobe, stone, or concrete walls or foundations, and concentrations of ceramic, glass, or metal materials. Native American archaeological materials could include obsidian and chert flaked stone tools (such as projectile and dart points), midden (culturally derived darkened soil containing heat-affected rock, artifacts, animal bones, and/or shellfish remains), and/or groundstone implements (such as mortars and pestles).

	Potentially Significant Impact	*Less-Than-Significant With Mitigation Incorporation*	*Less-Than-Significant Impact*	*No Impact*

Implementation of MM CULT-1 (Protect of Archaeological Resources Identified during Construction) would reduce impacts on any previously unrecorded and buried archaeological resources to less-than significant-levels by requiring the Project proponent and its contractors to adhere to appropriate procedures and protocols for minimizing such impacts, in the event that a possible archaeological resource is discovered during construction. Following construction, operation of the proposed project would not result in further ground disturbance within the project area. Therefore, no operational impacts to archaeological resources would occur.

Impacts to previously unidentified archaeological resources within the project area would be reduced to a less-than-significant level and no further mitigation is required.

(Sources: 1, 3, 4, 9, 21, 22)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
c. Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☒

Discussion:
No Impact: No known unique paleontological or geologic features have been identified within the project area or on the subject site. A search of the University of California Museum of Paleontology conducted on May 2, 2017 did not yield known fossil localities or unique geologic features within or near the project site. As no unique geologic features were identified in the archival study, no further study is necessary and there is no impact.

(Sources: 1, 3, 4, 9, 21, 22)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
d. Disturb any human remains, including those interred outside of dedicated cemeteries?	☐	☒	☐	☐

Discussion:
Less Than Significant Impact with Mitigation Incorporation: See discussion in V (b) above. There are no formal cemeteries or known interred human remains within the project area or on the subject site. No evidence of human remains was identified within the project area. However, the potential for their presence cannot be entirely ruled out. Construction-related excavation could expose and disturb or damage previously undiscovered human remains.

Therefore, to reduce the potential disturbance of unknown human remains during construction to less than significant levels, the following mitigation measure is proposed:

MM CULT-2: Protect Human Remains Identified During Construction: The Project proponent shall treat any human remains and associated or unassociated funerary objects discovered during soil-disturbing activities according to applicable State laws. Such treatment includes work stoppage and immediate notification of the Marin County Coroner and qualified archaeologist, and in the event that the Coroner's determination that the human remains are Native American, notification of NAHC according to the requirements in PRC Section 5097.98. NAHC would appoint a Most Likely Descendant ("MLD"). A qualified archaeologist, Project proponent, County of Marin, and MLD shall make all reasonable efforts to develop an agreement for the treatment, with appropriate dignity, of any human remains and associated or unassociated funerary objects

(CEQA Guidelines Section 15064.5[d]). The agreement would take into consideration the appropriate excavation, removal, recordation, analysis, custodianship, and final disposition of the human remains and associated or unassociated funerary objects. The PRC allows 48 hours to reach agreement on these matters.

MM CULT-2 would be implemented during project construction to minimize potential impacts on any buried human remains and associated or unassociated funerary objects that may be accidentally discovered during construction activities to less-than-significant levels by requiring the District to adhere to appropriate excavation, removal, recordation, analysis, custodianship, and final disposition protocols. Therefore, implementation of MM CULT-2 would reduce this potential impact on buried human remains to less than significant and no further mitigation is required.

(Sources: 1, 3, 4, 9, 21, 22)

VI. GEOLOGY AND SOILS

Would the project:	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
a. Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☐	☒

The project applicant contracted the services of Geosphere Consultants, Inc. of San Ramon, CA, to evaluate the subsurface conditions at the site and prepare geotechnical recommendations for the proposed new parking structure and roadway widening associated with potential mitigation that may be required for the proposed project. The Geosphere Geotechnical Engineering and Geologic Hazards (GEGH) study provides recommendations for foundations, lateral earth pressures, seismic design parameters, interior and exterior concrete slabs, site preparation, grading, foundation excavation, drainage, utility trench backfilling, and pavement design related to the parking structure and roadway widening and limited surface improvements around the existing building.

Discussion:

No Impact: The subject site is located within the tectonically active and geologically complex northern Coast Ranges but is not mapped within an Alquist-Priolo Earthquake Fault Zone. The northern Coast Ranges were segmented into a series of tectonic blocks separated by major faults including the San Andreas, Rodgers Creek, Hayward, and Calaveras. The project site is situated between the active Rodgers Creek and San Andreas faults, but no known active faults with Holocene movement (last 11,000 years) lie within the limits of the site. In the event of a major earthquake in the Bay Area, the site may be susceptible to seismic shaking and related ground failure. However, surface rupture is highly unlikely at this site since no active faults are known to cross the project site and the site is not located within the Alquist-Priolo Earthquake Fault Zone. There would be no impact.

(Sources: 1, 3, 4, 6, 15)

ii) Strong seismic ground shaking?	☐	☐	☒	☐

Discussion:
Less Than Significant Impact: As discussed in the proposed project's Geotechnical Investigation, strong seismic ground shaking at the site is highly probably during the life of the project. The site will likely experience severe ground shaking from a major earthquake originating from the major active Bay Area faults, particularly the nearby San Andreas Fault (approximately 10.5 miles from the site) or Hayward-Rodgers Creek Fault (approximately 8.5 miles from the site). The intensity of ground shaking will depend on the characteristics of the causative fault, distance from the fault, the earthquake magnitude and duration, and site-specific geologic conditions. The report concludes that the project improvements should be designed in accordance with the California Building Code and recommended seismic design parameters provided in the Table 6.2.1 of the GEGH study. Furthermore, construction level designs would be reviewed and approved by the City of San Rafael pursuant to the most current CBC regulations and standards. For these reasons, the impact is considered less than significant and no mitigation is required.

(Sources: 1, 3, 4, 6, 15)

iii) Seismic related ground failure, including liquefaction?	☐	☐	☒	☐

Discussion:
Less Than Significant Impact: Liquefaction refers to the sudden, temporary loss of soil strength during strong ground shaking. Research and historical data indicate that soil liquefaction generally occurs in saturated, loose granular soil (primarily fine to medium-grained, clean sand deposits) during or after strong seismic ground shaking and is typified by a loss of shear strength in the affected soil layer, thereby causing the soil to flow as a liquid. However, because of the higher inter-granular pressure of the soil at greater depths, the potential for liquefaction is generally limited to the upper 40 feet of the soil. Potential hazards associated with soil liquefaction below or near a structure include loss of foundation support, lateral spreading, sand boils, and areal and differential settlement. Lateral spreading is lateral ground movement, with some vertical component, as a result of liquefaction. Lateral spreading can occur on relatively flat sites with slopes less than two percent under certain circumstances. Lateral spreading can cause ground cracking and settlement.

The project site is not currently within the State of California Special Study Zones. However, as indicated on the Marin Map GIS online mapping tool and the liquefaction hazard susceptible map regenerated by Association of Bay Area Governments (ABAG) based on the United States Geological Survey (USGS), the site is located at the boundary between a zone of very low to low and moderate liquefaction potential. These conditions are also included in Figure 6, Liquefaction Susceptibility Map of the Geosphere GEGH study. The site is predominantly underlain by a layer of shallow very stiff to hard sandy clay to highly weathered, fractured bedrock. Groundwater was not encountered in any of the borings (up to a depth of 27 feet below the existing ground surface). Based on the information collected during the field investigation, laboratory test results, dense nature of the soils encountered in the borings within the project site, and great depth to groundwater, Geosphere concluded that the potential for liquefaction to occur at the project site is not likely. Soil tests at the project site indicate that ground settlement of the near surface soils in a seismic event would be minor. Lurching and ground cracking generally occur along the tops of slopes and the site is located on relatively flat ground, thus the potential for significant lurching and ground cracking is low. For these reasons, the impact is considered less than significant and no mitigation is required.

(Sources: 1, 3, 4, 6, 15)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
iv) Landslides?	☐	☐	☒	☐

Discussion:
Less Than Significant Impact: The project site, including existing office building, is located on an area mainly defined as surficial deposits and not susceptible to landsliding. However, the proposed parking structure site is located in an area defined as few landslides per the Marin Map GIS online mapping database. The parking structure would be constructed on an area previously developed with a surface parking lot but will require excavation and cuts to construct the foundations for the structure. The Geosphere GEGH study includes recommendations for project construction including criteria for foundations, slabs and retaining walls. Furthermore, the risk of slope instability is reduced by adhering to relevant CBC requirements for grading and building design. Therefore, the impact is considered less than significant and no mitigation is required.

(Sources: 3, 5, 6, 15)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
b. Result in substantial soil erosion or the loss of topsoil?	☐	☐	☒	☐

Discussion:
Less Than Significant Impact: Sandy soils on moderate slopes or clayey soils on steep slopes are susceptible to erosion when exposed to concentrated surface water flow. The site is relatively level with little relief thus the potential for significant erosion at the site is minimal. Project development would cover the entire site with the proposed structure and landscaping improvements. As proposed, the civil plans collect surface water into a storm drain system to temporary retention systems onsite and into the City storm drainage system. Erosion control measures during and after construction would be required to conform to the City of San Rafael Public Works Department (DPW) Grading and Construction Erosion and Sediment Control Plan Permit Application Package and the Regional Water Quality Control Board standards. Conditions of approval would be included in project approvals requiring adherence to the various local and regulatory agencies permitting procedures. For these reasons, the impact is considered less than significant and no mitigation is required.

(Sources: 1, 3, 4, 6)

	Potentially Significant Impact	*Less-Than-Significant With Mitigation Incorporation*	*Less-Than-Significant Impact*	*No Impact*
c. Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on, or offsite landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☒	☐

Discussion:

Less Than Significant Impact: The Geosphere GEGH study describes lateral spreading as lateral ground movement, with some vertical component, as a result of liquefaction. The soil rides on top of the liquefied layer. Lateral spreading can occur on relatively flat sites with slopes less than two percent under certain circumstances. Lateral spreading can cause ground cracking and settlement. The project site is not currently within the State of California Special Study Zones. However, per the liquefaction hazard susceptible map regenerated by ABAG based on the USGS and William Lettis & Associates, the site is located at the boundary between a zone of very low to moderate liquefaction potential (see Geosphere Figure 6, Liquefaction Susceptibility Map). The site is predominantly underlain by a layer of shallow very stiff to hard sandy clay to highly weathered, fractured bedrock. Groundwater was not encountered in any of the borings (up to a depth of 27 feet below the existing ground surface).

Withdrawal of groundwater and other fluids (i.e. petroleum and the extraction of natural gas) from beneath the surface has been linked to large-scale land subsidence and associated cracking on the ground surface. Other causes for ground cracking and subsidence include the oxidation and resultant compaction of peat beds, the decline of groundwater levels and consequent compaction of aquifers, hydro-compaction and subsequent settlement of alluvial deposits above the water table from irrigation, or a combination of any of these causes. These factors were not observed at the project site.

The result of the laboratory testing performed on representative sample of the near-surface soils indicated low plasticity soils. Subsurface deposits encountered during the drilling program generally consisted of stiff to hard or medium dense to very dense clay, clayey sand, and bedrock. Collapsible soils are loose chemically bonded fine sandy and silty soils that have been laid down by the action of flowing water, usually in alluvial fan deposits. Terrace deposits and fluvial deposits can also contain collapsible soil deposits. The soil particles are usually bound together with a mineral precipitate. The loose structure is maintained in the soil until a load is imposed on the soil and water is introduced. The water breaks down the inter-particle bonds and the newly imposed loading densifies the soil. These types of soils are not present at this site

Based on the information collected during the field investigation, laboratory test results, dense nature of the soils encountered in the borings within the project site, and great depth to groundwater, Geosphere concluded that there is low potential for liquefaction, subsidence or related ground cracking, and/or collapsible soils at the project site. For these reasons the potential impact is considered less than significant and no mitigation is required.

(Sources: 1, 3, 4, 6)

d. Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code	☐	☐	☒	☐

	Potentially Significant Impact	*Less-Than-Significant With Mitigation Incorporation*	*Less-Than-Significant Impact*	*No Impact*
(1994), creating substantial risks to life or property?				

Discussion:
Less Than Significant Impact: See Response VI (c) above. The Geosphere GEGH study indicates that expansive soils were not observed during their field investigations of the project site and state that the potential for structural damage due to expansive soils is low. Therefore, the potential impact is considered less than significant and no mitigation is required.

(Sources: 1, 3, 4, 6)

	Potentially Significant Impact	*Less-Than-Significant With Mitigation Incorporation*	*Less-Than-Significant Impact*	*No Impact*
e. Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	☐	☐	☐	☒

Discussion:
No Impact: The project site is located in north San Rafael where sewer disposal systems are in place. The project site is currently served with existing sewer service. The proposed project does not include septic tanks or alternative wastewater disposal systems. There would be no impact.

(Sources: 1, 3, 4, 6, 13)

VII. GREENHOUSE GAS EMMISSIONS

	Potentially Significant Impact	*Less-Than-Significant With Mitigation Incorporation*	*Less-Than-Significant Impact*	*No Impact*
Would the project: a. Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☒	☐	☐	☐

Discussion:
Potentially Significant Impact. In 2011, the City of San Rafael adopted a new Sustainability Element for General Plan 2020 that contains a Climate Change Action Plan (CCAP). The CCAP includes goals to achieve Greenhouse Gas (GHG) emissions level reductions by 2025 and 2050 that exceed the State's goals under AB 32.

City of San Rafael GHG Emissions Reduction Strategy
In 2011, the City of San Rafael prepared a GHG Emissions Reduction Strategy to provide technical support to the San Rafael General Plan 2020 (new Sustainability Element) and the 2009-adopted CCAP. This strategy serves as technical appendix (CCAP Appendix E) to the adopted CCAP and meets the BAAQMD requirements for a Qualified GHG Emissions Reduction Strategy. The strategy was adopted by the City Council in July 2011 and includes the following:

- An updated GHG emissions inventory. The initial inventory prepared for the CCAP using the ICLEI modeling program has been updated using more current methodologies for calculating vehicle miles traveled (VMT) and associated emissions. Methane emissions associated with waste disposal were updated using the California Air Resources Board (CARB) Landfill Emission Tool. Stationary sources of emissions have been included in the inventory update per the BAAQMD guidelines and thresholds. The strategy discloses that community-wide GHG emissions in 2005 were 412,804 metric tons of CO2 equivalents (MTCO2e), with 43% of this amount attributed to transportation. This emission estimate is considered the "baseline" for future reduction goals.

- GHG emission projections through year 2035 (consistent with target date set by Senate Bill 375). The projections rely on ABAG projections of housing, population, and employment growth within the City by 2020 (per Senate Bill 32) and 2035 (per Senate Bill 375), as well as Metropolitan Transportation Commission's (MTC) county-specific growth estimates of VTM for Marin County. Based on projected growth, annual emission forecasts under "business as usual" conditions (no application of GHG reduction measures) are estimated at 494,824 MTCO2e by 2035 (19.87% increase).

- Identification of reduction targets. SB 32 and the adopted CCAP target a 25% reduction in 2005 baseline GHG emissions by 2020. For San Rafael, the annual emission reduction target is 385,282 MTCOe for 2020 and 380,765 MTCO2 by 2035.

- Application of reduction measures from CCAP. The strategy quantifies numerous reduction measures from CCAP programs such as: implementing transit-oriented development; participation in Marin Clean Energy; SMART rail service; increased transit service; implementing transportation demand management; promoting alternative and fuel efficient vehicles; promoting zero waste; implementation of Green Building codes; and promoting affordable housing.

- Providing a GHG Emission Reduction Summary. Based on application of the reduction measures and projected growth, estimated annual emissions can be reduced by 56,858 MTCO2e by 2020 and 78,382 MTCO2e by 2035.

Application to new development projects consistent with the San Rafael General Plan 2020.
In order to meet the reduction targets, new construction projects must be determined to be consistent with the GHG Emissions Reduction Strategy. A checklist has been developed to be used in reviewing new development applications, to ensure that GHG reduction measures are incorporated into the project design and operation. Project compliance with the measures in the checklist would exempt individual, quantitative study of GHG emissions for an individual development project. Development projects that are not able to meet the standards in the checklist, or projects that propose an amendment to the San Rafael General Plan (e.g., a change in land use that results in changes to the projections used in the strategy) would require an individual, quantitative GHG emissions assessment.

The project proposes land uses that are permitted by the San Rafael General Plan. Because the proposed project includes the conversion of approximately 148,000 square feet of office space to medical office uses, a quantitative analysis of the new building will be prepared to evaluate the effects of additional peak hour and daily vehicle trips.

Project-related GHG emissions would include emissions from direct and indirect sources. The proposed project would result in direct and indirect emissions of CO2, N2O, and CH4, and would not result in other GHGs that would facilitate a meaningful analysis. Therefore, this analysis focuses on these three forms of GHG emissions. Direct project-related GHG emissions include emissions from construction activities, area sources, and mobile sources, while indirect sources include emissions from electricity consumption, water demand, and solid waste generation. Operational GHG estimations are based on energy emissions from natural gas usage and automobile emissions.

This Initial Study provides a preliminary analysis to identify the impacts of the project upon GHG emissions considerations. Because a comprehensive analysis of traffic, construction and operational activities has not yet been undertaken, the proposed project may potentially result in GHG impacts. This threshold will be discussed in the EIR for the proposed project. The EIR will analyze potential mitigation measures, as well as potential temporary and cumulative mitigation measures appropriate to reduce potential GHG emission impacts to less than significant levels.

(Sources: 1, 2, 3, 4, 5, 12)

b. Conflict with an applicable plan, policy or regulation for the purpose of reducing the emissions of greenhouse gases?	☒	☐	☐	☐

Discussion:
Potentially Significant Impact. See discussion in VII(a). above.

(Sources: 1, 2, 3, 4, 5, 12)

VIII. HAZARDS AND HAZARDOUS MATERIALS

Would the project:

a. Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☒	☐

Discussion:
Less Than Significant Impact. The proposed project includes the reuse of an existing three-story office building from general office uses to medical office use. It is anticipated that the transport of medical equipment and medical waste would occur. Medical and administrative activities would utilize and store hazardous materials typical in medical office and professional office environments. Common office chemicals such as toners, paints, lubricants, hand sanitizer, and kitchen as well as office and restroom cleaners would be used. Additional hazardous and biohazardous materials would be used during patient care, laboratory testing and medical diagnostics activities, as well as for facilities maintenance tasks. These products could potentially include fuels, liquid oxygen, waste oil, battery waste, various liquid medical use chemicals such as skin prep, tissue fixative and medications, and radioactive materials. In addition, the proposed project would include use of a diesel-powered emergency back-up generator. This generator would be located within the existing building footprint and would only be used during emergencies or when being tested (typically, monthly).

	Potentially Significant Impact	*Less-Than-Significant With Mitigation Incorporation*	*Less-Than-Significant Impact*	*No Impact*

Because of the potential health and safety risks of the above hazardous materials, medical facilities such as the proposed project are required to comply with specific federal, state, and local laws and regulations regarding the transportation, storage, use, and disposal of chemical and other materials considered a risk to public health. As a result, areas within the proposed medical office building that contain hazardous chemicals, gases or bio-hazards must be equipped with proper ventilation and secondary spill containment. In addition, flammable materials greater than 5-gallons stored indoors would be kept in fire safety cabinets when not in use. Hazardous materials would be stored in original containers until usage. The hazardous materials would also be stored in locations in each building according to compatibility and in storage enclosures (i.e., flammable material storage cabinets and biological safety cabinets) or in areas or rooms specially designed, protected, and for such storage. Hazardous materials would only be used by personnel that have been trained in the handling and use of the material and that have received proper hazard-communication training. Hazardous materials planning and reporting requirements under the California Hazardous Materials Business Planning, California Proposition 65 notification, and Emergency Planning and Community-Right-to-Know Act would be initiated and completed, as required, for acute care facilities. The proposed project's emergency back-up generator would be subject to the requirements of the California Fire Code, which includes placement limitations and fuel capacity limits. Compliance with specific federal, state, and local hazardous waste laws and regulations would reduce the risk of hazard and hazards to workers, the public, and the environment, such that they would not pose a threat to project occupants or the public. Furthermore, the project plans have been reviewed by City Departments, including Public Works, Police and Fire. Construction activities on the site would not involve materials hazardous to the public. Project development would be subject to City requirements for construction activities including management and transportation of debris disposal and recycling. All construction activities would be subject for inspection by the City.

The proposed project would not involve routine transport, use or disposal of hazardous materials and would not create a significant hazard to the public. For these reasons, the impact is considered less than significant and no mitigation is required.

(Sources: 3, 4, 6, 8, 13)

b. Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☒	☐

Discussion:
Less Than Significant Impact. See discussion in VIII (a) above. The proposed project would not include the use of hazardous materials. Although the proposed project includes the routine use and transport of materials and medical waste, these would not be of the type and/or quantity that would be considered hazardous. Furthermore, laws, regulations, and standards administered through the federal Resource Conservation and Recovery Act of 1976 (RCRA), California Occupational Safety and Health Administration (Cal/OSHA), California Department of Transportation, California Department of Health Services (CDHS), California Environmental Protection Agency (Cal EPA), and the California Fire Code would ensure that the proposed project would implement current safeguards and standards to reduce the risk or chemical and hazardous material exposure at the project site and surrounding environment. The project would not create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the

environment. For these reasons, the potential impact is considered less than significant and no mitigation is required.

(Sources: 3, 4, 8, 13)

c. Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☒	☐

Discussion:
Less Than Significant Impact. See discussion in VIII (a) and (b) above. There is a childcare facility (Bright Horizons at Marin Commons) and a private middle and high school (Fusion Academy) located within a ¼ mile of the project site at 1600 Los Gamos Drive. Federal, state and local laws, regulations, and standards would ensure that the proposed project would implement current safeguards and standards and reduce the risk of hazard and hazards to the public, such that they would not pose a threat to project occupants or the sensitive receptors within ¼ mile of the proposed project site. For these reasons, the impacts are considered less than significant and no mitigation is required.

(Sources: 3, 4, 8, 13)

d. Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒

Discussion:
No Impact: The project site is located within North San Rafael Commercial Center and is not included on a list of hazardous material sites. The project applicant had a Phase I Environmental Site Assessment prepared by Stantec in February 2016. The Phase I report provided research of potential underground storage tanks and concluded there are no such conditions on the project site. For these reasons, there would be no impact.

(Sources: 1, 3, 4, 8, 13)

e. For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒

Discussion:
No Impact: The project site is located within North San Rafael Commercial Center and is not within two miles of a public airport nor located within an airport land use plan. The nearest public airport, Marin County Airport - Gnoss Field in Novato, is approximately 8 miles north of the project site. There would be no impact.

	Potentially Significant Impact	*Less-Than-Significant With Mitigation Incorporation*	*Less-Than-Significant Impact*	*No Impact*

(Sources: 1, 3, 4, 8, 13)

f. For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☒	☐

<u>Discussion:</u>
Less Than Significant Impact: The project site is approximately one-mile west of the private airstrip, San Rafael Airport, in North San Rafael. However, the proposed project includes the conversion of existing office building to medical office uses and only includes minor exterior modifications to the existing building. A parking garage would be constructed in an area previously developed with surface parking. The existing building is not located within the flight path of the San Rafael Airport, nor is located within the noise contours for the airstrip. Construction of the proposed project would not introduce persons to flight paths for the airport. For these reasons, the impact is considered less than significant and no mitigation is required.

(Sources: 1, 3, 4, 8, 13)

g. Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒

<u>Discussion:</u>
No Impact: The proposed project, a reuse of an existing office building for medical office uses, located within North San Rafael Commercial Center, would be consistent with the General Plan and Zoning Ordinance in terms of the types of land uses, including general office and medial office. The proposed project has been reviewed by City Departments, including Public Works, Fire, and Police and responsible agencies. No concerns have been raised about the City's ability to provide continuing services to the project site nor that it would interfere with and adopted emergency response or evacuation plan. There would be no impact.

(Sources: 1, 2, 3, 13)

h. 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?	☐	☐	☒	☐

<u>Discussion:</u>
Less Than Significant Impact: The western parcel of project site, APN 165-220-12, is located within the City's Wildland-Urban Interface zone (WUI). This portion of the project site would include the proposed parking structure. The project includes design features that address potential fire related concerns including access and egress and sprinklers and other fire suppression measures. The proposed project has been reviewed by City Departments, including Public Works and Fire, and no concerns have been raised about exposing people or

structures to significant risk or loss, injury or death involving wildland fires. The existing office building is not located with a WUI zone but includes existing fire protection measures. For these reasons, the impact is considered less than significant and no mitigation is required.

(Sources: 1, 2, 3, 4)

IX. HYDROLOGY AND WATER QUALITY

Would the project:				
a. Violate any water quality standards or waste discharge requirements?	☐	☒	☐	☐

Discussion:

Less Than Significant Impact with Mitigation Incorporation: The site consists of two parcels totaling approximately 11.1 acres separated by a public roadway (City of San Rafael, Los Gamos Drive), in addition to 42 parking existing parking spaces located on the adjacent property at 1600 Los Gamos Drive. The 4.09-acre eastern parcel is fully developed with an office building, surface parking lots, and landscaping areas. The 7.02-acre western parcel is partially developed with surface parking lots and associated landscaping. The undeveloped areas of this parcel include hillsides with slopes up to 50 percent which are covered with trees and ground cover. The proposed project proposes to construct an approximately 511-space parking structure on the western parcel and continue to use the surface parking around the existing office building as well as 42 parking spaces at 1600 Los Gamos Drive. The development of these parcels preceded current stormwater treatment requirements. Drainage runoff is collected in area inlets and pipes and directly discharged to the City of San Rafael storm drainage system.

The proposed project includes the construction of a three-story parking structure in an area previously used for surface parking. Minor exterior modifications to the existing office building would not require expanding the existing footprint or significant development activities around the building. Minor circulation and landscape improvements as well as parking stall restriping would be required to update the existing surface parking areas on the parcel surrounding the existing office building. Development activities associated with the proposed project could result in the discharge of pollutants and could impact the quality of receiving waters during construction activities and during the operational phase.

Construction Activities

Development activities would involve demolition, grading, construction, and paving. During these activities, there would be the potential for surface water runoff from construction sites to carry sediment and pollutants into stormwater drainage systems and local waterways.

Grading and the exposure of shallow soils related to grading could result in erosion and sedimentation. The accumulation of sediment could result in the blockage of flows, potentially causing increased localized ponding or flooding. Construction activities would require the use of gasoline and diesel- powered heavy equipment, such as bulldozers, backhoes, water pumps, and air compressors. Chemicals such as gasoline, diesel fuel, lubricating oil, hydraulic oil, lubricating grease, automatic transmission fluid, paints, solvents, glues, and other substances could be used during construction. An accidental release of any of these substances could degrade the quality of the surface water runoff and adversely affect receiving waters. To ensure potential impacts for construction activities do not violate any water quality standards or west discharge requirements, the following mitigation measure is required:

MM HYDRO-1: Prior to grading activities, the project applicant shall prepare a Stormwater Pollution Prevention Plan (SWPPP) in accordance with the requirements of the statewide Construction General Permit. The SWPPP shall be prepared by a Qualified SWPPP Developer (QSD). The SWPPP shall include the minimum Best Management Practices (BMPs) required for the identified risk level. The SWPPP shall be designed to address the following objectives:

(1) All pollutants and their sources, including sources of sediment associated with construction, construction site erosion, and all other activities associated with construction activity are controlled;
(2) Where not otherwise required to be under a Regional Water Quality Control Board permit, all non-stormwater discharges are identified and either eliminated, controlled, or treated;
(3) Site BMPs are effective and result in the reduction or elimination of pollutants in stormwater discharges and authorized non-stormwater discharges from construction activity; and
(4) Stabilization BMPs installed to reduce or eliminate pollutants after construction are completed.
(5) BMP implementation shall be consistent with the BMP requirements in the most recent version of the California Stormwater Quality Association Stormwater Best Management Handbook-Construction or the Caltrans Stormwater Quality Handbook Construction Site BMPs Manual.

The SWPPP shall include a construction site monitoring program that identifies requirements for dry weather visual observations of pollutants at all discharge locations, and as appropriate, depending on the project risk level, sampling of site effluent and receiving waters. A QSP shall be responsible for implementing the BMPs at the project site. The QSP shall also be responsible for performing all required monitoring, BMP inspection, maintenance and repair activities, and reporting.

Operational Phase

The development of new or replacement impervious surfaces on the project site could result in the discharge of associated pollutants. Runoff from new landscaped areas may contain residual pesticides and nutrients, and occupants of the building and associated foot traffic could increase the amount of trash and debris entering the stormwater drainage system.

MM HYDRO-2: Prior to a certificate of occupancy, the Project applicant shall verify that operational stormwater quality control measures that comply with the requirements of the current Phase II Small MS4 Permit have been implemented. Responsibilities include, but are not limited to:

1) Designing BMPs into Project features and operations to reduce potential impacts to surface water quality and to manage changes in the timing and quantity of runoff associated with operation of the project. These features shall be included in the design-level drainage plan and final development drawings.
2) The proposed project shall incorporate site design measures and Low Impact Development design standards, including minimizing disturbed areas and impervious surfaces, infiltration, harvesting, evapotranspiration, and/or bio-treatment of stormwater runoff.
3) The Project applicant shall establish an Operation and Maintenance Plan. This plan shall specify a regular inspection schedule of stormwater treatment facilities in accordance with the requirements of the Phase II Small MS4 Permit.
4) Funding for long-term maintenance of all BMPs shall be specified.

Implementation of mitigation measures MM HYDRO-1 and 2 would ensure that development activities associated with the proposed project would not result in the discharge of pollutants or impact water quality of standards during construction activities and the ongoing operations of the project site. The potential impacts would be considered less than significant and no further mitigation is required.

(Sources: 1, 3, 4, 7)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
b. Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☐	☒

Discussion:

No Impact: The project is located within the Marin Municipal Water District (MMWD) and would utilize domestic water provided by the MMWD. As a result, the proposed project would not substantially deplete groundwater supplies. MMWD has reviewed the project plans and provided their comments in a letter to the City with the finding that there is adequate water supply to service the proposed project given that the site is already served for nearly 150,000 square feet of office and a reuse of the building to medical office would not significantly increase water use. There are no active wells at the site and the proposed project would have no impact upon groundwater recharge given that the site is fully developed.

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact

Since the new parking structure will displace the existing surface parking lot, there will be no net increase in the amount of impervious surface area. Similarly, improvements to the off-site roadways and existing surface parking lots around the office building will not increase impervious surface areas. As discussed in Response IX.(a) above, surface run off would be governed by a SWPPP, including minimum BMP standards as required by the RWQCB and City of San Rafael municipal code. Furthermore, construction level designs would be required to meet Marin County Stormwater Pollution Prevention Program (MCSTOPP) standards and regulations for storm water runoff as required by the City of San Rafael. As such, the proposed project would not interfere substantially with ground water recharge. For these reasons, the potential impact is considered less than significant and no mitigation is required.

(Sources: 3, 4, 7, 13)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
c. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner, which would result in substantial erosion or siltation on- or off-site?	☐	☒	☐	☐

Discussion:

Less Than Significant Impact with Mitigation Incorporation: The proposed project is an urban infill development and would not impact streambeds, nor result in substantial erosion or siltation on or off-site. However, development of the proposed project would include construction activities that would expose soils and could potentially result in substantial erosion. As discussed previously, the State Water Resources Control Board adopted a NPDES General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit). To obtain coverage under the Construction General Permit, a project applicant must submit various documents, including a Notice of Intent and a SWPPP. Activities subject to the Construction General Permit include clearing, grading, and disturbances to the ground, such as grubbing or excavation.

The purpose of the SWPPP is to identify the sources of sediment and other pollutants that could affect the quality of stormwater discharges and to describe and ensure the implementation of BMPs to reduce or eliminate sediment and other pollutants in stormwater as well as non-stormwater discharges resulting from construction activity. Since the new parking structure will displace an existing surface parking lot, there will be no net increase in the amount of impervious surface area. Similarly, improvements to the off-site roadways and existing surface parking lots around the office building will not significantly increase impervious surface areas. As such, the proposed project would not result in alterations of the existing drainage pattern of the area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site.

However, to ensure that construction activities do no result in substantial erosion or siltation on- or off- site during construction, implementation of mitigation measure MM HYDRO-1 would reduce potential impacts to less than significant levels. No further mitigation is required.

(Sources: 3, 4, 7, 13)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
d. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner, which would result in flooding on- or off- site?	☐	☐	☒	☐

Discussion:

Less Than Significant Impact: The project site contains existing storm drainage infrastructure serving the surface parking lots and office building roof area. The existing storm drainage infrastructure discharges runoff to connections with the City of San Rafael storm drainage system. This existing infrastructure would be repurposed to serve the new parking structure. The new parking structure will displace an existing surface parking lot in generally the same footprint and, as result, there would be no net increase in the amount of impervious surface area. Similarly, improvements to the off-site roadways and existing surface parking lots around the office building will not increase impervious surface areas. As such, the proposed project would not result in flooding on- or off-site.

It is required by Marin County and the City of San Rafael that the proposed development would not increase the discharged storm drain peak flow and volume. Because the site is currently fully covered with structures and a parking lot, redevelopment of the site with the proposed project would not change the flow and volume of storm drain run-off discharged from the site. Bioretention basins, infiltration planters and underground storage (if required) would be designed to eliminate impacts to water quality and quantity downstream. Construction level plans would be required to satisfy the City of San Rafael Urban Runoff Pollution Prevention Ordinance to ensure that no new net run-off or pollutants from stormwater runoff would result from the proposed project. Furthermore, the project would be required to satisfy BMPs and Low Impact Design (LID) to minimize impacts from construction activities. For these reasons, there would be no impact, and no mitigation would be required.

(Sources: 3, 4, 7, 13)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
e. Create or contribute runoff water, which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☒	☐

Discussion:

Less Than Significant Impact: See Response IX (d) above. The project site contains existing storm drainage infrastructure consisting of catch basins and underground piping. The existing storm drainage infrastructure

	Potentially Significant Impact	*Less-Than-Significant With Mitigation Incorporation*	*Less-Than-Significant Impact*	*No Impact*

discharges runoff to connections with the City of San Rafael storm drainage system. This existing infrastructure would be repurposed to serve the parking structure. Since the new parking structure will displace the existing surface parking lot, there will be no net increase in the amount of impervious surface area. Similarly, improvements to the off-site roadways and existing surface parking lots around the office building will not increase impervious surface areas. As such, the proposed project would not result in increased downstream flow rates that would exceed the capacity of the stormwater drainage systems.

(Sources: 3, 4, 7, 13)

f. Otherwise substantially degrade water quality?	☐	☒	☐	☐

Discussion:

Less Than Significant Impact with Mitigation Incorporation: See discussion in IX (d) above. Development activities associated with the proposed project could result in the discharge of pollutants and could impact the quality of receiving waters during construction activities and during the operational phase. As discussed in Section a) above, the project will obtain coverage under the State's Construction General Permit and Phase II Small MS4 Permit. Compliance with these required permits would ensure that runoff during construction and operation of the project site does not substantially degrade water quality.

However, to ensure that construction activities do not substantially degrade water quality, implementation of mitigation measure MM HYDRO-1 and MM HYDRO-2 would reduce potential impacts to less than significant levels. No further mitigation is required.

(Sources: 3, 4, 7, 13)

g. Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒

Discussion:

No Impact. As indicated in the San Rafael General Plan Exhibit 29: Flood Hazard Areas, the project site is located outside the area of the 100-year flood, in a zone that is mapped as the area between the limits of the 100-year flood and the 500-year flood on the current FEMA Flood Insurance Rate Map. The proposed project does not contain any housing units. For these reasons, there would be no impact.

(Sources: 1, 3, 4, 7, 14, 15)

h. Place within a 100-year flood hazard area structures that would impede or redirect flood flows?	☐	☐	☐	☒

Discussion:

No Impact. See discussion in IX (g) above. The proposed project is not located in or near a 100-year flood hazard area and would not redirect flood flows. According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map Number 06041C0293E dated March 16, 2016, the site is located within Zone X, Areas of Minimal Flood Hazard. The proposed improvements are outside any area which would potentially impede or redirect 100-year flood flows. Therefore, there would be no impact and no mitigation is required.

(Sources: 3, 4, 7, 14, 15)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
i. Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☒

<u>Discussion:</u>
No Impact. The project site is in North Central San Rafael and is not susceptible to flooding as a result of the failure of a levee or dam as no such structures are located within the vicinity of San Rafael. The nearest dam, Stafford Lake, is approximately 10 miles northwest of the project site. The project site also would not be subject to flooding from the tidal influenced Gallinas Creek, as identified on the Flood Insurance Rate Map. This is a relatively flat site with urban storm drainage facilities in place within adjacent streets. Stormwater run-off and other drainage infrastructure for the site would be upgraded as part of the development plan to manage runoff from a 100-year storm event, as discussed above in IX (d).

(Sources: 1, 3, 4, 7, 14, 15)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
j. Inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒

<u>Discussion:</u>
No Impact. There would be no risk of inundation by seiche, tsunami or mudflow at the project site. Areas of potential tsunami inundation associated with Gallinas Creek are over half a mile away and ten feet lower in elevation than the project site. In addition, there are no lakes, water towers or other water features that pose a rise of seiche near the building. There would be no impact.

(Sources: 1, 3, 14, 15)

X. LAND USE AND PLANNING

Would the project:

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
a. Physically divide an established community?	☐	☐	☐	☒

<u>Discussion:</u>
No Impact. The project site is designated in the San Rafael General Plan for office 15-32 units per acre (North San Rafael Commercial Center area) and has a PD zoning classification that allows general office (PD 1590). The General Plan designation allows for office, including general, administrative or medical office, however, since the PD1590 was specific to only allow general office, it requires an amendment for this proposed project. The PD 1590 designation also covers a County of Marin-owned property at 1600 Los Gamos Drive. This County-owned and operated building includes general office uses, as well as the Marin County Office of Emergency Services.

However, since the County building also includes a County facility on that site, it is exempt from local zoning control, since it is a superior governmental entity.

The current uses of the project site include similar types of uses to what is envisioned under the proposed project, although they are general office in nature. The project site also includes two surface parking lots: one surrounding the existing building on the east side of Los Gamos, and a second terraced surface lot on the west side of Los Gamos. The proposed project would be consistent with the General Plan land use and Zoning designations, but would require an amendment to the PD to allow for the medical office uses. The proposed project would involve interior remodel of the existing structure and the construction of on and off-site improvements for required parking and circulation upgrades. The proposed improvements are meant to enhance the existing circulation and parking network associated with the existing office building. For these reasons, the proposed project would not physically divide an established community, and therefore, there would be no impact, and no mitigation is required.

(Sources: 1, 2, 3)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
b. 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, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☒	☐	☐	☐

Discussion:

Potentially Significant Impact. As discussed above in X (a), the proposed medical office uses in the proposed project would be consistent with the General Plan Land Use Map designation. An amendment is required to the PD zoning designation to permit medical office use, however, amending the PD would still be consistent with overarching GP land use designation. For instance, the proposed project would be generally consistent with other development standards regulating building height, parking, and landscaping. No physical improvements are required to the existing office building, but a new three-story parking structure would be constructed to accommodate the current parking ratios required by the City of San Rafael. The design of the parking structure would be governed pursuant to San Rafael General Plan Community Design Element Policy CD-10: Nonresidential Design Guidelines.

The parking structure would replace an existing surface parking lot and is not higher than 43 feet above existing grade at the front of the structure (top of elevator tower) and a max height of 26 feet to the top of the third parking deck. The rear of the structure would be approximately 10 feet above existing grade and would be screened from above by existing mature vegetation. As designed, the parking structure would not be visible from surrounding residential neighborhoods, and thus compatible with the immediate neighborhood and the community as a whole. However, since a comprehensive analysis of traffic impacts has not yet been undertaken, the scope of potential project impacts and possible infrastructure improvements will be discussed in the EIR.

Furthermore, as discussed above in Section VII. the proposed project has not yet been evaluated for consistency with the policies in the General Plan CCAP, which seek to limit GHG emissions and implement regional air quality goals. This threshold will be discussed in the EIR for the proposed project. The EIR will analyze potential traffic, construction and operational impacts and develop potential temporary and cumulative mitigation measures appropriate to reduce potential GHG impacts to less than significant levels.

Therefore, the proposed project would need to be further evaluated to ensure there is no conflict with an applicable land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect.

(Sources: 1, 2, 3, 4, 5, 13)

c. Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒

Discussion:
No Impact. The project site is located in the North San Rafael Commercial Center area where there are no adopted habitat conservation plans nor natural community conservation plans for this area. Although the proposed project would include a three story, approximately 511-space parking garage and potential intersection improvements, these site modifications area largely contained within areas of existing disturbance and would not require natural community or habitat disturbance. There would no impact.

(Sources: 1, 3, 4, 5, 10, 11)

XI. MINERAL RESOURCES

Would the project:

a. Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒

Discussion:
No Impact. No known mineral resources would be impacted by the proposed project, which would be located on a previously disturbed site located in the North San Rafael Commercial Center area. There would be no impact.

(Sources: 1, 2, 3, 4)

b. Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒

Discussion:
No Impact. The project site is located in the North San Rafael Commercial Center area and is not identified in the General Plan as a mineral resource recovery site. There would be no impact.

(Sources: 1, 2, 3, 4)

	Potentially Significant Impact	*Less-Than-Significant With Mitigation Incorporation*	*Less-Than-Significant Impact*	*No Impact*

XII. NOISE

Would the project: *a.* Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☒	☐	☐	☐

Discussion:

Potentially Significant Impact. The project is located at the intersection of Lucas Valley Road and Los Gamos Drive in North San Rafael. Adjacent and surrounding properties include open spaces, residential housing and office uses, including the Mont San Rafael neighborhood to the west and the Marin County Office of Emergency Service at 1600 Los Gamos to the south. The undeveloped Oakview property is located north of Lucas Valley Road, and Highway 101 is located east of the project site. The noise environment of the project site is dominated by the traffic noise from Highway 101 and Lucas Valley Road. Additional technical assessment of the noise environment would be evaluated based on the final Traffic Impact Analysis submitted by the project proponent as part of the proposed project.

In addition to traffic related discussions, the proposed project would be evaluated for noise related impacts based on temporary and operational impacts. Although construction methods have not been determined yet, excavation work will be required and standard construction equipment, such as backhoe, drill rig, grader, cement trucks, dump trucks, and hammering of nails for garage construction are assumed. During construction, noise impacts due to construction activities would be required to meet the noise limits of the San Rafael Noise Ordinance (i.e., to be below 90 dBA property plane limit). The Noise Ordinance limits construction activities, including demolition, alteration, maintenance of construction equipment, and deliveries of materials or equipment to the site. Noise is limited to 90 dBA at any point outside the project site. Construction hours are limited to between 7:00 A.M. and 6:00 P.M. from Monday to Friday, and between 9:00 A.M. and 6:00 P.M on Saturday. The proposed project would be required, as a condition of approval, to comply with the City's Noise Ordinance at all times.

This Initial Study provides a preliminary analysis to identify the impacts of the project upon noise considerations. Because a comprehensive analysis of traffic, construction and operational activities has not yet been undertaken, the proposed project may potentially result in noise impacts. This threshold will be discussed in the EIR for the proposed project. The EIR will analyze potential mitigation measures, as well as potential temporary and cumulative mitigation measures appropriate to reduce potential noise impacts to less than significant levels.

(Sources: 1, 2, 3, 4, 5)

b. Exposure of persons to or generation of excessive ground borne vibration or ground borne noise levels?	☒	☐	☐	☐

Discussion:

Potentially Significant Impact. See discussion in XII(a) above. Construction activities are anticipated to include standard excavation equipment and methods for the development project including for placement of drilled piers that may be necessary to provide structural support to the proposed parking garage during site excavation.

Evaluation of the construction activities has not been determined to involve excessive ground borne vibration or ground borne noise levels. This threshold will be discussed in the EIR for the proposed project. The EIR will analyze potential mitigation measures, as well as potential temporary and cumulative mitigation measures appropriate to reduce potential noise impacts to less than significant levels.

(Sources: 1, 2, 3, 4, 5)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
c. A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☒	☐	☐	☐

Discussion:
Potentially Significant Impact. See discussion in XII (a) above. Long term operations of the proposed project are anticipated to function like typical office and/or medical office buildings uses. Activities and operations would not include uses that would be expected to create substantial permanent increases in ambient noise levels. However, with the change in use to medical office, peak hour vehicular access would be an increase over existing conditions. Similarly, the construction of the parking garage creates an increase of on-site parking over existing conditions

Because a comprehensive evaluation of the long-term operational activities of the proposed project has not yet been undertaken, the proposed project may potentially result in a substantial and permanent increase in ambient noise levels in the project vicinity. This threshold will be discussed in the EIR for the proposed project. The EIR will analyze potential mitigation measures, as well as potential temporary and cumulative mitigation measures appropriate to reduce potential noise impacts to less than significant levels.

(Sources: 1, 2, 3, 4, 5)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
d. A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☒	☐	☐	☐

Discussion:
Potentially Significant Impact. See Response XII (a) and (b) above. Discussion of temporary construction noise impacts and ongoing traffic impacts and potential recommended mitigation measures related to the proposed project would be addressed in a EIR.

(Sources: 1, 2, 3, 4, 5)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
e. For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the	☐	☐	☐	☒

project area to excessive noise levels?

Discussion:
No Impact. The project is located in the North San Rafael Commercial Center, near the Lucas Valley/Smith Ranch Road intersection east of the Highway 101. There are no public airports near the project site, but the San Rafael airport, a private airport, is located approximately one mile to the east of the project site but it does not have an airport land use plan. Furthermore, the runway and flight patterns for the airport are directed in a northeast/southwest alignment which directs air traffic away from the project site. There would be no impact.

(Sources: 1, 2, 3, 4)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
f. For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☒	☐

Discussion:
Less Than Significant Impact. See Response XII (e) above. The project is located in the North San Rafael Commercial Center and is approximately one mile west of the private San Rafael airstrip. However, the existing office building would be reused to accommodate medical office use and would not include renovations that would expand the current footprint. Furthermore, the project site is located directly adjacent and west of the Highway 101 freeway which dominates the noise setting for the project site. For these reasons, the impact would be considered less than significant and no mitigation is required.

(Sources: 1, 2, 3, 4)

XIII. POPULATION AND HOUSING

Would the project:

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
a. Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☒	☐

Discussion:
Less Than Significant Impact. The proposed project includes amending an existing San Rafael PD zoning designation to include medical office uses within the existing office building. A new parking structure and signalized intersection would be required to accommodate the traffic associated with the higher intensity of use, from general office to medical office. On the Kaiser Permanante San Rafael Medical Center campus, at 99 Montecillo Road, over half of the buildings are between 39 to 55 years old. Most of the campus has functioned in its current configuration since 1977. At the same time, medicine has significantly changed over the last fifty years, including the need for larger physical space to accommodate today's advancements in medical technology such as MRIs and CT scanners, which were not part of the original campus design.

As a result, space on the campus is very constrained and the ability to enhance services or renovate clinical areas is limited. To better serve the needs of the Kaiser Permanente members, as well as to make the existing medical center less crowded, Kaiser Permanente Kaiser Permanente would be relocating some non-emergency services and other outpatient services from the main Kaiser Hospital site located in Terra Linda at 99 Montecillo Road, San Rafael to the proposed medical office location at 1650 Los Gamos Drive.

There would be approximately 315 employees working at 1650 Los Gamos Drive at full buildout. Many of these employees, about 77%, or 245, would be relocated from existing Kaiser Permanente facilities in Marin County. Approximately 170 of these relocated Marin employees would be relocated from the Kaiser Permanente Medical Center in Terra Linda. Based on the DTIA, new signalization of the current unsignalized intersection at Los Gamos Drive/Lucas Valley Road would be necessary for improving turning movements and reducing the overall traffic congestion along Lucas Valley Road. This improvement is identified in the General Plan Circulation Element, as a circulation improvement identified for build out of the General Plan, and this project triggers the need for its installation.

The proposed project would continue to serve the existing member base and is not anticipated to facilitate growth along Lucas Valley Road. For these reasons, the new medical office building would not substantially induce population growth in the immediate area or within San Rafael. Therefore, the impact would be less than significant and no mitigation is required.

(Sources: 1, 3, 4, 5, 13)

b. Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

Discussion:
No Impact. The proposed project involves amending an existing PD zoning designation to allow medical office uses in an existing approximately 148,000 square foot office building. Proposed infrastructure improvements, including a parking structure and a signalized intersection, would be necessary to lessen potential traffic impacts but would be constructed in areas of previous disturbance. No housing would be impacted by the proposed project.   Therefore, there would be no impact, and no mitigation is required.

(Sources: 1, 3, 4, 5)

c. Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

Discussion:
No Impact. See discussion in XIII (b) above. The proposed project includes the reuse of an existing building comprised of general office uses to medical office space. No housing is proposed as part of the proposed project, and development of the project would include utilizing existing developed areas on a site used for office and related parking.   Therefore, there would be no impact, and no mitigation is required.

(Sources: 1, 3, 4, 5)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact

XIV. PUBLIC SERVICES

Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
a. Fire protection?	☐	☐	☐	☒

Discussion:
No Impact. The proposed project is considered an urban infill development on approximately 11acres. The existing building is currently service by the San Rafael Fire Department Station #6 located approximately 1.25 miles to the southwest at 670 Del Ganado Road. A Marin County Fire Department, Station #58, is located approximately ¾ of mile west of the site at 777 Miller Creek Road at Lucas Valley Road. The proposed project would not be of a scale to require new or physically altered government facilities, nor would it impact the quality of service, response times or other performance objectives for any of the public services. The San Rafael Fire Department has reviewed the proposed project and did not comment on a need for additional services. For these reasons, there would be no impact.

(Sources: 1, 3, 4, 13)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
b. Police protection?	☐	☐	☐	☒

Discussion:
No Impact. The San Rafael Police Department currently provides police protection to the property. The SRPD reviewed the proposed project and did not provide any comments regarding increased calls or additional services. There would be no impact.

(Sources: 1, 3, 4, 13)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
c. Schools?	☐	☐	☒	☐

Discussion:
Less Than Significant Impact. The project site is located in the North San Rafael Commercial Center is served by the San Rafael Unified School District for high schools and Dixie School District for elementary and middle schools. The proposed project includes the reuse of general office to medical office use in an existing office building. No new construction would be required to convert the existing building to medial office uses. Mitigation for impacts on schools is governed by Government Code Section 65995(h), which states that the payment or satisfaction of a fee, charge, or other requirement levied or imposed pursuant to Section 17620 of the Education Code is deemed to be full and complete mitigation of the impacts for the planning, use, development, or the provision of adequate school facilities. Likewise, Section 65996(b) states that the provisions of the Government Code provide full and complete school facilities mitigation. The City collects school impact fees

prior to the issuance of building permits. As such, potential impacts are considered less than significant and no mitigation is required.

(Sources: 1, 3, 4)

d. Parks?	☐	☐	☒	☐

Discussion:

Less Than Significant Impact. The proposed project does not include any residential units and would not result in an increase in population or an increased demand for public services such as parks. Existing San Rafael City parks and recreation facilities within close proximity to the project site in the North San Rafael area include Jerry Russom Memorial Park to the west, Oleander, Terra Linda Park, and Munson Park to the south, and the YMCA is located south of the project on Los Gamos Drive. Further to the east, is the McGuinness Park and Golf Club is located along the Bay shoreline to the east of North San Rafael. Within the City of San Rafael corporate limits, there are a total of 25 parks and three community centers.

As discussed in Section XIII(a) above, space on the campus is very constrained and the ability to enhance services or renovate clinical areas is limited. To better serve the needs of the Kaiser Permanente members, as well as to make the existing medical center less crowded, Kaiser Permanente Kaiser Permanente, would be relocating some non-emergency services and other outpatient services from the main Kaiser Hospital site located in Terra Linda at 99 Montecillo Road, San Rafael to the proposed medical office location at 1650 Los Gamos Drive.

There would be approximately 315 employees working at 1650 Los Gamos Drive at full buildout. Many of these employees, about 77%, or 245, would be relocated from existing Kaiser Permanente facilities in Marin County. Approximately 170 of these relocated Marin employees would be relocated from the Kaiser Permanente Medical Center in Terra Linda. The relocation of services and departments would not be replaced at the current hospital location; rather the vacated spaces would be assimilated by the existing hospital staff. Kaiser does not anticipate creating new jobs or increasing the overall staff and/or services at the two locations. New uses at the project site would be consistent with existing uses at the hospital, which is approximately one mile to the southeast. Access and demand for existing parks in this area would not substantially increase over existing use patterns and would not result in substantial adverse physical impacts. For these reasons, the impact would be considered less than significant and no mitigation is required.

(Sources: 1, 3)

e. Other public facilities?	☐	☐	☒	☐

Discussion:

No Impact. Other public facilities near the proposed project include the new SMART rail station at the Marin Civic Center. Most of the employees (77 percent) slated to work at the MOB at 1650 Los Gamos are current employees at the main Terra Linda Hospital or other local Kaiser Permanente medical facilities. New uses at the project site would be consistent with existing uses at the main hospital location which is approximately one mile to the southeast. Access and demand for existing public facilities in this area would not substantially increase over existing use patterns which would not result in substantial adverse physical impacts. For these reasons, the impact would be considered less than significant impact and no mitigation is required.

(Sources: 1, 2, 3, 4)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
XV. RECREATION				
Would the project:				
a. Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☒	☐

Discussion:

Less Than Significant Impact. See Response XIV(d) above. As discussed in Section XIII(a) and XIV (d) above, space on the campus is very constrained and the ability to enhance services or renovate clinical areas is limited. To better serve the needs of the Kaiser Permanente members, as well as to make the existing medical center less crowded, Kaiser Permanente Kaiser Permanente, would be relocating some non-emergency services and other outpatient services from the main Kaiser Hospital site located in Terra Linda at 99 Montecillo Road, San Rafael to the proposed medical office location at 1650 Los Gamos Drive.

There would be approximately 315 employees working at 1650 Los Gamos Drive at full buildout. Many of these employees, about 77%, or 245, would be relocated from existing Kaiser Permanente facilities in Marin County. Approximately 170 of these relocated Marin employees would be relocated from the Kaiser Permanente Medical Center in Terra Linda. The relocation of services and departments would not be replaced at the current hospital location; rather the vacated spaces would be assimilated by the existing hospital staff. Kaiser does not anticipate creating new jobs or increasing the overall staff and/or services at the two locations. As the proposed new MOB is generally within the same area as the existing hospital and these offices would mainly be occupied by employees of the current Terra Linda and downtown San Rafael locations, the potential increase in use would not result in substantial physical deterioration of existing neighborhood, regional parks or other recreational facilities. Therefore, the impact of the proposed project upon existing parks and recreation facilities would be less than significant and no mitigation is required.

(Sources: 1, 2, 3, 4)

b. Include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment?	☐	☐	☐	☒

Discussion:

No Impact. The proposed project includes the repurposing of an existing office building for use as medical offices. As discussed in XV(a) above, the project would not create a significant adverse impact upon existing City parks and recreational facilities, nor require construction or expansion of recreational facilities that might have an adverse physical effect on the environment. There would be no impact.

(Sources: 1, 2, 3, 4)

	Potentially Significant Impact	*Less-Than-Significant With Mitigation Incorporation*	*Less-Than-Significant Impact*	*No Impact*

XVI. TRANSPORTATION/TRAFFIC

Would the project:				
a. Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant component of the circulation system, including but not limited to intersections, streets, highways, and freeways, pedestrian and bicycle paths, and mass transit)?	☒	☐	☐	☐

Discussion:

Potentially Significant Impact. The project applicant contracted the services of Fehr & Peers to prepare the DTIA for the proposed project. The DTIA analyzes the transportation impacts associated with the applicant's proposal to add medical office as an allowed use at the existing 1650 Los Gamos Drive office building. Although not considered an environmental impact, the DTIA also included a parking analysis consistent with the City of San Rafael parking requirements. Fehr & Peers determined that the proposed project is an infill development because it does not require new construction on undeveloped land, as the existing office building will not be expanded and the proposed parking structure will be located on the existing parking lot. The project site is located in the City of San Rafael, just west of the US 101 / Lucas Valley Road interchange.

The following transportation and circulation significance criteria based on the CEQA Guidelines and the *San Rafael General Plan 2020* (City of San Rafael, 2004) are presented below.

The CEQA Guidelines specify that a project would have a significant traffic and circulation impact if it:

- Conflicts with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit.

- Conflicts with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways.

- Results in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks

- Substantially increases hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment).

- Conflicts with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

1.4.2.1 Signalized Intersections

The *San Rafael General Plan 2020* includes traffic LOS standards for signalized intersections and arterials. These criteria and interpretations consistent with the *San Rafael General Plan 2020* Environmental Impact Report (City of San Rafael, 2004), are presented below. The citywide LOS standard from the *San Rafael General Plan 2020* is LOS D

The *San Rafael General Plan 2020* defines the following as significant impacts:

- If a signalized intersection with baseline traffic volumes is operating at an acceptable LOS (LOS A, B, C, or D) and deteriorates to an unacceptable operation with the addition of project traffic.

- If a signalized intersection with baseline traffic volumes is at an unacceptable LOS (LOS E or F) and project traffic causes an increase in the delay of five seconds or more, the *San Rafael General Plan 2020* states that signalized intersections along US 101 and Interstate 580 are exempt from LOS standards because delay at these locations are affected by regional traffic and not significantly impacted by local measures.

1.4.2.2 Unsignalized Intersections

The *San Rafael General Plan 2020* does not provide significance thresholds for unsignalized intersections. Therefore, this analysis utilizes the commonly accepted methodology provided in the Highway Capacity Manual (2010) as documented by the Transportation Research Board. For the purposes of this analysis, a significant impact at an unsignalized intersection would be identified based on the following:

- If an unsignalized intersection with baseline traffic volumes is operating at an acceptable LOS (LOS A, B, C, D, or E) and deteriorates to an unacceptable operation (LOS F) with the addition of Project traffic; or

- If an unsignalized intersection with baseline traffic volumes is already operating at LOS F and Project traffic causes an increase in the delay of five seconds or more.

1.4.2.3 Freeway

The *San Rafael General Plan 2020* and *Transportation Authority of Marin Congestion Management Plan* (CMP) do not provide significance thresholds for freeway segments. Therefore, this analysis utilizes the commonly accepted methodology consistent with other traffic impact studies completed in the surrounding area. For the purposes of this analysis, a significant impact at a freeway segment would be identified based on the following:

- If operations on US 101 deteriorate from LOS E or better under conditions without the project to LOS F during the AM or PM peak hour; or

- If operations on US 101 operating at unacceptable LOS F under conditions without the project by causing the freeway volume over capacity ratio (v/c) to increase by 0.01 or more (i.e. one percent of the freeway segment capacity) during the AM or PM peak hour.

1.4.2.4 Bicycle/Pedestrian

The *San Rafael General Plan 2020* includes the following goals for pedestrian and bicycle conditions:

Goal 16: Bikeways. It is the goal of San Rafael to have safe, convenient and attractive bikeways and amenities.

Goal 17: Pedestrian Paths. It is the goal of San Rafael to have safe, convenient and pleasurable pedestrian amenities.

Consistent with these goals, bicycle/pedestrian impacts would be significant if the project:

- Caused a substantial inconvenience or substantial reduction in quality of service for users of existing bicycle or pedestrian travel
- Substantially reduced bicycle or pedestrian access
- Substantially reduced safety for bicyclists or pedestrians

1.4.2.5 Transit
The *San Rafael General Plan 2020* includes the following goals related to the transit network:

C-14 Transit Network. Encourage the continued development of a safe, efficient, and reliable regional and local transit network to provide convenient alternatives to driving. Consistent with this goal, transit impacts would be significant if the project:

- Induced substantial growth or concentration of population beyond the capacity of existing or planned public transit facilities.
- Increased demand for public transit service to such a degree that accepted service standards are not maintained.
- Reduced availability of public transit to users, or interfered with existing transit users.

1.4.2.6 Parking
While parking is not considered a parking an environmental impact, a parking analysis was completed for information purposes. The *San Rafael General Plan 2020* includes the following goal related to vehicle parking:

General Plan Goal 18: Adequate Parking. It is the goal of San Rafael to provide parking that is adequate and accessible, with attention to good design.

The DTIA study analyzes expected transportation conditions with the proposed project condition in place under Existing, Baseline, and Cumulative conditions. Fehr & Peers determined that the proposed project would result in transportation impacts at several intersections. As such, the DTIA includes potential mitigation measures to reduce the proposed project's impacts to less than significant with mitigation incorporated, where feasible. Potential mitigation measures include improving the Lucas Valley Road/Los Gamos Drive intersection, consistent with the improvements identified in the San Rafael General Plan 2020, and a Transportation Demand Management (TDM) program to reduce peak hour employee single-occupant vehicle trips.

This Initial Study provides a preliminary analysis to identify the impacts of the project upon traffic and transportation considerations. Because a comprehensive analysis of traffic and parking has not yet been completed, the proposed project may potentially result in significant traffic and transportation impacts. Based upon this potential for significant impacts, preparation of an EIR is required to further evaluate the project. As such, the preliminary evaluation of the DTIA recognizes that a full analysis, complete with revisions and updated data and discussions, will be prepared as a Final TIA and will be included as part of the EIR process. Although, the DTIA may be referenced in the EIR, the Final TIA would be the source document for the final analysis. Therefore, the EIR will analyze potential mitigation measures, as well as potential temporary and cumulative mitigation measures appropriate to reduce potential traffic and transportation impacts to less than significant levels.

(Sources: 1, 3, 4, 5, 12)

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
b. Conflict with an applicable congestion management program, including, but not	☒	☐	☐	☐

limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?

Discussion:

Potentially Significant Impact. See Response XVI (a) above. Intersection and freeway results will be summarized in the EIR by Level of Service (LOS). LOS is a qualitative description of operations ranging from LOS A, when the roadway facility has excess capacity and vehicles experience little or no delay, to LOS F, where the volume of vehicles exceeds the capacity, resulting in long queues and excessive delays. Typically, LOS E represents "at-capacity" conditions and LOS F represents "over-capacity" conditions. Intersection and freeway LOS were established based on traffic analysis of the study intersections, conducted using a method documented by the Transportation Research Board (TRB) in the 2010 Highway Capacity Manual (HCM).

The DTIA utilized traffic analysis software Synchro/SimTraffic 9.0 and was based on the City of San Rafael's existing traffic model. For purposes of modeling the entire network as a "system", micro-simulation (SimTraffic) was used. The primary difference between SimTraffic and HCM is that the HCM analyzes intersections in isolation and does not include the effects of upstream or downstream intersections, which directly affect traffic flow. SimTraffic provides measures of effectiveness that are consistent with the HCM such as movement delay and weighted average delay. For signalized intersections, the LOS is based on the average delay experienced by all vehicles passing through the intersection.

At unsignalized intersections, operations are defined by the average control delay per vehicle (measured in seconds) for each stop-controlled movement. This incorporates delay associated with deceleration, acceleration, stopping, and moving up in the queue. For side-street stop-controlled intersections, LOS is not defined for the intersection as a whole. Instead, the average delay and associated LOS reported in this study is for the worst-case controlled approach. For all-way stop-controlled intersections, the LOS is represented by the average control delay for the whole intersection.

Similar to intersection, the operating characteristics of freeway basic, merge, and diverge segments are evaluated using the concept of LOS. Freeway section LOS is based on vehicle density (passenger cars per lane per mile). Subsequent EIR analyses will consider freeway ramp density using the methods described in Chapter 13 of the HCM. The inputs to calculate freeway segment densities would be obtained through Caltrans data and field observations.

The purpose of the freeway analysis is to determine the proposed project's contribution to the available capacity on the freeway; therefore, the Highway Capacity Software (HCS) was used to complete the analysis. HCS was used because it applies the freeway methodologies in the HCM by accounting for the volume demand and available capacity by segment. The HCS tool is a static model which does not account for downstream queues. However, since the purpose of the analysis is to determine the proposed project's contribution to the regional network, and not to determine or mitigate existing bottlenecks or queues, the static model approach was the most appropriate to account for the proposed project's contribution. To supplement for existing queues as a result of downstream bottlenecks, field observations were completed and included in analysis findings.

The VMT analysis forecasted the propose project employee VMT and compared them to future projected VMT based on the regional transportation and land use model provided by the Metropolitan Transportation Commission

(MTC) and the Association of Bay Area Governments (ABAG). The proposed project will move employees from existing compressed Kaiser facilities in Marin County, to the building at 1650 Los Gamos Drive. As such, the proposed project is not expected to generate significant additional regional trips, rather, redistribute them to a new location within the region. The VMT analysis is based on the California Environmental Quality Act (CEQA) Guidelines on VMT developed by the Governor's Office of Planning and Research per SB 743 (Steinberg, 2013). SB 743 mandates a change in the way that public agencies evaluate the transportation impacts of projects under CEQA, away from LOS. The proposed changes to the CEQA Guidelines are not yet adopted; when they are, VMT will be the new metric for transportation analysis.

The San Rafael General Plan 2020 proposes circulation or capital improvements deemed necessary to maintain acceptable LOS standards and to improve the San Rafael circulation system, which are typically funded through traffic mitigation fees. As noted above in XVI (a), the proposed project would result in a net increase of 161 net new trips during the a.m. peak hour and 312 net new trips during the p.m. peak hour for a total of 473 peak hour trips. As provided in General Plan 2020 Policy C-5 B, the City Traffic Engineer makes the determination whether to apply LOS analysis for any development project. Presently, the Level of Service for intersections in the project vicinity along Lucas Valley and Los Gamos are at or very close to LOS D. The project's peak hour trips would cause additional delays of up to 50 seconds at these impacted intersections.

The City Traffic Engineer has reviewed the project plans and the DTIA and recommends a condition of project approval be required that the applicant pay traffic mitigation fee in the amount of $2,000,825 based on 473 net new peak hour trips x traffic mitigation fee ($4,246) prior to issuance of a Building Permit. This traffic impact fee would be credited to the applicant against proposed improvement or potential requirements for infrastructure upgrades, including the construction of a signalized intersection at Los Gamos and Lucas Valley Road. In addition, San Rafael DPW has an established construction vehicle impact fee that is required at the time of building permit issuance; which would be calculated at 1% of the total project valuation, with the first $10,000 of valuation exempt.

As the DTIA will be further evaluated by the City of San Rafael, potential conflicts with applicable congestion management programs, including, but not limited to level of service standards and travel demand measures have not yet been identified and could remain significant and unavoidable. Based upon this initial review, preparation of an EIR is required. The EIR will provide analysis of potential traffic impacts and potential cumulative impacts and mitigation measures necessary to reduce potential impacts to less than significant levels. The EIR would also address project alternatives to analyze this potentially significant adverse impact.

(Sources: 1, 2, 4, 5, 13)

c. Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒

Discussion:

No Impact. The proposed project would have no impact on the location or frequency of air traffic patterns at local private or regional-serving public airports due to its location. Although there is a private airport approximately one mile to the east of the subject property, the proposed project would be a continuation of office related uses and is consistent with the General Plan for development in this area. The existing building is not located within the flight path of the airport and the conversion of medical office would not result in a change of air traffic patterns.

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact

(Sources: 1, 3, 4, 5)

d. Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☒	☐	☐	☐

Discussion:

Potentially Significant Impact. The proposed project is an urban infill development within the North San Rafael Commercial Center and would be consistent with General Plan in terms of land use and intensity. The proposed project includes modification of existing site access, eliminating the primary driveway off Los Gamos to the existing surface parking lot and relocating it farther south for access to the new parking structure. The project traffic study was evaluated by the City of San Rafael Department of Public Works for traffic and circulation compliance with City standards, including potential conflicts to site distances, and found them to be acceptable. However, the full analysis of proposed project improvements, including proposed signalized intersection at Los Gamos and Lucas Valley Road have not yet been evaluated.

This Initial Study provides a preliminary analysis to identify the impacts of the project upon traffic and transportation considerations. Because a comprehensive analysis of traffic and transportation considerations has not yet been undertaken, the proposed project may potentially result in such impacts. This threshold will be discussed in the EIR for the proposed project. The EIR will analyze potential mitigation measures, as well as potential temporary and cumulative mitigation measures appropriate to reduce potential traffic and transportation impacts to less than significant levels.

(Sources: 1, 3, 4, 5, 13)

e. Result in inadequate emergency access?	☐	☐	☐	☒

Discussion:

Less Than Significant Impact. The proposed project includes the reuse of an existing office building to accommodate medical office uses. Access, parking and circulation patterns would remain largely unchanged for the building. Across Los Gamos Drive, a parking structure would be constructed in an area previously used for surface parking. The proposed ingress and egress, including required fire access and fire lanes surrounding the parking structure, have been reviewed by City departments, including the San Rafael Fire Department. It has been determined that the proposed project would have adequate emergency access. There would be no impact.

(Sources: 1, 3, 4, 5, 13)

f. Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	☒	☐	☐	☐

Discussion:

Potentially Significant Impact. Based on the DTIA, it is anticipated that the proposed project would include construction of a signalized intersection at Los Gamos Drive and Lucas Valley Road, as well as a new three-story parking structure west of the existing office building adjacent to Los Gamos Drive. Per the City's adopted Bicycle/Pedestrian Master Plan, which guides the City in the construction, upgrading and maintenance of the citywide bicycle and pedestrian infrastructure system, there is a Class III bike lane along Los Gamos Drive connecting Lucas Valley Road to Freitas Parkway to the south. Public transit is provided to the project area by Golden Gate Transit (GGT); the nearest GGT stop is located adjacent to Highway 101 just east of the project site. The project would be consistent with the City's General Plan policies that encourage urban infill development close to public transit services. The project site is located approximately 3.5 miles north of the San Rafael Transit Center and approximately 1.3 miles north of the new SMART rail station at the Marin Civic Center.

However, the full analysis of proposed project improvements, including a proposed signalized intersection at Los Gamos and Lucas Valley Road and the construction of the parking structure, have not been fully evaluated with regards to bicycle and pedestrian facilities or public access plans, programs, and/or policies.

This Initial Study provides a preliminary analysis to identify the impacts of the project upon traffic and transportation considerations. Because a comprehensive analysis of traffic and transportation considerations has not yet been undertaken, the proposed project may potentially result in such impacts. This threshold will be discussed in the EIR for the proposed project. The EIR will analyze potential mitigation measures, as well as potential temporary and cumulative mitigation measures appropriate to reduce potential traffic and transportation impacts to less than significant levels.

(Sources: 1, 2, 3, 4, 5, 13)

XVII. TRIBAL CULTURAL RESOURCES

Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is *G*eographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
a. Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or	☐	☒	☐	☐

	Potentially Significant Impact	*Less-Than-Significant With Mitigation Incorporation*	*Less-Than-Significant Impact*	*No Impact*
b. A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in Subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.	☐	☒	☐	☐

Discussion:

Less Than Significant Impact with Mitigation Incorporation. See Responses V (a), (b) and (c) above. The proposed project analyzed by GANDA included a cultural resources investigation. The report includes an archival and record search of the 24-acre subject parcel and a surrounding 0.25-mile radius, contact with the Native American Heritage Commission ("NAHC") and potential Native American stakeholders, and a field inventory of the subject parcel that included an architectural review of standing buildings and structures that lie within the proposed development area. The existing office building is less than 45 years old and was built in 1979.

Pursuant to AB 52, the scope of the evaluation at the project level should include consultation with Native American representatives identified by the NAHC for areas outside of reservations, and with Tribal representatives of federally recognized Tribes where projects are located near or within lands associated with federally recognized Tribes. The consultation should be undertaken and be consistent with most recent guidance provided by the Office of Planning and Research. The purpose of the consultation is to identify Tribal cultural resources and ensure that such resources are taken into consideration in the planning process.

On March 17, 2016, a records search was conducted at the NWIC/CHRIS at Sonoma State University in Rohnert Park, California by GANDA Archaeologist Robin Fies, M.A. (File No. 15-1354). The NWIC is a repository of all cultural resources site records, previously conducted cultural resources investigations, and historic information concerning cultural resources for 18 counties, including Marin County. The purpose of this records search was to compile information pertaining to the locations of previously recorded cultural resources and prior cultural resources studies within a 0.5-mile radius of the ADI that inform the cultural resources sensitivity of the Project.

The following sources were consulted during the records search:

- NWIC base map: USGS 7.5-minute series topographic quadrangles of Novato, California (1980);
- Survey reports from previous cultural resources investigations and cultural resources site records to identify recorded archaeological sites and built environmental resources (i.e, buildings, structures, and objects) located within a 0.5-mile radius of the ADI; and
- California Office of Historic Preservation (OHP) sources, including the California Inventory of Historic Resources (1976), California Archaeological Determinations of Eligibility (2012a), and the Historic Properties Directory (2012b), which combines cultural resources listed as California Points of Historical Interest and California Historical Landmarks and those that are listed in or determined eligible for listing in the NRHP or the CRHR.

The records search results indicate that two cultural resources investigations have been completed within or directly adjacent to the ADI: Chavez 1979 and Darko 2014. Additionally, the records search indicated that eight cultural resources investigations have been completed within a 0.25-mile radius of the ADI: Hastings 1975; Melandry 1981; Chavez 1985; Flynn 1989; Woodward-Clyde Consultants 1991; Holman 1976; and Roop 1992a and 1992b.

No cultural resources were identified within the project site or within a 0.25-mile radius of the project site; however, three documented prehistoric archaeological sites (CA-MRN-138, 139, and 145) along Miller Creek are within a 0.5-mile radius of the project site. The three prehistoric archaeological sites are listed below:

> **P-21-000163/CA-MRN-138:** This prehistoric shellmound site is located approximately 0.42 mile north of the ADI along the south bank of Miller Creek. Several artifacts have been identified in association with the site including chert debitage and a small cobble pestle. This site was likely heavily impacted as a result of historic and modern development (Riddell 1955a). This site has not been formally evaluated for listing in the CRHR or the NRHP.
>
> **P-21-000164/CA-MRN-139:** This prehistoric shellmound site is located approximately 0.49-mile northwest of the ADI along the south bank of Miller Creek. Human burials have been identified in association with the site in addition to chert debitage. This site was historically looted and was likely heavily impacted through historic and modern development (Riddell 1955a). This site has not been formally evaluated for listing in the CRHR or the NRHP.
>
> **P-21-000170/CA-MRN-145:** This prehistoric shellmound site is located approximately 0.50 mile northwest of the ADI along the north bank of Miller Creek (Nelson 1907). This site was likely destroyed through historic and modern development and has not been formally evaluated for listing in the CRHR or the NRHP.

Based on the results of the cultural resources investigation conducted for this proposed project, no tribal cultural resources were identified within the project area. The NAHC was contacted by letter on March 16, 2016. A search of the Sacred Lands File housed at the NAHC did not indicate the presence of any Native American cultural resources in the vicinity of the Project. In the response dated April 5, 2016, the NAHC also provided a list of individuals to contact from the FIGR) for further information regarding local knowledge of sacred lands. Letters and associated maps were sent to individuals listed by the NAHC (Greg Sarris and Gene Buvelot) on April 27, 2017 as well as Buffy McQuillen, FIGR's Tribal Heritage Preservation Officer (THPO). The THPO contacted GANDA on May 18, 2017 to schedule a formal consultation but no meeting has been confirmed as of the publication of this document.

Although construction of the proposed project would have no impact on known tribal cultural resources, there is a possibility that previously unidentified resources and subsurface deposits are present within the project area. If present, excavation, grading, and movement of heavy construction vehicles and equipment could expose, disturb or damage any such previously unrecorded tribal cultural resources. Because the possibility of encountering archaeological resources during construction cannot be completely discounted, the impact related to the potential disturbance or damage of previously undiscovered archaeological resources, if present, could be significant.

However, as the proposed project could have the potential to encounter unknown tribal cultural resources during ground-disturbance activities, implementation of the following mitigation measures is required:

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact

MM TRIBAL-1: Implementation of the unanticipated discovery measures outlined in Section V(b) and (d) above, address the potential discovery of previously unknown resources within the project area. If significant tribal cultural resources are identified onsite, all work would stop immediately within 50 feet of the resource(s) and the project applicant would comply with all relevant State and City policies and procedures prescribed under PRC Section 21074.

Therefore, implementation of the above mitigation measure as well as implementation of mitigation measures MM CULT-1 and MM CULT-2 will reduce the potential impact to less than significant levels and no further mitigation is required.

(Sources: 1, 3, 4, 9, 21, 22)

XVIII. UTILITIES AND SERVICE SYSTEMS

Would the project:	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
a. Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☒	☐

Discussion:

Less Than Significant Impact. The project site is within the North San Rafael Commercial Center which is served by the Las Gallinas Valley Sanitation District (LGVSD), which provides sanitary sewer service to the north San Rafael area. Wastewater is transmitted to the LGVSD treatment facility, located at 300 Smith Ranch Road in San Rafael. The proposed medical office use would result in similar intensity of development at the project site and would continue an existing use and service. Although the current occupancy of the existing building is well below 50 percent, the proposed project anticipates occupancy rates consistent with historical averages for the building. The LGVSD has reviewed the project, provided comments and will require that the development project submit an Application for Allocation of Capacity and pay additional capacity fees prior to submittal of a building permit. The proposed project would not conflict with the existing capacity of wastewater delivery to LGVSD or the ability of the waste water treatment facility to treat the additional wastewater generated by the project. For these reasons, the impact is considered less than significant and no mitigation is required.

(Sources: 1, 3, 4, 13)

b. Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☒	☐

Discussion:

Less Than Significant Impact. See discussion in XVIII(a), above. Local water service is currently provided by Marin Municipal Water District (MMWD) to the project site for the existing office building. It its comment letter, MMWD stated that providing water service to the new medical office building would not impair the District's ability to continue service to the property. However, MMWD has determined that the property's current annual water entitlement may be insufficient for the new uses (including the new parking structure) and the purchase of additional water entitlement may be required, as well as compliance with all indoor and outdoor requirements of District Code Title 13 for water conservation.

The construction of the proposed parking structure would require realignment and reconstruction of a portion of a 6-inch sanitary sewer pipe currently running under the middle of the surface parking lot. The proposed realignment would direct sanitary sewer to the north of the proposed parking structure and then east to a connection within Los Gamos Drive. The routing of the proposed sanitary sewer line would be located within the limits of disturbance propose for the parking structure and would not require increase or excessive grading or excavation to realign the pipe. The LGVSD has reviewed the proposed project and would require project design plans for the proposed realignment including preparation of a quitclaim deed and new sewer easement for recordation by the LGVSD. For the reasons, the impact is considered less than significant and no mitigation is required.

(Sources: 4, 13, 16)

c. Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☒	☐

Discussion:

Less Than Significant Impact. Proposed storm drainage design for the proposed project including assessment of impacts upon existing facilities in the vicinity of the project site have been evaluated in a Preliminary Drainage Analysis prepared by BKF Engineers. As discussed in Section IX, Hydrology and Water Quality, the construction of new stormwater drainage facilities or expansion of existing facilities would not be required for the proposed project, because the Project would not increase the amount of surface water runoff leaving the site. The project will incorporate the use of bio-filtration areas onsite to limit the amount of surface water runoff from the site. The application of this best management practice, as well as the application of the City's standard conditions of project approval, would result in an improved condition in comparison to the existing site conditions.

The San Rafael DPW has reviewed the proposed project plans and indicated that detailed project plans will be required to accurately define square footage of existing impervious areas, as well as proposed creation or replacement areas. In addition, San Rafael DPW will require that the proposed project detailed plans be compliant with requirements for the MCSTOPPP for improved water quality and reduction of runoff impacts compared to existing conditions. No new offsite storm drainage facilities or expansion of existing facilities would be required as a result of project construction. Therefore, the impact would be considered less than significant and no mitigation is required.

(Sources: 3, 4, 7, 16, 20)

d. Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☒	☐

Discussion:

Less Than Significant Impact. See discussion in XVIII (b) above. The MMWD prepared an Urban Water Management Plan (UWMP) in 2010 and an update in 2015. Based upon the MMWD 2015 UWMP update, adequate water supply is available for the proposed project. Based upon water demand projections, the UWMP forecasts that the MMWD would serve an additional 49 acre-feet per year of water for commercial uses by the year 2020. This is to serve a projected 251 additional commercial accounts by the year 2020. The District's water conservation measures are expected to result in a drop of per capita water demand resulting in an overall decrease in water use for commercial uses despite an increasing number of projected accounts by the year 2020. The proposed 150,000 square feet of medical office use is within the project amounts of the UWMP.

The State of California has recently endured a period of extended drought that spanned water years 2012 through 2016, which included the driest four-year statewide precipitation on record (2012-2015) and the smallest Sierra-Cascades snowpack on record (2015, with 5 percent of average). It was marked by extraordinary heat: 2014, 2015 and 2016 were California's first, second and third warmest year in terms of statewide average temperatures.

The State responded to the emergency with actions and investments that also advanced the California Water Action Plan, the Administration's five-year blueprint for more reliable, resilient water systems to prepare for climate change and population growth. To advance the priorities of the Water Action Plan and respond to drought, the voters passed a comprehensive water bond, the Legislature appropriated and accelerated funding and state agencies accelerated grants and loans to water projects.

California also enacted the historic Sustainable Groundwater Management Act, took action to improve measurement and management of water, retrofitted tens of thousands of inefficient toilets, replaced lawns with water-wise landscaping and provided safe drinking water to impacted communities.

However, on April 7, 2017, Governor Edmund G. Brown ended the drought state of emergency due to unprecedented water conservation and plentiful winter rain and snow. Executive Order B-40-17 lifts the drought emergency in all California counties except Fresno, Kings, Tulare and Tuolumne, where emergency drinking water projects will continue to help address diminished groundwater supplies. The order also rescinds two emergency proclamations from January and April 2014 and four drought-related executive orders issued in 2014 and 2015.

Executive Order B-40-17 builds on actions taken in Executive Order B-37-16, which remains in effect, to continue making water conservation a way of life in California:

- The State Water Resources Control Board will maintain urban water use reporting requirements and prohibitions on wasteful practices such as watering during or after rainfall, hosing off sidewalks and irrigating ornamental turf on public street medians.
- The State will continue its work to coordinate a statewide response on the unprecedented bark beetle outbreak in drought-stressed forests that has killed millions of trees across California.

Therefore, potential impacts to water supply are considered less than significant and no new or expanded entitlements are needed.

(Sources: 3, 4, 13, 16, 17)

e. Result in a determination by the wastewater treatment provider, which serves or may	☐	☐	☒	☐

serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?				

Discussion:
Less Than Significant Impact. See discussion in XVII (a) and (b), above. The LGVSD would provide wastewater services to the proposed project and has adequate facilities to accommodate the proposed use at the project site. Waste water generation and impacts on the LGVSD have been addressed in the in the San Rafael General Plan. The continuation of existing service to the project site would not result in impacts to the LGVSD facility at Smith Ranch Road. The LGVSD has reviewed the project and provided comments, indicating that the proposed project is required to submit an application for Allocation of Capacity as well as fees for sewer unit and plumbing fixtures as required. Thus, no additional impacts to wastewater treatment capacity would result from the proposed project and impacts would be considered less than significant.

(Sources: 1, 3, 4, 13, 16)

f. Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☒	☐

Discussion:
Less Than Significant Impact. Solid waste collected within the City of San Rafael is disposed of at the Redwood Landfill. The Redwood Landfill is a fully permitted Class III disposal site located approximately five miles north of the project site (3.5 miles north of the City of Novato), and is used for more than 95 percent of Marin County's solid waste disposal, including solid waste from the City of San Rafael. The Redwood Landfill site consists of 420 acres of which 222.5 acres are dedicated to waste disposal and the balance supports Composting, Recycling, and Operations facilities as well as open space and a fresh water lagoon. The Redwood Landfill has a permitted capacity of 19,100,000 cubic yards. Nearly one-half of the materials brought to the site are reused or recycled, contributing to one-third of the recycling that occurs in Marin County. Redwood Landfill is permitted to accept 2,310 tons of material daily. The conversion of existing office space to medical office uses would not significantly change the amount of solid waste generated within the City because the development would not significantly change the number of people working and living within the City as planned in the City's General Plan population counts and would not significantly alter the amount of waste generated within the City. As the project would be consistent with the existing General Plan, potential impacts are considered less than significant

(Sources: 1, 4, 19)

g. Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☒	☐

Discussion:
Less Than Significant Impact. See discussion in XVII (f), above. Solid waste disposal services for the project site would be handled by Marin Sanitary Service and the Redwood Landfill. Both entities are subject to the California Integrated Waste Management Act to meet state waste diversion goals. Both entities offer recycling services to minimize the solid waste that is deposited it the landfill. Marin Sanitary Service offers curbside recycling and green waste composting. The Redwood Landfill recycles approximately 50 percent of the

materials brought to the landfill site. The proposed project would be served by these entities and the existing recycling and waste reduction programs which comply with the California Integrated Waste Management Act.

The Marin Hazardous and Solid Waste Joint Powers Authority (JPA) provides hazardous waste collection, recycling, and disposal information to ensure compliance with state recycling mandates. The Marin County Department of Public Works/Waste Management administers the JPA. The JPA comprises the cities and towns of Belvedere, Corte Madera, Fairfax, Larkspur, Mill Valley, Novato, Ross, San Anselmo, San Rafael, Sausalito, and Tiburon, and the County of Marin. The JPA's purpose is to ensure Marin's compliance with the California Integrated Waste Management Act and its waste reduction mandates. The project would comply with the JPA through the recycling and waste reduction services provided by Marin Sanitary Service and the Redwood Landfill. Therefore, potential impacts are considered less than significant.

(Sources: 1, 4, 19)

XIX. MANDATORY FINDINGS OF SIGNIFICANCE

Would the project:	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporation	Less-Than-Significant Impact	No Impact
a. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☒	☐	☐

Discussion:

Less Than Significant Impact with Mitigation Incorporation. The proposed project, with implementation of the proposed mitigation measures, would not have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory. As discussed above, the proposed project would be located on areas of existing disturbance or development. Where potential impacts to wildlife or plant communities would occur, proposed mitigation measures in Section V. Biology would ensure that they would be reduce to less than significant levels. For these reasons, the impact would be considered less than significant after mitigation incorporation and no further mitigation would be required.

(Sources: 1-21)

b. Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in	☒	☐	☐	☐

	Potentially Significant Impact	*Less-Than-Significant With Mitigation Incorporation*	*Less-Than-Significant Impact*	*No Impact*
connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?				

Discussion:

Potentially Significant Impact. The project applicant has submitted a Draft Traffic Impact Analysis (DTIA) of the proposed project that will be evaluated pursuant to CEQA and the City of San Rafael standards and regulations. This Initial Study provides a preliminary analysis to identify the impacts of the project upon Air Quality, Greenhouse Gas Emissions, Noise, and Traffic and Transportation considerations. Based upon this initial review, preparation of an Environmental Impact Report (EIR) is required to understand the full evaluation of these potential environmental impacts. The EIR will provide analysis of the potential traffic, construction, and operational impacts and as a result would provide mitigation measures necessary to reduce potential cumulative impacts to less than significant levels. The EIR would also address project alternatives to analyze potentially significant cumulatively considerable adverse impacts.

(Sources: 1-21)

c. Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☒	☐	☐	☐

Discussion:

Potentially Significant Impact. See discussion above in XVIII (b), where potentially significant impacts on human beings from noise and traffic and transportation are identified and recommended mitigation measures to reduce these impacts to a less than significant level are identified.

(Sources: 1-21)

SOURCE REFERENCES

The following is a list of references used in the preparation of this document. Unless attached herein, copies of all reference reports, memorandums and letters are on file with the City of San Rafael Department of Community Development. References to Publications prepared by Federal or State agencies may be found with the agency responsible for providing such information.

1. City of San Rafael General Plan 2020, adopted November 2004; as amended through July 2016.

2. City of San Rafael General Zoning Ordinance, adopted September 1992; as amended May1996.

3. Marin County GIS; Marin Map; www.marinmap.org, accessed May 2017

4. Application Packet submitted by Kaiser Permanente, including site plan, architectural plans, landscape plans, civil plans, and additional materials and exhibits.

5. Focused Traffic Impact Analysis for Medical Office Building, Fehr & Peers, November 29, 2016.

6. Geotechnical Engineering and Geologic Hazards Study, GEOSPHERE Consultants, INC., October 19, 2016

7. Hydrology and Water Quality, Los Gamos Medical Office Building CEQA Review, BKF Engineers, February 10, 2017

8. Updated Phase I Environmental Site Assessment 1650 Los Gamos Drive and Adjacent West Parcel, San Rafael, California 94903, STANTEC, February 22, 2016

9. Archaeological Resources Report for the Kaiser Permanente 1650 Los Gamos Medical Office Project, San Rafael, Marin County, Ca; Garcia and Associates, May 2, 2017

10. Kaiser Permanente 1650 Los Gamos Drive Project, San Rafael, California – Biological Resources CEQA Review, Garcia and Associates, May 17, 2017

11. Arborist Plan Review, Urban Forestry Associates, March 17, 2017.

12. City of San Rafael Greenhouse Gas Reduction Strategy Compliance Checklist

13. Inter-departmental and Agency Memoranda: 1) Public Works Department, May 14, 2017; 2) Fire Prevention, March 15, 2017; Police Department, March 15, 2017; Las Galinas Valley Sanitation District, March 14, 2017; Marin Municipal Water District; comment letter, Christopher Borjian, May 23, 2017

14. Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM). Community Panel No. 06041C0293E, effective March 16, 2016

15. Association of Bay Area Governments, Alquist-Priolo Earthquake Fault Zoning and Hazard Maps

16. MMWD 2010 Urban Water Management Plan
17. California Drought Portal, www.drought.ca.gov, accessed May 2017

18. BAAQMD website: http://www.baaqmd.gov/

19. Redwood Landfill website: *http://www.redwoodlandfill.wm.com/*

20. MCSTOPP: *http://www.marincounty.org/depts/pw/divisions/mcstoppp*

21. City of San Rafael Archaeology Sensitivity Map, adopted October 2001.

22. PastFinder Archaeological Database, Archaeological Sensitivity Report, generated May 1, 2017

DETERMINATION FOR PROJECT

On the basis of this Initial Study and Environmental Checklist I find that the proposed project could have a Potentially Significant Effect on the environment and an ENVIRONMENTAL IMPACT REPORT will be required.

____ ____________________
Signature Date

___________________________________ ______________________________
Printed Name Title

REPORT AUTHORS AND CONSULTANTS

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KAISER MEDICAL OFFICE BUILDING AIR QUALITY AND GREENHOUSE GAS EMISSIONS ASSESSMENT

SAN RAFAEL, CALIFORNIA

February 16, 2018

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Project: 16-043

Introduction

The purpose of this report is to address the air quality and greenhouse gas (GHG) impacts associated with the proposed Kaiser Medical Office Building (MOB) and parking structure project at 1650 Los Gamos Drive in San Rafael, California. As part of the project, the existing three-story, 148,000-square-foot (sf) building would be converted into a medical office space.[1] Additionally, the construction of a three-story parking garage consisting of up to 476 parking spaces would be included in the proposed project. No changes are proposed to the existing surface parking lot located at the site.

Air pollutant and GHG emissions associated with construction of the project were modeled. In addition, the potential construction health risk impacts to nearby sensitive receptors were evaluated. This analysis addresses those issues following the guidance provided by the Bay Area Air Quality Management District (BAAQMD).

Setting

The project is located in the Marin County, which is in the San Francisco Bay Area Air Basin. Ambient air quality standards have been established at both the State and federal level. The Bay Area meets all ambient air quality standards with the exception of ground-level ozone, respirable particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$).

Air Pollutants of Concern

High ozone levels are caused by the cumulative emissions of reactive organic gases (ROG) and nitrogen oxides (NO_X). These precursor pollutants react under certain meteorological conditions to form high ozone levels. Controlling the emissions of these precursor pollutants is the focus of the Bay Area's attempts to reduce ozone levels. The highest ozone levels in the Bay Area occur in the eastern and southern inland valleys that are downwind of air pollutant sources. High ozone levels aggravate respiratory and cardiovascular diseases, reduced lung function, and increase coughing and chest discomfort.

Particulate matter is another problematic air pollutant of the Bay Area. Particulate matter is assessed and measured in terms of respirable particulate matter or particles that have a diameter of 10 micrometers or less (PM_{10}) and fine particulate matter where particles have a diameter of 2.5 micrometers or less ($PM_{2.5}$). Elevated concentrations of PM_{10} and $PM_{2.5}$ are the result of both region-wide (or cumulative) emissions and localized emissions. High particulate matter levels aggravate respiratory and cardiovascular diseases, reduce lung function, increase mortality (e.g., lung cancer), and result in reduced lung function growth in children.

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[1] While the current zoning allows up to 150,000 sf, 148,000 sf are proposed as part of the project. That is, the existing building would be reused with no sf additions.

Toxic Air Contaminants

Toxic air contaminants (TAC) are a broad class of compounds known to cause morbidity or mortality (usually because they cause cancer) and include, but are not limited to, the criteria air pollutants. TACs are found in ambient air, especially in urban areas, and are caused by industry, agriculture, fuel combustion, and commercial operations (e.g., dry cleaners). TACs are typically found in low concentrations, even near their source (e.g., diesel particulate matter [DPM] near a freeway). Because chronic exposure can result in adverse health effects, TACs are regulated at the regional, State, and federal level.

Diesel exhaust is the predominant TAC in urban air and is estimated to represent about three-quarters of the cancer risk from TACs (based on the Bay Area average). According to the California Air Resources Board (CARB), diesel exhaust is a complex mixture of gases, vapors, and fine particles. This complexity makes the evaluation of health effects of diesel exhaust a complex scientific issue. Some of the chemicals in diesel exhaust, such as benzene and formaldehyde, have been previously identified as TACs by the CARB, and are listed as carcinogens either under the State's Proposition 65 or under the Federal Hazardous Air Pollutants programs.

Applicable Regulatory Setting

Federal Regulations

The United States Environmental Protection Agency (EPA) sets nationwide emission standards for mobile sources, which include on-road (highway) motor vehicles such trucks, buses, and automobiles, and non-road (off-road) vehicles and equipment used in construction, agricultural, industrial, and mining activities (such as bulldozers and loaders). The EPA also sets nationwide fuel standards. California also has the ability to set motor vehicle emission standards and standards for fuel used in California, as long as they are the same or more stringent than the Federal standards.

In the past decade the EPA has established a number of emission standards for on- and non-road heavy-duty diesel engines used in trucks and other equipment. This was done in part because diesel engines are a significant source of nitrogen oxides, or NO_X, and particulate matter (PM_{10} and $PM_{2.5}$) and because the EPA has identified diesel particulate matter as a probable carcinogen. Implementation of the heavy-duty diesel on-road vehicle standards and the non-road diesel engine standards are estimated to reduce PM and NO_X emissions from diesel engines up to 95 percent in 2030 when the heavy-duty vehicle fleet is completely replaced with newer heavy-duty vehicles that comply with these emission standards.[2]

In concert with the diesel engine emission standards, the EPA has also substantially reduced the amount of sulfur allowed in diesel fuels. The sulfur contained in diesel fuel is a significant contributor to the formation of particulate matter in diesel-fueled engine exhaust. The new

[2] USEPA, 2000. Regulatory Announcement, Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements. EPA420-F-00-057. December 2000.

standards reduced the amount of sulfur allowed by 97 percent for highway diesel fuel (from 500 parts per million by weight [ppmw] to 15 ppmw), and by 99 percent for off-highway diesel fuel (from about 3,000 ppmw to 15 ppmw). The low sulfur highway fuel (15 ppmw sulfur), also called ultra-low sulfur diesel (ULSD) is currently required for use by all vehicles in the U.S.

All of the above Federal diesel engine and diesel fuel requirements have been adopted by California, in some cases with modifications making the requirements more stringent or the implementation dates sooner.

State Regulations

To address the issue of diesel emissions in the state, CARB developed the Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles.[3] In addition to requiring more stringent emission standards for new on-road and off-road mobile sources and stationary diesel-fueled engines to reduce particulate matter emissions by 90 percent, a significant component of the plan involves application of emission control strategies to existing diesel vehicles and equipment. Many of the measures of the Diesel Risk Reduction Plan have been approved and adopted, including the Federal on-road and non-road diesel engine emission standards for new engines, as well as adoption of regulations for low sulfur fuel in California.

CARB has adopted and implemented a number of regulations for stationary and mobile sources to reduce emissions of DPM. Several of these regulatory programs affect medium and heavy duty diesel trucks that represent the bulk of DPM emissions from California highways. CARB regulations require on-road diesel trucks to be retrofitted with particulate matter controls or replaced to meet 2010 or later engine standards that have much lower DPM and $PM_{2.5}$ emissions. This regulation will substantially reduce these emissions between 2013 and 2023. While new trucks and buses will meet strict federal standards, this measure is intended to accelerate the rate at which the fleet either turns over so there are more cleaner vehicles on the road, or is retrofitted to meet similar standards. With this regulation, older, more polluting trucks would be removed from the roads sooner.

CARB has also adopted and implemented regulations to reduce DPM and NO_X emissions from in-use (existing) and new off-road heavy-duty diesel vehicles (e.g., loaders, tractors, bulldozers, backhoes, off-highway trucks, etc.). The regulations apply to diesel-powered off-road vehicles with engines 25 horsepower (hp) or greater. The regulations are intended to reduce particulate matter and NO_X exhaust emissions by requiring owners to turn over their fleet (replace older equipment with newer equipment) or retrofit existing equipment in order to achieve specified fleet-averaged emission rates. Implementation of this regulation, in conjunction with stringent Federal off-road equipment engine emission limits for new vehicles, will significantly reduce emissions of DPM and NO_X.

[3] California Air Resources Board. *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles*. October 2000.

Bay Area Air Quality Management District (BAAQMD)

BAAQMD has jurisdiction over an approximately 5,600-square mile area, commonly referred to as the San Francisco Bay Area (Bay Area). The District's boundary encompasses the nine San Francisco Bay Area counties, including Alameda County, Contra Costa County, Marin County, San Francisco County, San Mateo County, Santa Clara County, Napa County, southwestern Solano County and southern Sonoma County.

BAAQMD is the lead agency in developing plans to address attainment and maintenance of the National Ambient Air Quality Standards and California Ambient Air Quality Standards. The District also has permit authority over most types of stationary equipment utilized for the proposed project. The BAAQMD is responsible for permitting and inspection of stationary sources; enforcement of regulations, including setting fees, levying fines, and enforcement actions; and ensuring that public nuisances are minimized.

The BAAQMD *CEQA Air Quality Guidelines*[4] were prepared to assist in the evaluation of air quality impacts of projects and plans proposed within the Bay Area. The guidelines provide recommended procedures for evaluating potential air impacts during the environmental review process consistent with CEQA requirements including thresholds of significance, mitigation measures, and background air quality information. They also include assessment methodologies for air toxics, odors, and greenhouse gas emissions. In June 2010, the BAAQMD's Board of Directors adopted CEQA thresholds of significance and an update of their *CEQA Guidelines*. In May 2011, the updated BAAQMD *CEQA Air Quality Guidelines* were amended to include a risk and hazards threshold for new receptors and modify procedures for assessing impacts related to risk and hazard impacts.

Sensitive Receptors

There are groups of people more affected by air pollution than others. CARB has identified the following persons who are most likely to be affected by air pollution: children under 16, the elderly over 65, athletes, and people with cardiovascular and chronic respiratory diseases. These groups are classified as sensitive receptors. Locations that may contain a high concentration of these sensitive population groups include residential areas, hospitals, daycare facilities, elder care facilities, elementary schools, and parks. For cancer risk assessments, children are the most sensitive receptors, since they are more susceptible to cancer causing TACs. Residential locations are assumed to include infants and small children. The closest sensitive receptors to the project site are residences to the west and southwest of the proposed parking structure, and the Bright Horizons daycare at Marin Commons to the south.

Significance Thresholds

In June 2010, BAAQMD adopted thresholds of significance to assist in the review of projects under CEQA. These thresholds were designed to establish the level at which BAAQMD believed air pollution emissions would cause significant environmental impacts under CEQA

[4] Bay Area Air Quality Management District, 2011. *CEQA Air Quality Guidelines*. May.

and were posted on BAAQMD's website and included in the Air District's updated CEQA Guidelines (updated May 2011). The significance thresholds identified by BAAQMD and used in this analysis are summarized in Table 1.

The BAAQMD's adoption of significance thresholds contained in the 2011 CEQA Air Quality Guidelines was called into question by an order issued March 5, 2012, in California Building Industry Association (CBIA) v. BAAQMD (Alameda Superior Court Case No. RGI0548693). In December 2015, the Supreme Court determined that an analysis of the impacts of the environment on a project – known as "CEQA-in-reverse" – is only required under two limited circumstances: (1) when a statute provides an express legislative directive to consider such impacts; and (2) when a proposed project risks exacerbating environmental hazards or conditions that already exist (Cal. Supreme Court Case No. S213478).

Table 1. Air Quality Significance Thresholds

Pollutant	Construction Thresholds	Operational Thresholds	
	Average Daily Emissions (lbs./day)	Average Daily Emissions (lbs./day)	Annual Average Emissions (tons/year)
Criteria Air Pollutants			
ROG	54	54	10
NO_x	54	54	10
PM_{10}	82 (Exhaust)	82	15
$PM_{2.5}$	54 (Exhaust)	54	10
CO	Not Applicable	9.0 ppm (8-hour average) or 20.0 ppm (1-hour average)	
Fugitive Dust	Construction Dust Ordinance or other Best Management Practices	Not Applicable	
Health Risks and Hazards for Single Sources			
Excess Cancer Risk	>10 per one million		
Hazard Index	>1.0		
Incremental annual $PM_{2.5}$	>0.3 µg/m^3		
Health Risks and Hazards for Combined Sources (Cumulative from all sources within 1,000 foot zone of influence)			
Excess Cancer Risk	>100 per one million		
Hazard Index	>10.0		
Annual Average $PM_{2.5}$	>0.8 µg/m^3		
Greenhouse Gas Emissions			
GHG Annual Emissions	Compliance with a Qualified GHG Reduction Strategy OR 1,100 metric tons or 4.6 metric tons per capita		
Note: ROG = reactive organic gases, NOx = nitrogen oxides, PM_{10} = course particulate matter or particulates with an aerodynamic diameter of 10 micrometers (µm) or less, $PM_{2.5}$ = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less; and GHG = greenhouse gas.			

Impact: Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable State or federal ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)? ***Less than significant with construction-period mitigation measures.***

The Bay Area is considered a non-attainment area for ground-level ozone and $PM_{2.5}$ under both the Federal Clean Air Act and the California Clean Air Act. The area is also considered non-attainment for PM_{10} under the California Clean Air Act, but not the federal act. The area has attained both State and federal ambient air quality standards for carbon monoxide. As part of an effort to attain and maintain ambient air quality standards for ozone and PM_{10}, the BAAQMD has established thresholds of significance for these air pollutants and their precursors. These thresholds are for ozone precursor pollutants (ROG and NO_X), PM_{10}, and $PM_{2.5}$ and apply to both construction period and operational period impacts.

The California Emissions Estimator Model (CalEEMod) Version 2016.3.2 was used to estimate emissions from construction and operation of the site assuming full build out of the project. The project land use types and size, and anticipated construction schedule were input to CalEEMod.

Construction Period Emissions

CalEEMod provided annual emissions for construction. CalEEMod provides emission estimates for both on-site and off-site construction activities. On-site activities are primarily made up of construction equipment emissions, while off-site activity includes worker and vendor traffic. A construction build-out scenario, including equipment list and schedule, was based on CalEEMod defaults for a project of this type and size. The proposed project land uses were input into CalEEMod, which included: 148,000 sf entered as "Medical Office Building," and 476 spaces entered as "Unenclosed Parking with Elevator."

The CalEEMod default schedule for a project of this type and size assumes that the project would be built out over a period of approximately one year beginning in January 2018, or an estimated 269 construction workdays. Average daily emissions were computed by dividing the total construction emissions by the number of construction days. Table 2 shows average daily construction emissions of ROG, NO_X, PM_{10} exhaust, and $PM_{2.5}$ exhaust during construction of the project. As indicated in Table 2, estimated construction period emissions would not exceed the BAAQMD significance thresholds. *Attachment 3, CalEEMod Worksheets* contains the CalEEMod modeling worksheets.

Construction activities, particularly during site preparation and grading, would temporarily generate fugitive dust in the form of PM_{10} and $PM_{2.5}$. Sources of fugitive dust would include disturbed soils at the construction site and trucks carrying uncovered loads of soils. Unless properly controlled, vehicles leaving the site would deposit mud on local streets, which could be an additional source of airborne dust after it dries. The BAAQMD CEQA Air Quality Guidelines consider these impacts to be less than significant if best management practices are implemented to reduce these emissions. *Mitigation Measure 1 would implement BAAQMD-recommended best management practices*.

Table 2. Construction Period Emissions

Scenario	ROG	NOx	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
Unmitigated				
Total construction emissions (tons) (CalEEMod)	1.27 tons	3.53 tons	0.17 tons	0.16 tons
Average daily emissions (pounds)[1]	9.4 lbs.	26.2 lbs.	1.3 lbs.	1.2 lbs.
BAAQMD Thresholds (pounds per day)	*54* lbs.	*54* lbs.	*82* lbs.	*54* lbs.
Exceed Threshold?	**No**	**No**	**No**	**No**
Notes: [1]Assumes 269 workdays.				

Operational Period Emissions

Operational air emissions from the project would be generated primarily from autos driven by future employees and patients. Evaporative emissions from architectural coatings and maintenance products (classified as consumer products) are typical emissions from these types of uses. CalEEMod was used to predict emissions from operation of the proposed project assuming full build-out.

Land Uses

The project land uses were input to CalEEMod, as described above. An additional CalEEMod run was set up to compute the emissions from the existing/approved land use. The land use entered was 148,000 sf as "General Office."

Model Year

Emissions associated with vehicle travel depend on the year of analysis because emission control technology requirements are phased-in over time. Therefore, the earlier the year analyzed in the model, the higher the emission rates utilized by CalEEMod. The earliest full year the buildout project could possibly be constructed and begin operating would be 2020. Emissions associated with build-out later than 2020 would be lower.

Trip Generation Rates

CalEEMod allows the user to enter specific vehicle trip generation rates. However, the trip generation rates from the project traffic report (36.13 trips per 1,000 sf for the project and 11.03 trips per 1,000 sf for the existing/approved use) are the same as the default trip rates in CalEEMod and were, therefore, not modified. The default trip lengths and trip types specified by CalEEMod were used. While the project would shift some employees from other nearby Kaiser facilities to the proposed project, a trip reduction credit was conservatively not taken.

Energy

CalEEMod defaults for energy use were used, which are assumed to include the latest 2016 Title 24 Building Standards.

Project Generator

The only source of stationary air pollutants identified with build-out of the project is assumed to be an emergency back-up generator. The project proposes use of a 600 kW (approximately 880 hp) generator. It is assumed for this assessment that the generator would be driven by a diesel-fueled engine.

The emergency back-up generator would be used for backup power in emergency conditions. The generator would be operated for testing and maintenance purposes, with a maximum of 50 hours each per year of non-emergency operation under normal conditions allowed by BAAQMD. During testing periods the engine would typically be run for less than one hour. The engine would be required to meet CARB and EPA emission standards and consume commercially available California low-sulfur diesel fuel. The generator emissions were modeled using CalEEMod.

Other Inputs

Default model assumptions for emissions associated with solid waste generation and water/wastewater use were applied to the project.

Total Project Emissions

Table 3 reports the predicted emission in terms of annual emissions in tons and average daily operational emissions, assuming 365 days of operation per year. As shown in Table 3, average daily and annual emissions of ROG, NOx, PM_{10}, or $PM_{2.5}$ emissions associated with operation would not exceed the BAAQMD significance thresholds.

Table 3. Operational Emissions

Scenario	ROG	NOx	PM_{10}	$PM_{2.5}$
Project Annual Operational Emissions (incl. Generator)	1.79 tons	3.83 tons	2.98 tons	0.83 tons
Existing Emissions	1.03 tons	1.36 tons	1.12 tons	0.32 tons
Net Project Emissions	0.76 tons	2.47 tons	1.86 tons	0.52 tons
BAAQMD Thresholds (tons /year)	*10 tons*	*10 tons*	*15 tons*	*10 tons*
Exceed Threshold?	**No**	***No***	**No**	**No**
Average Daily Project Operational Emissions (pounds)[1]	4.2 lbs.	13.5 lbs.	10.2 lbs.	2.8 lbs.
BAAQMD Thresholds (pounds/day)	*54* lbs.	*54* lbs.	*82* lbs.	*54* lbs.
Exceed Threshold?	**No**	**No**	**No**	**No**
[1] Assumes 365-day operation				

Mitigation Measure 1: **Include basic measures to control dust and exhaust during construction.**

During any construction period ground disturbance, the applicant shall ensure that the project contractor implement measures to control dust and exhaust. Implementation of the measures recommended by BAAQMD and listed below would reduce the air quality impacts associated with grading and new construction to a less than significant level. The contractor shall implement the following best management practices that are required of all projects:

1. All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.

2. All haul trucks transporting soil, sand, or other loose material off-site shall be covered.

3. All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.

4. All vehicle speeds on unpaved roads shall be limited to 15 miles per hour (mph).

5. All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.

6. Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points.

7. All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified mechanic and determined to be running in proper condition prior to operation.

8. Post a publicly visible sign with the telephone number and person to contact at the Lead Agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.

Impact: Violate any air quality standard or contribute substantially to an existing or projected air quality violation? ***Less-than-significant.***

As discussed under Impact 1, the project would have emissions less than the BAAQMD screening size for evaluating impacts related to ozone and particulate matter. Therefore, the project would not contribute substantially to existing or projected violations of those standards. Carbon monoxide emissions from traffic generated by the project would be the pollutant of greatest concern at the local level. Congested intersections with a large volume of traffic have the greatest potential to cause high-localized concentrations of carbon monoxide. Air pollutant monitoring data indicate that carbon monoxide levels have been at healthy levels (i.e., below State and federal standards) in the Bay Area since the early 1990s. As a result, the region has been designated as attainment for the standard. The highest measured level over any 8-hour averaging period during the last 3 years in the Bay Area is less than 3.0 parts per million (ppm), compared to the ambient air quality standard of 9.0 ppm. Intersections affected by the project would have traffic volumes less than the BAAQMD screening criteria and, thus, would not cause a violation of an ambient air quality standard or have a considerable contribution to cumulative violations of these standards.[5]

Impact: Expose sensitive receptors to substantial pollutant concentrations? ***Less than significant with construction period mitigation.***

Project impacts related to increased community risk can occur either by introducing a new sensitive receptor, such as a residential use, in proximity to an existing source of TACs or by introducing a new source of TACs with the potential to adversely affect existing sensitive receptors in the project vicinity. The BAAQMD recommends using a 1,000-foot screening radius around a project site for purposes of identifying community health risk from siting a new sensitive receptor or a new source of TACs. It is anticipated that the project would include an emergency back-up generator that is powered by diesel fuel. This generator would only be operated for testing and emergency purposes. The project would not introduce new sensitive receptors to the area. There are thresholds that address both the impact of single and cumulative TAC sources upon projects that include new sensitive receptors (see Table 1). Construction activity would generate dust and equipment exhaust on a temporary basis that could affect nearby sensitive receptors. *Attachment 1* provides the detailed construction risk modeling methodology and parameters.

Operational Community Risk Impacts

Project Generator

As previously described, the project would include a 600 kW emergency generator. The generator will be operated for testing and maintenance purposes, with a maximum of 50 hours per year of non-emergency operation under normal conditions. During testing periods the engine

[5] For a land-use project type, the BAAQMD CEQA Air Quality Guidelines state that a proposed project would result in a less than significant impact to localized carbon monoxide concentrations if the project would not increase traffic at affected intersections with more than 44,000 vehicles per hour.

would typically be run for less than one hour under light engine loads. The engines would be required to meet U.S. EPA emission standards and consume commercially available California low sulfur diesel fuel. The emissions from the operation of the generator were calculated based on the manufacturer's full load emission factors (see *Attachment 2* for Emission Data Sheet) and assuming each generator would operate for 50 hours.

Risk and $PM_{2.5}$ concentrations from a diesel generator of this size and average daily emissions were then calculated based on BAAQMD's *Risk and Hazards Emissions Screening Calculator (Beta Version)* and *Distance Adjustment Multiplier Tool for Diesel Internal Combustion Engines*. Results indicate that the project generator would result in an excess cancer risk of 3.1 per million,[6] $PM_{2.5}$ concentration of <0.01µg/m^3 and HI of <0.01 at the nearest sensitive receptor (Bright Horizons daycare to the south), all of which would be below BAAQMD thresholds of significance both on-site affecting project residences and at nearby sensitive receptors. *Therefore, this impact would be considered less than significant*. *Attachment 2* includes emission factors and risk modeling calculations for the project emergency back-up generator.

Project Construction Activity

Construction activities, particularly during site preparation and grading would temporarily generate fugitive dust in the form of respirable particulate matter (PM_{10}) and $PM_{2.5}$. Sources of fugitive dust would include disturbed soils at the construction site and trucks carrying uncovered loads of soils. Unless properly controlled, vehicles leaving the site would deposit mud on local streets, which could be an additional source of airborne dust after it dries. The BAAQMD CEQA Air Quality Guidelines consider these impacts to be less than significant if best management practices are employed to reduce these emissions. *Mitigation Measure 1 would implement BAAQMD-required best management practices*.

Construction equipment and associated heavy-duty truck traffic generates diesel exhaust, which is a known TAC. These exhaust air pollutant emissions would not be considered to contribute substantially to existing or projected air quality violations. Construction exhaust emissions may still pose community risks for sensitive receptors such as nearby residents. The primary community risk impact issues associated with construction emissions are cancer risk and exposure to $PM_{2.5}$. Diesel exhaust poses both a potential health and nuisance impact to nearby receptors. A community risk assessment of the project construction activities was conducted that evaluated potential health effects of sensitive receptors at these nearby residences from construction emissions of DPM and $PM_{2.5}$.[7] The closest sensitive receptors to the project site are residences to the west and southwest of the proposed parking structure and the Bright Horizons daycare to the south (see Figure 1). Emissions and dispersion modeling was conducted to predict the off-site DPM concentrations resulting from project construction, so that lifetime cancer risks and non-cancer health effects could be evaluated.

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[6] Includes adjustment factor of 1.3744 to account for latest OEHHA methodology per correspondence with Alison Kirk, BAAQMD, November 23, 2015.

[7] DPM is identified by California as a toxic air contaminant due to the potential to cause cancer.

On-Site Construction TAC Emissions

Construction period emissions were computed using CalEEMod along with projected construction activity, as described above. The CalEEMod model provided total annual PM_{10} exhaust emissions (assumed to be DPM) for the off-road construction equipment used for construction of the project and for the exhaust emissions from on-road vehicles (vendor trucks and worker vehicles) of 0.1635 tons (327 pounds) over the construction period. A trip length of one-half mile was used to represent vehicle travel while at or near the construction site. For modeling purposes, it was assumed that these emissions from on-road vehicles would occur at the construction site. Fugitive dust $PM_{2.5}$ emissions were also computed and included in this analysis. The model predicts emissions of 0.0126 tons (25 pounds) of fugitive $PM_{2.5}$ over the construction period.

Dispersion Modeling

The U.S.EPA ISCST3 dispersion model was used to predict concentrations of DPM and $PM_{2.5}$ concentrations at sensitive receptors (residences) in the vicinity of the project construction area. The ISCST3 dispersion model is a BAAQMD-recommended model for use in modeling analysis of these types of emission activities for CEQA projects.[8] The ISCST3 modeling utilized two area sources to represent the on-site construction emissions, one for exhaust emissions and one for fugitive dust emissions. To represent the construction equipment exhaust emissions, an emission release height of 6 meters (19.7 feet) was used for the area source. The elevated source height reflects the height of the equipment exhaust pipes plus an additional distance for the height of the exhaust plume above the exhaust pipes to account for plume rise of the exhaust gases. For modeling fugitive $PM_{2.5}$ emissions, a near-ground level release height of 2 meters (6.6 feet) was used for the area source. Emissions from the construction equipment and on-road vehicle travel were distributed throughout the modeled area sources. Construction emissions were modeled as occurring daily between 7 a.m. to 4 p.m., when the majority of construction activity would occur.

The modeling used a 5-year meteorological data set (2001 – 2005) from the Sonoma Baylands prepared for use with the AERMOD model by the BAAQMD. Annual DPM and $PM_{2.5}$ concentrations from construction activities during the 2018 - 2019 period were calculated using the model. DPM and $PM_{2.5}$ concentrations were calculated at nearby sensitive receptor locations. Receptor heights of 1.5 meters (4.9 feet) were used to represent the breathing heights of residents in first floor levels of nearby residences and the daycare.

The maximum-modeled cancer risk and annual $PM_{2.5}$ concentrations, which includes both the DPM and fugitive $PM_{2.5}$ concentrations, occurred at a residence the west of the project site, as shown in Figure 1. Using the maximum annual modeled DPM concentrations, the maximum increased cancer risks were calculated. *Attachment 3, Construction Risk Modeling* to this report includes the emission calculations used for the construction area source modeling and the cancer risk calculations.

[8] Bay Area Air Quality Management District (BAAQMD), 2012, *Recommended Methods for Screening and Modeling Local Risks and Hazards, Version 3.0.* May.

Cancer Risks

Results of this assessment indicate that the maximum excess residential cancer risks would be 4.1 in one million for an infant exposure and 0.1 in one million for an adult exposure. Excess cancer risk at the Bright Horizons daycare would be 2.1 in one million. The maximum excess cancer risk would not be greater than the BAAQMD significance threshold of 10 in one million.

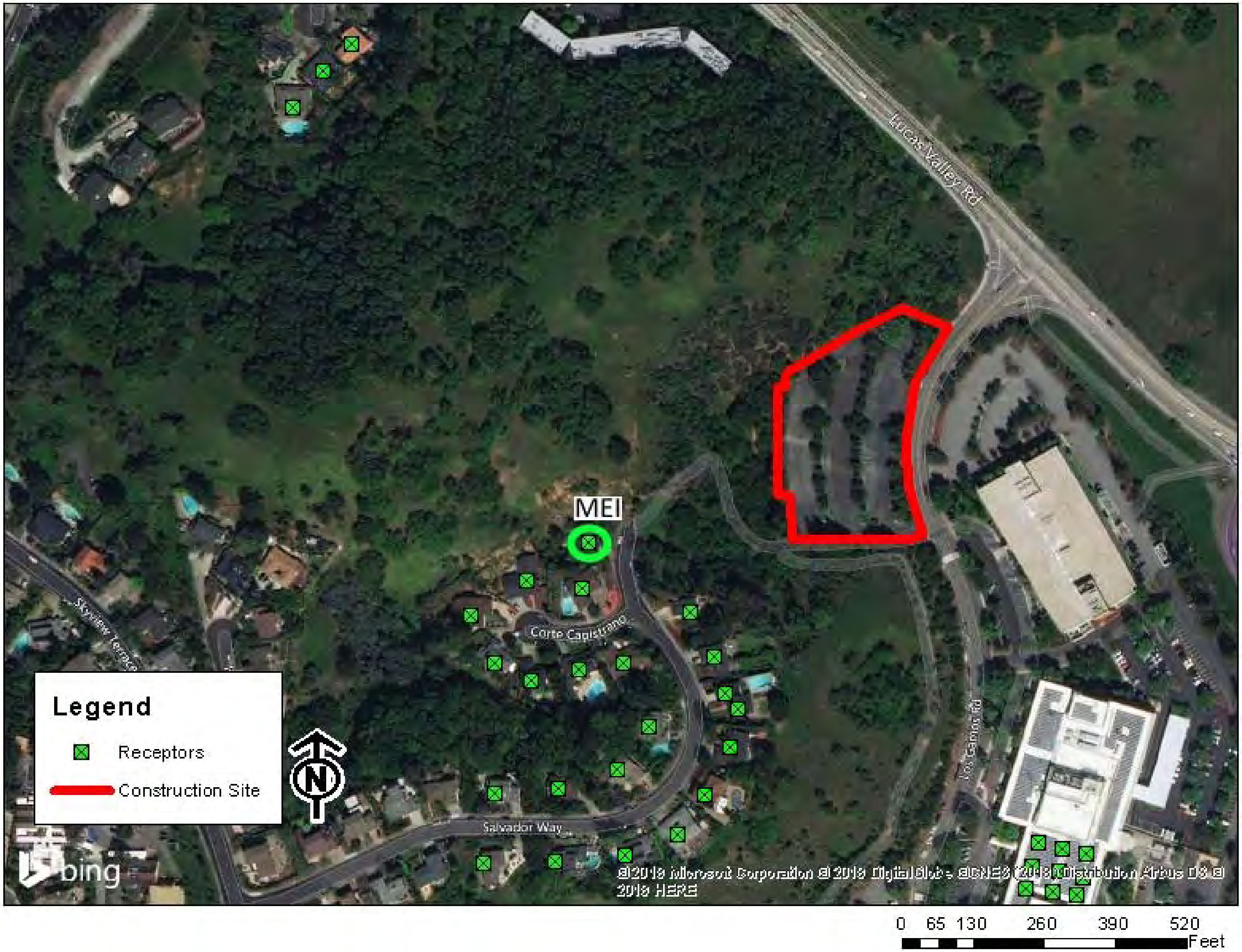
Predicted Annual $PM_{2.5}$ Concentration

The maximum-modeled annual $PM_{2.5}$ concentration, which is based on combined exhaust and fugitive dust emissions, was 0.03 $\mu g/m^3$. The maximum annual $PM_{2.5}$ concentration at the MEI receptor location would not exceed the BAAQMD significance threshold of 0.3 $\mu g/m^3$.

Non-Cancer Hazards

The maximum modeled annual residential DPM concentration (i.e., from construction exhaust) was 0.0249 $\mu g/m^3$. The maximum computed HI based on this DPM concentration is 0.01, which is much lower than the BAAQMD significance criterion of a HI greater than 1.0.

Figure 1. Project Construction Site and Locations of Off-Site Sensitive Receptors and Maximum TAC and $PM_{2.5}$ Impacts



Greenhouse Gas Emissions

Impact: Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment? ***Less than significant***

GHG emissions associated with development of the proposed project would occur over the short-term from construction activities, consisting primarily of emissions from equipment exhaust and worker and vendor trips. There would also be long-term operational emissions associated with vehicular traffic within the project vicinity, energy and water usage, and solid waste disposal. Emissions for the proposed project are discussed below and were analyzed using the methodology recommended in the BAAQMD CEQA Air Quality Guidelines.

<u>Consistency with Adopted Climate Action Plan</u>

The City of San Rafael Climate Change Action Plan (updated 2011) serves as a Qualified Greenhouse Gas Reduction Strategy or a community-wide plan to reduce greenhouse gas (GHG) emissions in accordance with AB 32 goals. A Scoping Plan for AB 32 was adopted by CARB in December 2008. It contains the State of California's main strategies to reduce GHGs from business-as-usual emissions projected in 2020 back down to 1990 levels. Business-as-usual (BAU) is the projected emissions in 2020, including increases in emissions caused by growth, without any GHG reduction measures. The Scoping Plan has a range of GHG reduction actions, including direct regulations, alternative compliance mechanisms, monetary and non-monetary incentives, voluntary actions, and market-based mechanisms such as a cap-and-trade system.

According to the Climate Change Action Plan, the San Rafael community emitted approximately 524,148 tons of carbon dioxide equivalent (CO_2e) in the year 2005. Of that, 61 percent associated with transportation, 17 percent from commercial buildings, 17 percent from residential buildings, and 5 percent from waste.

One purpose of the Qualified Greenhouse Gas Reduction Strategy is to streamline the decision-making process regarding a proposed project's impact on GHG emissions within the City. The proposed project would not require a General Plan Amendment, and thus the project's consistency with relevant Climate Action Plan measures and actions has been used to evaluate the significance of this impact.

Projects that show consistency with the plan forecasts and implement applicable strategies included in the plan are considered to have less-than-significant GHG emissions. The project would not involve an amendment to the General Plan, Specific or Precise Plan. Furthermore, the project would generally be consistent with the applicable Climate Change Action Plan measures, as shown in Table 4. As a result, the project GHG emissions would be less than significant.

Table 4. Climate Change Action Plan Consistency

Measure	Action Item/Project Standard	Consistency
LF1	Continue to encourage greater residential and commercial densities within walking distance of high frequency transit centers and corridors as called for in the General Plan. High frequency is defined as buses arriving at least every 15 minutes.	Consistent - the project is located within ¼ mile of the Highway 101 at Lucas Valley Road bus stop
LF8	Encourage ownership of plug-in electric vehicles, as they become available and in use, by providing charging stations in City garages and parking lots, consider requirements for charging stations in newly constructed private parking facilities, and participate in regional efforts to encourage widespread availability of charging stations.	Consistent – the project would, at a minimum, comply with CalGreen minimum requirements with a goal to exceed the minimum
LF10	Educate and encourage businesses and residents to limit vehicle idling	Consistent – the project would install signs limiting truck delivery idling to 10 minutes
LF11	Adopt a Zero Waste Goal and develop a Zero Waste Strategic Plan for San Rafael	Consistent – Goal to recycle, reuse, or compost 100% of our non-hazardous waste by 2025
LF15	Adopt a construction debris recycling and reuse ordinance	Consistent – the project would divert at least 50 percent of construction and demolition waste
BU4	Apply green building requirements to residential, commercial and civic remodeling projects as well as new construction	Consistent – the project would meet all City green building requirements
EN3	Update zoning regulations for parking lot landscaping to increase shading and reduce thermal gain	Consistent – the project would meet all City parking lot shading requirements

Impact: Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases? ***Less than significant.***

AB 32, the Global Warming Solutions Act of 2006, codifies the State of California's GHG emissions target by directing CARB to reduce the state's global warming emissions to 1990 levels by 2020. AB 32 was signed and passed into law by Governor Schwarzenegger on September 27, 2006. Since that time, CARB, CEC, the California Public Utilities Commission (CPUC), and the Building Standards Commission have all been developing regulations that will help meet the goals of AB 32 and Executive Order S-3-05.

A Scoping Plan for AB 32 was adopted by CARB in December 2008. It contains the State of California's main strategies to reduce GHGs from BAU emissions projected in 2020 back down to 1990 levels. BAU is the projected emissions in 2020, including increases in emissions caused by growth, without any GHG reduction measures. The Scoping Plan has a range of GHG reduction actions, including direct regulations, alternative compliance mechanisms, monetary and non-monetary incentives, voluntary actions, and market-based mechanisms such as a cap-and-trade system. It required CARB and other state agencies to develop and adopt regulations and other initiatives reducing GHGs by 2012.

As directed by AB 32, CARB has also approved a statewide GHG emissions limit. On December 6, 2007, CARB staff resolved an amount of 427 MMT of CO_2e as the total statewide GHG 1990 emissions level and 2020 emissions limit. The limit is a cumulative statewide limit, not a sector- or facility-specific limit. CARB updated the future 2020 BAU annual emissions forecast, in light of the economic downturn, to 545 MMT of CO_2e. Two GHG emissions reduction measures currently enacted that were not previously included in the 2008 Scoping Plan baseline inventory were included, further reducing the baseline inventory to 507 MMT of CO_2e. Thus, an estimated reduction of 80 MMT of CO_2e is necessary to reduce statewide emissions to meet the AB 32 target by 2020.

SB 32 was passed in 2016, which codified a 2030 GHG emissions reduction target of 40 percent below 1990 levels. CARB recently published a second update to the Scoping Plan to reflect the 2030 target set by Executive Order B-30-15 and codified by SB 32. The second Scoping Plan Update was published in November 2017 as directed by SB 32 companion legislation AB 197. The mid-term 2030 target is considered critical by CARB on the path to obtaining an even deeper GHG emissions target of 80 percent below 1990 levels by 2050, as directed in Executive Order S-3-05. The Scoping Plan outlines the suite of policy measures, regulations, planning efforts, and investments in clean technologies and infrastructure, providing a blueprint to continue driving down GHG emissions and obtain the statewide goals.

The proposed project would not conflict or otherwise interfere with the statewide GHG reduction measures identified in CARB's Scoping Plan. The project would comply with requirements of the Green Building Code. For example, proposed buildings would be renovated in conformance with CALGreen and the Title 24 Building Code, which requires high-efficiency water fixtures and water-efficient irrigation systems.

Attachment 1: Health Risk Calculation Methodology

A health risk assessment (HRA) for exposure to Toxic Air Contaminates (TACs) requires the application of a risk characterization model to the results from the air dispersion model to estimate potential health risk at each sensitive receptor location. The State of California Office of Environmental Health Hazard Assessment (OEHHA) and California Air Resources Board (CARB) develop recommended methods for conducting health risk assessments. The most recent OEHHA risk assessment guidelines were published in February of 2015.[1] These guidelines incorporate substantial changes designed to provide for enhanced protection of children, as required by State law, compared to previous published risk assessment guidelines. CARB has provided additional guidance on implementing OEHHA's recommended methods.[2] This HRA used the recent 2015 OEHHA risk assessment guidelines and CARB guidance. The BAAQMD has adopted recommended procedures for applying the newest OEHHA guidelines as part of Regulation 2, Rule 5: New Source Review of Toxic Air Contaminants.[3] Exposure parameters from the OEHHA guidelines and the recent BAAQMD HRA Guidelines were used in this evaluation.

Cancer Risk

Potential increased cancer risk from inhalation of TACs are calculated based on the TAC concentration over the period of exposure, inhalation dose, the TAC cancer potency factor, and an age sensitivity factor to reflect the greater sensitivity of infants and children to cancer causing TACs. The inhalation dose depends on a person's breathing rate, exposure time and frequency of exposure, and the exposure duration. These parameters vary depending on the age, or age range, of the persons being exposed and whether the exposure is considered to occur at a residential location or other sensitive receptor location.

The current OEHHA guidance recommends that cancer risk be calculated by age groups to account for different breathing rates and sensitivity to TACs. Specifically, they recommend evaluating risks for the third trimester of pregnancy to age zero, ages zero to less than two (infant exposure), ages two to less than 16 (child exposure), and ages 16 to 70 (adult exposure). Age sensitivity factors (ASFs) associated with the different types of exposure are an ASF of 10 for the third trimester and infant exposures, an ASF of 3 for a child exposure, and an ASF of 1 for an adult exposure. Also associated with each exposure type are different breathing rates, expressed as liters per kilogram of body weight per day (L/kg-day). As recommended by the BAAQMD, 95^{th} percentile breathing rates are used for the third trimester and infant exposures, and 80^{th} percentile breathing rates for child and adult exposures. Additionally, CARB and the BAAQMD recommend the use of a residential exposure duration of 30 years for sources with long-term emissions (e.g., roadways).

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[1] OEHHA, 2015. *Air Toxics Hot Spots Program Risk Assessment Guidelines, The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments*. Office of Environmental Health Hazard Assessment. February.

[2] CARB, 2015. *Risk Management Guidance for Stationary Sources of Air Toxics*. July 23.

[3] BAAQMD, 2016. *BAAQMD Air Toxics NSR Program Health Risk Assessment (HRA) Guidelines*. January 2016.

Under previous OEHHA and BAAQMD HRA guidance, residential receptors are assumed to be at their home 24 hours a day, or 100 percent of the time. In the 2015 Risk Assessment Guidance, OEHHA includes adjustments to exposure duration to account for the fraction of time at home (FAH), which can be less than 100 percent of the time, based on updated population and activity statistics. The FAH factors are age-specific and are: 0.85 for third trimester of pregnancy to less than 2 years old, 0.72 for ages 2 to less than 16 years, and 0.73 for ages 16 to 70 years. Use of the FAH factors is allowed by the BAAQMD if there are no schools in the project vicinity that would have a cancer risk of one in a million or greater assuming 100 percent exposure (FAH = 1.0).

Functionally, cancer risk is calculated using the following parameters and formulas:

Cancer Risk (per million) = $CPF \times Inhalation\ Dose \times ASF \times ED/AT \times FAH \times 10^{6}$

Where:

CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)
FAH = Fraction of time spent at home (unitless)

Inhalation Dose = $C_{air} \times DBR \times A \times (EF/365) \times 10^{-6}$

Where:

C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

The health risk parameters used in this evaluation are summarized as follows:

Parameter	Exposure Type →	Infant		Child		Adult
	Age Range →	3rd Trimester	0<2	2 < 9	2 < 16	16 - 30
DPM Cancer Potency Factor $(mg/kg\text{-}day)^{-1}$		1.10E+00	1.10E+00	1.10E+00	1.10E+00	1.10E+00
Daily Breathing Rate (L/kg-day)*		361	1,090	631	572	261
Inhalation Absorption Factor		1	1	1	1	1
Averaging Time (years)		70	70	70	70	70
Exposure Duration (years)		0.25	2	14	14	14
Exposure Frequency (days/year)		350	350	350	350	350
Age Sensitivity Factor		10	10	3	3	1
Fraction of Time at Home		0.85-1.0	0.85-1.0	0.72-1.0	0.72-1.0	0.73

* 95th percentile breathing rates for 3rd trimester and infants and 80th percentile for children and adults

Non-Cancer Hazards

Potential non-cancer health hazards from TAC exposure are expressed in terms of a hazard index (HI), which is the ratio of the TAC concentration to a reference exposure level (REL). OEHHA has defined acceptable concentration levels for contaminants that pose non-cancer health hazards. TAC concentrations below the REL are not expected to cause adverse health impacts, even for sensitive individuals. The total HI is calculated as the sum of the HIs for each TAC evaluated and the total HI is compared to the BAAQMD significance thresholds to determine whether a significant non-cancer health impact from a project would occur.

Typically, for residential projects located near roadways with substantial TAC emissions, the primary TAC of concern with non-cancer health effects is diesel particulate matter (DPM). For DPM, the chronic inhalation REL is 5 micrograms per cubic meter ($\mu g/m^3$).

Annual $PM_{2.5}$ Concentrations

While not a TAC, fine particulate matter ($PM_{2.5}$) has been identified by the BAAQMD as a pollutant with potential non-cancer health effects that should be included when evaluating potential community health impacts under the California Environmental Quality Act (CEQA). The thresholds of significance for $PM_{2.5}$ (project level and cumulative) are in terms of an increase in the annual average concentration. When considering $PM_{2.5}$ impacts, the contribution from all sources of $PM_{2.5}$ emissions should be included. For projects with potential impacts from nearby local roadways, the $PM_{2.5}$ impacts should include those from vehicle exhaust emissions, $PM_{2.5}$ generated from vehicle tire and brake wear, and fugitive emissions from re-suspended dust on the roads.

Attachment 2: Project Generator Emissions

Exhaust Emission Data Sheet
600DQCA
60 Hz Diesel Generator Set
EPA NSPS Stationary Emergency

Engine Information:

Model:	Cummins Inc QSK23-G7 NR2	Bore:	6.69 in. (170 mm)
Type:	4 Cycle, In Line, 6 Cylinder Diesel	Stroke:	6.69 in. (170 mm)
Aspiration:	Turbocharged and CAC	Displacement:	1413 cu. in. (23.1 liters)
Compression Ratio:	16.0:1		
Emission Control Device:	Turbocharged with Charge Air Cooled		

PERFORMANCE DATA	**1/4 Standby**	**1/2 Standby**	**3/4 Standby**	**Full Standby**	**Full Prime**
Engine HP @ Stated Load (1800 RPM)	220	440	660	880	792
Fuel Consumption (gal/hr)	12.9	22.6	32.3	41.8	38.1
Exhaust Gas Flow (CFM)	2029.9	2987.1	3862.8	4600.3	4390
Exhaust Temperature (°F)	576.7	685.6	750.6	810	774
EXHAUST EMISSION DATA					
HC (Total Unburned Hydrocarbons)	1.1	0.51	0.28	0.18	0.25
NOx (Oxides of Nitrogen as NO2)	2.99	3.15	3.64	4.49	4.05
CO (Carbon Monoxide)	1.24	0.6	0.3	0.21	0.2
PM (particular Matter)	0.34	0.17	0.08	0.05	0.05
SO2 (Sulfur Dioxide)	0.13	0.12	0.11	0.1	0.1
Smoke (Bosch)	0.8	0.63	0.44	0.35	0.36

All values are Grams per HP-Hour

TEST CONDITIONS

Data was recorded during steady-state rated engine speed (± 25 RPM) with full load (±2%). Pressures, temperatures, and emission rates were stabilized.

Fuel Specification:	46.5 Cetane Number, 0.035 Wt.% Sulfur; Reference ISO8178-5, 40CFR86.1313-98 Type 2-D and ASTM D975 No. 2-D.
Fuel Temperature:	99 ± 9 °F (at fuel pump inlet)
Intake Air Temperature:	77 ± 9 °F
Barometric Pressure:	29.6 ± 1 in. Hg
Humidity:	NOx measurement corrected to 75 grains H2O/lb dry air
Reference Standard:	ISO 8178

The NOx, HC, CO and PM emission data tabulated here were taken from a single engine under the test conditions shown above. Data for the other components are estimated. These data are subjected to instrumentation and engine-to-engine variability. Field emission test data are not guaranteed to these levels. Actual field test results may vary due to test site conditions, installation, fuel specification, test procedures and instrumentation. Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may results in elevated emission levels.

Generator Engine Information

Manufacturer/Model	**Cummins**
Generator Set	**600DQCA**
Engine	**QSK23-G7 NR2**
Total No. Units	1
Engine Operating Load	***100%***
Generator Output (kW)	600
Load During Testing	100%
Engine Output (hp)	880
Fuel Use (gal/hr) at Load	41.8
Fuel Sulfur Content (%)	0.0015
PM Emission Control	-
PM Control Efficiency	0%

Emission Testing Information

	Max. Daily Testing	**Maximum Annual Testing**
No. Units Tested. =	1	1
Test Duration/Unit (min) =	60	60
Tests per Period/Unit =	1	50
Operation./Unit (hours) =	1	50
Total Operation (hours) =	1	50

	Uncontrolled[1]	**Uncontrolled**	**Controlled**	**Operational**			**Operational - Total Emissions[2]**		
	Emission[1]	**Emission**	**Emission**	**Maximum Emissions per Unit**			**Average[4]**		
	Factor	**Rate per Unit**	**Rate per Unit**	**Daily**	**Annual**	**Annual**	**Daily**	**Annual**	
Pollutant	**(g/hp-hr)**	**(lb/hr)**	**(lb/hr)**	**(lb/day)**	**(lb/yr)**	**(ton/yr)**	**(lb/day)**	**(lb/yr)**	**(ton/yr)**
NOx	4.49	8.71	8.71	8.71	435.5	0.22	1.2	435.5	0.22
HC	0.18	0.35	0.35	0.35	17.5	0.01	0.0	17.5	0.01
CO	0.21	0.41	0.41	0.41	20.4	0.01	0.1	20.4	0.01
PM10	0.05	0.09	0.09	0.087	4.4	0.0022	0.01	4.4	0.00
PM2.5[3]	0.04	0.08	0.08	0.082	4.1	0.0020	0.0	4.1	0.00
SOx[1a]	-	0.009	0.009	0.009	0.4	0.0002	0.00	0.4	0.00
CO_2[1b]	22.38 lb/gal	935	935	935	46,767	23.4	-	46,767	23

Notes:
1) Based on Manufacturer emissions data for Cummins 600DQCA Generator Set (EDS- 1086c)
1a) Calculated based on fuel sulfur content and EPA AP-42 Table 3.4-1 emission factor.
1b) CO2 emission factor from California Climate Action Registry, General Reporting Protocol, Version 3.1, January 2009
2) Based on the number of units operating for the specified time period
3) Based on CARB CEIDERS PM profile for diesel IC engines, PM2.5 fraction of PM = 0.937
4) Average daily emissions calculated from total annual emissions and 365 days per year

Plant #: 19792
Plant Name: San Jose Water Company
Number of Sources: Generator

Pollutant Name	Emissions/lbs per day	Cancer Risk (in millions)
ACETALDEHYDE		0.00E+00
ACETAMIDE		0.00E+00
ACRYLAMIDE		0.00E+00
ACRYLONITRILE		0.00E+00
ALLYL CHLORIDE		0.00E+00
2-AMINOANTHRAQUINONE		0.00E+00
ANILINE		0.00E+00
ARSENIC AND COMPOUNDS (INORGANIC)[1,2]		0.00E+00
ASBESTOS [3]		0.00E+00
BENZENE[1]		0.00E+00
BENZIDINE (AND ITS SALTS) values also apply to:		0.00E+00
Benzidine based dyes		0.00E+00
Direct Black 38		0.00E+00
Direct Blue 6		0.00E+00
Direct Brown 95 (technical grade)		0.00E+00
BENZYL CHLORIDE		0.00E+00
BERYLLIUM AND COMPOUNDS[2]		0.00E+00
BIS(2-CHLOROETHYL)ETHER (Dichloroethyl ether)		0.00E+00
BIS(CHLOROMETHYL)ETHER		0.00E+00
POTASSIUM BROMATE		0.00E+00
1,3-BUTADIENE		0.00E+00
CADMIUM AND COMPOUNDS[2]		0.00E+00
CARBON TETRACHLORIDE[1] (Tetrachloromethane)		0.00E+00
CHLORINATED PARAFFINS		0.00E+00
4-CHLORO-O-PHENYLENEDIAMINE		0.00E+00
CHLOROFORM[1]		0.00E+00
PENTACHLOROPHENOL		0.00E+00
2,4,6-TRICHLOROPHENOL		0.00E+00
p-CHLORO-o-TOLUIDINE		0.00E+00
CHROMIUM 6+2		0.00E+00
Barium chromate2		0.00E+00
Calcium chromate2		0.00E+00
Lead chromate2		0.00E+00
Sodium dichromate2		0.00E+00
Strontium chromate2		0.00E+00
CHROMIC TRIOXIDE (as chromic acid mist)		0.00E+00
p-CRESIDINE		0.00E+00
CUPFERRON		0.00E+00
2,4-DIAMINOANISOLE		0.00E+00
2,4-DIAMINOTOLUENE		0.00E+00
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)		0.00E+00
1,4-DICHLOROBENZENE		0.00E+00
3,3-DICHLOROBENZIDINE		0.00E+00
1,1,-DICHLOROETHANE (Ethylidene dichloride)		0.00E+00
DI(2-ETHYLHEXYL)PHTHALATE (DEHP)		0.00E+00
p-DIMETHYLAMINOAZOBENZENE		0.00E+00
2,4-DINITROTOLUENE		0.00E+00
1,4-DIOXANE (1,4-Diethylene dioxide)		0.00E+00
EPICHLOROHYDRIN (1-Chloro-2,3-epoxypropane)		0.00E+00
ETHYL BENZENE		0.00E+00
ETHYLENE DIBROMIDE (1,2-Dibromoethane)		0.00E+00
ETHYLENE DICHLORIDE (1,2-Dichloroethane)		0.00E+00
ETHYLENE OXIDE (1,2-Epoxyethane)		0.00E+00
ETHYLENE THIOUREA		0.00E+00
FORMALDEHYDE		0.00E+00
HEXACHLOROBENZENE		0.00E+00
HEXACHLOROCYCLOHEXANES (mixed or technical grade)		0.00E+00
alpha-HEXACHLOROCYCLOHEXANE		0.00E+00
beta- HEXACHLOROCYCLOHEXANE		0.00E+00
gamma-HEXACHLOROCYCLOHEXANE (Lindane)		0.00E+00
HYDRAZINE		0.00E+00
LEAD AND COMPOUNDS 2,4 (inorganic) values also apply to:		0.00E+00
Lead acetate2		0.00E+00
Lead phosphate2		0.00E+00
Lead subacetate2		0.00E+00
METHYL tertiary-BUTYL ETHER		0.00E+00
4,4'-METHYLENE BIS (2-CHLOROANILINE) (MOCA)		0.00E+00
METHYLENE CHLORIDE (Dichloromethane)		0.00E+00
4,4'-METHYLENE DIANILINE (AND ITS DICHLORIDE)		0.00E+00
MICHLER'S KETONE (4,4'-Bis(dimethylamino)benzophenone)		0.00E+00
N-NITROSODI-n-BUTYLAMINE		0.00E+00
N-NITROSODI-n-PROPYLAMINE		0.00E+00
N-NITROSODIETHYLAMINE		0.00E+00
N-NITROSODIMETHYLAMINE		0.00E+00
N-NITROSODIPHENYLAMINE		0.00E+00
N-NITROSO-N-METHYLETHYLAMINE		0.00E+00
N-NITROSOMORPHOLINE		0.00E+00
N-NITROSOPIPERIDINE		0.00E+00
N-NITROSOPYRROLIDINE		0.00E+00
NICKEL AND COMPOUNDS2 (values also apply to:)		0.00E+00
Nickel acetate2		0.00E+00
Nickel carbonate2		0.00E+00
Nickel carbonyl2		0.00E+00
Nickel hydroxide2		0.00E+00
Nickelocene2		0.00E+00
NICKEL OXIDE2		0.00E+00
Nickel refinery dust from the pyrometallurgical process2		0.00E+00
Nickel subsulfide2		0.00E+00
p-NITROSODIPHENYLAMINE		0.00E+00
PARTICULATE EMISSIONS FROM DIESEL-FUELED ENGINES	1.20E-02	1.27E-05
PERCHLOROETHYLENE (Tetrachloroethylene)		0.00E+00
PCB (POLYCHLORINATED BIPHENYLS) [low risk] 2,6		0.00E+00
PCB (POLYCHLORINATED BIPHENYLS) [high risk] 2,6		0.00E+00
POLYCHLORINATED DIBENZO-P-DIOXINS (PCDD)(AS 2,3,7,8-PCDD EQUIV) 2,7		0.00E+00
2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN2,7		0.00E+00
POLYCHLORINATED DIBENZOFURANS (PCDF)(AS 2,3,7,8-PCDD EQUIV) 2,7		0.00E+00
2,3,7,8-TETRACHLORODIBENZOFURAN2,7		0.00E+00
POLYCYCLIC AROMATIC HYDROCARBON2 (PAH) (AS B(a)P-EQUIV)5		0.00E+00
BENZO(A)PYRENE2,5		0.00E+00
NAPHTHALENE		0.00E+00
1,3-PROPANE SULTONE		0.00E+00
PROPYLENE OXIDE		0.00E+00
1,1,2,2-TETRACHLOROETHANE		0.00E+00
THIOACETAMIDE		0.00E+00
Toluene diisocyantates		0.00E+00
TOLUENE-2,4-DIISOCYANATE		0.00E+00
TOLUENE-2,6-DIISOCYANATE		0.00E+00
1,1,2-TRICHLOROETHANE (Vinyl trichloride)		0.00E+00
TRICHLOROETHYLENE		0.00E+00
URETHANE (Ethyl carbamate)		0.00E+00
VINYL CHLORIDE (Chloroethylene)		0.00E+00
	TOTAL:	1.27E-05

Plant #:
Plant Name:
Number of Sources:

Pollutant Name	Emission/lbs per day	Chronic Hazard
ACETALDEHYDE	0	0
ACROLEIN		0
ACRYLONITRILE		0
AMMONIA		0
ARSENIC AND COMPOUNDS (INORGANIC)1,2		0
ARSINE		0
BENZENE1		0
BERYLLIUM AND COMPOUNDS2		0
1,3-BUTADIENE		0
CADMIUM AND COMPOUNDS2		0
CARBON DISULFIDE1		0
CARBON TETRACHLORIDE1 (Tetrachloromethane)		0
CHLORINE		0
CHLORINE DIOXIDE		0
CHLOROBENZENE		0
CHLOROFORM1		0
2,3,4,6-Tetrachlorophenol		0
CHLOROPICRIN		0
CHROMIUM 6+2		0
Barium chromate2		0
Calcium chromate2		0
Lead chromate2		0
Sodium dichromate2		0
Strontium chromate2		0
CHROMIC TRIOXIDE (as chromic acid mist)		0
CRESOLS		0
M-CRESOL		0
O-CRESOL		0
P-CRESOL		0
Cyanide And Compounds (inorganic)		0
HYDROGEN CYANIDE (Hydrocyanic acid)		0
1,4-DICHLOROBENZENE		0
DIETHANOLAMINE		0
DIMETHYLAMINE		0
N,N-DIMETHYL FORMAMIDE		0
1,4-DIOXANE (1,4-Diethylene dioxide)		0
EPICHLOROHYDRIN (1-Chloro-2,3-epoxypropane)		0
1,2-EPOXYBUTANE		0
ETHYL BENZENE		0
ETHYL CHLORIDE (Chloroethane)		0
ETHYLENE DIBROMIDE (1,2-Dibromoethane)		0
ETHYLENE DICHLORIDE (1,2-Dichloroethane)		0
ETHYLENE GLYCOL		0
ETHYLENE OXIDE (1,2-Epoxyethane)		0
Fluorides		0
HYDROGEN FLUORIDE (Hydrofluoric acid)		0
FORMALDEHYDE		0
GASOLINE VAPORS		0
GLUTARALDEHYDE		0
ETHYLENE GLYCOL ETHYL ETHER – EGEE1		0
ETHYLENE GLYCOL ETHYL ETHER ACETATE – EGEEA1		0
ETHYLENE GLYCOL METHYL ETHER – EGME1		0
ETHYLENE GLYCOL METHYL ETHER ACETATE – EGMEA		0
n-HEXANE		0
HYDRAZINE		0
HYDROCHLORIC ACID (Hydrogen chloride)		0
HYDROGEN SULFIDE		0
ISOPHORONE		0
ISOPROPYL ALCOHOL (Isopropanol)		0
MALEIC ANHYDRIDE		0
MANGANESE AND COMPOUNDS		0
MERCURY AND COMPOUNDS (INORGANIC) values also apply to:		0
Mercuric chloride		0
METHANOL		0
METHYL BROMIDE (Bromomethane)		0
METHYL tertiary-BUTYL ETHER		0
METHYL CHLOROFORM (1,1,1-Trichloroethane)		0
METHYL ISOCYANATE		0
METHYLENE CHLORIDE (Dichloromethane)		0
4,4'-METHYLENE DIANILINE (AND ITS DICHLORIDE)		0
METHYLENE DIPHENYL ISOCYANATE		0
NICKEL AND COMPOUNDS2 (values also apply to:)		0
Nickel acetate2		0
Nickel carbonate2		0
Nickel carbonyl2		0
Nickel hydroxide2		0
Nickelocene2		0
NICKEL OXIDE2		0
Nickel refinery dust from the pyrometallurgical process2		0
Nickel subsulfide2		0
NITROGEN DIOXIDE		0
PARTICULATE EMISSIONS FROM DIESEL-FUELED ENGINES	0.011959385	0.004515334
PERCHLOROETHYLENE (Tetrachloroethylene)		0
PHENOL		0
PHOSPHINE		0
PHOSPHORIC ACID		0
PHOSPHORUS (WHITE)		0
PHTHALIC ANHYDRIDE		0
POLYCHLORINATED DIBENZO-P-DIOXINS (PCDD)(AS 2,3,7,8-PCDD EQUIV) 2,7		0
2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN2,7		0
1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN2,7		0
1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN2,7		0
1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN2,7		0
1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN2,7		0
1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN2,7		0
1,2,3,4,6,7,8,9-OCTACHLORODIBENZO-P-DIOXIN2,7		0
POLYCHLORINATED DIBENZOFURANS (PCDF)(AS 2,3,7,8-PCDD EQUIV) 2,7		0
2,3,7,8-TETRACHLORODIBENZOFURAN2,7		0
1,2,3,7,8-PENTACHLORODIBENZOFURAN2,7		0
2,3,4,7,8-PENTACHLORODIBENZOFURAN2,7		0
1,2,3,4,7,8-HEXACHLORODIBENZOFURAN2,7		0
1,2,3,6,7,8-HEXACHLORODIBENZOFURAN2,7		0
1,2,3,7,8,9-HEXACHLORODIBENZOFURAN2,7		0
2,3,4,6,7,8-HEXACHLORODIBENZOFURAN2,7		0
1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN2,7		0
1,2,3,4,7,8,9-HEPTACHLORODIBENZOFURAN2,7		0
1,2,3,4,6,7,8,9-OCTACHLORODIBENZOFURAN2,7		0
NAPHTHALENE		0
PROPYLENE (PROPENE)		0
PROPYLENE GLYCOL MONOMETHYL ETHER		0
PROPYLENE OXIDE		0
SELENIUM AND COMPOUNDS		0
Selenium sulfide		0
SILICA (Crystalline, Respirable)		0
STYRENE		0
SULFUR DIOXIDE		0
SULFURIC ACID AND OLEUM		0
SULFURIC ACID		0
SULFUR TRIOXIDE		0
OLEUM		0
TOLUENE		0
Toluene diisocyantates		0
TOLUENE-2,4-DIISOCYANATE		0
TOLUENE-2,6-DIISOCYANATE		0
TRICHLOROETHYLENE		0
TRIETHYLAMINE		0
VINYL ACETATE		0
VINYLIDENE CHLORIDE (1,1-Dichloroethylene)		0
XYLENES (mixed isomers)		0
m-XYLENE		0
o-XYLENE		0
p-XYLENE		0
	TOTAL:	4.52E-03

Plant #:
Plant Name:
Number of Sources:

Diesel PM Concentrations	Emissions (lbs/day)	M2.5 Concentration (ug/m3)
	1.20E-02	0.023091779
		0
		0
		0
		0
		0
		0
		0
		0
		0
		0
		0
		0
TOTAL:		0.023091779

Cancer Risk and Chronic Hazard Index Distance Adjustment Multiplier for Diesel IC Engines		
Meters	Feet	Multiplier
25	83	0.85
30	99	0.73
35	116	0.64
40	132	0.58
50	165	0.5
60	198	0.41
70	231	0.31
80	264	0.28
90	297	0.25
100	330	0.22
110	363	0.18
120	396	0.16
130	429	0.15
140	462	0.14
150	495	0.12
160	528	0.1
180	594	0.09
200	661	0.08
220	727	0.07
240	793	0.06
260	859	0.05
280	925	0.04

Cancer Risk and Chronic Hazard Index Distance Adjustment Multiplier for Gasoline Dispensing Facilities						
Meters	Feet	Multiplier		Meters	Feet	Multiplier
20	66	1		140	459	0.052
25	82	0.728		145	476	0.049
30	98	0.559		150	492	0.046
35	115	0.445		155	509	0.044
40	131	0.365		160	525	0.042
45	148	0.305		165	541	0.04
50	164	0.26		170	558	0.038
55	180	0.225		175	574	0.036
60	197	0.197		180	591	0.034
65	213	0.174		185	607	0.033
70	230	0.155		190	623	0.031
75	246	0.139		195	640	0.03
80	262	0.126		200	656	0.029
85	279	0.114		205	673	0.028
90	295	0.104		210	689	0.027
95	312	0.096		220	722	0.025
100	328	0.088		230	755	0.023
110	361	0.076		250	820	0.02
120	394	0.066		270	886	0.018
130	427	0.058		290	951	0.016

Attachment 3: CalEEMod Output Worksheets and Construction Risk Modeling Results

CalEEMod Worksheets

Kaiser Los Gamos, San Rafael
Marin County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Medical Office Building	148.00	1000sqft	0.00	148,000.00	0
Unenclosed Parking with Elevator	476.00	Space	2.13	190,400.00	0

1.2 Other Project Characteristics

Urbanization Urban **Wind Speed (m/s)** 2.2 **Precipitation Freq (Days)** 69

Climate Zone 5 **Operational Year** 2020

Utility Company Pacific Gas & Electric Company

CO2 Intensity (lb/MWhr) 290 **CH4 Intensity (lb/MWhr)** 0.029 **N2O Intensity (lb/MWhr)** 0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - 2020 PG&E CO2 intensity factor

Land Use - disturbed acreage for parking structure estimated from risk modeling area. no acreage for MOB bc it would occupy existing bldg.

Construction Phase - default

Trips and VMT -

Energy Use - default

Table Name	Column Name	Default Value	New Value
tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	0	15

tblLandUse	LotAcreage	3.40	0.00
tblLandUse	LotAcreage	4.28	2.13
tblProjectCharacteristics	CO2IntensityFactor	641.35	290

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	0.6209	3.5253	2.7425	6.0000e-003	0.1738	0.1692	0.3430	0.0517	0.1614	0.2131	0.0000	535.0383	535.0383	0.0726	0.0000	536.8544
2019	0.6506	7.6100e-003	9.9900e-003	2.0000e-005	7.9000e-004	5.2000e-004	1.3100e-003	2.1000e-004	5.2000e-004	7.3000e-004	0.0000	1.7466	1.7466	1.1000e-004	0.0000	1.7492
Maximum	**0.6506**	**3.5253**	**2.7425**	**6.0000e-003**	**0.1738**	**0.1692**	**0.3430**	**0.0517**	**0.1614**	**0.2131**	**0.0000**	**535.0383**	**535.0383**	**0.0726**	**0.0000**	**536.8544**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	**1-1-2018**	**3-31-2018**	0.9559	0.9559
2	**4-1-2018**	**6-30-2018**	1.0331	1.0331
3	**7-1-2018**	**9-30-2018**	1.0444	1.0444
4	**10-1-2018**	**12-31-2018**	1.1619	1.1619
5	**1-1-2019**	**3-31-2019**	0.5877	0.5877
		Highest	1.1619	1.1619

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.6720	5.0000e-005	5.7700e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005	0.0000	0.0112	0.0112	3.0000e-005	0.0000	0.0119
Energy	0.0154	0.1402	0.1178	8.4000e-004		0.0107	0.0107		0.0107	0.0107	0.0000	444.2166	444.2166	0.0321	8.8300e-003	447.6503
Mobile	1.0983	3.4687	11.4380	0.0337	2.9303	0.0400	2.9704	0.7867	0.0376	0.8243	0.0000	3,078.2025	3,078.2025	0.1143	0.0000	3,081.0608
Waste						0.0000	0.0000		0.0000	0.0000	324.4608	0.0000	324.4608	19.1751	0.0000	803.8378
Water						0.0000	0.0000		0.0000	0.0000	5.8918	14.8470	20.7388	0.6066	0.0146	40.2540
Total	**1.7858**	**3.6090**	**11.5616**	**0.0346**	**2.9303**	**0.0507**	**2.9811**	**0.7867**	**0.0483**	**0.8349**	**330.3525**	**3,537.2773**	**3,867.6298**	**19.9281**	**0.0234**	**4,372.8148**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.6720	5.0000e-005	5.7700e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005	0.0000	0.0112	0.0112	3.0000e-005	0.0000	0.0119
Energy	0.0154	0.1402	0.1178	8.4000e-004		0.0107	0.0107		0.0107	0.0107	0.0000	444.2166	444.2166	0.0321	8.8300e-003	447.6503
Mobile	1.0983	3.4687	11.4380	0.0337	2.9303	0.0400	2.9704	0.7867	0.0376	0.8243	0.0000	3,078.2025	3,078.2025	0.1143	0.0000	3,081.0608
Waste						0.0000	0.0000		0.0000	0.0000	324.4608	0.0000	324.4608	19.1751	0.0000	803.8378
Water						0.0000	0.0000		0.0000	0.0000	5.8918	14.8470	20.7388	0.6066	0.0146	40.2540
Total	**1.7858**	**3.6090**	**11.5616**	**0.0346**	**2.9303**	**0.0507**	**2.9811**	**0.7867**	**0.0483**	**0.8349**	**330.3525**	**3,537.2773**	**3,867.6298**	**19.9281**	**0.0234**	**4,372.8148**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2018	1/26/2018	5	20	
2	Site Preparation	Site Preparation	1/27/2018	1/31/2018	5	3	
3	Grading	Grading	2/1/2018	2/8/2018	5	6	
4	Building Construction	Building Construction	2/9/2018	12/13/2018	5	220	
5	Paving	Paving	12/14/2018	12/27/2018	5	10	
6	Architectural Coating	Architectural Coating	12/28/2018	1/10/2019	5	10	

Acres of Grading (Site Preparation Phase): 4.5

Acres of Grading (Grading Phase): 3

Acres of Paving: 2.13

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 222,000; Non-Residential Outdoor: 74,000; Striped Parking Area:

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Rubber Tired Dozers	1	8.00	247	0.40
Demolition	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Site Preparation	Graders	1	8.00	187	0.41
Site Preparation	Scrapers	1	8.00	367	0.48
Site Preparation	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40

Grading	Tractors/Loaders/Backhoes	2	7.00	97	0.37
Building Construction	Cranes	1	8.00	231	0.29
Building Construction	Forklifts	2	7.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	1	6.00	97	0.37
Building Construction	Welders	3	8.00	46	0.45
Architectural Coating	Air Compressors	1	6.00	78	0.48
Paving	Cement and Mortar Mixers	1	8.00	9	0.56
Paving	Pavers	1	8.00	130	0.42
Paving	Paving Equipment	1	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Paving	Tractors/Loaders/Backhoes	1	8.00	97	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	5	13.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	3	8.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	4	10.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	8	127.00	55.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	25.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Off-Road	0.0248	0.2436	0.1511	2.4000e-004		0.0144	0.0144		0.0134	0.0134	0.0000	21.6923	21.6923	5.5000e-003	0.0000	21.8297
Total	**0.0248**	**0.2436**	**0.1511**	**2.4000e-004**		**0.0144**	**0.0144**		**0.0134**	**0.0134**	**0.0000**	**21.6923**	**21.6923**	**5.5000e-003**	**0.0000**	**21.8297**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.4000e-004	4.0000e-004	3.8500e-003	1.0000e-005	1.0200e-003	1.0000e-005	1.0300e-003	2.7000e-004	1.0000e-005	2.8000e-004	0.0000	0.9719	0.9719	3.0000e-005	0.0000	0.9726
Total	**5.4000e-004**	**4.0000e-004**	**3.8500e-003**	**1.0000e-005**	**1.0200e-003**	**1.0000e-005**	**1.0300e-003**	**2.7000e-004**	**1.0000e-005**	**2.8000e-004**	**0.0000**	**0.9719**	**0.9719**	**3.0000e-005**	**0.0000**	**0.9726**

3.3 Site Preparation - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					2.3900e-003	0.0000	2.3900e-003	2.6000e-004	0.0000	2.6000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.8500e-003	0.0354	0.0191	4.0000e-005		1.4300e-003	1.4300e-003		1.3200e-003	1.3200e-003	0.0000	3.3590	3.3590	1.0500e-003	0.0000	3.3851

Total	**2.8500e-003**	**0.0354**	**0.0191**	**4.0000e-005**	**2.3900e-003**	**1.4300e-003**	**3.8200e-003**	**2.6000e-004**	**1.3200e-003**	**1.5800e-003**	**0.0000**	**3.3590**	**3.3590**	**1.0500e-003**	**0.0000**	**3.3851**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.0000e-005	4.0000e-005	3.6000e-004	0.0000	9.0000e-005	0.0000	1.0000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.0897	0.0897	0.0000	0.0000	0.0898
Total	**5.0000e-005**	**4.0000e-005**	**3.6000e-004**	**0.0000**	**9.0000e-005**	**0.0000**	**1.0000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**0.0897**	**0.0897**	**0.0000**	**0.0000**	**0.0898**

3.4 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0197	0.0000	0.0197	0.0101	0.0000	0.0101	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	6.4500e-003	0.0729	0.0311	6.0000e-005		3.5000e-003	3.5000e-003		3.2200e-003	3.2200e-003	0.0000	5.6539	5.6539	1.7600e-003	0.0000	5.6979
Total	**6.4500e-003**	**0.0729**	**0.0311**	**6.0000e-005**	**0.0197**	**3.5000e-003**	**0.0232**	**0.0101**	**3.2200e-003**	**0.0133**	**0.0000**	**5.6539**	**5.6539**	**1.7600e-003**	**0.0000**	**5.6979**

Unmitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.2000e-004	9.0000e-005	8.9000e-004	0.0000	2.4000e-004	0.0000	2.4000e-004	6.0000e-005	0.0000	6.0000e-005	0.0000	0.2243	0.2243	1.0000e-005	0.0000	0.2245
Total	**1.2000e-004**	**9.0000e-005**	**8.9000e-004**	**0.0000**	**2.4000e-004**	**0.0000**	**2.4000e-004**	**6.0000e-005**	**0.0000**	**6.0000e-005**	**0.0000**	**0.2243**	**0.2243**	**1.0000e-005**	**0.0000**	**0.2245**

3.5 Building Construction - 2018

Unmitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Off-Road	0.3204	2.2778	1.7290	2.7500e-003		0.1383	0.1383		0.1326	0.1326	0.0000	232.4891	232.4891	0.0501	0.0000	233.7412
Total	**0.3204**	**2.2778**	**1.7290**	**2.7500e-003**		**0.1383**	**0.1383**		**0.1326**	**0.1326**	**0.0000**	**232.4891**	**232.4891**	**0.0501**	**0.0000**	**233.7412**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0375	0.7785	0.3287	1.6300e-003	0.0395	6.3600e-003	0.0459	0.0114	6.0900e-003	0.0175	0.0000	157.0644	157.0644	8.7300e-003	0.0000	157.2826
Worker	0.0581	0.0429	0.4137	1.1600e-003	0.1101	7.8000e-004	0.1108	0.0293	7.2000e-004	0.0300	0.0000	104.4429	104.4429	2.9900e-003	0.0000	104.5177
Total	**0.0956**	**0.8214**	**0.7423**	**2.7900e-003**	**0.1496**	**7.1400e-003**	**0.1567**	**0.0407**	**6.8100e-003**	**0.0475**	**0.0000**	**261.5073**	**261.5073**	**0.0117**	**0.0000**	**261.8002**

3.6 Paving - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	7.0200e-003	0.0713	0.0599	9.0000e-005		4.2500e-003	4.2500e-003		3.9200e-003	3.9200e-003	0.0000	8.0478	8.0478	2.4600e-003	0.0000	8.1093
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**7.0200e-003**	**0.0713**	**0.0599**	**9.0000e-005**		**4.2500e-003**	**4.2500e-003**		**3.9200e-003**	**3.9200e-003**	**0.0000**	**8.0478**	**8.0478**	**2.4600e-003**	**0.0000**	**8.1093**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Worker	3.1000e-004	2.3000e-004	2.2200e-003	1.0000e-005	5.9000e-004	0.0000	6.0000e-004	1.6000e-004	0.0000	1.6000e-004	0.0000	0.5607	0.5607	2.0000e-005	0.0000	0.5611
Total	**3.1000e-004**	**2.3000e-004**	**2.2200e-003**	**1.0000e-005**	**5.9000e-004**	**0.0000**	**6.0000e-004**	**1.6000e-004**	**0.0000**	**1.6000e-004**	**0.0000**	**0.5607**	**0.5607**	**2.0000e-005**	**0.0000**	**0.5611**

3.7 Architectural Coating - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.1623					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	2.0100e-003	1.8500e-003	0.0000		1.5000e-004	1.5000e-004		1.5000e-004	1.5000e-004	0.0000	0.2553	0.2553	2.0000e-005	0.0000	0.2559
Total	**0.1626**	**2.0100e-003**	**1.8500e-003**	**0.0000**		**1.5000e-004**	**1.5000e-004**		**1.5000e-004**	**1.5000e-004**	**0.0000**	**0.2553**	**0.2553**	**2.0000e-005**	**0.0000**	**0.2559**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0000e-004	8.0000e-005	7.4000e-004	0.0000	2.0000e-004	0.0000	2.0000e-004	5.0000e-005	0.0000	5.0000e-005	0.0000	0.1869	0.1869	1.0000e-005	0.0000	0.1870
Total	**1.0000e-004**	**8.0000e-005**	**7.4000e-004**	**0.0000**	**2.0000e-004**	**0.0000**	**2.0000e-004**	**5.0000e-005**	**0.0000**	**5.0000e-005**	**0.0000**	**0.1869**	**0.1869**	**1.0000e-005**	**0.0000**	**0.1870**

3.7 Architectural Coating - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.6492					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.0700e-003	7.3400e-003	7.3700e-003	1.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004	0.0000	1.0213	1.0213	9.0000e-005	0.0000	1.0235
Total	**0.6502**	**7.3400e-003**	**7.3700e-003**	**1.0000e-005**		**5.2000e-004**	**5.2000e-004**		**5.2000e-004**	**5.2000e-004**	**0.0000**	**1.0213**	**1.0213**	**9.0000e-005**	**0.0000**	**1.0235**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.8000e-004	2.7000e-004	2.6300e-003	1.0000e-005	7.9000e-004	1.0000e-005	7.9000e-004	2.1000e-004	1.0000e-005	2.1000e-004	0.0000	0.7253	0.7253	2.0000e-005	0.0000	0.7258
Total	**3.8000e-004**	**2.7000e-004**	**2.6300e-003**	**1.0000e-005**	**7.9000e-004**	**1.0000e-005**	**7.9000e-004**	**2.1000e-004**	**1.0000e-005**	**2.1000e-004**	**0.0000**	**0.7253**	**0.7253**	**2.0000e-005**	**0.0000**	**0.7258**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Mitigated	1.0983	3.4687	11.4380	0.0337	2.9303	0.0400	2.9704	0.7867	0.0376	0.8243	0.0000	3,078.2025	3,078.2025	0.1143	0.0000	3,081.0608
Unmitigated	1.0983	3.4687	11.4380	0.0337	2.9303	0.0400	2.9704	0.7867	0.0376	0.8243	0.0000	3,078.2025	3,078.2025	0.1143	0.0000	3,081.0608

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Medical Office Building	5,347.24	1,326.08	229.40	7,910,555	7,910,555
Unenclosed Parking with Elevator	0.00	0.00	0.00		
Total	5,347.24	1,326.08	229.40	7,910,555	7,910,555

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Medical Office Building	9.50	7.30	7.30	29.60	51.40	19.00	60	30	10
Unenclosed Parking with Elevator	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Medical Office Building	0.586103	0.042797	0.200835	0.113384	0.018054	0.005119	0.010148	0.010539	0.002013	0.003657	0.005892	0.000682	0.000777
Unenclosed Parking with Elevator	0.586103	0.042797	0.200835	0.113384	0.018054	0.005119	0.010148	0.010539	0.002013	0.003657	0.005892	0.000682	0.000777

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	291.5513	291.5513	0.0292	6.0300e-003	294.0778
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	291.5513	291.5513	0.0292	6.0300e-003	294.0778
NaturalGas Mitigated	0.0154	0.1402	0.1178	8.4000e-004		0.0107	0.0107		0.0107	0.0107	0.0000	152.6653	152.6653	2.9300e-003	2.8000e-003	153.5725
NaturalGas Unmitigated	0.0154	0.1402	0.1178	8.4000e-004		0.0107	0.0107		0.0107	0.0107	0.0000	152.6653	152.6653	2.9300e-003	2.8000e-003	153.5725

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Medical Office Building	2.86084e+006	0.0154	0.1402	0.1178	8.4000e-004		0.0107	0.0107		0.0107	0.0107	0.0000	152.6653	152.6653	2.9300e-003	2.8000e-003	153.5725
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0154**	**0.1402**	**0.1178**	**8.4000e-004**		**0.0107**	**0.0107**		**0.0107**	**0.0107**	**0.0000**	**152.6653**	**152.6653**	**2.9300e-003**	**2.8000e-003**	**153.5725**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Medical Office Building	2.86084e+006	0.0154	0.1402	0.1178	8.4000e-004		0.0107	0.0107		0.0107	0.0107	0.0000	152.6653	152.6653	2.9300e-003	2.8000e-003	153.5725
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0154**	**0.1402**	**0.1178**	**8.4000e-004**		**0.0107**	**0.0107**		**0.0107**	**0.0107**	**0.0000**	**152.6653**	**152.6653**	**2.9300e-003**	**2.8000e-003**	**153.5725**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Medical Office Building	1.84704e+006	242.9629	0.0243	5.0300e-003	245.0683
Unenclosed Parking with Elevator	369376	48.5884	4.8600e-003	1.0100e-003	49.0094
Total		**291.5513**	**0.0292**	**6.0400e-003**	**294.0778**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Medical Office Building	1.84704e+006	242.9629	0.0243	5.0300e-003	245.0683

Unenclosed Parking with Elevator	369376	48.5884	4.8600e-003	1.0100e-003	49.0094
Total		**291.5513**	**0.0292**	**6.0400e-003**	**294.0778**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.6720	5.0000e-005	5.7700e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005	0.0000	0.0112	0.0112	3.0000e-005	0.0000	0.0119
Unmitigated	0.6720	5.0000e-005	5.7700e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005	0.0000	0.0112	0.0112	3.0000e-005	0.0000	0.0119

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0811					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.5903					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	5.4000e-004	5.0000e-005	5.7700e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005	0.0000	0.0112	0.0112	3.0000e-005	0.0000	0.0119

Total	**0.6720**	**5.0000e-005**	**5.7700e-003**	**0.0000**		**2.0000e-005**	**2.0000e-005**		**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0112**	**0.0112**	**3.0000e-005**	**0.0000**	**0.0119**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0811					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.5903					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	5.4000e-004	5.0000e-005	5.7700e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005	0.0000	0.0112	0.0112	3.0000e-005	0.0000	0.0119
Total	**0.6720**	**5.0000e-005**	**5.7700e-003**	**0.0000**		**2.0000e-005**	**2.0000e-005**		**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0112**	**0.0112**	**3.0000e-005**	**0.0000**	**0.0119**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	20.7388	0.6066	0.0146	40.2540
Unmitigated	20.7388	0.6066	0.0146	40.2540

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Medical Office Building	18.5711 / 3.53736	20.7388	0.6066	0.0146	40.2540
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**20.7388**	**0.6066**	**0.0146**	**40.2540**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Medical Office Building	18.5711 / 3.53736	20.7388	0.6066	0.0146	40.2540
Unenclosed Parking with Elevator	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**20.7388**	**0.6066**	**0.0146**	**40.2540**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	324.4608	19.1751	0.0000	803.8378
Unmitigated	324.4608	19.1751	0.0000	803.8378

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Medical Office Building	1598.4	324.4608	19.1751	0.0000	803.8378
Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**324.4608**	**19.1751**	**0.0000**	**803.8378**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Medical Office Building	1598.4	324.4608	19.1751	0.0000	803.8378

Unenclosed Parking with Elevator	0	0.0000	0.0000	0.0000	0.0000
Total		**324.4608**	**19.1751**	**0.0000**	**803.8378**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Kaiser Los Gamos, San Rafael - Existing

Marin County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	148.00	1000sqft	3.40	148,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	69
Climate Zone	5			**Operational Year**	2020
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	290	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - 2020 PG&E CO2 intensity factor

Land Use - *

Construction Phase - default

Trips and VMT -

Energy Use - default

Construction Off-road Equipment Mitigation - Tier 2 engines for equip >50hp. BAAQMD BMPs.

Table Name	Column Name	Default Value	New Value
tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	0	15

tblProjectCharacteristics	CO2IntensityFactor	641.35	290

2.0 Emissions Summary

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.6553	1.0000e-005	1.3700e-003	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.6400e-003	2.6400e-003	1.0000e-005	0.0000	2.8200e-003
Energy	0.0154	0.1402	0.1178	8.4000e-004		0.0107	0.0107		0.0107	0.0107	0.0000	395.6283	395.6283	0.0272	7.8300e-003	398.6409
Mobile	0.3600	1.2156	4.0346	0.0125	1.0979	0.0147	1.1126	0.2947	0.0138	0.3086	0.0000	1,141.9882	1,141.9882	0.0411	0.0000	1,143.0148
Waste						0.0000	0.0000		0.0000	0.0000	27.9397	0.0000	27.9397	1.6512	0.0000	69.2194
Water						0.0000	0.0000		0.0000	0.0000	8.3452	26.1455	34.4907	0.8598	0.0208	62.1768
Total	**1.0307**	**1.3558**	**4.1537**	**0.0134**	**1.0979**	**0.0254**	**1.1233**	**0.2947**	**0.0245**	**0.3192**	**36.2849**	**1,563.7646**	**1,600.0495**	**2.5792**	**0.0286**	**1,673.0547**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.6553	1.0000e-005	1.3700e-003	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.6400e-003	2.6400e-003	1.0000e-005	0.0000	2.8200e-003
Energy	0.0154	0.1402	0.1178	8.4000e-004		0.0107	0.0107		0.0107	0.0107	0.0000	395.6283	395.6283	0.0272	7.8300e-003	398.6409

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Mobile	0.3600	1.2156	4.0346	0.0125	1.0979	0.0147	1.1126	0.2947	0.0138	0.3086	0.0000	1,141.988 2	1,141.9882	0.0411	0.0000	1,143.014 8
Waste						0.0000	0.0000		0.0000	0.0000	27.9397	0.0000	27.9397	1.6512	0.0000	69.2194
Water						0.0000	0.0000		0.0000	0.0000	8.3452	26.1455	34.4907	0.8598	0.0208	62.1768
Total	**1.0307**	**1.3558**	**4.1537**	**0.0134**	**1.0979**	**0.0254**	**1.1233**	**0.2947**	**0.0245**	**0.3192**	**36.2849**	**1,563.764 6**	**1,600.0495**	**2.5792**	**0.0286**	**1,673.054 7**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.3600	1.2156	4.0346	0.0125	1.0979	0.0147	1.1126	0.2947	0.0138	0.3086	0.0000	1,141.988 2	1,141.9882	0.0411	0.0000	1,143.014 8
Unmitigated	0.3600	1.2156	4.0346	0.0125	1.0979	0.0147	1.1126	0.2947	0.0138	0.3086	0.0000	1,141.988 2	1,141.9882	0.0411	0.0000	1,143.014 8

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	1,632.44	364.08	155.40	2,963,867	2,963,867
Total	1,632.44	364.08	155.40	2,963,867	2,963,867

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
General Office Building	0.586103	0.042797	0.200835	0.113384	0.018054	0.005119	0.010148	0.010539	0.002013	0.003657	0.005892	0.000682	0.000777

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	242.9629	242.9629	0.0243	5.0300e-003	245.0683
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	242.9629	242.9629	0.0243	5.0300e-003	245.0683
NaturalGas Mitigated	0.0154	0.1402	0.1178	8.4000e-004		0.0107	0.0107		0.0107	0.0107	0.0000	152.6653	152.6653	2.9300e-003	2.8000e-003	153.5725
NaturalGas Unmitigated	0.0154	0.1402	0.1178	8.4000e-004		0.0107	0.0107		0.0107	0.0107	0.0000	152.6653	152.6653	2.9300e-003	2.8000e-003	153.5725

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	2.86084e+006	0.0154	0.1402	0.1178	8.4000e-004		0.0107	0.0107		0.0107	0.0107	0.0000	152.6653	152.6653	2.9300e-003	2.8000e-003	153.5725
Total		**0.0154**	**0.1402**	**0.1178**	**8.4000e-004**		**0.0107**	**0.0107**		**0.0107**	**0.0107**	**0.0000**	**152.6653**	**152.6653**	**2.9300e-003**	**2.8000e-003**	**153.5725**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	2.86084e+006	0.0154	0.1402	0.1178	8.4000e-004		0.0107	0.0107		0.0107	0.0107	0.0000	152.6653	152.6653	2.9300e-003	2.8000e-003	153.5725
Total		**0.0154**	**0.1402**	**0.1178**	**8.4000e-004**		**0.0107**	**0.0107**		**0.0107**	**0.0107**	**0.0000**	**152.6653**	**152.6653**	**2.9300e-003**	**2.8000e-003**	**153.5725**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	1.84704e+006	242.9629	0.0243	5.0300e-003	245.0683
Total		**242.9629**	**0.0243**	**5.0300e-003**	**245.0683**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	1.84704e+006	242.9629	0.0243	5.0300e-003	245.0683
Total		**242.9629**	**0.0243**	**5.0300e-003**	**245.0683**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.6553	1.0000e-005	1.3700e-003	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.6400e-003	2.6400e-003	1.0000e-005	0.0000	2.8200e-003
Unmitigated	0.6553	1.0000e-005	1.3700e-003	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.6400e-003	2.6400e-003	1.0000e-005	0.0000	2.8200e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0772					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.5780					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.3000e-004	1.0000e-005	1.3700e-003	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.6400e-003	2.6400e-003	1.0000e-005	0.0000	2.8200e-003
Total	**0.6553**	**1.0000e-005**	**1.3700e-003**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**2.6400e-003**	**2.6400e-003**	**1.0000e-005**	**0.0000**	**2.8200e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0772					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.5780					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.3000e-004	1.0000e-005	1.3700e-003	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.6400e-003	2.6400e-003	1.0000e-005	0.0000	2.8200e-003
Total	**0.6553**	**1.0000e-005**	**1.3700e-003**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**2.6400e-003**	**2.6400e-003**	**1.0000e-005**	**0.0000**	**2.8200e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

Category	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	34.4907	0.8598	0.0208	62.1768
Unmitigated	34.4907	0.8598	0.0208	62.1768

7.2 Water by Land Use

Unmitigated

Land Use	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
	Mgal	MT/yr			
General Office Building	26.3046 / 16.1222	34.4907	0.8598	0.0208	62.1768
Total		**34.4907**	**0.8598**	**0.0208**	**62.1768**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e

Land Use	Mgal	MT/yr			
General Office Building	26.3046 / 16.1222	34.4907	0.8598	0.0208	62.1768
Total		**34.4907**	**0.8598**	**0.0208**	**62.1768**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	27.9397	1.6512	0.0000	69.2194
Unmitigated	27.9397	1.6512	0.0000	69.2194

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	137.64	27.9397	1.6512	0.0000	69.2194

Total		**27.9397**	**1.6512**	**0.0000**	**69.2194**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	137.64	27.9397	1.6512	0.0000	69.2194
Total		**27.9397**	**1.6512**	**0.0000**	**69.2194**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Kaiser Los Gamos, San Rafael - Construction TAC

Marin County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Medical Office Building	148.00	1000sqft	0.00	148,000.00	0
Unenclosed Parking with Elevator	476.00	Space	2.13	190,400.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	69
Climate Zone	5			**Operational Year**	2020
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	290	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Using the PG&E 2020 CO2 intensity factor

Land Use - disturbed acreage for parking structure estimated from risk modeling area. no acreage for MOB bc it would occupy existing bldg.

Construction Phase - default

Trips and VMT - 0.5mi trip length to calculate risk from on- and near-site vehicle travel

Energy Use - default

Table Name	Column Name	Default Value	New Value
tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	0	15

tblLandUse	LotAcreage	3.40	0.00
tblLandUse	LotAcreage	4.28	2.13
tblProjectCharacteristics	CO2IntensityFactor	641.35	290
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	WorkerTripLength	10.80	0.50
tblTripsAndVMT	WorkerTripLength	10.80	0.50
tblTripsAndVMT	WorkerTripLength	10.80	0.50
tblTripsAndVMT	WorkerTripLength	10.80	0.50
tblTripsAndVMT	WorkerTripLength	10.80	0.50
tblTripsAndVMT	WorkerTripLength	10.80	0.50

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Year	tons/yr										MT/yr					
2018	0.5584	3.0854	2.2915	3.6300e-003	0.0302	0.1630	0.1932	0.0126	0.1555	0.1681	0.0000	313.7551	313.7551	0.0656	0.0000	315.3955
2019	0.6503	7.3900e-003	8.0300e-003	1.0000e-005	4.0000e-005	5.2000e-004	5.5000e-004	1.0000e-005	5.2000e-004	5.3000e-004	0.0000	1.0750	1.0750	9.0000e-005	0.0000	1.0772
Maximum	**0.6503**	**3.0854**	**2.2915**	**3.6300e-003**	**0.0302**	**0.1630**	**0.1932**	**0.0126**	**0.1555**	**0.1681**	**0.0000**	**313.7551**	**313.7551**	**0.0656**	**0.0000**	**315.3955**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2018	1/26/2018	5	20	
2	Site Preparation	Site Preparation	1/27/2018	1/31/2018	5	3	
3	Grading	Grading	2/1/2018	2/8/2018	5	6	
4	Building Construction	Building Construction	2/9/2018	12/13/2018	5	220	
5	Architectural Coating	Architectural Coating	12/28/2018	1/10/2019	5	10	
6	Paving	Paving	12/14/2018	12/27/2018	5	10	

Acres of Grading (Site Preparation Phase): 4.5

Acres of Grading (Grading Phase): 3

Acres of Paving: 2.13

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 222,000; Non-Residential Outdoor: 74,000; Striped Parking Area:

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Rubber Tired Dozers	1	8.00	247	0.40
Demolition	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Site Preparation	Graders	1	8.00	187	0.41

Site Preparation	Scrapers	1	8.00	367	0.48
Site Preparation	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Tractors/Loaders/Backhoes	2	7.00	97	0.37
Building Construction	Cranes	1	8.00	231	0.29
Building Construction	Forklifts	2	7.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	1	6.00	97	0.37
Building Construction	Welders	3	8.00	46	0.45
Architectural Coating	Air Compressors	1	6.00	78	0.48
Paving	Cement and Mortar Mixers	1	8.00	9	0.56
Paving	Pavers	1	8.00	130	0.42
Paving	Paving Equipment	1	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Paving	Tractors/Loaders/Backhoes	1	8.00	97	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	5	13.00	0.00	0.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT
Site Preparation	3	8.00	0.00	0.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT
Grading	4	10.00	0.00	0.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT
Building Construction	8	127.00	55.00	0.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	25.00	0.00	0.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0248	0.2436	0.1511	2.4000e-004		0.0144	0.0144		0.0134	0.0134	0.0000	21.6923	21.6923	5.5000e-003	0.0000	21.8297
Total	**0.0248**	**0.2436**	**0.1511**	**2.4000e-004**		**0.0144**	**0.0144**		**0.0134**	**0.0134**	**0.0000**	**21.6923**	**21.6923**	**5.5000e-003**	**0.0000**	**21.8297**

<u>Unmitigated Construction Off-Site</u>

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.7000e-004	7.0000e-005	9.7000e-004	0.0000	5.0000e-005	0.0000	5.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0718	0.0718	1.0000e-005	0.0000	0.0719
Total	**1.7000e-004**	**7.0000e-005**	**9.7000e-004**	**0.0000**	**5.0000e-005**	**0.0000**	**5.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0718**	**0.0718**	**1.0000e-005**	**0.0000**	**0.0719**

3.3 Site Preparation - 2018

<u>Unmitigated Construction On-Site</u>

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Fugitive Dust					2.3900e-003	0.0000	2.3900e-003	2.6000e-004	0.0000	2.6000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.8500e-003	0.0354	0.0191	4.0000e-005		1.4300e-003	1.4300e-003		1.3200e-003	1.3200e-003	0.0000	3.3590	3.3590	1.0500e-003	0.0000	3.3851
Total	**2.8500e-003**	**0.0354**	**0.0191**	**4.0000e-005**	**2.3900e-003**	**1.4300e-003**	**3.8200e-003**	**2.6000e-004**	**1.3200e-003**	**1.5800e-003**	**0.0000**	**3.3590**	**3.3590**	**1.0500e-003**	**0.0000**	**3.3851**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.0000e-005	1.0000e-005	9.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.6300e-003	6.6300e-003	0.0000	0.0000	6.6400e-003
Total	**2.0000e-005**	**1.0000e-005**	**9.0000e-005**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**6.6300e-003**	**6.6300e-003**	**0.0000**	**0.0000**	**6.6400e-003**

3.4 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0197	0.0000	0.0197	0.0101	0.0000	0.0101	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	6.4500e-003	0.0729	0.0311	6.0000e-005		3.5000e-003	3.5000e-003		3.2200e-003	3.2200e-003	0.0000	5.6539	5.6539	1.7600e-003	0.0000	5.6979

Total	**6.4500e-003**	**0.0729**	**0.0311**	**6.0000e-005**	**0.0197**	**3.5000e-003**	**0.0232**	**0.0101**	**3.2200e-003**	**0.0133**	**0.0000**	**5.6539**	**5.6539**	**1.7600e-003**	**0.0000**	**5.6979**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.0000e-005	2.0000e-005	2.2000e-004	0.0000	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0166	0.0166	0.0000	0.0000	0.0166
Total	**4.0000e-005**	**2.0000e-005**	**2.2000e-004**	**0.0000**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0166**	**0.0166**	**0.0000**	**0.0000**	**0.0166**

3.5 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3204	2.2778	1.7290	2.7500e-003		0.1383	0.1383		0.1326	0.1326	0.0000	232.4891	232.4891	0.0501	0.0000	233.7412
Total	**0.3204**	**2.2778**	**1.7290**	**2.7500e-003**		**0.1383**	**0.1383**		**0.1326**	**0.1326**	**0.0000**	**232.4891**	**232.4891**	**0.0501**	**0.0000**	**233.7412**

Unmitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0161	0.3744	0.1931	3.6000e-004	2.8600e-003	8.3000e-004	3.6800e-003	8.4000e-004	7.9000e-004	1.6300e-003	0.0000	34.3918	34.3918	4.1800e-003	0.0000	34.4964
Worker	0.0178	7.8200e-003	0.1043	9.0000e-005	5.2300e-003	1.2000e-004	5.3500e-003	1.4100e-003	1.1000e-004	1.5200e-003	0.0000	7.7156	7.7156	5.5000e-004	0.0000	7.7295
Total	**0.0339**	**0.3822**	**0.2973**	**4.5000e-004**	**8.0900e-003**	**9.5000e-004**	**9.0300e-003**	**2.2500e-003**	**9.0000e-004**	**3.1500e-003**	**0.0000**	**42.1074**	**42.1074**	**4.7300e-003**	**0.0000**	**42.2258**

3.6 Architectural Coating - 2018

Unmitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Archit. Coating	0.1623					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	2.0100e-003	1.8500e-003	0.0000		1.5000e-004	1.5000e-004		1.5000e-004	1.5000e-004	0.0000	0.2553	0.2553	2.0000e-005	0.0000	0.2559
Total	**0.1626**	**2.0100e-003**	**1.8500e-003**	**0.0000**		**1.5000e-004**	**1.5000e-004**		**1.5000e-004**	**1.5000e-004**	**0.0000**	**0.2553**	**0.2553**	**2.0000e-005**	**0.0000**	**0.2559**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-005	1.0000e-005	1.9000e-004	0.0000	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0000	0.0000	0.0000	0.0138	0.0138	0.0000	0.0000	0.0138
Total	**3.0000e-005**	**1.0000e-005**	**1.9000e-004**	**0.0000**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0138**	**0.0138**	**0.0000**	**0.0000**	**0.0138**

3.6 Architectural Coating - 2019

<u>Unmitigated Construction On-Site</u>

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.6492					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.0700e-003	7.3400e-003	7.3700e-003	1.0000e-005		5.2000e-004	5.2000e-004		5.2000e-004	5.2000e-004	0.0000	1.0213	1.0213	9.0000e-005	0.0000	1.0235
Total	**0.6502**	**7.3400e-003**	**7.3700e-003**	**1.0000e-005**		**5.2000e-004**	**5.2000e-004**		**5.2000e-004**	**5.2000e-004**	**0.0000**	**1.0213**	**1.0213**	**9.0000e-005**	**0.0000**	**1.0235**

<u>Unmitigated Construction Off-Site</u>

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Worker	1.1000e-004	5.0000e-005	6.6000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0537	0.0537	0.0000	0.0000	0.0537
Total	**1.1000e-004**	**5.0000e-005**	**6.6000e-004**	**0.0000**	**4.0000e-005**	**0.0000**	**4.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0537**	**0.0537**	**0.0000**	**0.0000**	**0.0537**

3.7 Paving - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	7.0200e-003	0.0713	0.0599	9.0000e-005		4.2500e-003	4.2500e-003		3.9200e-003	3.9200e-003	0.0000	8.0478	8.0478	2.4600e-003	0.0000	8.1093
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**7.0200e-003**	**0.0713**	**0.0599**	**9.0000e-005**		**4.2500e-003**	**4.2500e-003**		**3.9200e-003**	**3.9200e-003**	**0.0000**	**8.0478**	**8.0478**	**2.4600e-003**	**0.0000**	**8.1093**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0000e-004	4.0000e-005	5.6000e-004	0.0000	3.0000e-005	0.0000	3.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0414	0.0414	0.0000	0.0000	0.0415
Total	**1.0000e-004**	**4.0000e-005**	**5.6000e-004**	**0.0000**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0414**	**0.0414**	**0.0000**	**0.0000**	**0.0415**

Construction Risk Modeling

Kaiser Los Gamos, San Rafael, California

DPM Emissions and Modeling Emission Rates

Emissions Model Year	Activity	DPM (ton/year)	Area Source	DPM Emissions (lb/yr)	(lb/hr)	(g/s)	Modeled Area (m^2)	DPM Emission Rate ($g/s/m^2$)
2018	Construction	0.1635	DPM	327.0	0.09954	1.25E-02	8,614	**1.46E-06**
Total		***0.1635***		***327.0***	***0.0995***	***0.0125***		
		Operation Hours						
		hr/day =	9	(7am - 4pm)				
		days/yr =	365					
		hours/year =	3285					

Kaiser Los Gamos, San Rafael, California

PM2.5 Fugitive Dust Emissions for Modeling

Construction Year	Activity	Area Source	PM2.5 Emissions (ton/year)	(lb/yr)	(lb/hr)	(g/s)	Modeled Area (m^2)	PM2.5 Emission Rate $g/s/m^2$
2018	Construction	FUG	0.0126	25.2	0.00767	9.67E-04	8,614	**1.12E-07**
Total			***0.0126***	***25.2***	***0.0077***	***0.0010***		
		Operation Hours						
		hr/day =	9	(7am - 4pm)				
		days/yr =	365					
		hours/year =	3285					

Kaiser Los Gamos, San Rafael, California

Maximum Impacts at Construction MEI Location

Emissions Year	Maximum Concentrations: Exhaust PM10/DPM ($\mu g/m^3$)	Fugitive PM2.5 ($\mu g/m^3$)	Cancer Risk (per million): Child	Adult	Hazard Index (-)	Maximum Annual PM2.5 Concentration ($\mu g/m^3$)
2018	0.0249	0.0021	4.1	0.1	0.005	0.03
Maximum	0.0249	0.0021	4.1	0.1	0.005	0.03

Maximum Impacts at Bright Horizons Daycare MEI Location

Emissions Year	Maximum Concentrations: Exhaust PM10/DPM ($\mu g/m^3$)	Fugitive PM2.5 ($\mu g/m^3$)	Cancer Risk (per million): Child	Adult	Hazard Index (-)	Maximum Annual PM2.5 Concentration ($\mu g/m^3$)
2018	0.0126	0.0010	2.1	0.0	0.003	0.01
Maximum	0.0126	0.0010	2.1	0.0	0.003	0.01

Kaiser Los Gamos, San Rafael, California
Maximum DPM Cancer Risk Calculations From Construction
Impacts at Off-Site Receptors-1.5 meter

Cancer Risk (per million) = CPF x Inhalation Dose x ASF x ED/AT x FAH x 1.0E6

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)
FAH = Fraction of time spent at home (unitless)

Inhalation Dose = C_{air} x DBR x A x (EF/365) x 10^{-6}

Where: C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

Values

	Infant/Child				Adult
Age -->	**3rd Trimester**	**0 - 2**	**2 - 9**	**2 - 16**	**16 - 30**
Parameter					
ASF =	10	10	3	3	1
CPF =	1.10E+00	1.10E+00	1.10E+00	1.10E+00	1.10E+00
DBR* =	361	1090	631	572	261
A =	1	1	1	1	1
EF =	350	350	350	350	350
AT =	70	70	70	70	70
FAH =	1.00	1.00	1.00	1.00	0.73

* 95th percentile breathing rates for infants and 80th percentile for children and adults

Construction Cancer Risk by Year - Maximum Impact Receptor Location

Exposure Year	Exposure Duration (years)	Age	Infant/Child - Exposure Information: DPM Conc (ug/m3) Year	DPM Conc (ug/m3) Annual	Age Sensitivity Factor	Infant/Child Cancer Risk (per million)	Adult - Exposure Information: Modeled DPM Conc (ug/m3) Year	Annual	Age Sensitivity Factor	Adult Cancer Risk (per million)	Fugitive PM2.5	Total PM2.5
0	0.25	-0.25 - 0*	-	-	10	-	-	-	-	-		
1	1	0 - 1	2018	0.0249	10	4.10	2018	0.0249	1	0.07	0.0021	0.027
2	1	1 - 2		0.0000	10	0.00		0.0000	1	0.00		
3	1	2 - 3		0.0000	3	0.00		0.0000	1	0.00		
4	1	3 - 4		0.0000	3	0.00		0.0000	1	0.00		
5	1	4 - 5		0.0000	3	0.00		0.0000	1	0.00		
6	1	5 - 6		0.0000	3	0.00		0.0000	1	0.00		
7	1	6 - 7		0.0000	3	0.00		0.0000	1	0.00		
8	1	7 - 8		0.0000	3	0.00		0.0000	1	0.00		
9	1	8 - 9		0.0000	3	0.00		0.0000	1	0.00		
10	1	9 - 10		0.0000	3	0.00		0.0000	1	0.00		
11	1	10 - 11		0.0000	3	0.00		0.0000	1	0.00		
12	1	11 - 12		0.0000	3	0.00		0.0000	1	0.00		
13	1	12 - 13		0.0000	3	0.00		0.0000	1	0.00		
14	1	13 - 14		0.0000	3	0.00		0.0000	1	0.00		
15	1	14 - 15		0.0000	3	0.00		0.0000	1	0.00		
16	1	15 - 16		0.0000	3	0.00		0.0000	1	0.00		
17	1	16-17		0.0000	1	0.00		0.0000	1	0.00		
18	1	17-18		0.0000	1	0.00		0.0000	1	0.00		
19	1	18-19		0.0000	1	0.00		0.0000	1	0.00		
20	1	19-20		0.0000	1	0.00		0.0000	1	0.00		
21	1	20-21		0.0000	1	0.00		0.0000	1	0.00		
22	1	21-22		0.0000	1	0.00		0.0000	1	0.00		
23	1	22-23		0.0000	1	0.00		0.0000	1	0.00		
24	1	23-24		0.0000	1	0.00		0.0000	1	0.00		
25	1	24-25		0.0000	1	0.00		0.0000	1	0.00		
26	1	25-26		0.0000	1	0.00		0.0000	1	0.00		
27	1	26-27		0.0000	1	0.00		0.0000	1	0.00		
28	1	27-28		0.0000	1	0.00		0.0000	1	0.00		
29	1	28-29		0.0000	1	0.00		0.0000	1	0.00		
30	1	29-30		0.0000	1	0.00		0.0000	1	0.00		
Total Increased Cancer Risk						**4.10**				**0.07**		

* Third trimester of pregnancy

Kaiser Los Gamos, San Rafael, California
Maximum DPM Cancer Risk Calculations From Construction
Impacts at Off-Site Receptors-1.5 meter

Cancer Risk (per million) = CPF x Inhalation Dose x ASF x ED/AT x FAH x 1.0E6

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)
FAH = Fraction of time spent at home (unitless)

Inhalation Dose = C_{air} x DBR x A x (EF/365) x 10^{-6}

Where: C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

Values

	Infant/Child				**Adult**
Age -->	**3rd Trimester**	**0 - 2**	**2 - 9**	**2 - 16**	**16 - 30**
Parameter					
ASF =	10	10	3	3	1
CPF =	1.10E+00	1.10E+00	1.10E+00	1.10E+00	1.10E+00
DBR* =	361	1090	631	572	261
A =	1	1	1	1	1
EF =	350	350	350	350	350
AT =	70	70	70	70	70
FAH =	1.00	1.00	1.00	1.00	0.73

* 95th percentile breathing rates for infants and 80th percentile for children and adults

Construction Cancer Risk by Year - Maximum Impact Daycare Location

Exposure Year	**Exposure Duration (years)**	**Age**	**Infant/Child - Exposure Information: DPM Conc (ug/m3) Year**	**Annual**	**Age Sensitivity Factor**	**Infant/Child Cancer Risk (per million)**	**Adult - Exposure Information: Modeled DPM Conc (ug/m3) Year**	**Annual**	**Age Sensitivity Factor**	**Adult Cancer Risk (per million)**	**Fugitive PM2.5**	**Total PM2.5**
0	0.25	-0.25 - 0*	-	-	10	-	-	-	-	-		
1	1	0 - 1	2018	0.0126	10	2.07	2018	0.0126	1	0.04	0.0010	0.014
2	1	1 - 2		0.0000	10	0.00		0.0000	1	0.00		
3	1	2 - 3		0.0000	3	0.00		0.0000	1	0.00		
4	1	3 - 4		0.0000	3	0.00		0.0000	1	0.00		
5	1	4 - 5		0.0000	3	0.00		0.0000	1	0.00		
6	1	5 - 6		0.0000	3	0.00		0.0000	1	0.00		
7	1	6 - 7		0.0000	3	0.00		0.0000	1	0.00		
8	1	7 - 8		0.0000	3	0.00		0.0000	1	0.00		
9	1	8 - 9		0.0000	3	0.00		0.0000	1	0.00		
10	1	9 - 10		0.0000	3	0.00		0.0000	1	0.00		
11	1	10 - 11		0.0000	3	0.00		0.0000	1	0.00		
12	1	11 - 12		0.0000	3	0.00		0.0000	1	0.00		
13	1	12 - 13		0.0000	3	0.00		0.0000	1	0.00		
14	1	13 - 14		0.0000	3	0.00		0.0000	1	0.00		
15	1	14 - 15		0.0000	3	0.00		0.0000	1	0.00		
16	1	15 - 16		0.0000	3	0.00		0.0000	1	0.00		
17	1	16-17		0.0000	1	0.00		0.0000	1	0.00		
18	1	17-18		0.0000	1	0.00		0.0000	1	0.00		
19	1	18-19		0.0000	1	0.00		0.0000	1	0.00		
20	1	19-20		0.0000	1	0.00		0.0000	1	0.00		
21	1	20-21		0.0000	1	0.00		0.0000	1	0.00		
22	1	21-22		0.0000	1	0.00		0.0000	1	0.00		
23	1	22-23		0.0000	1	0.00		0.0000	1	0.00		
24	1	23-24		0.0000	1	0.00		0.0000	1	0.00		
25	1	24-25		0.0000	1	0.00		0.0000	1	0.00		
26	1	25-26		0.0000	1	0.00		0.0000	1	0.00		
27	1	26-27		0.0000	1	0.00		0.0000	1	0.00		
28	1	27-28		0.0000	1	0.00		0.0000	1	0.00		
29	1	28-29		0.0000	1	0.00		0.0000	1	0.00		
30	1	29-30		0.0000	1	0.00		0.0000	1	0.00		
Total Increased Cancer Risk						**2.07**				**0.04**		

* Third trimester of pregnancy

KAISER MEDICAL OFFICE BUILDING PROJECT NOISE AND VIBRATION ASSESSMENT

SAN RAFAEL, CALIFORNIA

February 27, 2018

♦ ♦ ♦

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INTRODUCTION

A Kaiser Medical Office Building is proposed at 1650 Los Gamos Drive in San Rafael, California. As part of the project, the existing three-story, 148,000-square-foot building would be converted into a medical office space. Additionally, the construction of a three-story parking garage consisting of up to 476 parking spaces would be included in the proposed project. The nearby Los Gamos Drive/Lucas Valley Road intersection would also require improvements as part of this project. No changes are proposed to the existing surface parking lot located at the site. Access to the site would continue to be along Los Gamos Drive.

This report evaluates the project's potential to result in significant noise and vibration impacts with respect to applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into two sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise, summarizes applicable regulatory criteria, and discusses the results of the ambient noise monitoring survey completed to document existing noise conditions and 2) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts upon sensitive receivers, provides a discussion of each project impact, and presents measures, where necessary, to mitigate the identified impacts to a less-than-significant level.

SETTING

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (*frequency*) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level* (*DNL* or L_{dn}) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Effects of Noise

Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA CNEL. Typically, the highest steady traffic noise level during the daytime is about equal to the CNEL and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA CNEL with open windows and 65-70 dBA CNEL if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed; those facing major roadways and freeways typically need special glass windows.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The CNEL as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 50 dBA CNEL. At a CNEL of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the CNEL increases to 70 dBA, the percentage of the population highly annoyed increases to about 25-30 percent of the population. There is, therefore, an increase of about 2 percent per dBA between a CNEL of 60-70 dBA. Between a CNEL of 70-80 dBA, each decibel increase increases by about 3 percent the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the CNEL is 60 dBA, approximately 30-35 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 3 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 4 percent increase in the percentage of the population highly annoyed.

Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous vibration levels produce.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to induce structural damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Studies have shown that the threshold of perception for average persons is in the range of 0.008 to 0.012 in/sec PPV. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as minor cracking of building elements, or may threaten the integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher and there is no general consensus as to what amount of vibration may pose a threat for structural damage to the building. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

TABLE 3 Reaction of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Virtually no risk of damage to normal buildings
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to newer residential structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

Regulatory Background – Noise

The State of California and the City of San Rafael have established regulatory criteria that are applicable in this assessment. The State CEQA Guidelines, Appendix G, are used to assess the potential significance of impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. A summary of the applicable regulatory criteria is provided below.

State CEQA Guidelines. The CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

(b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;

(c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

(d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

(e) For a project located within an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, if the project would expose people residing or working in the project area to excessive noise levels;

(f) For a project within the vicinity of a private airstrip, if the project would expose people residing or working in the project area to excessive noise levels.

Pursuant to recent court decisions, the impacts of site constraints such as exposure of the proposed project to excessive levels of noise and vibration are not included in the Impacts and Mitigation Section of this report. Checklist item (a), regarding the compatibility of the project with noise levels at the site, is discussed in the General Plan Consistency section of the report. Checklist items (a) through (d) are applicable in the assessment of potential impacts resulting from the proposed project at off-site receptors.

CEQA does not define what noise level increase would be considered substantial. Typically, an increase in the L_{dn} noise level resulting from the project at noise sensitive land uses of 3 dBA or greater would be considered a significant impact when projected noise levels would exceed those considered acceptable for the affected land use. An increase of 5 dBA L_{dn} or greater would be considered a significant impact when projected noise levels would remain within those considered acceptable for the affected land use.

City of San Rafael General Plan 2020. The Noise Element of San Rafael's General Plan[1] is intended to reduce noise impacts and improve the quality of life of the residents. To accomplish this intent, the Noise Element contains goals and policies. The goals and policies that apply to the proposed project are as follows:

Goal 29: It is the goal of San Rafael to have acceptable noise levels. *Excessive noise is a concern for many residents of San Rafael. These concerns can be managed with proper mitigation or through the implementation of the noise ordinance. The City of San Rafael recognizes the issue of noise and has standards to protect people from excessive, unnecessary and unreasonable noises from any and all sources in the community.*

N-1. Noise Impacts on New Development. Protect people in new development from excessive noise by applying noise standards in land use decisions. Apply the Land Use Compatibility Standards (see Exhibit 31) to the siting of new uses in existing noise environments. These standards identify the acceptability of a project based on noise exposure. If a project exceeds the standards in Exhibit 31, an acoustical analysis shall be required to identify noise impacts and potential noise mitigations. Mitigation should include the research and use of state-of-the-art abating materials and technology.

N-1a. Acoustical Studies. Require acoustical studies for all new residential projects within the projected L_{dn} 60 dB noise contours (see Exhibit 31) so that noise mitigation measures can be incorporated into project design. Acoustical studies shall identify noise sources and contain a discussion of the existing and future noise exposure and the mitigation measures that may be used to achieve the appropriate outdoor and indoor noise standards.

1 City of San Rafael, *City of San Rafael General Plan 2020*, Noise Element, January 18, 2013.

N-3. Planning and Design of New Development. Encourage new development to be planned and designed to minimize noise impacts from outside noise sources.

N-3a. Noise Mitigation. Require, where appropriate, the following mitigation measures to minimize noise impacts on proposed development projects:

1. **Site planning.** Proper site planning is the first mitigation measure that should be investigated to reduce noise impacts. By taking advantage of the natural shape and terrain of the site, it often is possible to arrange the buildings and other uses in a manner that will reduce and possibly eliminate noise impacts. Specific site planning techniques include:
   a. Increasing the distance between the noise source and the receiver;
   b. Placing non-noise sensitive land uses such as parking lots, maintenance facilities, and utility areas between the source and the receiver;
   c. Using non-noise sensitive structures such as garages to shield noise-sensitive areas; and
   d. Orienting buildings to shield outdoor spaces from a noise source.

2. **Architectural layout of buildings.** In many cases, noise reduction can be attained by careful layout of noise-sensitive spaces. Bedrooms, for example, should be placed away from freeways. Quiet outdoor spaces can be provided next to a noisy highway by creating a U-shaped development, which faces away from the highway.

3. **Noise barriers.** Absorptive types of noise barriers or walls should be used to reduce noise levels from ground transportation noise sources and industrial sources. A barrier must interrupt the line of sight between the noise source and the receiver in order to reduce noise level both outdoors and indoors. A barrier should provide at least L_{dn} 5 dB of noise reduction to achieve a noticeable change in noise levels.

4. **Construction modifications.** If site planning, architectural layout, noise barriers, or a combination of these measures does not achieve the required noise reduction, then mitigation should be facilitated through construction modification to walls, roofs, ceilings, doors, windows.

5. **Alternatives to sound walls.** Encourage new development to identify alternatives to the use of sound walls to ease noise impacts.

N-4. Noise from New Nonresidential Development. Design nonresidential development to minimize noise impacts on neighboring uses.

a. **Performance Standards for Uses Affecting Residential Districts.** New nonresidential development shall not increase noise levels in a residential district by more than L_{dn} 3 dB, or create noise impacts that would increase noise levels to more than L_{dn} 60 dB at the property line of the noise receiving use, whichever is the more restrictive standard.

b. **Performance Standards for Uses Affecting Nonresidential and Mixed-Use Districts.** New nonresidential projects shall not increase noise levels in a nonresidential or mixed-use district by more than L_{dn} 5 dB, or create noise impacts that would increase noise levels to more than L_{dn} 65 dB (Office, Retail) or L_{dn} 70 dB (Industrial), at the property line of the noise receiving use, whichever is the more restrictive standard.

c. **Waiver.** These standards may be waived if, as determined by an acoustical study, there are mitigating circumstances (such as higher existing noise levels), and no uses would be adversely affected.

N-4a. Require Acoustical Study. Identify through an acoustical study noise mitigation measures to be designed and built into new nonresidential and mixed-use development, and encourage absorptive types of mitigation measures between noise sources and residential districts.

N-5. Traffic Noise from New Development. Minimize noise impacts of increased off-site traffic caused by new development. Where the exterior L_{dn} is 65 dB or greater at a residential building or outdoor use area and a plan, program, or project increases traffic noise levels by more than L_{dn} 3 dB, reasonable noise mitigation measures shall be included in the plan, program or project.

N-5a. Traffic Noise Studies. Require acoustical studies to evaluate potential off-site noise impacts resulting from traffic generated by new development.

N-6. Traffic Noise. Attempt to minimize traffic noise through land use policies, law enforcement, and street improvements.

N-6a. Enforce Speed Limits. Enforce speed limits on roads generating numerous noise complaints.

N-6b. Mixed-Use. Develop land use districts to allow housing close to offices and services to reduce the amount of traffic from local trips.

N-6c. Coordination with Local and State Agencies. Coordinate with CalTrans, Marin Countywide Planning Agency, Congestion Management Agency and other agencies to achieve noise reduction along Pt. San Pedro Road, Highways 101 and 580, and the Sonoma Marin Area Rail Transit corridor.

N-6d. Vehicle Code. Enforce the California Vehicle Code regarding noisy vehicles.

N-6e. Street Improvements. Pursue feasible cost-effective new street paving technologies to minimize traffic noise.

N-6f. Widening of US 101 and 580. Encourage Caltrans to mitigate highway noise impacts as a part of the US 101 widening project. Review and comment, as necessary, on any proposed sound walls in San Rafael. Encourage Caltrans to use noise mitigation measures other than walls if they can be shown to be effective. These measures may include alternative pavement types and sound-absorptive treatments on existing and future noise barriers.

N-7. Airport/Heliport. To the extent allowed by federal and state law, consider and mitigate noise impacts of any changes in facilities or operations that require use permit mitigations or other land use permits at the San Rafael Airport in north San Rafael and the heliport in East San Rafael (see Noise Contours for San Rafael Airport and Heliport in Exhibits 32 and 33).

N-8. Sonoma Marin Area Rail Transit. If a commuter rail service or other use is developed along the Sonoma Marin Area Rail Transit right-of-way, minimize noise impacts on existing development.

N-8a. Future Transitway Mitigation Measures. A detailed noise assessment and appropriate mitigation measures should be prepared for any rail project on the Sonoma Marin Area Rail Transit right-of-way. The analysis should address the City's noise standards and the Federal Transit Administrations (FTA) guidelines.

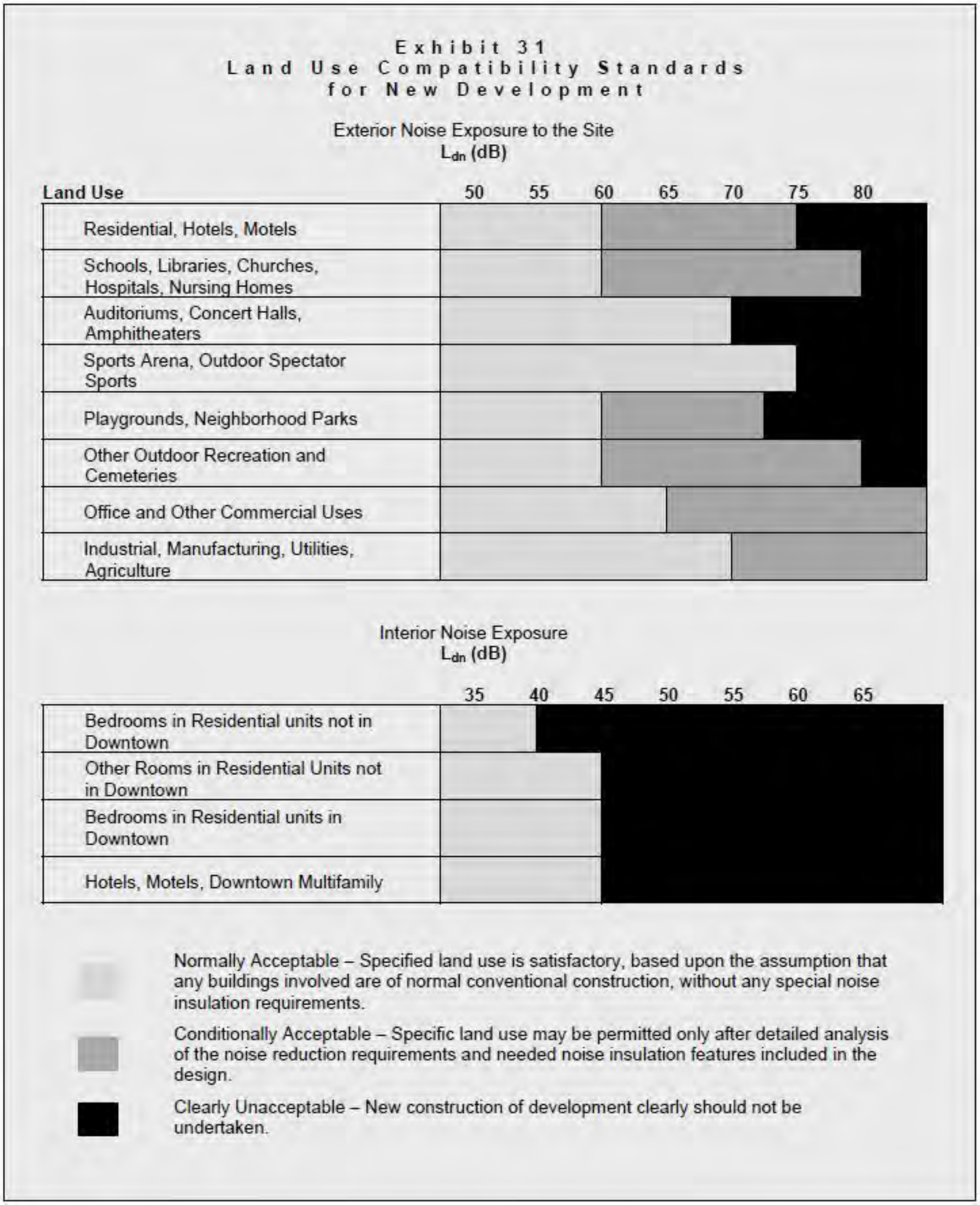
N-9. Nuisance Noise. Minimize impacts from noise levels that exceed community sound levels.

N-9a. Enforce and Update the Noise Ordinance. Enforce and update, as necessary, the City's Noise Ordinance that addresses common noise nuisances including amplified music, outdoor mechanical equipment and construction activities.

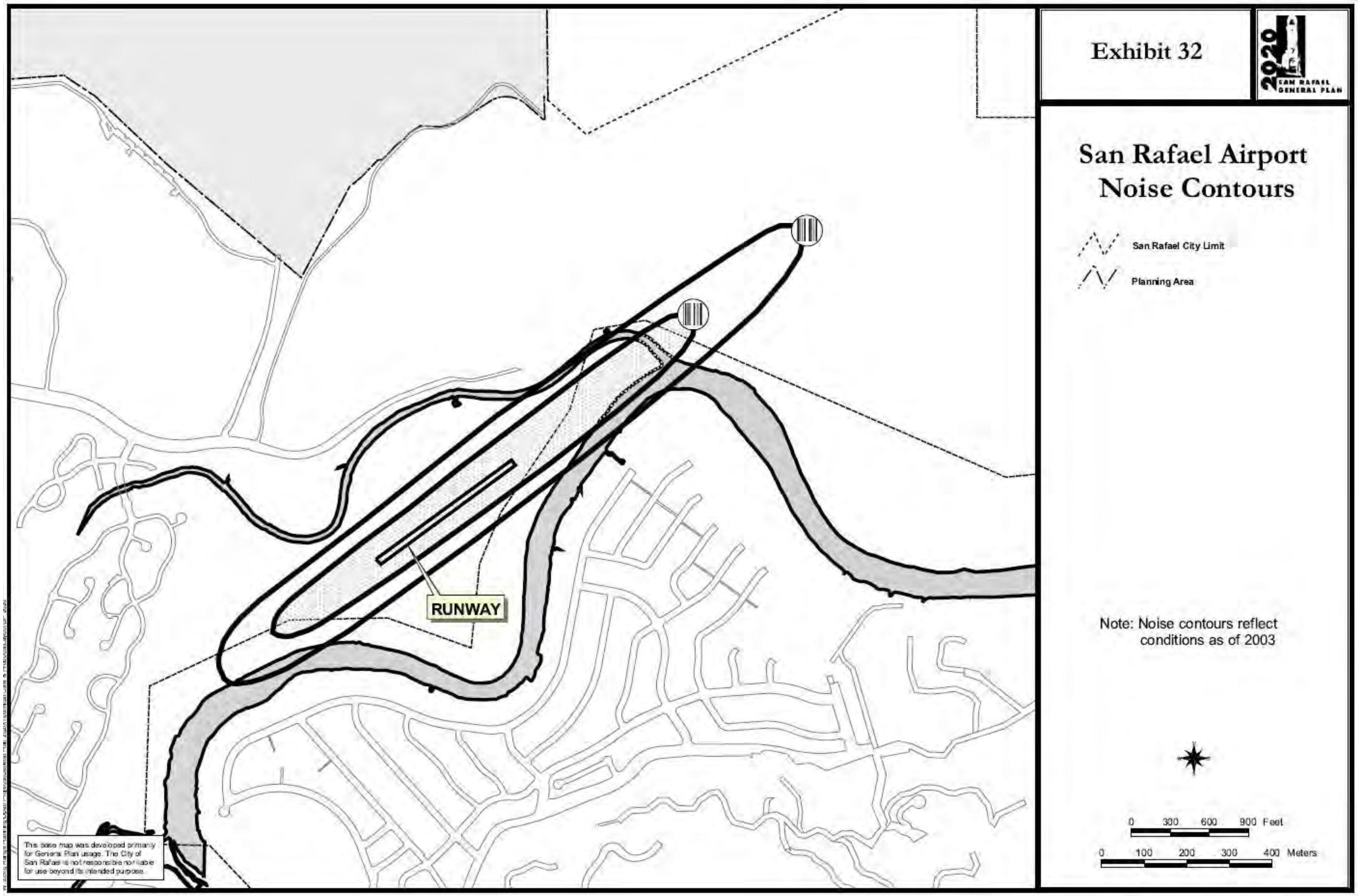
N-10b. Mitigation for Construction Activity Noise. Through environmental review, identify mitigation measures to minimize the exposure of neighboring properties to excessive noise levels from construction-related activity.

N-10c. Noise Specifications. Include noise specifications in requests for equipment information and bids for new City equipment and consider this information as part of evaluation of the bids.

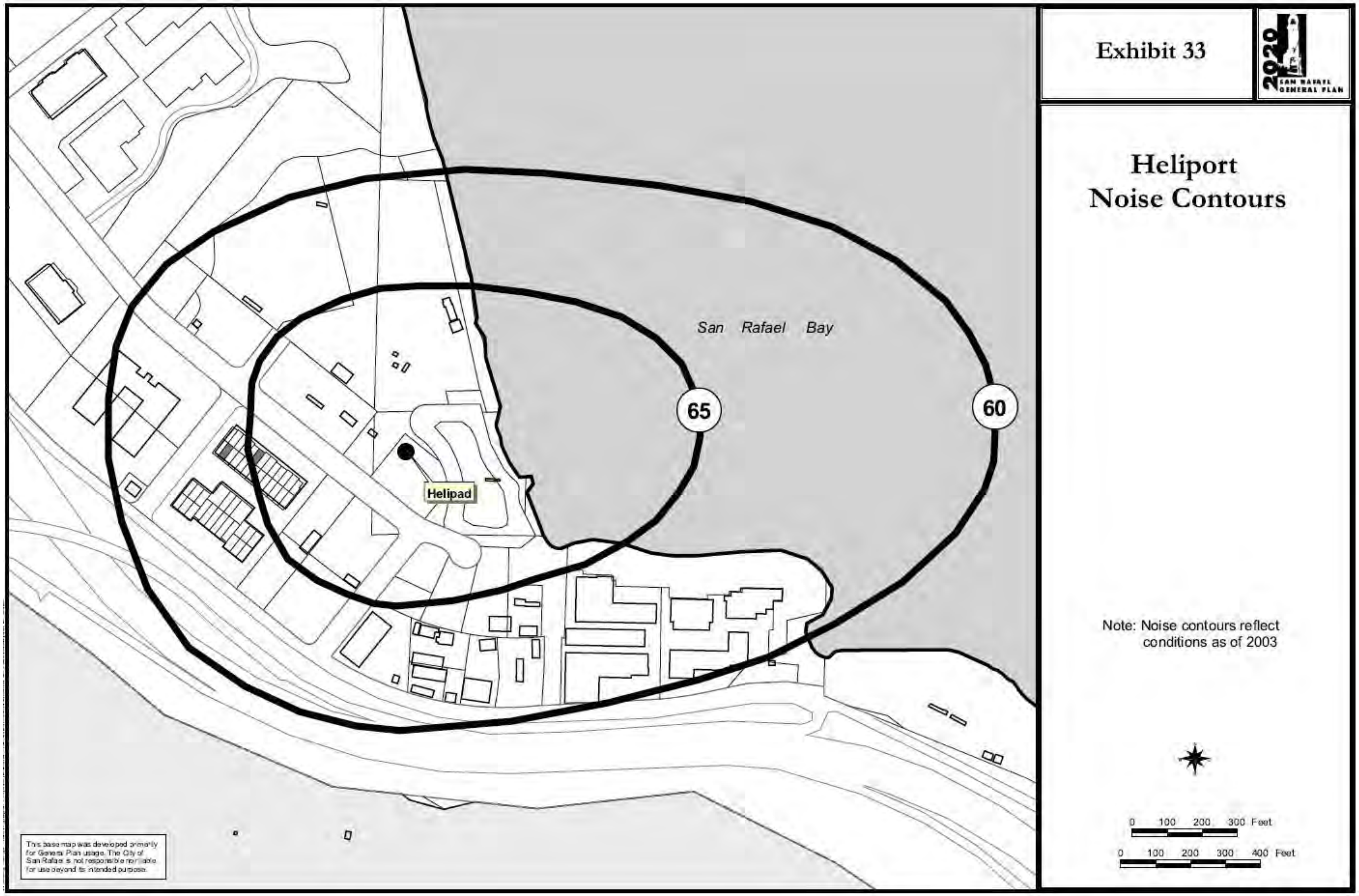
N-10d. San Rafael Rock Quarry. Seek to minimize noise impacts of the quarry and brickyard operations through cooperative efforts with the County of Marin through its code enforcement and land use entitlement processes.



Source: San Rafael General Plan 2020, 2013.



Source: San Rafael General Plan 2020, 2013.



Source: San Rafael General Plan 2020, 2013.

City of San Rafael Municipal Code. Chapter 8.13, Noise, in the City's Municipal Code seeks to protect the peace, health, safety, and general welfare of the citizens of San Rafael from excessive, unnecessary, and unreasonable noises from any and all sources in the community. Section 8.13.040 provides General Noise Limits.

Chapter 8.13.040 General noise limits. Subject to the exceptions and exemptions set forth in Sections 8.13.050 and 8.13.060 of this chapter, the general noise limits set forth in this section shall apply. A summary of the general noise limits set forth in this section is set forth in Table 4. Where two or more noise limits may apply, the more restrictive noise limit shall govern. For purposes of determining sound levels from any source of sound, a sound level measurement shall be made at any point on any receiving private or public property. Notwithstanding the foregoing, in multifamily structures, the microphone shall be placed no closer than 3-1/2 feet from a wall through which the source of sound at issue is transmitting, and shall also be placed five (5) feet above the floor regardless of whether the source of sound at issue transmits through the floor, ceiling or wall. Sound level measurements shall be made with a sound level meter (Type 1 or 2) set to A-weighting, and "fast" response for intermittent sound. Slow or fast response may be used for constant noise sources. For intermittent sound, the one second rms maximum level (L_{max}) shall be used. For constant sound, the average level (L_{eq}) shall be used.

A. Residential property noise limits.

1. No person shall produce, suffer or allow to be produced by any machine, animal or device, or by any other means, a noise level greater than the following, when measured on any residential property:

   Daytime: 60 dBA intermittent, 50 dBA constant
   Nighttime: 50 dBA intermittent, 40 dBA constant

2. No person shall produce, suffer or allow to be produced by any machine, animal, or device, or by any other means, a noise level greater than the following, when measured on any mixed-use property:

   Daytime: 65 dBA intermittent, 55 dBA constant
   Nighttime: 55 dBA intermittent, 45 dBA constant

3. No person shall produce, suffer or allow to be produced by any machine, animal or device, or by any other means, within the interior of a multifamily residential structure, a noise level greater than the following, when measured through a common interior partition (wall, floor or ceiling) from any other interior location:

   Daytime: 40 dBA intermittent, 35 dBA constant
   Nighttime: 35 dBA intermittent, 30 dBA constant

B. Commercial property noise limits. No person shall produce, suffer or allow to be produced by any machine, animal, or device, or by any other means, a noise level greater than sixty-five

(65) dBA intermittent or fifty-five (55) dBA constant, when measured on any commercial property.

C. Industrial property noise limits. No person shall produce, suffer or allow to be produced by any machine, animal or device, or by any other means, a noise level greater than seventy (70) dBA intermittent or sixty (60) dBA constant, when measured on any industrial property.

D. Public property noise limits. No person shall produce, suffer or allow to be produced by any machine, animal or device, or by any other means, a noise level, when measured on any public property, that is greater than the most restrictive noise standard applicable under this chapter to any private property adjoining the receiving public property.

Chapter 8.13.050 Standard exceptions to general noise limits. The following standard exceptions to the provisions of Section 8.13.040 shall be allowed as of right, to the extent and during the hours specified. A summary of the standard exceptions provided in this section is set forth in Table 4.

A. Construction. Except as otherwise provided in subsection B of this section, or by the planning commission or city council as part of the development review for the project, on any construction project on property within the city, construction, alteration, demolition, maintenance of construction equipment, deliveries of materials or equipment, or repair activities otherwise allowed under applicable law shall be allowed between the hours of seven a.m. (7:00 a.m.) and six p.m. (6:00 p.m.), Monday through Friday, and nine a.m. (9:00 a.m.) and six p.m. (6:00 p.m.) on Saturdays, provided that the noise level at any point outside of the property plane of the project shall not exceed ninety (90) dBA. All such activities shall be precluded on Sundays and holidays. Violation of the foregoing may subject the permittee to suspension of work by the chief building official for up to two (2) days per violation.

Noise level at any point outside the construction property plane shall not exceed ninety (90) dBA.

Violation of the construction hours and noise limits may be enforced as either an infraction or a misdemeanor punishable by fines or jail time or both, or by an administrative citation with a fine, or by a civil action with a monetary penalty, injunction and/or other remedies, as provided in Chapter 1.42 of this code. In addition, the chief building official may issue a stop work order requiring suspension of work for up to two (2) days per violation.

C. Sound Performances; Sound-Generating Devices. Notwithstanding anything in this chapter to the contrary, on public property or any other open area to which the public has access, whether publicly or privately owned, sound-generating devices or instruments used for any indoor or outdoor sound performances, athletic events, and special events shall be permitted, provided they do not exceed a noise level of eighty (80) dBA measured at a distance of not less than fifty feet (50’) from the property plane or such other limit as may be established by any required approvals and permits therefor obtained from the appropriate governmental entity. Except pursuant to an approved special event, street closure or parade permit, the use of any sound-generating device or instrument for such performances or events between the hours of ten p.m. (10:00 p.m.) and ten a.m. (10:00 a.m.) is unlawful.

D. Refuse Collection. Refuse collection activities shall be permitted as specified in this section, provided they do not produce a noise level in excess of ninety-five (95) dBA measured at a distance of twenty-five feet (25’) from the activity:

1. Residential or mixed-use property: between the hours of six a.m. (6:00 a.m.) and nine p.m. (9:00 p.m.), Monday through Saturday;

2. Industrial or commercial property: between the hours of four a.m. (4:00 a.m.) and nine p.m. (9:00 p.m.) daily.

TABLE 4 General Noise Limits

Property type or zone	Daytime limits	Nighttime limits
Residential	60 dBA Intermittent	50 dBA Intermittent
	50 dBA Constant	40 dBA Constant
Mixed-Use	65 dBA Intermittent	55 dBA Intermittent
	55 dBA Constant	45 dBA Constant
Multifamily residential (interior sound source)	40 dBA Intermittent	35 dBA Intermittent
	35 dBA Constant	30 dBA Constant
Commercial	65 dBA Intermittent	65 dBA Intermittent
	55 dBA Constant	55 dBA Constant
Industrial	70 dBA Intermittent	70 dBA Intermittent
	60 dBA Constant	60 dBA Constant
Public property	Most restrictive noise limit applicable to adjoining private property	Most restrictive noise limit applicable to adjoining private property

Source: City of San Rafael Municipal Code, 2002.

TABLE 5 Standard Exceptions to General Noise Limits

Type of Activity	Maximum Noise Level	Days/Hours Permitted
Construction	90 dBA	Mon-Fri 7:00 a.m.-6:00 p.m. Sat 9:00 a.m.-6:00 p.m. Sun, Hol. – prohibited or as otherwise set by city approval
Residential Power Equipment and Construction Activities Undertaken by Residential Property Owners	90 dBA	Mon-Fri 8:00 a.m.-8:00 p.m. Sat, Sun, Hol. 9:00 a.m.-6:00 p.m.
Sound Performances	80 dBA measured 50 feet or more from property plane, or as excepted by permit approval	Every day 10:00 a.m.-10:00 p.m., or as excepted by permit approval
Refuse Collection	95 dBA	Residential or mixed-use property: Mon-Sat 6:00 a.m.-9:00 p.m. Industrial or commercial property: Daily 4:00 a.m.-9:00 p.m.

Source: City of San Rafael Municipal Code, 2002.

Existing Noise Environment

The project site is located south of Lucas Valley Road between U.S. Highway 101 and Los Gamos Drive, in the City of San Rafael. The project site is currently developed with a two-story office building that would be converted into the medical offices as part of the proposed project. Adjacent to the site along the southern boundary is an existing office building. Opposite Los Gamos Drive, at a higher elevation, are existing single-family residences.

A noise monitoring survey was performed at the site beginning on Wednesday, March 8, 2017 and concluding on Friday, March 10, 2017. The monitoring survey included two long-term and four short-term noise measurements, as shown in Figure 1. The noise environment at the site and in the project vicinity is dominated by traffic noise along U.S. Highway 101. The surrounding local roadways (Lucas Valley Road and Los Gamos Drive) would also affect the noise environment, as would aircraft flyovers associated with the San Rafael Airport.

Long-term noise measurement LT-1 was made from the project site's existing parking lot. LT-1 had direct line-of-sight to U.S. Highway 101, with a setback from the centerline of the nearest through travel lane of approximately 295 feet. LT-1 represented the existing noise environment at the project site. Hourly average noise levels at this location typically ranged from 59 to 67 dBA L_{eq} during the day and from 54 to 66 dBA L_{eq} at night. The day-night average noise level measured on Thursday, March 9, 2017 was 68 dBA L_{dn}. The daily trend in noise levels measured at LT-1 is shown in Figures 2 through 4.

Long-term noise measurement LT-2 was made across the roadway from 59 Salvador Way in a tree. LT-2 was approximately 20 feet from the centerline of Salvador Way. LT-2 represented the existing noise environment of the nearest residential land uses surrounding the project site. Hourly average noise levels at this location typically ranged from 43 to 54 dBA L_{eq} during the day and from 35 to 49 dBA L_{eq} at night. The day-night average noise level measured on Thursday, March 9, 2017 was 56 dBA L_{dn}. The daily trend in noise levels measured at LT-2 is shown in Figures 5 through 7.

Short-term measurements were made on Friday March 10, 2017 in ten-minute intervals between 11:30 a.m. and 12:40 p.m. ST-1 was made approximately 30 feet from the northeast corner of the existing office building and approximately 50 feet from the chilling unit. Noise from the chilling unit is audible when traffic along U.S. Highway 101 slows down, with levels of about 49 dBA at 50 feet. The ten-minute average noise level measured at ST-1 was 59 dBA $L_{eq(10)}$, and the estimated day-night average noise level was 61 dBA L_{dn}. ST-2 was made approximately 30 feet from the northwest corner of the existing office building. The ten-minute average noise level measured at ST-2 was 55 dBA $L_{eq(10)}$, and the estimated day-night average noise level was 58 dBA L_{dn}. ST-3 was made at the front of the existing office building, approximately 40 feet from the centerline of Los Gamos Drive. Noise levels from ST-3 were affected by vehicle pass-bys along Los Gamos Drive, which typically reached levels of 60 to 65 dBA. The ten-minute average noise level measured at ST-3 was 58 dBA $L_{eq(10)}$, and the estimated day-night average noise level was 61 dBA L_{dn}. ST-4 was made in front of 40 Salvador Way. ST-4 was approximately 20 feet from the centerline of Salvador Way. The ten-minute average noise level measured at ST-4 was 42 dBA $L_{eq(10)}$, and the estimated day-night average noise level was 52 dBA L_{dn}. Table 6 summarizes the results of the short-term noise measurements.

FIGURE 1 Noise Measurement Locations

Source: Google Earth, 2018.

FIGURE 2 Daily Trend in Noise Levels at LT-1, Wednesday, March 8, 2017

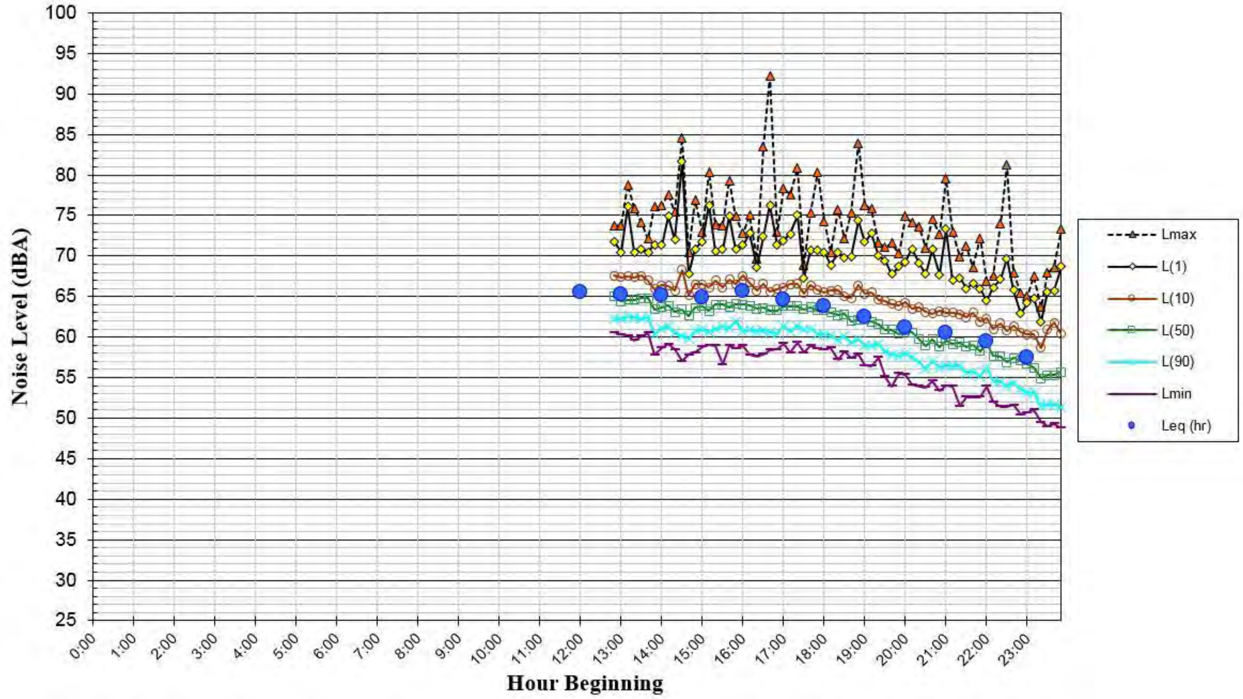


FIGURE 3 Daily Trend in Noise Levels at LT-1, Thursday, March 9, 2017

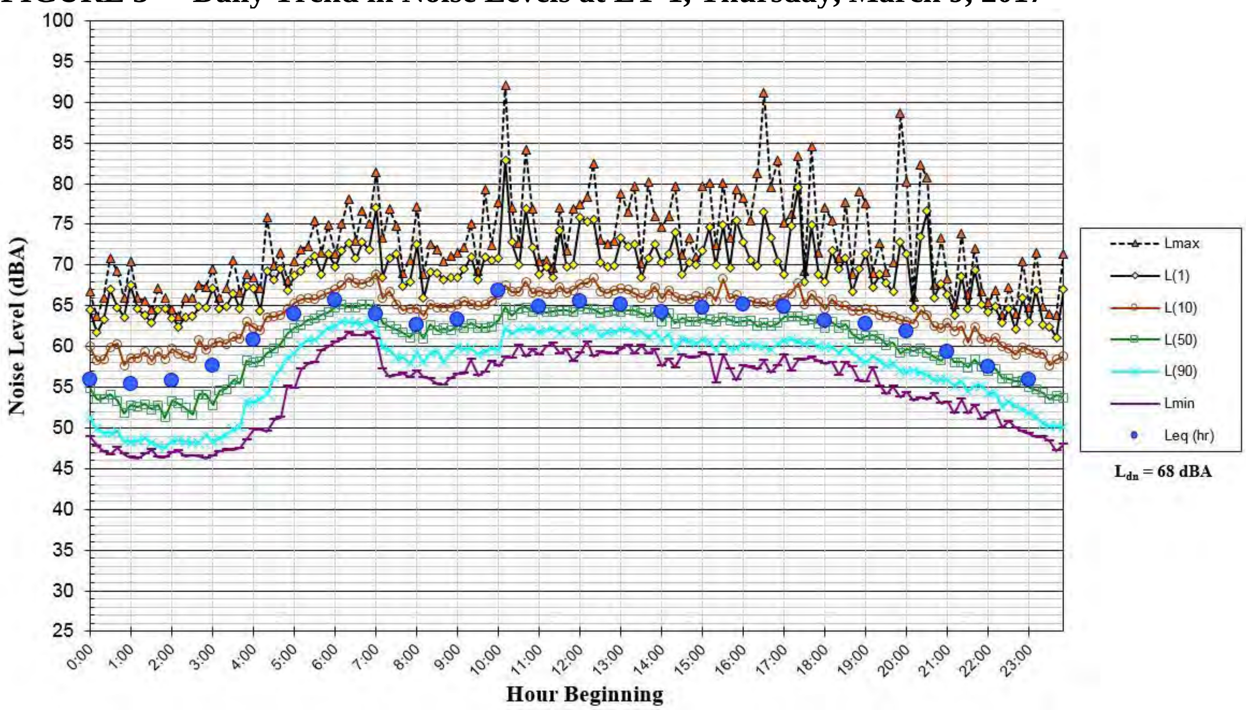


FIGURE 4 Daily Trend in Noise Levels at LT-1, Friday, March 10, 2017

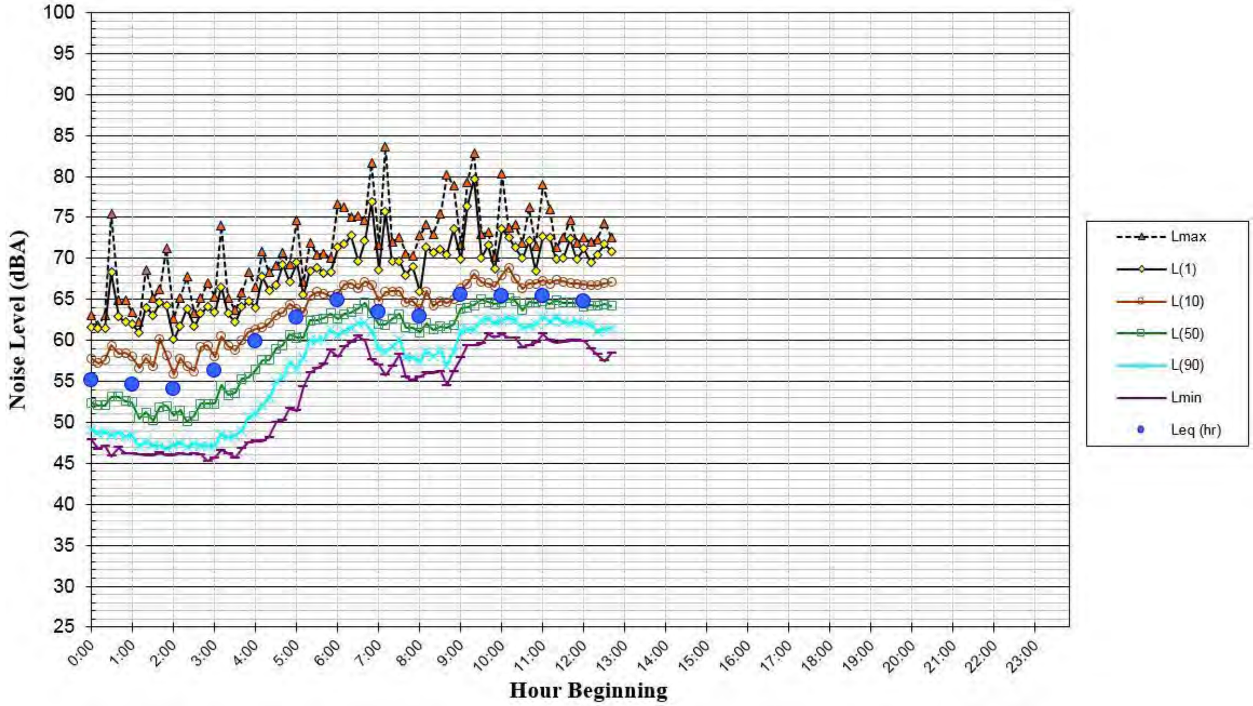


FIGURE 5 Daily Trend in Noise Levels at LT-2, Wednesday, March 8, 2017

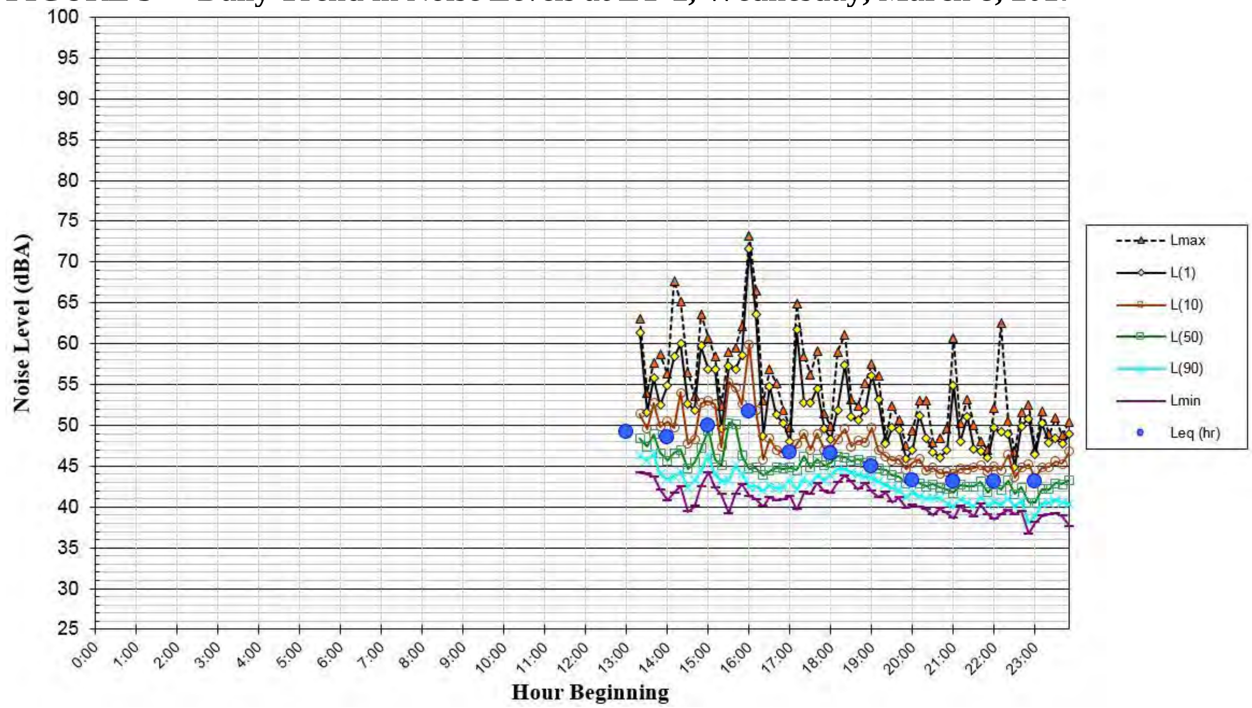


FIGURE 6 Daily Trend in Noise Levels at LT-2, Thursday, March 9, 2017

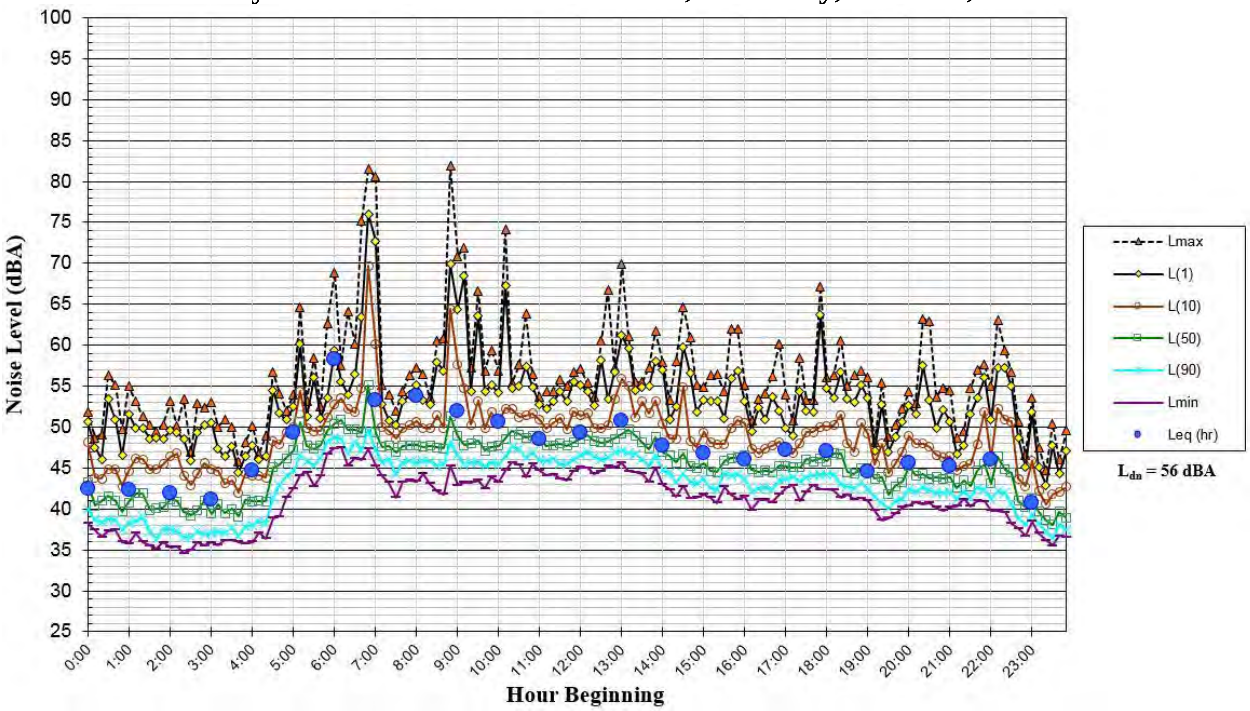


FIGURE 7 Daily Trend in Noise Levels at LT-2, Friday, March 10, 2017

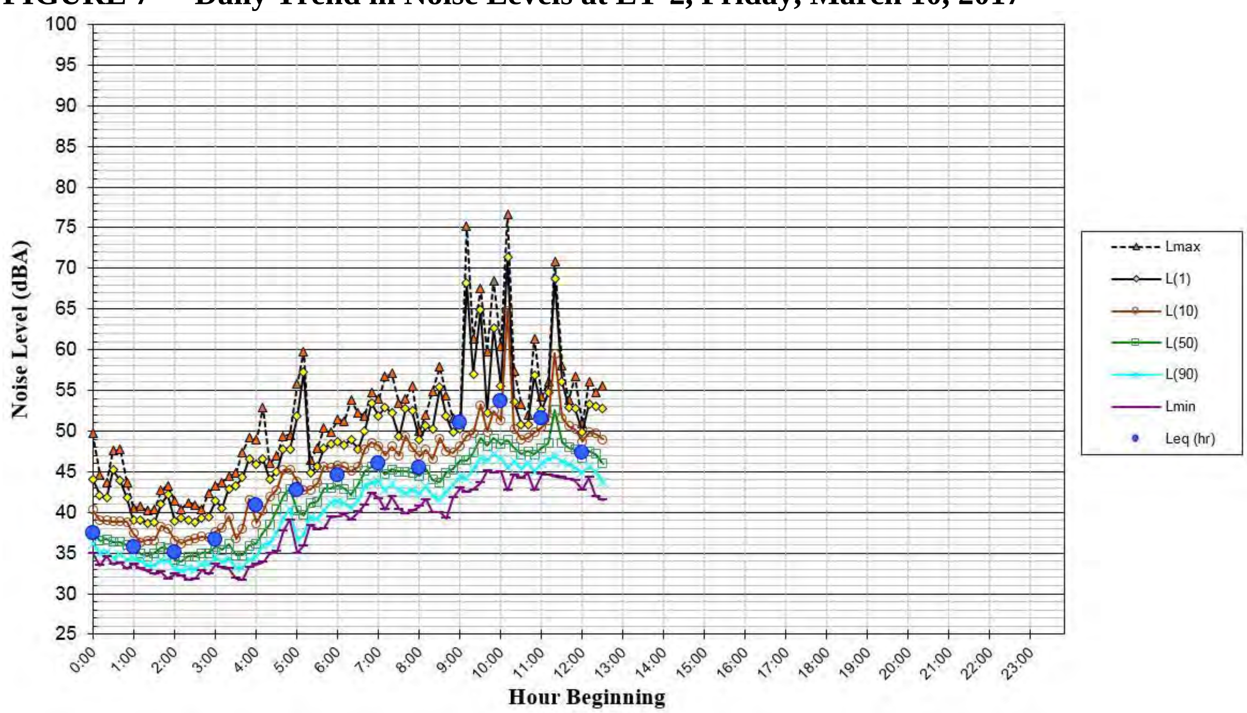


TABLE 6 Summary of Short-Term Noise Measurement Data

Noise Measurement Location	Date, Time	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	$L_{eq(10)}$	L_{dn}[a]
ST-1: Near northeast corner of existing office building	3/10/2017, 11:30-11:40	70	65	60	58	56	59	61
ST-2: Near northwest corner of existing office building	3/10/2017, 11:50-12:00	62	59	57	55	53	55	58
ST-3: ~40 feet east of Los Gamos Drive	3/10/2017, 12:10-12:20	67	66	63	56	49	58	61
ST-4: Front of 40 Salvador Way	3/10/2017, 12:30-12:40	60	56	43	41	40	42	52

[a] L_{dn} was approximated by correlating to corresponding period at long-term site.

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

Paraphrasing from Appendix G of the CEQA Guidelines, a project would normally result in significant noise impacts if noise levels generated by the project conflict with adopted environmental standards or plans, if the project would generate excessive groundborne vibration levels, or if ambient noise levels at sensitive receivers would be substantially increased over a permanent, temporary, or periodic basis. The following criteria were used to evaluate the significance of environmental noise resulting from the project:

- A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan or Municipal Code.

- A significant impact would be identified if the construction of the project would expose persons to excessive vibration levels. Groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in cosmetic damage to normal buildings.

- A significant impact would be identified if traffic generated by the project or project improvements/operations would substantially increase noise levels at sensitive receivers in the vicinity. A substantial increase would occur if: a) the noise level increase is 5 dBA L_{dn} or greater, with a future noise level of less than the "normally acceptable" standard, or b) the noise level increase is 3 dBA L_{dn} or greater, with a future noise level equal to or greater than the "normally acceptable" standard.

- A significant noise impact would be identified if construction-related noise would temporarily increase ambient noise levels at sensitive receptors. Hourly average noise levels exceeding 60 dBA L_{eq}, and the ambient by at least 5 dBA L_{eq}, for a period of more than one year would constitute a significant temporary noise increase at adjacent residential land uses.

Impact 1: **Noise Levels in Excess of Standards.** The proposed project would not produce noise levels that would exceed the City's established noise thresholds or increase the existing ambient noise environment. **This is a less-than-significant impact.**

Mechanical Equipment Noise

Chapter 8.13.040 of the City's Municipal Code limits mechanical equipment noise, as measured at residential property lines, to 50 dBA during daytime hours and to 40 dBA during nighttime hours for constant noise-generating equipment and to 60 dBA during daytime hours and to 50 dBA during nighttime hours for intermittent noise-generating equipment. While the Municipal Code does not define daytime and nighttime hours, it is assumed that daytime hours are 7:00 a.m. to 10:00 p.m. and nighttime hours are 10:00 p.m. to 7:00 a.m., consistent with the L_{dn} acoustical descriptor used by the City in the General Plan. Additionally, Policy N-4 of the City's General Plan states that new nonresidential developments shall not increase noise levels in a residential district by more than 3 dBA L_{dn}, or create noise impacts that would increase noise levels to more than 60 dBA L_{dn} at the property line of the noise receiving use, whichever is more restrictive. Since the existing day-night average noise level at the residential land uses is 56 dBA L_{dn}, the more restrictive criteria would be the 3 dBA L_{dn} increase.

Further, mechanical equipment noise shall not exceed 55 dBA when measured at any commercial property line for constant noise-generating equipment and shall not exceed 65 dBA for intermittent noise-generating equipment.

While the structure and equipment associated with the existing office building would not change under proposed project conditions, the parking garage would likely require mechanical equipment, such as elevators. According to the site plan, the electrical room/elevator control room would be located on the first floor, on the interior of the building, and the elevator tower is located in the southeastern corner of the structure. Detailed noise information for the specific equipment included in the project was not available at the time of this study. The following analysis is based on typical noise levels expected from parking garages.

Typical noise levels from electrical equipment rooms would be 50 to 60 dBA L_{eq} at 10 feet. The walls of the electrical equipment room would provide 5 to 10 dBA reduction, and the exterior walls of the garage would provide an additional 5 to 10 dBA reduction. Typical elevators have levels of about 46 to 47 dBA at a distance of 10 feet when the doors open, while reaching levels of 52 to 53 dBA at 10 feet during movement between floors.

The nearest residential property line would be approximately 150 feet to southwest of the garage façade. In addition to the wall assemblies providing shielding, the elevation difference between the residences, which are approximately 50 feet higher in elevation than the pad elevation of the parking garage floor, would also provide some shielding. At 150 feet and assuming shielding from the intervening wall assemblies and elevation of the receptor, the expected noise due to electrical room equipment would be less than 40 dBA L_{eq}, which would meet both the daytime and nighttime thresholds established in the City's Municipal Code for residential land uses. These residences would potentially have direct line-of-sight to the third floor of the elevator tower since the third floor would not have a roof. The distance from the nearest residential property line to the elevator tower would be approximately 320 feet, and the elevated height of the residence above the third-floor elevator doors would provide some shielding. At 320 feet and assuming some shielding, the elevator noise at the nearest residential property would be less than 30 dBA, which would meet the City's Municipal Code thresholds.

The ambient hourly average noise levels at the residential land uses, which is represented by the data collected at LT-2, range from 43 to 54 dBA L_{eq} during daytime hours and from 35 to 49 dBA L_{eq} during nighttime hours. The mechanical equipment noise generated by the proposed project would fall within or below the existing hourly average noise levels at the nearby residences during daytime and nighttime hours. If the mechanical equipment associated with the proposed parking garage ran continuously for a 24-hour period, the day-night average noise level at the residential property line would be less than 50 dBA L_{dn}, which would be below the existing day-night average of 56 dBA L_{dn}. Therefore, mechanical equipment noise would have a less-than-significant impact on the residential land uses located to the west of the project site.

While the proposed Kaiser medical office building would be the closest commercial building to the proposed parking garage, this would be considered one project site. Therefore, the nearest off-site commercial property would be the existing office building to the south, along Los Gamos Drive. The property line of this off-site office building is approximately 325 feet from the nearest parking garage façade. At this distance and assuming shielding from the intervening wall assemblies, the noise levels generated by equipment in the electrical room would be less than 40 dBA L_{eq}. This would meet the City's threshold for commercial properties.

The elevator tower would be approximately 325 feet to the nearest commercial property line, and since the first-floor of the elevator would be the closest access, the wall assemblies of the parking structure would provide 5 to 10 dBA of shielding. At 325 feet and assuming partial shielding from the wall assemblies, elevator noise would be at or below 30 dBA at the nearest commercial property line. This would meet the City's thresholds.

Since all new mechanical equipment associated with the proposed project would be below the City's thresholds during daytime and nighttime hours and would not increase the day-night average noise level at the residential land uses, this would be a less-than-significant impact.

Parking Lot Noise

Intermittent noise from the parking structure must meet the intermittent noise thresholds established in the City's Municipal Code. Additionally, the parking structure noise cannot increase the ambient noise levels at existing residential land uses by more than 3 dBA L_{dn}.

Regular office hours at the Kaiser medical offices would be from 7:00 a.m. until 7:00 p.m.; however, after hour clinic hours would be available until 12:00 a.m. According to the project statement, the surface parking currently available around the existing building would remain under project conditions. This is 242 parking spaces. Additionally, the parking structure shall provide up to 476 spaces, for a total of 718. The surface parking lot currently in the location of the proposed parking structure has 213 spaces. With the proposed project, the available parking shall increase by 263 spaces.

The surrounding land uses are currently exposed to the parking lot noise and will continue to be exposed to the parking lot noise surrounding the existing office building. The three-story parking structure would move the parking lot noise approximately 25 feet closer to the residences located on the hill to the west; however, these noise-sensitive receptors would be shielded from parking lot noise located on the first and second floors. The third level would have approximately 150 spaces, and an up-ramp on the third level would lead to an additional 40 spaces, to which the residences would have direct exposure. This would be fewer vehicles than the existing surface lot. Due to the shielding that the parking structure would provide, the existing office building to the south of the project site would be exposed to less parking lot noise than under existing conditions with the surface lot.

Noise associated with parking lot usage would include vehicular circulation, loud engines, car alarms, squealing tires, door slams, and human voices. The maximum sound (L_{max}) of a passing car at 15 mph typically ranges from 40 to 50 dBA L_{max} at 200 feet. The noise generated during an engine start is similar. Door slams create lower noise levels. The hourly average noise level resulting from all of these noise-generating activities in a busy parking lot, without taking shielding into account, could range from 35 to 40 dBA L_{eq} at a distance of 200 feet from the parking area.

As stated above, the nearest residential property line would be approximately 150 feet from the nearest parking structure façade. At this distance and taking into account the elevation difference between the third-floor of the parking structure and residential property, hourly average noise levels due to parking lot noise would range from 37 to 42 dBA L_{eq}. This would meet the daytime and nighttime intermittent noise thresholds established in the Municipal Code. During daytime hours, parking lot activity on the third-floor of the structure may be fairly constant, which possibly makes it subject to comparison with the constant daytime threshold of 50 dBA. However, the third-floor of the parking structure is expected to be sparsely used during nighttime hours due to minimal medical office usage during these hours. It is most likely that the surface parking spaces surrounding the medical office building would be used during the nighttime hours, and if the parking structure is used during these hours, the first-floor parking spaces would be the likely locations for any activity. The third-floor would barely be used, and therefore, the constant nighttime threshold would not be appropriate for the assessment of nighttime parking lot noise at the proposed parking structure.

In addition to the Municipal Code standards, parking lot noise at the property line of the nearest residence is assessed against the existing day-night average noise level of 56 dBA L_{dn} (measured at LT-2). Assuming the maximum hourly average noise level of 42 dBA L_{eq} occurred continuously through a 24-hour period, the measured day-night average noise level would be 49 dBA L_{dn}, which is less than the existing ambient measurement. Therefore, the parking structure would not increase the ambient environment at the nearest residential property line by 3 dBA L_{dn}. This is a less-than-significant impact.

The nearest façade of the parking structure would be approximately 325 feet from the property line of the nearest off-site commercial building. At this distance, hourly average parking lot noise would be at or below 36 dBA L_{eq}. This would meet the City's 65 dBA threshold. This would be a less-than-significant impact.

Noise from Refuse Collection

The City of San Rafael requires that refuse collection at commercial properties be limited to the hours of 4:00 a.m. to 9:00 p.m. daily. Additionally, refuse collection shall not exceed 95 dBA at a distance of 25 feet from the collection activities.

The proposed medical office building would require refuse collection, which may be of greater quantity than the existing office building; however, it is unlikely that the proposed project would require more frequent trash pickups than the existing land use. Therefore, the proposed project is not expected to change the existing noise environment due to refuse collection activities and would be compatible with the City's noise limits. This is a less-than-significant impact.

Construction Noise

Chapter 8.13.050 of the City's Municipal Code exempts construction noise from the general noise limits, but limits all noise due to construction to at or below 90 dBA at any point outside the construction property plane. Additionally, construction allowable hours in the City of San Rafael are limited to 7:00 a.m. and 6:00 p.m. on weekdays and to between 9:00 a.m. and 6:00 p.m. on Saturdays. Construction activities are prohibited on Sundays and national holidays.

Construction activities generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. The highest maximum noise levels expected to be generated by project construction would range from about 80 to 90 dBA L_{max} at a distance of 50 feet from the noise source. Pile driving, which generates noise levels up to 105 dBA L_{max} at 50 feet, is not expected to be required for this project. A list of typical maximum instantaneous noise levels measured at 50 feet are provided in Table 7.

For the proposed project, all construction occurring at the future medical office building would be indoor renovations, which would reduce construction noise emitting from the site substantially. Construction phases for the parking garage would include demolition of the existing parking lot, excavation, grading, exterior building erection, architectural coating, and paving. Typical hourly average construction-generated noise levels for parking structures are about 77 to 89 dBA L_{eq} measured at a distance of 50 feet from the center of the site during busy construction periods (e.g., earth moving equipment, impact tools, etc.), as shown in Table 8. The improvements at the Los Gamos Drive/Lucas Valley Road intersection would include reconfiguring the intersection, new light/traffic signals, power for the crossings, new crosswalks, and new sidewalk ramps. Typical hourly average noise levels for this type of construction would range from 78 to 88 dBA L_{eq} at a distance of 50 feet. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Shielding by buildings or terrain can provide an additional 5 to 10 dBA noise reduction at distant receptors.

A detailed list of equipment expected to be used for the proposed project construction and phasing information were not available at the time of this study. Additionally, a construction schedule was not provided. While it is possible for the parking garage construction and intersection improvements to occur concurrently, the geometrical center of each construction site would be approximately 460 feet away from each other, and activities occurring at each site would vary at any given time. Therefore, construction noise levels provided in Table 8 for parking structures and for roadway improvements were used, separately, to estimate the worst-case scenario of noise levels for each type of construction. The modeling results for the parking garage construction are summarized in Table 9, and the modeling results for the intersection improvements are summarized in Table 10. The estimated construction levels in both tables were measured from the center of the construction sites to 5 feet outside the construction site boundaries in each direction.

As shown in Tables 9 and 10, noise levels generated by construction of the proposed parking garage are not expected to exceed the City’s 90 dBA threshold. This would be a less-than-significant impact.

TABLE 7 Construction Equipment, 50-foot Noise Emission Limits

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor[3]	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 KVA or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous
All other equipment with engines larger than 5 HP	85	Continuous

Notes: [1] Measured at 50 feet from the construction equipment, with a “slow” (1 sec.) time constant.

[2] Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.

[3]Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.

TABLE 8 Typical Ranges of Construction Noise Levels at 50 Feet, L_{eq} (dBA)

	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station		Public Works Roads & Highways, Sewers, and Trenches	
	I	**II**	**I**	**II**	**I**	**II**	**I**	**II**
Ground Clearing	83	83	84	84	84	83	84	84
Excavation	88	75	89	79	89	71	88	78
Foundations	81	81	78	78	77	77	88	88
Erection	81	65	87	75	84	72	79	78
Finishing	88	72	89	75	89	74	84	84

I - All pertinent equipment present at site.
II - Minimum required equipment present at site.

Source: U.S.E.P.A., Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.

TABLE 9 Estimated Construction Noise Levels 5 feet from the Construction Boundary of the Proposed Parking Garage

Phase	Estimated Noise Levels, dBA L_{eq}[a]			
	North Boundary (180ft)	East Boundary (115ft)	South Boundary (195ft)	West Boundary (110ft)
Ground Clearing	72-73 dBA L_{eq}	76-77 dBA L_{eq}	71-72 dBA L_{eq}	76-77 dBA L_{eq}
Excavation	60-78 dBA L_{eq}	64-82 dBA L_{eq}	59-77 dBA L_{eq}	64-82 dBA L_{eq}
Foundations	66 dBA L_{eq}	70 dBA L_{eq}	65 dBA L_{eq}	70 dBA L_{eq}
Erection	61-73 dBA L_{eq}	65-77 dBA L_{eq}	60-72 dBA L_{eq}	65-77 dBA L_{eq}
Finishing	63-78 dBA L_{eq}	67-82 dBA L_{eq}	62-77 dBA L_{eq}	67-82 dBA L_{eq}

[a] Range of noise levels indicates the noise levels calculated for the minimum required equipment present at site to all pertinent equipment present at site.

TABLE 10 Estimated Construction Noise Levels 5 feet from the Construction Boundary of the Los Gamos Drive/Lucas Valley Road Intersection

Phase	Estimated Noise Levels, dBA L_{eq}[a]		
	Northeast Boundary (70ft)	South Boundary (80ft)	West Boundary (95ft)
Ground Clearing	81 dBA L_{eq}	80 dBA L_{eq}	78 dBA L_{eq}
Excavation	75-85 dBA L_{eq}	74-84 dBA L_{eq}	72-82 dBA L_{eq}
Foundations	85 dBA L_{eq}	84 dBA L_{eq}	82 dBA L_{eq}
Erection	75-76 dBA L_{eq}	74-75 dBA L_{eq}	72-73 dBA L_{eq}
Finishing	81 dBA L_{eq}	80 dBA L_{eq}	78 dBA L_{eq}

[a] Range of noise levels indicates the noise levels calculated for the minimum required equipment present at site to all pertinent equipment present at site.

Mitigation Measure 1: **None required.**

Impact 2: **Exposure to Excessive Groundborne Vibration due to Construction.** Construction-related vibration levels resulting from activities at the project site would not exceed 0.3 in/sec PPV at the nearest noise-sensitive receptors. **This is a less-than-significant impact.**

The construction of the project may generate vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams) are used. For the repurposing of the existing office building, heavy construction equipment that would generate excessive vibration levels would be required. However, construction activities for the proposed parking structure would include demolition, grading, foundation work, paving, and new building framing and finishing. The intersection improvements would include intersection reconfiguring, new light/traffic signal installation, power for the crossings, new crosswalks, and new sidewalk ramps. Activities for the construction of the parking garage and the intersection improvements would potentially generate considerable vibration levels. The proposed project is not expected to require pile driving, which can cause excessive vibration.

For structural damage, the California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, 0.3 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and a conservative limit of 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened. No known ancient buildings or buildings that are documented to be structurally weakened adjoin the project area. Therefore, conservatively, groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in a significant vibration impact.

Table 11 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.), may generate substantial vibration in the immediate vicinity. Jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used.

The nearest residential structure located to the west of the project site and at a higher elevation, would be approximately 215 feet from the parking structure construction site boundary. At this distance, vibration levels would be up to 0.02 in/sec PPV, which would not exceed the 0.3 in/sec PPV threshold. The distance from the nearest residential structure to the boundary of the intersection improvements construction zone would be approximately 690 feet, and at this distance, vibration levels would be at or below 0.01 in/sec PPV. The nearest off-site commercial building would be approximately 325 feet south of the parking garage and approximately 615 feet from the intersection. Vibration levels experienced at this building due to construction of the parking garage would be up to 0.01 in/sec PPV and due to intersection improvements would be up to 0.01 in/sec PPV. The on-site proposed medical office building would be approximately 115 feet east of the parking garage construction site and approximately 200 feet from the boundary of the intersection improvements. At these distances, vibration levels would be up to 0.04 in/sec PPV and up to 0.02 in/sec PPV, respectively. Construction of the proposed project would not generate vibration levels of 0.3 in/sec PPV or more at existing noise-sensitive land uses located off- and on-site. This would be a less-than-significant impact.

TABLE 11 Vibration Source Levels for Construction Equipment

Equipment		**PPV at 25 ft. (in/sec)**	**Approximate L_v at 25 ft. (VdB)**
Pile Driver (Impact)	upper range	1.158	112
	typical	0.644	104
Pile Driver (Sonic)	upper range	0.734	105
	typical	0.170	93
Clam shovel drop		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Vibratory Roller		0.210	94
Hoe Ram		0.089	87
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006.

Mitigation Measure 2: None required.

Impact 3: **Permanent Noise Level Increase.** The proposed project would not result in a substantial permanent noise level increase due to project-generated traffic at the existing noise-sensitive land uses in the project vicinity. **This is a less-than-significant impact.**

Policy N-5 of the City's General Plan states that where the exterior is 65 dBA L_{dn} or greater at a residential building or outdoor use area and a project increases traffic noise levels by more than 3 dBA L_{dn}, a permanent noise impact would be considered significant. For reference, a 3 dBA L_{dn} noise increase would be expected if the project would double existing traffic volumes along a roadway.

Existing ambient noise levels at the nearby residential land uses are 56 dBA L_{dn}, according to noise measurements made at LT-2.

To determine the effect of the project-generated traffic on the nearby existing residences, the existing plus project peak hour traffic volumes provided in the traffic study conducted for the proposed project[2] was compared to the existing peak hour traffic volumes. While peak hour traffic

2 *Fehr Peers*, "1650 Los Gamos Drive Kaiser Transportation Impact Analysis ," October 2017.

volumes along Los Gamos Drive indicated an increase of 3 dBA L_{dn}, the traffic noise increase at all other segments included in the traffic study was 1 dBA L_{dn} or less. The existing peak hour turning movement data provided in the traffic study reflect current low occupancy at the surrounding commercial buildings. Since the existing plus project peak hour turning movement data represents the existing conditions plus the project trips generated by the proposed project, the existing plus project turning movement data would also reflect the low occupancy scenario. If the occupancy of the commercial buildings in the project vicinity increased, this increase would be reflected in both existing and existing plus project traffic scenarios. However, the project trips generated by the proposed project would not change. If the same project trips were applied to existing traffic volumes that were higher than those presented in the traffic study, then the total project trips would be a lower percentage of the existing volumes, and therefore, the noise level increase from the existing to the existing plus project traffic scenarios would be less. The calculated 3 dBA L_{dn} increase along Los Gamos Drive and the 1 dBA L_{dn} or less increase along every other roadway segment would be the worst-case scenario.

Under worst-case conditions, the residential land uses to the west of the project site would experience an increase of up to 1 dBA L_{dn}, resulting in ambient noise levels below 60 dBA L_{dn} with the inclusion of the proposed project. While the traffic increase along Los Gamos Drive would result in a permanent noise increase of 3 dBA L_{dn}, this increase would only apply to the commercial office buildings to the south of the project site. Therefore, the project-generated traffic would not cause a permanent noise increase at the surrounding residential receptors. This impact is a less-than-significant impact.

Mitigation Measure 3: None required.

Impact 4: **Cumulative Noise Increase.** The proposed project would not make a cumulatively considerable contribution to future noise levels at residential land uses in the project vicinity. **This is a less-than-significant impact.**

The City of San Rafael does not define the noise increase that would constitute a significant cumulative noise impact. Therefore, a significant impact would occur if the cumulative traffic noise level increase was 3 dBA L_{dn} or greater for future levels exceeding 60 dBA L_{dn} or was 5 dBA L_{dn} or greater for future levels at or below 60 dBA L_{dn} and if the project would make a "cumulatively considerable" contribution to the overall traffic noise increase. A "cumulatively considerable" contribution would be defined as an increase of 1 dBA L_{dn} or more attributable solely to the proposed project.

Cumulative traffic noise level increases were calculated by comparing the cumulative (no project) peak hour traffic volumes and the cumulative plus project peak hour traffic volumes to existing traffic volumes. From these comparisons, future traffic noise increase along Las Gallinas avenue, north of Lucas Valley Road; North Redwood Drive, north of Smith Ranch Road; and Redwood Highway, south of Smith Ranch Road would be 3 dBA L_{dn} under both cumulative scenarios (with and without the project). However, under the cumulative plus project traffic scenario, the increase from existing conditions was calculated to be 4 dBA L_{dn} along Los Gamos Drive, while the increase of the cumulative (no project) would be 3 dBA L_{dn}. Since the difference between the two cumulative scenarios would result in 1 dBA L_{dn} or more, the project would make a "cumulative considerable" contribution to the overall traffic noise increase along Los Gamos Drive. However, the office buildings located along this roadway would not be considered noise-sensitive, and therefore, this would not be a significant impact.

Mitigation Measure 4: None required.

Impact 5: **Temporary Construction Noise.** Existing noise-sensitive land uses would be exposed to a temporary increase in ambient noise levels due to project construction activities. The incorporation of construction best management practices as project conditions of approval would result in a **less-than-significant** temporary noise impact.

Noise impacts resulting from temporary construction depend upon the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise-sensitive areas. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time.

As discussed in the Fundamentals section of this report, thresholds for speech interference indoors is 45 dBA. Assuming a 15 dBA exterior-to-interior reduction for standard residential construction and a 25 dBA exterior-to-interior reduction for standard commercial construction, this would correlate to an exterior threshold of 60 dBA L_{eq} at residential land uses and 70 dBA L_{eq} at commercial land uses. Additionally, temporary construction would be annoying to surrounding land uses if the ambient noise environment increased by at least 5 dBA L_{eq} for an extended period of time. Therefore, the temporary construction noise impact would be considered significant if project construction activities exceeded 60 dBA L_{eq} at property line of nearby residences or exceeded 70 dBA L_{eq} at the property line of nearby commercial land uses and exceeded the ambient noise environment by 5 dBA L_{eq} or more for a period longer than one year.

Ambient noise measurements during daytime hours at the nearest residences were estimated at LT-2 to range from 43 to 54 dBA L_{eq}. The existing ambient noise environment at the nearby commercial land uses would range from 59 to 67 dBA L_{eq} during daytime hours, as measured at LT-1. These long-term measurements represent the ambient noise environment for off-site receptors that would be affected by construction activities occurring at the project site.

As stated in Impact 1, phasing information, including time duration and equipment to be used, were not available at the time of this study. However, construction activities at the proposed medical office building is expected to consist of mostly interior renovations; activities at the proposed parking structure would include demolition of the existing surface parking lot, grading/excavation, building construction, paving, and architectural coating; and activities at the Los Gamos Drive/Lucas Valley Road intersection would include reconfiguring the intersection, new light/traffic signals, power for the crossings, new crosswalks, and new sidewalk ramps. During each stage of construction, there would be a different mix of equipment operating, and noise levels would vary by stage and vary within stages, based on the amount of equipment in operation and the location at which the equipment is operating. Once construction moves indoors for the parking structure, minimal noise would be generated at off-site locations. As mentioned above, due to the distance between the intersection and the parking garage, the construction noise levels for each site was calculated separately. Depending upon the location of the nearby receptors, the nearest construction site would represent the dominant noise source.

Typical noise levels for parking structures and roadway improvement projects were estimated at 5 feet outside the construction site in Tables 9 and 10, respectively, and to compare the expected noise levels due to construction activities at the receptor property lines to the ambient noise levels, parking garage construction levels and roadway improvement construction levels were estimated at the distances of the nearby receptor property lines to the center of the construction site. These are summarized in Tables 12 and 13, respectively.

TABLE 12 Estimated Construction Noise Levels for Parking Garage at Nearby Receptor Property Lines

Phase	Estimated Noise Levels, dBA L_{eq}[a]			
	Nearest Residence to the West (305ft)	Nearest Residence to the Northwest (985ft)	Nearest Commercial Office Building to the South (505ft)	Nearest Commercial Office Building to the Northwest (550ft)
Ground Clearing	67-68 dBA L_{eq}	57-58 dBA L_{eq}	63-64 dBA L_{eq}	62-63 dBA L_{eq}
Excavation	55-73 dBA L_{eq}	45-63 dBA L_{eq}	51-69 dBA L_{eq}	50-68 dBA L_{eq}
Foundations	61 dBA L_{eq}	51 dBA L_{eq}	57 dBA L_{eq}	56 dBA L_{eq}
Erection	56-68 dBA L_{eq}	46-58 dBA L_{eq}	52-64 dBA L_{eq}	51-63 dBA L_{eq}
Finishing	58-73 dBA L_{eq}	48-63 dBA L_{eq}	54-69 dBA L_{eq}	53-68 dBA L_{eq}

[a] Range of noise levels indicates the noise levels calculated for the minimum required equipment present at site to all pertinent equipment present at site.

TABLE 13 Estimated Construction Noise Levels for Roadway Improvements at Nearby Receptor Property Lines

Phase	Estimated Noise Levels, dBA L_{eq}[a]			
	Nearest Residence to the West (825ft)	Nearest Residence to the Northwest (1,175ft)	Nearest Commercial Office Building to the South (735ft)	Nearest Commercial Office Building to the Northwest (680ft)
Ground Clearing	60 dBA L_{eq}	57 dBA L_{eq}	61 dBA L_{eq}	61 dBA L_{eq}
Excavation	54-64 dBA L_{eq}	51-61 dBA L_{eq}	55-65 dBA L_{eq}	55-65 dBA L_{eq}
Foundations	64 dBA L_{eq}	61 dBA L_{eq}	65 dBA L_{eq}	65 dBA L_{eq}
Erection	54-55 dBA L_{eq}	51-52 dBA L_{eq}	55-56 dBA L_{eq}	55-56 dBA L_{eq}
Finishing	60 dBA L_{eq}	57 dBA L_{eq}	61 dBA L_{eq}	61 dBA L_{eq}

[a] Range of noise levels indicates the noise levels calculated for the minimum required equipment present at site to all pertinent equipment present at site.

Estimated construction levels shown in Tables 12 and 13 would exceed 60 dBA L_{eq} at residential land uses and would exceed ambient noise levels by more than 5 dBA L_{eq}. While the total time duration of construction is unknown at this time, the proposed project can conservatively be considered a significant impact.

Mitigation Measure 5:

Reasonable regulation of the hours of construction, as well as regulation of the arrival and operation of heavy equipment and the delivery of construction material, are necessary to protect the health and safety of persons, promote the general welfare of the community, and maintain the quality of life. In compliance with the City's Municipal Code, the project shall adhere to the allowable construction hours of 7:00 a.m. to 6:00 p.m. on weekdays and 9:00 a.m. to 6:00 p.m. on Saturdays. Construction activities are prohibited on Sundays and national holidays. Additionally, the construction crew shall adhere to the following construction best management practices to reduce construction noise levels emanating from the site and minimize disruption and annoyance at existing noise-sensitive receptors in the project vicinity.

Construction Best Management Practices

Develop a construction noise control plan, including, but not limited to, the following available controls:

- Construct temporary noise barriers, where feasible, to screen stationary noise-generating equipment. Temporary noise barrier fences would provide a 5 dBA noise reduction if the noise barrier interrupts the line-of-sight between the noise source and receptor and if the barrier is constructed in a manner that eliminates any cracks or gaps.

- Equip all internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.

- Unnecessary idling of internal combustion engines should be strictly prohibited.

- Locate stationary noise-generating equipment, such as air compressors or portable power generators, as far as possible from sensitive receptors as feasible. If they must be located near receptors, adequate muffling (with enclosures where feasible and appropriate) shall be used to reduce noise levels at the adjacent sensitive receptors. Any enclosure openings or venting shall face away from sensitive receptors.

- Utilize "quiet" air compressors and other stationary noise sources where technology exists.

- Construction staging areas shall be established at locations that will create the greatest distance between the construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction.

- Locate material stockpiles, as well as maintenance/equipment staging and parking areas, as far as feasible from residential receptors.

- Route construction-related traffic along major roadways and as far as feasible from sensitive receptors.

- Control noise from construction workers' radios to a point where they are not audible at existing residences bordering the project site.

- The contractor shall prepare a detailed construction schedule for major noise-generating construction activities. The construction plan shall identify a procedure for coordination with adjacent residential land uses so that construction activities can be scheduled to minimize noise disturbance.

- Designate a "disturbance coordinator" who would be responsible for responding to any complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., bad muffler, etc.) and will require that reasonable measures be implemented to correct the problem. Conspicuously post a telephone number for the disturbance coordinator at the construction site and include in it the notice sent to neighbors regarding the construction schedule.

The implementation of the reasonable and feasible controls outlined above would reduce construction noise levels emanating from the site by 5 to 10 dBA in order to minimize disruption and annoyance. With the implementation of these controls, as well as the Municipal Code limits on allowable construction hours, and considering that construction is temporary, the impact would be reduced to a less-than-significant level.

Prepared fo

City of San Rafael

1650 Los Gamos Drive Kaiser

Transportation Impact Analysis

Prepared by

FEHR & PEERS

Final

SF15-0858

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EXECUTIVE SUMMARY

This Transportation Impact Analysis (TIA) analyzes the transportation impacts associated with Kaiser Permanente's proposal to add medical office as an allowed use at the existing 1650 Los Gamos Drive office building (henceforth referred to as the "Project") and related parking in a new parking structure and on an existing surface parking lot. The Project is considered an infill development because it does not require new construction on undeveloped land, as the existing office building will not be expanded and the proposed parking structure will be located on the existing parking lot. The Project is located in the City of San Rafael, just west of the US 101 / Lucas Valley Road interchange.

This study analyzes expected transportation conditions with the proposed Project condition in place under Existing, Baseline, and Cumulative conditions. The Project would result in transportation impacts at several intersections. Potential mitigation measures are proposed to reduce the Project's impacts to less than significant with mitigation incorporated, where feasible. Several traffic impacts would remain significant and unavoidable even where mitigation is identified. Potential mitigation measures include improving the Lucas Valley Road/Los Gamos Drive intersection, consistent with the improvements identified in the San Rafael General Plan 2020, and a Transportation Demand Management (TDM) program to reduce peak hour employee single-occupant vehicle trips. Pedestrian, bicycle, and transit impacts were not identified, thus no mitigation measures to directly address those topics were identified. However, the TDM mitigation measure may benefit these sustainable modes of transportation.

PROJECT DESCRIPTION

The proposed Project, located at 1650 Los Gamos Drive would permit the addition of medical office as an allowed use for the existing 148,000[1] square foot building (1650 Los Gamos Drive), in addition to the currently allowed office uses. In addition, the proposed Project includes the construction of an up to 511-space parking structure on the west side of Los Gamos Drive, where there is an existing surface lot associated with the building, and the continued use (provided via a legal easement) of 42 parking spaces located on the adjacent property at 1600 Los Gamos Drive.

The existing building is part of a Planned Development (PD) District, which allows up to 150,000 square feet of office uses at 1650 Los Gamos Drive. The Project sponsor does not plan to rebuild or construct the remaining 2,000 square feet; however, for the purpose of this analysis, we have assumed the Project building is 150,000 square feet.

[1] The existing building is 148,000 square feet; however, the Planned Development District allows up to 150,000 square feet of office space, so for the purpose of the analysis, we have assumed a 150,000 square-feet building. The Project does not plan to rebuild or construct the remaining 2,000 square foot balance.

The existing 1650 Los Gamos Drive building is currently partially occupied by office uses; however, the Project plans to fully occupy (100-percent) the existing building with medical office.

STUDY APPROACH

The Project analysis evaluated three scenarios: Existing, Baseline, and Cumulative. Existing conditions represents present conditions based on recently collected traffic data. Information for the Baseline volumes, which represents existing traffic, assumes 100% occupancy at existing buildings, plus approved projects. The Cumulative volumes, which represent traffic estimates consistent with development patterns proposed in the *San Rafael General Plan 2020*, were provided by the City of San Rafael. Intersection analysis included five study intersections and two freeway segments in the Project vicinity, which were evaluated during the weekday AM and PM peak hour.

PROJECT TRAVEL CHARACTERISTICS

Table ES-1 displays the project's expected AM and PM peak hour trip generation for the Project. This table indicates that the Project would generate approximately 150 additional AM peak hour trips and 300 additional PM peak hour trips. Refer to Chapter 2 for a detailed discussion of reasons this occurs.

TABLE ES-1: PROJECT TRIP GENERATION ESTIMATES

Building	Land Use	ITE Code	Size (KSF)[1]	Daily	AM Peak Hour	PM Peak Hour
Planned Development (PD) Allowed at 1650 Los Gamos Drive	General Office	710	150	1,655	234	224
Proposed Project	Medical Office	720	150	5,420	359	536
NET NEW PROJECT TRIPS				**3,765**	**161**	**312**

Notes:
1. ksf = 1,000 square-feet
Source: Trip Generation (9th Edition), ITE, 2012

PROJECT IMPACTS UNDER EXISTING CONDITIONS

The following summarizes key findings from this analysis scenario.

The Lucas Valley Road / Los Gamos Drive intersection would degrade below the LOS D threshold, resulting in a significant impact. However, identified mitigation measures reduce the Project's impact to less-than-significant for the intersection.

In contrast, the US 101 southbound corridor operates under congested conditions and as a result, the Project would contribute 1-percent or more of Project related traffic, thereby triggering a significant impact.[2] Feasible mitigation measures were not identified, so the Project's impact was concluded as significant and unavoidable.

PROJECT IMPACTS UNDER BASELINE CONDITIONS

Under Baseline conditions, the following two intersections would degrade and result in a significant impact:

- Lucas Valley Road / Las Gallinas Avenue
- Lucas Valley Road / Los Gamos Drive

The mitigation measure identified for the Lucas Valley Road / Los Gamos Drive intersection would reduce the Project's impact to less-than-significant. A feasible mitigation measure was not identified at the Lucas Valley / Las Gallinas Avenue intersection. Thus, the Project's impact to the Lucas Valley / Las Gallinas Avenue intersection was concluded as significant and unavoidable.

The US 101 southbound corridor would continue to operate under congested conditions; however, the Project's contribution to baseline traffic is less than 1-percent of the capacity. Therefore, the Project does not result in a significant impact to US 101 southbound.

PROJECT IMPACTS UNDER CUMULATIVE CONDITIONS

Under Cumulative conditions, no study intersection triggers a significant impact during the AM and PM peak hours, except the Lucas Valley Road / Las Gallinas Avenue intersection. Like the Baseline conditions, a feasible mitigation measure was not identified. Thus, the Project's impact to the intersection analysis concluded the impact from this one intersection is significant and unavoidable.

Under the Cumulative scenario, the Southbound US 101 freeway segments would continue to operate unacceptably; however, the Project's contribution to the cumulative traffic is less than 1-percent of the capacity. Therefore, the Project does not result in a significant impact in the southbound direction. In the northbound direction, the Cumulative No Project traffic increases such that mainline freeway operations begin to degrade under Cumulative No Project conditions. However, the addition of Project traffic under

[2] The *San Rafael General Plan 2020* and *Transportation Authority of Marin Congestion Management Plan (CMP)* does not provide significance thresholds for freeway segments; thus, the analysis utilizes a 1-percent trigger which is a commonly accepted methodology for determining significant impacts for freeway segments consistent with other traffic impact studies conducted for projects in the surrounding area.

the Cumulative PM peak hour is less than 1-percent. Therefore, the Project does not result in a significant impact in the northbound direction.

1 INTRODUCTION

This report presents the results of a transportation impact analysis (TIA) for including medical office as an allowed use by Kaiser Permanente at 1650 Los Gamos Drive in the City of San Rafael, construction of a new parking structure, and the continued use of parking spaces on the adjacent property at 1600 Los Gamos Drive (henceforth referred to as the "Project"). This chapter discusses the TIA purpose, Project area, analysis scenarios, methodology, and criteria to identify significant impacts.

1.1 STUDY PURPOSE & PROJECT DESCRIPTION

The purpose of this analysis is to evaluate the transportation impacts of the Project. The Project site is located at 1650 Los Gamos Drive in San Rafael, California, and is bound by Lucas Valley Road to the north, 1600 Los Gamos Drive to the south, US 101 to the east, and the hillsides to the west of Los Gamos Drive, as illustrated on **Figure 1-1**. The Project site is owned by Kaiser and includes an existing 148,000[3] gross square foot office building, including an open lobby and underground utility space, surrounding surface parking lot, and surface parking lot on the west side of Los Gamos Drive which abuts an undeveloped hillside slope. Kaiser also has the right to use 42 parking spaces at 1600 Los Gamos Drive via an existing legal easement.

1650 Los Gamos Drive was originally constructed pursuant to a Planned Development (PD) District, which allows up to 150,000 square feet of office uses at 1650 Los Gamos Drive and up to 340,000 square feet of office uses at the neighboring property at 1600 Los Gamos Drive. A potential amendment to the existing PD district would separate 1600 Los Gamos Drive and 1650 Los Gamos Drive into separate PD districts. 1600 Los Gamos Drive includes an existing office building, currently owned and partially occupied by the County of Marin. The County currently uses the building for both office and non-office uses, such as staging emergency vehicles, and also leases a portion of the building to other office and warehousing uses. However, for the purpose of this Project, it is assumed that 1600 Los Gamos Drive is 100-percent (340,000 square feet) occupied by office space. Thus, the traffic generated as part of the Project is based on changes to 1650 Los Gamos Drive (no changes to 1600 Los Gamos Drive are evaluated).

The Project would maintain the existing three-story building footprint, which is approximately 150,000 square feet in total. At the time of data collection (November 2015), the building was 34-percent occupied (50,000 square feet) with office and now it is 7-percent occupied with two-office tenants. However, since the building was constructed, in the late 1970's, through 2006, the building was 100-percent occupied by office. From

[3] The existing building is 148,000 square feet; however, the Planned Development District allows up to 150,000 square feet of office space so for the purpose of the analysis, we have assumed a 150,000 square-feet building, though the Project does not plan to rebuild or construct the remaining 2,000 square foot balance.

2006 to 2016, the building occupancy ranged from 25-percent to 40-percent. The Great Recession and building purchase for re-use contributed to a lower occupancy rate than usual in the last ten years. As part of the Project, the Project Sponsor is proposing to add medical office as an allowed use to 100-percent of the 150,000 square feet of allowed building space at 1650 Los Gamos Drive. The two remaining tenants will remain temporarily in the building through the term of their leases. Eventually, Kaiser anticipates occupying the remaining portion of the building to medical office, for a total of up to 150,000 square feet of total medical office use.

Table 1-1 summarizes the land use assumptions described above.

TABLE 1-1: 1650 LOS GAMOS DRIVE LAND USE ASSUMPTIONS

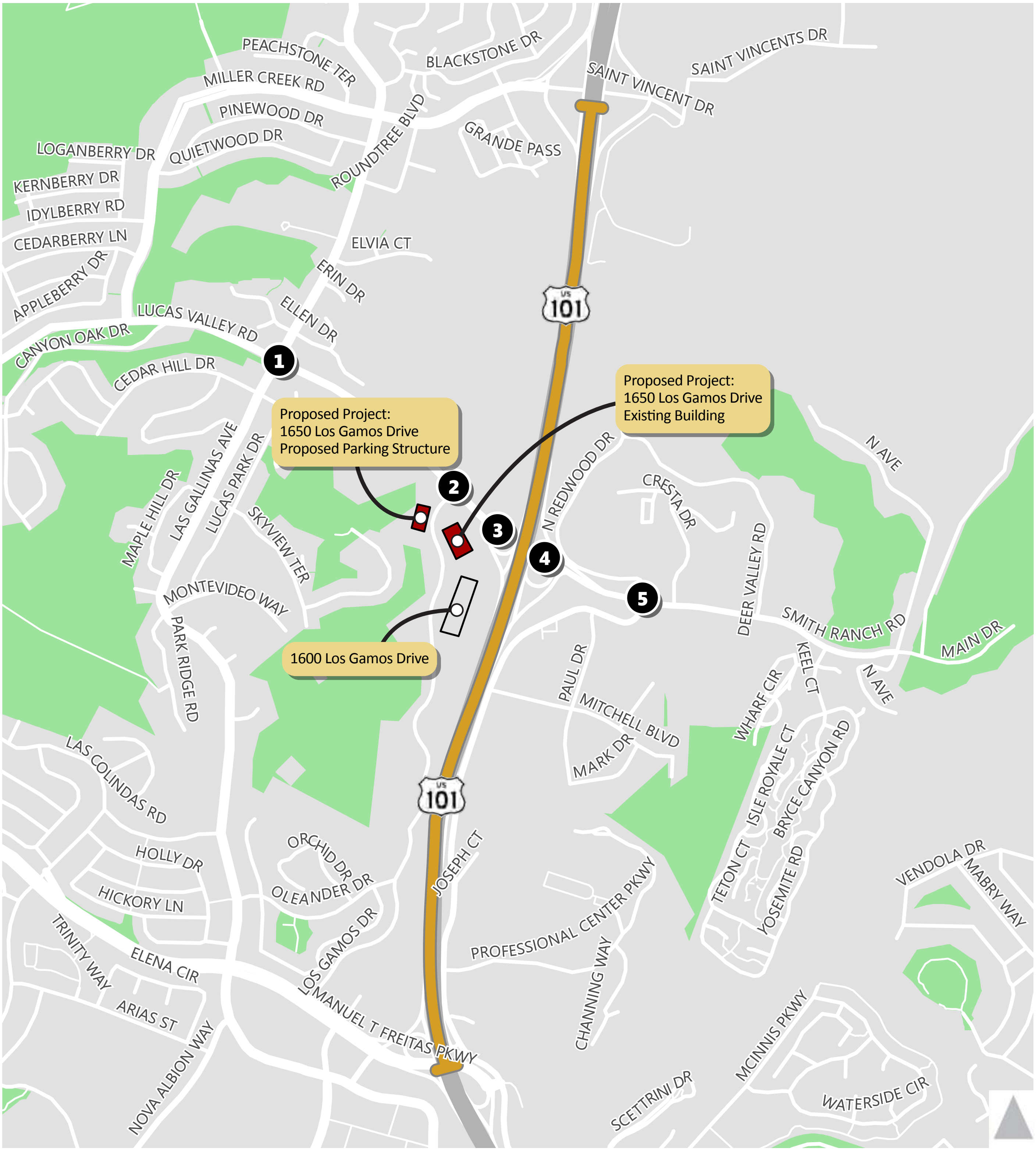
Scenario	Land Use Size (KSF[1]) [2]	
	General Office	Medical Office
Planned Development Allowed	150	--
Proposed Project[3]	--	150

Notes:

1. ksf= 1,000 square-feet
2. 1650 Los Gamos Drive was originally constructed pursuant to a Planned Development (PD) District for 1650 Los Gamos Drive and 1600 Los Gamos Drive. 1600 Los Gamos Drive is currently owned by the County of Marin. The building is permitted to contain up to 340,000 square feet of general office; however, the County of Marin currently uses the building for a mixture of uses, such as emergency services. Although the County's current uses generate significantly less travel than the 340,000 square feet of permitted office use would, the analysis conservatively assumes full use of the allowable 340,000 square feet to ensure maximum potential impacts are identified.
3. The Project Sponsor is proposing to add medical office, in addition to general office, as an allowed use.

The purpose of this analysis is to evaluate the transportation impacts of the Project. The Project site is located at 1650 Los Gamos Drive in San Rafael, California, and is bound by Lucas Valley Road to the north, 1600 Los Gamos Drive to the south, US 101 to the east, and the hillside to the west of Los Gamos Drive, as illustrated on **Figure 1-1**.

The proposed Project would permit the addition of medical office as an allowed use, in addition to the currently allowed office use for the existing building at 1650 Los Gamos Drive. In addition, the proposed Project includes the construction of an up to 511-space parking structure on the west side of Los Gamos Drive, where there is an existing surface lot associated with the building, as well as the continued use of 42 parking spaces located on the adjacent property at 1600 Los Gamos Drive. **Figure 1-2** shows the proposed site plan with the existing building and proposed parking garage.



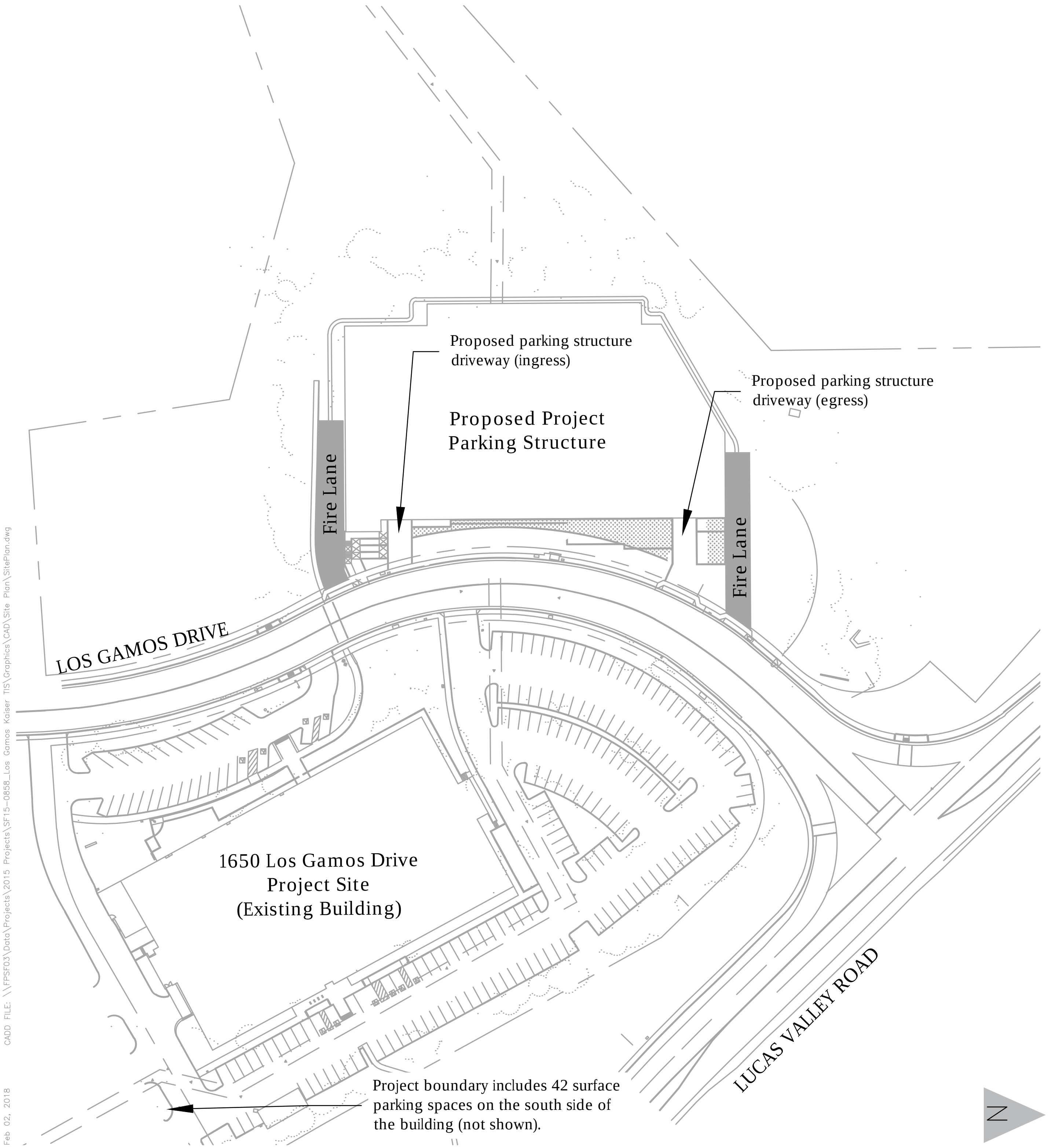
Study Intersections

Freeway Analysis Segment

Project Site

Figure 1-1

Project Site & Analysis Locations



Note: The Project applicant proposes to occupy the existing building located at 1650 Los Gamos Drive and construct a three-level parking garage structure on the west side of Los Gamos Drive.

Figure 1-2

1650 Los Gamos Drive
Proposed Site Plan

1.2 PROJECT STUDY AREA

Intersections are generally the critical capacity-controlling elements of suburban roadway networks. Therefore, the operations of critical intersections surrounding the project site are used as indicators of the adequacy of the vehicular circulation system. Five intersections were selected by City of San Rafael staff as those most likely to be affected by the project and thus warranting analysis.

An analysis for the proposed project focused on the AM and PM peak hour operations at the following intersections (**Figure 1-1**):

1. Lucas Valley Road and Las Gallinas Avenue
2. Lucas Valley Road and Los Gamos Drive
3. Lucas Valley Road and US 101 Southbound Ramps
4. Lucas Valley Road and Smith Ranch Road and US 101 Northbound Ramps
5. Smith Ranch Road and N Redwood Drive and Redwood Highway

Freeways provide regional access connecting different cities and communities. Near the Project site, US 101 serves as a major regional freeway system and its operations are critical to provide access to the Project site. Two freeway segments were selected as the most likely to be affected by the Project: US 101 between Miller Creek and Lucas Valley Road and US 101 between Lucas Valley Road and Manuel T Freitas Parkway.

Freeway segments are typically divided into four sections: merge, diverge, weave, and basic:

- Merge and diverge segments extend 1,500 feet downstream and upstream, respectively, from the ramp gore (where the freeway mainline and ramp split)
- Weave segments must have a continuous auxiliary lane connecting the on-ramp and the downstream off-ramp
- All other freeway segments not covered by the above are considered basic segments

Additionally, existing pedestrian, bicycle, and transit facilities within the Project study area were identified and the Project's impacts to these existing facilities were evaluated.

1.3 ANALYSIS SCENARIOS

The analysis includes an evaluation of transportation conditions during a typical weekday AM and PM peak hour, occurring between 7:00 to 9:00 AM and 4:00 to 6:00 PM, when the surrounding transportation network is at its most congested. This report presents the analysis of the following scenarios:

- Existing No Project– Based on recently collected traffic counts (in order to calilbrate micro-simulation model).
- Existing Plus Project– Traffic volumes from existing conditions plus traffic volume estimates for the proposed Project.
- Baseline No Project– Existing conditions volumes plus traffic estimates for approved, but not yet constructed, developments; background traffic increases due to regional growth expected prior to the proposed Project opening; and approved/funded transportation system improvements expected to be in place when the Project opens.
- Baseline Plus Project– Traffic volumes from Baseline conditions plus traffic volume estimates for the proposed Project.
- Cumulative No Project– Traffic estimates for development patterns as proposed in the *San Rafael General Plan 2020* ; background traffic increases due to regional growth expected through year 2020; and approved/funded/proposed transportation system improvements.
- Cumulative Plus Project– Traffic volumes from *San Rafael General Plan 2020* conditions plus traffic volume estimates for the proposed Project

As described in the Project description above, since the time the building was constructed in the late 1970's through the year 2006, the building was 100-percent occupied by office. From 2006 to 2016, the building occupancy ranged from 25-percent to 40-percent. The Great Recession and building purchase for re-use contributed to a lower occupancy rate than usual in the last ten years; however, historically, the building has been 100-percent occupied. Thus, for the purpose of this analysis the Baseline No Project and Cumulative No Project assumes 100-percent office occupancy.

1.4 STUDY METHODOLOGY

This section describes the study methodology for evaluating intersection operations, freeways, and vehicle-miles-traveled (VMT); and describes the significance criteria for identifying significant project impacts.

1.4.1 Analysis Methods

Intersection and freeway results will be summarized by Level of Service (LOS). LOS is a qualitative description of operations ranging from LOS A, when the roadway facility has excess capacity and vehicles experience little or no delay, to LOS F, where the volume of vehicles exceeds the capacity, resulting in long queues and excessive delays. Typically, LOS E represents "at-capacity" conditions and LOS F represents "over-capacity" conditions. Intersection and freeway LOS were established based on traffic analysis of the study intersections, conducted using a method documented by the Transportation Research Board (TRB) in the 2010 Highway Capacity Manual (HCM).

1.4.1.1 Study Intersections

The traffic analysis software Synchro/SimTraffic 9.0 was used for this study and was based on the City's existing traffic model. For purposes of modeling the entire network as a "system", micro-simulation (SimTraffic) was used. The primary difference between SimTraffic and HCM is that the HCM analyzes intersections in isolation and does not include the effects of upstream or downstream intersections, which directly affect traffic flow. SimTraffic provides measures of effectiveness that are consistent with the HCM such as movement delay and weighted average delay.

For signalized intersections, the LOS is based on the average delay experienced by all vehicles passing through the intersection. This methodology uses various intersection characteristics (such as traffic volumes, lane geometry, and signal phasing) to estimate the delay per vehicle. The delay is the portion of the total delay attributed to the signal operations and includes initial deceleration, queue move up time, time stopped, and acceleration.

At unsignalized intersections, operations are defined by the average control delay per vehicle (measured in seconds) for each stop-controlled movement. This incorporates delay associated with deceleration, acceleration, stopping, and moving up in the queue. For side-street stop-controlled intersections, LOS is not defined for the intersection as a whole. Instead, the average delay and associated LOS reported in this study is for the worst-case controlled approach. For all-way stop-controlled intersections, the LOS is represented by the average control delay for the whole intersection.

Table 1-2 shows the correlation of average control delays and LOS designations for signalized and unsignalized intersections.

TABLE 1-2: INTERSECTION LOS CRITERIA

Level of Service	Average Control Delay (seconds/vehicle)	
	Signalized	Unsignalized
A	< 10.0	< 10.0
B	> 10.0 to 20.0	> 10.0 – 15.0
C	> 20.0 to 35.0	> 15.0 – 25.0
D	> 35.0 to 55.0	> 25.0 – 35.0
E	> 55.0 to 80.0	> 35.0 – 50.0
F	> 80.0	> 50.0

Source: 2010 Highway Capacity Manual.

1.4.1.2 Freeways

Similar to intersection, the operating characteristics of freeway basic, merge, and diverge segments are evaluated using the concept of LOS. Freeway section LOS is based on vehicle density (passenger cars per lane per mile). **Table 1-3** shows the correlation of density and LOS. Freeway ramp density was calculated using the methods described in Chapter 13 of the HCM. The inputs to calculate freeway segment densities would be obtained through Caltrans data and field observations.

The purpose of the freeway analysis is to determine the Project's contribution to the available capacity on the freeway; therefore, the Highway Capacity Software (HCS) was used to complete this analysis. HCS is an appropriate analysis tool because it applies the freeway methodologies in the HCM by accounting for the volume demand and available capacity by segment. The HCS tool is a static model, which does not account for downstream queues. However, since the purpose of this analysis is to determine the Project's contribution to the regional network, and not to determine or mitigate existing bottlenecks or queues, the static model approach was the most appropriate to account for the Project's contribution. To supplement for existing queues as a result of downstream bottlenecks, field observations were completed and included in analysis findings.

TABLE 1-3: FREEWAY LOS CRITERIA

LOS	Density (pc/mi/ln)[1]
A	< 11
B	> 11 – 18
C	> 18 – 26
D	> 26 – 35
E	> 35 – 45
F	> 45

Notes:
1. pc/mi/ln = passenger car per mile per lane
Source: 2010 Highway Capacity Manual.

1.4.1.3 Vehicle Miles Traveled Analysis

The VMT analysis forecasted the Project employee VMT and compared them to future projected VMT based on the regional transportation and land use model provided by the Metropolitan Transportation Commission (MTC) and the Association of Bay Area Governments (ABAG). The proposed Project will move employees from existing compressed Kaiser facilities in Marin County, to the building at 1650 Los Gamos Drive. As such, the Project is not expected to generate significant additional regional trips, rather, it will redistribute them to a new location within the same region. The VMT analysis is be based on the California

Environmental Quality Act (CEQA) Guidelines on VMT developed by the Governor's Office of Planning and Research per SB 743 (Steinberg, 2013). SB 743 mandates a change in the way that public agencies evaluate the transportation impacts of projects under CEQA, away from LOS. The proposed changes to the CEQA Guidelines are not yet adopted; when they are, VMT will be the new metric for transportation analysis.

1.4.2 Significance Criteria

The following transportation and circulation significance criteria based on the CEQA Guidelines and the *San Rafael General Plan 2020* (City of San Rafael, 2004) are presented below.

The CEQA Guidelines specify that a project would have a significant traffic and circulation impact if it:

- Conflicts with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit.
- Conflicts with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways.
- Results in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks[4]
- Substantially increases hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment).
- Conflicts with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

1.4.2.1 Signalized Intersections

The *San Rafael General Plan 2020* includes traffic LOS standards for signalized intersections and arterials. These criteria and interpretations consistent with the *San Rafael General Plan 2020* Environmental Impact Report (City of San Rafael, 2004), are presented below.

The Citywide LOS standard from the *San Rafael General Plan 2020* is LOS D except as noted below:

[4] Air traffic pattern analysis is not part of the scope of work for this Transportation Impact Study and will be addressed elsewhere in the CEQA process.

- LOS E
    - Downtown
    - Irwin Street and Grand Avenue between 2nd Street and Mission Avenue
    - Andersen Drive and West Francisco Boulevard
    - Andersen Drive and Bellam Boulevard
    - Freitas at Civic Center/Redwood Highway
    - Merrydale at Civic Center Drive
- LOS F
    - Mission Avenue and Irwin Street

The *San Rafael General Plan 2020* defines the following as significant impacts:

- If a signalized intersection with baseline traffic volumes is operating at an acceptable LOS and deteriorates to an unacceptable operation with the addition of project traffic
- If a signalized intersection with baseline traffic volumes is at an unacceptable LOS and project traffic causes an increase in the delay of five seconds or more

The *San Rafael General Plan 2020* states that signalized intersections along US 101 and Interstate 580 are exempt from LOS standards because delay at these locations are affected by regional traffic and not significantly impacted by local measures.

1.4.2.2 Unsignalized Intersections

The *San Rafael General Plan 2020* does not provide significance thresholds for unsignalized intersections. Therefore, this analysis utilizes the commonly accepted methodology provided in the Highway Capacity Manual (2010) as documented by the Transportation Research Board. For the purposes of this analysis, a significant impact at an unsignalized intersection would be identified based on the following:

- If an unsignalized intersection with baseline traffic volumes is operating at an acceptable LOS (LOS A, B, C, D, or E) and deteriorates to an unacceptable operation (LOS F) with the addition of Project traffic; or
- If an unsignalized intersection with baseline traffic volumes is already operating at LOS F and Project traffic causes an increase in the delay of five seconds or more.

1.4.2.3 Freeway

The *San Rafael General Plan 2020* and *Transportation Authority of Marin Congestion Management Plan* (CMP) does not provide significance thresholds for freeway segments. Therefore, this analysis utilizes a 1-percent trigger, which is a commonly accepted methodology for determining significant impacts for freeway segments consistent with other traffic impact studies completed in the surrounding area. For the purposes of this analysis, a significant impact at a freeway segment would be identified based on the following:

- If operations on US 101 deteriorate from LOS E or better under conditions without the project to LOS F during the AM or PM peak hour; or
- If operations on US 101 operating at unacceptable LOS F under conditions without the project by causing the freeway volume over capacity ratio (v/c) to increase by 0.01 or more (i.e. 1 percent of the freeway segment capacity) during the AM or PM peak hour.

1.4.2.4 Bicycle/Pedestrian

The *San Rafael General Plan 2020* includes the following goals for pedestrian and bicycle conditions:

> **Goal 16: Bikeways**. It is the goal of San Rafael to have safe, convenient and attractive bikeways and amenities.
>
> **Goal 17: Pedestrian Paths**. It is the goal of San Rafael to have safe, convenient and pleasurable pedestrian amenities.

Consistent with these goals, bicycle/pedestrian impacts would be significant if the project:

- Caused a substantial inconvenience or substantial reduction in quality of service for users of existing bicycle or pedestrian travel
- Substantially reduced bicycle or pedestrian access
- Substantially reduced safety for bicyclists or pedestrians

1.4.2.5 Transit

The *San Rafael General Plan 2020* includes the following goals related to the transit network:

> **C-14 Transit Network.** Encourage the continued development of a safe, efficient, and reliable regional and local transit network to provide convenient alternatives to driving.

Consistent with this goal, transit impacts would be significant if the project:

- Induced substantial growth or concentration of population beyond the capacity of existing or planned public transit facilities.
- Increased demand for public transit service to such a degree that accepted service standards are not maintained.
- Reduced availability of public transit to users, or interfered with existing transit users.

1.4.2.6 Parking

While parking is not considered a parking an environmental impact, a parking analysis was completed for information purposes. The *San Rafael General Plan 2020* includes the following goal related to vehicle parking:

> **Goal 18: Adequate Parking**. It is the goal of San Rafael to provide parking that is adequate and accessible, with attention to good design.

2 EXISTING CONDITIONS

The existing conditions scenario includes present day transportation conditions based on field observations and data collected in the Project vicinity in November 2015. The existing scenario includes quantitative and qualitative analysis for vehicle, pedestrian, bicycle, and transit conditions.

2.1 ROADWAY NETWORK

This section describes the regional and local roadway network in the vicinity of the Project site.

2.1.1 Regional Access

US 101 is the major north-south freeway in Marin County and provides regional access to the project site. The freeway is located less than a half mile east of the project site and extends southward to San Francisco and beyond and northward to Sonoma County and beyond. The freeway provides three travel lanes in each direction, a high occupancy vehicle (HOV) lane in each direction, and occasionally an auxiliary lane in both the northbound and southbound directions. An interchange at Lucas Valley Road/Smith Ranch Road provides access from US 101 to the project site.

Lucas Valley Road is primarily a two-lane road west of US 101 that provides east-west access between US 101 and Lucas Valley to the west. Near the US 101 interchange, Lucas Valley Road becomes a four-lane road, with two lanes in each direction and entrance and exit ramps to US 101. East of US 101, Lucas Valley Road becomes Smith Ranch Road.

2.1.2 Local Access

The local circulation system serving the project vicinity is shown on **Figure 1-1**. The project site is located north of downtown San Rafael and just west of US 101. The following roadways provide local access to the proposed project site.

Los Gamos Drive is a two lane north-south facility with on-street parking and sidewalk on a majority of the corridor and is designated as a Class III bicycle route. The north-south street bisects Lucas Valley Road, just west of US 101, at an unsignalized intersection. The Los Gamos Drive corridor provides access to several buildings fronting the west side of US 101 including the Project site.

Smith Ranch Road is a four-lane east-west road east of US-101. Smith Ranch Road includes on-street parking and sidewalks east of the Redwood Drive intersection. Intersections east of the Redwood Drive intersection are unsignalized and typically include marked pedestrian crossings.

Las Gallinas Avenue is a two-lane road with on-street parking runs north-south, west of US 101. Las Gallinas Avenue also has bicycle lanes running from Nova Albion Way to Miller Creek Road. South of Northgate Drive, Las Gallinas becomes Los Ranchitos Road.

2.2 DATA COLLECTION

Weekday morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak period intersection turning movement counts were collected at the study intersections, including separate counts of pedestrians and bicyclists, supplemented with field observations within the Project study area in November 2015. Intersection count data was analyzed to identify, the single hour with the highest traffic volumes during the count periods. The weekday AM peak hour in the study area is generally 8:00 to 9:00 AM and the weekday PM peak hour is generally from 4:30 to 5:30 PM. Peak hour intersection volumes are summarized on **Figure 2-1** along with existing lane configuration and traffic control. The intersection traffic counts for existing conditions are provided in **Appendix A**.

Freeway volumes were based on available data provided by Caltrans. The counts received ranged from 2012 through 2015 and, when possible, data for the same time period intersection counts were collected and used.

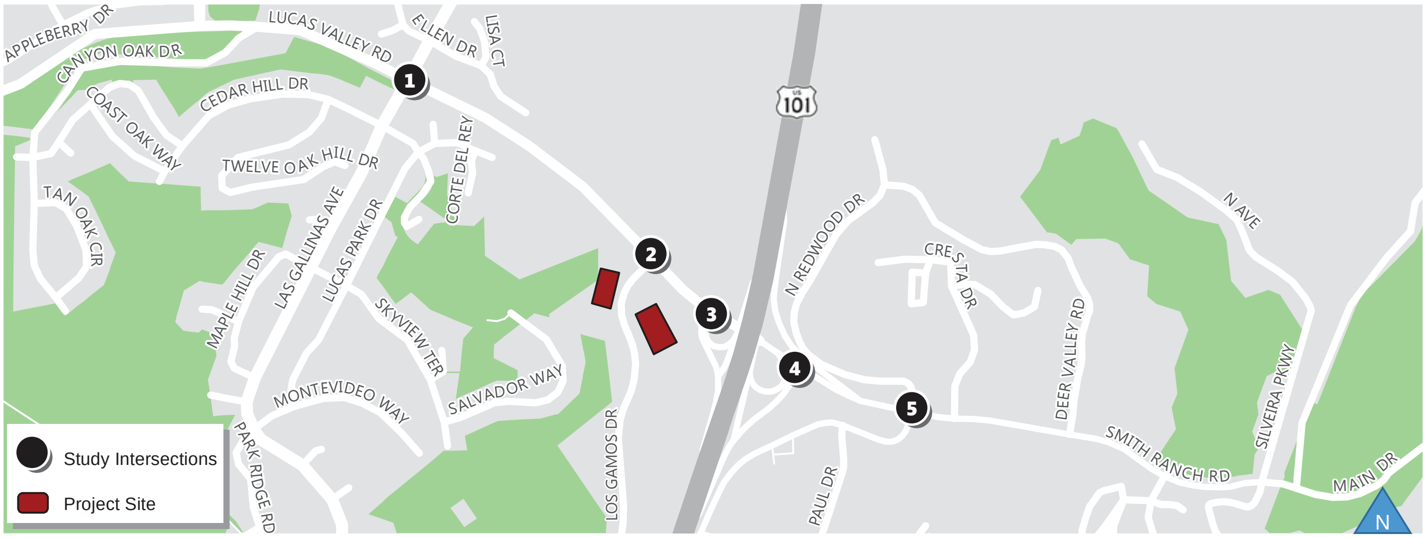
2.3 VEHICLE OPERATIONS

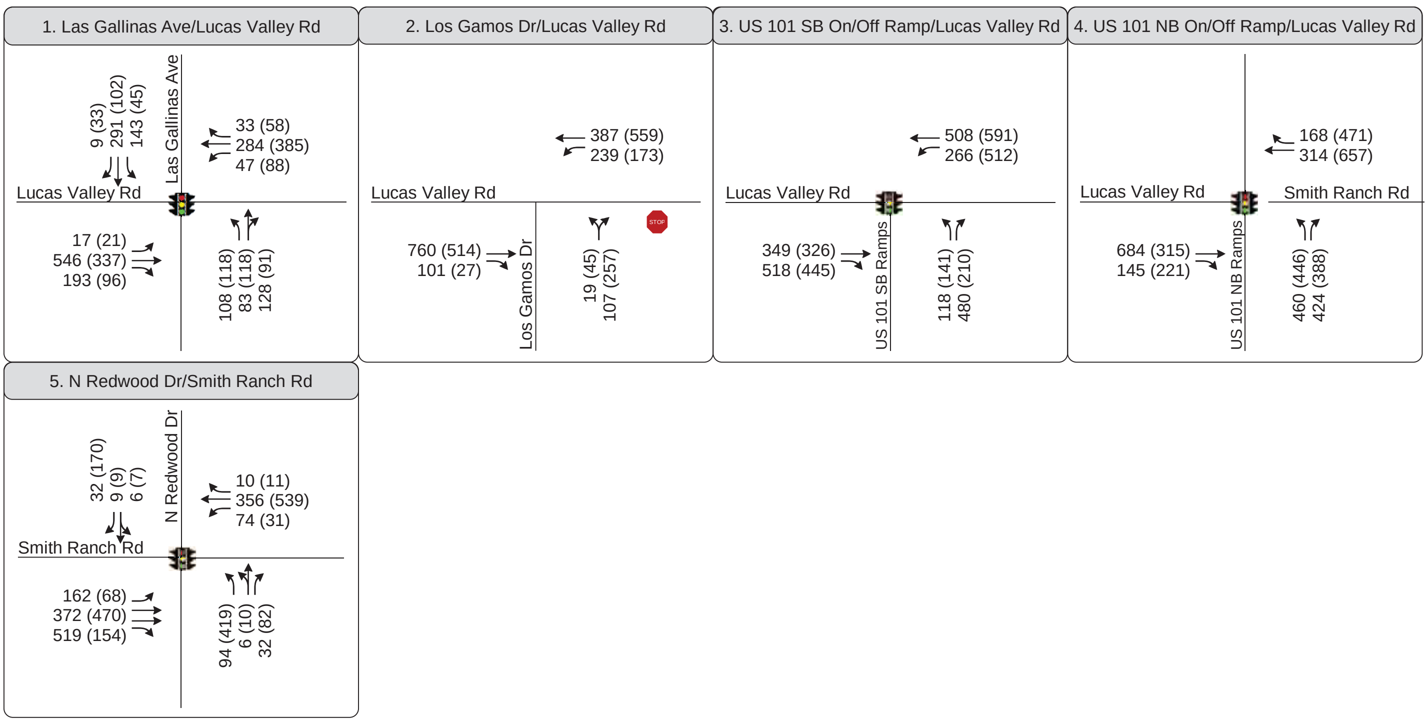
This section describes existing vehicle operations in the Project vicinity.

2.3.1 Intersection Operations

Existing intersection operations were evaluated using the method described in Chapter 1 for the weekday AM and PM peak hours at all study intersections. The existing levels of service of study intersections can be seen in **Table 2-1**. The existing lane configurations and peak hour traffic volumes are shown on **Figure 2-1**. Observed global peak hour factors were used at all intersections for the existing analysis. Pedestrian and bicycle activity was also factored into the analysis.

All intersections are operating at an acceptable level of service C or better during the AM and PM peak hour conditions, consistent with field observations conducted in November 2015. **Appendix B** presents all LOS calculations.





Legend

XX(YY) AM (PM) Peak Hour Traffic

Signalized Intersection

STOP Stop Controlled Approach

Figure 2-1

Existing Peak Hour

Intersection Control, Volumes, and Lane Configuration

TABLE 2-1: INTERSECTION LOS AND DELAY				
Intersection	**Intersection Control[1]**	**Time Period**	**LOS[2,3]**	**Delay[2,3]**
1. Lucas Valley Road and Las Gallinas Avenue	Signal	AM PM	C B	22 14
2. Lucas Valley Road and Los Gamos Drive	SSSC	AM PM	A (C) A (A)	<10 (17) <10 (<10)
3. Lucas Valley Road and US 101 Southbound Ramps	Signal	AM PM	B C	16 22
4. Lucas Valley Road / Smith Ranch Road and US 101 Northbound Ramps	Signal	AM PM	B B	20 12
5. Lucas Valley Road / Smith Ranch Road and Redwood Drive / Redwood Highway	Signal	AM PM	A B	10 12

Notes:
1. SSSC = Side-Street Stop Control
2. Worst approach is noted for side street stop controlled intersections.
3. **Bold** denotes unacceptable level of service and delay.

2.3.1.1 Signal Warrants

The Manual of Uniform Traffic Control (MUTCD) (Federal Highway Administration 2012) presents eight signal warrants to assess if existing stop-controlled intersections warrant signalization. Three of the eight signal warrants were used in this study as a supplemental analysis tool to assess operations at the unsignalized intersection of Los Gamos Drive and Lucas Valley Road, including:

- Warrant 1: Eight Hour Signal Warrant
- Warrant 2: Four Hour Signal Warrant
- Warrant 3; Peak Hour Signal Warrant

Based on this analysis, existing conditions currently fulfill the three warrants evaluated for a signalized intersection, therefore a signal should be considered at this intersection. Signal warrant worksheets are provided in **Appendix C**.

2.3.2 Freeway Operations

Under the guidelines detailed in Chapter 1, the on-ramp merge, off-ramp diverge, and basic segments located near the Project site were analyzed. **Table 2-2** summarizes the freeway segment density and LOS results and detailed calculations are included in **Appendix D**. As shown, all segments operate at acceptable levels during the AM and PM peak hour which is consistent with existing field observations with the exception of the southbound segments during the AM peak hour which operates over capacity and under congested conditions. As described in Chapter 1, the analysis software does not account for downstream bottlenecks and as a result, the software accounts for the number of vehicles that are able to use the facility, not the number of vehicles that want to use the facility and are in queue (demand). Additionally, the methodology accounts for the free-flow speed and does not account for the observed or congested speed based on downstream bottlenecks. The southbound AM peak hour queue through the study area is a result of a downstream bottleneck located between the San Pedro on-ramp and Mission Avenue off-ramp near Downtown San Rafael.

TABLE 2-2: EXISTING CONDITIONS FREEWAY DENSITY AND LOS

Segment	Segment Type	AM Peak Hour		PM Peak Hour	
		Density (pc/mi/ln)[1]	LOS[2]	Density (pc/mi/ln)[1]	LOS
Northbound					
Manuel T Freitas Off / Manuel T Freitas On	Basic	19.4	C	28.6	D
Manuel T Freitas On / Redwood Highway On	Basic	15.9	B	33.7	D
Redwood Highway On	Merge	18	B	25.5	C
Smith Ranch Road Off	Basic	16.4	B	24.7	C
Smith Ranch Road Off / Lucas Road EB On	Basic	18	B	21.7	C
Lucas Road EB On / Smith Ranch Road WB On	Basic	14	B	22.4	C
Smith Ranch Road WB On	Merge	16.7	B	25.5	C
Miller Creek Off	Basic	14.5	B	24.1	C
Miller Creek On	Basic	18.7	C	32.9	D
Southbound					
Miller Creek Off	Basic	19.8	**F[3]**	21.1	C
Miller Creek On	Merge	28.8	**F[3]**	24.7	C
Lucas Valley Road Off	Basic	18.3	**F[3]**	16.5	B
Lucas Valley Road Off / Lucas Valley Road On	Basic	21.9	**F[3]**	20.5	C
Lucas Valley Road On	Merge	28.6	**F[3]**	28.5	D
Lucas Valley Road On / Manuel T Freitas Off	Basic	25.5	**F[3]**	24.8	C
Manuel T Freitas Off	Diverge	31.1	**F[3]**	30.4	D
Manuel T Freitas Off / Manuel T Freitas On	Basic	21.4	**F[3]**	21.4	C

Notes:
1. pc/mi/ln = passenger car per mile per lane
2. **Bold** = unacceptable LOS
3. The LOS results were revised to match existing observations.

2.4 BICYCLE & PEDESTRIAN NETWORK

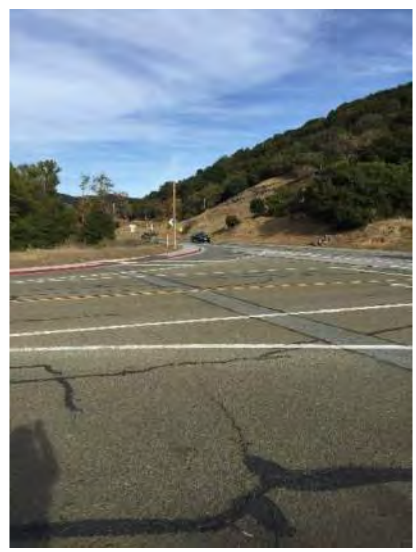
Bicycle facilities are typically described by four classes:

- Class I (Bicycle Path): These facilities are located off-street and can serve both bicyclists and pedestrians
- Class II (Bicycle Lanes): These facilities provide a dedicated area of bicyclists within the paved street width through the use of striping and appropriate signage.
- Class III (Bicycle Routes): These facilities are found along streets that do no provide sufficient width for dedicated Class II bicycle lanes. The street is designated as a bicycle route through the use of signage informing drivers to expect bicyclists.
- Class IV (Cycletrack): These facilities are for the exclusive use of bicycles and requires a vertical element that separates the bikeway and adjacent vehicular traffic.

Currently, Class II bicycle lanes are provided along Las Gallinas Avenue and Lucas Valley Road, west of Los Gamos Drive. Class III facilities are provided along Los Gamos Drive and Frontage Road. **Figure 2-2** illustrates the existing and proposed bicycle facilities in the study area.

Sidewalks are present along Los Gamos Drive and Lucas Valley Road, two roads adjacent to the project site. At the intersection of Los Gamos Drive and Lucas Valley Road there is a crosswalk across Los Gamos Drive serving the east / west direction. Along Lucas Valley Road there is a sidewalk along the south side of the corridor providing access to nearby transit stops; however, there are no pedestrian facilities provided on the north side from Las Gallinas Avenue to North Redwood Drive.

There is a midblock crosswalk on Los Gamos Drive serving the surface parking lot (which is the location of the future parking structure) and 1650 Los Gamos Drive building, as well as sidewalks serving both east and west sides of Los Gamos Drive. Additionally, a narrow sidewalk is provided from the 1650 Los Gamos Drive surface parking lot directly to the Lucas Valley / Southbound US 101 intersection.

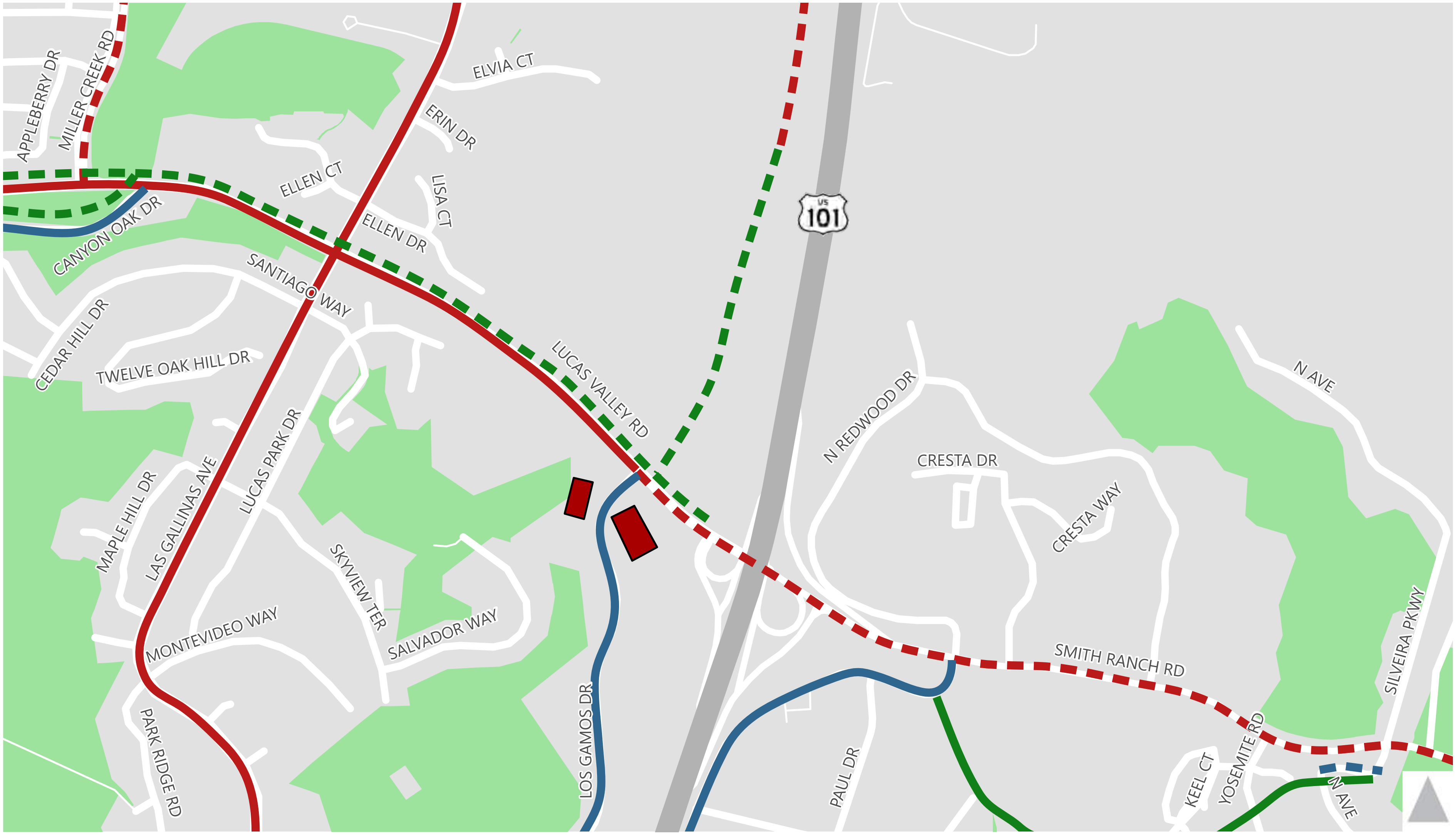


Los Gamos Drive at Lucas Valley Road east-west crosswalk

Based on field observations, there are two narrow foot paths located on the south side of Lucas Valley Road to the northbound and southbound transit stops on US 101. The field visit accounted for several pedestrians using the foot path as an alternate route to and from the transit stop to decrease their walk distance. **Figure 2-3** illustrates the existing and proposed pedestrian facilities in the study area.

Sidewalk from Lucas Valley Road to Southbound US 101 Transit Stop

Footpath from Lucas Valley Road to Southbound US 101 Transit Stop



Existing	Proposed	
		Class I Bikeway/Multi-Use Path
		Class II Bikeway
		Class III Bikeway

Project Site

Figure 2-2

Existing and Proposed Bicycle Facilities in Project Vicinity

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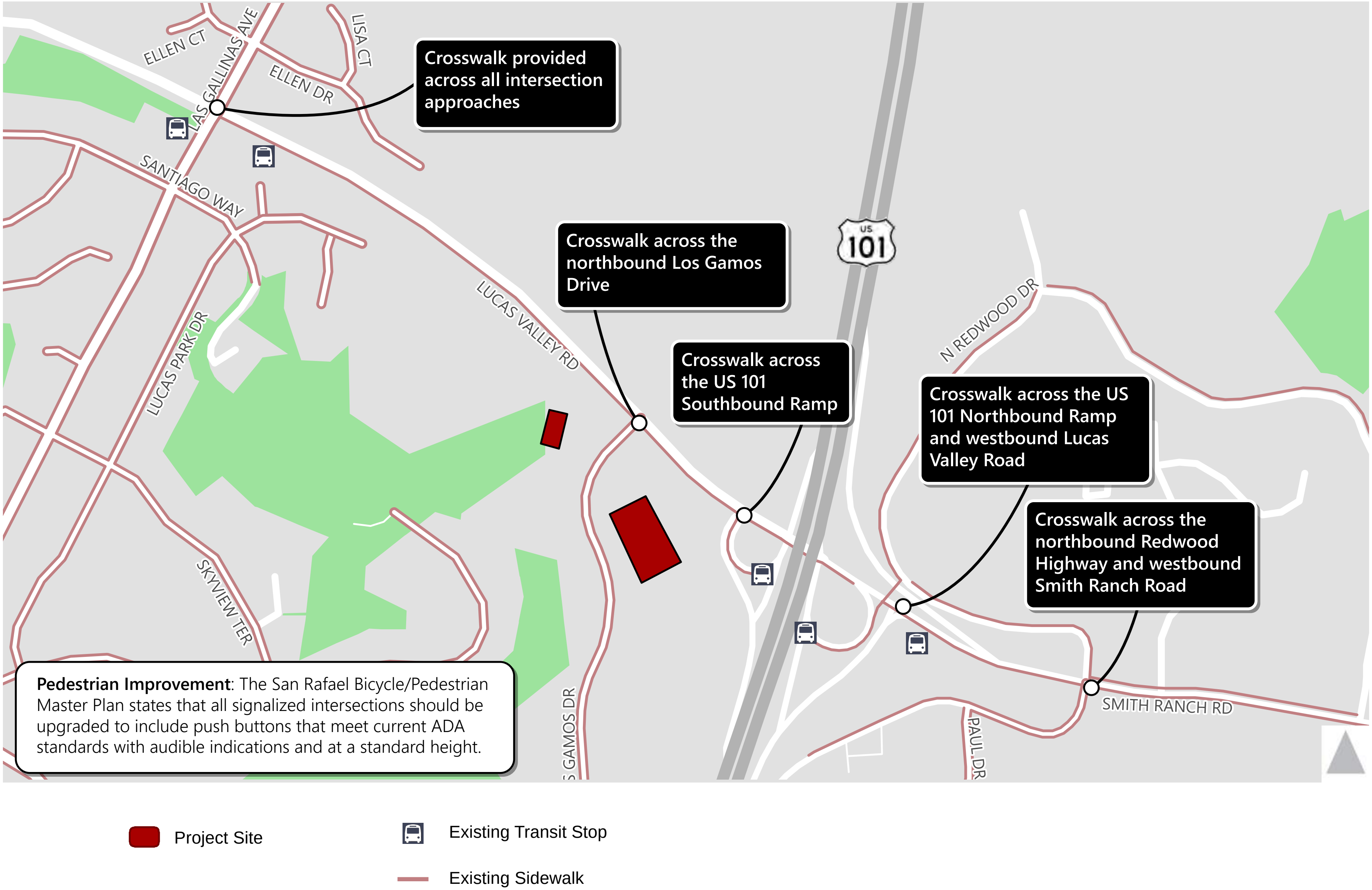

Figure 2-3

Existing and Proposed Pedestrian Facilities in Project Vicinity

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2.5 TRANSIT NETWORK

Golden Gate Transit is the primary regional transit provider within Marin and Sonoma Counties. Golden Gate Transit provides extensive bus service to the San Rafael Transit Center in Downtown San Rafael from Marin and Sonoma counties, San Francisco, and Contra Costa County. Marin Transit provides local bus service within Marin County. Bus service in the Project vicinity is provided along Lucas Valley, Smith Ranch Road, Las Gallinas Avenue, and along US 101. **Figure 2-4** illustrates the existing Golden Gate Transit and Marin Transit routes in the vicinity of the Project site. **Table 2-3** describes the service provided on these routes and the nearest stops to the site. The nearest bus stop is at the US 101 / Lucas Valley Road interchange.

US 101 is an active bus corridor, particularly for regional bus travel. The bus stops at the US 101 / Lucas Valley Road interchange, referred to as the Lucas Valley Bus Pad, allows for nearby access and serves both local and regional routes serving people with origins or destinations outside the immediate vicinity. A Park & Ride surface lot is provided just east of the US 101 / Lucas Valley Road interchange. Two bus stops located near the Lucas Valley Road and Las Gallinas Avenue intersection, located 0.6 miles west of the Project site, serves routes including the 44, 245, and 257. Commute routes including route 44, 54, and 58 offer transportation to San Francisco though do not offer weekend services. Marin transit routes including route 35, 49, and 245 offer local service operating each day of the week.

TABLE 2-3: GOLDEN GATE TRANSIT SERVICE SUMMARY						
Line[1]	**Route**	**Nearest Stop**	**Weekday Operations**		**Weekend Operations**	
			Hours of Operation	**Frequency**	**Hours of Operation**	**Frequency**
35	Canal-Novato	Lucas Valley Bus Pad	6:05 AM – 8:11 PM (SB) 6:41 AM – 11:12 PM (NB)	30 minutes	6:49 AM – 7:41 PM (SB) 7:11 AM – 11:05PM (NB)	30 minutes
44	Marinwood-San Francisco	Lucas Valley and Las Gallinas	6:41 AM – 9:04 AM (SB) 5:05 PM – 7:29 PM (NB)	60 minutes	-	-
49	San Rafael-Novato	Lucas Valley Bus Pad	6:11 AM – 8:10 PM (SB) 6:15 AM – 9:01 PM (NB)	30 minutes	8:20 AM – 10:55 PM (SB) 7:15 AM – 9:41 PM (NB)	60 minutes
54	Marin-San Francisco	Lucas Valley Bus Pad	4:40 AM – 10:02 AM (SB) 2:27 PM – 8:29 PM (NB)	30 minutes	-	-
58	Novato-San Francisco	Lucas Valley Bus Pad	6:06 AM – 9:06 AM (SB) 4:26 PM – 6:57 PM (NB)	30 minutes	-	-
70	Novato-San Francisco	Lucas Valley Bus Pad	5:00 AM – 12:38 AM (SB) 5:00 AM – 1:26 AM (NB)	60 minutes	5:00 AM – 12:28 PM (SB) 5:55 AM – 1:28 AM (NB)	60 minutes
245	Gallinas-San Rafael	Las Gallinas Ave/Cedar Hill Dr	7:28 AM – 6:55 PM (SB) 7:00 AM – 6:26 PM (NB)	60 minutes	7:30 AM – 6:55 PM (SB) 7:00 AM – 6:26 PM (NB)	60 minutes
257	San Rafael/Ignacio	Las Gallinas Ave/Cedar Hill Dr	6:00 AM - 10:25 PM (SB) 7:30 AM – 9:22 PM (NB)	60 minutes	-	-

Source: Golden Gate Transit and Marin Transit, 2017

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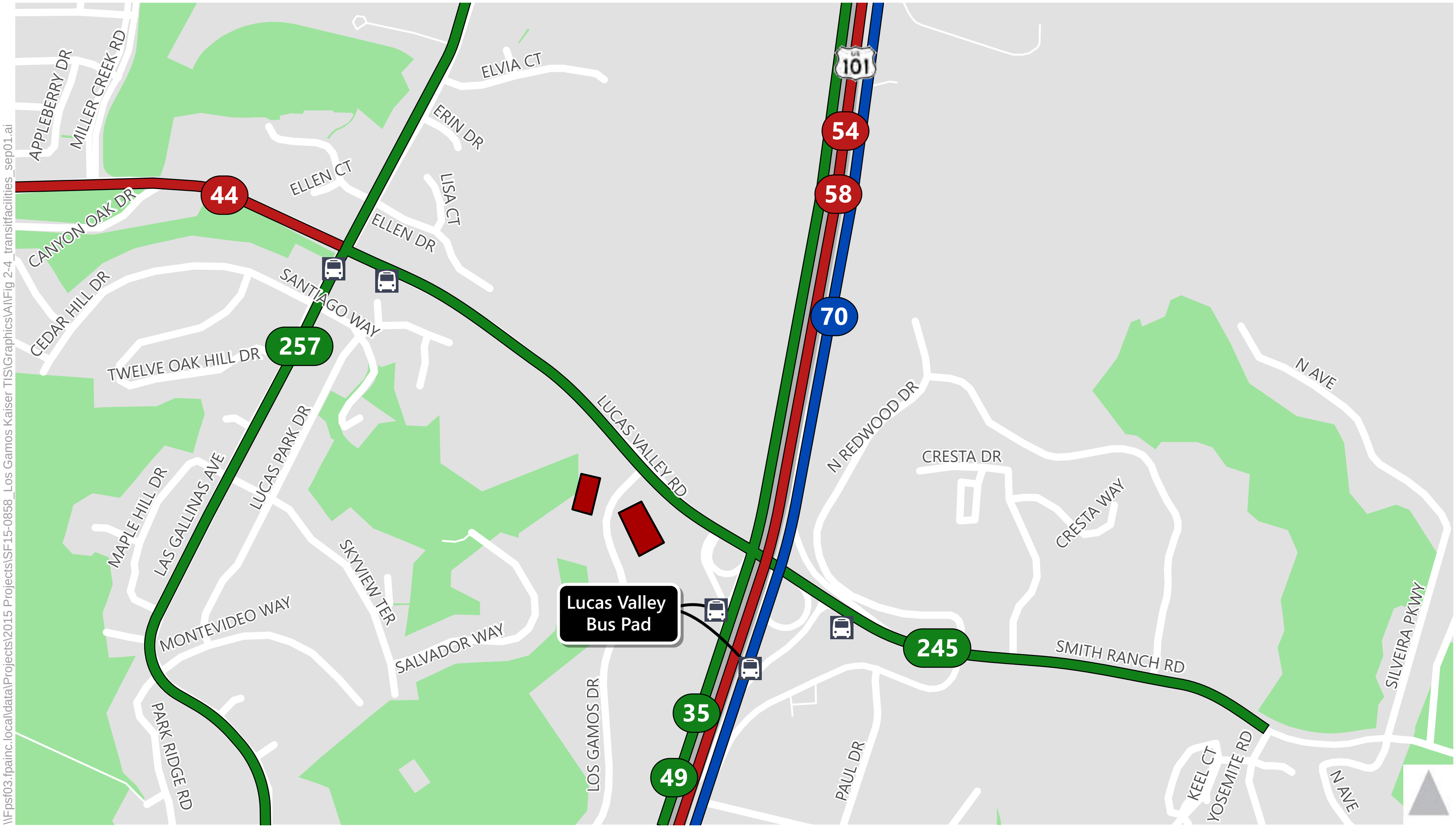


Existing

Local Routes (35, 49, 257)

Commute Routes (44, 54, 58)

Regional Routes (70)

Bus Stop

Project Site

Figure 2-4

Existing Transit Facilities in Project Vicinity

3 PROJECT CONDITIONS

This chapter provides an overview of the proposed Project components and summarizes the proposed Project trip generation, distribution, and assignment characteristics, allowing for an evaluation of Project impacts on the surrounding roadway network. The amount of traffic associated with the Project was estimated using a three-step process:

1) **Trip Generation** – The *amount* of vehicle traffic entering/existing the Project site was estimated.
2) **Trip Distribution** – The *direction* of trips would use to approach and depart the site was projected.
3) **Trip Assignment** – Trips were then *assigned* to specific roadway segments and intersection turning movements.

3.1 PROJECT DESCRIPTION

As described in Chapter 1, the Project site is located at 1650 Los Gamos Drive in San Rafael, California, and is bound by Lucas Valley Road to the north, 1600 Los Gamos Drive to the south, US 101 to the east, and the hillside to the west of Los Gamos Drive, as illustrated on **Figure 1-1**.

The proposed Project is part of an existing office complex. The Project would permit the addition of medical office as an allowed use for the existing 150,000[5] square foot building located at 1650 Los Gamos Drive. The Project Sponsor also proposes to construct an up to 511-space parking garage structure on the west side of Los Gamos Drive, where there is an existing surface lot associated with the building. The project will also continue to use 42 existing parking spaces located on the adjacent property at 1600 Los Gamos Drive via an existing legal easement. For purposes of the transportation analysis, the building was assumed to be 150,000 square feet, the maximum amount of development allowed under the existing zoning.

3.1.1 Transportation Demand Management (TDM) Considerations

Transportation Demand Management (TDM) are programs or tools that incentivize users to change their transportation mode choice from a single occupant vehicle. As a result, a TDM program can reduce impacts to a transportation system by reducing trip generation, air quality, energy use, and travel costs, while still

[5] The existing building is 148,000 square feet; however, the Planned Development District allows up to 150,000 square feet of office space so for the purpose of the analysis, we have assumed a 150,000 square-feet building, though the Project does not plan to rebuild or construct the remaining 2,000 square foot balance.

preserving mobility options. As part of the PD District approval, the building and Project is subject to participating in a TDM program that includes:

- A TDM manager who is responsible for but not limited to: developing and disseminating transportation information, aiding employees in the selection of transportation options, communicating available transit alternatives, and informing tenants of the benefits of flexible work schedules;
- A transit information center that describes current public transit, buspools, vanpools, carpools and shuttle services serving the area;
- A carpool and vanpool matching program

In addition to the above required program, the Project Sponsor will include additional TDM program strategies, most of which are currently implemented at nearby Kaiser Permanente facilities, including:

- Commuter subsidy for transit, bicycle or vanpool use
- Pre-tax community spending accounts
- Guaranteed Ride Home program
- Internal website that provides information on the San Rafael Kaiser Permanente TDM program and alternative modes of transportation to/from the site
- Designated bicycle parking on-site
- Local Kaiser Shuttle: An employee shuttle linking the SMART Station and San Rafael Kaiser Permanente facilities
- Provide on-site amenities such as a café to reduce midday vehicle trips and exercise programs to spread out some vehicle trips before the AMpeak hour and following the PM peak hour
- Partner with organizations to provide employees with additional information on transportation options and encourage employees to attend Kaiser-sponsored events such as Wellness Events

The Project Sponsor is committed to providing a comprehensive TDM program, thus they are exploring additional program opportunities above and beyond the strategies listed above, including:

- Partner with the City of San Rafael and nearby busineesses to explore opportunities to enhance nearby bicycle facilities
- Work with local transit providers to support improvements to the regional transit system
- Explore the dedication of on-site parking spaces for use by car-sharing services
- Partner with neighboring businesses (such as the Marin County Department of Education and YMCA) to identify additional programs to increase transit usage and spread out peak hour trips such as discounts for transit passes and/or a shared shuttle; and discounted gym memberships for nearby facilities

- Allow staff to adjust start/end their work times to better match transit schedules

The Project Sponsor applies similar strategies at other Bay Area locations to reduce vehicle trip generation. In order to understand the effectiveness of the program, the Project Sponsor is committed to completing an annual employee transportation survey that would ask employees how the travel to the project site, time of day, and mode. The results of the survey will be reviewed by Kaiser staff, such that adjustments to the TDM program could be made in order to address employee needs. Based on guidance provided by the California Air Pollution Control Officers Association (CAPCOA), the maximum vehicle trip reduction for suburban developments such as the Proposed Project is generally accepted to be 15-percent. Thus, it is expected that even with implementation of the comprehensive TDM program as described above, vehicle trip generation would be reduced by no more than 15-percent. In order to present a conservative analysis, reductions were not made to the Proposed Project trip generation as presented in this report to account for the TDM strategies. Therefore, the Project trip generation in this report is conservative and the actual number of trips generated by the Proposed Project would be lower than presented and used for impact analysis purposes.

3.2 PROJECT TRIP GENERATION

Trip generation refers to the process of estimating the amount of vehicular traffic a project would add to the surrounding roadway system. Estimates are created on a daily basis and for the peak one-hour periods during the morning and evening commute periods when traffic volumes on the adjacent streets are the highest. The Project trip generation was estimated using rates from the Institute of Transportation Engineers *Trip Generation (*9th Edition) land use numbers 710 (office building) and 720 (medical office building).

The net new project trips represent the increase in vehicular trips that the building would generate after the 150,000 square feet building is occupied by medical office instead of general office. **Table 3-1** shows the Project's daily, weekday AM peak hour, and weekday PM peak hour contribution. . As shown, the Project would contribute 3,765 daily, and 125 AM and 312 PM peak hour trips.

TABLE 3-1: PROJECT TRIP GENERATION ESTIMATES

Scenario	Land Use	ITE Code 1	Size (KSF)2, 3	Daily	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
Planned Development (PD) Allowed	General Office	710	150	1,655	206	28	234	38	186	224
Proposed Project	Medical Office	720	150	5,420	284	75	359	150	386	536
NET NEW PROJECT TRIPS				**3,765**	**78**	**47**	**125**	**112**	**200**	**312**

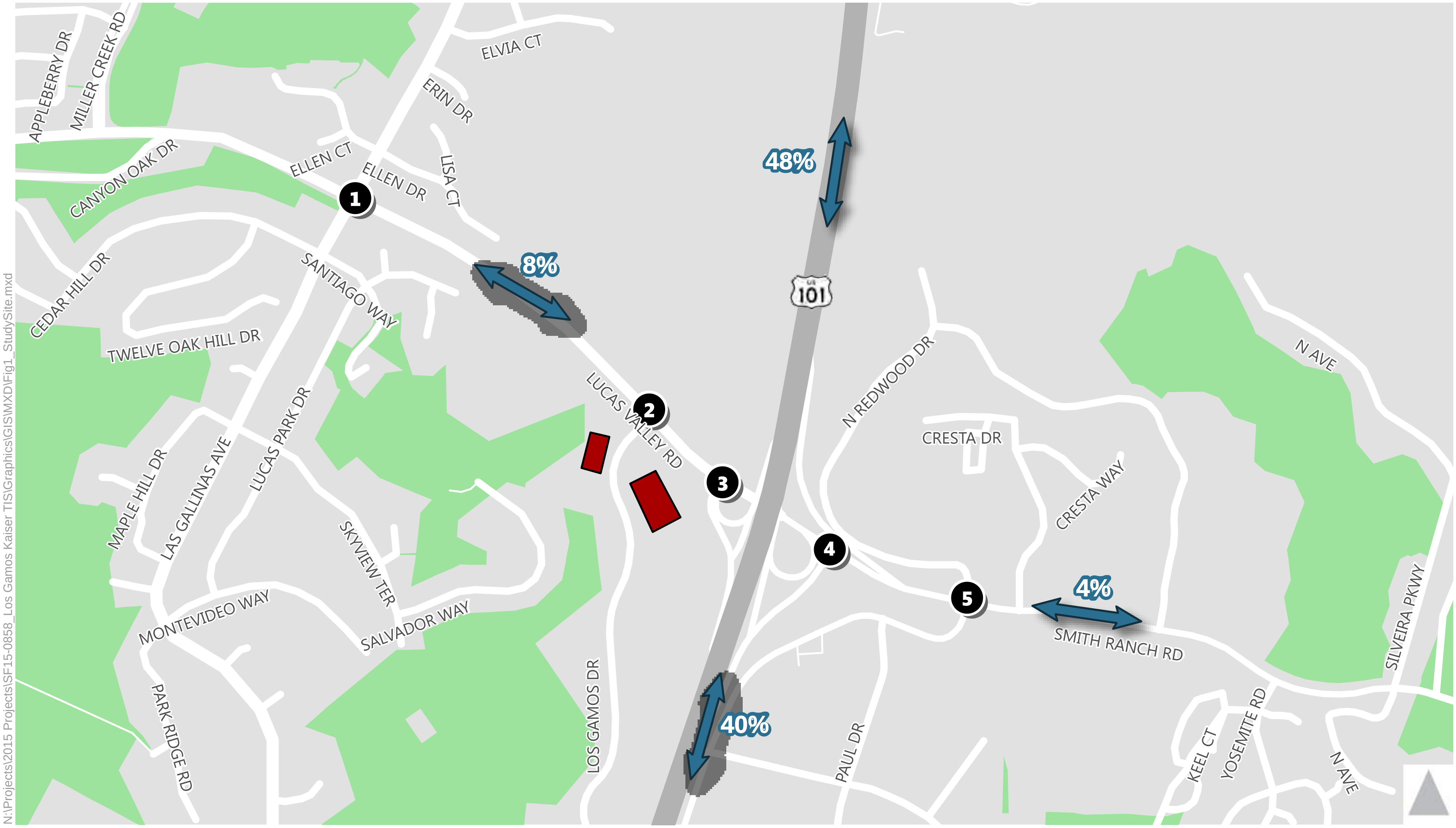
Notes:
1. Trip generated based on Institute of Transportation Engineers (ITE), Trip Generation (9th Edition) equations for:
General Office (Land Use Code 710):
Daily: 11.03
AM Peak Hour: 1.56; Enter = 88%; Exit = 12%
PM Peak Hour: 1.49; Enter = 17%; Exit = 83%
Medical Office (Land Use Code 720):
Daily: 36.13
AM Peak Hour: 2.39; Enter= 79% Exit= 21%
PM Peak Hour: 3.57; Enter= 28% Exit= 72%
2. ksf = 1,000 square-feet
3. The existing building is 148,000 square feet; however, the Planned Development District allows up to 150,000 square feet of office space so for the purpose of the analysis, we have assumed a 150,000 square-feet building, though the Project does not plan to rebuild or construct the remaining 2,000 square foot balance.
Source: Trip Generation (9th Edition), ITE, 2012

3.3 PROJECT TRIP DISTRIBUTION & ASSIGNMENT

Trip distribution percentages, as shown in **Table 3-2** and **Figure 3-1,** were developed based on the Project site location, anonymous existing Kaiser Permanente employee and membership data, existing intersection counts, and surrounding land uses. Net new Project-generated trips, as summarized in **Table 3-1**, were assigned to the roadway system based on the trip distribution patterns shown below. **Figure 3-2** illustrates the net new Project trip assignments at the five study intersections compared to the No Project.

TABLE 3-2: TRIP DISTRIBUTION

Origin/Destination	Percentage
US 101 North	48%
US- 101 South	40%
Lucas Valley Road	8%
Redwood Highway	4%
Total	**100%**



Study Intersections

Project Site

Figure 3-1

Project Trip Distribution

Legend

XX(YY) AM (PM) Peak Hour Traffic

Signalized Intersection

STOP Stop Controlled Approach

Note: Project Trip Assignment based on project trips added on top of Planned Development District Allowed (100% office)

Figure 3-2

Project Trip Assignment

4 VEHICLE MILES TRAVELED EVALUATION

A Vehicle Miles Traveled (VMT) analysis was completed for the Project. Although not currently required, the Sponsor anticipates the CEQA Guidelines will be revised to include VMT analysis in the near future. Caltrans has released new internal interim intergovernmental review (IGR) guidance to its districts which accepts VMT analysis. While the results of this analysis are for informational purposes only, the methodology and analysis summary is consistent with Caltrans procedures.

This section explains the methodology used to calculate the daily VMT per Kaiser Permanente Employee. The results are presented along with a short discussion below.

4.1 ASSUMPTIONS & METHODOLOGY

Kaiser Permanente is planning to staff the Project site with 315 employees at full build out. Approximately 75-percent (245 people) of the staff at the Proposed Project will be relocated from five existing Kaiser Permanente facilities in Marin County including the Downtown San Rafael, San Rafael Medical Center, and Novato. The remaining 25-percent (70 people) are expected to be new employees. The number of existing Kaiser staff at other facilities that are estimated to move to the Proposed Project are presented in **Table 4-1**.

TABLE 4-1: KAISER EMPLOYEES MOVING FROM EXISTING FACILITIES TO PROPOSED PROJECT

Existing Facility Name	Existing Facility Location	Estimated Number of Employees Planned to Relocate to 1650 Los Gamos Drive	
		Number	Percent
Downtown San Rafael	1033 3rd St, San Rafael	53	22%
San Rafael Medical Center	99 Montecillo Rd, San Rafael	171	70%
Novato	97 San Marin Dr, Novato	5	2%
Other sites	Mill Valley & Paul Drive (San Rafael)	16	6%
	Total	245	100%

Source: Kaiser Permanente, 2017

Kaiser Permanente provided anonymous employee zip code data for existing employees that work at the three main locations which employees are to transfer from nearby Kaiser facilities. **Figure 4-1** illustrates the existing employee residential distribution.

VMT per employee was calculated, consistent with methodologies outlined in the IGR for office developments. Using Kaiser Permanente employee data above, the average VMT per employee by existing facility was calculated by using the weighted average of distances between each site and zip based on the number of employees residing in each zip code. The weighted average of the VMT per existing employee was calculated to/from the existing facilities based on the number of staff that are planned to move to the Proposed Project from the existing facilities in order to determine the average VMT per employee at the proposed Project.

The main limitation of this approach is that distances were calculated based on zip codes, which provides an approximate estimate of distance traveled. Additionally, zip code data was available for only three of the five existing Kaiser facilities that plan to move employees to the Proposed Project. However, approximately 93-percent of the 245 existing employees that would move to the Proposed Project currently work at the three sites. As shown in **Figure 4-1**, the distribution of home locations for the three sites used to estimate average VMT were similar; therefore the analysis assumes that the distribution of home locations for existing Kaiser Permanente employees at the Mill Valley and Paul Drive (San Rafael) site, and new Kaiser Permanente employees as part of the proposed Project would parallel the existing distribution and would not fundamentally alter the results.

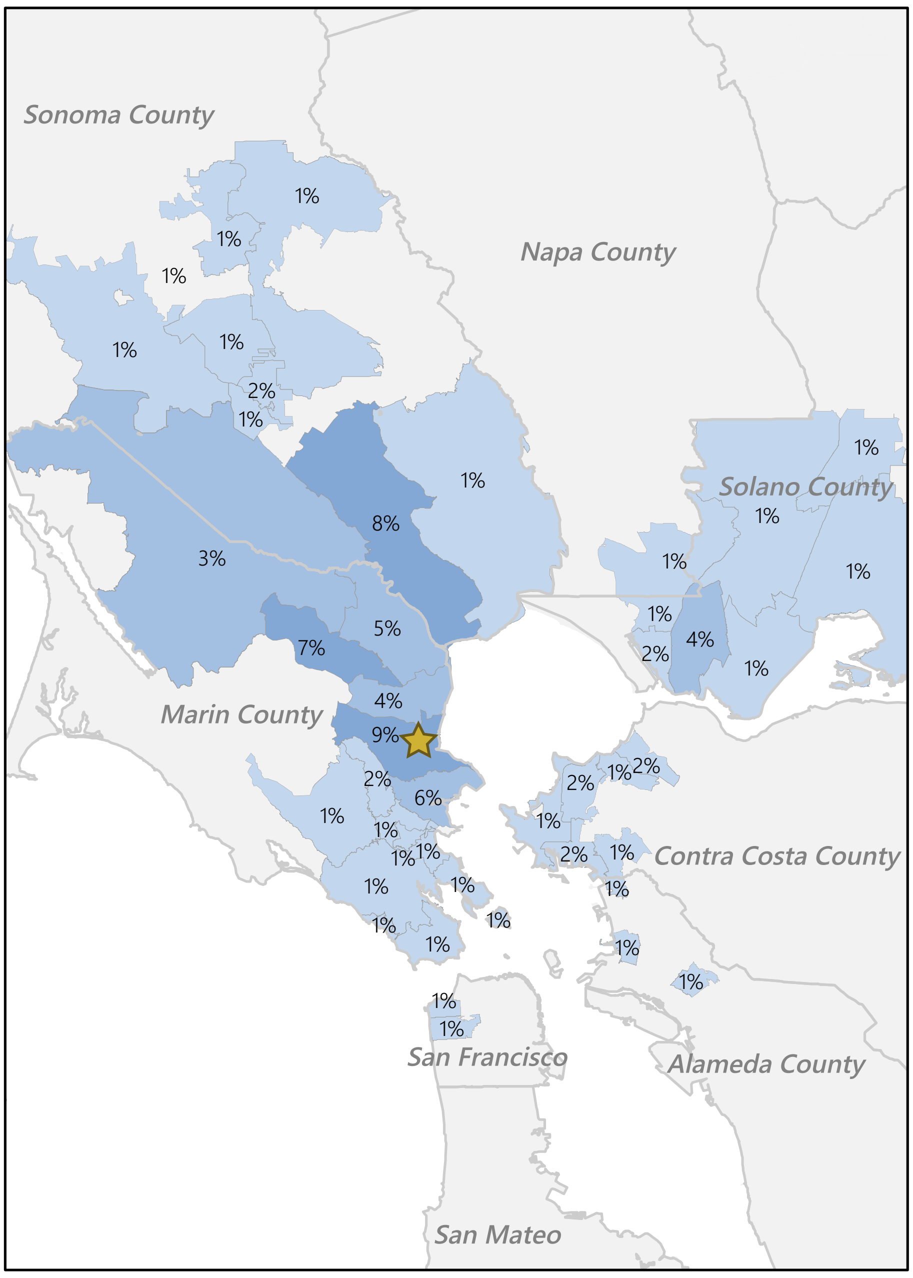
Since many of the existing Kaiser facilities are operating beyond max capacity, not all of the employees that will be relocated to 1650 Los Gamos Drive will be backfilled at their current location. However, for a conservative VMT analysis, it was assumed that all of the Project employees will result in new VMT; thus, off-sets from a reduction of trips at the existing Kaiser sites were not incorporated in the analysis. As a result, the actual VMT generated by the Project would likely be less than assumed in the following analysis.

4.1.1 Significance Criteria

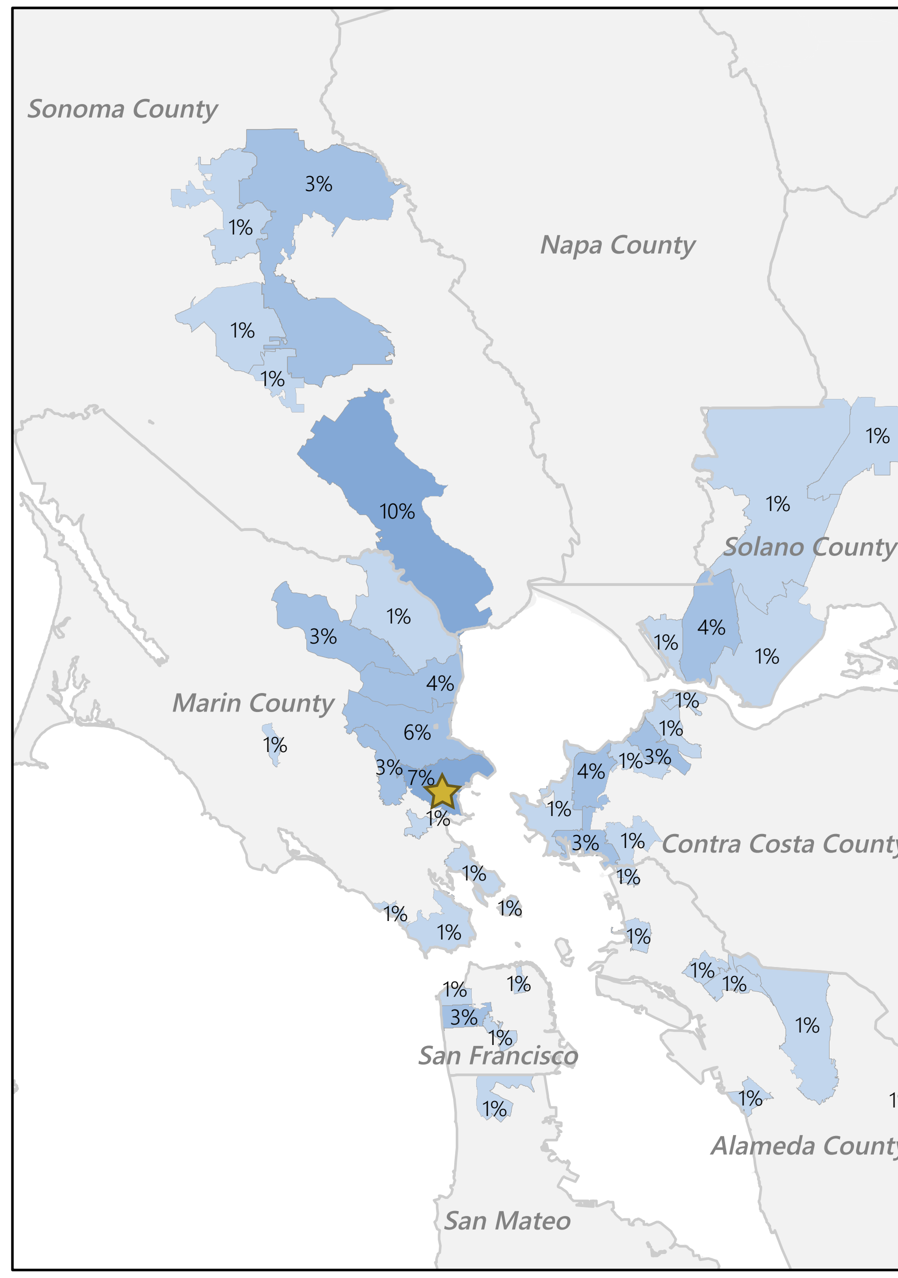
As noted above, the results of this analysis are for informational purposes only because the local agency has yet to adopt VMT thresholds; therefore, there is no formal significance criteria set for the VMT analysis. However, in order to understand the Project's contribution to the transportation network, the Governor's Office of Planning and Research (OPR) Technical Advisory recommendations, consistent with guidance presented in Caltrans IGR, were used. In summary, OPR's Technical Advisory states that office developments that would generate vehicle travel exceeding 15-percent below existing VMT per employee for the region may indicate a significant transportation impact.

For this analysis, VMT per employee results were compared to the Project Transportation Analysis Zone (TAZ) from the Metropolitan Transportation Commission (MTC) and the Association of Bay Area Governments (ABAG) regional model. Existing VMT data by TAZ was not available, so the Projected VMT estimates for Year 2020 were used.

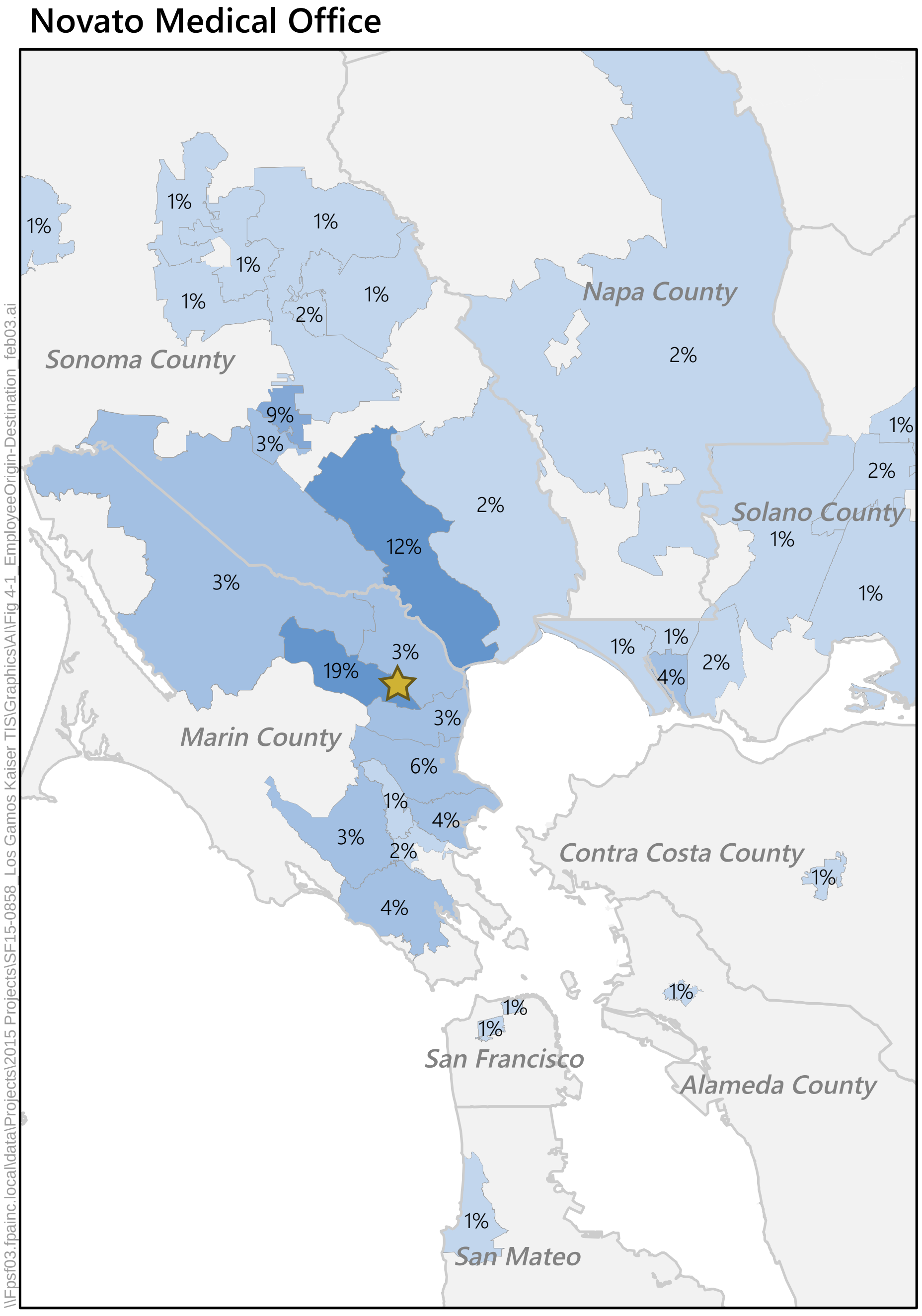
Los Gamos Medical Office



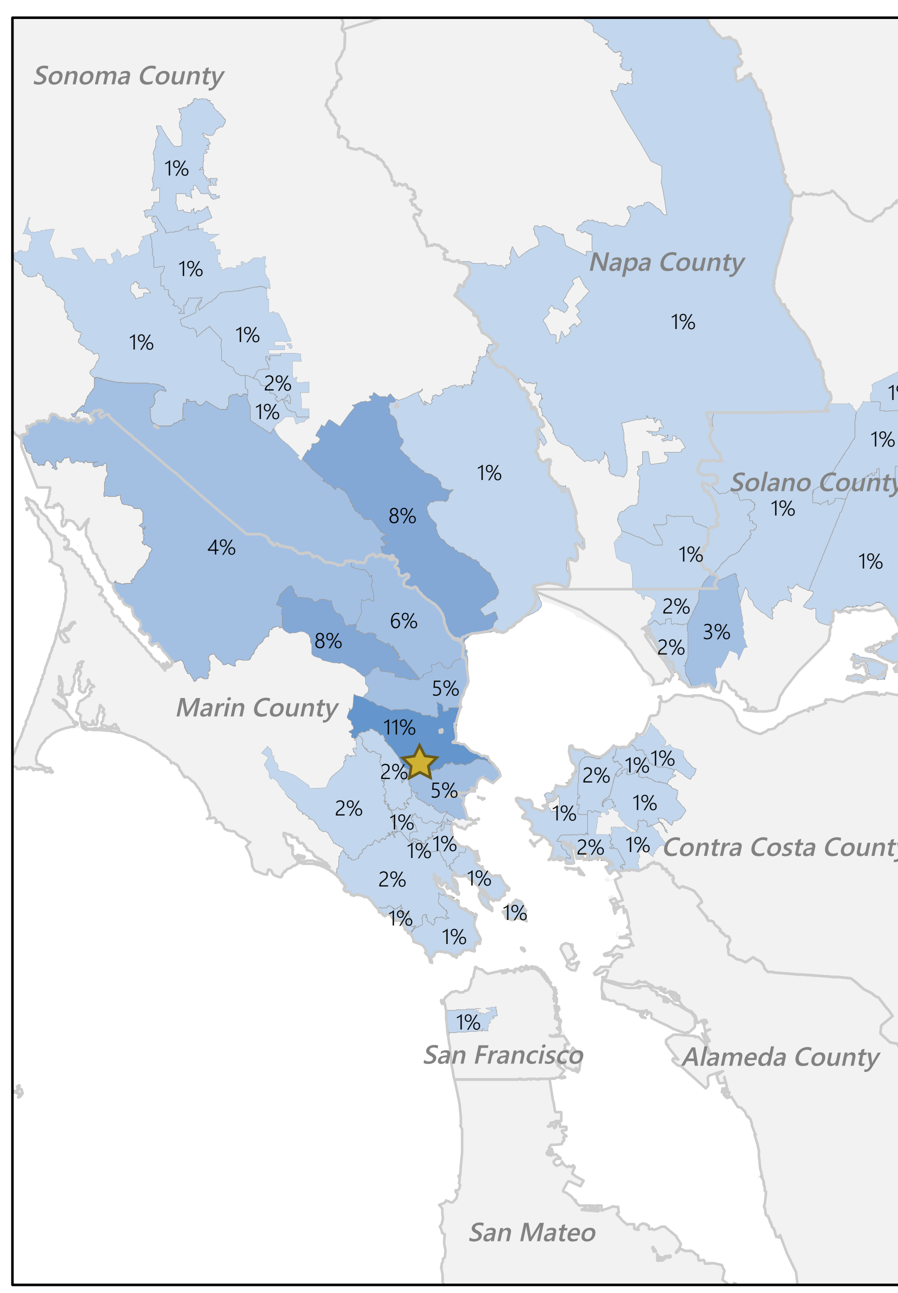
Downtown San Rafael Medical Office



Novato Medical Office



San Rafael Medical Center



Employee Origin

- Less than 1%
- 1% - 2%
- 3% - 6%
- 7% - 10%
- Greater than 10%

Employee Destination

Figure 4-1

Employee Origin-Destination

4.2 RESULTS

The results of the analysis described above are presented in **Table 4-2.** A detailed summary of the analysis results and information gathered from the MTC/ABAG model for Baseline (2020) and Cumulative (2040) conditions is presented in **Appendix E.**

The MTC/ABAG model projects that the 2020 VMT per employee for the Project site TAZ is 32 VMT per employee. A 15-percent reduction of the project VMT per employee would result in 27 VMT per employee. As shown, the average trip length for employees at the proposed Project is estimated to be 20 miles, 40-percent under the 2020 projected VMT per employee. Therefore, based on the OPR's Technical Advisory, the Project would not result in a significant impact.

TABLE 4-2: AVERAGE VMT PER EMPLOYEE COMPARISON

2020 MTC/ABAG Model		Kaiser Permanente	
Estimated Average VMT / Employee[1]	Maximum Average VMT/Employee[2]	Empirically Derived Estimated Average VMT / Employee[3,4]	Below Maximum Average VMT / Employee?
32	27	20	Yes

Notes:

1. 2020 VMT/Employee estimates are determined by the MTC regional travel model for the TAZ zone where the facility is located.
2. Maximum average VMT/Employee based on 15-percent reduction from baseline per OPR's Technical Advisory.
3. Average VMT/Kaiser Employee at existing facilities is based on anonymous employee home zip code data provided by Kaiser Permanente.
4. Average VMT/Kaiser Employee at Proposed Project is based on Average VMT/Kaiser Employee at existing facilities and the planned number of employees to be moved to the Proposed Project from each existing facility.

5 EXISTING PLUS PROJECT CONDITIONS

This chapter evaluates potential traffic impacts under Existing Plus Project conditions.

5.1 ASSUMED ROADWAY IMPROVEMENTS

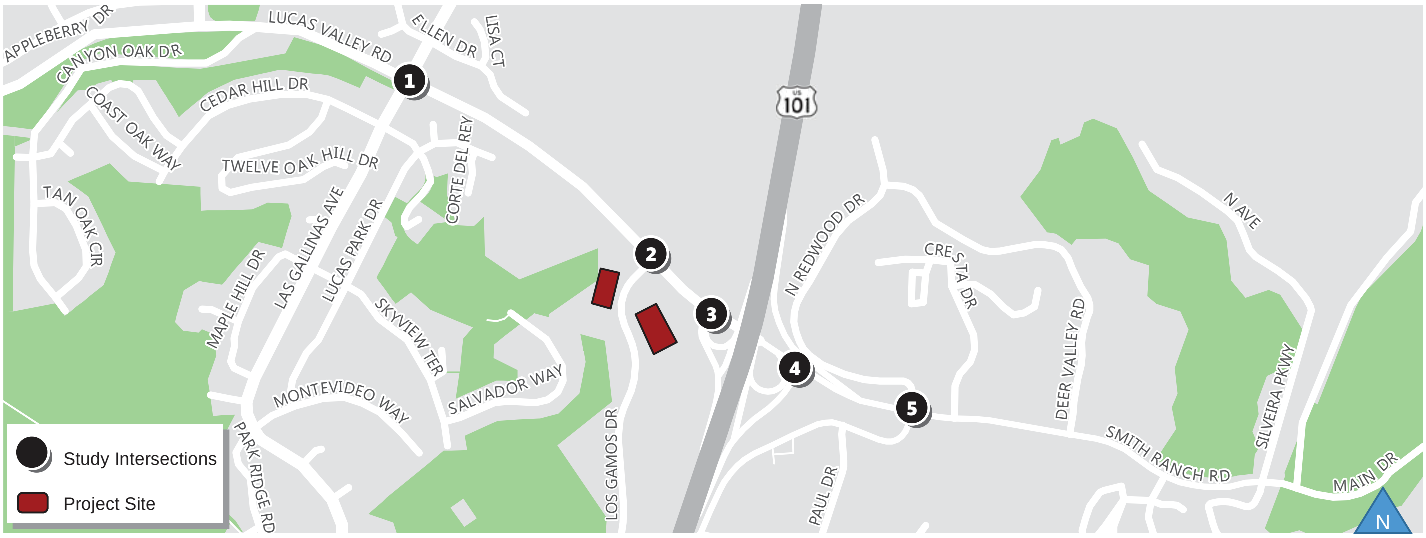
No roadway improvements are anticipated as part of the Project. As such, no additional improvements were included as part of the Existing Plus Project analysis.

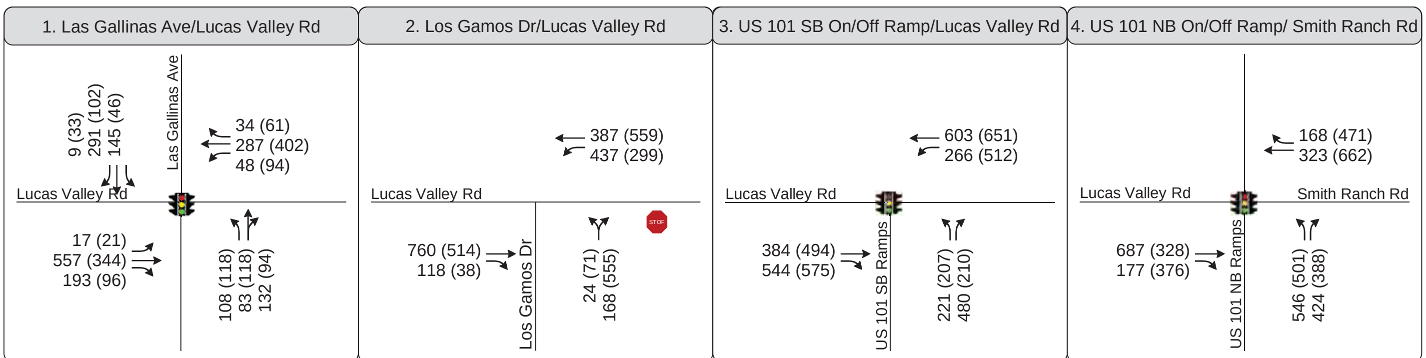
5.2 VEHICLE OPERATIONS

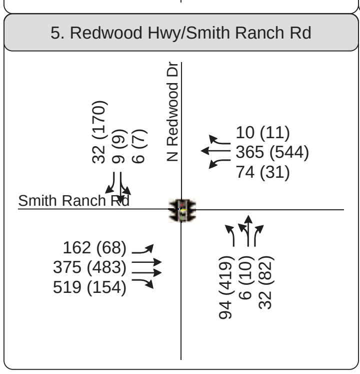
This section describes the Project's impacts to the transportation network under the Existing Plus Project scenario.

5.2.1 Traffic Volumes

As described in Chapter 1, at the time of data collection the Project site was 34-percent occupied; thus, trip generation estimates were calculated for the unoccupied office space to account for a fully occupied building. The additional trips were added to the existing volumes shown in **Figure 2-1**. Project-generated traffic volumes were then added to the peak hour traffic volumes to estimate the Existing Plus Project peak hour traffic volumes as shown on **Figure 5-1**. No roadway improvements were assumed as part of the Project.







Note:
At the time of data collection, the existing 1650 Los Gamos building was about 34-percent occupied. Thus, the Existing Plus Project volumes were adjusted such that the Plus Project volumes account for the lower occupancy and assume a higher trip generation and Project trip assignment than what is represented in Figure 3-2.

Legend

XX(YY)	AM (PM) Peak Hour Traffic
	Signalized Intersection
STOP	Stop Controlled Approach

Figure 5-1
Existing Plus Project
Peak Hour Intersection Control, Volumes, and Lane Configurations

5.2.2 Intersection Operations

Existing Plus Project conditions were evaluated using the methods described in Chapter 1. The Existing Plus Project analysis results are presented in **Table 5-1** and are based on the traffic volumes shown on **Figure 5-1**.

TABLE 5-1: EXISTING INTERSECTION LEVEL OF SERVICE AND DELAY RESULTS

Intersection	Intersection Control[1]	Time Period	Existing No Project		Existing Plus Project	
			LOS[2,3]	Delay[2,3]	LOS[2,3]	Delay[2,3]
1. Lucas Valley Road and Las Gallinas Avenue	Signal	AM PM	C B	22 14	C B	22 14
2. Lucas Valley Road and Los Gamos Drive	SSSC	AM PM	A (C) A (A)	<10 (17) <10 (<10)	B (**E**) D (**F**)	15 (**37**) 30 (**>50**)
3. Lucas Valley Road and US 101 Southbound Ramps	Signal	AM PM	B C	16 22	C D	24 51
4. Lucas Valley Road / Smith Ranch Road and US 101 Northbound Ramps	Signal	AM PM	B B	20 12	**E** B	**56** 12
5. Lucas Valley Road / Smith Ranch Road and Redwood Drive / Redwood Highway	Signal	AM PM	A B	10 12	A B	10 12

Notes:
1. SSSC = Side-Street Stop Control
2. Worst approach is noted for side street stop controlled intersections.
3. **Bold** denotes unacceptable level of service and delay.

As shown on **Table 5-1**, signalized intersections would continue to operate at LOS D or better with the exception of the Lucas Valley Road/Smith Ranch Road/US 101 Northbound Ramps intersection. The intersection operating conditions would worsen from LOS B to LOS E with the Project during the AM peak hour and would continue to operate at the acceptable LOS B during the PM peak hour. The Project's contribution during the AM peak hour would worsen the intersection operations below the LOS D threshold during the AM peak hour which triggers a significant impact. However, the *San Rafael 2020 General Plan* exempts US 101 interchange intersections from LOS standards because delay at these locations are affected by regional traffic and not significantly impacted by local measures. Therefore, the Project's contribution to the Lucas Valley Road/Smith Ranch Road/US 101 intersection is not considered a significant impact. Though the Project does not result in an impact, a potential improvement was identified for informational purposes. Signal timings should be adjusted at the Lucas Valley Road/Smith Ranch Road/US 101 Northbound Ramps intersection to account for the new intersection demand. With implementation, operations at the Lucas Valley Road / Smith Ranch Road / US 101 Northbound Ramps would reduce the Project's impact to less than significant, if the intersection were subject to the significance criteria, similar to other intersections included in this study. Though the Project Sponsor is not required to address the Project's impact to the intersection, based on the significance criteria set in the *San Rafael 2020 General Plan,* the Project Sponsor has committed to voluntarily coordinating signal timing updates with Caltrans during the development and opening of the Project to mitigate the Project's impact to less than significant.

The addition of Project traffic at the Lucas Valley Road/Los Gamos Drive side street stop controlled intersection would increase vehicle delay during the AM and PM peak hour. Although the intersection would continue to operate at LOS D or better during Existing Plus Project conditions, average delay and associated LOS for the side-street stop-controlled intersection is reported for the worst-case controlled approach in this study, as defined in **Section 1.4.1.1**. During Existing Plus Project conditions, Project traffic would worsen the side street stop controlled approach from LOS C to LOS E during the AM peak hour and LOS A to LOS F during the PM peak hour. As a result, the Project's contribution during the PM peak hour would result in a ***significant impact*** because the Project's contribution would worsen the intersection operations to an unacceptable LOS. Mitigation Measure TR-1, described below, has been identified to address the impact.

Mitigation Measure TR-1. Signalize the Lucas Valley Road / Los Gamos Drive Intersection

The Lucas Valley Road / Los Gamos Drive intersection should be signalized to mitigate poor operating conditions. Signalizing the intersection is consistent with improvements identified in the *San Rafael 2020 General Plan* and as discussed in **Chapter 2**, the Lucas Valley Road / Los Gamos Drive intersection fulfills the peak hour signal warrant under existing conditions. Due to its close proximity to the US-101 Ramp terminal intersections, the new signal should include traffic signal interconnect and be coordinated with the adjacent interchange signals. Additionally, interagency coordination will be required during design, construction and maintenance of the new signal, since the interchange signals are operated and maintained by the Caltrans, while the new Lucas Valley Road / Los Gamos Drive signal would likely be operated and maintained by the City of San Rafael County of Marin, or Caltrans. The Project sponsor would pay their fair share cost to the City of San Rafael to design and implement the proposed mitigation measure. Signalizing the intersection would mitigate the project impact to a ***less-than-significant impact***.

5.2.2.1 Queue Summary

The traffic analysis was completed using SimTraffic software which accounts for vehicle queues and the relationship between adjacent intersections within the study area. A queue summary narrative is provided below to supplement the intersection operations analysis; however, results are not part of the significance criteria and the narrative provided is for informational purposes only. Detailed queue results tables are included in **Appendix F**.

During Existing Plus Project Conditions, vehicle queues through the study area remain the same or increase as a result of the Project's traffic contribution. During the AM peak period, the average queue for westbound left turning vehicles at the Lucas Valley / Los Gamos Drive intersection, exceed the existing storage capacity and occasionally blocks westbound through vehicles from continuing east on Lucas Valley Road.[6]

At the Lucas Valley Road/US 101 Southbound Ramps intersection, the queue for vehicles traveling from the US 101 Southbound off-ramp increases with the Project during both the AM and PM peak periods. The southbound right turn off-ramp queue exceeds the available turn pocket storage length during both the Existing No Project and Existing Plus Project AM peak periods; however, the queue is kept within the ramp storage and does not spillback onto the mainline. During the PM peak period, the addition of the Project increases the westbound left turn queue and occasionally, spills back onto the adjacent westbound through lane on Lucas Valley Road.

At the Lucas Valley Road/US 101 Northbound Ramps intersection, queues from the intersection remain within the available storage length during the AM and PM peak hour. Vehicles queues at this intersection do not change substantially under Existing Plus Project conditions during the AM or PM peak period.

In addition, vehicles queues do not change substantially at the Lucas Valley Road/Las Gallinas Avenue and Smith Ranch Road/N Redwood Drive/Redwood Highway intersections during AM and PM peak periods with the addition of Project-related traffic.

5.2.2.2 Signal Warrants

As mentioned in Chapter 2, the existing volumes fulfill the three signal warrants evaluated, therefore a signal should be considered at the Lucas Valley Road/Los Gamos Drive intersection. The addition of Project traffic would further qualify the intersection for a signal. Furthermore, implementation of Mitigation Measure TR-1: Signalize Lucas Valley Road/Los Gamos Drive would mitigate the project impact during Existing Conditions to a less-than-significant level.

5.2.3 Freeway Operations

Existing Plus Project conditions were evaluated using the methods described in Chapter 1. As described in Chapter 4, the Project plans to shift existing employees from existing Kaiser Permanente facilities in Marin

[6] Implementation of MM TR-1 would improve intersection operations and reduce the westbound left turn queue. Occasionally, the westbound left turn queue will exceed the available pocket storage length and block the westbound through lane; however, queues do not spillback to the adjacent intersection.

County to the proposed Project site; however, the freeway analysis methodology assumes that all Project trips are added to the No Project freeway volumes. Therefore, the approach is conservative and may be double counting vehicle trips that are already accounted for in the No Project volume.

The Existing Plus Project analysis results are presented in **Table 5-2** and **Table 5-3**, for the AM and PM peak hours, respectively. Detailed freeway level of service calculation sheets are provided in **Appendix D**.

TABLE 5-2: EXISTING CONDITIONS FREEWAY DENSITY AND LOS – AM PEAK HOUR

Segment	Segment Type	Existing No Project		Existing Plus Project	
		Density (pc/mi/ln)[1]	LOS[2]	Density (pc/mi/ln)[1]	LOS
Northbound					
Manuel T Freitas Off / Manuel T Freitas On	Basic	19.4	C	20.3	C
Manuel T Freitas On / Redwood Highway On	Basic	15.9	B	16.6	B
Redwood Highway On	Merge	18	B	18.5	B
Smith Ranch Road Off	Basic	16.4	B	17	B
Smith Ranch Road Off / Lucas Road EB On	Basic	18	B	18.5	C
Lucas Road EB On / Smith Ranch Road WB On	Basic	14	B	14.4	B
Smith Ranch Road WB On	Merge	16.7	B	17	B
Miller Creek Off	Basic	14.5	B	15	B
Miller Creek On	Basic	18.7	C	19.3	C
Southbound					
Miller Creek Off	Basic	19.8	**F[3]**	20.2	**F[3]**
Miller Creek On	Merge	28.8	**F[3]**	29.2	**F[3]**
Lucas Valley Road Off	Basic	18.3	**F[3]**	18.6	**F[3]**
Lucas Valley Road Off / Lucas Valley Road On	Basic	21.9	**F[3]**	21.9	**F[3]**
Lucas Valley Road On	Merge	28.6	**F[3]**	28.8	**F[3]**
Lucas Valley Road On / Manuel T Freitas Off	Basic	25.5	**F[3]**	25.6	**F[3]**
Manuel T Freitas Off	Diverge	31.1	**F[3]**	31.2	**F[3]**
Manuel T Freitas Off / Manuel T Freitas On	Basic	21.4	**F[3]**	21.6	**F[3]**

Notes:
1. pc/mi/ln = passenger car per mile per lane
2. **Bold** = unacceptable LOS
3. The LOS results were revised to match existing observations. (add language from other similar footnote that explains why revised.)

TABLE 5-3: EXISTING CONDITIONS FREEWAY DENSITY AND LOS – PM PEAK HOUR					
Segment	**Segment Type**	**Existing No Project**		**Existing Plus Project**	
		Density (pc/mi/ln)[1]	**LOS**	**Density (pc/mi/ln)**[1]	**LOS**
Northbound					
Manuel T Freitas Off / Manuel T Freitas On	Basic	28.6	D	28.9	D
Manuel T Freitas On / Redwood Highway On	Basic	33.7	D	34.1	D
Redwood Highway On	Merge	25.5	C	25.6	C
Smith Ranch Road Off	Basic	24.7	C	24.9	C
Smith Ranch Road Off / Lucas Road EB On	Basic	21.7	C	21.7	C
Lucas Road EB On / Smith Ranch Road WB On	Basic	22.4	C	23	C
Smith Ranch Road WB On	Merge	25.5	C	25.9	C
Miller Creek Off	Basic	24.1	C	24.7	C
Miller Creek On	Basic	32.9	D	34.1	D
Southbound					
Miller Creek Off	Basic	21.1	C	20.8	C
Miller Creek On	Merge	24.7	C	24.4	C
Lucas Valley Road Off	Basic	16.5	B	16.3	B
Lucas Valley Road Off / Lucas Valley Road On	Basic	20.5	C	20	C
Lucas Valley Road On	Merge	28.5	D	28.8	D
Lucas Valley Road On / Manuel T Freitas Off	Basic	24.8	C	24.8	C
Manuel T Freitas Off	Diverge	30.4	D	30.4	D
Manuel T Freitas Off / Manuel T Freitas On	Basic	21.4	C	21.4	C

Notes:

1. pc/mi/ln = passenger car per mile per lane

During the weekday AM and PM peak hours, all of the freeway segments would operate at LOS D or better, except southbound segments during the AM peak hour. As mentioned in **Section 2.3.2** the southbound segments are currently in queue due to a downstream bottleneck between the San Pedro on-ramp and Mission Avenue off-ramp. The addition of Project trips would contribute to the existing failing condition, as such, to understand the Project's impact, the Project's volume-to-capacity (v/c) ratio contribution calculation was completed and is summarized in **Table 5-4**. The purpose of calculating a v/c ratio is to understand the Project's contribution to an existing facility. The v/c ratio is based on the estimated or counted volume over the study segment capacity. Segments with a v/c ratio greater than 1.0 means the number of vehicles that want to use the facility exceed the available capacity and as a result, delays and queuing are anticipated.

TABLE 5-4: EXISTING CONDITIONS VOLUME TO CAPACITY (V/C) SUMMARY[1] - AM PEAK HOUR					
Segment	**Segment Capacity[1]**	**Existing No Project**		**Exiting Plus Project**	
		Volume[2]	**v/c**	**Volume[2]**	**v/c[3]**
Southbound					
Miller Creek Off / Miller Creek On	6,600	3,616	0.55	3,694	**0.56**
Miller Creek On / Lucas Valley Road Off	8,100	4,454	0.55	4,532	0.55
Lucas Valley Road Off / Lucas Valley Road On	6,600	4,002	0.61	4,002	0.61
Lucas Valley Road On / Manuel T Freitas Off	6,600	4,595	0.70	4,615	0.70
Manuel T Freitas Off / Manuel T Freitas On	6,600	3,916	0.59	3,936	0.59

Notes:

1. Summary based on mixed flow lanes only. High Occupancy Vehicles lane not included in analysis.
2. v/c calculation assumes the following capacities:
   - Mixed Flow Lanes: 2,200 vehicles per lane
   - Auxiliary Lanes: 1,500 vehicles per lane
3. The total volume reported does not account for the HOV volume.
4. **Bold** = Project contributes greater than at least 0.01 v/c to the No Project condition resulting in a significant impact

As summarized in Chapter 4, the Project's expected VMT / employee is less than the expected VMT / employee for the TAZ. However, because the Project adds less than 2-percent of traffic to the existing corridor, the Project's contribution increases the corridor's v/c ratio by 0.01, resulting in a ***significant impact***, between the Miller Creek Off-Ramp and Miller Creek On-Ramp segment.

Within the Project vicinity, US 101 roadway improvements are neither planned nor funded. Thus, it is infeasible for the Project Sponsor to contribute its fair-share contribution to the regional network. However, Caltrans IGR states that implementation of a TDM program could reduce VMT and the Project's impact to the regional network. The Project description already includes TDM elements based on the TDM program that Project Sponsor currently provides at its nearby facilities. The Project Sponsor proposed TDM goes beyond what is required under the existing PD District. In order to further reduce the Project's impact to the regional network and ensure the implementation of the Project Sponsor proposed TDM, Mitigation Measure TR-2 would have the Project Sponsor implement TDM measures which go beyond those already included in the PD District.

Mitigation Measure TR-2. Project Sponsor shall identify and implement additional TDM measures

The Project Sponsor shall implement a TDM Program as described in the Project Description and **Section 3.1.1**. Implementation of these TDM elements would go beyond what is already required as part of the PD District with the goal of reducing employee vehicle trips, thereby, reducing the

Project's impact on the regional network. The program will be submitted to the City of San Rafael for review and comment. The Project Sponsor will coordinate with the City of San Rafael, as necessary. As described in **Section 3.1.1,** the Project Sponsor shall conduct an annual employee transportation survey and prepare a corresponding monitoring report that evaluates the effectiveness of the Project's TDM Plan. Based on a quantitative assessment of the TDM strategies proposed, the TDM plan may yield a Project vehicle trip generation reduction of up to 12-percent. If maximally effective across the vehicle trips, implementation of the TDM strategies would result in a project trip reduction of up to 10-15 AM peak hour trips along this segment, which would result in a project contribution of less than 0.01. Therefore, implementation of the TDM Program, coupled with an annual monitoring to ensure and report on implementation would reduce the Project's impact to ***less than significant***.

5.3 ON-SITE VEHICLE ACCESS AND CIRCULATION

While not required under CEQA to avoid a significant impact, on-site vehicle access and circulation were evaluated. Access to the Project would be provided from four unsignalized driveways as well as two additional driveways on either side of the proposed parking structure for fire access, as indicated in **Figure 1-2**. Three driveways on the east side of Los Gamos Drive, which are existing driveways, would lead to surface parking lots adjacent to the Project building. The existing northern most driveway, located on the west side of Los Gamos Drive, would be moved 100 feet south and provide direct access to the proposed parking garage structure. The relocated driveway would provide a longer storage length between the driveway and vehicles traveling north to the Los Gamos Drive / Lucas Valley Road intersection. The Project is not expected to substantially increase hazards due to a design feature since the Project will use existing driveways, where feasible, and does not propose to change the roadway alignment.

5.4 BICYCLE AND PEDESTRIAN IMPACTS

Bicycling and pedestrian trips in the study area may increase as a result of the proposed Project. Bicycle travel would likely occur along Lucas Valley Road and Los Gamos Drive since they provide direct connections to the Project site and are designated bicycle facilities. Pedestrian travel would likely occur on Lucas Valley Road as it provides direct access to nearby transit facilities. The projected increase in vehicles at the intersections in the vicinity of the Proposed Project may result in an increase in vehicle-bicycle-pedestrian conflicts at intersections in the study area. However, the proposed Project would not create potentially hazardous conditions for bicycles, pedestrians, or otherwise interfere with bicycle and pedestrian accessibility to the site and adjoining areas because the Project does not remove existing facilities and does not prohibit the construction of proposed future facilities in the Project vicinity.

The Project includes construction of an approximately 500 car parking structure on the west side of Los Gamos Drive which would increase the number of pedestrian crossings across Los Gamos Drive. Due to the increase in pedestrian crossings, the Project Sponsor will include crosswalk enhancements to the existing crossing, located just north of the existing driveway into the front side of 1650 Los Gamos Drive. Enhancements include:

- Shifting the existing crosswalk north such that the crosswalk fronts the pedestrian ingress/egress of the parking structure
- The addition of bulbouts on both sides of the road to increase pedestrian visibility
- The addition of a Rectangular Rapid Flashing Beacon (RRFB). The RRFB is a pedestrian activated supplemental warning system, which flashes lights to increase a drivers awareness of a potential pedestrian crossing.

The Project's impact to bicycle and pedestrian facilities are considered ***less than significant*** and mitigations are not required under Existing Plus Project conditions.

5.5 TRANSIT IMPACTS

Transit trips in the study area may increase as a result of the Project. However, Project related transit trips would have no foreseeable impacts to transit operations because the Project would not likely generate enough transit demand to exceed the capacity of existing or planned transit service nor does it interfere with existing or future transit users. Therefore, the Project impacts to transit facilities are considered ***less than significant*** and mitigations are not required.

5.6 PARKING

While parking is not considered an environmental impact under CEQA, a parking analysis was completed for information purposes only.

The City of San Rafael parking requirements for off-street parking were reviewed. For medical office uses, 1 space is required for every 225 gross building square feet, resulting in a code requirement of 657 spaces (assuming 148,000 sf medical office building). The Project sponsor is proposing a higher parking ratio based on existing parking demand at nearby medical facilities. The proposed parking plan currently includes 753 parking spaces which exceeds the City's requirements by 96 spaces. Of the 753 parking spaces, there are 23 ADA parking spaces (10 spaces in the parking structure and 13 in the surface lot) which meets the minimum ADA parking requirements from the United States Access Board; and 155 compact spaces, which is under the City's 30-percent compact parking maximum.

The *City of San Rafael Bicycle/Pedestrian Master Plan Update (2011)* includes an objective to provide bicycle parking in employment and commercial areas; and the City of San Rafael Code of Ordinances requires a minimum number of short term and long term bicycle parking spaces equivalent to 5-percent of the requirement for automobile parking spaces, with a minimum of one two-bike capacity rack; therefore, the ordinance requires 38 short term bicycle parking spaces (based on 148,000 sf medical office building). Based on the proposed parking plan, the Project will provide 34 short term parking spaces and 33 long term parking spaces, thereby meeting the minimum number of bicycle parking spaces required.

Based on this review, the total number of parking spaces the Project provides is sufficient and meets the City of San Rafael's parking requirements.

6 BASELINE CONDITIONS

The baseline scenario includes existing transportation conditions plus traffic generated from approved developments that are not yet constructed. Under the Baseline Condition, the San Rafael Airport Recreational Facility is included.

6.1 ASSUMED ROADWAY IMPROVEMENTS

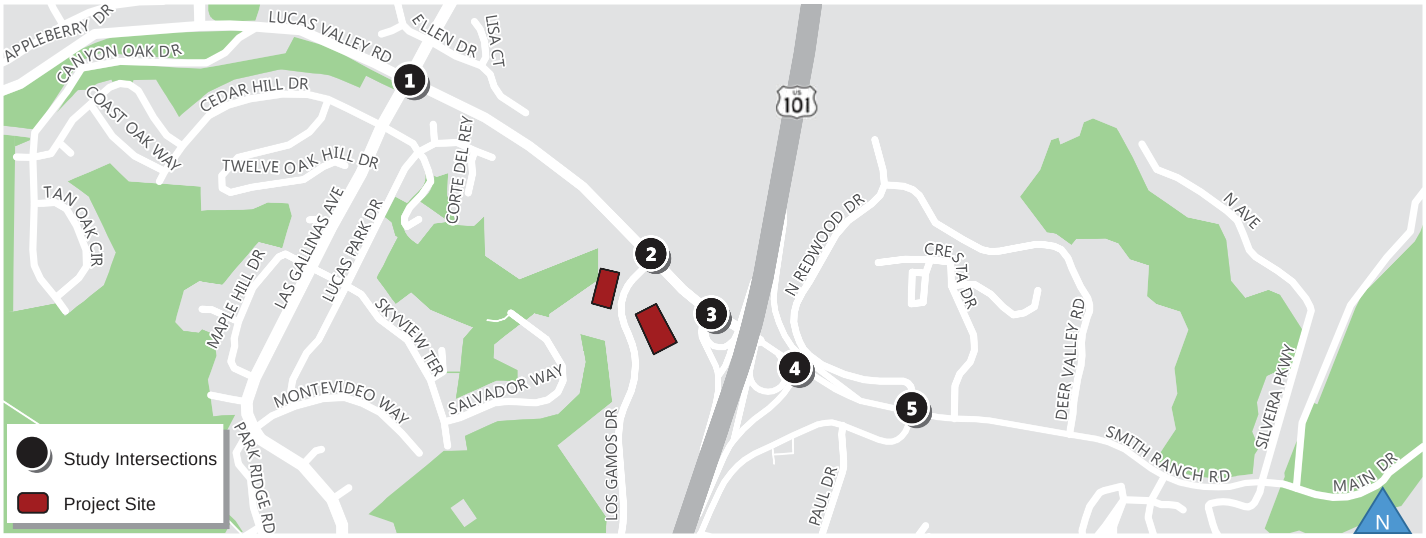
No roadway improvements are anticipated as part of the Project. As such, no additional improvements were included as part of the Baseline Plus Project analysis.

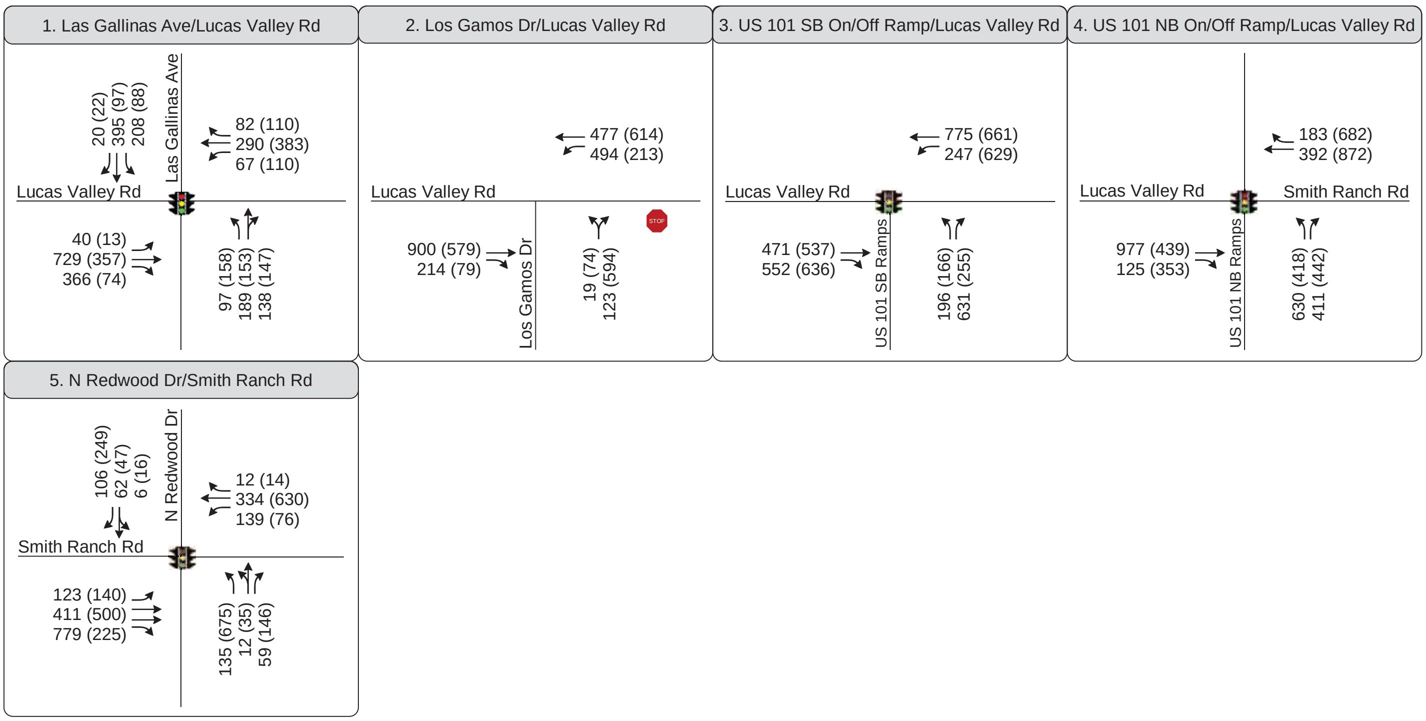
6.2 VEHICLE OPERATIONS

This section describes the Project's impacts to vehicles under the Baseline No Project and Baseline Plus Project scenarios.

6.2.1 Traffic Volumes

The City of San Rafael maintains a database of baseline traffic volumes, which assumes the 100-perecent occupied building at 1650 Los Gamos Drive, and provided Synchro files for use in this traffic study. The baseline peak hour intersection volumes, lane configurations, and traffic controls at each intersection for the AM and PM peak hours is summarized on **Figure 6-1**. Similar to Existing Plus Project conditions, Project traffic volumes were added to the baseline peak hour traffic volumes to estimate the Baseline Plus Project peak hour traffic volumes, summarized on **Figure 6-2**.





Legend

XX(YY) AM (PM) Peak Hour Traffic

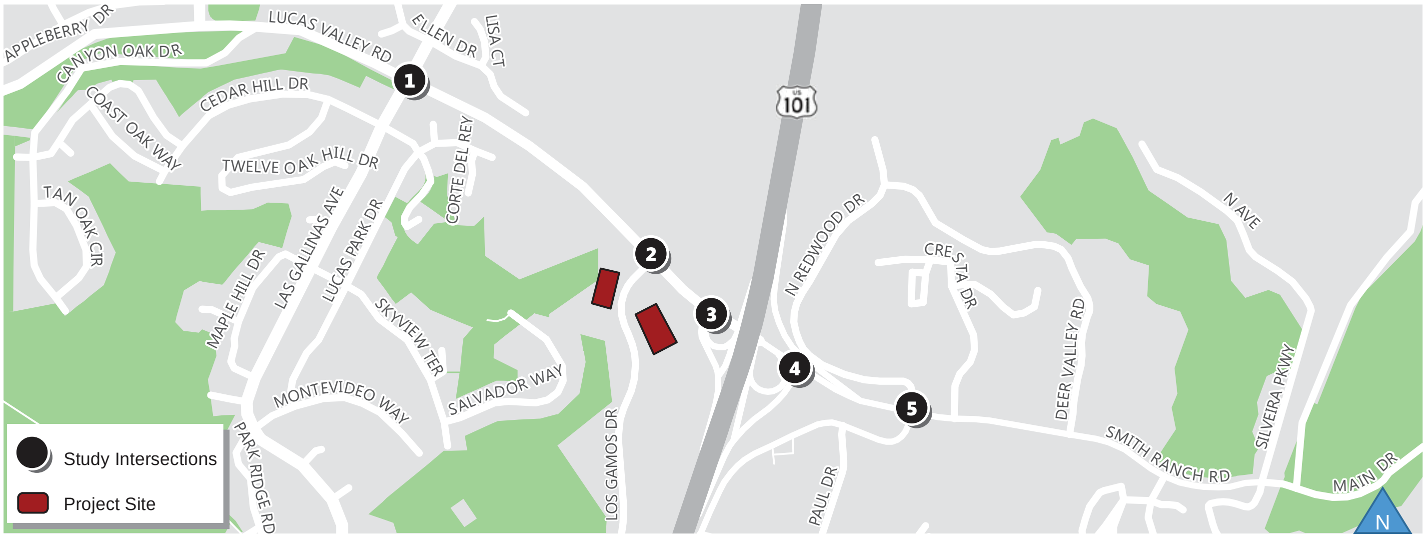
Signalized Intersection

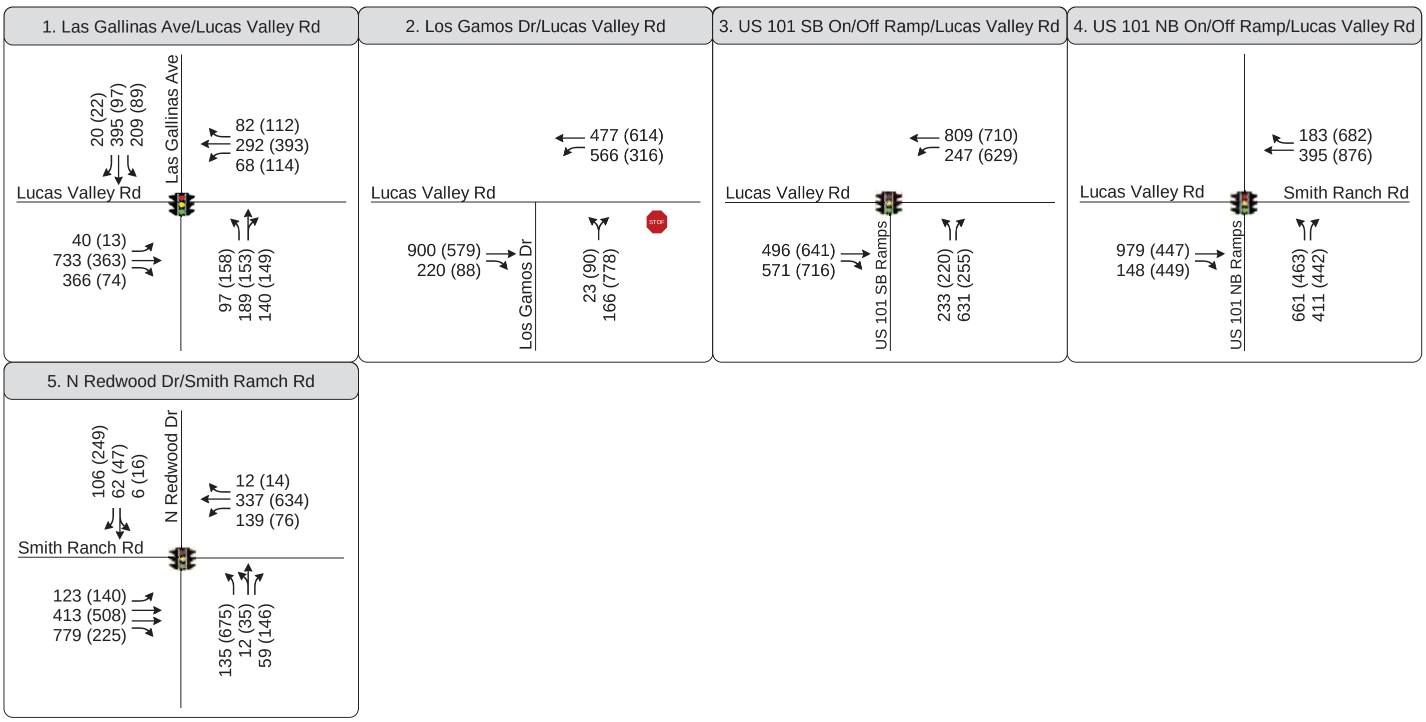
STOP Stop Controlled Approach

Figure 6-1

Baseline No Project

Peak Hour Intersection Control, Volumes, and Lane Configuration





Legend

XX(YY) AM (PM) Peak Hour Traffic

Signalized Intersection

STOP Stop Controlled Approach

Figure 6-2

Baseline Plus Project

Peak Hour Intersection Control, Volumes, and Lane Configurations

6.2.2 Intersection Operations

Baseline No Project and Baseline Plus Project conditions were evaluated using the same methods described in Chapter 1. The Baseline analysis results are presented in **Table 6-1**, based on the traffic volumes presented in **Figure 6-1** and **Figure 6-2**, respectively.

TABLE 6-1: BASELINE INTERSECTION LEVEL OF SERVICE AND DELAY RESULTS

Intersection	Intersection Control[1]	Time Period	Baseline No Project		Baseline Plus Project	
			LOS[2,3]	Delay[2,3,4]	LOS[2,3]	Delay[2,3,4]
1. Lucas Valley Road and Las Gallinas Avenue	Signal	AM PM	**F** C	**94** 34	**F** D	**182** 38
2. Lucas Valley Road and Los Gamos Drive	SSSC	AM PM	**E (F)** **F (F)**	**44 (67)** **>80(375)**	**E (F)** **F (F)**	**41 (>80)** **>80 (364)**
3. Lucas Valley Road and US 101 Southbound Ramps	Signal	AM PM	**E** **F**	**58** **156**	**F** **F**	**87** **156**
4. Lucas Valley Road / Smith Ranch Road and US 101 Northbound Ramps	Signal	AM PM	D B	44 15	**F** B	**84** 16
5. Lucas Valley Road / Smith Ranch Road and Redwood Drive / Redwood Highway	Signal	AM PM	B C	15 35	B D	13 51

Notes:
1. SSSC = Side-Street Stop Control
2. Worst approach is noted for side street stop controlled intersections.
3. **Bold** denotes unacceptable level of service and delay.
4. Standard industry practice is to summarize delay greater than 80 seconds (LOS F) as ">80". However, in some instances, the ">80" was over written with the estimated delay to better under the Project's impact to the No Project conditions and its relationship to the significance criteria.

As shown on **Table 6-1**, the Lucas Valley Road / Smith Ranch Road / Redwood Drive/Redwood Highway signalized intersection operates at LOS D or better during the No Project and Plus Project scenarios, therefore the Project's contribution to this intersection is considered ***less than significant***. However, two intersections trigger a significant impact, as described below.

The Lucas Valley Road/Las Gallinas Avenue intersection operates below LOS D during the weekday AM and/or PM peak hour, under Baseline No Project and Baseline Plus Project conditions. The proposed Project would contribute to deficient operations by increasing the average delay by more than five seconds, thus resulting in a ***significant impact*** and would require mitigation as described in Mitigation Measure TR-3.

With the addition of Project traffic, the side street stop controlled intersection at Lucas Valley Road/Los Gamos Drive would experience increased vehicle delay during the AM peak hour. The Project would add 102 trips to the stop-controlled northbound approach during the AM peak period, which would contribute to deficient operations and increase average delay by more than five seconds at the stopped controlled approach compared to Baseline No Project conditions. Therefore, the Project impact to this intersection is ***significant*** and would require mitigation, as described in Mitigation Measure TR-4.

The Lucas Valley Road/US 101 Southbound Ramps intersection operates below LOS D during the weekday AM and/or PM peak hour, under Baseline No Project and Baseline Plus Project conditions. The proposed Project would contribute to deficient operations by increasing the average delay by more than five seconds, triggering a significant impact during the AM peak hour. However, the *San Rafael 2020 General Plan* exempts US 101 interchange intersections from LOS standards because delay at these locations are affected by regional traffic and not significantly impacted by local measures. Therefore, the Project's contribution to the Lucas Valley Road/US 101 Southbound Ramps intersection is not considered a significant impact.

Though the Project does not result in an impact, a potential improvement was identified for informational purposes only. Signal timings could be adjusted at the Lucas Valley Road/US 101 Southbound Ramps intersection to account for the new intersection demand. With implementation, operations at the Lucas Valley Road / Smith Ranch Road / US 101 Southbound Ramps would reduce the Project's impact to less than significant, if the intersection were subject to the significance criteria, similar to other intersections included in this study. Though the Project Sponsor is not required to address the Project's impact to the intersection, based on the significance criteria set in the *San Rafael 2020 General Plan,* the Project Sponsor has voluntarily committed to coordinating signal timing updates with Caltrans during the development and opening of the Project to mitigate the Project's impact to less than significant.

The Lucas Valley Road/Smith Ranch Road/US 101 Northbound Ramps intersection operates below the LOS D threshold with the Project during the weekday AM peak hour, thus would result in a significant impact. However, as explained above, the intersection is part of the US 101 interchange, therefore the intersection is exempt from the significance criteria and the Project's impact is not considered a significant impact. A potential improvement was identified for information purposes only. The intersection should reconfigure the eastbound approach to provide two through lanes, which is consistent with improvements identified in the City of San Rafael General Plan 2020. Implementing these intersection improvements would improve intersection operations and reduce the Project's impact to less than significant, if the intersection were subject to the significance criteria, similar to other intersections included in this study. While the Project Sponsor is not required to address the Project's impact to the intersection, the Project Sponsor is voluntarily considering TDM measures that would reduce the Project's trip generation as described in MM-TR 2.

Implementation would likely reduce the Project's impact to the intersection; however, it is unknown if the reduction in vehicle trips would mitigate the Project's contribution to the intersection to less than significant.

Mitigation Measure TR-3. Improve Intersection Operations at Lucas Valley Road/Las Gallinas Avenue

Intersection improvements have yet to be identified through the City of *San Rafael's General Plan 2020*; however, several vehicle capacity improvements (such as reconfiguring the intersection to remove channelized turn islands or replacing the existing signal with a roundabout) may be considered by the City of San Rafael to mitigate poor operating conditions at the intersection. Capacity increasing improvements include their fair share of trade-offs, for example adding capacity would facilitate more vehicular traffic; however, could have an adverse impact to pedestrians and bicyclists and result in the diversion of more pass-through traffic along Las Gallinas Avenue and an increase in VMT. The feasibility of potential mitigations will require further study and coordination with the City of San Rafael, local community, and County of Marin, who operates and maintains the existing traffic signal. Ultimately, the City of San Rafael, in coordination with the County of Marin, would be responsible for implementing improvements, which the Project Sponsor would pay their fair share; however, since the intersection is not part of a traffic fee program and intersection improvements have yet to be identified, the Project would result in a ***significant and unavoidable impact***.[7]

Mitigation Measure TR-4. Signalize and Reconfigure the Lucas Valley Road/Los Gamos Drive Intersection

The San Rafael General Plan 2020 identifies improvements at the Lucas Valley Road / Los Gamos Drive intersection including signalizing the intersection, adding dual westbound left turn lanes, reconfiguring the northbound approach, and removing existing striped channelized islands, as illustrated in **Figure 6-3**. Due to its close proximity to the US-101 Ramp terminal intersections, the new signal should include traffic signal interconnect and be coordinated with the adjacent interchange signals. Additionally, interagency coordination will be required during design, construction and maintenance of the new signal, since the interchange signals are operated and maintained by Caltrans, while the new Lucas Valley Road / Los Gamos Drive signal would likely be operated and maintained by the City of San Rafael, County of Marin, or Caltrans. Implementing

[7] As described in MM-TR 2, the Project Sponsor is considering additional TDM measures that would likely reduce the Project's trip generation and potentially reduce the Project's impact to the Lucas Valley Road / Las Gallinas Avenue intersection. However, it is unknown if the reduction in vehicle trips would mitigate the Project's contribution to the intersection to less than significant.

these improvements would mitigate the Project's impact to ***less than significant***. Therefore, the Project sponsor will coordinate with the City of San Rafael to pay their fair share cost to implement Mitigation Measure TR-5.

Note: Conceptual illustration not to scale.
Source: BKF, Kaiser Permanente (2017)

CADD FILE: \\FPSF03\Data\Projects\2015 Projects\SF15-0858_Los Gamos Kaiser TIS\Graphics\CAD\Los Gamos Lucas Valley\Fig 6-3_Mitigation Measure TR-5.dwg
Feb 15, 2017

Figure 6-3
Mitigation Measure TR-4
Signalize and Reconfigure Intersection at Lucas Valley Road / Los Gamos Drive

6.2.2.1 Queue Summary

A queue summary narrative is provided below to supplement the intersection operations analysis; however, results are not part of the significance criteria and the narrative provided is for informational purposes only. Detailed queue results tables are included in **Appendix F**.

Under Baseline Conditions queue lengths at the Lucas Valley Road/Los Gamos Drive intersection during the AM peak period increase as a result of the Project for the following movements going into and out of the site. The 95-percentile vehicle queue for westbound left movements into the project site at the Lucas Valley Road/Los Gamos Drive intersection exceeds the queue storage length under both No Project and Plus Project conditions, which impacts vehicles continuing westbound on Lucas Valley Road during the AM peak period.

During the PM peak period, the queue for vehicles traveling northbound left at the Lucas Valley Road/Los Gamos Drive intersection extends beyond the proposed parking structure driveway during both the No Project and Plus Project conditions; however, the addition of the Project does not result in a substantial increase in queue lengths. As recommended in Chapter 5, the Project Sponsor should consider striping a "Keep Clear" pavement legend to help accommodate vehicle egress from the proposed parking structure.

At the Lucas Valley Road/US 101 Southbound Ramps intersection, the addition of Project traffic generally contributes to longer queues compared to the No Project. The queue for vehicles traveling from the US 101 Southbound off-ramp increases substantially under Plus Project conditions during the AM peak period and as a result, exceeds the available storage length. During the PM peak period, the addition of Project traffic contributes to longer queues; however, the queue does not spillback past the available storage length. In the eastbound direction of Lucas Valley Road, queue lengths extend past the upstream intersection at Los Gamos Drive during the PM peak hour for both the No Project and Plus Project condition.

At the Lucas Valley Road/US 101 Northbound Ramps intersection, the AM peak hour and PM peak hour queues remain within the available storage length during both the No Project and Plus Project conditions.

At the Lucas Valley Road/Las Gallinas Avenue intersection, the queue lengths for vehicles traveling eastbound and southbound exceed storage capacity under both No Project and Plus Project conditions during the AM peak period; Plus Project conditions exacerbate these conditions. Vehicles queues do not change substantially at the Lucas Valley Road/Las Gallinas Avenue during the PM peak period.

Vehicles queues do not change substantially at Smith Ranch Road/N Redwood Drive/Redwood Highway intersections during AM and PM peak periods under plus project conditions.

6.2.2.2 Signal Warrants

As mentioned in Chapter 2, the existing volumes fulfill the peak hour signal warrants, therefore a signal should be considered at the Lucas Valley Road/Los Gamos Drive intersection. The addition of Baseline growth and Project traffic would further qualify the intersection for a signal based on Peak Hour Warrant (Warrant 3). Furthermore, implementation of Mitigation Measure TR-1: Signalize Lucas Valley Road/Los Gamos Drive would mitigate the project impact during Baseline Plus Project conditions to a less-than-significant level.

6.2.3 Freeway Operations

Baseline freeway conditions were evaluated using the same methods described in Chapter 1. The Baseline conditions analysis results are presented in **Table 6-2** and **Table 6-3**, for the AM and PM peak hours, respectively. Detailed freeway level of service calculation sheets are provided in **Appendix D**.

TABLE 6-2: BASELINE CONDITIONS FREEWAY DENSITY AND LOS – AM PEAK HOUR

Segment	Segment Type	Baseline No Project		Baseline Plus Project	
		Density (pc/mi/ln)[1]	LOS[2]	Density (pc/mi/ln)[1]	LOS[2]
Northbound					
Manuel T Freitas Off / Manuel T Freitas On	Basic	20.6	C	20.7	C
Manuel T Freitas On / Redwood Highway On	Basic	16.9	B	17	B
Redwood Highway On	Merge	18.8	B	18.9	B
Smith Ranch Road Off	Basic	17.4	B	17.4	B
Smith Ranch Road Off / Lucas Road EB On	Basic	18.9	C	19.1	C
Lucas Road EB On / Smith Ranch Road WB On	Basic	14.7	B	14.9	B
Smith Ranch Road WB On	Merge	17.3	B	17.5	B
Miller Creek Off	Basic	15.3	B	15.5	B
Miller Creek On	Basic	19.6	C	19.9	C
Southbound					
Miller Creek Off	Basic	21.7	**F[3]**	21.9	**F[3]**
Miller Creek On	Merge	30.9	**F[3]**	31.0	**F[3]**
Lucas Valley Road Off	Basic	19.9	**F[3]**	20.0	**F[3]**
Lucas Valley Road Off / Lucas Valley Road On	Basic	23.2	**F[3]**	23.2	**F[3]**

TABLE 6-2: BASELINE CONDITIONS FREEWAY DENSITY AND LOS – AM PEAK HOUR

Segment	Segment Type	Baseline No Project		Baseline Plus Project	
		Density (pc/mi/ln)[1]	LOS[2]	Density (pc/mi/ln)[1]	LOS[2]
Lucas Valley Road On	Merge	29.9	**F[3]**	30.0	**F[3]**
Lucas Valley Road On / Manuel T Freitas Off	Basic	27.0	**F[3]**	27.1	**F[3]**
Manuel T Freitas Off	Diverge	32.2	**F[3]**	32.3	**F[3]**
Manuel T Freitas Off / Manuel T Freitas On	Basic	22.5	**F[3]**	22.6	**F[3]**

Notes:

1. pc/mi/ln = passenger car per mile per lane
2. **Bold** = unacceptable LOS
3. This segment operates in queue; however, the results reported in the analysis software does not match existing condition observations because the methodology accounts for the number of vehicles that are able to use the facility, not the number of vehicles that want to use the facility and are in queue (demand). The LOS results were revised to match existing observations.

TABLE 6-3: BASELINE CONDITIONS FREEWAY DENSITY AND LOS – PM PEAK HOUR

Segment	Segment Type	Baseline No Project		Baseline Plus Project	
		Density (pc/mi/ln)[1]	LOS[2]	Density (pc/mi/ln)[1]	LOS
Northbound					
Manuel T Freitas Off / Manuel T Freitas On	Basic	30.6	D	31.8	D
Manuel T Freitas On / Redwood Highway On	Basic	36.7	E	38.3	E
Redwood Highway On	Merge	26.6	C	27	C
Smith Ranch Road Off	Basic	26.1	D	26.9	D
Smith Ranch Road Off / Lucas Road EB On	Basic	22.8	C	23.3	C
Lucas Road EB On / Smith Ranch Road WB On	Basic	23.8	C	24.5	C
Smith Ranch Road WB On	Merge	26.7	C	27.2	C
Miller Creek Off	Basic	25.8	C	26.5	D
Miller Creek On	Basic	36.1	E	37.7	E
Southbound					

TABLE 6-3: BASELINE CONDITIONS FREEWAY DENSITY AND LOS – PM PEAK HOUR					
Segment	**Segment Type**	**Baseline No Project**		**Baseline Plus Project**	
		Density (pc/mi/ln)[1]	**LOS[2]**	**Density (pc/mi/ln)[1]**	**LOS**
Miller Creek Off	Basic	22	C	22.6	C
Miller Creek On	Merge	25.5	C	26.1	C
Lucas Valley Road Off	Basic	17.2	B	17.7	B
Lucas Valley Road Off / Lucas Valley Road On	Basic	21.3	C	21.8	C
Lucas Valley Road On	Merge	29.8	D	30.4	D
Lucas Valley Road On / Manuel T Freitas Off	Basic	26.2	D	26.9	D
Manuel T Freitas Off	Diverge	31.5	D	32	D
Manuel T Freitas Off / Manuel T Freitas On	Basic	22.4	C	23	C

Notes:

1. pc/mi/ln = passenger car per mile per lane
2. **Bold** = unacceptable LOS

During the weekday AM and PM peak hours, all of the freeway segments operate at LOS E or better during the No Project and Plus Project Baseline scenarios, except southbound segments during the AM peak hour. As described in the sections above, the southbound segments operate in congestion under existing conditions due to a downstream bottleneck between the San Pedro on-ramp and Mission Avenue off-ramp. The addition of Project trips would contribute to the existing failing operations. The v/c ratio calculations are summarized in **Table 6-4**.

TABLE 6-4: BASELINE CONDITIONS VOLUME TO CAPACITY (V/C) SUMMARY[1] – AM PEAK HOUR					
Segment	**Segment Capacity[1]**	**Baseline No Project**		**Baseline Plus Project**	
		Volume[2]	**v/c**	**Volume[2]**	**v/c[3]**
Southbound					
Miller Creek Off / Miller Creek On	6,600	3,966	0.60	3,994	0.60
Miller Creek On / Lucas Valley Road Off	8,100	4,847	0.60	4,875	0.60
Lucas Valley Road Off / Lucas Valley Road On	6,600	4,221	0.64	4,221	0.64
Lucas Valley Road On / Manuel T Freitas Off	6,600	4,826	0.73	4,840	0.73

TABLE 6-4: BASELINE CONDITIONS VOLUME TO CAPACITY (V/C) SUMMARY[1] – AM PEAK HOUR

Segment	Segment Capacity[1]	Baseline No Project		Baseline Plus Project	
		Volume[2]	v/c	Volume[2]	v/c[3]
Manuel T Freitas Off / Manuel T Freitas On	6,600	4,112	0.62	4,126	0.62

Notes:

1. Summary based on mixed flow lanes only. High Occupancy Vehicles lane not included in analysis.
2. v/c calculation assumes the following capacities:
    - Mixed Flow Lanes: 2,200 vehicles per lane
    - Auxiliary Lanes: 1,500 vehicles per lane
3. The total volume reported does not account for the HOV volume.
4. **Bold** = Project contributes greater than 0.01 v/c to the No Project condition resulting in a significant impact

As illustrated in **Table 6-4**, the addition of Project traffic would not increase the freeway's v/c ratio by 0.01 or more. Therefore, the Project results in a ***less than significant impact*** during the Baseline Plus Project AM peak hour.

6.3 BICYCLE & PEDESTRIAN IMPACTS

Bicycling and pedestrian trips in the study area may increase as a result of the proposed Project and Baseline growth; however, in this scenario bicycle and pedestrian impacts are typically site-specific and generally do not contribute to impacts from other development projects. As indicated in Chapter 5, there is a projected increase in vehicles at the intersections in the vicinity of the Proposed Project, which may result in an increase in vehicle-bicycle-pedestrian conflicts at intersections in the study area. However, the proposed Project would not create potentially hazardous conditions for bicycles, pedestrians, or otherwise interfere with bicycle and pedestrian accessibility to the site and adjoining areas because the Project does not remove existing facilities and does not prohibit the construction of proposed facilities in the Project vicinity. As described in Chapter 5, the addition of the proposed parking structure on the west side of Los Gamos Drive would result in an increase to pedestrian crossings across Los Gamos Drive. Thus, the Project Sponsor will include pedestrian enhancements to the existing Los Gamos Drive crossing, just north of the 1650 Los Gamos Drive driveway. Therefore, the Project's impact to bicycle and pedestrian facilities are considered ***less than significant*** and mitigations are not required under Baseline Plus Project conditions.

6.4 TRANSIT IMPACTS

Transit trips in the study area may increase as a result of the Project. However, Project related transit trips would have no foreseeable impacts to transit operations because the Project would not likely generate enough transit demand to exceed the capacity of existing or planned transit service nor does it interfere with existing or future transit users. Therefore, the Project impacts to transit facilities are considered ***less than significant*** and mitigations are not required.

7 CUMULATIVE CONDITIONS

The cumulative scenario includes traffic estimates and transportation infrastructure improvements as proposed in the San Rafael General Plan 2020.

7.1 ASSUMED ROADWAY IMPROVEMENTS

The *San Rafael General Plan 2020* identifies proposed roadway improvements along Lucas Valley Road and Smith Ranch Road near the Project. Capital improvements include:

- Widening Lucas Valley Road to provide two westbound and two eastbound lanes between Redwood Highway and Los Gamos Drive
- Widening the US 101 northbound and southbound off-ramps with additional right and left turn lanes
- Signalizing the Los Gamos Drive / Lucas Valley Road intersection and coordinating the new signal with adjacent intersections
- Providing the westbound Lucas Valley Road approach at Los Gamos Drive two left turn lanes and two southbound receiving lanes on Los Gamos Drive

The improvements listed above were included in the Cumulative No Project and Cumulative Plus Project scenarios.

The *City of San Rafael Bicycle/Pedestrian Master Plan Update (2011)* proposes to continue Class II bicycle lanes along Lucas Valley Road and Smith Ranch Road, to the east. Additionally, a Class I facility is proposed to extend north of Los Gamos Drive and connect to Marinwood Avenue.

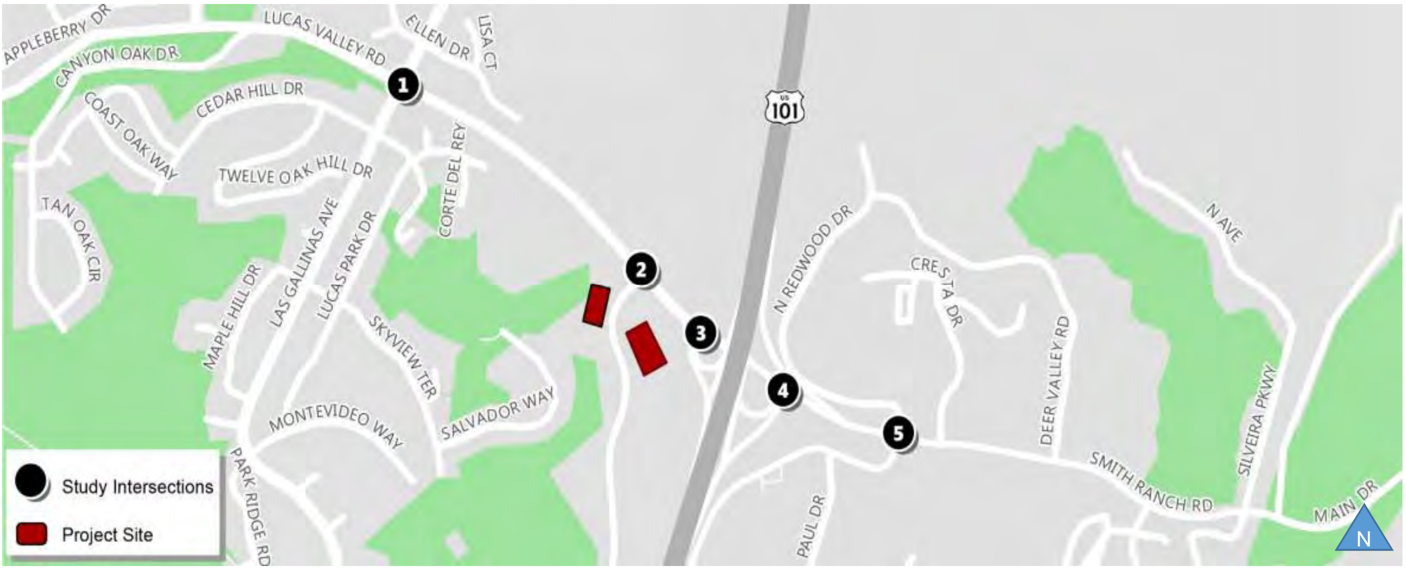
The Caltrans approved the Project Study Report (Project Development Support) [PSR(PDS)] for the Route 101/Lucas Valley Interchange Improvement Project in 2003. Caltrans prepared the PSR (PDS) at the request of the City of San Rafael through the Marin County Congestion Management Agency. The PSR/PDS documents consensus between Caltrans and City of San Rafael on the purpose-and-need, scope, and schedule of a project. As part of the PSR(PDS) project development and capital costs are estimated. The next phase of project development is not yet funded. Improvements for this interchange was not identified in the San Rafael General Plan 2020; However, a supplementary cumulative analysis was completed for informational purposes and is summarized in **Section 7.2.2.2**.

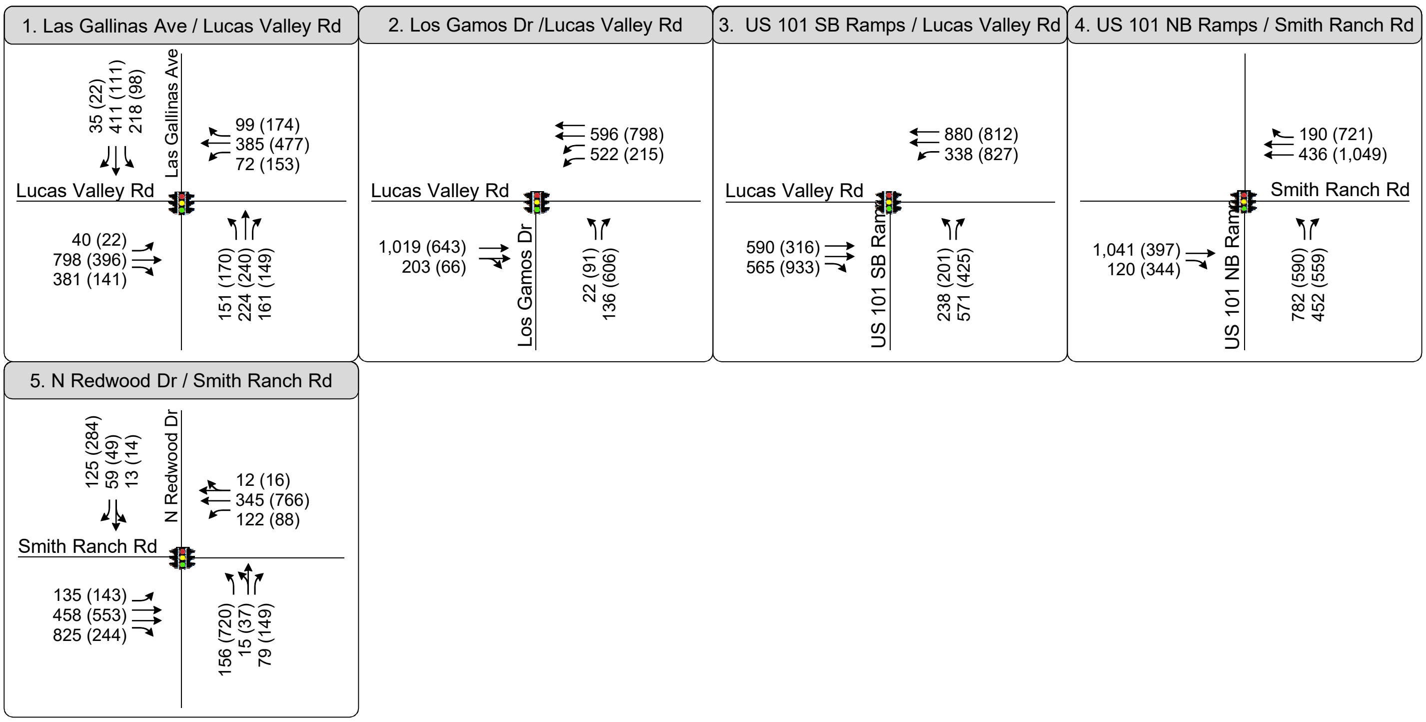
7.2 VEHICLE OPERATIONS

This section describes the Project's impacts to vehicles under the Cumulative and Cumulative Plus Project scenario.

7.2.1 Traffic Volumes

Similar to the Baseline Condition, the analysis used cumulative traffic volumes from the City of San Rafael's traffic database which is consistent with assumptions developed in the City of San Rafael General Plan 2020. The Cumulative No Project and Cumulative Plus Project peak hour intersection volumes, lane configurations, and traffic controls at each Project intersection is summarized on **Figure 7-1** and **Figure 7-2**, respectively.





Legend

XX(YY) AM (PM) Peak Hour Traffic

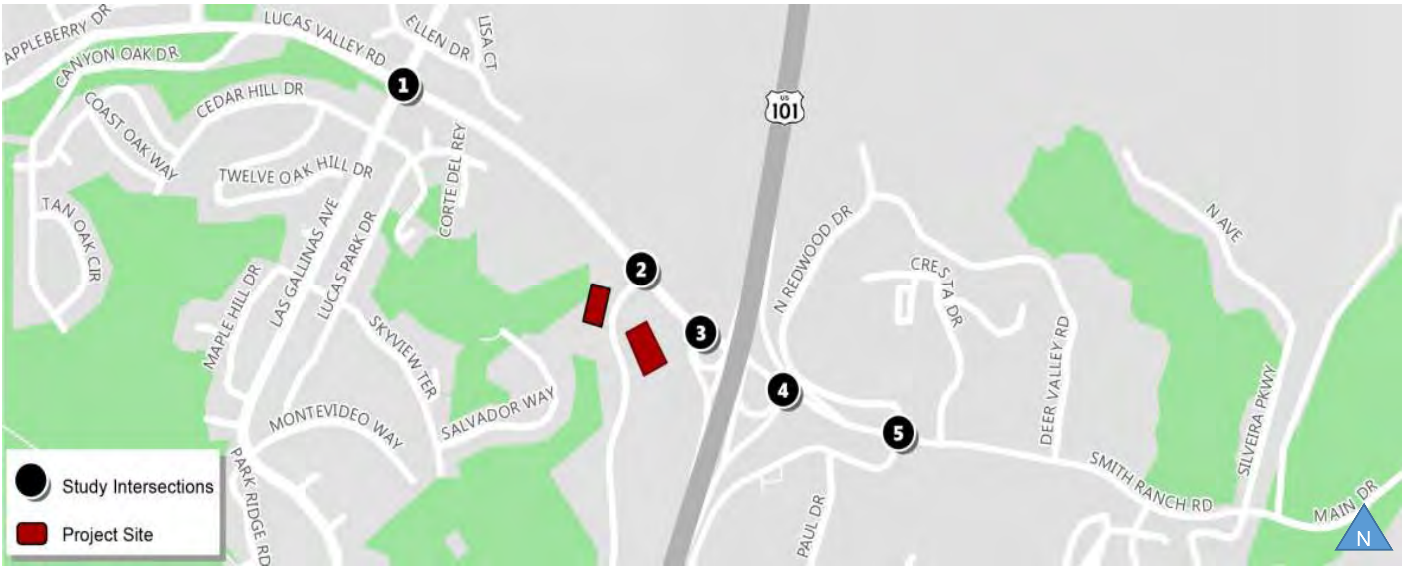
Signalized Intersection

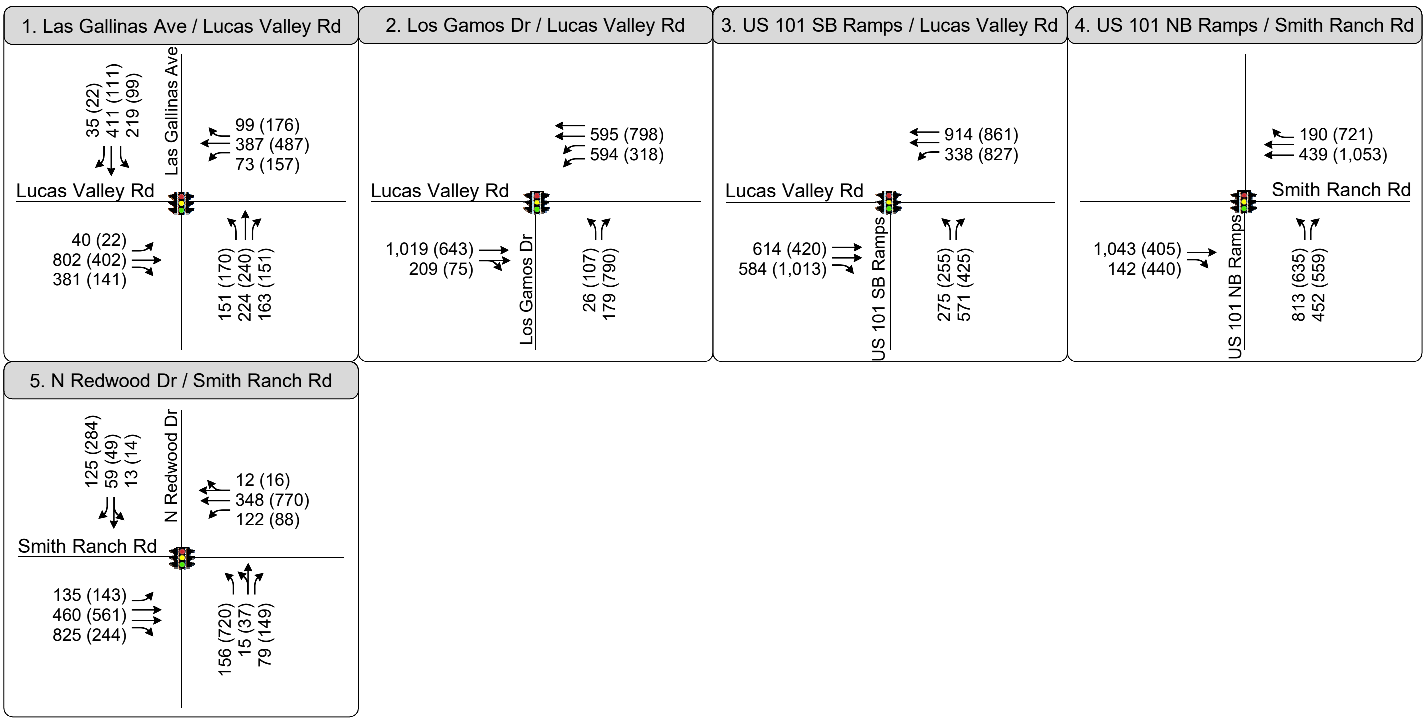
STOP Stop Controlled Approach

Figure 7-1

Cumulative No Project

Peak Hour Intersection Control, Volumes, and Lane Configuration





Legend

XX(YY) AM (PM) Peak Hour Traffic

Signalized Intersection

Stop Controlled Approach

Figure 7-2

Cumulative Plus Project

Peak Hour Intersection Control, Volumes, and Lane Configuration

7.2.2 Intersection Operations

Cumulative No Project and Cumulative Plus Project conditions were evaluated using the same methods described in Chapter 1. The Cumulative Plus Project analysis results are presented in **Table 7-1**, based on the traffic volumes presented in **Figure 7-1** and **Figure 7-2**, respectively.

TABLE 7-1: CUMULATIVE INTERSECTION LEVEL OF SERVICE AND DELAY RESULTS

Intersection	Intersection Control	Time Period	Cumulative No Project		Cumulative Plus Project	
			LOS[1]	Delay[1,2]	LOS[1]	Delay[1, 2]
1. Lucas Valley Road and Las Gallinas Avenue	Signal	AM PM	**F** D	**>80** 38	**F** D	**>80** 38
2. Lucas Valley Road and Los Gamos Drive	Signal	AM PM	B **E**	20 **67**	C **E**	25 **67**
3. Lucas Valley Road and US 101 Southbound Ramps	Signal	AM PM	B D	19 46	C D	23 47
4. Lucas Valley Road / Smith Ranch Road and US 101 Northbound Ramps	Signal	AM PM	C C	23 30	C C	24 30
5. Lucas Valley Road / Smith Ranch Road and Redwood Drive / Redwood Highway	Signal	AM PM	B **F**	16 **185**	B **F**	17 **185**

Notes:

1. **Bold** denotes unacceptable level of service and delay.
2. Standard industry practice is to summarize delay greater than 80 seconds (LOS F) as ">80". However, in some instances, the ">80" was over written with the estimated delay to better under the Project's impact to the No Project conditions and its relationship to the significance criteria.

As shown on **Table 7-1,** all intersections would operate at an acceptable LOS C or better during the AM peak hour with exception to Lucas Valley Road / Las Gallinas Avenue intersection which operates at LOS F under No Project and Plus Project conditions. The addition of the Project-related traffic would exacerbate the No Project condition and contribute more than 5 seconds of delay, resulting in a ***significant impact*** which would require mitigation as described in Mitigation Measure TR-6.

During the PM peak hour, all intersections operate at an acceptable LOS D or better except the Lucas Valley Road / Los Gamos Drive and the Lucas Valley Road / Smith Ranch Road / Redwood Drive / Redwood Highway intersections, which operate at LOS E and LOS F, respectively. While the Project would contribute additional traffic to both the intersections, the overall intersection delay would not increase by more than five seconds compared to the Cumulative No Project conditions. Therefore, the Project impact is considered **less-than-significant** during the PM peak hour.

Mitigation Measure TR-6. Improve Intersection Operations at Lucas Valley Road/Las Gallinas Avenue (MM TR-3)

Intersection improvements have yet to be identified through the City of *San Rafael's General Plan 2020*; however, several vehicle capacity improvements may be considered to mitigate poor operating conditions at the intersection. The feasibility of the potential projects (such as reconfiguring the intersection to remove channelized turn islands or replacing the existing signal with a roundabout) and its adverse impacts will require further study and coordination with the City of San Rafael and local community. Since the intersection is not part of a traffic fee program and intersection improvements have yet to be identified, the Project would result in a ***significant and unavoidable impact***.

7.2.2.1 Queue Summary

A queue summary narrative is provided below to supplement the intersection operations analysis; however, results are not part of the significance criteria and the narrative provided is for informational purposes only. Detailed queue results tables are included in **Appendix F**.

Under Cumulative Conditions during the AM peak period, 95-percentile queue lengths exceed storage capacity under both Cumulative No Project and Plus Project conditions for the following movements at the Lucas Valley Road/Los Gamos Drive intersection: northbound left, northbound right, westbound left and eastbound through. Under both Cumulative conditions, queues for vehicles traveling eastbound at this intersection extend past upstream driveways. The addition of the Project increases eastbound queue lengths but does not substantially increase northbound or westbound queues during the AM peak period. During the PM peak period, the 95-percentile queue lengths for northbound movements exceed storage capacity under both No Project and Plus Project conditions; however, the addition of the Project does not substantially increase the queue length.

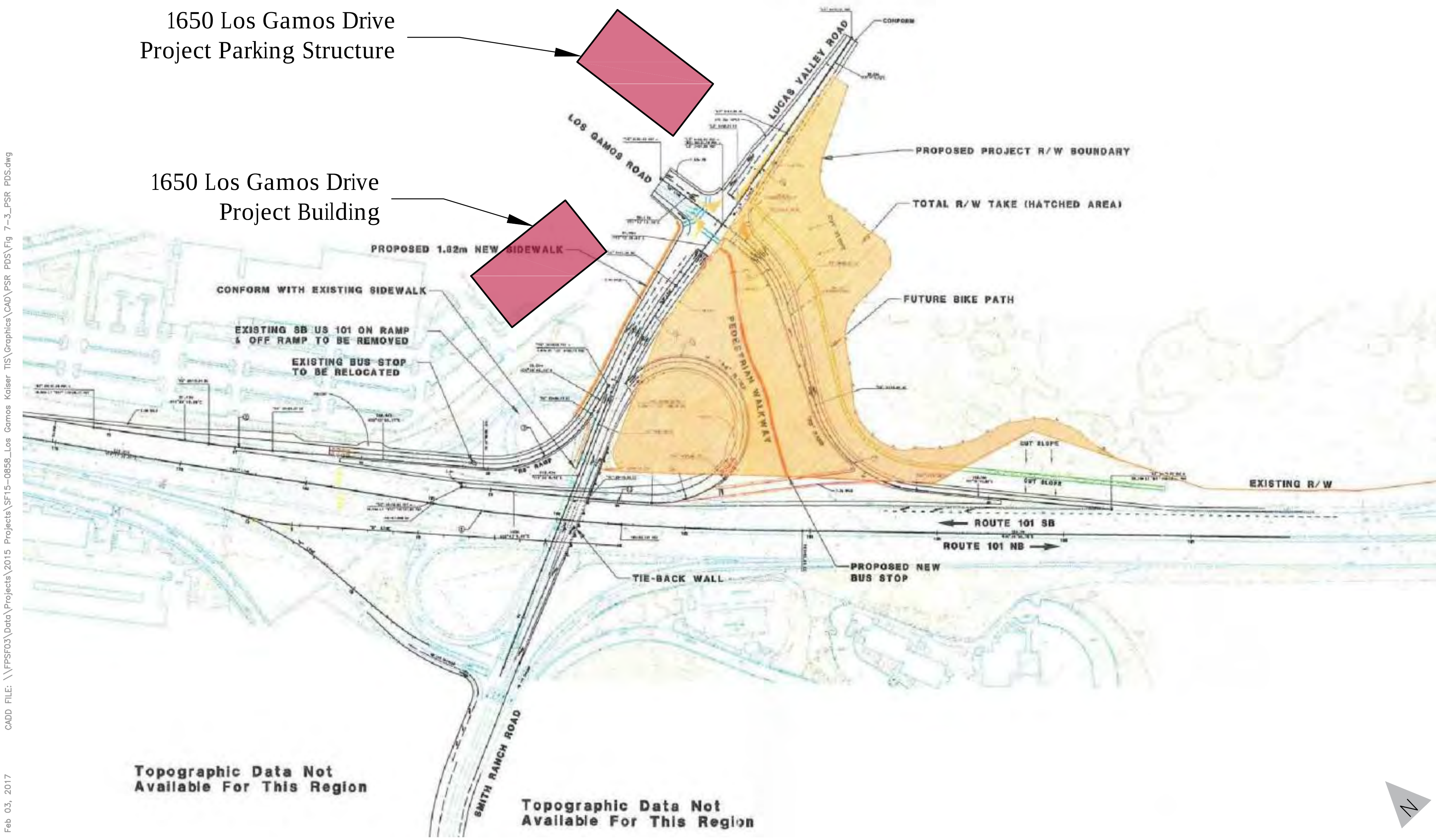
At the Lucas Valley Road/US 101 Southbound Ramps intersection, average queues for vehicles traveling from the off-ramp exceed the available storage capacity under both No Project and Plus Project conditions, thus spilling back onto mainline US 101, during both peak periods. During the AM peak period, average eastbound queues extend past the upstream intersection (i.e. Los Gamos Drive) during both No Project and Plus Project conditions, although the addition of the Project does not substantially increase eastbound queue lengths. During the PM peak period, westbound 95-percentile vehicle queues extend past the upstream intersection (i.e. US 101 Northbound Ramps) under both No Project and Plus Project conditions; however, the addition of the Project does not substantially increase the queue length.

At the Lucas Valley Road/US 101 Northbound Ramps intersection, the queue for vehicles traveling northbound exceeds the available off-ramp storage length under both No Project and Plus Project conditions during both AM and PM peak periods, thereby spilling onto mainline US 101. During the AM peak period, the queue for vehicles traveling eastbound at this intersection exceeds the storage length under both No Project and Plus Project conditions past the upstream intersection (i.e. US 101 Southbound Ramps). However, the addition of the project does not substantially increase northbound or eastbound queue lengths.

Vehicle queues do not change substantially with the addition of the Project at the Lucas Valley Road/Las Gallinas Avenue and Smith Ranch Road/N Redwood Drive/Redwood Highway intersections.

7.2.2.2 Cumulative Conditions with Interchange Improvements

In 2003, Caltrans approved the PSR(PDS) for the US 101/Lucas Valley Interchange Improvement Project to relieve congestion at the existing interchange. The project defined include modifications to the interchange by replacing the existing southbound loop off-ramp with a new diagonal off-ramp on the north side of Lucas Valley Road, which would meet Los Gamos Drive as the fourth leg of the intersection. Additionally, the project would construct a new southbound US 101 loop on-ramp to serve traffic from westbound Smith Ranch Road, widen Lucas Valley Road the US 101 overpass, and add a second right turn lane at the existing northbound off-ramp. The existing southbound on-ramp on the south side of Lucas Valley Road would remain; however, the existing signal would be removed and the eastbound right turn lane would be changed to a free movement. **Figure 7-3** illustrates the proposed interchange improvements.



Note: Conceptual illustration not to scale.
Source: Caltrans Approved Project Study Report (Project Development Support) for the Route 101 / Lucas Valley Interchange Improvement Project (2003)

Figure 7-3
US 101 / Lucas Valley Interchange Improvement Project

The PSR(PDS) is not yet funded and was not identified in the San Rafael General Plan 2020; however, a supplementary cumulative analysis was completed for informational purposes, summarized below.

The Cumulative with PSR(PDS) Interchange Improvements were evaluated using the same methods described in Chapter 1. The Cumulative with PSR(PDS) Interchange Improvements analysis results are presented in **Table 7-2**, based on the cumulative traffic volumes presented in **Figure 7-1** and **Figure 7-2**. Detailed LOS calculation worksheets are included in **Appendix B** and queue summary worksheets in **Appendix F**.

During the AM peak hour, Project traffic would result in an increase of more than five seconds in average delay, the threshold for a Project-related impact, at the Lucas Valley Road/Las Gallinas and Lucas Valley Road/Los Gamos Drive intersections. However, the remaining three intersections would operate at an acceptable LOS C or better. During the PM peak hour, the addition of Project traffic would increase delay; however, intersections would continue to operate at an acceptable LOS D or better.

Since the PSR/PDS is not yet funded and was not identified in the San Rafael General Plan 2020 the Project's impact to the proposed interchange is not assumed to be effected by the Significance Criteria set by the City of San Rafael. If the PSR/PDS is to be further considered, a Project Approval/Environmental Document (PA/ED) and further engineering studies must be completed, in which case the Project's contribution may be considered. However, the PSR/PDS has remained stagnant since the 2003 approval and no further studies have been completed.

TABLE 7-2: CUMULATIVE WITH INTERCHANGE IMPROVEMENTS INTERSECTION LEVEL OF SERVICE AND DELAY RESULTS

Intersection	Intersection Control	Time Period	Cumulative No Project		Cumulative Plus Project	
			LOS[1]	Delay[1]	LOS[1]	Delay[1]
1. Lucas Valley Road and Las Gallinas Avenue	Signal	AM PM	**F** C	**>80** 26	**F** C	**>80** 34
2. Lucas Valley Road and Los Gamos Drive / US 101 Southbound Off-Ramp[2]	Signal	AM PM	**F** D	**>80** 43	**F** D	**>80** 47
3. Lucas Valley Road and US 101 Southbound On-Ramps[2]	Unsig.[2]	AM PM	B A	11 <10	C A	18 <10
4. Lucas Valley Road / Smith Ranch Road and US 101 Northbound Ramps	Signal	AM PM	C B	21 20	C B	27 16
5. Lucas Valley Road / Smith Ranch Road and Redwood Drive / Redwood Highway	Signal	AM PM	B C	16 29	B C	16 31

TABLE 7-2: CUMULATIVE WITH INTERCHANGE IMPROVEMENTS INTERSECTION LEVEL OF SERVICE AND DELAY RESULTS

Notes:
1. **Bold** denotes unacceptable level of service and delay.
2. The PSR configuration proposes a southbound US 101 diagonal off-ramp which would represent the fourth leg of the Los Gamos Drive / Lucas Valley Road intersection. A new southbound US 101 on-ramp from westbound Lucas Valley Road would be constructed as free loop on-ramp. The existing diagonal on-ramp for eastbound Lucas Valley Road traffic would remain and the intersection would become unsignalized and free.

7.2.2.3 Signal Warrants

As described above, the City of San Rafael General Plan 2020 proposes to signalize the Lucas Valley Road / Los Gamos Drive intersection. Therefore, no study intersection remains unsignalized and needs to be evaluated as part of the signal warrant analysis.

7.2.3 Freeway Operations

Cumulative freeway conditions were evaluated using the same methods described in Chapter 1. The Cumulative conditions analysis results are presented in **Table 7-3** and **Table 7-4**, for the AM and PM peak hours, respectively. Detailed freeway level of service calculation sheets are provided in **Appendix D**.

TABLE 7-3: CUMULATIVE CONDITIONS FREEWAY DENSITY AND LOS – AM PEAK HOUR

Segment	Segment Type	Cumulative No Project		Cumulative Plus Project	
		Density (pc/mi/ln)[1]	LOS[2]	Density (pc/mi/ln)[1]	LOS
Northbound					
Manuel T Freitas Off / Manuel T Freitas On	Basic	25.4	C	25.4	C
Manuel T Freitas On / Redwood Highway On	Basic	28.4	D	28.5	D
Redwood Highway On	Merge	22	C	22	C
Smith Ranch Road Off	Basic	21.1	C	21.2	C
Smith Ranch Road Off / Lucas Road EB On	Basic	23	C	23.3	C
Lucas Road EB On / Smith Ranch Road WB On	Basic	17.9	B	18.1	C
Smith Ranch Road WB On	Merge	20.1	C	20.3	C
Miller Creek Off	Basic	18.6	C	18.8	C
Miller Creek On	Basic	24	C	24.3	C

TABLE 7-3: CUMULATIVE CONDITIONS FREEWAY DENSITY AND LOS – AM PEAK HOUR

Segment	Segment Type	Cumulative No Project		Cumulative Plus Project	
		Density (pc/mi/ln)[1]	LOS[2]	Density (pc/mi/ln)[1]	LOS
Southbound					
Miller Creek Off	Basic	26.4	**F[3]**	26.5	**F[3]**
Miller Creek On	Merge	36.0	**F[3]**	36.2	**F[3]**
Lucas Valley Road Off	Basic	23.9	**F[3]**	24.1	**F[3]**
Lucas Valley Road Off / Lucas Valley Road On	Basic	29.7	**F[3]**	29.7	**F[3]**
Lucas Valley Road On	Merge	35.7	**F[3]**	35.8	**F[3]**
Lucas Valley Road On / Manuel T Freitas Off	Basic	35.9	**F[3]**	36.0	**F[3]**
Manuel T Freitas Off	Diverge	36.9	**F[3]**	37.0	**F[3]**
Manuel T Freitas Off / Manuel T Freitas On	Basic	28.3	**F[3]**	28.4	**F[3]**

Notes:

1. pc/mi/ln = passenger car per mile per lane
2. **Bold** = unacceptable LOS
3. This segment operates in queue; however, the results reported in the analysis software does not match existing condition observations because the methodology accounts for the number of vehicles that are able to use the facility, not the number of vehicles that want to use the facility and are in queue (demand). The LOS results were revised to match existing observations.

TABLE 7-4: CUMULATIVE CONDITIONS FREEWAY DENSITY AND LOS – PM PEAK HOUR

Segment	Segment Type	Cumulative No Project		Cumulative Plus Project	
		Density (pc/mi/ln)[1]	LOS[2]	Density (pc/mi/ln)[1]	LOS[2]
Northbound					
Manuel T Freitas Off / Manuel T Freitas On	Basic	42.8	E	**47.5**	**F**
Manuel T Freitas On / Redwood Highway On	Basic	**56.7**	**F**	**60.1**	**F**
Redwood Highway On	Merge	31.4	D	31.9	D
Smith Ranch Road Off	Basic	34.3	D	35.4	E

TABLE 7-4: CUMULATIVE CONDITIONS FREEWAY DENSITY AND LOS – PM PEAK HOUR					
Segment	**Segment Type**	**Cumulative No Project**		**Cumulative Plus Project**	
		Density (pc/mi/ln)[1]	**LOS[2]**	**Density (pc/mi/ln)[1]**	**LOS[2]**
Smith Ranch Road Off / Lucas Road EB On	Basic	28.7	D	29.3	D
Lucas Road EB On / Smith Ranch Road WB On	Basic	30.4	D	31.2	D
Smith Ranch Road WB On	Merge	31.6	D	32	D
Miller Creek Off	Basic	33.7	D	34.6	D
Miller Creek On	Basic	**55.4**	**F**	**58.4**	**F**
Southbound					
Miller Creek Off	Basic	27.4	D	28.3	D
Miller Creek On	Merge	30	D	30.6	D
Lucas Valley Road Off	Basic	20.9	C	21.4	C
Lucas Valley Road Off / Lucas Valley Road On	Basic	26.4	D	27	D
Lucas Valley Road On	Merge	35.3	E	35.8	E
Lucas Valley Road On / Manuel T Freitas Off	Basic	34.5	D	35.5	E
Manuel T Freitas Off	Diverge	36.1	E	36.5	E
Manuel T Freitas Off / Manuel T Freitas On	Basic	28.2	D	28.9	D

Notes:

1. pc/mi/ln = passenger car per mile per lane
2. **Bold** = unacceptable LOS

During the weekday AM peak hour, all of the freeway study segments operate at LOS E or better across both Cumulative scenarios, except southbound segments during the AM peak hour. As described under Existing conditions, the southbound segments currently operate in congestion due to a downstream bottleneck between the San Pedro on-ramp and Mission Avenue off-ramp. The addition of Project trips would contribute to the existing failing operations. The v/c ratio calculation is summarized in **Table 7-5**.

TABLE 7-5: CUMULATIVE CONDITIONS VOLUME TO CAPACITY (V/C) SUMMARY[1] – AM PEAK HOUR					
Segment	**Segment Capacity[1]**	**Cumulative No Project**		**Cumulative Plus Project**	
		Volume[2]	**v/c**	**Volume[2]**	**v/c[3]**
Southbound					
Miller Creek Off / Miller Creek On	6,600	4,729	0.72	4,757	0.72
Miller Creek On / Lucas Valley Road Off	8,100	5,800	0.72	5,828	0.72
Lucas Valley Road Off / Lucas Valley Road On	6,600	5,188	0.79	5,188	0.79
Lucas Valley Road On / Manuel T Freitas Off	6,600	5,871	0.89	5,886	0.89
Manuel T Freitas Off / Manuel T Freitas On	6,600	5,003	0.76	5,018	0.76

Notes:

1. Summary based on mixed flow lanes only. High Occupancy Vehicles lane not included in analysis.
2. v/c calculation assumes the following capacities:
   - Mixed Flow Lanes: 2,200 vehicles per lane
   - Auxiliary Lanes: 1,500 vehicles per lane
3. The total volume reported does not account for the HOV volume.
4. **Bold** = Project contributes greater than 0.01 v/c to the No Project condition resulting in a significant impact

As shown in **Table 7-5** the Project would not increase the freeway's v/c ratio by 0.01 or more with the Project's contribution. Therefore, the Project results in a ***less than significant impact*** during the Cumulative Plus Project AM peak hour.

During the PM peak hour, all freeway study segments operate at LOS E or better across all Cumulative scenarios, except the following northbound segments:

- Manuel T Freitas Off to Manuel T Freitas On (degrades from LOS E to LOS F with the Project)
- Manuel T Freitas On to Redwood Highway On (operates at LOS F across all PM peak hour Cumulative scenarios)
- Miller Creek On (operates at LOS F across all PM peak hour Cumulative scenarios)

The Project's contribution to these segments are summarized in **Table 7-6**. As shown, the Project's addition to these segment is less than 1-percent of total traffic on the corridor. However, at the Miller Creek segment, the Project's contribution results in a v/c ratio increase of 0.01, thereby resulting in **significant impact,** even though the Project's expected VMT per employee is less than the expected VMT per employee for the TAZ.

TABLE 7-6: CUMULATIVE CONDITIONS VOLUME TO CAPACITY (V/C) SUMMARY[1] – PM PEAK HOUR					
Segment	**Segment Capacity[1]**	**Cumulative No Project**		**Cumulative Plus Project**	
		Volume[2]	**v/c**	**Volume[2]**	**v/c[3]**
Northbound					
Manuel T Freitas Off / Manuel T Freitas On	6,600	6,451	0.98	6,468	0.98
Manuel T Freitas On / Redwood Highway On	8,800	7,236	0.82	7,262	0.82
Miller Creek On	8,100	7,405	0.91	7,421	0.91

Notes:

1. Summary based on mixed flow lanes only. High Occupancy Vehicles lane not included in analysis.
2. v/c calculation assumes the following capacities:
   - Mixed Flow Lanes: 2,200 vehicles per lane
   - Auxiliary Lanes: 1,500 vehicles per lane
3. The total volume reported does not account for the HOV volume.
4. **Bold** = Project contributes greater than 0.01 v/c to the No Project condition resulting in a significant impact

As shown in **Table 7-6** the Project would not increase the freeway's v/c ratio by 0.01 or more with the Project's contribution. Therefore, the Project results in a ***less than significant impact*** during the Cumulative Plus Project PM peak hour.

7.3 BICYCLE & PEDESTRIAN IMPACTS

Bicycling and pedestrian trips in the study area may increase as a result of the proposed Project and Cumulative growth, which may result in an increase in vehicle-bicycle-pedestrian conflicts at intersections in the study area. However, the proposed Project would not create potentially hazardous conditions for bicycles, pedestrians, or otherwise interfere with bicycle and pedestrian accessibility to the site and adjoining areas because the Project does not remove existing facilities and does not prohibit the construction of proposed future facilities as documented under the Cumulative Roadway Assumptions. As described in Chapter 5, the addition of the proposed parking structure on the west side of Los Gamos Drive would result in an increase to pedestrian crossings across Los Gamos Drive. Thus, the Project Sponsor will include pedestrian enhancements to the existing Los Gamos Drive crossing, just north of the 1650 Los Gamos Drive driveway. Therefore, the Project's impact to bicycle and pedestrian facilities are considered ***less than significant*** and mitigations are not required under Cumulative Plus Project conditions.

7.4 TRANSIT IMPACTS

Transit trips in the study area may increase as a result of the Project. However, Project related transit trips would have no foreseeable impacts to transit operations because the Project would not likely generate enough transit demand to exceed the capacity of existing or planned transit service nor does it interfere with existing or future transit users. Therefore, the Project impacts to transit facilities are considered ***less than significant*** and mitigations are not required.

1650 Los Gamos Drive Kaiser

Transportation Impact Analysis

Appendix

Final

February 2018

Prepared for the City of San Rafael

SF15-0858

Appendices

Appendix A: Peak Hour Intersection Counts

Appendix B: Detailed Intersection LOS Results

Appendix C: Signal Warrants

Appendix D: Detailed Freeway LOS Results

Appendix E: Detailed VMT Comparison Table

Appendix F: Detailed Intersection Queue Summary

APPENDIX A: PEAK HOUR INTERSECTION COUNTS

TRAFFIC COUNTS PLUS

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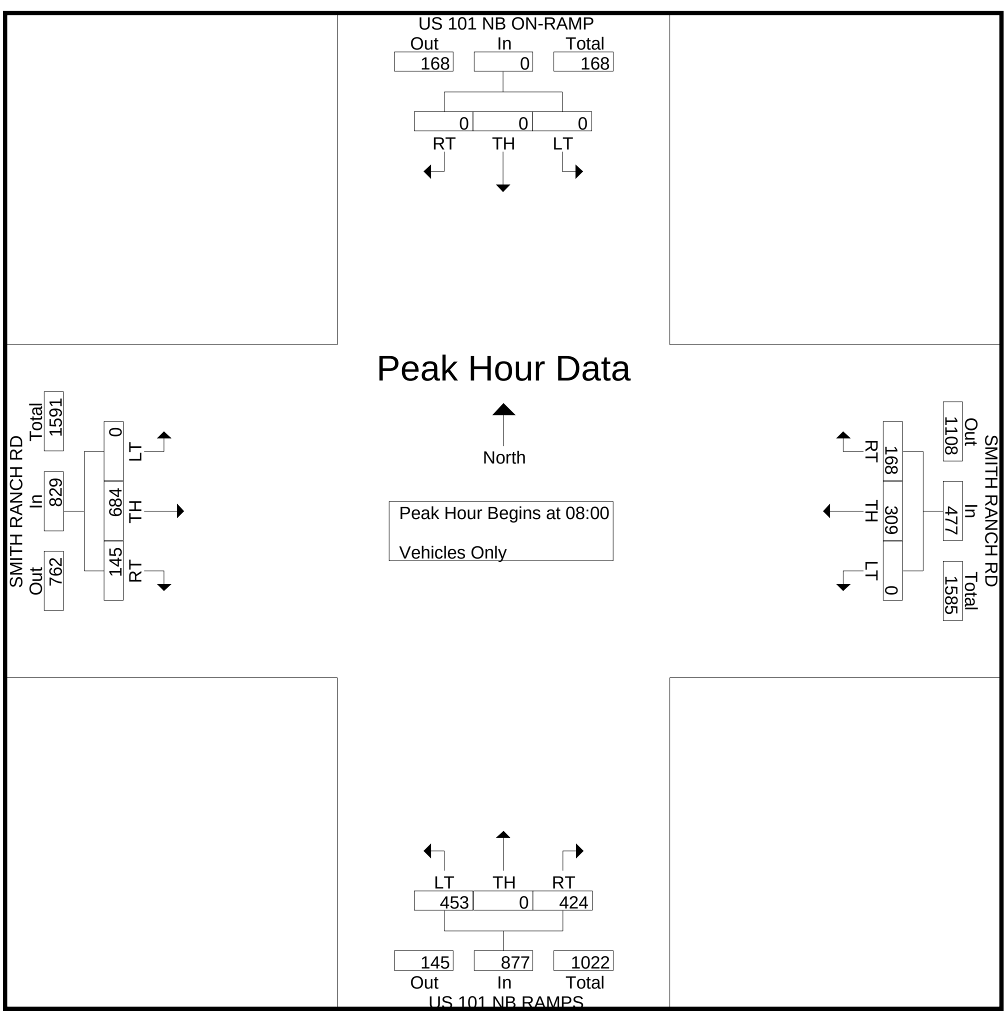
CITY OF SAN RAFAEL

File Name : 101 nb-smitch ranch-a
Site Code : 4
Start Date : 11/18/2015
Page No : 1

Groups Printed- Vehicles Only

	US 101 NB ON-RAMP Southbound				SMITH RANCH RD Westbound				US 101 NB RAMPS Northbound				SMITH RANCH RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
07:00	0	0	0	0	24	81	0	105	47	0	42	89	11	127	0	138	332
07:15	0	0	0	0	26	94	0	120	53	0	56	109	22	121	0	143	372
07:30	0	0	0	0	34	94	0	128	71	0	67	138	20	119	0	139	405
07:45	0	0	0	0	45	104	0	149	77	0	83	160	23	142	0	165	474
Total	0	0	0	0	129	373	0	502	248	0	248	496	76	509	0	585	1583
08:00	0	0	0	0	46	83	0	129	92	0	126	218	29	169	0	198	545
08:15	0	0	0	0	45	79	0	124	106	0	117	223	38	165	0	203	550
08:30	0	0	0	0	35	75	0	110	105	0	118	223	43	163	0	206	539
08:45	0	0	0	0	42	72	0	114	121	0	92	213	35	187	0	222	549
Total	0	0	0	0	168	309	0	477	424	0	453	877	145	684	0	829	2183
Grand Total	0	0	0	0	297	682	0	979	672	0	701	1373	221	1193	0	1414	3766
Apprch %	0	0	0		30.3	69.7	0		48.9	0	51.1		15.6	84.4	0		
Total %	0	0	0	0	7.9	18.1	0	26	17.8	0	18.6	36.5	5.9	31.7	0	37.5	

	US 101 NB ON-RAMP Southbound				SMITH RANCH RD Westbound				US 101 NB RAMPS Northbound				SMITH RANCH RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00																	
08:00	0	0	0	0	**46**	**83**	0	**129**	92	0	**126**	218	29	169	0	198	545
08:15	0	0	0	0	45	79	0	124	106	0	117	**223**	38	165	0	203	**550**
08:30	0	0	0	0	35	75	0	110	105	0	118	223	**43**	163	0	206	539
08:45	0	0	0	0	42	72	0	114	**121**	0	92	213	35	**187**	0	**222**	549
Total Volume	0	0	0	0	168	309	0	477	424	0	453	877	145	684	0	829	2183
% App. Total	0	0	0		35.2	64.8	0		48.3	0	51.7		17.5	82.5	0		
PHF	.000	.000	.000	.000	.913	.931	.000	.924	.876	.000	.899	.983	.843	.914	.000	.934	.992



TRAFFIC COUNTS PLUS
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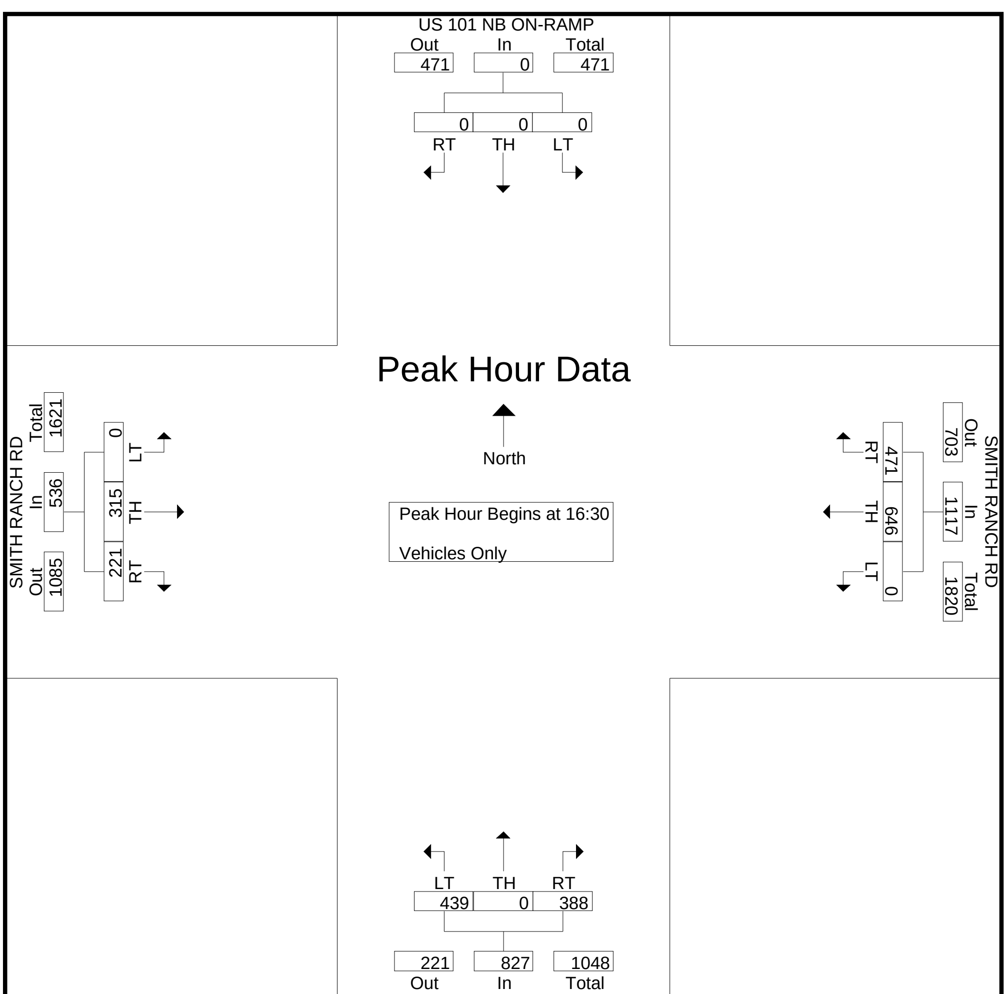
CITY OF SAN RAFAEL

File Name : 101 nb-smitch ranch-p
Site Code : 4
Start Date : 11/18/2015
Page No : 1

Groups Printed- Vehicles Only

	US 101 NB ON-RAMP Southbound				SMITH RANCH RD Westbound				US 101 NB RAMPS Northbound				SMITH RANCH RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
16:00	0	0	0	0	113	149	0	262	104	0	81	185	67	75	0	142	589
16:15	0	0	0	0	102	149	0	251	99	0	95	194	32	79	0	111	556
16:30	0	0	0	0	116	158	0	274	86	0	110	196	49	72	0	121	591
16:45	0	0	0	0	111	151	0	262	125	0	107	232	40	84	0	124	618
Total	0	0	0	0	442	607	0	1049	414	0	393	807	188	310	0	498	2354
17:00	0	0	0	0	144	200	0	344	77	0	114	191	77	76	0	153	688
17:15	0	0	0	0	100	137	0	237	100	0	108	208	55	83	0	138	583
17:30	0	0	0	0	94	147	0	241	88	0	93	181	51	59	0	110	532
17:45	0	0	0	0	75	104	0	179	91	0	104	195	42	70	0	112	486
Total	0	0	0	0	413	588	0	1001	356	0	419	775	225	288	0	513	2289
Grand Total	0	0	0	0	855	1195	0	2050	770	0	812	1582	413	598	0	1011	4643
Apprch %	0	0	0		41.7	58.3	0		48.7	0	51.3		40.9	59.1	0		
Total %	0	0	0	0	18.4	25.7	0	44.2	16.6	0	17.5	34.1	8.9	12.9	0	21.8	

	US 101 NB ON-RAMP Southbound				SMITH RANCH RD Westbound				US 101 NB RAMPS Northbound				SMITH RANCH RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:30																	
16:30	0	0	0	0	116	158	0	274	86	0	110	196	49	72	0	121	591
16:45	0	0	0	0	111	151	0	262	**125**	0	107	**232**	40	**84**	0	124	618
17:00	0	0	0	0	**144**	**200**	0	**344**	77	0	**114**	191	**77**	76	0	**153**	**688**
17:15	0	0	0	0	100	137	0	237	100	0	108	208	55	83	0	138	583
Total Volume	0	0	0	0	471	646	0	1117	388	0	439	827	221	315	0	536	2480
% App. Total	0	0	0		42.2	57.8	0		46.9	0	53.1		41.2	58.8	0		
PHF	.000	.000	.000	.000	.818	.808	.000	.812	.776	.000	.963	.891	.718	.938	.000	.876	.901



TRAFFIC COUNTS PLUS
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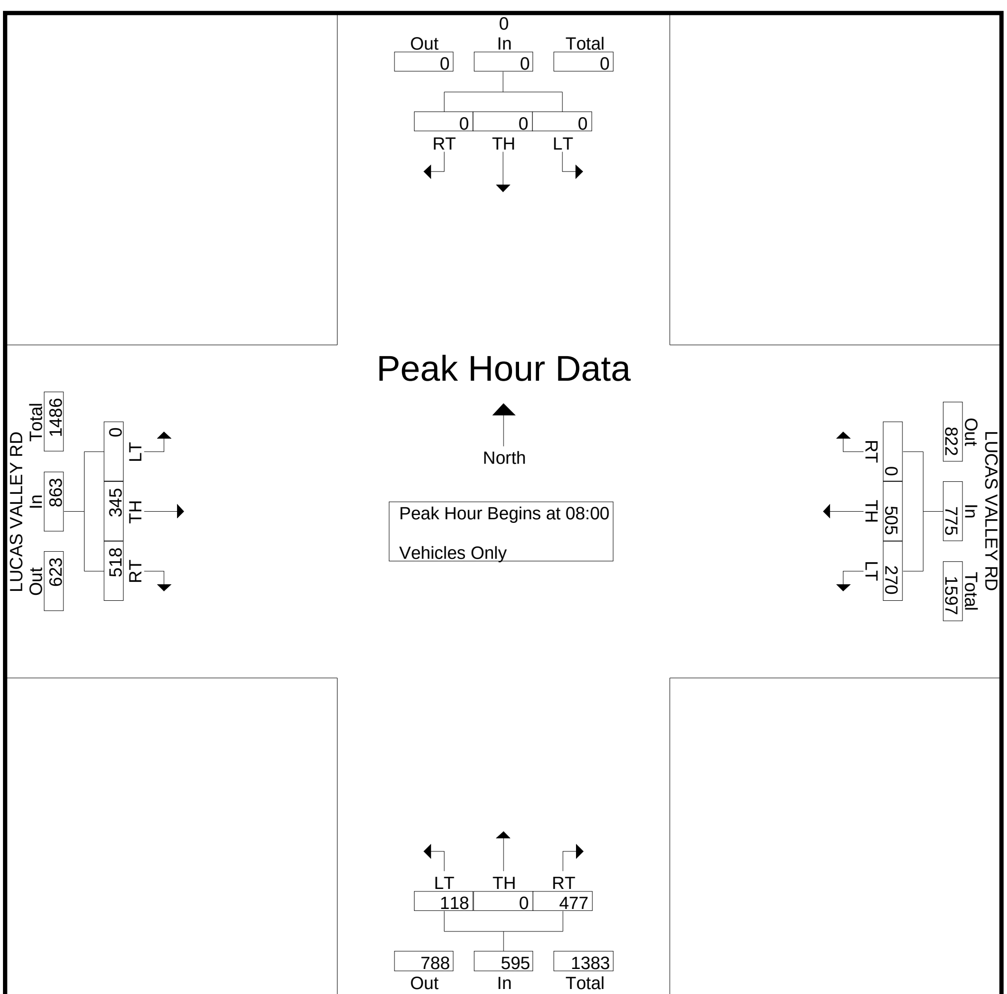
CITY OF SAN RAFAEL

File Name : 101 sb-lucas valley-a
Site Code : 3
Start Date : 11/18/2015
Page No : 1

Groups Printed- Vehicles Only

	0				**LUCAS VALLEY RD**				**US 101 SB RAMPS**				**LUCAS VALLEY RD**				
	Southbound				**Westbound**				**Northbound**				**Eastbound**				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
07:00	0	0	0	0	0	47	71	118	97	0	20	117	91	36	0	127	362
07:15	0	0	0	0	5	69	75	149	92	0	16	108	116	48	0	164	421
07:30	0	0	0	0	0	77	79	156	84	0	18	102	138	58	0	196	454
07:45	0	0	0	0	0	104	82	186	93	0	15	108	145	69	0	214	508
Total	0	0	0	0	5	297	307	609	366	0	69	435	490	211	0	701	1745
08:00	0	0	0	0	0	138	68	206	114	0	32	146	127	89	0	216	568
08:15	0	0	0	0	0	133	74	207	112	0	28	140	131	87	0	218	565
08:30	0	0	0	0	0	137	66	203	124	0	22	146	141	75	0	216	565
08:45	0	0	0	0	0	97	62	159	127	0	36	163	119	94	0	213	535
Total	0	0	0	0	0	505	270	775	477	0	118	595	518	345	0	863	2233
Grand Total	0	0	0	0	5	802	577	1384	843	0	187	1030	1008	556	0	1564	3978
Apprch %	0	0	0		0.4	57.9	41.7		81.8	0	18.2		64.5	35.5	0		
Total %	0	0	0	0	0.1	20.2	14.5	34.8	21.2	0	4.7	25.9	25.3	14	0	39.3	

	0				**LUCAS VALLEY RD**				**US 101 SB RAMPS**				**LUCAS VALLEY RD**				
	Southbound				**Westbound**				**Northbound**				**Eastbound**				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00																	
08:00	0	0	0	0	0	**138**	68	206	114	0	32	146	127	89	0	216	**568**
08:15	0	0	0	0	0	133	**74**	**207**	112	0	28	140	131	87	0	**218**	565
08:30	0	0	0	0	0	137	66	203	124	0	22	146	**141**	75	0	216	565
08:45	0	0	0	0	0	97	62	159	**127**	0	**36**	**163**	119	**94**	0	213	535
Total Volume	0	0	0	0	0	505	270	775	477	0	118	595	518	345	0	863	2233
% App. Total	0	0	0		0	65.2	34.8		80.2	0	19.8		60	40	0		
PHF	.000	.000	.000	.000	.000	.915	.912	.936	.939	.000	.819	.913	.918	.918	.000	.990	.983



TRAFFIC COUNTS PLUS
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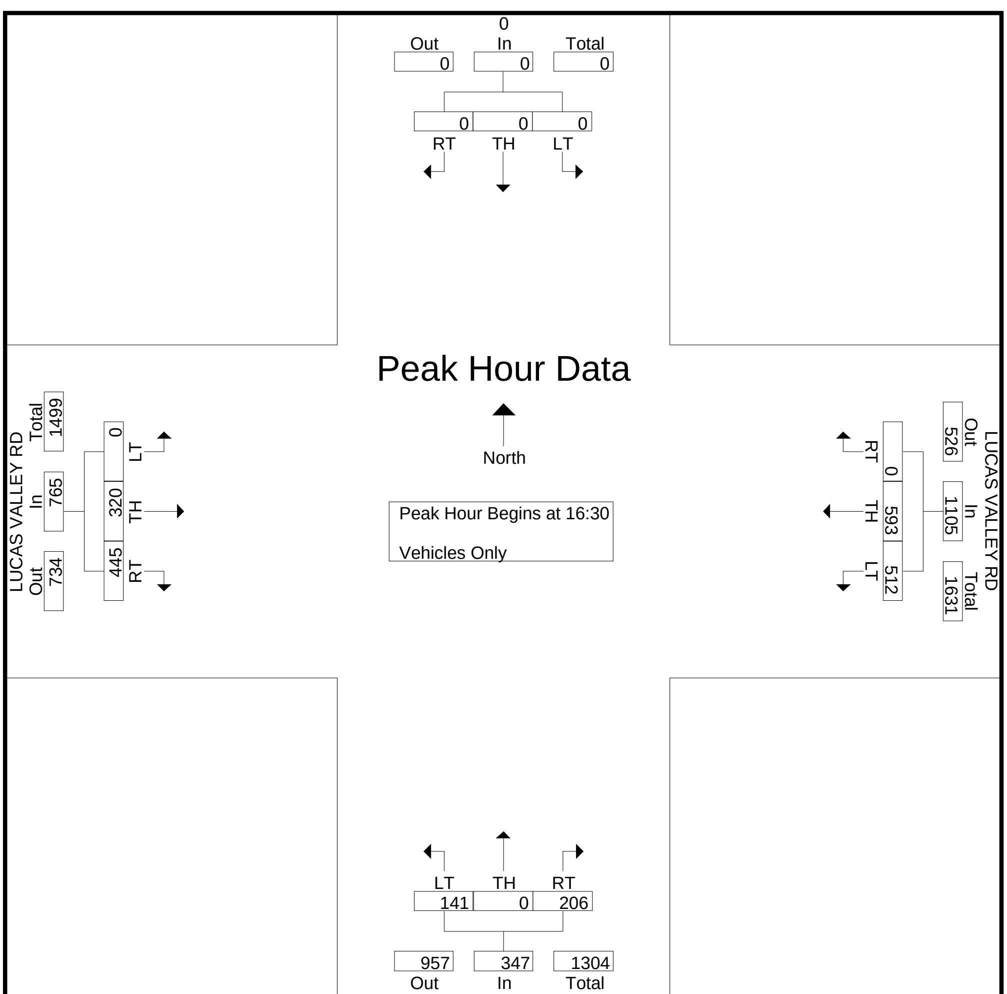
CITY OF SAN RAFAEL

File Name : 101 sb-lucas valley-p
Site Code : 3
Start Date : 11/18/2015
Page No : 1

Groups Printed- Vehicles Only

	0 Southbound				LUCAS VALLEY RD Westbound				US 101 SB RAMPS Northbound				LUCAS VALLEY RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
16:00	0	0	0	0	0	114	106	220	51	0	22	73	87	93	0	180	473
16:15	0	0	0	0	0	107	103	210	45	0	24	69	71	59	0	130	409
16:30	0	0	0	0	0	152	109	261	42	0	36	78	142	78	0	220	559
16:45	0	0	0	0	0	150	116	266	50	0	37	87	117	68	0	185	538
Total	0	0	0	0	0	523	434	957	188	0	119	307	417	298	0	715	1979
17:00	0	0	0	0	0	160	169	329	61	0	28	89	100	101	0	201	619
17:15	0	0	0	0	0	131	118	249	53	0	40	93	86	73	0	159	501
17:30	0	0	0	0	0	125	118	243	32	0	42	74	110	79	0	189	506
17:45	0	0	0	0	0	147	79	226	49	0	29	78	102	51	0	153	457
Total	0	0	0	0	0	563	484	1047	195	0	139	334	398	304	0	702	2083
Grand Total	0	0	0	0	0	1086	918	2004	383	0	258	641	815	602	0	1417	4062
Apprch %	0	0	0		0	54.2	45.8		59.8	0	40.2		57.5	42.5	0		
Total %	0	0	0	0	0	26.7	22.6	49.3	9.4	0	6.4	15.8	20.1	14.8	0	34.9	

	0 Southbound				LUCAS VALLEY RD Westbound				US 101 SB RAMPS Northbound				LUCAS VALLEY RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:30																	
16:30	0	0	0	0	0	152	109	261	42	0	36	78	**142**	78	0	**220**	559
16:45	0	0	0	0	0	150	116	266	50	0	37	87	117	68	0	185	538
17:00	0	0	0	0	0	**160**	**169**	**329**	**61**	0	28	89	100	**101**	0	201	**619**
17:15	0	0	0	0	0	131	118	249	53	0	**40**	**93**	86	73	0	159	501
Total Volume	0	0	0	0	0	593	512	1105	206	0	141	347	445	320	0	765	2217
% App. Total	0	0	0		0	53.7	46.3		59.4	0	40.6		58.2	41.8	0		
PHF	.000	.000	.000	.000	.000	.927	.757	.840	.844	.000	.881	.933	.783	.792	.000	.869	.895



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CITY OF SAN RAFAEL

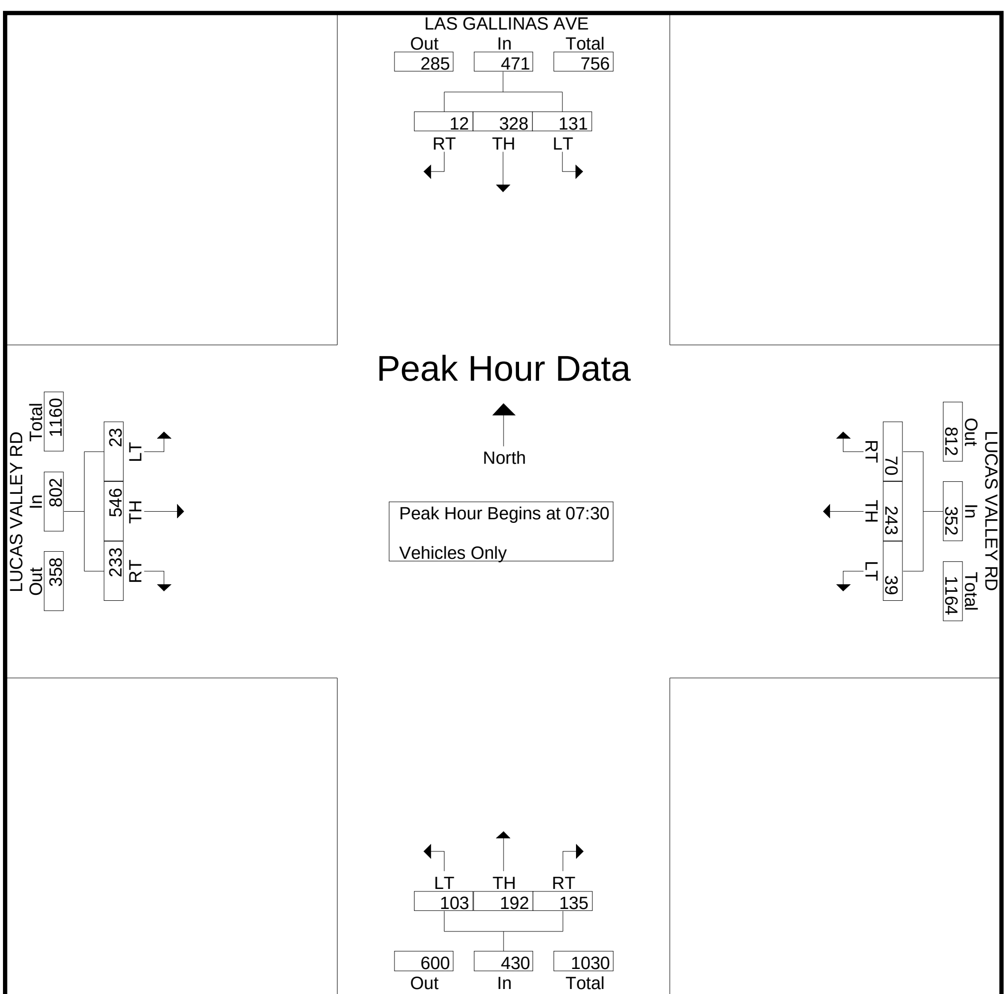
File Name : las gallinas-lucas valley-a
Site Code : 1
Start Date : 11/19/2015
Page No : 1

Groups Printed- Vehicles Only

	LAS GALLINAS AVE Southbound				LUCAS VALLEY RD Westbound				LAS GALLINAS AVE Northbound				LUCAS VALLEY RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
07:00	1	51	35	87	7	25	7	39	12	7	5	24	10	85	2	97	247
07:15	1	81	35	117	8	17	5	30	32	18	12	62	21	107	10	138	347
07:30	1	83	32	116	22	39	7	68	27	71	10	108	68	130	9	207	499
07:45	9	97	38	144	33	52	12	97	35	61	22	118	46	123	3	172	531
Total	12	312	140	464	70	133	31	234	106	157	49	312	145	445	24	614	1624
08:00	2	84	31	117	8	93	10	111	37	48	49	134	56	142	3	201	563
08:15	0	64	30	94	7	59	10	76	36	12	22	70	63	151	8	222	462
08:30	3	80	34	117	9	61	14	84	26	12	22	60	33	126	1	160	421
08:45	4	63	48	115	9	71	13	93	29	11	15	55	41	127	5	173	436
Total	9	291	143	443	33	284	47	364	128	83	108	319	193	546	17	756	1882
Grand Total	21	603	283	907	103	417	78	598	234	240	157	631	338	991	41	1370	3506
Apprch %	2.3	66.5	31.2		17.2	69.7	13		37.1	38	24.9		24.7	72.3	3		
Total %	0.6	17.2	8.1	25.9	2.9	11.9	2.2	17.1	6.7	6.8	4.5	18	9.6	28.3	1.2	39.1	

Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 07:30

	LAS GALLINAS AVE Southbound				LUCAS VALLEY RD Westbound				LAS GALLINAS AVE Northbound				LUCAS VALLEY RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
07:30	1	83	32	116	22	39	7	68	27	**71**	10	108	**68**	130	**9**	207	499
07:45	**9**	**97**	**38**	**144**	**33**	52	**12**	97	35	61	22	118	46	123	3	172	531
08:00	2	84	31	117	8	**93**	10	**111**	**37**	48	**49**	**134**	56	142	3	201	**563**
08:15	0	64	30	94	7	59	10	76	36	12	22	70	63	**151**	8	**222**	462
Total Volume	12	328	131	471	70	243	39	352	135	192	103	430	233	546	23	802	2055
% App. Total	2.5	69.6	27.8		19.9	69	11.1		31.4	44.7	24		29.1	68.1	2.9		
PHF	.333	.845	.862	.818	.530	.653	.813	.793	.912	.676	.526	.802	.857	.904	.639	.903	.913



TRAFFIC COUNTS PLUS

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CITY OF SAN RAFAEL

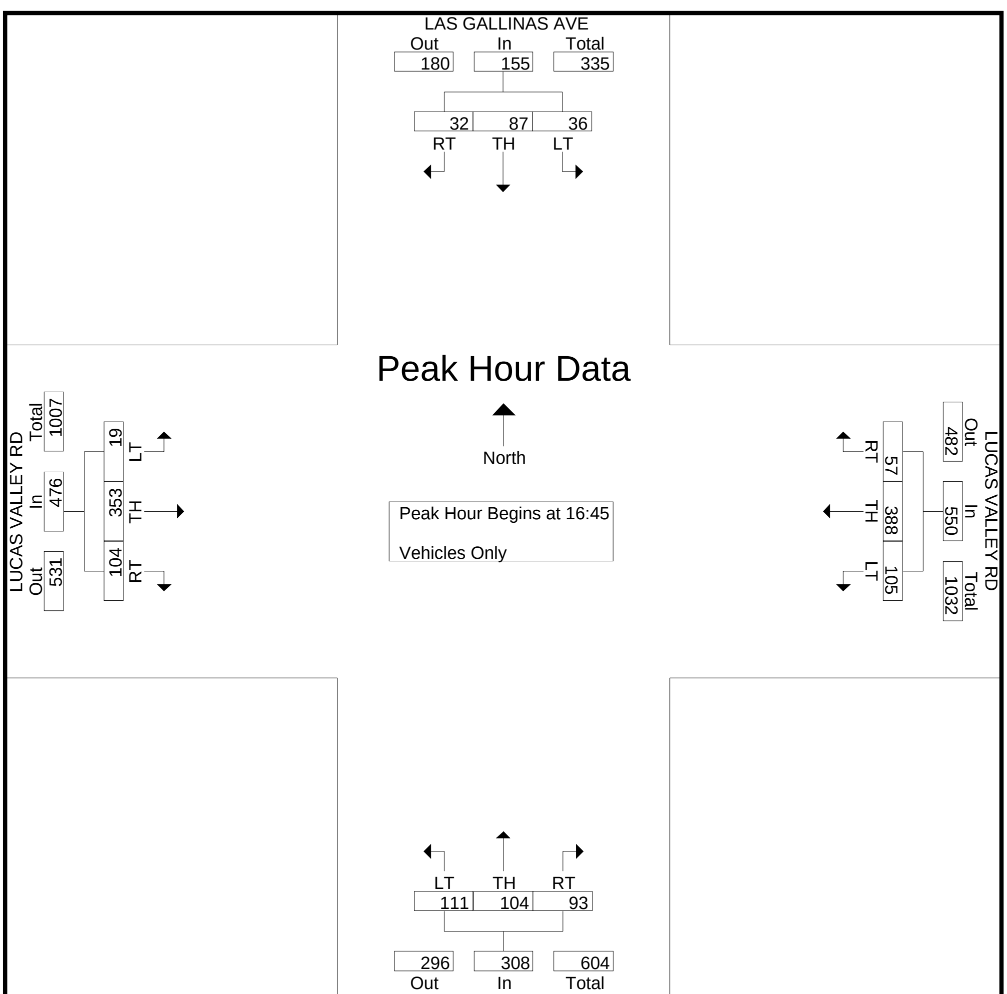
File Name : las gallinas-lucas valley-p
Site Code : 1
Start Date : 11/19/2015
Page No : 1

Groups Printed- Vehicles Only

	LAS GALLINAS AVE Southbound				LUCAS VALLEY RD Westbound				LAS GALLINAS AVE Northbound				LUCAS VALLEY RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
16:00	5	17	8	30	11	89	21	121	18	21	31	70	16	75	5	96	317
16:15	1	20	12	33	8	78	17	103	23	42	27	92	25	82	8	115	343
16:30	8	37	16	61	12	91	21	124	18	39	34	91	12	59	7	78	354
16:45	12	26	14	52	21	107	18	146	22	21	25	68	31	82	5	118	384
Total	26	100	50	176	52	365	77	494	81	123	117	321	84	298	25	407	1398
17:00	5	23	5	33	8	84	22	114	24	31	35	90	19	99	5	123	360
17:15	8	16	10	34	17	103	27	147	27	27	24	78	34	88	4	126	385
17:30	7	22	7	36	11	94	38	143	20	25	27	72	20	84	5	109	360
17:45	10	19	9	38	12	81	22	115	25	23	25	73	17	48	2	67	293
Total	30	80	31	141	48	362	109	519	96	106	111	313	90	319	16	425	1398
Grand Total	56	180	81	317	100	727	186	1013	177	229	228	634	174	617	41	832	2796
Apprch %	17.7	56.8	25.6		9.9	71.8	18.4		27.9	36.1	36		20.9	74.2	4.9		
Total %	2	6.4	2.9	11.3	3.6	26	6.7	36.2	6.3	8.2	8.2	22.7	6.2	22.1	1.5	29.8	

Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 16:45

	LAS GALLINAS AVE Southbound				LUCAS VALLEY RD Westbound				LAS GALLINAS AVE Northbound				LUCAS VALLEY RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
16:45	**12**	**26**	**14**	**52**	**21**	**107**	18	146	22	21	25	68	31	82	**5**	118	384
17:00	5	23	5	33	8	84	22	114	24	**31**	**35**	**90**	19	**99**	5	123	360
17:15	8	16	10	34	17	103	27	**147**	**27**	27	24	78	**34**	88	4	**126**	**385**
17:30	7	22	7	36	11	94	**38**	143	20	25	27	72	20	84	5	109	360
Total Volume	32	87	36	155	57	388	105	550	93	104	111	308	104	353	19	476	1489
% App. Total	20.6	56.1	23.2		10.4	70.5	19.1		30.2	33.8	36		21.8	74.2	4		
PHF	.667	.837	.643	.745	.679	.907	.691	.935	.861	.839	.793	.856	.765	.891	.950	.944	.967



TRAFFIC COUNTS PLUS
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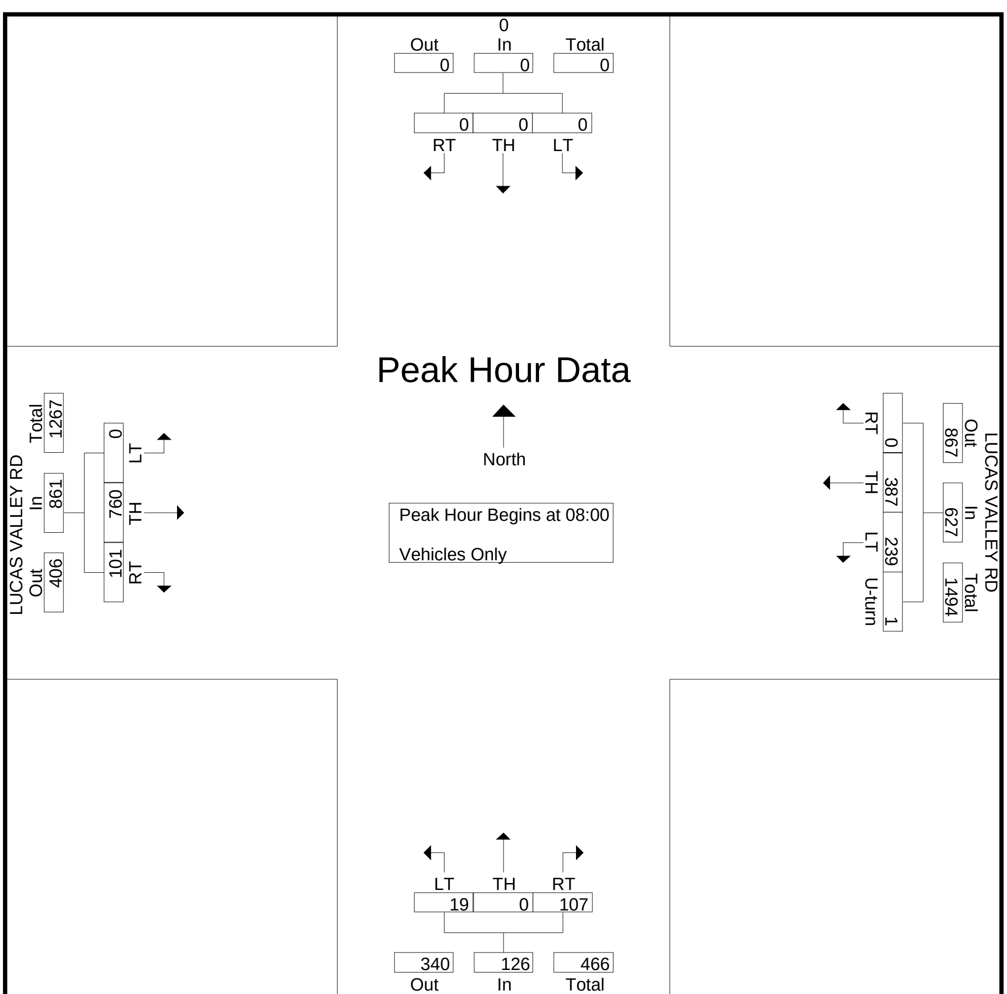
CITY OF SAN RAFAEL

File Name : los gamos-lucas valley-a
Site Code : 2
Start Date : 11/18/2015
Page No : 1

Groups Printed- Vehicles Only

	0 Southbound				LUCAS VALLEY RD Westbound					LOS GAMOS DR Northbound				LUCAS VALLEY RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
07:00	0	0	0	0	0	33	31	0	64	21	0	5	26	8	107	0	115	205
07:15	0	0	0	0	0	48	36	1	85	17	0	4	21	16	150	0	166	272
07:30	0	0	0	0	0	73	32	0	105	25	0	5	30	15	163	0	178	313
07:45	0	0	0	0	0	91	30	0	121	26	0	7	33	19	197	0	216	370
Total	0	0	0	0	0	245	129	1	375	89	0	21	110	58	617	0	675	1160
08:00	0	0	0	0	0	116	60	1	177	24	0	3	27	21	183	0	204	408
08:15	0	0	0	0	0	93	62	0	155	25	0	6	31	30	197	0	227	413
08:30	0	0	0	0	0	92	61	0	153	26	0	4	30	19	194	0	213	396
08:45	0	0	0	0	0	86	56	0	142	32	0	6	38	31	186	0	217	397
Total	0	0	0	0	0	387	239	1	627	107	0	19	126	101	760	0	861	1614
Grand Total	0	0	0	0	0	632	368	2	1002	196	0	40	236	159	1377	0	1536	2774
Apprch %	0	0	0		0	63.1	36.7	0.2		83.1	0	16.9		10.4	89.6	0		
Total %	0	0	0	0	0	22.8	13.3	0.1	36.1	7.1	0	1.4	8.5	5.7	49.6	0	55.4	

	0 Southbound				LUCAS VALLEY RD Westbound					LOS GAMOS DR Northbound				LUCAS VALLEY RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 08:00																		
08:00	0	0	0	0	0	**116**	60	**1**	**177**	24	0	3	27	21	183	0	204	408
08:15	0	0	0	0	0	93	**62**	0	155	25	0	**6**	31	30	**197**	0	**227**	**413**
08:30	0	0	0	0	0	92	61	0	153	26	0	4	30	19	194	0	213	396
08:45	0	0	0	0	0	86	56	0	142	**32**	0	6	**38**	**31**	186	0	217	397
Total Volume	0	0	0	0	0	387	239	1	627	107	0	19	126	101	760	0	861	1614
% App. Total	0	0	0		0	61.7	38.1	0.2		84.9	0	15.1		11.7	88.3	0		
PHF	.000	.000	.000	.000	.000	.834	.964	.250	.886	.836	.000	.792	.829	.815	.964	.000	.948	.977



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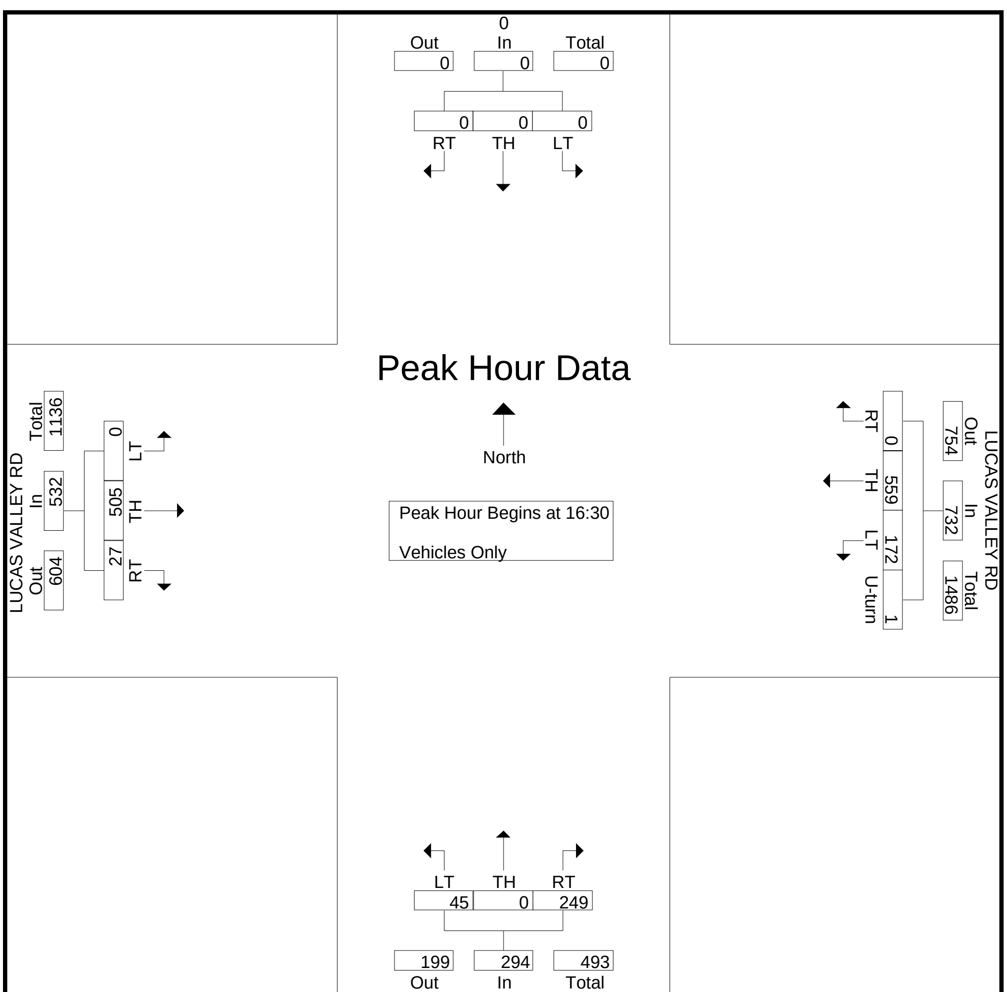
CITY OF SAN RAFAEL

File Name : los gamos-lucas valley-p
Site Code : 2
Start Date : 11/18/2015
Page No : 1

Groups Printed- Vehicles Only

	0 Southbound				LUCAS VALLEY RD Westbound					LOS GAMOS DR Northbound				LUCAS VALLEY RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
16:00	0	0	0	0	0	105	31	1	137	51	0	8	59	8	121	0	129	325
16:15	0	0	0	0	0	100	31	0	131	44	0	8	52	7	109	0	116	299
16:30	0	0	0	0	0	136	53	1	190	59	0	6	65	3	141	0	144	399
16:45	0	0	0	0	0	139	47	0	186	55	0	9	64	5	137	0	142	392
Total	0	0	0	0	0	480	162	2	644	209	0	31	240	23	508	0	531	1415
17:00	0	0	0	0	0	149	37	0	186	77	0	16	93	10	122	0	132	411
17:15	0	0	0	0	0	135	35	0	170	58	0	14	72	9	105	0	114	356
17:30	0	0	0	0	0	134	26	0	160	58	0	3	61	5	113	0	118	339
17:45	0	0	0	0	0	138	35	0	173	45	0	9	54	9	101	0	110	337
Total	0	0	0	0	0	556	133	0	689	238	0	42	280	33	441	0	474	1443
Grand Total	0	0	0	0	0	1036	295	2	1333	447	0	73	520	56	949	0	1005	2858
Apprch %	0	0	0		0	77.7	22.1	0.2		86	0	14		5.6	94.4	0		
Total %	0	0	0	0	0	36.2	10.3	0.1	46.6	15.6	0	2.6	18.2	2	33.2	0	35.2	

	0 Southbound				LUCAS VALLEY RD Westbound					LOS GAMOS DR Northbound				LUCAS VALLEY RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 16:30																		
16:30	0	0	0	0	0	136	**53**	**1**	**190**	59	0	6	65	3	**141**	0	**144**	399
16:45	0	0	0	0	0	139	47	0	186	55	0	9	64	5	137	0	142	392
17:00	0	0	0	0	0	**149**	37	0	186	**77**	0	**16**	**93**	**10**	122	0	132	**411**
17:15	0	0	0	0	0	135	35	0	170	58	0	14	72	9	105	0	114	356
Total Volume	0	0	0	0	0	559	172	1	732	249	0	45	294	27	505	0	532	1558
% App. Total	0	0	0		0	76.4	23.5	0.1		84.7	0	15.3		5.1	94.9	0		
PHF	.000	.000	.000	.000	.000	.938	.811	.250	.963	.808	.000	.703	.790	.675	.895	.000	.924	.948



TRAFFIC COUNTS PLUS

mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

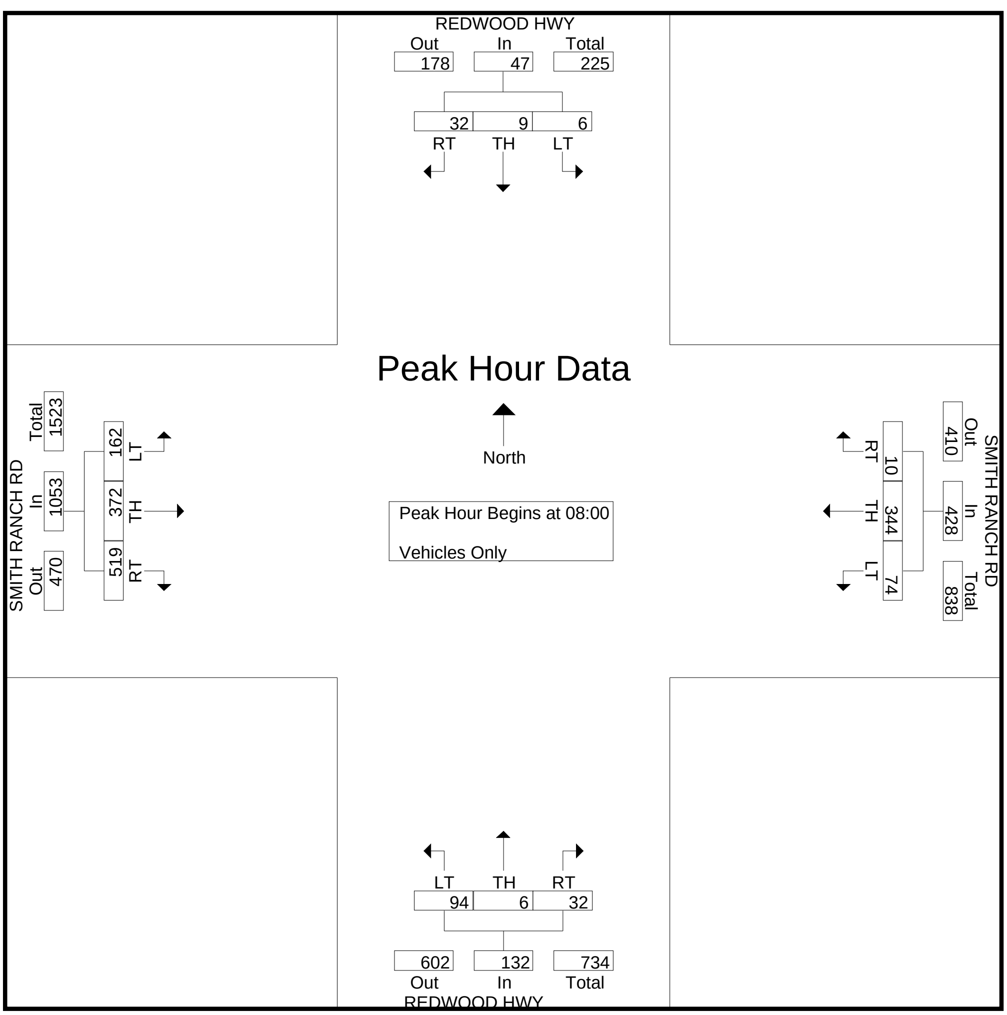
File Name : redwood-smith ranch-a
Site Code : 5
Start Date : 11/18/2015
Page No : 1

Groups Printed- Vehicles Only

	REDWOOD HWY Southbound				SMITH RANCH RD Westbound				REDWOOD HWY Northbound				SMITH RANCH RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
07:00	5	1	0	6	1	84	19	104	4	0	15	19	99	43	29	171	300
07:15	1	2	0	3	2	101	12	115	4	0	17	21	95	42	32	169	308
07:30	6	3	1	10	2	106	24	132	2	1	14	17	82	63	38	183	342
07:45	3	1	0	4	3	114	34	151	4	5	31	40	107	67	37	211	406
Total	15	7	1	23	8	405	89	502	14	6	77	97	383	215	136	734	1356
08:00	5	1	2	8	1	100	15	116	8	0	23	31	128	79	36	243	398
08:15	6	1	2	9	3	89	20	112	7	1	26	34	128	91	44	263	418
08:30	7	2	1	10	1	75	18	94	7	2	26	35	114	86	43	243	382
08:45	14	5	1	20	5	80	21	106	10	3	19	32	149	116	39	304	462
Total	32	9	6	47	10	344	74	428	32	6	94	132	519	372	162	1053	1660
Grand Total	47	16	7	70	18	749	163	930	46	12	171	229	902	587	298	1787	3016
Apprch %	67.1	22.9	10		1.9	80.5	17.5		20.1	5.2	74.7		50.5	32.8	16.7		
Total %	1.6	0.5	0.2	2.3	0.6	24.8	5.4	30.8	1.5	0.4	5.7	7.6	29.9	19.5	9.9	59.3	

Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 08:00

	REDWOOD HWY Southbound				SMITH RANCH RD Westbound				REDWOOD HWY Northbound				SMITH RANCH RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
08:00	5	1	**2**	8	1	**100**	15	**116**	8	0	23	31	128	79	36	243	398
08:15	6	1	2	9	3	89	20	112	7	1	**26**	34	128	91	**44**	263	418
08:30	7	2	1	10	1	75	18	94	7	2	26	**35**	114	86	43	243	382
08:45	**14**	**5**	1	**20**	**5**	80	**21**	106	**10**	**3**	19	32	**149**	**116**	39	**304**	**462**
Total Volume	32	9	6	47	10	344	74	428	32	6	94	132	519	372	162	1053	1660
% App. Total	68.1	19.1	12.8		2.3	80.4	17.3		24.2	4.5	71.2		49.3	35.3	15.4		
PHF	.571	.450	.750	.588	.500	.860	.881	.922	.800	.500	.904	.943	.871	.802	.920	.866	.898



TRAFFIC COUNTS PLUS

mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

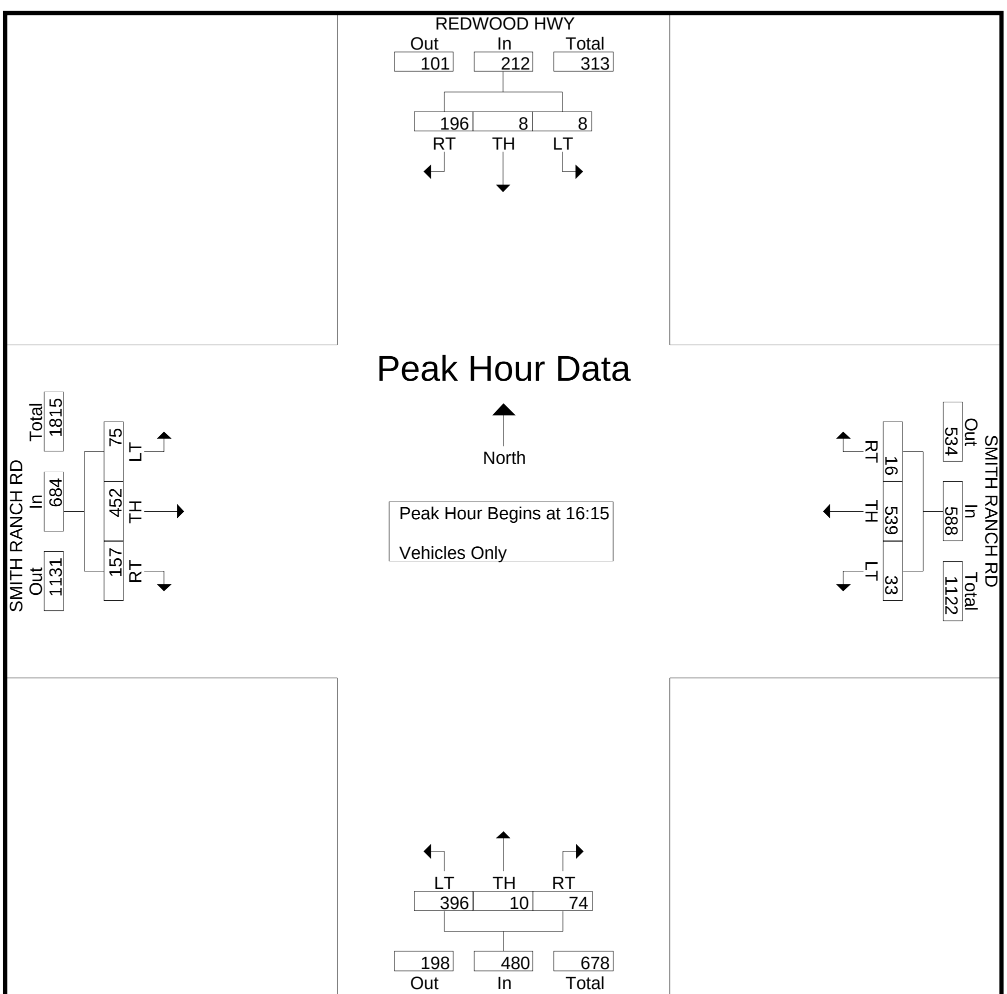
File Name : redwood-smith ranch-p
Site Code : 5
Start Date : 11/18/2015

Groups Printed- Vehicles Only

	REDWOOD HWY Southbound				SMITH RANCH RD Westbound				REDWOOD HWY Northbound				SMITH RANCH RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
16:00	55	3	1	59	7	100	13	120	21	1	103	125	49	116	13	178	482
16:15	54	1	1	56	8	121	8	137	13	1	74	88	37	113	20	170	451
16:30	53	2	4	59	3	129	6	138	21	3	90	114	40	90	24	154	465
16:45	43	3	0	46	2	129	14	145	16	1	93	110	51	133	20	204	505
Total	205	9	6	220	20	479	41	540	71	6	360	437	177	452	77	706	1903
17:00	46	2	3	51	3	160	5	168	24	5	139	168	29	116	11	156	543
17:15	28	2	0	30	3	112	6	121	21	1	92	114	34	131	13	178	443
17:30	46	0	0	46	4	120	7	131	13	0	69	82	26	114	7	147	406
17:45	19	0	1	20	3	95	6	104	16	1	59	76	37	98	14	149	349
Total	139	4	4	147	13	487	24	524	74	7	359	440	126	459	45	630	1741
Grand Total	344	13	10	367	33	966	65	1064	145	13	719	877	303	911	122	1336	3644
Apprch %	93.7	3.5	2.7		3.1	90.8	6.1		16.5	1.5	82		22.7	68.2	9.1		
Total %	9.4	0.4	0.3	10.1	0.9	26.5	1.8	29.2	4	0.4	19.7	24.1	8.3	25	3.3	36.7	

Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 16:15

	REDWOOD HWY Southbound				SMITH RANCH RD Westbound				REDWOOD HWY Northbound				SMITH RANCH RD Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
16:15	**54**	1	1	56	**8**	121	8	137	13	1	74	88	37	113	20	170	451
16:30	53	2	**4**	**59**	3	129	6	138	21	3	90	114	40	90	**24**	154	465
16:45	43	**3**	0	46	2	129	**14**	145	16	1	93	110	**51**	**133**	20	**204**	505
17:00	46	2	3	51	3	**160**	5	**168**	**24**	**5**	**139**	**168**	29	116	11	156	**543**
Total Volume	196	8	8	212	16	539	33	588	74	10	396	480	157	452	75	684	1964
% App. Total	92.5	3.8	3.8		2.7	91.7	5.6		15.4	2.1	82.5		23	66.1	11		
PHF	.907	.667	.500	.898	.500	.842	.589	.875	.771	.500	.712	.714	.770	.850	.781	.838	.904



Location: Lucas Valley Rd E/O Los Gamos Dr
Date Range: 8/30/2017 - 9/5/2017
Site Code: 01

DATA SOLUTIONS

	Wednesday			Thursday			Friday			Saturday			Sunday			Monday			Tuesday					
	8/30/2017			8/31/2017			9/1/2017			9/2/2017			9/3/2017			9/4/2017			9/5/2017			Mid-Week Average		
Time	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total
12:00 AM	19	21	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	21	40
1:00 AM	15	9	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	9	24
2:00 AM	7	3	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	3	10
3:00 AM	7	5	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	5	12
4:00 AM	28	52	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	52	80
5:00 AM	90	197	287	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	90	197	287
6:00 AM	300	211	511	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	300	211	511
7:00 AM	723	424	1,147	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	723	424	1,147
8:00 AM	916	584	1,500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	916	584	1,500
9:00 AM	718	495	1,213	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	718	495	1,213
10:00 AM	578	442	1,020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	578	442	1,020
11:00 AM	651	501	1,152	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	651	501	1,152
12:00 PM	653	566	1,219	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	653	566	1,219
1:00 PM	650	575	1,225	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	650	575	1,225
2:00 PM	666	557	1,223	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	666	557	1,223
3:00 PM	682	566	1,248	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	682	566	1,248
4:00 PM	676	539	1,215	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	676	539	1,215
5:00 PM	634	702	1,336	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	634	702	1,336
6:00 PM	522	533	1,055	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	522	533	1,055
7:00 PM	323	371	694	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	323	371	694
8:00 PM	272	287	559	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	272	287	559
9:00 PM	200	174	374	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200	174	374
10:00 PM	94	112	206	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	94	112	206
11:00 PM	24	48	72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	48	72
Total	**9,448**	**7,974**	**17,422**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**9,448**	**7,974**	**17,422**
Percent	**54%**	**46%**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**54%**	**46%**	-

1. Mid-week average includes data between Tuesday and Thursday.

Deon Fouche: (415) 757-7714
deon.fouche@idaxdata.com

Location: Los Gamos Dr S/O Lucas Valley Rd
Date Range: 8/30/2017 - 9/5/2017
Site Code: 02

	Wednesday			Thursday			Friday			Saturday			Sunday			Monday			Tuesday					
	8/30/2017			8/31/2017			9/1/2017			9/2/2017			9/3/2017			9/4/2017			9/5/2017			Mid-Week Average		
Time	NB	SB	Total	NB	SB	Total	NB	SB	Total	NB	SB	Total	NB	SB	Total	NB	SB	Total	NB	SB	Total	NB	SB	Total
12:00 AM	6	3	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	3	9
1:00 AM	3	0	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	0	3
2:00 AM	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	3
3:00 AM	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	3
4:00 AM	2	22	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	22	24
5:00 AM	13	145	158	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	145	158
6:00 AM	72	107	179	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72	107	179
7:00 AM	100	155	255	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	155	255
8:00 AM	132	281	413	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	132	281	413
9:00 AM	164	244	408	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	164	244	408
10:00 AM	158	168	326	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	158	168	326
11:00 AM	195	136	331	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	195	136	331
12:00 PM	176	163	339	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	176	163	339
1:00 PM	168	125	293	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	168	125	293
2:00 PM	145	151	296	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	145	151	296
3:00 PM	191	152	343	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	191	152	343
4:00 PM	178	113	291	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	178	113	291
5:00 PM	214	173	387	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	214	173	387
6:00 PM	180	98	278	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180	98	278
7:00 PM	106	67	173	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	106	67	173
8:00 PM	76	52	128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	76	52	128
9:00 PM	71	21	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	71	21	92
10:00 PM	34	11	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	34	11	45
11:00 PM	6	3	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	3	9
Total	**2,393**	**2,393**	**4,786**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2,393**	**2,393**	**4,786**
Percent	**50%**	**50%**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**50%**	**50%**	-

1. Mid-week average includes data between Tuesday and Thursday.

Deon Fouche: (415) 757-7714
deon.fouche@idaxdata.com

Location: Lucas Valley Rd W/O Los Gamos Dr
Date Range: 8/30/2017 - 9/5/2017
Site Code: 03

	Wednesday			Thursday			Friday			Saturday			Sunday			Monday			Tuesday					
	8/30/2017			8/31/2017			9/1/2017			9/2/2017			9/3/2017			9/4/2017			9/5/2017			Mid-Week Average		
Time	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total
12:00 AM	14	19	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	19	33
1:00 AM	13	10	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	10	23
2:00 AM	4	2	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	6
3:00 AM	6	3	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	3	9
4:00 AM	27	31	58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27	31	58
5:00 AM	118	93	211	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	118	93	211
6:00 AM	259	131	390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	259	131	390
7:00 AM	686	322	1,008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	686	322	1,008
8:00 AM	903	411	1,314	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	903	411	1,314
9:00 AM	651	335	986	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	651	335	986
10:00 AM	492	339	831	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	492	339	831
11:00 AM	522	404	926	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	522	404	926
12:00 PM	521	434	955	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	521	434	955
1:00 PM	512	485	997	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	512	485	997
2:00 PM	579	429	1,008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	579	429	1,008
3:00 PM	545	475	1,020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	545	475	1,020
4:00 PM	545	468	1,013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	545	468	1,013
5:00 PM	492	594	1,086	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	492	594	1,086
6:00 PM	379	490	869	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	379	490	869
7:00 PM	244	345	589	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	244	345	589
8:00 PM	216	257	473	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	216	257	473
9:00 PM	138	157	295	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	138	157	295
10:00 PM	62	105	167	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62	105	167
11:00 PM	18	45	63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	45	63
Total	**7,946**	**6,384**	**14,330**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**7,946**	**6,384**	**14,330**
Percent	**55%**	**45%**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**55%**	**45%**	-

1. Mid-week average includes data between Tuesday and Thursday.

Deon Fouche: (415) 757-7714
deon.fouche@idaxdata.com

APPENDIX B: DETAILED INTERSECTION LOS RESULTS

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Existing**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	108	109	100.9%	31.1	5.4	C
	Through	83	82	98.2%	28.1	6.2	C
	Right Turn	128	130	101.2%	3.0	1.2	A
	Subtotal	319	320	100.3%	18.5	2.4	B
SB	Left Turn	143	146	102.4%	37.7	10.2	D
	Through	291	293	100.6%	28.9	8.1	C
	Right Turn	9	10	110.0%	5.2	6.3	A
	Subtotal	443	449	101.4%	31.3	8.3	C
EB	Left Turn	17	16	92.9%	34.3	9.5	C
	Through	546	556	101.8%	25.9	2.1	C
	Right Turn	193	192	99.5%	8.7	1.7	A
	Subtotal	756	763	101.0%	21.5	2.1	C
WB	Left Turn	47	47	98.9%	37.4	6.2	D
	Through	284	297	104.4%	14.7	2.7	B
	Right Turn	33	33	99.1%	2.2	0.9	A
	Subtotal	364	376	103.2%	16.2	2.9	B
Total		1,882	1,908	101.4%	22.4	2.7	C

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	19	20	103.7%	67.5	87.4	F
	Through						
	Right Turn	107	107	99.9%	2.3	0.6	A
	Subtotal	126	127	100.5%	17.3	28.3	C
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	760	772	101.6%	3.9	0.5	A
	Right Turn	101	105	104.0%	3.0	0.5	A
	Subtotal	861	877	101.8%	3.8	0.5	A
WB	Left Turn	239	248	103.8%	13.0	3.7	B
	Through	387	405	104.7%	1.9	0.3	A
	Right Turn						
	Subtotal	626	653	104.3%	6.4	2.0	A
Total		1,613	1,657	102.7%	5.7	2.4	A

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	118	117	98.8%	31.1	6.4	C
	Through						
	Right Turn	480	478	99.6%	16.5	2.4	B
	Subtotal	598	595	99.5%	19.4	2.3	B
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	349	350	100.3%	31.7	6.9	C
	Right Turn	518	529	102.1%	15.4	3.3	B
	Subtotal	867	879	101.4%	22.1	3.0	C
WB	Left Turn	266	251	94.4%	17.2	2.7	B
	Through	508	539	106.0%	2.6	0.3	A
	Right Turn						
	Subtotal	774	790	102.1%	7.3	1.3	A
Total		2,239	2,264	101.1%	16.3	2.1	B

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	460	471	102.4%	51.8	17.6	D
	Through						
	Right Turn	424	425	100.3%	9.1	7.6	A
	Subtotal	884	896	101.4%	32.1	13.9	C
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	684	686	100.3%	15.7	5.8	B
	Right Turn	145	141	97.4%	9.4	3.2	A
	Subtotal	829	827	99.8%	14.7	5.4	B
WB	Left Turn						
	Through	314	320	101.9%	7.4	1.7	A
	Right Turn	168	171	101.7%	0.6	0.1	A
	Subtotal	482	491	101.8%	5.1	1.1	A
Total		2,195	2,214	100.9%	19.7	6.8	B

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	94	93	99.0%	14.3	3.0	B
	Through	6	6	103.3%	7.6	7.8	A
	Right Turn	32	34	105.9%	0.2	0.2	A
	Subtotal	132	133	100.9%	11.0	2.4	B
SB	Left Turn	6	5	88.3%	14.5	13.8	B
	Through	9	9	98.9%	20.6	8.6	C
	Right Turn	32	34	105.9%	0.3	0.2	A
	Subtotal	47	48	102.3%	6.2	3.2	A
EB	Left Turn	162	163	100.6%	16.0	3.4	B
	Through	372	380	102.1%	8.8	2.0	A
	Right Turn	519	516	99.5%	5.2	0.6	A
	Subtotal	1,053	1,059	100.6%	8.1	1.3	A
WB	Left Turn	74	69	93.4%	17.5	4.5	B
	Through	356	363	101.9%	12.9	1.6	B
	Right Turn	10	11	107.0%	4.9	3.1	A
	Subtotal	440	443	100.6%	13.4	1.4	B
Total		1,672	1,683	100.7%	9.7	1.1	A

SimTraffic Post-Processor **Los Gamos Kaiser**
Average Results from 10 Runs **Existing**
Volume and Delay by Movement **PM Peak Hour**

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	118	120	101.8%	18.1	2.4	B
	Through	118	117	98.9%	16.1	3.5	B
	Right Turn	91	92	100.7%	1.9	0.4	A
	Subtotal	327	328	100.4%	12.8	2.2	B
SB	Left Turn	45	44	98.7%	21.9	3.7	C
	Through	102	100	98.0%	18.8	2.6	B
	Right Turn	33	33	99.7%	1.4	0.3	A
	Subtotal	180	177	98.5%	16.3	1.8	B
EB	Left Turn	21	18	87.1%	23.9	9.1	C
	Through	337	336	99.7%	16.6	2.0	B
	Right Turn	96	90	93.8%	3.4	0.4	A
	Subtotal	454	444	97.9%	14.3	1.7	B
WB	Left Turn	88	90	102.4%	23.1	5.4	C
	Through	385	389	101.0%	12.7	1.6	B
	Right Turn	58	59	102.4%	2.6	0.5	A
	Subtotal	531	538	101.4%	13.1	1.6	B
Total		1,492	1,488	99.8%	13.8	1.4	B

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	45	47	105.1%	29.0	10.7	D
	Through						
	Right Turn	257	255	99.1%	3.6	0.7	A
	Subtotal	302	302	100.0%	8.3	2.5	A
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	514	519	101.0%	2.4	0.2	A
	Right Turn	27	28	102.2%	1.9	0.7	A
	Subtotal	541	547	101.0%	2.3	0.2	A
WB	Left Turn	173	171	98.8%	6.7	1.6	A
	Through	559	562	100.6%	1.3	0.2	A
	Right Turn						
	Subtotal	732	733	100.2%	2.6	0.6	A
Total		1,575	1,582	100.4%	3.5	0.7	A

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	141	135	95.5%	31.6	4.5	C
	Through						
	Right Turn	210	213	101.2%	8.0	3.1	A
	Subtotal	351	347	98.9%	17.6	3.8	B
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	326	327	100.2%	33.5	9.5	C
	Right Turn	445	446	100.2%	19.8	2.9	B
	Subtotal	771	773	100.2%	25.7	5.0	C
WB	Left Turn	512	521	101.7%	39.9	3.6	D
	Through	591	600	101.5%	3.5	0.5	A
	Right Turn						
	Subtotal	1,103	1,120	101.6%	19.8	2.5	B
Total		2,225	2,240	100.7%	21.6	2.1	C

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	446	440	98.6%	28.1	6.5	C
	Through						
	Right Turn	388	388	99.9%	4.1	2.3	A
	Subtotal	834	828	99.2%	17.2	5.2	B
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	315	322	102.2%	9.0	1.5	A
	Right Turn	221	217	98.4%	5.9	0.3	A
	Subtotal	536	539	100.6%	7.8	1.0	A
WB	Left Turn						
	Through	657	678	103.2%	15.0	4.2	B
	Right Turn	471	462	98.0%	1.1	0.2	A
	Subtotal	1,128	1,140	101.0%	9.6	2.7	A
Total		2,498	2,507	100.3%	11.6	3.1	B

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Existing**
Volume and Delay by Movement | **PM Peak Hour**

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	419	412	98.4%	13.7	1.6	B
	Through	10	12	121.0%	9.7	7.2	A
	Right Turn	82	82	100.2%	0.7	0.3	A
	Subtotal	511	506	99.1%	11.5	1.5	B
SB	Left Turn	7	7	97.1%	23.8	18.7	C
	Through	9	10	112.2%	22.3	10.2	C
	Right Turn	170	167	98.1%	1.1	0.7	A
	Subtotal	186	184	98.7%	3.4	1.8	A
EB	Left Turn	68	66	96.5%	23.4	4.2	C
	Through	470	474	100.9%	12.2	2.0	B
	Right Turn	154	160	104.2%	3.0	0.3	A
	Subtotal	692	700	101.2%	11.2	1.4	B
WB	Left Turn	31	31	101.3%	27.3	5.7	C
	Through	539	560	103.8%	16.0	2.3	B
	Right Turn	11	11	103.6%	10.7	7.4	B
	Subtotal	581	602	103.7%	16.4	2.2	B
Total		1,970	1,992	101.1%	12.2	1.1	B

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Existing Plus Project**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	108	104	96.4%	29.4	8.1	C
	Through	83	83	100.4%	27.6	8.9	C
	Right Turn	132	134	101.7%	3.0	0.9	A
	Subtotal	323	322	99.6%	18.2	5.2	B
SB	Left Turn	145	147	101.1%	36.3	8.1	D
	Through	291	287	98.7%	28.7	6.7	C
	Right Turn	9	8	91.1%	5.4	7.1	A
	Subtotal	445	442	99.3%	30.8	7.0	C
EB	Left Turn	17	17	101.2%	44.6	17.0	D
	Through	557	562	100.8%	25.6	2.9	C
	Right Turn	193	187	97.0%	8.6	2.1	A
	Subtotal	767	766	99.9%	21.5	2.8	C
WB	Left Turn	48	45	94.0%	34.1	7.9	C
	Through	287	289	100.7%	13.9	2.6	B
	Right Turn	34	33	96.5%	2.1	0.5	A
	Subtotal	369	367	99.4%	16.1	3.7	B
Total		1,904	1,897	99.6%	22.1	3.3	C

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	24	22	91.7%	200.2	152.5	F
	Through						
	Right Turn	168	158	94.0%	9.2	18.8	A
	Subtotal	192	180	93.8%	36.5	40.1	E
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	760	769	101.2%	4.7	0.6	A
	Right Turn	118	121	102.1%	3.4	0.5	A
	Subtotal	878	890	101.4%	4.5	0.5	A
WB	Left Turn	437	440	100.6%	31.9	13.4	D
	Through	387	383	99.0%	7.6	7.5	A
	Right Turn						
	Subtotal	824	823	99.9%	20.6	11.1	C
Total		1,894	1,893	99.9%	14.7	6.7	B

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	221	227	102.5%	57.3	18.1	E
	Through						
	Right Turn	480	491	102.3%	36.4	16.5	D
	Subtotal	701	717	102.3%	42.8	17.4	D
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	384	387	100.7%	31.2	3.3	C
	Right Turn	544	541	99.4%	15.8	1.5	B
	Subtotal	928	928	99.9%	22.6	1.7	C
WB	Left Turn	266	250	94.1%	18.3	5.6	B
	Through	603	595	98.7%	6.7	8.6	A
	Right Turn						
	Subtotal	869	845	97.3%	10.3	7.4	B
Total		2,498	2,490	99.7%	24.2	5.9	C

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	546	524	96.0%	142.0	35.1	F
	Through						
	Right Turn	424	389	91.6%	94.4	34.8	F
	Subtotal	970	912	94.1%	122.1	35.1	F
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	687	702	102.2%	19.2	3.9	B
	Right Turn	177	176	99.3%	12.2	2.6	B
	Subtotal	864	878	101.6%	17.7	3.5	B
WB	Left Turn						
	Through	323	323	99.9%	7.1	1.3	A
	Right Turn	168	174	103.7%	0.5	0.3	A
	Subtotal	491	497	101.2%	5.1	0.8	A
Total		2,325	2,287	98.4%	55.9	13.3	E

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	94	92	98.1%	12.2	2.8	B
	Through	6	6	101.7%	10.4	8.9	B
	Right Turn	32	37	115.0%	0.2	0.1	A
	Subtotal	132	135	102.3%	9.5	1.7	A
SB	Left Turn	6	7	108.3%	17.8	17.5	B
	Through	9	9	103.3%	22.6	10.0	C
	Right Turn	32	34	104.7%	0.4	0.1	A
	Subtotal	47	49	104.9%	8.1	3.9	A
EB	Left Turn	162	155	95.4%	15.7	3.0	B
	Through	375	370	98.8%	8.4	1.0	A
	Right Turn	519	505	97.3%	6.0	1.0	A
	Subtotal	1,056	1,030	97.5%	8.3	0.9	A
WB	Left Turn	74	69	93.0%	18.8	3.0	B
	Through	365	370	101.5%	12.6	1.6	B
	Right Turn	10	10	97.0%	5.3	7.3	A
	Subtotal	449	449	100.0%	13.3	1.7	B
Total		1,684	1,663	98.8%	9.8	1.1	A

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Existing Plus Project**
Volume and Delay by Movement | **PM Peak Hour**

Intersection 1 | **Las Gallinas Ave/Lucas Valley Rd** | **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	118	120	101.7%	18.3	3.5	B
	Through	118	119	101.0%	17.1	4.1	B
	Right Turn	94	95	100.5%	2.0	0.3	A
	Subtotal	330	334	101.1%	13.2	2.5	B
SB	Left Turn	46	45	97.8%	23.0	4.1	C
	Through	102	105	102.9%	19.4	3.2	B
	Right Turn	33	32	96.1%	1.5	0.4	A
	Subtotal	181	182	100.4%	17.4	2.3	B
EB	Left Turn	21	22	103.8%	26.7	5.5	C
	Through	344	344	100.0%	16.1	2.2	B
	Right Turn	96	99	103.1%	3.6	0.5	A
	Subtotal	461	465	100.8%	13.9	1.8	B
WB	Left Turn	94	92	97.3%	22.9	2.8	C
	Through	401	411	102.5%	12.4	2.0	B
	Right Turn	61	61	100.7%	2.5	0.4	A
	Subtotal	556	564	101.4%	12.9	1.7	B
Total		1,528	1,544	101.1%	13.8	1.6	B

Intersection 2 | **Los Gamos Dr/Lucas Valley Rd** | **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	71	65	91.7%	101.4	107.2	F
	Through						
	Right Turn	555	539	97.2%	59.2	101.0	F
	Subtotal	626	604	96.5%	64.1	101.2	F
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	514	508	98.9%	34.2	61.5	D
	Right Turn	38	37	97.6%	20.6	44.8	C
	Subtotal	552	545	98.8%	33.4	60.5	D
WB	Left Turn	299	306	102.2%	11.2	2.8	B
	Through	559	577	103.2%	1.7	0.2	A
	Right Turn						
	Subtotal	858	882	102.8%	5.0	1.0	A
Total		2,036	2,032	99.8%	30.1	43.5	D

SimTraffic Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

Los Gamos Kaiser
Existing Plus Project
PM Peak Hour

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	207	216	104.3%	37.3	9.4	D
	Through						
	Right Turn	210	209	99.4%	11.1	4.0	B
	Subtotal	417	425	101.8%	24.5	7.7	C
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	494	479	96.9%	120.0	88.2	F
	Right Turn	575	569	99.0%	80.9	73.6	F
	Subtotal	1,069	1,048	98.1%	98.9	80.8	F
WB	Left Turn	512	502	98.0%	38.6	4.1	D
	Through	651	666	102.2%	3.8	0.7	A
	Right Turn						
	Subtotal	1,163	1,168	100.4%	19.3	2.2	B
Total		2,649	2,640	99.7%	50.8	29.2	D

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	501	499	99.5%	24.3	4.0	C
	Through						
	Right Turn	388	390	100.5%	3.4	0.9	A
	Subtotal	889	889	99.9%	14.8	3.1	B
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	328	325	98.9%	10.3	1.7	B
	Right Turn	377	364	96.4%	7.1	0.2	A
	Subtotal	705	688	97.6%	8.7	0.9	A
WB	Left Turn						
	Through	662	670	101.3%	20.4	5.1	C
	Right Turn	471	474	100.5%	1.2	0.2	A
	Subtotal	1,133	1,144	101.0%	12.5	3.2	B
Total		2,727	2,720	99.8%	12.3	1.4	B

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	419	425	101.5%	13.3	1.1	B
	Through	10	8	84.0%	8.3	6.7	A
	Right Turn	82	84	102.7%	0.7	0.2	A
	Subtotal	511	518	101.3%	11.2	1.0	B
SB	Left Turn	7	9	121.4%	20.6	14.9	C
	Through	9	9	95.6%	17.9	13.9	B
	Right Turn	170	174	102.1%	1.8	1.0	A
	Subtotal	186	191	102.5%	3.7	1.9	A
EB	Left Turn	68	66	97.2%	22.1	3.3	C
	Through	483	478	99.0%	12.1	2.2	B
	Right Turn	154	156	101.0%	3.1	0.3	A
	Subtotal	705	700	99.3%	11.0	1.6	B
WB	Left Turn	31	31	98.4%	27.8	3.5	C
	Through	544	544	100.0%	17.0	4.0	B
	Right Turn	11	11	101.8%	13.1	10.4	B
	Subtotal	586	586	100.0%	17.5	3.9	B
Total		1,988	1,994	100.3%	12.2	1.9	B

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Baseline No Project**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	97	94	97.0%	34.8	4.7	C
	Through	189	188	99.2%	28.1	4.5	C
	Right Turn	138	140	101.4%	6.6	2.3	A
	Subtotal	424	422	99.4%	22.9	2.9	C
SB	Left Turn	208	150	71.9%	223.4	29.6	F
	Through	395	282	71.4%	200.6	18.0	F
	Right Turn	20	13	67.0%	178.9	72.0	F
	Subtotal	623	445	71.4%	208.8	22.5	F
EB	Left Turn	40	32	81.0%	123.7	19.2	F
	Through	729	596	81.8%	107.7	15.9	F
	Right Turn	366	310	84.6%	88.0	12.6	F
	Subtotal	1,135	938	82.7%	101.7	14.4	F
WB	Left Turn	67	55	81.9%	46.5	10.0	D
	Through	290	253	87.2%	16.5	3.5	B
	Right Turn	82	74	90.1%	2.4	0.5	A
	Subtotal	439	382	87.0%	17.6	3.1	B
Total		2,621	2,186	83.4%	94.4	7.4	F

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	19	20	103.7%	240.7	185.1	F
	Through						
	Right Turn	123	121	98.7%	47.4	99.6	E
	Subtotal	142	141	99.4%	66.5	111.2	F
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	900	736	81.8%	48.6	41.9	E
	Right Turn	214	177	82.6%	43.7	38.1	E
	Subtotal	1,114	913	81.9%	47.6	41.2	E
WB	Left Turn	494	428	86.6%	43.7	28.0	E
	Through	477	404	84.7%	17.4	16.7	C
	Right Turn						
	Subtotal	971	832	85.6%	31.1	22.4	D
Total		2,227	1,885	84.7%	44.1	24.5	E

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	196	173	88.1%	76.7	28.6	E
	Through						
	Right Turn	631	558	88.4%	52.7	10.2	D
	Subtotal	827	730	88.3%	58.9	15.1	E
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	471	383	81.3%	129.3	72.6	F
	Right Turn	552	466	84.3%	68.0	47.4	E
	Subtotal	1,023	849	83.0%	97.1	60.1	F
WB	Left Turn	247	244	98.7%	20.4	8.1	C
	Through	775	661	85.3%	17.2	22.0	B
	Right Turn						
	Subtotal	1,022	904	88.5%	17.9	17.8	B
Total		2,872	2,484	86.5%	57.5	25.1	E

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	630	513	81.4%	88.6	17.3	F
	Through						
	Right Turn	411	328	79.8%	33.5	6.6	C
	Subtotal	1,041	841	80.8%	67.2	12.8	E
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	977	841	86.1%	47.3	15.8	D
	Right Turn	125	99	79.0%	34.2	14.6	C
	Subtotal	1,102	940	85.3%	45.8	15.9	D
WB	Left Turn						
	Through	392	396	101.0%	11.2	4.8	B
	Right Turn	183	184	100.8%	0.5	0.1	A
	Subtotal	575	580	100.9%	7.9	3.4	A
Total		2,718	2,361	86.9%	43.9	3.7	D

SimTraffic Post-Processor **Los Gamos Kaiser**
Average Results from 10 Runs **Baseline No Project**
Volume and Delay by Movement **AM Peak Hour**

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	Total Delay (sec/veh) LOS
NB	Left Turn	135	134	99.6%	15.1	3.9	B
	Through	12	14	113.3%	18.0	6.5	B
	Right Turn	59	63	107.3%	0.4	0.2	A
	Subtotal	206	211	102.6%	11.5	3.2	B
SB	Left Turn	6	6	105.0%	22.2	10.2	C
	Through	62	63	101.0%	22.2	4.1	C
	Right Turn	106	106	99.9%	1.0	0.3	A
	Subtotal	174	175	100.5%	9.0	2.2	A
EB	Left Turn	123	102	83.1%	20.5	3.5	C
	Through	411	356	86.6%	14.6	2.9	B
	Right Turn	779	656	84.2%	13.5	3.8	B
	Subtotal	1,313	1,114	84.8%	14.4	2.8	B
WB	Left Turn	139	138	99.6%	24.7	5.4	C
	Through	334	341	102.2%	15.2	2.3	B
	Right Turn	12	12	102.5%	5.0	3.6	A
	Subtotal	485	492	101.4%	17.7	2.7	B
Total		2,178	1,992	91.5%	14.5	2.0	B

SimTraffic Post-Processor **Los Gamos Kaiser**
Average Results from 10 Runs **Baseline No Project**
Volume and Delay by Movement **PM Peak Hour**

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	158	146	92.5%	27.7	6.0	C
	Through	153	161	105.0%	25.5	3.7	C
	Right Turn	147	148	100.9%	5.7	4.1	A
	Subtotal	458	455	99.4%	20.0	4.0	C
SB	Left Turn	88	82	93.3%	77.5	54.1	E
	Through	97	92	95.3%	42.9	21.6	D
	Right Turn	22	23	105.9%	18.6	25.4	B
	Subtotal	207	198	95.6%	52.6	32.3	D
EB	Left Turn	13	14	108.5%	62.5	34.6	E
	Through	357	344	96.2%	75.4	45.0	E
	Right Turn	74	78	105.3%	33.4	26.1	C
	Subtotal	444	436	98.1%	66.3	39.1	E
WB	Left Turn	110	108	97.7%	30.9	7.1	C
	Through	383	371	97.0%	13.0	2.5	B
	Right Turn	110	111	100.7%	2.4	0.5	A
	Subtotal	603	590	97.8%	13.8	1.7	B
Total		1,712	1,678	98.0%	33.8	13.7	C

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	74	53	70.9%	338.4	57.3	F
	Through						
	Right Turn	594	405	68.1%	378.9	21.6	F
	Subtotal	668	457	68.4%	374.6	22.9	F
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	579	499	86.1%	186.9	31.7	F
	Right Turn	79	69	86.7%	156.1	34.8	F
	Subtotal	658	567	86.2%	183.8	31.3	F
WB	Left Turn	213	216	101.6%	9.4	1.6	A
	Through	614	616	100.4%	1.6	0.2	A
	Right Turn						
	Subtotal	827	833	100.7%	3.7	0.4	A
Total		2,153	1,857	86.2%	150.0	9.0	F

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	166	163	98.1%	28.6	5.4	C
	Through						
	Right Turn	255	254	99.6%	6.5	0.7	A
	Subtotal	421	417	99.0%	15.3	2.5	B
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	537	431	80.2%	462.4	94.2	F
	Right Turn	636	468	73.6%	379.0	93.4	F
	Subtotal	1,173	899	76.6%	419.3	93.1	F
WB	Left Turn	629	628	99.8%	39.1	5.6	D
	Through	661	670	101.3%	5.5	0.7	A
	Right Turn						
	Subtotal	1,290	1,297	100.6%	22.1	3.5	C
Total		2,884	2,613	90.6%	156.1	29.8	F

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	418	419	100.1%	28.1	7.8	C
	Through						
	Right Turn	442	433	98.0%	4.1	1.3	A
	Subtotal	860	852	99.0%	15.9	4.3	B
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	439	402	91.5%	9.3	1.1	A
	Right Turn	353	284	80.4%	6.6	0.2	A
	Subtotal	792	685	86.5%	8.3	0.7	A
WB	Left Turn						
	Through	872	878	100.7%	28.9	7.4	C
	Right Turn	682	673	98.7%	2.0	0.3	A
	Subtotal	1,554	1,551	99.8%	17.0	4.8	B
Total		3,206	3,088	96.3%	14.6	2.4	B

SimTraffic Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

Los Gamos Kaiser
Baseline No Project
PM Peak Hour

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	675	684	101.3%	27.7	11.4	C
	Through	35	36	103.7%	30.1	14.1	C
	Right Turn	146	156	106.6%	3.2	3.2	A
	Subtotal	856	876	102.3%	23.3	9.8	C
SB	Left Turn	16	13	82.5%	35.3	17.1	D
	Through	47	49	104.5%	36.2	12.0	D
	Right Turn	249	253	101.8%	5.9	2.7	A
	Subtotal	312	316	101.2%	11.5	3.9	B
EB	Left Turn	140	132	94.6%	30.7	5.2	C
	Through	500	474	94.8%	21.3	3.6	C
	Right Turn	225	207	92.0%	3.6	0.5	A
	Subtotal	865	814	94.1%	18.1	2.8	B
WB	Left Turn	76	73	96.3%	78.2	65.7	E
	Through	630	618	98.1%	78.8	65.7	E
	Right Turn	14	13	92.1%	59.9	72.0	E
	Subtotal	720	704	97.8%	78.2	65.7	E
Total		2,753	2,710	98.4%	35.0	20.5	C

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Baseline with Existing Occupancy No Project**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	97	99	102.1%	40.8	12.8	D
	Through	189	180	95.4%	27.3	3.3	C
	Right Turn	135	133	98.1%	5.4	1.8	A
	Subtotal	421	412	97.8%	24.1	4.6	C
SB	Left Turn	207	146	70.7%	218.5	22.4	F
	Through	395	278	70.4%	194.1	25.2	F
	Right Turn	20	14	71.0%	197.9	46.9	F
	Subtotal	622	439	70.5%	202.2	24.7	F
EB	Left Turn	40	33	83.3%	115.8	16.7	F
	Through	722	603	83.6%	99.7	6.8	F
	Right Turn	366	320	87.5%	80.4	4.1	F
	Subtotal	1,128	957	84.8%	93.9	5.6	F
WB	Left Turn	67	64	95.1%	48.8	12.5	D
	Through	289	273	94.6%	15.3	4.3	B
	Right Turn	82	82	99.8%	2.9	0.5	A
	Subtotal	438	419	95.6%	17.8	2.2	B
Total		2,609	2,226	85.3%	89.6	4.2	F

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	17	17	98.2%	103.2	119.9	F
	Through						
	Right Turn	106	106	100.0%	2.4	0.8	A
	Subtotal	123	123	99.8%	24.1	28.8	C
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	900	751	83.4%	31.7	29.4	D
	Right Turn	203	175	86.0%	27.5	26.0	D
	Subtotal	1,103	925	83.9%	30.9	28.7	D
WB	Left Turn	368	351	95.3%	26.4	13.2	D
	Through	477	453	95.0%	7.0	6.8	A
	Right Turn						
	Subtotal	845	804	95.1%	15.8	9.8	C
Total		2,071	1,852	89.4%	23.6	15.1	C

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Baseline with Existing Occupancy No Project**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	130	131	101.1%	46.1	5.0	D
	Through						
	Right Turn	631	635	100.6%	37.0	5.9	D
	Subtotal	761	767	100.7%	38.4	5.5	D
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	461	391	84.9%	111.9	59.5	F
	Right Turn	545	462	84.8%	49.9	38.0	D
	Subtotal	1,006	854	84.9%	78.1	48.0	E
WB	Left Turn	247	245	99.2%	17.2	3.6	B
	Through	715	672	94.0%	5.8	7.0	A
	Right Turn						
	Subtotal	962	917	95.4%	8.9	5.9	A
Total		2,729	2,537	93.0%	40.7	16.3	D

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	575	526	91.5%	78.6	7.3	E
	Through						
	Right Turn	411	365	88.8%	27.7	3.7	C
	Subtotal	986	891	90.4%	57.9	7.3	E
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	976	925	94.8%	47.2	2.1	D
	Right Turn	116	96	82.6%	36.0	3.6	D
	Subtotal	1,092	1,021	93.5%	46.2	2.4	D
WB	Left Turn						
	Through	387	393	101.5%	8.6	1.7	A
	Right Turn	183	194	105.8%	0.6	0.2	A
	Subtotal	570	586	102.9%	6.0	1.3	A
Total		2,648	2,498	94.4%	40.5	2.6	D

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Baseline with Existing Occupancy No Project**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 5 | **Redwood Dr/Smith Ranch Rd** | **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	135	139	103.0%	16.1	3.8	B
	Through	12	12	101.7%	16.2	6.3	B
	Right Turn	59	58	98.3%	0.4	0.2	A
	Subtotal	206	209	101.6%	11.6	3.3	B
SB	Left Turn	6	6	91.7%	15.5	12.4	B
	Through	62	61	98.5%	22.8	4.3	C
	Right Turn	106	109	102.9%	1.0	0.2	A
	Subtotal	174	176	101.0%	9.4	2.5	A
EB	Left Turn	123	115	93.7%	22.6	2.5	C
	Through	410	378	92.1%	19.9	2.5	B
	Right Turn	779	726	93.2%	19.4	6.9	B
	Subtotal	1,312	1,219	92.9%	19.9	4.9	B
WB	Left Turn	139	142	102.1%	22.0	3.5	C
	Through	329	341	103.6%	14.8	3.2	B
	Right Turn	12	13	108.3%	4.7	2.7	A
	Subtotal	480	496	103.3%	16.6	2.4	B
Total		2,172	2,100	96.7%	17.4	3.3	B

SimTraffic Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

Los Gamos Kaiser
Baseline with Existing Occupancy No Project
PM Peak Hour

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	158	155	98.2%	29.9	8.1	C
	Through	153	162	105.6%	26.6	7.3	C
	Right Turn	146	142	97.4%	4.8	3.1	A
	Subtotal	457	459	100.4%	21.2	4.7	C
SB	Left Turn	88	83	94.1%	72.7	59.1	E
	Through	97	97	99.9%	50.6	53.2	D
	Right Turn	22	19	88.2%	17.2	30.7	B
	Subtotal	207	199	96.2%	57.9	54.8	E
EB	Left Turn	13	13	103.1%	110.4	88.2	F
	Through	356	343	96.3%	117.4	92.4	F
	Right Turn	74	76	103.2%	85.8	84.0	F
	Subtotal	443	433	97.7%	111.1	90.2	F
WB	Left Turn	108	106	98.1%	30.0	7.5	C
	Through	377	365	96.9%	11.6	0.9	B
	Right Turn	109	116	106.1%	3.0	0.6	A
	Subtotal	594	587	98.8%	13.3	1.8	B
Total		1,701	1,678	98.6%	46.6	30.2	D

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	64	52	80.9%	369.4	67.9	F
	Through						
	Right Turn	480	396	82.5%	361.5	28.4	F
	Subtotal	544	448	82.3%	362.0	30.6	F
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	579	496	85.6%	200.1	17.6	F
	Right Turn	77	64	82.5%	182.0	21.1	F
	Subtotal	656	559	85.2%	198.0	17.4	F
WB	Left Turn	190	187	98.3%	8.8	1.1	A
	Through	614	625	101.8%	2.0	0.3	A
	Right Turn						
	Subtotal	804	812	101.0%	3.6	0.5	A
Total		2,004	1,819	90.8%	151.5	8.4	F

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	154	157	101.7%	27.9	4.5	C
	Through						
	Right Turn	255	252	99.0%	9.7	4.1	A
	Subtotal	409	409	100.0%	16.9	4.8	B
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	473	433	91.5%	492.4	24.1	F
	Right Turn	586	457	78.1%	410.1	20.4	F
	Subtotal	1,059	890	84.1%	450.1	22.7	F
WB	Left Turn	629	619	98.4%	38.9	2.9	D
	Through	650	654	100.6%	5.8	1.4	A
	Right Turn						
	Subtotal	1,279	1,273	99.5%	22.4	2.5	C
Total		2,747	2,572	93.6%	168.0	9.0	F

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	408	408	100.1%	25.3	3.7	C
	Through						
	Right Turn	442	449	101.5%	4.3	1.3	A
	Subtotal	850	857	100.8%	14.4	2.9	B
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	434	414	95.3%	10.8	1.6	B
	Right Turn	294	272	92.5%	8.0	0.4	A
	Subtotal	728	686	94.2%	9.7	1.0	A
WB	Left Turn						
	Through	871	867	99.5%	30.0	5.5	C
	Right Turn	682	677	99.3%	2.0	0.3	A
	Subtotal	1,553	1,544	99.4%	17.3	3.3	B
Total		3,131	3,087	98.6%	14.8	2.1	B

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	675	665	98.5%	25.1	5.0	C
	Through	35	35	100.0%	23.6	7.8	C
	Right Turn	146	145	99.0%	2.5	2.6	A
	Subtotal	856	845	98.7%	21.2	4.6	C
SB	Left Turn	16	17	108.8%	39.3	15.7	D
	Through	47	49	105.1%	39.3	8.1	D
	Right Turn	249	248	99.4%	8.5	3.5	A
	Subtotal	312	314	100.8%	14.9	2.9	B
EB	Left Turn	140	133	95.1%	32.8	3.8	C
	Through	495	487	98.4%	22.5	3.3	C
	Right Turn	225	227	101.0%	5.1	1.6	A
	Subtotal	860	848	98.6%	19.5	2.3	B
WB	Left Turn	76	72	94.7%	90.0	57.5	F
	Through	629	632	100.5%	84.4	57.9	F
	Right Turn	14	13	93.6%	61.4	65.5	E
	Subtotal	719	717	99.7%	84.8	57.7	F
Total		2,747	2,724	99.2%	36.1	14.6	D

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Baseline Plus Project**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	97	89	92.0%	39.6	9.1	D
	Through	189	187	99.2%	35.0	4.0	C
	Right Turn	140	144	103.0%	9.9	4.8	A
	Subtotal	426	421	98.8%	27.6	3.0	C
SB	Left Turn	209	179	85.5%	318.7	65.4	F
	Through	395	342	86.6%	313.5	58.9	F
	Right Turn	20	18	89.5%	283.6	80.1	F
	Subtotal	624	538	86.3%	314.6	61.2	F
EB	Left Turn	40	38	95.0%	263.1	54.3	F
	Through	733	662	90.3%	245.9	38.9	F
	Right Turn	366	333	90.8%	233.9	36.9	F
	Subtotal	1,139	1,033	90.7%	242.8	37.3	F
WB	Left Turn	68	54	78.8%	44.2	11.3	D
	Through	292	235	80.5%	17.9	2.7	B
	Right Turn	82	69	83.9%	2.3	0.3	A
	Subtotal	442	358	80.9%	18.9	3.3	B
Total		2,631	2,349	89.3%	182.3	23.2	F

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	23	10	41.3%	662.0	176.3	F
	Through						
	Right Turn	166	109	65.8%	519.1	235.1	F
	Subtotal	189	119	62.8%	463.1	279.3	F
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	901	808	89.7%	25.8	40.6	D
	Right Turn	220	202	92.0%	24.2	41.8	C
	Subtotal	1,121	1,011	90.1%	25.4	40.7	D
WB	Left Turn	566	472	83.4%	51.9	12.3	F
	Through	476	386	81.1%	16.5	7.3	C
	Right Turn						
	Subtotal	1,042	858	82.3%	35.6	9.7	E
Total		2,352	1,987	84.5%	41.1	19.7	E

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	233	198	85.2%	202.4	44.0	F
	Through						
	Right Turn	631	518	82.1%	182.5	26.5	F
	Subtotal	864	717	82.9%	188.3	31.0	F
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	496	399	80.4%	94.4	95.0	F
	Right Turn	571	516	90.4%	59.2	73.4	E
	Subtotal	1,067	915	85.7%	75.4	85.9	E
WB	Left Turn	247	235	95.3%	22.0	3.5	C
	Through	809	660	81.6%	13.5	10.6	B
	Right Turn						
	Subtotal	1,056	895	84.8%	15.7	8.4	B
Total		2,987	2,527	84.6%	87.1	33.3	F

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	661	509	77.0%	213.7	40.6	F
	Through						
	Right Turn	411	319	77.7%	162.2	21.6	F
	Subtotal	1,072	829	77.3%	193.8	33.3	F
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	979	805	82.2%	35.2	9.5	D
	Right Turn	148	114	77.0%	26.5	8.2	C
	Subtotal	1,127	919	81.5%	34.1	9.4	C
WB	Left Turn						
	Through	395	386	97.7%	14.1	10.3	B
	Right Turn	183	195	106.3%	0.4	0.1	A
	Subtotal	578	581	100.4%	9.6	6.6	A
Total		2,777	2,328	83.8%	84.1	5.4	F

SimTraffic Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

Los Gamos Kaiser
Baseline Plus Project
AM Peak Hour

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	135	130	96.4%	15.4	2.4	B
	Through	12	14	115.8%	13.1	5.6	B
	Right Turn	59	57	96.6%	1.2	0.7	A
	Subtotal	206	201	97.6%	11.5	2.4	B
SB	Left Turn	6	7	121.7%	24.5	12.9	C
	Through	62	63	101.5%	18.6	2.8	B
	Right Turn	106	110	103.8%	0.8	0.2	A
	Subtotal	174	180	103.6%	8.7	2.4	A
EB	Left Turn	123	98	79.8%	19.1	2.6	B
	Through	413	340	82.4%	13.4	3.2	B
	Right Turn	779	632	81.1%	12.1	3.5	B
	Subtotal	1,315	1,070	81.4%	13.2	2.0	B
WB	Left Turn	139	136	97.6%	20.1	3.1	C
	Through	337	340	100.7%	12.7	2.6	B
	Right Turn	12	14	120.0%	6.3	4.7	A
	Subtotal	488	490	100.3%	14.6	2.0	B
Total		2,183	1,941	88.9%	13.0	1.1	B

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	158	158	100.0%	22.6	5.7	C
	Through	153	155	101.0%	24.0	6.5	C
	Right Turn	149	148	99.6%	4.7	2.6	A
	Subtotal	460	461	100.2%	17.5	4.4	B
SB	Left Turn	89	83	93.6%	118.9	159.2	F
	Through	97	87	90.0%	90.2	129.1	F
	Right Turn	22	21	95.5%	44.4	83.0	D
	Subtotal	208	192	92.1%	100.5	143.2	F
EB	Left Turn	13	11	86.9%	83.9	102.3	F
	Through	363	353	97.4%	89.4	97.8	F
	Right Turn	74	70	94.7%	68.8	100.9	E
	Subtotal	450	435	96.6%	85.7	97.7	F
WB	Left Turn	114	105	92.2%	30.4	8.4	C
	Through	393	383	97.4%	11.7	1.9	B
	Right Turn	112	107	95.6%	3.0	0.5	A
	Subtotal	619	595	96.1%	13.5	2.4	B
Total		1,737	1,682	96.8%	38.4	31.4	D

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	90	49	54.6%	374.4	31.1	F
	Through						
	Right Turn	778	410	52.8%	363.2	12.2	F
	Subtotal	868	460	52.9%	364.5	11.6	F
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	579	501	86.5%	195.1	13.1	F
	Right Turn	88	76	86.1%	170.7	16.4	F
	Subtotal	667	577	86.4%	191.9	12.6	F
WB	Left Turn	316	314	99.4%	11.2	1.9	B
	Through	614	623	101.5%	2.8	0.4	A
	Right Turn						
	Subtotal	930	937	100.8%	5.6	1.0	A
Total		2,465	1,973	80.0%	143.8	6.7	F

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	220	227	103.0%	36.4	7.6	D
	Through						
	Right Turn	255	259	101.5%	14.9	8.9	B
	Subtotal	475	485	102.2%	25.0	9.0	C
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	641	426	66.4%	472.5	59.8	F
	Right Turn	716	483	67.4%	387.0	54.9	F
	Subtotal	1,357	908	66.9%	426.7	56.8	F
WB	Left Turn	629	610	97.0%	36.3	3.6	D
	Through	710	712	100.2%	5.7	0.7	A
	Right Turn						
	Subtotal	1,339	1,322	98.7%	20.0	1.8	B
Total		3,171	2,716	85.6%	155.6	16.3	F

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	463	461	99.5%	23.4	7.2	C
	Through						
	Right Turn	442	439	99.3%	4.8	2.5	A
	Subtotal	905	899	99.4%	14.2	4.7	B
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	447	386	86.4%	10.0	1.3	A
	Right Turn	449	300	66.8%	7.9	0.3	A
	Subtotal	896	686	76.6%	9.1	0.8	A
WB	Left Turn						
	Through	876	862	98.4%	36.4	3.7	D
	Right Turn	682	684	100.2%	2.1	0.5	A
	Subtotal	1,558	1,546	99.2%	20.9	2.2	C
Total		3,359	3,131	93.2%	16.3	1.1	B

SimTraffic Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

Los Gamos Kaiser
Baseline Plus Project
PM Peak Hour

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	675	676	100.2%	38.7	25.6	D
	Through	35	35	99.7%	35.4	24.0	D
	Right Turn	146	149	101.8%	7.3	10.0	A
	Subtotal	856	860	100.4%	33.1	22.6	C
SB	Left Turn	16	17	108.8%	34.7	10.5	C
	Through	47	46	97.0%	38.4	6.9	D
	Right Turn	249	248	99.6%	9.5	5.9	A
	Subtotal	312	311	99.7%	15.4	5.9	B
EB	Left Turn	140	131	93.8%	32.7	5.2	C
	Through	508	464	91.4%	23.2	3.3	C
	Right Turn	225	213	94.5%	5.0	1.5	A
	Subtotal	873	808	92.6%	19.9	1.6	B
WB	Left Turn	76	71	93.4%	138.1	88.3	F
	Through	634	624	98.5%	131.1	82.3	F
	Right Turn	14	14	99.3%	115.9	74.2	F
	Subtotal	724	709	98.0%	131.2	81.4	F
Total		2,765	2,688	97.2%	51.1	23.6	D

SimTraffic Post-Processor **Los Gamos Kaiser**
Average Results from 10 Runs **Cumulative No Project**
Volume and Delay by Movement **AM Peak Hour**

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	151	150	99.1%	53.4	24.4	D
	Through	224	228	101.6%	32.2	5.9	C
	Right Turn	161	166	102.9%	8.8	3.4	A
	Subtotal	536	543	101.3%	30.8	8.6	C
SB	Left Turn	218	137	62.7%	593.6	21.1	F
	Through	411	263	63.9%	581.6	31.6	F
	Right Turn	35	19	54.3%	572.0	66.6	F
	Subtotal	664	418	63.0%	584.1	23.2	F
EB	Left Turn	40	29	72.8%	407.4	66.4	F
	Through	798	633	79.3%	401.5	32.5	F
	Right Turn	381	309	81.2%	414.7	36.0	F
	Subtotal	1,219	971	79.7%	405.7	32.7	F
WB	Left Turn	72	72	99.3%	51.9	6.1	D
	Through	385	389	100.9%	16.9	2.3	B
	Right Turn	99	97	97.8%	3.5	0.6	A
	Subtotal	556	557	100.2%	19.3	1.9	B
Total		2,975	2,489	83.7%	267.0	10.1	F

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	22	25	111.8%	30.4	9.7	C
	Through						
	Right Turn	136	145	106.3%	8.4	2.3	A
	Subtotal	158	169	107.1%	11.8	2.9	B
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	1,019	819	80.4%	16.9	1.1	B
	Right Turn	203	160	78.8%	14.8	1.7	B
	Subtotal	1,222	979	80.1%	16.6	1.1	B
WB	Left Turn	522	529	101.4%	45.2	12.6	D
	Through	596	603	101.2%	3.0	0.6	A
	Right Turn						
	Subtotal	1,118	1,133	101.3%	23.4	7.2	C
Total		2,498	2,281	91.3%	19.7	3.7	B

SimTraffic Post-Processor **Los Gamos Kaiser**
Average Results from 10 Runs **Cumulative No Project**
Volume and Delay by Movement **AM Peak Hour**

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	238	237	99.5%	37.3	7.2	D
	Through						
	Right Turn	571	566	99.2%	27.6	5.4	C
	Subtotal	809	803	99.3%	30.5	5.9	C
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	590	504	85.4%	16.7	1.5	B
	Right Turn	565	464	82.2%	10.4	1.5	B
	Subtotal	1,155	968	83.8%	13.7	1.4	B
WB	Left Turn	338	322	95.3%	38.4	8.4	D
	Through	880	892	101.4%	5.7	2.6	A
	Right Turn						
	Subtotal	1,218	1,214	99.7%	14.6	4.5	B
Total		3,182	2,986	93.8%	18.7	2.7	B

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	782	771	98.6%	25.7	2.9	C
	Through						
	Right Turn	452	446	98.7%	29.6	6.9	C
	Subtotal	1,234	1,217	98.6%	27.1	4.2	C
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	1,041	974	93.6%	25.9	14.8	C
	Right Turn	120	101	84.5%	20.5	9.1	C
	Subtotal	1,161	1,075	92.6%	25.4	14.2	C
WB	Left Turn						
	Through	436	439	100.6%	10.4	1.3	B
	Right Turn	190	185	97.5%	0.6	0.2	A
	Subtotal	626	624	99.7%	7.3	1.1	A
Total		3,021	2,916	96.5%	22.5	6.7	C

SimTraffic Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

Los Gamos Kaiser
Cumulative No Project
AM Peak Hour

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	Total Delay (sec/veh) LOS
NB	Left Turn	156	149	95.6%	18.2	3.2	B
	Through	15	15	102.0%	19.9	3.9	B
	Right Turn	79	76	96.3%	3.0	1.0	A
	Subtotal	250	241	96.2%	13.5	2.1	B
SB	Left Turn	13	11	86.9%	20.8	8.8	C
	Through	59	59	99.5%	22.0	3.6	C
	Right Turn	125	130	103.9%	2.4	0.6	A
	Subtotal	197	200	101.5%	9.4	2.3	A
EB	Left Turn	135	130	96.2%	20.7	3.0	C
	Through	458	425	92.8%	13.6	2.4	B
	Right Turn	825	786	95.3%	18.5	6.4	B
	Subtotal	1,418	1,341	94.6%	17.4	3.9	B
WB	Left Turn	122	123	101.1%	26.7	5.0	C
	Through	345	341	98.9%	14.9	1.9	B
	Right Turn	12	15	127.5%	11.5	13.0	B
	Subtotal	479	480	100.2%	17.8	2.8	B
Total		2,344	2,262	96.5%	16.3	2.4	B

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	170	168	98.7%	33.1	14.6	C
	Through	240	240	100.0%	27.2	5.9	C
	Right Turn	149	145	97.0%	7.7	4.0	A
	Subtotal	559	552	98.8%	24.0	8.1	C
SB	Left Turn	98	101	102.9%	43.6	28.2	D
	Through	111	114	102.5%	28.5	6.7	C
	Right Turn	22	24	108.6%	13.9	15.3	B
	Subtotal	231	239	103.2%	34.1	17.3	C
EB	Left Turn	22	22	97.7%	48.2	18.9	D
	Through	396	399	100.7%	47.2	44.8	D
	Right Turn	141	138	97.6%	28.2	36.8	C
	Subtotal	559	558	99.8%	43.0	42.3	D
WB	Left Turn	153	146	95.1%	95.7	75.5	F
	Through	477	438	91.9%	38.7	46.6	D
	Right Turn	174	166	95.4%	24.9	46.8	C
	Subtotal	804	750	93.3%	47.6	53.6	D
Total		2,153	2,099	97.5%	38.2	32.0	D

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	91	63	69.7%	30.9	13.4	C
	Through						
	Right Turn	606	441	72.8%	63.9	38.4	E
	Subtotal	697	505	72.4%	60.2	35.6	E
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	643	600	93.3%	131.3	72.7	F
	Right Turn	66	63	95.2%	134.0	76.0	F
	Subtotal	709	663	93.5%	131.6	73.0	F
WB	Left Turn	215	214	99.4%	53.7	25.9	D
	Through	798	769	96.4%	23.5	25.0	C
	Right Turn						
	Subtotal	1,013	983	97.0%	30.3	25.2	C
Total		2,419	2,150	88.9%	66.7	30.0	E

SimTraffic Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

Los Gamos Kaiser
Cumulative No Project
PM Peak Hour

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

		Demand	Served Volume (vph)		Total Delay (sec/veh)		
Direction	Movement	Volume (vph)	Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	201	198	98.4%	56.5	61.6	E
	Through						
	Right Turn	425	428	100.7%	37.3	57.7	D
	Subtotal	626	626	100.0%	43.3	58.9	D
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	316	441	139.4%	41.6	13.4	D
	Right Turn	933	594	63.6%	64.7	31.6	E
	Subtotal	1,249	1,034	82.8%	57.2	26.2	E
WB	Left Turn	827	681	82.3%	73.9	16.0	E
	Through	812	787	96.9%	20.0	20.3	B
	Right Turn						
	Subtotal	1,639	1,467	89.5%	45.8	14.9	D
Total		3,514	3,128	89.0%	46.5	13.5	D

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

		Demand	Served Volume (vph)		Total Delay (sec/veh)		
Direction	Movement	Volume (vph)	Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	590	595	100.8%	26.2	2.2	C
	Through						
	Right Turn	559	560	100.1%	23.5	3.1	C
	Subtotal	1,149	1,154	100.5%	24.9	2.4	C
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	397	458	115.3%	16.9	5.0	B
	Right Turn	344	413	120.0%	9.6	2.3	A
	Subtotal	741	871	117.5%	13.7	3.4	B
WB	Left Turn						
	Through	1,049	872	83.1%	69.8	10.1	E
	Right Turn	721	593	82.2%	3.9	0.4	A
	Subtotal	1,770	1,465	82.7%	43.3	6.2	D
Total		3,660	3,489	95.3%	29.5	1.4	C

SimTraffic Post-Processor **Los Gamos Kaiser**
Average Results from 10 Runs **Cumulative No Project**
Volume and Delay by Movement **PM Peak Hour**

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	720	606	84.1%	303.6	94.6	F
	Through	37	30	80.0%	290.2	102.9	F
	Right Turn	149	132	88.5%	272.8	100.4	F
	Subtotal	906	767	84.7%	297.6	94.5	F
SB	Left Turn	14	13	90.7%	47.4	18.4	D
	Through	49	50	102.7%	47.8	10.3	D
	Right Turn	284	282	99.3%	18.4	8.6	B
	Subtotal	347	345	99.4%	24.0	8.3	C
EB	Left Turn	143	148	103.6%	37.5	5.6	D
	Through	553	583	105.3%	23.3	3.0	C
	Right Turn	244	266	109.0%	6.8	1.8	A
	Subtotal	940	997	106.0%	20.9	2.2	C
WB	Left Turn	88	67	76.4%	393.7	133.1	F
	Through	766	590	77.0%	398.1	133.1	F
	Right Turn	16	14	85.0%	402.5	146.4	F
	Subtotal	870	670	77.0%	398.1	133.0	F
Total		3,063	2,779	90.7%	184.5	36.2	F

SimTraffic Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

Los Gamos Kaiser
Cumulative No Project Ex Occ
AM Peak Hour

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	151	154	101.7%	59.6	26.6	E
	Through	224	222	98.9%	35.8	4.7	D
	Right Turn	158	154	97.7%	9.4	3.8	A
	Subtotal	533	529	99.3%	35.2	9.1	D
SB	Left Turn	217	136	62.7%	581.8	34.3	F
	Through	411	259	63.1%	574.4	34.0	F
	Right Turn	35	19	55.1%	643.9	74.6	F
	Subtotal	663	415	62.5%	578.1	32.9	F
EB	Left Turn	40	29	72.0%	422.5	54.8	F
	Through	791	625	79.0%	408.6	43.8	F
	Right Turn	381	309	81.2%	409.5	52.2	F
	Subtotal	1,212	963	79.5%	409.3	44.7	F
WB	Left Turn	72	77	106.5%	54.9	15.6	D
	Through	384	393	102.3%	16.4	1.8	B
	Right Turn	99	98	98.5%	3.7	0.4	A
	Subtotal	555	567	102.2%	19.3	3.9	B
Total		2,963	2,474	83.5%	266.2	17.7	F

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	20	24	119.5%	31.4	8.6	C
	Through						
	Right Turn	119	118	99.2%	9.5	1.7	A
	Subtotal	139	142	102.1%	13.6	2.8	B
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	1,019	806	79.1%	16.2	2.0	B
	Right Turn	192	153	79.5%	14.2	2.2	B
	Subtotal	1,211	959	79.2%	15.8	2.0	B
WB	Left Turn	396	403	101.7%	30.1	4.1	C
	Through	596	608	102.0%	3.0	0.7	A
	Right Turn						
	Subtotal	992	1,011	101.9%	14.0	2.0	B
Total		2,342	2,112	90.2%	14.8	1.4	B

SimTraffic Post-Processor **Los Gamos Kaiser**
Average Results from 10 Runs **Cumulative No Project Ex Occ**
Volume and Delay by Movement **AM Peak Hour**

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	172	168	97.4%	33.5	15.8	C
	Through						
	Right Turn	571	577	101.0%	24.6	18.4	C
	Subtotal	743	744	100.2%	26.8	17.7	C
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	580	480	82.8%	17.4	3.4	B
	Right Turn	558	446	80.0%	10.2	1.2	B
	Subtotal	1,138	926	81.4%	13.9	2.3	B
WB	Left Turn	338	318	94.0%	34.1	9.0	C
	Through	820	838	102.2%	3.7	1.7	A
	Right Turn						
	Subtotal	1,158	1,156	99.8%	12.1	4.1	B
Total		3,039	2,826	93.0%	16.8	5.9	B

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	727	722	99.4%	25.3	3.6	C
	Through						
	Right Turn	452	458	101.3%	32.6	10.3	C
	Subtotal	1,179	1,180	100.1%	28.4	6.2	C
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	1,040	974	93.7%	24.5	14.9	C
	Right Turn	111	87	78.7%	20.2	11.5	C
	Subtotal	1,151	1,062	92.2%	24.2	14.5	C
WB	Left Turn						
	Through	431	428	99.3%	9.8	1.7	A
	Right Turn	190	182	95.7%	0.5	0.2	A
	Subtotal	621	610	98.2%	6.8	1.3	A
Total		2,951	2,852	96.6%	22.3	7.6	C

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	156	155	99.2%	17.3	2.6	B
	Through	15	14	92.0%	25.1	12.8	C
	Right Turn	79	76	96.3%	3.5	1.5	A
	Subtotal	250	245	97.9%	13.4	2.4	B
SB	Left Turn	13	12	93.8%	19.0	11.0	B
	Through	59	60	101.0%	21.6	6.3	C
	Right Turn	125	126	100.6%	2.3	0.6	A
	Subtotal	197	198	100.3%	9.2	2.5	A
EB	Left Turn	135	130	96.3%	23.7	4.8	C
	Through	457	435	95.3%	14.2	2.1	B
	Right Turn	825	789	95.6%	19.5	7.8	B
	Subtotal	1,417	1,354	95.6%	18.2	4.8	B
WB	Left Turn	122	126	103.2%	25.3	4.6	C
	Through	340	327	96.0%	16.1	2.3	B
	Right Turn	12	12	103.3%	7.5	7.6	A
	Subtotal	474	465	98.1%	18.7	2.6	B
Total		2,338	2,261	96.7%	17.0	3.2	B

SimTraffic Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

Los Gamos Kaiser
Cumulative No Project Ex Occ
PM Peak Hour

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	170	169	99.6%	30.6	8.1	C
	Through	240	242	100.8%	26.7	6.5	C
	Right Turn	148	150	101.6%	6.9	3.9	A
	Subtotal	558	562	100.7%	22.4	5.5	C
SB	Left Turn	98	94	96.3%	55.2	62.1	E
	Through	111	109	98.5%	47.1	61.3	D
	Right Turn	22	22	101.8%	17.2	18.9	B
	Subtotal	231	226	97.9%	48.8	62.4	D
EB	Left Turn	22	23	102.3%	48.2	19.3	D
	Through	395	390	98.8%	35.2	18.3	D
	Right Turn	141	141	99.9%	17.0	8.8	B
	Subtotal	558	554	99.2%	31.2	15.4	C
WB	Left Turn	151	142	94.2%	92.6	69.8	F
	Through	474	439	92.7%	44.3	42.5	D
	Right Turn	173	161	93.1%	32.3	46.6	C
	Subtotal	798	743	93.1%	51.2	49.4	D
Total		2,145	2,084	97.2%	37.5	26.0	D

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	81	70	86.0%	33.0	10.4	C
	Through						
	Right Turn	492	409	83.2%	60.7	32.1	E
	Subtotal	573	479	83.6%	56.5	28.7	E
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	643	600	93.3%	113.1	74.5	F
	Right Turn	64	63	98.3%	118.0	80.5	F
	Subtotal	707	663	93.8%	113.3	74.9	F
WB	Left Turn	192	188	97.9%	45.5	9.3	D
	Through	801	769	96.0%	17.3	8.7	B
	Right Turn						
	Subtotal	993	957	96.4%	22.5	8.6	C
Total		2,273	2,099	92.3%	57.9	30.3	E

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	189	187	99.1%	36.6	4.6	D
	Through						
	Right Turn	425	428	100.8%	18.9	5.7	B
	Subtotal	614	616	100.2%	24.4	5.0	C
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	252	408	161.9%	45.1	12.5	D
	Right Turn	883	592	67.0%	70.3	22.4	E
	Subtotal	1,135	1,000	88.1%	61.3	19.5	E
WB	Left Turn	824	683	82.9%	67.5	11.3	E
	Through	804	772	96.0%	12.5	2.0	B
	Right Turn						
	Subtotal	1,628	1,455	89.4%	38.7	5.8	D
Total		3,377	3,070	90.9%	42.0	3.0	D

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	580	562	96.9%	28.2	2.1	C
	Through						
	Right Turn	559	553	99.0%	21.2	2.9	C
	Subtotal	1,139	1,115	97.9%	24.7	1.6	C
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	392	450	114.8%	13.2	3.3	B
	Right Turn	285	385	135.2%	9.8	1.8	A
	Subtotal	677	836	123.4%	11.6	2.3	B
WB	Left Turn						
	Through	1,048	893	85.2%	69.2	16.9	E
	Right Turn	721	622	86.3%	3.8	0.6	A
	Subtotal	1,769	1,515	85.7%	42.7	10.1	D
Total		3,585	3,466	96.7%	28.5	3.5	C

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	720	643	89.3%	216.3	97.8	F
	Through	37	36	96.2%	225.5	90.1	F
	Right Turn	149	132	88.9%	187.5	99.8	F
	Subtotal	906	811	89.5%	212.2	98.3	F
SB	Left Turn	14	14	100.7%	32.2	10.3	C
	Through	49	47	95.9%	44.5	13.3	D
	Right Turn	284	284	100.1%	16.5	10.0	B
	Subtotal	347	345	99.5%	20.8	9.6	C
EB	Left Turn	143	151	105.7%	40.7	6.2	D
	Through	548	576	105.2%	21.9	3.1	C
	Right Turn	244	260	106.6%	5.6	0.9	A
	Subtotal	935	988	105.6%	20.2	3.0	C
WB	Left Turn	88	66	74.5%	384.2	125.0	F
	Through	765	603	78.8%	402.6	143.8	F
	Right Turn	16	12	76.9%	396.0	196.5	F
	Subtotal	869	681	78.4%	401.0	142.4	F
Total		3,057	2,825	92.4%	168.2	59.2	F

SimTraffic Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

Los Gamos Kaiser
Cumulative Plus Project
AM Peak Hour

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	151	147	97.2%	56.1	20.0	E
	Through	224	230	102.5%	34.6	6.6	C
	Right Turn	163	162	99.5%	9.7	3.3	A
	Subtotal	538	539	100.1%	33.5	8.4	C
SB	Left Turn	219	136	62.3%	597.7	35.5	F
	Through	411	257	62.6%	584.4	32.0	F
	Right Turn	35	23	64.9%	573.2	76.6	F
	Subtotal	665	416	62.6%	588.1	32.3	F
EB	Left Turn	40	32	81.0%	425.1	63.9	F
	Through	802	630	78.6%	436.3	20.3	F
	Right Turn	381	300	78.7%	422.5	24.1	F
	Subtotal	1,223	962	78.7%	431.7	18.4	F
WB	Left Turn	73	73	99.6%	66.0	21.0	E
	Through	387	393	101.5%	19.3	7.2	B
	Right Turn	99	100	101.1%	5.1	4.3	A
	Subtotal	559	566	101.2%	22.8	8.0	C
Total		2,985	2,483	83.2%	278.1	10.5	F

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	26	26	100.0%	32.4	5.7	C
	Through						
	Right Turn	179	182	101.8%	9.2	2.4	A
	Subtotal	205	208	101.6%	12.1	2.1	B
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	1,019	804	78.9%	17.0	1.3	B
	Right Turn	209	168	80.5%	14.7	1.3	B
	Subtotal	1,228	972	79.1%	16.6	1.2	B
WB	Left Turn	594	605	101.8%	61.6	12.2	E
	Through	595	603	101.3%	4.1	1.0	A
	Right Turn						
	Subtotal	1,189	1,208	101.6%	32.9	6.6	C
Total		2,622	2,388	91.1%	24.7	3.7	C

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	275	268	97.3%	51.9	17.3	D
	Through						
	Right Turn	571	583	102.0%	39.8	16.4	D
	Subtotal	846	850	100.5%	43.7	16.7	D
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	614	529	86.2%	17.7	2.4	B
	Right Turn	584	461	79.0%	10.2	1.3	B
	Subtotal	1,198	990	82.7%	14.2	1.6	B
WB	Left Turn	338	328	97.1%	36.6	8.3	D
	Through	914	941	102.9%	7.1	3.3	A
	Right Turn						
	Subtotal	1,252	1,269	101.3%	14.6	3.6	B
Total		3,296	3,109	94.3%	22.7	4.9	C

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	813	818	100.7%	26.7	3.6	C
	Through						
	Right Turn	452	457	101.1%	30.8	5.7	C
	Subtotal	1,265	1,275	100.8%	28.2	4.2	C
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	1,043	995	95.4%	30.0	10.4	C
	Right Turn	142	121	85.2%	25.1	9.2	C
	Subtotal	1,185	1,116	94.2%	29.4	10.2	C
WB	Left Turn						
	Through	439	442	100.6%	9.3	1.1	A
	Right Turn	190	180	94.9%	0.6	0.3	A
	Subtotal	629	622	98.9%	6.8	1.0	A
Total		3,079	3,013	97.9%	24.4	4.0	C

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Cumulative Plus Project**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	156	152	97.4%	18.1	2.0	B
	Through	15	16	106.7%	18.0	3.5	B
	Right Turn	79	81	102.5%	3.4	0.7	A
	Subtotal	250	249	99.6%	13.1	1.6	B
SB	Left Turn	13	14	106.9%	16.5	7.6	B
	Through	59	61	103.7%	21.2	5.3	C
	Right Turn	125	125	100.2%	2.6	0.8	A
	Subtotal	197	200	101.7%	9.3	1.9	A
EB	Left Turn	135	125	92.8%	22.2	3.1	C
	Through	460	449	97.6%	14.5	3.1	B
	Right Turn	825	799	96.9%	19.8	5.3	B
	Subtotal	1,420	1,373	96.7%	18.4	2.8	B
WB	Left Turn	122	120	98.0%	23.8	5.0	C
	Through	348	342	98.2%	14.5	1.0	B
	Right Turn	12	11	92.5%	4.3	3.1	A
	Subtotal	482	473	98.0%	16.6	2.0	B
Total		2,349	2,295	97.7%	16.7	1.6	B

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Cumulative Plus Project**
Volume and Delay by Movement | **PM Peak Hour**

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	170	168	98.7%	33.1	14.6	C
	Through	240	240	100.0%	27.2	5.9	C
	Right Turn	151	145	95.7%	7.7	4.0	A
	Subtotal	561	552	98.4%	24.0	8.1	C
SB	Left Turn	99	101	101.8%	43.6	28.2	D
	Through	111	114	102.5%	28.5	6.7	C
	Right Turn	22	24	108.6%	13.9	15.3	B
	Subtotal	232	239	102.8%	34.1	17.3	C
EB	Left Turn	22	22	97.7%	48.2	18.9	D
	Through	402	399	99.2%	47.2	44.8	D
	Right Turn	141	138	97.6%	28.2	36.8	C
	Subtotal	565	558	98.7%	43.0	42.3	D
WB	Left Turn	157	146	92.7%	95.7	75.5	F
	Through	487	438	90.0%	38.7	46.6	D
	Right Turn	176	166	94.3%	24.9	46.8	C
	Subtotal	820	750	91.5%	47.6	53.6	D
Total		2,178	2,099	96.3%	38.2	32.0	D

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	107	63	59.3%	30.9	13.4	C
	Through						
	Right Turn	790	441	55.8%	63.9	38.4	E
	Subtotal	897	505	56.2%	60.2	35.6	E
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	643	600	93.3%	131.3	72.7	F
	Right Turn	75	63	83.7%	134.0	76.0	F
	Subtotal	718	663	92.3%	131.6	73.0	F
WB	Left Turn	318	214	67.2%	53.7	25.9	D
	Through	798	769	96.4%	23.5	25.0	C
	Right Turn						
	Subtotal	1,116	983	88.1%	30.3	25.2	C
Total		2,731	2,150	78.7%	66.7	30.0	E

SimTraffic Post-Processor **Los Gamos Kaiser**
Average Results from 10 Runs **Cumulative Plus Project**
Volume and Delay by Movement **PM Peak Hour**

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	255	198	77.6%	56.5	61.6	E
	Through						
	Right Turn	425	428	100.7%	37.3	57.7	D
	Subtotal	680	626	92.0%	43.3	58.9	D
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	420	441	104.9%	41.6	13.4	D
	Right Turn	1,013	594	58.6%	64.7	31.6	E
	Subtotal	1,433	1,034	72.2%	57.2	26.2	E
WB	Left Turn	827	681	82.3%	73.9	16.0	E
	Through	861	787	91.4%	20.0	20.3	B
	Right Turn						
	Subtotal	1,688	1,467	86.9%	45.8	14.9	D
Total		3,801	3,128	82.3%	46.5	13.5	D

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	635	595	93.6%	26.2	2.2	C
	Through						
	Right Turn	559	560	100.1%	23.5	3.1	C
	Subtotal	1,194	1,154	96.7%	24.9	2.4	C
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	405	458	113.0%	16.9	5.0	B
	Right Turn	440	413	93.8%	9.6	2.3	A
	Subtotal	845	871	103.0%	13.7	3.4	B
WB	Left Turn						
	Through	1,053	872	82.8%	69.8	10.1	E
	Right Turn	721	593	82.2%	3.9	0.4	A
	Subtotal	1,774	1,465	82.6%	43.3	6.2	D
Total		3,813	3,489	91.5%	29.5	1.4	C

SimTraffic Post-Processor **Los Gamos Kaiser**
Average Results from 10 Runs **Cumulative Plus Project**
Volume and Delay by Movement **PM Peak Hour**

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	720	606	84.1%	303.6	94.6	F
	Through	37	30	80.0%	290.2	102.9	F
	Right Turn	149	132	88.5%	272.8	100.4	F
	Subtotal	906	767	84.7%	297.6	94.5	F
SB	Left Turn	14	13	90.7%	47.4	18.4	D
	Through	49	50	102.7%	47.8	10.3	D
	Right Turn	284	282	99.3%	18.4	8.6	B
	Subtotal	347	345	99.4%	24.0	8.3	C
EB	Left Turn	143	148	103.6%	37.5	5.6	D
	Through	561	583	103.8%	23.3	3.0	C
	Right Turn	244	266	109.0%	6.8	1.8	A
	Subtotal	948	997	105.1%	20.9	2.2	C
WB	Left Turn	88	67	76.4%	393.7	133.1	F
	Through	770	590	76.6%	398.1	133.1	F
	Right Turn	16	14	85.0%	402.5	146.4	F
	Subtotal	874	670	76.7%	398.1	133.0	F
Total		3,075	2,779	90.4%	184.5	36.2	F

SimTraffic Post-Processor **Los Gamos Kaiser**
Average Results from 10 Runs **Cumulative No Project**
Volume and Delay by Movement **AM Peak Hour**
PSR/PDS

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	151	140	92.6%	193.3	95.4	F
	Through	224	225	100.5%	76.1	49.3	E
	Right Turn	161	160	99.5%	48.8	56.5	D
	Subtotal	536	525	98.0%	101.5	59.4	F
SB	Left Turn	218	171	78.6%	458.4	45.3	F
	Through	411	309	75.3%	447.3	53.1	F
	Right Turn	35	28	79.4%	409.0	78.4	F
	Subtotal	664	509	76.6%	449.3	48.8	F
EB	Left Turn	40	28	71.0%	324.3	70.0	F
	Through	798	679	85.0%	344.5	37.3	F
	Right Turn	381	323	84.8%	331.9	39.0	F
	Subtotal	1,219	1,030	84.5%	339.9	37.6	F
WB	Left Turn	72	71	98.5%	66.5	31.6	E
	Through	385	393	102.1%	18.0	5.0	B
	Right Turn	99	102	103.4%	3.6	0.7	A
	Subtotal	556	566	101.8%	22.0	7.4	C
Total		2,975	2,630	88.4%	246.2	27.4	F

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	22	21	94.1%	41.6	12.0	D
	Through						
	Right Turn	136	137	100.9%	23.4	2.0	C
	Subtotal	158	158	99.9%	25.8	2.5	C
SB	Left Turn	571	547	95.8%	143.3	81.7	F
	Through	111	112	101.3%	90.3	68.8	F
	Right Turn	127	124	97.7%	62.3	65.1	E
	Subtotal	809	783	96.8%	122.9	78.7	F
EB	Left Turn						
	Through	1,019	855	83.9%	126.0	55.5	F
	Right Turn	203	169	83.3%	101.3	54.6	F
	Subtotal	1,222	1,024	83.8%	121.3	55.5	F
WB	Left Turn	411	402	97.8%	76.1	43.2	E
	Through	469	484	103.2%	31.4	18.1	C
	Right Turn						
	Subtotal	880	886	100.7%	52.2	29.6	D
Total		3,069	2,851	92.9%	95.1	29.4	F

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	1,161	1,055	90.9%	4.7	0.3	A
	Right Turn	565	484	85.6%	8.4	0.3	A
	Subtotal	1,726	1,539	89.2%	5.8	0.4	A
WB	Left Turn						
	Through	880	889	101.0%	18.5	15.7	C
	Right Turn	338	318	94.1%	10.7	11.1	B
	Subtotal	1,218	1,207	99.1%	16.6	14.5	C
Total		2,944	2,745	93.3%	10.6	6.7	B

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	782	781	99.8%	22.9	2.7	C
	Through						
	Right Turn	452	440	97.3%	24.1	4.9	C
	Subtotal	1,234	1,220	98.9%	23.3	2.5	C
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	1,041	937	90.0%	25.6	5.5	C
	Right Turn	120	115	96.2%	21.4	5.2	C
	Subtotal	1,161	1,052	90.6%	25.1	5.3	C
WB	Left Turn						
	Through	436	429	98.3%	14.1	1.7	B
	Right Turn	190	192	100.9%	3.1	0.2	A
	Subtotal	626	620	99.1%	10.6	1.3	B
Total		3,021	2,893	95.7%	21.3	2.3	C

SimTraffic Post-Processor **Los Gamos Kaiser**
Average Results from 10 Runs **Cumulative No Project**
Volume and Delay by Movement **AM Peak Hour**
PSR/PDS

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	Total Delay (sec/veh) LOS
NB	Left Turn	156	158	101.2%	18.4	4.5	B
	Through	15	15	97.3%	21.6	10.4	C
	Right Turn	79	75	94.4%	3.0	1.4	A
	Subtotal	250	247	98.8%	14.4	4.0	B
SB	Left Turn	13	13	99.2%	18.2	8.0	B
	Through	59	62	105.1%	20.4	4.6	C
	Right Turn	125	126	100.4%	1.9	0.5	A
	Subtotal	197	200	101.7%	9.5	1.9	A
EB	Left Turn	135	122	90.6%	20.0	4.1	B
	Through	458	424	92.5%	15.2	2.6	B
	Right Turn	825	755	91.5%	15.0	3.3	B
	Subtotal	1,418	1,301	91.7%	15.6	2.2	B
WB	Left Turn	122	121	99.3%	25.2	10.9	C
	Through	345	335	97.0%	16.5	2.7	B
	Right Turn	12	13	108.3%	10.7	8.2	B
	Subtotal	479	469	97.9%	18.6	3.8	B
Total		2,344	2,217	94.6%	15.5	1.5	B

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Cumulative No Project**
Volume and Delay by Movement | **PM Peak Hour**
PSR/PDS

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	170	173	101.8%	53.5	35.2	D
	Through	240	245	102.2%	28.3	8.8	C
	Right Turn	149	152	102.1%	7.6	6.8	A
	Subtotal	559	570	102.0%	30.6	16.7	C
SB	Left Turn	98	96	97.8%	35.3	6.2	D
	Through	111	108	97.6%	29.0	4.0	C
	Right Turn	22	23	104.1%	9.6	8.2	A
	Subtotal	231	227	98.3%	29.8	4.4	C
EB	Left Turn	22	19	86.4%	42.1	14.0	D
	Through	396	393	99.3%	27.6	3.9	C
	Right Turn	141	141	100.1%	12.8	1.8	B
	Subtotal	559	554	99.0%	24.6	3.5	C
WB	Left Turn	153	147	95.9%	58.4	26.3	E
	Through	477	478	100.2%	18.8	3.2	B
	Right Turn	174	180	103.3%	5.9	1.1	A
	Subtotal	804	805	100.1%	22.5	6.3	C
Total		2,153	2,155	100.1%	25.8	5.2	C

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	91	92	100.9%	46.1	7.4	D
	Through						
	Right Turn	606	611	100.8%	31.0	4.4	C
	Subtotal	697	703	100.8%	33.0	4.0	C
SB	Left Turn	425	422	99.2%	45.8	9.4	D
	Through	43	45	103.5%	34.7	9.6	C
	Right Turn	158	162	102.2%	8.7	2.1	A
	Subtotal	626	628	100.3%	36.1	6.9	D
EB	Left Turn						
	Through	643	642	99.8%	70.9	25.5	E
	Right Turn	66	63	94.7%	35.0	21.5	C
	Subtotal	709	704	99.3%	67.6	24.9	E
WB	Left Turn	172	169	98.3%	49.9	2.8	D
	Through	640	637	99.6%	28.5	3.0	C
	Right Turn						
	Subtotal	812	806	99.3%	33.1	2.8	C
Total		2,844	2,841	99.9%	43.1	7.7	D

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Cumulative No Project**
Volume and Delay by Movement | **PM Peak Hour**
PSR/PDS

Intersection 3 | **US-101 SB Ramps/Lucas Valley Rd** | **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	741	742	100.1%	3.5	0.5	A
	Right Turn	933	932	99.9%	10.6	1.3	B
	Subtotal	1,674	1,674	100.0%	7.4	1.0	A
WB	Left Turn						
	Through	812	810	99.8%	12.6	1.8	B
	Right Turn	827	828	100.1%	9.4	1.8	A
	Subtotal	1,639	1,638	99.9%	11.0	1.8	B
Total		3,313	3,311	100.0%	9.2	1.1	A

Intersection 4 | **US-101 NB Ramps/Smith Ranch Rd** | **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	590	580	98.3%	25.0	2.7	C
	Through						
	Right Turn	559	561	100.4%	17.2	4.0	B
	Subtotal	1,149	1,141	99.3%	21.2	2.7	C
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	397	391	98.6%	21.4	3.7	C
	Right Turn	344	352	102.2%	19.9	3.7	B
	Subtotal	741	743	100.3%	20.7	3.4	C
WB	Left Turn						
	Through	1,049	1,057	100.7%	23.7	2.4	C
	Right Turn	721	719	99.8%	9.3	0.7	A
	Subtotal	1,770	1,776	100.4%	17.8	1.6	B
Total		3,660	3,660	100.0%	19.5	1.7	B

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Cumulative No Project**
Volume and Delay by Movement | **PM Peak Hour**

PSR/PDS

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	720	719	99.8%	36.7	5.6	D
	Through	37	39	106.5%	38.4	9.7	D
	Right Turn	149	151	101.1%	11.7	2.1	B
	Subtotal	906	909	100.3%	32.5	5.3	C
SB	Left Turn	14	15	104.3%	37.9	9.6	D
	Through	49	47	95.9%	33.8	6.7	C
	Right Turn	284	282	99.3%	15.1	6.7	B
	Subtotal	347	344	99.0%	18.4	6.2	B
EB	Left Turn	143	149	104.3%	35.1	3.9	D
	Through	553	546	98.6%	22.7	2.5	C
	Right Turn	244	243	99.4%	4.4	0.7	A
	Subtotal	940	937	99.7%	20.0	2.1	C
WB	Left Turn	88	79	89.3%	48.6	8.8	D
	Through	766	776	101.3%	36.7	5.1	D
	Right Turn	16	18	112.5%	32.7	7.4	C
	Subtotal	870	872	100.3%	37.9	4.8	D
Total		3,063	3,062	100.0%	28.7	2.7	C

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Cumulative Plus Project**
Volume and Delay by Movement | **AM Peak Hour**
PSR/PDS

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	151	146	96.8%	80.2	53.0	F
	Through	224	229	102.4%	37.1	6.1	D
	Right Turn	163	161	98.8%	11.1	3.0	B
	Subtotal	538	537	99.7%	41.3	16.6	D
SB	Left Turn	219	117	53.2%	613.7	39.9	F
	Through	411	217	52.7%	614.8	61.2	F
	Right Turn	35	18	51.1%	603.2	65.4	F
	Subtotal	665	351	52.8%	612.8	52.1	F
EB	Left Turn	40	34	85.0%	371.4	53.0	F
	Through	802	657	81.9%	384.2	40.5	F
	Right Turn	381	310	81.3%	384.5	51.0	F
	Subtotal	1,223	1,001	81.8%	384.0	42.6	F
WB	Left Turn	73	71	97.0%	60.4	14.1	E
	Through	387	388	100.2%	19.4	5.5	B
	Right Turn	99	101	102.1%	4.8	0.9	A
	Subtotal	559	560	100.1%	21.7	5.5	C
Total		2,985	2,448	82.0%	259.7	21.8	F

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	26	27	102.3%	46.1	15.7	D
	Through						
	Right Turn	179	175	97.9%	21.3	2.3	C
	Subtotal	205	202	98.4%	24.1	2.9	C
SB	Left Turn	571	559	97.9%	161.1	82.9	F
	Through	148	150	101.3%	124.6	80.4	F
	Right Turn	127	125	98.2%	76.6	73.9	E
	Subtotal	846	834	98.5%	141.4	80.4	F
EB	Left Turn						
	Through	1,019	813	79.8%	97.3	51.4	F
	Right Turn	209	160	76.7%	75.4	51.7	E
	Subtotal	1,228	973	79.3%	93.9	51.1	F
WB	Left Turn	445	438	98.4%	131.2	58.1	F
	Through	469	472	100.6%	68.6	49.2	E
	Right Turn						
	Subtotal	914	910	99.6%	99.1	53.3	F
Total		3,193	2,919	91.4%	104.5	33.4	F

SimTraffic Post-Processor **Los Gamos Kaiser**
Average Results from 10 Runs **Cumulative Plus Project**
Volume and Delay by Movement **AM Peak Hour**
PSR/PDS

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	1,185	1,069	90.2%	4.3	0.4	A
	Right Turn	584	478	81.8%	7.7	0.6	A
	Subtotal	1,769	1,547	87.5%	5.3	0.4	A
WB	Left Turn						
	Through	914	921	100.8%	34.9	30.6	D
	Right Turn	338	325	96.1%	26.5	25.4	D
	Subtotal	1,252	1,246	99.5%	32.5	29.0	D
Total		3,021	2,793	92.4%	17.7	13.3	C

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	813	813	100.0%	38.0	27.0	D
	Through						
	Right Turn	452	451	99.8%	33.5	11.9	C
	Subtotal	1,265	1,264	99.9%	36.7	20.5	D
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	1,043	936	89.8%	20.0	2.3	B
	Right Turn	142	132	93.0%	18.2	3.0	B
	Subtotal	1,185	1,068	90.1%	19.7	2.2	B
WB	Left Turn						
	Through	439	441	100.4%	29.0	27.9	C
	Right Turn	190	196	103.2%	3.9	1.8	A
	Subtotal	629	637	101.3%	21.7	20.1	C
Total		3,079	2,969	96.4%	27.3	12.6	C

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	156	163	104.2%	18.1	3.2	B
	Through	15	16	104.0%	21.4	7.0	C
	Right Turn	79	78	98.4%	3.4	1.3	A
	Subtotal	250	256	102.3%	13.7	2.4	B
SB	Left Turn	13	12	93.8%	20.3	10.7	C
	Through	59	57	96.6%	20.9	4.4	C
	Right Turn	125	130	103.8%	2.0	0.6	A
	Subtotal	197	199	101.0%	8.4	2.2	A
EB	Left Turn	135	127	94.0%	22.2	3.9	C
	Through	460	419	91.1%	14.2	1.8	B
	Right Turn	825	766	92.8%	17.9	4.2	B
	Subtotal	1,420	1,312	92.4%	17.1	3.0	B
WB	Left Turn	122	122	100.2%	22.7	5.2	C
	Through	348	346	99.3%	15.5	3.3	B
	Right Turn	12	14	114.2%	8.1	6.4	A
	Subtotal	482	481	99.9%	17.1	3.1	B
Total		2,349	2,248	95.7%	15.9	2.4	B

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	170	169	99.1%	48.9	19.7	D
	Through	240	253	105.4%	26.8	5.9	C
	Right Turn	151	157	103.6%	6.0	3.0	A
	Subtotal	561	578	103.0%	28.0	7.0	C
SB	Left Turn	99	95	95.6%	33.7	6.0	C
	Through	111	108	97.2%	27.0	4.8	C
	Right Turn	22	23	106.4%	9.2	5.0	A
	Subtotal	232	226	97.4%	28.3	4.0	C
EB	Left Turn	22	24	107.3%	44.8	11.0	D
	Through	402	407	101.2%	28.7	1.3	C
	Right Turn	141	140	99.2%	13.5	1.9	B
	Subtotal	565	570	100.9%	26.0	1.0	C
WB	Left Turn	157	157	99.7%	102.2	50.7	F
	Through	487	485	99.5%	35.1	27.7	D
	Right Turn	176	179	101.4%	21.8	27.7	C
	Subtotal	820	820	100.0%	45.4	32.6	D
Total		2,178	2,194	100.7%	34.1	11.7	C

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	107	103	96.4%	52.0	19.3	D
	Through						
	Right Turn	790	781	98.8%	50.3	27.8	D
	Subtotal	897	884	98.5%	50.5	26.8	D
SB	Left Turn	425	423	99.6%	28.3	4.0	C
	Through	97	95	97.6%	25.1	4.3	C
	Right Turn	158	157	99.4%	11.5	1.7	B
	Subtotal	680	675	99.3%	23.8	2.6	C
EB	Left Turn						
	Through	643	640	99.6%	98.5	52.2	F
	Right Turn	75	75	100.1%	54.8	43.7	D
	Subtotal	718	715	99.6%	94.1	52.0	F
WB	Left Turn	221	228	102.9%	34.9	3.8	C
	Through	640	653	102.0%	17.4	2.7	B
	Right Turn						
	Subtotal	861	881	102.3%	22.0	2.9	C
Total		3,156	3,155	100.0%	47.3	16.4	D

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Cumulative Plus Project**
Volume and Delay by Movement | **PM Peak Hour**
PSR/PDS

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	845	845	100.0%	3.7	0.4	A
	Right Turn	1,013	996	98.3%	10.4	0.9	B
	Subtotal	1,858	1,841	99.1%	7.3	0.7	A
WB	Left Turn						
	Through	861	875	101.7%	12.6	3.0	B
	Right Turn	827	811	98.1%	10.1	2.4	B
	Subtotal	1,688	1,687	99.9%	11.4	2.7	B
Total		3,546	3,528	99.5%	9.3	1.2	A

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	635	624	98.3%	19.3	2.8	B
	Through						
	Right Turn	559	547	97.9%	16.0	2.5	B
	Subtotal	1,194	1,172	98.1%	17.8	1.9	B
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	405	407	100.4%	14.0	1.7	B
	Right Turn	440	448	101.8%	12.4	1.4	B
	Subtotal	845	855	101.1%	13.1	1.5	B
WB	Left Turn						
	Through	1,053	1,065	101.2%	20.3	2.6	C
	Right Turn	721	716	99.3%	9.0	0.9	A
	Subtotal	1,774	1,781	100.4%	15.8	2.0	B
Total		3,813	3,808	99.9%	15.8	0.7	B

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Cumulative Plus Project**
Volume and Delay by Movement | **PM Peak Hour**
PSR/PDS

Intersection 5 | **Redwood Dr/Smith Ranch Rd** | **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	720	712	98.8%	35.5	3.9	D
	Through	37	37	100.5%	37.8	9.3	D
	Right Turn	149	147	98.3%	12.0	1.8	B
	Subtotal	906	895	98.8%	31.8	3.5	C
SB	Left Turn	14	14	102.1%	43.3	29.3	D
	Through	49	49	99.0%	43.7	12.3	D
	Right Turn	284	286	100.5%	26.0	20.1	C
	Subtotal	347	348	100.4%	29.2	18.9	C
EB	Left Turn	143	142	99.3%	40.5	7.8	D
	Through	561	549	97.9%	21.5	2.2	C
	Right Turn	244	244	100.1%	4.1	0.5	A
	Subtotal	948	936	98.7%	19.7	2.1	B
WB	Left Turn	88	89	101.6%	53.5	7.6	D
	Through	770	776	100.7%	38.8	12.3	D
	Right Turn	16	18	112.5%	31.4	21.1	C
	Subtotal	874	883	101.0%	40.3	11.4	D
Total		3,075	3,062	99.6%	30.5	6.5	C

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	27	28	104.1%	36.3	13.3	D
	Through						
	Right Turn	201	191	95.0%	2.9	0.5	A
	Subtotal	228	219	96.1%	7.0	1.8	A
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	760	761	100.2%	66.3	41.1	E
	Right Turn	118	115	97.1%	55.8	39.8	E
	Subtotal	878	876	99.8%	65.0	41.1	E
WB	Left Turn	437	445	101.7%	36.3	8.8	D
	Through	387	390	100.9%	13.4	6.6	B
	Right Turn						
	Subtotal	824	835	101.3%	25.8	8.3	C
Total		1,930	1,930	100.0%	41.3	17.4	D

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	546	537	98.4%	33.9	5.4	C
	Through						
	Right Turn	424	421	99.3%	9.8	3.8	A
	Subtotal	970	958	98.8%	23.2	5.0	C
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	688	693	100.8%	33.0	16.6	C
	Right Turn	194	190	97.9%	23.0	11.9	C
	Subtotal	882	883	100.2%	30.8	15.6	C
WB	Left Turn						
	Through	323	313	96.7%	10.7	1.6	B
	Right Turn	168	171	101.9%	0.5	0.1	A
	Subtotal	491	484	98.5%	7.1	1.2	A
Total		2,343	2,325	99.2%	22.8	7.3	C

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	71	68	96.2%	42.6	12.5	D
	Through						
	Right Turn	555	552	99.4%	15.4	9.5	B
	Subtotal	626	620	99.0%	18.1	8.9	B
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	514	489	95.2%	144.8	84.5	F
	Right Turn	38	36	94.5%	110.0	76.7	F
	Subtotal	552	525	95.1%	142.7	83.7	F
WB	Left Turn	299	306	102.4%	37.3	12.0	D
	Through	559	553	98.9%	7.5	3.9	A
	Right Turn						
	Subtotal	858	859	100.1%	18.2	7.2	B
Total		2,036	2,004	98.4%	49.4	21.9	D

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	26	25	97.7%	38.0	8.9	D
	Through						
	Right Turn	199	196	98.3%	17.3	3.3	B
	Subtotal	225	221	98.3%	19.3	3.0	B
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	901	834	92.6%	97.7	78.8	F
	Right Turn	220	201	91.2%	87.8	77.2	F
	Subtotal	1,121	1,035	92.3%	95.8	78.6	F
WB	Left Turn	565	564	99.7%	38.9	4.6	D
	Through	477	475	99.5%	7.5	2.0	A
	Right Turn						
	Subtotal	1,042	1,038	99.6%	24.0	3.5	C
Total		2,388	2,294	96.1%	54.4	33.0	D

Intersection 4 **US-101 SB Ramps/Smith Ranch Rd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	661	652	98.7%	71.3	31.6	E
	Through						
	Right Turn	411	408	99.2%	63.2	33.3	E
	Subtotal	1,072	1,060	98.9%	68.2	32.1	E
SB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
EB	Left Turn						
	Through	980	966	98.5%	43.5	2.6	D
	Right Turn	165	154	93.5%	37.0	3.6	D
	Subtotal	1,145	1,120	97.8%	42.6	2.5	D
WB	Left Turn						
	Through	395	395	100.0%	15.0	1.9	B
	Right Turn	183	178	97.0%	0.7	0.6	A
	Subtotal	578	573	99.0%	10.4	1.5	B
Total		2,795	2,752	98.5%	46.4	13.0	D

APPENDIX C: SIGNAL WARRANTS

WARRANT 1: EIGHT-HOUR SIGNAL WARRANT

Type	Volume									Analysis		
	Major			Major			Minor			Major Exceeds 500 vph	Minor (One-Direction) Exceed 150 vph	Meets Both Criteria?
Segment	Lucas Valley Road, EO Los Gamos			Lucas Valley Road, WO Los Gamos			Los Gamos Drive					
Time	EB	WB	Total	EB	WB	Total	NB	SB	Total			
12:00 AM	19	21	40	14	19	33	6	3	9	No	No	No
1:00 AM	15	9	24	13	10	23	3	0	3	No	No	No
2:00 AM	7	3	10	4	2	6	2	1	3	No	No	No
3:00 AM	7	5	12	6	3	9	1	2	3	No	No	No
4:00 AM	28	52	80	27	31	58	2	22	24	No	No	No
5:00 AM	90	197	287	118	93	211	13	145	158	No	No	No
6:00 AM	300	211	511	259	131	390	72	107	179	Yes	No	No
7:00 AM	723	424	1147	686	322	1,008	100	155	255	Yes	Yes	Yes
8:00 AM	916	584	1500	903	411	1,314	132	281	413	Yes	Yes	Yes
9:00 AM	718	495	1213	651	335	986	164	244	408	Yes	Yes	Yes
10:00 AM	578	442	1020	492	339	831	158	168	326	Yes	Yes	Yes
11:00 AM	651	501	1152	522	404	926	195	136	331	Yes	Yes	Yes
12:00 PM	653	566	1219	521	434	955	176	163	339	Yes	Yes	Yes
1:00 PM	650	575	1225	512	485	997	168	125	293	Yes	Yes	Yes
2:00 PM	666	557	1223	579	429	1,008	145	151	296	Yes	Yes	Yes
3:00 PM	682	566	1248	545	475	1,020	191	152	343	Yes	Yes	Yes
4:00 PM	676	539	1215	545	468	1,013	178	113	291	Yes	Yes	Yes
5:00 PM	634	702	1336	492	594	1,086	214	173	387	Yes	Yes	Yes
6:00 PM	522	533	1055	379	490	869	180	98	278	Yes	Yes	Yes
7:00 PM	323	371	694	244	345	589	106	67	173	Yes	No	No
8:00 PM	272	287	559	216	257	473	76	52	128	Yes	No	No
9:00 PM	200	174	374	138	157	295	71	21	92	No	No	No
10:00 PM	94	112	206	62	105	167	34	11	45	No	No	No
11:00 PM	24	48	72	18	45	63	6	3	9	No	No	No

Figure 4C-101 (CA). Traffic Signal Warrants Worksheet (Sheet 2 of 5)

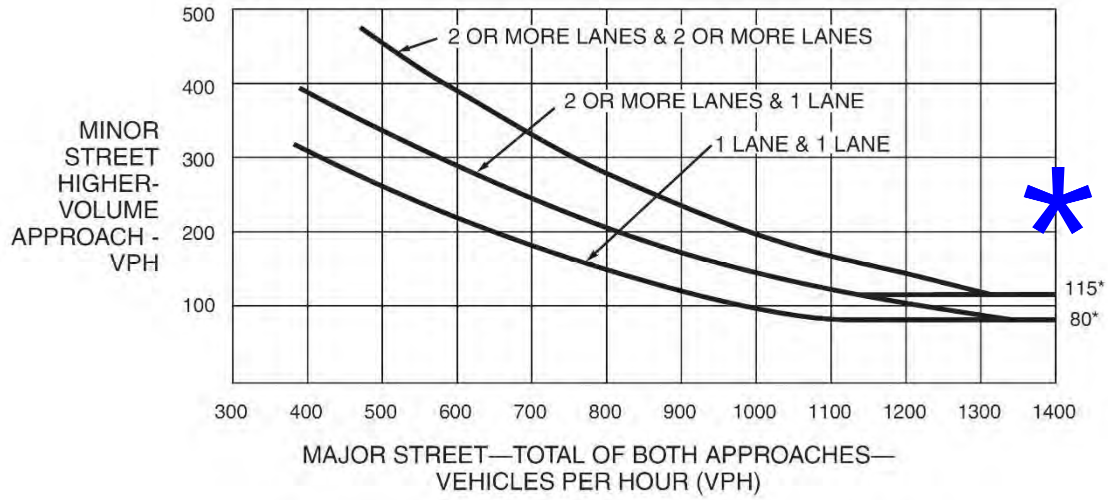
WARRANT 2 - Four Hour Vehicular Volume **SATISFIED* YES ☐ NO ☐**

Record hourly vehicular volumes for any four hours of an average day.

APPROACH LANES	One	2 or More	8:00AM	9:00AM	2:00PM	3:00PM Hour
Both Approaches - Major Street	X		1,500	1,213	1,223	1,248
Higher Approach - Minor Street	X		281	244	151	191

*All plotted points fall above the applicable curve in Figure 4C-1. (URBAN AREAS)	Yes ☐ No ☐
OR, All plotted points fall above the applicable curve in Figure 4C-2. (RURAL AREAS)	Yes ☐ No ☐

Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume

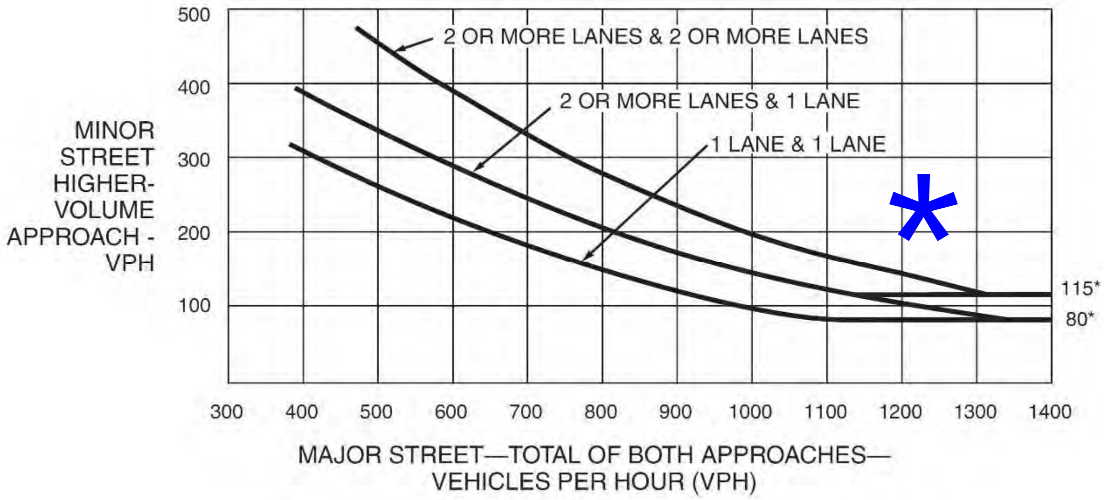


*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

HOUR 1
Time: 8:00 AM
Major: Lucas Valley Road (1,500 vph)
Minor: Los Gamos Drive (281 vph)

Meets Signal Warrant Criteria? **Yes**

Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume

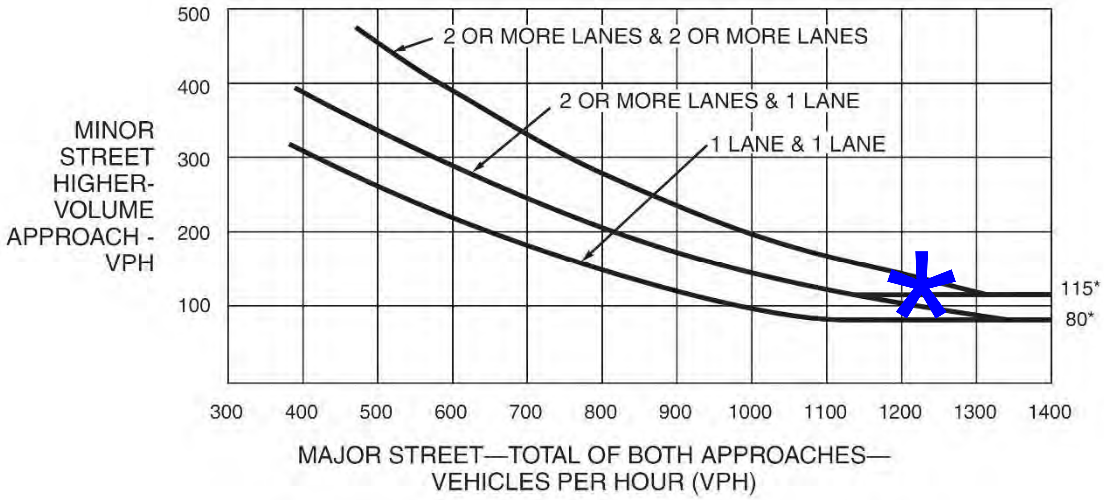


*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

HOUR 2
Time: 9:00 AM
Major: Lucas Valley Road (1,213 vph)
Minor: Los Gamos Drive (244 vph)

Meets Signal Warrant Criteria? **Yes**

Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume

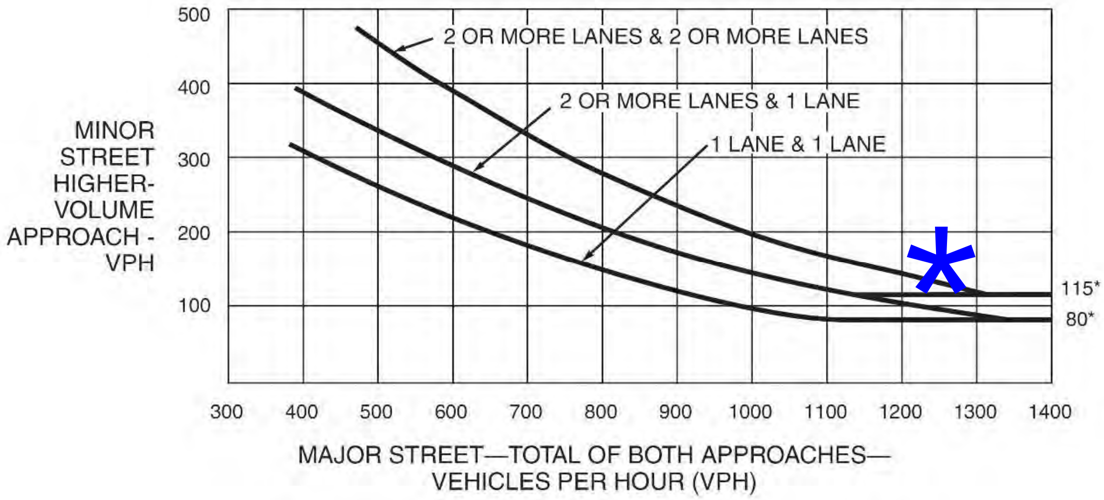


*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

<u>HOUR 3</u>
Time: 2:00 PM
Major: Lucas Valley Road (1,223 vph)
Minor: Los Gamos Drive (151 vph)

Meets Signal Warrant Criteria? **Yes**

Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

HOUR 4
Time: 3:00 PM
Major: Lucas Valley Road (1,248 vph)
Minor: Los Gamos Drive (191 vph)

Meets Signal Warrant Criteria? **Yes**

FEHR PEERS

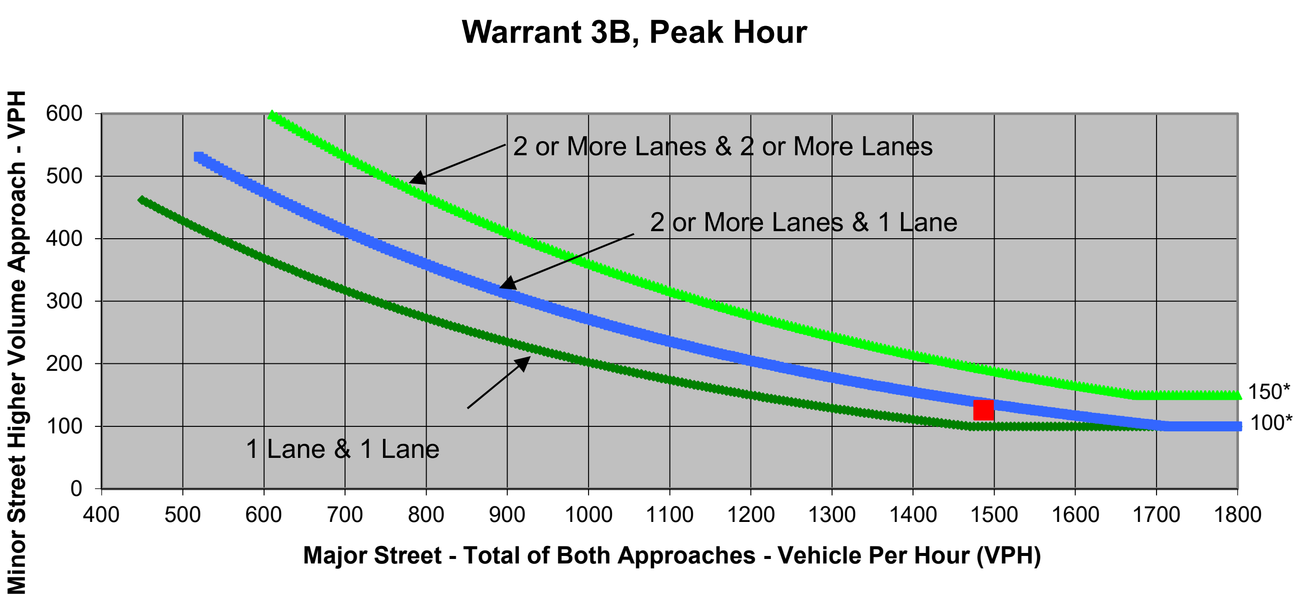
			Project	Los Gamos Kaiser
Major Street	Lucas Valley Rd		Scenario	Existing Conditions
Minor Street	Los Gamos Dr		Peak Hour	AM

Turn Movement Volumes

	NB	SB	EB	WB
Left	19	0	0	239
Through	0	0	760	387
Right	107	0	101	0
Total	126	0	861	626

Major Street Direction

	North/South
x	East/West



* 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 approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Lucas Valley Rd	Minor Street Los Gamos Dr	Warrant Met
Number of Approach Lanes	**1**	**1**	**YES**
Traffic Volume (VPH) *	**1,487**	**126**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

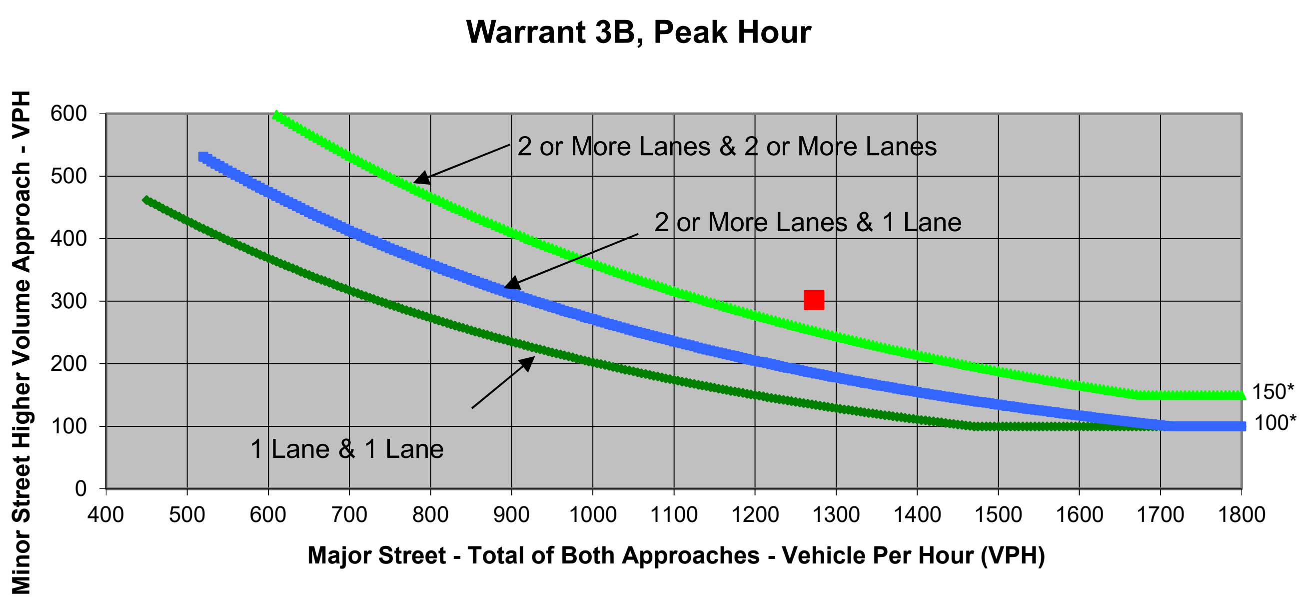
Major Street	Lucas Valley Rd		Project	Los Gamos Kaiser
Minor Street	Los Gamos Dr		Scenario	Existing Conditions
			Peak Hour	PM

Turn Movement Volumes

	NB	SB	EB	WB
Left	45	0	0	173
Through	0	0	514	559
Right	257	0	27	0
Total	302	0	541	732

Major Street Direction

	North/South
x	East/West



* 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 approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Lucas Valley Rd	Minor Street Los Gamos Dr	Warrant Met
Number of Approach Lanes	**1**	**1**	**YES**
Traffic Volume (VPH) *	**1,273**	**302**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

APPENDIX D: DETAILED FREEWAY LOS RESULTS

HCS 2010: Basic Freeway Segments Release 6.60

Phone:	Fax:
E-mail:	

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas off-on
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3540	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	922	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1260	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1260	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	19.4	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas on/Redwood on
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3882	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1011	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1036	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1036	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	15.9	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/16/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Redwood Highway On
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3882	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	101	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3882		101			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1011		26			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4145	108	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.204 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 847 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4253	9400	No
v_3 or v_{av34}	1649 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 1658 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1766	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 18.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.331	
Space mean speed in ramp influence area,	S_R = 57.4	mph
Space mean speed in outer lanes,	S_0 = 62.3	mph
Space mean speed for all vehicles,	S = 60.2	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Road off
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3983	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1037	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1063	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1063	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	16.4	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Rd off/Lucas Rd on
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3284	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	855	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1169	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1169	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	18.0-	pc/mi/ln
Level of service, LOS	B	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Lucas Rd on/Smith Ranch Rd on
Jurisdiction:	San Rafael
Analysis Year:	Existing
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3400	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	885	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	908	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	908	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	14.0	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

_______________Merge Analysis_______________

Analyst: LP
Agency/Co.: Fehr & Peers
Date performed: 9/21/2016
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: 101 NB
Junction: Smith Ranch Rd WB on
Jurisdiction: San Rafael
Analysis Year: Existing
Description: 1650 Los Gamos

_______________Freeway Data_______________

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3400	vph

_______________On Ramp Data_______________

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	134	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

_______________Adjacent Ramp Data (if one exists)_______________

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

_______________Conversion to pc/h Under Base Conditions_______________

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3400	134		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	885	35		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

```
Heavy vehicle adjustment, fHV          0.976        0.976
Driver population factor, fP           1.00         1.00
Flow rate, vp                          3630         143                    pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =             (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.200   Using Equation  4
                   FM
                  v  = v  (P  ) =  726    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     3773          9400            No
      FO
     v  or v               1452 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 1452                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                1595          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   16.7    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.327
                                              S
Space mean speed in ramp influence area,     S  = 57.5    mph
                                              R
Space mean speed in outer lanes,             S  = 62.9    mph
                                              0
Space mean speed for all vehicles,           S  = 60.5    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3534	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	920	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	943	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	943	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	14.5	pc/mi/ln
Level of service, LOS	B	

Phone:	Fax:
E-mail:	

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3407	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	887	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1213	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1213	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	18.7	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Period
Freeway/Direction:	101 SB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3616	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	942	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1287	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1287	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	19.8	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Miller Creek on
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3616	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	838	vph
Length of first accel/decel lane	110	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3616	838		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	942	218		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3861	895	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.581 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2242 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4756	7050	No
v_3 or v_{av34}	1619 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 Yes

If yes, v_{12A} = 2242 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	3137	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 28.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.403	
Space mean speed in ramp influence area,	S_R = 55.7	mph
Space mean speed in outer lanes,	S_0 = 61.0	mph
Space mean speed for all vehicles,	S = 57.4	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Period
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd off
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4454	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1160	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1189	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1189	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	18.3	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd on/off
Jurisdiction:	San Rafael
Analysis Year:	Existing
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4002	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1042	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1424	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1424	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	21.9	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Lucas Valley On
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3999	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	596	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3999		596			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1041		155			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          4270        636                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.582   Using Equation  1
                   FM
                  v  = v  (P  ) =  2484   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     4906          7050            No
      FO
     v  or v               1786 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 2484                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                3120          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   28.6    pc/mi/ln
         R                    R           12             A
Level of service for ramp-freeway junction areas of influence  D

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.399
                                              S
Space mean speed in ramp influence area,     S  = 55.8    mph
                                              R
Space mean speed in outer lanes,             S  = 60.4    mph
                                              0
Space mean speed for all vehicles,           S  = 57.4    mph
_______________________________________________________________________________
```

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyON/ManuelFreitasOFF
Jurisdiction:	San Rafael
Analysis Year:	Existing
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4595	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1197	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1635	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1635	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.2	mi/h
Number of lanes, N	3	
Density, D	25.5	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

______________________________Diverge Analysis______________________________

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Manuel T Freitas off
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

______________________________Freeway Data______________________________

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4595	vph

______________________________Off Ramp Data______________________________

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	679	vph
Length of first accel/decel lane	120	ft
Length of second accel/decel lane		ft

______________________Adjacent Ramp Data (if one exists)______________________

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

__________________Conversion to pc/h Under Base Conditions__________________

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4595		679			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1197		177			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4906	725	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.604 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3250 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4906	7050	No
$v_{FO} = v_F - v_R$	4181	7050	No
v_R	725	2000	No
v_3 or v_{av34}	1656 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 3250 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3250	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 31.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	D_S = 0.493	
Space mean speed in ramp influence area,	S_R = 53.7	mph
Space mean speed in outer lanes,	S_0 = 68.7	mph
Space mean speed for all vehicles,	S = 57.9	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	Manuel T Freitas on / off
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3916	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1020	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1394	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1394	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	21.4	pc/mi/ln
Level of service, LOS	C	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas off-on
Jurisdiction:	San Rafael
Analysis Year:	Existing
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5040	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1313	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1794	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1794	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.8	mi/h
Number of lanes, N	3	
Density, D	28.6	pc/mi/ln
Level of service, LOS	D	

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Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	ManuelTFreitasON/RedwoodHwyON
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5654	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1472	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2012	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2012	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	59.7	mi/h
Number of lanes, N	3	
Density, D	33.7	pc/mi/ln
Level of service, LOS	D	

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Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Redwood Highway on
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5654	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	301	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5654	301		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1472	78		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	6037	321	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.178 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1073 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6358	9400	No
v_3 or v_{av34}	2482 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 2414 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	2735	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 25.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.368	
Space mean speed in ramp influence area,	S_R = 56.5	mph
Space mean speed in outer lanes,	S_0 = 60.3	mph
Space mean speed for all vehicles,	S = 58.6	mph

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Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Rd off
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5955	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1551	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1590	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1590	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.5	mi/h
Number of lanes, N	4	
Density, D	24.7	pc/mi/ln
Level of service, LOS	C	

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Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	SmithRanchRd off/LucasRdEB on
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5274	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1373	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1408	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1408	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	21.7	pc/mi/ln
Level of service, LOS	C	

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Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	LucasValleyRdON/SmithRanchRdON
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5456	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1421	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1456	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1456	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	22.4	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Smith Ranch Rd WB on
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5456	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	388	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5456		388			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1421		101			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	5825	414	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.166 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 967 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6239	9400	No
v_3 or v_{av34}	2429 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 2330 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	2744	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 25.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.368	
Space mean speed in ramp influence area,	S_R = 56.5	mph
Space mean speed in outer lanes,	S_0 = 60.5	mph
Space mean speed for all vehicles,	S = 58.7	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5844	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1522	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1560	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1560	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.6	mi/h
Number of lanes, N	4	
Density, D	24.1	pc/mi/ln
Level of service, LOS	C	

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Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5567	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1450	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1981	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1981	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	60.2	mi/h
Number of lanes, N	3	
Density, D	32.9	pc/mi/ln
Level of service, LOS	D	

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Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Period
Freeway/Direction:	101 SB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3849	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1002	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1370	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1370	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	21.1	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Miller Creek on
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3849	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	164	vph
Length of first accel/decel lane	110	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3849		164			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1002		43			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%	%	
Length		mi		mi	mi	
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          4110        175                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =             (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.581   Using Equation  1
                   FM
                  v  = v  (P  ) =  2386   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     4285          7050            No
      FO
     v  or v               1724 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 2386                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                2561          4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   24.7    pc/mi/ln
         R                    R           12             A
Level of service for ramp-freeway junction areas of influence  C

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.364
                                              S
Space mean speed in ramp influence area,     S  = 56.6    mph
                                              R
Space mean speed in outer lanes,             S  = 60.6    mph
                                              0
Space mean speed for all vehicles,           S  = 58.2    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd off
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4013	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1045	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1071	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1071	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	16.5	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyRd off/on
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3745	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	975	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1333	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1333	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	20.5	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	LucasValleyON
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3745	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	740	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3745	740		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	975	193		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          3999        790                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.582   Using Equation  1
                   FM
                  v  = v  (P  ) =  2326   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     4789          7050            No
      FO
     v  or v               1673 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 2326                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                3116          4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   28.5    pc/mi/ln
          R                   R            12             A
Level of service for ramp-freeway junction areas of influence  D

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.398
                                              S
Space mean speed in ramp influence area,     S  = 55.8    mph
                                              R
Space mean speed in outer lanes,             S  = 60.8    mph
                                              0
Space mean speed for all vehicles,           S  = 57.5    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyON/ManuelFreitasOFF
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4485	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1168	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1596	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1596	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.5	mi/h
Number of lanes, N	3	
Density, D	24.8	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Manuel T Freitas off
Jurisdiction:	San Rafael
Analysis Year:	Existing

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4485	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	584	vph
Length of first accel/decel lane	120	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4485		584			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1168		152			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%	%	
Length	0.00	mi	0.00	mi	mi	
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4789	624	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.612 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3171 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4789	7050	No
$v_{FO} = v_F - v_R$	4165	7050	No
v_R	624	2000	No
v_3 or v_{av34}	1618 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 3171 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3171	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 30.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	D_S = 0.484	
Space mean speed in ramp influence area,	S_R = 53.9	mph
Space mean speed in outer lanes,	S_0 = 68.9	mph
Space mean speed for all vehicles,	S = 58.2	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst: LP
Agency or Company: Fehr & Peers
Date Performed: 9/22/2016
Analysis Time Period: AM Peak Hour
Freeway/Direction: 101 SB
From/To: Manuel T Freitas on / off
Jurisdiction: San Rafael
Analysis Year: Existing
Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3901	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1016	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1388	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1388	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	21.4	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas off-on
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3702	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	964	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1318	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1318	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	20.3	pc/mi/ln
Level of service, LOS	C	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas on/Redwood on
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4044	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1053	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1079	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1079	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	16.6	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/16/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Redwood Highway On
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4044	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	101	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4044	101		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1053	26		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

```
Heavy vehicle adjustment, fHV           0.976       0.976
Driver population factor, fP            1.00        1.00
Flow rate, vp                           4318        108                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L   =             (Equation 13-6 or 13-7)
                   EQ
                  P   =    0.204   Using Equation  4
                   FM
                  v  = v  (P  ) =  882    pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     4426          9400            No
      FO
     v  or v               1718 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 1727                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                1835          4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   18.5    pc/mi/ln
         R                    R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.332
                                              S
Space mean speed in ramp influence area,     S  = 57.4    mph
                                              R
Space mean speed in outer lanes,             S  = 62.1    mph
                                              0
Space mean speed for all vehicles,           S  = 60.1    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Road off
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4145	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1079	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1106	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1106	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	17.0	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Rd off/Lucas Rd on
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3378	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	880	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1202	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1202	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	18.5	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone:	Fax:
E-mail:	

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Lucas Rd on/Smith Ranch Rd on
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3519	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	916	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	939	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	939	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	14.4	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Smith Ranch Rd WB on
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3519	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	134	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3519		134			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	916		35			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          3757        143                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =              (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.200   Using Equation  4
                   FM
                  v  = v  (P  ) =  751    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     3900          9400            No
      FO
     v  or v               1503 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 1502                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable          Violation?
     v                1645          4600                   No
      12A
________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   17.0    pc/mi/ln
          R                   R           12            A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.328
                                              S
Space mean speed in ramp influence area,     S  = 57.5    mph
                                              R
Space mean speed in outer lanes,             S  = 62.7    mph
                                              0
Space mean speed for all vehicles,           S  = 60.4    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3653	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	951	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	975	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	975	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	15.0	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3526	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	918	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1255	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1255	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	19.3	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Period
Freeway/Direction:	101 SB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3694	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	962	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1315	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1315	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	20.2	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Miller Creek on
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3694	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	838	vph
Length of first accel/decel lane	110	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3694		838			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	962		218			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3944	895	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.581 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2290 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4839	7050	No
v_3 or v_{av34}	1654 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 Yes

If yes, v_{12A} = 2290 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	3185	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 29.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.408	
Space mean speed in ramp influence area,	S_R = 55.6	mph
Space mean speed in outer lanes,	S_0 = 60.8	mph
Space mean speed for all vehicles,	S = 57.3	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Period
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd off
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4532	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1180	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1210	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1210	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	18.6	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd on/off
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4002	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1042	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1424	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1424	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	21.9	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Lucas Valley On
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4002	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	616	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4002		616			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1042		160			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          4273        658                    pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.582   Using Equation  1
                   FM
                  v  = v  (P  ) =  2486   pc/h
                   12   F   FM

_______________________________Capacity Checks________________________________

                           Actual        Maximum         LOS F?
     v                     4931          7050            No
      FO
     v  or v               1787 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 2486                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                3144          4600                  No
      12A
_________________Level of Service Determination (if not F)____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   28.8    pc/mi/ln
          R                   R            12             A
Level of service for ramp-freeway junction areas of influence  D

_____________________________Speed Estimation_________________________________

Intermediate speed variable,                 M  = 0.401
                                              S
Space mean speed in ramp influence area,     S  = 55.8    mph
                                              R
Space mean speed in outer lanes,             S  = 60.4    mph
                                              0
Space mean speed for all vehicles,           S  = 57.4    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyON/ManuelFreitasOFF
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4615	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1202	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1642	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1642	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.2	mi/h
Number of lanes, N	3	
Density, D	25.6	pc/mi/ln
Level of service, LOS	C	

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Manuel T Freitas off
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4615	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	679	vph
Length of first accel/decel lane	120	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4615		679			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1202		177			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4927	725	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.603 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3261 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4927	7050	No
$v_{FO} = v_F - v_R$	4202	7050	No
v_R	725	2000	No
v_3 or v_{av34}	1666 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 3261 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3261	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 31.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	D_S = 0.493	
Space mean speed in ramp influence area,	S_R = 53.7	mph
Space mean speed in outer lanes,	S_0 = 68.7	mph
Space mean speed for all vehicles,	S = 57.9	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	Manuel T Freitas on / off
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3936	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1025	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1401	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1401	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	21.6	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas off-on
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5085	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1324	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1810	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1810	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.6	mi/h
Number of lanes, N	3	
Density, D	28.9	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	ManuelTFreitasON/RedwoodHwyON
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5699	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1484	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2028	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2028	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	59.4	mi/h
Number of lanes, N	3	
Density, D	34.1	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Redwood Highway on
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5699	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	301	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5699		301			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1484		78			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	6085	321	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.178 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1081 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6406	9400	No
v_3 or v_{av34}	2502 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 2434 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	2755	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 25.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.369	
Space mean speed in ramp influence area,	S_R = 56.5	mph
Space mean speed in outer lanes,	S_0 = 60.2	mph
Space mean speed for all vehicles,	S = 58.6	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Rd off
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	6000	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1563	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1602	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1602	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.4	mi/h
Number of lanes, N	4	
Density, D	24.9	pc/mi/ln
Level of service, LOS	C	

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Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	SmithRanchRd off/LucasRdEB on
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5274	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1373	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1408	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1408	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	21.7	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	LucasValleyRdON/SmithRanchRdON
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5584	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1454	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1491	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1491	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.9	mi/h
Number of lanes, N	4	
Density, D	23.0	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Smith Ranch Rd WB on
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5584	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	388	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5584	388		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1454	101		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

```
Heavy vehicle adjustment, fHV           0.976       0.976
Driver population factor, fP            1.00        1.00
Flow rate, vp                           5962        414                    pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.166   Using Equation  4
                   FM
                  v  = v  (P  ) =  990    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     6376          9400            No
      FO
     v  or v               2486 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v     > 2700 pc/h?            No
      3     av34
Is   v  or v     > 1.5 v  /2             Yes
      3     av34          12
If yes, v    = 2384                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                2798          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   25.9    pc/mi/ln
         R                    R           12             A
Level of service for ramp-freeway junction areas of influence  C

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.372
                                              S
Space mean speed in ramp influence area,     S  = 56.5    mph
                                              R
Space mean speed in outer lanes,             S  = 60.4    mph
                                              0
Space mean speed for all vehicles,           S  = 58.6    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

______________________Operational Analysis______________________

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

______________________Flow Inputs and Adjustments______________________

Volume, V	5972	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1555	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1594	pc/h/ln

______________________Speed Inputs and Adjustments______________________

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

______________________LOS and Performance Measures______________________

Flow rate, vp	1594	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.5	mi/h
Number of lanes, N	4	
Density, D	24.7	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5695	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1483	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2027	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2027	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	59.4	mi/h
Number of lanes, N	3	
Density, D	34.1	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Period
Freeway/Direction:	101 SB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3799	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	989	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1352	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1352	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	20.8	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Miller Creek on
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3799	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	164	vph
Length of first accel/decel lane	110	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3799	164		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	989	43		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4056	175	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.581 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2355 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4231	7050	No
v_3 or v_{av34}	1701 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 Yes

If yes, v_{12A} = 2355 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	2530	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 24.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.362	
Space mean speed in ramp influence area,	S_R = 56.7	mph
Space mean speed in outer lanes,	S_0 = 60.7	mph
Space mean speed for all vehicles,	S = 58.2	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd off
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3963	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1032	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1058	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1058	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	16.3	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyRd off/on
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3644	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	949	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1297	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1297	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	20.0	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	LucasValleyON
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3644	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	841	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3644	841		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	949	219		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3891	898	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.582 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2263 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4789	7050	No
v_3 or v_{av34}	1628 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 2263 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	3161	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 28.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.403	
Space mean speed in ramp influence area,	S_R = 55.7	mph
Space mean speed in outer lanes,	S_0 = 60.9	mph
Space mean speed for all vehicles,	S = 57.4	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyON/ManuelFreitasOFF
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4485	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1168	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1596	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1596	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.5	mi/h
Number of lanes, N	3	
Density, D	24.8	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: LP
Agency/Co.: Fehr & Peers
Date performed: 9/22/2016
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: 101 SB
Junction: Manuel T Freitas off
Jurisdiction: San Rafael
Analysis Year: Existing Plus Project
Description: 1650 Los Gamos

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4485	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	584	vph
Length of first accel/decel lane	120	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4485		584			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1168		152			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%	%	
Length	0.00	mi	0.00	mi	mi	
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          4789        624                  pcph

_________________________Estimation of V12 Diverge Areas_______________________

                  L  =            (Equation 13-12 or 13-13)
                   EQ
                  P  =    0.612   Using Equation  5
                   FD
                  v  = v  + (v - v ) P  =  3171   pc/h
                   12   R     F   R   FD

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v  = v                4789          7050            No
      Fi   F
     v  = v - v            4165          7050            No
      FO   F   R
     v                     624           2000            No
      R
     v  or v               1618 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 3171                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

______________________Flow Entering Diverge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                3171          4400                 No
      12
_________________Level of Service Determination (if not F)_____________________

Density,               D = 4.252 + 0.0086 v  - 0.009  L   =   30.4    pc/mi/ln
                        R                  12          D
Level of service for ramp-freeway junction areas of influence D

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 D  = 0.484
                                              S
Space mean speed in ramp influence area,     S  = 53.9    mph
                                              R
Space mean speed in outer lanes,             S  = 68.9    mph
                                              0
Space mean speed for all vehicles,           S  = 58.2    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	Manuel T Freitas on / off
Jurisdiction:	San Rafael
Analysis Year:	Existing Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3901	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1016	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1388	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1388	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	21.4	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone:	Fax:
E-mail:	

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas off-on
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occupancy NP
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3764	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	980	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1340	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1340	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	20.6	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas on/Redwood on
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4123	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1074	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1101	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1101	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	16.9	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst: LP
Agency/Co.: Fehr & Peers
Date performed: 9/16/2016
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: 101 NB
Junction: Redwood Highway On
Jurisdiction: San Rafael
Analysis Year: Baseline 100% Occ No Project
Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4123	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	106	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4123		106			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1074		28			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV           0.976       0.976
Driver population factor, fP            1.00        1.00
Flow rate, vp                           4402        113                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.204   Using Equation  4
                   FM
                  v  = v  (P  ) =  897    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     4515          9400            No
      FO
     v  or v               1752 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 1760                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                1873          4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   18.8    pc/mi/ln
         R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.333
                                              S
Space mean speed in ramp influence area,     S  = 57.3    mph
                                              R
Space mean speed in outer lanes,             S  = 62.0    mph
                                              0
Space mean speed for all vehicles,           S  = 60.0    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Road off
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4229	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1101	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1129	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1129	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	17.4	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Rd off/Lucas Rd on
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3449	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	898	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1228	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1228	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	18.9	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Lucas Rd on/Smith Ranch Rd on
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3578	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	932	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	955	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	955	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	14.7	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Smith Ranch Rd WB on
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3578	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	141	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3578		141			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	932		37			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3820	151	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.199 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 760 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3971	9400	No
v_3 or v_{av34}	1530 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 1528 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1679	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 17.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.329	
Space mean speed in ramp influence area,	S_R = 57.4	mph
Space mean speed in outer lanes,	S_0 = 62.7	mph
Space mean speed for all vehicles,	S = 60.4	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3719	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	968	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	993	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	993	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	15.3	pc/mi/ln
Level of service, LOS	B	

Phone:	Fax:
E-mail:	

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occupancy NP
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3586	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	934	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1276	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1276	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	19.6	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Period
Freeway/Direction:	101 SB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occupancy NP
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3966	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1033	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1412	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1412	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	21.7	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Miller Creek on
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3966	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	881	vph
Length of first accel/decel lane	110	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3966	881		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1033	229		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4235	941	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.581 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2459 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5176	7050	No
v_3 or v_{av34}	1776 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 2459 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	3400	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 30.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.430	
Space mean speed in ramp influence area,	S_R = 55.1	mph
Space mean speed in outer lanes,	S_0 = 60.4	mph
Space mean speed for all vehicles,	S = 56.8	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Period
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd off
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4847	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1262	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1294	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1294	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	19.9	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd on/off
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4221	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1099	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1502	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1502	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.9	mi/h
Number of lanes, N	3	
Density, D	23.2	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Lucas Valley On
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4221	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	633	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4221	633		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1099	165		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4507	676	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.582 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2622 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5183	7050	No
v_3 or v_{av34}	1885 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 Yes

If yes, v_{12A} = 2622 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	3298	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 29.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.416	
Space mean speed in ramp influence area,	S_R = 55.4	mph
Space mean speed in outer lanes,	S_0 = 60.0	mph
Space mean speed for all vehicles,	S = 57.0	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyON/ManuelFreitasOFF
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4826	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1257	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1718	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1718	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.6	mi/h
Number of lanes, N	3	
Density, D	27.0	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Manuel T Freitas off
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4826	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	714	vph
Length of first accel/decel lane	120	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4826		714			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1257		186			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	5153	762	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.596 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3380 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5153	7050	No
$v_{FO} = v_F - v_R$	4391	7050	No
v_R	762	2000	No
v_3 or v_{av34}	1773 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 3380 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3380	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 32.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	D_S = 0.497	
Space mean speed in ramp influence area,	S_R = 53.6	mph
Space mean speed in outer lanes,	S_0 = 68.3	mph
Space mean speed for all vehicles,	S = 57.9	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	Manuel T Freitas on / off
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4112	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1071	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1463	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1463	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.9	mi/h
Number of lanes, N	3	
Density, D	22.5	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas off-on
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5302	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1381	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1887	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1887	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	61.6	mi/h
Number of lanes, N	3	
Density, D	30.6	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	ManuelTFreitasON/RedwoodHwyON
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5947	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1549	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2117	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2117	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	57.7	mi/h
Number of lanes, N	3	
Density, D	36.7	pc/mi/ln
Level of service, LOS	E	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Redwood Highway on
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5947	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	316	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5947	316		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1549	82		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	6350	337	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.176 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1116 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6687	9400	No
v_3 or v_{av34}	2617 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	
If yes, v_{12A} = 2540		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	2877	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 26.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.377	
Space mean speed in ramp influence area,	S_R = 56.3	mph
Space mean speed in outer lanes,	S_0 = 59.9	mph
Space mean speed for all vehicles,	S = 58.3	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Rd off
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	6263	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1631	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1672	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1672	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.0	mi/h
Number of lanes, N	4	
Density, D	26.1	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	SmithRanchRd off/LucasRdEB on
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5539	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1442	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1479	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1479	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.9	mi/h
Number of lanes, N	4	
Density, D	22.8	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	LucasValleyRdON/SmithRanchRdON
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5782	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1506	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1543	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1543	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.7	mi/h
Number of lanes, N	4	
Density, D	23.8	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Smith Ranch Rd WB on
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5782	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	407	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5782		407			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1506		106			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV           0.976       0.976
Driver population factor, fP            1.00        1.00
Flow rate, vp                           6173        435                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L   =            (Equation 13-6 or 13-7)
                   EQ
                  P   =    0.163   Using Equation  4
                   FM
                  v  = v  (P  ) =  1009   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     6608          9400            No
      FO
     v  or v               2582 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 2469                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                2904          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   26.7    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  C

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.379
                                              S
Space mean speed in ramp influence area,     S  = 56.3    mph
                                              R
Space mean speed in outer lanes,             S  = 60.1    mph
                                              0
Space mean speed for all vehicles,           S  = 58.4    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	6189	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1612	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1652	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1652	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.1	mi/h
Number of lanes, N	4	
Density, D	25.8	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5898	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1536	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2099	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2099	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	58.1	mi/h
Number of lanes, N	3	
Density, D	36.1	pc/mi/ln
Level of service, LOS	E	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Period
Freeway/Direction:	101 SB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4013	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1045	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1428	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1428	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	22.0	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

__________Merge Analysis__________

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Miller Creek on
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

__________Freeway Data__________

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4013	vph

__________On Ramp Data__________

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	172	vph
Length of first accel/decel lane	110	ft
Length of second accel/decel lane		ft

__________Adjacent Ramp Data (if one exists)__________

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

__________Conversion to pc/h Under Base Conditions__________

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4013	172		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1045	45		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4285	184	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.581 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2488 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4469	7050	No
v_3 or v_{av34}	1797 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	
If yes, v_{12A} = 2488		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	2672	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 25.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.370	
Space mean speed in ramp influence area,	S_R = 56.5	mph
Space mean speed in outer lanes,	S_0 = 60.3	mph
Space mean speed for all vehicles,	S = 58.0	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd off
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4185	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1090	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1117	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1117	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	17.2	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.60

Phone:	Fax:
E-mail:	

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyRd off/on
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3893	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1014	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1386	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1386	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	21.3	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	LucasValleyON
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3893	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	818	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3893		818			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1014		213			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4157	873	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.582 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2418 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5030	7050	No
v_3 or v_{av34}	1739 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 2418 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	3291	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 29.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.415	
Space mean speed in ramp influence area,	S_R = 55.4	mph
Space mean speed in outer lanes,	S_0 = 60.5	mph
Space mean speed for all vehicles,	S = 57.1	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone:	Fax:
E-mail:	

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyON/ManuelFreitasOFF
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occ No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4711	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1227	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1677	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1677	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.9	mi/h
Number of lanes, N	3	
Density, D	26.2	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: LP
Agency/Co.: Fehr & Peers
Date performed: 9/22/2016
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: 101 SB
Junction: Manuel T Freitas off
Jurisdiction: San Rafael
Analysis Year: Baseline 100% Occ No Project
Description: 1650 Los Gamos

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4711	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	613	vph
Length of first accel/decel lane	120	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4711		613			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1227		160			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	5030	655	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.604 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3298 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5030	7050	No
$v_{FO} = v_F - v_R$	4375	7050	No
v_R	655	2000	No
v_3 or v_{av34}	1732 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 3298 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3298	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 31.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, D_S = 0.487

Space mean speed in ramp influence area, S_R = 53.8 mph

Space mean speed in outer lanes, S_0 = 68.5 mph

Space mean speed for all vehicles, S = 58.1 mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	Manuel T Freitas on / off
Jurisdiction:	San Rafael
Analysis Year:	Baseline 100% Occupancy NP
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4098	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1067	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1458	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1458	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	22.4	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas off-on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Existing Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3718	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	968	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1323	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1323	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	20.4	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas on/Redwood on
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4077	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1062	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1088	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1088	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	16.7	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/16/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Redwood Highway On
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4077	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	106	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4077	106		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1062	28		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4353	113	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.204 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 887 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4466	9400	No
v_3 or v_{av34}	1733 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 Yes

If yes, v_{12A} = 1741 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1854	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 18.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.333	
Space mean speed in ramp influence area,	S_R = 57.4	mph
Space mean speed in outer lanes,	S_0 = 62.1	mph
Space mean speed for all vehicles,	S = 60.0	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Road off
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4183	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1089	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1117	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1117	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	17.2	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Rd off/Lucas Rd on
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3449	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	898	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1228	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1228	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	18.9	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Lucas Rd on/Smith Ranch Rd on
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3570	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	930	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	953	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	953	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	14.7	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Smith Ranch Rd WB on
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3570	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	141	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3570		141			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	930		37			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV           0.976       0.976
Driver population factor, fP            1.00        1.00
Flow rate, vp                           3812        151                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L   =            (Equation 13-6 or 13-7)
                   EQ
                  P   =    0.199   Using Equation  4
                   FM
                  v  = v  (P  ) =  758    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     3963          9400            No
      FO
     v  or v               1527 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34        12
If yes, v    = 1524                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                1675          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   17.3    pc/mi/ln
          R                   R           12            A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.329
                                              S
Space mean speed in ramp influence area,     S  = 57.4    mph
                                              R
Space mean speed in outer lanes,             S  = 62.7    mph
                                              0
Space mean speed for all vehicles,           S  = 60.4    mph
_______________________________________________________________________________
```

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3711	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	966	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	991	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	991	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	15.2	pc/mi/ln
Level of service, LOS	B	

Phone:	Fax:
E-mail:	

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Existing Occupancy NP
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3578	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	932	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1273	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1273	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	19.6	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Period
Freeway/Direction:	101 SB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Existing Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3917	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1020	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1394	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1394	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	21.4	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst: LP
Agency/Co.: Fehr & Peers
Date performed: 9/21/2016
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: 101 SB
Junction: Miller Creek on
Jurisdiction: San Rafael
Analysis Year: Baseline No Project
Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3917	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	881	vph
Length of first accel/decel lane	110	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3917		881			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1020		229			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4182	941	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.581 Using Equation 1

$v_{12} = v_F\ (P_{FM})$ = 2428 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5123	7050	No
v_3 or v_{av34}	1754 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 Yes

If yes, v_{12A} = 2428 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	3369	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 30.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.427	
Space mean speed in ramp influence area,	S_R = 55.2	mph
Space mean speed in outer lanes,	S_0 = 60.5	mph
Space mean speed for all vehicles,	S = 56.9	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Period
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd off
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4798	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1249	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1281	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1281	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	19.7	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd on/off
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4222	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1099	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1503	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1503	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.8	mi/h
Number of lanes, N	3	
Density, D	23.2	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Lucas Valley On
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4222	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	626	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4222	626		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1099	163		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4508	668	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.582 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2622 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5176	7050	No
v_3 or v_{av34}	1886 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 Yes

If yes, v_{12A} = 2622 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	3290	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 29.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.415	
Space mean speed in ramp influence area,	S_R = 55.5	mph
Space mean speed in outer lanes,	S_0 = 60.0	mph
Space mean speed for all vehicles,	S = 57.0	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyON/ManuelFreitasOFF
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4821	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1255	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1716	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1716	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.6	mi/h
Number of lanes, N	3	
Density, D	27.0	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Manuel T Freitas off
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4821	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	714	vph
Length of first accel/decel lane	120	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4821		714			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1255		186			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	5147	762	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.596 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3377 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5147	7050	No
$v_{FO} = v_F - v_R$	4385	7050	No
v_R	762	2000	No
v_3 or v_{av34}	1770 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 3377 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3377	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 32.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, D_S = 0.497

Space mean speed in ramp influence area, S_R = 53.6 mph

Space mean speed in outer lanes, S_0 = 68.3 mph

Space mean speed for all vehicles, S = 57.9 mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	Manuel T Freitas on / off
Jurisdiction:	San Rafael
Analysis Year:	Baseline Existing Occupancy NP
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4107	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1070	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1462	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1462	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.9	mi/h
Number of lanes, N	3	
Density, D	22.5	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas off-on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Existing Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5293	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1378	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1884	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1884	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	61.7	mi/h
Number of lanes, N	3	
Density, D	30.5	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	ManuelTFreitasON/RedwoodHwyON
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5938	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1546	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2113	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2113	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	57.8	mi/h
Number of lanes, N	3	
Density, D	36.6	pc/mi/ln
Level of service, LOS	E	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Redwood Highway on
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5938	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	316	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5938	316		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1546	82		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

```
Heavy vehicle adjustment, fHV           0.976       0.976
Driver population factor, fP            1.00        1.00
Flow rate, vp                           6340        337                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.176   Using Equation  4
                   FM
                  v  = v  (P  ) =  1114   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     6677          9400            No
      FO
     v  or v               2613 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 2536                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                2873          4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   26.5    pc/mi/ln
         R                    R           12             A
Level of service for ramp-freeway junction areas of influence  C

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.377
                                              S
Space mean speed in ramp influence area,     S  = 56.3    mph
                                              R
Space mean speed in outer lanes,             S  = 60.0    mph
                                              0
Space mean speed for all vehicles,           S  = 58.3    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Rd off
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	6254	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1629	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1669	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1669	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.0	mi/h
Number of lanes, N	4	
Density, D	26.1	pc/mi/ln
Level of service, LOS	D	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	SmithRanchRd off/LucasRdEB on
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5539	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1442	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1479	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1479	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.9	mi/h
Number of lanes, N	4	
Density, D	22.8	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	LucasValleyRdON/SmithRanchRdON
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5730	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1492	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1529	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1529	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.8	mi/h
Number of lanes, N	4	
Density, D	23.6	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

___Merge Analysis___

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Smith Ranch Rd WB on
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project

Description: 1650 Los Gamos

___Freeway Data___

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5730	vph

___On Ramp Data___

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	407	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

___Adjacent Ramp Data (if one exists)___

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

___Conversion to pc/h Under Base Conditions___

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5730	407		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1492	106		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          6118        435                    pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.163   Using Equation  4
                   FM
                  v  = v  (P  ) =  1000   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     6553          9400            No
      FO
     v  or v               2559 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34          12
If yes, v    = 2447                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                2882          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   26.6    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  C

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.377
                                              S
Space mean speed in ramp influence area,     S  = 56.3    mph
                                              R
Space mean speed in outer lanes,             S  = 60.2    mph
                                              0
Space mean speed for all vehicles,           S  = 58.4    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	6137	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1598	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1638	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1638	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.2	mi/h
Number of lanes, N	4	
Density, D	25.5	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Existing Occupancy NP
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5846	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1522	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2081	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2081	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	58.4	mi/h
Number of lanes, N	3	
Density, D	35.6	pc/mi/ln
Level of service, LOS	E	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Period
Freeway/Direction:	101 SB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Existing Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4044	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1053	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1439	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1439	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	22.1	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

```
Phone:                                      Fax:
E-mail:

_________________________________Merge Analysis________________________________

Analyst:                 LP
Agency/Co.:              Fehr & Peers
Date performed:          9/22/2016
Analysis time period:    PM Peak Hour
Freeway/Dir of Travel:   101 SB
Junction:                Miller Creek on
Jurisdiction:            San Rafael
Analysis Year:           Baseline No Project
Description:  1650 Los Gamos

__________________________________Freeway Data_________________________________

Type of analysis                            Merge
Number of lanes in freeway                  3
Free-flow speed on freeway                  65.0          mph
Volume on freeway                           4044          vph

__________________________________On Ramp Data_________________________________

Side of freeway                             Right
Number of lanes in ramp                     1
Free-flow speed on ramp                     35.0          mph
Volume on ramp                              172           vph
Length of first accel/decel lane            110           ft
Length of second accel/decel lane                         ft

_________________________Adjacent Ramp Data (if one exists)____________________

Does adjacent ramp exist?                   No
Volume on adjacent Ramp                                   vph
Position of adjacent Ramp
Type of adjacent Ramp
Distance to adjacent Ramp                                 ft

____________________Conversion to pc/h Under Base Conditions___________________
```

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4044	172		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1053	45		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

```
Heavy vehicle adjustment, fHV           0.976       0.976
Driver population factor, fP            1.00        1.00
Flow rate, vp                           4318        184                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.581   Using Equation  1
                   FM
                  v  = v  (P  ) =  2507   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum          LOS F?
     v                     4502          7050             No
      FO
     v  or v               1811 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 2507                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                2691          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   25.7    pc/mi/ln
         R                    R           12             A
Level of service for ramp-freeway junction areas of influence  C

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.371
                                              S
Space mean speed in ramp influence area,     S  = 56.5    mph
                                              R
Space mean speed in outer lanes,             S  = 60.3    mph
                                              0
Space mean speed for all vehicles,           S  = 57.9    mph
_______________________________________________________________________________
```

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd off
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4216	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1098	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1125	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1125	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	17.3	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyRd off/on
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3934	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1024	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1400	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1400	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	21.5	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	LucasValleyON
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3934	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	777	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3934		777			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1024		202			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4200	830	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.582 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2443 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5030	7050	No
v_3 or v_{av34}	1757 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 Yes

If yes, v_{12A} = 2443 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	3273	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 29.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.413	
Space mean speed in ramp influence area,	S_R = 55.5	mph
Space mean speed in outer lanes,	S_0 = 60.5	mph
Space mean speed for all vehicles,	S = 57.1	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyON/ManuelFreitasOFF
Jurisdiction:	San Rafael
Analysis Year:	Baseline No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4711	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1227	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1677	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1677	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.9	mi/h
Number of lanes, N	3	
Density, D	26.2	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: LP
Agency/Co.: Fehr & Peers
Date performed: 9/22/2016
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: 101 SB
Junction: Manuel T Freitas off
Jurisdiction: San Rafael
Analysis Year: Baseline No Project
Description: 1650 Los Gamos

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4711	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	613	vph
Length of first accel/decel lane	120	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4711		613			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1227		160			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%	%	
Length	0.00	mi	0.00	mi	mi	
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          5030        655                     pcph

_________________________Estimation of V12 Diverge Areas_______________________

                  L   =            (Equation 13-12 or 13-13)
                   EQ
                  P   =    0.604   Using Equation  5
                   FD
                  v   = v  + (v - v ) P  =  3298   pc/h
                   12    R      F   R   FD

_______________________________Capacity Checks_________________________________

                             Actual        Maximum         LOS F?
     v  = v                  5030          7050            No
      Fi   F
     v  = v - v              4375          7050            No
      FO   F   R
     v                       655           2000            No
      R
     v  or v                 1732 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?             No
      3     av34
Is   v  or v      > 1.5 v  /2              No
      3     av34         12
If yes, v    = 3298                     (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

______________________Flow Entering Diverge Influence Area______________________
                      Actual        Max Desirable        Violation?
     v                3298          4400                 No
      12
_________________Level of Service Determination (if not F)______________________

Density,               D = 4.252 + 0.0086 v  - 0.009  L   =   31.5    pc/mi/ln
                        R                  12          D
Level of service for ramp-freeway junction areas of influence D

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 D  = 0.487
                                              S
Space mean speed in ramp influence area,     S  = 53.8    mph
                                              R
Space mean speed in outer lanes,             S  = 68.5    mph
                                              0
Space mean speed for all vehicles,           S  = 58.1    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	Manuel T Freitas on / off
Jurisdiction:	San Rafael
Analysis Year:	Baseline Existing Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4098	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1067	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1458	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1458	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	22.4	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas off-on
Jurisdiction:	San Rafael
Analysis Year:	Basline Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3785	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	986	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1347	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1347	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	20.7	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas on/Redwood on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4144	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1079	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1106	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1106	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	17.0	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/16/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Redwood Highway On
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4144	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	106	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4144		106			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1079		28			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV           0.976       0.976
Driver population factor, fP            1.00        1.00
Flow rate, vp                           4425        113                      pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.204   Using Equation  4
                   FM
                  v  = v  (P  ) =  901    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     4538          9400            No
      FO
     v  or v               1762 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 1770                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                1883          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   18.9    pc/mi/ln
         R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.333
                                              S
Space mean speed in ramp influence area,     S  = 57.3    mph
                                              R
Space mean speed in outer lanes,             S  = 62.0    mph
                                              0
Space mean speed for all vehicles,           S  = 60.0    mph
_______________________________________________________________________________
```

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Road off
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4250	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1107	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1134	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1134	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	17.4	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Rd off/Lucas Rd on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3492	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	909	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1243	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1243	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	19.1	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Lucas Rd on/Smith Ranch Rd on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3632	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	946	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	969	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	969	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	14.9	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

______________________________Merge Analysis______________________________

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Smith Ranch Rd WB on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

______________________________Freeway Data______________________________

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3632	vph

______________________________On Ramp Data______________________________

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	141	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

______________________Adjacent Ramp Data (if one exists)______________________

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

____________________Conversion to pc/h Under Base Conditions____________________

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3632		141			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	946		37			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3878	151	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.199 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 771 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4029	9400	No
v_3 or v_{av34}	1553 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 1551 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1702	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 17.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.329	
Space mean speed in ramp influence area,	S_R = 57.4	mph
Space mean speed in outer lanes,	S_0 = 62.6	mph
Space mean speed for all vehicles,	S = 60.3	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3773	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	983	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1007	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1007	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	15.5	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3640	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	948	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1295	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1295	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	19.9	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Period
Freeway/Direction:	101 SB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3994	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1040	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1421	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1421	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	21.9	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Miller Creek on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3994	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	881	vph
Length of first accel/decel lane	110	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3994		881			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1040		229			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4264	941	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.581 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2476 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5205	7050	No
v_3 or v_{av34}	1788 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 Yes

If yes, v_{12A} = 2476 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	3417	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 31.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.432	
Space mean speed in ramp influence area,	S_R = 55.1	mph
Space mean speed in outer lanes,	S_0 = 60.4	mph
Space mean speed for all vehicles,	S = 56.8	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Period
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd off
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4875	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1270	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1301	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1301	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	20.0	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd on/off
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4221	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1099	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1502	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1502	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.9	mi/h
Number of lanes, N	3	
Density, D	23.2	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Lucas Valley On
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4221	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	641	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4221		641			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1099		167			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4507	684	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.582 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2622 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5191	7050	No
v_3 or v_{av34}	1885 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	
If yes, v_{12A} = 2622		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	3306	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 30.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.417	
Space mean speed in ramp influence area,	S_R = 55.4	mph
Space mean speed in outer lanes,	S_0 = 60.0	mph
Space mean speed for all vehicles,	S = 57.0	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyON/ManuelFreitasOFF
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4840	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1260	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1723	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1723	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.5	mi/h
Number of lanes, N	3	
Density, D	27.1	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: LP
Agency/Co.: Fehr & Peers
Date performed: 9/22/2016
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: 101 SB
Junction: Manuel T Freitas off
Jurisdiction: San Rafael
Analysis Year: Baseline Plus Project
Description: 1650 Los Gamos

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4840	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	714	vph
Length of first accel/decel lane	120	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4840		714			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1260		186			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV           0.976       0.976
Driver population factor, fP            1.00        1.00
Flow rate, vp                           5168        762                     pcph

_________________________Estimation of V12 Diverge Areas________________________

                  L  =            (Equation 13-12 or 13-13)
                   EQ
                  P  =    0.596   Using Equation  5
                   FD
                  v  = v  + (v - v ) P  =  3387   pc/h
                   12   R     F   R   FD

_______________________________Capacity Checks__________________________________

                           Actual        Maximum         LOS F?
     v  = v                5168          7050            No
      Fi   F
     v  = v - v            4406          7050            No
      FO   F   R
     v                     762           2000            No
      R
     v  or v               1781 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 3387                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

______________________Flow Entering Diverge Influence Area______________________
                        Actual        Max Desirable         Violation?
     v                  3387          4400                  No
      12
_________________Level of Service Determination (if not F)______________________

Density,                 D = 4.252 + 0.0086 v  - 0.009  L   =   32.3    pc/mi/ln
                          R                  12          D
Level of service for ramp-freeway junction areas of influence D

_____________________________Speed Estimation___________________________________

Intermediate speed variable,                 D  = 0.497
                                              S
Space mean speed in ramp influence area,     S  = 53.6    mph
                                              R
Space mean speed in outer lanes,             S  = 68.3    mph
                                              0
Space mean speed for all vehicles,           S  = 57.9    mph
________________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	Manuel T Freitas on / off
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4126	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1074	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1468	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1468	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.9	mi/h
Number of lanes, N	3	
Density, D	22.6	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas off-on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5446	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1418	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1938	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1938	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	60.9	mi/h
Number of lanes, N	3	
Density, D	31.8	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	ManuelTFreitasON/RedwoodHwyON
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	6091	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1586	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2168	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2168	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	56.6	mi/h
Number of lanes, N	3	
Density, D	38.3	pc/mi/ln
Level of service, LOS	E	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Redwood Highway on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6091	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	316	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6091	316		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1586	82		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

```
Heavy vehicle adjustment, fHV           0.976       0.976
Driver population factor, fP            1.00        1.00
Flow rate, vp                           6503        337                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.176   Using Equation  4
                   FM
                  v  = v  (P  ) =  1142   pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     6840          9400            No
      FO
     v  or v               2680 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 2601                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                2938          4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   27.0    pc/mi/ln
          R                   R           12            A
Level of service for ramp-freeway junction areas of influence  C

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.381
                                              S
Space mean speed in ramp influence area,     S  = 56.2    mph
                                              R
Space mean speed in outer lanes,             S  = 59.8    mph
                                              0
Space mean speed for all vehicles,           S  = 58.2    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Rd off
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	6407	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1668	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1710	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1710	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.6	mi/h
Number of lanes, N	4	
Density, D	26.9	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	SmithRanchRd off/LucasRdEB on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5655	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1473	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1509	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1509	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.8	mi/h
Number of lanes, N	4	
Density, D	23.3	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	LucasValleyRdON/SmithRanchRdON
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5925	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1543	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1582	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1582	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.5	mi/h
Number of lanes, N	4	
Density, D	24.5	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Smith Ranch Rd WB on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5925	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	407	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5925		407			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1543		106			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	6326	435	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.163 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1034 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6761	9400	No
v_3 or v_{av34}	2646 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	
If yes, v_{12A} = 2530		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	2965	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 27.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.383	
Space mean speed in ramp influence area,	S_R = 56.2	mph
Space mean speed in outer lanes,	S_0 = 60.0	mph
Space mean speed for all vehicles,	S = 58.2	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	6332	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1649	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1690	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1690	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.8	mi/h
Number of lanes, N	4	
Density, D	26.5	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	6041	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1573	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2150	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2150	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	37.7	pc/mi/ln
Level of service, LOS	E	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Period
Freeway/Direction:	101 SB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4127	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1075	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1469	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1469	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.9	mi/h
Number of lanes, N	3	
Density, D	22.6	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Miller Creek on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4127	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	172	vph
Length of first accel/decel lane	110	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4127		172			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1075		45			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          4406        184                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =             (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.581   Using Equation  1
                   FM
                  v  = v  (P  ) =  2558   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     4590          7050            No
      FO
     v  or v               1848 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 2558                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                2742          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   26.1    pc/mi/ln
         R                    R            12             A
Level of service for ramp-freeway junction areas of influence  C

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.374
                                              S
Space mean speed in ramp influence area,     S  = 56.4    mph
                                              R
Space mean speed in outer lanes,             S  = 60.1    mph
                                              0
Space mean speed for all vehicles,           S  = 57.9    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone:	Fax:
E-mail:	

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd off
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4299	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1120	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1148	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1148	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	17.7	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyRd off/on
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	3975	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1035	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1415	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1415	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	21.8	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

_____Merge Analysis_____

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	LucasValleyON
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3975	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	839	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3975		839			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1035		218			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4244	896	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.582 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2469 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5140	7050	No
v_3 or v_{av34}	1775 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 Yes

If yes, v_{12A} = 2469 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	3365	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 30.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.423	
Space mean speed in ramp influence area,	S_R = 55.3	mph
Space mean speed in outer lanes,	S_0 = 60.4	mph
Space mean speed for all vehicles,	S = 56.9	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyON/ManuelFreitasOFF
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4814	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1254	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1713	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1713	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.6	mi/h
Number of lanes, N	3	
Density, D	26.9	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Manuel T Freitas off
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4814	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	613	vph
Length of first accel/decel lane	120	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4814		613			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1254		160			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	5140	655	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.601 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3352 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5140	7050	No
$v_{FO} = v_F - v_R$	4485	7050	No
v_R	655	2000	No
v_3 or v_{av34}	1788 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 3352 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3352	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 32.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	D_S = 0.487	
Space mean speed in ramp influence area,	S_R = 53.8	mph
Space mean speed in outer lanes,	S_0 = 68.2	mph
Space mean speed for all vehicles,	S = 58.1	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	Manuel T Freitas on / off
Jurisdiction:	San Rafael
Analysis Year:	Baseline Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4201	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1094	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1495	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1495	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.9	mi/h
Number of lanes, N	3	
Density, D	23.0	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas off-on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100% Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4579	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1192	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1630	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1630	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.2	mi/h
Number of lanes, N	3	
Density, D	25.4	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	ManuelTFreitasON/RedwoodHwyON
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5016	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1306	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1785	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1785	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.9	mi/h
Number of lanes, N	3	
Density, D	28.4	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

_____Merge Analysis_____

Analyst: LP
Agency/Co.: Fehr & Peers
Date performed: 9/16/2016
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: 101 NB
Junction: Redwood Highway On
Jurisdiction: San Rafael
Analysis Year: Cumulative 100 Occ No Project
Description: 1650 Los Gamos

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5016	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	129	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5016	129		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1306	34		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	5356	138	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.201 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1074 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5494	9400	No
v_3 or v_{av34}	2141 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 2142 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	2280	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 22.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.346	
Space mean speed in ramp influence area,	S_R = 57.0	mph
Space mean speed in outer lanes,	S_0 = 61.0	mph
Space mean speed for all vehicles,	S = 59.3	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone:	Fax:
E-mail:	

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Road off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5145	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1340	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1373	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1373	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	21.1	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Rd off/Lucas Rd on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4196	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1093	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1493	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1493	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.9	mi/h
Number of lanes, N	3	
Density, D	23.0	pc/mi/ln
Level of service, LOS	C	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Lucas Rd on/Smith Ranch Rd on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4353	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1134	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1162	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1162	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	17.9	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Smith Ranch Rd WB on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4353	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	171	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4353	171		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1134	45		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4648	183	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.195 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 906 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4831	9400	No
v_3 or v_{av34}	1871 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 Yes

If yes, v_{12A} = 1859 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	2042	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 20.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.338	
Space mean speed in ramp influence area,	S_R = 57.2	mph
Space mean speed in outer lanes,	S_0 = 61.8	mph
Space mean speed for all vehicles,	S = 59.8	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4524	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1178	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1208	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1208	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	18.6	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100% Occupancy NP
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4362	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1136	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1552	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1552	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.7	mi/h
Number of lanes, N	3	
Density, D	24.0	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Period
Freeway/Direction:	101 SB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100% Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4729	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1232	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1683	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1683	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.9	mi/h
Number of lanes, N	3	
Density, D	26.4	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Miller Creek on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4729	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1071	vph
Length of first accel/decel lane	110	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4729	1071		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1232	279		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	5049	1144	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.581 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2931 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6193	7050	No
v_3 or v_{av34}	2118 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 2931 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	4075	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 36.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	M_S = 0.543	
Space mean speed in ramp influence area,	S_R = 52.5	mph
Space mean speed in outer lanes,	S_0 = 59.2	mph
Space mean speed for all vehicles,	S = 54.6	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Period
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5800	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1510	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1548	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1548	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.7	mi/h
Number of lanes, N	4	
Density, D	23.9	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd on/off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5188	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1351	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1846	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1846	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.2	mi/h
Number of lanes, N	3	
Density, D	29.7	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Lucas Valley On
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5188	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	770	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5188	770		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1351	201		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	5539	822	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.582 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 3222 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6361	7050	No
v_3 or v_{av34}	2317 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	
If yes, v_{12A} = 3222		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	4044	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 35.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	M_S = 0.533	
Space mean speed in ramp influence area,	S_R = 52.7	mph
Space mean speed in outer lanes,	S_0 = 58.4	mph
Space mean speed for all vehicles,	S = 54.7	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyON/ManuelFreitasOFF
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5871	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1529	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2090	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2090	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	58.2	mi/h
Number of lanes, N	3	
Density, D	35.9	pc/mi/ln
Level of service, LOS	E	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: LP
Agency/Co.: Fehr & Peers
Date performed: 9/22/2016
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: 101 SB
Junction: Manuel T Freitas off
Jurisdiction: San Rafael
Analysis Year: Cumulative 100 Occ No Project
Description: 1650 Los Gamos

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5871	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	868	vph
Length of first accel/decel lane	120	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5871		868			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1529		226			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          6269        927                   pcph

_________________________Estimation of V12 Diverge Areas_______________________

                  L  =            (Equation 13-12 or 13-13)
                   EQ
                  P  =    0.561   Using Equation  5
                   FD
                  v  = v  + (v - v ) P  =  3922   pc/h
                   12   R     F   R   FD

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v  = v                6269          7050            No
      Fi   F
     v  = v - v            5342          7050            No
      FO   F   R
     v                     927           2000            No
      R
     v  or v               2347 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 3922                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

______________________Flow Entering Diverge Influence Area______________________
                      Actual        Max Desirable         Violation?
     v                3922          4400                  No
      12
_________________Level of Service Determination (if not F)______________________

Density,               D = 4.252 + 0.0086 v  - 0.009  L   =   36.9    pc/mi/ln
                        R                  12          D
Level of service for ramp-freeway junction areas of influence E

_____________________________Speed Estimation__________________________________

Intermediate speed variable,              D  = 0.511
                                           S
Space mean speed in ramp influence area,  S  = 53.2    mph
                                           R
Space mean speed in outer lanes,          S  = 66.1    mph
                                           0
Space mean speed for all vehicles,        S  = 57.4    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	Manuel T Freitas on / off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100% Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5003	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1303	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1781	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1781	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.9	mi/h
Number of lanes, N	3	
Density, D	28.3	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas off-on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100% Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	6451	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1680	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2296	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2296	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	53.6	mi/h
Number of lanes, N	3	
Density, D	42.8	pc/mi/ln
Level of service, LOS	E	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	ManuelTFreitasON/RedwoodHwyON
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	7236	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1884	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2575	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2575	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	45.4	mi/h
Number of lanes, N	3	
Density, D	56.7	pc/mi/ln
Level of service, LOS	F	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Redwood Highway on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	7236	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	384	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7236	384		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1884	100		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          7726        410                    pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L   =            (Equation 13-6 or 13-7)
                   EQ
                  P   =    0.167   Using Equation  4
                   FM
                  v  = v  (P  ) =  1287   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     8136          9400            No
      FO
     v  or v               3219 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           Yes
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 3090                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                3500          4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   31.4    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  D

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.437
                                              S
Space mean speed in ramp influence area,     S  = 55.0    mph
                                              R
Space mean speed in outer lanes,             S  = 58.4    mph
                                              0
Space mean speed for all vehicles,           S  = 56.8    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Rd off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	7620	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1984	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2034	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2034	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	59.3	mi/h
Number of lanes, N	4	
Density, D	34.3	pc/mi/ln
Level of service, LOS	D	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	SmithRanchRd off/LucasRdEB on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	6739	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1755	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1799	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1799	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.7	mi/h
Number of lanes, N	4	
Density, D	28.7	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone:	Fax:
E-mail:	

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	LucasValleyRdON/SmithRanchRdON
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	7035	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1832	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1878	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1878	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	61.8	mi/h
Number of lanes, N	4	
Density, D	30.4	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Smith Ranch Rd WB on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	7035	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	495	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7035	495		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1832	129		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	7511	529	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.152 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1139 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	8040	9400	No

v_3 or v_{av34} 3186 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? Yes

Is v_3 or v_{av34} > 1.5 v_{12}/2 Yes

If yes, v_{12A} = 3004 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	3533	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 31.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M_S = 0.441

Space mean speed in ramp influence area, S_R = 54.9 mph

Space mean speed in outer lanes, S_0 = 58.7 mph

Space mean speed for all vehicles, S = 56.9 mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	7530	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1961	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2010	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2010	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	59.7	mi/h
Number of lanes, N	4	
Density, D	33.7	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100% Occupancy NP
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	7177	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1869	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2554	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2554	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	46.1	mi/h
Number of lanes, N	3	
Density, D	55.4	pc/mi/ln
Level of service, LOS	F	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Period
Freeway/Direction:	101 SB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100% Occupancy NP
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4882	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1271	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1738	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1738	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.4	mi/h
Number of lanes, N	3	
Density, D	27.4	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

_____Merge Analysis_____

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Miller Creek on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4882	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	209	vph
Length of first accel/decel lane	110	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4882		209			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1271		54			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV           0.976       0.976
Driver population factor, fP            1.00        1.00
Flow rate, vp                           5213        223                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L   =            (Equation 13-6 or 13-7)
                   EQ
                  P   =    0.581   Using Equation  1
                   FM
                  v   = v  (P   ) =  3027   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     5436          7050            No
      FO
     v  or v               2186 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 3027                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                3250          4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   30.0    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  D

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.414
                                              S
Space mean speed in ramp influence area,     S  = 55.5    mph
                                              R
Space mean speed in outer lanes,             S  = 58.9    mph
                                              0
Space mean speed for all vehicles,           S  = 56.8    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5091	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1326	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1359	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1359	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	20.9	pc/mi/ln
Level of service, LOS	C	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyRd off/on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4736	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1233	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1686	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1686	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.8	mi/h
Number of lanes, N	3	
Density, D	26.4	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

____Merge Analysis____

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	LucasValleyON
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

____Freeway Data____

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4736	vph

____On Ramp Data____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	995	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

____Adjacent Ramp Data (if one exists)____

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

____Conversion to pc/h Under Base Conditions____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4736	995		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1233	259		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	5057	1062	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.582 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2942 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6119	7050	No
v_3 or v_{av34}	2115 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 2942 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	4004	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 35.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, M_S = 0.524

Space mean speed in ramp influence area, S_R = 52.9 mph

Space mean speed in outer lanes, S_0 = 59.2 mph

Space mean speed for all vehicles, S = 54.9 mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyON/ManuelFreitasOFF
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5731	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1492	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2040	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2040	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	59.2	mi/h
Number of lanes, N	3	
Density, D	34.5	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Manuel T Freitas off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5731	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	746	vph
Length of first accel/decel lane	120	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5731		746			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1492		194			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	6119	797	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.570 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3832 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6119	7050	No
$v_{FO} = v_F - v_R$	5322	7050	No
v_R	797	2000	No
v_3 or v_{av34}	2287 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 3832 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3832	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 36.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D_S = 0.500

Space mean speed in ramp influence area, S_R = 53.5 mph

Space mean speed in outer lanes, S_0 = 66.3 mph

Space mean speed for all vehicles, S = 57.7 mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	Manuel T Freitas on / off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100% Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4985	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1298	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1774	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1774	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.0	mi/h
Number of lanes, N	3	
Density, D	28.2	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas off-on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Exist Occupancy NP
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4523	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1178	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1610	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1610	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.4	mi/h
Number of lanes, N	3	
Density, D	25.0	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone:	Fax:
E-mail:	

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	ManuelTFreitasON/RedwoodHwyON
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4960	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1292	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1765	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1765	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.1	mi/h
Number of lanes, N	3	
Density, D	28.0	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/16/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Redwood Highway On
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4960	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	129	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4960		129			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1292		34			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          5296        138                    pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L   =            (Equation 13-6 or 13-7)
                   EQ
                  P   =    0.201   Using Equation  4
                   FM
                  v  = v  (P  ) =  1062   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     5434          9400            No
      FO
     v  or v               2117 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 2118                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable          Violation?
     v                2256          4600                   No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   21.8    pc/mi/ln
         R                   R           12            A
Level of service for ramp-freeway junction areas of influence  C

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.345
                                              S
Space mean speed in ramp influence area,     S  = 57.1    mph
                                              R
Space mean speed in outer lanes,             S  = 61.1    mph
                                              0
Space mean speed for all vehicles,           S  = 59.3    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Road off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5089	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1325	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1358	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1358	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	20.9	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Rd off/Lucas Rd on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4196	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1093	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1493	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1493	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.9	mi/h
Number of lanes, N	3	
Density, D	23.0	pc/mi/ln
Level of service, LOS	C	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Lucas Rd on/Smith Ranch Rd on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4344	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1131	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1160	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1160	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	17.8	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Smith Ranch Rd WB on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4344	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	171	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4344		171			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1131		45			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%	%	
Length		mi		mi	mi	
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV           0.976       0.976
Driver population factor, fP            1.00        1.00
Flow rate, vp                           4638        183                    pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.195   Using Equation  4
                   FM
                  v  = v  (P  ) =  904    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     4821          9400            No
      FO
     v  or v               1867 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 1855                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                2038          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   20.1    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  C

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.338
                                              S
Space mean speed in ramp influence area,     S  = 57.2    mph
                                              R
Space mean speed in outer lanes,             S  = 61.8    mph
                                              0
Space mean speed for all vehicles,           S  = 59.8    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4515	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1176	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1205	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1205	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	18.5	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Exist Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4353	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1134	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1549	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1549	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.7	mi/h
Number of lanes, N	3	
Density, D	23.9	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Period
Freeway/Direction:	101 SB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Exist Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4679	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1218	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1665	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1665	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.0	mi/h
Number of lanes, N	3	
Density, D	26.0+	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Miller Creek on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4679	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1071	vph
Length of first accel/decel lane	110	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4679	1071		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1218	279		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4996	1144	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.581 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2901 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6140	7050	No
v_3 or v_{av34}	2095 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 2901 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	4045	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 35.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	M_S = 0.536	
Space mean speed in ramp influence area,	S_R = 52.7	mph
Space mean speed in outer lanes,	S_0 = 59.3	mph
Space mean speed for all vehicles,	S = 54.7	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Period
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5750	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1497	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1535	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1535	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.7	mi/h
Number of lanes, N	4	
Density, D	23.7	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd on/off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5188	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1351	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1846	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1846	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.2	mi/h
Number of lanes, N	3	
Density, D	29.7	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Lucas Valley On
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5188	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	762	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5188		762			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1351		198			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          5539        814                  pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.582   Using Equation  1
                   FM
                  v  = v  (P  ) =  3222   pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     6353          7050            No
      FO
     v  or v               2317 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 3222                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual       Max Desirable        Violation?
     v                4036         4600                 No
      12A
_________________Level of Service Determination (if not F)______________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   35.6    pc/mi/ln
          R                   R           12            A
Level of service for ramp-freeway junction areas of influence  E

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.531
                                              S
Space mean speed in ramp influence area,     S  = 52.8    mph
                                              R
Space mean speed in outer lanes,             S  = 58.4    mph
                                              0
Space mean speed for all vehicles,           S  = 54.7    mph
_______________________________________________________________________________
```

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyON/ManuelFreitasOFF
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5866	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1528	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2088	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2088	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	58.3	mi/h
Number of lanes, N	3	
Density, D	35.8	pc/mi/ln
Level of service, LOS	E	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

____________________________________Diverge Analysis________________________________

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Manuel T Freitas off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

_____________________________________Freeway Data____________________________________

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5866	vph

____________________________________Off Ramp Data____________________________________

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	868	vph
Length of first accel/decel lane	120	ft
Length of second accel/decel lane		ft

_________________________Adjacent Ramp Data (if one exists)____________________

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

____________________Conversion to pc/h Under Base Conditions___________________

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5866		868			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1528		226			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV           0.976       0.976
Driver population factor, fP            1.00        1.00
Flow rate, vp                           6263        927                     pcph

_________________________Estimation of V12 Diverge Areas_______________________

                  L  =            (Equation 13-12 or 13-13)
                   EQ
                  P  =    0.561   Using Equation  5
                   FD
                  v  = v  + (v - v ) P  =  3919   pc/h
                   12   R     F   R   FD

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v  = v                6263          7050            No
      Fi   F
     v  = v - v            5336          7050            No
      FO   F   R
     v                     927           2000            No
      R
     v  or v               2344 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 3919                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

______________________Flow Entering Diverge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                3919          4400                 No
      12
_________________Level of Service Determination (if not F)_____________________

Density,               D = 4.252 + 0.0086 v  - 0.009  L   =   36.9    pc/mi/ln
                        R                  12          D
Level of service for ramp-freeway junction areas of influence E

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 D  = 0.511
                                              S
Space mean speed in ramp influence area,     S  = 53.2    mph
                                              R
Space mean speed in outer lanes,             S  = 66.1    mph
                                              0
Space mean speed for all vehicles,           S  = 57.4    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	Manuel T Freitas on / off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Exist Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4998	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1302	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1779	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1779	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.0	mi/h
Number of lanes, N	3	
Density, D	28.3	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas off-on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Exist Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	6440	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1677	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2292	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2292	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	53.7	mi/h
Number of lanes, N	3	
Density, D	42.7	pc/mi/ln
Level of service, LOS	E	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	ManuelTFreitasON/RedwoodHwyON
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	7225	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1882	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2571	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2571	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	45.6	mi/h
Number of lanes, N	3	
Density, D	56.4	pc/mi/ln
Level of service, LOS	F	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Redwood Highway on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	7225	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	384	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	7225		384			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1882		100			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          7714        410                  pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.167   Using Equation  4
                   FM
                  v  = v  (P  ) =  1285   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     8124          9400            No
      FO
     v  or v               3214 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           Yes
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 3085                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                3495          4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   31.4    pc/mi/ln
         R                    R           12             A
Level of service for ramp-freeway junction areas of influence  D

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.436
                                              S
Space mean speed in ramp influence area,     S  = 55.0    mph
                                              R
Space mean speed in outer lanes,             S  = 58.4    mph
                                              0
Space mean speed for all vehicles,           S  = 56.9    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Rd off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	7609	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1982	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2031	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2031	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	59.4	mi/h
Number of lanes, N	4	
Density, D	34.2	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	SmithRanchRd off/LucasRdEB on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	6739	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1755	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1799	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1799	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.7	mi/h
Number of lanes, N	4	
Density, D	28.7	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	LucasValleyRdON/SmithRanchRdON
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	6971	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1815	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1861	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1861	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.0	mi/h
Number of lanes, N	4	
Density, D	30.0	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst: LP
Agency/Co.: Fehr & Peers
Date performed: 9/22/2016
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: 101 NB
Junction: Smith Ranch Rd WB on
Jurisdiction: San Rafael
Analysis Year: Cumulative No Project
Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6971	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	495	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6971	495		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1815	129		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	7443	529	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.152 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1129 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	7972	9400	No
v_3 or v_{av34}	3157 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		Yes	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 2977 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	3506	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 31.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.438	
Space mean speed in ramp influence area,	S_R = 54.9	mph
Space mean speed in outer lanes,	S_0 = 58.8	mph
Space mean speed for all vehicles,	S = 57.0	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	7466	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1944	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1993	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1993	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	4	
Density, D	33.2	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Exist Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	7113	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1852	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2532	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2532	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	46.8	mi/h
Number of lanes, N	3	
Density, D	54.1	pc/mi/ln
Level of service, LOS	F	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Period
Freeway/Direction:	101 SB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Exist Occupancy NP
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4919	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1281	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1751	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1751	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.3	mi/h
Number of lanes, N	3	
Density, D	27.7	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Miller Creek on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4919	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	209	vph
Length of first accel/decel lane	110	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4919		209			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1281		54			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          5252        223                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.581   Using Equation  1
                   FM
                  v  = v  (P  ) =  3049   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     5475          7050            No
      FO
     v  or v               2203 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 3049                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                3272          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   30.2    pc/mi/ln
          R                   R          12             A
Level of service for ramp-freeway junction areas of influence  D

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.416
                                              S
Space mean speed in ramp influence area,     S  = 55.4    mph
                                              R
Space mean speed in outer lanes,             S  = 58.9    mph
                                              0
Space mean speed for all vehicles,           S  = 56.8    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone:	Fax:
E-mail:	

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5128	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1335	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1369	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1369	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	21.1	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyRd off/on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4785	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1246	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1703	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1703	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.7	mi/h
Number of lanes, N	3	
Density, D	26.7	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	LucasValleyON
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4785	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	946	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4785		946			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1246		246			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	5109	1010	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.582 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2972 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6119	7050	No
v_3 or v_{av34}	2137 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 Yes

If yes, v_{12A} = 2972 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	3982	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 35.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	M_S = 0.520	
Space mean speed in ramp influence area,	S_R = 53.0	mph
Space mean speed in outer lanes,	S_0 = 59.1	mph
Space mean speed for all vehicles,	S = 55.0	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyON/ManuelFreitasOFF
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5731	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1492	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2040	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2040	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	59.2	mi/h
Number of lanes, N	3	
Density, D	34.5	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

______Diverge Analysis______

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Manuel T Freitas off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative No Project

Description: 1650 Los Gamos

______Freeway Data______

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5731	vph

______Off Ramp Data______

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	746	vph
Length of first accel/decel lane	120	ft
Length of second accel/decel lane		ft

______Adjacent Ramp Data (if one exists)______

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

______Conversion to pc/h Under Base Conditions______

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5731		746			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1492		194			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	6119	797	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.570 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3832 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6119	7050	No
$v_{FO} = v_F - v_R$	5322	7050	No
v_R	797	2000	No
v_3 or v_{av34}	2287 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 3832 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3832	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 36.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	D_S = 0.500	
Space mean speed in ramp influence area,	S_R = 53.5	mph
Space mean speed in outer lanes,	S_0 = 66.3	mph
Space mean speed for all vehicles,	S = 57.7	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	Manuel T Freitas on / off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Exist Occupancy NP

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4985	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1298	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1774	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1774	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.0	mi/h
Number of lanes, N	3	
Density, D	28.2	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas off-on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4590	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1195	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1634	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1634	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.2	mi/h
Number of lanes, N	3	
Density, D	25.4	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	ManuelTFreitasON/RedwoodHwyON
Jurisdiction:	San Rafael
Analysis Year:	Cumulative 100 Occ No Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5027	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1309	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1789	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1789	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.9	mi/h
Number of lanes, N	3	
Density, D	28.5	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/16/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Redwood Highway On
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5027	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	129	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5027		129			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1309		34			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          5367        138                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.201   Using Equation  4
                   FM
                  v  = v  (P  ) =  1076   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     5505          9400            No
      FO
     v  or v               2145 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 2146                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                2284          4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   22.0    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  C

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.346
                                              S
Space mean speed in ramp influence area,     S  = 57.0    mph
                                              R
Space mean speed in outer lanes,             S  = 61.0    mph
                                              0
Space mean speed for all vehicles,           S  = 59.3    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Road off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5156	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1343	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1376	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1376	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	21.2	pc/mi/ln
Level of service, LOS	C	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Rd off/Lucas Rd on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4239	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1104	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1509	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1509	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.8	mi/h
Number of lanes, N	3	
Density, D	23.3	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Lucas Rd on/Smith Ranch Rd on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4405	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1147	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1176	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1176	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	18.1	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Smith Ranch Rd WB on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4405	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	171	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4405		171			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1147		45			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4703	183	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.195 Using Equation 4

$v_{12} = v_{F} (P_{FM})$ = 917 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4886	9400	No
v_3 or v_{av34}	1893 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 1881 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	2064	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 20.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.338	
Space mean speed in ramp influence area,	S_R = 57.2	mph
Space mean speed in outer lanes,	S_0 = 61.7	mph
Space mean speed for all vehicles,	S = 59.7	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4576	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1192	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1221	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1221	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	18.8	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone:	Fax:	
E-mail:		

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4414	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1149	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1571	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1571	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.6	mi/h
Number of lanes, N	3	
Density, D	24.3	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Period
Freeway/Direction:	101 SB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4757	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1239	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1693	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1693	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.8	mi/h
Number of lanes, N	3	
Density, D	26.5	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/21/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Miller Creek on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4757	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1071	vph
Length of first accel/decel lane	110	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4757	1071		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1239	279		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          5079        1144                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =             (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.581   Using Equation  1
                   FM
                  v  = v  (P  ) =  2949   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     6223          7050            No
      FO
     v  or v               2130 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 2949                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                4093          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   36.2    pc/mi/ln
          R                   R           12            A
Level of service for ramp-freeway junction areas of influence  E

______________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.547
                                              S
Space mean speed in ramp influence area,     S  = 52.4    mph
                                              R
Space mean speed in outer lanes,             S  = 59.1    mph
                                              0
Space mean speed for all vehicles,           S  = 54.5    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Period
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5828	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1518	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1556	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1556	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.7	mi/h
Number of lanes, N	4	
Density, D	24.1	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd on/off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5188	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1351	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1846	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1846	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.2	mi/h
Number of lanes, N	3	
Density, D	29.7	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Lucas Valley On
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5188	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	776	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5188		776			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1351		202			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          5539        829                    pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L   =             (Equation 13-6 or 13-7)
                   EQ
                  P   =    0.582   Using Equation  1
                   FM
                  v   = v  (P   ) =  3222   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     6368          7050            No
      FO
     v  or v               2317 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 3222                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                4051          4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   35.8    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  E

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.535
                                              S
Space mean speed in ramp influence area,     S  = 52.7    mph
                                              R
Space mean speed in outer lanes,             S  = 58.4    mph
                                              0
Space mean speed for all vehicles,           S  = 54.6    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone:	Fax:
E-mail:	

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyON/ManuelFreitasOFF
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5886	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1533	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2095	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2095	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	58.2	mi/h
Number of lanes, N	3	
Density, D	36.0	pc/mi/ln
Level of service, LOS	E	

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Manuel T Freitas off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5886	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	868	vph
Length of first accel/decel lane	120	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5886		868			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1533		226			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	6285	927	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.560 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3929 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6285	7050	No
$v_{FO} = v_F - v_R$	5358	7050	No
v_R	927	2000	No
v_3 or v_{av34}	2356 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 3929 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3929	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 37.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D_S = 0.511

Space mean speed in ramp influence area, S_R = 53.2 mph

Space mean speed in outer lanes, S_0 = 66.0 mph

Space mean speed for all vehicles, S = 57.4 mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	101 SB
From/To:	Manuel T Freitas on / off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5018	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1307	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1786	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1786	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.9	mi/h
Number of lanes, N	3	
Density, D	28.4	pc/mi/ln
Level of service, LOS	D	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/16/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Manuel T Freitas off-on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	6764	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1761	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2407	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2407	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	50.6	mi/h
Number of lanes, N	3	
Density, D	47.5	pc/mi/ln
Level of service, LOS	F	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	ManuelTFreitasON/RedwoodHwyON
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	7378	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1921	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2626	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2626	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	43.7	mi/h
Number of lanes, N	3	
Density, D	60.1	pc/mi/ln
Level of service, LOS	F	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Redwood Highway on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	7378	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	384	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7378	384		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1921	100		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	7878	410	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.167 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1312 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	8288	9400	No
v_3 or v_{av34}	3283 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		Yes	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 3151 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	3561	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 31.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.445	
Space mean speed in ramp influence area,	S_R = 54.8	mph
Space mean speed in outer lanes,	S_0 = 58.1	mph
Space mean speed for all vehicles,	S = 56.6	mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Smith Ranch Rd off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	7762	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	2021	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2072	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2072	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	58.6	mi/h
Number of lanes, N	4	
Density, D	35.4	pc/mi/ln
Level of service, LOS	E	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	SmithRanchRd off/LucasRdEB on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	6855	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1785	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1830	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1830	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.4	mi/h
Number of lanes, N	4	
Density, D	29.3	pc/mi/ln
Level of service, LOS	D	

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	LucasValleyRdON/SmithRanchRdON
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	7167	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1866	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1913	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1913	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	61.3	mi/h
Number of lanes, N	4	
Density, D	31.2	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 NB
Junction:	Smith Ranch Rd WB on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	7167	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	495	vph
Length of first accel/decel lane	190	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	7167		495			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1866		129			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	7652	529	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.152 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1161 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	8181	9400	No
v_3 or v_{av34}	3245 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		Yes	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 3060 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	3589	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 32.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.449	
Space mean speed in ramp influence area,	S_R = 54.7	mph
Space mean speed in outer lanes,	S_0 = 58.5	mph
Space mean speed for all vehicles,	S = 56.8	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	7662	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1995	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2045	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2045	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	59.1	mi/h
Number of lanes, N	4	
Density, D	34.6	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/21/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 NB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	7309	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1903	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2601	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2601	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	44.5	mi/h
Number of lanes, N	3	
Density, D	58.4	pc/mi/ln
Level of service, LOS	F	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Period
Freeway/Direction:	101 SB
From/To:	Miller Creek off / on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5004	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1303	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1781	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1781	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.9	mi/h
Number of lanes, N	3	
Density, D	28.3	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Miller Creek on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5004	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	209	vph
Length of first accel/decel lane	110	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5004		209			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1303		54			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV         0.976       0.976
Driver population factor, fP          1.00        1.00
Flow rate, vp                         5343        223                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =             (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.581   Using Equation  1
                   FM
                  v  = v  (P  ) =  3102   pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     5566          7050            No
      FO
     v  or v               2241 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 3102                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                3325          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   30.6    pc/mi/ln
          R                   R           12            A
Level of service for ramp-freeway junction areas of influence  D

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.422
                                              S
Space mean speed in ramp influence area,     S  = 55.3    mph
                                              R
Space mean speed in outer lanes,             S  = 58.7    mph
                                              0
Space mean speed for all vehicles,           S  = 56.6    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	Lucas Valley Rd off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5213	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1358	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1391	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1391	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	4	
Density, D	21.4	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyRd off/on
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	4828	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1257	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1718	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1718	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.6	mi/h
Number of lanes, N	3	
Density, D	27.0	pc/mi/ln
Level of service, LOS	D	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	LucasValleyON
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4828	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1007	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4828	1007		vph
Peak-hour factor, PHF	0.96	0.96		
Peak 15-min volume, v15	1257	262		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

```
Heavy vehicle adjustment, fHV          0.976       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          5155        1075                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.582   Using Equation  1
                   FM
                  v  = v  (P  ) =  2999   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     6230          7050            No
      FO
     v  or v               2156 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 2999                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                4074          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   35.8    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  E

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.540
                                              S
Space mean speed in ramp influence area,     S  = 52.6    mph
                                              R
Space mean speed in outer lanes,             S  = 59.0    mph
                                              0
Space mean speed for all vehicles,           S  = 54.7    mph
_______________________________________________________________________________
```

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	LucasValleyON/ManuelFreitasOFF
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5835	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1520	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2077	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2077	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	58.5	mi/h
Number of lanes, N	3	
Density, D	35.5	pc/mi/ln
Level of service, LOS	E	

HCS 2010: Freeway Merge and Diverge Segments Release 6.60

Phone: Fax:
E-mail:

_____Diverge Analysis_____

Analyst:	LP
Agency/Co.:	Fehr & Peers
Date performed:	9/22/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	101 SB
Junction:	Manuel T Freitas off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project

Description: 1650 Los Gamos

_____Freeway Data_____

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5835	vph

_____Off Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	746	vph
Length of first accel/decel lane	120	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5835		746			vph
Peak-hour factor, PHF	0.96		0.96			
Peak 15-min volume, v15	1520		194			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	6230	797	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.568 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3881 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6230	7050	No
$v_{FO} = v_F - v_R$	5433	7050	No
v_R	797	2000	No
v_3 or v_{av34}	2349 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 3881 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3881	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 36.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	D_S = 0.500	
Space mean speed in ramp influence area,	S_R = 53.5	mph
Space mean speed in outer lanes,	S_0 = 66.0	mph
Space mean speed for all vehicles,	S = 57.6	mph

HCS 2010: Basic Freeway Segments Release 6.60

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	LP
Agency or Company:	Fehr & Peers
Date Performed:	9/22/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	101 SB
From/To:	Manuel T Freitas on / off
Jurisdiction:	San Rafael
Analysis Year:	Cumulative Plus Project
Description:	1650 Los Gamos

Flow Inputs and Adjustments

Volume, V	5089	veh/h
Peak-hour factor, PHF	0.96	
Peak 15-min volume, v15	1325	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1811	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1811	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.6	mi/h
Number of lanes, N	3	
Density, D	28.9	pc/mi/ln
Level of service, LOS	D	

APPENDIX E: DETAILED VMT COMPARISON TABLE

APPENDIX F:

AVERAGE VMT PER EMPLOYEE BY KAISER LOCATION VS. MTC/ABAG MODEL PROJECTIONS

Facility Name	2020 MTC / ABAG Model		Kaiser Permanente	
	Estimated Average VMT / Employee[1]	Maximum Average VMT/Employee[2]	Empirically Derived Estimated Average VMT / Employee[3,4]	Below 2020 Maximum Average VMT / Employee?
Downtown San Rafael	25	21	21	Yes
Novato	31	26	19	Yes
San Rafael Medical Center	30	26	11	Yes
San Rafael Los Gamos	32	27	20	Yes

Notes

1. 2020 VMT/Employee estimates are determined by the MTC regional travel model for the TAZ zone where the facility is located.
2. Maximum average VMT/Employee based on 15-percent reduction from baseline per OPR's Technical Advisory.
3. Average VMT/Kaiser Employee at existing facilities is based on anonymous employee home zip code data provided by Kaiser Permanente.
4. Average VMT/Kaiser Employee at Proposed Project is based on Average VMT/Kaiser Employee at existing facilities and the planned number of employees to be moved to the Proposed Project from each existing facility.

Source: Kaiser Permanente, MTC http://analytics.mtc.ca.gov/foswiki/Main/PlanBayAreaVmtPerWorker (data collected on 11/8/2016)

APPENDIX F: DETAILED INTERSECTION QUEUE SUMMARY

SimTraffic Post-Processor
Average Results from 10 Runs
Queue Length

Los Gamos Kaiser
Existing
AM Peak Hour

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	160	20	4	60	18	120	74	0%	0%
	Through	980	220	21	360	54	460	79	15%	0%
	Right Turn	160	60	12	200	22	220	0	0%	0%
NB	Left Turn	320	80	5	140	14	160	35	0%	0%
	Through	1,240	60	5	100	12	140	23	2%	0%
	Right Turn	100	20	7	60	36	120	59	1%	0%
SB	Left Turn	60	100	8	140	5	120	0	31%	0%
	Through	980	200	40	340	93	420	132	41%	0%
	Right Turn	120	20	4	40	30	60	73	0%	0%
WB	Left Turn	160	40	4	80	14	120	50	0%	0%
	Through	960	100	8	200	18	260	38	2%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	1,080	20	1	20	5	20	13	0%	0%
	Right Turn	140	20	2	60	8	80	14	0%	0%
NB	Left Turn	1,060	40	2	60	6	80	14	0%	0%
	Right Turn	160	20	0	20	0	20	0	0%	0%
WB	Left Turn	160	100	6	160	13	180	24	2%	0%
	Through	520	20	9	60	68	140	168	0%	0%

Intersection 3 **US-101 NB Ramps/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	520	160	15	260	15	320	37	0%	0%
	Right Turn	520	140	11	240	22	280	29	0%	0%
NB	Left Turn	1,100	180	22	360	52	420	98	7%	0%
	Right Turn	120	140	7	200	5	180	0	20%	0%
WB	Left Turn	440	80	15	160	22	180	36	0%	0%
	Through	680	20	3	60	9	60	18	0%	0%

Intersection 4 **US-101 SB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	680	240	20	420	53	500	91	11%	0%
	Right Turn	200	60	20	200	47	240	1	0%	0%
NB	Left Turn	1,520	360	55	640	163	820	310	14%	0%
	Right Turn	320	120	35	400	61	380	0	0%	0%
WB	Through	360	100	9	180	18	220	33	0%	0%
	Right Turn	360	20	1	20	5	20	12	0%	0%

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	260	80	6	120	14	160	43	0%	0%
	Through	400	60	9	140	34	240	67	1%	0%
	Right Turn	120	40	14	120	33	160	4	1%	0%
NB	Left Turn	260	40	4	80	5	80	2	0%	0%
	Left/Through	520	20	3	60	8	80	20	0%	0%
	Right Turn	260	20	1	20	6	20	19	0%	0%
SB	Left/Through	440	20	1	40	5	40	15	0%	0%
WB	Left Turn	120	40	3	60	10	80	26	0%	0%
	Through	780	80	7	120	13	140	20	1%	0%
	Through/Right	780	60	2	100	10	120	20	0%	0%

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	160	20	2	60	4	60	7	0%	0%
	Through	980	120	8	180	19	220	30	2%	0%
	Right Turn	160	20	3	20	25	40	74	0%	0%
NB	Left Turn	320	80	5	120	10	140	21	0%	0%
	Through	1,240	80	5	120	11	140	24	2%	0%
	Right Turn	100	20	3	40	29	80	77	0%	0%
SB	Left Turn	60	40	3	80	7	100	17	3%	0%
	Through	980	60	7	120	15	160	31	13%	0%
	Right Turn	120	20	2	20	17	40	49	0%	0%
WB	Left Turn	160	60	6	100	16	140	46	0%	0%
	Through	960	100	11	180	27	240	54	1%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	1,080	20	0	20	3	20	10	0%	0%
	Right Turn	140	20	1	20	6	20	18	0%	0%
NB	Left Turn	1,080	40	5	80	5	100	12	0%	0%
	Right Turn	160	20	0	20	0	20	0	0%	0%
WB	Left Turn	160	60	3	80	10	100	19	0%	0%

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	520	180	12	280	43	360	95	0%	0%
	Right Turn	520	160	12	280	21	320	79	0%	0%
NB	Left Turn	1,000	100	11	180	22	240	71	9%	0%
	Right Turn	120	80	10	140	18	200	19	2%	0%
WB	Left Turn	440	260	19	380	29	440	54	0%	0%
	Through	680	60	5	140	41	200	138	0%	0%

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through/Right	200	20	0	20	0	20	0	0%	0%
	Right Turn	200	20	3	20	29	40	85	0%	0%
NB	Left Turn	1,500	240	22	400	79	540	173	3%	0%
	Right Turn	320	40	23	200	92	360	1	0%	0%
WB	Through	360	200	16	340	33	360	22	0%	0%
	Right Turn	360	20	3	40	11	60	21	0%	0%

SimTraffic Post-Processor
Average Results from 10 Runs
Queue Length

Los Gamos Kaiser
Existing
PM Peak Hour

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	260	40	4	80	8	100	11	0%	0%
	Through	400	80	8	140	15	160	42	4%	0%
	Right Turn	120	20	2	20	19	40	78	0%	0%
NB	Left Turn	260	100	6	160	13	200	36	0%	0%
	Left/Through	520	80	9	120	13	140	15	0%	0%
	Right Turn	260	20	2	20	9	40	17	0%	0%
SB	Left/Through	440	20	2	40	5	40	7	0%	0%
	Right Turn	80	20	5	60	11	80	15	1%	0%
WB	Left Turn	120	20	3	40	15	80	50	0%	0%
	Through	780	100	8	180	26	220	40	5%	0%
	Through/Right	780	100	10	160	23	200	39	0%	0%

SimTraffic Post-Processor
Average Results from 10 Runs
Queue Length

Los Gamos Kaiser
Existing Plus Project
AM Peak Hour

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

		Storage	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
Direction	Lane Group	(ft)	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	160	40	8	80	32	200	60	0%	0%
	Through	980	220	22	380	49	460	88	16%	0%
	Right Turn	160	60	18	200	32	220	0	0%	0%
NB	Left Turn	320	80	7	120	14	160	32	0%	0%
	Through	1,240	60	7	120	20	180	57	2%	0%
	Right Turn	100	20	6	60	29	120	61	0%	0%
SB	Left Turn	60	100	4	140	3	120	0	32%	0%
	Through	980	200	25	320	54	380	90	43%	0%
	Right Turn	120	20	4	40	31	120	76	0%	0%
WB	Left Turn	160	40	8	80	16	100	43	0%	0%
	Through	960	100	9	160	24	180	40	1%	0%
	Right Turn	260	20	0	20	0	20	0	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

		Storage	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
Direction	Lane Group	(ft)	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	1,080	20	1	20	5	20	14	0%	0%
	Right Turn	140	20	6	60	14	100	30	0%	0%
NB	Left Turn	1,080	60	14	120	34	140	37	2%	0%
	Right Turn	160	20	2	20	22	40	65	0%	0%
WB	Left Turn	160	160	15	240	9	220	1	21%	0%
	Through	520	100	50	360	121	500	70	0%	1%

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	520	180	16	280	29	340	49	0%	0%
	Right Turn	520	140	11	240	20	300	53	0%	0%
NB	Left Turn	1,020	400	129	700	265	740	239	31%	3%
	Right Turn	120	160	5	200	12	180	0	29%	0%
WB	Left Turn	440	80	14	180	60	260	130	0%	0%
	Through	680	40	26	140	123	260	245	1%	0%

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	680	260	44	480	81	560	101	14%	0%
	Right Turn	200	60	14	220	28	260	0	0%	0%
NB	Left Turn	1,500	1,100	252	1,780	272	1,560	12	46%	32%
	Right Turn	320	320	46	500	50	380	0	0%	0%
WB	Through	360	100	11	180	20	220	44	0%	0%
	Right Turn	360	20	1	20	7	40	18	0%	0%

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Existing Plus Project**
Queue Length | **AM Peak Hour**

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

		Storage	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
Direction	Lane Group	(ft)	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	260	80	6	120	11	140	30	0%	0%
	Through	400	60	12	140	45	220	77	1%	0%
	Right Turn	120	40	13	120	34	160	8	2%	0%
NB	Left Turn	260	40	2	60	4	80	11	0%	0%
	Left/Through	520	20	5	60	10	80	17	0%	0%
	Right Turn	260	20	0	20	3	20	8	0%	0%
SB	Left/Through	440	20	2	40	4	40	16	0%	0%
	Right Turn	80	20	0	20	0	20	0	0%	0%
WB	Left Turn	120	40	5	80	16	100	33	0%	0%
	Through	780	80	7	140	13	160	24	1%	0%
	Through/Right	780	60	4	100	12	140	30	0%	0%

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Left Turn	160	20	4	60	5	60	15	0%	0%
	Through	980	120	11	180	27	220	34	2%	0%
	Right Turn	160	20	4	20	28	60	75	0%	0%
NB	Left Turn	320	80	5	120	11	140	24	0%	0%
	Through	1,240	60	4	120	14	140	26	2%	0%
	Right Turn	100	20	4	40	31	60	72	0%	0%
SB	Left Turn	60	40	4	80	10	100	23	5%	0%
	Through	980	60	7	120	15	140	26	13%	0%
	Right Turn	120	20	2	20	22	60	65	0%	0%
WB	Left Turn	160	60	3	100	6	120	12	0%	0%
	Through/Right	260	20	0	20	0	20	0	0%	0%
	Right Turn	260	20	4	20	35	60	103	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	1,080	200	93	520	237	660	275	27%	0%
	Right Turn	140	60	18	180	42	220	0	0%	0%
NB	Left Turn	1,060	560	197	1,200	280	1,060	58	14%	25%
	Right Turn	160	160	20	300	9	220	0	49%	0%
WB	Left Turn	160	100	11	180	15	220	25	4%	0%
	Through	520	20	10	100	69	240	169	0%	0%

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	520	480	32	660	24	580	11	0%	24%
	Right Turn	520	500	37	740	24	620	0	0%	48%
NB	Left Turn	1,040	140	18	260	43	320	57	24%	0%
	Right Turn	120	100	11	200	19	200	0	3%	0%
WB	Left Turn	440	280	10	380	22	420	62	0%	0%
	Through	680	60	7	120	16	160	31	0%	0%

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	680	80	10	160	19	200	38	0%	0%
	Right Turn	200	20	0	20	0	20	0	0%	0%
NB	Left Turn	1,560	260	23	400	65	520	128	4%	0%
	Right Turn	320	60	31	200	122	300	152	0%	0%
WB	Through	360	220	12	360	16	380	6	0%	1%
	Right Turn	360	20	2	40	12	60	29	0%	0%

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Left Turn	260	40	6	80	16	120	32	0%	0%
	Through	400	80	9	140	14	180	38	4%	0%
	Right Turn	120	20	3	40	32	120	93	0%	0%
NB	Left Turn	260	100	7	160	9	200	22	0%	0%
	Left/Through	520	80	5	120	7	140	22	0%	0%
	Right Turn	260	20	1	20	7	60	21	0%	0%
SB	Left/Through	440	20	2	40	6	60	15	0%	0%
	Right Turn	80	20	4	60	10	100	16	1%	0%
WB	Left Turn	120	20	3	60	15	80	49	0%	0%
	Through	780	120	7	180	23	220	41	6%	0%
	Through/Right	780	100	7	180	11	200	22	0%	0%

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	160	60	10	140	26	180	1	0%	0%
	Through	980	1,000	12	1,060	44	1,040	6	45%	58%
	Right Turn	160	160	11	240	12	180	0	2%	0%
NB	Left Turn	320	80	7	140	26	200	79	0%	0%
	Through	1,240	140	11	260	21	320	33	19%	0%
	Right Turn	100	60	9	160	10	120	0	1%	0%
SB	Left Turn	60	80	1	100	3	80	0	60%	0%
	Through	980	1,000	9	1,040	48	1,020	0	42%	93%
	Right Turn	120	20	7	100	22	140	0	0%	0%
WB	Left Turn	160	60	9	120	19	140	39	0%	0%
	Through	960	100	6	200	33	260	99	2%	0%
	Right Turn	260	20	4	40	34	100	101	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	1,080	240	158	780	321	1,040	86	15%	2%
	Right Turn	140	80	19	160	28	160	0	1%	0%
NB	Left Turn	1,000	80	27	160	90	240	168	6%	0%
	Right Turn	160	20	10	80	51	120	82	0%	0%
WB	Left Turn	160	160	8	220	8	180	0	29%	0%
	Through	520	220	75	540	130	520	6	0%	5%

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	520	360	27	520	41	520	11	0%	12%
	Right Turn	520	280	42	580	53	560	23	0%	2%
NB	Left Turn	1,000	920	103	1,160	110	1,040	0	19%	62%
	Right Turn	120	140	3	140	18	140	0	45%	0%
WB	Left Turn	440	100	36	220	112	300	158	0%	0%
	Through	680	120	82	380	239	520	262	5%	2%

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	680	600	49	840	61	700	2	38%	4%
	Right Turn	200	40	16	160	43	220	0	0%	0%
NB	Left Turn	1,460	1,460	52	1,620	109	1,520	0	53%	70%
	Right Turn	320	320	10	400	46	340	0	1%	0%
WB	Through	360	140	21	240	53	280	70	0%	1%
	Right Turn	360	20	1	20	6	20	19	0%	0%

SimTraffic Post-Processor
Average Results from 10 Runs
Queue Length

Los Gamos Kaiser
Baseline No Project
AM Peak Hour

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	260	60	8	100	17	120	28	0%	0%
	Through	400	200	23	360	34	360	77	2%	0%
	Right Turn	120	100	9	180	4	140	0	14%	0%
NB	Left Turn	260	60	4	100	7	100	8	0%	0%
	Left/Through	520	40	3	60	9	80	14	0%	0%
	Right Turn	260	20	1	20	6	20	16	0%	0%
SB	Left/Through	440	40	6	80	15	100	26	2%	0%
	Right Turn	80	20	4	40	14	80	11	0%	0%
WB	Left Turn	120	60	6	120	16	140	14	1%	0%
	Through	780	80	10	160	21	200	37	2%	0%
	Through/Right	780	60	7	120	18	160	37	0%	0%

SimTraffic Post-Processor
Average Results from 10 Runs
Queue Length

Los Gamos Kaiser
Baseline No Project
PM Peak Hour

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Left Turn	160	20	10	100	50	180	102	0%	0%
	Through	980	380	176	820	385	900	226	40%	15%
	Right Turn	160	80	34	240	68	260	0	0%	0%
NB	Left Turn	320	100	6	160	13	200	26	0%	0%
	Through	1,240	100	14	180	30	240	57	6%	0%
	Right Turn	100	20	10	100	36	140	47	2%	0%
SB	Left Turn	60	80	11	120	14	120	1	43%	0%
	Through	980	140	89	360	245	460	270	18%	0%
	Right Turn	120	20	7	60	46	100	84	0%	0%
WB	Left Turn	160	80	9	120	15	160	40	0%	0%
	Through	960	100	8	180	14	220	45	2%	0%
	Right Turn	260	20	1	20	9	40	26	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	1,080	960	65	1,360	67	1,100	1	84%	23%
	Right Turn	140	180	14	320	5	220	0	0%	0%
NB	Left Turn	920	920	47	1,040	91	960	0	0%	90%
	Right Turn	160	220	1	220	5	220	0	99%	0%
WB	Left Turn	160	80	6	120	9	140	19	0%	0%
		160	20	0	20	0	20	0	0%	0%

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	520	520	4	520	5	520	5	0%	52%
	Right Turn	520	580	2	600	4	620	0	0%	94%
NB	Left Turn	1,080	100	9	180	15	220	31	10%	0%
	Right Turn	120	80	9	160	17	180	21	2%	0%
WB	Left Turn	440	320	13	440	34	500	44	2%	0%
	Through	680	100	24	220	109	380	245	0%	0%

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	680	100	5	160	13	200	25	0%	0%
NB	Left Turn	1,480	200	13	340	38	440	99	1%	0%
	Right Turn	320	40	20	140	100	260	174	0%	0%
WB	Through	360	320	17	440	17	400	12	0%	10%
	Right Turn	360	20	7	80	24	120	40	0%	0%

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Baseline No Project**
Queue Length | **PM Peak Hour**

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Left Turn	260	80	9	140	18	160	23	0%	0%
	Through	400	120	7	180	17	220	39	14%	0%
	Right Turn	120	20	7	100	35	200	3	0%	0%
NB	Left Turn	260	180	7	280	14	300	18	2%	0%
	Left/Through	520	180	14	280	29	360	83	1%	0%
	Right Turn	260	20	9	80	54	200	128	0%	0%
SB	Left/Through	440	60	10	140	39	200	62	5%	0%
	Right Turn	80	60	4	120	9	120	1	10%	0%
WB	Left Turn	120	100	21	220	31	220	1	0%	0%
	Through	780	280	94	500	200	560	157	47%	3%
	Through/Right	780	260	91	480	204	520	146	0%	3%

SimTraffic Post-Processor
Average Results from 10 Runs
Queue Length

Los Gamos Kaiser
Baseline No Project with Existing Occupancy
AM Peak Hour

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	160	60	10	140	20	180	0	0%	0%
	Through	980	1,000	25	1,080	80	1,040	0	43%	57%
	Right Turn	160	160	11	240	15	180	0	2%	0%
NB	Left Turn	320	80	4	140	13	180	57	0%	0%
	Through	1,240	140	22	220	47	260	56	15%	0%
	Right Turn	100	40	11	140	18	120	0	1%	0%
SB	Left Turn	60	80	2	100	4	80	0	59%	0%
	Through	980	1,000	8	1,020	24	1,020	0	45%	95%
	Right Turn	120	20	7	100	18	140	0	0%	0%
WB	Left Turn	160	60	4	120	13	160	34	0%	0%
	Through	960	120	14	200	32	260	68	3%	0%
	Right Turn	260	20	9	60	56	120	120	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	1,080	140	250	340	544	380	500	8%	1%
	Right Turn	140	60	29	120	51	120	36	0%	0%
NB	Left Turn	980	40	7	80	15	100	28	0%	0%
	Right Turn	20	20	0	20	0	20	0	0%	0%
WB	Left Turn	160	140	17	200	16	180	3	12%	0%
	Through	520	80	68	260	184	380	166	0%	2%

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	520	280	113	440	166	440	113	0%	6%
	Right Turn	520	200	120	380	199	400	155	0%	1%
NB	Left Turn	1,100	520	219	820	273	880	208	8%	4%
	Right Turn	120	140	2	140	13	140	0	41%	0%
WB	Left Turn	440	80	15	160	65	220	127	0%	0%
	Through	680	60	33	160	145	240	253	1%	0%

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	680	520	87	760	84	680	18	31%	2%
	Right Turn	200	20	7	60	48	120	106	0%	0%
NB	Left Turn	1,480	1,160	232	1,720	153	1,520	0	46%	42%
	Right Turn	320	300	33	420	61	340	0	1%	0%
WB	Through	360	120	12	200	25	260	50	0%	0%
	Right Turn	360	20	2	20	11	40	21	0%	0%

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Left Turn	260	60	11	120	41	180	72	0%	0%
	Through	400	260	54	480	85	440	22	2%	5%
	Right Turn	120	120	6	180	2	140	0	19%	0%
NB	Left Turn	260	60	6	80	10	120	18	0%	0%
	Left/Through	520	40	5	60	10	80	18	0%	0%
	Right Turn	260	20	1	20	9	20	23	0%	0%
SB	Left/Through	440	40	6	80	11	100	19	2%	0%
	Right Turn	80	20	5	40	18	80	17	0%	0%
WB	Left Turn	120	60	10	120	19	140	15	1%	0%
	Through	780	80	7	140	20	180	44	1%	0%
	Through/Right	780	60	9	100	22	140	40	0%	0%

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Baseline with Existing Occupancy No Project**
Queue Length | **PM Peak Hour**

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Left Turn	160	20	11	80	43	120	73	0%	0%
	Through	980	180	122	340	271	420	268	13%	1%
	Right Turn	160	40	32	100	81	140	70	0%	0%
NB	Left Turn	320	100	17	160	47	200	59	0%	0%
	Through	1,240	100	38	180	130	240	211	5%	0%
	Right Turn	100	20	16	80	37	120	4	2%	0%
SB	Left Turn	60	60	10	100	7	80	0	22%	0%
	Through	980	140	173	260	356	260	268	14%	3%
	Right Turn	120	20	13	60	47	80	52	0%	0%
WB	Left Turn	160	80	7	120	17	160	32	0%	0%
	Through	960	100	11	180	27	240	44	2%	0%
	Right Turn	260	20	3	20	29	60	82	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	1,080	720	195	1,280	268	1,100	12	67%	13%
	Right Turn	140	100	20	220	8	160	0	0%	0%
NB	Left Turn	900	760	110	1,160	87	960	0	2%	65%
	Right Turn	160	180	18	220	39	180	0	88%	0%
WB	Left Turn	160	60	6	120	13	160	27	0%	0%
		160	20	0	20	0	20	0	0%	0%

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	520	520	16	520	39	520	7	0%	45%
	Right Turn	520	560	23	640	68	600	1	0%	86%
NB	Left Turn	1,000	120	11	200	30	280	62	9%	0%
	Right Turn	120	100	9	160	7	140	0	3%	0%
WB	Left Turn	440	320	22	420	33	440	24	1%	0%
	Through	680	100	20	220	100	340	206	0%	0%

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	680	100	11	180	23	240	51	0%	0%
	Right Turn	200	20	9	80	52	180	86	0%	0%
NB	Left Turn	1,520	220	16	360	78	500	256	2%	0%
	Right Turn	320	40	20	160	89	280	125	0%	0%
WB	Through	360	320	29	440	25	380	2	0%	9%
	Right Turn	360	20	6	60	23	100	26	0%	0%

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Left Turn	260	80	9	140	19	180	35	0%	0%
	Through	400	140	11	220	21	280	41	16%	0%
	Right Turn	120	60	11	160	12	140	0	0%	0%
NB	Left Turn	260	180	17	260	29	260	21	2%	0%
	Left/Through	520	180	34	320	94	380	138	2%	1%
	Right Turn	260	20	16	100	65	200	103	0%	0%
SB	Left/Through	440	60	9	140	25	200	54	5%	0%
	Right Turn	80	60	6	120	5	100	0	10%	0%
WB	Left Turn	120	80	10	160	14	160	0	1%	0%
	Through	780	260	70	400	145	460	146	42%	0%
	Through/Right	780	220	64	380	140	420	147	0%	0%

SimTraffic Post-Processor
Average Results from 10 Runs
Queue Length

Los Gamos Kaiser
Baseline Plus Project
AM Peak Hour

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Left Turn	160	60	8	120	23	180	32	0%	0%
	Through	3,640	3,020	265	4,440	228	3,700	0	45%	53%
	Right Turn	160	160	11	260	5	180	0	2%	0%
NB	Left Turn	320	80	8	140	24	200	76	0%	0%
	Through	3,380	140	18	260	45	320	102	17%	0%
	Right Turn	100	60	15	160	16	120	0	2%	0%
SB	Left Turn	60	80	1	100	5	80	0	63%	0%
	Through	2,780	2,420	166	3,360	133	2,820	0	42%	64%
	Right Turn	120	20	9	100	34	120	40	0%	0%
WB	Left Turn	160	60	10	100	23	160	36	0%	0%
	Through	960	100	10	200	25	240	53	2%	0%
	Right Turn	260	20	4	20	30	60	84	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	1,080	220	160	740	425	880	350	14%	3%
	Right Turn	140	60	17	160	28	160	2	1%	0%
NB	Left Turn	960	220	207	520	451	540	411	23%	7%
	Right Turn	160	40	29	120	82	140	73	4%	0%
WB	Left Turn	160	160	11	220	12	180	0	34%	0%
	Through	520	240	89	560	94	520	31	0%	6%

SimTraffic Post-Processor **Los Gamos Kaiser**
Average Results from 10 Runs **Baseline Plus Project**
Queue Length **AM Peak Hour**

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	520	340	65	520	95	520	48	0%	10%
	Right Turn	520	260	81	540	148	540	88	0%	5%
NB	Left Turn	1,000	1,020	14	1,080	45	1,040	0	28%	83%
	Right Turn	120	140	3	160	18	140	0	44%	0%
WB	Left Turn	440	100	35	240	114	320	148	0%	0%
	Through	680	120	82	340	217	480	229	4%	1%

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	680	500	42	820	55	700	4	29%	3%
	Right Turn	200	60	14	180	30	220	0	0%	0%
NB	Left Turn	1,500	1,520	7	1,560	20	1,560	0	54%	80%
	Right Turn	320	320	16	380	59	340	0	1%	0%
WB	Through	360	120	16	200	28	240	44	0%	0%
	Right Turn	360	20	2	20	11	20	22	0%	0%

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Left Turn	260	60	3	100	8	140	16	0%	0%
	Through	400	160	14	340	33	360	107	1%	0%
	Right Turn	120	100	11	180	2	140	0	12%	0%
NB	Left Turn	260	60	5	80	6	100	9	0%	0%
	Left/Through	1,940	40	4	60	7	80	16	0%	0%
	Right Turn	260	20	1	20	5	20	12	0%	0%
SB	Left/Through	1,020	40	5	80	12	120	29	2%	0%
	Right Turn	80	20	4	40	21	80	9	0%	0%
WB	Left Turn	120	60	6	120	14	140	14	1%	0%
	Through	780	80	7	140	18	180	27	2%	0%
	Through/Right	780	60	8	100	21	140	44	0%	0%

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Baseline Plus Project**
Queue Length | **PM Peak Hour**

Intersection 1 | **Las Gallinas Ave/Lucas Valley Rd** | **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	160	20	5	60	26	100	66	0%	0%
	Through	980	220	153	440	347	500	343	18%	1%
	Right Turn	160	40	29	140	64	180	0	0%	0%
NB	Left Turn	320	100	8	140	12	160	21	0%	0%
	Through	1,240	100	19	160	31	200	46	6%	0%
	Right Turn	100	40	11	100	32	120	3	1%	0%
SB	Left Turn	60	60	6	100	4	80	0	27%	0%
	Through	980	120	71	220	198	280	250	15%	0%
	Right Turn	120	20	9	80	26	140	0	0%	0%
WB	Left Turn	160	80	5	140	14	180	17	1%	0%
	Through	960	120	7	200	28	260	70	1%	0%
	Right Turn	260	20	3	40	30	80	83	0%	0%

Intersection 2 | **Los Gamos Dr/Lucas Valley Rd** | **Side-street Stop**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	1,080	920	148	1,300	134	1,100	6	74%	15%
	Right Turn	140	120	15	220	9	160	0	0%	0%
NB	Left Turn	1,100	1,120	2	1,140	4	1,160	0	6%	99%
	Right Turn	160	180	3	200	20	180	0	95%	0%
WB	Left Turn	160	100	10	160	14	180	9	1%	0%
	Through	520	20	9	60	68	140	180	0%	0%

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	520	520	3	520	21	520	6	0%	46%
	Right Turn	520	580	5	600	9	620	0	0%	93%
NB	Left Turn	980	200	54	400	136	460	165	26%	0%
	Right Turn	120	120	6	160	5	140	0	6%	0%
WB	Left Turn	440	320	13	400	24	440	39	1%	0%
	Through	680	100	16	260	77	520	202	0%	0%

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	680	100	9	160	23	200	64	0%	0%
	Right Turn	200	20	4	60	35	120	102	0%	0%
NB	Left Turn	1,500	260	21	460	73	640	135	3%	0%
	Right Turn	320	80	16	280	34	340	0	0%	0%
WB	Through	360	340	24	440	22	380	8	0%	16%
	Right Turn	360	20	5	60	30	120	91	0%	0%

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Left Turn	260	100	8	160	16	180	20	0%	0%
	Through	400	140	10	220	20	260	33	16%	0%
	Right Turn	120	60	12	160	14	140	0	0%	0%
NB	Left Turn	260	200	28	280	32	280	6	4%	0%
	Left/Through	520	220	79	380	169	420	126	6%	5%
	Right Turn	260	40	32	160	75	280	2	0%	0%
SB	Left/Through	440	80	19	160	47	240	60	5%	0%
	Right Turn	80	60	5	120	3	100	0	13%	0%
WB	Left Turn	120	80	12	180	16	160	0	1%	0%
	Through	780	320	174	540	307	540	224	49%	9%
	Through/Right	780	300	175	520	313	520	233	0%	7%

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

		Storage	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
Direction	Lane Group	(ft)	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	160	60	12	160	29	180	1	0%	0%
	Through	9,040	5,160	618	9,120	849	8,820	504	44%	7%
	Right Turn	160	160	15	260	6	180	0	1%	0%
NB	Left Turn	320	160	31	260	41	340	3	1%	0%
	Through	1,240	200	21	360	53	480	92	26%	0%
	Right Turn	100	80	9	160	5	120	0	2%	0%
SB	Left Turn	60	80	2	100	3	80	0	64%	0%
	Through	6,060	4,320	341	7,080	340	6,100	13	44%	29%
	Right Turn	120	40	11	120	27	140	0	0%	0%
WB	Left Turn	160	80	12	160	19	180	1	1%	0%
	Through	960	160	18	260	38	300	73	7%	0%
	Right Turn	260	20	8	40	40	80	73	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

		Storage	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
Direction	Lane Group	(ft)	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	1,040	80	4	160	12	230	31	0%	0%
	Through/Right	240	140	6	200	15	220	27	0%	0%
NB	Left Turn	220	20	4	60	8	80	15	0%	0%
	Right Turn	160	60	4	100	7	120	18	0%	0%
WB	Left Turn	160	160	9	200	7	180	1	12%	0%
	Through	500	100	43	320	101	400	164	0%	0%

Intersection 3 **US-101 NB Ramps/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	500	120	6	200	24	260	80	0%	0%
	Right Turn	220	80	7	160	23	200	34	0%	0%
NB	Left Turn	960	240	44	480	90	640	170	15%	0%
	Right Turn	120	120	6	160	7	140	0	7%	0%
WB	Left Turn	440	160	11	260	25	340	90	0%	0%
	Through	660	60	11	220	49	400	111	0%	0%

Intersection 4 **US-101 SB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	660	140	25	300	52	420	91	0%	0%
	Through/Right	660	260	33	440	60	480	82	0%	0%
NB	Left Turn	1,520	180	13	240	48	380	127	0%	0%
	Right Turn	320	180	15	280	23	320	6	1%	0%
WB	Through	360	80	8	120	12	140	28	0%	0%
	Right Turn	360	20	3	20	17	60	42	0%	0%

SimTraffic Post-Processor
Average Results from 11 Runs
Queue Length

Los Gamos Kaiser
Cumulative No Project
AM Peak Hour

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	260	80	6	120	10	140	17	0%	0%
	Through	400	220	33	400	37	400	72	2%	1%
	Right Turn	120	100	8	180	2	140	0	12%	0%
NB	Left Turn	260	40	4	60	6	80	10	0%	0%
	Left/Through	1,320	60	4	100	8	120	22	0%	0%
	Right Turn	260	20	2	20	10	40	25	0%	0%
SB	Left/Through	2,280	40	5	80	10	120	28	3%	0%
	Right Turn	80	20	5	60	11	100	6	0%	0%
WB	Left Turn	120	60	5	100	9	120	17	1%	0%
	Through	4,220	60	7	120	23	160	44	0%	0%
	Through/Right	4,220	80	8	120	15	140	31	0%	0%

SimTraffic Post-Processor
Average Results from 10 Runs
Queue Length

Los Gamos Kaiser
Cumulative No Project
PM Peak Hour

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	160	40	9	100	32	180	36	0%	0%
	Through	9,040	220	131	420	332	540	373	15%	0%
	Right Turn	160	60	24	180	39	180	3	0%	0%
NB	Left Turn	320	120	18	200	40	260	78	0%	0%
	Through	1,240	160	24	280	58	360	115	18%	0%
	Right Turn	100	60	13	140	13	120	0	1%	0%
SB	Left Turn	60	60	5	100	2	80	0	28%	0%
	Through	6,060	120	20	220	45	300	59	20%	0%
	Right Turn	120	20	7	60	35	100	52	0%	0%
WB	Left Turn	160	120	14	200	16	180	1	15%	0%
	Through	960	220	104	440	253	560	271	7%	1%
	Right Turn	260	40	35	180	82	260	58	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	1,040	479	27	864	20	811	14	0%	10%
	Through/Right	240	220	22	280	16	280	12	0%	23%
NB	Left Turn	940	570	19	1,035	17	919	13	1%	40%
	Right Turn	160	180	4	200	9	180	0	54%	0%
WB	Left Turn	160	120	11	180	19	180	7	2%	0%
	Through	500	160	26	240	61	300	88	3%	0%

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

		Storage	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
Direction	Lane Group	(ft)	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	500	460	78	640	67	560	20	27%	17%
	Right Turn	220	240	2	240	4	240	0	47%	0%
NB	Left Turn	940	260	63	520	145	640	193	20%	0%
	Right Turn	120	120	8	160	36	140	47	13%	0%
WB	Left Turn	440	440	18	480	11	460	0	29%	0%
	Through	660	560	96	840	129	720	44	19%	8%

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

		Storage	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
Direction	Lane Group	(ft)	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	660	180	19	300	41	380	44	0%	0%
	Right Turn	660	60	32	220	101	380	92	0%	0%
NB	Left Turn	1,440	140	9	200	16	240	56	0%	0%
	Right Turn	320	160	11	260	23	300	31	0%	0%
WB	Through	360	380	5	400	15	400	10	0%	48%
	Right Turn	360	60	23	240	67	340	42	0%	0%

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Left Turn	260	100	6	180	18	240	33	0%	0%
	Through	400	180	11	260	19	300	40	22%	0%
	Right Turn	120	100	11	180	5	140	0	0%	0%
NB	Left Turn	260	260	12	320	16	280	0	15%	0%
	Left/Through	1,220	1,020	161	1,600	68	1,280	6	50%	54%
	Right Turn	260	160	30	380	23	280	0	0%	0%
SB	Left/Through	2,280	140	36	280	83	360	117	7%	0%
	Right Turn	80	80	6	120	8	100	0	32%	0%
WB	Left Turn	120	100	15	180	9	140	0	2%	0%
	Through	4,220	1,620	354	3,100	786	3,000	859	78%	0%
	Through/Right	4,220	1,620	348	3,080	765	2,960	845	0%	0%

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Left Turn	160	60	10	140	24	180	0	0%	0%
	Through	9,040	5,020	566	9,000	913	8,500	708	44%	3%
	Right Turn	160	160	16	240	19	180	0	1%	0%
NB	Left Turn	320	140	21	240	39	320	48	1%	0%
	Through	1,240	180	27	320	46	400	53	28%	0%
	Right Turn	100	80	10	180	6	120	0	2%	0%
SB	Left Turn	60	80	1	100	2	80	0	65%	0%
	Through	6,060	4,320	321	7,200	271	6,100	0	40%	31%
	Right Turn	120	40	11	140	20	140	0	0%	0%
WB	Left Turn	160	80	16	140	33	160	38	1%	0%
	Through	960	140	17	240	36	300	66	5%	0%
	Right Turn	260	20	8	60	53	160	131	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	260	80	9	140	21	200	46	0%	0%
	Through/Right	260	140	8	200	15	220	20	0%	0%
NB	Left Turn	200	20	2	40	5	60	16	0%	0%
	Right Turn	160	60	4	80	7	100	19	0%	0%
WB	Left Turn	160	120	10	180	12	180	3	3%	0%
	Through	480	40	13	120	63	280	123	0%	0%

Intersection 3 **US-101 NB Ramps/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	480	120	11	200	43	240	98	0%	0%
	Right Turn	220	80	10	140	23	200	49	0%	0%
NB	Left Turn	1,080	160	31	300	61	400	93	7%	0%
	Right Turn	120	100	7	160	4	140	0	5%	0%
WB	Left Turn	440	160	24	260	54	300	63	0%	0%
	Through	660	80	36	240	101	380	127	0%	0%

Intersection 4 **US-101 SB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	660	140	25	320	51	420	94	0%	0%
	Through/Right	660	280	29	460	47	520	68	0%	0%
NB	Left Turn	1,460	160	23	260	114	380	241	0%	0%
	Right Turn	320	200	14	300	29	320	23	1%	0%
WB	Through	360	80	7	120	18	160	28	0%	0%
	Right Turn	360	20	1	20	8	40	23	0%	0%

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	260	80	9	120	18	140	39	0%	0%
	Through	400	240	24	420	36	400	77	2%	1%
	Right Turn	120	120	6	180	6	140	0	14%	0%
NB	Left Turn	260	40	3	60	7	80	13	0%	0%
	Left/Through	3,460	60	3	80	6	120	19	0%	0%
	Right Turn	260	20	1	20	6	40	16	0%	0%
SB	Left/Through	2,280	40	5	80	15	120	46	2%	0%
	Right Turn	80	20	6	60	16	100	6	0%	0%
WB	Left Turn	120	60	7	100	15	120	20	1%	0%
	Through	4,220	60	4	120	11	140	36	1%	0%
	Through/Right	4,220	80	6	120	9	160	27	0%	0%

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Cumulative No Project Ex Occ**
Queue Length | **PM Peak Hour**

Intersection 1 — **Las Gallinas Ave/Lucas Valley Rd** — **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	160	20	5	80	20	120	59	0%	0%
	Through	9,040	200	39	340	115	420	176	10%	0%
	Right Turn	160	60	17	180	28	180	2	0%	0%
NB	Left Turn	320	100	12	180	37	260	85	0%	0%
	Through	1,240	160	16	260	45	360	93	16%	0%
	Right Turn	100	60	10	140	16	120	0	0%	0%
SB	Left Turn	60	60	4	100	3	80	0	24%	0%
	Through	6,060	100	11	180	31	240	71	20%	0%
	Right Turn	120	20	5	40	32	80	63	0%	0%
WB	Left Turn	160	120	11	200	13	180	0	11%	0%
	Through	960	200	42	400	124	560	239	7%	0%
	Right Turn	260	40	21	140	73	240	86	0%	0%

Intersection 2 — **Los Gamos Dr/Lucas Valley Rd** — **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	1,060	580	21	1,200	22	1,090	6	0%	16%
	Through/Right	260	240	16	320	15	300	11	0%	28%
NB	Left Turn	880	610	19	1,210	10	990	13	2%	49%
	Right Turn	160	180	3	220	6	180	0	63%	0%
WB	Left Turn	160	100	10	160	17	180	6	1%	0%
	Through	480	160	14	240	18	300	50	2%	0%

Intersection 3 **US-101 NB Ramps/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	480	460	46	660	16	540	13	36%	25%
	Right Turn	220	240	2	240	6	240	0	58%	0%
NB	Left Turn	1,060	200	32	380	70	460	92	18%	0%
	Right Turn	120	120	6	160	20	140	0	10%	0%
WB	Left Turn	440	420	10	500	6	460	0	26%	0%
	Through	660	520	54	900	47	720	14	15%	7%

Intersection 4 **US-101 SB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	660	140	21	260	36	300	55	0%	0%
	Right Turn	660	20	17	140	86	280	166	0%	0%
NB	Left Turn	1,500	140	12	240	75	320	205	0%	0%
	Right Turn	320	160	13	260	22	300	28	0%	0%
WB	Through	360	380	4	400	7	400	9	0%	45%
	Right Turn	360	60	19	260	56	360	30	0%	0%

SimTraffic Post-Processor
Average Results from 10 Runs
Queue Length

Los Gamos Kaiser
Cumulative No Project Ex Occ
PM Peak Hour

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

		Storage	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
Direction	Lane Group	(ft)	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	260	100	9	160	12	200	39	0%	0%
	Through	400	180	13	280	22	320	43	22%	0%
	Right Turn	120	100	12	180	4	140	0	1%	0%
NB	Left Turn	260	280	9	320	23	280	0	15%	0%
	Left/Through	3,460	2,540	377	4,420	173	3,520	1	49%	40%
	Right Turn	260	180	21	400	10	280	0	0%	0%
SB	Left/Through	2,280	120	21	260	47	320	65	7%	0%
	Right Turn	80	80	3	120	3	100	0	30%	0%
WB	Left Turn	120	100	11	200	8	140	0	2%	0%
	Through	4,220	1,820	447	3,460	738	3,200	731	78%	1%
	Through/Right	4,220	1,820	439	3,460	715	3,200	728	0%	0%

SimTraffic Post-Processor
Average Results from 10 Runs
Queue Length

Los Gamos Kaiser
Cumulative Plus Project
AM Peak Hour

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
		(ft)	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	160	60	9	140	24	180	1	0%	0%
	Through	9,040	5,380	913	9,460	1,087	8,980	233	44%	14%
	Right Turn	160	160	9	260	5	180	0	1%	0%
NB	Left Turn	320	140	17	240	36	300	52	0%	0%
	Through	1,240	180	26	320	58	420	152	26%	0%
	Right Turn	100	80	9	160	9	120	0	2%	0%
SB	Left Turn	60	80	1	100	4	80	1	65%	0%
	Through	6,060	4,360	377	7,020	253	6,100	12	41%	30%
	Right Turn	120	40	8	120	18	140	0	0%	0%
WB	Left Turn	160	80	11	160	25	180	17	2%	0%
	Through	960	160	19	280	62	340	92	7%	0%
	Right Turn	260	20	10	80	59	180	117	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
		(ft)	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	1,040	100	6	170	11	220	31	0%	0%
	Through/Right	240	140	9	220	13	220	26	0%	0%
NB	Left Turn	200	40	3	60	5	80	9	0%	0%
	Right Turn	160	80	5	120	9	140	12	0%	0%
WB	Left Turn	160	160	8	200	9	180	0	30%	0%
	Through	500	240	80	520	84	500	60	0%	2%

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	500	140	10	220	33	320	94	1%	0%
	Right Turn	220	100	14	180	25	240	9	0%	0%
NB	Left Turn	1,020	380	97	780	221	880	181	23%	3%
	Right Turn	120	120	5	160	6	140	0	10%	0%
WB	Left Turn	440	160	29	280	69	360	99	0%	0%
	Through	660	100	43	320	129	440	179	1%	0%

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	660	220	61	460	125	540	123	0%	0%
	Through/Right	660	340	73	600	124	620	80	0%	1%
NB	Left Turn	1,500	180	10	260	50	360	162	0%	0%
	Right Turn	320	180	17	280	33	320	32	0%	0%
WB	Through	360	80	8	120	12	160	19	0%	0%
	Right Turn	360	20	1	20	7	40	16	0%	0%

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

		Storage	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
Direction	Lane Group	(ft)	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	260	60	4	120	11	160	33	0%	0%
	Through	400	240	35	420	30	400	68	2%	1%
	Right Turn	120	120	13	180	16	140	0	13%	0%
NB	Left Turn	260	40	3	60	5	80	17	0%	0%
	Left/Through	1,540	60	7	100	11	100	17	0%	0%
	Right Turn	260	20	1	20	8	20	19	0%	0%
SB	Left/Through	2,280	40	6	80	18	120	24	3%	0%
	Right Turn	80	20	5	60	14	100	5	0%	0%
WB	Left Turn	120	60	6	100	12	120	15	0%	0%
	Through	4,220	60	8	100	16	140	23	0%	0%
	Through/Right	4,220	80	6	120	12	140	26	0%	0%

SimTraffic Post-Processor
Average Results from 10 Runs
Queue Length

Los Gamos Kaiser
Cumulative Plus Project
PM Peak Hour

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Left Turn	160	40	5	80	25	140	57	0%	0%
	Through	9,040	180	17	300	39	360	53	10%	0%
	Right Turn	160	60	15	180	25	180	0	0%	0%
NB	Left Turn	320	120	16	200	39	260	64	0%	0%
	Through	1,240	160	26	280	53	340	82	20%	0%
	Right Turn	100	60	8	160	8	120	0	1%	0%
SB	Left Turn	60	60	4	100	4	80	0	24%	0%
	Through	6,060	120	19	220	45	260	71	20%	0%
	Right Turn	120	20	8	60	31	120	39	0%	0%
WB	Left Turn	160	140	9	220	11	180	0	19%	0%
	Through	960	260	97	520	241	640	246	8%	0%
	Right Turn	260	60	39	220	85	280	0	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	1,040	410	21	780	11	830	7	0%	11%
	Through/Right	240	240	17	280	12	280	10	0%	20%
NB	Left Turn	1,040	990	4	1,270	17	1,130	14	1%	42%
	Right Turn	160	180	0	180	2	180	0	62%	0%
WB	Left Turn	160	160	15	200	9	180	0	23%	0%
	Through	500	240	34	420	55	480	67	2%	0%

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	500	400	67	600	58	560	19	9%	6%
	Right Turn	220	220	4	240	10	240	0	30%	0%
NB	Left Turn	1,000	640	208	1,040	250	980	121	39%	26%
	Right Turn	120	140	7	160	15	140	0	23%	0%
WB	Left Turn	440	440	9	500	7	460	0	28%	0%
	Through	660	580	61	880	66	720	15	21%	10%

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	660	180	30	360	62	460	81	0%	0%
	Right Turn	660	120	45	380	99	500	57	0%	0%
NB	Left Turn	1,540	140	7	240	32	320	111	0%	0%
	Right Turn	320	160	14	260	33	300	34	0%	0%
WB	Through	360	380	6	400	17	400	9	0%	53%
	Right Turn	360	40	16	200	68	320	98	0%	0%

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	260	100	11	180	21	200	29	0%	0%
	Through	400	180	14	260	18	280	30	22%	0%
	Right Turn	120	80	13	180	7	140	0	0%	0%
NB	Left Turn	260	280	8	320	19	280	0	16%	0%
	Left/Through	1,100	960	82	1,460	40	1,160	6	53%	55%
	Right Turn	260	180	10	380	7	280	0	0%	0%
SB	Left/Through	2,280	160	45	320	101	380	114	8%	0%
	Right Turn	80	80	4	120	5	100	0	37%	0%
WB	Left Turn	120	100	11	200	7	140	0	1%	0%
	Through	4,220	2,360	302	4,460	448	4,040	357	83%	10%
	Through/Right	4,220	2,360	300	4,440	449	4,020	372	0%	9%

SimTraffic Post-Processor | **Los Gamos Kaiser**
Average Results from 10 Runs | **Cumulative No Project**
Queue Length | **AM Peak Hour**

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Left Turn	160	60	9	160	33	200	42	0%	0%
	Through	980	4,220	1,037	7,340	1,517	7,400	1,040	44%	2%
	Right Turn	160	180	9	300	7	220	0	2%	0%
NB	Left Turn	320	260	39	420	31	360	0	29%	0%
	Through	1,240	400	185	820	395	900	379	31%	4%
	Right Turn	100	80	14	200	19	160	0	3%	0%
SB	Left Turn	60	120	2	120	7	120	0	70%	0%
	Through	980	3,080	578	5,200	923	5,100	713	59%	3%
	Right Turn	120	60	18	160	35	180	0	0%	0%
WB	Left Turn	160	80	11	160	21	220	21	1%	0%
	Through	960	140	13	260	27	300	40	6%	0%
	Right Turn	260	20	6	40	45	100	124	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	1,080	1,020	303	1,640	399	1,660	356	57%	1%
	Right Turn	140	160	19	260	10	200	0	0%	0%
NB	Left Turn	2,340	20	3	40	9	60	13	0%	0%
	Right Turn	160	60	6	100	14	120	19	0%	0%
SB	Left Turn	2,060	480	209	720	280	800	274	0%	0%
	Through	280	80	13	140	21	180	31	0%	0%
	Right Turn	280	60	11	120	21	160	35	0%	0%
WB	Left Turn	160	200	10	260	10	220	0	32%	0%
	Through	1,180	380	110	860	204	1,020	165	0%	0%

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Uncontrolled**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	520	20	19	140	107	380	240	0%	0%
	Right Turn	220	40	5	80	11	100	25	0%	0%
WB	Through/Right	680	100	67	380	164	540	103	0%	0%
	Right Turn	680	60	61	240	190	520	108	0%	0%

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	680	160	21	420	47	760	71	0%	0%
	Through/Right	680	240	33	380	64	460	65	0%	0%
NB	Left Turn	580	200	14	300	42	380	90	0%	0%
	Right Turn	320	200	19	320	31	340	34	2%	0%
WB	Through	360	60	5	120	16	140	30	0%	0%
	Right Turn	360	20	1	20	13	40	38	0%	0%

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	260	60	8	120	18	160	54	0%	0%
	Through	400	200	35	380	47	400	86	2%	0%
	Right Turn	120	140	11	240	5	180	0	15%	0%
NB	Left Turn	260	40	4	60	9	100	16	0%	0%
	Left/Through	520	60	3	100	9	120	20	0%	0%
	Right Turn	260	20	1	20	6	40	24	0%	0%
SB	Left/Through	440	40	4	80	7	100	9	2%	0%
	Right Turn	80	20	3	40	12	80	20	0%	0%
WB	Left Turn	120	60	6	120	20	140	26	1%	0%
	Through	780	60	4	100	18	140	51	0%	0%
	Through/Right	780	80	5	120	8	140	14	0%	0%

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	160	40	7	80	36	140	77	0%	0%
	Through	980	160	12	280	33	340	65	8%	0%
	Right Turn	160	40	6	160	15	220	0	0%	0%
NB	Left Turn	320	140	29	240	68	280	63	3%	0%
	Through	1,240	160	36	300	142	400	226	15%	0%
	Right Turn	100	40	14	140	48	140	47	0%	0%
SB	Left Turn	60	80	5	120	7	120	2	21%	0%
	Through	980	80	9	140	21	180	37	20%	0%
	Right Turn	120	20	2	20	23	60	76	0%	0%
WB	Left Turn	160	120	14	220	22	220	1	12%	0%
	Through	960	180	39	320	120	400	179	6%	0%
	Right Turn	260	40	15	120	64	220	118	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	1,080	320	57	560	94	680	96	41%	0%
	Right Turn	140	80	15	200	25	200	0	0%	0%
NB	Left Turn	2,340	140	21	260	18	240	9	3%	5%
	Right Turn	160	240	20	400	32	520	38	12%	0%
SB	Left Turn	2,060	160	14	220	34	260	39	0%	1%
	Through	280	40	5	80	10	100	21	0%	0%
	Right Turn	280	60	5	100	10	120	17	0%	0%
WB	Left Turn	160	120	6	180	16	220	13	4%	0%
	Through	1,180	180	20	460	43	680	68	2%	0%

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Uncontrolled**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	520	40	36	180	157	480	250	0%	0%
	Right Turn	220	100	8	200	14	240	26	1%	0%
WB	Through/Right	680	60	16	240	64	420	94	0%	0%
	Right Turn	680	20	23	120	118	260	227	0%	0%

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	680	160	36	400	74	660	82	0%	0%
	Through/Right	680	180	14	280	29	320	43	0%	0%
NB	Left Turn	580	160	6	240	17	280	55	0%	0%
	Right Turn	320	160	16	260	34	300	43	0%	0%
WB	Through	360	180	12	280	25	320	40	0%	0%
	Right Turn	360	20	7	100	32	200	82	0%	0%

SimTraffic Post-Processor
Average Results from 10 Runs
Queue Length

Los Gamos Kaiser
Cumulative No Project
PM Peak Hour

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	260	100	8	160	17	180	27	0%	0%
	Through	400	140	12	200	22	240	41	17%	0%
	Right Turn	120	40	9	140	20	180	0	0%	0%
NB	Left Turn	260	200	6	280	22	320	13	1%	0%
	Left/Through	520	200	15	320	59	380	115	3%	0%
	Right Turn	260	20	13	80	61	140	123	0%	0%
SB	Left/Through	440	80	16	180	44	260	67	5%	0%
	Right Turn	80	80	7	140	9	140	0	19%	0%
WB	Left Turn	120	80	8	200	15	180	0	1%	0%
	Through	780	220	16	340	37	360	58	34%	0%
	Through/Right	780	220	14	340	33	360	40	0%	0%

SimTraffic Post-Processor
Average Results from 10 Runs
Queue Length

Los Gamos Kaiser
Cumulative Plus Project
AM Peak Hour

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Left Turn	160	60	12	140	28	180	1	0%	0%
	Through	980	5,120	997	8,700	1,598	8,280	1,093	42%	8%
	Right Turn	160	160	7	260	5	180	0	1%	0%
NB	Left Turn	320	160	30	280	53	320	43	2%	0%
	Through	1,240	180	25	340	61	420	110	27%	0%
	Right Turn	100	80	11	160	6	120	0	2%	0%
SB	Left Turn	60	80	2	100	2	80	0	58%	0%
	Through	980	4,620	301	7,360	114	6,100	13	51%	43%
	Right Turn	120	40	11	120	27	140	4	0%	0%
WB	Left Turn	160	80	11	160	25	180	2	1%	0%
	Through	960	160	9	280	30	380	72	7%	0%
	Right Turn	260	20	13	100	65	200	113	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	1,080	620	220	1,060	343	1,140	344	52%	0%
	Right Turn	140	120	9	200	4	160	0	0%	0%
NB	Left Turn	2,340	40	7	80	24	120	49	0%	0%
	Right Turn	160	60	10	120	19	140	31	0%	0%
SB	Left Turn	2,060	580	253	880	314	940	291	0%	0%
	Through	280	240	30	340	17	320	18	0%	11%
	Right Turn	280	100	23	200	50	260	39	0%	0%
WB	Left Turn	160	160	9	200	7	180	0	41%	0%
	Through	1,180	620	259	1,000	265	1,020	180	50%	4%

SimTraffic Post-Processor **Los Gamos Kaiser**
Average Results from 10 Runs **Cumulative Plus Project**
Queue Length **AM Peak Hour**

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Uncontrolled**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	520	20	16	100	92	220	209	0%	0%
	Right Turn	220	20	6	80	11	80	14	0%	0%
WB	Through/Right	680	260	211	540	242	560	128	0%	4%
	Right Turn	680	220	213	520	267	540	144	0%	4%

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	680	160	30	360	78	560	93	0%	0%
	Through/Right	680	240	35	380	77	440	88	0%	0%
NB	Left Turn	580	240	76	420	164	520	201	5%	0%
	Right Turn	320	200	29	320	44	340	6	2%	0%
WB	Through	360	80	35	180	84	220	102	0%	1%
	Right Turn	360	20	3	40	28	60	83	0%	0%

SimTraffic Post-Processor
Average Results from 10 Runs
Queue Length

Los Gamos Kaiser
Cumulative Plus Project
AM Peak Hour

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Left Turn	260	80	5	120	8	140	14	0%	0%
	Through	400	240	30	420	38	400	82	2%	1%
	Right Turn	120	120	10	180	7	140	0	12%	0%
NB	Left Turn	260	40	5	60	9	80	17	0%	0%
	Left/Through	520	60	4	100	8	100	13	0%	0%
	Right Turn	260	20	2	20	10	40	22	0%	0%
SB	Left/Through	440	40	4	80	10	120	25	3%	0%
	Right Turn	80	20	5	60	15	100	11	0%	0%
WB	Left Turn	120	60	5	120	10	140	11	1%	0%
	Through	780	60	6	120	13	160	30	1%	0%
	Through/Right	780	80	6	140	11	180	29	0%	0%

Intersection 1 **Las Gallinas Ave/Lucas Valley Rd** **Signal**

		Storage	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
Direction	Lane Group	(ft)	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Left Turn	160	40	6	100	33	160	76	0%	0%
	Through	980	180	10	300	26	360	56	9%	0%
	Right Turn	160	40	18	140	56	200	48	0%	0%
NB	Left Turn	320	140	20	240	41	340	67	1%	0%
	Through	1,240	160	16	280	47	420	109	18%	0%
	Right Turn	100	60	11	160	18	160	0	0%	0%
SB	Left Turn	60	80	5	120	7	120	1	21%	0%
	Through	980	80	10	160	24	200	27	21%	0%
	Right Turn	120	20	2	20	16	40	66	0%	0%
WB	Left Turn	160	140	24	240	23	220	0	25%	0%
	Through	960	260	149	540	331	640	316	7%	1%
	Right Turn	260	60	47	200	127	240	113	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

		Storage	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
Direction	Lane Group	(ft)	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	1,080	380	166	660	243	720	207	50%	1%
	Right Turn	140	100	21	220	28	200	0	0%	0%
NB	Left Turn	2,340	180	32	320	17	280	14	2%	11%
	Right Turn	160	360	147	680	233	860	236	23%	0%
SB	Left Turn	2,060	120	8	180	13	200	17	0%	0%
	Through	280	80	9	140	21	160	28	0%	0%
	Right Turn	280	60	3	100	6	140	18	0%	0%
WB	Left Turn	160	100	10	160	16	200	15	2%	0%
	Through	1,180	120	21	340	44	580	60	0%	0%

Intersection 3 **US-101 SB Ramps/Lucas Valley Rd** **Uncontrolled**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	520	60	40	220	157	480	252	0%	0%
	Right Turn	220	100	9	200	16	220	19	0%	0%
WB	Through/Right	680	60	20	240	68	440	55	0%	0%
	Right Turn	680	40	24	180	105	360	182	0%	0%

Intersection 4 **US-101 NB Ramps/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Through	680	140	37	380	70	700	75	0%	0%
	Through/Right	680	120	10	220	28	300	60	0%	0%
NB	Left Turn	580	140	18	240	95	340	292	0%	0%
	Right Turn	320	160	17	260	36	300	60	1%	0%
WB	Through	360	200	27	380	61	540	86	0%	0%
	Right Turn	360	20	7	80	26	140	52	0%	0%

SimTraffic Post-Processor
Average Results from 10 Runs
Queue Length

Los Gamos Kaiser
Cumulative Plus Project
PM Peak Hour

Intersection 5 **Redwood Dr/Smith Ranch Rd** **Signal**

Direction	Lane Group	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	95th Queue (ft) Average	95th Queue (ft) Std. Dev.	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Block Time Pocket	Block Time Upstream
EB	Left Turn	260	100	11	180	25	220	32	0%	0%
	Through	400	140	6	200	12	260	28	17%	0%
	Right Turn	120	40	11	140	26	180	0	0%	0%
NB	Left Turn	260	200	11	280	13	320	12	1%	0%
	Left/Through	520	200	16	320	52	420	161	3%	0%
	Right Turn	260	20	9	80	56	180	128	0%	0%
SB	Left/Through	440	100	35	260	99	340	122	7%	0%
	Right Turn	80	100	8	140	8	140	0	25%	0%
WB	Left Turn	120	100	12	200	14	180	1	2%	0%
	Through	780	220	25	340	51	380	69	32%	0%
	Through/Right	780	220	22	340	44	380	56	0%	0%

SimTraffic Post-Processor
Average Results from 10 Runs
Queue Length

Los Gamos Kaiser
Existing Plus Project - Mitigation
AM Peak Hour

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

		Storage	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
Direction	Lane Group	(ft)	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	1,080	20	0	20	3	20	10	0%	0%
	Right Turn	140	20	3	40	12	80	15	0%	0%
NB	Left Turn	2,340	40	6	60	15	80	27	0%	0%
	Right Turn	160	20	0	20	0	20	0	0%	0%
WB	Left Turn	160	100	13	160	19	180	8	2%	0%
	Through	520	20	8	40	56	120	142	0%	0%

Intersection 4 **US-101 SB Ramps/Smith Ranch Rd** **Signal**

		Storage	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
Direction	Lane Group	(ft)	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	680	240	17	420	60	480	85	10%	0%
	Right Turn	200	40	12	140	39	220	0	0%	0%
NB	Left Turn	580	340	64	560	112	580	69	13%	5%
	Right Turn	320	140	57	380	75	340	0	0%	0%
WB	Through	360	80	10	160	23	200	42	0%	0%
	Right Turn	360	20	1	20	5	40	12	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Side-street Stop**

Direction	Lane Group	Storage (ft)	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
			Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	1,080	140	247	340	425	420	309	14%	1%
	Right Turn	140	20	30	80	86	140	102	0%	0%
NB	Left Turn	2,340	300	407	680	890	680	726	3%	2%
	Right Turn	160	80	60	200	111	180	89	21%	0%
WB	Left Turn	160	100	7	160	20	180	33	1%	0%
	Through	520	20	4	40	42	80	123	0%	0%

Intersection 2 **Los Gamos Dr/Lucas Valley Rd** **Signal**

		Storage	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
Direction	Lane Group	(ft)	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	1,080	340	60	620	166	680	244	24%	0%
	Right Turn	140	100	16	240	17	200	0	0%	0%
NB	Left Turn	220	20	6	60	27	140	68	0%	0%
	Right Turn	160	100	7	160	14	200	16	2%	0%
WB	Left Turn	160	180	13	240	8	220	0	17%	0%
	Through	480	180	55	440	97	480	4	0%	1%

Intersection 4 **US-101 SB Ramps/Smith Ranch Rd** **Signal**

		Storage	Average Queue (ft)		95th Queue (ft)		Maximum Queue (ft)		Block Time	
Direction	Lane Group	(ft)	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Pocket	Upstream
EB	Through	680	640	38	800	61	700	5	4%	9%
	Through/Right	200	240	3	260	11	260	0	46%	0%
NB	Left Turn	1,780	380	87	720	226	1,020	334	11%	0%
	Right Turn	320	240	31	420	37	380	0	0%	0%
WB	Through	360	160	14	280	20	320	36	0%	0%
	Right Turn	360	20	2	20	19	40	52	0%	0%