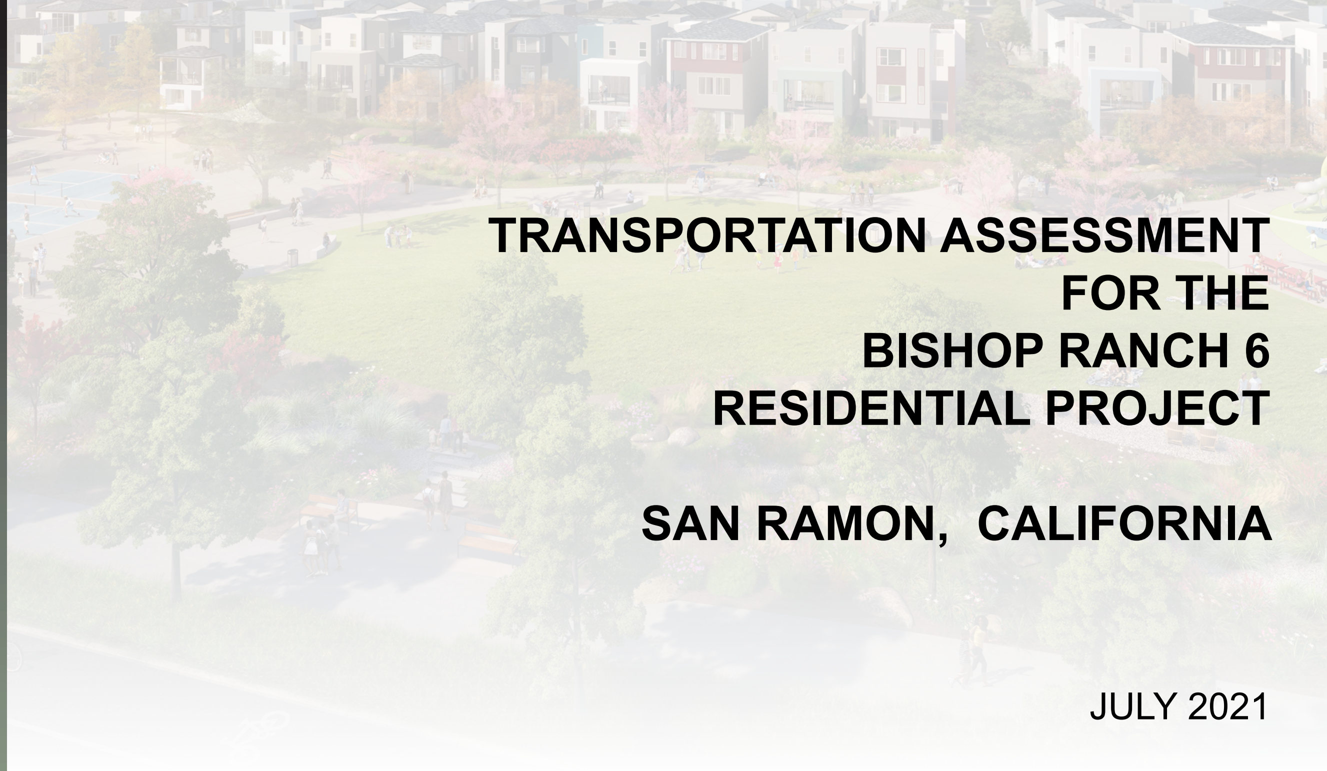
Appendix I:
Traffic Impact Analysis

THIS PAGE INTENTIONALLY LEFT BLANK



TRANSPORTATION ASSESSMENT FOR THE BISHOP RANCH 6 RESIDENTIAL PROJECT

SAN RAMON, CALIFORNIA

JULY 2021

PREPARED FOR

SUMMERHILL HOMES

PREPARED BY

Gibson transportation consulting, inc.

TRANSPORTATION ASSESSMENT FOR THE BISHOP RANCH 6 RESIDENTIAL PROJECT

SAN RAMON, CALIFORNIA

July 2021

Prepared for:

SUMMERHILL HOMES

Prepared by:

GIBSON TRANSPORTATION CONSULTING, INC.
555 W. 5th Street, Suite 3375
Los Angeles, California 90013
(213) 683-0088

Ref: J1877

Table of Contents

List of Figures

<u>NO.</u>

List of Tables

<u>NO.</u>

Chapter 1

Introduction

This study presents the transportation assessment required by California Environmental Quality Act (CEQA) for the Bishop Ranch 6 project (Project) located at 2400-2440 Camino Ramon (Project Site) in the *North Camino Ramon Specific Plan* (City of San Ramon, 2012) (NCRSP) of the City of San Ramon, California (City). The methodology and base assumptions used in the analysis were established in conjunction with the City Public Works Department Engineering Services Division.

PROJECT DESCRIPTION

The Project, proposed by SummerHill Homes (Applicant), would construct 404 residential units consisting of 268 single-family detached homes and 136 multi-family dwelling units, including 114 detached row homes, 154 detached courtyard homes, and 136 attached town homes. The Project Site is currently occupied with approximately 564,000 square feet (sf) of office uses that would be removed with the development of the Project.

The Project would provide multiple pedestrian entry points for residents and guests along Executive Parkway, Camino Ramon, and Norris Canyon Road. A two-acre park, along with an enhanced landscaped pedestrian walkway along Camino Ramon, would be provided for the use of residents and the local community.

Existing parking for the current office uses on the Project Site is provided within surface parking lots. On-site parking for the Project would be provided in a two-car garage for each unit and an additional 120 parking spaces for guests, for a total of 928 spaces. The Project Site currently provides four access points, two full-access driveways on Camino Ramon and one full access driveway each on Executive Parkway and Norris Canyon Road. Vehicular access to the Project

Site would be provided via existing full-access driveways along Executive Parkway, Camino Ramon, and Norris Canyon Road. The two full-access driveways on Camino Ramon would be consolidated into one full-access driveway on Camino Ramon. An additional driveway, accommodating right-turn ingress and egress only, would also be provided on Executive Parkway. The conceptual Project Site plan is shown in Figure 1.

The Project is projected to be developed over a four to six-year time period following approval of the Project. The long-range travel projections used in this report are based on the latest Contra Costa Transportation Authority (CCTA) Travel Demand Forecast Model (CCTA Model) which assumes travel and land use conditions for Year 2040. the travel forecasts also assume full buildout of the CityCenter residential project recently approved by the City of San Ramon. Consistent with the longest future forecasts available, the conditions in this analysis assume that the full buildout of the Project would take place by Year 2040.

PROJECT LOCATION

Generally, the Project Site is bounded by Norris Canyon Road to the north, Camino Ramon to the east, Executive Parkway to the south, and commercial and office uses to the west. Other nearby uses include medical centers as well as office and commercial developments.

The Project Site is 0.50 miles east of Interstate 680 (I-680), which provides regional access. Regional and local access to the Project Site is provided via several arterials, including Crow Canyon Road, Norris Canyon Road, Executive Parkway, Bollinger Canyon Road, Camino Ramon, and Alcosta Boulevard.

The Project Site is located less than 600 feet west of the San Ramon Transit Center, which is located east of the intersection of Camino Ramon & Executive Parkway. The San Ramon Transit Center serves several bus routes, including Central Contra Costa Transit Authority (CCCTA or County Connection) Routes 21, 35, 92X, 95X, 96X, 97X, and 321. The existing transit lines provide service to the Bay Area Rapid Transit (BART) rail stations in Dublin/Pleasanton, West Dublin/Pleasanton, and Walnut Creek, as well as Park-N-Ride lots in Danville and Walnut Creek.

ANALYSIS METHODOLOGY

Study Scope and Analysis Conditions

The scope of analysis for this study was developed in consultation with City staff and in compliance with the California Code of Regulations, Title 14, Section 15000 (CEQA Guidelines). The base assumptions and technical methodologies (i.e., trip generation, study locations, analysis methodology, etc.) were identified as part of the study approach and were outlined in a Scoping Form which was reviewed and approved by City staff. A copy of the Scoping Form is provided in Appendix A.

This study analyzed the potential Project-generated transportation impacts on the transportation network in the vicinity of the Project Site.

State of California Senate Bill No. 743

Senate Bill No. 743 (Steinberg, 2013) (SB 743), made effective in January 2014, requires the Governor's Office of Planning and Research to change the CEQA Guidelines regarding the analysis of transportation impacts. Under SB 743, the focus of transportation analysis will shift from driver delay (level of service [LOS] to vehicle miles traveled (VMT) to promote a reduction of greenhouse gas emissions and to encourage creation of multimodal networks and promotion of mixed-use developments. Although originally scheduled to be fully implemented in guidelines by January 1, 2016, an extension has allowed cities more time to establish an analysis methodology. The City is in the process of updating its transportation impact methodology, and CCTA is in the process of updating *CCTA Technical Procedures* (January 16, 2013) to include thresholds based on VMT as well. To better align with the State's multimodal transportation and environmental action goals, the California Department of Transportation (Caltrans) is also pursuing VMT as a metric of Project impacts, which is outlined in *Local Development - Intergovernmental Review (LD-IGR) Interim Guidance* (Caltrans, Approved September 2016) (Caltrans Interim Guidance). The Caltrans Interim Guidance, which is provided in Appendix B, discusses the shift away from congestion and toward VMT as a measure of environmental impact.

Though not yet approved, *VMT Analysis Methodology for Land Use Projects in Contra Costa, GMTF Review Draft* (Fehr & Peers, July 2020) (Draft CCTA VMT Methodology), which is provided in Appendix C, follows the recommended VMT analysis methodology for compliance with the requirements of SB 743. Per the Draft CCTA VMT Methodology, the guidelines are intended to assist lead agencies in their CEQA VMT analysis consistent with new requirements of the CCTA Growth Management Program. The Project's VMT screening and impact analyses are discussed in Chapter 3 and 4, respectively.

ADDITIONAL TRANSPORTATION ANALYSES

CCTA

The CCTA is the Congestion Management Agency for Contra Costa County and oversees implementation of sub-regional Action Plans for Routes of Regional Significance, which sets forth performance objectives for Routes of Regional Significance. In the San Ramon Valley, the Tri-Valley Transportation Council Action Plan includes Routes of Regional Significance. I-680, San Ramon Valley Boulevard, and the Iron Horse Trail are considered Routes of Regional Significance within the Study Area.

Caltrans

The Caltrans Interim Guidance discusses the importance of transit, alternate modes of travel, and pedestrian considerations as part of project evaluation and suggests the approach with which Caltrans can recommend improvements to enhance pedestrian safety and increase pedestrian accessibility to help meet the goals and targets of *Caltrans Strategic Management Plan 2015-2020* (Caltrans, March 2015) and *California Transportation Plan 2040* (Caltrans, June 2016). The Caltrans Interim Guidance directs lead agencies to consider "multi-modal solutions from existing regional transportation plans, regional plans, transit plans, bicycle plans, and pedestrian plans."

The Caltrans Interim Guidance states that Caltrans' "comments henceforth should take into consideration whether the project exhibits low or high VMT (by place type e.g., urban, suburban, and rural areas) and should focus recommendations on smart land use, multimodal access, safety for all users, and reducing single occupant vehicle trips. Well planned urban infill projects which are located close to transit, bike and pedestrian facilities… which also have proximity benefits to employment centers, services and goods – will reduce travel demand on the entire transportation system and will therefore require significantly less review and mitigation than rural fringe projects (Project Type 5), which generate proportionately higher number of trips and vehicle miles traveled. Senate Bill 743 (2013) mandated that CEQA review of transportation impacts of proposed development be modified by eliminating consideration of delay- and capacity- based metrics such as LOS and instead focusing analysis on another metric of impact."

The Governor's Office of Planning and Research has proposed that VMT be the primary metric used in identifying transportation impacts.

ORGANIZATION OF REPORT

This report is divided into five chapters, including this Introduction. Chapter 2 describes the Project context including the existing and future circulation system, traffic volumes, and traffic conditions in the Project area. Chapter 3 describes the procedure used to forecast Project traffic volumes and distribution. Chapter 4 presents the CEQA analysis of transportation impacts. Chapter 5 provides a summary of the report. The Appendices contain supporting documentation and additional details of the technical analyses, as well as the additional analysis described above.

Source: William Hezmalhalch Architects, Inc. July, 2021.

PROJECT SITE PLAN

FIGURE 1

Chapter 2
Project Context

A comprehensive data collection effort was undertaken to develop a detailed description of existing and future conditions in the Project area.

The Existing Conditions analysis includes an assessment of the existing public transit service, as well as pedestrian and bicycle circulation, at the time of the issuance of the Notice of Preparation in Year 2021.

In addition, this Chapter contains a discussion of the future conditions detailing the assumptions used to develop the Future without Project Conditions in Year 2040.

STUDY AREA

The Project’s Study Area, shown in Figure 2, is generally bounded by Norris Canyon Road to the north, Camino Ramon to the east, Executive Parkway to the south, and San Ramon Valley Boulevard to the west.

EXISTING STREET SYSTEM

The existing street system in the Study Area consists of a regional roadway system including freeways, arterials, collectors, and local streets which provide regional, sub-regional, or local access and circulation within the Study Area. These transportation facilities generally provide two to eight travel lanes and may allow parking on either side of the street. Typically, the speed limits range between 25 and 50 miles per hour (mph) on the streets and 65 mph on freeways.

Street classifications for roadways within the City are designated in *City of San Ramon General Plan 2035* (City of San Ramon, Effective May 28, 2015) (General Plan). The available facilities in the Study Area are defined by the following in the General Plan:

- Freeways are high-volume, high-speed roadways with limited access provided by interchanges that carry regional traffic through and do not provide local access to adjacent land uses.

- Arterial Streets are major roadways that serve higher traffic volumes and accommodate intercity circulation, as well as provide access to major commercial activity centers. Typically, Arterial Streets provide two to four travel lanes in each direction separated by a center median.

- Collector Streets are generally located in residential neighborhoods and employment areas and provide access to and from arterial streets for local traffic and are not intended for cut-through traffic. Typically, Collector Streets provide one to two travel lanes in each direction with no center median.

- Local Streets are intended to accommodate lower volumes of vehicle traffic and used to travel within neighborhoods. Typically, Local Streets provide one travel lane in each direction with parking on both sides of the street.

- Routes of Regional Significance are major arterials and freeways that serve regional traffic and generally serve as a means of travel across Contra Costa County or between Contra Costa County and adjacent counties.

Primary regional access to the Project Site is provided by I-680. The major arterials providing regional and sub-regional access to the Study Area include Norris Canyon Road, Executive Parkway, and Camino Ramon. The following is a brief description of the major roadways in the transportation analysis Study Area, including their classification under the General Plan:

Freeways

- I-680 – I-680 is a classified Route of Regional Significance and generally runs in the north-south direction, less than 0.30 miles west of the Project Site. In the vicinity of the Study Area, I-680 provides three travel lanes and one express lane in each direction. An auxiliary lane is present in the northbound direction within the Study Area. Access to and from I-680 is available via interchanges at Crow Canyon Road and Bollinger Canyon Road.

Roadways

- Camino Ramon – Camino Ramon is a classified Arterial Street within the Study Area. It travels in the north-south direction and is located along the eastern boundary of the Project Site. It generally provides two travel lanes in each direction, with a two-way left-turn lane, and left-turn lanes at intersections and driveways. Parking is generally not available on either side of the street within the Study Area.

- Bishop Drive – Bishop Drive is a classified Local Street. It travels in the north-south direction within the Study Area. It is located approximately 0.25 miles west of the Project Site. It generally provides one travel lane in each direction and Class II bicycle lanes on both sides of the street south of Norris Canyon Road. Parking is generally not available on either side of the street within the Study Area.

- Norris Canyon Road – Norris Canyon Road is a classified Arterial Street within the Study Area. It travels in the east-west direction and is located along the northern boundary of the Project Site. It generally provides two travel lanes in each direction and Class II bicycle lanes on both sides of the street. It provides a two-way left-turn lane and left-turn lanes at most intersections. Parking is generally not available on either side of the street within the Study Area.

- Executive Parkway – Executive Parkway is a classified Local Street within the Study Area. It generally travels in the east-west direction and is located along the southern boundary of the Project Site. It generally provides two travel lanes in each direction east of Camino Ramon and one travel lane in each direction west of Camino Ramon. Left-turn lanes are provided at intersections and driveways. Parking is generally not available on either side of the street within the Study Area.

EXISTING TRANSIT SYSTEM

The Study Area is served by CCCTA routes 21, 35, 92X, 95X, 96X, and 97X, in addition to weekend routes 321 and 335. Figure 3A illustrates the existing transit service in the Study Area. Table 1 summarizes the transit lines operating in the Study Area for each of the service providers in the region, the type of service (peak vs. off-peak, express vs. local), and frequency of service, as described above. The average frequency of transit service during the peak hour was derived from the number of peak-period stops made at the stop nearest the Project Site.

BICYCLE AND PEDESTRIAN NETWORK

Existing Bicycle System

Based on *City of San Ramon Bicycle Master Plan* (City of San Ramon, April 2018) (Bicycle Master Plan), the existing bicycle system in the Study Area consists of a limited coverage of multi-use paths (Class I), bicycle lanes (Class II), and bicycle routes (Class III). Multi-use paths are two-way paved facilities, physically separated from vehicle traffic and can be used by bicyclists, pedestrians and other non-motorized users. Bicycle lanes are a component of street design with dedicated striping and symbols on the roadway surface, separating vehicular traffic from bicycle traffic. Buffered bicycle lanes provide a painted flush buffer zone between a bicycle lane and adjacent travel lane. Bicycle routes are identified as bicycle-friendly streets where motorists and cyclists share the roadway and there is no dedicated striping of a bicycle lane. Bicycle routes are preferably located on Local, Collector, and lower volume Arterial Streets as part of a signed route or bicycle boulevard, which is typically applied on quiet streets such as residential neighborhoods. The following bicycle facilities are provided along corridors within the Study Area:

Multi-Use Paths (Class I)

- Iron Horse Trail

Bicycle Lanes (Class II)

- Bishop Drive
- San Ramon Valley Boulevard
- Norris Canyon Road
- Executive Parkway

Figure 3B depicts the existing bicycle network within the Project vicinity.

Existing Pedestrian Facilities

The walkability of existing facilities is based on the availability of pedestrian routes necessary to accomplish daily tasks without the use of an automobile. The Project area is comprised of employment and retail land uses and cultural facilities served by transit stops, a bicycle network, and an extensive sidewalk system. There are wide sidewalks lining the streets, crosswalks available at the intersections, and many shops, restaurants, and other services within walking distance of the Project Site.

The sidewalks that serve as routes to the Project Site provide proper connectivity and adequate widths to pedestrian crossings at intersections for a comfortable and safe pedestrian environment. The following signalized intersections provide pedestrian facilities to limit illegal mid-block crossings to the Project Site (all intersections have marked pedestrian crossings):

- Camino Ramon & Norris Canyon Road
- Camino Ramon & Executive Parkway

Each of the listed signalized intersections provides pedestrian phasing, crosswalk striping, and Americans with Disabilities Act accessible ramps.

Figure 3C illustrates the existing sidewalk and crosswalk systems along the project frontages.

FUTURE IMPROVEMENTS

The analysis of future conditions considered pedestrian, bicycle, transit, roadway and intersection improvements via capital projects that are reasonably expected to be implemented prior to the buildout of the proposed Project (Year 2040). The City has developed a comprehensive five-year plan in which it identifies needed capital projects in the area and the financing and timing of such improvements. The latest update to this plan is outlined in *Capital Improvement Program 2019/2020 – 2023/24 Final Report* (City of San Ramon, Adopted June 11, 2019) (CIP).

Prior to construction, planned improvements that are not currently funded will be programmed for funding from various sources including bond proceeds, development impact fees, grants, taxes, etc. A number of the improvements are also mitigation measures for larger projects that have already undergone CEQA review such as Project #905530, which has also undergone National Environmental Policy Act review. Therefore, substantial evidence supports the conclusion that these capital projects will be completed when warranted prior to buildout of the Project.

The following intersection improvement detailed in the CIP is not warranted at this time and, therefore, was conservatively omitted from the future analyses:

- Project #975609: Norris Canyon Road & Bishop Drive/Annabel Lane (Intersection #1)– Bishop Drive will be widened to provide an additional left-turn lane in the northbound direction. The resulting northbound lane configuration will include one left-turn lane, one shared through/left-turn lane, and one shared through/right-turn lane. In addition, the project includes the replacement of the signal pole on the northeast corner and upgrades to the pedestrian ramps on the north side of Norris Canyon Road. The 2040 LOS analysis showed that this intersection would operate at an acceptable LOS operation under future operating conditions prior to any improvements (LOS C during the morning peak hour and LOS D during the afternoon peak hour). Based on discussions with the City, the improvement has been deferred indefinitely due to geometric constraints. Therefore, no future improvement was assumed under Future without Project Conditions.

Future Bicycle Improvements

The Bicycle Master Plan identifies the City's vision for a more integrated bicycle network throughout the City, including within the Study Area. It proposes the following bicycle facilities within the Study Area:

Multi-Use Path (Class I)

- Camino Ramon

Bicycle Lanes (Class II)

- Executive Parkway west of Camino Ramon (installed)

Separated Bicycle Lanes (Class IV)

- San Ramon Valley Boulevard
- Norris Canyon Road
- Executive Parkway east of Camino Ramon

CITYWALK MASTER PLAN FUTURE ROADWAY IMPROVEMENTS

The following proposed roadway improvements from *Transportation Impact Study for the CityWalk Master Plan Project* (Gibson Transportation Consulting, Inc., March 2020), which are neither included as part of the planned roadway improvements detailed in the CIP nor required to reduce the CityWalk Master Plan's impacts to less than significant levels, have been assumed as part of the CityWalk Master Plan's design features:

Roadway Segment Improvements

- Executive Parkway between Bishop Drive and Camino Ramon – Executive Parkway will be reconfigured to provide a wider center median while still retaining the existing on-street bike lanes. A new separated multi-use, off-street trail would be provided along the south side of the street. In addition, the existing landscape median will be reconfigured to provide additional left-turn lanes into parcels along both the north and south sides of the street. As proposed, Executive Parkway will provide one through lane in each direction with left-turn lanes protected by the wider raised median.

Intersection Improvements

- Camino Ramon & Executive Parkway (Intersection #8) – Executive Parkway will be reconfigured to provide an exclusive left-turn lane in the eastbound direction. The resulting eastbound lane configuration will include one left-turn lane, one through lane, and one right-turn lane.

Pedestrian Improvements

The CityWalk Master Plan Project includes a proposed High-Intensity Activated Crosswalk signalized/controlled midblock crosswalk along Executive Parkway, immediately west of the new parking structure within BR 2600 NW. This midblock crosswalk would provide pedestrians an accessible pathway between the Bishop Ranch campuses as well as direct access to one of the three new mobility hubs proposed in the CityWalk Master Plan.

OTHER FUTURE TRANSPORTATION IMPROVEMENT PROGRAMS

As described below, there are several other transportation programs in various stages of development that are located outside of the direct Study Area that could have a substantial effect on the transportation system performance in the Study Area and therefore on the total VMT generated by the Project. For conservative purposes, the effects of these potential programs were not considered in the analysis of the Project.

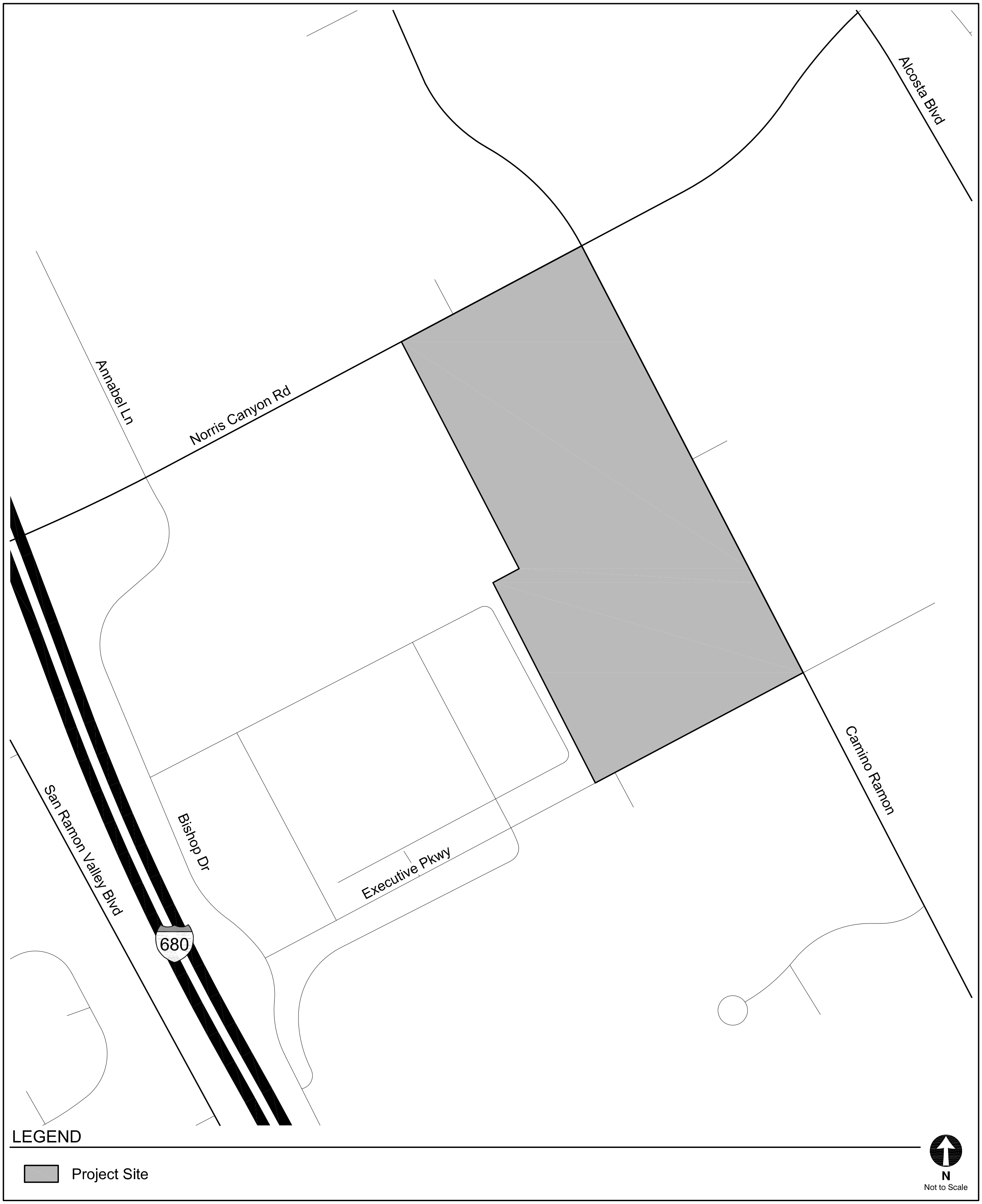
Freeway Express Lane Improvements

Caltrans is currently constructing express lanes on I-680 between the Benicia-Martinez Bridge and US 101, which will provide a continuous express lane for approximately 55 miles between the Carquinez Strait and the City of San Jose. This project will reduce travel times for carpools, buses, and rideshares, which in turn will lead to a reduction in single-occupancy vehicle travel. Portions of the project have already been completed and are in operation; the remaining segments are scheduled for completion by 2030.

Innovate 680

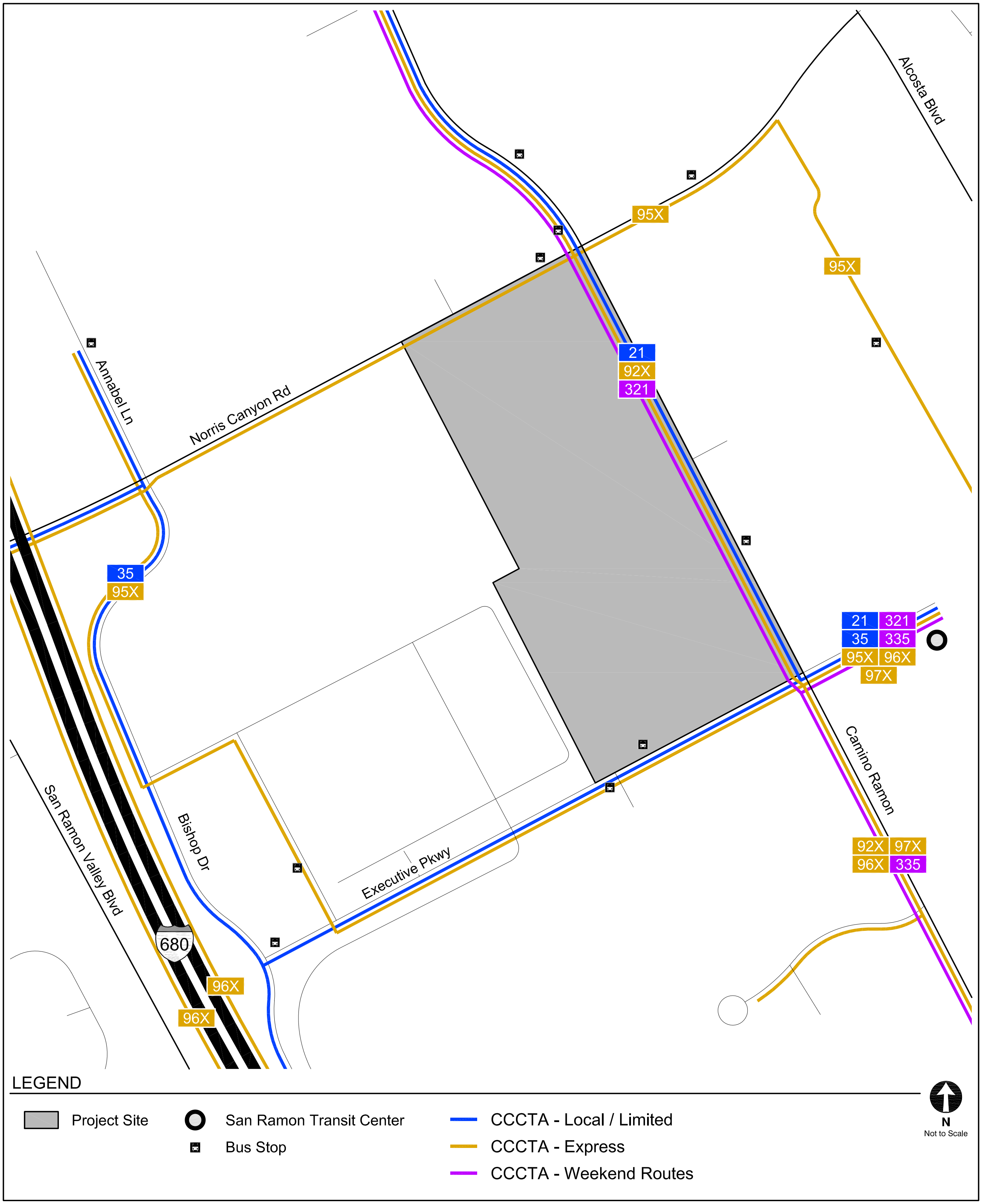
CCTA has identified seven strategies for improving the operations of I-680 through the City:

1. Complete Express Lanes
2. Cool Corridor “Hot Spots”
3. Enhance Transit Service with Bus-On-Shoulder Operations
4. Innovative Operational Strategies
5. Provide First/Last Mile Connections with Shared Autonomous Vehicles
6. Prepare the Corridor for the Future
7. Transportation Demand Management



STUDY AREA

FIGURE 2



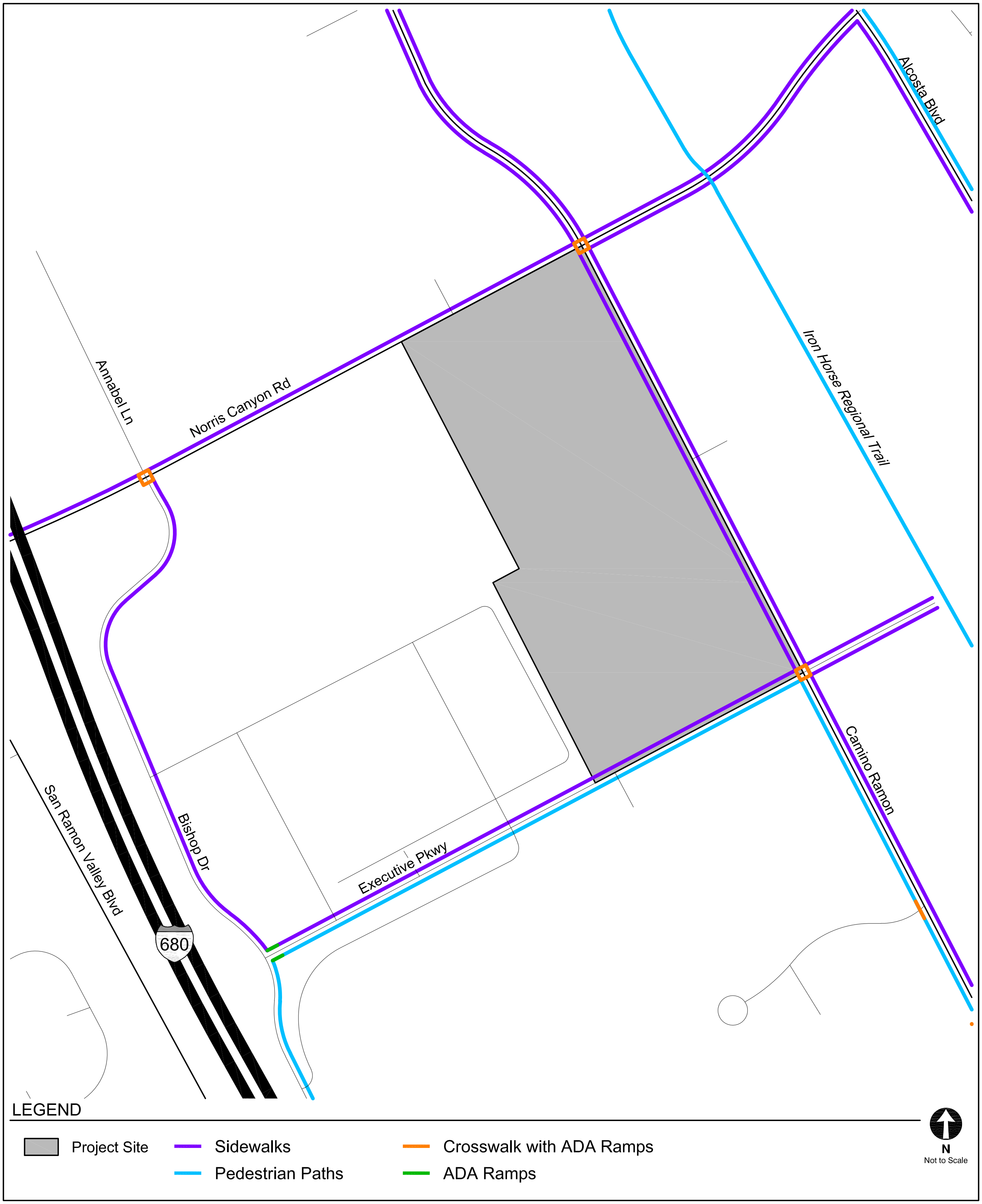
EXISTING TRANSIT SERVICE

FIGURE 3A

EXISTING BICYCLE NETWORK

FIGURE 3B

Gibson transportation consulting, inc.



EXISTING PEDESTRIAN NETWORK

FIGURE 3C

TABLE 1
EXISTING TRANSIT SERVICE IN STUDY AREA

Provider, Route, and Service Area		Service Type	Hours of Operation	Average Headway (minutes)	
CCCTA - Weekdays Only				**Peak**	**Off-Peak**
21	BART Walnut Creek - San Ramon	Local	5:30 AM - 10:30 PM	30	60
35	BART Dublin/Pleasanton - San Ramon	Local	6:00 AM - 8:30 PM	15-20	30-60
92X	ACE Express	Express	5:30 AM - 9:00 AM 3:30 PM - 7:30 PM	60	--
95X	San Ramon - BART Walnut Creek	Express	6:00 AM - 9:00 AM 3:30 PM - 7:30 PM	20 min peak only	--
96X	BART Walnut Creek - Bishop Ranch	Express	5:30 AM - 7:15 PM	20 min peak only	3 peak trips
97X	BART Dublin/Pleasonton - Bishop Ranch	Express	6:30 AM - 9:00 AM 4:00 PM - 6:00 PM	60 min peak only	--
Provider, Route, and Service Area		**Service Type**	**Hours of Operation**	**Average Headway (minutes)**	
CCCTA - Weekends Only				**Peak**	**Off-Peak**
321	BART Walnut Creek - San Ramon	Limited	7:30 AM - 10:30 PM	60	60
335	BART Dublin/Pleasonton - San Ramon	Limited	7:45 AM - 7:15 PM	60	60

Notes

Transit peak hours generally occur during 6:00 AM - 9:00 AM and 3:00 PM - 6:00 PM.

CCCTA: Central Contra Costa Transit Authority

BART: Bay Area Rapid Transit

ACE: Altamont Corridor Express

Chapter 3
CEQA Project Screening Analysis

This chapter describes the assumptions and methodology used in developing the traffic volumes associated with the Project as well as discusses the CEQA analysis screening criteria applied to the Project.

PROJECT DESCRIPTION

As described in Chapter 1, the Applicant proposes to construct a residential project in the urban core of the City. The Project would construct 404 residential units consisting of 268 single-family detached homes and 136 multi-family dwelling units, including 114 detached row homes, 154 detached courtyard homes, and 136 attached town homes, as well as a two-acre park. The Project Site is currently occupied with approximately 564,000 sf of office uses, which would be removed with the development of the Project.

Other elements of the Project description are detailed in Chapter 1 of this report. The conceptual Project site plan is shown in Figure 1.

PROJECT DESIGN FEATURES

The following proposed roadway improvements have been assumed as part of the Project design features:

Intersection Improvements

- I Street Project Driveway & Executive Parkway (Intersection #6) – Currently, an intersection exists on the south side of Executive Parkway, opposite this proposed access, and includes one through/right-turn lane in the eastbound direction and one exclusive left-turn lane and one through lane in the westbound direction to serve the parcel at 2600 Camino Ramon. A shared left/right-turn lane is provided in the northbound direction for exiting traffic. The Project will be constructing a new driveway on the north side of Executive Parkway to align with the 2600 Camino Ramon driveway. The new Project driveway will include a southbound right-turn-only lane as left turns would be prohibited both in/out of the driveway. No reconfiguration of lanes on Executive Parkway would be necessary.

Pedestrian and Bicycle Improvements

In order to support and facilitate bicycle use to and from the Project Site, short-term and long-term bicycle parking spaces would be provided in each residential component of the Project. The Project will enhance pedestrian connectivity through multiple site access points for residents and guests along Executive Parkway, Camino Ramon, and Norris Canyon Road, as well as an enhanced landscaped pedestrian walkway along Camino Ramon. The Project also proposes to provide a two-acre park open to residents and the public at the northwest corner of Camino Ramon & Executive Parkway. The Project would provide direct access to the park via internal pedestrian connections.

The Project is consistent with the goals and priorities of the City's bike and pedestrian network plans and would not preclude the implementation of any improvements detailed in those plans.

PROJECT TRIP GENERATION

The number of vehicular trips expected to be generated by the Project was estimated using rates published in *Trip Generation Manual, 10th Edition* (Institute of Transportation Engineers, September 2017) based on developments located in "General Urban/Suburban" locations. These rates are based on surveys of similar land uses at sites around the country and are provided as both daily rates and morning and afternoon peak hour rates. The number of vehicle trips traveling to and from the Project Site is related to the size of development and type of land use proposed.

After accounting for the removal of the existing office uses on site, the Project is anticipated to generate a net decrease of 2,154 daily trips, including a net decrease of 296 morning peak hour trips (-413 inbound, +117 outbound) and a net decrease of 248 afternoon peak hour trips (+121 inbound, -369 outbound), as summarized in Table 2.

SCREENING FOR CEQA TRANSPORTATION ANALYSIS

Table 3 summarizes the Project screening application for the CEQA transportation analyses identified in the Draft CCTA VMT Methodology. The Project must meet at least one of the five screening criteria in order to be exempt from conducting a Project-level VMT analysis. As shown in Table 3, the Project meets Screening Criteria 2.4 of the Draft CCTA VMT Methodology for projects located in a Transit Priority Area[1] (TPA) and would qualify the Project for a VMT analysis exemption.

Screening Criteria 2.4: Projects Located in TPAs

In order to qualify for a VMT analysis exemption, the Project must be located in a TPA and meet all the further qualifications for exemption. Screening Criteria 2.4 can only apply if the Project meets all the following criteria:

1. The Project has a total floor area ratio (FAR) greater than 0.75.
2. The Project does not provide more parking for use by residents, customers, or employees than required by the lead agency (if the agency allows but does not require the project to supply a certain amount of parking).

[1] A transit priority area is defined as an area within 0.50 miles of an existing or planned major transit stop. SB 743 Public Resources Code Section 21064.3 defines a major transit stop as a "site containing an existing rail transit station, a ferry terminal served by either a bus or rail transit service, or the intersection of two or more major bus routes with a frequency of service interval of 15 minutes or less during the morning and afternoon commute periods."

3. The Project is consistent with the applicable Sustainable Communities Strategy (SCS), as determined by the lead agency, with input from the Metropolitan Transportation Commission.

4. The Project results in a net increase in multi-family housing units.

The Project Site is well served by public transit and, thus, the Project qualifies as a TPA. As previously described, the San Ramon Transit Center is located less than 600 feet from the Project Site and serves CCCTA bus lines, which serve the entire area with average headways of 10 to 30 minutes in each direction during the morning and afternoon peak hours. The bus service in the San Ramon Transit Center connects the Project to the Dublin/Pleasanton, West Dublin/Pleasanton, and Walnut Creek BART stations and to the Altamont Commuter Express train in Pleasanton.

<u>FAR.</u> The Project has a total FAR of 0.92 with 912,780 sf of total net floor area within 993,103 sf of gross lot area. The gross lot area does not include the 87,555-sf park provided by the Project, nor the 271,814 sf of dedicated on-site streets. With a FAR of 0.92, the Project meets the criteria of having a FAR greater than 0.75.

<u>Project Parking Supply</u>. The NCRSP details City parking requirements for new developments in the NCRSP area. Table 4 summarizes the Project's standard parking requirement based on the Project's anticipated mix of residential units by applying rates from Table 4-4 of the NCRSP. As shown in Table 4, a total of 913 parking spaces would be required for the Project based on standard NCRSP rates. The NCRSP does not provide rates for public parks; however, the Project will be providing seven striped spaces for the park. The Project would also provide four striped spaces reserved for electric car charging. In addition to the 812 residential parking spaces provided in garages and 11 striped parking spaces allotted for electric car charging and guest parking for the park, the Project would provide room for 90 parallel on-street parking spaces for guests. By providing 913 parking spaces, the Project would meet the criteria of not providing more than the standard code required parking.

<u>Consistency with SCS</u>. *Plan Bay Area 2040* (Metropolitan Transportation Commission and Association of Bay Area Governments, Adopted July 26, 2017) (RTP/SCS) presents a long-term vision for the region's transportation system through Year 2040 and balances the region's future mobility and housing needs with economic, environmental, and social equity goals. The RTP/SCS seeks to integrate regional transportation, land use, and housing to meet greenhouse gases reduction targets set by the California Air Resources Board.

As previously mentioned, the Project Site is located less than 600 feet west of the San Ramon Transit Center that serves CCCTA bus lines, which serve the entire area with average headways of 10 to 30 minutes in each direction during the morning and afternoon peak hours and connect the Project to the Dublin/Pleasanton, West Dublin/Pleasanton, and Walnut Creek BART stations and the Altamont Commuter Express train in Pleasanton. The Project would contribute to the productivity and use of the regional transportation system by providing residential uses near transit and employment centers, in line with RTP/SCS goals. Thus, the Project encourages a variety of transportation options and is consistent with the RTP/SCS goal of maximizing mobility and accessibility in the region.

Single- and Multi-Family Housing Units. As discussed previously, the Project would construct 404 residential units consisting of 268 single-family detached homes and 136 multi-family dwelling units, including 114 detached row homes, 154 detached courtyard homes, and 136 attached town homes, as well as a two-acre park accessible to the residents and general public. Because the Project Site is currently occupied with approximately 564,000 sf of office uses, which would be removed with the development of the Project, the Project would meet the criteria of providing a net increase in housing units.

As shown above and in Table 3, the Project meets Screening Criteria 2.4 for projects located in TPAs and is exempt from a VMT analysis; therefore, further VMT analysis is not required, and the Project would not result in a significant CEQA impact.

TABLE 2
PROJECT TRIP GENERATION

Land Use	ITE Land Use	Rate	Daily	Morning Peak Hour			Afternoon Peak Hour		
				In	Out	Total	In	Out	Total
TRIP GENERATION RATES [a]									
Single-Family Detached Housing	210	per Dwelling Unit	9.44	25%	75%	0.74	63%	37%	0.99
Multi-Family Housing (Low-Rise)	220	per Dwelling Unit	7.32	26%	74%	0.46	63%	37%	0.56
Public Park	411	per Acre	0.78	59%	41%	0.02	55%	45%	0.11
General Office Building	710	per ksf	[b]	86%	14%	[b]	16%	84%	[b]
TRIP GENERATION ESTIMATES									
Proposed Project									
Single-Family Detached Housing	210	268 du	2,530	50	148	198	167	98	265
Multi-Family Housing (Low-Rise)	220	136 du	996	16	47	63	48	28	76
Public Park	411	2 acres	2	0	0	0	0	0	0
TOTAL - PROPOSED USES			*3,528*	*66*	*195*	*261*	*215*	*126*	*341*
Existing to be Removed									
General Office	710	564.0 ksf	(5,682)	(479)	(78)	(557)	(94)	(495)	(589)
TOTAL - EXISTING TO BE REMOVED			*(5,682)*	*(479)*	*(78)*	*(557)*	*(94)*	*(495)*	*(589)*
TOTAL - NET NEW PROJECT TRIPS			**(2,154)**	**(413)**	**117**	**(296)**	**121**	**(369)**	**(248)**

Notes:
ksf: 1,000 square feet
[a] Trip generation rates are from *Trip Generation Manual, 10th Edition* (Institute of Transportation Engineers, 2017) and are based on developments located in "General Urban/Suburban" location.
[b] Trip generation rate based on the best-fit curve formula listed in the *Trip Generation Manual, 10th Edition* for the General Office land use.

Weekday Daily - $\ln(T) = 0.97 \ln(X) + 2.50$ T = Average Vehicle Trips X = Gross Leasable Area (ksf)
A.M. Peak Hour - $T = 0.94 (X) + 26.49$
P.M. Peak Hour - $\ln(T) = 0.95 \ln(X) + 0.36$

TABLE 3
TRANSPORTATION IMPACT ANALYSIS SCREENING - CEQA ANALYSES

CCTA VMT Methodology Screening Criteria [a]	**Met by Project**
CEQA Exemption (Screening Criteria 2.1)	
The Project is exemepted from CEQA.	No
VMT Analysis Not Required	**No**
Small Projects (Screening Criteria 2.2)	
The Project would provide 10,000 square feet or less of non-residential space or 20 residential units or less, or otherwise generate less than 836 VMT per day.	No
VMT Analysis Not Required	**No**
Local-Serving Uses (Screening Criteria 2.3)	
The Project would serve as a local use and draw users and customers from a relatively small geographic area that will lead to short-distance trips and trips linked to other destinations.	No
VMT Analysis Not Required	**No**
Projects Located in Transit Priority Areas (TPAs) (Screening Criteria 2.4)	
The Project is located within a TPA. [b]	Yes
Project only qualifies for Screening Criteria 2.4 if the following criteria is met:	
The Project has a total FAR greater than 0.75.	Yes
The Project does not provide more parking for use by residents, customers, or employees than required by the lead agency (if the agency allows but does not require the project to supply a certain	Yes
The Project is consistent with the applicable Sustainable Communities Strategy (SCS) (as determined by the lead agency, with input from the Metropolitan Transportation Commission (MTC)).	Yes
The Project results in a net increase in multi-family housing units.	Yes
VMT Analysis Not Required (All Criteria Met)	**Yes**
Projects Located in Low VMT Areas (Screening Criteria 2.5)	
For housing projects: Cities and unincorporated portions within CCTA's five subregions that have existing home-based VMT per capita that is 85% or less of the existing County-wide average.	No
VMT Analysis Not Required	**No**

Notes:

[a] Screening criteria from *VMT Analysis Methodology for Land Use Projects in Contra Costa, GMTF Review Draft*, *Fehr & Peers, July 2020.*

[b] A transit priority area is defined as an area within 0.5 miles of an existing or planned major transit stop. SB 743 Public Resources Code Section 21064.3 defines a major transit stop as a "site containing an existing rail transit station, a ferry terminal served by either a bus or rail transit service, or the intersection of two or more major bus routes with a frequency of service interval of 15 minutes or less during the morning and afternoon commute periods."

TABLE 4
CITY PARKING CODE REQUIREMENTS

LAND USE	CODE REQUIREMENTS [a]		PROJECT SIZE		SPACES REQUIRED
Residential	2.0	spaces per unit for 2 & 3 bedroom units	90	du	180
	3.0	spaces per unit for 4 or more bedrooom units	314	du	632
	0.25	spaces per unit for guests	404	du	101
			TOTAL CODE PARKING REQUIRED		**913**

Notes:
[a] Parking rates from North Camino Ramon Specific Plan, Chapter 4, Table 4-4, July 24, 2012.

Chapter 4
CEQA Analysis of Transportation Impacts

This chapter section presents the results of an analysis of CEQA-related transportation impacts. The analysis identifies any potential conflicts the proposed Project may have with adopted City plans and policies and the improvements associated with the potential conflicts that satisfies State guidelines under SB 743.

METHODOLOGY

SB 743, made effective in January 2014, required the Governor's Office of Planning and Research to change the CEQA guidelines regarding the analysis of transportation impacts. Under SB 743, the focus of transportation analysis shifted from driver delay (LOS) to VMT, in order to reduce greenhouse gas emissions, create multimodal networks, and promote mixed-use developments.

Both the City and CCTA are currently working on VMT guidelines consistent with SB 743.

The CEQA transportation analysis contains the following analyses intended to identify impacts:

- Threshold 1: Conflicting with Plans, Programs, Ordinances, or Policies
- Threshold 2: Causing Substantial VMT
- Threshold 3: Substantially Inducing Additional Automobile Travel
- Threshold 4: Substantially Increasing Hazards Due to a Geometric Design Feature or Incompatible Use
- Threshold 5: Transportation Safety

The thresholds were reviewed and analyzed, as detailed in the following discussion.

THRESHOLD 1: CONFLICTING WITH PLANS, PROGRAMS, ORDINANCES, OR POLICIES ANALYSIS

Threshold 1 states that a project would result in an impact if it conflicts with a program, plan, ordinance, or policy addressing the circulation system, including transit, roadways, bicycle, and pedestrian facilities.

RTP/SCS

As stated above, the Project would contribute to the productivity and use of the regional transportation system by providing residential uses near transit and employment centers, in line with RTP/SCS goals. Thus, the Project encourages a variety of transportation options and is consistent with the RTP/SCS goal of maximizing mobility and accessibility in the region.

NCRSP Area

The Project would provide housing, including affordable housing and required in-lieu fees, near transit opportunities to serve the office buildings and future residents in the area, as well as provide pedestrian connections to the rest of the Specific Plan area. As such, the Project is consistent with the goals and policies contained in the NCRSP including the following elements:

- GOAL VIS-1: Create an identifiable district with a unique sense of place.
- Policy VIS-1.1: Plan for an integrated system of public spaces, transit and sidewalks to promote walkability and connectivity with a focus on the Central Commons, integrated landscape and site amenities.
- Policy VIS-1.2: Encourage a compatible mix of uses, connectivity, and architectural and visual diversity through the Specific Plan Development Standards and Architectural Guidelines.
- GOAL VIS-3: Provide for a variety of housing options in the Planning Area to serve the existing and future housing needs of San Ramon residents.
- Policy VIS-3.1: Encourage residential development to serve existing and anticipated employment base in and adjacent to the Plan Area.

- Policy VIS-3.3: Limit the number of residential units to a maximum of 1,124 units within the Specific Plan Area. The Project will add 404 residential dwelling units to the Specific Plan area, bringing the total residential count within the Specific Plan area to 520 units.

- Policy VIS-3.5: Require each residential project to provide a minimum of 25% of the units as affordable workforce housing, 15% must be built on-site and up to 10% of the workforce housing requirement may be met with the payment of an in-lieu fee unless an alternative affordable housing program demonstrating public benefit is approved by a Development Agreement or detailed Affordable Housing Agreement. The Project proposes to amend the North Camino Ramon Specific Plan to be consistent with the recently adopted Inclusionary Housing Ordinance. Consistent with the Inclusionary Housing Ordinance, 15% of the attached townhomes will be deed restricted and designated as Affordable Units. An in-lieu fee will be paid for the detached Row Homes and detached Courtyard Homes in accordance with the Inclusionary Housing Ordinance.

Consistency

The Project does not preclude the implementation of any City or Contra Costa County planning documents and requirements; therefore, the Project would not result in a significant impact under Threshold 1.

Cumulative Analysis

In addition to potential Project-specific impacts, the Project must be reviewed in combination with nearby Related Projects to determine if there may be a cumulatively significant impact resulting from inconsistency with a particular program, plan, policy, or ordinance.

Similar to the Project, the Related Projects would be individually responsible for complying with relevant plans, programs, ordinances, or policies addressing the circulation system. Thus, the Project, together with the Related Projects, would not result in cumulative impacts with respect to consistency with each of the plans, ordinances, or policies reviewed. The Project and the Related Projects do not interfere with any of the general policy recommendations and, therefore, there would be no significant Project impact or cumulative impact.

THRESHOLD 2: CAUSING SUBSTANTIAL VMT ANALYSIS

As described in Chapter 3, the Project is located in a TPA and it meets the four criteria for VMT screening exemption:

1. FAR greater than 0.75
2. Parking per local zoning code
3. Consistency with Sustainable Community Strategies
4. Net increase in multifamily dwelling units

Since the Project meets all four qualifying criteria and is located in a TPA, the Project is exempt from further VMT analysis and would not result in a significant CEQA impact.

THRESHOLD 3: SUBSTANTIALLY INDUCING ADDITIONAL AUTOMOBILE TRAVEL ANALYSIS

The intent of Threshold 3 is to assess whether a transportation project would induce substantial VMT, such as through the addition of through traffic lanes on existing or new highways, including general-purpose lanes, high-occupancy vehicle lanes, peak period lanes, auxiliary lanes, and lanes through grade-separated interchanges.

The Project does not propose a transportation project that would induce automobile travel. Therefore, the Project would not result in a significant impact under Threshold 3 and no further evaluation is required.

THRESHOLD 4: SUBSTANTIALLY INCREASING HAZARDS DUE TO A GEOMETRIC DESIGN FEATURE OR INCOMPATIBLE USE ANALYSIS

Further evaluation is required for projects that propose new access points or modifications along the public right-of-way (i.e., street dedications) under Threshold 4. A review of Project access points, internal circulation, and parking access was conducted to determine whether the Project would substantially increase hazards due to geometric design features, including safety, operational, or capacity impacts.

Vehicular access to the Project would be maintained along public streets on the north, east, and south sides of the Project site. The Project does not intend to widen any roads in the area, nor does it intend to increase the number of access points along the adjacent public street system. One new right-in/right-out-only access point will be created on Executive Parkway, but the Project will consolidate the two full-access driveways on Camino Ramon into one full-access driveway, thereby reducing the number of vehicle/pedestrian interactions along the Project frontage.

The location and design of any access points would need to meet City standards and be approved by the City. An initial review of the Project site plan does not indicate any potential sight distance, safety, or operational concerns associated with the proposed access locations.

Consistency

Based on the site plan review and design assumptions, the Project does not present any geometric design hazards related to traffic movement, mobility, or pedestrian accessibility, and is considered less than significant.

Cumulative Analysis

In addition to potential Project-specific impacts, the Project must be reviewed in combination with Related Projects with access points along the same block to determine if there may be a cumulatively significant impact. The analysis used Year 2040 traffic volume projections that include CityWalk Master Plan full buildout so the Related Projects within the vicinity of the Project were all included in the transportation analysis. The Project and all Related Projects would be required to provide driveways in compliance with all local guidelines and requirements. Therefore, the Project would not result in cumulative impacts that would substantially increase hazards due to geometric design features, including safety, operational, or capacity impacts.

THRESHOLD 5: TRANSPORTATION SAFETY

The evaluation of transportation safety involves the consideration of pedestrian, bicycle, and vehicular safety on the streets surrounding and inside the Project and an investigation of the Project's potential impacts on the safety of the freeway system serving the Project site.

The Project's internal streets will all be designed to City standards and sight distance at the internal intersections will also meet City design standards.

The Project will not interfere with the City's continuing implementation of its citywide bicycle and pedestrian systems. The pedestrian and bicycle connection between the Project Site and the San Ramon Transit Center is controlled by crosswalks at the signalized intersection of Camino Ramon and Executive Parkway and the route is served by continuous sidewalks.

The project-level evaluation of impacts on the freeway system typically focuses on the impact of traffic on the off-ramps serving the site. If the Project traffic, combined with Related Project traffic, does not cause a freeway off-ramp to back up onto the freeway mainline lanes, it is generally considered to not have a significant impact on freeway safety or operations.

Table 5 shows the results of a queuing analysis from *Transportation Operational Analyses for the Bishop Ranch 6 Residential Project, San Ramon, California* (Gibson Transportation Consulting, Inc., February 2021) at the four I-680 off-ramps serving the Project traffic. Because of the decrease in overall trips and the change in directionality as compared to the existing office use on-site, the Project traffic reduces the off-ramp trips in the morning peak hour and, thus, the morning off-ramp queues are lessened. In the afternoon peak hour, three of the eight movements leaving the four off-ramps experience an increase in traffic and, thus, an increase in queue lengths. In no case, however, did the increase cause a queue to extend back to the mainline freeway lanes.

Consistency

Based on the site plan review and calculation of freeway off-ramp queues, the Project is not anticipated to result in significant safety impacts on the local or regional street system or on the safety of the pedestrian and bicycle systems serving the site.

Cumulative Analysis

The evaluation of potential Project safety impacts was accomplished using Year 2040 traffic volume projections which include the known regional land use growth in addition to the local major projects approved since the latest updates of the CCTA model forecasts (including the CityWalk Master Plan). Since the analysis used Year 2040 traffic volume projections that include the CityWalk Master Plan full buildout, the effects of full buildout traffic on the pedestrian, bicycle, and vehicular local and regional system safety were taken into account in the analysis. Therefore, the Project would not result in cumulative impacts that would substantially increase safety hazards in the area.

TABLE 5
FREEWAY OFF-RAMP QUEUE EVALUATION
FUTURE OPERATING CONDITIONS (YEAR 2040)

ID	Freeway Off-ramp	Ramp and Lane Description	Vehicle Storage Capacity [a]	Future without Project Conditions		Future with Project Conditions	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
				Vehicle Queue Length [b]	Vehicle Queue Length [b]	Vehicle Queue Length [b]	Vehicle Queue Length [b]
Q-1.	I-680 Southbound Ramps &	I-680 Southbound Off-Ramp					
	Crow Canyon Road	Left (two 740-ft lanes and one 660-ft lane on ramp)	2,140	1,350	756	1,050	770
		Right (two 570-ft lanes and one 830-ft lane on ramp)	1,970	1,166	1,160	890	1,180
Q-2.	I-680 Northbound Ramps &	I-680 Northbound Off-Ramp					
	Crow Canyon Road	Left (one 565-ft lane and one 760-ft lane on ramp)	1,325	580	585	510	585
		Right (one 590-ft shared left/right lane, one 590-ft exclusive right lane, and one 760-ft lane on ramp)	1,940	1,236	1,236	1,076	1,236
Q-3.	I-680 Southbound Ramps &	I-680 Southbound Off-Ramp					
	Bollinger Canyon Road	Left (one 455-ft exclusive left lane, one 470-ft shared left-through lane, and one 855-ft lane on ramp)	1,780	1,516	1,396	1,210	1,396
		Right (two 225-lanes and one 855-ft lane on ramp	1,305	406	556	330	556
Q-4.	I-680 Northbound Ramps &	I-680 Northbound Off-Ramp					
	Bollinger Canyon Road	Left (one 525-ft lane and one 785-ft lane on ramp)	1,310	430	335	335	318
		Right (two 525-ft lanes, one 300-ft lane, and one 785-ft lane on ramp)	2,135	2,094	789	1,305	810

[a] Expressed in feet.

[b] 95th Percentile queue results per Synchro 10 (HCM 6th Edition Methodology). Synchro queue results expressed in number of vehicles and were converted to feet; vehicle length is assumed to be 25 feet.

Chapter 5
Summary and Conclusions

This study was undertaken to analyze the potential CEQA transportation impacts of the Project on the local street system. The following summarizes the results of this analysis:

- The Project is located at 2400-2440 Camino Ramon in the City.
- The Project proposes to construct a residential project in the urban core of the City. The Project would construct 404 residential units consisting of 268 single-family detached homes and 136 multi-family dwelling units, including 114 detached row homes, 154 detached courtyard homes, and 136 attached town homes, as well as a two- acre park to serve Project residents and the general public. The Project Site is currently occupied with approximately 564,000 sf of office uses that would be removed with the development of the Project.
- The Project is projected to be developed over a four to six-year time period. To be consistent with the longest future forecasts available in the CCTA Model, the conditions in this analysis assume that the full buildout of the Project would take place by Year 2040.
- Vehicular access to the Project Site would be provided via existing and proposed driveways along Executive Parkway, Camino Ramon, and Norris Canyon Road.
- As part of the Project, the intersection of I Street Project Driveway & Executive Parkway would feature an additional Project driveway in the southbound direction that would accommodate right-turn ingress and right-turn egress movements only.
- With the removal of the existing office uses on site, the Project is anticipated to generate a total decrease of approximately 2,154 daily trips, including a decrease of 296 morning peak hour trips and a decrease of 248 afternoon peak hour trips.
- The evaluation of potential CEQA impacts included:
    - A review of the Project's consistency with adopted state and local transportation and land use plans
    - An analysis of the requirements for VMT screening, which showed that the Project is located in a TPA and meets the screening criteria to be exempt from conducting a VMT analysis
    - A review of the VMT-inducing effects of the Project

- An analysis of the access and geometric design of the transportation elements of the Project
- An evaluation of the transportation safety aspects of the Project.

The analysis indicated that the Project would not result in a significant impact under any of the five CEQA evaluation criteria.

References

California Transportation Plan 2040, California Department of Transportation, June 2016.

Caltrans Strategic Management Plan 2015-2020, California Department of Transportation, March 2015.

Capital Improvement Program 2019/2020 – 2023/24 Final Report, City of San Ramon, Adopted June 11, 2019.

CCTA Technical Procedures, Contra Costa Transportation Authority, January 16, 2013.

City of San Ramon Bicycle Master Plan, City of San Ramon, April 2018.

City of San Ramon General Plan 2035, City of San Ramon, Effective May 28, 2015.

Local Development - Intergovernmental Review (LD-IGR) Interim Guide, California Department of Transportation, Approved September 2016.

North Camino Ramon Specific Plan, City of San Ramon, July 24, 2012.

Plan Bay Area 2040, Metropolitan Transportation Commission and Association of Bay Area Governments, Adopted July 26, 2017.

State of California Senate Bill No. 743, Steinberg, 2013.

Transportation Impact Study for the CityWalk Master Plan Project, Gibson Transportation Consulting, Inc., March 2020.

Transportation Operational Analyses for the Bishop Ranch 6 Residential Project, Gibson Transportation Consulting, Inc., February 2021.

Trip Generation Manual, 10th Edition, Institute of Transportation Engineers, 2017.

VMT Analysis Methodology for Land Use Projects in Contra Costa, GMTF Review Draft, Fehr & Peers, July 2020.

Appendix A

Scoping Form

Appendix H

DRAFT SCOPE FOR TRAFFIC IMPACT ANALYSIS

Date: 1/4/21 Application No.:
Project Name: BR6 Residential Project Developer: SummerHill Homes
Project Description: See Figure 1 and Table 3 Traffic Consultant: Gibson Transportation Consulting, Inc.

Traffic Impact Analysis for the above listed project shall encompass the following scope, in accordance with the City of San Ramon's Traffic Study Guidelines:

General Information and Assumptions

1. Limits of the Study Area: See Figure 2 and Table 1

2. Assumed Year of Project Completion: 2024

3. Project Phasing (units/phase and years): None assumed in Traffic Study

4. Scenarios to be studied (check if applicable):

- ☑ Existing Conditions (Year: 2021) and Existing Plus Project
- ☐ Short-Term Conditions: existing + approved/pending projects
- ☐ Short-Term Plus Project: existing + approved/pending projects + project
- ☑ Cumulative 2040 Conditions (Includes CityWalk in regional forecast model)
- ☑ Cumulative 2040 Plus Project

5. Approved and Pending Projects List: Not required, Cumulative volumes will be taken from regional traffic forecasting model

6. Programmed Transportation Improvements: To be conservative only planned and 100% funded improvements will be included (i.e. I-580 continuous lane project)

7. Assumptions for trip generation, reductions, distribution, and any model land use changes must be submitted for pre-approval prior to the draft traffic study.
Please see Figures 3 & 4 and Table 3

Data Requirements

8. Data Collection and Periods (check if applicable):

- ☑ Weekday AM peak hour turning movements
- ☐ Weekday midday peak hour turning movements
- ☑ Weekday PM peak hour turning movements
- ☐ Saturday mid-day peak hour turning movements
- ☐ Sunday mid-day peak hour turning movements
- ☐ Daily total traffic
- ☐ Radar speed survey- location:
- ☐ License plate survey – location:

- ☐ Pedestrian counts – location: ______
- ☐ Determine actual grade(s) – location: ______
- ☑ Other data collection: Year 2040 CCTA Model Runs

Intersections and Roadway Segments

9. Study Roadway Segments:

1	See Figure 2 for Study Intersections	11	
2		12	
3		13	
4		14	
5		15	
6		16	
7		17	
8		18	
9		19	
10		20	

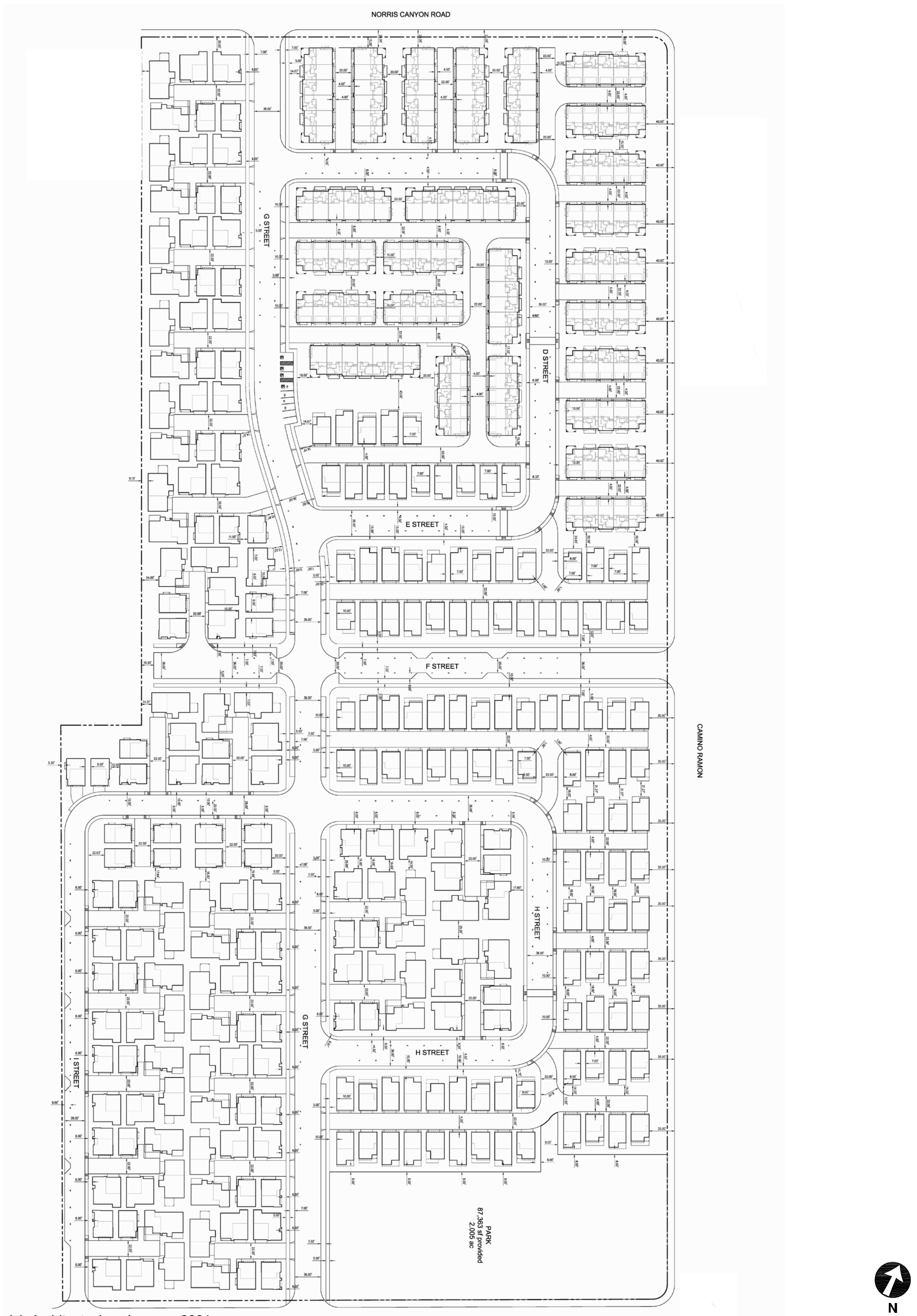
Required Analysis Elements

10. Traffic Analysis (check if applicable):

- ☑ Intersection level of service (LOS)
- ☑ Queue analysis
- ☑ Signal warrants
- ☐ Roadway segment analysis
- ☐ Coordinated corridor analysis
- ☐ Average and 85th percentile speeds
- ☐ Collision history and collision rate analysis
- ☑ Pedestrian and bicycle facilities
- ☑ Transit Services
- ☑ Project access analysis
- ☑ On-site parking and circulation
- ☐ On-Street Parking
- ☐ Drive-thru queuing analysis
- ☐ Traffic calming recommendations
- ☑ Freeway LOS
- ☐ Weaving section LOS
- ☐ Ramp merge and diverge LOS
- ☑ Project and mitigation phasing analysis
- ☐ Fair share calculation
- ☐ Cost estimates for mitigation
- ☐ Financing plan for improvements
- ☑ Other analysis: Will check for conflicts with driveways on opposite sides of Norris Canyon Road, Camino Ramon, and Executive Parkway.

SIGNED: Richard Gibson Date: 1/20/2021
Applicant or Consultant

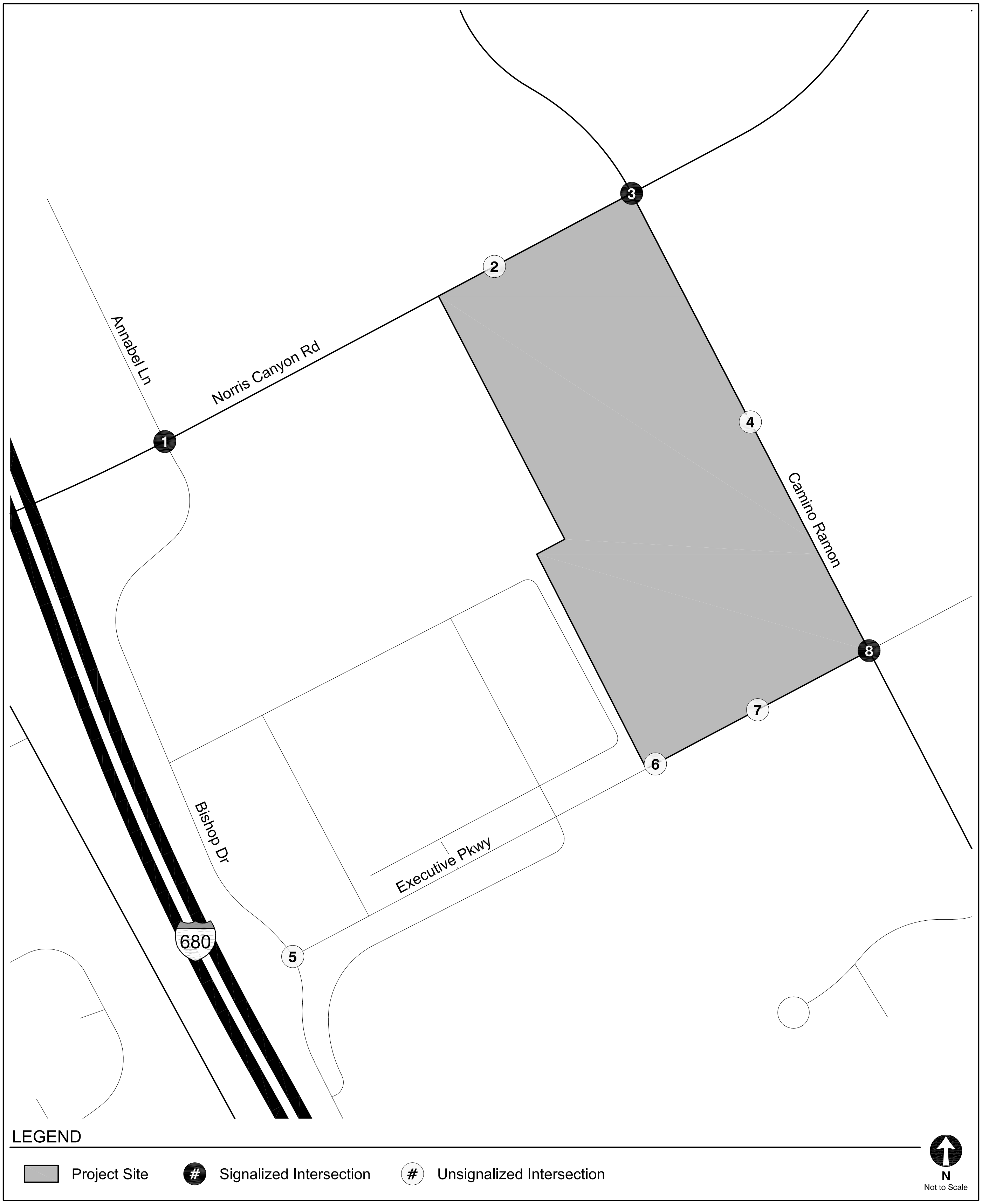
SIGNED: ______ Date: ______
City of San Ramon Representative



Source: William Hezmalhalch Architects, Inc. January, 2021.

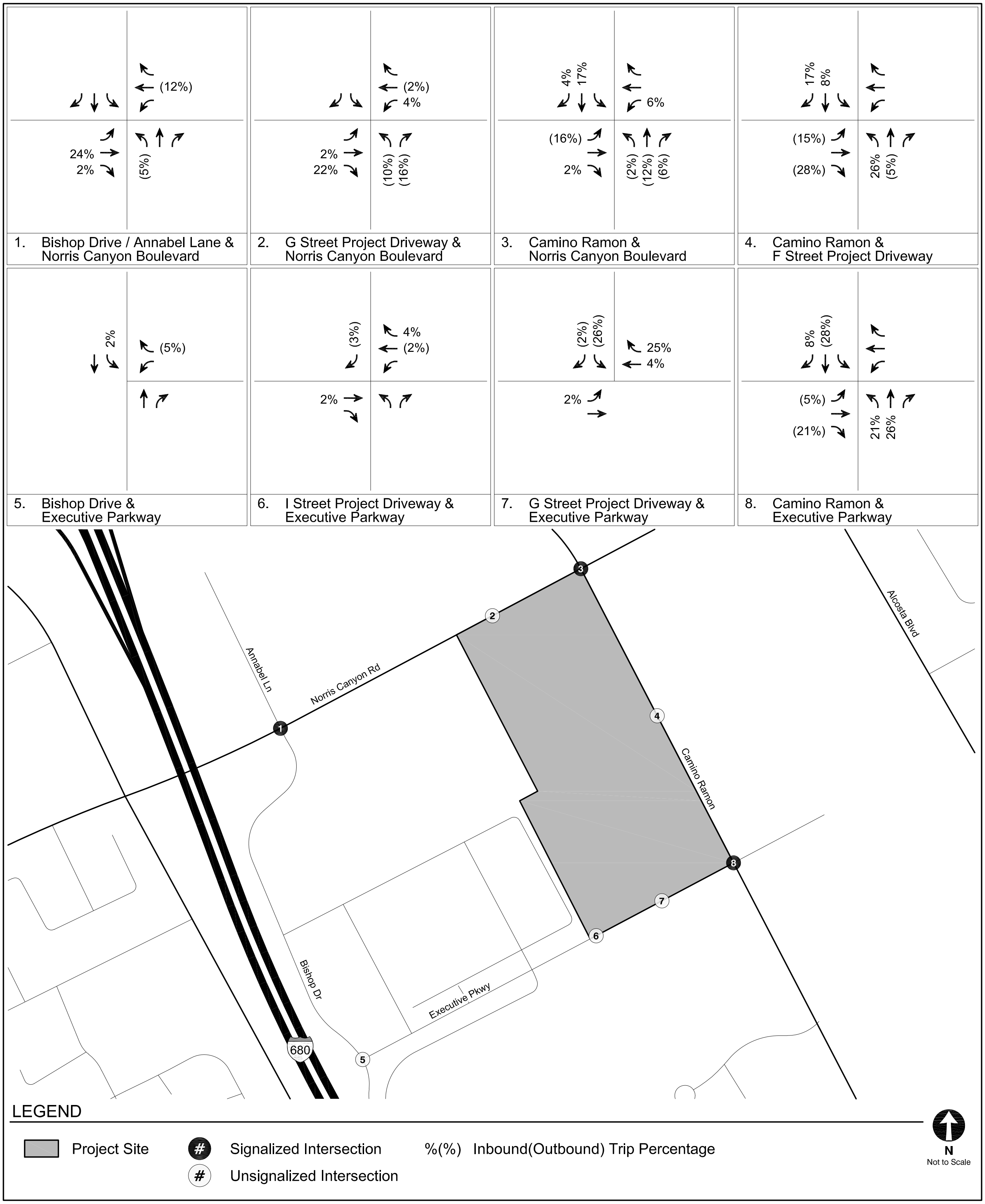
PROJECT SITE PLAN

FIGURE 1



STUDY AREA & ANALYZED INTERSECTIONS

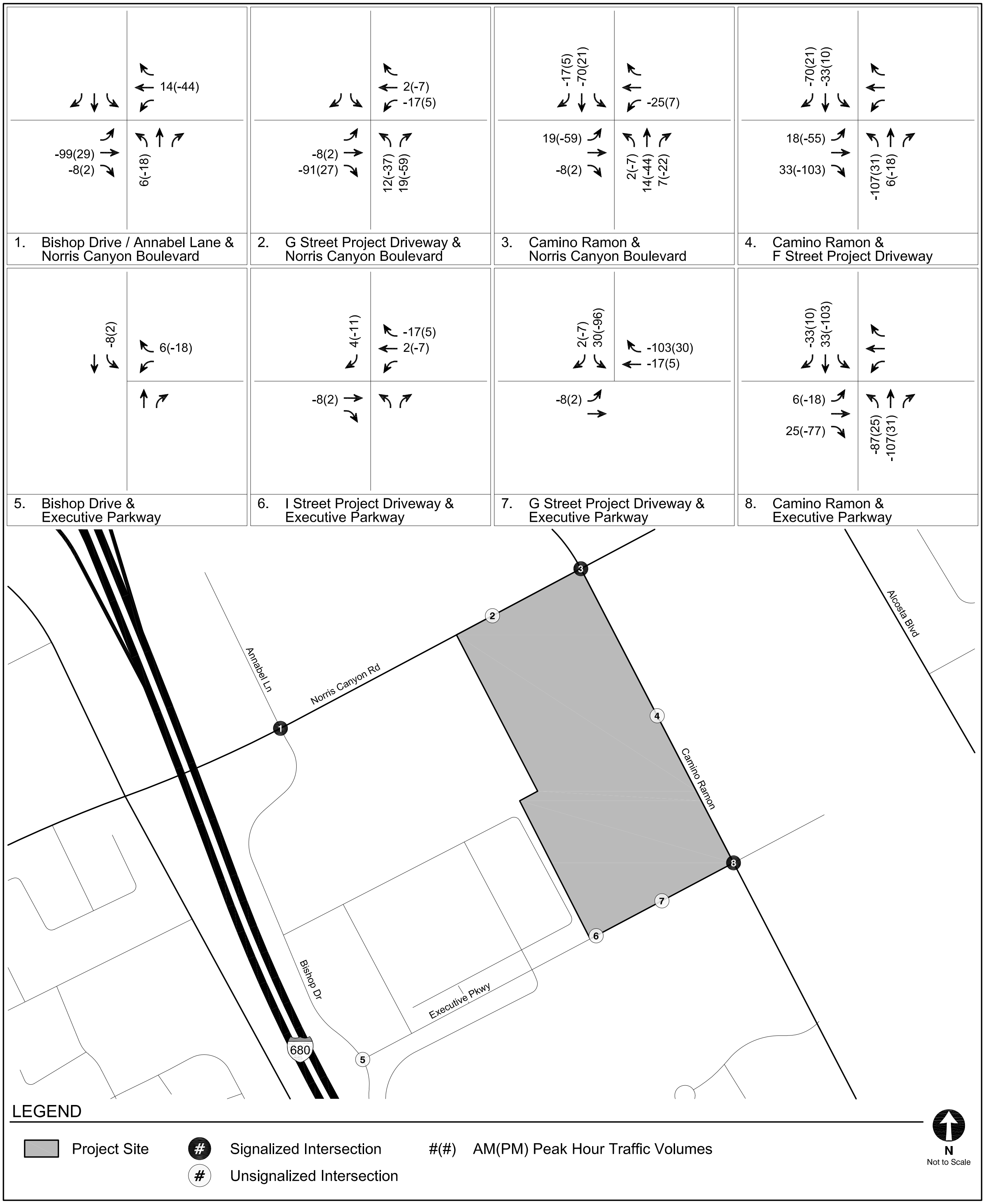
FIGURE 2



PROJECT TRIP DISTRIBUTION

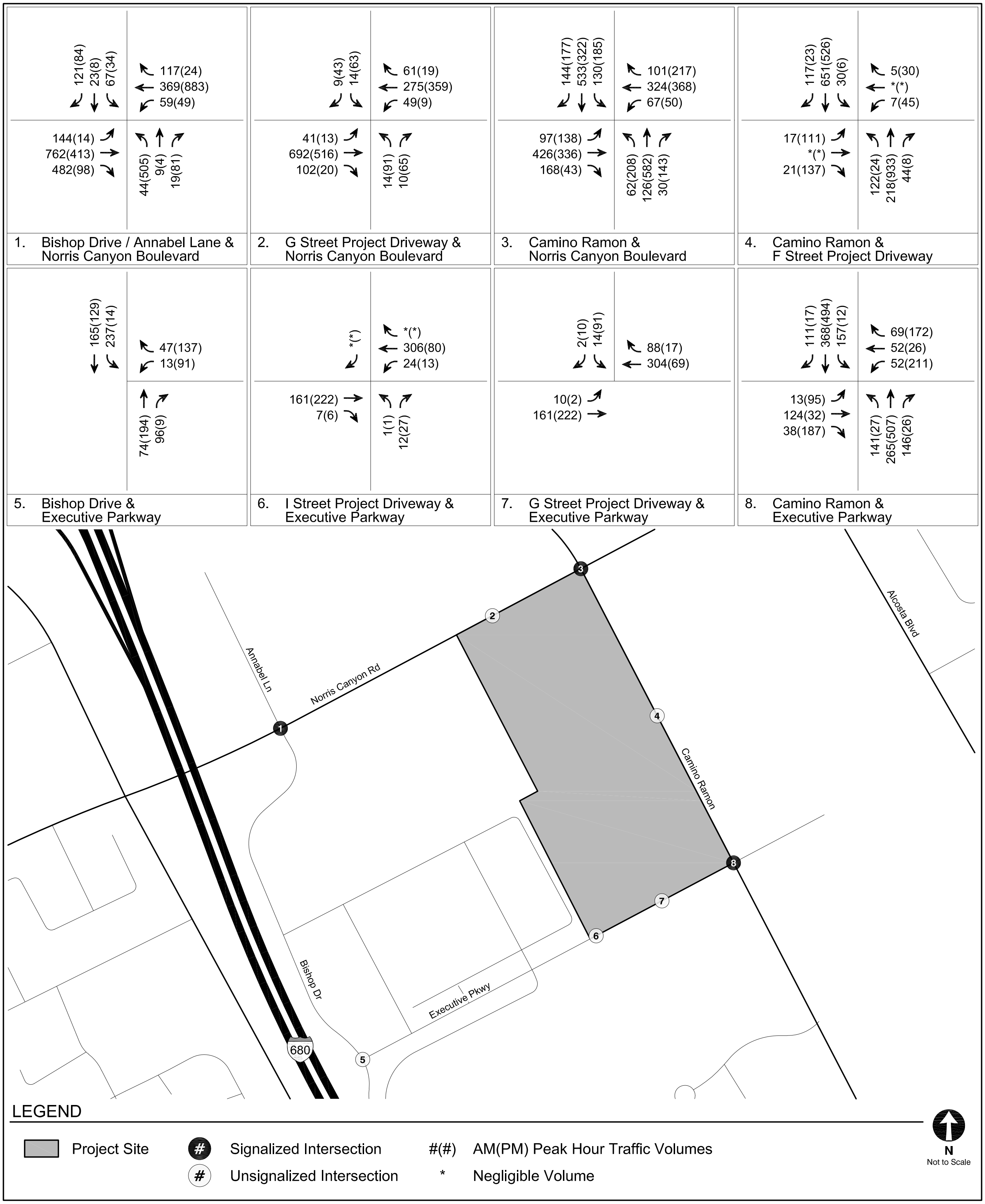
FIGURE 3

Gibson transportation consulting, inc.



PROJECT-ONLY
PEAK HOUR TRAFFIC VOLUMES

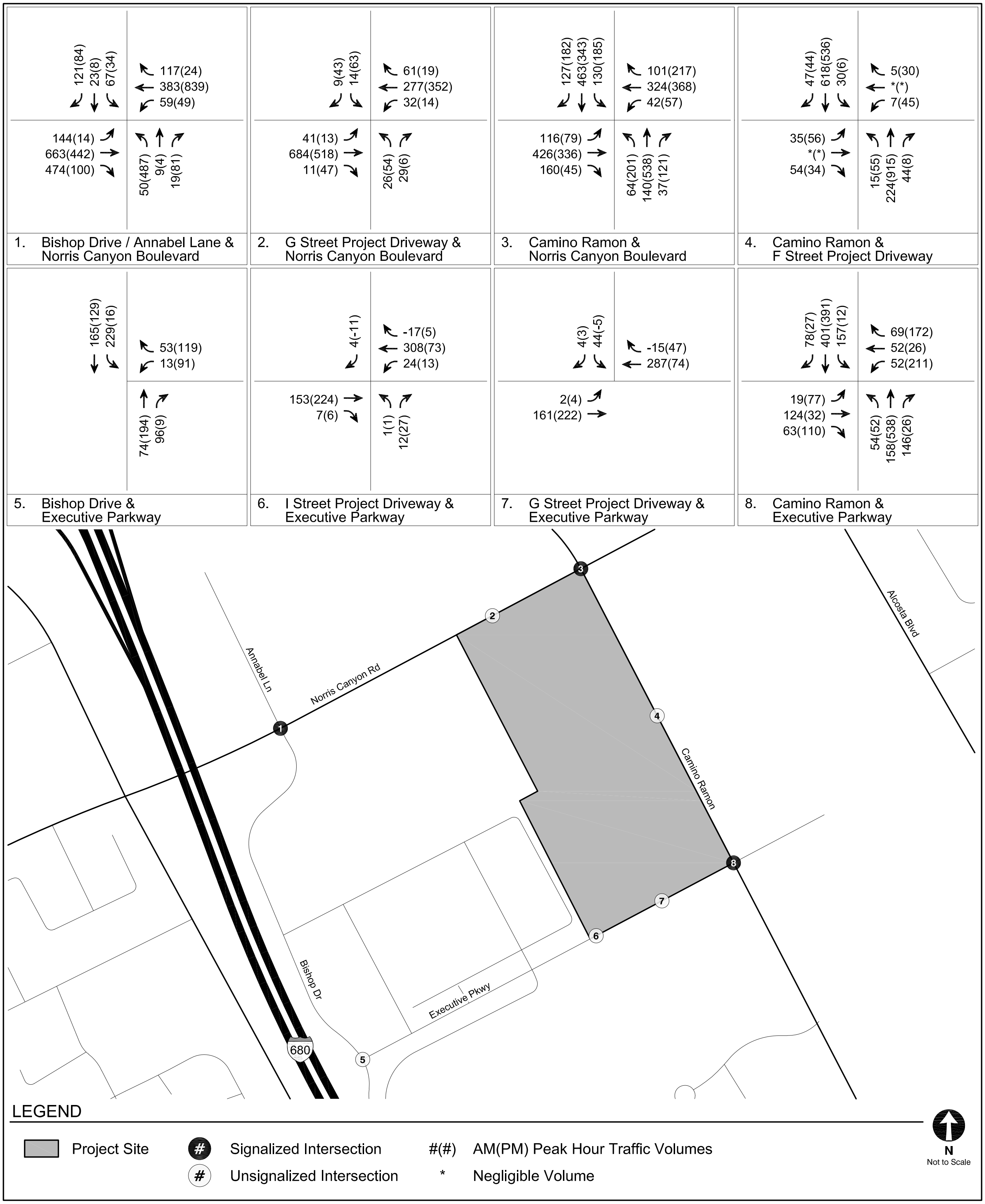
FIGURE
4



EXISTING CONDITIONS (YEAR 2021)
PEAK HOUR TRAFFIC VOLUMES

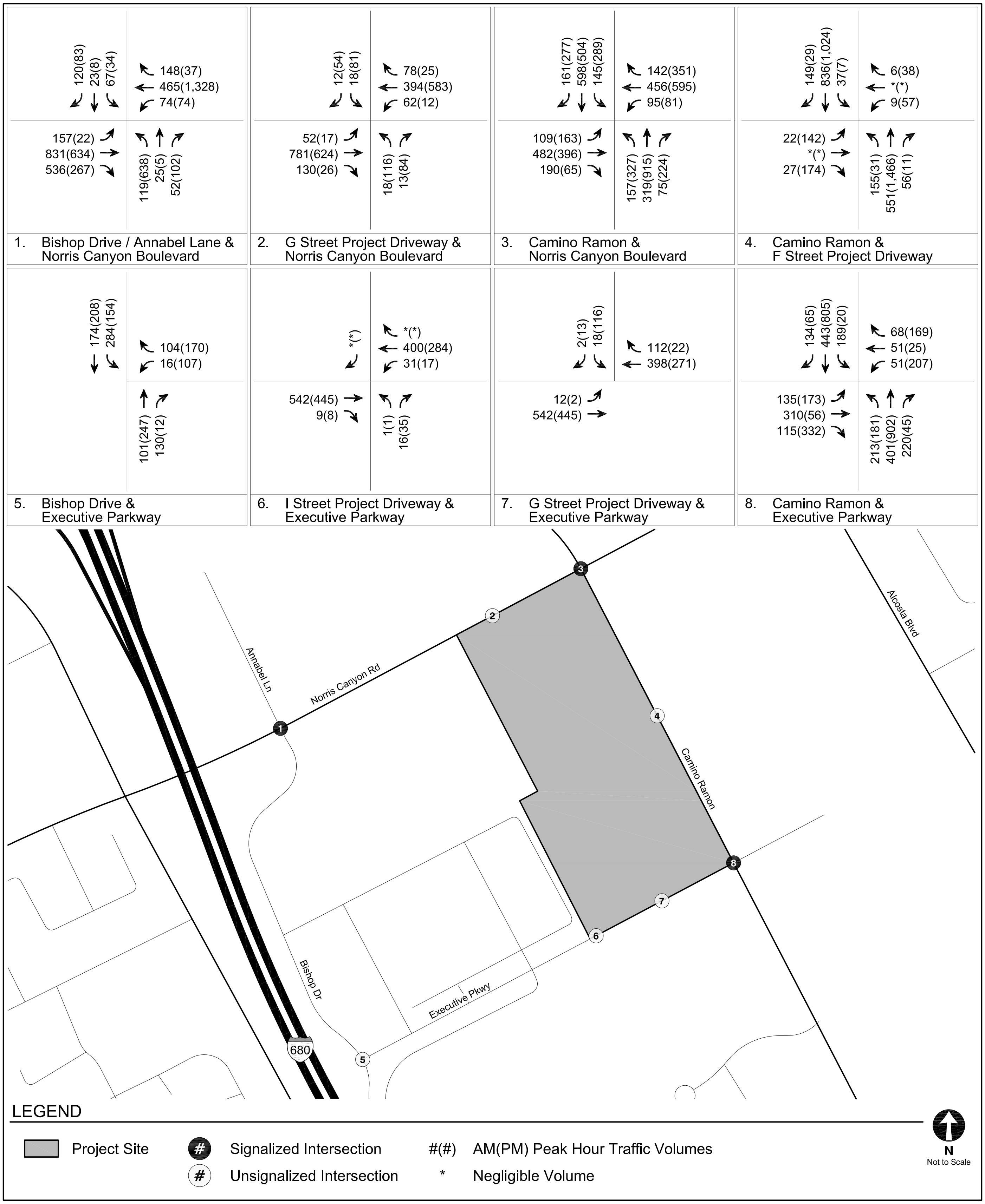
FIGURE
5

Gibson transportation consulting, inc.



EXISTING WITH PROJECT CONDITIONS (YEAR 2021)
PEAK HOUR TRAFFIC VOLUMES

FIGURE 6



FUTURE WITHOUT PROJECT CONDITIONS (YEAR 2040)
PEAK HOUR TRAFFIC VOLUMES

FIGURE
7

FUTURE WITH PROJECT CONDITIONS (YEAR 2040)
PEAK HOUR TRAFFIC VOLUMES

FIGURE
8

TABLE 1
ANALYZED STUDY INTERSECTIONS

No	North / South Street	East / West Street	Jurisdiction
1	Bishop Drive/Annabel Lane	Norris Canyon Road	City of San Ramon
2. [a]	G Street Project Driveway	Norris Canyon Road	City of San Ramon
3.	Camino Ramon	Norris Canyon Road	City of San Ramon
4. [a]	Camino Ramon	F Street Project Driveway	City of San Ramon
5. [a]	Bishop Drive	Executive Parkway	City of San Ramon
6. [a]	I Street Project Driveway	Executive Parkway	City of San Ramon
7. [a]	G Street Project Driveway	Executive Parkway	City of San Ramon
8.	Camino Ramon	Executive Parkway	City of San Ramon

Notes
[a] Intersection operates with two-way stop-controlled (TWSC).

TABLE 2
LEVEL OF SERVICE DEFINITIONS FOR INTERSECTIONS

Level of Service	Description	Delay [a]	
		Signalized Intersections	Unsignalized Intersections
A	EXCELLENT. No vehicle waits longer than one red light and no approach phase is fully used.	≤ 10	0.0 - 10.0
B	VERY GOOD. An occasional approach phase is fully utilized; many drivers begin to feel somewhat restricted within groups of vehicles.	> 10 and ≤ 20	10.1 - 15.0
C	GOOD. Occasionally drivers may have to wait through more than one red light; backups may develop behind turning vehicles.	> 20 and ≤ 35	15.1 - 25.0
D	FAIR. Delays may be substantial during portions of the rush hours, but enough lower volume periods occur to permit clearing of developing lines, preventing excessive backups.	> 35 and ≤ 55	25.1 - 35.0
E	POOR. Represents the most vehicles intersection approaches can accommodate; may be long lines of waiting vehicles through several signal cycles.	> 55 and ≤ 80	35.1 - 50.0
F	FAILURE. Backups from nearby locations or on cross streets may restrict or prevent movement of vehicles out of the intersection approaches. Tremendous delays with continuously increasing queue lengths.	> 80	> 50.0

Notes

Source: *Highway Capacity Manual, 6th Edition* (Transportation Research Board, 2016).

[a] Measured in seconds.

TABLE 3
PROJECT TRIP GENERATION

Land Use	ITE Land Use	Rate	Daily	Morning Peak Hour			Afternoon Peak Hour		
				In	Out	Total	In	Out	Total
TRIP GENERATION RATES [a]									
Single-Family Detached Housing	210	per Dwelling Unit	9.44	25%	75%	0.74	63%	37%	0.99
Multi-Family Housing (Low-Rise)	220	per Dwelling Unit	7.32	26%	74%	0.46	63%	37%	0.56
General Office Building	710	per ksf	[b]	86%	14%	[b]	16%	84%	[b]
TRIP GENERATION ESTIMATES									
Proposed Project									
Single-Family Detached Housing	210	268 du	2,530	50	148	198	167	98	265
Multi-Family Housing (Low-Rise)	220	136 du	996	16	47	63	48	28	76
TOTAL - PROPOSED USES			*3,526*	*66*	*195*	*261*	*215*	*126*	*341*
Existing to be Removed									
General Office	710	564.0 ksf	(5,682)	(479)	(78)	(557)	(94)	(495)	(589)
TOTAL - EXISTING TO BE REMOVED			*(5,682)*	*(479)*	*(78)*	*(557)*	*(94)*	*(495)*	*(589)*
TOTAL - NEW PROJECT TRIPS			**(2,156)**	**(413)**	**117**	**(296)**	**121**	**(369)**	**(248)**

Notes:
ksf: 1,000 square feet
[a] Trip generation rates are from *Trip Generation Manual, 10th Edition* (Institute of Transportation Engineers, 2017) and are based on developments located in "General Urban/Suburban" location.
[b] Trip generation rate based on the best-fit curve formula listed in the *Trip Generation Manual, 10th Edition* for the General Office land use.

Weekday Daily - $\ln(T) = 0.97 \ln(X) + 2.50$ T = Average Vehicle Trips X = Gross Leasable Area (ksf)
A.M. Peak Hour - $T = 0.94 (X) + 26.49$
P.M. Peak Hour - $\ln(T) = 0.95 \ln(X) + 0.36$

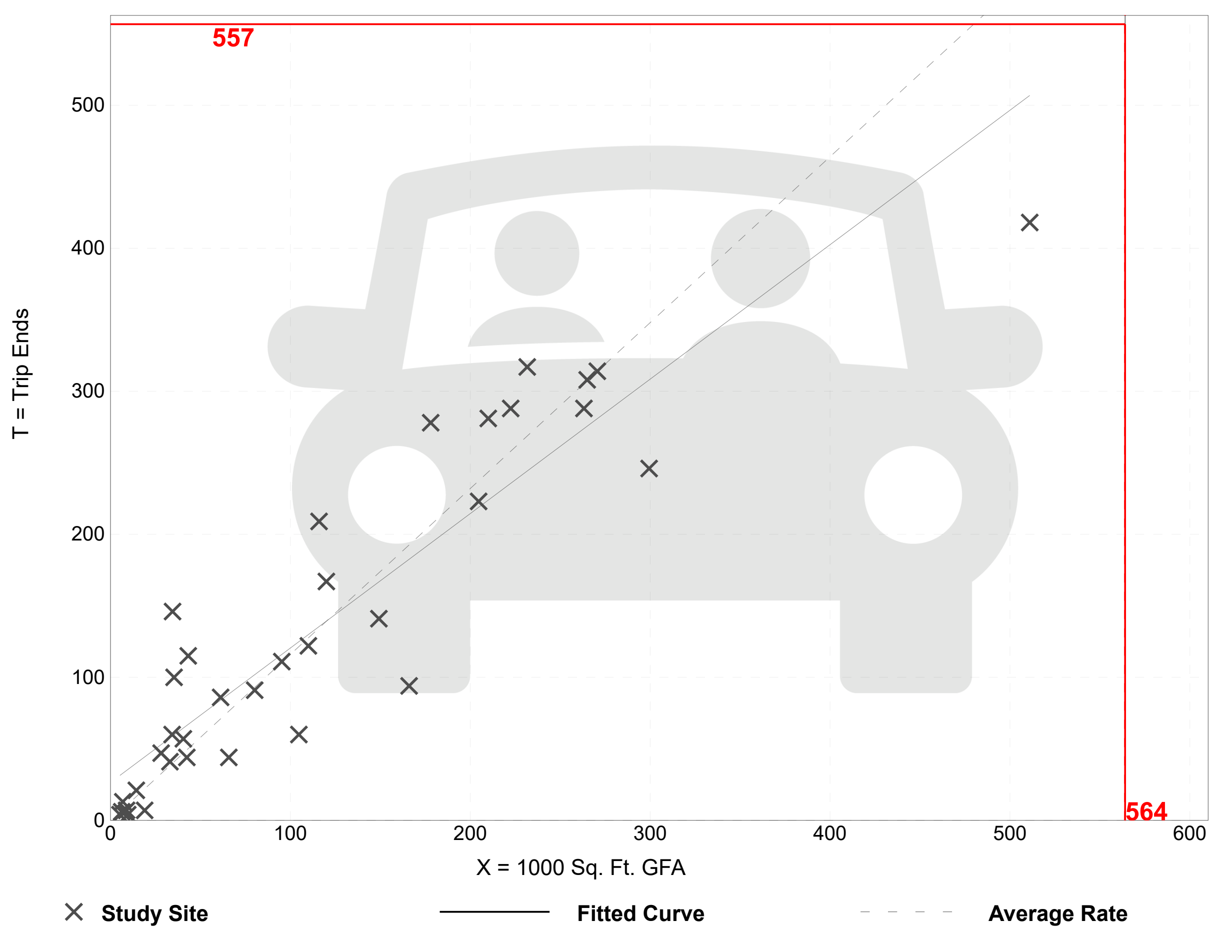
General Office Building
(710)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 a.m.**
Setting/Location:	**General Urban/Suburban**
Number of Studies:	35
Avg. 1000 Sq. Ft. GFA:	117
Directional Distribution:	86% entering, 14% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.16	0.37 - 4.23	0.47

Data Plot and Equation



Fitted Curve Equation: T = 0.94(X) + 26.49 **R^2= 0.85**

Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

General Office Building
(710)

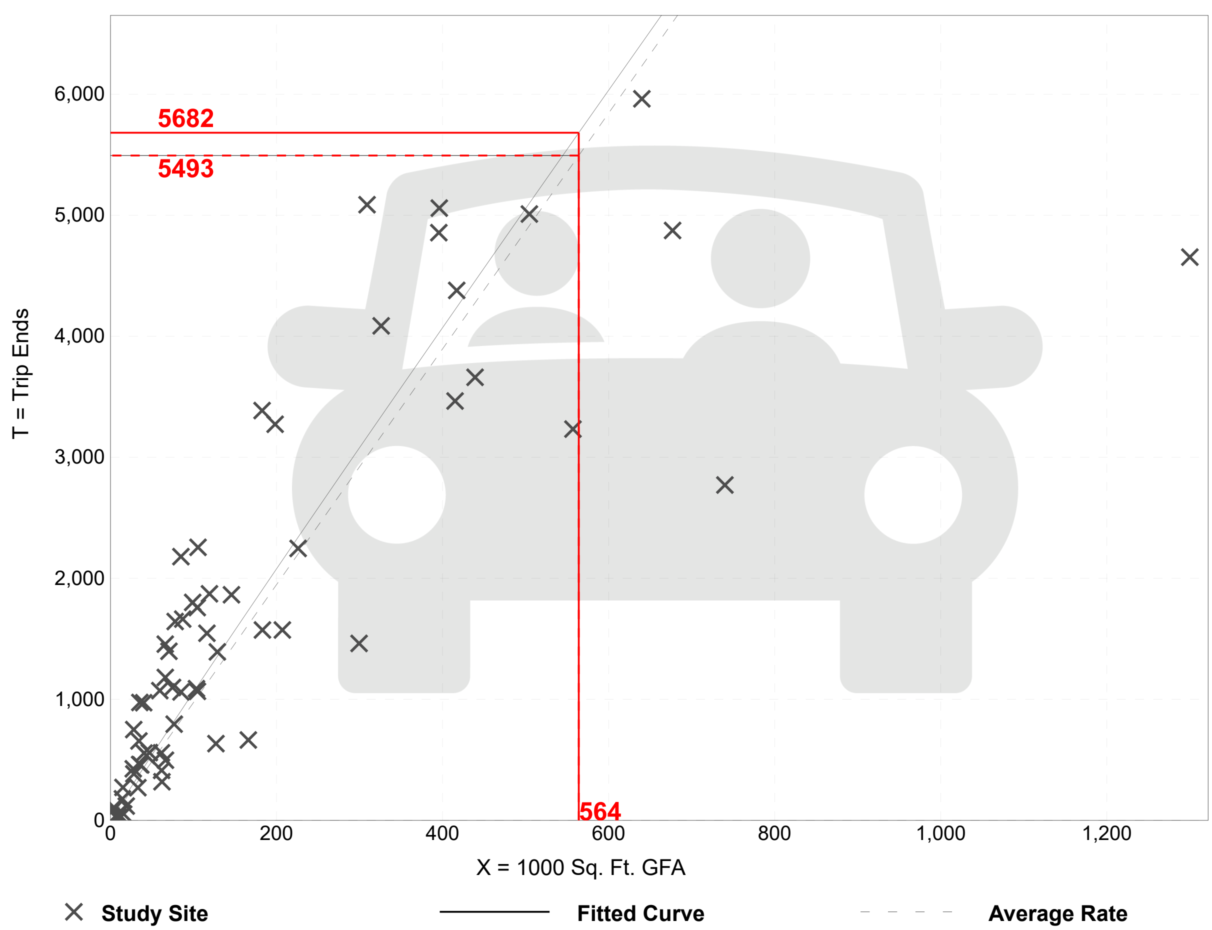
Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Weekday

Setting/Location: General Urban/Suburban
Number of Studies: 66
Avg. 1000 Sq. Ft. GFA: 171
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
9.74	2.71 - 27.56	5.15

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.97 Ln(X) + 2.50 **R^2= 0.83**

Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

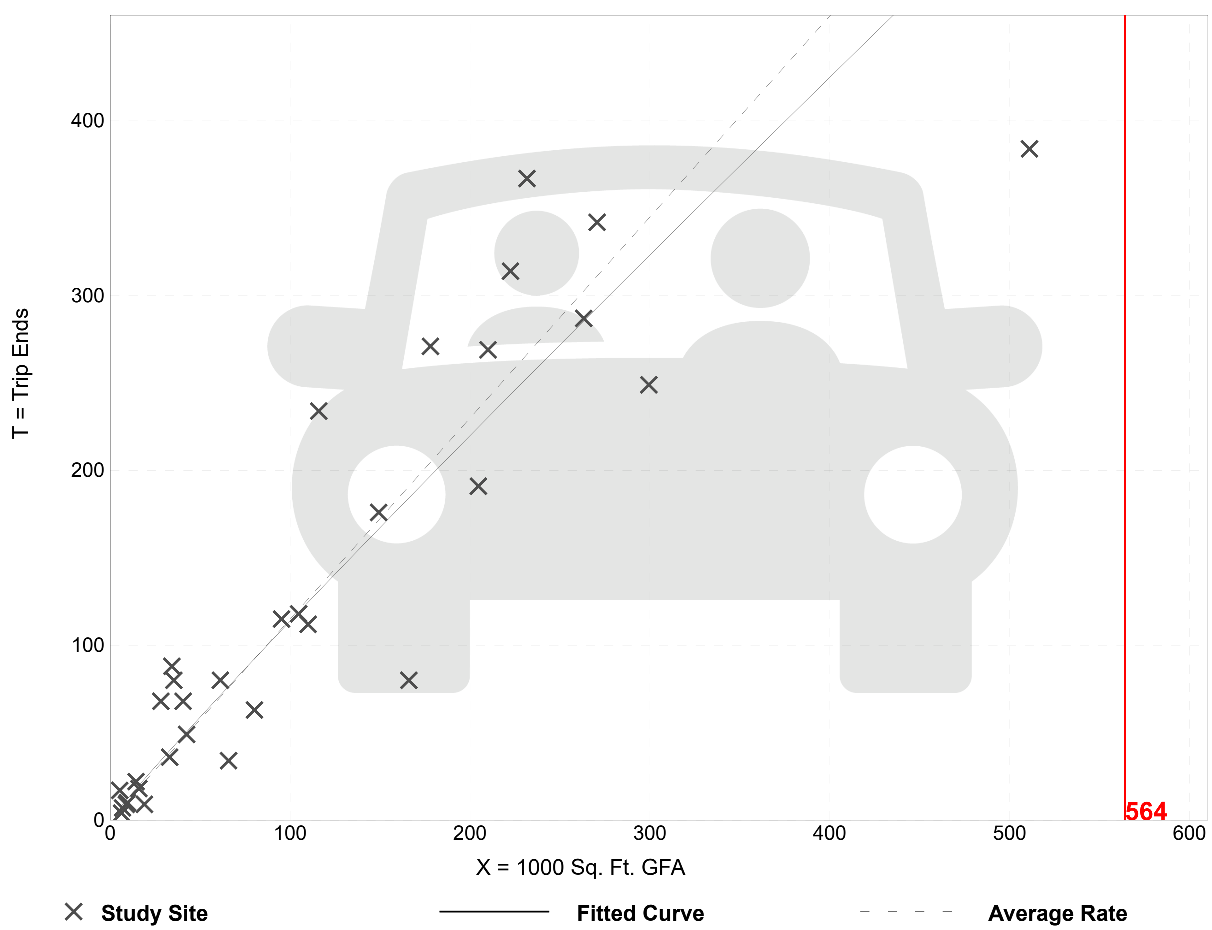
General Office Building
(710)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	32
Avg. 1000 Sq. Ft. GFA:	114
Directional Distribution:	16% entering, 84% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.15	0.47 - 3.23	0.42

Data Plot and Equation



Fitted Curve Equation: $Ln(T) = 0.95 Ln(X) + 0.36$ **$R^2= 0.88$**

Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

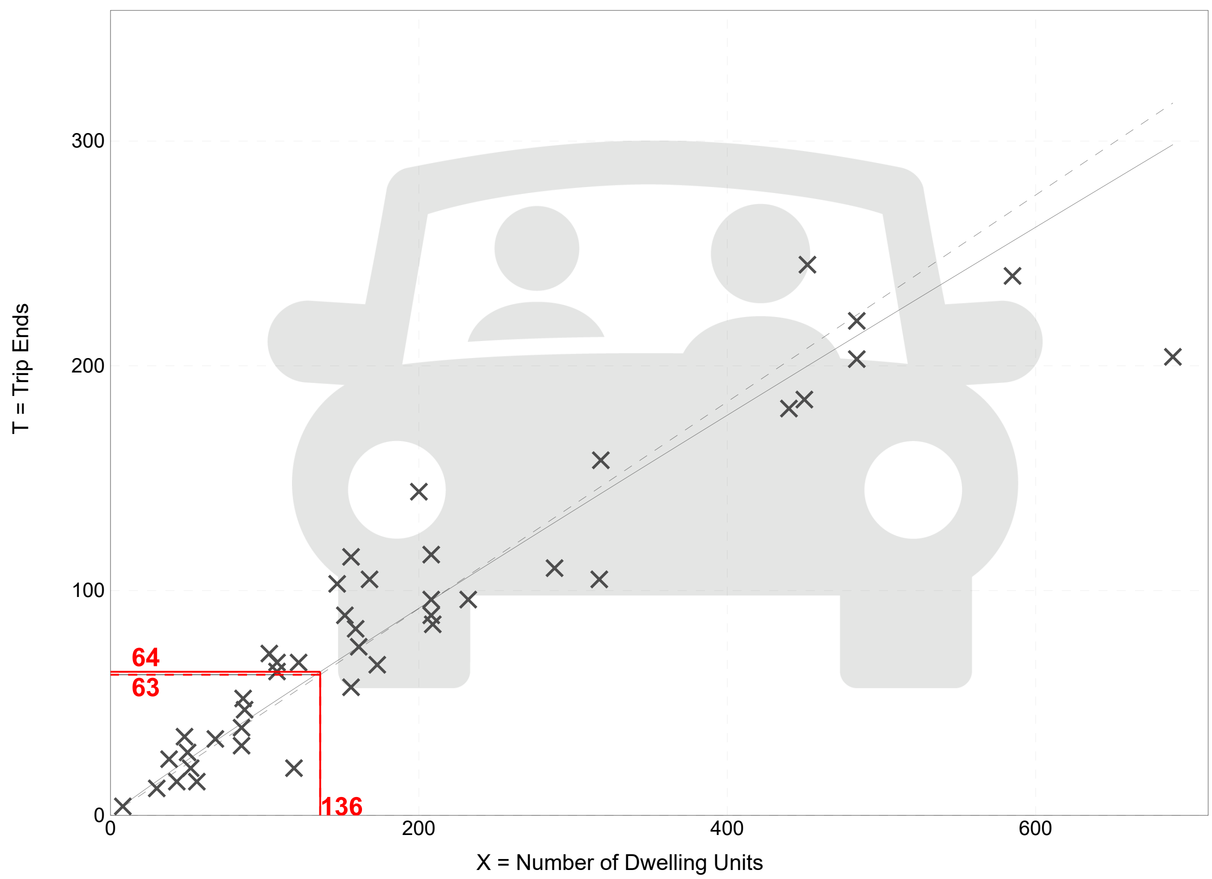
Multifamily Housing (Low-Rise)
(220)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,** **Peak Hour of Adjacent Street Traffic,** **One Hour Between 7 and 9 a.m.**
Setting/Location:	**General Urban/Suburban**
Number of Studies:	42
Avg. Num. of Dwelling Units:	199
Directional Distribution:	23% entering, 77% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.46	0.18 - 0.74	0.12

Data Plot and Equation



× **Study Site** — **Fitted Curve** - - - **Average Rate**

Fitted Curve Equation: Ln(T) = 0.95 Ln(X) - 0.51 **R^2= 0.90**

Trip Gen Manual, 10th Ed + Supplement ● Institute of Transportation Engineers

Multifamily Housing (Low-Rise)
(220)

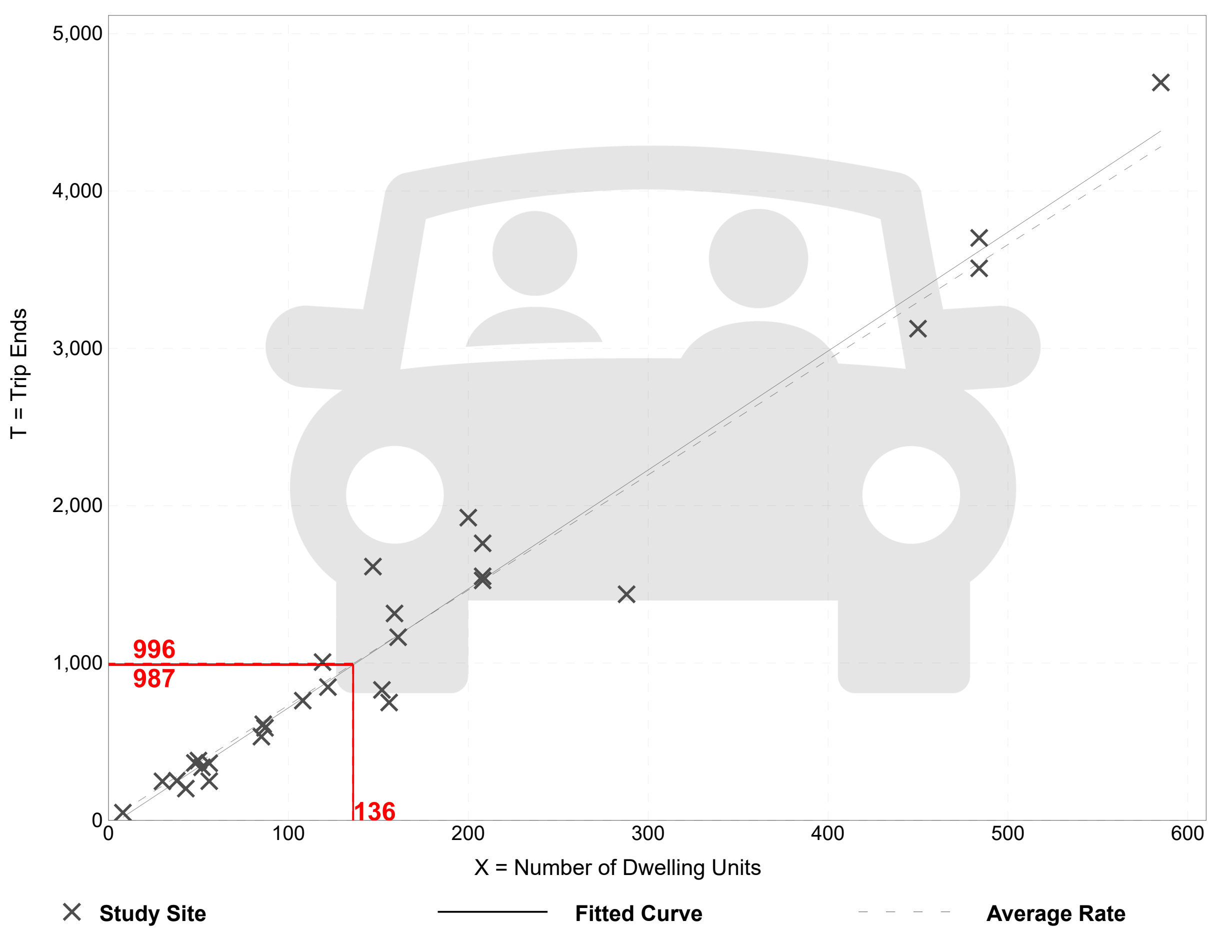
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 29
Avg. Num. of Dwelling Units: 168
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
7.32	4.45 - 10.97	1.31

Data Plot and Equation



Fitted Curve Equation: T = 7.56(X) - 40.86 **R^2= 0.96**

Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

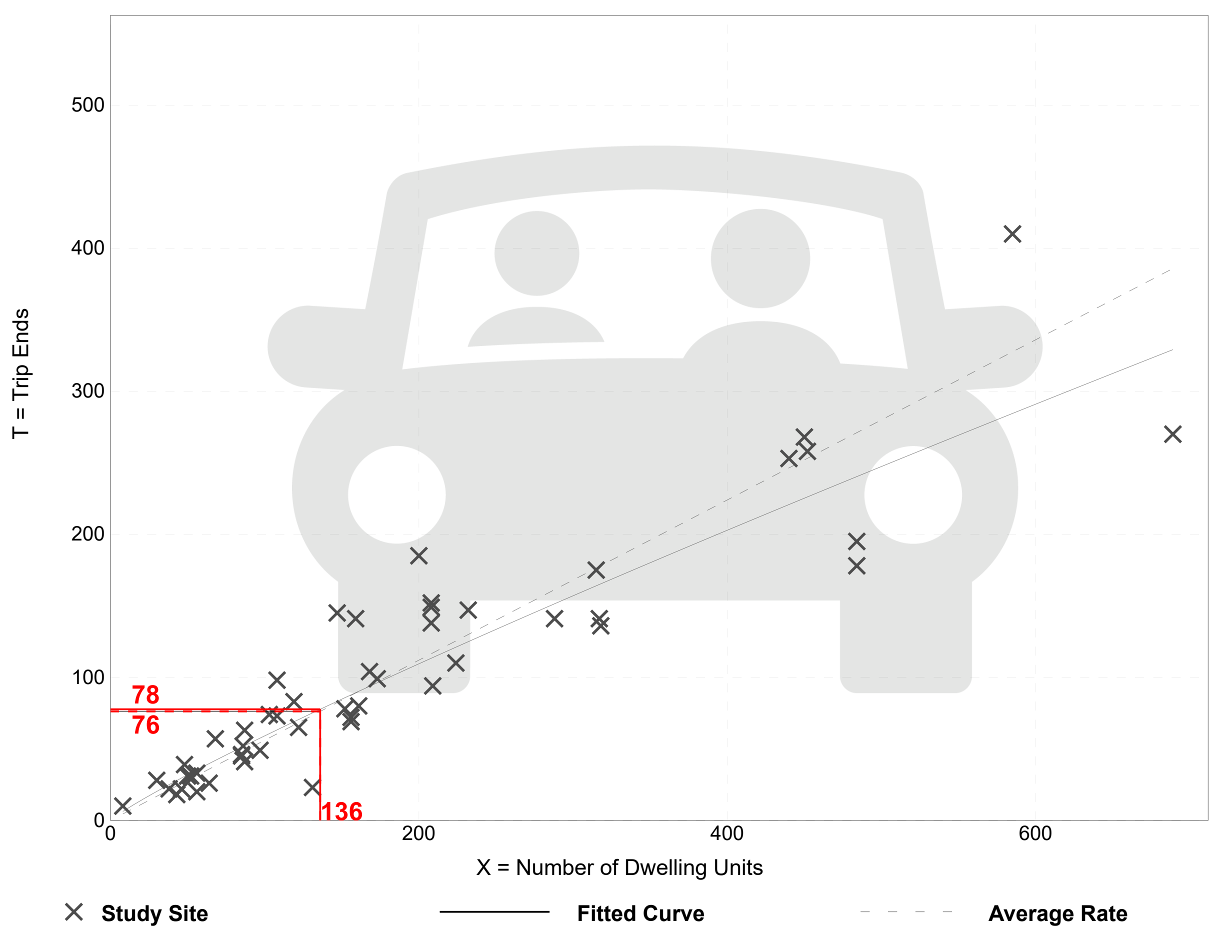
Multifamily Housing (Low-Rise)
(220)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m.**
Setting/Location:	**General Urban/Suburban**
Number of Studies:	50
Avg. Num. of Dwelling Units:	187
Directional Distribution:	63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.56	0.18 - 1.25	0.16

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.89 Ln(X) - 0.02

R^2= 0.86

Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

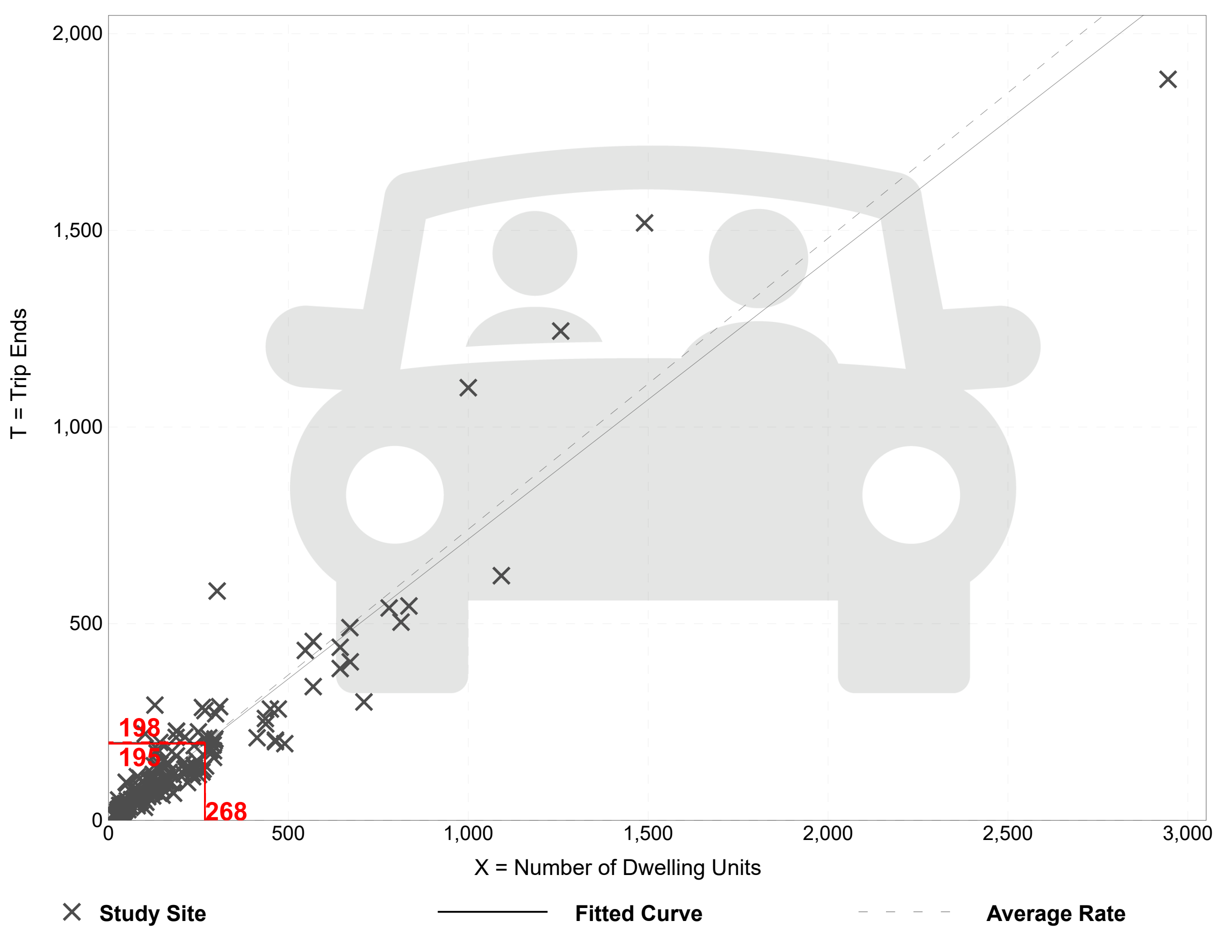
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 a.m.**
Setting/Location:	**General Urban/Suburban**
Number of Studies:	173
Avg. Num. of Dwelling Units:	219
Directional Distribution:	25% entering, 75% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.74	0.33 - 2.27	0.27

Data Plot and Equation



Fitted Curve Equation: T = 0.71(X) + 4.80 **R^2= 0.89**

Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

Single-Family Detached Housing
(210)

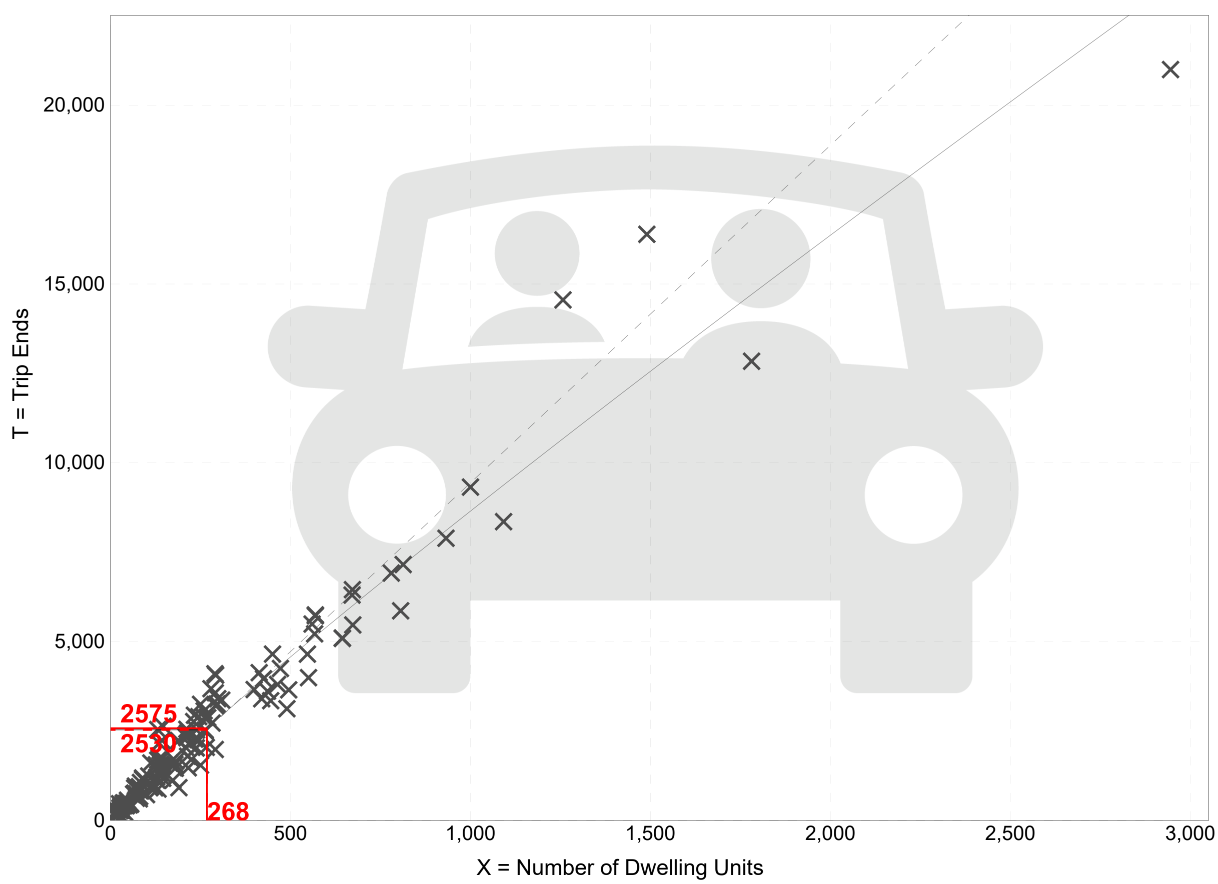
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 159
Avg. Num. of Dwelling Units: 264
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.44	4.81 - 19.39	2.10

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.92 Ln(X) + 2.71 **R^2= 0.95**

Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

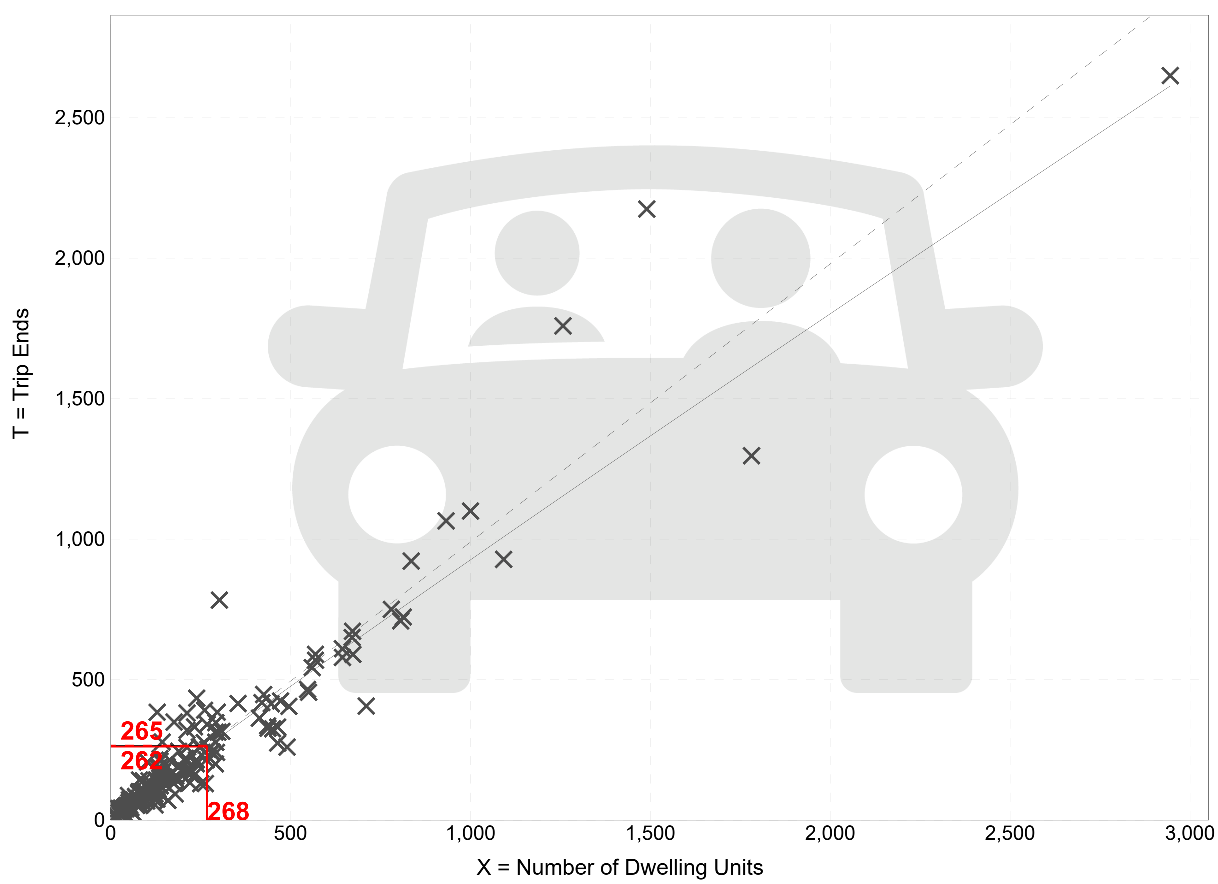
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 190
Avg. Num. of Dwelling Units: 242
Directional Distribution: 63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.99	0.44 - 2.98	0.31

Data Plot and Equation



× **Study Site** — **Fitted Curve** - - - **Average Rate**

Fitted Curve Equation: Ln(T) = 0.96 Ln(X) + 0.20 **R^2= 0.92**

Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

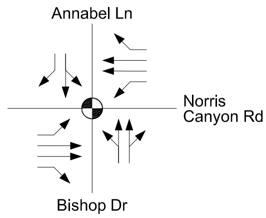
Attachment

LEGEND

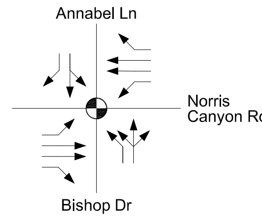
- Traffic Signal
- Stop Sign

Intersection	EXISTING CONDITIONS (YEAR 2021)	FUTURE WITHOUT PROJECT CONDITIONS (YEAR 2040)	PROJECT DESIGN FEATURE
1. Bishop Drive / Annabel Lane & Norris Canyon Road	see diagram below	see diagram below	Same as Existing Conditions
2. G Street Project Driveway & Norris Canyon Road	see diagram below	Same as Existing Conditions	Same as Existing Conditions
3. Camino Ramon & Norris Canyon Road	see diagram below	see diagram below	Same as Existing Conditions
4. Camino Ramon & F Street Project Driveway	see diagram below	Same as Existing Conditions	Same as Existing Conditions
5. Bishop Drive & Executive Parkway	see diagram below	Same as Existing Conditions	Same as Existing Conditions
6. I Street Project Driveway & Executive Parkway	see diagram below	Same as Existing Conditions	see diagram below

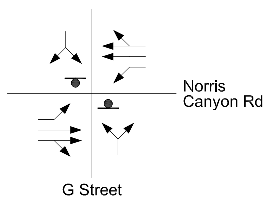
1. Bishop Drive / Annabel Lane & Norris Canyon Road — Existing Conditions (Year 2021)



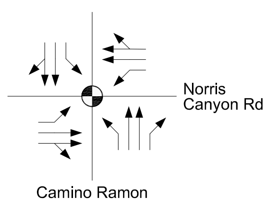
1. Bishop Drive / Annabel Lane & Norris Canyon Road — Future Without Project Conditions (Year 2040)



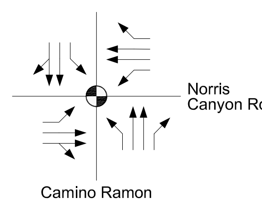
2. G Street Project Driveway & Norris Canyon Road — Existing Conditions (Year 2021)



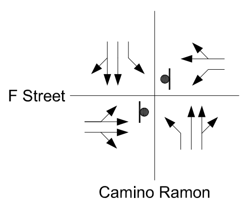
3. Camino Ramon & Norris Canyon Road — Existing Conditions (Year 2021)



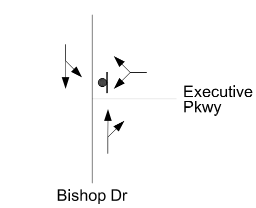
3. Camino Ramon & Norris Canyon Road — Future Without Project Conditions (Year 2040)



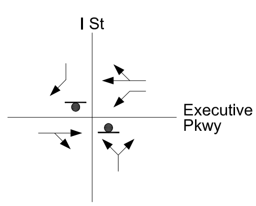
4. Camino Ramon & F Street Project Driveway — Existing Conditions (Year 2021)



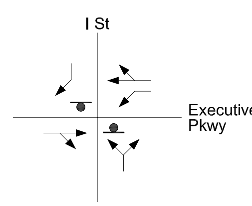
5. Bishop Drive & Executive Parkway — Existing Conditions (Year 2021)



6. I Street Project Driveway & Executive Parkway — Existing Conditions (Year 2021)



6. I Street Project Driveway & Executive Parkway — Project Design Feature



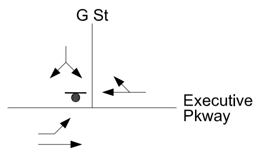
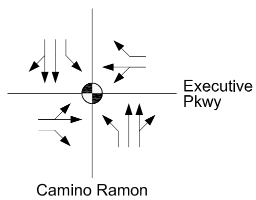
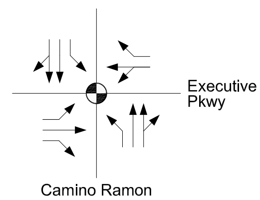
N
Not to Scale

INTERSECTION LANE CONFIGURATIONS

FIGURE A

LEGEND

- Traffic Signal
- Stop Sign

	EXISTING CONDITIONS (YEAR 2021)	FUTURE WITHOUT PROJECT CONDITIONS (YEAR 2040)	PROJECT DESIGN FEATURE
7. G Street Project Driveway & Executive Parkway		Same as Existing Conditions	Same as Existing Conditions
8. Camino Ramon & Executive Parkway			Same as Existing Conditions

N
Not to Scale

INTERSECTION LANE CONFIGURATIONS

FIGURE A (CONT.)

BR6 Volume Development

- Uses CityWalk Master Plan intersection volumes taken in 2019
- CityWalk Master Plan counts grown 1% per year to Existing Year 2021
- Analyzes Camino Ramon driveways (2) as one driveway to be conservative

Existing Conditions (Year 2021)

- CityWalk Master Plan counts used at Signalized Intersections 1, 3,5, and 8
- No counts were able to be taken at Project driveways; therefore, CityWalk Master Plan counts used to estimate *through movements* at driveways
- Turning Movements at Project Driveways
    - Turning movements at Project Driveways utilize Project Trip Generation for Existing Uses (564 ksf General Office) for turning movements inbound and outbound from three current Project Driveways
        - General Office distribution from CityWalk Master Plan
    - No addition of traffic from Existing Uses distributed to signalized intersections as they are assumed to already include Existing Uses traffic
    - Turning movements for driveways directly adjacent to site (2300 Camino Ramon for Intersection #2, BR7 for Intersection #4, and 2600 Camino Ramon for Intersection #6)
        - Trip generation estimates for BR7 and 2300 Camino Ramon based on ITE 10th Edition
            - 1/3 of traffic from both projects used due to at least 2 other driveway accesses at each site
        - 2600 Camino Ramon driveway volumes from CityWalk Master Plan
- Grow 1% per year for a total of 2% to 2021

Existing Plus Project (Year 2021)

- Added Net New Project volumes to driveways and intersections because Existing Conditions includes Existing Driveway Volumes already

Future without Project (Year 2040)

- Uses CityWalk Master Plan's Future with Project volumes
- Adds Existing Driveway movements from Existing Conditions (Year 2021)
    - Existing Driveway movements grown from Year 2021 to Year 2040 with growth rate based on counts at signalized intersections (approximately 30% growth)

Future with Project (Year 2040)

- Added Net New Project volumes to driveways and intersections because Existing Conditions includes Existing Driveway Volumes already

Appendix B

Caltrans Interim Guidance

LOCAL DEVELOPMENT – INTERGOVERNMENTAL REVIEW PROGRAM INTERIM GUIDANCE

APPROVED – SEPTEMBER 2, 2016

Implementing Caltrans Strategic Management Plan 2015-2020
Consistent with SB 743 (Steinberg, 2013)

Table of Contents

I. Introduction and Background

Caltrans' Local Development-Intergovernmental Review (LD-IGR) program reviews land use and infrastructure plans and projects across the state for potential impacts and enhancements to the State's environment, natural resources and multimodal transportation system for the California public. Through the LD-IGR process, Caltrans advises Lead Agencies on what these impacts might be and ways to avoid, minimize, and/or mitigate adverse impacts. Caltrans also identifies land use and design strategies that may enhance connectivity and access to destinations. As required through a host of state and federal planning requirements, the LD-IGR program has historically supported smart growth policies designed to create vibrant communities with a sustainable multimodal transportation system. For example, the program's 2005 Deputy Directive 25-R1 states:

> *"The Department works to ensure that local land use planning and development decisions include the provision of transportation choices, including transit, intercity rail passenger service, air service, walking, and biking, when appropriate. The Department advocates community design (e.g., urban infill, mixed use, transit oriented development) that promotes an efficient transportation system and healthy communities."*

With the enactment of legislation such as AB 32 (2006), SB 375 (2008), SB 226 (2011), SB 743 (2013), etc. and the development of planning guidance such as the Smart Mobility Framework, Complete Streets Implementation Action Plan, the California Transportation Plan 2040, as well as Caltrans' adoption of its new mission, vision, goals and the Strategic Management Plan 2015 – 2020 (SMP), the LD-IGR program is strengthening its focus on transportation infrastructure that supports smart growth and efficient development. This is intended to help ensure that greenhouse gas (GHG) emissions reduction, good community design, improved proximity to key destinations, and a safe, multimodal transportation system are all integral parts of land use decision making throughout the state. Past LD-IGR practices primarily utilized Level of Service to identify various impacts to the State Highway System (SHS), and often limited its recommended mitigation to traditional road improvements. Although Caltrans recognized that Lead Agencies could implement other measures, such as improvements to other modes of transportation or incentive programs to encourage use of other modes, the Lead Agencies often rely on Caltrans' recommended measures. Going forward, efforts to fulfill our LD-IGR obligation should consider multimodal solutions to not only improve access to destinations for all system users (motorists, transit riders, bicyclists, pedestrians), but also encourage efficient land use that helps achieve the multitude of goals sought, including quality of life, economic prosperity, the development of multimodal networks, and GHG emissions reduction.

The LD-IGR program provides an important opportunity to encourage Lead Agencies to implement the goals and targets of the Caltrans Strategic Management Plan. By year 2020, the SMP calls for several specific targets related to the LD-IGR program:

- a doubling of walking and transit, and tripling of bicycle trips as a percentage of overall trips
- a reduction of per capita vehicle miles traveled (VMT) by 15%
- a reduction of the number of fatalities in each travel mode by 10% a year
- a reduction of GHG and other pollutants consistent with the Air Resources Board's AB 32 Scoping Plan and State Implementation Plan
- an increase of freight system efficiency by 10 %

- a reduction to an 8% rate of growth in Daily Vehicle Hours of Delay (DVHD) under 35 miles per hour on urban State highways

The SMP also contains several strategic objectives related to the LD-IGR program, including:

- reduce user fatalities and injuries by adopting a "Toward Zero Deaths" practice
- promote community health through active transportation and reduced pollution in communities
- effectively manage taxpayer funds and maximize the use of available financial resources
- improve the quality of life for all Californians by providing mobility choice, increasing accessibility to all modes of transportation and creating transportation corridors not only for conveyance of people, goods, and services, but also as livable public spaces
- reduce environmental impacts from the transportation system with emphasis on supporting a statewide reduction of greenhouse gas emissions to achieve 80% below 1990 levels by 2050
- improve economic prosperity of the State and local communities through a resilient and integrated transportation system
- improve travel time reliability for all modes
- reduce peak period travel times and delay for all modes through intelligent transportation systems, operational strategies, demand management, and land use/ transportation integration
- increase the number of Complete Streets features on State highways that are also local streets in urban, suburban, and small town settings
- improve collaborative partnerships with agencies, industries, municipalities and tribal governments and advance national engagement with the transportation research and policy committees

As highlighted in the guidance below, the LD-IGR program's revised approach to commenting on plans and projects will help meet the goals and targets of the Strategic Management Plan. One important component to help achieve these goals is Caltrans' current process of creating a statewide Transportation Analysis Guide (TAG) and completing a comprehensive update of our Transportation Impact Study Guide (TISG). The TAG-TISG will better inform transportation infrastructure investment and land use and infrastructure project impact analysis, bring Caltrans practices in line with state policy (including those policies named above), and bring Caltrans analysis practices up to state of the practice by providing a suite of methodologies, tools, and best practices. It will help public and private sector practitioners across the state perform the various types of analysis needed to identify multimodal transportation impacts from new land use, transportation, and infrastructure plans and projects.

In the interim, this Interim Guidance document intends to ensure that all Caltrans LD-IGR comments on growth plans, development projects, and infrastructure investments align with state policies through the use of efficient development patterns, innovative demand reduction mitigation strategies, and necessary multimodal roadway improvements. This is in addition to Caltrans' long-standing commitment to maintain a safe, multimodal transportation system that provides access to destinations for all users. We also continue to recognize that under the California Environmental Quality Act (CEQA), it is ultimately the Lead Agency's responsibility to perform a CEQA analysis, set local thresholds of significance, analyze potential impacts, determine significance, and identify, implement, and monitor any required mitigations.

This guidance supersedes the 2002 Caltrans Guide for the Preparation of Traffic Impact Studies in comments to local agencies. Instead of referencing the 2002 guide, Districts should make specific analysis requests of the Lead Agency when additional information is needed. The District can offer to provide the Lead Agency assistance in developing the scope of any analysis and answering questions. Headquarters

LD-IGR staff is also able to assist with scoping required analysis and developing recommended solutions for the Districts' and Caltrans' local and regional partners to consider.

In order to ensure alignment of Caltrans comments with state goals described above, LD-IGR comments henceforth should take into consideration whether the project exhibits low or high VMT (by place type e.g., urban, suburban, and rural areas) and should focus recommendations on smart land use, multimodal access, safety for all users, and reducing single occupant vehicle trips. Well planned urban infill projects which are located close to transit, bike and pedestrian facilities (see Appendix A: Project Type 1), which also have proximity benefits to employment centers, services and goods – will reduce travel demand on the entire transportation system and will therefore require significantly less review and mitigation than rural fringe projects (Project Type 5), which generate proportionately higher number of trips and vehicle miles traveled.

Senate Bill 743 (2013) mandated that CEQA review of transportation impacts of proposed development be modified by eliminating consideration of delay- and capacity- based metrics such as level of service (LOS) and instead focusing analysis on another metric of impact. The Governor's Office of Planning and Research (OPR) is currently updating its CEQA Guidelines to implement SB 743 and is proposing that vehicle miles traveled be the primary metric used in identifying transportation impacts. OPR has released a separate "Technical Advisory" outlining recommended techniques for measuring impacts with this new metric, which applies statewide. The General Plan Guidelines are also concurrently being updated to align with state policy, including SB 743.

The need to evolve LD-IGR comments on local development transportation analysis and local development mitigation responses was articulated in a California State Transportation Agency (CalSTA) commissioned review of Caltrans practices in the State Smart Transportation Initiative (SSTI). Their January 2014 report stated that *"SB 743 could do more to advance state planning goals than anything else Caltrans has done", and "would put California and Caltrans back at the leading edge of modern transportation practice ….. It would begin to make Caltrans a real contributor to the success of modern policy in the state, and it would provide a model for how the staff could help implement a challenging new charge."* A December 2014 report titled *A Follow-Up to The California Department of Transportation: SSTI Assessment and Recommendations* noted that OPR, CalSTA and Caltrans have been collaborating closely on remaining CEQA rulemaking issues, such as "*to manage operational challenges, namely where congested exit ramps may back up onto freeways, in a way that is not simply level of service by another name, failing to deliver the relief to infill development as the law directs. The draft rulemaking would also base mitigation on a development's total vehicle-miles generated."*

The TAG-TISG will also help implement Caltrans Strategic Management Plan 2015-2020 objectives consistent with SB 743 changes to CEQA. The TAG-TISG focuses transportation analysis on VMT impacts, assessing impacts from growth plans and development projects on the multimodal transportation network, and quantifying VMT and GHG reductions achieved through smart mobility principles and Transportation Demand Management (TDM) strategies. Until the TAG-TISG is complete, the Interim Guidance provided herein is intended to help ensure that District LD-IGR comment letters evolve to carry out state law, reflect the State's strategic safety goals and planning priorities, and align with California's climate change goals.

Purpose of this Interim Guidance

With the Strategic Management Plan objectives and SB 743's changes to CEQA, LD-IGR coordinators and functional reviewers will transition away from using delay based analysis, such as LOS or similar measures of vehicular capacity or traffic congestion, to determine the impacts of land use and infrastructure plans and projects. Instead, they will identify opportunities for reduced VMT generation, advise Lead Agencies on maintaining safe operations, and provide recommendations on developing location-efficient (e.g., centrally located, infill) and travel-efficient (e.g., inclusion of TDM measures) land use.

This Interim Guidance will remain in effect until superseded by Caltrans Transportation Impact Study Guidelines (TISG), currently under development.

Henceforth, LD-IGR comment letters should reflect the "top six" elements discussed below, as well as the more detailed guidance in the accompanying appendices. It is important to note that this Interim Guidance is intended to be the overarching policy and guidance of the LD-IGR program, aside from any Director's Policies or Deputy Directives. The Headquarters LD-IGR program will be updating guidance and training to be aligned with the Strategic Management Plan 2015-2020 lens over the upcoming months. If reviewers notice any discrepancies in policy and direction between the existing guidance on the Caltrans intranet and this Interim Guidance, please notify the LD-IGR program manager for further direction. Similarly, if reviewers experience any difficulties in applying this Interim Guidance to individual development-related plans, programs, or projects, they are encouraged to contact Alyssa Begley, SB 743 Program Implementation Manager, for assistance on a statewide perspective, and suggested solutions that might be useful.

Active participation by the Districts in regularly scheduled LD-IGR Teleforum meetings with Headquarters will also help District staff keep abreast of emerging methodologies, relevant examples, and current events that may further inform this Interim Guidance while OPR's CEQA Guidelines Update and Caltrans' TAG-TISG Update are in progress.

The existing LD-IGR program's intranet guidance and the technical resources are found at:
http://transplanning.onramp.dot.ca.gov/local-development-intergovernmental-review-ld-igr-branch

II. Key Elements to Include in LD-IGR Letters

This section summarizes the "top six" elements to emphasize when reviewing development plans and project proposals for transportation impacts and when drafting LD-IGR comment letters. The following appendices provide explicit guidance, technical considerations, and template language for District LD-IGR coordinators and functional reviewers to incorporate as needed.

A. Comment on Vehicle Miles Traveled associated with the project.

Reviewers should comment on vehicle miles traveled resulting from the land use project, applying local agency thresholds or absent those, thresholds recommended by the most recent draft of OPR's CEQA Guidelines and Technical Advisory. If an assessment of VMT is not presented, Caltrans should request it be presented. Though SB 743 clarifies requirements for transportation analysis, a VMT analysis is already needed to meet other CEQA requirements.[1] Methods for assessing VMT should be compared to the methods recommended in the OPR Technical Advisory. Where methods are not consistent with the recommendations in the Technical Advisory, Caltrans should comment on those methods. Where the project exhibits less than threshold VMT, Caltrans comments should acknowledge the project's transportation efficiency. Where the project exhibits greater than threshold VMT, Caltrans should request mitigation. Examples of mitigation measures are included in the OPR Technical Advisory. Contact the SB 743 Program Implementation Manager, Alyssa Begley, for assistance with VMT calculation.

B. Rather than providing recommendations that primarily accommodate motor vehicle travel, provide recommendations that strive to reduce VMT generation; improve pedestrian, bike, and transit service and infrastructure; and which don't induce additional VMT.

As demonstrated by the template language provided in Appendix C of this Interim Guidance, it is important that Caltrans comment letters express the intent and purpose of the LD-IGR program and Caltrans' review of land use and infrastructure plans and projects through the new lens of the Caltrans Strategic Management Plan 2015-2020. In other words, providing recommendations for solutions that reduce automobile travel rather than recommendations that accommodate more of it. For example, consider the following sample paragraph intended for letter introductions:

> *"The mission of Caltrans is to provide a safe, sustainable, integrated, and efficient transportation system to enhance California's economy and livability. The Local Development-Intergovernmental Review (LD-IGR) Program reviews land use and infrastructure plans and projects through the lenses of our mission, vision, and goals as guided by the State's planning priorities of prioritizing infill, conservation, and efficient development."*

Consider also the following paragraph intended to discuss demand reduction and mitigation strategies:

> *"Caltrans seeks to reduce vehicle trips and new vehicle miles traveled associated with development and recommends appropriate measures to avoid, minimize, or mitigate transportation impacts through smart mobility community design and innovative multimodal demand reduction strategies."*

C. Focus on travel efficiency

Coordinators and reviewers should use the terms *"transportation impact study"* rather than *"traffic impact study"* and note that the study should analyze all modes. Such terminology helps developers, decision makers, and the public better understand that Caltrans seeks a holistic perspective on the infrastructure (roadways, bicycle facilities, sidewalks, transit stations, etc.), the service (e.g. transit, rail, etc.) needs, opportunities for closer proximity to key destinations, and other factors that may be created by growth plans and development projects under review. This language acknowledges and builds upon the multimodal perspective taken by the LD-IGR program since its inception, but not always followed in practice. This approach will also help shape the analysis techniques applied to the review so that the right kinds of data and analyses are provided for consideration. For example, Districts should help the Lead Agency contextualize the project by describing not just what and where it is, but also

[1] See CEQA Guidelines §15064.4 (analysis of greenhouse gas emissions) and Appendix F (requiring analysis of "the project's projected transportation energy use requirements and its overall use of efficient transportation alternatives". See also California Clean Energy Committee v. City of Woodland (2014) 225 Cal. App. 4th 173, 210.

how those factors relate to both the multimodal transportation system and parallel objectives such as job creation, resource and open space conservation, or housing affordability—especially for projects and plans that generate high VMT. If the project is on the suburban edge of a region or far from transit, it is likely to induce more VMT than an infill project. In assessing how the project might be able to reduce its VMT generation, it is also critical to understand how the project can enhance a multimodal transportation network, how the project may increase access to key destinations (by foot or bicycle), and what aspects of the system can be utilized as feasible TDM mitigation measures. See Appendix D for additional information.

Districts should be cognizant of land use economics when reviewing local development projects in order to be mindful of all factors that lead to viability of individual project, more specifically, for projects that generate less overall vehicle miles traveled.

Districts are strongly encouraged to work with Lead Agencies to address transportation deficiencies and enhancements through policies at the planning level and through mitigation fee programs. Districts should still encourage Lead Agencies to share plans and projects for review that directly abut the SHS, are in vicinity of a State Highway, or projects for which Caltrans must approve and issue an encroachment permit.

Headquarters LD-IGR staff recognizes that this type of analysis will be a dramatic shift in process for Caltrans, and that Headquarters programs, District coordinators, and functional reviewers will need extensive training to adapt to the new analysis methods. Headquarters LD-IGR staff will coordinate with the Districts to ensure additional training and tools are provided throughout the Department. If Districts have training requests or concerns, please contact their Headquarters LD-IGR coordinator.

D. Remain neutral on project purpose while framing recommendations for mitigation of the project's impacts within statewide policy.

Commenting on local development can be controversial and should be written in a tone that promotes partnership, promotes collaboration, focuses on technical aspects of plans and projects, and is deferential to the Lead Agency's discretionary authority. However, Caltrans has a responsibility to advance the state's legislative priorities and carry out its role as a Responsible or Commenting Agency under CEQA. In order to strike this balance, our response letters should convey Caltrans' desire to be an active partner in Lead Agencies understand the transportation implications of development and to assist Lead Agencies in shaping projects to make more efficient use of our transportation system. Districts may choose to, for example:

- State whether the project is location-efficient (e.g. transit-oriented infill), with safe and adequate access to a multimodal transportation system and key destinations, that will help the state meet its GHG reduction targets under AB 32; or if it is sprawl that will increase VMT and regional emissions. As described in Section A above, ascertain VMT per OPR's guidance. Residential development should be assessed on a per capita basis. Office development VMT should be assessed on a per employee basis. Retail project VMT should be assessed on an absolute basis, but need not be calculated for local-serving retail (which generally reduces VMT). Land use project VMT should be compared to thresholds created by the local agency. In the absence of local agency thresholds, use recommendations in OPR's Technical Advisory, i.e., 15 percent below overall regional or city VMT per capita for residential projects, 15 percent below regional VMT per employee for office projects, and any increase in overall VMT for retail (further details can be found in the Technical Advisory). For residential and office development, VMT Maps produced by either regional travel demand models, or the California Statewide Travel Demand Model may be used as a shortcut to estimating VMT. VMT Calculation training will be made available to District staff. Sample language is provided in Appendix C.

- Note if the project is consistent or inconsistent with the growth patterns and future infrastructure features identified in the General Plan or Master-Specific Plans, as well as Regional Transportation Plans (RTP) or Sustainable Community Strategies (SCSs).
- Note if the project is consistent or inconsistent with State planning priorities of infill, conservation, and efficient development. For more information on the State's planning priorities, see the text from AB 857 (2002) and SB 226 (2011).

While it is not necessary to "take a stand" by commenting on a Lead Agency's actual decision to adopt a plan or approve-deny a project, comment letters should express findings of consistency or concern related to the implications and impacts, particularly VMT impacts, of development projects. And remember, Caltrans can recommend plan changes or project re-design where impact avoidance or minimization could be achieved. For example, a high-VMT-inducing edge development may consider walking or biking connectivity around a new major transit station with high-quality transit service (see SB 375), or if such a transit station is not present or planned, then around a neighborhood town center. Similarly, a jurisdiction or developer might be able to take advantage of reduced parking requirements or affordability density-bonus credits for projects located in infill areas to achieve a more efficient growth pattern. Such suggestions can point to a "win-win" by substantially reducing the plan's or project's VMT generation while still meeting the developer and Lead Agency's overarching economic and community development objectives. Our comment letters should note when Caltrans has had discussions in person with Lead Agency staff.

E. Be collaborative – Create paths for workable solutions and overcome roadblocks.

Cities, counties, and developers, as well as Regional Transportation Planning Agencies (RTPAs), Metropolitan Planning Organizations (MPOs), transit and inner-city rail operators, and a wide array of employers and service providers across the State face increasing pressures to accommodate California's population growth with limited funding, while also facing environmental and community-acceptance constraints. Caltrans, through our LD-IGR role, can work collaboratively to assist these agencies. Comment letters should not just identify potential concerns or problems, but offer suggested solutions that could be taken toward their resolution.

District staff should proactively establish early consultation in the planning and development project process. For example, request face-to-face meetings with Lead Agencies and project proponents to discuss how state law and the multimodal policies in city/county General Plans and RTPA/MPO RTPs and SCSs apply to the development project being reviewed or plan amendments being considered. This would allow both plan-level and project-specific technical concerns to be conveyed and, if possible, resolved with Lead Agencies as part of on-going information sharing. Such meetings can be used to link "early" and "late" steps in the development approval process by identifying potential planning policies and avoidance or minimization strategies, and developing mitigation implementation programs that help achieve Caltrans Strategic Management Plan 2015-2020 objectives and other state goals. Specifically, Districts should perform robust review of the land use and transportation analysis contained in the transportation impact studies for the environmental impact reports performed on General Plans, Specific/Master/Community plans, Regional Transportation Plans, Sustainable Community Strategies, etc.. This affords District staff a better understanding of how individual “streamlined” developments and infrastructure investments “tier” off of the analysis in plan- or program-level EIRs and provides opportunities for Caltrans to encourage and help shape new VMT-based impact fees.

F. Comments related to impacts to the State Highway System (SHS) will be focused on VMT impacts not delay or effects on road capacity.

Transportation analysis under CEQA is evolving, in part because of SB 743, to measure impacts using vehicle miles traveled. Similarly, Caltrans has adopted Strategic Management Plan goals related to reducing VMT per capita and increasing use of non-auto modes. Therefore, in reviewing project proposals and related CEQA documents, LD-IGR will focus its comments on reducing demand on the SHS as measured with VMT. Caltrans continues to be responsible for ensuring that encroachments on or changes to the SHS are designed to provide for safe operations.

The use of LOS as a CEQA threshold of significance will soon be disallowed and replaced with vehicle miles traveled. SB 743 did not alter a Lead Agency’s responsibility to “analyze a project’s potentially significant transportation impacts related to air quality, noise, safety, or any other impact associated with transportation.”[2] Any information requests should be consistent with the guidance found in Appendices A and B.

This section will not address specifics of how to conduct an operational impacts analysis for all modes of transportation. This section is focused on the general policy, tone, and approach.

Improvements on conventional roadways should, as appropriate to the context, emphasize a complete streets approach to improvements (improvements such as lane width reduction, landscaped medians, pedestrian bulb outs, etc.) and should avoid increasing automobile capacity and/or other measures that would significantly increase VMT.

Suggested improvements to address operational impacts should not result in increased speeds that are not suitable for vulnerable users on the conventional facility. Operational impact improvements should be appropriate to the context and consistent with complete streets principles wherever feasible. Capacity improvements to freeway ramps and freeway mainlines to address operational impacts should be a last resort. Improved crosswalk signal timing, intelligent transportation systems improvements, enhanced signage, roadway designs that result in reduced speed limits, and other effective methods that do not significantly increase VMT should first be explored as potential solutions.

[2] A safety-related transportation impact under CEQA is not the same as, and does not establish, an unsafe condition. Instead, the CEQA determinations are based on modeling and projections of potential future conditions and any mitigation is focused on making conditions safer.

Appendix A: Recommended Guidance for Site-Specific Development Project Review

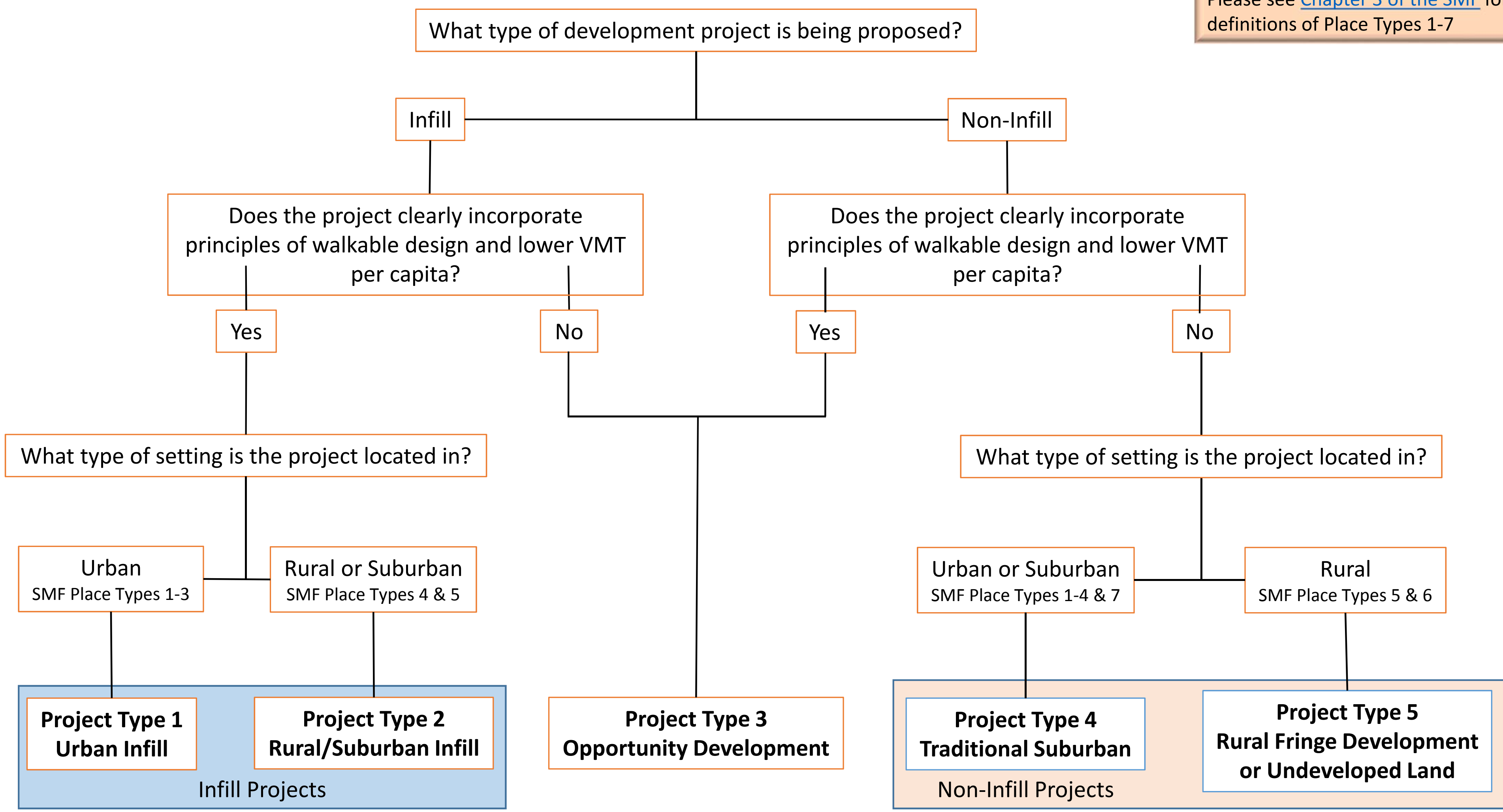
Please use this flow chart and the guidance following it to determine whether to comment on site-specific projects and what types of comments to make based on the type of project and its location. Reviewers should first consider the project's geographic setting and whether projects are located in an infill location, have a walkable project design, and assess VMT generation (definitions of key terms are at the end of this appendix). Projects may not fall perfectly into the place type categories below, so please use your best judgment on types of comments to make. We recognize every project is different.

Before sending a comment letter, the District LD-IGR coordinator should consider what the main objective of sending a letter is, what point of the process the project is in, and if it is necessary to even make comments. A request for additional analysis should be followed by an explanation of why that analysis is needed. If we request a Lead Agency to provide additional analysis on how a project impacts the SHS, we should articulate our concerns. Districts should not just ask for studies or analysis for projects just to have the information. For high-VMT projects, comments should have a primary focus on helping a project reduce VMT loaded onto roadway networks, including the State Highway System.

LD-IGR Site-Specific Development Project Review Decision Tree

See the definitions section on p. 7 of this appendix for guidance on terminology used in this decision tree

SMF = Smart Mobility Framework
Please see Chapter 3 of the SMF for definitions of Place Types 1-7



Guidance for Site-Specific Development Project Review by Place Type

	Urban Infill Project Type 1	Rural/Suburban Infill Project Type 2	Opportunity Development Project Type 3	Traditional Suburban Project Type 4	Rural Fringe/ Undeveloped Land Project Type 5
a. General Review Approach	• Generally Districts should have minimal comments (or no comments) on Type 1-2 because they are well planned infill projects which are located close to transit, bike and pedestrian facilities which also have proximity benefits to employment centers, services, and goods will reduce travel demand on the entire transportation system and will therefore require significantly less review and mitigation than rural fringe projects (Project Type 5) which generate proportionally higher number of trips and vehicle miles traveled. Districts should coordinate with SB 743 Program Implementation Manager when developing letters for Type 1 land use projects. • Consistent with the new Caltrans mission, vision, and goals, and other statewide laws and policy, projects meeting Type 1-2 criteria typically minimize the overall demand on the SHS compared to what would be built in their place to accommodate demand. • Infill projects have the benefit of proximity to employment, services, and retail that helps reduce trip length and increase accessibility for all modes. • While in some cases, projects with a walk and bike friendly design may actually increase regional VMT in rural areas, projects in town centers that incorporate pedestrian friendly designs could encourage more trips by walking, biking, and transit for local residents. Districts may still encourage project construction traffic to avoid peak hours when specific non-delay operational concerns arise.		• Opportunity development projects are similar to those in Type 1 and Type 2, but they are typically designed in such a way that is traditional suburban type development that happens to reduce VMT due to its location. Or they are projects on the fringe of urban areas designed in a way that minimizes VMT impacts. • Districts may encourage the Lead Agency to improve pedestrian connectivity both within the project and its connections to surrounding areas. The Districts may also encourage a reduction in parking spaces (when warranted), and potentially reorienting the development so that parking lots are not located between buildings and the streets. • If some of the individual components of the project exceed VMT thresholds on page 6 of this appendix (when accounting for mixed-use trip reduction), then Districts can encourage transportation demand management (TDM) measures. See the Appendix D section on Demand Management for suggestions on TDM. • Other projects that typically do not generate permanent traffic (such as levee repairs, signs, pipelines, solar farms, etc.) should follow existing LD-IGR guidance. Comments related to these types of projects should not focus on congestion.	• Type 4 and 5 projects generally are considered traditional suburban or rural fringe development that generate higher VMT, and do not encourage walking or biking by their project design. • Districts should make comments on ways projects can minimize VMT generation to meet VMT reduction goals from SB 743 and assist the State in meeting GHG reduction targets. Caltrans should press for significant connections to existing pedestrian, bicycle, and transit infrastructure to avoid a development relying solely on the existing local roadway system or State Highway System. • Districts are also encouraged to use the Smart Growth Principles language suggested in the Appendix C: Recommended Language that identifies whether or not a project incorporates smart growth principles. • Districts should make comments on ways the projects can improve internal circulation for all modes, better integrate with other nearby land uses, and provide a network of complete streets that benefits all users of the transportation system.	

Guidance for Site-Specific Development Project Review by Place Type

<table>
<tr><th></th><th>Urban Infill

Project Type 1</th><th>Rural/ Suburban Infill
Project Type 2</th><th>Opportunity Development
Project Type 3</th><th>Traditional Suburban
Project Type 4</th><th>Rural Fringe/ Undeveloped Land
Project Type 5</th></tr>
<tr><td>b. Multimodal Operational Impacts Analysis</td><td>• For purposes of this Interim Guidance, projects in Urban Infill areas are presumed to have multiple community benefits that include multimodal mobility, increased access, and safety for all users. Urban Infill projects also tend to increase pedestrian and bicycling travel, which promotes livable and healthy communities. This is important to note, because an important goal of this guidance is to help implement statewide objectives to minimize VMT generation and reduce GHGs--which research suggests infill development helps accomplish.
• Well planned infill projects which are located close to transit, bike and pedestrian facilities which also have proximity benefits to employment centers, services, and goods will reduce travel demand on the entire transportation system and will therefore require significantly less review and mitigation than rural fringe projects (Project Type 5) which generate proportionally higher number of trips and vehicle miles traveled.
• In cases where the Districts have specific substantial evidence that operational impacts or safety concerns exist, the Districts should work with the Lead Agency to identify the appropriate analysis needed, ways it can be provided, and how the operational impacts can be addressed.
• Districts are encouraged to work with Lead Agencies to proactively address relevant transportation concerns at the plan-level or corridor-level; this helps ensure that the Department is able to carry out its responsibilities as owner/operator of the SHS without having to ask for additional project-level analysis when individual Urban Infill developments move forward to approval, if it is not needed.
• Consideration should be given to the context of the area in relation to the SHS. Comments related to operational impacts should not be used as a mechanism to increase capacity of the roadway--they should only be made to address specific operational impacts as defined above. Districts should coordinate with SB 743 Program Implementation Manager when developing letters for Type 1 land use projects.</td><td colspan="4">• While an important overall goal of this guidance is to minimize VMT generation, many new development projects will increase traffic in a localized area and could create or exacerbate operational concerns that may increase the potential for future collisions (operational impacts).
• When necessary, the Districts should still analyze a project’s potential operational impacts and impact of significant increases of VMT on walkers, bikers, and drivers using the SHS.
• Well planned infill projects which are located close to transit, bike and pedestrian facilities (see Appendix A: Project Type 1), which also have proximity benefits to employment centers, services and goods – will reduce travel demand on the entire transportation system and will therefore require significantly less review and mitigation than traditional suburban projects (Project Type 4), and rural fringe projects (Project Type 5), which generate proportionately higher number of trips and vehicle miles traveled. Caltrans should press for significant and safe connections to existing pedestrian, bicycle, and transit infrastructure to avoid a Project Type 2-5 relying solely on the existing local roadway system or State Highway System.
• In cases where multimodal operational impact analysis is needed, but it is not provided, the Districts should work with the Lead Agency to identify the appropriate analysis needed and ways it can be provided. To date, no state law has exempted project proponents from performing a safety analysis for all transportation modes. That does not mean that project proponents necessarily need to perform an analysis. Consideration should be given to the context of the area in relation to the SHS.
• The Districts can also ask for construction traffic management plans. See Appendix C for sample language.</td></tr>
</table>

Guidance for Site-Specific Development Project Review by Place Type

	Urban Infill Project Type 1	Rural/Suburban Infill Project Type 2	Opportunity Development Project Type 3	Traditional Suburban Project Type 4	Rural Fringe/ Undeveloped Land Project Type 5
c. Pedestrian, Bicycle, and Transit Facilities	For projects that directly abut the SHS, agreements may be required for maintenance of pedestrian facilities. The Districts are strongly encouraged to advocate in comment letters for completing a network of pedestrian walkways along the SHS where feasible and appropriate to the context. The Districts should make efforts to familiarize themselves with local agencies' policies and design standards and work with project proponents early to resolve any design or safety-related issues for the walkways. Bicycle and transit facilities within the Caltrans ROW should also be considered and encouraged on a case-by-case basis. Agreements with other agencies may be necessary.				
d. Fee Programs	The Districts can request that projects pay into established fee programs (mandatory or voluntary programs are ok). Districts are encouraged to promote projects or improvements within the fee programs that help reduce VMT and enhance efficient access to destinations when feasible. Programmatic fee programs to address operational impacts are also encouraged to help avoid individual development projects avoid triggering direct operational impacts; this is especially important for Project Type 1-2.				
e. Level of Service (LOS) Related Comments Aimed at Reducing VMT	Not applicable		Some jurisdictions have set LOS thresholds for the SHS either through plans or by ballot measures and will provide this analysis during project review. Until the TAG-TISG is completed, Districts can make technical comments about a Lead Agency's deficiencies in LOS analysis of the SHS when a project is inconsistent with smart growth principles ("sprawl"). In this circumstance, the District can also point out LOS deficiencies on the SHS and request mitigation that minimizes new VMT on the SHS. Please note that the District should suggest capacity increasing improvements sparingly. Comments can focus on operational impacts and should be consistent with complete streets principles. Particularly for Project Type 3-5, Districts should assist the Lead Agency in identifying appropriate demand reduction measures by listing specific programs (see Appendix D – Section A "Demand Management")		
f. ROW Preservation	In areas where Caltrans system planning documents are aligned with local plans that call for the eventual widening of the SHS, Caltrans may find it necessary to make comments about preserving that ROW. The context of the situation is critical. District staff should consult with System Planning to maintain consistency with any existing local plans to enhance the livability and neighborhood connectivity of a State Highway segment, and determine whether Caltrans is working with a local agency to relinquish that portion of the State Highway.				
g. Responsible Agency	Caltrans is a Responsible Agency under CEQA when we have to approve and issue an Encroachment Permit for a local development project. We are a Commenting Agency when the local development project does not require an Encroachment Permit. Districts should inform the Lead Agency when an Encroachment Permit is required as early as possible in the local development project's process. District Planning should coordinate with District Encroachment Permits regarding which local development projects are not required to provide a transportation analysis. The Encroachment Permit process still requires some level of transportation analysis. Particularly for infill, the level of analysis required should balance the engineer's need for information with monetary costs incurred by the project. Time and money will be saved if Caltrans and the Lead Agency discuss the analysis needs for the Encroachment Permit as early as possible. See the "Encroachment Permits" section in Appendix C for language that should be included in a comment letter.				

Guidance for Site-Specific Development Project Review by Place Type

	Urban Infill Project Type 1	Rural/Suburban Infill Project Type 2	Opportunity Development Project Type 3	Traditional Suburban Project Type 4	Rural Fringe/ Undeveloped Land Project Type 5
h. Projects in Close Proximity to the SHS	The Districts should consider commenting on projects that border or are within a few hundred feet of Caltrans ROW. Some specific examples include projects that may have hydraulic impacts to the SHS, ROW Engineering concerns, sound wall placement along freeways, and other cases. For projects that border or plan any work within the state highway system ROW, Districts should comment about the potential need for an encroachment permit. The Lead Agency and developers appreciate being made aware of issues that could affect the cost, scope, or schedule of the project. We recommend working with Lead Agencies as early in the process as possible to resolve issues before CEQA-stage documents are released for public review and comment. The tone in the letters should be of a cooperative approach.				
i. Parking	If District staff notice an excessive number of parking spaces, greater than required by local zoning, associated with a development related to its context (i.e., in places with excessive amounts of underutilized parking nearby, in places with very high transit connectivity, etc.) the District may choose to comment that a reduction in parking may help reduce VMT and development project costs. Note that AB 744 (2015) identifies maximum parking ratios for affordable housing projects located within one-half mile of a major transit stop, and affordable housing projects outside of those locations.				

Questions to Consider for VMT Impacts

Questions to consider for VMT impacts:
Reviewers should comment on vehicle miles traveled resulting from the land use project, applying local agency thresholds. Or absent those, apply thresholds recommended by the most recent draft of OPR's CEQA Guidelines and Technical Advisory.

a) Will residential components of the project lower both the citywide (or countywide) and the regionwide existing VMT per capita by at least 15%?
b) Will office components of the project lower existing VMT per employee across the region by at least 15%?
c) Will retail components of the project decrease total VMT (note: can presume local serving retail will)?
Note: These questions are consistent with the most recent draft of the OPR Technical Advisory Implementing SB 743.

If the answer is no to any of the above questions (when accounting for internal trip capture for mixed use projects), then it may be appropriate to request the Lead Agency to minimize VMT generated by a project. See Appendix D for Transportation Demand Management suggestions.

Definitions of Key Terms

Infill Site: According California Public Resources Code Section 21061.3, an infill site is defined as "a site in an urbanized area that meets either of the following criteria: (a) The site has not been previously developed for urban uses and both of the following apply: (1) The site is immediately adjacent to parcels that are developed with qualified urban uses, or at least 75 percent of the perimeter of the site adjoins parcels that are developed with qualified urban uses, and the remaining 25 percent of the site adjoins parcels that have previously been developed for qualified urban uses. (2) No parcel within the site has been created within the past 10 years unless the parcel was created as a result of the plan of a redevelopment agency. (b) The site has been previously developed for qualified urban uses." For purposes of LD-IGR evaluation, whether or not a project is considered infill should also be considered with its effects on VMT. If it is unclear whether a project is infill or not, if a project induces high-VMT, the District should treat the project as a Type 3 Opportunity Development. Taking projects through the project place type decision tree above may help in determining the types of comments to make on the project.

***Walkable Project Design*:** There is no perfect definition of what comprises a project with good walkable design. However, there are resources that help define some of the principles of walkable design. The San Francisco Planning and Urban Research Association (SPUR) has developed seven principles of walkable urban districts that may be useful to District staff to help understand what walkable design incorporates: create fine-grained pedestrian circulation; orient buildings to street and open spaces; organize uses to support public activity; place parking behind or below buildings; address the human scale with building and landscape details; provide clear, continuous pedestrian access; and build complete streets. A project does not necessarily have to incorporate all of these principles to be considered having walkable design, but it should incorporate almost all of them.

Operational Impacts: When new development may create or exacerbate operational concerns that may increase the potential for future collisions. A safety-related transportation impact under CEQA is not the same as, and does not establish, an unsafe condition. Instead, the CEQA determinations are based on modeling and projections of potential future conditions and any mitigation is focused on making conditions safer.

***Place Types*:** Districts should not be too concerned with whether or not a project is considered rural, urban, or suburban to navigate the decision tree. What matters more is the project design and the VMT generated by the project (i.e., which project type box is selected). The Districts can also use the Smart Mobility Framework (SMF) Place Types to help navigate the decision tree. The SMF Place Type descriptions are located in Chapter 3 of the SMF. The SMF Place Type numbers on the decision tree correspond to the numbers in Chapter 3.

Appendix B: Recommended Guidance for Plans and Programs Review

There are many different types of plans (General, Specific, Community, Regional Transportation, Watershed, Air Quality to name a few) and programs that LD-IGR reviewers receive. To cover all the different types of them would defeat the purpose of keeping this guidance brief and just providing an overall policy framework.

OPR's Technical Advisory provides guidance on VMT-based impact analysis and mitigation. An array of research is available on this topic, much of which is summarized and packaged for deployment in the California Air Pollution Control Officers Association (CAPCOA) Quantifying Greenhouse Gas Mitigation Measures document (which focuses also on VMT). Further, HQ will post Technical Bulletins on Onramp as further information becomes available. In the meantime, HQ will provide the Districts with an SB 743 notification letter template for transmittal to Lead Agencies explaining what SB 743 requires them to consider, noting how Caltrans can assist, and stating that OPR is drafting an update of its CEQA Guidelines in order to spell out the new requirements in more detail.

It is important to note that one of the likely outcomes of SB 743 implementation will be the closer alignment of project-specific impact analysis and mitigation with the regional growth and program-level management strategies identified through the regional and systems planning process. Through regional and system planning efforts, the existing transportation system is analyzed and future improvements are planned to improve human mobility and system operations based on the regional population growth and mobility needs identified through city and county General Plans, RTPs/MTPs, etc. For example, when District system planners update Transportation Concept Reports (TCR), District System Management Plans (DSMPs), and Corridor System Management Plans (CSMP), coordination with LD-IGR is an opportunity to reflect long range growth plans, development projects, and regional improvement plans identified in regional planning documents. Similarly, when LD-IGR coordinators are reviewing development plans and projects, coordination with regional and system planning can be used to identify ultimate ROW setbacks, access management restrictions, planned frontage improvements, and facility improvements identified in system planning documents that should be factored into a project's site plan and mitigation measures.

Particularly at a project level, we want to avoid disadvantaging the last-in development. Caltrans (as well as other agencies) is sometimes criticized for being a barrier to local infill development by asking for costly studies or mitigation. In order to achieve equity in transportation financing and not place unreasonable burdens on site-specific development projects that advance state goals of smart growth and reduced greenhouse gas emissions, Caltrans should work with Lead Agencies to address impacts to the SHS at the plan level and in fee programs. In general, plans and programs can be an extremely important and efficient mechanism to identify and mitigate issues at a macro level and thus avoid issues with the site-specific project analysis. VMT reduction can have substantial safety benefits, so Districts should emphasize VMT reduction in their comments on lead agency plans or programs.

One way Districts can work with their partners to address mitigation issues is to proactively and directly participate in the development of comprehensive plans (e.g. General Plans, Master Plans, Specific Plans, etc.) and mitigation implementation programs (regional advance mitigation programs, impact fee nexus plans and capital improvement plans, etc.). For instance, a local agency could forecast expected development, identify needed transportation improvements that provides safe access for all modes (like lowering speeds at interchanges, mid-block crossings for pedestrians, cycle tracks for bicyclists, bus bays, added transit capacity, etc.), create cost estimates for those improvements, and create a financing program that development projects pay into to implement those improvements. Then local development projects would simply pay their fair share toward those improvements. There are many examples around the state where local agencies have established fee programs to pay for improvements. One example of a plan and fee program that does comprehensively address transportation needs (including safety and multimodal improvements) based on projected development is the Martell Triangle Plan in Amador County.

This process may also be beneficial for Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) and CEQA streamlining. The District should work with the MPO to address potential safety issues and needed mitigation in the RTP/SCS, in an effort to establish a corresponding fee program is established to pay for those improvements; then local development projects could simply pay fair share toward those improvements based upon their proportional impact and therefore would not need to perform any additional analysis of the SHS during the environmental review process if they met the CEQA streamlining provisions of the RTP/SCS. Please contact the HQ LD-IGR program manager for assistance with individual development projects tiering from programmatic-level CEQA documents.

LD-IGR coordinators should be proactively engaged in the regional and system planning processes and provide comments on the development of General Plans, Specific Plans/Master Plans, RTPs, and SCSs or Alternative Planning Strategies that integrate policies, priorities, and projects identified in TCRs, DSMPs, and CSMPs. Reviewers should advise lead agencies of any regional or system planning implications related to their travel demand models and RTP/SCSs-General Plans. Specifically, coordinators should also ask lead agencies if their regional models and Transportation Impact Mitigation (TIM) fee programs reflect long-range multimodal system improvements. In coordinating these efforts with System Planning, coordinators should be focused on helping lead agencies integrate their plan's or project's mitigation measures with corridor and system level management strategies and planned multimodal improvements on specific facilities. The Districts may also need to work with lead agencies on preserving ROW in some SHS corridors for future improvements and ensure consistency with Caltrans system planning documents.

Similarly, when evaluating proposed mitigation measures, reviewers should analyze the potential effects of induced travel (both VMT and GHG increases) resulting from any roadway capacity expansion improvements intended to reduce congestion. Reviewers should also evaluate the potential for connectivity improvements, such as internal circulation within a development or local roadway extensions-connections, to reduce VMT and GHG emissions by providing more efficient land use and direct routes between locations.

The intention for this integration should be conveyed to cities and counties through on-going communication and specifically requested at the Initial Study stage for growth plans, financing programs, and development projects. In order acquire the necessary data, to provide peer review, and in cases where District staff may need to assist lead agencies in performing these evaluations, LD-IGR coordinators should ask the regions to share their model platforms through a Model Users Agreement (contact HQ for examples) and Caltrans should share the California State Transportation Demand Model. Coordinators should also request copies of any sub-area models that might be developed for Traffic Operations Reports required in the capital project delivery process as these may include additional levels of refinement not available in regional models. Depending on the answers received, coordinators should recommend changes to ensure that planned plan-level and project-specific mitigation measures are consistent with adopted regional and system plans. If needed, coordinators should recommend changes to ensure that local and regional TIM programs include multimodal improvement intended to <u>reduce</u>, rather than <u>induce</u> VMT. Districts should create an electronic archive of the models they ask for and receive from local partners.

Districts should, when appropriate, request that local agencies provide a multimodal transportation demand and impact analysis for plans and programs. The Districts should note that this plan/program level analysis may also be useful for the evaluation of individual development projects that are utilizing CEQA streamlining provisions. Appendix C contains sample language for use in comment letters on plans and programs.

For certain projects and plans, District staff should coordinate with transit operators so information can be jointly shared for the purpose of service coordination and long-range transit planning.

Level of Service (LOS) Related Comments Aimed at Reducing VMT

Some jurisdictions have set LOS thresholds for the SHS either through plans or by ballot measures and will provide this analysis during plan review. LOS can still be used as a transportation analysis tool, however, for CEQA purposes District comments should address VMT.

Until the TAG-TISG guidance is provided, Districts can make technical comments about a lead agency's deficiencies in LOS analysis of the SHS when a plan is inconsistent with smart growth principles ("sprawl"). In this circumstance, the District can also point out LOS deficiencies on the SHS and request mitigation that minimizes new VMT on the SHS. Please note that the District should suggest roadway capacity improvements sparingly. Comments should focus on operational impacts and should be consistent with complete streets principles. Particularly for Project Types 3-5, Districts should assist the lead agency in identifying appropriate transportation demand reduction measures by listing specific programs (see Appendix D).

Appendix C: Recommended Language for LD-IGR Comment Letters

The template language below is provided for District LD-IGR coordinators to adapt as needed in order to reflect the key terms and general guidance outlined above. Please note that LD-IGR letters should be tailored to reflect the context surrounding the different types of plans and projects under review, what stage they are at in the review and approval process, and relevant background information such their scope and relationship to the multimodal transportation system.

All letters should contain introductory language that references the Department's new vision, mission, and goals, as well as versions of the general language below where appropriate in the standard LD-IGR letter format.

A. Caltrans New Mission

"Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the project referenced above. The mission of Caltrans is to provide a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability. The Local Development-Intergovernmental Review (LD-IGR) Program reviews land use projects and plans through the lenses of our mission and state planning priorities of infill, conservation, and travel-efficient development. To ensure a safe and efficient transportation system, we encourage early consultation and coordination with local jurisdictions and project proponents on all development projects that utilize the multimodal transportation network. We provide these comments consistent with the State's smart mobility goals that support a vibrant economy, and build communities, not sprawl. The following comments are based on the (insert type of document)*."*

"Caltrans new mission supports safety and sustainability in its call to "provide a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability". Caltrans Sustainability, Livability, and Economy goal states we will "make long-lasting, smart mobility decisions that improve the environment, support a vibrant economy, and build communities, not sprawl."

"Caltrans supports six smart mobility principles of location efficiency, reliable mobility, health and safety, environmental stewardship, social equity, and robust economy. The California Transportation Plan 2040 further encourages infill development and conservation opportunities as a way to reduce urban sprawl, allow for better transit and to be consistent with SB 375."

"The following comments are based on the (insert type of document)*. We provide these comments consistent with the State's smart mobility goals that support a vibrant economy and sustainable communities."*

B. Plan Development, Project Design and Mitigation Strategies

*"In (*developing this plan/designing this project*) we encourage the (*City/County/Developer*) to integrate transportation and land use in a way that reduces Vehicle Miles Traveled (VMT) and Greenhouse Gas (GHG) emissions by facilitating the provision of more proximate goods and services to shorten trip lengths, and achieve a high level of non-motorized travel and transit use. As such, we encourage the (*City/County/Developer*) evaluate the potential of Transportation Demand Management (TDM) strategies and Intelligent Transportation System (ITS) applications in order to better manage the transportation network, as well as transit service and bicycle or pedestrian connectivity improvements. The Department also seeks to reduce serious injuries and fatalities, as well as provide equitable mobility options for people*

*who are economically, socially, or physically disadvantaged. Therefore, we ask the (*City/County/Developer*) to evaluate the (*plan/project site*) for access problems, VMT and service needs that may need to be addressed.*

*For example, we recommend that the (*City/County/Developer*) analyze the following issues related to the (*plan/project*):"* (identify the scope of what we are asking for)

C. Multimodal Transportation Impact Study

Well planned infill projects which are located close to transit, bike and pedestrian facilities (see Appendix A: Project Type 1) which also have proximity benefits to employment centers, services and goods – will reduce travel demand on the entire transportation system and will therefore require significantly less review and mitigation than rural fringe projects (Project Type 5) which generate proportionately higher number of trips and vehicle miles traveled.

Districts should coordinate with SB 743 Program Implementation Manager when developing letters for Type 1 land use projects.

Below is suggested language for consideration and is generally targeted for Type 4 and 5 projects from Appendix A and some plans.

> *"The environmental document should include an analysis of the multimodal travel demand expected from the proposed project. This analysis should also identify potentially significant adverse impacts from such demands and avoidance, minimization, and mitigation measures needed to address them.*
>
> *Early collaboration, such as sharing the analysis for review and comment prior to the environmental document, leads to better outcomes for all stakeholders.*
>
> *Given that Caltrans current guidelines are in the process of being updated, a transportation impact study scoping meeting with District staff could be used to discuss the most appropriate methodology for this analysis. At a minimum, the analysis should provide the following:*
>
> 1. *Vicinity maps, regional location map, and a site plan clearly showing project access in relation to nearby roadways and key destinations. Ingress and egress for all project components should be clearly identified. Clearly identify the State right-of-way (ROW). Project driveways, the State Highway System and local roads, intersections and interchanges, pedestrian and bicycle routes, car/bike parking, and transit routes and facilities should be mapped.*
> 2. *Project-related VMT should be calculated factoring in per capita use of transit, rideshare or active transportation modes and VMT reduction factors. The assumptions and methodologies used to develop this information should be detailed in the study, should utilize the latest place based research, and should be supported with appropriate documentation. Mitigation for any roadway section or intersection with increasing VMT should be identified and mitigated in a manner that does not further raise VMT.*
> 3. *Schematic illustrations of walking, biking and auto traffic conditions at the project site and study area roadways, trip distribution percentages and volumes as well as intersection geometrics, i.e., lane configurations, for AM and PM peak periods. Operational concerns for*

all road users that may increase the potential for future collisions should be identified and fully mitigated in a manner that does not further raise VMT.

D. Encroachment Permits

*"Please be advised that any ingress-egress, work (e.g. construction, vegetation management, drainage improvement, etc.), or traffic control that is conducted within or adjacent to or encroaches upon the State Right of Way (ROW) requires an encroachment permit that is issued by Caltrans. Where construction related traffic restrictions and detour affect State highways, a Transportation Management Plan or construction traffic impact study may be required. Traffic-related mitigation measures should be incorporated into the construction plans prior to the encroachment permit process. To apply, a completed encroachment permit application, environmental documentation, and six (6) sets of plans clearly indicating State ROW as well as any applicable specifications, calculations, maps, etc. must be submitted to the following address: (*insert District Permits contact and address*). It is important to note that, in order to uphold the Department's statutory responsibility to protect the safety of the traveling public, if this information is not adequately provided, then a permit will not be issued for said encroachments. See the following website for more information:*
http://www.dot.ca.gov/hq/traffops/developserv/permits"

A note about encroachment permits: compliance with CEQA must be completely addressed before an encroachment permit application is submitted to the District Encroachment Permits Office. Before an encroachment permit application package can be deemed as complete, all applicable Federal and State statutory requirements including but not limited to Storm Water, Americans with Disabilities Act (ADA), and CEQA must be complied with. Therefore it is critical that all issues have been ironed out prior to the applicant submitting an application package to the District Encroachment Permits Office. This is also critical to provide documentation for District Encroachment Permit Engineers' consideration when issuing subsequent encroachments or when processing developer-built mitigation measures within State right-of-way. Comment letters should remind the reader that such analysis is required during the permit review process and a development's needed improvements, even opening day access, may be delayed if adequate detail is not provided during the environmental process upfront. This should be explained in such a way to convey that Caltrans is also trying to help save time and money for all those concerned.

E. Smart Growth Principles

"Support for infill and smart growth development is found in our new Mission, Vision, and Goals, the California Transportation Plan 2040, Smart Mobility Framework, Strategic Management Plan, and related guidance documents.

*Based on its place-type, VMT, design characteristics, potential impacts, and proposed mitigations, the Department feels that this (*plan/project*) (*is/is not*) representative of the smart growth principles and* (assists/does not assist) *in meeting the state's goals."*

Note: If the plan/project is *not* representative of smart growth principles, assist the lead agency by recommending specific changes that could help it move in a different direction. This should be done at the earliest point in the planning process possible.

F. Transportation Impact Fees

*"We request that an analysis of the (*plans/project's*) impacts and mitigation include information regarding the (*city/county's*) local and/or regional impact fee program. The analysis should identify if those*

programs include improvements to pedestrian, bicycle and transit infrastructure or that could be considered representative of the project's likely TDM mitigation measures. If no such fee exists, we would appreciate exploring with you the establishment of (local or regional) *VMT-based transportation impact fee programs."*

Two jurisdictions are currently using VMT-based thresholds: City of Pasadena, and City of San Francisco. City of Pasadena is updating a nexus study for its fee program that includes bicycle, pedestrian, and VMT metrics. City of San Francisco legislated a fee program based upon square footage of new development.

G. Responsiveness of the Lead Agency to Caltrans Comments

Generally, the second introductory paragraph of comment letters should reiterate the project description, reference previous comment letters, summarize the results of interagency coordination and outcome of previous comments, clarify where the project is currently at in the process, and identify key decision points.

Specifically, it is important to compare issues raised in the NOP stage with those addressed in the Draft TIS and EIR, as well as those between the Draft and Final EIRs, so that decision makers and the public know what concerns were addressed/resolved or remain a concern. If all of Caltrans concerns have been resolved, that would be valuable information for the public and decision makers to know. A brief summary paragraph should be adequate to summarize relevant points related to key concerns and convey a conclusion to the reader.

In the event that substantive concerns were brought up in the NOP stage and commented on in the Draft TIS-EIR stage, but not sufficiently resolved by the Final EIR stage, then IGR coordinators should consider making a statement related to adequacy of the FEIR based on either CEQA's public disclosure or reasonable argument provisions and recommend to the lead agency how it could be corrected prior to certification. Any comments on adequacy of an FEIR should consider the policies outlined earlier in this document.

No template language is provided because this information is specific to the nature and history of each plan/project and District staff would be best suited to summarize the relevant issues for the public record.

Appendix D: Additional Technical Considerations

Note that any considerations below must fall into the policy framework of the main guidance.

A. Transportation Demand Management

Transportation Demand Management is a set of tools that increases the efficiency of the transportation system by providing options for users other than driving alone, or by shifting travel away from peak periods. In direct support of SB 743, reviewers should always evaluate opportunities for TDM measures that could be deployed to reduce VMT and increase walking, biking, and transit use. Evidence of VMT reduction benefits resulting from the project's design, siting, and TDM mitigation measures should provide a clear nexus in the VMT analysis. This analysis should be place-based and utilize the latest trip-generation research available to describe influencing factors such as mode-shift due to transit availability and internal capture attributable to mixed use developments (see the Caltrans research on new trip generation rates for infill development). District and Headquarters staff can help recommend emerging methodologies that could be used to better estimate mixed use infill trip generation rates or quantify VMT reduction from TDM mitigation measures. Similarly, rather than making a vague reference that a lead agency should use VMT-based impact fees to mitigate the effects of its cumulative development, provide sample language for an actual Condition of Approval or Mitigation Measure to that effect and offer to participate in its creation. If there were questions about the project or assumptions about the analysis that were resolved or agreed to, comment letters should reflect those outcomes for the record and state that Caltrans' concerns were adequately addressed.

Reviewers should request that Lead Agencies include in their transportation impact studies (TIS) a project vicinity map and site-design layout plan that identifies all of the priority pedestrian and bicycle routes and transit routes/stops serving the site (based on relevant bike-pedestrian and transit service-development plans). It would be helpful for the lead agency if reviewers included a brief summary of what the District thinks the potential impacts of concern are likely to be based on the project and its location. This will help them focus the emphasis of their TIS. One repository for TDM strategies is found in the CAPCOA Quantifying Greenhouse Gas Mitigation Measures document (which focuses also on VMT). Also consider the following as a non-exhaustive list of potential TDM strategies:

1. Parking Management:
   a) In urban settings, recommend eliminating parking where transit is adjacent, significantly reduce parking where transit is within ¼ mile. See AB 744 (2015), which identifies maximum parking ratios for affordable housing projects located within one-half mile of a major transit stop, and affordable housing projects outside of those locations.
   b) In rural resort and special event settings, ensure an adequate balance between on-site parking and availability of off-site parking coupled with shuttle service for peak demand dates/times.
   c) Raise the cost of parking in general parking zones.
   d) Give preferential parking for carpools, vanpools, carshare, and rideshare programs.
   e) Create park and ride lots adjacent to transit commuter facilities or near HOV entrances.
   f) Establish maximum parking units per dwelling unit equivalent (d.u.e.) and thousand square foot (k.s.f.) ratios.
   g) Provide preferred and/or restricted parking stalls for Transportation Network Companies at select locations.

2. <u>Additional non-auto centric measures</u>

a) Add or extend transit routes or increase transit frequency.
b) Issue transit passes or subsidies to employees.
c) Issue housing-based transit passes.
d) Promote telecommuting and flexible work schedules.
e) Provide shelter and lighting for pedestrians as well as quality street furniture.
f) Compliment bicycle routes with secure bicycle parking facilities and showers at strategic locations.
g) Establish bike share programs or systems.
h) Establish safe routes to school programs (for example: a walking school bus program)
i) Complete sidewalk systems and mixed-use pathways for non-motorized travel.
j) Implement bus rapid transit (BRT) systems along key corridors.
k) Encourage light rail stations and complimentary adjacent TOD.
l) Develop toll-funded TOD redevelopment incentive programs for high density residential corridors.
m) Integrate solar-power shade structures and electric vehicle charging stations with rideshare parking lots and transit-rail station planning.

It may also be useful for Districts to provide lead agencies with links to local/regional TDM program resources that serve those jurisdictions.

B. Safety Considerations

Generally, Districts should have minimal comments (or no comments) on Project Type 1-2 (Appendix A) because well-planned, well-located infill projects are presumed to have multiple community benefits that include increased access and safety for all users. Urban infill projects also tend to increase pedestrian and bicycling travel, which promotes livable and healthy communities. In cases where the Districts have specific substantial evidence that safety concerns exist, the Districts should work with the Lead Agency to identify the appropriate analysis needed, ways it can be provided, and how the safety concerns can be addressed. Appropriate multimodal mitigation can be suggested that advances safety for bicyclists, pedestrians, transit users, and motorists. Districts should coordinate with the SB 743 Program Implementation Manager when developing letters for Type 1 land use projects.

Districts should analyze how increased VMT from either planned development (particularly project types 3-5) or proposed infrastructure investments may cause traffic operational dynamics that exacerbate modal conflict in the transportation system. For example, increased traffic volumes from high-VMT development and/or high speeds can exacerbate safety concerns related to inadequate acceleration-deceleration lengths, sight-distance, and reaction-time that may affect adjacent pedestrian facilities. Similarly, increasing traffic volumes at uncontrolled turn-movement points or in locations without adequate modal separation/refuge can increase the vulnerability for all modes, especially pedestrians and bicyclists.

Highway intersections and interchanges are often a challenge for motorists, bicyclists, and pedestrians. This is due to higher volumes, variable speeds, complex or unique designs, numerous conflict points, a mix of vehicle types, and changes in land uses. Care must be employed to assure all system users perceive the design, operating conditions, and speed limits allow them to act and react in a safe manner.

This transition zone between free flow and metered flow is considered a “critical transition area”. Traffic design speeds near intersections and interchanges should be appropriate to the context. Where pedestrians and bicyclists are present, design speeds should be slower to help ensure the safety of all road users. For more guidance on intersections and interchanges, please see Caltrans Complete Intersections: A Guide to Reconstructing Intersections and Interchanges for Bicyclists and Pedestrians, 2010. Page 15 of the document states:

> *Any reduction in vehicle speed benefits pedestrian and bicyclist safety, since there is a direct link between impact speeds and the likelihood of fatality. Methods to reduce pedestrian and bicyclist exposure to vehicles improve safety by lessening the time that the user is in the likely path of a motor vehicle. These methods include the construction of physically separated facilities such as sidewalks, raised medians, refuge islands, and off-road paths and trails, or reductions in crossing distances through roadway narrowing.*
>
> *Pedestrian and bicyclist warning signage, flashing beacons, crosswalks, and other signage and striping should be used to indicate to motorists that they should expect to see and yield to pedestrians and bicyclists. Formal information from traffic control devices should be reinforced by informal sources of information such as lane widths, landscaping, street furniture, and other road design features.*

Other documents that should be referenced include the Caltrans Class IV Bikeway (Separated Bikeways/Cycletracks) Guidance, 2015 and the Highway Design Manual.

All discussions or comments should keep in mind Caltrans Strategic Management Plan goals, including to increase walking, biking, and transit use, and reduce per capita vehicle miles traveled. Suggested Operational Impact improvements must consider the most vulnerable roadway users (i.e., children and elderly pedestrians, children bicyclists, etc.).

Caltrans staff should be ready to provide a list of potential multimodal mitigation measures for specific concerns that might be raised. Listed below are a few resources to reference when making Operational Impact determinations for development projects and plans:

The American Association of State Highway and Transportation Officials (AASHTO) Highway Safety Manual (2010) can be found here.

The Caltrans Highway Design Manual (HDM) can be found at:
http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm

Topics contained within the California Manual on Uniform Traffic Control Devices (California MUTCD), such as pedestrian hybrid beacons, can be found at:
http://www.dot.ca.gov/hq/traffops/engineering/mutcd/ca_mutcd2014.htm

The Caltrans-endorsed National Association of City Transportation Officials (NACTO) guides on Urban Street Design and Urban Bikeways provide best practices and standards for pedestrian, bicycle, and transit features. The guides can be found in the Caltrans Library. More information about the guides can be found here: http://nacto.org/

More Caltrans resources related to Complete Streets and Smart Mobility can be found at: http://www.dot.ca.gov/hq/tpp/offices/ocp/smbr.html

C. Access Management

Access management is a particular concern at the interface between vehicular and bicycle-pedestrian use of roadways, shoulders, bike lanes, and sidewalks and the ingress-egress points for land use destinations. Avoiding operational impacts that may increase the likelihood of collisions is an integral and important part of multimodal access management. Significant speed differentials and travel volumes can result in a need for access management mitigation measures. These include efforts to limit modal conflicts and increase accessibility for vulnerable road users, reduce speed differentials between vehicles, modulate flow volumes for specific directions, control specific turning movements, and provide adequate stopping sight distance and decision site distance. These issues are amplified where large buses or trucks are involved. Where design features are recommended to mitigate pedestrian and/or bicycle safety concerns, various issues should be considered such as topography, ADA accessibility, maintenance, and seasonal factors (e.g. snow removal and/or storage, etc.). Access management efforts must also take into consideration of other state goals such as designing for motor vehicle speeds appropriate to the place setting, protection of vulnerable road users, reduction in motor vehicle travel, and adding features that increase driver attention.

Reviewers may also highlight the benefits of roundabouts because they facilitate road diets, produce narrower pedestrian crossing widths compared to signalized and stop-controlled intersections, and produce lower speeds and speed differential at and near pedestrian and bike conflict areas. Roundabouts may not be appropriate at some intersection contexts and locations. See the Intersection Control Evaluation guidance for more information.

Appendix C

Draft CCTA VMT Methodology

Technical Memorandum

Date: July 9, 2020

To: Matt Kelly, CCTA

From: Julie Morgan, Fehr & Peers
David Early and Carey Stone, PlaceWorks

Subject: VMT Analysis Methodology for Land Use Projects in Contra Costa, GMTF Review Draft

WC19-3664

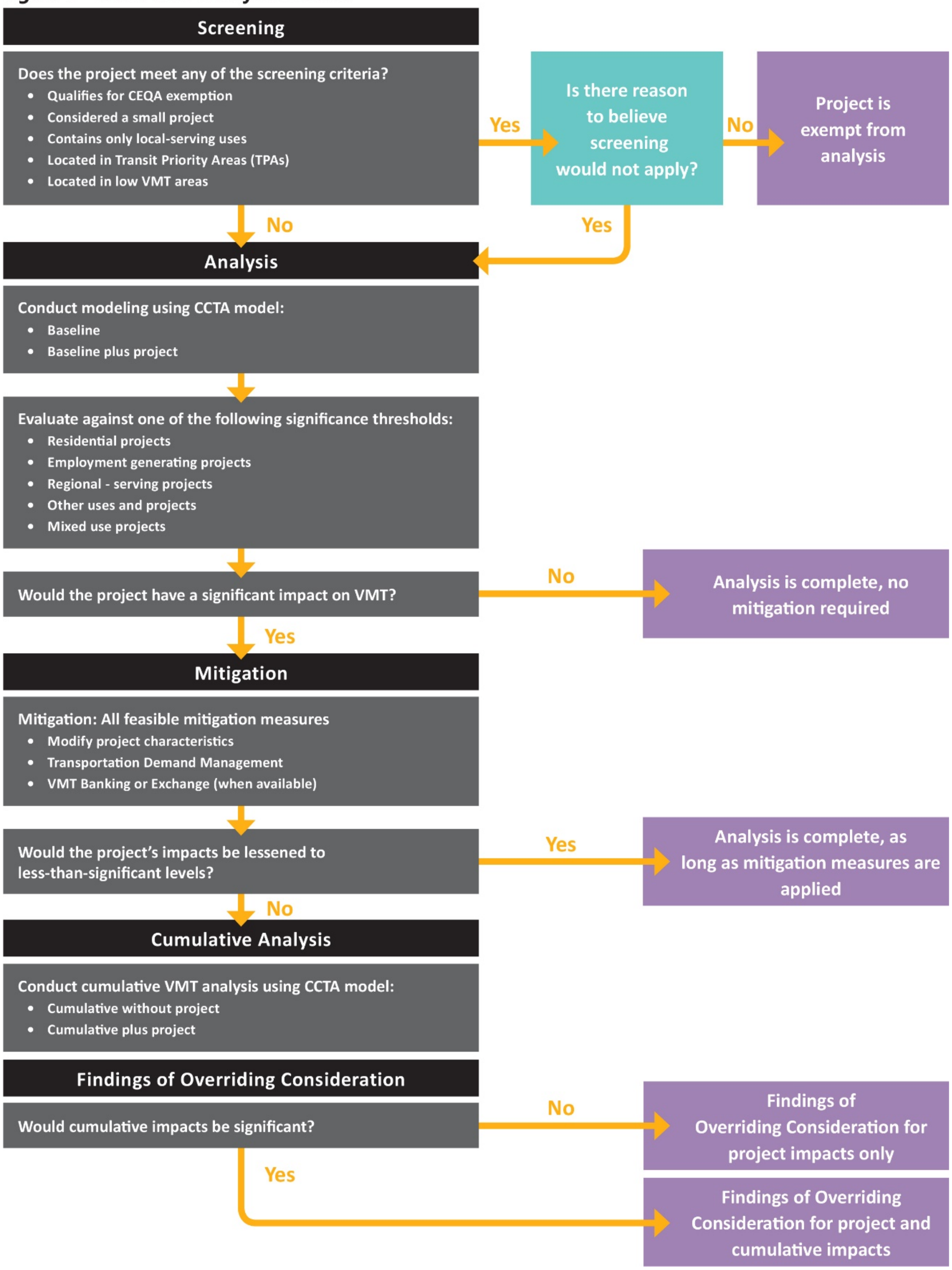
This memorandum describes CCTA's recommended methodology for compliance with the requirements of Senate Bill 743 (SB 743) regarding analysis of vehicle miles traveled (VMT) for land use projects that are subject to the California Environmental Quality Act (CEQA). This guidance is intended to assist lead agencies in their CEQA VMT analysis consistent with new requirements of the CCTA Growth Management Program (GMP). The lead agency[1] will determine which projects are subject to CEQA and will oversee the VMT analysis. Figure 1 illustrates the CCTA CEQA VMT analysis process described in Sections 3, 4, and 5.

Compliance with the requirements of this document is mandatory as part of fulfillment of local jurisdictions' requirements under the CCTA GMP. Jurisdictions will be considered to be in compliance so long as they follow the procedures outlined here, regardless of whether these procedures result in exemption of a project from VMT analysis, a finding that a project would have no significant VMT impact, mitigation of a project to achieve less-than-significant levels of impact, or findings of significant unavoidable impacts accompanied by findings of overriding consideration.

Local jurisdictions may choose to apply methods and thresholds that are more stringent than those outlined in this document, and would still be considered to be in compliance with CCTA GMP requirements. Lead agencies have the ultimate responsibility for determining the most appropriate way to comply with CEQA when conducting environmental review of their projects;

[1] As explained in the definitions, Lead agency refers to the 19 incorporated jurisdictions in Contra Costa County, the County of Contra Costa, or any other agency overseeing and certifying a CEQA document.

Figure 1 – CCTA VMT Analysis Process



nothing in this memorandum should be construed as legal advice nor should it take the place of consultation with the lead agency's CEQA experts.

The methodology and thresholds contained in this memorandum, including the Target VMT Reduction of 85% of baseline levels (which is the same as 15% below baseline levels), are based largely on guidance from the Governor's Office of Planning and Research (OPR) entitled *Technical Advisory on Evaluating Transportation Impacts in CEQA* (also referred to as the Technical Advisory), dated December 2018. CCTA staff may amend this methodology, including the Target VMT Reduction, if there is new guidance from OPR or other relevant agencies and/or if new substantial evidence indicates that a reduction of more than 15% of existing baseline is needed in order to achieve the State's greenhouse gas reduction goals. Analysts implementing this methodology for individual project assessments should clearly document the assumptions, procedures, and methods used to reach conclusions about the VMT analysis.

The methods outlined in this memorandum primarily rely on the CCTA travel demand forecasting model (referred to in this document as the "CCTA Model" and sometimes also referred to as "The Countywide Model") to generate estimates of trip length and VMT for different land use types in different locations. Simple single-use projects may not require a new application of the CCTA model and may only need to refer to maps and tables of model outputs available from CCTA. Most projects will require the application of the model to represent the proposed a project's land use and location characteristics and to prepare a robust analysis of a project's effect on VMT.

The guidance contained in this memorandum is intended to apply to the VMT evaluation of land use projects. Evaluating the VMT effects of land use plans should be directed by each lead agency, following the same concepts and principles outlined in this memorandum.

The evaluation of VMT impacts is also required as part of the CEQA review of transportation projects, which is not addressed in this memorandum. Each lead agency should develop methods and thresholds to apply to the environmental review of transportation projects for which that agency is responsible. The OPR Technical Advisory contains guidance (see pages 19-25 of the OPR Technical Advisory) on conducting environmental analysis of transportation projects, including a list of project types that are considered to be unlikely to lead to substantial or measurable increases in VMT. Another source of guidance for lead agencies will come from Caltrans, which is in the process of developing guidance to address the evaluation of VMT impacts of projects on the State Highway System (see *Draft Transportation Analysis Framework: Induced Travel Analysis*, dated March 2020, and *Draft Transportation Impacts Analysis under CEQA for Projects on the State Highway System*, dated March 2020).

1. Definitions

Analyst refers to the person conducting the VMT impact analysis, usually a lead agency staff person or a transportation or CEQA consultant.

Baseline year. The base year of the CCTA model that is used to represent existing conditions. Note that the model is not updated every year, so there may be a discrepancy between the base year of the model and the current year. CCTA may provide VMT metrics that are interpolated between different model years in order to match the current year more closely. In all cases, CEQA requires using the best data that is currently available.

CCTA Model. CCTA maintains a travel demand model for use in producing forecasts of future transportation system usage. The model is a four-step, trip-based model that encompasses the entire nine-county Bay Area region, with additional zonal and network detail within Contra Costa County. CCTA maintains a detailed database of land use and demographic data that is used in the model, based on census-tract-level forecasts prepared by the Association of Bay Area Governments (ABAG). Analysts should refer to Chapter 5 of the CCTA Technical Procedures for a complete description of the model and how to acquire and apply it. Analysts may also contact CCTA for additional guidance. A new script has recently been developed for the CCTA Model in order to extract the VMT metrics described in this document. In addition, adjustments have recently been made to account for the portion of trip length that occurs outside of the nine-county Bay Area region that is covered by the CCTA model. These adjustments were needed to comply with the OPR guidance to account for the full lengths of all trips and not truncate trips at the model boundary. Similar adjustments should continue to be applied whenever the CCTA model is updated or when other alternative methods are used to produce VMT estimates, to ensure that the full length of each trip is captured.

CEQA. The California Environmental Quality Act. This statute requires identification of any significant environmental impacts due to certain state or local actions including approval of new development or infrastructure projects. The process of identifying these impacts is typically referred to as the environmental review process.

Employment Generating Uses/Projects. Office, industrial, logistics or other land uses where most of the activity at the site is related to employment functions.[2]

Home-based VMT. VMT for trips that begin or end at a residence.

[2] Analysis of non-employee trips (such as those made by trucks) is not required for Employment-Based Uses since it is assumed that these trips are either 1) incidental compared to employee trips and/or 2) constitute trips to and from way points along a trip from a product's ultimate origin to its ultimate destination.

Home-work VMT. VMT associated with commute trips between a residence and an employment-generating use, also referred to as home-based-work trips.

Horizon year. The planning horizon year used for cumulative analysis. Currently, the horizon year of the CCTA model is 2040.

Lead Agency. The 19 incorporated Contra Costa jurisdictions in Contra Cost County, the County of Contra Costa, or another government agency responsible for preparing and certifying a given CEQA document.

Level of Service (LOS). A metric that assigns a letter grade to transportation network performance. The most common application of LOS in jurisdictions has been to measure the average amount of delay experienced by vehicle drivers along a roadway segment or at an intersection during the most congested time of day and to assign a rating that ranges from LOS A (fewer than 10 seconds of delay) to LOS F (more than 80 seconds of delay). Per the requirements of SB 743, LOS and other measures of vehicle delay are no longer to be used in determining significant impacts under CEQA.

Local-Serving Uses/Projects. Land uses that are expected to draw users from a local area, typically no more than a 2- to 3-mile radius. The definition of local-serving uses may vary by jurisdiction. These uses may generally include local-serving public facilities such as a branch library, a police or fire station, neighborhood-based schools, and local-serving retail businesses such as grocery stores, coffee shops or dry cleaners.

Low VMT Areas. Jurisdictions and unincorporated portions of the subregions that have existing VMT that is 85% or less of the countywide average (for home-based VMT) or of the Bay Area region-wide average (for work-based VMT). A list of these jurisdictions and areas is available on the CCTA website. The Analyst should confirm that these maps are up to date and represent the latest available information.

Mixed Use Projects/Uses: Projects that consist of a mix of uses otherwise described in this document.

Other Uses/Other Projects: Uses and projects which do not qualify as Residential, Employment-Generating, Local-Serving, or Regional-Serving (all of which are defined in this document).

Physical Design Measures. VMT reduction strategies that involve changes to the built environment. Examples include changes to the density or mixture of land uses, or the installation of new pedestrian or bicycle facilities.

Regional-Serving Uses/Projects. Land uses that are expected to draw users from a region that is larger than that for "local-serving uses," meaning a radius that is typically up to 3 miles. The definition of regional-serving uses may vary by jurisdiction. These uses may generally include regional-serving public facilities such as a regional library or museum, private schools and colleges, hospitals, movie theaters and other entertainment, and regional retailers such as furniture stores, shopping malls and big box retailers.

Residential Uses/Projects: Uses and projects consisting solely of residential units such as single-family and multi-family units.

Target VMT Reduction. The level of VMT reduction defined by the lead agency as being necessary to avoid a significant VMT impact. Consistent with OPR recommendations, the target reduction in this document is being set at 15% below the existing VMT (equivalent to 85% of existing VMT).

Total VMT. All of the VMT from all types of vehicles and for all trip purposes.

Traffic Analysis Zone (TAZ). A geographic polygon somewhat similar to a Census block group that is used in a travel model to represent an area of relatively homogenous travel behavior.

Transit Priority Area (TPA). An area of close proximity to a significant transit mode, defined as a one-half mile area around an existing major transit stop or an existing stop along a high-quality transit corridor. Public Resources Code, § 21064.3 defines major transit stop as a site containing an existing rail transit station, a ferry terminal served by either a bus or rail transit service, or the intersection of two or more major bus routes with a frequency of 15 minutes or less during the morning and afternoon peak commute periods. Public Resources Code, § 21155 defines a 'high-quality transit corridor' as a corridor with fixed route bus service with service intervals no longer than 15 minutes during peak commute hours. Locations of the Transit Priority Areas (TPAs) in Contra Costa County can be found in maps available on the CCTA website. [3] The Analyst should confirm these maps are up to date and represent the latest available information.

Transportation Demand Management (TDM). Strategies that are intended to reduce vehicular travel through programs and projects that maximizes traveler choices through information, encouragement and incentives geared toward modifying travel behavior and choices.

Truck Trips. Trips made by heavy vehicles. Per the OPR recommendations and their interpretation of Public Resources Code, §15064.3, VMT analysis for transportation impact purposes can focus solely on automobile travel and can exclude truck trips. Truck trips are included in the analysis of other environmental topic areas, such as air quality, noise, and greenhouse gas.

Vehicle Miles Traveled (VMT). A metric that captures the total amount of vehicular travel through measuring the number of vehicle trips generated and the length or distance of those trips. For transportation impact analysis purposes, VMT is usually measured on a typical weekday,

[3] https://ccta1.maps.arcgis.com/apps/webappviewer/index.html?id=4135020bb272458f824152fedb78a088

and can be expressed in several ways, such as total VMT, total VMT per service population (residents plus employees), home-based VMT per resident, and home-based work VMT per employee.

VMT Reduction Strategies: Strategies intended to reduce VMT, including TDM and physical design measures.

VMT Study Area. A geographic area over which the project's effect on total VMT will be evaluated. The study area should be defined such that it captures the reasonably foreseeable VMT changes associated with the project, but not so large that the effects of the project get swamped by broader economic and land use changes. In many instances, a city boundary would be a reasonable study area; in cases where a project is located at the edge of a city or in an unincorporated area, or if the project is very large such that it is likely to affect travel patterns in neighboring cities, then a subregion of the County or even the entire County might be a more appropriate study area.

2. Project Screening

There are five screening criteria that lead agencies can apply to screen projects out of conducting project-level VMT analysis. Even if a project satisfies one or more of the screening criteria, lead agencies may still require a VMT analysis if there is evidence that the project has characteristics that might lead to a significant amount of VMT.

2.1: CEQA Exemption. Any project that is exempt from CEQA is not required to conduct a VMT analysis.

2.2: Small Projects. Small projects can be presumed to cause a less-than-significant VMT impact. Small projects are defined as having 10,000 square feet or less of non-residential space or 20 residential units or less, or otherwise generating less than 836 VMT per day.[4]

2.3: Local-Serving Uses. Projects that consist of Local-Serving Uses can generally be presumed to have a less-than-significant impact absent substantial evidence to the contrary, since these

[4] This threshold ties directly to the OPR Technical Advisory which notes that CEQA provides a categorical exemption for existing facilities, including additions to existing structures of up to 10,000 square feet, so long as the project is in an area where public infrastructure is available to allow for maximum planned development and the project is not in an environmentally sensitive area. (CEQA Guidelines, § 15301, subd. (e)(2).) Using statewide average data from the California Statewide Household Travel Survey (CHTS), the amount of daily VMT associated with 10,000 square feet of non-residential space is 836 VMT. Also using statewide average CHTS data, this level of VMT is associated with 20 housing units. Therefore, absent substantial evidence otherwise, it is reasonable to conclude that the addition of 20 housing units or 10,000 square feet of non-residential space could be considered not to lead to a significant impact.

types of projects will primarily draw users and customers from a relatively small geographic area that will lead to short-distance trips and trips that are linked to other destinations.

2.4: Projects Located in Transit Priority Areas (TPAs). Projects located within a TPA can be presumed to have a less-than-significant impact absent substantial evidence to the contrary. This exemption would not apply if the project:

1. Has a Floor Area Ratio (FAR) of less than 0.75;
2. Includes more parking for use by residents, customers, or employees than required by the lead agency (if the agency allows but does not require the project to supply a certain amount of parking);
3. Is inconsistent with the applicable Sustainable Communities Strategy (SCS) (as determined by the lead agency, with input from the Metropolitan Transportation Commission (MTC)); or
4. Results in a net reduction in multi-family housing units.

2.5: Projects Located in Low VMT Areas. Residential and employment-generating projects located within a low VMT-generating area can be presumed to have a less-than-significant impact absent substantial evidence to the contrary.

A low VMT area is defined as follows:

- For housing projects: Cities and unincorporated portions within CCTA's five subregions[5] that have existing home-based VMT per capita that is 85% or less of the existing County-wide average.

- For employment-generating projects: Cities and unincorporated portions of CCTA's five subregions that have existing home-work VMT per worker that is 85% or less of the existing regional average.

There is no definition of a low VMT area for Regional-Serving and Other Projects, since these projects always require a VMT Analysis as described in Section 3 of this memo (unless they are screened out under Criteria 2.1 through 2.4).

[5] The five CCTA subregions include SWAT Lamorinda (Lafayette, Moraga and Orinda), SWAT Tri-Valley (Danville, San Ramon, and the Tri-Valley area of Alameda County (note that Alameda County jurisdictions are not subject to the CCTA GMP requirements and thus are not subject to the VMT methods outlined in this document)), TRANSPAC (Clayton, Concord, Martinez, Pleasant Hill, and Walnut Creek), TRANSPLAN (Antioch, Brentwood, Oakley, and Pittsburg), and WCCTAC (El Cerrito, Hercules, Pinole, Richmond, and San Pablo).

Mixed-use projects may qualify for the use of this screening criterion if they include only housing, employment-generating uses and local-serving uses, and can reasonably be expected to generate VMT per resident and/or per worker that is similar to the existing land uses in the low VMT area.

3. Projects Requiring VMT Analysis

A project not excluded from VMT analysis through the screening process described above shall be subject to a VMT analysis to determine if it has a significant VMT impact.

Analysis Scenarios

The following scenarios should be addressed in the VMT analysis:

- Baseline conditions: The most current version of the baseline CCTA model should be used to determine the baseline VMT for the TAZ in which the project is to occur. This information is available from the VMT screening maps on the CCTA website.
- Baseline plus project: If the project is a simple, single-use project that is very similar to other developments that already exist in that TAZ, then the analyst may conclude that the project generated home-based VMT per capita or the home-work VMT per worker will be the same as the existing VMT per capita or per worker in that TAZ; in that instance, a separate Baseline plus project model run would not be required. However, if the project contains one or more uses, or a mix of uses, the does not exist in the TAZ, then a model run is required. In this case, the proposed land use(s) should be added to the baseline condition for the relevant TAZ, or a separate TAZ should be created in the CCTA model to contain the project land uses. A full baseline model run should then be performed. The analyst should review the model output to confirm reasonableness of the results and to check production and attraction balancing to ensure that the project's effect is being captured.

VMT Metrics and Significance Thresholds

The output from each model run will include total VMT per service population, home-based VMT per capita, and home-work VMT per worker, which should be analyzed as described below. In addition, to calculate the total study area VMT, the analyst would define a VMT study area and the VMT occurring on all network links inside that study area should be summed.

The following describes the specific VMT metrics and significance thresholds that should be used in evaluating different project types: [6]

Residential Projects should use the home-based VMT per capita metric to evaluate their project generated VMT. The project generated home-based VMT per resident constitutes a significant impact if it is higher than 85% of the home-based VMT per resident in the subject municipality or unincorporated CCTA subregion (for areas outside of municipalities) or 85% of the existing County-wide average home-based VMT per resident, whichever is less stringent.

Employment-Generating Projects should use the home-work VMT per worker metric for their project generated VMT estimates. The project generated home-work VMT per worker constitutes a significant impact if it is higher than 85% of the home-work VMT per worker in the subject municipality or unincorporated CCTA subregion (for areas outside of municipalities) or 85% of the existing Bay Area region-wide average home-work VMT per worker, , whichever is less stringent.

Regional-Serving Projects should use the metric of total study area VMT and should define a VMT study area over which to evaluate that metric. The project generated VMT constitutes a significant impact if the baseline project generated total VMT per service population is higher than 85% of the existing countywide average total VMT per service population.

Other Uses and Projects need to be analyzed using a methodology developed by the lead agency specifically for the project, prepared and documented based on available data and taking into account the specific methodologies and thresholds identified in this document.

Mixed-Use Projects may be analyzed using a combination of techniques described above, as follows:

- Mixed use projects that contain a combination of housing, employment-generating and regional-serving uses may choose to evaluate each use separately using the metrics and significance thresholds described above for those uses.
- Mixed use projects that include a local-serving component may ignore that component for analysis purposes, and analyze only the remaining uses. Note that it may be more beneficial to the project to conduct a full analysis that takes account of on-site local-

[6] The metrics of "home-based VMT per capita" and "home-work VMT per worker" are taken from the production-attraction trip matrices in the CCTA model, which is a stage of the modeling process in which trips are still categorized by purpose. This stage of the modeling process does not yet include truck trips so these VMT metrics do not include the VMT associated with trucks. This is consistent with the guidance from the OPR Technical Advisory, in which it interprets the Section 15064.3 language referring to automobile VMT as being focused on light-duty passenger vehicles. The "total VMT per service population" metric is taken from the final origin-destination trip matrices in the CCTA model and therefore it does include the VMT associated with trucks. Per the OPR guidance it is acceptable to include truck VMT when needed for modeling convenience, as long as the Analyst ensures there is an apples-to-apples comparison by using the same vehicle types in each step of the analysis process.

serving uses, since this analysis can take credit for reductions in trips resulting from the on-site mix.

In all cases, the *analyst should consider whether that approach will effectively capture the likely interactions between the different uses*. Other analytical options that would capture interactions between different uses are to analyze the project by conducting a full run of the CCTA model, or to use a sketch planning tool designed to estimate the trip generation effects of a mixed-use project.

4. VMT Mitigation Strategies

If the conclusion is that the project would have the potential to cause a significant VMT impact per one or more of the significance thresholds defined above, then mitigation is required. CEQA requires that all feasible measures be implemented to reduce identified impacts to less-than-significant levels.

Method of Calculating Mitigation Reductions

The analyst, working with the lead agency and applicant, shall specify a series of mitigation measures, each of which shall have a specific percent level of VMT reduction assigned to it. Reduction levels may be taken from Appendix 1 (described further below) or from other defensible sources. In each case, the analyst shall explain the basis for the reduction applied, and shall also consider any interactions among the mitigation measures that make them cumulatively less effective than they are by themselves.

Each reduction shall be applied to the overall VMT associated with the project, until the total VMT is reduced to a less-than-significant level or all feasible mitigation reductions have been applied.

Required Levels of Mitigation

In order to reduce impacts to less-than-significant levels, the proposed mitigation measures must reduce VMT to the relevant threshold as defined in Section 3 above.

Types of Mitigation

To mitigate VMT impacts, the following actions could be taken:

- Modify the project's characteristics to reduce VMT generated by the project. This might involve changing the density or mixture of land uses on the project site, or changing the project's location to one that is more accessible by transit or other travel modes. The effectiveness of such changes should be modeled using the analysis techniques described in Part 3, above.
- Implement transportation demand management (TDM) or physical design measures to reduce VMT generated by the project. A description of such options is included below.

- Participate in a CCTA-approved VMT impact fee program and/or VMT mitigation exchange/banking program. CCTA will be developing such a program in Contra Costa County in the near future.

VMT Reductions from TDM and Physical Design Measures

TDM and physical design measures that could potentially be applicable in Contra Costa County are summarized in Appendix 1. It should be noted that the understanding of the availability, applicability, and effectiveness of VMT mitigation measures is continuing to evolve and the evaluation of TDM measures should be updated periodically. Any evaluation of the effectiveness of VMT reduction measures should recognize that many TDM strategies are dependent on things that are likely to change over time, such as the level of priority a building tenant places on achieving trip reductions, or the frequency of nearby transit services. As such, actual real-time VMT reduction cannot be reliably predicted and ongoing monitoring should be considered to ensure that mitigation expectations are being met.

The effectiveness of each strategy shown in Appendix 1 will vary depending on the context in which it is implemented and the types of trips to which it applies. It is the analyst's responsibility to review the available research and suggest a level of VMT reduction that is reasonable to apply to the project being studied, taking into account the project's specific characteristics and the context in which it would be constructed.

It should also be noted that the incremental benefit of each VMT reduction strategy will diminish as strategies are combined together. Therefore, the analyst should carefully document how the interaction between TDM strategies is accounted for. The California Air Pollution Control Officers Association (CAPCOA) report *Quantifying Greenhouse Gas Mitigation Measures* provides guidance on how to account for combinations of strategies.

5. Significant and Unavoidable Impacts, Cumulative Analysis and Findings of Overriding Consideration

Findings of Overriding Consideration

If the lead agency includes all feasible measures described in Section 4 above and those measures are not sufficient to fully mitigate the impact, then the VMT impact will be classified as significant and unavoidable. The lead agency may still approve the project, as allowed by CEQA, by making a finding of overriding consideration.

Before making such a finding and approving the project, the lead agency must also conduct a cumulative VMT analysis for the project, as described below.[7]

Cumulative Analysis

Projects that are unable to mitigate their project-specific VMT impacts to less-than-significant levels require a Cumulative VMT analysis.

The cumulative analysis of a project involves understanding the project's effect on overall VMT within its study area. This analysis is needed to address circumstances where an individual project might affect travel patterns from other developments in the broader area; this might happen for a variety of reasons, such as that the project offers different housing, employment or other opportunities than would otherwise exist in the area and that causes other users to change their travel decisions, or because the drivers and transit users generated by the project take up available system capacity and cause other users to change their travel routes or modes.

The project's effect on VMT should be measured by defining a VMT study area and calculating the total VMT occurring on all network links inside that study area, in both the cumulative without project and cumulative with project scenarios. To allow for a reasonable comparison between those two scenarios, the total study area VMT should be normalized in some fashion to reflect that there are different numbers of people within the study area (i.e., because the project has added people to the study area as compared to the without project scenario). If the project adds residents to the study area, then it would be reasonable to present the VMT results as total study area VMT divided by number of study area residents. If the project adds employees to the study area, then it would be reasonable to use total study area VMT divided by number of study area employees. The exact method for normalizing the VMT number is not critical; what is essential is that the same method be used for both the cumulative without project and the cumulative with project scenarios, to allow for an apples-to-apples comparison between the two scenarios.

Specific steps in the process are defined below:

Model Runs. The Cumulative VMT analysis will be based on two CCTA Model runs:

- Cumulative without project: The most current version of the horizon year of the CCTA model. If development similar to that found in the proposed project is already foreseen in the subject TAZ in the "cumulative without project" model, this development should be subtracted from the "cumulative without project" scenario before this model run is conducted.

[7] As per OPR's guidance, cumulative VMT analysis is not necessary for projects that are found to have a less-than-significant impact on VMT at the project level.

- Cumulative plus project: Unless development similar to that found in the proposed project is already foreseen in the subject TAZ in the "cumulative without project" model, the proposed land use(s) should be added to the "cumulative without project" condition for the TAZ, or a separate TAZ should be created to contain the proposed land use(s). The Analyst should also consider whether it would be advisable to offset the addition of these proposed land uses by lessening projected increases in development in other TAZs, particularly if the proposed project is substantial in size such that it might change the distribution of future developments. This recognizes that individual land use projects will generally not change the regionwide totals for population and employment growth, but will influence localized land use and VMT impacts.

Cumulative Threshold. Cumulative VMT impacts should be considered significant if there is a net increase in the total study area VMT normalized to the number of people within the study area, when comparing cumulative no project to cumulative plus project conditions.

Additional Significant Impact and Findings of Overriding Consideration. If the Cumulative VMT Analysis finds a significant impact, this impact shall be considered to be significant and unavoidable, and must therefore be called out in the project's EIR and subject to the Finding of Overriding Consideration described earlier in this section.

Appendix 1. Summary of Potential VMT Reduction Strategies

	Strategy	Types of Trips Affected	Range of Potential VMT Reduction for Affected Trips
Project-Scale Strategies			
1	Increase land use diversity through greater mix of uses on site	All	0% - 12%
2	Implement ride-sharing program	Primarily commute trips	2.5% - 8.3%
3	Subsidize or discount transit passes	Primarily commute trips	0.1% - 16%
4	Incentivize telework and alternative schedules	Commute trips	0.2% - 4.5%
5	Price and manage parking	All	2% - 30%
Community-Scale Strategies			
6	Improve the pedestrian network	All	0.5% - 5.7%
7	Implement traffic calming and low-stress bicycle facilities	All	0% - 1.7%
8	Increase transit service frequency	All	0.3% - 6.3%
9	Implement neighborhood or community-wide car-sharing programs	All	0.3% - 1.6%
10	Coordinate school pools	School	7% - 15%

Source: *Quantifying Greenhouse Gas Mitigation Measures*, CAPCOA, 2010, supplemented with new research review by Fehr & Peers, 2019.

Further Description of VMT Reduction Strategies

Project-Scale Strategies

1. Increase land use diversity – This strategy focuses on inclusion of mixed uses within projects or in consideration of the surrounding area to minimize vehicle travel in terms of both the number of trips and the length of those trips.

2. Implement ride-sharing program – This strategy focuses on encouraging carpooling and vanpooling by project site/building tenants, which depends on the ultimate building tenants; this should be a factor in considering the potential VMT reduction.

3. Subsidize or discount transit passes – This strategy reduces the need to own a vehicle or reduces the number of vehicles owned by a household by incentivizing individuals to use transit for their daily commute. This strategy depends on the ultimate building tenants and may require monitoring. This strategy also relies on local transit providers continuing

to provide similar or better service throughout the County, in terms of frequency and speed.

4. Incentivize telework and alternative schedules – This strategy relies on effective internet access and speeds to individual project sites/buildings to provide the opportunity for telecommuting. The effectiveness of the strategy depends on the ultimate building tenants and the nature of work done by tenants' employees (can the work be done remotely in the first place?); two factors that should be considered for potential VMT reduction. Effectiveness may also be limited in more rural areas of the County with limited broadband internet access.

5. Price and manage parking – Parking management strategies focus on the management of parking to influence vehicle travel. Free and ubiquitous parking supply tends to increase vehicle use while reducing parking supply and pricing spaces can help reduce vehicle travel. A reduction in parking supply can also be used to incentivize infill development and higher density development by reducing the cost of building parking spaces. This strategy may be less effective in suburban settings such as Contra Costa County but will depend on the specific project site and the surrounding parking supply.

Community-Scale Strategies

6. Improve the pedestrian network – This strategy focuses on creating a pedestrian network within the project and connecting to nearby destinations. Projects in Contra Costa County tend to be small so the emphasis of this strategy would likely be the construction of network improvements that connect the project site directly to nearby destinations. Alternatively, implementation could occur through an impact fee program (discussed in more detail below) or benefit/assessment district targeted to various areas in the County designated for improvements through local or regional plans. Implementation of this strategy may require regional or local agency coordination and may not be applicable for all individual land use development projects.

7. Implement traffic calming measures and low-stress bicycle facilities – This strategy combines the CAPCOA research focused on traffic calming with new research on providing a low-stress bicycle network. Traffic calming creates networks with low vehicle speeds and volumes that are more conducive to walking and bicycling. Building a low-stress bicycle network produces a similar outcome. One potential change in this strategy over time is that e-bikes (and e-scooters) could extend the effective range of travel on the bicycle network, which could enhance the effectiveness of this strategy. Implementation options are similar to strategy 2 above. Implementation of this strategy may require regional or local agency coordination and may not be applicable for all individual land use development projects.

8. Increase transit service frequency – This strategy focuses on improving transit service convenience and travel time competitiveness with driving. Given land use density in Contra Costa County, this strategy may be limited to traditional commuter transit where trips can be pooled at the start and end locations or require new forms of demand-responsive transit service. The demand-responsive service could be provided as subsidized trips by contracting to private TNCs or taxi companies. Alternatively, a public transit operator could provide the subsidized service but would need to improve on traditional cost effectiveness by relying on TNC ride-hailing technology, using smaller vehicles sized to demand, and flexible driver employment terms where drivers are paid by trip versus by hour. Implementation of this strategy would require regional or local agency implementation and/or substantial changes to current transit practices, and therefore would not likely be applicable to individual development projects.

9. Implement neighborhood or community-wide car-sharing programs – This strategy reduces the need to own a vehicle or reduces the number of vehicles owned by a household by making it convenient to access a shared vehicle for those trips where vehicle use is essential. Note that implementation of this strategy would require regional or local agency implementation and coordination.

10. Coordinate SchoolPools – This strategy helps families share in the responsibilities of getting kids to school and back via carpooling, walking, biking, or riding the school bus together. Effectiveness of this program depends on the extent to which resident schoolchildren are already walking, biking, and riding the school bus to school.

Appendix 1: Detailed TDM Strategies Assessment

FEHR & PEERS

Relevant Strategies for Implementation in Contra Costa Jurisdictions

CAPCOA Category	CAPCOA #	CAPCOA Strategy	CAPCOA Estimate of VMT Reduction	Strength of Evidence for Application in CEQA?	Applicable to Individual Land Use Projects?	New Information Since CAPCOA was Published in 2010		
						New information	New Estimate of VMT Reduction	Literature or Evidence Cited
Land Use/ Location	3.1.3	LUT-3 Increase Diversity of Urban and Suburban Developments	9%-30% VMT reduction due to mixing land uses within a single development	Adequate	Yes	1] VMT reduction due to mix of land uses within a single development; 2] Reduction in VMT due to regional change in entropy index of diversity.	1] 0%-12% 2] 0.3%-4%	1] Ewing, R. and Cervero, R. (2010). Travel and the Built Environment - A Meta-Analysis. Journal of the American Planning Association,76(3),265-294. Cited in California Air Pollution Control Officers Association. (2010).Quantifying Greenhouse Gas Mitigation Measures. Retrieved from: http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf Frank, L., Greenwald, M., Kavage, S. and Devlin, A. (2011). An Assessment of Urban Form and Pedestrian and Transit Improvements as an Integrated GHG Reduction Strategy. WSDOT Research Report WA-RD 765.1. Washington State Department of Transportation. Retrieved from: http://www.wsdot.wa.gov/research/reports/fullreports/765.1.pdf Nasri, A. and Zhang, L. (2012). Impact of Metropolitan-Level Built Environment on Travel Behavior. Transportation Research Record: Journal of the Transportation Research Board, 2323(1), 75-79. Sadek, A. et al. (2011). Reducing VMT through Smart Land-Use Design. New York State Energy Research and Development Authority. Retrieved from: https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-08-29%20Final%20Report_December%202011%20%282%29.pdf Spears, S.et al. (2014). Impacts of Land-Use Mix on Passenger Vehicle Use and Greenhouse Gas Emissions- Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm 2] Zhang, Wengia et al. "Short- and Long-Term Effects of Land Use on Reducing Personal Vehicle Miles of Travel."
Neighborhood Site Enhancements	3.2.1	SDT-1 Provide Pedestrian Network Improvements	0%-2% reduction in VMT for creating a connected pedestrian network within the development and connecting to nearby destinations	Adequate	No - this strategy would require a project to integrate into a larger overall network of pedestrian facilities that would require local and/or regional agency coordination to implement. Current research supports city and neighborhood level VMT reductions, but none of the literature reviewed evaluates project-specific reductions.	VMT reduction due to provision of complete pedestrian networks.	0.5%-5.7%	Handy, S. et al. (2014). Impacts of Pedestrian Strategies on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm
Neighborhood Site Enhancements	3.2.2	SDT-2 Provide Traffic Calming Measures	0.25%-1% VMT reduction due to traffic calming on streets within and around the development	Adequate	Potentially yes - The requirements for the project-level definition must be met. In general, this strategy would require a project to integrate into a larger overall network of bicycle facilities that would require local and/or regional agency coordination to implement.	Reduction in VMT due to building out a low-stress bike network; reduction in VMT due to expansion of bike networks in urban areas.	0%-1.7%	1] California Air Resources Board. (2016). Greenhouse Gas Quantification Methodology for the California Transportation Commission Active Transportation Program Greenhouse Gas Reduction Fund Fiscal Year 2016-17. Retrieved from: https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/ctc_atp_finalqm_16-17.pdf. 2] Zahabi, S. et al. (2016). Exploring the link between the neighborhood typologies, bicycle infrastructure and commuting cycling over time and the potential impact on commuter GHG emissions. Transportation Research Part D: Transport and Environment. 47, 89-103.
Parking Pricing	3.3.1	PDT-1 Limit Parking Supply	5%-12.5% VMT reduction in response to reduced parking supply vs. ITE parking generation rate	Weak - not recommended. Fehr & Peers has developed new estimates for residential projects only that may be used.	Yes - evidence is only available to support taking these reductions in high-transit urban areas.	CAPCOA reduction range derived from estimate of reduced vehicle ownership, not supported by observed trip or VMT reductions. Evidence is available for mode shift due to presence/absence of parking in high-transit urban areas; additional investigation ongoing.	Up to 30% reduction in suburban centers with high transit availability.	Fehr & Peers estimated a linear regression formula based on observed data from multiple locations. Resulting equation produces maximum VMT reductions for residential land use only of 30% in suburban locations and 50% in urban locations based on parking supply percentage reductions.
Parking Pricing	3.3.2	PDT-2 Unbundle Parking Costs from Property Cost	2.6% -13% VMT reduction due to decreased vehicle ownership rates	Adequate - conditional on the agency not requiring parking minimums and pricing/managing on-street parking (i.e., residential parking permit districts, etc.).	Yes - however, the project must be in a location that does not require parking minimums and has priced or permitted on-street parking.	Reduction in VMT, primarily for residential uses, based on range of elasticities for vehicle ownership in response to increased residential parking fees. Does not account for self-selection. Only applies if the city does not require parking minimums and if on-street parking is priced and managed (i.e., residential parking permit districts).	2%-12%	Victoria Transport Policy Institute (2009). Parking Requirement Impacts on Housing Affordability. Retrieved March 2010 from: http://www.vtpi.org/park-hou.pdf.

Appendix 1: Detailed TDM Strategies Assessment

FEHR PEERS

Relevant Strategies for Implementation in Contra Costa Jurisdictions

CAPCOA Category	CAPCOA #	CAPCOA Strategy	CAPCOA Estimate of VMT Reduction	Strength of Evidence for Application in CEQA?	Applicable to Individual Land Use Projects?	New Information Since CAPCOA was Published in 2010		
						New information	New Estimate of VMT Reduction	Literature or Evidence Cited
Parking Pricing	3.3.3	PDT-3 Implement Market Price Public Parking	2.8%-5.5% VMT reduction due to "park once" behavior and disincentive to driving	Adequate	Yes - however, the VMT reductions would only apply to visitor or customer trips.	Implement a pricing strategy for parking by pricing all central business district/employment center/retail center on-street parking, to encourage "park once" behavior. The benefit of this measure above that of paid parking at the project site only is that it deters parking spillover from the project to other public parking nearby. It may also generate sufficient area-wide mode shifts to justify increased transit service to the area. VMT reduction applies to VMT from visitor/customer trips only. Reductions higher than top end of range from CAPCOA report apply only in conditions with highly constrained on-street parking supply and lack of comparably-priced off-street parking.	2.8%-14.5%	Clinch, J.P. and Kelly, J.A. (2003). Temporal Variance Of Revealed Preference On-Street Parking Price Elasticity. Dublin: Department of Environmental Studies, University College Dublin. Retrieved from: http://www.ucd.ie/gpep/research/workingpapers/2004/04-02.pdf. Cited in Victoria Transport Policy Institute (2017). Transportation Elasticities: How Prices and Other Factors Affect Travel Behavior. Retrieved from: http://www.vtpi.org/tdm/tdm11.htm Hensher, D. and King, J. (2001). Parking Demand and Responsiveness to Supply, Price and Location in Sydney Central Business District. Transportation Research A. 35(3), 177-196. Millard-Ball, A. et al. (2013). Is the curb 80% full or 20% empty? Assessing the impacts of San Francisco's parking pricing experiment. Transportation Research Part A. 63(2014), 76-92. Shoup, D. (2011). The High Cost of Free Parking. APA Planners Press. p. 290. Cited in Pierce, G. and Shoup, D. (2013). Getting the Prices Right. Journal of the American Planning Association. 79(1), 67-81.
Commute Trip Reduction	3.4.3	TRT-3 Provide Ride-Sharing Programs	1%-15% commute VMT reduction due to employer ride share coordination and facilities	Adequate - Effectiveness is highly dependent on participation of individual building tenants.	Yes - however, the effectiveness of the ride-sharing programs is building tenant specific and may require monitoring to evaluate the program's effectiveness.	Commute vehicle trips reduction due to employer ride-sharing programs	2.5%-8.3%	Victoria Transport Policy Institute. (2015). Ridesharing: Carpooling and Vanpooling. Online TDM Encyclopedia. Retrieved from: http://vtpi.org/tdm/tdm34.htm
Commute Trip Reduction	3.4.4	TRT-4 Implement Subsidized or Discounted Transit Program	0.3%-20% commute VMT reduction due to transit subsidy of up to $6/day	Adequate - Effectiveness is highly dependent on participation of individual building tenants.	Yes - however, the effectiveness of a transit subsidy program would be building tenant specific and may require monitoring to evaluate the program's effectiveness.	1] Reduction in vehicle trips in response to reduced cost of transit use, assuming that 10-50% of new bus trips replace vehicle trips; 2] Reduction in commute trip VMT due to employee benefits that include transit 3] Reduction in all vehicle trips due to reduced transit fares system-wide, assuming 25% of new transit trips would have been vehicle trips.	1] 0.3%-14% 2] 0-16% 3] 0.1% to 6.9%	1] Victoria Transport Policy Institute. (2017). Understanding Transport Demands and Elasticities. Online TDM Encyclopedia. Retrieved from: http://www.vtpi.org/tdm/tdm11.htm 2] Carolina, P. et al. (2016). Do Employee Commuter Benefits Increase Transit Ridership? Evidence rom the NY-NJ Region. Washington, DC: Transportation Research Board, 96th Annual Meeting. 3] Handy, S. et al. (2013). Impacts of Transit Service Strategies on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm
Commute Trip Reduction	3.4.6	TRT-6 Encourage Telecommuting and Alternative Work Schedules	0.07%-5.5% commute VMT reduction due to reduced commute trips	Adequate - Effectiveness is highly dependent on participation of individual building tenants.	Yes - however, the effectiveness of telecommuting and alternative work schedules is building tenant specific and may require monitoring to evaluate the program's effectiveness.	VMT reduction due to adoption of telecommuting	0.2%-4.5%	Handy, S. et al. (2013). Policy Brief on the Impacts of Telecommuting Based on a Review of the Empirical Literature. California Air Resources Board. Retrieved from: https://www.arb.ca.gov/cc/sb375/policies/telecommuting/telecommuting_brief120313.pdf
Commute Trip Reduction	3.4.9	TRT-9 Implement Car-Sharing Program	0.4% - 0.7% VMT reduction due to lower vehicle ownership rates and general shift to non-driving modes	Adequate	No - this strategy would require local and/or regional agency coordination to implement.	Vehicle trip reduction due to car-sharing programs; assumes 1%-5% program participation rate. Car sharing effect on VMT is still evolving due to TNC effects. UCD research showed less effect on car ownership due to car sharing participation and an uncertain effect on VMT.	0.3%-1.6%	Lovejoy, K. et al. (2013). Impacts of Carsharing on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm Clewlow, Regina R. and Mishra, Gouri Shankar, (2017). Disruptive Transportation: The Adoption, Utilization, and Impacts of Ride-Hailing in the United States. UC Davis, Institute of Transportation Studies. Research Report - UCD-ITS-RR-17-07.

Appendix 1: Detailed TDM Strategies Assessment

FEHR PEERS

Relevant Strategies for Implementation in Contra Costa Jurisdictions

CAPCOA Category	CAPCOA #	CAPCOA Strategy	CAPCOA Estimate of VMT Reduction	Strength of Evidence for Application in CEQA?	Applicable to Individual Land Use Projects?	New Information Since CAPCOA was Published in 2010		
						New information	New Estimate of VMT Reduction	Literature or Evidence Cited
Commute Trip Reduction	3.4.10	TRT-10 Implement a School Pool Program	7.2%-15.8% reduction in school VMT due to school pool implementation	Adequate - School VMT only.	Not applicable, unless if the project being evaluated is a school.	Limited new evidence available, not conclusive	7% - 15%	Transportation Demand Management Institute of the Association for Commuter Transportation. TDM Case Studies and Commuter Testimonials. Prepared for the US EPA. 1997. (p. 10, 36-38) WayToGo 2015 Annual Report. Accessed on March 12, 2017 from http://www.waytogo.org/sites/default/files/attachments/waytogo-annual-report-2015.pdf
Transit System	3.5.4	TST-4 Increase Transit Service Frequency/Speed	0.02%-2.5% VMT reduction due to reduced headways and increased speed and reliability	Adequate	No - increasing the quality of transit service would require local and/or regional agency coordination to implement.	Reduction in vehicle trips due to increased transit frequency/decreased headway.	0.3%-6.3%	Handy, S. et al. (2013). Impacts of Transit Service Strategies on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm

TRANSPORTATION OPERATIONAL ANALYSES FOR THE BISHOP RANCH 6 RESIDENTIAL PROJECT

SAN RAMON, CALIFORNIA

JULY 2021

PREPARED FOR

SUMMERHILL HOMES

PREPARED BY

Gibson transportation consulting, inc.

TRANSPORTATION OPERATIONAL ANALYSES FOR THE BISHOP RANCH 6 RESIDENTIAL PROJECT

SAN RAMON, CALIFORNIA

July 2021

Prepared for:

SUMMERHILL HOMES

Prepared by:

GIBSON TRANSPORTATION CONSULTING, INC.
555 W. 5th Street, Suite 3375
Los Angeles, California 90013
(213) 683-0088

Ref: J1877

Table of Contents

Table of Contents, cont.

List of Figures

NO.

List of Tables

NO.

Chapter 1
Introduction

This study presents the transportation operational analyses for the Bishop Ranch 6 project (Project) located at 2400-2440 Camino Ramon (Project Site) in the *North Camino Ramon Specific Plan* (City of San Ramon, 2012) area of the City of San Ramon, California (City). The methodology and base assumptions used in the analysis were established in conjunction with the City Public Works Department Engineering Services Division.

Although *Senate Bill No. 743* (Steinberg, 2013) (SB 743), made effective in January 2014, changed the California Environmental Quality Act (CEQA) guidelines regarding the analysis of transportation impacts, shifting the focus from traffic operations and level of service (LOS) to vehicle miles traveled (VMT) to promote a reduction of greenhouse gas emissions (GHG) and to encourage creation of multimodal networks and promotion of mixed-use developments, the legislation allows individual jurisdictions to include additional analyses beyond those required by CEQA within their guidelines. This study presents those additional analyses requested by the City but not required by CEQA.

The detailed analysis of VMT is considered in the CEQA analysis of Project impacts provided in *Transportation Assessment for the Bishop Ranch 6 Residential Project* (Gibson Transportation Consulting, Inc., February 2021).

PROJECT DESCRIPTION

The Project, proposed by SummerHill Homes (Applicant), would construct 404 residential units consisting of 268 single-family detached homes and 136 multi-family dwelling units, including 114 detached row homes, 154 detached courtyard homes, and 136 attached town homes. The Project Site is currently occupied with approximately 564,000 square feet (sf) of office uses that would be removed with the development of the Project.

The Project would provide multiple pedestrian entry points for residents and guests along Executive Parkway, Camino Ramon, and Norris Canyon Road. A two-acre park, along with an enhanced landscaped pedestrian walkway along Camino Ramon, would be provided for the use of residents and the local community.

Existing parking for the current office uses on the Project Site is provided within surface parking lots. On-site parking for the Project would be provided in a two-car garage for each unit and an additional 120 parking spaces for guests, for a total of 928 spaces. The Project Site currently provides four access points, two full-access driveways on Camino Ramon and one full access driveway each on Executive Parkway and Norris Canyon Road. Vehicular access to the Project Site would be provided via existing full-access driveways along Executive Parkway, Camino Ramon, and Norris Canyon Road. The two full-access driveways on Camino Ramon would be consolidated into one full-access driveway on Camino Ramon. An additional driveway, accommodating right-turn ingress and egress only, would also be provided on Executive Parkway. The conceptual Project Site plan is shown in Figure 1.

The Project is projected to be developed over a four to six-year time period following approval of the Project. The long-range travel projections used in this report are based on the latest Contra Costa Transportation Authority (CCTA) Travel Demand Forecast Model (CCTA Model) which assumes travel and land use conditions for Year 2040. the travel forecasts also assume full buildout of the CityCenter residential project recently approved by the City of San Ramon. Consistent with the longest future forecasts available, the conditions in this analysis assume that the full buildout of the Project would take place by Year 2040.

PROJECT LOCATION

Generally, the Project Site is bounded by Norris Canyon Road to the north, Camino Ramon to the east, Executive Parkway to the south, and commercial and office uses to the west. Other nearby uses include medical centers as well as office and commercial developments.

The Project Site is 0.50 miles east of Interstate 680 (I-680), which provides regional access. Regional and local access to the Project Site is provided via several arterials, including Crow Canyon Road, Norris Canyon Road, Executive Parkway, Bollinger Canyon Road, Camino Ramon, and Alcosta Boulevard

The Project Site is located less than 600 feet west of the San Ramon Transit Center, which is located east of the intersection of Camino Ramon & Executive Parkway. The San Ramon Transit Center serves several bus routes, including Central Contra Costa Transit Authority (CCCTA or County Connection) Routes 21, 35, 92X, 95X, 96X, 97X, and 321. The existing transit lines provide service to the Bay Area Rapid Transit (BART) rail stations in Dublin/Pleasanton, West Dublin/Pleasanton, and Walnut Creek, as well as Park-N-Ride lots in Danville and Walnut Creek.

TRAFFIC ANALYSIS METHODOLOGY

Study Scope and Analysis Conditions

The scope of analysis for this study was developed in consultation with City staff. The base assumptions and technical methodologies (i.e., trip generation, study locations, analysis methodology, etc.) were identified as part of the study approach and were outlined in a Scoping Form that was reviewed and approved by City staff. A copy of the Scoping Form is provided in Appendix A.

This study analyzed the potential Project-generated operational impacts on the street system in the vicinity of the Project Site as compared to existing conditions and projected future conditions at the time the Project is expected to be completed and occupied (Year 2040). Potential intersection impacts were evaluated for typical weekday morning (7:00 AM to 9:00 AM) and afternoon (4:00 PM to 6:00 PM) peak periods. A total of eight study intersections, including three signalized and five unsignalized intersections, in the vicinity of the Project Site were selected for detailed traffic analysis and are listed in Table 1 and shown in Figure 2.

Consistent with Chapter 12 of *Engineering Design, Grading and Procedures Manual: City of San Ramon* (San Ramon Public Works Department Engineering Services Division, April 2010) (Traffic Study Guidelines), the following traffic conditions were developed and analyzed as part of this study:

- Existing Conditions (Year 2021) – The analysis of existing traffic conditions provides a basis for the assessment of future traffic conditions. The Existing Conditions analysis includes a description of key area streets and highways, traffic volumes and current operating conditions, and transit service in the Study Area. Fieldwork results (lane configurations and signal phasing) for the analyzed intersections are provided in Appendix B. Intersection turning movement counts were collected at four of the eight study intersections during the weekday morning and afternoon peak periods in March and May 2019. These counts were increased by 1% per year to account for growth to Year 2021 conditions. The remaining four intersection turning movement counts were estimated using the collected counts and estimates of traffic generated by existing developments adjacent to Project driveways. The volume assumptions and methodology are provided in Appendix A and traffic count worksheets are provided in Appendix C. Detailed LOS worksheets are provided in Appendix D.

- Existing with Project Conditions (Year 2021) – This analysis condition projects the potential intersection operating conditions that could be expected if the Project components were fully occupied and added to existing Year 2021 traffic levels. This represents a conservative, worst-case scenario for traffic conditions as the Project is scheduled to be constructed over a four-six year time period.

- Future without Project Conditions (Year 2040) – This analysis condition projects the potential intersection operating conditions that could be expected as a result of regional growth and related project traffic in the Study Area by Year 2040. This analysis provides the conditions by which the Project impacts are evaluated in the future at full buildout. This scenario includes roadway improvements constructed by the City's Capital Improvement Project and by other projects in the Study Area that will be in place prior to the full occupancy of the Project. The Future without Project Conditions (Year 2040) were projected using the CCTA Model.

- Future with Project Conditions (Year 2040) – This analysis condition projects the potential intersection operating conditions that could be expected if the Project components were fully occupied in the projected buildout year. In this scenario, the traffic generated by the Project is added to Future without Project Conditions.

Intersection Analysis Methodology

In accordance with the City's Traffic Study Guidelines and the current *CCTA Technical Procedures* (CCTA, January 16, 2013), the intersection capacity analysis was conducted using the Synchro 10th Edition software to implement the *Highway Capacity Manual, 6th Edition* (Transportation Research Board, 2016) (HCM) methodology to determine the overall intersection delay. The HCM methodology calculates the average delay, in seconds, of a vehicle passing through the intersection in any direction during the peak hours. The average delay is used to determine the intersection LOS according to the LOS definitions provided in Table 2. The analysis worksheets for each scenario are provided in Appendix D.

OPERATIONAL IMPACT CRITERIA AND THRESHOLDS

The potential operational impacts of Project generated traffic at the study intersections was determined using criteria identified in the Traffic Study Guidelines, as detailed in Table 3. The Traffic Study Guidelines indicate that a project is considered to have an operational transportation impact when the project causes any of the thresholds to be exceeded under any scenario. The relative impact of the added traffic volumes generated by the Project was evaluated based on analysis of existing and future operating conditions at the study intersections, with and without the Project.

Signal Warrants

To assess the need for signalization of a stop-controlled intersection, *California Manual on Uniform Traffic Control Devices* (California Department of Transportation [Caltrans], 2020) (CA MUTCD) presents nine signal warrants. Satisfying one or more of the signal warrants could justify signalization of an intersection; however, the full set of warrants should be considered as part of an evaluation, and an engineering study should be conducted before the decision to install a signal is made.

In addition, satisfaction of one or more signal warrants does not in itself require an installation of a traffic signal. The peak hour volume warrant (Warrant 3) analysis for urban conditions was conducted for the unsignalized study intersections that are candidates for signalization.

ADDITIONAL TRAFFIC ANALYSES

CCTA

The CCTA is the Congestion Management Agency for Contra Costa County. The CCTA oversees implementation of sub-regional Action Plans for Routes of Regional Significance, which sets forth performance objectives for Routes of Regional Significance. In the San Ramon Valley, the Tri-Valley Transportation Council (TVTC) Action Plan includes Routes of Regional Significance. I-680, San Ramon Valley Boulevard, and the Iron Horse Trail are considered Routes of Regional Significance within the Study Area.

Caltrans

The Caltrans Interim Guidance discusses the importance of transit, alternate modes of travel, and pedestrian considerations as part of project evaluation, and suggests the approach with which Caltrans can recommend improvements to enhance pedestrian safety and increase pedestrian accessibility to help meet the goals and targets of *Caltrans Strategic Management Plan 2015-2020* (Caltrans, March 2015) and *California Transportation Plan 2040* (Caltrans, June 2016). The Caltrans Interim Guidance directs lead agencies to consider “multi-modal solutions from existing regional transportation plans, regional plans, transit plans, bicycle plans, and pedestrian plans.”

The analysis of the Caltrans facilities affected by the Project was conducted using the HCM methodology and is summarized in Chapter 8, with supporting data in Appendix F.

Project Access and Circulation

In addition to the various intersection and Caltrans analyses, this study includes a review of the Project access and circulation.

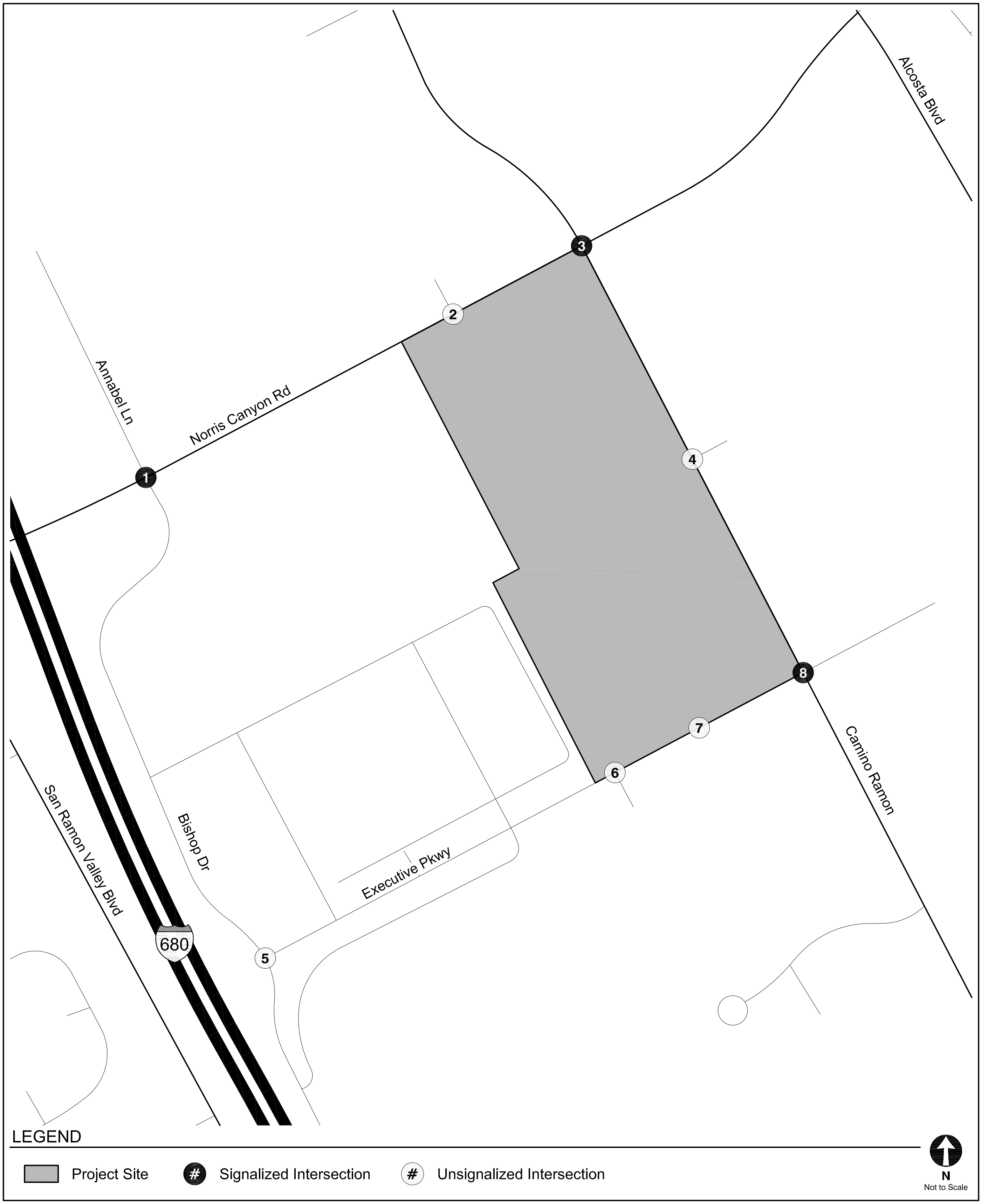
ORGANIZATION OF REPORT

This report is divided into eight chapters, including this introduction. Chapter 2 describes the existing circulation system, traffic volumes, and transportation conditions in the Study Area. Chapter 3 forecasts the Future without Project Conditions. Chapter 4 describes the procedure used to forecast Project traffic volumes and distribution through the Study Area. Chapter 5 presents the intersection operating conditions associated with both Existing with Project and Future with Project Conditions (Year 2040). Chapter 6 presents the analysis of Caltrans facilities. Chapter 7 describes site access and internal circulation. Chapter 8 provides a summary of the report. The Appendices contain supporting documentation and additional details of the technical analyses, as well as the additional analysis described above.

Source: William Hezmalhalch Architects, Inc. July, 2021.

N
Not to Scale

PROJECT SITE PLAN	FIGURE 1



STUDY AREA & ANALYZED INTERSECTIONS

FIGURE 2

TABLE 1
ANALYZED STUDY INTERSECTIONS

No	North / South Street	East / West Street	Jurisdiction
1	Bishop Drive/Annabel Lane	Norris Canyon Road	City of San Ramon
2. [a]	G Street Project Driveway	Norris Canyon Road	City of San Ramon
3.	Camino Ramon	Norris Canyon Road	City of San Ramon
4. [a]	Camino Ramon	F Street Project Driveway	City of San Ramon
5. [a]	Bishop Drive	Executive Parkway	City of San Ramon
6. [a]	I Street Project Driveway	Executive Parkway	City of San Ramon
7. [a]	G Street Project Driveway	Executive Parkway	City of San Ramon
8.	Camino Ramon	Executive Parkway	City of San Ramon

Notes
[a] Intersection operates with two-way stop-controlled (TWSC).

TABLE 2
LEVEL OF SERVICE DEFINITIONS FOR INTERSECTIONS

Level of Service	Description	Delay [a]	
		Signalized Intersections	Unsignalized Intersections
A	EXCELLENT. No vehicle waits longer than one red light and no approach phase is fully used.	≤ 10	0.0 - 10.0
B	VERY GOOD. An occasional approach phase is fully utilized; many drivers begin to feel somewhat restricted within groups of vehicles.	> 10 and ≤ 20	10.1 - 15.0
C	GOOD. Occasionally drivers may have to wait through more than one red light; backups may develop behind turning vehicles.	> 20 and ≤ 35	15.1 - 25.0
D	FAIR. Delays may be substantial during portions of the rush hours, but enough lower volume periods occur to permit clearing of developing lines, preventing excessive backups.	> 35 and ≤ 55	25.1 - 35.0
E	POOR. Represents the most vehicles intersection approaches can accommodate; may be long lines of waiting vehicles through several signal cycles.	> 55 and ≤ 80	35.1 - 50.0
F	FAILURE. Backups from nearby locations or on cross streets may restrict or prevent movement of vehicles out of the intersection approaches. Tremendous delays with continuously increasing queue lengths.	> 80	> 50.0

<u>Notes</u>

Source: *Highway Capacity Manual, 6th Edition* (Transportation Research Board, 2016).

[a] Measured in seconds.

TABLE 3
OPERATIONAL IMPACT CRITERIA AND THRESHOLDS

Intersection Control Type	Operational Impact Threshold
Signalized	The Project... • ...causes an acceptable LOS (LOS D or better) to decline to an unacceptable LOS (LOS E or F), or • ...increases the average delay by more than 5 seconds per vehicle at an intersection having an unacceptable LOS without project traffic
Two-Way Stop	• The Project causes a turning movement's acceptable LOS to decline to an unacceptable LOS and the peak hour volume signal warrant is met.

Notes
Source: *Engineering Design, Grading and Procedures Manual: City of San Ramon* (Public Works Department Engineering Services Division, April 2010)

Chapter 2
Existing Conditions

A comprehensive data collection effort was undertaken to develop a detailed description of existing conditions in the Project's Study Area. The Existing Conditions analysis includes an assessment of the existing freeway and street systems, an analysis of traffic volumes and current operating conditions, and an assessment of the existing public transit service, as well as pedestrian and bicycle circulation in Year 2021.

STUDY AREA

The Project's Study Area, shown in Figure 2, is generally bounded by Norris Canyon Road to the north, Camino Ramon to the east, Executive Parkway to the south, and San Ramon Valley Boulevard to the west. The Study Area was established in consultation with the City to encompass those intersections with a reasonable potential to experience significant transportation impacts due to Project traffic.

A total of eight intersections, including three signalized and five unsignalized intersections, were identified during the scoping process for detailed analysis of the above conditions. All four Project access points are included in the analysis. Figure 2 illustrates the location of the Project Site in relation to the surrounding street system and the eight study intersections. The existing lane configurations at the analyzed intersections are provided in Appendix B.

EXISTING STREET SYSTEM

The existing street system in the Study Area consists of a regional roadway system including freeways, arterials, collectors, and local streets which provide regional, sub-regional, or local access and circulation within the Study Area. These transportation facilities generally provide two to eight travel lanes and may allow parking on either side of the street. Typically, the speed limits range between 25 and 50 miles per hour (mph) on the streets and 65 mph on freeways.

Street classifications for roadways within the City are designated in *City of San Ramon General Plan 2035* (City of San Ramon, Effective May 28, 2015) (General Plan). The available facilities in the Study Area are defined by the following in the General Plan:

- Freeways are high-volume, high-speed roadways with limited access provided by interchanges that carry regional traffic through and do not provide local access to adjacent land uses.
- Arterial Streets are major roadways that serve higher traffic volumes and accommodate intercity circulation, as well as provide access to major commercial activity centers. Typically, Arterial Streets provide two to four travel lanes in each direction separated by a center median.
- Collector Streets are generally located in residential neighborhoods and employment areas and provide access to and from arterial streets for local traffic and are not intended for cut-through traffic. Typically, Collector Streets provide one to two travel lanes in each direction with no center median.
- Local Streets are intended to accommodate lower volumes of vehicle traffic and used to travel within neighborhoods. Typically, Local Streets provide one travel lane in each direction with parking on both sides of the street.
- Routes of Regional Significance are major arterials and freeways that serve regional traffic and generally serve as a means of travel across Contra Costa County or between Contra Costa County and adjacent counties.

Primary regional access to the Project Site is provided by I-680. The major arterials providing regional and sub-regional access to the Study Area include Norris Canyon Road, Executive Parkway, and Camino Ramon. The following is a brief description of the major roadways in the transportation analysis Study Area, including their classification under the General Plan:

Freeways

- I-680 – I-680 is a classified Route of Regional Significance and generally runs in the north-south direction, less than 0.30 miles west of the Project Site. In the vicinity of the Study

Area, I-680 provides three travel lanes and one express lane in each direction. An auxiliary lane is present in the northbound direction within the Study Area. Access to and from I-680 is available via interchanges at Crow Canyon Road and Bollinger Canyon Road.

Roadways

- Camino Ramon – Camino Ramon is a classified Arterial Street within the Study Area. It travels in the north-south direction and is located along the eastern boundary of the Project Site. It generally provides two travel lanes in each direction, with a two-way left-turn lane and left-turn lanes at intersections and driveways. Parking is generally not available on either side of the street within the Study Area.

- Bishop Drive – Bishop Drive is a classified Local Street. It travels in the north-south direction within the Study Area. It is located approximately 0.25 miles west of the Project Site. It generally provides one travel lane in each direction and Class II bicycle lanes on both sides of the street south of Norris Canyon Road. Parking is generally not available on either side of the street within the Study Area.

- Norris Canyon Road – Norris Canyon Road is a classified Arterial Street within the Study Area. It travels in the east-west direction and is located along the northern boundary of the Project Site. It generally provides two travel lanes in each direction and Class II bicycle lanes on both sides of the street. It provides a two-way left-turn lane and left-turn lanes at most intersections. Parking is generally not available on either side of the street within the Study Area.

- Executive Parkway – Executive Parkway is a classified Local Street within the Study Area. It generally travels in the east-west direction and is located along the southern boundary of the Project Site. It generally provides two travel lanes in each direction east of Camino Ramon and one travel lane in each direction west of Camino Ramon. Left-turn lanes are provided at intersections and driveways. Parking is generally not available on either side of the street within the Study Area.

EXISTING TRANSIT SYSTEM

The Study Area is served by CCCTA routes 21, 35, 92X, 95X, 96X, and 97X, in addition to weekend routes 321 and 335. Figure 3A illustrates the existing transit service in the Study Area. Table 4 summarizes the transit lines operating in the Study Area for each of the service providers in the region, the type of service (peak vs. off-peak, express vs. local), and frequency of service, as described above. The average frequency of transit service during the peak hour was derived from the number of peak-period stops made at the stop nearest the Project Site.

BICYCLE AND PEDESTRIAN NETWORK

Existing Bicycle System

Based on *City of San Ramon Bicycle Master Plan* (City of San Ramon, April 2018) (Bicycle Master Plan), the existing bicycle system in the Study Area consists of a limited coverage of multi-use paths (Class I), bicycle lanes (Class II), and bicycle routes (Class III). Multi-use paths are two-way paved facilities, physically separated from vehicle traffic and can be used by bicyclists, pedestrians, and other non-motorized users. Bicycle lanes are a component of street design with dedicated striping and symbols on the roadway surface, separating vehicular traffic from bicycle traffic. Buffered bicycle lanes provide a -painted flush buffer zone between a bicycle lane and adjacent travel lane. Bicycle routes are identified as bicycle-friendly streets where motorists and cyclists share the roadway and there is no dedicated striping of a bicycle lane. Bicycle routes are preferably located on Local, Collector, and lower volume Arterial Streets as part of a signed route or bicycle boulevard, which is typically applied on quiet streets such as residential neighborhoods. The following bicycle facilities are provided along corridors within the Study Area:

Multi-Use Paths (Class I)

- Iron Horse Trail

Bicycle Lanes (Class II)

- Bishop Drive
- San Ramon Valley Boulevard
- Norris Canyon Road
- Executive Parkway

Figure 3B depicts the existing bicycle network within the Project vicinity.

Existing Pedestrian Facilities

The walkability of existing facilities is based on the availability of pedestrian routes necessary to accomplish daily tasks without the use of an automobile. The Project area is comprised of employment and retail land uses and cultural facilities served by transit stops, a bicycle network, and an extensive sidewalk system. There are wide sidewalks lining the streets, crosswalks available at the intersections, and many shops, restaurants, and other services within walking distance of the Project Site.

The sidewalks that serve as routes to the Project Site provide proper connectivity and adequate widths to pedestrian crossings at intersections for a comfortable and safe pedestrian environment. The following signalized intersections provide pedestrian facilities to limit illegal mid-block crossings to the Project Site (all intersections have marked pedestrian crossings):

- Camino Ramon & Norris Canyon Road (Intersection #3)
- Camino Ramon & Executive Parkway (Intersection #8)

Each of the listed signalized intersections provides pedestrian phasing, crosswalk striping, and Americans with Disabilities Act accessible ramps.

Figure 3C illustrates the existing sidewalk and crosswalk systems along the project frontages.

EXISTING TRAFFIC VOLUMES AND LEVELS OF SERVICE

This section presents the existing peak hour turning movement traffic volumes for the intersections analyzed in this study, describes the methodology used to assess the traffic conditions at each intersection, and analyzes the operating conditions at each intersection indicating delay and LOS.

Existing Traffic Volumes

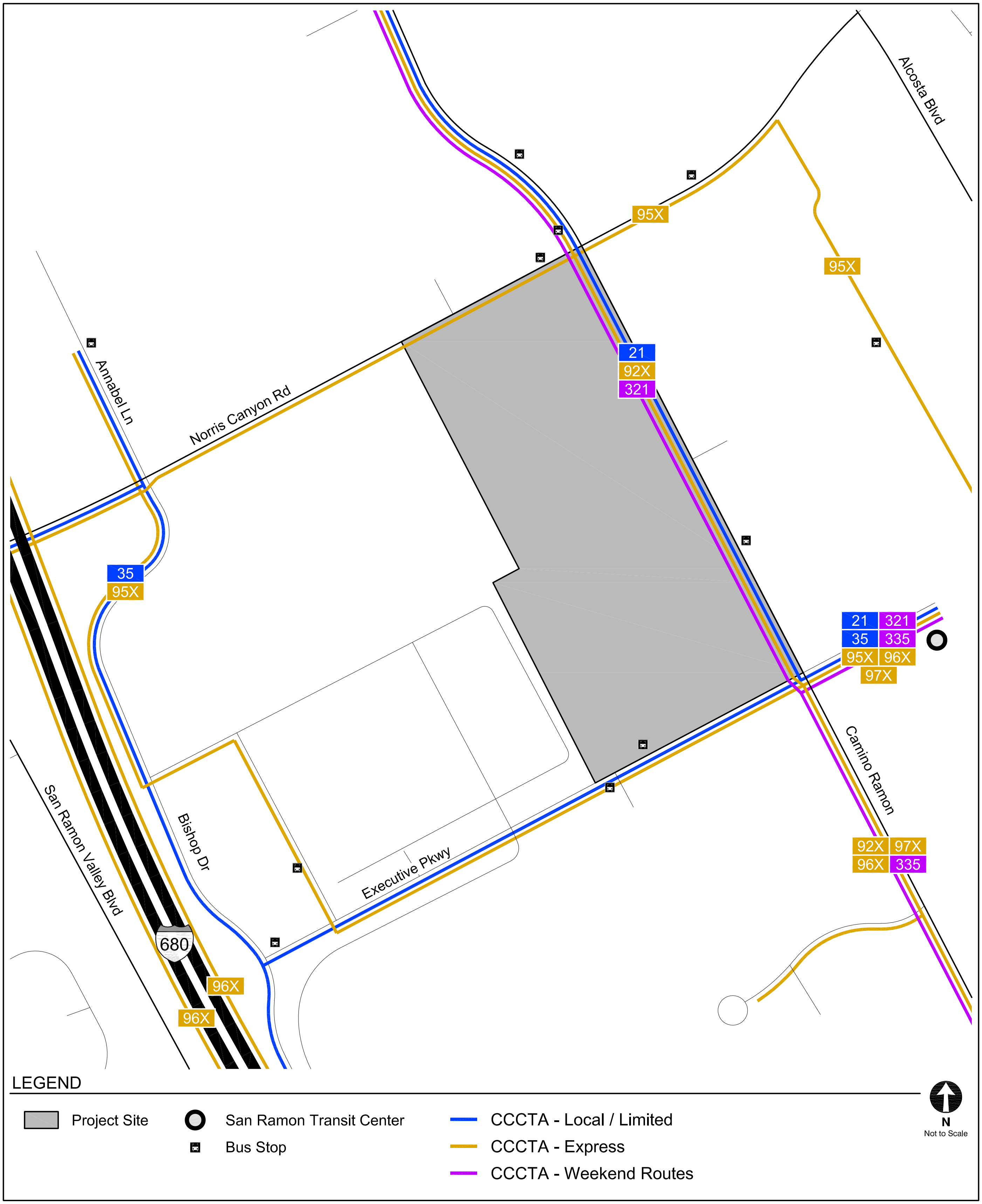
Intersection turning movement counts were conducted at four of the eight study intersections during the weekday morning (7:00 AM to 9:00 AM) and afternoon (4:00 PM and 6:00 PM) peak periods in March and May 2019 in accordance with the Traffic Study Guidelines. Local schools were in session and the weather conditions were typical when all traffic counts were conducted. These counts were increased by 1% per year to account for growth to Year 2021 conditions.

Due to the COVID-19 pandemic and its effects on traffic patterns, peak hour intersection turning movement counts could not be collected at the remaining four intersections, which are also locations of Project driveways. The intersection turning movement counts collected from 2019 and estimates of traffic generated by the existing developments adjacent to the Project driveways were used to estimate the peak hour turning movement counts for the remaining four intersections. The methodology and assumptions used in the volume estimation were reviewed and approved by the City and are provided in Appendix A. The existing intersection peak hour traffic volumes are illustrated in Figure 4. Traffic count worksheets are provided in Appendix C.

Existing Intersection LOS

Table 5 summarizes the weekday morning and afternoon peak hour LOS results for each of the study intersections under Existing Conditions. As shown in Table 5, seven of the eight study intersections currently operate at acceptable LOS D or better during both the morning and afternoon peak hours. The remaining study intersection at Camino Ramon & F Street Project Driveway (Intersection #4) is anticipated to operate at LOS D during the morning peak hour and at LOS F during the afternoon peak hours.

The LOS calculation worksheets are provided in Appendix D.

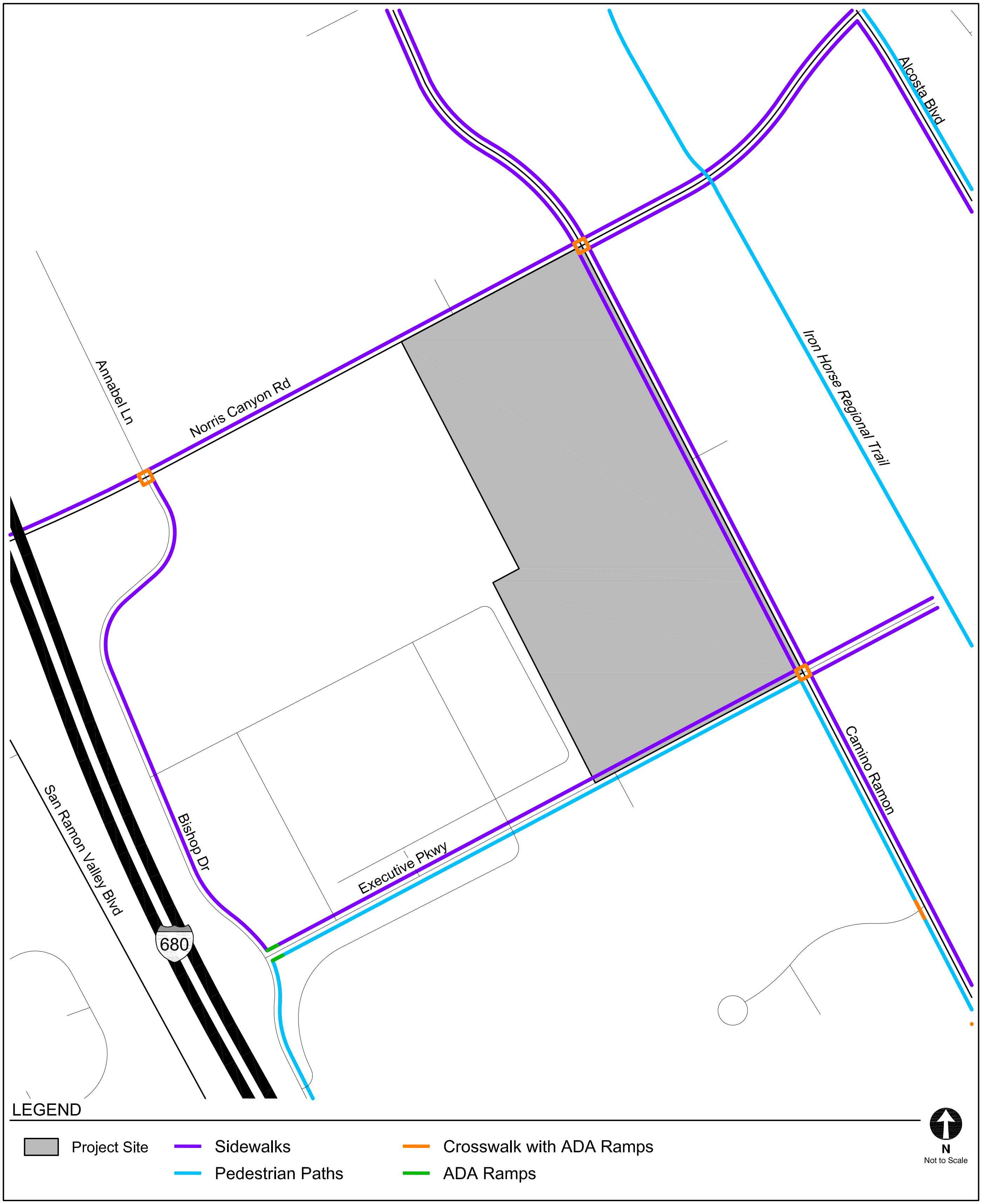


EXISTING TRANSIT SERVICE

FIGURE 3A

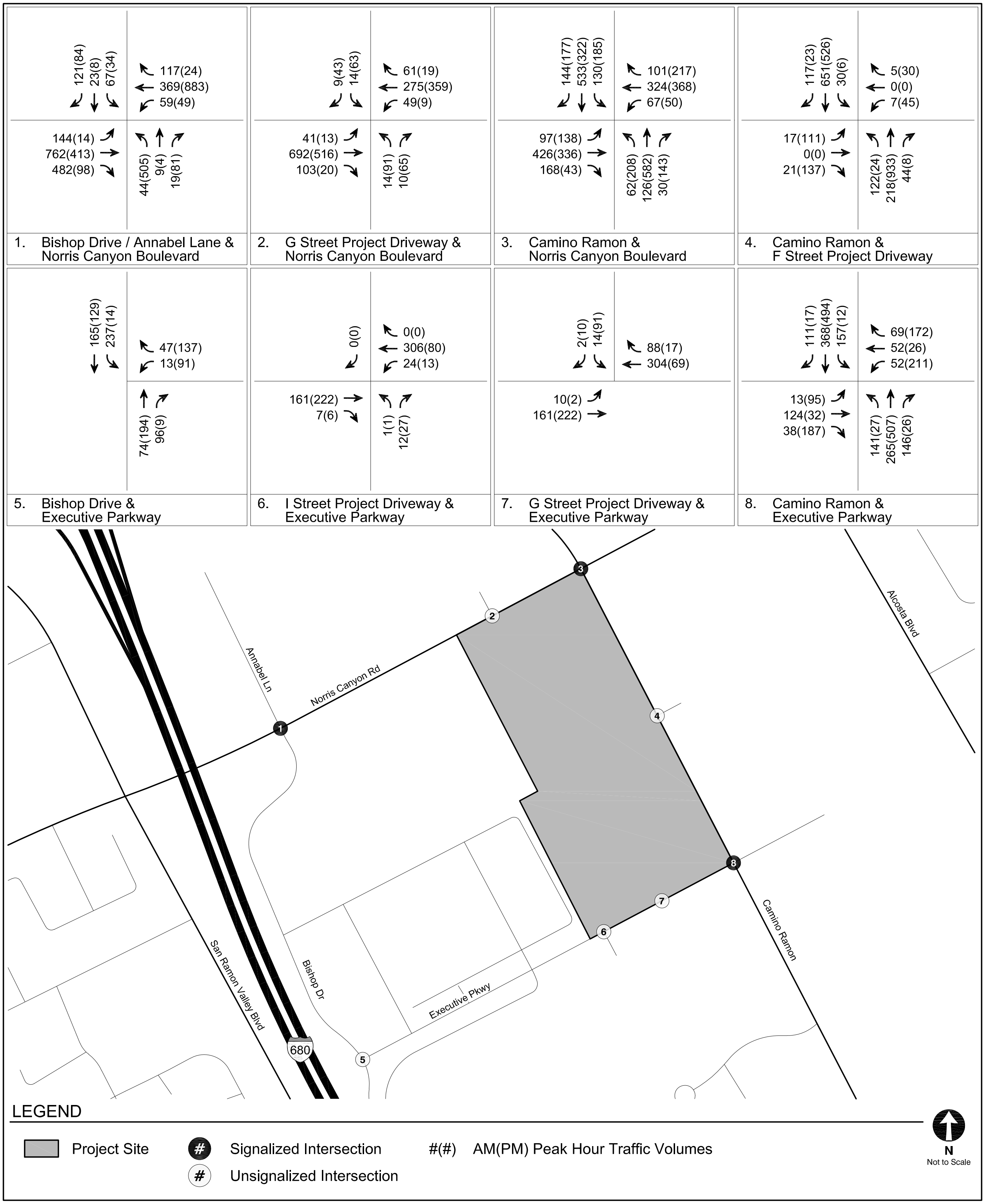
EXISTING BICYCLE NETWORK

FIGURE 3B



EXISTING PEDESTRIAN NETWORK

FIGURE 3C



EXISTING CONDITIONS (YEAR 2021)
PEAK HOUR TRAFFIC VOLUMES

FIGURE 4

TABLE 4
EXISTING TRANSIT SERVICE IN STUDY AREA

Provider, Route, and Service Area		Service Type	Hours of Operation	Average Headway (minutes)	
CCCTA - Weekdays Only				**Peak**	**Off-Peak**
21	BART Walnut Creek - San Ramon	Local	5:30 AM - 10:30 PM	30	60
35	BART Dublin/Pleasanton - San Ramon	Local	6:00 AM - 8:30 PM	15-20	30-60
92X	ACE Express	Express	5:30 AM - 9:00 AM 3:30 PM - 7:30 PM	60	--
95X	San Ramon - BART Walnut Creek	Express	6:00 AM - 9:00 AM 3:30 PM - 7:30 PM	20 min peak only	--
96X	BART Walnut Creek - Bishop Ranch	Express	5:30 AM - 7:15 PM	20 min peak only	3 peak trips
97X	BART Dublin/Pleasonton - Bishop Ranch	Express	6:30 AM - 9:00 AM 4:00 PM - 6:00 PM	60 min peak only	--
Provider, Route, and Service Area		**Service Type**	**Hours of Operation**	**Average Headway (minutes)**	
CCCTA - Weekends Only				**Peak**	**Off-Peak**
321	BART Walnut Creek - San Ramon	Limited	7:30 AM - 10:30 PM	60	60
335	BART Dublin/Pleasonton - San Ramon	Limited	7:45 AM - 7:15 PM	60	60

Notes

Transit peak hours generally occur during 6:00 AM - 9:00 AM and 3:00 PM - 6:00 PM.

CCCTA: Central Contra Costa Transit Authority

BART: Bay Area Rapid Transit

ACE: Altamont Corridor Express

TABLE 5
EXISTING CONDITIONS (YEAR 2021)
INTERSECTION LEVELS OF SERVICE ANALYSIS

No.	Intersection	Peak Hour	Existing Conditions	
			Delay	LOS
1.	Bishop Drive/Annabel Lane & Norris Canyon Road	AM PM	30.1 47.1	C D
2. [a]	G Street Project Driveway & Norris Canyon Road	AM PM	25.4 25.6	D D
3.	Camino Ramon & Norris Canyon Road	AM PM	39.7 44.7	D D
4. [a]	Camino Ramon & F Street Project Driveway	AM PM	25.2 67.5	D F
5. [a]	Bishop Drive & Executive Parkway	AM PM	11.7 12.6	B B
6. [a]	I Street Project Driveway & Executive Parkway	AM PM	9.5 9.8	A A
7. [a]	G Street Project Driveway & Executive Parkway	AM PM	12.6 11.2	B B
8.	Camino Ramon & Executive Parkway	AM PM	29.5 23.0	C C

Notes

Delay is measured in seconds per vehicle

[a] Intersection operates with two-way stop-controlled (TWSC).

Chapter 3

Future without Project Conditions

Estimates of future traffic conditions without the Project, representing cumulative conditions, were developed to provide a base condition on which to evaluate the potential impacts of the Project on the local street system. This chapter details the assumptions used to develop the Future without Project Conditions in Year 2040.

CEQA GUIDELINES REGARDING FUTURE TRAFFIC CONDITIONS

The forecast traffic volumes for the Future without Project Conditions scenario were prepared in accordance with procedures outlined in the CEQA guidelines. Specifically, two options are provided for developing the cumulative traffic volume forecast:

> "(A) A list of past, present, and probable future projects producing related or cumulative impacts, including, if necessary, those projects outside the control of the [lead] agency, or
>
> "(B) A summary of projections contained in an adopted general plan or related planning document, or in a prior environmental document which has been adopted or certified, which described or evaluated regional or area wide conditions contributing to the cumulative impact. Any such planning document shall be referenced and made available to the public at a location specified by the lead agency."

As described in detail below, this analysis includes traffic growth both from future projects (Option "A" above, the "Related Projects") and from regional growth projections (Option "B" above, or ambient growth) based on the CCTA Model. The CCTA Model provides a method to analyze and estimate traffic relative to the land use policies and potential development footprints as well as the effects of regional growth within the Study Area. Therefore, the CCTA Model traffic projections are inclusive of local and regional development when applied to the freeways and arterial/surface streets.

CCTA MODEL ANALYSIS METHODOLOGY

The development of the future travel forecasts was accomplished through the use of the CCTA Model[1] volumes developed in *Transportation Impact Study for the CityWalk Master Plan Project* (Gibson Transportation Consulting, Inc., March 2020). The CCTA Model was used to distribute the Project trips from the CityWalk Master Plan on the network based on a dynamic trip distribution[2] methodology from each Project traffic analysis zone (TAZ). This same methodology was used to develop the background traffic growth. The Project Site is located in the same TAZ as the CityWalk Master Plan; therefore, the same future model volumes were utilized. The following describes the use of the CCTA Model to develop the future weekday peak hour traffic volumes at the study intersections and is further detailed in Appendix G:

1. It is anticipated that several cumulative development projects within the Study Area will be constructed by the Project Buildout Year, including the CityWalk Master Plan. Assumptions related to the cumulative development in the unaffected non-Project TAZs and the development of background traffic conditions were not changed from the model's approved future land use assumptions. Therefore, the existing office uses on site are also included in the background traffic conditions.

2. The model runs were performed by adding the CityWalk Master Plan development in the Project TAZ to distribute the additional CityWalk Master Plan Project's trip origin and destinations to other origins and destinations using the CCTA model distribution and subsequently assigning the resulting trip tables to the model network.

3. The results of each model run were provided as intersection approach/departure link volumes at each analyzed location during morning and afternoon peak hours. The peak hour intersection approach/departure link volumes were further developed into specific intersection level turning movement volumes via the Furness process, which allows the preparation of the intersection LOS analysis.

This methodology is the state of the practice approach to long-range travel demand forecasting when empirical data is available to compare to base year model output information.

---

[1] The version of the CCTA Model obtained consists of the Metropolitan Transportation Commission Plan Bay Area 2040 and 2017 Regional Transportation Plan Update (documented in April 2019)

[2] Dynamic trip distribution takes into account the congested locations projected to occur on the model network as a result of assigning background traffic and the trips generated by specific zones. During a model run, the model will distribute trips to the least congested routes in an iterative process until equilibrium is reached. Trips are distributed to locations within the street network and not based on a fixed/predetermined route. Trip patterns between model scenarios may vary, even though identical parameters are used.

FUTURE IMPROVEMENTS

The analysis of future conditions considered roadway and intersection improvements via capital projects that are reasonably expected to be implemented prior to the buildout of the proposed Project (Year 2040). The City has developed a comprehensive five-year plan in which it identifies needed capital projects in the area and the financing and timing of such improvements. The latest update to this plan is outlined in *Capital Improvement Program 2019/2020 – 2023/24 Final Report* (City of San Ramon, Adopted June 11, 2019) (CIP).

Prior to construction, planned improvements that are not currently funded will be programmed for funding from various sources including bond proceeds, development impact fees, grants, taxes, etc. A number of the improvements are also mitigation measures for larger projects that have already undergone CEQA review such as Project #905530, which has also undergone National Environmental Policy Act review. Therefore, substantial evidence supports the conclusion that these capital projects will be completed when warranted prior to buildout of the Project that could cause a significant impact.

The following intersection improvement detailed in the CIP is not warranted at this time or deferred indefinitely and, therefore, was conservatively omitted from the future analyses:

- <u>Project #975609: Norris Canyon Road & Bishop Drive/Annabel Lane (Intersection #1)</u> – Bishop Drive will be widened to provide an additional left-turn lane in the northbound direction. The resulting northbound lane configuration will include one left-turn lane, one shared through/left-turn lane, and one shared through/right-turn lane. In addition, the project includes the replacement of the signal pole on the northeast corner and upgrades to the pedestrian ramps on the north side of Norris Canyon Road. The 2040 LOS analysis showed that this intersection would operate at an acceptable LOS operation under future operating conditions prior to any improvements (LOS C during the morning peak hour and LOS D during the afternoon peak hour). Based on discussions with the City, the improvement has been deferred indefinitely due to geometric constraints. Therefore, no future improvement was assumed under Future without Project Conditions.

Future Bicycle Improvements

The Bicycle Master Plan identifies the City's vision for a more integrated bicycle network throughout the City, including within the Study Area. It proposes the following bicycle facilities within the Study Area:

Multi-Use Path (Class I)

- Camino Ramon

Bicycle Lanes (Class II)

- Executive Parkway west of Camino Ramon (installed)

Separated Bicycle Lanes (Class IV)

- San Ramon Valley Boulevard
- Norris Canyon Road
- Executive Parkway east of Camino Ramon

CITYWALK MASTER PLAN FUTURE ROADWAY IMPROVEMENTS

The following proposed roadway improvements, which are neither included as part of the planned roadway improvements detailed in the CIP nor required to reduce the CityWalk Master Plan's impacts to less than significant levels, have been assumed as part of the CityWalk Master Plan's design features:

Roadway Segment Improvements

- Executive Parkway between Bishop Drive and Camino Ramon – Executive Parkway will be reconfigured to provide a wider center median while still retaining the existing on-street bike lanes. A new separated multi-use, off-street trail would be provided along the south side of the street. In addition, the existing landscape median will be reconfigured to provide additional left-turn lanes into parcels along both the north and south sides of the street. As proposed, Executive Parkway will provide one through lane in each direction with left-turn lanes protected by the wider raised median.

Intersection Improvements

- Camino Ramon & Executive Parkway (Intersection #8) – Executive Parkway will be reconfigured to provide an exclusive left-turn lane in the eastbound direction. The resulting eastbound lane configuration will include one left-turn lane, one through lane, and one right-turn lane.

Pedestrian Improvements

The CityWalk Master Plan includes a proposed High-Intensity Activated Crosswalk signalized/controlled midblock crosswalk along Executive Parkway, immediately west of the new parking structure within BR 2600 NW. This midblock crosswalk would provide pedestrians an accessible pathway between the Bishop Ranch campuses as well as direct access to one of the three new mobility hubs proposed in the CityWalk Master Plan.

OTHER FUTURE TRANSPORTATION IMPROVEMENT PROGRAMS

As described below, there are several other transportation programs in various stages of development that could have a substantial effect on the transportation system performance in the Study Area. For conservative purposes, the effects of these potential programs were not considered in the analysis of the Project.

Freeway Express Lane Improvements

Caltrans is currently constructing express lanes on I-680 between the Benicia-Martinez Bridge and US 101, which will provide a continuous express lane for approximately 55 miles between the Carquinez Strait and the City of San Jose. This project will reduce travel times for carpools, buses, and rideshares, which in turn will lead to a reduction in single-occupancy vehicle travel. Portions of the project have already been completed and are in operation; the remaining segments are scheduled for completion by 2030.

Innovate 680

CCTA has identified seven strategies for improving the operations of I-680 through the City:

1. Complete Express Lanes
2. Cool Corridor "Hot Spots"
3. Enhance Transit Service with Bus-On-Shoulder Operations
4. Innovative Operational Strategies
5. Provide First/Last Mile Connections with Shared Autonomous Vehicles
6. Prepare the Corridor for the Future
7. Transportation Demand Management (TDM)

FUTURE TRAFFIC VOLUMES

CCTA Model Traffic Volumes

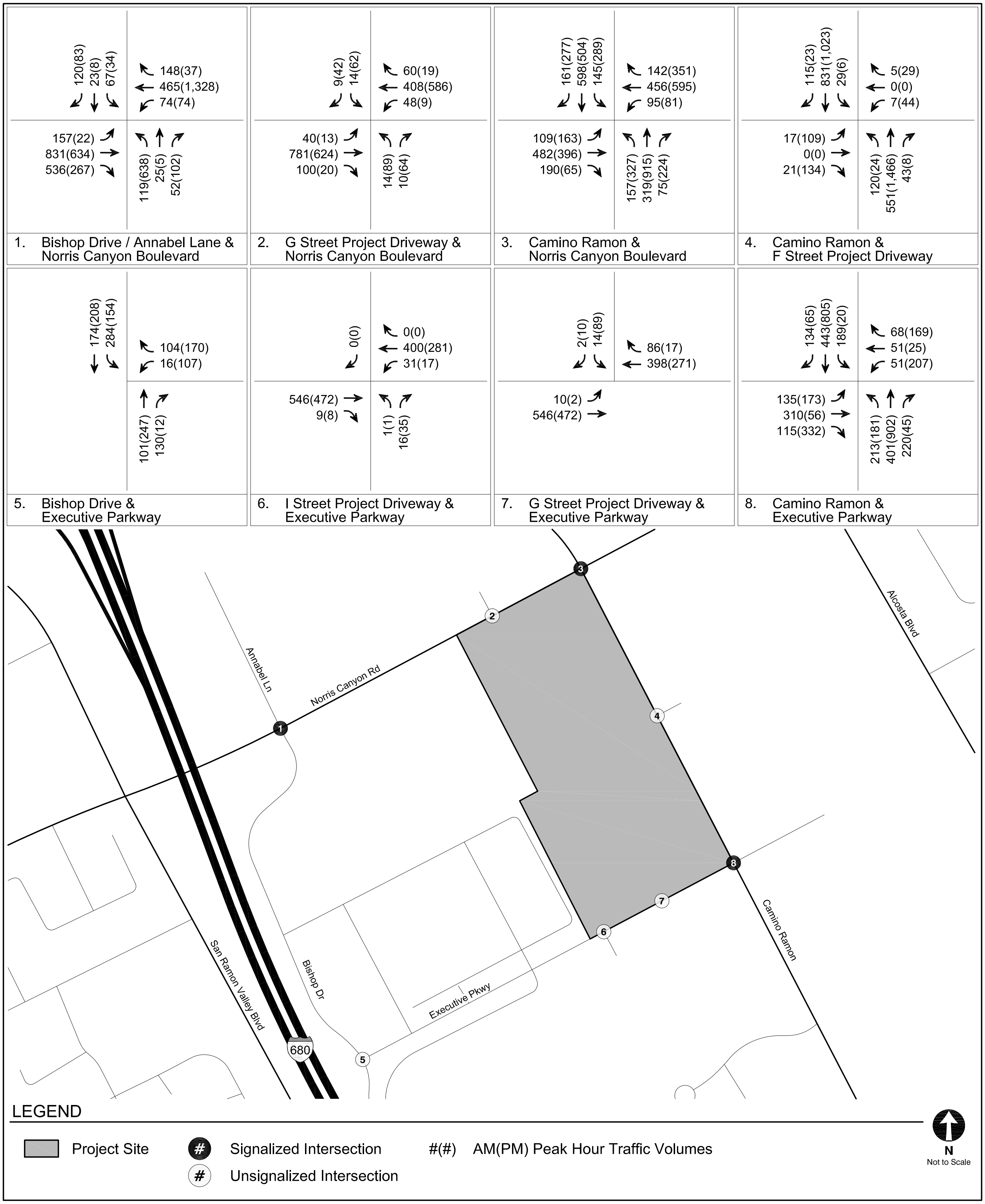
The process for developing the weekday morning and afternoon peak hour traffic volumes from the CCTA Model is described above. Figure 5 illustrates the weekday morning and afternoon peak hour volumes for the Future without Project Conditions scenario.

FUTURE WITHOUT PROJECT INTERSECTION LEVELS OF SERVICE

Table 6 summarizes the weekday morning and afternoon peak hour LOS results for each of the signalized study intersections under Future without Project Conditions. As shown, five of the eight study intersections are anticipated to continue to operate at LOS D or better during both the weekday morning and afternoon peak hours. The following three study intersections are anticipated to operate at LOS E or F during at least one of the analyzed peak hours:

- G Street Project Driveway & Norris Canyon Road (Intersection #2): LOS E during the morning peak hour and LOS F during the afternoon peak hour)
- Camino Ramon & Norris Canyon Road (Intersection #3): LOS F during the afternoon peak hour
- Camino Ramon & F Street Project Driveway (Intersection #4): LOS F during the morning and afternoon peak hours)

The LOS calculation worksheets are provided in Appendix D.



FUTURE WITHOUT PROJECT CONDITIONS (YEAR 2040)
PEAK HOUR TRAFFIC VOLUMES

FIGURE 5

TABLE 6
FUTURE WITHOUT PROJECT CONDITIONS (YEAR 2040)
INTERSECTION LEVELS OF SERVICE ANALYSIS

No.	Intersection	Peak Hour	Future without Project Conditions	
			Delay	LOS
1.	Bishop Drive/Annabel Lane & Norris Canyon Road	AM PM	28.5 57.3	C E
2. [a]	G Street Project Driveway & Norris Canyon Road	AM PM	32.7 49.0	D E
3. [b]	Camino Ramon & Norris Canyon Road	AM PM	48.2 82.6	D F
4. [a]	Camino Ramon & F Street Project Driveway	AM PM	47.9 842.7	E F
5. [a]	Bishop Drive & Executive Parkway	AM PM	12.7 25.8	B D
6. [a]	I Street Project Driveway & Executive Parkway	AM PM	13.0 12.1	B B
7. [a]	G Street Project Driveway & Executive Parkway	AM PM	20.3 19.0	C C
8. [b]	Camino Ramon & Executive Parkway	AM PM	33.8 32.8	C C

Notes

Delay is measured in seconds per vehicle

[a] Intersection operates with two-way stop-controlled (TWSC).

[b] Intersection includes intersection improvements under Future Conditions per the CityWalk Master Plan Project as warrantec

Chapter 4
Project Traffic

This chapter describes the assumptions and methodology used in developing the traffic volumes associated with the Project.

PROJECT DESCRIPTION

As described in Chapter 1, the Applicant proposes to construct a residential project in the urban core of the City. The Project would construct 404 residential units consisting of 268 single-family detached homes and 136 multi-family dwelling units, including 114 detached row homes, 154 detached courtyard homes, and 136 attached town homes. The Project Site is currently occupied with approximately 564,000 sf of office uses, which would be removed with the development of the Project.

The Project would provide multiple pedestrian entry points for residents and guests along Executive Parkway, Camino Ramon, and Norris Canyon Road. A two-acre park, along with an enhanced landscaped pedestrian walkway along Camino Ramon, would be provided for residents and the local community.

Existing parking for the current office uses on the Project Site is provided within surface parking lots. Parking for the Project would be provided on-site, including a two-car garage for each unit and an additional 120 parking spaces for guests for a total of 928 spaces. The Project Site currently provides four access points, two full-access driveways on Camino Ramon and one full access driveway each on Executive Parkway and Norris Canyon Road. Vehicular access to the Project Site would be provided via existing full-access driveways along Executive Parkway, Camino Ramon, and Norris Canyon Road. The two full-access driveways on Camino Ramon would be consolidated into one full-access driveway on Camino Ramon and an additional driveway on Executive Parkway, accommodating right-turn ingress and egress only, would be provided. The conceptual Project Site plan is shown in Figure 1.

PROJECT DESIGN FEATURES

The following proposed roadway improvements have been assumed as part of the Project design features:

Intersection Improvements

- I Street Project Driveway & Executive Parkway (Intersection #6) – Currently, an intersection exists on the south side of Executive Parkway, opposite this proposed access, and includes one through/right-turn lane in the eastbound direction and one exclusive left-turn lane and one through lane in the westbound direction to serve the parcel at 2600 Camino Ramon. A shared left/right-turn lane is provided in the northbound direction for exiting traffic. The Project will be constructing a new driveway on the north side of Executive Parkway to align with the 2600 Camino Ramon driveway. The new Project driveway will include a southbound right-turn-only lane as left turns would be prohibited both in/out of the driveway. No reconfiguration of lanes on Executive Parkway would be necessary.

Pedestrian and Bicycle Improvements

In order to support and facilitate bicycle use to and from the Project Site, short-term and long-term bicycle parking spaces would be provided in each residential component of the Project. The Project will enhance pedestrian connectivity through multiple site access points for residents and guests along Executive Parkway, Camino Ramon, and Norris Canyon Road, as well as an enhanced landscaped pedestrian walkway along Camino Ramon. The Project also proposes to provide a two-acre park open to residents and the public at the northwest corner of Camino Ramon & Executive Parkway. The Project would provide direct access to the park via internal pedestrian connections.

The Project is consistent with the goals and priorities of the City's bike and pedestrian network plans and would not preclude the implementation of any improvements detailed in those plans.

PROJECT TRIP GENERATION

The number of vehicular trips expected to be generated by the Project was estimated using rates published in *Trip Generation Manual, 10th Edition* (Institute of Transportation Engineers, September 2017) based on developments located in "General Urban/Suburban" locations. These rates are based on surveys of similar land uses at sites around the country and are provided as both daily rates and morning and afternoon peak hour rates. The number of vehicle trips traveling to and from the Project Site is related to the size of development and type of land use proposed.

After accounting for the removal of the existing office uses on site, the Project is anticipated to generate a net decrease of 2,154 daily trips, including a net decrease of 296 morning peak hour trips (-413 inbound, +117 outbound) and a net decrease of 248 afternoon peak hour trips (+121 inbound, -369 outbound), as summarized in Table 7.

PROJECT TRIP DISTRIBUTION

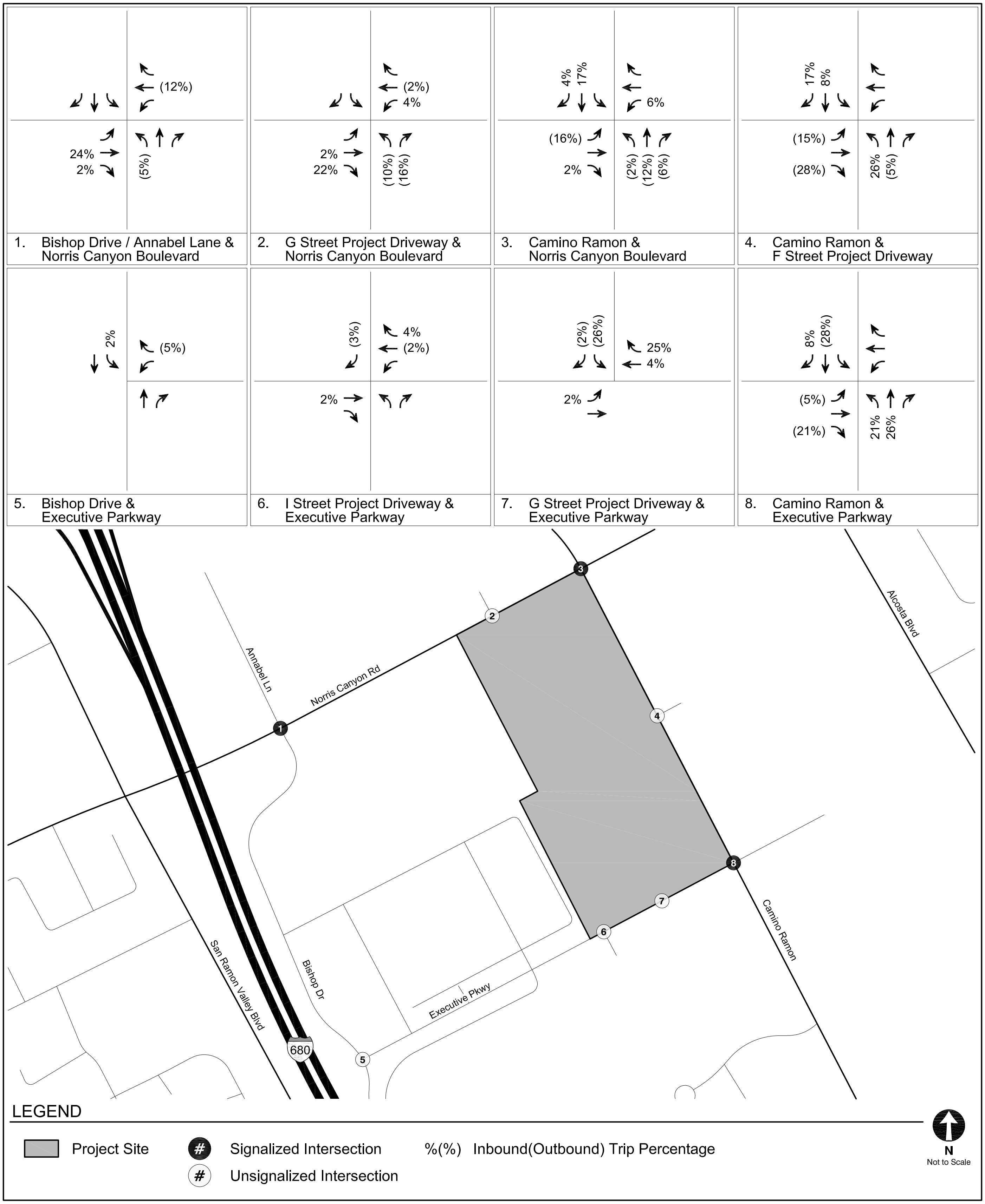
The Project trip distribution was developed based on the residential trip distribution detailed in CityWalk Master Plan. These trip distribution patterns were compared to the distribution patterns developed in the CCTA Model. The trip distribution patterns were then adjusted to account for characteristics of the street system serving the Project Site, the land use patterns in the Study Area, the level of accessibility of the routes to and from the Project Site, existing intersection traffic volumes, the Project ingress/egress availability based on the proposed site access and circulation scheme, the location of the proposed driveways, and input from City staff.

Based on these considerations, traffic entering and exiting the Project Site was assigned to the surrounding street system. The trip distribution patterns within the Study Area for the Project are shown in Figure 6.

It should be noted that parents taking their children to local schools during the peak hours are included in the inbound and outbound residential trip generation rates. Special consideration was given to the residential project trip distribution patterns so that the appropriate connections between the Project residential buildings and the local schools were taken into account.

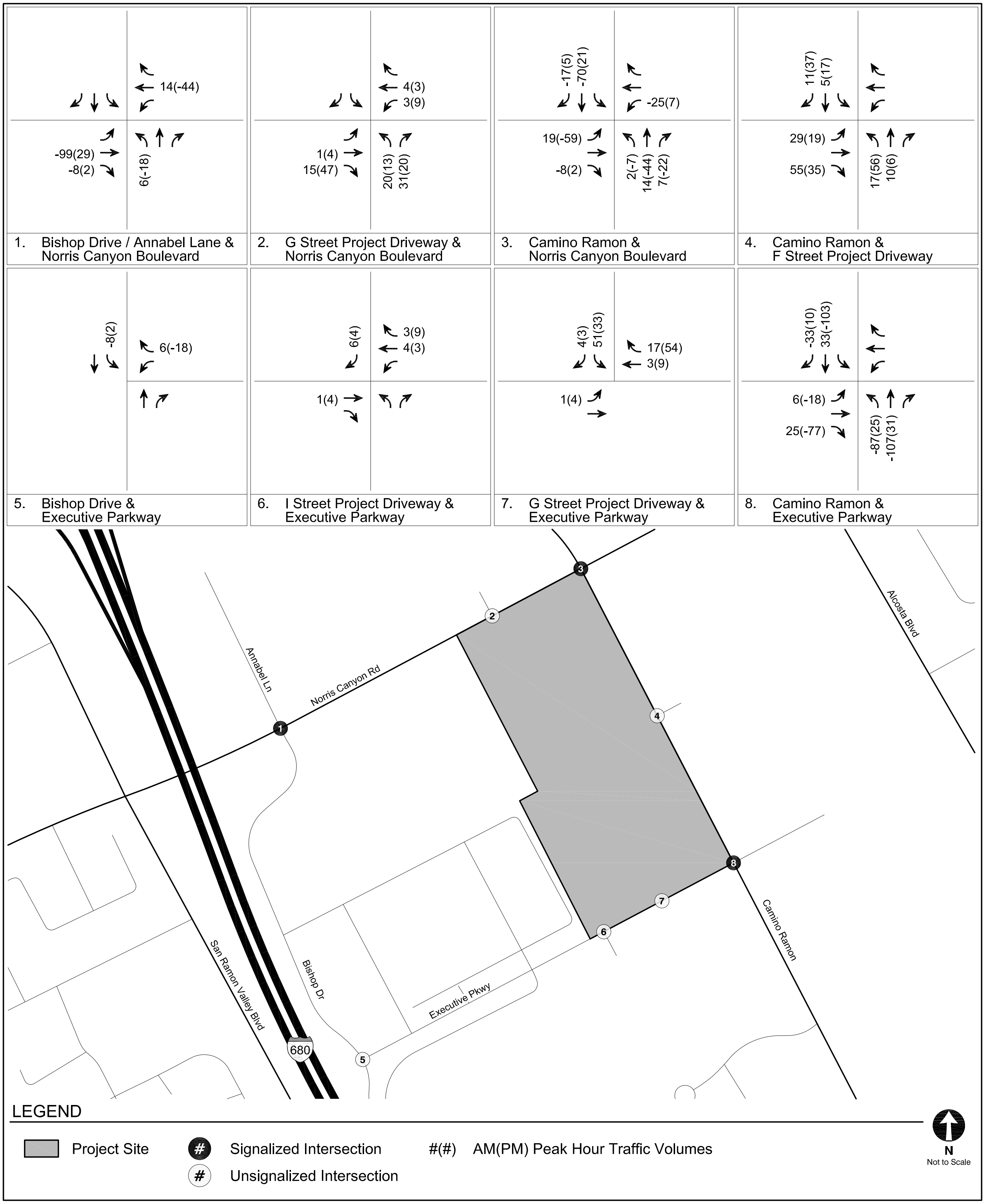
PROJECT TRIP ASSIGNMENT

The Project trip generation estimates summarized in Table 7 and the trip distribution patterns shown in Figure 6 were used to assign the Project-generated traffic through the study intersections. Figure 7 illustrates the Project-only traffic volumes at the study intersections during typical weekday morning and afternoon peak hours.



PROJECT TRIP DISTRIBUTION

FIGURE 6



NET PROJECT-ONLY
PEAK HOUR TRAFFIC VOLUMES

FIGURE 7

TABLE 7
PROJECT TRIP GENERATION

Land Use	ITE Land Use	Rate	Daily	Morning Peak Hour			Afternoon Peak Hour		
				In	Out	Total	In	Out	Total
TRIP GENERATION RATES [a]									
Single-Family Detached Housing	210	per Dwelling Unit	9.44	25%	75%	0.74	63%	37%	0.99
Multi-Family Housing (Low-Rise)	220	per Dwelling Unit	7.32	23%	77%	0.46	63%	37%	0.56
Public Park	411	per Acre	0.78	59%	41%	0.02	55%	45%	0.11
General Office Building	710	per ksf	[b]	86%	14%	[b]	16%	84%	[b]
TRIP GENERATION ESTIMATES									
Proposed Project									
Single-Family Detached Housing	210	268 du	2,530	50	148	198	167	98	265
Multi-Family Housing (Low-Rise)	220	136 du	996	14	49	63	48	28	76
Public Park	411	2 acres	2	0	0	0	0	0	0
TOTAL - PROPOSED USES			*3,528*	*64*	*197*	*261*	*215*	*126*	*341*
Existing to be Removed									
General Office	710	564.0 ksf	(5,682)	(479)	(78)	(557)	(94)	(495)	(589)
TOTAL - EXISTING TO BE REMOVED			*(5,682)*	*(479)*	*(78)*	*(557)*	*(94)*	*(495)*	*(589)*
TOTAL - NET NEW PROJECT TRIPS			**(2,154)**	**(415)**	**119**	**(296)**	**121**	**(369)**	**(248)**

Notes:

ksf: 1,000 square feet

[a] Trip generation rates are from *Trip Generation Manual, 10th Edition* (Institute of Transportation Engineers, 2017) and are based on developments located in "General Urban/Suburban" location.

[b] Trip generation rate based on the best-fit curve formula listed in the *Trip Generation Manual, 10th Edition* for the General Office land use.

Weekday Daily - Ln (T) = 0.97 Ln (X) + 2.50 T = Average Vehicle Trips X = Gross Leasable Area (ksf)

A.M. Peak Hour - T = 0.94 (X) + 26.49

P.M. Peak Hour - Ln (T) = 0.95 Ln (X) + 0.36

Chapter 5
Existing and Future with Project Conditions

This chapter describes the results of the intersection operating conditions analysis when the Existing and Future with Project Conditions are compared to Existing and Future without Project Conditions. The analysis year of 2040 corresponds to the anticipated buildout year of the Project. All future cumulative traffic growth and transportation infrastructure improvements described in Chapter 3 are incorporated into this analysis.

EXISTING WITH PROJECT TRAFFIC VOLUMES

The Project-only morning and afternoon peak hour traffic volumes described in Chapter 4 and shown in Figure 7 were added to the Existing morning and afternoon peak hour traffic volumes shown in Figure 4. The resulting volumes are illustrated in Figure 8 and represent Existing with Project Conditions.

EXISTING WITH PROJECT INTERSECTION LEVELS OF SERVICE

Table 8 summarizes the results of the analysis of the Existing with Project Conditions during the weekday morning and afternoon peak hours for the eight study intersections. Since the Project generates substantially fewer trips than the existing use, intersection delays demonstrate improved performance at several locations. As shown, seven of the eight study intersections are anticipated to operate at acceptable LOS D conditions or better during both the morning and afternoon peak hours under Existing with Project Conditions. Camino Ramon & F Street Project Driveway (Intersection #4) is anticipated to operate at LOS C during the morning peak hour and at LOS F during the afternoon peak hours under Existing with Project Conditions (although the

Project is responsible for a four-second reduction in afternoon peak hour intersection delay as a result of the decrease in Project trips as compared to the existing on-site land uses).

EXISTING WITH PROJECT OPERATIONAL IMPACTS

The impact of adding Project traffic volumes during the peak hours to the Existing Conditions was evaluated based on analysis of operating conditions at the study intersections without and with the Project. The previously discussed impact criteria and thresholds summarized in Chapter 1 were then used to determine the level of a transportation impact caused by the Project on each study intersection, prior to any off-site Project improvements or trip reduction measures.

The Existing with Project Conditions during the weekday morning and afternoon peak hours are shown in Table 8. As shown, the Project is not expected to result in operational impacts at any of the eight study intersections during the morning or afternoon peak hours under Existing with Project conditions. Therefore, improvements would not be required.

FUTURE WITH PROJECT TRAFFIC VOLUMES

The Project-only morning and afternoon peak hour traffic volumes described in Chapter 4 and shown in Figure 7 were added to the Future without Project morning and afternoon peak hour traffic volumes shown in Figure 5. The resulting volumes are illustrated in Figure 9 and represent Future with Project Conditions after the full development of the Project by Year 2040.

FUTURE WITH PROJECT INTERSECTION LEVELS OF SERVICE

Table 9 summarizes the results of the Future with Project Conditions during the weekday morning and afternoon peak hours for the eight study intersections. Since the Project generates substantially fewer trips than the existing use, intersection delays demonstrate improved performance at several locations. As shown, five of the eight study intersections are anticipated to operate at acceptable LOS D conditions or better during both the morning and afternoon peak hours under Future with Project Conditions. The following three study intersections are anticipated to operate at LOS E or F during one or both peak hours under Future with Project Conditions:

- G Street Project Driveway & Norris Canyon Road (Intersection #2): LOS E during the morning peak hour and LOS F during the afternoon peak hour
- Camino Ramon & Norris Canyon Road (Intersection #3): LOS F during the afternoon peak hour
- Camino Ramon & F Street Project Driveway (Intersection #4): LOS E during the morning peak hour and LOS F during the afternoon peak hour

FUTURE WITH PROJECT OPERATIONAL IMPACTS

The relative impact of the added Project traffic volumes during the peak hours was evaluated based on analysis of future operating conditions at the study intersections without and with the Project. The previously discussed impact criteria and thresholds summarized in Chapter 1 were then used to determine the level of a transportation impact caused by the Project on each study intersection, prior to any off-site Project improvements or trip reduction measures.

The Future with Project Conditions during the weekday morning and afternoon peak hours are shown in Table 9. As shown, the Project is not expected to result in any operational impacts at the eight study intersections in Year 2040 under Future with Project Conditions. Therefore, improvements would not be required.

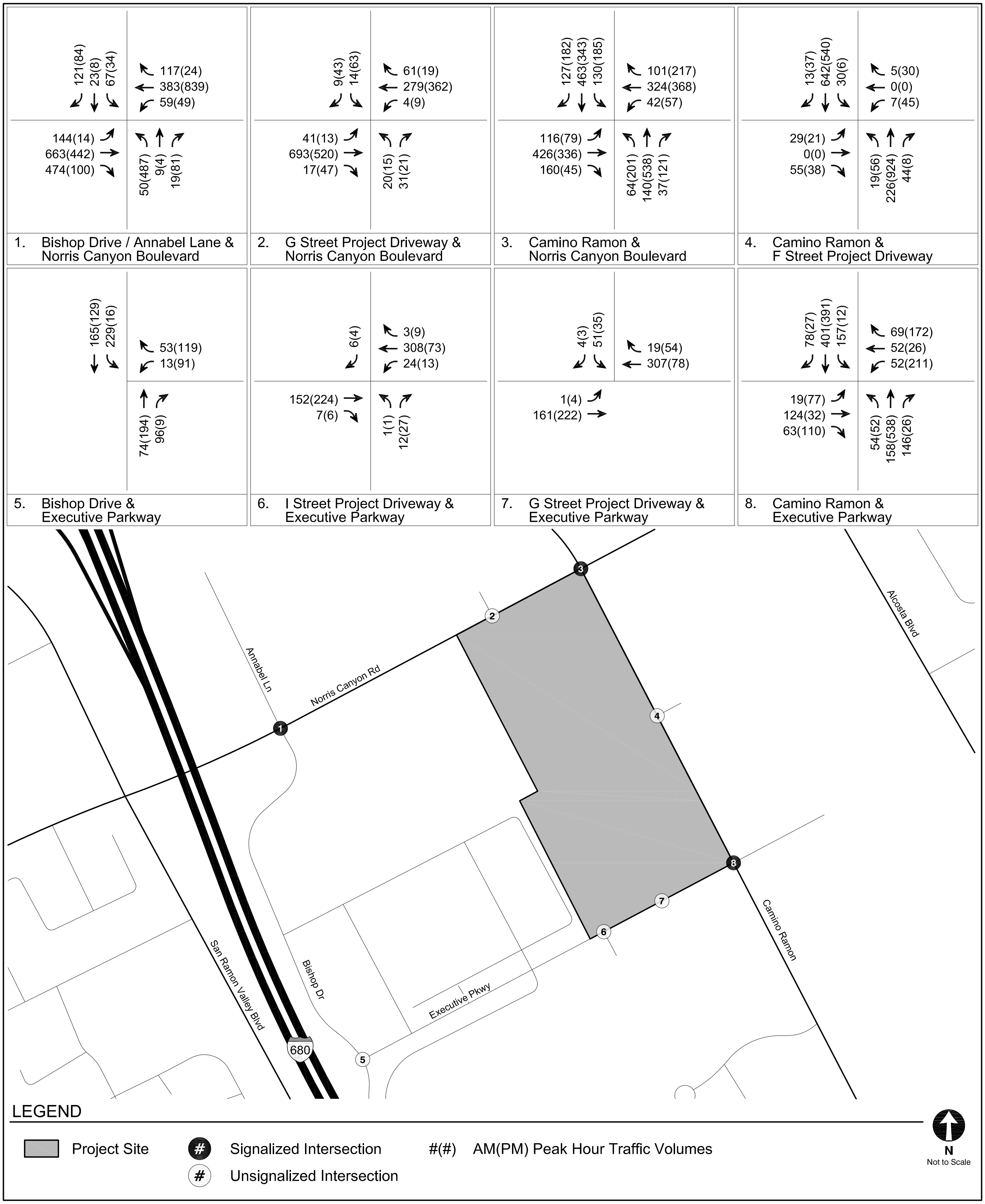
Signal Warrant Analysis

Signal warrant analyses were conducted to evaluate for the potential installation of a new traffic signal at the Project driveway of Camino Ramon & F Street Project Driveway (Intersection #4) which operates at LOS F during the afternoon peak hour under Future with Project Conditions.

The signal warrant analyses follow the guidelines set forth in CA MUTCD, by applying the thresholds from Warrant 3 (peak hour). The following methodology, as quoted from the CA MUTCD, was used to evaluate signal warrants at the location:

> ***Warrant 3, Peak-Hour Vehicular Volume Warrant***
>
> *Signal Warrant 3 is intended for use at a location where traffic conditions are such that for a minimum of one hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street. Combined volumes for both approaches of the major street are included while only the volume from the higher minor street approach is included. At an intersection with a high volume of left-turn traffic from the major street, the analysis may include the major street left-turn volumes plus the minor street approach volume as the total "minor street" volume. The warrant is satisfied if traffic volumes for any one hour of an average day exceed the plotted lines shown in the following figure.*

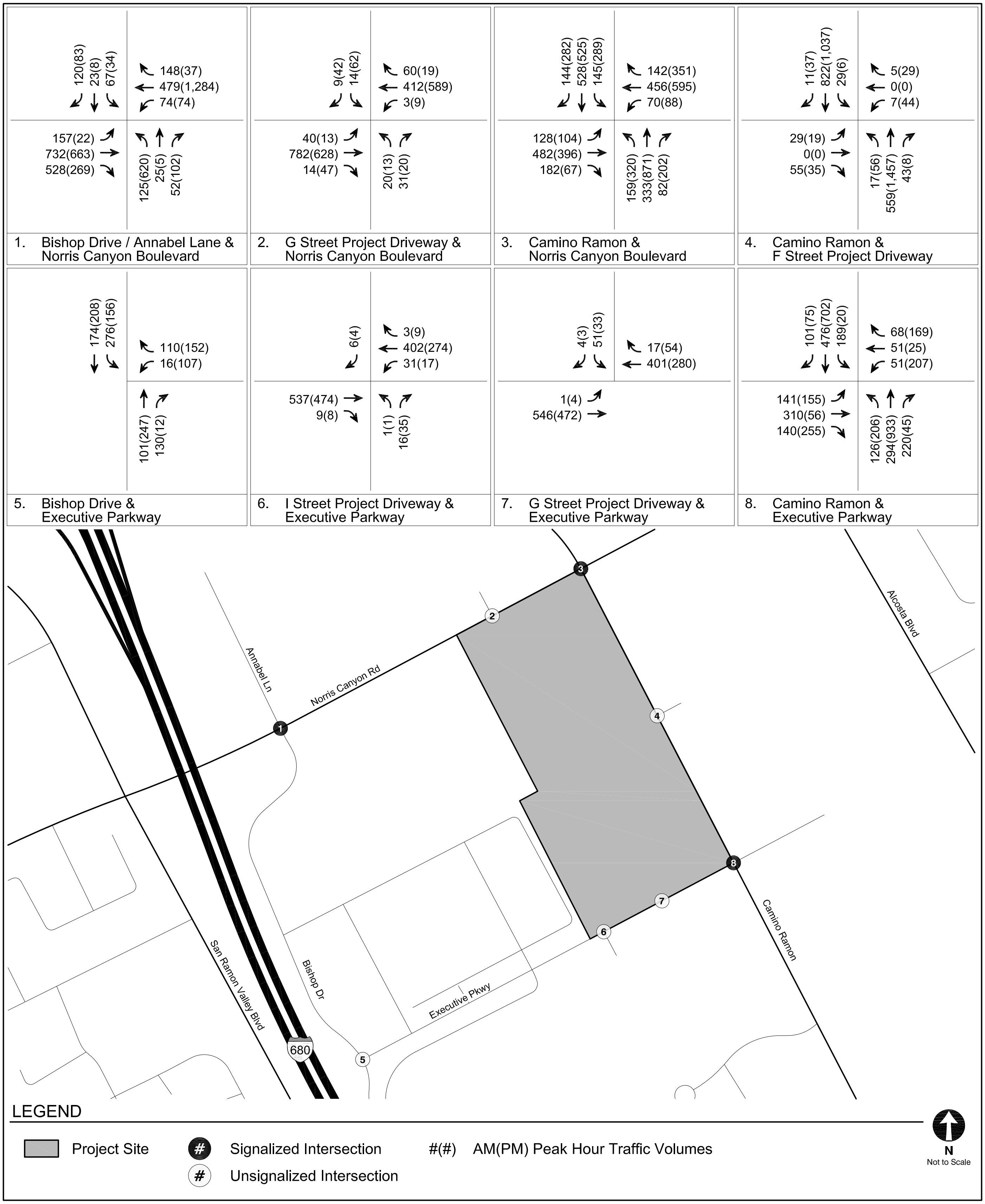
The analyzed unsignalized intersection at Camino Ramon & F Street Project Driveway (Intersection #4) does not meet the minimum peak hour traffic volume threshold of Warrant 3 and signalization is not recommended. Although the future projected volumes on northbound and southbound Camino Ramon are high (over 1,000 vehicles per hour in the afternoon peak hour), the volume of traffic leaving the Project site in the afternoon peak hour is not high enough to meet warrants. With the level of delay shown in Table 8 for Intersection #4 in the afternoon peak hour, it is likely that the repeat residents leaving the site would use other exit driveways in order to avoid the congestion at this intersection. Detailed signal warrant worksheets are provided in Appendix H.



EXISTING WITH PROJECT CONDITIONS (YEAR 2021)
PEAK HOUR TRAFFIC VOLUMES

FIGURE 8

Gibson transportation consulting, inc.



FUTURE WITH PROJECT CONDITIONS (YEAR 2040)
PEAK HOUR TRAFFIC VOLUMES

FIGURE 9

TABLE 8
EXISTING WITH PROJECT CONDITIONS (YEAR 2021)
OPERATIONAL IMPACT ANALYSIS

No.	Intersection	Peak Hour	Existing Conditions		Existing with Project Conditions			
			Delay	LOS	Delay	LOS	Change in Delay [c]	Operational Impact [d]
1.	Bishop Drive/Annabel Lane &	AM	30.1	C	31.1	C	1.0	NO
	Norris Canyon Road	PM	47.1	D	44.7	D	-2.4	NO
2.	G Street Project Driveway &	AM	25.4	D	18.5	C	-6.9	NO
[a]	Norris Canyon Road	PM	25.6	D	17.9	C	-7.7	NO
3.	Camino Ramon &	AM	39.7	D	37.0	D	-2.7	NO
	Norris Canyon Road	PM	44.7	D	44.4	D	-0.3	NO
4.	Camino Ramon &	AM	25.2	D	16.0	C	-9.2	NO
[a]	F Street Project Driveway	PM	67.5	F	63.5	F	-4.0	NO
5.	Bishop Drive &	AM	11.7	B	11.4	B	-0.3	NO
[a]	Executive Parkway	PM	12.6	B	12.4	B	-0.2	NO
6.	I Street Project Driveway &	AM	9.5	A	10.2	B	0.7	NO
[a] [b]	Executive Parkway	PM	9.8	A	9.8	A	0.0	NO
7.	G Street Project Driveway &	AM	12.6	B	12.8	B	0.2	NO
[a]	Executive Parkway	PM	11.2	B	10.9	B	-0.3	NO
8.	Camino Ramon &	AM	29.5	C	29.1	C	-0.4	NO
	Executive Parkway	PM	23.0	C	23.4	C	0.4	NO

Notes

Delay is measured in seconds per vehicle

[a] Intersection operates with TWSC.

[b] Intersection includes intersection improvements under "with Project" Conditions per Project Design Feature.

[c] Average delay at an intersection may decrease with the addition of traffic when additional traffic is added to a movement or direction with less congestion than the overall intersection. Therefore, the average delay per vehicle at an intersection actually decreases.

[d] Operational impacts based on thresholds outlined in Table 3 and detailed below.

Signalized Intersection: The Project worsens intersection operations from LOS D or better to LOS E or F, or the change in average delay is more than 5 seconds per vehicle at an intersection operating at LOS E or F without project traffic.

Two-Way Stop-Controlled (TWSC): The Project causes a turning movement's acceptable LOS to decline to an unacceptable LOS and the peak hour volume signal warrant is met.

TABLE 9
FUTURE WITH PROJECT CONDITIONS (YEAR 2040)
OPERATIONAL IMPACT ANALYSIS

No.	Intersection	Peak Hour	Future without Project Conditions		Future with Project Conditions			
			Delay	LOS	Delay	LOS	Change in Delay [d]	Operational Impact [e]
1.	Bishop Drive/Annabel Lane & Norris Canyon Road	AM PM	28.5 57.3	C E	28.6 52.7	C D	0.1 -4.6	NO NO
2. [a]	G Street Project Driveway & Norris Canyon Road	AM PM	32.7 49.0	D E	22.6 31.1	C D	-10.1 -17.9	NO NO
3. [b]	Camino Ramon & Norris Canyon Road	AM PM	48.2 82.6	D F	42.7 80.2	D F	-5.5 -2.4	NO NO
4. [a]	Camino Ramon & F Street Project Driveway	AM PM	47.9 842.7	E F	25.2 780.7	D F	-22.7 -62.0	NO NO
5. [a]	Bishop Drive & Executive Parkway	AM PM	12.7 25.8	B D	12.5 25.4	B D	-0.2 -0.4	NO NO
6. [a] [c]	I Street Project Driveway & Executive Parkway	AM PM	13.0 12.1	B B	13.2 12.2	B B	0.2 0.1	NO NO
7. [a]	G Street Project Driveway & Executive Parkway	AM PM	20.3 19.0	C C	22.4 16.8	C C	2.1 -2.2	NO NO
8. [b]	Camino Ramon & Executive Parkway	AM PM	33.8 32.8	C C	29.0 33.3	C C	-4.8 0.5	NO NO

Notes

Delay is measured in seconds per vehicle

[a] Intersection operates with TWSC.

[b] Intersection includes intersection improvements under Future Conditions per the CityWalk Master Plan Project as warranted.

[c] Intersection includes intersection improvements under "with Project" Conditions per Project Design Feature.

[d] Average delay at an intersection may decrease with the addition of traffic when additional traffic is added to a movement or direction with less congestion than the overall intersection. Therefore, the average delay per vehicle at an intersection actually decreases.

[e] Operational impacts based on thresholds outlined in Table 3 and detailed below.

Signalized Intersection	The Project worsens intersection operations from LOS D or better to LOS E or F, or the change in average delay is more than 5 seconds per vehicle at an intersection operating at LOS E or F without project traffic.
Two-Way Stop-Controlled (TWSC)	The Project causes a turning movement's acceptable LOS to decline to an unacceptable LOS and the peak hour volume signal warrant is met.

Chapter 6
Caltrans Analysis

This chapter presents an analysis of Caltrans facilities, including freeway mainline segments, Caltrans intersections, ramp sections, and off-ramp queuing to provide further information to the decision makers.

ANALYZED FACILITIES

As shown in Table 10, the analyses conducted on Caltrans facilities included freeway mainline segments, signalized ramp intersections, and off-ramp queuing. Freeway mainline segments were analyzed using proprietary spreadsheets implementing the HCM methodology. Intersections and off-ramp queue analyses were assessed using Synchro software. Three freeway mainline segments (or a total of six freeway mainline sections) on I-680 were analyzed using HCM methodology to determine density, speed, and LOS. The LOS definitions for freeway mainline segments based on HCM methodology are presented in Table 11. Four signalized intersections located at freeway ramps and under partial Caltrans jurisdiction were analyzed using HCM methodology to identify average vehicle delay and LOS. Four freeway off-ramps were analyzed for ramp queue lengths using the Synchro software to estimate queues. Detailed LOS worksheets for each type of analysis are included in Appendix F.

The cumulative analysis of freeway facilities discussed in this chapter includes projections of Year 2040 conditions without and with Project traffic.

FREEWAY MAINLINE SEGMENTS

Three freeway mainline segments on I-680 were analyzed using the HCM methodology. Existing Year 2018 freeway volume data was collected from the CCTA Model outputs and adjusted to reflect Existing Year 2021 Conditions and are summarized in Table 12. These volumes are consistent with Caltrans Performance Management System volumes for the latest published data available. Traffic volumes were also projected for Year 2040 utilizing the CCTA Model to reflect the Project buildout year and are summarized in Table 12. The CCTA Model outputs for Future Year 2040 and base year were compared to determine the incremental difference in traffic volumes.

Any decrease in the incremental volume difference was conservatively overridden to assume no negative growth, in the same manner as future traffic volumes were developed for Year 2040 in Chapter 3.

Freeway Mainline Segments Analysis

Table 13 summarizes the results of the HCM analysis for Existing Conditions and Existing with Project Conditions. As shown, the Project is not anticipated to change the LOS operations at any of the six freeway mainline sections (three northbound and three southbound) during the morning or afternoon peak hours under Existing with Project Conditions.

Table 14 summarizes the results of the HCM analysis for Future without Project Conditions and Future with Project Conditions Year 2040. As shown, the Project is not anticipated to change the LOS operations at any of the six freeway mainline sections during the morning or afternoon peak hours under Future with Project Conditions.

Incremental changes of less than one vehicle per mile per lane on the mainline freeway segments indicate the minimal impact of the Project on the freeway operations.

INTERSECTION OPERATIONS

As shown in Table 10, this Caltrans analysis focused on four signalized freeway ramp locations associated with the I-680 interchanges at Crow Canyon Road and Bollinger Canyon Road. Intersection turning movement counts were collected at these four intersections during the weekday morning and afternoon peak periods in March and May 2019 and are provided in Appendix C. The traffic control operations of all four intersections are shared between Caltrans and the City.

Overview

Caltrans does not have specific criteria to determine the impact of incremental changes in intersection operations. Therefore, the operational impact of the traffic-related impacts on Caltrans facilities is identified by the analyses based on the lead agency's significance thresholds, which is presented in Chapter 1 of this study.

The intersections under Caltrans jurisdiction, listed in Table 10, were analyzed using the HCM methodology and implemented using the Synchro software in the same manner as the analysis presented in Chapters 1 through 5 of this study. Table 15 summarizes the LOS definitions for signalized intersections.

Intersection Analysis

The analysis of Year 2021 conditions was conducted using the traffic volumes for Year 2021 utilized for the Existing Conditions analysis presented in Chapter 2. Table 16 summarizes the results of the signalized HCM analysis for Existing Conditions and Existing with Project Conditions for Year 2021. As shown, all intersections operate at LOS C or better during both the analyzed peak hours under Existing Conditions and Existing with Project Conditions.

The Year 2040 traffic volumes were developed based on the CCTA Model outputs in the same manner as future traffic volumes were developed for Year 2040 in Chapter 3 of this study.

Table 17 summarizes the results of the signalized HCM analysis for Future without Project Conditions and Future with Project Conditions for Year 2040. As shown, all intersections operate at LOS D or better during both the analyzed peak hours under Future without and with Project Conditions and no intersection levels of service changed as a result of Project traffic.

OFF-RAMP QUEUES

Four off-ramps from I-680 were analyzed to determine whether the lengths of the ramps were sufficient to accommodate vehicle queue lengths. The queue lengths were estimated using Synchro, which reports the 95th percentile queue length for each approach lane on the off-ramp. Synchro queue results are expressed in vehicle lengths. These vehicle lengths were converted to linear feet by multiplying each vehicle by 25 feet to account for the length of the vehicle plus a distance between vehicles in the queue.

The assessment of the off-ramps includes a review of the vehicle queue length as compared to the total available queuing capacity of the ramp to determine whether the vehicle queue would extend beyond the length of the ramp onto the mainline. To this end, the queuing analysis looked at two separate components of ramp capacity: (1) the length of each approach lane to the intersection, and (2) the remaining length of the ramp, behind any approach lane delineation lines, to the gore point where the ramp diverges from the freeway mainline. The queue may exceed the striped length of a given approach lane; as long as there is sufficient additional queuing capacity on the ramp, it will not spill over onto the mainline.

Off-Ramp Queue Analysis

The analysis of Year 2021 conditions was conducted using available traffic count data utilized for the Existing Conditions analysis presented in Chapter 2. Table 18 summarizes the results of the queuing analysis for Existing Conditions and Existing with Project Conditions for Year 2021. The queues at all four off-ramps do not extend beyond the available storage capacity under Existing Conditions, regardless of Project traffic additions.

The Year 2040 traffic volumes were developed based on the CCTA Model outputs in the same manner as future traffic volumes were developed for Year 2040 in Chapter 3 of this study. Table 19 summarizes the results of the queuing analysis for Future without Project Conditions and Future with Project Conditions for Year 2040. The queues at all four off-ramps do not extend beyond the available storage capacity under Future Conditions, regardless of Project traffic additions.

TABLE 10
ANALYZED CALTRANS FACILITIES

ID	Location
Freeway Mainline Segments	
FS-1.	I-680 north of Crow Canyon Road
FS-2.	I-680 between Crow Canyon Road and Bollinger Canyon Road
FS-3.	I-680 south of Bollinger Canyon Road
Signalized Intersections	
S-1.	I-680 Southbound Ramps & Crow Canyon Road
S-2.	I-680 Northbound Ramps & Crow Canyon Road
S-3.	I-680 Southbound Ramps & Bollinger Canyon Road
S-4.	I-680 Northbound Ramps & Bollinger Canyon Road
Off-Ramp Queues	
Q-1.	I-680 Southbound Ramps & Crow Canyon Road
Q-2.	I-680 Northbound Ramps & Crow Canyon Road
Q-3.	I-680 Southbound Ramps & Bollinger Canyon Road
Q-4.	I-680 Northbound Ramps & Bollinger Canyon Road

TABLE 11
FREEWAY SEGMENT LEVEL OF SERVICE DEFINITIONS - DENSITY

Level of Service	Description	Density [a]
A	Free-flow speeds prevail. Vehicles are almost completely unimpeded in their ability to maneuver within the traffic stream.	≤ 11
B	Free-flow speeds are maintained. The ability to maneuver with the traffic stream is only slightly restricted.	> 11 and ≤ 18
C	Flow with speeds at or near free-flow speeds. Freedom to maneuver within the traffic stream is noticeably restricted, and lane changes require more care and vigilance on the part of the driver.	> 18 and ≤ 26
D	Speeds decline slightly with increasing flows. Freedom to maneuver with the traffic stream is more noticeably limited, and the driver experiences reduced physical and psychological comfort.	> 26 and ≤ 35
E	Operation at capacity. There are virtually no usable gaps within the traffic stream, leaving little room to maneuver. Any disruption can be expected to produce a breakdown with queuing.	> 35 and ≤ 45
F	Represents a breakdown in flow and oversaturated conditions.	> 45

Notes
Source: *Highway Capacity Manual, 6th Edition, A Guide for Multimodal Mobility Analysis* (Transportation Research Board, 2016) and Caltrans.
[a] Density is defined in vehicles per mile per lane and describes the proximity to other vehicles and is related to the freedom to maneuver within the traffic stream (*Highway Capacity Manual, 6th Edition, A Guide for Multimodal Mobility Analysis).*

TABLE 12
FREEWAY MAINLINE SEGMENT TRAFFIC VOLUMES

ID	Freeway Mainline Segment	Peak Hour	Direction	Vehicles per Hour (VPH)			
				Existing Conditions (Year 2021) [a]	Existing with Project Conditions (Year 2021)	Future without Project Conditions (Year 2040)	Future with Project Conditions (Year 2040)
FS-1.	I-680 north of Crow Canyon Road	AM	NB	5,784	5,819	6,890	6,925
			SB	8,118	7,994	8,061	7,937
		PM	NB	7,833	7,722	8,919	8,808
			SB	6,865	6,901	8,159	8,195
FS-2.	I-680 between Crow Canyon Road & Bollinger Canyon Road	AM	NB	5,629	5,629	6,551	6,551
			SB	8,151	8,151	7,967	7,967
		PM	NB	7,148	7,148	7,824	7,824
			SB	6,771	6,771	7,875	7,875
FS-3.	I-680 south of Bollinger Canyon Road	AM	NB	5,749	5,584	6,461	6,296
			SB	7,334	7,381	7,513	7,560
		PM	NB	6,841	6,889	7,239	7,287
			SB	6,297	6,149	7,112	6,964

Notes
[a] 2021 freeway traffic volumes based on 2018 weekday traffic volume data from CCTA Model. These volumes are consistent with Caltrans' Performance Management System (PeMS) volumes for 2017 (the latest published data available). To be conservative, an ambient growth rate of 1% per year was applied to the 2018 volumes to reflect Existing Year 2021 traffic conditions.

TABLE 13
EXISTING OPERATING CONDITIONS (YEAR 2021)
FREEWAY SEGMENT LEVEL OF SERVICE EVALUATION

ID	Freeway Segment	Peak Hour	Direction	Existing Conditions			Existing with Project Conditions			
				Speed [a][b]	**Density** [b][c]	**LOS**	**Speed** [a][b]	**Density** [b][c]	**LOS**	**Δ Density**
FS-1.	I-680 north of Crow Canyon Road	AM	NB	55.0	23.3	C	55.0	23.4	C	0.1
			SB	55.0	32.7	D	55.0	32.2	D	-0.5
		PM	NB	55.0	31.5	D	55.0	31.1	D	-0.4
			SB	55.0	27.6	D	55.0	27.8	D	0.2
FS-2.	I-680 between Crow Canyon Road & Bollinger Canyon Road	AM	NB	55.0	22.7	C	55.0	22.7	C	0
			SB	55.0	32.8	D	55.0	32.8	D	0
		PM	NB	55.0	28.8	D	55.0	28.8	D	0
			SB	55.0	27.3	D	55.0	27.3	D	0
FS-3.	I-680 south of Bollinger Canyon Road	AM	NB	55.0	28.9	D	55.0	28.1	D	-0.8
			SB	53.7	37.8	E	53.5	38.2	E	0.4
		PM	NB	54.8	34.5	D	54.7	34.9	D	0.4
			SB	55.0	31.7	D	55.0	30.9	D	-0.8

Notes
[a] Mean speed measured in miles per hour (mph).
[b] Methodology from *Highway Capacity Manual, 6th Edition, A Guide for Multimodal Mobility Analysis* (Transportation Research Board, 2016).
[c] Measured in vehicles per mile per lane (v/m/l) for freeways with a free-flow speed of 55 mph. Free-flow speed, as defined in HCM 6th Edition, is the theoretical speed when the density and flow rate of the freeway mainline segment are both zero.

TABLE 14
FUTURE OPERATING CONDITIONS (YEAR 2040)
FREEWAY SEGMENT LEVEL OF SERVICE EVALUATION

ID	Freeway Segment	Peak Hour	Direction	Future without Project Conditions			Future with Project Conditions			
				Speed [a][b]	**Density** [b][c]	**LOS**	**Speed** [a][b]	**Density** [b][c]	**LOS**	**Δ Density**
FS-1.	I-680 north of Crow Canyon Road	AM	NB	55.0	27.7	D	55.0	27.9	D	0.2
			SB	55.0	32.4	D	55.0	32.0	D	-0.4
		PM	NB	54.2	36.4	E	54.4	35.8	E	-0.6
			SB	55.0	32.8	D	55.0	33.0	D	0.2
FS-2.	I-680 between Crow Canyon Road & Bollinger Canyon Road	AM	NB	55.0	26.4	D	55.0	26.4	D	0
			SB	55.0	32.1	D	55.0	32.1	D	0
		PM	NB	55.0	31.5	D	55.0	31.5	D	0
			SB	55.0	31.7	D	55.0	31.7	D	0
FS-3.	I-680 south of Bollinger Canyon Road	AM	NB	55.0	32.5	D	55.0	31.7	D	-0.8
			SB	53.1	39.2	E	52.9	39.6	E	0.4
		PM	NB	54.0	37.1	E	53.8	37.5	E	0.4
			SB	54.3	36.2	E	54.6	35.3	E	-0.9

Notes
[a] Mean speed measured in miles per hour (mph).
[b] Methodology from *Highway Capacity Manual, 6th Edition, A Guide for Multimodal Mobility Analysis* (Transportation Research Board, 2016).
[c] Measured in vehicles per mile per lane (v/m/l) for freeways with a free-flow speed of 55 mph. Free-flow speed, as defined in HCM 6th Edition, is the theoretical speed when the density and flow rate of the freeway mainline segment are both zero.

TABLE 15
CALTRANS INTERSECTION LEVEL OF SERVICE DEFINITIONS

Level of Service	Description	Delay [a] Signalized Intersections
A	EXCELLENT. No vehicle waits longer than one red light and no approach phase is fully used.	≤ 10
B	VERY GOOD. An occasional approach phase is fully utilized; many drivers begin to feel somewhat restricted within groups of vehicles.	> 10 and ≤ 20
C	GOOD. Occasionally drivers may have to wait through more than one red light; backups may develop behind turning vehicles.	> 20 and ≤ 35
D	FAIR. Delays may be substantial during portions of the rush hours, but enough lower volume periods occur to permit clearing of developing lines, preventing excessive backups.	> 35 and ≤ 55
E	POOR. Represents the most vehicles intersection approaches can accommodate; may be long lines of waiting vehicles through several signal cycles.	> 55 and ≤ 80
F	FAILURE. Backups from nearby locations or on cross streets may restrict or prevent movement of vehicles out of the intersection approaches. Tremendous delays with continuously increasing queue lengths.	> 80

<u>Notes</u>
Source: *Highway Capacity Manual, 6th Edition, A Guide for Multimodal Mobility Analysis* (Transportation Research Board, 2016).
[a] Measured in seconds.

TABLE 16
EXISTING WITH PROJECT CONDITIONS (YEAR 2021)
SIGNALIZED INTERSECTION PEAK HOUR LEVELS OF SERVICE

No.	Intersection	Peak Hour	Existing Conditions		Existing with Project Conditions		
			Delay	LOS	Delay	LOS	Δ Delay
S-1.	I-680 Southbound Ramps & Crow Canyon Road	A.M. P.M.	19.8 15.0	B B	19.5 15.1	B B	-0.3 0.1
S-2.	I-680 Northbound Ramps & Crow Canyon Road	A.M. P.M.	16.3 14.9	B B	16.6 14.9	B B	0.3 0.0
S-3.	I-680 Southbound Ramps & Bollinger Canyon Road	A.M. P.M.	22.7 23.5	C C	22.7 23.6	C C	0.0 0.1
S-4.	I-680 Northbound Ramps & Bollinger Canyon Road	A.M. P.M.	23.1 16.2	C B	22.7 17.3	C B	-0.4 1.1

Delay is measured in seconds per vehicle
LOS = Level of service
Results per Synchro 10 (HCM 6th Edition methodology).

TABLE 17
FUTURE WITH PROJECT CONDITIONS (YEAR 2040)
SIGNALIZED INTERSECTION PEAK HOUR LEVELS OF SERVICE

No.	Intersection	Peak Hour	Future without Project Conditions		Future with Project Conditions		
			Delay	LOS	Delay	LOS	Δ Delay
S-1.	I-680 Southbound Ramps & Crow Canyon Road	A.M. P.M.	21.3 15.1	C B	20.3 15.7	C B	-1.0 0.6
S-2.	I-680 Northbound Ramps & Crow Canyon Road	A.M. P.M.	16.3 15.5	B B	14.3 15.5	B B	-2.0 0.0
S-3.	I-680 Southbound Ramps & Bollinger Canyon Road	A.M. P.M.	25.0 52.3	C D	31.0 51.3	C D	6.0 -1.0
S-4.	I-680 Northbound Ramps & Bollinger Canyon Road	A.M. P.M.	34.0 17.6	C B	30.9 18.2	C B	-3.1 0.6

Delay is measured in seconds per vehicle

LOS = Level of service

Results per Synchro 10 (HCM 6th Edition methodology).

Intersection S-4 assumes that the continuous green improvement is implemented under both scenarios above.

TABLE 18
FREEWAY OFF-RAMP QUEUE EVALUATION
EXISTING OPERATING CONDITIONS (YEAR 2021)

ID	Freeway Off-ramp	Ramp and Lane Description	Vehicle Storage Capacity [a]	Existing Conditions		Existing with Project Conditions	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
				Vehicle Queue Length [b]	Vehicle Queue Length [b]	Vehicle Queue Length [b]	Vehicle Queue Length [b]
Q-1.	I-680 Southbound Ramps &	I-680 Southbound Off-Ramp					
	Crow Canyon Road	Left (two 740-ft lanes and one 660-ft lane on ramp)	2,140	1,246	710	1,200	726
		Right (two 570-ft lanes and one 830-ft lane on ramp)	1,970	1,070	1,050	1,016	1,070
Q-2.	I-680 Northbound Ramps &	I-680 Northbound Off-Ramp					
	Crow Canyon Road	Left (one 565-ft lane and one 760-ft lane on ramp)	1,325	518	520	518	520
		Right (one 590-ft shared left/right lane, one 590-ft exclusive right lane, and one 760-ft lane on ramp)	1,940	1,096	1,086	1,096	1,086
Q-3.	I-680 Southbound Ramps &	I-680 Southbound Off-Ramp					
	Bollinger Canyon Road	Left (one 455-ft exclusive left lane, one 470-ft shared left-through lane, and one 855-ft lane on ramp)	1,780	1,330	1,220	1,330	1,220
		Right (two 225-lanes and one 855-ft lane on ramp	1,305	380	490	380	490
Q-4.	I-680 Northbound Ramps &	I-680 Northbound Off-Ramp					
	Bollinger Canyon Road	Left (one 525-ft lane and one 785-ft lane on ramp)	1,310	455	763	485	763
		Right (two 525-ft lanes, one 300-ft lane, and one 785-ft lane on ramp)	2,135	2,019	960	1,809	1,035

[a] Expressed in feet.

[b] 95th Percentile queue results per Synchro 10 (HCM 6th Edition Methodology). Synchro queue results expressed in number of vehicles and were converted to feet; vehicle length is assumed to be 25 feet.

TABLE 19
FREEWAY OFF-RAMP QUEUE EVALUATION
FUTURE OPERATING CONDITIONS (YEAR 2040)

ID	Freeway Off-ramp	Ramp and Lane Description	Vehicle Storage Capacity [a]	Future without Project Conditions		Future with Project Conditions	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
				Vehicle Queue Length [b]	Vehicle Queue Length [b]	Vehicle Queue Length [b]	Vehicle Queue Length [b]
Q-1.	I-680 Southbound Ramps &	I-680 Southbound Off-Ramp					
	Crow Canyon Road	Left (two 740-ft lanes and one 660-ft lane on ramp)	2,140	1,350	756	1,050	770
		Right (two 570-ft lanes and one 830-ft lane on ramp)	1,970	1,166	1,160	890	1,180
Q-2.	I-680 Northbound Ramps &	I-680 Northbound Off-Ramp					
	Crow Canyon Road	Left (one 565-ft lane and one 760-ft lane on ramp)	1,325	580	585	510	585
		Right (one 590-ft shared left/right lane, one 590-ft exclusive right lane, and one 760-ft lane on ramp)	1,940	1,236	1,236	1,076	1,236
Q-3.	I-680 Southbound Ramps &	I-680 Southbound Off-Ramp					
	Bollinger Canyon Road	Left (one 455-ft exclusive left lane, one 470-ft shared left-through lane, and one 855-ft lane on ramp)	1,780	1,516	1,396	1,210	1,396
		Right (two 225-lanes and one 855-ft lane on ramp	1,305	406	556	330	556
Q-4.	I-680 Northbound Ramps &	I-680 Northbound Off-Ramp					
	Bollinger Canyon Road	Left (one 525-ft lane and one 785-ft lane on ramp)	1,310	430	335	335	318
		Right (two 525-ft lanes, one 300-ft lane, and one 785-ft lane on ramp)	2,135	2,094	789	1,305	810

[a] Expressed in feet.
[b] 95th Percentile queue results per Synchro 10 (HCM 6th Edition Methodology). Synchro queue results expressed in number of vehicles and were converted to feet; vehicle length is assumed to be 25 feet.

Chapter 7
Site Access and Internal Circulation

This chapter summarizes the site access and internal circulation of the Project Site.

VEHICULAR ACCESS AND CIRCULATION

Vehicular access to the Project Site would be maintained at some existing driveways and also provided at new driveways. The Project Site currently provides four access points, two full-access driveways on Camino Ramon and one full access driveway each on Executive Parkway and Norris Canyon Road. Vehicular access to the Project Site would be provided via existing full-access driveways along Executive Parkway, Camino Ramon, and Norris Canyon Road. The two full-access driveways on Camino Ramon would be consolidated into one full-access driveway on Camino Ramon. An additional driveway, accommodating right-turn ingress and egress only, would also be provided on Executive Parkway.

The conceptual Project Site plan featuring the vehicular access and circulation is shown in Figure 1.

QUEUING ANALYSIS

Table 20 shows the projected volumes at each Project driveway after completion of the Project. Queuing measures storage capacity by movement at intersections. The purpose of a queuing analysis is to identify turning movements that may not provide sufficient storage capacity at peak-hour conditions and determine whether the left-turn lane should be lengthened or an additional left-turn lane should be added. It should be noted that many of the existing left-turn lanes have been extended to the maximum allowed per the existing geometry and additional right-of-way would be required to add a second left-turn lane.

Table 21 provides the results of the left-turn queuing analysis at the study intersections adjacent to the Project:

1. Bishop Drive/Annabel Lane & Norris Canyon Road
3. Camino Ramon & Norris Canyon Road
5. Bishop Drive & Executive Parkway (unsignalized)
8. Camino Ramon & Executive Parkway

Table 21 shows the worst-case peak hour left-turn queuing analysis results for Year 2040 Future without Project and Future with Project conditions. The table shows:

> Queue Storage Measured or the total queue length capacity for the current or proposed storage at each left-turn lane (or left-turn/through lane if a separate left-turn lane is not provided) based on existing or proposed improvements. The queue length capacity is assumed to be the striped left-turn lane area plus the potential for one car to be shadowed in the taper area of the turn lane (two cars in the taper area for dual left-turn lanes).
>
> 95th Percentile Queue Length, which provides the results of a Synchro analysis for the peak hour conditions that measures the probability that a queue length will reach a certain length. In this case, the Synchro analysis identifies the maximum queue length for each left-turn lane that would not be exceeded 95% of the time. In other words, the queue would exceed the values in Table 21 only 5% of the time.
>
> To explain the concept of the 95th percentile, if the signal cycle length is 120 seconds (typical in the Study Area), that means there would be 30 cycles during the peak hour. If one observed 100 cycles and 95 of them had queues equal or less than the 95th percentile length shown in the table, only five cycles in 100 cycles would exceed the queue length shown in the table. With 30 signal cycles per hour, there would be five cycles every 3.3 hours that exceeded the calculated queue – or about one to two cycles during the peak hour of any given day.

Queuing Assumptions

The Synchro analysis worksheets provide the queue lengths in terms of number of vehicles per lane (to the tenth of a car). These vehicle lengths were converted to linear feet by multiplying each vehicle by 25 feet to account for the length of the vehicle plus a distance between vehicles in the queue.

Queuing Results

As detailed in Table 21, the queuing analysis indicates that peak hour left-turn movements at three of the four study intersections would experience queuing overflow of one or more vehicles under both the Future without Project conditions and Future with Project Conditions during the morning and/or afternoon peak hour. Based on the results of the analysis, when compared to the Future without Project conditions at those left-turn movements, the queuing overflow under Future with Project Conditions would:

(a) change by less than 25 feet (one car length) at seven peak hour turning movements:
   a. Bishop Drive/Anabel Lane & Norris Canyon Road
      i. Westbound Left Turn (morning and afternoon peak hour)
   b. Camino Ramon & Norris Canyon Road
      i. Southbound Left Turn (afternoon peak hour)
      ii. Northbound Left Turn (morning and afternoon peak hour)
   c. Camino Ramon & Executive Parkway
      i. Southbound Left Turn (morning peak hour)
      ii. Eastbound Left Turn (morning peak hour)

(b) be reduced by 25 feet or more at two left-turn movements during the morning and/or the afternoon peak hours, or
   a. Camino Ramon & Norris Canyon Road
      i. Eastbound Left Turn (afternoon peak hour) reduced by 167 feet (seven vehicles)
   b. Camino Ramon & Executive Parkway
      i. Northbound Left Turn (morning peak hour) reduced by 175 feet (seven vehicles)

(c) increase by more than one car length at three left-turn locations:

   a. Camino Ramon & Norris Canyon Road

      i. Eastbound Left Turn (morning peak hour) increased by 60 feet (two-three vehicles)

   b. Camino Ramon & Executive Parkway

      i. Northbound Left Turn (afternoon peak hour) increased by 88 feet (three-four vehicles)

      ii. Eastbound Left Turn (afternoon peak hour) increased by 112 feet (four-five vehicles)

As shown in Table 21, the Future with Project intersections where the Project adds one vehicle or more to the left-turn queue exceedance (when compared to Future without Project Conditions) are projected to operate at LOS D or better during the peak hours. This means that there is flexibility in the signal timing such that additional time added to the left-turn phases could alleviate the incremental Project queuing impact. The intersections where the exceedances occur should be monitored and the signal timing adjusted if the left-turn queues become an operational problem.

It should also be pointed out that there are four peak hour left-turn movements at the three study intersections where left-turn queues decrease by as many as seven vehicles as a result of “flipping” the inbound and outbound traffic flows when office and employment uses change to residential uses on the Project Site.

PEDESTRIAN ACCESS AND CIRCULATION

Pedestrian access to the Project Site would be provided via the sidewalks along Camino Ramon, Bishop Drive, and Executive Parkway, as well as a pedestrian-only access along pathways through the on-site park and within the Project Site. The Project would minimize pedestrian and automobile traffic conflicts by utilizing controlled crosswalks at the signalized intersections. Pedestrian circulation internal to the Project Site would be provided via sidewalks and off-street pedestrian pathways. Pedestrian crossings across local streets internal to the site would be focused on intersections where marked crosswalks would be provided subject to City review and approval.

The Project will enhance the existing pedestrian network with new parkways, park paths, and internal sidewalks serving the project. None of the proposed improvements will conflict with or preclude the implementation of the City's pedestrian network.

BICYCLE ACCESS AND CIRCULATION

The Project seeks to supplement the Bicycle Master Plan adjacent to the Project so that residents and visitors arriving by bicycle would have a continuous access system similar to that provided to pedestrians and vehicles. In order to encourage and facilitate bicycle use, the Project would provide code-required bicycle parking spaces. None of the proposed improvements will conflict with or preclude the implementation of the Bicycle Master Plan, as provided in Appendix I.

TABLE 20
PROJECT DRIVEWAY INGRESS/EGRESS VOLUMES

Project Driveways			Weekday Morning Peak Hour												Weekday Afternoon Peak Hour											
Access	**N/S Street**	**E/W Street**	**SBR**	**SBT**	**SBL**	**WBR**	**WBT**	**WBL**	**NBR**	**NBT**	**NBL**	**EBR**	**EBT**	**EBL**	**SBR**	**SBT**	**SBL**	**WBR**	**WBT**	**WBL**	**NBR**	**NBT**	**NBL**	**EBR**	**EBT**	**EBL**
Full	G Street Project Dwy	Norris Canyon Road						3	31		20	15								9	20		13	47		
Full	Camino Ramon	F Street Project Dwy	11								17	55		29	37								56	35		19
Right In/Out	Street I Project Dwy	Executive Parkway	6			3									4			9								
Full	G Street Project Dwy	Executive Parkway	4		51	17								6	3		33	54								4

TABLE 21
INTERSECTION QUEUE ANALYSIS

No.	Intersection	Movement	Queue Storage Measured (feet)	Future without Project Conditions (Year 2040)		Future with Project Conditions (Year 2040)			
				AM Peak Hour	PM Peak Hour	AM Peak Hour		PM Peak Hour	
				95th Queue Length (ft)	95th Queue Length (ft)	LOS	95th Queue Length (ft)	LOS	95th Queue Length (ft)
1.	Bishop Drive/Annabel Lane & Norris Canyon Road	SBLT	320	48	43	C	48	D	43
		WBL	110	**233**	**143**		**233**		**140**
		NBLTR	1500	63	1185		63		1058
		EBL	200	68	98		70		98
3.	Camino Ramon & Norris Canyon Road	SBL	235	195	**478**	D	195	F	**478**
		WBL	190	165	125		88		148
		NBL	180	**225**	**468**		**230**		**448**
		EBL	180	145	**315**		**205**		148
5.	Bishop Drive & Executive Parkway	SBLT	1500	23	10	B	23	D	13
		WBLR	2225	20	113		20		105
8.	Camino Ramon & Executive Parkway	SBL	160	**260**	18	C	**260**	C	18
		WBLT	380	83	175		83		175
		NBL	200	**283**	**255**		108		**343**
		EBL	150	**213**	108		**218**		**220**
###	Denotes a queue length greater than 25 feet more than available storage			5	5		5		5
###	Denotes an increase of more than 25 feet over Future Without Project Conditions			NA	NA		1		2

Chapter 8
Summary and Conclusions

This study was undertaken to analyze the potential transportation impacts of the Project on the local street system. The following summarizes the results of this analysis:

- The Project is located at 2400-2440 Camino Ramon in the City.
- The Project proposes to construct a residential project in the urban core of the City. The Project would construct 404 residential units consisting of 268 single-family detached homes and 136 multi-family dwelling units, including 114 detached row homes, 154 detached courtyard homes, and 136 attached town homes, as well as a two- acre park to serve Project residents and the general public. The Project Site is currently occupied with approximately 564,000 sf of office uses that would be removed with the development of the Project.
- The Project is projected to be developed over a four to six-year time period following approvals. To be consistent with the longest future forecasts available in the CCTA Model, the conditions in this analysis assume that the full buildout of the Project would take place by Year 2040.
- Vehicular access to the Project Site would be provided via existing and proposed driveways along Executive Parkway, Camino Ramon, and Norris Canyon Road.
- A detailed operational impact analysis was conducted at a total of eight study intersections. Seven of the eight study intersections currently operate at LOS D or better during both the morning and afternoon peak hours under Existing Conditions (Year 2021). The remaining intersection of Camino Ramon & F Street Project Driveway (Intersection #4) currently operates at LOS D during the morning peak hour and LOS F during the afternoon peak hour.
- Under Future without Project Conditions (Year 2040), five of the eight study intersections are anticipated to operate at LOS D or better during both the morning and afternoon peak hours. The remaining three intersections are anticipated to operate at LOS E or F during at least one of the analyzed peak hours.
- As part of the Project, the intersection of I Street Project Driveway & Executive Parkway (Intersection #6) would be reconfigured to include a southbound right-turn-only driveway for Project egress and allow right-turn-only ingress from westbound Executive Parkway.

- With the removal of the existing office uses on site, the Project is anticipated to generate a total decrease of approximately 2,154 daily trips, including a decrease of 296 morning peak hour trips and 248 afternoon peak hour trips.

- Analysis of Existing with Project Conditions and Future with Project Conditions (Year 2040) indicate that the Project is not anticipated to have an operational impact at any of the eight study intersections based on the City impact criteria.

- Supplemental analyses of Caltrans facilities and ramps were conducted and provided for informational purposes. According to the analysis, the Project will change the LOS or operating density of the main line freeway segments or the freeway ramp intersections. The Project traffic will not create any queueing issues on any analyzed freeway exit ramp.

- The Project provides adequate parking and internal circulation to accommodate pedestrian, bicycle, and vehicular traffic without impeding through traffic movements on City streets.

References

California Manual on Uniform Traffic Control Devices, California Department of Transportation, Revised March 2020.

California Transportation Plan 2040, California Department of Transportation, June 2016.

Caltrans Strategic Management Plan 2015-2020, California Department of Transportation, March 2015.

Capital Improvement Program 2019/2020 – 2023/24 Final Report, City of San Ramon, Adopted June 11, 2019.

CCTA Technical Procedures, Contra Costa Transportation Authority, January 16, 2013.

City of San Ramon Bicycle Master Plan, City of San Ramon, April 2018.

City of San Ramon General Plan 2035, City of San Ramon, Effective May 28, 2015.

Engineering Design, Grading and Procedures Manual: City of San Ramon, Public Works Department Engineering Services Division, April 2010.

Highway Capacity Manual, 6th Edition, Transportation Research Board, 2016.

Local Development - Intergovernmental Review (LD-IGR) Interim Guidance, California Department of Transportation, Approved September 2016.

North Camino Ramon Specific Plan, City of San Ramon, July 24, 2012.

State of California Senate Bill No. 743, Steinberg, 2013.

Transportation Impact Study for the CityWalk Master Plan Project, Gibson Transportation Consulting, Inc., March 2020.

Trip Generation Manual, 10th Edition, Institute of Transportation Engineers, 2017.

Appendix A

Scoping Form

Appendix H

San Ramon
CALIFORNIA

DRAFT SCOPE FOR TRAFFIC IMPACT ANALYSIS

Date:	1/4/21	Application No.:	
Project Name:	BR6 Residential Project	Developer:	SummerHill Homes
Project Description:	See Figure 1 and Table 3	Traffic Consultant:	Gibson Transportation Consulting, Inc.

Traffic Impact Analysis for the above listed project shall encompass the following scope, in accordance with the City of San Ramon's Traffic Study Guidelines:

General Information and Assumptions

1. Limits of the Study Area: See Figure 2 and Table 1

2. Assumed Year of Project Completion: 2024

3. Project Phasing (units/phase and years): None assumed in Traffic Study

4. Scenarios to be studied (check if applicable):

- ☑ Existing Conditions (Year: 2021) and Existing Plus Project
- ☐ Short-Term Conditions: existing + approved/pending projects
- ☐ Short-Term Plus Project: existing + approved/pending projects + project
- ☑ Cumulative 2040 Conditions (Includes CityWalk in regional forecast model)
- ☑ Cumulative 2040 Plus Project

5. Approved and Pending Projects List: Not required, Cumulative volumes will be taken from regional traffic forecasting model

6. Programmed Transportation Improvements: To be conservative only planned and 100% funded improvements will be included (i.e. I-580 continuous lane project)

7. Assumptions for trip generation, reductions, distribution, and any model land use changes must be submitted for pre-approval prior to the draft traffic study.

Please see Figures 3 & 4 and Table 3

Data Requirements

8. Data Collection and Periods (check if applicable):

- ☑ Weekday AM peak hour turning movements
- ☐ Weekday midday peak hour turning movements
- ☑ Weekday PM peak hour turning movements
- ☐ Saturday mid-day peak hour turning movements
- ☐ Sunday mid-day peak hour turning movements
- ☐ Daily total traffic
- ☐ Radar speed survey- location: ______
- ☐ License plate survey – location: ______

- [ ] Pedestrian counts – location: ______________________________
- [ ] Determine actual grade(s) – location: ______________________________
- [x] Other data collection: Year 2040 CCTA Model Runs

Intersections and Roadway Segments

9. Study Roadway Segments:

1	See Figure 2 for Study Intersections	11	
2		12	
3		13	
4		14	
5		15	
6		16	
7		17	
8		18	
9		19	
10		20	

Required Analysis Elements

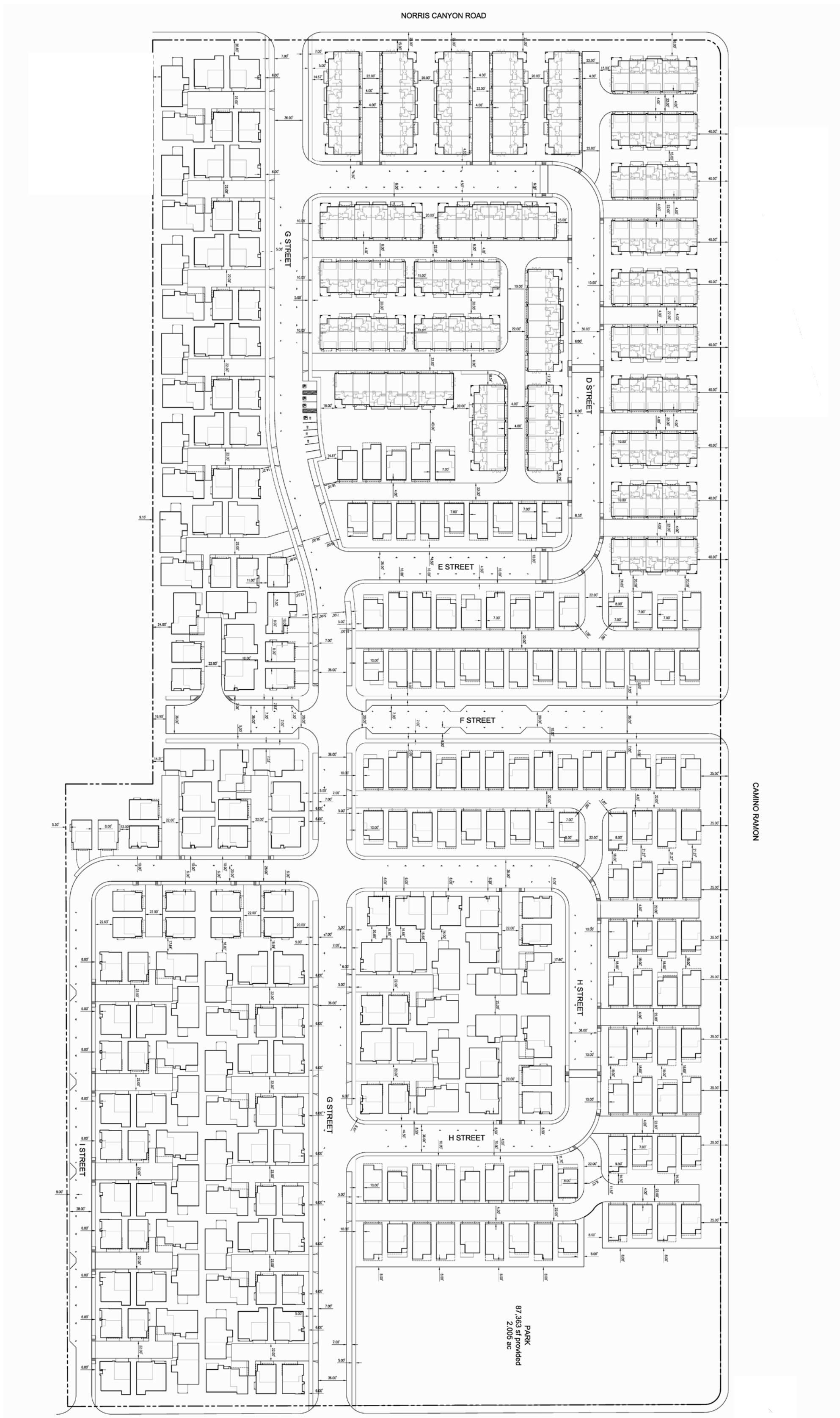
10. Traffic Analysis (check if applicable):

- [x] Intersection level of service (LOS)
- [x] Queue analysis
- [x] Signal warrants
- [ ] Roadway segment analysis
- [ ] Coordinated corridor analysis
- [ ] Average and 85th percentile speeds
- [ ] Collision history and collision rate analysis
- [x] Pedestrian and bicycle facilities
- [x] Transit Services
- [x] Project access analysis
- [x] On-site parking and circulation
- [ ] On-Street Parking
- [ ] Drive-thru queuing analysis
- [ ] Traffic calming recommendations
- [x] Freeway LOS
- [ ] Weaving section LOS
- [ ] Ramp merge and diverge LOS
- [x] Project and mitigation phasing analysis
- [ ] Fair share calculation
- [ ] Cost estimates for mitigation
- [ ] Financing plan for improvements
- [x] Other analysis: Will check for conflicts with driveways on opposite sides of Norris Canyon Road, Camino Ramon, and Executive Parkway.

SIGNED: Richard Gibson Date: 1/20/2021
Applicant or Consultant

SIGNED: ______________________ Date: ____________
City of San Ramon Representative

transportation consulting, inc.



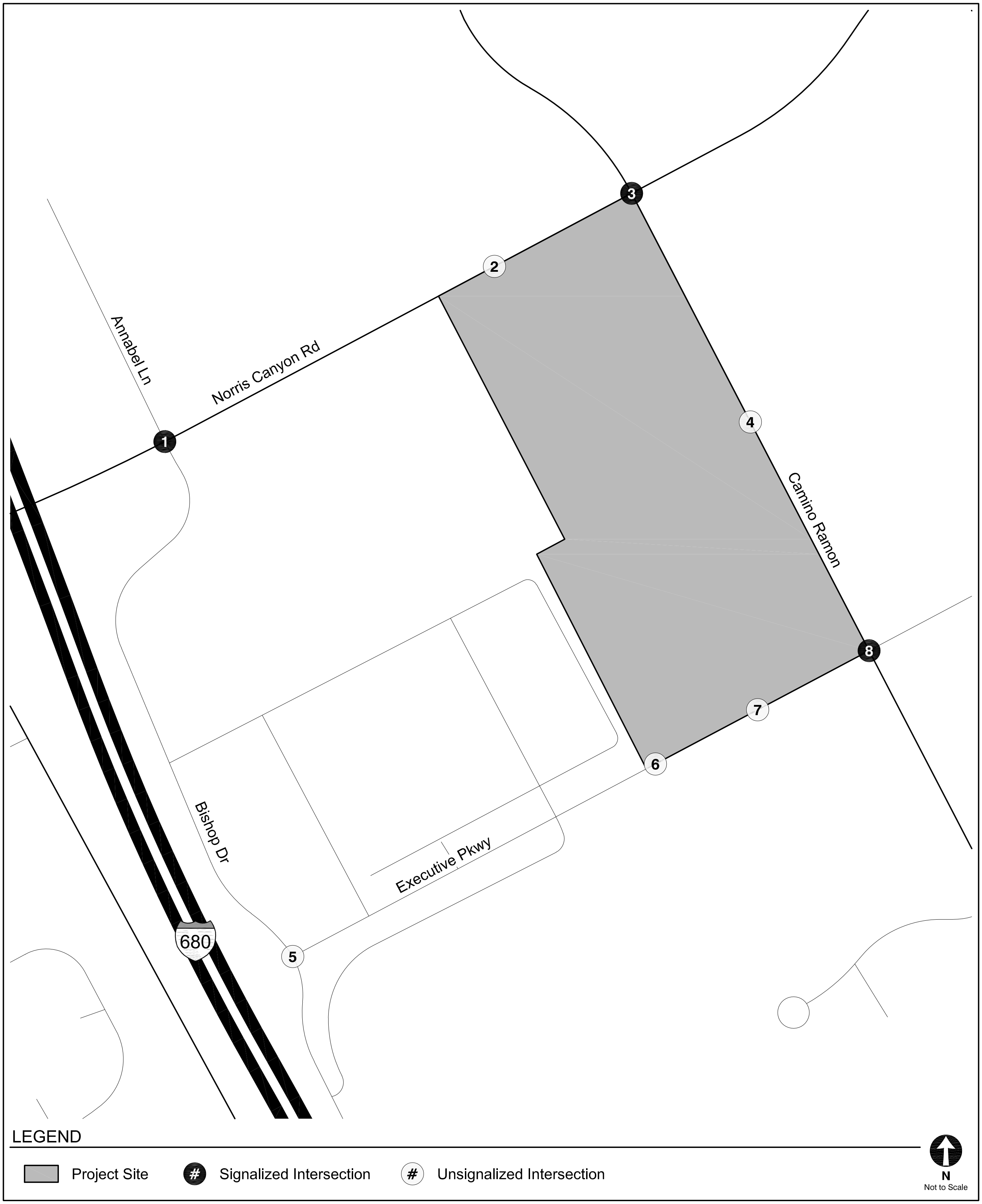
Source: William Hezmalhalch Architects, Inc. January, 2021.

N
Not to Scale

PROJECT SITE PLAN

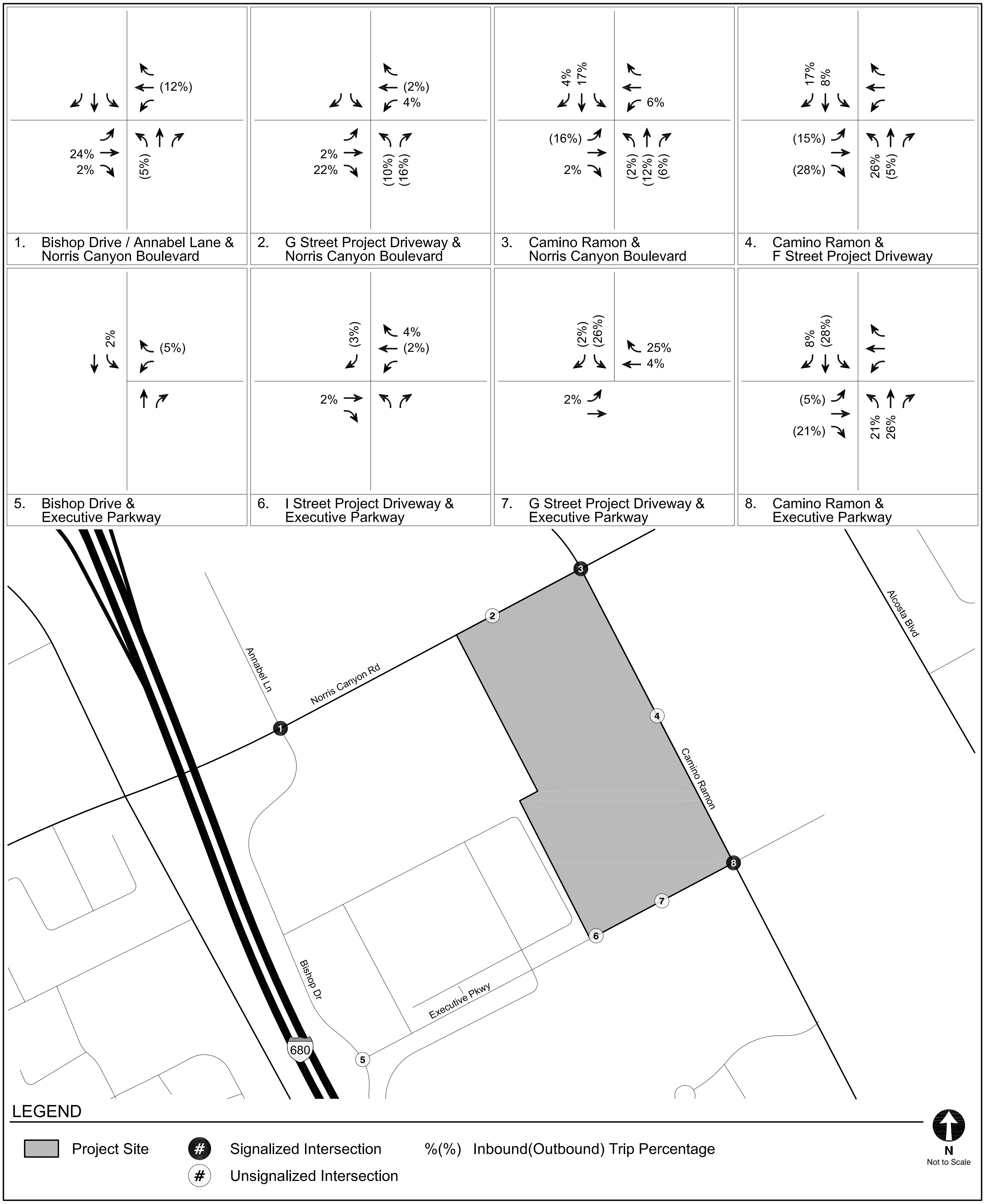
FIGURE 1

Gibson transportation consulting, inc.



STUDY AREA & ANALYZED INTERSECTIONS

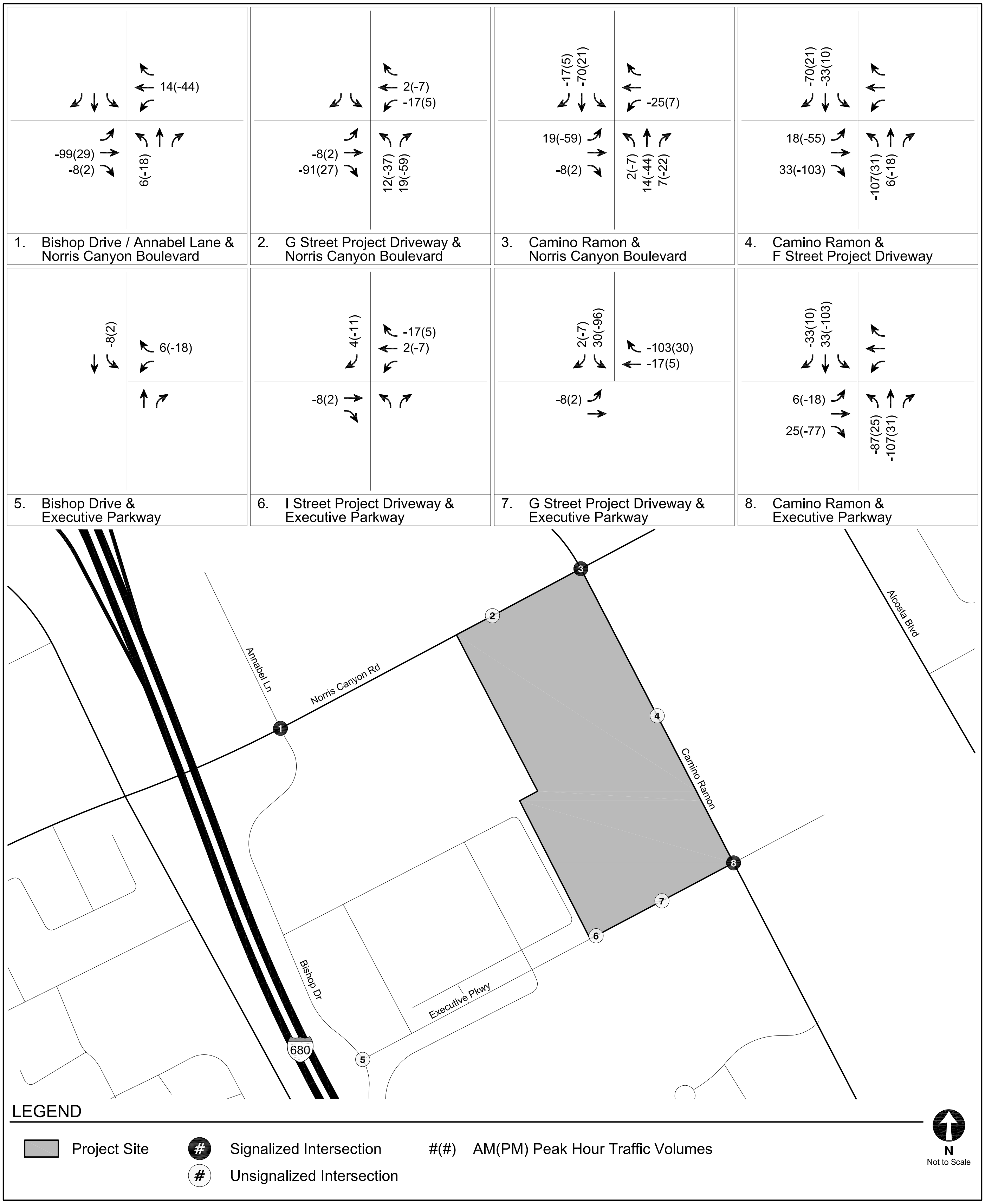
FIGURE 2



PROJECT TRIP DISTRIBUTION

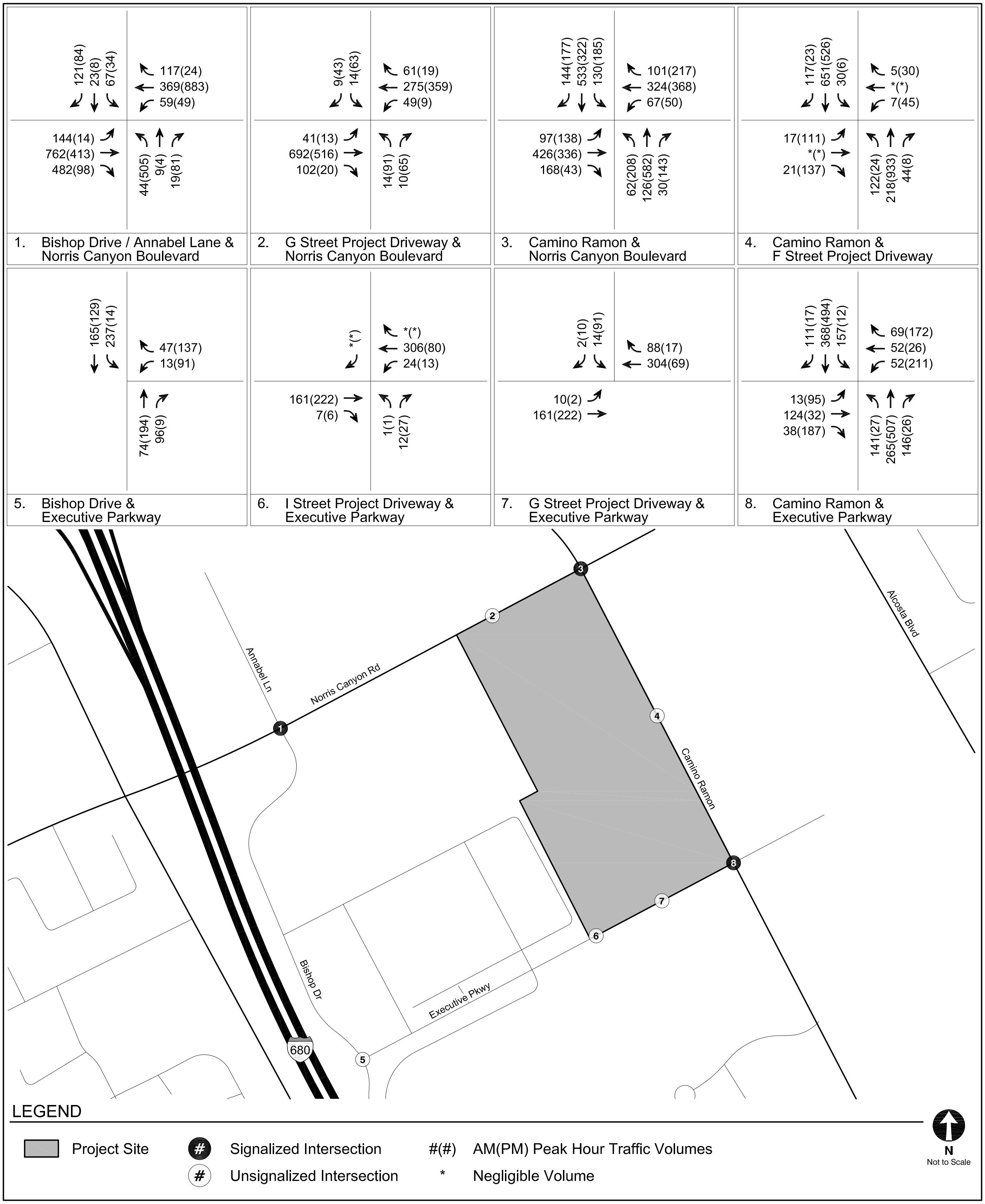
FIGURE 3

Gibson transportation consulting, inc.



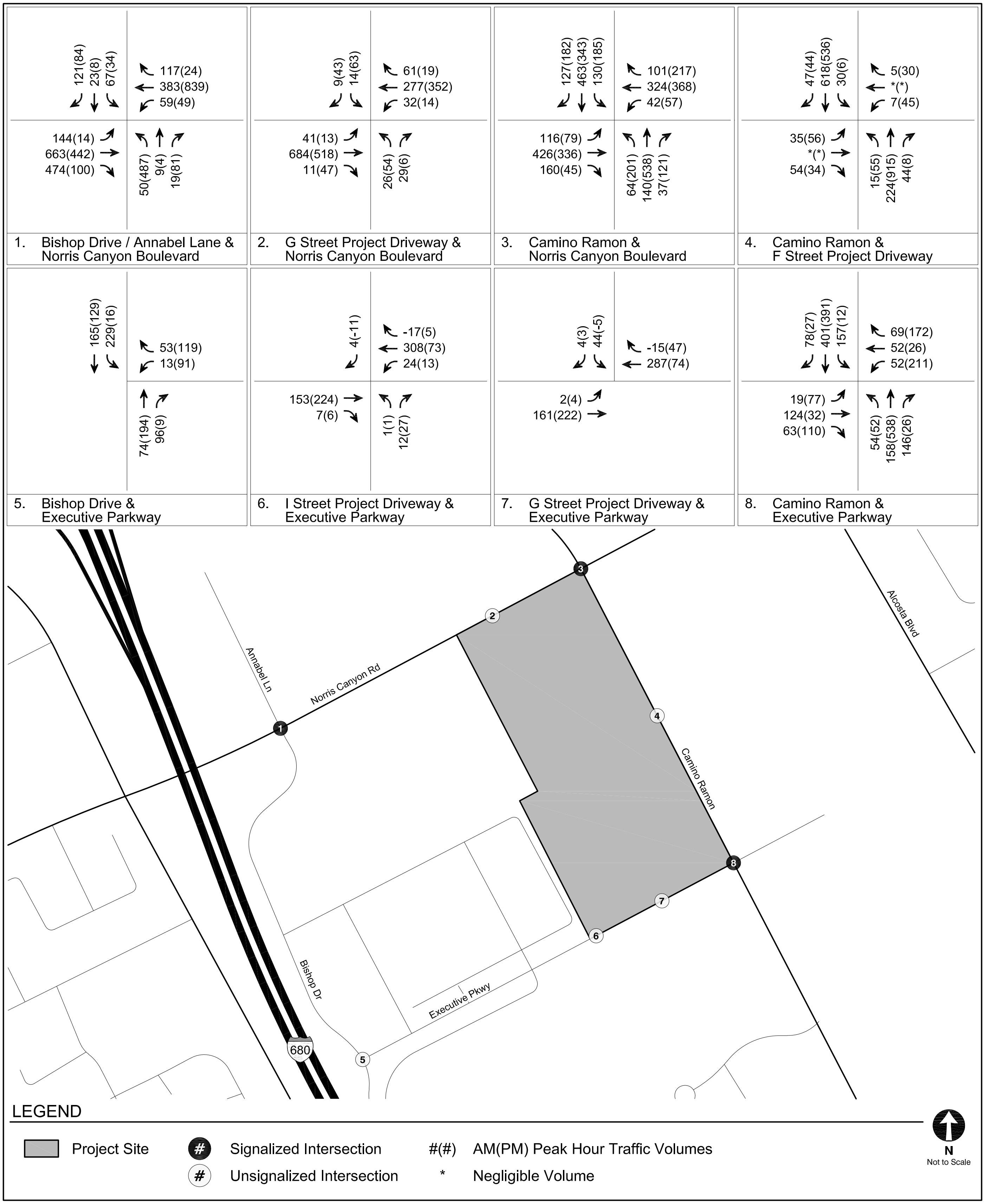
PROJECT-ONLY
PEAK HOUR TRAFFIC VOLUMES

FIGURE 4



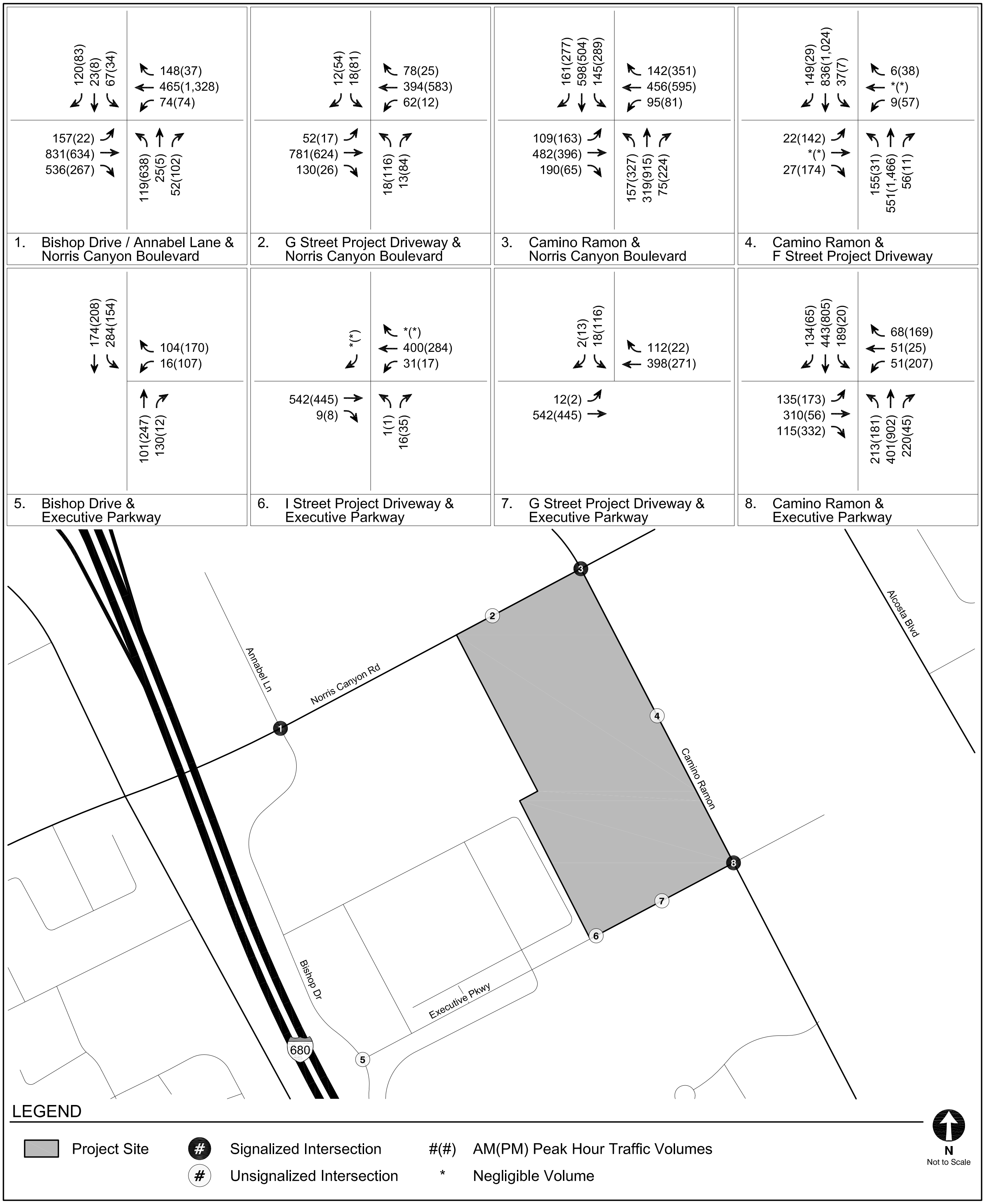
EXISTING CONDITIONS (YEAR 2021)
PEAK HOUR TRAFFIC VOLUMES

FIGURE 5



EXISTING WITH PROJECT CONDITIONS (YEAR 2021)
PEAK HOUR TRAFFIC VOLUMES

FIGURE 6



FUTURE WITHOUT PROJECT CONDITIONS (YEAR 2040)
PEAK HOUR TRAFFIC VOLUMES

FIGURE 7

FUTURE WITH PROJECT CONDITIONS (YEAR 2040)
PEAK HOUR TRAFFIC VOLUMES

FIGURE 8

TABLE 1
ANALYZED STUDY INTERSECTIONS

No	North / South Street	East / West Street	Jurisdiction
1	Bishop Drive/Annabel Lane	Norris Canyon Road	City of San Ramon
2. [a]	G Street Project Driveway	Norris Canyon Road	City of San Ramon
3.	Camino Ramon	Norris Canyon Road	City of San Ramon
4. [a]	Camino Ramon	F Street Project Driveway	City of San Ramon
5. [a]	Bishop Drive	Executive Parkway	City of San Ramon
6. [a]	I Street Project Driveway	Executive Parkway	City of San Ramon
7. [a]	G Street Project Driveway	Executive Parkway	City of San Ramon
8.	Camino Ramon	Executive Parkway	City of San Ramon

Notes
[a] Intersection operates with two-way stop-controlled (TWSC).

TABLE 2
LEVEL OF SERVICE DEFINITIONS FOR INTERSECTIONS

Level of Service	Description	Delay [a]	
		Signalized Intersections	Unsignalized Intersections
A	EXCELLENT. No vehicle waits longer than one red light and no approach phase is fully used.	≤ 10	0.0 - 10.0
B	VERY GOOD. An occasional approach phase is fully utilized; many drivers begin to feel somewhat restricted within groups of vehicles.	> 10 and ≤ 20	10.1 - 15.0
C	GOOD. Occasionally drivers may have to wait through more than one red light; backups may develop behind turning vehicles.	> 20 and ≤ 35	15.1 - 25.0
D	FAIR. Delays may be substantial during portions of the rush hours, but enough lower volume periods occur to permit clearing of developing lines, preventing excessive backups.	> 35 and ≤ 55	25.1 - 35.0
E	POOR. Represents the most vehicles intersection approaches can accommodate; may be long lines of waiting vehicles through several signal cycles.	> 55 and ≤ 80	35.1 - 50.0
F	FAILURE. Backups from nearby locations or on cross streets may restrict or prevent movement of vehicles out of the intersection approaches. Tremendous delays with continuously increasing queue lengths.	> 80	> 50.0

Notes

Source: *Highway Capacity Manual, 6th Edition* (Transportation Research Board, 2016).

[a] Measured in seconds.

TABLE 3
PROJECT TRIP GENERATION

Land Use	ITE Land Use	Rate	Daily	Morning Peak Hour			Afternoon Peak Hour		
				In	Out	Total	In	Out	Total
TRIP GENERATION RATES [a]									
Single-Family Detached Housing	210	per Dwelling Unit	9.44	25%	75%	0.74	63%	37%	0.99
Multi-Family Housing (Low-Rise)	220	per Dwelling Unit	7.32	26%	74%	0.46	63%	37%	0.56
General Office Building	710	per ksf	[b]	86%	14%	[b]	16%	84%	[b]
TRIP GENERATION ESTIMATES									
Proposed Project									
Single-Family Detached Housing	210	268 du	2,530	50	148	198	167	98	265
Multi-Family Housing (Low-Rise)	220	136 du	996	16	47	63	48	28	76
TOTAL - PROPOSED USES			*3,526*	*66*	*195*	*261*	*215*	*126*	*341*
Existing to be Removed									
General Office	710	564.0 ksf	(5,682)	(479)	(78)	(557)	(94)	(495)	(589)
TOTAL - EXISTING TO BE REMOVED			*(5,682)*	*(479)*	*(78)*	*(557)*	*(94)*	*(495)*	*(589)*
TOTAL - NEW PROJECT TRIPS			**(2,156)**	**(413)**	**117**	**(296)**	**121**	**(369)**	**(248)**

Notes:
ksf: 1,000 square feet
[a] Trip generation rates are from *Trip Generation Manual, 10th Edition* (Institute of Transportation Engineers, 2017) and are based on developments located in "General Urban/Suburban" location.
[b] Trip generation rate based on the best-fit curve formula listed in the *Trip Generation Manual, 10th Edition* for the General Office land use.

Weekday Daily -	Ln (T) = 0.97 Ln (X) + 2.50	T = Average Vehicle Trips	X = Gross Leasable Area (ksf)
A.M. Peak Hour -	T = 0.94 (X) + 26.49		
P.M. Peak Hour -	Ln (T) = 0.95 Ln (X) + 0.36		

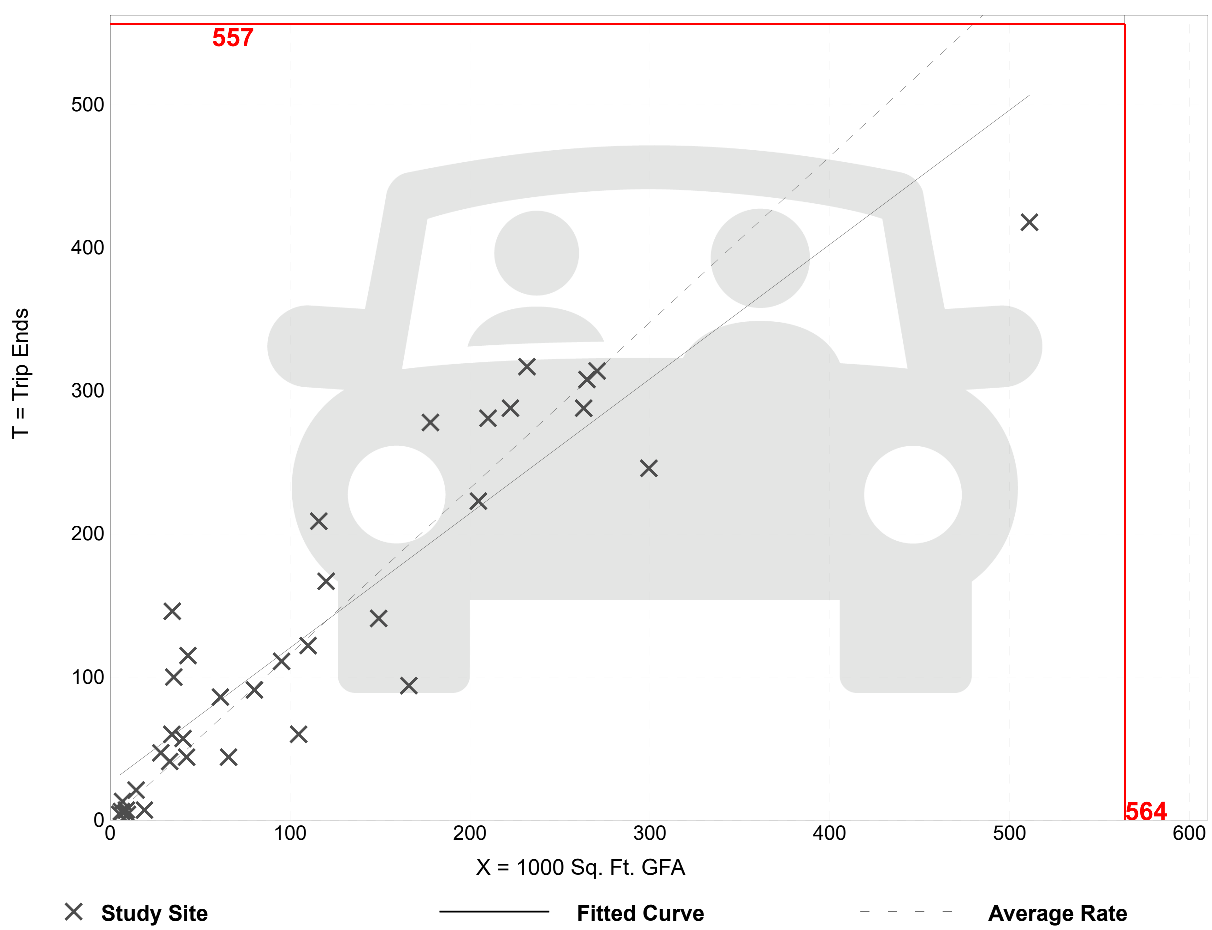
General Office Building
(710)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 35
Avg. 1000 Sq. Ft. GFA: 117
Directional Distribution: 86% entering, 14% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.16	0.37 - 4.23	0.47

Data Plot and Equation



Fitted Curve Equation: T = 0.94(X) + 26.49 **R^2= 0.85**

Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

General Office Building
(710)

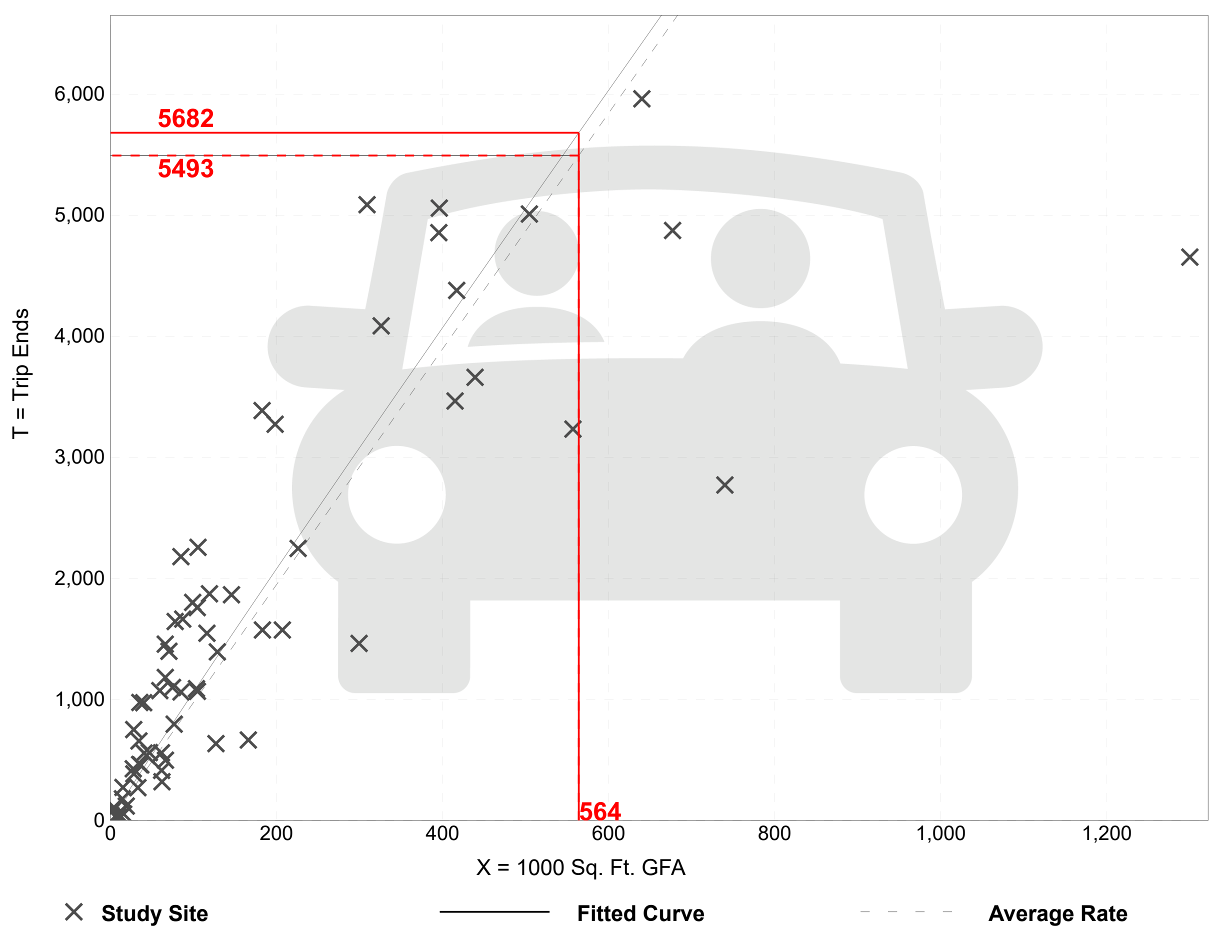
Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 66
Avg. 1000 Sq. Ft. GFA: 171
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
9.74	2.71 - 27.56	5.15

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.97 Ln(X) + 2.50 **R^2= 0.83**

Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

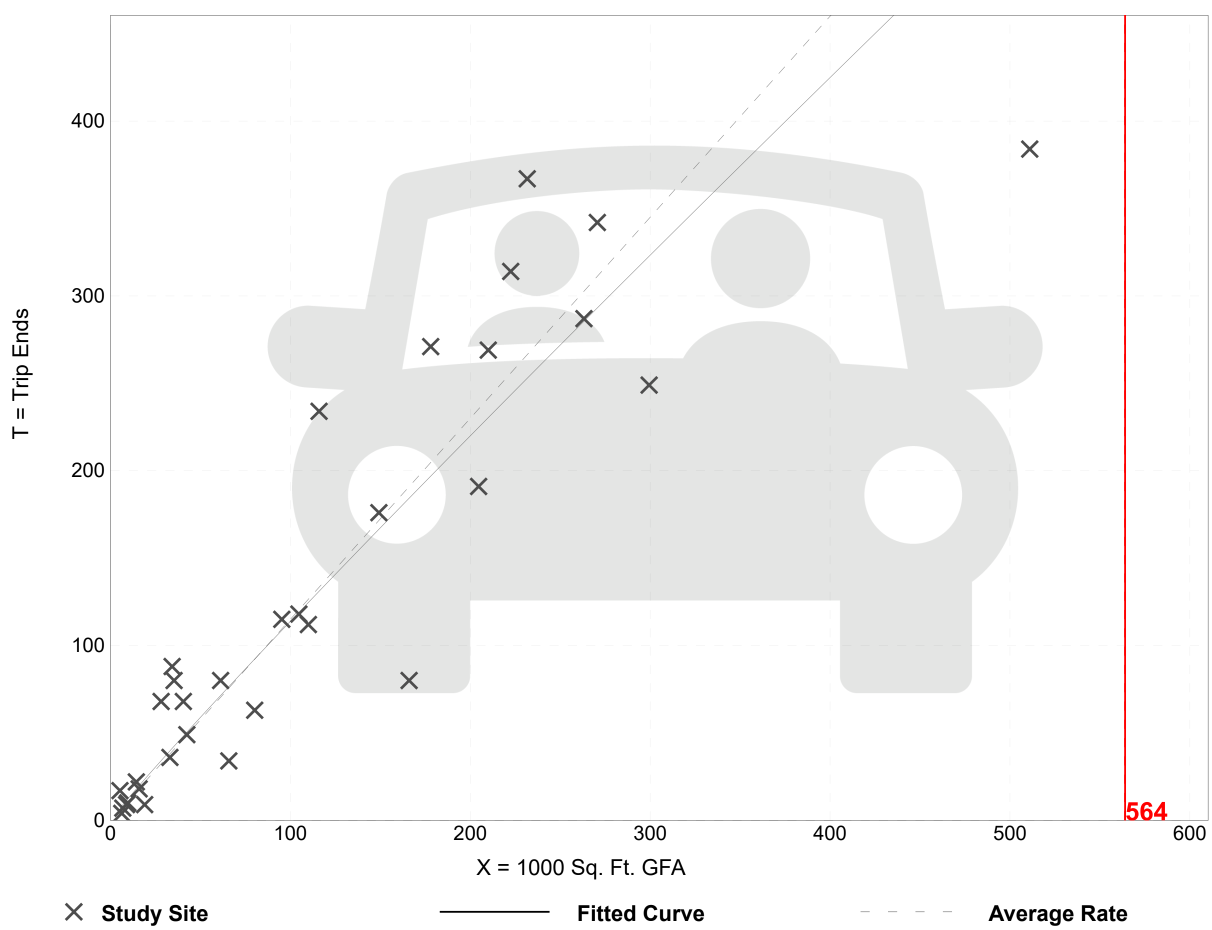
General Office Building
(710)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m.**
Setting/Location:	**General Urban/Suburban**
Number of Studies:	32
Avg. 1000 Sq. Ft. GFA:	114
Directional Distribution:	16% entering, 84% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.15	0.47 - 3.23	0.42

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.95 Ln(X) + 0.36

R^2= 0.88

Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

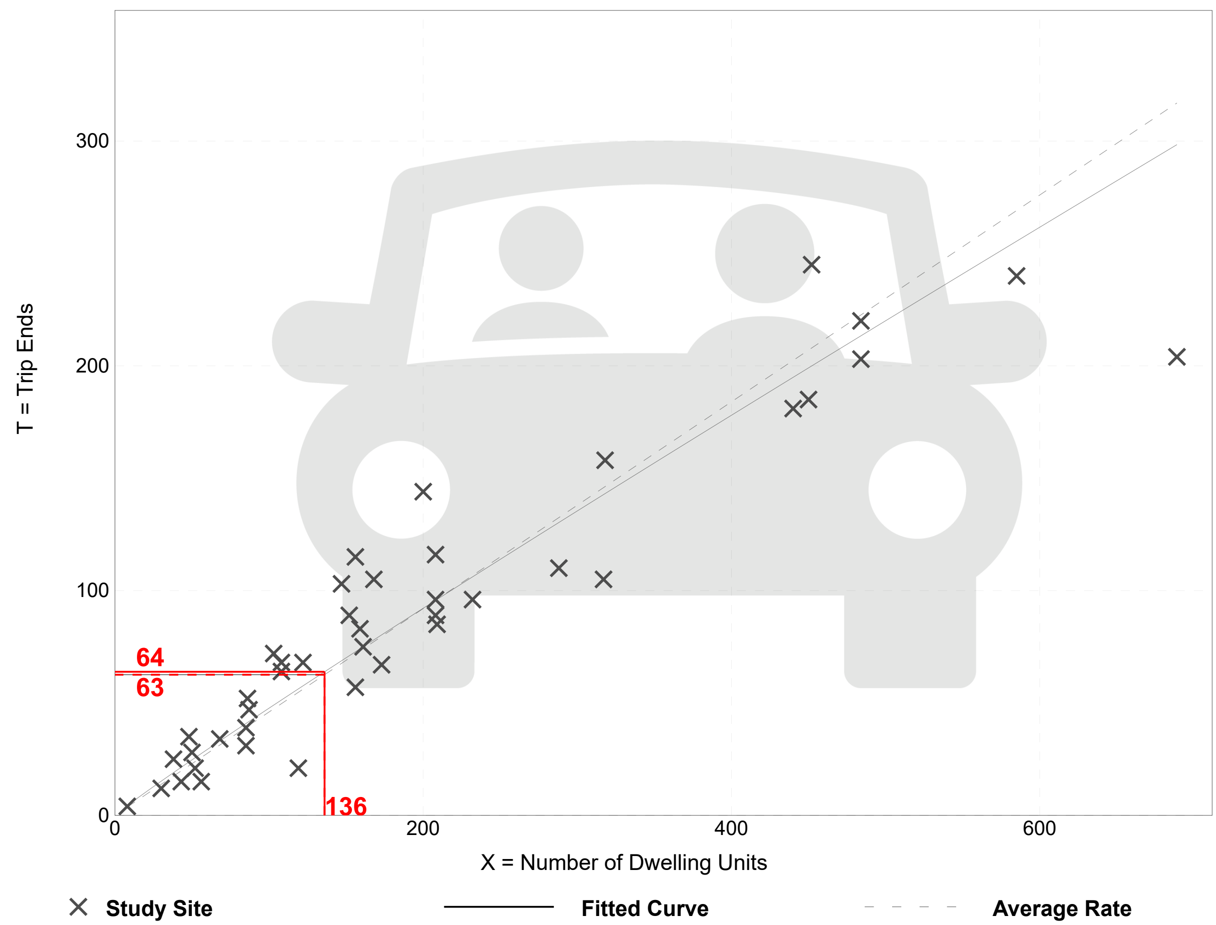
Multifamily Housing (Low-Rise)
(220)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	42
Avg. Num. of Dwelling Units:	199
Directional Distribution:	23% entering, 77% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.46	0.18 - 0.74	0.12

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.95 Ln(X) - 0.51 **R^2= 0.90**

Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

Multifamily Housing (Low-Rise)
(220)

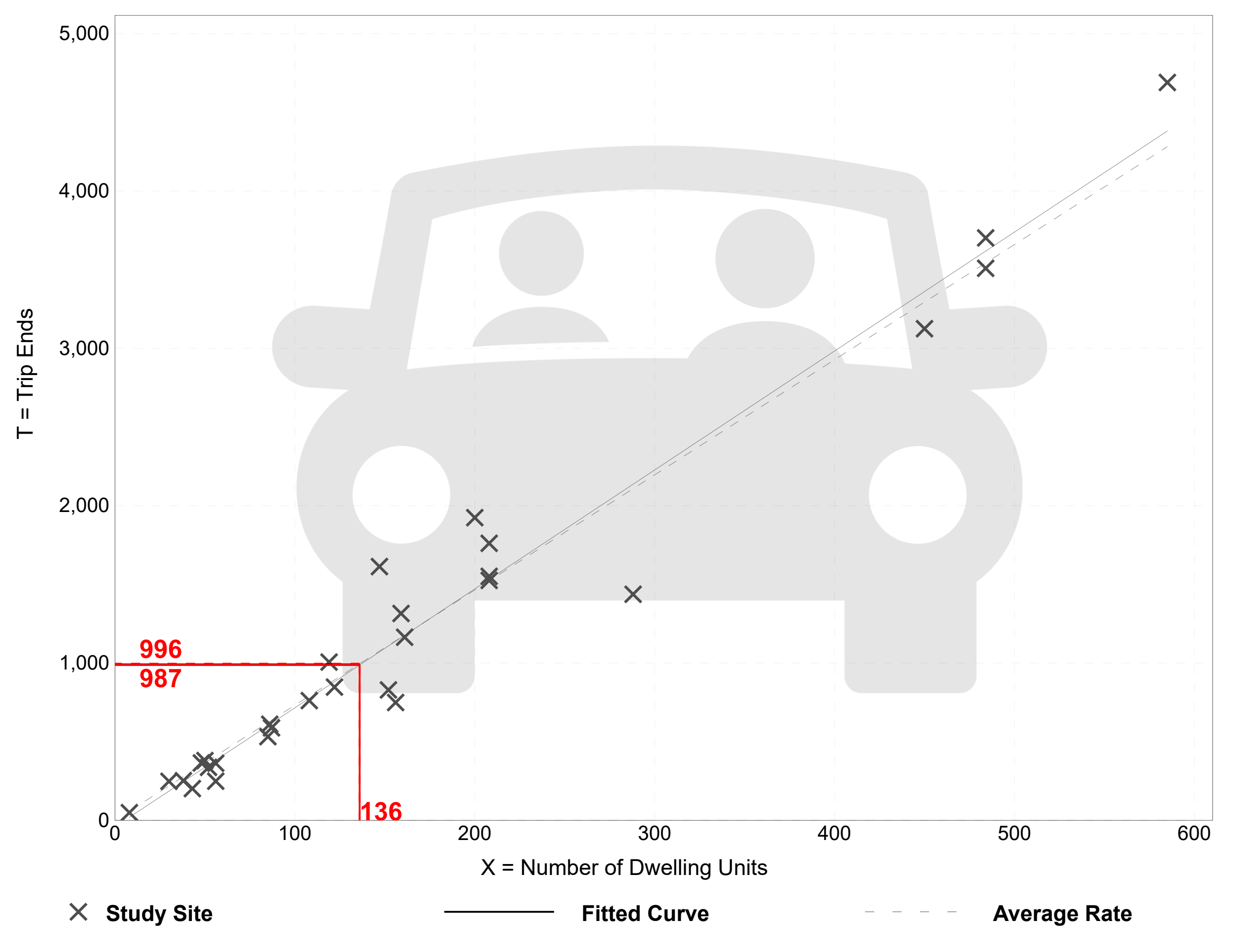
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 29
Avg. Num. of Dwelling Units: 168
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
7.32	4.45 - 10.97	1.31

Data Plot and Equation



Fitted Curve Equation: T = 7.56(X) - 40.86 **R^2= 0.96**

Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

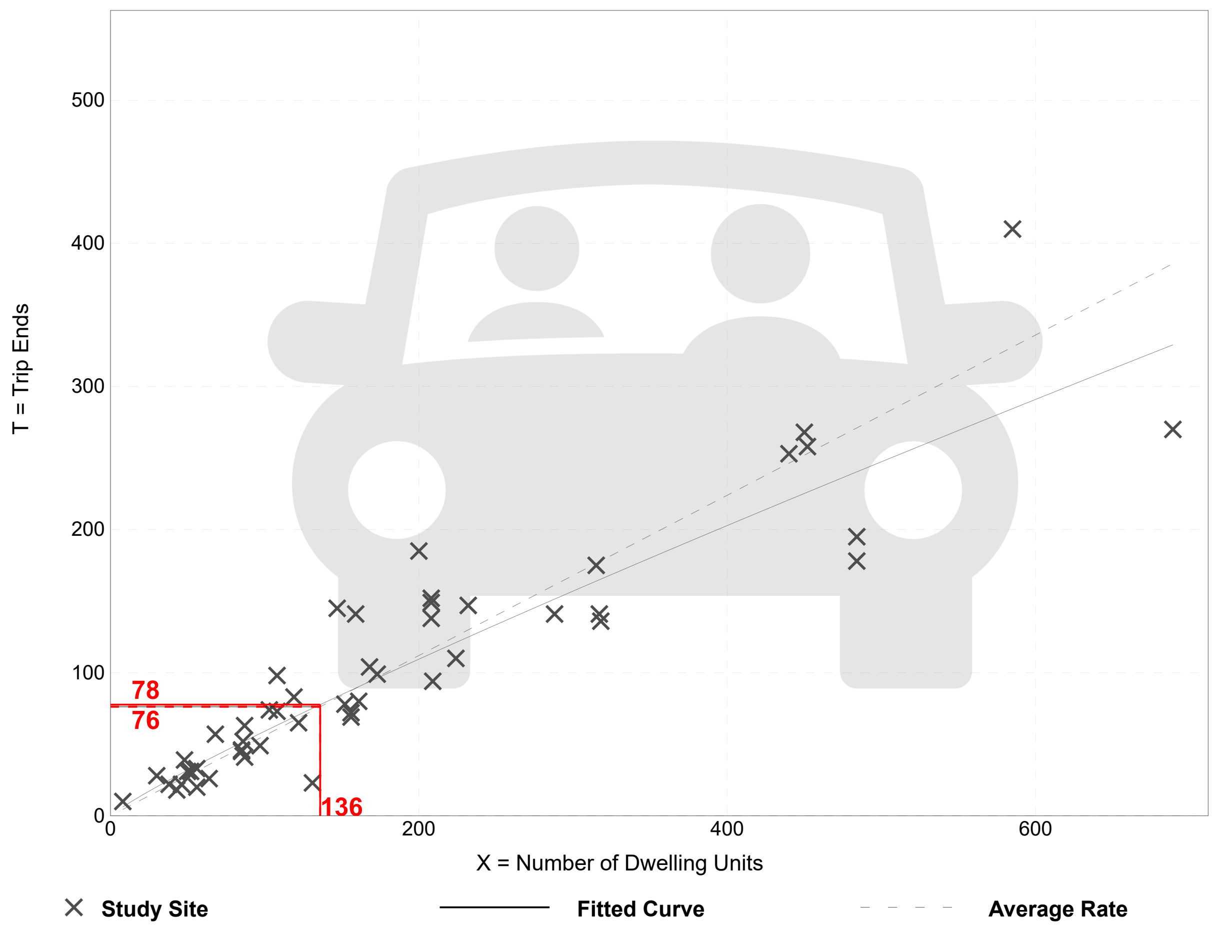
Multifamily Housing (Low-Rise)
(220)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m.**
Setting/Location:	**General Urban/Suburban**
Number of Studies:	50
Avg. Num. of Dwelling Units:	187
Directional Distribution:	63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.56	0.18 - 1.25	0.16

Data Plot and Equation



Fitted Curve Equation: $Ln(T) = 0.89\ Ln(X) - 0.02$ **$R^2 = 0.86$**

Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

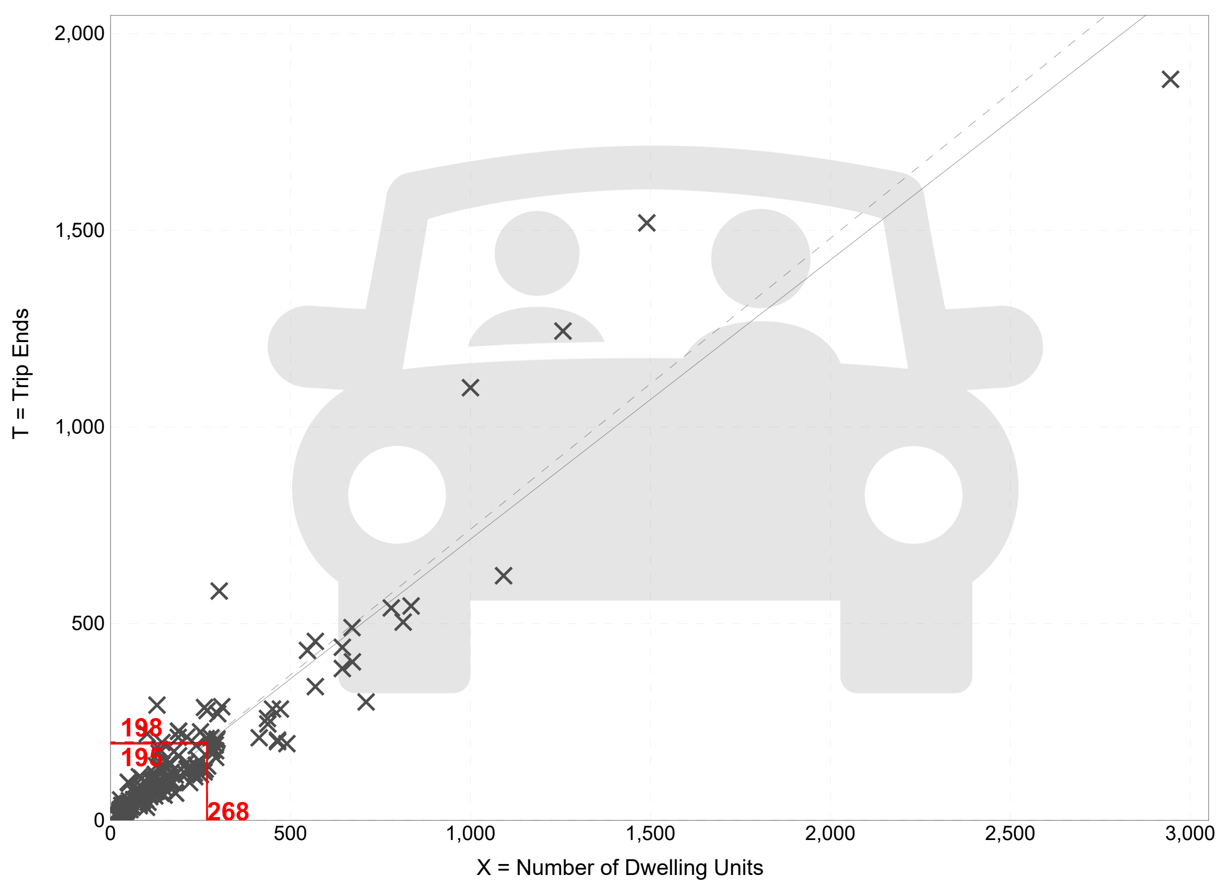
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 173
Avg. Num. of Dwelling Units: 219
Directional Distribution: 25% entering, 75% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.74	0.33 - 2.27	0.27

Data Plot and Equation



× **Study Site** —— **Fitted Curve** - - - **Average Rate**

Fitted Curve Equation: T = 0.71(X) + 4.80 **R^2= 0.89**

Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

Single-Family Detached Housing
(210)

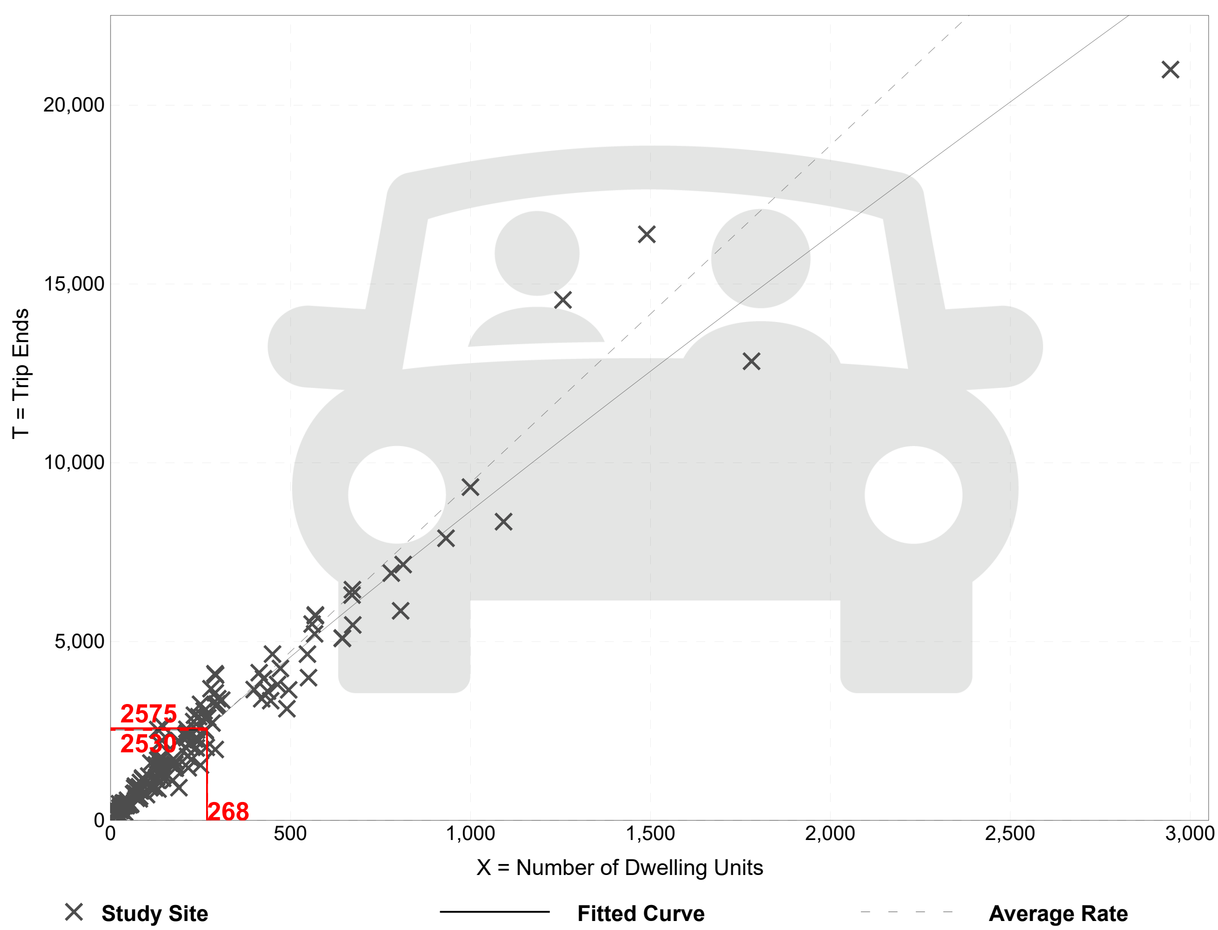
Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Setting/Location: General Urban/Suburban
Number of Studies: 159
Avg. Num. of Dwelling Units: 264
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.44	4.81 - 19.39	2.10

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.92 Ln(X) + 2.71

R^2= 0.95

Trip Gen Manual, 10th Ed + Supplement ● Institute of Transportation Engineers

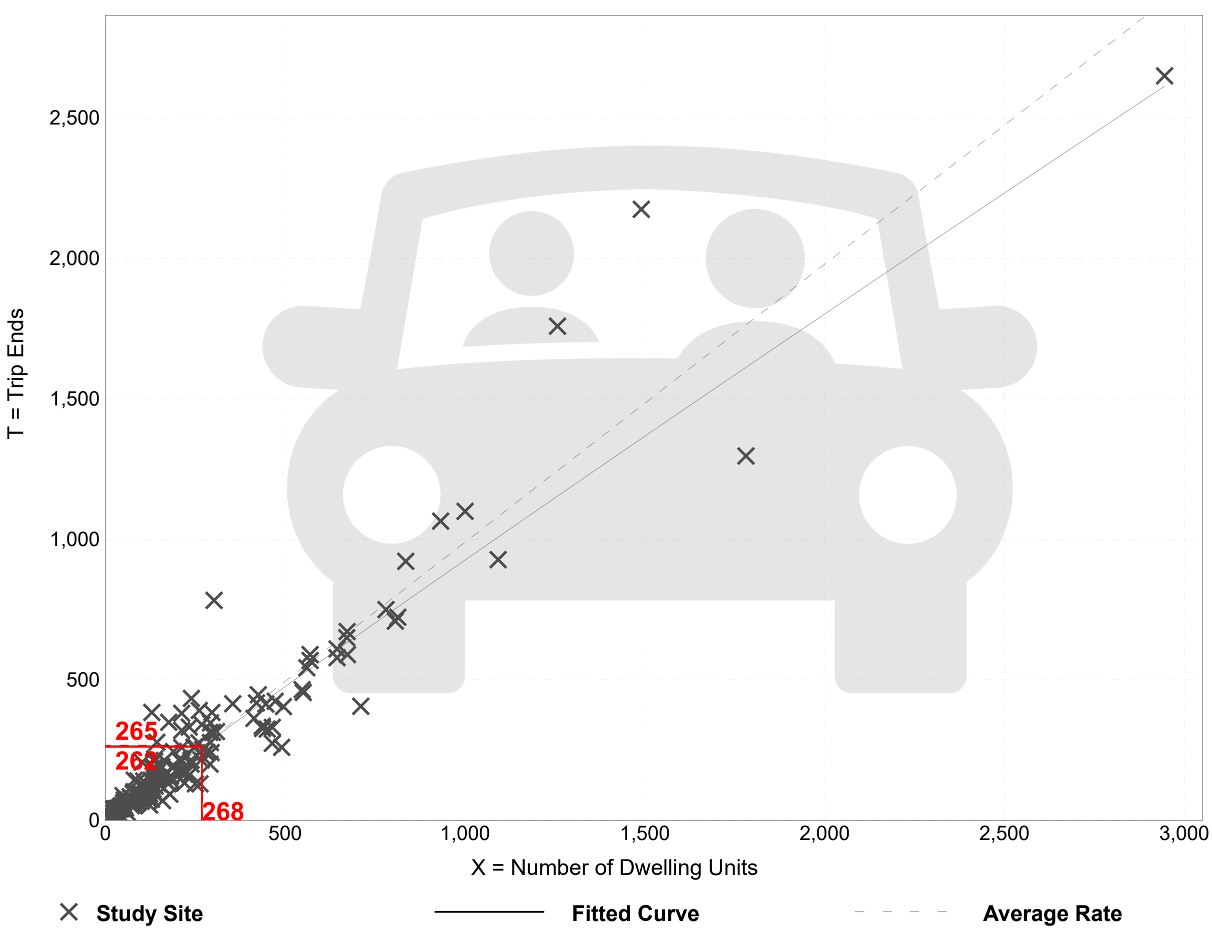
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	190
Avg. Num. of Dwelling Units:	242
Directional Distribution:	63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.99	0.44 - 2.98	0.31

Data Plot and Equation



Fitted Curve Equation: $Ln(T) = 0.96 Ln(X) + 0.20$ **$R^2 = 0.92$**

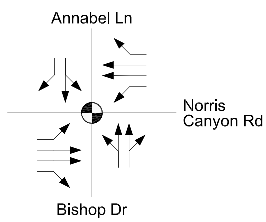
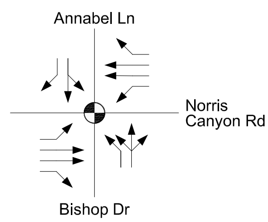
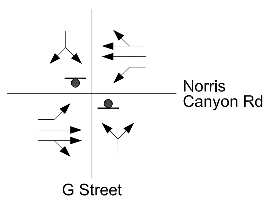
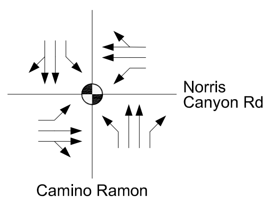
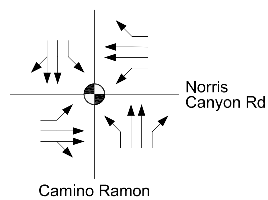
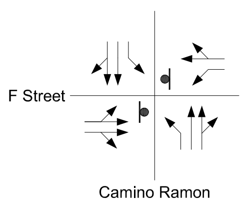
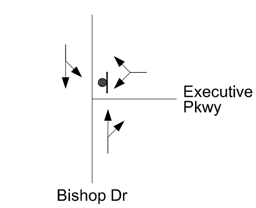
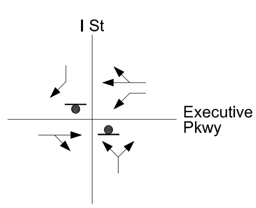
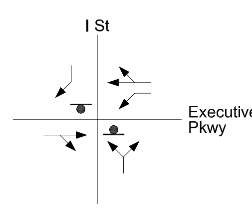
Trip Gen Manual, 10th Ed + Supplement • Institute of Transportation Engineers

Attachment

Gibson transportation consulting, inc.

LEGEND

- Traffic Signal
- Stop Sign

	EXISTING CONDITIONS (YEAR 2021)	FUTURE WITHOUT PROJECT CONDITIONS (YEAR 2040)	PROJECT DESIGN FEATURE
1. Bishop Drive / Annabel Lane & Norris Canyon Road			Same as Existing Conditions
2. G Street Project Driveway & Norris Canyon Road		Same as Existing Conditions	Same as Existing Conditions
3. Camino Ramon & Norris Canyon Road			Same as Existing Conditions
4. Camino Ramon & F Street Project Driveway		Same as Existing Conditions	Same as Existing Conditions
5. Bishop Drive & Executive Parkway		Same as Existing Conditions	Same as Existing Conditions
6. I Street Project Driveway & Executive Parkway		Same as Existing Conditions	

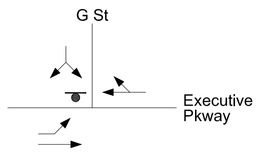
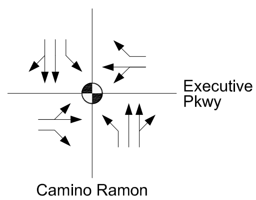
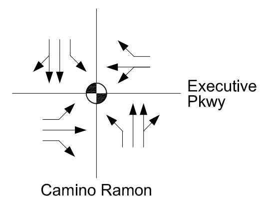
N
Not to Scale

INTERSECTION LANE CONFIGURATIONS

FIGURE A

LEGEND

- Traffic Signal
- Stop Sign

	EXISTING CONDITIONS (YEAR 2021)	FUTURE WITHOUT PROJECT CONDITIONS (YEAR 2040)	PROJECT DESIGN FEATURE
7. G Street Project Driveway & Executive Parkway		Same as Existing Conditions	Same as Existing Conditions
8. Camino Ramon & Executive Parkway			Same as Existing Conditions

N
Not to Scale

INTERSECTION LANE CONFIGURATIONS

FIGURE A (CONT.)

BR6 Volume Development

- Uses CityWalk Master Plan intersection volumes taken in 2019
- CityWalk Master Plan counts grown 1% per year to Existing Year 2021
- Analyzes Camino Ramon driveways (2) as one driveway to be conservative

Existing Conditions (Year 2021)

- CityWalk Master Plan counts used at Signalized Intersections 1, 3,5, and 8
- No counts were able to be taken at Project driveways; therefore, CityWalk Master Plan counts used to estimate *through movements* at driveways
- Turning Movements at Project Driveways
    - Turning movements at Project Driveways utilize Project Trip Generation for Existing Uses (564 ksf General Office) for turning movements inbound and outbound from three current Project Driveways
        - General Office distribution from CityWalk Master Plan
    - No addition of traffic from Existing Uses distributed to signalized intersections as they are assumed to already include Existing Uses traffic
    - Turning movements for driveways directly adjacent to site (2300 Camino Ramon for Intersection #2, BR7 for Intersection #4, and 2600 Camino Ramon for Intersection #6)
        - Trip generation estimates for BR7 and 2300 Camino Ramon based on ITE 10th Edition
            - 1/3 of traffic from both projects used due to at least 2 other driveway accesses at each site
        - 2600 Camino Ramon driveway volumes from CityWalk Master Plan
- Grow 1% per year for a total of 2% to 2021

Existing Plus Project (Year 2021)

- Added Net New Project volumes to driveways and intersections because Existing Conditions includes Existing Driveway Volumes already

Future without Project (Year 2040)

- Uses CityWalk Master Plan's Future with Project volumes
- Adds Existing Driveway movements from Existing Conditions (Year 2021)
    - Existing Driveway movements grown from Year 2021 to Year 2040 with growth rate based on counts at signalized intersections (approximately 30% growth)

Future with Project (Year 2040)

- Added Net New Project volumes to driveways and intersections because Existing Conditions includes Existing Driveway Volumes already

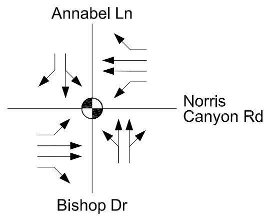
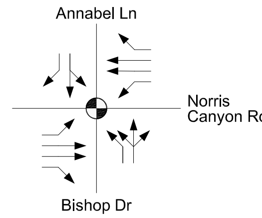
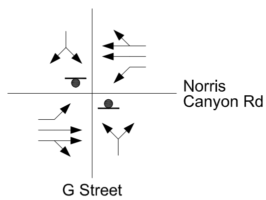
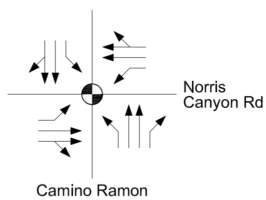
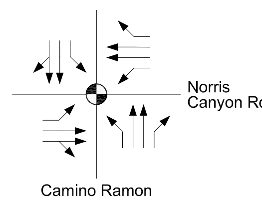
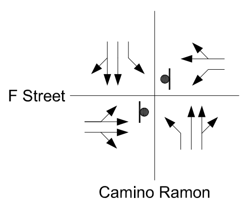
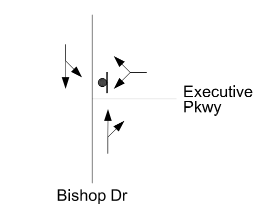
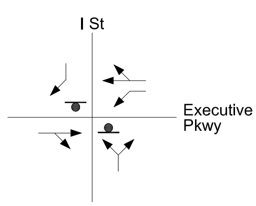
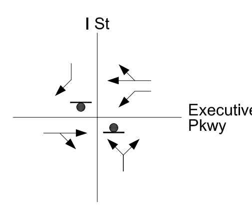
Appendix B

Intersection Lane Configurations

transportation consulting, inc.

LEGEND

- Traffic Signal
- Stop Sign

	EXISTING CONDITIONS (YEAR 2021)	FUTURE WITHOUT PROJECT CONDITIONS (YEAR 2040)	PROJECT DESIGN FEATURE
1. Bishop Drive / Annabel Lane & Norris Canyon Road			Same as Existing Conditions
2. G Street Project Driveway & Norris Canyon Road		Same as Existing Conditions	Same as Existing Conditions
3. Camino Ramon & Norris Canyon Road			Same as Existing Conditions
4. Camino Ramon & F Street Project Driveway		Same as Existing Conditions	Same as Existing Conditions
5. Bishop Drive & Executive Parkway		Same as Existing Conditions	Same as Existing Conditions
6. I Street Project Driveway & Executive Parkway		Same as Existing Conditions	

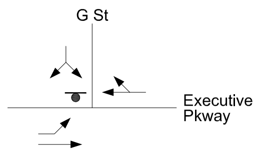
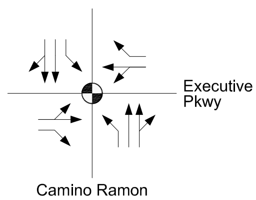
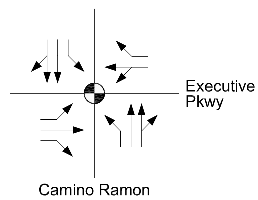
N
Not to Scale

INTERSECTION LANE CONFIGURATIONS

APPENDIX B

LEGEND

- Traffic Signal
- Stop Sign

	EXISTING CONDITIONS (YEAR 2021)	FUTURE WITHOUT PROJECT CONDITIONS (YEAR 2040)	PROJECT DESIGN FEATURE
7. G Street Project Driveway & Executive Parkway		Same as Existing Conditions	Same as Existing Conditions
8. Camino Ramon & Executive Parkway			Same as Existing Conditions

N
Not to Scale

INTERSECTION LANE CONFIGURATIONS

APPENDIX B (CONT.)

Appendix C

Traffic Counts

WILTEC Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

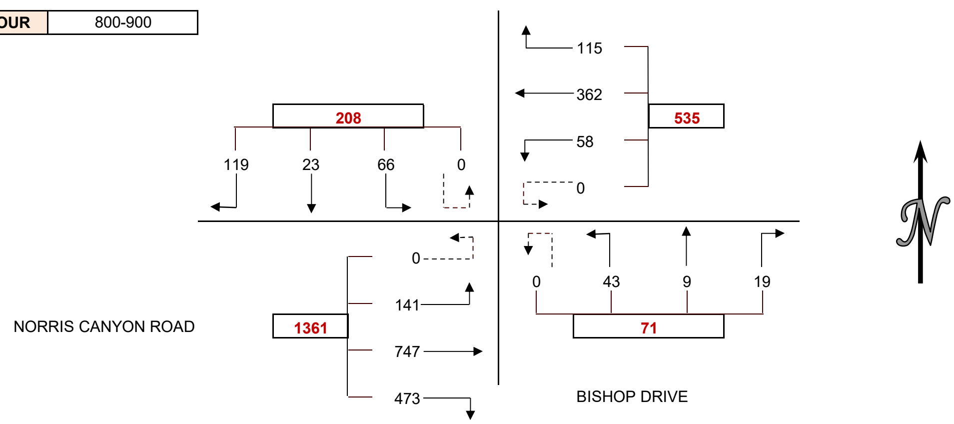
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT: GIBSON TRANSPORTATION
PROJECT: BISHOP RANCH STUDY, CITY OF SAN RAMON
DATE: WEDNESDAY MAY 29, 2018
PERIOD: 7:00 AM TO 9:00 AM
INTERSECTION: N/S BISHOP DRIVE
E/W NORRIS CANYON ROAD
CITY: SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-715	3	1	1	0	3	68	10	0	3	2	6	0	50	93	15	0	255
715-730	3	0	0	0	6	88	3	0	7	2	14	0	82	167	16	0	388
730-745	4	6	2	0	9	96	6	0	4	2	13	0	95	115	19	0	371
745-800	5	1	2	0	7	84	13	0	5	4	6	0	108	166	33	0	434
800-815	20	3	14	0	40	67	9	0	3	3	8	0	113	175	44	0	499
815-830	70	13	41	0	61	81	17	0	4	3	6	0	114	159	67	0	636
830-845	22	6	10	0	9	102	19	0	5	0	11	0	120	200	17	0	521
845-900	7	1	1	0	5	112	13	0	7	3	18	0	126	213	13	0	519
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-800	15	8	5	0	25	336	32	0	19	10	39	0	335	541	83	0	1448
715-815	32	10	18	0	62	335	31	0	19	11	41	0	398	623	112	0	1692
730-830	99	23	59	0	117	328	45	0	16	12	33	0	430	615	163	0	1940
745-845	117	23	67	0	117	334	58	0	17	10	31	0	455	700	161	0	2090
800-900	119	23	66	0	115	362	58	0	19	9	43	0	473	747	141	0	2175

PEAK HOUR	800-900



PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	0	0	0
715-730	1	2	0	0	3
730-745	4	4	1	1	10
745-800	3	1	0	0	4
800-815	2	0	0	0	2
815-830	1	0	0	0	1
830-845	3	1	0	0	4
845-900	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	8	7	1	1	17
715-815	10	7	1	1	19
730-830	10	5	1	1	17
745-845	9	2	0	0	11
800-900	6	1	0	0	7

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	0	0	0
715-730	1	0	1	0	2
730-745	0	0	0	0	0
745-800	0	0	1	0	1
800-815	2	0	1	0	3
815-830	1	0	0	0	1
830-845	1	0	0	0	1
845-900	2	0	2	0	4
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	1	0	2	0	3
715-815	3	0	3	0	6
730-830	3	0	2	0	5
745-845	4	0	2	0	6
800-900	6	0	3	0	9

WILTEC

Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

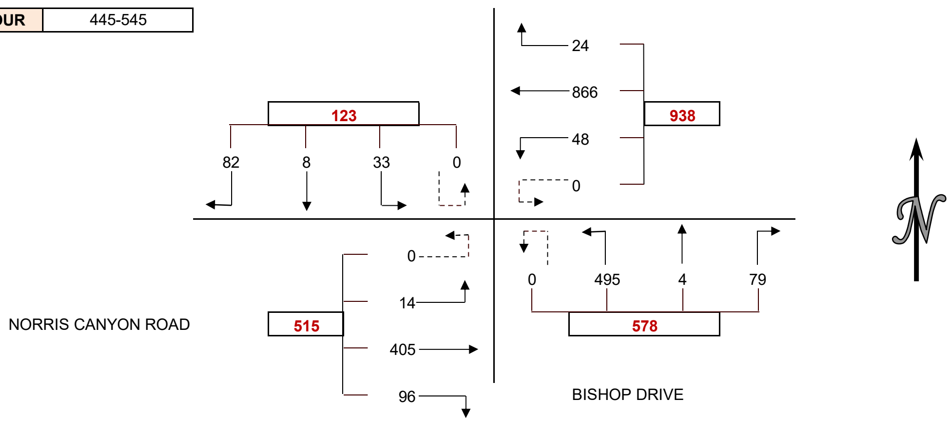
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT:		GIBSON TRANSPORTATION
PROJECT:		BISHOP RANCH STUDY, CITY OF SAN RAMON
DATE:		WEDNESDAY MAY 29, 2018
PERIOD:		4:00 PM TO 6:00 PM
INTERSECTION:	N/S	BISHOP DRIVE
	E/W	NORRIS CANYON ROAD
CITY:		SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-415	26	4	7	0	3	140	8	0	25	3	84	0	15	78	4	0	397
415-430	15	2	2	0	4	136	18	0	15	1	90	0	27	87	2	0	399
430-445	20	4	6	0	6	174	12	0	19	4	102	0	21	91	6	0	465
445-500	8	2	9	0	4	192	13	0	20	0	102	0	27	97	5	0	479
500-515	35	1	11	0	6	238	9	0	24	1	158	0	23	108	3	0	617
515-530	27	4	11	0	9	222	15	0	25	2	125	0	23	100	5	0	568
530-545	12	1	2	0	5	214	11	0	10	1	110	0	23	100	1	0	490
545-600	10	2	1	0	3	150	3	0	17	0	72	0	27	118	1	0	404
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-500	69	12	24	0	17	642	51	0	79	8	378	0	90	353	17	0	1740
415-515	78	9	28	0	20	740	52	0	78	6	452	0	98	383	16	0	1960
430-530	90	11	37	0	25	826	49	0	88	7	487	0	94	396	19	0	2129
445-545	82	8	33	0	24	866	48	0	79	4	495	0	96	405	14	0	2154
500-600	84	8	25	0	23	824	38	0	76	4	465	0	96	426	10	0	2079

PEAK HOUR	445-545



PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	1	2	0	0	3
415-430	1	0	0	0	1
430-445	2	0	0	0	2
445-500	3	2	0	0	5
500-515	4	1	2	2	9
515-530	1	1	0	0	2
530-545	4	2	1	0	7
545-600	2	0	1	0	3
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	7	4	0	0	11
415-515	10	3	2	2	17
430-530	10	4	2	2	18
445-545	12	6	3	2	23
500-600	11	4	4	2	21

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	1	0	0	0	1
415-430	0	0	0	0	0
430-445	2	0	0	0	2
445-500	0	0	0	0	0
500-515	3	2	2	0	7
515-530	0	0	0	0	0
530-545	4	0	1	0	5
545-600	2	0	0	0	2
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	3	0	0	0	3
415-515	5	2	2	0	9
430-530	5	2	2	0	9
445-545	7	2	3	0	12
500-600	9	2	3	0	14

WILTEC

Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

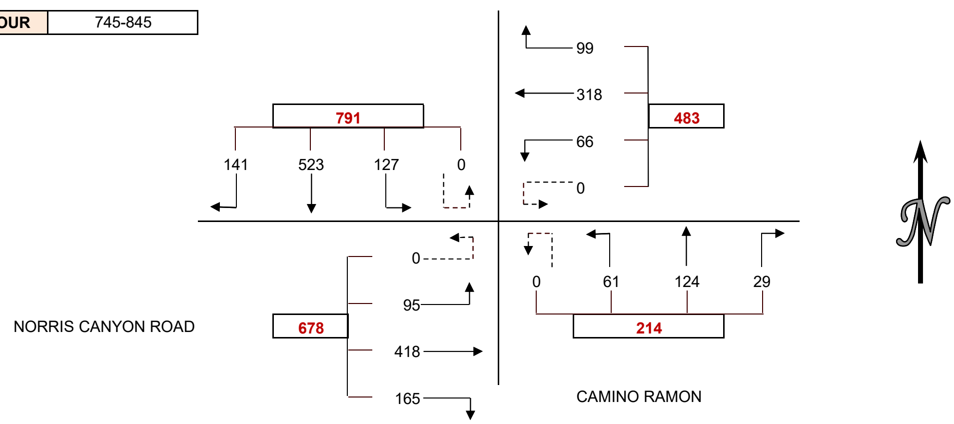
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT:		GIBSON TRANSPORTATION
PROJECT:		BISHOP RANCH STUDY, CITY OF SAN RAMON
DATE:		THURSDAY MAY 23, 2019
PERIOD:		7:00 AM TO 9:00 AM
INTERSECTION:	N/S	CAMINO RAMON
	E/W	NORRIS CANYON ROAD
CITY:		SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-715	31	75	22	0	10	28	6	0	5	21	6	0	16	38	6	0	264
715-730	18	94	18	0	13	35	18	0	9	13	3	0	18	40	14	0	293
730-745	34	117	26	0	17	35	8	0	7	18	7	0	17	50	17	0	353
745-800	30	130	34	0	25	57	13	0	9	25	15	0	41	121	27	0	527
800-815	31	138	35	0	22	79	22	0	11	43	32	0	54	162	21	0	650
815-830	39	121	25	0	24	110	13	0	5	33	13	0	33	81	25	0	522
830-845	41	134	33	0	28	72	18	0	4	23	1	0	37	54	22	0	467
845-900	33	116	35	0	29	64	18	0	12	40	9	0	35	52	25	0	468
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-800	113	416	100	0	65	155	45	0	30	77	31	0	92	249	64	0	1437
715-815	113	479	113	0	77	206	61	0	36	99	57	0	130	373	79	0	1823
730-830	134	506	120	0	88	281	56	0	32	119	67	0	145	414	90	0	2052
745-845	141	523	127	0	99	318	66	0	29	124	61	0	165	418	95	0	2166
800-900	144	509	128	0	103	325	71	0	32	139	55	0	159	349	93	0	2107

PEAK HOUR	745-845



PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	2	1	3
715-730	1	0	0	0	1
730-745	1	1	0	0	2
745-800	0	10	0	1	11
800-815	1	-10	0	0	-9
815-830	1	0	1	1	3
830-845	0	0	0	1	1
845-900	0	0	1	3	4
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	2	11	2	2	17
715-815	3	1	0	1	5
730-830	3	1	1	2	7
745-845	2	0	1	3	6
800-900	2	-10	2	5	-1

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	0	0	0
715-730	0	0	0	0	0
730-745	1	1	2	0	4
745-800	1	0	0	0	1
800-815	2	0	0	0	2
815-830	0	0	1	0	1
830-845	0	0	0	0	0
845-900	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	2	1	2	0	5
715-815	4	1	2	0	7
730-830	4	1	3	0	8
745-845	3	0	1	0	4
800-900	2	0	1	0	3

WILTEC Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

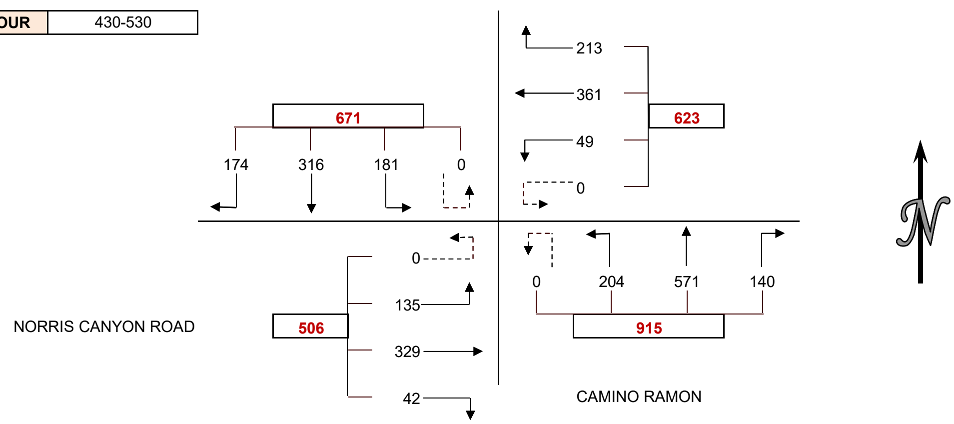
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT: GIBSON TRANSPORTATION
PROJECT: BISHOP RANCH STUDY, CITY OF SAN RAMON
DATE: THURSDAY MAY 23, 2019
PERIOD: 4:00 PM TO 6:00 PM
INTERSECTION: N/S CAMINO RAMON
E/W NORRIS CANYON ROAD
CITY: SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-415	42	67	32	0	58	87	11	0	30	122	32	0	9	63	28	0	581
415-430	34	56	23	0	46	88	18	0	25	117	21	0	10	78	41	0	557
430-445	54	64	40	0	48	86	19	0	34	141	37	0	9	69	37	0	638
445-500	39	81	48	0	48	81	8	0	30	117	49	0	11	88	31	0	631
500-515	40	77	53	0	59	108	12	0	53	157	52	0	10	85	30	0	736
515-530	41	94	40	0	58	86	10	0	23	156	66	0	12	87	37	0	710
530-545	39	84	45	0	40	64	11	0	26	136	25	0	7	75	37	0	589
545-600	36	59	31	0	40	59	7	0	17	123	26	0	11	66	28	0	503
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-500	169	268	143	0	200	342	56	0	119	497	139	0	39	298	137	0	2407
415-515	167	278	164	0	201	363	57	0	142	532	159	0	40	320	139	0	2562
430-530	174	316	181	0	213	361	49	0	140	571	204	0	42	329	135	0	2715
445-545	159	336	186	0	205	339	41	0	132	566	192	0	40	335	135	0	2666
500-600	156	314	169	0	197	317	40	0	119	572	169	0	40	313	132	0	2538

PEAK HOUR	430-530



PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	2	0	0	2	4
415-430	2	0	0	2	4
430-445	2	0	0	0	2
445-500	2	1	0	0	3
500-515	2	2	0	1	5
515-530	2	0	0	0	2
530-545	0	0	0	1	1
545-600	2	1	0	0	3
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	8	1	0	4	13
415-515	8	3	0	3	14
430-530	8	3	0	1	12
445-545	6	3	0	2	11
500-600	6	3	0	2	11

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	1	0	1	0	2
415-430	0	0	0	0	0
430-445	1	0	0	0	1
445-500	0	0	0	0	0
500-515	0	0	0	1	1
515-530	0	0	0	0	0
530-545	0	1	1	0	2
545-600	0	1	0	0	1
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	2	0	1	0	3
415-515	1	0	0	1	2
430-530	1	0	0	1	2
445-545	0	1	1	1	3
500-600	0	2	1	1	4

WILTEC

Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

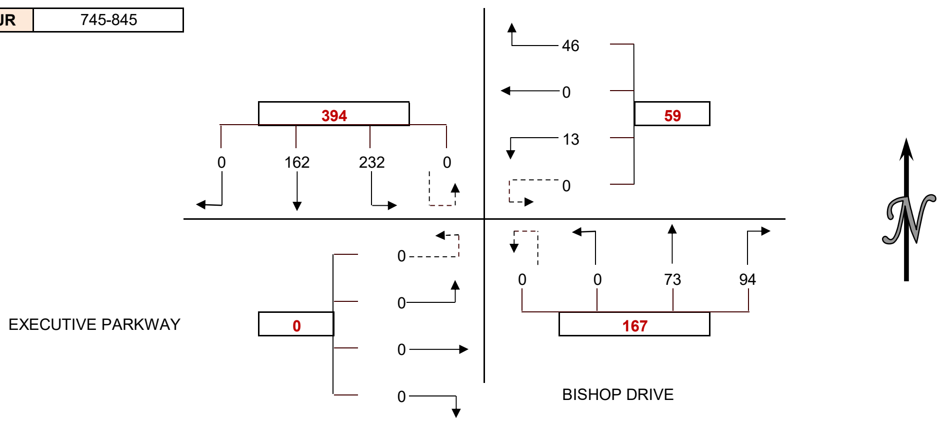
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT:		GIBSON TRANSPORTATION
PROJECT:		SAN RAMON
DATE:		WEDNESDAY MARCH 13, 2019
PERIOD:		7:00 AM TO 9:00 AM
INTERSECTION:	N/S	BISHOP DRIVE
	E/W	EXECUTIVE PARKWAY
CITY:		SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-715	0	13	20	0	1	0	1	0	10	16	0	0	0	0	0	0	61
715-730	0	24	25	0	2	0	0	0	19	19	0	0	0	0	0	0	89
730-745	0	18	36	0	2	0	1	0	25	12	0	0	0	0	0	0	94
745-800	0	33	84	0	10	0	1	0	24	22	0	0	0	0	0	0	174
800-815	0	46	82	0	28	0	5	0	16	21	0	0	0	0	0	0	198
815-830	0	38	32	0	6	0	4	0	25	18	0	0	0	0	0	0	123
830-845	0	45	34	0	2	0	3	0	29	12	0	0	0	0	0	0	125
845-900	0	44	28	0	4	0	3	0	23	21	0	0	0	0	0	0	123
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-800	0	88	165	0	15	0	3	0	78	69	0	0	0	0	0	0	418
715-815	0	121	227	0	42	0	7	0	84	74	0	0	0	0	0	0	555
730-830	0	135	234	0	46	0	11	0	90	73	0	0	0	0	0	0	589
745-845	0	162	232	0	46	0	13	0	94	73	0	0	0	0	0	0	620
800-900	0	173	176	0	40	0	15	0	93	72	0	0	0	0	0	0	569

PEAK HOUR	745-845



PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	0	0	0
715-730	0	4	0	0	4
730-745	0	0	0	0	0
745-800	0	4	0	0	4
800-815	0	0	0	0	0
815-830	0	2	0	0	2
830-845	0	0	0	0	0
845-900	0	1	0	0	1
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	0	8	0	0	8
715-815	0	8	0	0	8
730-830	0	6	0	0	6
745-845	0	6	0	0	6
800-900	0	3	0	0	3

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	0	0	0
715-730	0	0	0	0	0
730-745	0	0	0	0	0
745-800	0	0	0	0	0
800-815	0	0	0	0	0
815-830	0	0	0	0	0
830-845	0	0	0	0	0
845-900	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	0	0	0	0	0
715-815	0	0	0	0	0
730-830	0	0	0	0	0
745-845	0	0	0	0	0
800-900	0	0	0	0	0

WILTEC Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

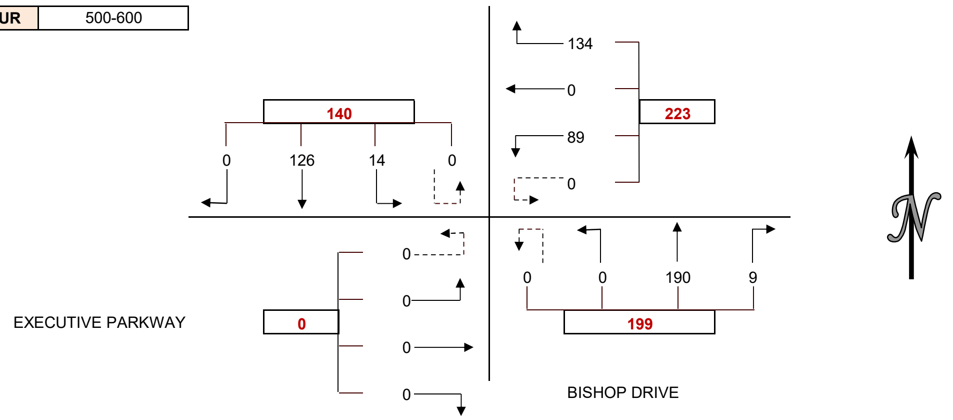
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT:		GIBSON TRANSPORTATION
PROJECT:		SAN RAMON
DATE:		WEDNESDAY MARCH 13, 2019
PERIOD:		4:00 PM TO 6:00 PM
INTERSECTION:	N/S	BISHOP DRIVE
	E/W	EXECUTIVE PARKWAY
CITY:		SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-415	0	33	2	0	20	0	17	0	0	44	0	0	0	0	0	0	116
415-430	0	23	5	0	21	0	19	0	3	39	0	0	0	0	0	0	110
430-445	0	32	7	0	38	0	29	0	1	32	0	0	0	0	0	0	139
445-500	0	25	5	0	28	0	25	0	3	43	0	0	0	0	0	0	129
500-515	0	30	4	0	48	0	26	0	0	48	0	0	0	0	0	0	156
515-530	0	25	3	0	39	0	18	0	3	42	0	0	0	0	0	0	130
530-545	0	34	2	0	24	0	18	0	2	46	0	0	0	0	0	0	126
545-600	0	37	5	0	23	0	27	0	4	54	0	0	0	0	0	0	150
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-500	0	113	19	0	107	0	90	0	7	158	0	0	0	0	0	0	494
415-515	0	110	21	0	135	0	99	0	7	162	0	0	0	0	0	0	534
430-530	0	112	19	0	153	0	98	0	7	165	0	0	0	0	0	0	554
445-545	0	114	14	0	139	0	87	0	8	179	0	0	0	0	0	0	541
500-600	0	126	14	0	134	0	89	0	9	190	0	0	0	0	0	0	562

PEAK HOUR	500-600



PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	0	2	0	0	2
415-430	0	0	0	0	0
430-445	0	1	0	0	1
445-500	0	1	0	0	1
500-515	0	0	0	0	0
515-530	0	1	0	0	1
530-545	0	2	0	0	2
545-600	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	0	4	0	0	4
415-515	0	2	0	0	2
430-530	0	3	0	0	3
445-545	0	4	0	0	4
500-600	0	3	0	0	3

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	0	0	0	0	0
415-430	0	0	0	0	0
430-445	0	0	0	0	0
445-500	0	1	0	0	1
500-515	0	0	0	0	0
515-530	0	0	0	0	0
530-545	0	0	0	0	0
545-600	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	0	1	0	0	1
415-515	0	1	0	0	1
430-530	0	1	0	0	1
445-545	0	1	0	0	1
500-600	0	0	0	0	0

WILTEC

Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

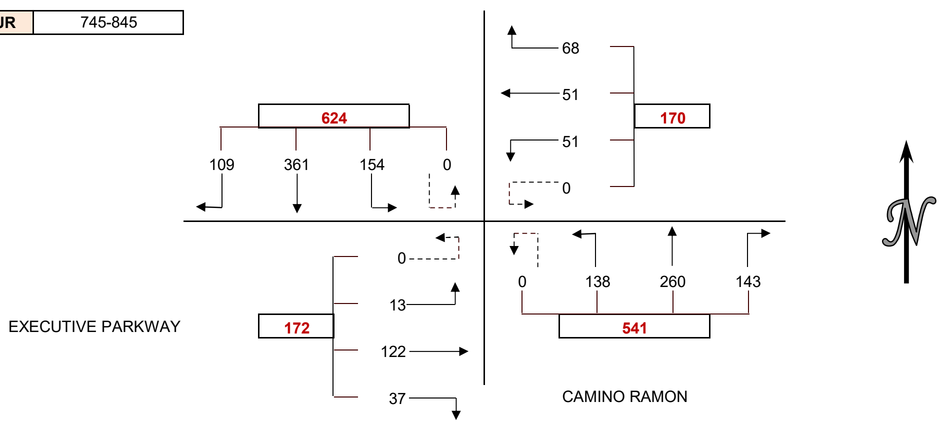
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT:		GIBSON TRANSPORTATION
PROJECT:		SAN RAMON
DATE:		THURSDAY MARCH 14, 2019
PERIOD:		7:00 AM TO 9:00 AM
INTERSECTION:	N/S	CAMINO RAMON
	E/W	EXECUTIVE PARKWAY
CITY:		SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-715	19	60	7	0	2	2	4	0	19	32	15	0	10	3	0	0	173
715-730	10	84	14	0	0	6	2	0	18	43	23	0	6	5	7	0	218
730-745	15	76	23	0	5	8	5	0	22	47	19	0	9	12	5	0	246
745-800	21	99	46	0	22	11	19	0	32	74	43	0	13	45	4	0	429
800-815	29	87	39	0	38	25	20	0	31	69	35	0	5	53	5	0	436
815-830	30	96	34	0	6	10	5	0	36	49	28	0	11	16	2	0	323
830-845	29	79	35	0	2	5	7	0	44	68	32	0	8	8	2	0	319
845-900	23	102	43	0	3	6	3	0	48	64	34	0	7	10	3	0	346
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-800	65	319	90	0	29	27	30	0	91	196	100	0	38	65	16	0	1066
715-815	75	346	122	0	65	50	46	0	103	233	120	0	33	115	21	0	1329
730-830	95	358	142	0	71	54	49	0	121	239	125	0	38	126	16	0	1434
745-845	109	361	154	0	68	51	51	0	143	260	138	0	37	122	13	0	1507
800-900	111	364	151	0	49	46	35	0	159	250	129	0	31	87	12	0	1424

PEAK HOUR	745-845



PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	1	0	1
715-730	0	0	0	0	0
730-745	1	0	2	0	3
745-800	0	0	1	1	2
800-815	0	0	0	0	0
815-830	1	0	0	0	1
830-845	0	0	0	2	2
845-900	1	0	0	2	3
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	1	0	4	1	6
715-815	1	0	3	1	5
730-830	2	0	3	1	6
745-845	1	0	1	3	5
800-900	2	0	0	4	6

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	0	0	0
715-730	0	0	0	0	0
730-745	0	0	1	0	1
745-800	1	0	0	0	1
800-815	0	0	0	0	0
815-830	0	0	0	1	1
830-845	0	0	0	0	0
845-900	1	0	1	0	2
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	1	0	1	0	2
715-815	1	0	1	0	2
730-830	1	0	1	1	3
745-845	1	0	0	1	2
800-900	1	0	1	1	3

WILTEC

Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

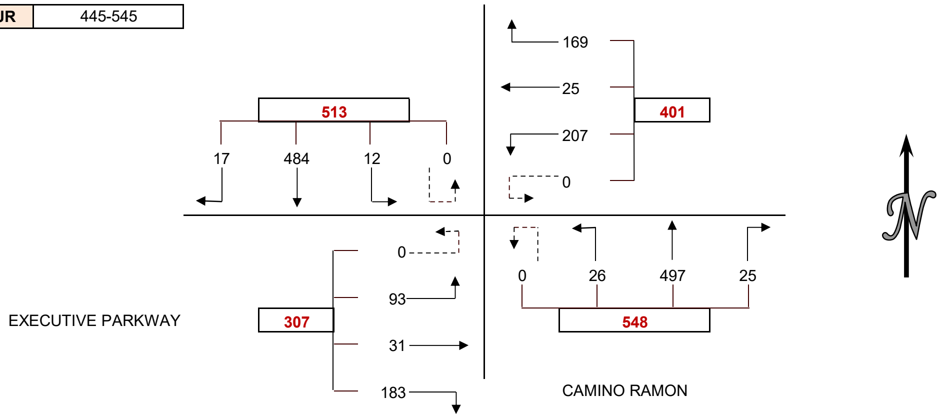
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT:		GIBSON TRANSPORTATION
PROJECT:		SAN RAMON
DATE:		THURSDAY MARCH 14, 2019
PERIOD:		4:00 PM TO 6:00 PM
INTERSECTION:	N/S	CAMINO RAMON
	E/W	EXECUTIVE PARKWAY
CITY:		SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-415	6	85	7	0	14	2	27	0	0	120	8	0	26	4	13	0	312
415-430	4	96	4	0	26	9	42	0	4	102	6	0	30	8	9	0	340
430-445	5	79	4	0	37	7	39	0	7	133	5	0	21	15	21	0	373
445-500	3	113	1	0	28	2	51	0	7	103	9	0	37	9	27	0	390
500-515	5	137	5	0	64	11	67	0	6	141	5	0	61	10	22	0	534
515-530	6	122	2	0	40	4	52	0	7	128	9	0	48	5	27	0	450
530-545	3	112	4	0	37	8	37	0	5	125	3	0	37	7	17	0	395
545-600	2	89	3	0	32	8	44	0	4	108	5	0	25	4	16	0	340
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-500	18	373	16	0	105	20	159	0	18	458	28	0	114	36	70	0	1415
415-515	17	425	14	0	155	29	199	0	24	479	25	0	149	42	79	0	1637
430-530	19	451	12	0	169	24	209	0	27	505	28	0	167	39	97	0	1747
445-545	17	484	12	0	169	25	207	0	25	497	26	0	183	31	93	0	1769
500-600	16	460	14	0	173	31	200	0	22	502	22	0	171	26	82	0	1719

PEAK HOUR	445-545



PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	0	0	1	2	3
415-430	0	0	1	1	2
430-445	3	0	0	3	6
445-500	0	0	1	0	1
500-515	1	1	1	1	4
515-530	0	0	1	1	2
530-545	0	0	0	0	0
545-600	1	0	1	3	5
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	3	0	3	6	12
415-515	4	1	3	5	13
430-530	4	1	3	5	13
445-545	1	1	3	2	7
500-600	2	1	3	5	11

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	0	0	0	1	1
415-430	0	0	0	0	0
430-445	0	0	0	0	0
445-500	0	0	0	0	0
500-515	0	0	1	0	1
515-530	0	0	1	0	1
530-545	0	0	0	0	0
545-600	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	0	0	0	1	1
415-515	0	0	1	0	1
430-530	0	0	2	0	2
445-545	0	0	2	0	2
500-600	0	0	2	0	2

WILTEC

Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

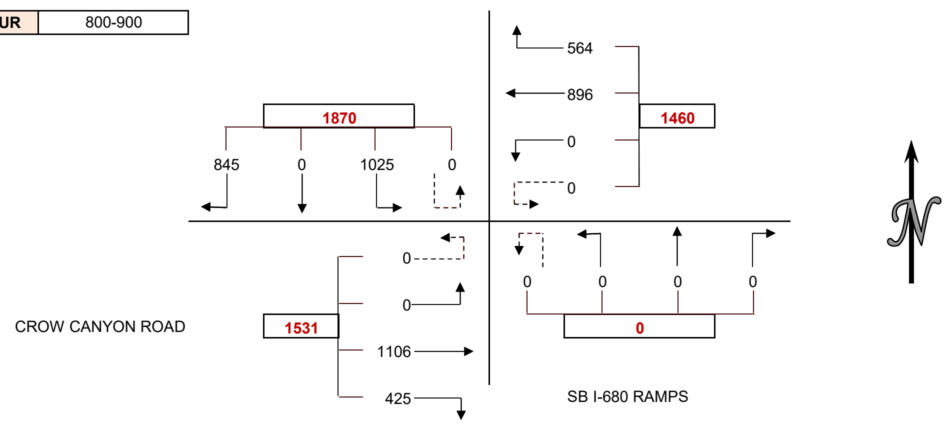
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT:		GIBSON TRANSPORTATION
PROJECT:		BISHOP RANCH STUDY, CITY OF SAN RAMON
DATE:		WEDNSEDAY MAY 22, 2019
PERIOD:		7:00 AM TO 9:00 AM
INTERSECTION:	N/S	SB I-680 RAMPS
	E/W	CROW CANYON ROAD
CITY:		SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-715	211	0	176	0	108	103	0	0	0	0	0	0	90	178	0	0	866
715-730	218	0	211	0	104	141	0	0	0	0	0	0	116	240	0	0	1030
730-745	218	0	246	0	153	168	0	0	0	0	0	0	112	253	0	0	1150
745-800	245	0	284	0	143	180	0	0	0	0	0	0	100	275	0	0	1227
800-815	216	0	223	0	153	188	0	0	0	0	0	0	98	303	0	0	1181
815-830	224	0	253	0	145	203	0	0	0	0	0	0	109	275	0	0	1209
830-845	186	0	272	0	140	188	0	0	0	0	0	0	106	293	0	0	1185
845-900	219	0	277	0	126	317	0	0	0	0	0	0	112	235	0	0	1286
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-800	892	0	917	0	508	592	0	0	0	0	0	0	418	946	0	0	4273
715-815	897	0	964	0	553	677	0	0	0	0	0	0	426	1071	0	0	4588
730-830	903	0	1006	0	594	739	0	0	0	0	0	0	419	1106	0	0	4767
745-845	871	0	1032	0	581	759	0	0	0	0	0	0	413	1146	0	0	4802
800-900	845	0	1025	0	564	896	0	0	0	0	0	0	425	1106	0	0	4861

PEAK HOUR	800-900



PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	1	0	1
715-730	0	0	0	0	0
730-745	0	0	0	0	0
745-800	0	0	0	0	0
800-815	0	0	0	0	0
815-830	0	0	1	0	1
830-845	0	0	0	0	0
845-900	0	0	1	0	1
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	0	0	1	0	1
715-815	0	0	0	0	0
730-830	0	0	1	0	1
745-845	0	0	1	0	1
800-900	0	0	2	0	2

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	0	0	0
715-730	0	0	0	0	0
730-745	0	0	0	0	0
745-800	0	0	0	0	0
800-815	0	0	0	0	0
815-830	0	0	0	0	0
830-845	0	0	0	0	0
845-900	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	0	0	0	0	0
715-815	0	0	0	0	0
730-830	0	0	0	0	0
745-845	0	0	0	0	0
800-900	0	0	0	0	0

WILTEC

Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

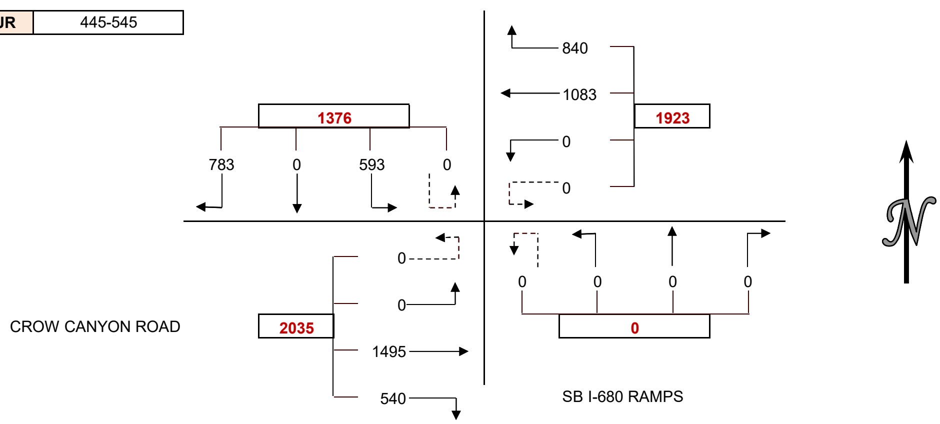
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT: GIBSON TRANSPORTATION
PROJECT: BISHOP RANCH STUDY, CITY OF SAN RAMON
DATE: WEDNSEDAY MAY 22, 2019
PERIOD: 4:00 PM TO 6:00 PM
INTERSECTION: N/S SB I-680 RAMPS
E/W CROW CANYON ROAD
CITY: SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-415	166	0	135	0	202	249	0	0	0	0	0	0	127	370	0	0	1249
415-430	186	0	114	0	196	252	0	0	0	0	0	0	134	397	0	0	1279
430-445	173	0	126	0	217	263	0	0	0	0	0	0	139	350	0	0	1268
445-500	215	0	156	0	212	256	0	0	0	0	0	0	143	357	0	0	1339
500-515	189	0	158	0	229	273	0	0	0	0	0	0	150	369	0	0	1368
515-530	179	0	152	0	215	286	0	0	0	0	0	0	118	406	0	0	1356
530-545	200	0	127	0	184	268	0	0	0	0	0	0	129	363	0	0	1271
545-600	166	0	150	0	200	272	0	0	0	0	0	0	118	372	0	0	1278
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-500	740	0	531	0	827	1020	0	0	0	0	0	0	543	1474	0	0	5135
415-515	763	0	554	0	854	1044	0	0	0	0	0	0	566	1473	0	0	5254
430-530	756	0	592	0	873	1078	0	0	0	0	0	0	550	1482	0	0	5331
445-545	783	0	593	0	840	1083	0	0	0	0	0	0	540	1495	0	0	5334
500-600	734	0	587	0	828	1099	0	0	0	0	0	0	515	1510	0	0	5273

PEAK HOUR	445-545



PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	0	0	0	0	0
415-430	0	0	0	0	0
430-445	0	0	0	0	0
445-500	0	0	0	0	0
500-515	0	0	0	0	0
515-530	0	0	0	0	0
530-545	0	0	0	0	0
545-600	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	0	0	0	0	0
415-515	0	0	0	0	0
430-530	0	0	0	0	0
445-545	0	0	0	0	0
500-600	0	0	0	0	0

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	0	0	0	0	0
415-430	0	0	0	0	0
430-445	0	0	0	0	0
445-500	0	0	0	0	0
500-515	0	0	0	0	0
515-530	0	0	0	0	0
530-545	0	0	0	0	0
545-600	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	0	0	0	0	0
415-515	0	0	0	0	0
430-530	0	0	0	0	0
445-545	0	0	0	0	0
500-600	0	0	0	0	0

WILTEC

Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

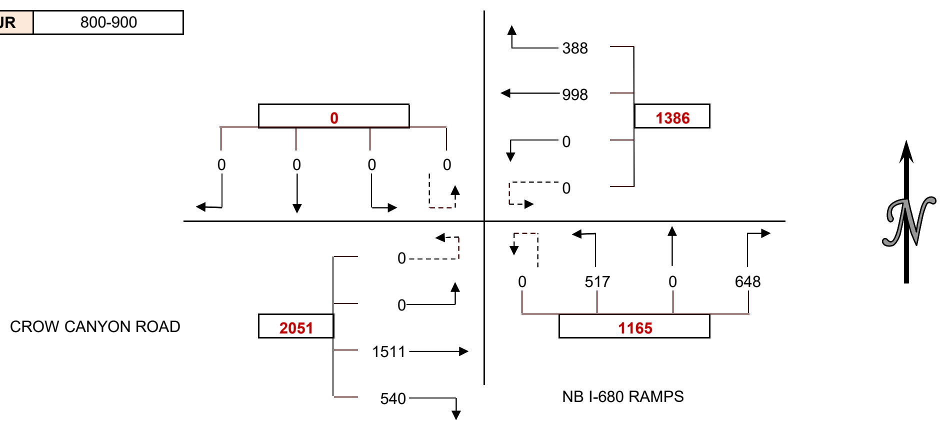
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT:		GIBSON TRANSPORTATION
PROJECT:		BISHOP RANCH STUDY, CITY OF SAN RAMON
DATE:		WEDNESDAY MAY 22 ,2019
PERIOD:		7:00 AM TO 9:00 AM
INTERSECTION:	N/S	NB I-680 RAMPS
	E/W	CROW CANYON ROAD
CITY:		SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-715	0	0	0	0	110	140	0	0	106	0	63	0	118	268	0	0	805
715-730	0	0	0	0	115	165	0	0	148	0	74	0	109	289	0	0	900
730-745	0	0	0	0	101	200	0	0	160	0	91	0	135	336	0	0	1023
745-800	0	0	0	0	104	232	0	0	184	0	103	0	127	419	0	0	1169
800-815	0	0	0	0	92	227	0	0	143	0	127	0	169	371	0	0	1129
815-830	0	0	0	0	107	242	0	0	178	0	88	0	149	365	0	0	1129
830-845	0	0	0	0	114	257	0	0	175	0	109	0	139	367	0	0	1161
845-900	0	0	0	0	75	272	0	0	152	0	193	0	83	408	0	0	1183
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-800	0	0	0	0	430	737	0	0	598	0	331	0	489	1312	0	0	3897
715-815	0	0	0	0	412	824	0	0	635	0	395	0	540	1415	0	0	4221
730-830	0	0	0	0	404	901	0	0	665	0	409	0	580	1491	0	0	4450
745-845	0	0	0	0	417	958	0	0	680	0	427	0	584	1522	0	0	4588
800-900	0	0	0	0	388	998	0	0	648	0	517	0	540	1511	0	0	4602

PEAK HOUR	800-900



PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	1	0	1
715-730	0	0	0	0	0
730-745	0	0	0	0	0
745-800	0	0	0	0	0
800-815	0	0	0	0	0
815-830	0	0	1	0	1
830-845	0	0	0	0	0
845-900	0	0	1	0	1
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	0	0	1	0	1
715-815	0	0	0	0	0
730-830	0	0	1	0	1
745-845	0	0	1	0	1
800-900	0	0	2	0	2

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	0	0	0
715-730	0	0	0	0	0
730-745	0	0	0	0	0
745-800	0	0	0	0	0
800-815	0	0	0	0	0
815-830	0	0	0	0	0
830-845	0	0	0	0	0
845-900	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	0	0	0	0	0
715-815	0	0	0	0	0
730-830	0	0	0	0	0
745-845	0	0	0	0	0
800-900	0	0	0	0	0

WILTEC

Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

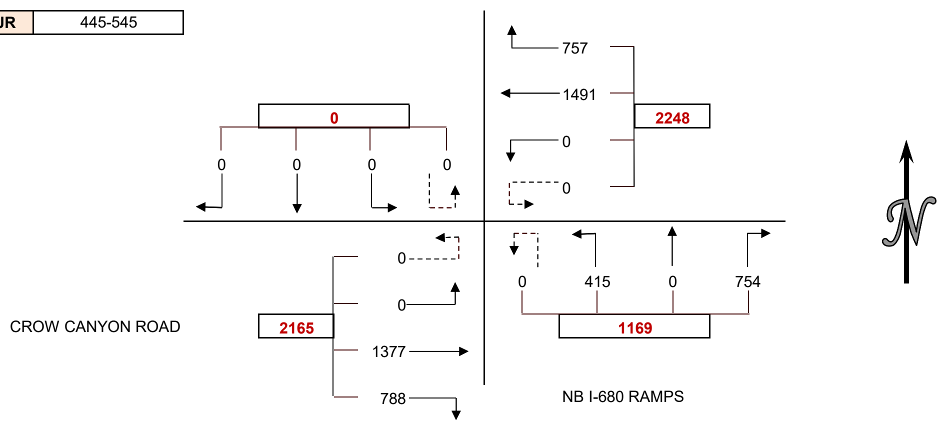
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT: GIBSON TRANSPORTATION
PROJECT: BISHOP RANCH STUDY, CITY OF SAN RAMON
DATE: WEDNESDAY MAY 22, 2019
PERIOD: 4:00 PM TO 6:00 PM
INTERSECTION: N/S NB I-680 RAMPS
E/W CROW CANYON ROAD
CITY: SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-415	0	0	0	0	196	345	0	0	170	0	92	0	178	344	0	0	1325
415-430	0	0	0	0	152	319	0	0	149	0	110	0	190	322	0	0	1242
430-445	0	0	0	0	184	392	0	0	173	0	104	0	158	332	0	0	1343
445-500	0	0	0	0	166	371	0	0	166	0	97	0	195	350	0	0	1345
500-515	0	0	0	0	220	413	0	0	186	0	92	0	174	340	0	0	1425
515-530	0	0	0	0	186	373	0	0	186	0	126	0	207	359	0	0	1437
530-545	0	0	0	0	185	334	0	0	216	0	100	0	212	328	0	0	1375
545-600	0	0	0	0	153	307	0	0	199	0	107	0	166	396	0	0	1328
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-500	0	0	0	0	698	1427	0	0	658	0	403	0	721	1348	0	0	5255
415-515	0	0	0	0	722	1495	0	0	674	0	403	0	717	1344	0	0	5355
430-530	0	0	0	0	756	1549	0	0	711	0	419	0	734	1381	0	0	5550
445-545	0	0	0	0	757	1491	0	0	754	0	415	0	788	1377	0	0	5582
500-600	0	0	0	0	744	1427	0	0	787	0	425	0	759	1423	0	0	5565

PEAK HOUR	445-545



PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	0	0	2	0	2
415-430	0	0	1	0	1
430-445	0	0	0	0	0
445-500	0	0	1	0	1
500-515	0	0	0	0	0
515-530	0	0	1	0	1
530-545	0	0	1	0	1
545-600	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	0	0	4	0	4
415-515	0	0	2	0	2
430-530	0	0	2	0	2
445-545	0	0	3	0	3
500-600	0	0	2	0	2

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	0	0	0	0	0
415-430	0	0	0	0	0
430-445	0	0	0	0	0
445-500	0	0	0	0	0
500-515	0	0	0	0	0
515-530	0	0	2	0	2
530-545	0	0	1	0	1
545-600	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	0	0	0	0	0
415-515	0	0	0	0	0
430-530	0	0	2	0	2
445-545	0	0	3	0	3
500-600	0	0	3	0	3

WILTEC Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

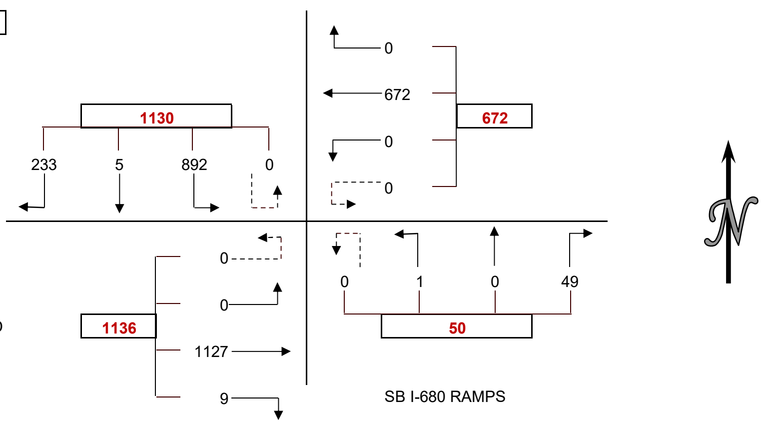
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT: GIBSON TRANSPORTATION
PROJECT: SAN RAMON
DATE: THURSDAY MARCH 14, 2019
PERIOD: 7:00 AM TO 9:00 AM
INTERSECTION: N/S SB I-680 RAMPS
E/W BOLLINGER CANYON ROAD
CITY: SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-715	43	1	196	0	0	84	0	0	4	0	0	0	3	179	0	0	510
715-730	54	0	200	0	0	98	0	0	10	0	0	0	1	241	0	0	604
730-745	53	3	210	0	0	101	0	0	12	0	1	0	1	274	0	0	655
745-800	64	0	230	0	0	142	0	0	26	0	0	0	1	261	0	0	724
800-815	68	3	219	0	0	191	0	0	13	0	0	0	2	296	0	0	792
815-830	50	0	212	0	0	185	0	0	2	0	0	0	5	307	0	0	761
830-845	51	2	231	0	0	154	0	0	8	0	1	0	1	263	0	0	711
845-900	53	0	217	0	0	135	0	0	10	0	0	0	1	261	0	0	677
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-800	214	4	836	0	0	425	0	0	52	0	1	0	6	955	0	0	2493
715-815	239	6	859	0	0	532	0	0	61	0	1	0	5	1072	0	0	2775
730-830	235	6	871	0	0	619	0	0	53	0	1	0	9	1138	0	0	2932
745-845	233	5	892	0	0	672	0	0	49	0	1	0	9	1127	0	0	2988
800-900	222	5	879	0	0	665	0	0	33	0	1	0	9	1127	0	0	2941

PEAK HOUR	745-845



BOLLINGER CANYON ROAD

PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	0	0	0
715-730	0	0	0	0	0
730-745	0	0	0	0	0
745-800	0	0	0	0	0
800-815	0	0	0	0	0
815-830	0	0	0	0	0
830-845	0	0	0	0	0
845-900	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	0	0	0	0	0
715-815	0	0	0	0	0
730-830	0	0	0	0	0
745-845	0	0	0	0	0
800-900	0	0	0	0	0

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	0	0	0
715-730	0	0	1	0	1
730-745	0	0	0	0	0
745-800	0	0	0	0	0
800-815	0	0	0	0	0
815-830	0	0	1	0	1
830-845	0	0	0	0	0
845-900	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	0	0	1	0	1
715-815	0	0	1	0	1
730-830	0	0	1	0	1
745-845	0	0	1	0	1
800-900	0	0	1	0	1

WILTEC Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

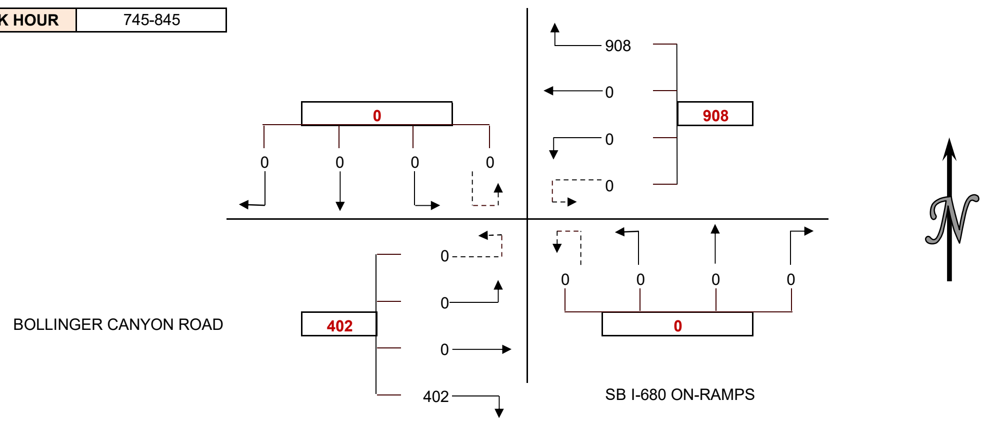
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT: GIBSON TRANSPORTATION
PROJECT: SAN RAMON
DATE: THURSDAY MARCH 14, 2019
PERIOD: 7:00 AM TO 9:00 AM
INTERSECTION: N/S SB I-680 ON-RAMPS
E/W BOLLINGER CANYON ROAD
CITY: SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-715	0	0	0	0	158	0	0	0	0	0	0	0	62	0	0	0	220
715-730	0	0	0	0	176	0	0	0	0	0	0	0	75	0	0	0	251
730-745	0	0	0	0	192	0	0	0	0	0	0	0	84	0	0	0	276
745-800	0	0	0	0	215	0	0	0	0	0	0	0	107	0	0	0	322
800-815	0	0	0	0	232	0	0	0	0	0	0	0	107	0	0	0	339
815-830	0	0	0	0	238	0	0	0	0	0	0	0	106	0	0	0	344
830-845	0	0	0	0	223	0	0	0	0	0	0	0	82	0	0	0	305
845-900	0	0	0	0	209	0	0	0	0	0	0	0	92	0	0	0	301
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-800	0	0	0	0	741	0	0	0	0	0	0	0	328	0	0	0	1069
715-815	0	0	0	0	815	0	0	0	0	0	0	0	373	0	0	0	1188
730-830	0	0	0	0	877	0	0	0	0	0	0	0	404	0	0	0	1281
745-845	0	0	0	0	908	0	0	0	0	0	0	0	402	0	0	0	1310
800-900	0	0	0	0	902	0	0	0	0	0	0	0	387	0	0	0	1289

PEAK HOUR	745-845



PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	0	0	0
715-730	0	0	0	0	0
730-745	0	0	0	0	0
745-800	0	0	0	0	0
800-815	0	0	0	0	0
815-830	0	0	0	0	0
830-845	0	0	0	0	0
845-900	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	0	0	0	0	0
715-815	0	0	0	0	0
730-830	0	0	0	0	0
745-845	0	0	0	0	0
800-900	0	0	0	0	0

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	0	0	0
715-730	0	0	0	0	0
730-745	0	0	0	0	0
745-800	0	0	0	0	0
800-815	0	0	0	0	0
815-830	0	0	0	0	0
830-845	0	0	0	0	0
845-900	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	0	0	0	0	0
715-815	0	0	0	0	0
730-830	0	0	0	0	0
745-845	0	0	0	0	0
800-900	0	0	0	0	0

WILTEC

Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

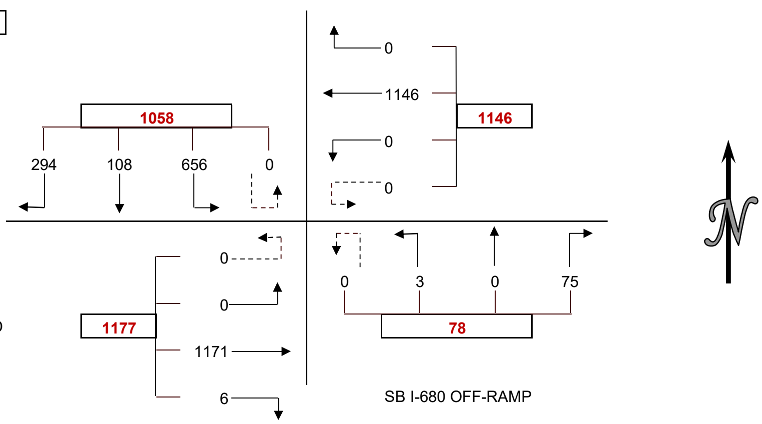
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT:		GIBSON TRANSPORTATION
PROJECT:		SAN RAMON
DATE:		THURSDAY MARCH 14, 2019
PERIOD:		4:00 PM TO 6:00 PM
INTERSECTION:	N/S	SB I-680 OFF-RAMP
	E/W	BOLLINGER CANYON ROAD
CITY:		SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-415	68	3	157	0	0	197	0	0	5	0	0	0	0	244	0	0	674
415-430	79	8	157	0	0	218	0	0	3	0	1	0	3	239	0	0	708
430-445	74	26	152	0	0	244	0	0	7	0	0	0	2	237	0	0	742
445-500	89	18	164	0	0	254	0	0	16	0	1	0	3	275	0	0	820
500-515	63	32	169	0	0	278	0	0	16	0	0	0	0	293	0	0	851
515-530	61	33	152	0	0	322	0	0	30	0	2	0	3	339	0	0	942
530-545	81	25	171	0	0	292	0	0	13	0	0	0	0	264	0	0	846
545-600	93	24	188	0	0	225	0	0	7	0	0	0	4	243	0	0	784
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-500	310	55	630	0	0	913	0	0	31	0	2	0	8	995	0	0	2944
415-515	305	84	642	0	0	994	0	0	42	0	2	0	8	1044	0	0	3121
430-530	287	109	637	0	0	1098	0	0	69	0	3	0	8	1144	0	0	3355
445-545	294	108	656	0	0	1146	0	0	75	0	3	0	6	1171	0	0	3459
500-600	298	114	680	0	0	1117	0	0	66	0	2	0	7	1139	0	0	3423

PEAK HOUR	445-545



BOLLINGER CANYON ROAD

PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	0	0	0	0	0
415-430	0	0	0	0	0
430-445	0	0	7	0	7
445-500	0	0	2	0	2
500-515	0	0	0	0	0
515-530	0	0	2	0	2
530-545	0	0	2	0	2
545-600	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	0	0	9	0	9
415-515	0	0	9	0	9
430-530	0	0	11	0	11
445-545	0	0	6	0	6
500-600	0	0	4	0	4

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	0	0	0	0	0
415-430	0	0	0	0	0
430-445	0	0	0	0	0
445-500	0	0	0	0	0
500-515	0	0	0	0	0
515-530	0	0	0	0	0
530-545	0	0	0	0	0
545-600	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	0	0	0	0	0
415-515	0	0	0	0	0
430-530	0	0	0	0	0
445-545	0	0	0	0	0
500-600	0	0	0	0	0

WILTEC

Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

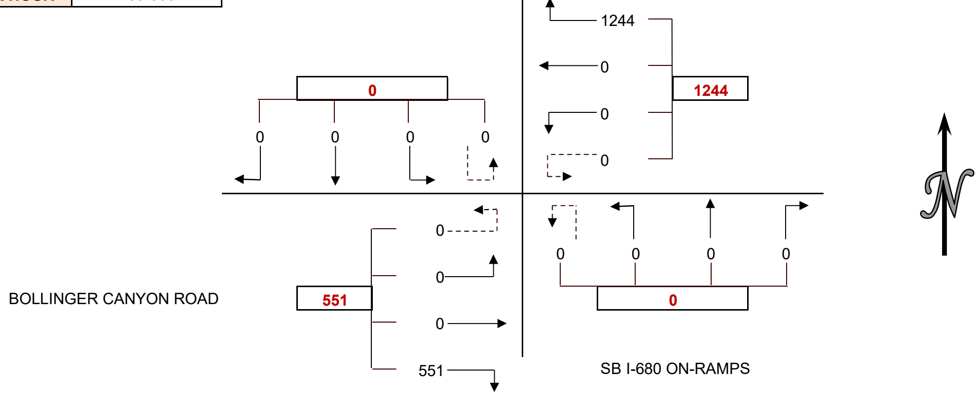
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT: GIBSON TRANSPORTATION
PROJECT: SAN RAMON
DATE: THURSDAY MARCH 14, 2019
PERIOD: 4:00 PM TO 6:00 PM
INTERSECTION: N/S SB I-680 ON-RAMPS
E/W BOLLINGER CANYON ROAD
CITY: SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-415	0	0	0	0	297	0	0	0	0	0	0	0	102	0	0	0	399
415-430	0	0	0	0	356	0	0	0	0	0	0	0	98	0	0	0	454
430-445	0	0	0	0	335	0	0	0	0	0	0	0	123	0	0	0	458
445-500	0	0	0	0	313	0	0	0	0	0	0	0	121	0	0	0	434
500-515	0	0	0	0	291	0	0	0	0	0	0	0	153	0	0	0	444
515-530	0	0	0	0	305	0	0	0	0	0	0	0	154	0	0	0	459
530-545	0	0	0	0	291	0	0	0	0	0	0	0	155	0	0	0	446
545-600	0	0	0	0	298	0	0	0	0	0	0	0	109	0	0	0	407
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-500	0	0	0	0	1301	0	0	0	0	0	0	0	444	0	0	0	1745
415-515	0	0	0	0	1295	0	0	0	0	0	0	0	495	0	0	0	1790
430-530	0	0	0	0	1244	0	0	0	0	0	0	0	551	0	0	0	1795
445-545	0	0	0	0	1200	0	0	0	0	0	0	0	583	0	0	0	1783
500-600	0	0	0	0	1185	0	0	0	0	0	0	0	571	0	0	0	1756

PEAK HOUR 430-530



PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	0	0	0	0	0
415-430	0	0	0	0	0
430-445	0	0	0	0	0
445-500	0	0	0	0	0
500-515	0	0	0	0	0
515-530	0	0	0	0	0
530-545	0	0	0	0	0
545-600	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	0	0	0	0	0
415-515	0	0	0	0	0
430-530	0	0	0	0	0
445-545	0	0	0	0	0
500-600	0	0	0	0	0

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	0	0	0	0	0
415-430	0	0	0	0	0
430-445	0	0	0	0	0
445-500	0	0	0	0	0
500-515	0	0	0	0	0
515-530	0	0	0	0	0
530-545	0	0	0	0	0
545-600	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	0	0	0	0	0
415-515	0	0	0	0	0
430-530	0	0	0	0	0
445-545	0	0	0	0	0
500-600	0	0	0	0	0

WILTEC

Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

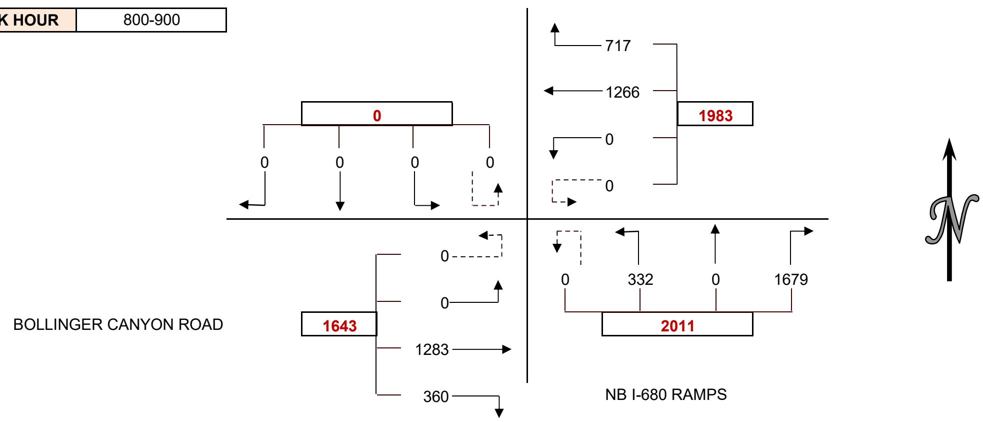
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT:		GIBSON TRANSPORTATION
PROJECT:		SAN RAMON
DATE:		THURSDAY MARCH 14, 2019
PERIOD:		7:00 AM TO 9:00 AM
INTERSECTION:	N/S	NB I-680 RAMPS
	E/W	BOLLINGER CANYON ROAD
CITY:		SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-715	0	0	0	0	180	229	0	0	263	0	61	0	65	253	0	0	1051
715-730	0	0	0	0	222	242	0	0	318	0	64	0	115	264	0	0	1225
730-745	0	0	0	0	214	255	0	0	390	0	71	0	113	282	0	0	1325
745-800	0	0	0	0	181	245	0	0	450	0	81	0	87	325	0	0	1369
800-815	0	0	0	0	191	338	0	0	415	0	95	0	102	338	0	0	1479
815-830	0	0	0	0	159	315	0	0	447	0	119	0	110	310	0	0	1460
830-845	0	0	0	0	157	327	0	0	399	0	-445	0	66	328	0	0	832
845-900	0	0	0	0	210	286	0	0	418	0	563	0	82	307	0	0	1866
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
700-800	0	0	0	0	797	971	0	0	1421	0	277	0	380	1124	0	0	4970
715-815	0	0	0	0	808	1080	0	0	1573	0	311	0	417	1209	0	0	5398
730-830	0	0	0	0	745	1153	0	0	1702	0	366	0	412	1255	0	0	5633
745-845	0	0	0	0	688	1225	0	0	1711	0	150	0	365	1301	0	0	5440
800-900	0	0	0	0	717	1266	0	0	1679	0	332	0	360	1283	0	0	5637

PEAK HOUR	800-900



PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	0	0	0
715-730	0	0	2	0	2
730-745	0	0	1	0	1
745-800	0	0	0	0	0
800-815	0	0	0	0	0
815-830	0	0	1	0	1
830-845	0	0	1	0	1
845-900	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	0	0	3	0	3
715-815	0	0	3	0	3
730-830	0	0	2	0	2
745-845	0	0	2	0	2
800-900	0	0	2	0	2

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-715	0	0	0	0	0
715-730	0	0	1	0	1
730-745	0	0	0	0	0
745-800	0	0	0	0	0
800-815	0	0	1	0	1
815-830	0	0	0	0	0
830-845	0	0	0	0	0
845-900	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
700-800	0	0	1	0	1
715-815	0	0	2	0	2
730-830	0	0	1	0	1
745-845	0	0	1	0	1
800-900	0	0	1	0	1

WILTEC
Phone: (626) 564-1944 Fax: (626) 564-0969 info@wiltecusa.com

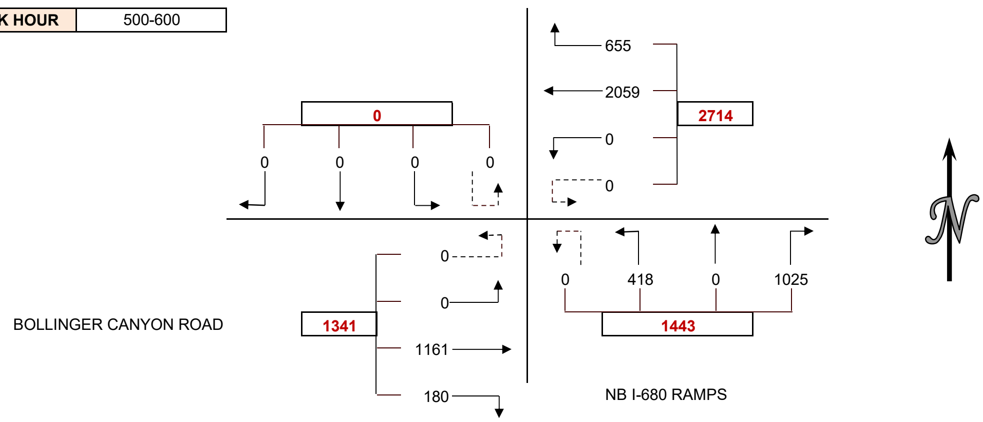
INTERSECTION CAR/PED/BIKE TRAFFIC COUNT RESULTS SUMMARY

CLIENT: GIBSON TRANSPORTATION
PROJECT: SAN RAMON
DATE: THURSDAY MARCH 14, 2019
PERIOD: 4:00 PM TO 6:00 PM
INTERSECTION: N/S NB I-680 RAMPS
E/W BOLLINGER CANYON ROAD
CITY: SAN RAMON

VEHICLE COUNTS

15 MIN COUNTS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-415	0	0	0	0	206	419	0	0	162	0	79	0	61	249	0	0	1176
415-430	0	0	0	0	206	472	0	0	172	0	69	0	49	247	0	0	1215
430-445	0	0	0	0	188	474	0	0	166	0	85	0	56	241	0	0	1210
445-500	0	0	0	0	198	487	0	0	179	0	88	0	46	284	0	0	1282
500-515	0	0	0	0	162	518	0	0	214	0	95	0	47	280	0	0	1316
515-530	0	0	0	0	172	569	0	0	242	0	127	0	49	298	0	0	1457
530-545	0	0	0	0	153	506	0	0	267	0	105	0	36	282	0	0	1349
545-600	0	0	0	0	168	466	0	0	302	0	91	0	48	301	0	0	1376
HOUR TOTALS	1	2	3	3U	4	5	6	6U	7	8	9	9U	10	11	12	12U	
PERIOD	SBRT	SBTH	SBLT	SBUT	WBRT	WBTH	WBLT	WBUT	NBRT	NBTH	NBLT	NBUT	EBRT	EBTH	EBLT	EBUT	TOTAL
400-500	0	0	0	0	798	1852	0	0	679	0	321	0	212	1021	0	0	4883
415-515	0	0	0	0	754	1951	0	0	731	0	337	0	198	1052	0	0	5023
430-530	0	0	0	0	720	2048	0	0	801	0	395	0	198	1103	0	0	5265
445-545	0	0	0	0	685	2080	0	0	902	0	415	0	178	1144	0	0	5404
500-600	0	0	0	0	655	2059	0	0	1025	0	418	0	180	1161	0	0	5498

PEAK HOUR 500-600



PEDESTRIAN COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	0	0	0	0	0
415-430	0	0	0	0	0
430-445	0	0	7	0	7
445-500	0	0	2	0	2
500-515	0	0	0	0	0
515-530	0	0	0	0	0
530-545	0	0	2	0	2
545-600	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	0	0	9	0	9
415-515	0	0	9	0	9
430-530	0	0	9	0	9
445-545	0	0	4	0	4
500-600	0	0	2	0	2

BICYCLE COUNTS

15 MIN COUNTS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-415	0	0	1	0	1
415-430	0	0	0	0	0
430-445	0	0	0	0	0
445-500	0	0	0	0	0
500-515	0	0	1	0	1
515-530	0	0	0	0	0
530-545	0	0	0	0	0
545-600	0	0	0	0	0
HOUR TOTALS	NORTH	EAST	SOUTH	WEST	TOTAL
PERIOD	LEG	LEG	LEG	LEG	
400-500	0	0	1	0	1
415-515	0	0	1	0	1
430-530	0	0	1	0	1
445-545	0	0	1	0	1
500-600	0	0	1	0	1

Appendix D

Level of Service Worksheets

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	144	762	482	59	369	117	44	9	19	67	23	121
Future Volume (veh/h)	144	762	482	59	369	117	44	9	19	67	23	121
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	157	828	524	64	401	127	48	10	21	73	25	132
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	442	1439	642	30	618	276	330	60	133	249	46	186
Arrive On Green	0.25	0.40	0.40	0.02	0.17	0.17	0.12	0.12	0.12	0.12	0.12	0.12
Sat Flow, veh/h	1781	3554	1585	1781	3554	1585	1508	513	1128	944	392	1585
Grp Volume(v), veh/h	157	828	524	64	401	127	51	0	28	98	0	132
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1777	1585	1651	0	1499	1336	0	1585
Q Serve(g_s), s	3.3	8.2	13.4	0.8	4.8	3.3	0.0	0.0	0.8	2.6	0.0	3.7
Cycle Q Clear(g_c), s	3.3	8.2	13.4	0.8	4.8	3.3	1.2	0.0	0.8	3.4	0.0	3.7
Prop In Lane	1.00		1.00	1.00		1.00	0.94		0.75	0.74		1.00
Lane Grp Cap(c), veh/h	442	1439	642	30	618	276	347	0	176	295	0	186
V/C Ratio(X)	0.36	0.58	0.82	2.11	0.65	0.46	0.15	0.00	0.16	0.33	0.00	0.71
Avail Cap(c_a), veh/h	442	1714	765	117	1636	730	892	0	756	899	0	834
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.1	10.5	12.1	22.4	17.5	16.9	18.3	0.0	18.1	19.5	0.0	19.4
Incr Delay (d2), s/veh	0.5	0.4	5.9	529.2	1.2	1.2	0.2	0.0	0.4	0.7	0.0	4.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	2.2	4.7	8.2	8.6	3.3	2.0	0.8	0.0	0.5	1.7	0.0	2.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	14.6	10.9	18.0	551.6	18.7	18.1	18.5	0.0	18.5	20.1	0.0	24.3
LnGrp LOS	B	B	B	F	B	B	B	A	B	C	A	C
Approach Vol, veh/h		1509			592			79			230	
Approach Delay, s/veh		13.7			76.2			18.5			22.5	
Approach LOS		B			E			B			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.8	25.5		12.4	18.3	14.9		12.4				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	5.0	24.0		25.0	6.0	23.0		26.0				
Max Q Clear Time (g_c+I1), s	3.8	16.4		4.2	6.3	7.8		6.7				
Green Ext Time (p_c), s	0.0	4.1		0.2	0.0	2.1		0.9				
Intersection Summary												
HCM 6th Ctrl Delay			30.1									
HCM 6th LOS			C									

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	41	692	102	49	275	61	14	0	10	14	0	9
Future Vol, veh/h	41	692	102	49	275	61	14	0	10	14	0	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	45	752	111	53	299	66	15	0	11	15	0	10

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	365	0	0	863	0	0	1154	1369	432	904	1391	183
Stage 1	-	-	-	-	-	-	898	898	-	438	438	-
Stage 2	-	-	-	-	-	-	256	471	-	466	953	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1190	-	-	775	-	-	152	145	572	232	141	828
Stage 1	-	-	-	-	-	-	301	356	-	567	577	-
Stage 2	-	-	-	-	-	-	726	558	-	546	336	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1190	-	-	775	-	-	138	130	572	209	126	828
Mov Cap-2 Maneuver	-	-	-	-	-	-	138	130	-	209	126	-
Stage 1	-	-	-	-	-	-	290	342	-	545	538	-
Stage 2	-	-	-	-	-	-	668	520	-	515	323	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	1.3	25.4	18.3
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	202	1190	-	-	775	-	-	295
HCM Lane V/C Ratio	0.129	0.037	-	-	0.069	-	-	0.085
HCM Control Delay (s)	25.4	8.1	-	-	10	-	-	18.3
HCM Lane LOS	D	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.4	0.1	-	-	0.2	-	-	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	97	426	168	67	324	101	62	126	30	130	533	144
Future Volume (veh/h)	97	426	168	67	324	101	62	126	30	130	533	144
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	105	463	183	73	352	110	67	137	6	141	579	157
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	158	665	261	119	654	201	198	869	387	198	676	183
Arrive On Green	0.09	0.27	0.27	0.07	0.24	0.24	0.11	0.24	0.24	0.11	0.24	0.24
Sat Flow, veh/h	1781	2493	978	1781	2675	824	1781	3554	1585	1781	2765	748
Grp Volume(v), veh/h	105	329	317	73	232	230	67	137	6	141	372	364
Grp Sat Flow(s),veh/h/ln	1781	1777	1694	1781	1777	1722	1781	1777	1585	1781	1777	1736
Q Serve(g_s), s	5.1	15.0	15.2	3.6	10.2	10.5	3.1	2.7	0.3	6.9	18.0	18.1
Cycle Q Clear(g_c), s	5.1	15.0	15.2	3.6	10.2	10.5	3.1	2.7	0.3	6.9	18.0	18.1
Prop In Lane	1.00		0.58	1.00		0.48	1.00		1.00	1.00		0.43
Lane Grp Cap(c), veh/h	158	474	452	119	434	421	198	869	387	198	434	424
V/C Ratio(X)	0.66	0.69	0.70	0.61	0.53	0.55	0.34	0.16	0.02	0.71	0.86	0.86
Avail Cap(c_a), veh/h	158	474	452	119	434	421	198	869	387	198	434	424
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	39.7	29.7	29.8	40.9	29.5	29.6	36.9	26.7	25.8	38.6	32.5	32.5
Incr Delay (d2), s/veh	9.9	4.4	4.8	9.1	1.3	1.5	1.0	0.1	0.0	11.4	15.3	16.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	4.7	10.8	10.6	3.3	7.7	7.7	2.5	2.0	0.2	6.3	14.1	14.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	49.6	34.1	34.6	50.0	30.8	31.1	37.9	26.8	25.8	50.0	47.8	48.6
LnGrp LOS	D	C	C	D	C	C	D	C	C	D	D	D
Approach Vol, veh/h		751			535			210			877	
Approach Delay, s/veh		36.5			33.6			30.3			48.5	
Approach LOS		D			C			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.8	28.0	15.8	25.7	13.8	25.9	13.5	28.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	8.0	26.0	12.0	24.0	10.0	24.0	12.0	24.0
Max Q Clear Time (g_c+I1), s	6.6	18.2	9.9	5.7	8.1	13.5	6.1	21.1
Green Ext Time (p_c), s	0.0	1.7	0.1	0.5	0.0	1.3	0.1	1.0

Intersection Summary	
HCM 6th Ctrl Delay	39.7
HCM 6th LOS	D

Intersection	
Int Delay, s/veh	2.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	17	0	21	7	0	5	122	218	44	30	651	117
Future Vol, veh/h	17	0	21	7	0	5	122	218	44	30	651	117
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	152	-	-	148	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	18	0	23	8	0	5	133	237	48	33	708	127

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1223	1389	418	947	1428	143	835	0	0	285	0	0
Stage 1	838	838	-	527	527	-	-	-	-	-	-	-
Stage 2	385	551	-	420	901	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	135	141	584	216	134	879	794	-	-	1274	-	-
Stage 1	327	380	-	502	527	-	-	-	-	-	-	-
Stage 2	610	514	-	581	355	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	115	114	584	177	109	879	794	-	-	1274	-	-
Mov Cap-2 Maneuver	115	114	-	177	109	-	-	-	-	-	-	-
Stage 1	272	370	-	418	438	-	-	-	-	-	-	-
Stage 2	505	428	-	544	346	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	25.2	19.1	3.3	0.3
HCM LOS	D	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	794	-	-	115	584	177	879	1274	-	-
HCM Lane V/C Ratio	0.167	-	-	0.161	0.039	0.043	0.006	0.026	-	-
HCM Control Delay (s)	10.4	-	-	42.2	11.4	26.3	9.1	7.9	-	-
HCM Lane LOS	B	-	-	E	B	D	A	A	-	-
HCM 95th %tile Q(veh)	0.6	-	-	0.5	0.1	0.1	0	0.1	-	-

Intersection						
Int Delay, s/veh	4.2					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	13	47	74	96	237	165
Future Vol, veh/h	13	47	74	96	237	165
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	14	51	80	104	258	179

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	827	132	0	0	184	0
Stage 1	132	-	-	-	-	-
Stage 2	695	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	341	917	-	-	1391	-
Stage 1	894	-	-	-	-	-
Stage 2	495	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	271	917	-	-	1391	-
Mov Cap-2 Maneuver	271	-	-	-	-	-
Stage 1	894	-	-	-	-	-
Stage 2	393	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.7	0	4.8
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	605	1391	-
HCM Lane V/C Ratio	-	-	0.108	0.185	-
HCM Control Delay (s)	-	-	11.7	8.2	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0.7	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	161	7	24	306	1	12
Future Vol, veh/h	161	7	24	306	1	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	73	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	175	8	26	333	1	13

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	183	0	564	179
Stage 1	-	-	-	-	179	-
Stage 2	-	-	-	-	385	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1392	-	487	864
Stage 1	-	-	-	-	852	-
Stage 2	-	-	-	-	688	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1392	-	478	864
Mov Cap-2 Maneuver	-	-	-	-	478	-
Stage 1	-	-	-	-	852	-
Stage 2	-	-	-	-	675	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	9.5
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	813	-	-	1392	-
HCM Lane V/C Ratio	0.017	-	-	0.019	-
HCM Control Delay (s)	9.5	-	-	7.6	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	10	161	304	88	14	2
Future Vol, veh/h	10	161	304	88	14	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	76	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	175	330	96	15	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	426	0	-	0	575	378
Stage 1	-	-	-	-	378	-
Stage 2	-	-	-	-	197	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1133	-	-	-	480	669
Stage 1	-	-	-	-	693	-
Stage 2	-	-	-	-	836	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1133	-	-	-	475	669
Mov Cap-2 Maneuver	-	-	-	-	475	-
Stage 1	-	-	-	-	686	-
Stage 2	-	-	-	-	836	-

Approach	EB	WB	SB
HCM Control Delay, s	0.5	0	12.6
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1133	-	-	-	493
HCM Lane V/C Ratio	0.01	-	-	-	0.035
HCM Control Delay (s)	8.2	-	-	-	12.6
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	124	38	52	52	69	141	265	146	157	368	111
Future Volume (veh/h)	13	124	38	52	52	69	141	265	146	157	368	111
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	14	135	41	57	57	75	153	288	159	171	400	121
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	59	441	396	225	209	396	392	692	372	410	863	258
Arrive On Green	0.25	0.25	0.25	0.25	0.25	0.25	0.22	0.31	0.31	0.23	0.32	0.32
Sat Flow, veh/h	77	1764	1585	686	836	1585	1781	2232	1199	1781	2696	806
Grp Volume(v), veh/h	149	0	41	114	0	75	153	228	219	171	262	259
Grp Sat Flow(s),veh/h/ln	1840	0	1585	1521	0	1585	1781	1777	1654	1781	1777	1725
Q Serve(g_s), s	0.0	0.0	2.0	0.0	0.0	3.7	7.3	10.1	10.5	8.2	11.8	12.0
Cycle Q Clear(g_c), s	6.5	0.0	2.0	5.7	0.0	3.7	7.3	10.1	10.5	8.2	11.8	12.0
Prop In Lane	0.09		1.00	0.50		1.00	1.00		0.72	1.00		0.47
Lane Grp Cap(c), veh/h	499	0	396	434	0	396	392	551	513	410	569	552
V/C Ratio(X)	0.30	0.00	0.10	0.26	0.00	0.19	0.39	0.41	0.43	0.42	0.46	0.47
Avail Cap(c_a), veh/h	499	0	396	434	0	396	392	551	513	410	569	552
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.6	0.0	28.9	30.1	0.0	29.5	33.3	27.3	27.4	32.8	27.1	27.2
Incr Delay (d2), s/veh	0.3	0.0	0.1	0.3	0.0	0.2	0.6	0.5	0.6	0.7	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	5.3	0.0	1.4	4.0	0.0	2.6	5.6	7.6	7.4	6.3	8.5	8.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.9	0.0	29.0	30.5	0.0	29.8	33.9	27.8	28.0	33.5	27.7	27.8
LnGrp LOS	C	A	C	C	A	C	C	C	C	C	C	C
Approach Vol, veh/h		190			189			600			692	
Approach Delay, s/veh		30.5			30.2			29.4			29.2	
Approach LOS		C			C			C			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	23.3	29.5		23.6	22.3	30.5		23.6				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	25.0	33.0		27.0	24.0	34.0		27.0				
Max Q Clear Time (g_c+I1), s	11.2	13.5		9.5	10.3	15.0		8.7				
Green Ext Time (p_c), s	0.5	1.6		0.6	0.4	1.9		0.7				
Intersection Summary												
HCM 6th Ctrl Delay			29.5									
HCM 6th LOS			C									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	14	413	98	49	883	24	505	4	81	34	8	84
Future Volume (veh/h)	14	413	98	49	883	24	505	4	81	34	8	84
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	15	449	107	53	960	26	549	4	88	37	9	91
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	2	1058	472	31	1155	515	675	25	549	485	109	627
Arrive On Green	0.00	0.30	0.30	0.02	0.32	0.32	0.40	0.40	0.40	0.40	0.40	0.40
Sat Flow, veh/h	1781	3554	1585	1781	3554	1585	1457	63	1389	1000	275	1585
Grp Volume(v), veh/h	15	449	107	53	960	26	549	0	92	46	0	91
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1777	1585	1457	0	1452	1275	0	1585
Q Serve(g_s), s	0.1	7.4	3.7	1.3	18.1	0.8	22.5	0.0	3.0	0.9	0.0	2.7
Cycle Q Clear(g_c), s	0.1	7.4	3.7	1.3	18.1	0.8	26.4	0.0	3.0	3.9	0.0	2.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.96	0.80		1.00
Lane Grp Cap(c), veh/h	2	1058	472	31	1155	515	675	0	574	593	0	627
V/C Ratio(X)	6.11	0.42	0.23	1.68	0.83	0.05	0.81	0.00	0.16	0.08	0.00	0.15
Avail Cap(c_a), veh/h	74	1468	655	172	1664	742	739	0	640	656	0	699
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	36.3	20.5	19.2	35.7	22.7	16.8	20.8	0.0	14.2	14.6	0.0	14.1
Incr Delay (d2), s/veh	2477.2	0.3	0.2	335.5	2.5	0.0	6.4	0.0	0.1	0.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.1	5.3	2.4	6.3	11.9	0.5	14.4	0.0	1.7	0.9	0.0	1.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	2513.5	20.8	19.4	371.2	25.2	16.9	27.3	0.0	14.3	14.6	0.0	14.2
LnGrp LOS	F	C	B	F	C	B	C	A	B	B	A	B
Approach Vol, veh/h		571			1039			641			137	
Approach Delay, s/veh		86.0			42.6			25.4			14.3	
Approach LOS		F			D			C			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.3	28.6		35.7	6.3	30.6		35.7				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	9.0	32.0		34.0	5.0	36.0		34.0				
Max Q Clear Time (g_c+I1), s	4.3	10.4		29.4	3.1	21.1		6.9				
Green Ext Time (p_c), s	0.0	2.5		1.3	0.0	4.5		0.5				

Intersection Summary			
HCM 6th Ctrl Delay			46.7
HCM 6th LOS			D

Intersection	
Int Delay, s/veh	5.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	516	20	9	359	19	91	0	65	63	0	43
Future Vol, veh/h	13	516	20	9	359	19	91	0	65	63	0	43
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	14	561	22	10	390	21	99	0	71	68	0	47

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	411	0	0	583	0	0	815	1031	292	730	1032	206
Stage 1	-	-	-	-	-	-	600	600	-	421	421	-
Stage 2	-	-	-	-	-	-	215	431	-	309	611	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1144	-	-	987	-	-	269	232	704	310	231	800
Stage 1	-	-	-	-	-	-	455	488	-	581	587	-
Stage 2	-	-	-	-	-	-	767	581	-	676	482	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1144	-	-	987	-	-	249	227	704	274	226	800
Mov Cap-2 Maneuver	-	-	-	-	-	-	249	227	-	274	226	-
Stage 1	-	-	-	-	-	-	450	482	-	574	581	-
Stage 2	-	-	-	-	-	-	715	575	-	601	476	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.2	25.6	18.9
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	341	1144	-	-	987	-	-	374
HCM Lane V/C Ratio	0.497	0.012	-	-	0.01	-	-	0.308
HCM Control Delay (s)	25.6	8.2	-	-	8.7	-	-	18.9
HCM Lane LOS	D	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	2.6	0	-	-	0	-	-	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	138	336	43	50	368	217	208	582	143	185	322	177
Future Volume (veh/h)	138	336	43	50	368	217	208	582	143	185	322	177
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	150	365	47	54	400	236	226	633	128	201	350	192
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	214	856	109	125	475	277	303	817	365	267	468	252
Arrive On Green	0.12	0.27	0.27	0.07	0.22	0.22	0.17	0.23	0.23	0.15	0.21	0.21
Sat Flow, veh/h	1781	3169	405	1781	2161	1260	1781	3554	1585	1781	2230	1201
Grp Volume(v), veh/h	150	203	209	54	328	308	226	633	128	201	278	264
Grp Sat Flow(s),veh/h/ln	1781	1777	1797	1781	1777	1644	1781	1777	1585	1781	1777	1654
Q Serve(g_s), s	8.1	9.4	9.6	2.9	17.7	18.0	12.1	16.7	6.8	10.8	14.6	15.0
Cycle Q Clear(g_c), s	8.1	9.4	9.6	2.9	17.7	18.0	12.1	16.7	6.8	10.8	14.6	15.0
Prop In Lane	1.00		0.23	1.00		0.77	1.00		1.00	1.00		0.73
Lane Grp Cap(c), veh/h	214	480	485	125	391	362	303	817	365	267	373	347
V/C Ratio(X)	0.70	0.42	0.43	0.43	0.84	0.85	0.75	0.77	0.35	0.75	0.74	0.76
Avail Cap(c_a), veh/h	214	480	485	125	391	362	303	817	365	267	373	347
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	42.3	30.1	30.1	44.6	37.3	37.4	39.5	36.1	32.2	40.7	37.0	37.1
Incr Delay (d2), s/veh	9.8	0.6	0.6	2.4	14.9	17.4	9.7	4.7	0.6	11.4	7.9	9.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	7.3	7.1	7.3	2.4	13.9	13.5	9.9	11.9	4.7	9.3	11.3	11.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	52.1	30.7	30.7	47.0	52.2	54.8	49.2	40.7	32.8	52.1	44.8	46.6
LnGrp LOS	D	C	C	D	D	D	D	D	C	D	D	D
Approach Vol, veh/h		562			690			987			743	
Approach Delay, s/veh		36.4			53.0			41.6			47.4	
Approach LOS		D			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.8	33.6	20.5	28.2	17.5	27.9	22.2	26.5
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	9.0	29.0	17.0	25.0	14.0	24.0	19.0	23.0
Max Q Clear Time (g_c+I1), s	15.9	12.6	13.8	19.7	11.1	21.0	15.1	18.0
Green Ext Time (p_c), s	0.0	1.4	0.2	1.7	0.1	0.9	0.3	1.1

Intersection Summary	
HCM 6th Ctrl Delay	44.7
HCM 6th LOS	D

Intersection	
Int Delay, s/veh	10.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	111	0	137	45	0	30	24	933	8	6	526	23
Future Vol, veh/h	111	0	137	45	0	30	24	933	8	6	526	23
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	152	-	-	148	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	121	0	149	49	0	33	26	1014	9	7	572	25

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1158	1674	299	1371	1682	512	597	0	0	1023	0	0
Stage 1	599	599	-	1071	1071	-	-	-	-	-	-	-
Stage 2	559	1075	-	300	611	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	151	95	697	105	94	507	976	-	-	674	-	-
Stage 1	455	489	-	236	295	-	-	-	-	-	-	-
Stage 2	481	294	-	684	482	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	137	91	697	80	91	507	976	-	-	674	-	-
Mov Cap-2 Maneuver	137	91	-	80	91	-	-	-	-	-	-	-
Stage 1	443	484	-	230	287	-	-	-	-	-	-	-
Stage 2	438	286	-	532	477	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	55.6	67.5	0.2	0.1
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	976	-	-	137	697	80	507	674	-	-
HCM Lane V/C Ratio	0.027	-	-	0.881	0.214	0.611	0.064	0.01	-	-
HCM Control Delay (s)	8.8	-	-	110	11.6	104.1	12.6	10.4	-	-
HCM Lane LOS	A	-	-	F	B	F	B	B	-	-
HCM 95th %tile Q(veh)	0.1	-	-	5.8	0.8	2.8	0.2	0	-	-

Intersection	
Int Delay, s/veh	5.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	91	137	194	9	14	129
Future Vol, veh/h	91	137	194	9	14	129
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	99	149	211	10	15	140

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	386	216	0	0	221	0
Stage 1	216	-	-	-	-	-
Stage 2	170	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	617	824	-	-	1348	-
Stage 1	820	-	-	-	-	-
Stage 2	860	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	610	824	-	-	1348	-
Mov Cap-2 Maneuver	610	-	-	-	-	-
Stage 1	820	-	-	-	-	-
Stage 2	850	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.6	0	0.8
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	723	1348	-
HCM Lane V/C Ratio	-	-	0.343	0.011	-
HCM Control Delay (s)	-	-	12.6	7.7	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	1.5	0	-

Intersection						
Int Delay, s/veh	1.1					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	222	6	13	80	1	27
Future Vol, veh/h	222	6	13	80	1	27
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	73	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	241	7	14	87	1	29

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	248	0	360	245
Stage 1	-	-	-	-	245	-
Stage 2	-	-	-	-	115	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1318	-	639	794
Stage 1	-	-	-	-	796	-
Stage 2	-	-	-	-	910	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1318	-	632	794
Mov Cap-2 Maneuver	-	-	-	-	632	-
Stage 1	-	-	-	-	796	-
Stage 2	-	-	-	-	900	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.1	9.8
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	787	-	-	1318	-
HCM Lane V/C Ratio	0.039	-	-	0.011	-
HCM Control Delay (s)	9.8	-	-	7.8	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	2.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	2	222	69	17	91	10
Future Vol, veh/h	2	222	69	17	91	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	76	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	241	75	18	99	11

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	93	0	-	0	329	84
Stage 1	-	-	-	-	84	-
Stage 2	-	-	-	-	245	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1501	-	-	-	665	975
Stage 1	-	-	-	-	939	-
Stage 2	-	-	-	-	796	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1501	-	-	-	664	975
Mov Cap-2 Maneuver	-	-	-	-	664	-
Stage 1	-	-	-	-	938	-
Stage 2	-	-	-	-	796	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	11.2
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1501	-	-	-	686
HCM Lane V/C Ratio	0.001	-	-	-	0.16
HCM Control Delay (s)	7.4	-	-	-	11.2
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	95	32	187	211	26	172	27	507	26	12	494	17
Future Volume (veh/h)	95	32	187	211	26	172	27	507	26	12	494	17
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	103	35	203	229	28	187	29	551	28	13	537	18
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	524	168	634	590	63	634	99	1147	58	59	1092	37
Arrive On Green	0.40	0.40	0.40	0.40	0.40	0.40	0.06	0.33	0.33	0.03	0.31	0.31
Sat Flow, veh/h	1135	421	1585	1286	157	1585	1781	3441	175	1781	3509	117
Grp Volume(v), veh/h	138	0	203	257	0	187	29	284	295	13	272	283
Grp Sat Flow(s),veh/h/ln	1556	0	1585	1443	0	1585	1781	1777	1839	1781	1777	1849
Q Serve(g_s), s	0.0	0.0	7.9	5.3	0.0	7.2	1.4	11.4	11.5	0.6	11.2	11.2
Cycle Q Clear(g_c), s	4.7	0.0	7.9	11.1	0.0	7.2	1.4	11.4	11.5	0.6	11.2	11.2
Prop In Lane	0.75		1.00	0.89		1.00	1.00		0.09	1.00		0.06
Lane Grp Cap(c), veh/h	692	0	634	653	0	634	99	592	613	59	553	575
V/C Ratio(X)	0.20	0.00	0.32	0.39	0.00	0.29	0.29	0.48	0.48	0.22	0.49	0.49
Avail Cap(c_a), veh/h	692	0	634	653	0	634	99	592	613	59	553	575
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.6	0.0	18.6	19.4	0.0	18.4	40.8	23.8	23.8	42.4	25.2	25.2
Incr Delay (d2), s/veh	0.1	0.0	0.3	0.4	0.0	0.3	1.6	0.6	0.6	1.8	0.7	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.3	0.0	5.2	6.8	0.0	4.7	1.2	8.1	8.3	0.5	8.0	8.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	17.7	0.0	18.9	19.8	0.0	18.6	42.4	24.4	24.4	44.2	25.9	25.9
LnGrp LOS	B	A	B	B	A	B	D	C	C	D	C	C
Approach Vol, veh/h		341			444			608			568	
Approach Delay, s/veh		18.4			19.3			25.3			26.3	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.2	29.6		32.0	9.8	28.1		32.0				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	5.0	32.0		38.0	7.0	30.0		38.0				
Max Q Clear Time (g_c+I1), s	3.6	14.5		10.9	4.4	14.2		14.1				
Green Ext Time (p_c), s	0.0	2.1		1.5	0.0	1.9		1.9				

Intersection Summary												
HCM 6th Ctrl Delay			23.0									
HCM 6th LOS			C									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	144	663	474	59	383	117	50	9	19	67	23	121
Future Volume (veh/h)	144	663	474	59	383	117	50	9	19	67	23	121
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	157	721	515	64	416	127	54	10	21	73	25	132
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	418	1415	631	30	640	285	345	59	127	250	46	187
Arrive On Green	0.23	0.40	0.40	0.02	0.18	0.18	0.12	0.12	0.12	0.12	0.12	0.12
Sat Flow, veh/h	1781	3554	1585	1781	3554	1585	1583	498	1073	936	392	1585
Grp Volume(v), veh/h	157	721	515	64	416	127	55	0	30	98	0	132
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1777	1585	1644	0	1509	1328	0	1585
Q Serve(g_s), s	3.3	6.9	13.0	0.8	4.9	3.2	0.0	0.0	0.8	2.6	0.0	3.6
Cycle Q Clear(g_c), s	3.3	6.9	13.0	0.8	4.9	3.2	1.3	0.0	0.8	3.4	0.0	3.6
Prop In Lane	1.00		1.00	1.00		1.00	0.97		0.71	0.74		1.00
Lane Grp Cap(c), veh/h	418	1415	631	30	640	285	352	0	178	297	0	187
V/C Ratio(X)	0.38	0.51	0.82	2.15	0.65	0.45	0.16	0.00	0.17	0.33	0.00	0.71
Avail Cap(c_a), veh/h	418	1739	776	119	1660	740	901	0	772	911	0	846
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.4	10.2	12.1	22.1	17.1	16.4	18.0	0.0	17.8	19.2	0.0	19.1
Incr Delay (d2), s/veh	0.6	0.3	5.6	546.5	1.1	1.1	0.2	0.0	0.4	0.6	0.0	4.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	2.2	3.9	8.0	8.7	3.3	2.0	0.9	0.0	0.5	1.7	0.0	2.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	15.0	10.5	17.7	568.6	18.2	17.5	18.2	0.0	18.3	19.8	0.0	23.9
LnGrp LOS	B	B	B	F	B	B	B	A	B	B	A	C
Approach Vol, veh/h		1393			607			85			230	
Approach Delay, s/veh		13.7			76.1			18.3			22.1	
Approach LOS		B			E			B			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.8	24.9		12.3	17.6	15.1		12.3				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	5.0	24.0		25.0	6.0	23.0		26.0				
Max Q Clear Time (g_c+I1), s	3.8	16.0		4.3	6.3	7.9		6.6				
Green Ext Time (p_c), s	0.0	3.9		0.2	0.0	2.2		0.9				

Intersection Summary		
HCM 6th Ctrl Delay		31.1
HCM 6th LOS		C

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	41	693	17	4	279	61	20	0	31	14	0	9
Future Vol, veh/h	41	693	17	4	279	61	20	0	31	14	0	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	45	753	18	4	303	66	22	0	34	15	0	10

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	369	0	0	771	0	0	1012	1229	386	811	1205	185
Stage 1	-	-	-	-	-	-	852	852	-	344	344	-
Stage 2	-	-	-	-	-	-	160	377	-	467	861	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1186	-	-	840	-	-	193	177	612	271	183	826
Stage 1	-	-	-	-	-	-	321	374	-	645	635	-
Stage 2	-	-	-	-	-	-	826	614	-	545	371	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1186	-	-	840	-	-	185	169	612	248	175	826
Mov Cap-2 Maneuver	-	-	-	-	-	-	185	169	-	248	175	-
Stage 1	-	-	-	-	-	-	309	360	-	620	632	-
Stage 2	-	-	-	-	-	-	812	611	-	495	357	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0.1	18.5	16.4
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	321	1186	-	-	840	-	-	342
HCM Lane V/C Ratio	0.173	0.038	-	-	0.005	-	-	0.073
HCM Control Delay (s)	18.5	8.2	-	-	9.3	-	-	16.4
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.6	0.1	-	-	0	-	-	0.2

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	29	0	55	7	0	5	19	226	44	30	642	13
Future Vol, veh/h	29	0	55	7	0	5	19	226	44	30	642	13
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	152	-	-	148	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	32	0	60	8	0	5	21	246	48	33	698	14

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	936	1107	356	727	1090	147	712	0	0	294	0	0
Stage 1	771	771	-	312	312	-	-	-	-	-	-	-
Stage 2	165	336	-	415	778	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	220	209	640	312	214	873	884	-	-	1264	-	-
Stage 1	359	408	-	673	656	-	-	-	-	-	-	-
Stage 2	821	640	-	585	405	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	210	199	640	272	204	873	884	-	-	1264	-	-
Mov Cap-2 Maneuver	210	199	-	272	204	-	-	-	-	-	-	-
Stage 1	350	397	-	657	640	-	-	-	-	-	-	-
Stage 2	797	625	-	517	394	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	16	14.7	0.6	0.3
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	884	-	-	210	640	272	873	1264	-	-
HCM Lane V/C Ratio	0.023	-	-	0.15	0.093	0.028	0.006	0.026	-	-
HCM Control Delay (s)	9.2	-	-	25.1	11.2	18.6	9.2	7.9	-	-
HCM Lane LOS	A	-	-	D	B	C	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.5	0.3	0.1	0	0.1	-	-

Intersection	
Int Delay, s/veh	4.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	13	53	74	96	229	165
Future Vol, veh/h	13	53	74	96	229	165
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	14	58	80	104	249	179

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	809	132	0	0	184	0
Stage 1	132	-	-	-	-	-
Stage 2	677	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	350	917	-	-	1391	-
Stage 1	894	-	-	-	-	-
Stage 2	505	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	280	917	-	-	1391	-
Mov Cap-2 Maneuver	280	-	-	-	-	-
Stage 1	894	-	-	-	-	-
Stage 2	405	-	-	-	-	-

Approach	WB		NB		SB	
HCM Control Delay, s	11.4		0		4.7	
HCM LOS	B					

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	633	1391	-
HCM Lane V/C Ratio	-	-	0.113	0.179	-
HCM Control Delay (s)	-	-	11.4	8.2	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0.7	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	152	7	24	308	3	1	0	12	0	0	6
Future Vol, veh/h	0	152	7	24	308	3	1	0	12	0	0	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	73	-	-	-	-	-	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	165	8	26	335	3	1	0	13	0	0	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	173	0	0	561	559	169	-	-	337
Stage 1	-	-	-	-	-	-	169	169	-	-	-	-
Stage 2	-	-	-	-	-	-	392	390	-	-	-	-
Critical Hdwy	-	-	-	4.12	-	-	7.12	6.52	6.22	-	-	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	-	-	-	2.218	-	-	3.518	4.018	3.318	-	-	3.318
Pot Cap-1 Maneuver	0	-	-	1404	-	-	438	438	875	0	0	705
Stage 1	0	-	-	-	-	-	833	759	-	0	0	-
Stage 2	0	-	-	-	-	-	633	608	-	0	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	-	-	-	1404	-	-	428	430	875	-	-	705
Mov Cap-2 Maneuver	-	-	-	-	-	-	428	430	-	-	-	-
Stage 1	-	-	-	-	-	-	833	759	-	-	-	-
Stage 2	-	-	-	-	-	-	616	596	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.5	9.5	10.2
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	810	-	-	1404	-	-	705
HCM Lane V/C Ratio	0.017	-	-	0.019	-	-	0.009
HCM Control Delay (s)	9.5	-	-	7.6	-	-	10.2
HCM Lane LOS	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-	-	0

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	161	307	19	51	4
Future Vol, veh/h	1	161	307	19	51	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	76	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	175	334	21	55	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	355	0	-	0	522	345
Stage 1	-	-	-	-	345	-
Stage 2	-	-	-	-	177	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1204	-	-	-	515	698
Stage 1	-	-	-	-	717	-
Stage 2	-	-	-	-	854	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1204	-	-	-	514	698
Mov Cap-2 Maneuver	-	-	-	-	514	-
Stage 1	-	-	-	-	716	-
Stage 2	-	-	-	-	854	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	12.8
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1204	-	-	-	524
HCM Lane V/C Ratio	0.001	-	-	-	0.114
HCM Control Delay (s)	8	-	-	-	12.8
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	116	426	160	42	324	101	64	140	37	130	463	127
Future Volume (veh/h)	116	426	160	42	324	101	64	140	37	130	463	127
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	126	463	174	46	352	110	70	152	13	141	503	138
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	158	675	252	119	654	201	198	869	387	198	674	184
Arrive On Green	0.09	0.27	0.27	0.07	0.24	0.24	0.11	0.24	0.24	0.11	0.24	0.24
Sat Flow, veh/h	1781	2533	945	1781	2675	824	1781	3554	1585	1781	2759	753
Grp Volume(v), veh/h	126	324	313	46	232	230	70	152	13	141	323	318
Grp Sat Flow(s),veh/h/ln	1781	1777	1700	1781	1777	1722	1781	1777	1585	1781	1777	1735
Q Serve(g_s), s	6.2	14.7	14.9	2.2	10.2	10.5	3.3	3.0	0.6	6.9	15.1	15.3
Cycle Q Clear(g_c), s	6.2	14.7	14.9	2.2	10.2	10.5	3.3	3.0	0.6	6.9	15.1	15.3
Prop In Lane	1.00		0.56	1.00		0.48	1.00		1.00	1.00		0.43
Lane Grp Cap(c), veh/h	158	474	453	119	434	421	198	869	387	198	434	424
V/C Ratio(X)	0.80	0.68	0.69	0.39	0.53	0.55	0.35	0.17	0.03	0.71	0.74	0.75
Avail Cap(c_a), veh/h	158	474	453	119	434	421	198	869	387	198	434	424
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	40.2	29.6	29.7	40.2	29.5	29.6	37.0	26.8	25.9	38.6	31.4	31.5
Incr Delay (d2), s/veh	23.9	4.0	4.4	2.1	1.3	1.5	1.1	0.1	0.0	11.4	6.8	7.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	6.6	10.6	10.4	1.8	7.7	7.7	2.6	2.2	0.4	6.3	11.3	11.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	64.1	33.6	34.1	42.3	30.8	31.1	38.1	26.9	25.9	50.0	38.2	38.7
LnGrp LOS	E	C	C	D	C	C	D	C	C	D	D	D
Approach Vol, veh/h		763			508			235			782	
Approach Delay, s/veh		38.8			32.0			30.2			40.5	
Approach LOS		D			C			C			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.8	28.1	15.8	24.6	14.4	24.4	13.6	26.8
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	8.0	26.0	12.0	24.0	10.0	24.0	12.0	24.0
Max Q Clear Time (g_c+I1), s	5.2	17.9	9.9	6.0	9.2	13.5	6.3	18.3
Green Ext Time (p_c), s	0.0	1.7	0.1	0.6	0.0	1.3	0.1	1.4

Intersection Summary		
HCM 6th Ctrl Delay		37.0
HCM 6th LOS		D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	124	63	52	52	69	54	158	146	157	401	78
Future Volume (veh/h)	19	124	63	52	52	69	54	158	146	157	401	78
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	21	135	68	57	57	75	59	172	159	171	436	85
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	75	420	396	225	208	396	392	560	484	410	950	184
Arrive On Green	0.25	0.25	0.25	0.25	0.25	0.25	0.22	0.31	0.31	0.23	0.32	0.32
Sat Flow, veh/h	136	1681	1585	683	833	1585	1781	1805	1561	1781	2969	575
Grp Volume(v), veh/h	156	0	68	114	0	75	59	169	162	171	260	261
Grp Sat Flow(s),veh/h/ln	1817	0	1585	1516	0	1585	1781	1777	1589	1781	1777	1767
Q Serve(g_s), s	0.0	0.0	3.4	0.0	0.0	3.7	2.7	7.3	7.8	8.2	11.6	11.8
Cycle Q Clear(g_c), s	6.8	0.0	3.4	5.8	0.0	3.7	2.7	7.3	7.8	8.2	11.6	11.8
Prop In Lane	0.13		1.00	0.50		1.00	1.00		0.98	1.00		0.33
Lane Grp Cap(c), veh/h	495	0	396	433	0	396	392	551	493	410	569	565
V/C Ratio(X)	0.32	0.00	0.17	0.26	0.00	0.19	0.15	0.31	0.33	0.42	0.46	0.46
Avail Cap(c_a), veh/h	495	0	396	433	0	396	392	551	493	410	569	565
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.7	0.0	29.4	30.2	0.0	29.5	31.5	26.3	26.5	32.8	27.1	27.1
Incr Delay (d2), s/veh	0.4	0.0	0.2	0.3	0.0	0.2	0.2	0.3	0.4	0.7	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	5.6	0.0	2.3	4.0	0.0	2.6	2.0	5.4	5.2	6.3	8.4	8.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	31.0	0.0	29.6	30.5	0.0	29.8	31.6	26.6	26.9	33.5	27.7	27.7
LnGrp LOS	C	A	C	C	A	C	C	C	C	C	C	C
Approach Vol, veh/h		224			189			390			692	
Approach Delay, s/veh		30.6			30.2			27.5			29.1	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	23.3	27.5		23.8	19.3	31.5		23.8
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	25.0	33.0		27.0	24.0	34.0		27.0
Max Q Clear Time (g_c+I1), s	11.2	10.8		9.8	5.7	14.8		8.8
Green Ext Time (p_c), s	0.5	1.2		0.8	0.1	1.9		0.7

Intersection Summary	
HCM 6th Ctrl Delay	29.1
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	14	442	100	49	839	24	487	4	81	34	8	84
Future Volume (veh/h)	14	442	100	49	839	24	487	4	81	34	8	84
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	15	480	109	53	912	26	529	4	88	37	9	91
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	3	1022	456	30	1123	501	670	24	537	481	107	613
Arrive On Green	0.00	0.29	0.29	0.02	0.32	0.32	0.39	0.39	0.39	0.39	0.39	0.39
Sat Flow, veh/h	1781	3554	1585	1781	3554	1585	1458	63	1389	996	277	1585
Grp Volume(v), veh/h	15	480	109	53	912	26	529	0	92	46	0	91
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1777	1585	1458	0	1452	1272	0	1585
Q Serve(g_s), s	0.1	7.6	3.6	1.2	16.1	0.8	19.9	0.0	2.8	0.9	0.0	2.5
Cycle Q Clear(g_c), s	0.1	7.6	3.6	1.2	16.1	0.8	23.6	0.0	2.8	3.7	0.0	2.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.96	0.80		1.00
Lane Grp Cap(c), veh/h	3	1022	456	30	1123	501	670	0	562	588	0	613
V/C Ratio(X)	5.73	0.47	0.24	1.74	0.81	0.05	0.79	0.00	0.16	0.08	0.00	0.15
Avail Cap(c_a), veh/h	79	1566	699	183	1775	792	787	0	683	703	0	745
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	34.0	20.0	18.5	33.5	21.4	16.2	19.7	0.0	13.7	14.0	0.0	13.6
Incr Delay (d2), s/veh	2296.1	0.3	0.3	360.3	1.6	0.0	4.7	0.0	0.1	0.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.1	5.4	2.3	6.4	10.6	0.5	12.7	0.0	1.6	0.8	0.0	1.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	2330.1	20.3	18.8	393.8	23.0	16.2	24.3	0.0	13.8	14.0	0.0	13.7
LnGrp LOS	F	C	B	F	C	B	C	A	B	B	A	B
Approach Vol, veh/h		604			991			621			137	
Approach Delay, s/veh		77.4			42.7			22.8			13.8	
Approach LOS		E			D			C			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.2	26.6		33.3	6.2	28.5		33.3				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	9.0	32.0		34.0	5.0	36.0		34.0				
Max Q Clear Time (g_c+I1), s	4.2	10.6		26.6	3.1	19.1		6.7				
Green Ext Time (p_c), s	0.0	2.7		1.7	0.0	4.4		0.5				

Intersection Summary			
HCM 6th Ctrl Delay			44.7
HCM 6th LOS			D

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	520	47	9	362	19	15	0	21	63	0	43
Future Vol, veh/h	13	520	47	9	362	19	15	0	21	63	0	43
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	14	565	51	10	393	21	16	0	23	68	0	47

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	414	0	0	616	0	0	836	1053	308	735	1068	207
Stage 1	-	-	-	-	-	-	619	619	-	424	424	-
Stage 2	-	-	-	-	-	-	217	434	-	311	644	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1141	-	-	960	-	-	260	225	688	308	220	799
Stage 1	-	-	-	-	-	-	443	478	-	578	585	-
Stage 2	-	-	-	-	-	-	765	579	-	674	466	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1141	-	-	960	-	-	241	220	688	293	215	799
Mov Cap-2 Maneuver	-	-	-	-	-	-	241	220	-	293	215	-
Stage 1	-	-	-	-	-	-	438	472	-	571	579	-
Stage 2	-	-	-	-	-	-	713	573	-	644	460	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.2	15.3	17.9
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	388	1141	-	-	960	-	-	394
HCM Lane V/C Ratio	0.101	0.012	-	-	0.01	-	-	0.292
HCM Control Delay (s)	15.3	8.2	-	-	8.8	-	-	17.9
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	1.2

Intersection	
Int Delay, s/veh	3.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	21	0	38	45	0	30	56	924	8	6	540	37
Future Vol, veh/h	21	0	38	45	0	30	56	924	8	6	540	37
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	152	-	-	148	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	23	0	41	49	0	33	61	1004	9	7	587	40

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1245	1756	314	1439	1772	507	627	0	0	1013	0	0
Stage 1	621	621	-	1131	1131	-	-	-	-	-	-	-
Stage 2	624	1135	-	308	641	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	130	84	682	94	82	511	951	-	-	680	-	-
Stage 1	442	477	-	217	277	-	-	-	-	-	-	-
Stage 2	440	275	-	677	468	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	115	78	682	83	76	511	951	-	-	680	-	-
Mov Cap-2 Maneuver	115	78	-	83	76	-	-	-	-	-	-	-
Stage 1	414	472	-	203	259	-	-	-	-	-	-	-
Stage 2	386	257	-	629	463	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	22.5	63.5	0.5	0.1
HCM LOS	C	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	951	-	-	115	682	83	511	680	-	-
HCM Lane V/C Ratio	0.064	-	-	0.198	0.061	0.589	0.064	0.01	-	-
HCM Control Delay (s)	9	-	-	43.9	10.6	97.5	12.5	10.3	-	-
HCM Lane LOS	A	-	-	E	B	F	B	B	-	-
HCM 95th %tile Q(veh)	0.2	-	-	0.7	0.2	2.7	0.2	0	-	-

Intersection	
Int Delay, s/veh	4.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	91	119	194	9	16	129
Future Vol, veh/h	91	119	194	9	16	129
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	99	129	211	10	17	140

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	390	216	0	0	221	0
Stage 1	216	-	-	-	-	-
Stage 2	174	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	614	824	-	-	1348	-
Stage 1	820	-	-	-	-	-
Stage 2	856	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	605	824	-	-	1348	-
Mov Cap-2 Maneuver	605	-	-	-	-	-
Stage 1	820	-	-	-	-	-
Stage 2	844	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.4	0	0.9
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	712	1348	-
HCM Lane V/C Ratio	-	-	0.321	0.013	-
HCM Control Delay (s)	-	-	12.4	7.7	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	1.4	0	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	224	6	13	73	9	1	0	27	0	0	4
Future Vol, veh/h	0	224	6	13	73	9	1	0	27	0	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	73	-	-	-	-	-	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	243	7	14	79	10	1	0	29	0	0	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	250	0	0	361	364	247	-	-	84
Stage 1	-	-	-	-	-	-	247	247	-	-	-	-
Stage 2	-	-	-	-	-	-	114	117	-	-	-	-
Critical Hdwy	-	-	-	4.12	-	-	7.12	6.52	6.22	-	-	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	-	-	-	2.218	-	-	3.518	4.018	3.318	-	-	3.318
Pot Cap-1 Maneuver	0	-	-	1316	-	-	595	564	792	0	0	975
Stage 1	0	-	-	-	-	-	757	702	-	0	0	-
Stage 2	0	-	-	-	-	-	891	799	-	0	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	-	-	-	1316	-	-	587	558	792	-	-	975
Mov Cap-2 Maneuver	-	-	-	-	-	-	587	558	-	-	-	-
Stage 1	-	-	-	-	-	-	757	702	-	-	-	-
Stage 2	-	-	-	-	-	-	878	790	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1.1	9.8	8.7
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	782	-	-	1316	-	-	975
HCM Lane V/C Ratio	0.039	-	-	0.011	-	-	0.004
HCM Control Delay (s)	9.8	-	-	7.8	-	-	8.7
HCM Lane LOS	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-	-	0

Intersection						
Int Delay, s/veh	1.1					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	222	78	54	35	3
Future Vol, veh/h	4	222	78	54	35	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	76	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	241	85	59	38	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	144	0	-	0	364	115
Stage 1	-	-	-	-	115	-
Stage 2	-	-	-	-	249	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1438	-	-	-	635	937
Stage 1	-	-	-	-	910	-
Stage 2	-	-	-	-	792	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1438	-	-	-	633	937
Mov Cap-2 Maneuver	-	-	-	-	633	-
Stage 1	-	-	-	-	907	-
Stage 2	-	-	-	-	792	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	10.9
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1438	-	-	-	650
HCM Lane V/C Ratio	0.003	-	-	-	0.064
HCM Control Delay (s)	7.5	-	-	-	10.9
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	79	336	45	57	368	217	201	538	121	185	343	182
Future Volume (veh/h)	79	336	45	57	368	217	201	538	121	185	343	182
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	86	365	49	62	400	236	218	585	105	201	373	198
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	214	851	113	125	475	277	303	817	365	267	474	248
Arrive On Green	0.12	0.27	0.27	0.07	0.22	0.22	0.17	0.23	0.23	0.15	0.21	0.21
Sat Flow, veh/h	1781	3152	420	1781	2161	1260	1781	3554	1585	1781	2256	1179
Grp Volume(v), veh/h	86	205	209	62	328	308	218	585	105	201	293	278
Grp Sat Flow(s),veh/h/ln	1781	1777	1795	1781	1777	1644	1781	1777	1585	1781	1777	1658
Q Serve(g_s), s	4.5	9.5	9.6	3.4	17.7	18.0	11.6	15.2	5.5	10.8	15.6	15.9
Cycle Q Clear(g_c), s	4.5	9.5	9.6	3.4	17.7	18.0	11.6	15.2	5.5	10.8	15.6	15.9
Prop In Lane	1.00		0.23	1.00		0.77	1.00		1.00	1.00		0.71
Lane Grp Cap(c), veh/h	214	480	485	125	391	362	303	817	365	267	373	348
V/C Ratio(X)	0.40	0.43	0.43	0.50	0.84	0.85	0.72	0.72	0.29	0.75	0.78	0.80
Avail Cap(c_a), veh/h	214	480	485	125	391	362	303	817	365	267	373	348
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	40.7	30.1	30.2	44.8	37.3	37.4	39.2	35.5	31.7	40.7	37.4	37.5
Incr Delay (d2), s/veh	1.2	0.6	0.6	3.0	14.9	17.4	8.1	3.0	0.4	11.4	10.5	12.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.6	7.2	7.4	2.8	13.9	13.5	9.4	10.9	3.8	9.3	12.2	12.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.9	30.7	30.8	47.8	52.2	54.8	47.3	38.5	32.2	52.1	47.8	49.9
LnGrp LOS	D	C	C	D	D	D	D	D	C	D	D	D
Approach Vol, veh/h		500			698			908			772	
Approach Delay, s/veh		32.7			53.0			39.9			49.7	
Approach LOS		C			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.1	31.2	20.5	27.9	15.4	27.9	21.9	26.5
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	9.0	29.0	17.0	25.0	14.0	24.0	19.0	23.0
Max Q Clear Time (g_c+I1), s	6.4	12.6	13.8	18.2	7.5	21.0	14.6	18.9
Green Ext Time (p_c), s	0.0	1.4	0.2	1.8	0.1	0.9	0.3	1.0

Intersection Summary	
HCM 6th Ctrl Delay	44.4
HCM 6th LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	77	32	110	211	26	172	52	538	26	12	391	27
Future Volume (veh/h)	77	32	110	211	26	172	52	538	26	12	391	27
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	84	35	120	229	28	187	57	585	28	13	425	29
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	500	197	634	591	63	634	99	1151	55	59	1050	71
Arrive On Green	0.40	0.40	0.40	0.40	0.40	0.40	0.06	0.33	0.33	0.03	0.31	0.31
Sat Flow, veh/h	1078	493	1585	1287	157	1585	1781	3452	165	1781	3376	230
Grp Volume(v), veh/h	119	0	120	257	0	187	57	301	312	13	223	231
Grp Sat Flow(s),veh/h/ln	1571	0	1585	1445	0	1585	1781	1777	1841	1781	1777	1829
Q Serve(g_s), s	0.0	0.0	4.4	6.0	0.0	7.2	2.8	12.2	12.3	0.6	8.9	9.0
Cycle Q Clear(g_c), s	3.9	0.0	4.4	11.0	0.0	7.2	2.8	12.2	12.3	0.6	8.9	9.0
Prop In Lane	0.71		1.00	0.89		1.00	1.00		0.09	1.00		0.13
Lane Grp Cap(c), veh/h	697	0	634	654	0	634	99	592	614	59	553	569
V/C Ratio(X)	0.17	0.00	0.19	0.39	0.00	0.29	0.58	0.51	0.51	0.22	0.40	0.41
Avail Cap(c_a), veh/h	697	0	634	654	0	634	99	592	614	59	553	569
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.4	0.0	17.5	19.4	0.0	18.4	41.5	24.1	24.1	42.4	24.4	24.4
Incr Delay (d2), s/veh	0.1	0.0	0.1	0.4	0.0	0.3	8.0	0.7	0.7	1.8	0.5	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	2.8	0.0	2.9	6.8	0.0	4.7	2.5	8.6	8.8	0.5	6.5	6.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	17.5	0.0	17.7	19.8	0.0	18.6	49.4	24.8	24.8	44.2	24.9	24.9
LnGrp LOS	B	A	B	B	A	B	D	C	C	D	C	C
Approach Vol, veh/h		239			444			670			467	
Approach Delay, s/veh		17.6			19.3			26.9			25.4	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.2	29.7		32.0	10.7	27.2		32.0
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	32.0		38.0	7.0	30.0		38.0
Max Q Clear Time (g_c+I1), s	3.6	15.3		7.4	5.8	12.0		14.0
Green Ext Time (p_c), s	0.0	2.2		1.0	0.0	1.6		1.9

Intersection Summary	
HCM 6th Ctrl Delay	23.4
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	157	831	536	74	465	148	119	25	52	67	23	120
Future Volume (veh/h)	157	831	536	74	465	148	119	25	52	67	23	120
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	171	903	583	80	505	161	129	27	57	73	25	130
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	422	1474	658	48	729	325	349	65	147	219	54	214
Arrive On Green	0.24	0.41	0.41	0.03	0.21	0.21	0.14	0.14	0.14	0.14	0.14	0.14
Sat Flow, veh/h	1781	3554	1585	1781	3554	1585	1527	478	1089	685	399	1585
Grp Volume(v), veh/h	171	903	583	80	505	161	134	0	79	98	0	130
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1777	1585	1589	0	1506	1084	0	1585
Q Serve(g_s), s	4.0	9.9	16.9	1.3	6.5	4.5	0.0	0.0	2.4	2.5	0.0	3.8
Cycle Q Clear(g_c), s	4.0	9.9	16.9	1.3	6.5	4.5	3.8	0.0	2.4	4.9	0.0	3.8
Prop In Lane	1.00		1.00	1.00		1.00	0.96		0.72	0.74		1.00
Lane Grp Cap(c), veh/h	422	1474	658	48	729	325	357	0	204	273	0	214
V/C Ratio(X)	0.41	0.61	0.89	1.66	0.69	0.49	0.38	0.00	0.39	0.36	0.00	0.61
Avail Cap(c_a), veh/h	422	1575	702	108	1503	670	816	0	698	768	0	766
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	16.0	11.4	13.4	24.2	18.3	17.5	20.2	0.0	19.6	21.1	0.0	20.2
Incr Delay (d2), s/veh	0.6	0.6	12.6	346.4	1.2	1.2	0.7	0.0	1.2	0.8	0.0	2.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	2.7	5.9	11.4	9.3	4.5	2.8	2.5	0.0	1.5	1.9	0.0	2.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	16.6	12.0	26.0	370.6	19.5	18.6	20.9	0.0	20.8	21.9	0.0	23.0
LnGrp LOS	B	B	C	F	B	B	C	A	C	C	A	C
Approach Vol, veh/h		1657			746			213			228	
Approach Delay, s/veh		17.4			56.9			20.8			22.5	
Approach LOS		B			E			C			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.3	27.6		13.7	18.7	17.2		13.7				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	5.0	24.0		25.0	6.0	23.0		26.0				
Max Q Clear Time (g_c+I1), s	4.3	19.9		6.8	7.0	9.5		7.9				
Green Ext Time (p_c), s	0.0	2.7		0.7	0.0	2.7		0.8				

Intersection Summary			
HCM 6th Ctrl Delay			28.5
HCM 6th LOS			C

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱			✥			✥	
Traffic Vol, veh/h	40	781	100	48	408	60	14	0	10	14	0	9
Future Vol, veh/h	40	781	100	48	408	60	14	0	10	14	0	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	43	849	109	52	443	65	15	0	11	15	0	10

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	508	0	0	958	0	0	1316	1602	479	1091	1624	254
Stage 1	-	-	-	-	-	-	990	990	-	580	580	-
Stage 2	-	-	-	-	-	-	326	612	-	511	1044	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1053	-	-	714	-	-	115	105	533	169	102	745
Stage 1	-	-	-	-	-	-	264	323	-	467	498	-
Stage 2	-	-	-	-	-	-	661	482	-	514	304	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1053	-	-	714	-	-	104	93	533	152	91	745
Mov Cap-2 Maneuver	-	-	-	-	-	-	104	93	-	152	91	-
Stage 1	-	-	-	-	-	-	253	310	-	448	462	-
Stage 2	-	-	-	-	-	-	605	447	-	483	292	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	1	32.7	23.4
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	156	1053	-	-	714	-	-	221
HCM Lane V/C Ratio	0.167	0.041	-	-	0.073	-	-	0.113
HCM Control Delay (s)	32.7	8.6	-	-	10.4	-	-	23.4
HCM Lane LOS	D	A	-	-	B	-	-	C
HCM 95th %tile Q(veh)	0.6	0.1	-	-	0.2	-	-	0.4

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	17	0	21	7	0	5	120	551	43	29	831	115
Future Vol, veh/h	17	0	21	7	0	5	120	551	43	29	831	115
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	152	-	-	148	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	18	0	23	8	0	5	130	599	47	32	903	125

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1590	1936	514	1399	1975	323	1028	0	0	646	0	0
Stage 1	1030	1030	-	883	883	-	-	-	-	-	-	-
Stage 2	560	906	-	516	1092	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	72	65	505	100	61	673	671	-	-	935	-	-
Stage 1	250	309	-	307	362	-	-	-	-	-	-	-
Stage 2	480	353	-	510	289	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	59	51	505	79	48	673	671	-	-	935	-	-
Mov Cap-2 Maneuver	59	51	-	79	48	-	-	-	-	-	-	-
Stage 1	202	298	-	247	292	-	-	-	-	-	-	-
Stage 2	384	285	-	470	279	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	47.9	36.7	2	0.3
HCM LOS	E	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	671	-	-	59	505	79	673	935	-	-
HCM Lane V/C Ratio	0.194	-	-	0.313	0.045	0.096	0.008	0.034	-	-
HCM Control Delay (s)	11.7	-	-	91.7	12.5	55.4	10.4	9	-	-
HCM Lane LOS	B	-	-	F	B	F	B	A	-	-
HCM 95th %tile Q(veh)	0.7	-	-	1.1	0.1	0.3	0	0.1	-	-

Intersection	
Int Delay, s/veh	4.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	16	104	101	130	284	174
Future Vol, veh/h	16	104	101	130	284	174
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	17	113	110	141	309	189

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	988	181	0	0	251	0
Stage 1	181	-	-	-	-	-
Stage 2	807	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	274	862	-	-	1314	-
Stage 1	850	-	-	-	-	-
Stage 2	439	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	202	862	-	-	1314	-
Mov Cap-2 Maneuver	202	-	-	-	-	-
Stage 1	850	-	-	-	-	-
Stage 2	324	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.7	0	5.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	600	1314	-
HCM Lane V/C Ratio	-	-	0.217	0.235	-
HCM Control Delay (s)	-	-	12.7	8.6	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.8	0.9	-

Intersection						
Int Delay, s/veh	0.5					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	546	9	31	400	1	16
Future Vol, veh/h	546	9	31	400	1	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	73	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	593	10	34	435	1	17

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	603	0	1101	598
Stage 1	-	-	-	-	598	-
Stage 2	-	-	-	-	503	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	975	-	235	502
Stage 1	-	-	-	-	549	-
Stage 2	-	-	-	-	607	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	975	-	227	502
Mov Cap-2 Maneuver	-	-	-	-	227	-
Stage 1	-	-	-	-	549	-
Stage 2	-	-	-	-	586	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	13
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	469	-	-	975	-
HCM Lane V/C Ratio	0.039	-	-	0.035	-
HCM Control Delay (s)	13	-	-	8.8	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-

Intersection						
Int Delay, s/veh	0.4					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↱		Y	
Traffic Vol, veh/h	10	546	398	86	14	2
Future Vol, veh/h	10	546	398	86	14	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	76	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	593	433	93	15	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	526	0	-	0	1095	480
Stage 1	-	-	-	-	480	-
Stage 2	-	-	-	-	615	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1041	-	-	-	236	586
Stage 1	-	-	-	-	622	-
Stage 2	-	-	-	-	539	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1041	-	-	-	233	586
Mov Cap-2 Maneuver	-	-	-	-	233	-
Stage 1	-	-	-	-	615	-
Stage 2	-	-	-	-	539	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	20.3
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1041	-	-	-	252
HCM Lane V/C Ratio	0.01	-	-	-	0.069
HCM Control Delay (s)	8.5	-	-	-	20.3
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	109	482	190	95	456	142	157	319	75	145	598	161
Future Volume (veh/h)	109	482	190	95	456	142	157	319	75	145	598	161
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	118	524	207	103	496	154	171	347	55	158	650	175
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	158	664	261	119	869	387	198	869	387	198	677	182
Arrive On Green	0.09	0.27	0.27	0.07	0.24	0.24	0.11	0.24	0.24	0.11	0.24	0.24
Sat Flow, veh/h	1781	2491	980	1781	3554	1585	1781	3554	1585	1781	2769	745
Grp Volume(v), veh/h	118	373	358	103	496	154	171	347	55	158	417	408
Grp Sat Flow(s),veh/h/ln	1781	1777	1694	1781	1777	1585	1781	1777	1585	1781	1777	1736
Q Serve(g_s), s	5.8	17.5	17.7	5.2	11.0	7.3	8.5	7.4	2.4	7.8	20.8	20.9
Cycle Q Clear(g_c), s	5.8	17.5	17.7	5.2	11.0	7.3	8.5	7.4	2.4	7.8	20.8	20.9
Prop In Lane	1.00		0.58	1.00		1.00	1.00		1.00	1.00		0.43
Lane Grp Cap(c), veh/h	158	474	452	119	869	387	198	869	387	198	434	424
V/C Ratio(X)	0.75	0.79	0.79	0.87	0.57	0.40	0.86	0.40	0.14	0.80	0.96	0.96
Avail Cap(c_a), veh/h	158	474	452	119	869	387	198	869	387	198	434	424
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	40.0	30.6	30.7	41.6	29.9	28.5	39.3	28.5	26.6	39.0	33.6	33.6
Incr Delay (d2), s/veh	17.3	8.6	9.3	44.8	0.9	0.7	30.4	0.3	0.2	20.1	32.9	33.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	5.8	12.9	12.6	6.6	8.1	0.1	9.0	5.4	1.6	7.8	18.2	18.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	57.4	39.2	40.0	86.4	30.8	29.1	69.7	28.8	26.8	59.2	66.5	67.3
LnGrp LOS	E	D	D	F	C	C	E	C	C	E	E	E
Approach Vol, veh/h		849			753			573			983	
Approach Delay, s/veh		42.1			38.0			40.8			65.7	
Approach LOS		D			D			D			E	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	12.8	29.1	16.3	29.3	14.2	27.7	16.7	29.0				
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0				
Max Green Setting (Gmax), s	8.0	26.0	12.0	24.0	10.0	24.0	12.0	24.0				
Max Q Clear Time (g_c+I1), s	8.2	20.7	10.8	10.4	8.8	14.0	11.5	23.9				
Green Ext Time (p_c), s	0.0	1.5	0.1	1.4	0.0	2.1	0.0	0.0				
Intersection Summary												
HCM 6th Ctrl Delay			48.2									
HCM 6th LOS			D									

HCM 6th Signalized Intersection Summary
8: Camino Ramon & Executive Pkwy

02/04/2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱		↰↑	↱	↰	↑↑↱		↰	↑↑↱	
Traffic Volume (veh/h)	135	310	115	51	51	68	213	401	220	189	443	134
Future Volume (veh/h)	135	310	115	51	51	68	213	401	220	189	443	134
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	147	337	125	55	55	74	232	436	239	205	482	146
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	506	549	465	151	129	465	242	679	369	216	782	235
Arrive On Green	0.29	0.29	0.29	0.29	0.29	0.29	0.14	0.31	0.31	0.12	0.29	0.29
Sat Flow, veh/h	1349	1870	1585	269	439	1585	1781	2222	1208	1781	2691	810
Grp Volume(v), veh/h	147	337	125	110	0	74	232	348	327	205	317	311
Grp Sat Flow(s),veh/h/ln	1349	1870	1585	709	0	1585	1781	1777	1653	1781	1777	1725
Q Serve(g_s), s	0.9	11.6	4.5	2.9	0.0	2.6	9.7	12.7	12.9	8.6	11.6	11.7
Cycle Q Clear(g_c), s	5.6	11.6	4.5	16.0	0.0	2.6	9.7	12.7	12.9	8.6	11.6	11.7
Prop In Lane	1.00		1.00	0.50		1.00	1.00		0.73	1.00		0.47
Lane Grp Cap(c), veh/h	506	549	465	280	0	465	242	543	505	216	516	501
V/C Ratio(X)	0.29	0.61	0.27	0.39	0.00	0.16	0.96	0.64	0.65	0.95	0.61	0.62
Avail Cap(c_a), veh/h	506	549	465	280	0	465	242	543	505	216	516	501
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.7	22.8	20.3	24.3	0.0	19.6	32.2	22.5	22.6	32.7	23.0	23.0
Incr Delay (d2), s/veh	0.3	2.0	0.3	0.9	0.0	0.2	46.0	2.6	2.9	46.7	2.2	2.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.5	8.9	3.0	3.3	0.0	1.7	11.3	8.9	8.6	10.4	8.3	8.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	21.0	24.9	20.6	25.2	0.0	19.8	78.2	25.1	25.5	79.5	25.1	25.4
LnGrp LOS	C	C	C	C	A	B	E	C	C	E	C	C
Approach Vol, veh/h		609			184			907			833	
Approach Delay, s/veh		23.1			23.0			38.8			38.6	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	16.1	26.4		26.7	17.2	25.3		26.7
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	11.1	24.9		24.0	12.2	23.8		24.0
Max Q Clear Time (g_c+I1), s	11.6	15.9		14.6	12.7	14.7		19.0
Green Ext Time (p_c), s	0.0	2.0		1.9	0.0	1.8		0.3

Intersection Summary	
HCM 6th Ctrl Delay	33.8
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	634	267	74	1328	37	638	5	102	34	8	83
Future Volume (veh/h)	22	634	267	74	1328	37	638	5	102	34	8	83
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	24	689	290	80	1443	40	693	5	111	37	9	90
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	12	1431	638	88	1583	706	600	24	526	408	94	600
Arrive On Green	0.01	0.40	0.40	0.05	0.45	0.45	0.38	0.38	0.38	0.38	0.38	0.38
Sat Flow, veh/h	1781	3554	1585	1781	3554	1585	1430	63	1389	939	248	1585
Grp Volume(v), veh/h	24	689	290	80	1443	40	693	0	116	46	0	90
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1777	1585	1430	0	1452	1186	0	1585
Q Serve(g_s), s	0.8	17.8	16.6	5.5	47.0	1.8	38.1	0.0	6.7	2.2	0.0	4.6
Cycle Q Clear(g_c), s	0.8	17.8	16.6	5.5	47.0	1.8	47.0	0.0	6.7	8.9	0.0	4.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.96	0.80		1.00
Lane Grp Cap(c), veh/h	12	1431	638	88	1583	706	600	0	550	502	0	600
V/C Ratio(X)	2.05	0.48	0.45	0.91	0.91	0.06	1.16	0.00	0.21	0.09	0.00	0.15
Avail Cap(c_a), veh/h	43	1461	652	215	1805	805	600	0	550	502	0	600
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	61.6	27.5	27.1	58.7	32.1	19.6	40.5	0.0	26.0	27.8	0.0	25.4
Incr Delay (d2), s/veh	553.4	0.3	0.5	27.0	6.9	0.0	87.8	0.0	0.2	0.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.9	12.1	10.5	5.7	28.8	1.2	47.4	0.0	4.3	1.7	0.0	3.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	615.1	27.7	27.6	85.7	39.0	19.6	128.3	0.0	26.2	27.9	0.0	25.5
LnGrp LOS	F	C	C	F	D	B	F	A	C	C	A	C
Approach Vol, veh/h		1003			1563			809			136	
Approach Delay, s/veh		41.7			40.9			113.7			26.3	
Approach LOS		D			D			F			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.1	56.9		54.0	7.8	62.3		54.0
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	17.0	53.0		49.0	5.0	65.0		26.0
Max Q Clear Time (g_c+I1), s	8.5	20.8		50.0	3.8	50.0		11.9
Green Ext Time (p_c), s	0.1	5.2		0.0	0.0	7.2		0.4

Intersection Summary			
HCM 6th Ctrl Delay			57.3
HCM 6th LOS			E

Intersection	
Int Delay, s/veh	7.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	624	20	9	586	19	89	0	64	62	0	42
Future Vol, veh/h	13	624	20	9	586	19	89	0	64	62	0	42
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	14	678	22	10	637	21	97	0	70	67	0	46

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	658	0	0	700	0	0	1056	1395	350	1035	1396	329
Stage 1	-	-	-	-	-	-	717	717	-	668	668	-
Stage 2	-	-	-	-	-	-	339	678	-	367	728	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	926	-	-	893	-	-	180	140	646	186	140	667
Stage 1	-	-	-	-	-	-	387	432	-	414	455	-
Stage 2	-	-	-	-	-	-	649	450	-	625	427	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	926	-	-	893	-	-	164	136	646	163	136	667
Mov Cap-2 Maneuver	-	-	-	-	-	-	164	136	-	163	136	-
Stage 1	-	-	-	-	-	-	381	426	-	408	450	-
Stage 2	-	-	-	-	-	-	598	445	-	549	421	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.1	49	33.7
HCM LOS			E	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	238	926	-	-	893	-	-	235
HCM Lane V/C Ratio	0.699	0.015	-	-	0.011	-	-	0.481
HCM Control Delay (s)	49	8.9	-	-	9.1	-	-	33.7
HCM Lane LOS	E	A	-	-	A	-	-	D
HCM 95th %tile Q(veh)	4.6	0	-	-	0	-	-	2.4

Intersection	
Int Delay, s/veh	80.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	109	0	134	44	0	29	24	1466	8	6	1023	23
Future Vol, veh/h	109	0	134	44	0	29	24	1466	8	6	1023	23
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	152	-	-	148	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	118	0	146	48	0	32	26	1593	9	7	1112	25

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1988	2793	569	2220	2801	801	1137	0	0	1602	0	0
Stage 1	1139	1139	-	1650	1650	-	-	-	-	-	-	-
Stage 2	849	1654	-	570	1151	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	~ 36	18	465	~ 24	18	327	610	-	-	404	-	-
Stage 1	214	274	-	103	155	-	-	-	-	-	-	-
Stage 2	322	154	-	474	271	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 31	17	465	~ 16	17	327	610	-	-	404	-	-
Mov Cap-2 Maneuver	~ 31	17	-	~ 16	17	-	-	-	-	-	-	-
Stage 1	205	269	-	99	148	-	-	-	-	-	-	-
Stage 2	279	147	-	320	266	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	$ 696.4	$ 842.7	0.2	0.1
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	610	-	-	31	465	16	327	404	-	-
HCM Lane V/C Ratio	0.043	-	-	3.822	0.313	2.989	0.096	0.016	-	-
HCM Control Delay (s)	11.2	-	$ -	1532.5	16.2	$ 1386.7	17.2	14.1	-	-
HCM Lane LOS	B	-	-	F	C	F	C	B	-	-
HCM 95th %tile Q(veh)	0.1	-	-	14.1	1.3	6.7	0.3	0	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Int Delay, s/veh	9.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	107	170	247	12	154	208
Future Vol, veh/h	107	170	247	12	154	208
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	116	185	268	13	167	226

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	835	275	0	0	281	0
Stage 1	275	-	-	-	-	-
Stage 2	560	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	338	764	-	-	1282	-
Stage 1	771	-	-	-	-	-
Stage 2	572	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	288	764	-	-	1282	-
Mov Cap-2 Maneuver	288	-	-	-	-	-
Stage 1	771	-	-	-	-	-
Stage 2	487	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	25.8	0	3.5
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	466	1282	-
HCM Lane V/C Ratio	-	-	0.646	0.131	-
HCM Control Delay (s)	-	-	25.8	8.2	0
HCM Lane LOS	-	-	D	A	A
HCM 95th %tile Q(veh)	-	-	4.5	0.4	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	472	8	17	281	1	35
Future Vol, veh/h	472	8	17	281	1	35
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	73	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	513	9	18	305	1	38

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	522	0	859	518
Stage 1	-	-	-	-	518	-
Stage 2	-	-	-	-	341	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1044	-	327	558
Stage 1	-	-	-	-	598	-
Stage 2	-	-	-	-	720	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1044	-	321	558
Mov Cap-2 Maneuver	-	-	-	-	321	-
Stage 1	-	-	-	-	598	-
Stage 2	-	-	-	-	708	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	12.1
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	547	-	-	1044	-
HCM Lane V/C Ratio	0.072	-	-	0.018	-
HCM Control Delay (s)	12.1	-	-	8.5	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.2	-	-	0.1	-

Intersection						
Int Delay, s/veh	2.2					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	2	472	271	17	89	10
Future Vol, veh/h	2	472	271	17	89	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	76	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	513	295	18	97	11

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	313	0	-	0	821	304
Stage 1	-	-	-	-	304	-
Stage 2	-	-	-	-	517	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1247	-	-	-	344	736
Stage 1	-	-	-	-	748	-
Stage 2	-	-	-	-	598	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1247	-	-	-	343	736
Mov Cap-2 Maneuver	-	-	-	-	343	-
Stage 1	-	-	-	-	747	-
Stage 2	-	-	-	-	598	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	19
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1247	-	-	-	363
HCM Lane V/C Ratio	0.002	-	-	-	0.296
HCM Control Delay (s)	7.9	-	-	-	19
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	163	396	65	81	595	351	327	915	224	289	504	277
Future Volume (veh/h)	163	396	65	81	595	351	327	915	224	289	504	277
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	177	430	71	88	647	382	355	995	216	314	548	301
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	178	694	114	130	711	317	372	969	432	308	523	287
Arrive On Green	0.10	0.23	0.23	0.07	0.20	0.20	0.21	0.27	0.27	0.17	0.24	0.24
Sat Flow, veh/h	1781	3056	501	1781	3554	1585	1781	3554	1585	1781	2214	1214
Grp Volume(v), veh/h	177	249	252	88	647	382	355	995	216	314	440	409
Grp Sat Flow(s),veh/h/ln	1781	1777	1780	1781	1777	1585	1781	1777	1585	1781	1777	1652
Q Serve(g_s), s	10.9	13.8	14.0	5.3	19.6	22.0	21.7	30.0	12.6	19.0	26.0	26.0
Cycle Q Clear(g_c), s	10.9	13.8	14.0	5.3	19.6	22.0	21.7	30.0	12.6	19.0	26.0	26.0
Prop In Lane	1.00		0.28	1.00		1.00	1.00		1.00	1.00		0.74
Lane Grp Cap(c), veh/h	178	404	405	130	711	317	372	969	432	308	420	390
V/C Ratio(X)	0.99	0.62	0.62	0.68	0.91	1.21	0.95	1.03	0.50	1.02	1.05	1.05
Avail Cap(c_a), veh/h	178	404	405	130	711	317	372	969	432	308	420	390
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	49.5	38.2	38.3	49.7	43.0	44.0	43.0	40.0	33.7	45.5	42.0	42.0
Incr Delay (d2), s/veh	65.5	2.8	3.0	13.4	15.9	118.3	34.5	35.9	0.9	56.7	56.6	58.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	12.6	10.3	10.4	5.0	15.1	28.4	18.7	24.7	8.4	19.1	25.1	23.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	114.9	41.0	41.2	63.1	58.9	162.3	77.5	75.9	34.6	102.2	98.6	100.9
LnGrp LOS	F	D	D	E	E	F	E	F	C	F	F	F
Approach Vol, veh/h		678			1117			1566			1163	
Approach Delay, s/veh		60.4			94.6			70.6			100.4	
Approach LOS		E			F			E			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.9	33.1	26.0	37.0	18.0	29.0	29.9	33.1
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	27.0	21.0	32.0	13.0	24.0	25.0	28.0
Max Q Clear Time (g_c+I1), s	8.3	17.0	22.0	33.0	13.9	25.0	24.7	29.0
Green Ext Time (p_c), s	0.0	1.4	0.0	0.0	0.0	0.0	0.1	0.0

Intersection Summary	
HCM 6th Ctrl Delay	82.6
HCM 6th LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	173	56	332	207	25	169	181	902	45	20	805	65
Future Volume (veh/h)	173	56	332	207	25	169	181	902	45	20	805	65
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	188	61	361	225	27	184	197	980	49	22	875	71
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	541	534	453	394	36	453	204	1279	64	76	999	81
Arrive On Green	0.29	0.29	0.29	0.29	0.29	0.29	0.11	0.37	0.37	0.04	0.30	0.30
Sat Flow, veh/h	1383	1870	1585	1038	125	1585	1781	3444	172	1781	3329	270
Grp Volume(v), veh/h	188	61	361	252	0	184	197	506	523	22	467	479
Grp Sat Flow(s),veh/h/ln	1383	1870	1585	1163	0	1585	1781	1777	1839	1781	1777	1822
Q Serve(g_s), s	0.0	1.7	14.7	11.8	0.0	6.6	7.7	17.5	17.5	0.8	17.5	17.5
Cycle Q Clear(g_c), s	6.3	1.7	14.7	15.0	0.0	6.6	7.7	17.5	17.5	0.8	17.5	17.5
Prop In Lane	1.00		1.00	0.89		1.00	1.00		0.09	1.00		0.15
Lane Grp Cap(c), veh/h	541	534	453	430	0	453	204	660	683	76	533	547
V/C Ratio(X)	0.35	0.11	0.80	0.59	0.00	0.41	0.97	0.77	0.77	0.29	0.88	0.88
Avail Cap(c_a), veh/h	541	534	453	430	0	453	204	660	683	76	533	547
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.1	18.5	23.1	24.7	0.0	20.2	30.9	19.3	19.3	32.5	23.3	23.3
Incr Delay (d2), s/veh	0.4	0.1	9.6	2.1	0.0	0.6	53.6	5.4	5.2	2.0	15.2	14.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	4.3	1.3	10.5	7.0	0.0	0.1	10.2	11.7	12.0	0.7	13.6	13.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	20.5	18.6	32.8	26.8	0.0	20.8	84.5	24.7	24.5	34.5	38.4	38.1
LnGrp LOS	C	B	C	C	A	C	F	C	C	C	D	D
Approach Vol, veh/h		610			436			1226			968	
Approach Delay, s/veh		27.6			24.2			34.2			38.2	
Approach LOS		C			C			C			D	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.4	33.9		25.5	15.0	27.3		25.5				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	5.0	28.0		22.0	10.0	23.0		22.0				
Max Q Clear Time (g_c+I1), s	3.8	20.5		17.7	10.7	20.5		18.0				
Green Ext Time (p_c), s	0.0	2.7		1.2	0.0	1.1		0.7				

Intersection Summary		
HCM 6th Ctrl Delay		32.8
HCM 6th LOS		C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	157	732	528	74	479	148	125	25	52	67	23	120
Future Volume (veh/h)	157	732	528	74	479	148	125	25	52	67	23	120
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	171	796	574	80	521	161	136	27	57	73	25	130
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	404	1460	651	48	750	334	356	66	145	220	55	216
Arrive On Green	0.23	0.41	0.41	0.03	0.21	0.21	0.14	0.14	0.14	0.14	0.14	0.14
Sat Flow, veh/h	1781	3554	1585	1781	3554	1585	1550	482	1063	678	401	1585
Grp Volume(v), veh/h	171	796	574	80	521	161	139	0	81	98	0	130
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1777	1585	1585	0	1511	1079	0	1585
Q Serve(g_s), s	4.0	8.4	16.5	1.3	6.7	4.4	0.0	0.0	2.4	2.5	0.0	3.8
Cycle Q Clear(g_c), s	4.0	8.4	16.5	1.3	6.7	4.4	3.9	0.0	2.4	4.9	0.0	3.8
Prop In Lane	1.00		1.00	1.00		1.00	0.98		0.70	0.74		1.00
Lane Grp Cap(c), veh/h	404	1460	651	48	750	334	360	0	206	274	0	216
V/C Ratio(X)	0.42	0.55	0.88	1.67	0.69	0.48	0.39	0.00	0.39	0.36	0.00	0.60
Avail Cap(c_a), veh/h	404	1587	708	108	1515	676	821	0	705	774	0	772
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	16.3	11.0	13.4	24.0	18.0	17.1	20.1	0.0	19.4	20.9	0.0	20.0
Incr Delay (d2), s/veh	0.7	0.3	11.9	347.9	1.2	1.1	0.7	0.0	1.2	0.8	0.0	2.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	2.8	4.9	11.1	9.3	4.6	2.7	2.6	0.0	1.5	1.9	0.0	2.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	17.0	11.3	25.3	371.9	19.1	18.1	20.7	0.0	20.6	21.7	0.0	22.7
LnGrp LOS	B	B	C	F	B	B	C	A	C	C	A	C
Approach Vol, veh/h		1541			762			220			228	
Approach Delay, s/veh		17.2			56.0			20.7			22.3	
Approach LOS		B			E			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.3	27.2		13.7	18.2	17.4		13.7				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	5.0	24.0		25.0	6.0	23.0		26.0				
Max Q Clear Time (g_c+I1), s	4.3	19.5		6.9	7.0	9.7		7.9				
Green Ext Time (p_c), s	0.0	2.8		0.8	0.0	2.7		0.8				

Intersection Summary		
HCM 6th Ctrl Delay		28.6
HCM 6th LOS		C

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	40	782	14	3	412	60	20	0	31	14	0	9
Future Vol, veh/h	40	782	14	3	412	60	20	0	31	14	0	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	43	850	15	3	448	65	22	0	34	15	0	10

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	513	0	0	865	0	0	1174	1463	433	998	1438	257
Stage 1	-	-	-	-	-	-	944	944	-	487	487	-
Stage 2	-	-	-	-	-	-	230	519	-	511	951	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1049	-	-	774	-	-	147	127	571	198	132	742
Stage 1	-	-	-	-	-	-	282	339	-	531	549	-
Stage 2	-	-	-	-	-	-	752	531	-	514	336	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1049	-	-	774	-	-	140	121	571	180	126	742
Mov Cap-2 Maneuver	-	-	-	-	-	-	140	121	-	180	126	-
Stage 1	-	-	-	-	-	-	270	325	-	509	547	-
Stage 2	-	-	-	-	-	-	739	529	-	464	322	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0.1	22.6	20.6
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	259	1049	-	-	774	-	-	256
HCM Lane V/C Ratio	0.214	0.041	-	-	0.004	-	-	0.098
HCM Control Delay (s)	22.6	8.6	-	-	9.7	-	-	20.6
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.8	0.1	-	-	0	-	-	0.3

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	29	0	55	7	0	5	17	559	43	29	822	11
Future Vol, veh/h	29	0	55	7	0	5	17	559	43	29	822	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	152	-	-	148	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	32	0	60	8	0	5	18	608	47	32	893	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1303	1654	453	1179	1637	328	905	0	0	655	0	0
Stage 1	963	963	-	668	668	-	-	-	-	-	-	-
Stage 2	340	691	-	511	969	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	118	97	554	146	100	668	747	-	-	928	-	-
Stage 1	274	332	-	414	455	-	-	-	-	-	-	-
Stage 2	648	444	-	514	330	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	112	91	554	125	94	668	747	-	-	928	-	-
Mov Cap-2 Maneuver	112	91	-	125	94	-	-	-	-	-	-	-
Stage 1	267	321	-	404	444	-	-	-	-	-	-	-
Stage 2	627	433	-	443	319	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	25.1	25.2	0.3	0.3
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	747	-	-	112	554	125	668	928	-	-
HCM Lane V/C Ratio	0.025	-	-	0.281	0.108	0.061	0.008	0.034	-	-
HCM Control Delay (s)	9.9	-	-	49.3	12.3	35.7	10.4	9	-	-
HCM Lane LOS	A	-	-	E	B	E	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	1.1	0.4	0.2	0	0.1	-	-

Intersection						
Int Delay, s/veh	4.9					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	16	110	101	130	276	174
Future Vol, veh/h	16	110	101	130	276	174
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	17	120	110	141	300	189

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	970	181	0	0	251	0
Stage 1	181	-	-	-	-	-
Stage 2	789	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	281	862	-	-	1314	-
Stage 1	850	-	-	-	-	-
Stage 2	448	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	209	862	-	-	1314	-
Mov Cap-2 Maneuver	209	-	-	-	-	-
Stage 1	850	-	-	-	-	-
Stage 2	334	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.5	0	5.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	617	1314	-
HCM Lane V/C Ratio	-	-	0.222	0.228	-
HCM Control Delay (s)	-	-	12.5	8.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.8	0.9	-

Intersection												
Int Delay, s/veh	0.5											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	537	9	31	402	3	1	0	16	0	0	6
Future Vol, veh/h	0	537	9	31	402	3	1	0	16	0	0	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	73	-	-	-	-	-	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	584	10	34	437	3	1	0	17	0	0	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	594	0	0	1099	1097	589	-	-	439
Stage 1	-	-	-	-	-	-	589	589	-	-	-	-
Stage 2	-	-	-	-	-	-	510	508	-	-	-	-
Critical Hdwy	-	-	-	4.12	-	-	7.12	6.52	6.22	-	-	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	-	-	-	2.218	-	-	3.518	4.018	3.318	-	-	3.318
Pot Cap-1 Maneuver	0	-	-	982	-	-	190	213	508	0	0	618
Stage 1	0	-	-	-	-	-	494	495	-	0	0	-
Stage 2	0	-	-	-	-	-	546	539	-	0	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	-	-	-	982	-	-	183	206	508	-	-	618
Mov Cap-2 Maneuver	-	-	-	-	-	-	183	206	-	-	-	-
Stage 1	-	-	-	-	-	-	494	495	-	-	-	-
Stage 2	-	-	-	-	-	-	522	520	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.6	13.2	10.9
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	460	-	-	982	-	-	618
HCM Lane V/C Ratio	0.04	-	-	0.034	-	-	0.011
HCM Control Delay (s)	13.2	-	-	8.8	-	-	10.9
HCM Lane LOS	B	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-	-	0

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	546	401	17	51	4
Future Vol, veh/h	1	546	401	17	51	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	76	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	593	436	18	55	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	454	0	-	0	1040	445
Stage 1	-	-	-	-	445	-
Stage 2	-	-	-	-	595	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1107	-	-	-	255	613
Stage 1	-	-	-	-	646	-
Stage 2	-	-	-	-	551	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1107	-	-	-	255	613
Mov Cap-2 Maneuver	-	-	-	-	255	-
Stage 1	-	-	-	-	645	-
Stage 2	-	-	-	-	551	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	22.4
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1107	-	-	-	266
HCM Lane V/C Ratio	0.001	-	-	-	0.225
HCM Control Delay (s)	8.3	-	-	-	22.4
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	128	482	182	70	456	142	159	333	82	145	528	144
Future Volume (veh/h)	128	482	182	70	456	142	159	333	82	145	528	144
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	139	524	198	76	496	154	173	362	62	158	574	157
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	158	674	253	119	869	387	198	869	387	198	674	184
Arrive On Green	0.09	0.27	0.27	0.07	0.24	0.24	0.11	0.24	0.24	0.11	0.24	0.24
Sat Flow, veh/h	1781	2526	950	1781	3554	1585	1781	3554	1585	1781	2759	753
Grp Volume(v), veh/h	139	368	354	76	496	154	173	362	62	158	369	362
Grp Sat Flow(s),veh/h/ln	1781	1777	1699	1781	1777	1585	1781	1777	1585	1781	1777	1735
Q Serve(g_s), s	6.9	17.2	17.4	3.7	11.0	7.3	8.6	7.7	2.8	7.8	17.8	17.9
Cycle Q Clear(g_c), s	6.9	17.2	17.4	3.7	11.0	7.3	8.6	7.7	2.8	7.8	17.8	17.9
Prop In Lane	1.00		0.56	1.00		1.00	1.00		1.00	1.00		0.43
Lane Grp Cap(c), veh/h	158	474	453	119	869	387	198	869	387	198	434	424
V/C Ratio(X)	0.88	0.78	0.78	0.64	0.57	0.40	0.87	0.42	0.16	0.80	0.85	0.85
Avail Cap(c_a), veh/h	158	474	453	119	869	387	198	869	387	198	434	424
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	40.5	30.5	30.6	40.9	29.9	28.5	39.4	28.6	26.7	39.0	32.4	32.5
Incr Delay (d2), s/veh	38.7	7.9	8.6	11.0	0.9	0.7	32.3	0.3	0.2	20.1	14.7	15.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	8.2	12.6	12.4	3.5	8.1	0.1	9.2	5.7	1.8	7.8	13.9	13.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	79.3	38.5	39.1	51.9	30.8	29.1	71.7	28.9	26.9	59.2	47.1	47.9
LnGrp LOS	E	D	D	D	C	C	E	C	C	E	D	D
Approach Vol, veh/h		861			726			597			889	
Approach Delay, s/veh		45.3			32.6			41.1			49.6	
Approach LOS		D			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.9	29.0	16.3	28.4	14.8	26.0	16.7	28.0
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	8.0	26.0	12.0	24.0	10.0	24.0	12.0	24.0
Max Q Clear Time (g_c+I1), s	6.7	20.4	10.8	10.7	9.9	14.0	11.6	20.9
Green Ext Time (p_c), s	0.0	1.6	0.1	1.5	0.0	2.1	0.0	1.0

Intersection Summary		
HCM 6th Ctrl Delay		42.7
HCM 6th LOS		D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	141	310	140	51	51	68	126	294	220	189	476	101
Future Volume (veh/h)	141	310	140	51	51	68	126	294	220	189	476	101
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	153	337	152	55	55	74	137	320	239	205	517	110
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	506	549	465	151	129	465	242	598	437	216	848	180
Arrive On Green	0.29	0.29	0.29	0.29	0.29	0.29	0.14	0.31	0.31	0.12	0.29	0.29
Sat Flow, veh/h	1349	1870	1585	269	439	1585	1781	1959	1430	1781	2918	618
Grp Volume(v), veh/h	153	337	152	110	0	74	137	289	270	205	314	313
Grp Sat Flow(s),veh/h/ln	1349	1870	1585	709	0	1585	1781	1777	1613	1781	1777	1759
Q Serve(g_s), s	1.2	11.6	5.6	2.9	0.0	2.6	5.4	10.1	10.5	8.6	11.4	11.5
Cycle Q Clear(g_c), s	5.9	11.6	5.6	16.0	0.0	2.6	5.4	10.1	10.5	8.6	11.4	11.5
Prop In Lane	1.00		1.00	0.50		1.00	1.00		0.89	1.00		0.35
Lane Grp Cap(c), veh/h	506	549	465	280	0	465	242	543	492	216	516	511
V/C Ratio(X)	0.30	0.61	0.33	0.39	0.00	0.16	0.57	0.53	0.55	0.95	0.61	0.61
Avail Cap(c_a), veh/h	506	549	465	280	0	465	242	543	492	216	516	511
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.8	22.8	20.7	24.3	0.0	19.6	30.3	21.6	21.7	32.7	22.9	23.0
Incr Delay (d2), s/veh	0.3	2.0	0.4	0.9	0.0	0.2	3.0	1.0	1.3	46.7	2.1	2.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.7	8.9	3.7	3.3	0.0	1.7	4.3	7.2	6.8	10.4	8.2	8.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	21.1	24.9	21.1	25.2	0.0	19.8	33.4	22.6	23.0	79.5	25.0	25.1
LnGrp LOS	C	C	C	C	A	B	C	C	C	E	C	C
Approach Vol, veh/h		642			184			696			832	
Approach Delay, s/veh		23.1			23.0			24.9			38.4	
Approach LOS		C			C			C			D	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	16.1	25.1		26.7	15.1	26.1		26.7
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	11.1	24.9		24.0	12.2	23.8		24.0
Max Q Clear Time (g_c+I1), s	11.6	13.5		14.6	8.4	14.5		19.0
Green Ext Time (p_c), s	0.0	1.8		2.0	0.1	1.8		0.3

Intersection Summary	
HCM 6th Ctrl Delay	29.0
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	663	269	74	1284	37	620	5	102	34	8	83
Future Volume (veh/h)	22	663	269	74	1284	37	620	5	102	34	8	83
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	24	721	292	80	1396	40	674	5	111	37	9	90
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	11	1395	622	88	1547	690	611	24	536	417	96	612
Arrive On Green	0.01	0.39	0.39	0.05	0.44	0.44	0.39	0.39	0.39	0.39	0.39	0.39
Sat Flow, veh/h	1781	3554	1585	1781	3554	1585	1430	63	1389	943	249	1585
Grp Volume(v), veh/h	24	721	292	80	1396	40	674	0	116	46	0	90
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1777	1585	1430	0	1452	1192	0	1585
Q Serve(g_s), s	0.8	18.8	16.7	5.4	44.5	1.8	38.4	0.0	6.5	2.2	0.0	4.5
Cycle Q Clear(g_c), s	0.8	18.8	16.7	5.4	44.5	1.8	47.0	0.0	6.5	8.6	0.0	4.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.96	0.80		1.00
Lane Grp Cap(c), veh/h	11	1395	622	88	1547	690	611	0	560	513	0	612
V/C Ratio(X)	2.10	0.52	0.47	0.91	0.90	0.06	1.10	0.00	0.21	0.09	0.00	0.15
Avail Cap(c_a), veh/h	44	1488	664	219	1838	820	611	0	560	513	0	612
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	60.5	28.2	27.5	57.6	32.0	19.9	39.4	0.0	25.0	26.7	0.0	24.4
Incr Delay (d2), s/veh	572.0	0.3	0.6	27.3	5.9	0.0	68.1	0.0	0.2	0.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.9	12.7	10.6	5.6	27.2	1.2	42.3	0.0	4.1	1.7	0.0	3.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	632.5	28.5	28.1	84.9	37.9	20.0	107.5	0.0	25.2	26.7	0.0	24.5
LnGrp LOS	F	C	C	F	D	B	F	A	C	C	A	C
Approach Vol, veh/h		1037			1516			790			136	
Approach Delay, s/veh		42.4			39.9			95.4			25.2	
Approach LOS		D			D			F			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.0	54.8		54.0	7.8	60.0		54.0				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	17.0	53.0		49.0	5.0	65.0		26.0				
Max Q Clear Time (g_c+I1), s	8.4	21.8		50.0	3.8	47.5		11.6				
Green Ext Time (p_c), s	0.1	5.4		0.0	0.0	7.5		0.4				
Intersection Summary												
HCM 6th Ctrl Delay			52.7									
HCM 6th LOS			D									

Intersection	
Int Delay, s/veh	2.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	628	47	9	589	19	13	0	20	62	0	42
Future Vol, veh/h	13	628	47	9	589	19	13	0	20	62	0	42
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	14	683	51	10	640	21	14	0	22	67	0	46

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	661	0	0	734	0	0	1077	1418	367	1041	1433	331
Stage 1	-	-	-	-	-	-	737	737	-	671	671	-
Stage 2	-	-	-	-	-	-	340	681	-	370	762	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	923	-	-	867	-	-	173	136	630	184	133	665
Stage 1	-	-	-	-	-	-	376	423	-	412	453	-
Stage 2	-	-	-	-	-	-	648	448	-	622	412	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	923	-	-	867	-	-	158	132	630	174	129	665
Mov Cap-2 Maneuver	-	-	-	-	-	-	158	132	-	174	129	-
Stage 1	-	-	-	-	-	-	370	417	-	406	448	-
Stage 2	-	-	-	-	-	-	597	443	-	591	406	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.1	19.2	31.1
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	289	923	-	-	867	-	-	248
HCM Lane V/C Ratio	0.124	0.015	-	-	0.011	-	-	0.456
HCM Control Delay (s)	19.2	9	-	-	9.2	-	-	31.1
HCM Lane LOS	C	A	-	-	A	-	-	D
HCM 95th %tile Q(veh)	0.4	0	-	-	0	-	-	2.2

Intersection	
Int Delay, s/veh	23.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	19	0	35	44	0	29	56	1457	8	6	1037	37
Future Vol, veh/h	19	0	35	44	0	29	56	1457	8	6	1037	37
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	152	-	-	148	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	21	0	38	48	0	32	61	1584	9	7	1127	40

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2075	2876	584	2289	2892	797	1167	0	0	1593	0	0
Stage 1	1161	1161	-	1711	1711	-	-	-	-	-	-	-
Stage 2	914	1715	-	578	1181	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	31	16	455	~ 21	16	329	594	-	-	408	-	-
Stage 1	208	268	-	94	144	-	-	-	-	-	-	-
Stage 2	294	144	-	468	262	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	25	14	455	~ 17	14	329	594	-	-	408	-	-
Mov Cap-2 Maneuver	25	14	-	~ 17	14	-	-	-	-	-	-	-
Stage 1	187	263	-	84	129	-	-	-	-	-	-	-
Stage 2	239	129	-	422	258	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	130	$ 780.7	0.4	0.1
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	594	-	-	25	455	17	329	408	-	-
HCM Lane V/C Ratio	0.102	-	-	0.826	0.084	2.813	0.096	0.016	-	-
HCM Control Delay (s)	11.8	-	-	$ 344.5	13.6	$ 1284	17.1	14	-	-
HCM Lane LOS	B	-	-	F	B	F	C	B	-	-
HCM 95th %tile Q(veh)	0.3	-	-	2.5	0.3	6.6	0.3	0	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	8.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	107	152	247	12	156	208
Future Vol, veh/h	107	152	247	12	156	208
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	116	165	268	13	170	226

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	841	275	0	0	281	0
Stage 1	275	-	-	-	-	-
Stage 2	566	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	335	764	-	-	1282	-
Stage 1	771	-	-	-	-	-
Stage 2	568	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	284	764	-	-	1282	-
Mov Cap-2 Maneuver	284	-	-	-	-	-
Stage 1	771	-	-	-	-	-
Stage 2	482	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	25.4	0	3.5
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	450	1282	-
HCM Lane V/C Ratio	-	-	0.626	0.132	-
HCM Control Delay (s)	-	-	25.4	8.2	0
HCM Lane LOS	-	-	D	A	A
HCM 95th %tile Q(veh)	-	-	4.2	0.5	-

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	474	8	17	274	9	1	0	35	0	0	4
Future Vol, veh/h	0	474	8	17	274	9	1	0	35	0	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	73	-	-	-	-	-	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	515	9	18	298	10	1	0	38	0	0	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	524	0	0	861	864	520	-	-	303
Stage 1	-	-	-	-	-	-	520	520	-	-	-	-
Stage 2	-	-	-	-	-	-	341	344	-	-	-	-
Critical Hdwy	-	-	-	4.12	-	-	7.12	6.52	6.22	-	-	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	-	-	-	2.218	-	-	3.518	4.018	3.318	-	-	3.318
Pot Cap-1 Maneuver	0	-	-	1043	-	-	276	292	556	0	0	737
Stage 1	0	-	-	-	-	-	539	532	-	0	0	-
Stage 2	0	-	-	-	-	-	674	637	-	0	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	-	-	-	1043	-	-	271	287	556	-	-	737
Mov Cap-2 Maneuver	-	-	-	-	-	-	271	287	-	-	-	-
Stage 1	-	-	-	-	-	-	539	532	-	-	-	-
Stage 2	-	-	-	-	-	-	658	626	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.5	12.2	9.9
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	540	-	-	1043	-	-	737
HCM Lane V/C Ratio	0.072	-	-	0.018	-	-	0.006
HCM Control Delay (s)	12.2	-	-	8.5	-	-	9.9
HCM Lane LOS	B	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0.2	-	-	0.1	-	-	0

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	472	280	54	33	3
Future Vol, veh/h	4	472	280	54	33	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	76	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	513	304	59	36	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	363	0	-	0	855	334
Stage 1	-	-	-	-	334	-
Stage 2	-	-	-	-	521	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1196	-	-	-	329	708
Stage 1	-	-	-	-	725	-
Stage 2	-	-	-	-	596	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1196	-	-	-	328	708
Mov Cap-2 Maneuver	-	-	-	-	328	-
Stage 1	-	-	-	-	723	-
Stage 2	-	-	-	-	596	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	16.8
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1196	-	-	-	343
HCM Lane V/C Ratio	0.004	-	-	-	0.114
HCM Control Delay (s)	8	-	-	-	16.8
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	104	396	67	88	595	351	320	871	202	289	525	282
Future Volume (veh/h)	104	396	67	88	595	351	320	871	202	289	525	282
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	113	430	73	96	647	382	348	947	193	314	571	307
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	178	691	117	130	711	317	372	969	432	308	528	283
Arrive On Green	0.10	0.23	0.23	0.07	0.20	0.20	0.21	0.27	0.27	0.17	0.24	0.24
Sat Flow, veh/h	1781	3042	513	1781	3554	1585	1781	3554	1585	1781	2232	1199
Grp Volume(v), veh/h	113	250	253	96	647	382	348	947	193	314	454	424
Grp Sat Flow(s),veh/h/ln	1781	1777	1778	1781	1777	1585	1781	1777	1585	1781	1777	1655
Q Serve(g_s), s	6.7	13.9	14.1	5.8	19.6	22.0	21.1	29.1	11.1	19.0	26.0	26.0
Cycle Q Clear(g_c), s	6.7	13.9	14.1	5.8	19.6	22.0	21.1	29.1	11.1	19.0	26.0	26.0
Prop In Lane	1.00		0.29	1.00		1.00	1.00		1.00	1.00		0.72
Lane Grp Cap(c), veh/h	178	404	404	130	711	317	372	969	432	308	420	391
V/C Ratio(X)	0.63	0.62	0.63	0.74	0.91	1.21	0.93	0.98	0.45	1.02	1.08	1.08
Avail Cap(c_a), veh/h	178	404	404	130	711	317	372	969	432	308	420	391
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	47.6	38.2	38.3	50.0	43.0	44.0	42.8	39.7	33.1	45.5	42.0	42.0
Incr Delay (d2), s/veh	7.2	2.9	3.0	20.1	15.9	118.3	30.4	23.4	0.7	56.7	67.7	69.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	5.9	10.3	10.4	5.9	15.1	28.4	17.9	21.8	7.6	19.1	27.2	25.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	54.7	41.1	41.3	70.1	58.9	162.3	73.2	63.0	33.8	102.2	109.7	111.6
LnGrp LOS	D	D	D	E	E	F	E	E	C	F	F	F
Approach Vol, veh/h		616			1125			1488			1192	
Approach Delay, s/veh		43.7			95.0			61.6			108.4	
Approach LOS		D			F			E			F	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.2	31.1	26.0	37.0	16.2	29.0	29.6	33.4
Change Period (Y+Rc), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Green Setting (Gmax), s	10.0	27.0	21.0	32.0	13.0	24.0	25.0	28.0
Max Q Clear Time (g_c+I1), s	8.8	17.1	22.0	32.1	9.7	25.0	24.1	29.0
Green Ext Time (p_c), s	0.0	1.4	0.0	0.0	0.1	0.0	0.1	0.0

Intersection Summary	
HCM 6th Ctrl Delay	80.2
HCM 6th LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	155	56	255	207	25	169	206	933	45	20	702	75
Future Volume (veh/h)	155	56	255	207	25	169	206	933	45	20	702	75
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	168	61	277	225	27	184	224	1014	49	22	763	82
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	541	534	453	394	36	453	204	1282	62	76	971	104
Arrive On Green	0.29	0.29	0.29	0.29	0.29	0.29	0.11	0.37	0.37	0.04	0.30	0.30
Sat Flow, veh/h	1383	1870	1585	1038	125	1585	1781	3450	167	1781	3237	348
Grp Volume(v), veh/h	168	61	277	252	0	184	224	522	541	22	419	426
Grp Sat Flow(s),veh/h/ln	1383	1870	1585	1163	0	1585	1781	1777	1840	1781	1777	1808
Q Serve(g_s), s	0.0	1.7	10.6	11.8	0.0	6.6	8.0	18.3	18.3	0.8	15.1	15.1
Cycle Q Clear(g_c), s	5.6	1.7	10.6	15.0	0.0	6.6	8.0	18.3	18.3	0.8	15.1	15.1
Prop In Lane	1.00		1.00	0.89		1.00	1.00		0.09	1.00		0.19
Lane Grp Cap(c), veh/h	541	534	453	430	0	453	204	660	684	76	533	542
V/C Ratio(X)	0.31	0.11	0.61	0.59	0.00	0.41	1.10	0.79	0.79	0.29	0.79	0.79
Avail Cap(c_a), veh/h	541	534	453	430	0	453	204	660	684	76	533	542
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.9	18.5	21.6	24.7	0.0	20.2	31.0	19.6	19.6	32.5	22.4	22.4
Incr Delay (d2), s/veh	0.3	0.1	2.4	2.1	0.0	0.6	92.5	6.5	6.3	2.0	7.6	7.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.8	1.3	7.2	7.0	0.0	0.1	13.7	12.3	12.6	0.7	11.0	11.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	20.2	18.6	24.1	26.8	0.0	20.8	123.5	26.1	25.9	34.5	30.0	30.0
LnGrp LOS	C	B	C	C	A	C	F	C	C	C	C	C
Approach Vol, veh/h		506			436			1287			867	
Approach Delay, s/veh		22.1			24.2			42.9			30.1	
Approach LOS		C			C			D			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.4	33.0		25.4	15.0	26.4		25.4
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	5.0	28.0		22.0	10.0	23.0		22.0
Max Q Clear Time (g_c+I1), s	3.8	21.3		13.6	11.0	18.1		18.0
Green Ext Time (p_c), s	0.0	2.6		1.5	0.0	1.7		0.7

Intersection Summary			
HCM 6th Ctrl Delay			33.3
HCM 6th LOS			C

Appendix E

Caltrans Interim Guidance

LOCAL DEVELOPMENT – INTERGOVERNMENTAL REVIEW PROGRAM INTERIM GUIDANCE

APPROVED – SEPTEMBER 2, 2016

Implementing Caltrans Strategic Management Plan 2015-2020
Consistent with SB 743 (Steinberg, 2013)

Table of Contents

I. Introduction and Background

Caltrans' Local Development-Intergovernmental Review (LD-IGR) program reviews land use and infrastructure plans and projects across the state for potential impacts and enhancements to the State's environment, natural resources and multimodal transportation system for the California public. Through the LD-IGR process, Caltrans advises Lead Agencies on what these impacts might be and ways to avoid, minimize, and/or mitigate adverse impacts. Caltrans also identifies land use and design strategies that may enhance connectivity and access to destinations. As required through a host of state and federal planning requirements, the LD-IGR program has historically supported smart growth policies designed to create vibrant communities with a sustainable multimodal transportation system. For example, the program's 2005 Deputy Directive 25-R1 states:

> *"The Department works to ensure that local land use planning and development decisions include the provision of transportation choices, including transit, intercity rail passenger service, air service, walking, and biking, when appropriate. The Department advocates community design (e.g., urban infill, mixed use, transit oriented development) that promotes an efficient transportation system and healthy communities."*

With the enactment of legislation such as AB 32 (2006), SB 375 (2008), SB 226 (2011), SB 743 (2013), etc. and the development of planning guidance such as the Smart Mobility Framework, Complete Streets Implementation Action Plan, the California Transportation Plan 2040, as well as Caltrans' adoption of its new mission, vision, goals and the Strategic Management Plan 2015 – 2020 (SMP), the LD-IGR program is strengthening its focus on transportation infrastructure that supports smart growth and efficient development. This is intended to help ensure that greenhouse gas (GHG) emissions reduction, good community design, improved proximity to key destinations, and a safe, multimodal transportation system are all integral parts of land use decision making throughout the state. Past LD-IGR practices primarily utilized Level of Service to identify various impacts to the State Highway System (SHS), and often limited its recommended mitigation to traditional road improvements. Although Caltrans recognized that Lead Agencies could implement other measures, such as improvements to other modes of transportation or incentive programs to encourage use of other modes, the Lead Agencies often rely on Caltrans' recommended measures. Going forward, efforts to fulfill our LD-IGR obligation should consider multimodal solutions to not only improve access to destinations for all system users (motorists, transit riders, bicyclists, pedestrians), but also encourage efficient land use that helps achieve the multitude of goals sought, including quality of life, economic prosperity, the development of multimodal networks, and GHG emissions reduction.

The LD-IGR program provides an important opportunity to encourage Lead Agencies to implement the goals and targets of the Caltrans Strategic Management Plan. By year 2020, the SMP calls for several specific targets related to the LD-IGR program:

- a doubling of walking and transit, and tripling of bicycle trips as a percentage of overall trips
- a reduction of per capita vehicle miles traveled (VMT) by 15%
- a reduction of the number of fatalities in each travel mode by 10% a year
- a reduction of GHG and other pollutants consistent with the Air Resources Board's AB 32 Scoping Plan and State Implementation Plan
- an increase of freight system efficiency by 10 %

- a reduction to an 8% rate of growth in Daily Vehicle Hours of Delay (DVHD) under 35 miles per hour on urban State highways

The SMP also contains several strategic objectives related to the LD-IGR program, including:

- reduce user fatalities and injuries by adopting a “Toward Zero Deaths” practice
- promote community health through active transportation and reduced pollution in communities
- effectively manage taxpayer funds and maximize the use of available financial resources
- improve the quality of life for all Californians by providing mobility choice, increasing accessibility to all modes of transportation and creating transportation corridors not only for conveyance of people, goods, and services, but also as livable public spaces
- reduce environmental impacts from the transportation system with emphasis on supporting a statewide reduction of greenhouse gas emissions to achieve 80% below 1990 levels by 2050
- improve economic prosperity of the State and local communities through a resilient and integrated transportation system
- improve travel time reliability for all modes
- reduce peak period travel times and delay for all modes through intelligent transportation systems, operational strategies, demand management, and land use/ transportation integration
- increase the number of Complete Streets features on State highways that are also local streets in urban, suburban, and small town settings
- improve collaborative partnerships with agencies, industries, municipalities and tribal governments and advance national engagement with the transportation research and policy committees

As highlighted in the guidance below, the LD-IGR program’s revised approach to commenting on plans and projects will help meet the goals and targets of the Strategic Management Plan. One important component to help achieve these goals is Caltrans’ current process of creating a statewide Transportation Analysis Guide (TAG) and completing a comprehensive update of our Transportation Impact Study Guide (TISG). The TAG-TISG will better inform transportation infrastructure investment and land use and infrastructure project impact analysis, bring Caltrans practices in line with state policy (including those policies named above), and bring Caltrans analysis practices up to state of the practice by providing a suite of methodologies, tools, and best practices. It will help public and private sector practitioners across the state perform the various types of analysis needed to identify multimodal transportation impacts from new land use, transportation, and infrastructure plans and projects.

In the interim, this Interim Guidance document intends to ensure that all Caltrans LD-IGR comments on growth plans, development projects, and infrastructure investments align with state policies through the use of efficient development patterns, innovative demand reduction mitigation strategies, and necessary multimodal roadway improvements. This is in addition to Caltrans’ long-standing commitment to maintain a safe, multimodal transportation system that provides access to destinations for all users. We also continue to recognize that under the California Environmental Quality Act (CEQA), it is ultimately the Lead Agency’s responsibility to perform a CEQA analysis, set local thresholds of significance, analyze potential impacts, determine significance, and identify, implement, and monitor any required mitigations.

This guidance supersedes the 2002 Caltrans Guide for the Preparation of Traffic Impact Studies in comments to local agencies. Instead of referencing the 2002 guide, Districts should make specific analysis requests of the Lead Agency when additional information is needed. The District can offer to provide the Lead Agency assistance in developing the scope of any analysis and answering questions. Headquarters

LD-IGR staff is also able to assist with scoping required analysis and developing recommended solutions for the Districts' and Caltrans' local and regional partners to consider.

In order to ensure alignment of Caltrans comments with state goals described above, LD-IGR comments henceforth should take into consideration whether the project exhibits low or high VMT (by place type e.g., urban, suburban, and rural areas) and should focus recommendations on smart land use, multimodal access, safety for all users, and reducing single occupant vehicle trips. Well planned urban infill projects which are located close to transit, bike and pedestrian facilities (see Appendix A: Project Type 1), which also have proximity benefits to employment centers, services and goods – will reduce travel demand on the entire transportation system and will therefore require significantly less review and mitigation than rural fringe projects (Project Type 5), which generate proportionately higher number of trips and vehicle miles traveled.

Senate Bill 743 (2013) mandated that CEQA review of transportation impacts of proposed development be modified by eliminating consideration of delay- and capacity- based metrics such as level of service (LOS) and instead focusing analysis on another metric of impact. The Governor's Office of Planning and Research (OPR) is currently updating its CEQA Guidelines to implement SB 743 and is proposing that vehicle miles traveled be the primary metric used in identifying transportation impacts. OPR has released a separate "Technical Advisory" outlining recommended techniques for measuring impacts with this new metric, which applies statewide. The General Plan Guidelines are also concurrently being updated to align with state policy, including SB 743.

The need to evolve LD-IGR comments on local development transportation analysis and local development mitigation responses was articulated in a California State Transportation Agency (CalSTA) commissioned review of Caltrans practices in the State Smart Transportation Initiative (SSTI). Their January 2014 report stated that *"SB 743 could do more to advance state planning goals than anything else Caltrans has done", and "would put California and Caltrans back at the leading edge of modern transportation practice ….. It would begin to make Caltrans a real contributor to the success of modern policy in the state, and it would provide a model for how the staff could help implement a challenging new charge."* A December 2014 report titled *A Follow-Up to The California Department of Transportation: SSTI Assessment and Recommendations* noted that OPR, CalSTA and Caltrans have been collaborating closely on remaining CEQA rulemaking issues, such as "*to manage operational challenges, namely where congested exit ramps may back up onto freeways, in a way that is not simply level of service by another name, failing to deliver the relief to infill development as the law directs. The draft rulemaking would also base mitigation on a development's total vehicle-miles generated."*

The TAG-TISG will also help implement Caltrans Strategic Management Plan 2015-2020 objectives consistent with SB 743 changes to CEQA. The TAG-TISG focuses transportation analysis on VMT impacts, assessing impacts from growth plans and development projects on the multimodal transportation network, and quantifying VMT and GHG reductions achieved through smart mobility principles and Transportation Demand Management (TDM) strategies. Until the TAG-TISG is complete, the Interim Guidance provided herein is intended to help ensure that District LD-IGR comment letters evolve to carry out state law, reflect the State's strategic safety goals and planning priorities, and align with California's climate change goals.

Purpose of this Interim Guidance

With the Strategic Management Plan objectives and SB 743's changes to CEQA, LD-IGR coordinators and functional reviewers will transition away from using delay based analysis, such as LOS or similar measures of vehicular capacity or traffic congestion, to determine the impacts of land use and infrastructure plans and projects. Instead, they will identify opportunities for reduced VMT generation, advise Lead Agencies on maintaining safe operations, and provide recommendations on developing location-efficient (e.g., centrally located, infill) and travel-efficient (e.g., inclusion of TDM measures) land use.

This Interim Guidance will remain in effect until superseded by Caltrans Transportation Impact Study Guidelines (TISG), currently under development.

Henceforth, LD-IGR comment letters should reflect the "top six" elements discussed below, as well as the more detailed guidance in the accompanying appendices. It is important to note that this Interim Guidance is intended to be the overarching policy and guidance of the LD-IGR program, aside from any Director's Policies or Deputy Directives. The Headquarters LD-IGR program will be updating guidance and training to be aligned with the Strategic Management Plan 2015-2020 lens over the upcoming months. If reviewers notice any discrepancies in policy and direction between the existing guidance on the Caltrans intranet and this Interim Guidance, please notify the LD-IGR program manager for further direction. Similarly, if reviewers experience any difficulties in applying this Interim Guidance to individual development-related plans, programs, or projects, they are encouraged to contact Alyssa Begley, SB 743 Program Implementation Manager, for assistance on a statewide perspective, and suggested solutions that might be useful.

Active participation by the Districts in regularly scheduled LD-IGR Teleforum meetings with Headquarters will also help District staff keep abreast of emerging methodologies, relevant examples, and current events that may further inform this Interim Guidance while OPR's CEQA Guidelines Update and Caltrans' TAG-TISG Update are in progress.

The existing LD-IGR program's intranet guidance and the technical resources are found at:
http://transplanning.onramp.dot.ca.gov/local-development-intergovernmental-review-ld-igr-branch

II. Key Elements to Include in LD-IGR Letters

This section summarizes the "top six" elements to emphasize when reviewing development plans and project proposals for transportation impacts and when drafting LD-IGR comment letters. The following appendices provide explicit guidance, technical considerations, and template language for District LD-IGR coordinators and functional reviewers to incorporate as needed.

A. Comment on Vehicle Miles Traveled associated with the project.

Reviewers should comment on vehicle miles traveled resulting from the land use project, applying local agency thresholds or absent those, thresholds recommended by the most recent draft of OPR's CEQA Guidelines and Technical Advisory. If an assessment of VMT is not presented, Caltrans should request it be presented. Though SB 743 clarifies requirements for transportation analysis, a VMT analysis is already needed to meet other CEQA requirements.[1] Methods for assessing VMT should be compared to the methods recommended in the OPR Technical Advisory. Where methods are not consistent with the recommendations in the Technical Advisory, Caltrans should comment on those methods. Where the project exhibits less than threshold VMT, Caltrans comments should acknowledge the project's transportation efficiency. Where the project exhibits greater than threshold VMT, Caltrans should request mitigation. Examples of mitigation measures are included in the OPR Technical Advisory. Contact the SB 743 Program Implementation Manager, Alyssa Begley, for assistance with VMT calculation.

B. Rather than providing recommendations that primarily accommodate motor vehicle travel, provide recommendations that strive to reduce VMT generation; improve pedestrian, bike, and transit service and infrastructure; and which don't induce additional VMT.

As demonstrated by the template language provided in Appendix C of this Interim Guidance, it is important that Caltrans comment letters express the intent and purpose of the LD-IGR program and Caltrans' review of land use and infrastructure plans and projects through the new lens of the Caltrans Strategic Management Plan 2015-2020. In other words, providing recommendations for solutions that reduce automobile travel rather than recommendations that accommodate more of it. For example, consider the following sample paragraph intended for letter introductions:

> *"The mission of Caltrans is to provide a safe, sustainable, integrated, and efficient transportation system to enhance California's economy and livability. The Local Development-Intergovernmental Review (LD-IGR) Program reviews land use and infrastructure plans and projects through the lenses of our mission, vision, and goals as guided by the State's planning priorities of prioritizing infill, conservation, and efficient development."*

Consider also the following paragraph intended to discuss demand reduction and mitigation strategies:

> *"Caltrans seeks to reduce vehicle trips and new vehicle miles traveled associated with development and recommends appropriate measures to avoid, minimize, or mitigate transportation impacts through smart mobility community design and innovative multimodal demand reduction strategies."*

C. Focus on travel efficiency

Coordinators and reviewers should use the terms *"transportation impact study"* rather than *"traffic impact study"* and note that the study should analyze all modes. Such terminology helps developers, decision makers, and the public better understand that Caltrans seeks a holistic perspective on the infrastructure (roadways, bicycle facilities, sidewalks, transit stations, etc.), the service (e.g. transit, rail, etc.) needs, opportunities for closer proximity to key destinations, and other factors that may be created by growth plans and development projects under review. This language acknowledges and builds upon the multimodal perspective taken by the LD-IGR program since its inception, but not always followed in practice. This approach will also help shape the analysis techniques applied to the review so that the right kinds of data and analyses are provided for consideration. For example, Districts should help the Lead Agency contextualize the project by describing not just what and where it is, but also

[1] See CEQA Guidelines §15064.4 (analysis of greenhouse gas emissions) and Appendix F (requiring analysis of "the project's projected transportation energy use requirements and its overall use of efficient transportation alternatives". See also California Clean Energy Committee v. City of Woodland (2014) 225 Cal. App. 4th 173, 210.

how those factors relate to both the multimodal transportation system and parallel objectives such as job creation, resource and open space conservation, or housing affordability—especially for projects and plans that generate high VMT. If the project is on the suburban edge of a region or far from transit, it is likely to induce more VMT than an infill project. In assessing how the project might be able to reduce its VMT generation, it is also critical to understand how the project can enhance a multimodal transportation network, how the project may increase access to key destinations (by foot or bicycle), and what aspects of the system can be utilized as feasible TDM mitigation measures. See Appendix D for additional information.

Districts should be cognizant of land use economics when reviewing local development projects in order to be mindful of all factors that lead to viability of individual project, more specifically, for projects that generate less overall vehicle miles traveled.

Districts are strongly encouraged to work with Lead Agencies to address transportation deficiencies and enhancements through policies at the planning level and through mitigation fee programs. Districts should still encourage Lead Agencies to share plans and projects for review that directly abut the SHS, are in vicinity of a State Highway, or projects for which Caltrans must approve and issue an encroachment permit.

Headquarters LD-IGR staff recognizes that this type of analysis will be a dramatic shift in process for Caltrans, and that Headquarters programs, District coordinators, and functional reviewers will need extensive training to adapt to the new analysis methods. Headquarters LD-IGR staff will coordinate with the Districts to ensure additional training and tools are provided throughout the Department. If Districts have training requests or concerns, please contact their Headquarters LD-IGR coordinator.

D. Remain neutral on project purpose while framing recommendations for mitigation of the project's impacts within statewide policy.

Commenting on local development can be controversial and should be written in a tone that promotes partnership, promotes collaboration, focuses on technical aspects of plans and projects, and is deferential to the Lead Agency's discretionary authority. However, Caltrans has a responsibility to advance the state's legislative priorities and carry out its role as a Responsible or Commenting Agency under CEQA. In order to strike this balance, our response letters should convey Caltrans' desire to be an active partner in Lead Agencies understand the transportation implications of development and to assist Lead Agencies in shaping projects to make more efficient use of our transportation system. Districts may choose to, for example:

- State whether the project is location-efficient (e.g. transit-oriented infill), with safe and adequate access to a multimodal transportation system and key destinations, that will help the state meet its GHG reduction targets under AB 32; or if it is sprawl that will increase VMT and regional emissions. As described in Section A above, ascertain VMT per OPR's guidance. Residential development should be assessed on a per capita basis. Office development VMT should be assessed on a per employee basis. Retail project VMT should be assessed on an absolute basis, but need not be calculated for local-serving retail (which generally reduces VMT). Land use project VMT should be compared to thresholds created by the local agency. In the absence of local agency thresholds, use recommendations in OPR's Technical Advisory, i.e., 15 percent below overall regional or city VMT per capita for residential projects, 15 percent below regional VMT per employee for office projects, and any increase in overall VMT for retail (further details can be found in the Technical Advisory). For residential and office development, VMT Maps produced by either regional travel demand models, or the California Statewide Travel Demand Model may be used as a shortcut to estimating VMT. VMT Calculation training will be made available to District staff. Sample language is provided in Appendix C.

- Note if the project is consistent or inconsistent with the growth patterns and future infrastructure features identified in the General Plan or Master-Specific Plans, as well as Regional Transportation Plans (RTP) or Sustainable Community Strategies (SCSs).
- Note if the project is consistent or inconsistent with State planning priorities of infill, conservation, and efficient development. For more information on the State's planning priorities, see the text from AB 857 (2002) and SB 226 (2011).

While it is not necessary to "take a stand" by commenting on a Lead Agency's actual decision to adopt a plan or approve-deny a project, comment letters should express findings of consistency or concern related to the implications and impacts, particularly VMT impacts, of development projects. And remember, Caltrans can recommend plan changes or project re-design where impact avoidance or minimization could be achieved. For example, a high-VMT-inducing edge development may consider walking or biking connectivity around a new major transit station with high-quality transit service (see SB 375), or if such a transit station is not present or planned, then around a neighborhood town center. Similarly, a jurisdiction or developer might be able to take advantage of reduced parking requirements or affordability density-bonus credits for projects located in infill areas to achieve a more efficient growth pattern. Such suggestions can point to a "win-win" by substantially reducing the plan's or project's VMT generation while still meeting the developer and Lead Agency's overarching economic and community development objectives. Our comment letters should note when Caltrans has had discussions in person with Lead Agency staff.

E. Be collaborative – Create paths for workable solutions and overcome roadblocks.

Cities, counties, and developers, as well as Regional Transportation Planning Agencies (RTPAs), Metropolitan Planning Organizations (MPOs), transit and inner-city rail operators, and a wide array of employers and service providers across the State face increasing pressures to accommodate California's population growth with limited funding, while also facing environmental and community-acceptance constraints. Caltrans, through our LD-IGR role, can work collaboratively to assist these agencies. Comment letters should not just identify potential concerns or problems, but offer suggested solutions that could be taken toward their resolution.

District staff should proactively establish early consultation in the planning and development project process. For example, request face-to-face meetings with Lead Agencies and project proponents to discuss how state law and the multimodal policies in city/county General Plans and RTPA/MPO RTPs and SCSs apply to the development project being reviewed or plan amendments being considered. This would allow both plan-level and project-specific technical concerns to be conveyed and, if possible, resolved with Lead Agencies as part of on-going information sharing. Such meetings can be used to link "early" and "late" steps in the development approval process by identifying potential planning policies and avoidance or minimization strategies, and developing mitigation implementation programs that help achieve Caltrans Strategic Management Plan 2015-2020 objectives and other state goals. Specifically, Districts should perform robust review of the land use and transportation analysis contained in the transportation impact studies for the environmental impact reports performed on General Plans, Specific/Master/Community plans, Regional Transportation Plans, Sustainable Community Strategies, etc.. This affords District staff a better understanding of how individual "streamlined" developments and infrastructure investments "tier" off of the analysis in plan- or program-level EIRs and provides opportunities for Caltrans to encourage and help shape new VMT-based impact fees.

F. Comments related to impacts to the State Highway System (SHS) will be focused on VMT impacts not delay or effects on road capacity.

Transportation analysis under CEQA is evolving, in part because of SB 743, to measure impacts using vehicle miles traveled. Similarly, Caltrans has adopted Strategic Management Plan goals related to reducing VMT per capita and increasing use of non-auto modes. Therefore, in reviewing project proposals and related CEQA documents, LD-IGR will focus its comments on reducing demand on the SHS as measured with VMT. Caltrans continues to be responsible for ensuring that encroachments on or changes to the SHS are designed to provide for safe operations.

The use of LOS as a CEQA threshold of significance will soon be disallowed and replaced with vehicle miles traveled. SB 743 did not alter a Lead Agency's responsibility to "analyze a project's potentially significant transportation impacts related to air quality, noise, safety, or any other impact associated with transportation."[2] Any information requests should be consistent with the guidance found in Appendices A and B.

This section will not address specifics of how to conduct an operational impacts analysis for all modes of transportation. This section is focused on the general policy, tone, and approach.

Improvements on conventional roadways should, as appropriate to the context, emphasize a complete streets approach to improvements (improvements such as lane width reduction, landscaped medians, pedestrian bulb outs, etc.) and should avoid increasing automobile capacity and/or other measures that would significantly increase VMT.

Suggested improvements to address operational impacts should not result in increased speeds that are not suitable for vulnerable users on the conventional facility. Operational impact improvements should be appropriate to the context and consistent with complete streets principles wherever feasible. Capacity improvements to freeway ramps and freeway mainlines to address operational impacts should be a last resort. Improved crosswalk signal timing, intelligent transportation systems improvements, enhanced signage, roadway designs that result in reduced speed limits, and other effective methods that do not significantly increase VMT should first be explored as potential solutions.

[2] A safety-related transportation impact under CEQA is not the same as, and does not establish, an unsafe condition. Instead, the CEQA determinations are based on modeling and projections of potential future conditions and any mitigation is focused on making conditions safer.

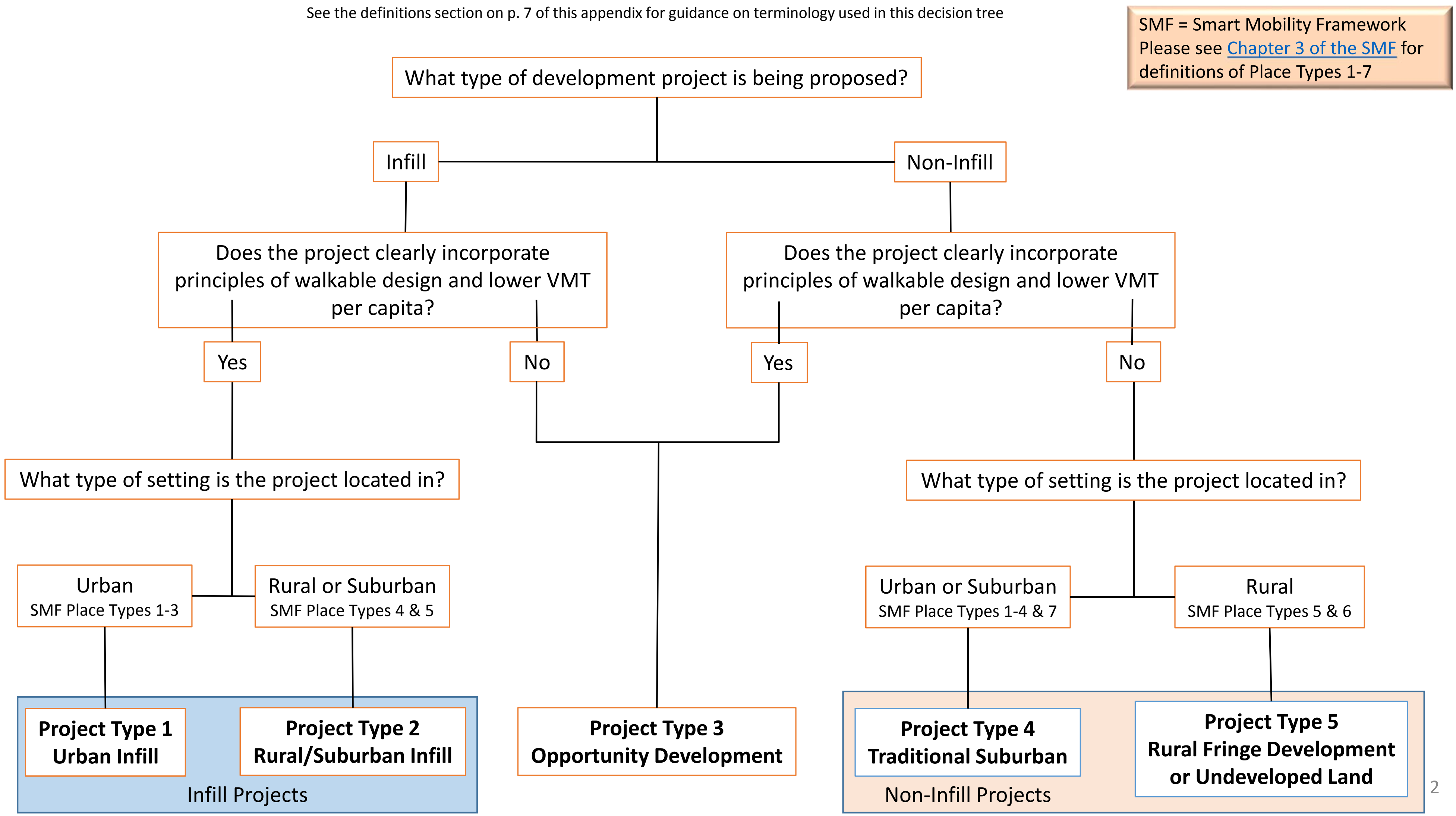
Appendix A: Recommended Guidance for Site-Specific Development Project Review

Please use this flow chart and the guidance following it to determine whether to comment on site-specific projects and what types of comments to make based on the type of project and its location. Reviewers should first consider the project's geographic setting and whether projects are located in an infill location, have a walkable project design, and assess VMT generation (definitions of key terms are at the end of this appendix). Projects may not fall perfectly into the place type categories below, so please use your best judgment on types of comments to make. We recognize every project is different.

Before sending a comment letter, the District LD-IGR coordinator should consider what the main objective of sending a letter is, what point of the process the project is in, and if it is necessary to even make comments. A request for additional analysis should be followed by an explanation of why that analysis is needed. If we request a Lead Agency to provide additional analysis on how a project impacts the SHS, we should articulate our concerns. Districts should not just ask for studies or analysis for projects just to have the information. For high-VMT projects, comments should have a primary focus on helping a project reduce VMT loaded onto roadway networks, including the State Highway System.

LD-IGR Site-Specific Development Project Review Decision Tree

See the definitions section on p. 7 of this appendix for guidance on terminology used in this decision tree



Guidance for Site-Specific Development Project Review by Place Type

	Urban Infill Project Type 1	Rural/Suburban Infill Project Type 2	Opportunity Development Project Type 3	Traditional Suburban Project Type 4	Rural Fringe/ Undeveloped Land Project Type 5
a. General Review Approach	• Generally Districts should have minimal comments (or no comments) on Type 1-2 because they are well planned infill projects which are located close to transit, bike and pedestrian facilities which also have proximity benefits to employment centers, services, and goods will reduce travel demand on the entire transportation system and will therefore require significantly less review and mitigation than rural fringe projects (Project Type 5) which generate proportionally higher number of trips and vehicle miles traveled. Districts should coordinate with SB 743 Program Implementation Manager when developing letters for Type 1 land use projects. • Consistent with the new Caltrans mission, vision, and goals, and other statewide laws and policy, projects meeting Type 1-2 criteria typically minimize the overall demand on the SHS compared to what would be built in their place to accommodate demand. • Infill projects have the benefit of proximity to employment, services, and retail that helps reduce trip length and increase accessibility for all modes. • While in some cases, projects with a walk and bike friendly design may actually increase regional VMT in rural areas, projects in town centers that incorporate pedestrian friendly designs could encourage more trips by walking, biking, and transit for local residents. Districts may still encourage project construction traffic to avoid peak hours when specific non-delay operational concerns arise.		• Opportunity development projects are similar to those in Type 1 and Type 2, but they are typically designed in such a way that is traditional suburban type development that happens to reduce VMT due to its location. Or they are projects on the fringe of urban areas designed in a way that minimizes VMT impacts. • Districts may encourage the Lead Agency to improve pedestrian connectivity both within the project and its connections to surrounding areas. The Districts may also encourage a reduction in parking spaces (when warranted), and potentially reorienting the development so that parking lots are not located between buildings and the streets. • If some of the individual components of the project exceed VMT thresholds on page 6 of this appendix (when accounting for mixed-use trip reduction), then Districts can encourage transportation demand management (TDM) measures. See the Appendix D section on Demand Management for suggestions on TDM. • Other projects that typically do not generate permanent traffic (such as levee repairs, signs, pipelines, solar farms, etc.) should follow existing LD-IGR guidance. Comments related to these types of projects should not focus on congestion.	• Type 4 and 5 projects generally are considered traditional suburban or rural fringe development that generate higher VMT, and do not encourage walking or biking by their project design. • Districts should make comments on ways projects can minimize VMT generation to meet VMT reduction goals from SB 743 and assist the State in meeting GHG reduction targets. Caltrans should press for significant connections to existing pedestrian, bicycle, and transit infrastructure to avoid a development relying solely on the existing local roadway system or State Highway System. • Districts are also encouraged to use the Smart Growth Principles language suggested in the Appendix C: Recommended Language that identifies whether or not a project incorporates smart growth principles. • Districts should make comments on ways the projects can improve internal circulation for all modes, better integrate with other nearby land uses, and provide a network of complete streets that benefits all users of the transportation system.	

Guidance for Site-Specific Development Project Review by Place Type

<table>
<tr><th></th><th>Urban Infill

Project Type 1</th><th>Rural/ Suburban Infill
Project Type 2</th><th>Opportunity Development
Project Type 3</th><th>Traditional Suburban
Project Type 4</th><th>Rural Fringe/ Undeveloped Land
Project Type 5</th></tr>
<tr><td>b. Multimodal Operational Impacts Analysis</td><td>For purposes of this Interim Guidance, projects in Urban Infill areas are presumed to have multiple community benefits that include multimodal mobility, increased access, and safety for all users. Urban Infill projects also tend to increase pedestrian and bicycling travel, which promotes livable and healthy communities. This is important to note, because an important goal of this guidance is to help implement statewide objectives to minimize VMT generation and reduce GHGs--which research suggests infill development helps accomplish.
Well planned infill projects which are located close to transit, bike and pedestrian facilities which also have proximity benefits to employment centers, services, and goods will reduce travel demand on the entire transportation system and will therefore require significantly less review and mitigation than rural fringe projects (Project Type 5) which generate proportionally higher number of trips and vehicle miles traveled.
In cases where the Districts have specific substantial evidence that operational impacts or safety concerns exist, the Districts should work with the Lead Agency to identify the appropriate analysis needed, ways it can be provided, and how the operational impacts can be addressed.
Districts are encouraged to work with Lead Agencies to proactively address relevant transportation concerns at the plan-level or corridor-level; this helps ensure that the Department is able to carry out its responsibilities as owner/operator of the SHS without having to ask for additional project-level analysis when individual Urban Infill developments move forward to approval, if it is not needed.
Consideration should be given to the context of the area in relation to the SHS. Comments related to operational impacts should not be used as a mechanism to increase capacity of the roadway--they should only be made to address specific operational impacts as defined above. Districts should coordinate with SB 743 Program Implementation Manager when developing letters for Type 1 land use projects.</td><td colspan="4">While an important overall goal of this guidance is to minimize VMT generation, many new development projects will increase traffic in a localized area and could create or exacerbate operational concerns that may increase the potential for future collisions (operational impacts).
When necessary, the Districts should still analyze a project’s potential operational impacts and impact of significant increases of VMT on walkers, bikers, and drivers using the SHS.
Well planned infill projects which are located close to transit, bike and pedestrian facilities (see Appendix A: Project Type 1), which also have proximity benefits to employment centers, services and goods – will reduce travel demand on the entire transportation system and will therefore require significantly less review and mitigation than traditional suburban projects (Project Type 4), and rural fringe projects (Project Type 5), which generate proportionately higher number of trips and vehicle miles traveled. Caltrans should press for significant and safe connections to existing pedestrian, bicycle, and transit infrastructure to avoid a Project Type 2-5 relying solely on the existing local roadway system or State Highway System.
In cases where multimodal operational impact analysis is needed, but it is not provided, the Districts should work with the Lead Agency to identify the appropriate analysis needed and ways it can be provided. To date, no state law has exempted project proponents from performing a safety analysis for all transportation modes. That does not mean that project proponents necessarily need to perform an analysis. Consideration should be given to the context of the area in relation to the SHS.
The Districts can also ask for construction traffic management plans. See Appendix C for sample language.</td></tr>
</table>

Guidance for Site-Specific Development Project Review by Place Type

	Urban Infill Project Type 1	Rural/Suburban Infill Project Type 2	Opportunity Development Project Type 3	Traditional Suburban Project Type 4	Rural Fringe/ Undeveloped Land Project Type 5
c. Pedestrian, Bicycle, and Transit Facilities	For projects that directly abut the SHS, agreements may be required for maintenance of pedestrian facilities. The Districts are strongly encouraged to advocate in comment letters for completing a network of pedestrian walkways along the SHS where feasible and appropriate to the context. The Districts should make efforts to familiarize themselves with local agencies' policies and design standards and work with project proponents early to resolve any design or safety-related issues for the walkways. Bicycle and transit facilities within the Caltrans ROW should also be considered and encouraged on a case-by-case basis. Agreements with other agencies may be necessary.				
d. Fee Programs	The Districts can request that projects pay into established fee programs (mandatory or voluntary programs are ok). Districts are encouraged to promote projects or improvements within the fee programs that help reduce VMT and enhance efficient access to destinations when feasible. Programmatic fee programs to address operational impacts are also encouraged to help avoid individual development projects avoid triggering direct operational impacts; this is especially important for Project Type 1-2.				
e. Level of Service (LOS) Related Comments Aimed at Reducing VMT	Not applicable		Some jurisdictions have set LOS thresholds for the SHS either through plans or by ballot measures and will provide this analysis during project review. Until the TAG-TISG is completed, Districts can make technical comments about a Lead Agency's deficiencies in LOS analysis of the SHS when a project is inconsistent with smart growth principles ("sprawl"). In this circumstance, the District can also point out LOS deficiencies on the SHS and request mitigation that minimizes new VMT on the SHS. Please note that the District should suggest capacity increasing improvements sparingly. Comments can focus on operational impacts and should be consistent with complete streets principles. Particularly for Project Type 3-5, Districts should assist the Lead Agency in identifying appropriate demand reduction measures by listing specific programs (see Appendix D – Section A "Demand Management")		
f. ROW Preservation	In areas where Caltrans system planning documents are aligned with local plans that call for the eventual widening of the SHS, Caltrans may find it necessary to make comments about preserving that ROW. The context of the situation is critical. District staff should consult with System Planning to maintain consistency with any existing local plans to enhance the livability and neighborhood connectivity of a State Highway segment, and determine whether Caltrans is working with a local agency to relinquish that portion of the State Highway.				
g. Responsible Agency	Caltrans is a Responsible Agency under CEQA when we have to approve and issue an Encroachment Permit for a local development project. We are a Commenting Agency when the local development project does not require an Encroachment Permit. Districts should inform the Lead Agency when an Encroachment Permit is required as early as possible in the local development project's process. District Planning should coordinate with District Encroachment Permits regarding which local development projects are not required to provide a transportation analysis. The Encroachment Permit process still requires some level of transportation analysis. Particularly for infill, the level of analysis required should balance the engineer's need for information with monetary costs incurred by the project. Time and money will be saved if Caltrans and the Lead Agency discuss the analysis needs for the Encroachment Permit as early as possible. See the "Encroachment Permits" section in Appendix C for language that should be included in a comment letter.				

Guidance for Site-Specific Development Project Review by Place Type

	Urban Infill Project Type 1	Rural/Suburban Infill Project Type 2	Opportunity Development Project Type 3	Traditional Suburban Project Type 4	Rural Fringe/ Undeveloped Land Project Type 5
h. Projects in Close Proximity to the SHS	The Districts should consider commenting on projects that border or are within a few hundred feet of Caltrans ROW. Some specific examples include projects that may have hydraulic impacts to the SHS, ROW Engineering concerns, sound wall placement along freeways, and other cases. For projects that border or plan any work within the state highway system ROW, Districts should comment about the potential need for an encroachment permit. The Lead Agency and developers appreciate being made aware of issues that could affect the cost, scope, or schedule of the project. We recommend working with Lead Agencies as early in the process as possible to resolve issues before CEQA-stage documents are released for public review and comment. The tone in the letters should be of a cooperative approach.				
i. Parking	If District staff notice an excessive number of parking spaces, greater than required by local zoning, associated with a development related to its context (i.e., in places with excessive amounts of underutilized parking nearby, in places with very high transit connectivity, etc.) the District may choose to comment that a reduction in parking may help reduce VMT and development project costs. Note that AB 744 (2015) identifies maximum parking ratios for affordable housing projects located within one-half mile of a major transit stop, and affordable housing projects outside of those locations.				

Questions to Consider for VMT Impacts

Questions to consider for VMT impacts:
Reviewers should comment on vehicle miles traveled resulting from the land use project, applying local agency thresholds. Or absent those, apply thresholds recommended by the most recent draft of OPR's CEQA Guidelines and Technical Advisory.

a) Will residential components of the project lower both the citywide (or countywide) and the regionwide existing VMT per capita by at least 15%?
b) Will office components of the project lower existing VMT per employee across the region by at least 15%?
c) Will retail components of the project decrease total VMT (note: can presume local serving retail will)?
Note: These questions are consistent with the most recent draft of the OPR Technical Advisory Implementing SB 743.

If the answer is no to any of the above questions (when accounting for internal trip capture for mixed use projects), then it may be appropriate to request the Lead Agency to minimize VMT generated by a project. See Appendix D for Transportation Demand Management suggestions.

Definitions of Key Terms

Infill Site: According California Public Resources Code Section 21061.3, an infill site is defined as "a site in an urbanized area that meets either of the following criteria: (a) The site has not been previously developed for urban uses and both of the following apply: (1) The site is immediately adjacent to parcels that are developed with qualified urban uses, or at least 75 percent of the perimeter of the site adjoins parcels that are developed with qualified urban uses, and the remaining 25 percent of the site adjoins parcels that have previously been developed for qualified urban uses. (2) No parcel within the site has been created within the past 10 years unless the parcel was created as a result of the plan of a redevelopment agency. (b) The site has been previously developed for qualified urban uses." For purposes of LD-IGR evaluation, whether or not a project is considered infill should also be considered with its effects on VMT. If it is unclear whether a project is infill or not, if a project induces high-VMT, the District should treat the project as a Type 3 Opportunity Development. Taking projects through the project place type decision tree above may help in determining the types of comments to make on the project.

Walkable Project Design**:** There is no perfect definition of what comprises a project with good walkable design. However, there are resources that help define some of the principles of walkable design. The San Francisco Planning and Urban Research Association (SPUR) has developed seven principles of walkable urban districts that may be useful to District staff to help understand what walkable design incorporates: create fine-grained pedestrian circulation; orient buildings to street and open spaces; organize uses to support public activity; place parking behind or below buildings; address the human scale with building and landscape details; provide clear, continuous pedestrian access; and build complete streets. A project does not necessarily have to incorporate all of these principles to be considered having walkable design, but it should incorporate almost all of them.

Operational Impacts: When new development may create or exacerbate operational concerns that may increase the potential for future collisions. A safety-related transportation impact under CEQA is not the same as, and does not establish, an unsafe condition. Instead, the CEQA determinations are based on modeling and projections of potential future conditions and any mitigation is focused on making conditions safer.

Place Types**:** Districts should not be too concerned with whether or not a project is considered rural, urban, or suburban to navigate the decision tree. What matters more is the project design and the VMT generated by the project (i.e., which project type box is selected). The Districts can also use the Smart Mobility Framework (SMF) Place Types to help navigate the decision tree. The SMF Place Type descriptions are located in Chapter 3 of the SMF. The SMF Place Type numbers on the decision tree correspond to the numbers in Chapter 3.

Appendix B: Recommended Guidance for Plans and Programs Review

There are many different types of plans (General, Specific, Community, Regional Transportation, Watershed, Air Quality to name a few) and programs that LD-IGR reviewers receive. To cover all the different types of them would defeat the purpose of keeping this guidance brief and just providing an overall policy framework.

OPR's Technical Advisory provides guidance on VMT-based impact analysis and mitigation. An array of research is available on this topic, much of which is summarized and packaged for deployment in the California Air Pollution Control Officers Association (CAPCOA) Quantifying Greenhouse Gas Mitigation Measures document (which focuses also on VMT). Further, HQ will post Technical Bulletins on Onramp as further information becomes available. In the meantime, HQ will provide the Districts with an SB 743 notification letter template for transmittal to Lead Agencies explaining what SB 743 requires them to consider, noting how Caltrans can assist, and stating that OPR is drafting an update of its CEQA Guidelines in order to spell out the new requirements in more detail.

It is important to note that one of the likely outcomes of SB 743 implementation will be the closer alignment of project-specific impact analysis and mitigation with the regional growth and program-level management strategies identified through the regional and systems planning process. Through regional and system planning efforts, the existing transportation system is analyzed and future improvements are planned to improve human mobility and system operations based on the regional population growth and mobility needs identified through city and county General Plans, RTPs/MTPs, etc. For example, when District system planners update Transportation Concept Reports (TCR), District System Management Plans (DSMPs), and Corridor System Management Plans (CSMP), coordination with LD-IGR is an opportunity to reflect long range growth plans, development projects, and regional improvement plans identified in regional planning documents. Similarly, when LD-IGR coordinators are reviewing development plans and projects, coordination with regional and system planning can be used to identify ultimate ROW setbacks, access management restrictions, planned frontage improvements, and facility improvements identified in system planning documents that should be factored into a project's site plan and mitigation measures.

Particularly at a project level, we want to avoid disadvantaging the last-in development. Caltrans (as well as other agencies) is sometimes criticized for being a barrier to local infill development by asking for costly studies or mitigation. In order to achieve equity in transportation financing and not place unreasonable burdens on site-specific development projects that advance state goals of smart growth and reduced greenhouse gas emissions, Caltrans should work with Lead Agencies to address impacts to the SHS at the plan level and in fee programs. In general, plans and programs can be an extremely important and efficient mechanism to identify and mitigate issues at a macro level and thus avoid issues with the site-specific project analysis. VMT reduction can have substantial safety benefits, so Districts should emphasize VMT reduction in their comments on lead agency plans or programs.

One way Districts can work with their partners to address mitigation issues is to proactively and directly participate in the development of comprehensive plans (e.g. General Plans, Master Plans, Specific Plans, etc.) and mitigation implementation programs (regional advance mitigation programs, impact fee nexus plans and capital improvement plans, etc.). For instance, a local agency could forecast expected development, identify needed transportation improvements that provides safe access for all modes (like lowering speeds at interchanges, mid-block crossings for pedestrians, cycle tracks for bicyclists, bus bays, added transit capacity, etc.), create cost estimates for those improvements, and create a financing program that development projects pay into to implement those improvements. Then local development projects would simply pay their fair share toward those improvements. There are many examples around the state where local agencies have established fee programs to pay for improvements. One example of a plan and fee program that does comprehensively address transportation needs (including safety and multimodal improvements) based on projected development is the Martell Triangle Plan in Amador County.

This process may also be beneficial for Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) and CEQA streamlining. The District should work with the MPO to address potential safety issues and needed mitigation in the RTP/SCS, in an effort to establish a corresponding fee program is established to pay for those improvements; then local development projects could simply pay fair share toward those improvements based upon their proportional impact and therefore would not need to perform any additional analysis of the SHS during the environmental review process if they met the CEQA streamlining provisions of the RTP/SCS. Please contact the HQ LD-IGR program manager for assistance with individual development projects tiering from programmatic-level CEQA documents.

LD-IGR coordinators should be proactively engaged in the regional and system planning processes and provide comments on the development of General Plans, Specific Plans/Master Plans, RTPs, and SCSs or Alternative Planning Strategies that integrate policies, priorities, and projects identified in TCRs, DSMPs, and CSMPs. Reviewers should advise lead agencies of any regional or system planning implications related to their travel demand models and RTP/SCSs-General Plans. Specifically, coordinators should also ask lead agencies if their regional models and Transportation Impact Mitigation (TIM) fee programs reflect long-range multimodal system improvements. In coordinating these efforts with System Planning, coordinators should be focused on helping lead agencies integrate their plan's or project's mitigation measures with corridor and system level management strategies and planned multimodal improvements on specific facilities. The Districts may also need to work with lead agencies on preserving ROW in some SHS corridors for future improvements and ensure consistency with Caltrans system planning documents.

Similarly, when evaluating proposed mitigation measures, reviewers should analyze the potential effects of induced travel (both VMT and GHG increases) resulting from any roadway capacity expansion improvements intended to reduce congestion. Reviewers should also evaluate the potential for connectivity improvements, such as internal circulation within a development or local roadway extensions-connections, to reduce VMT and GHG emissions by providing more efficient land use and direct routes between locations.

The intention for this integration should be conveyed to cities and counties through on-going communication and specifically requested at the Initial Study stage for growth plans, financing programs, and development projects. In order acquire the necessary data, to provide peer review, and in cases where District staff may need to assist lead agencies in performing these evaluations, LD-IGR coordinators should ask the regions to share their model platforms through a Model Users Agreement (contact HQ for examples) and Caltrans should share the California State Transportation Demand Model. Coordinators should also request copies of any sub-area models that might be developed for Traffic Operations Reports required in the capital project delivery process as these may include additional levels of refinement not available in regional models. Depending on the answers received, coordinators should recommend changes to ensure that planned plan-level and project-specific mitigation measures are consistent with adopted regional and system plans. If needed, coordinators should recommend changes to ensure that local and regional TIM programs include multimodal improvement intended to <u>reduce</u>, rather than <u>induce</u> VMT. Districts should create an electronic archive of the models they ask for and receive from local partners.

Districts should, when appropriate, request that local agencies provide a multimodal transportation demand and impact analysis for plans and programs. The Districts should note that this plan/program level analysis may also be useful for the evaluation of individual development projects that are utilizing CEQA streamlining provisions. Appendix C contains sample language for use in comment letters on plans and programs.

For certain projects and plans, District staff should coordinate with transit operators so information can be jointly shared for the purpose of service coordination and long-range transit planning.

Level of Service (LOS) Related Comments Aimed at Reducing VMT

Some jurisdictions have set LOS thresholds for the SHS either through plans or by ballot measures and will provide this analysis during plan review. LOS can still be used as a transportation analysis tool, however, for CEQA purposes District comments should address VMT.

Until the TAG-TISG guidance is provided, Districts can make technical comments about a lead agency's deficiencies in LOS analysis of the SHS when a plan is inconsistent with smart growth principles ("sprawl"). In this circumstance, the District can also point out LOS deficiencies on the SHS and request mitigation that minimizes new VMT on the SHS. Please note that the District should suggest roadway capacity improvements sparingly. Comments should focus on operational impacts and should be consistent with complete streets principles. Particularly for Project Types 3-5, Districts should assist the lead agency in identifying appropriate transportation demand reduction measures by listing specific programs (see Appendix D).

Appendix C: Recommended Language for LD-IGR Comment Letters

The template language below is provided for District LD-IGR coordinators to adapt as needed in order to reflect the key terms and general guidance outlined above. Please note that LD-IGR letters should be tailored to reflect the context surrounding the different types of plans and projects under review, what stage they are at in the review and approval process, and relevant background information such their scope and relationship to the multimodal transportation system.

All letters should contain introductory language that references the Department's new vision, mission, and goals, as well as versions of the general language below where appropriate in the standard LD-IGR letter format.

A. Caltrans New Mission

"Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the project referenced above. The mission of Caltrans is to provide a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability. The Local Development-Intergovernmental Review (LD-IGR) Program reviews land use projects and plans through the lenses of our mission and state planning priorities of infill, conservation, and travel-efficient development. To ensure a safe and efficient transportation system, we encourage early consultation and coordination with local jurisdictions and project proponents on all development projects that utilize the multimodal transportation network. We provide these comments consistent with the State's smart mobility goals that support a vibrant economy, and build communities, not sprawl. The following comments are based on the (insert type of document)*."*

"Caltrans new mission supports safety and sustainability in its call to "provide a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability". Caltrans Sustainability, Livability, and Economy goal states we will "make long-lasting, smart mobility decisions that improve the environment, support a vibrant economy, and build communities, not sprawl."

"Caltrans supports six smart mobility principles of location efficiency, reliable mobility, health and safety, environmental stewardship, social equity, and robust economy. The California Transportation Plan 2040 further encourages infill development and conservation opportunities as a way to reduce urban sprawl, allow for better transit and to be consistent with SB 375."

"The following comments are based on the (insert type of document)*. We provide these comments consistent with the State's smart mobility goals that support a vibrant economy and sustainable communities."*

B. Plan Development, Project Design and Mitigation Strategies

*"In (*developing this plan/designing this project*) we encourage the (*City/County/Developer*) to integrate transportation and land use in a way that reduces Vehicle Miles Traveled (VMT) and Greenhouse Gas (GHG) emissions by facilitating the provision of more proximate goods and services to shorten trip lengths, and achieve a high level of non-motorized travel and transit use. As such, we encourage the (*City/County/Developer*) evaluate the potential of Transportation Demand Management (TDM) strategies and Intelligent Transportation System (ITS) applications in order to better manage the transportation network, as well as transit service and bicycle or pedestrian connectivity improvements. The Department also seeks to reduce serious injuries and fatalities, as well as provide equitable mobility options for people*

*who are economically, socially, or physically disadvantaged. Therefore, we ask the (*City/County/Developer*) to evaluate the (*plan/project site*) for access problems, VMT and service needs that may need to be addressed.*

*For example, we recommend that the (*City/County/Developer*) analyze the following issues related to the (*plan/project*):"* (identify the scope of what we are asking for)

C. Multimodal Transportation Impact Study

Well planned infill projects which are located close to transit, bike and pedestrian facilities (see Appendix A: Project Type 1) which also have proximity benefits to employment centers, services and goods – will reduce travel demand on the entire transportation system and will therefore require significantly less review and mitigation than rural fringe projects (Project Type 5) which generate proportionately higher number of trips and vehicle miles traveled.

Districts should coordinate with SB 743 Program Implementation Manager when developing letters for Type 1 land use projects.

Below is suggested language for consideration and is generally targeted for Type 4 and 5 projects from Appendix A and some plans.

> *"The environmental document should include an analysis of the multimodal travel demand expected from the proposed project. This analysis should also identify potentially significant adverse impacts from such demands and avoidance, minimization, and mitigation measures needed to address them.*
>
> *Early collaboration, such as sharing the analysis for review and comment prior to the environmental document, leads to better outcomes for all stakeholders.*
>
> *Given that Caltrans current guidelines are in the process of being updated, a transportation impact study scoping meeting with District staff could be used to discuss the most appropriate methodology for this analysis. At a minimum, the analysis should provide the following:*

1. *Vicinity maps, regional location map, and a site plan clearly showing project access in relation to nearby roadways and key destinations. Ingress and egress for all project components should be clearly identified. Clearly identify the State right-of-way (ROW). Project driveways, the State Highway System and local roads, intersections and interchanges, pedestrian and bicycle routes, car/bike parking, and transit routes and facilities should be mapped.*
2. *Project-related VMT should be calculated factoring in per capita use of transit, rideshare or active transportation modes and VMT reduction factors. The assumptions and methodologies used to develop this information should be detailed in the study, should utilize the latest place based research, and should be supported with appropriate documentation. Mitigation for any roadway section or intersection with increasing VMT should be identified and mitigated in a manner that does not further raise VMT.*
3. *Schematic illustrations of walking, biking and auto traffic conditions at the project site and study area roadways, trip distribution percentages and volumes as well as intersection geometrics, i.e., lane configurations, for AM and PM peak periods. Operational concerns for*

all road users that may increase the potential for future collisions should be identified and fully mitigated in a manner that does not further raise VMT.

D. Encroachment Permits

*"Please be advised that any ingress-egress, work (e.g. construction, vegetation management, drainage improvement, etc.), or traffic control that is conducted within or adjacent to or encroaches upon the State Right of Way (ROW) requires an encroachment permit that is issued by Caltrans. Where construction related traffic restrictions and detour affect State highways, a Transportation Management Plan or construction traffic impact study may be required. Traffic-related mitigation measures should be incorporated into the construction plans prior to the encroachment permit process. To apply, a completed encroachment permit application, environmental documentation, and six (6) sets of plans clearly indicating State ROW as well as any applicable specifications, calculations, maps, etc. must be submitted to the following address: (*insert District Permits contact and address*). It is important to note that, in order to uphold the Department's statutory responsibility to protect the safety of the traveling public, if this information is not adequately provided, then a permit will not be issued for said encroachments. See the following website for more information:*
http://www.dot.ca.gov/hq/traffops/developserv/permits*"*

A note about encroachment permits: compliance with CEQA must be completely addressed before an encroachment permit application is submitted to the District Encroachment Permits Office. Before an encroachment permit application package can be deemed as complete, all applicable Federal and State statutory requirements including but not limited to Storm Water, Americans with Disabilities Act (ADA), and CEQA must be complied with. Therefore it is critical that all issues have been ironed out prior to the applicant submitting an application package to the District Encroachment Permits Office. This is also critical to provide documentation for District Encroachment Permit Engineers' consideration when issuing subsequent encroachments or when processing developer-built mitigation measures within State right-of-way. Comment letters should remind the reader that such analysis is required during the permit review process and a development's needed improvements, even opening day access, may be delayed if adequate detail is not provided during the environmental process upfront. This should be explained in such a way to convey that Caltrans is also trying to help save time and money for all those concerned.

E. Smart Growth Principles

"Support for infill and smart growth development is found in our new Mission, Vision, and Goals, the California Transportation Plan 2040, Smart Mobility Framework, Strategic Management Plan, and related guidance documents.

*Based on its place-type, VMT, design characteristics, potential impacts, and proposed mitigations, the Department feels that this (*plan/project*) (*is/is not*) representative of the smart growth principles and* (assists/does not assist) *in meeting the state's goals."*

Note: If the plan/project is *not* representative of smart growth principles, assist the lead agency by recommending specific changes that could help it move in a different direction. This should be done at the earliest point in the planning process possible.

F. Transportation Impact Fees

*"We request that an analysis of the (*plans/project's*) impacts and mitigation include information regarding the (*city/county's*) local and/or regional impact fee program. The analysis should identify if those*

programs include improvements to pedestrian, bicycle and transit infrastructure or that could be considered representative of the project's likely TDM mitigation measures. If no such fee exists, we would appreciate exploring with you the establishment of (local or regional) *VMT-based transportation impact fee programs."*

Two jurisdictions are currently using VMT-based thresholds: City of Pasadena, and City of San Francisco. City of Pasadena is updating a nexus study for its fee program that includes bicycle, pedestrian, and VMT metrics. City of San Francisco legislated a fee program based upon square footage of new development.

G. Responsiveness of the Lead Agency to Caltrans Comments

Generally, the second introductory paragraph of comment letters should reiterate the project description, reference previous comment letters, summarize the results of interagency coordination and outcome of previous comments, clarify where the project is currently at in the process, and identify key decision points.

Specifically, it is important to compare issues raised in the NOP stage with those addressed in the Draft TIS and EIR, as well as those between the Draft and Final EIRs, so that decision makers and the public know what concerns were addressed/resolved or remain a concern. If all of Caltrans concerns have been resolved, that would be valuable information for the public and decision makers to know. A brief summary paragraph should be adequate to summarize relevant points related to key concerns and convey a conclusion to the reader.

In the event that substantive concerns were brought up in the NOP stage and commented on in the Draft TIS-EIR stage, but not sufficiently resolved by the Final EIR stage, then IGR coordinators should consider making a statement related to adequacy of the FEIR based on either CEQA's public disclosure or reasonable argument provisions and recommend to the lead agency how it could be corrected prior to certification. Any comments on adequacy of an FEIR should consider the policies outlined earlier in this document.

No template language is provided because this information is specific to the nature and history of each plan/project and District staff would be best suited to summarize the relevant issues for the public record.

Appendix D: Additional Technical Considerations

Note that any considerations below must fall into the policy framework of the main guidance.

A. Transportation Demand Management

Transportation Demand Management is a set of tools that increases the efficiency of the transportation system by providing options for users other than driving alone, or by shifting travel away from peak periods. In direct support of SB 743, reviewers should always evaluate opportunities for TDM measures that could be deployed to reduce VMT and increase walking, biking, and transit use. Evidence of VMT reduction benefits resulting from the project's design, siting, and TDM mitigation measures should provide a clear nexus in the VMT analysis. This analysis should be place-based and utilize the latest trip-generation research available to describe influencing factors such as mode-shift due to transit availability and internal capture attributable to mixed use developments (see the Caltrans research on new trip generation rates for infill development). District and Headquarters staff can help recommend emerging methodologies that could be used to better estimate mixed use infill trip generation rates or quantify VMT reduction from TDM mitigation measures. Similarly, rather than making a vague reference that a lead agency should use VMT-based impact fees to mitigate the effects of its cumulative development, provide sample language for an actual Condition of Approval or Mitigation Measure to that effect and offer to participate in its creation. If there were questions about the project or assumptions about the analysis that were resolved or agreed to, comment letters should reflect those outcomes for the record and state that Caltrans' concerns were adequately addressed.

Reviewers should request that Lead Agencies include in their transportation impact studies (TIS) a project vicinity map and site-design layout plan that identifies all of the priority pedestrian and bicycle routes and transit routes/stops serving the site (based on relevant bike-pedestrian and transit service-development plans). It would be helpful for the lead agency if reviewers included a brief summary of what the District thinks the potential impacts of concern are likely to be based on the project and its location. This will help them focus the emphasis of their TIS. One repository for TDM strategies is found in the CAPCOA Quantifying Greenhouse Gas Mitigation Measures document (which focuses also on VMT). Also consider the following as a non-exhaustive list of potential TDM strategies:

1. Parking Management:
   a) In urban settings, recommend eliminating parking where transit is adjacent, significantly reduce parking where transit is within ¼ mile. See AB 744 (2015), which identifies maximum parking ratios for affordable housing projects located within one-half mile of a major transit stop, and affordable housing projects outside of those locations.
   b) In rural resort and special event settings, ensure an adequate balance between on-site parking and availability of off-site parking coupled with shuttle service for peak demand dates/times.
   c) Raise the cost of parking in general parking zones.
   d) Give preferential parking for carpools, vanpools, carshare, and rideshare programs.
   e) Create park and ride lots adjacent to transit commuter facilities or near HOV entrances.
   f) Establish maximum parking units per dwelling unit equivalent (d.u.e.) and thousand square foot (k.s.f.) ratios.
   g) Provide preferred and/or restricted parking stalls for Transportation Network Companies at select locations.

2. <u>Additional non-auto centric measures</u>

a) Add or extend transit routes or increase transit frequency.
b) Issue transit passes or subsidies to employees.
c) Issue housing-based transit passes.
d) Promote telecommuting and flexible work schedules.
e) Provide shelter and lighting for pedestrians as well as quality street furniture.
f) Compliment bicycle routes with secure bicycle parking facilities and showers at strategic locations.
g) Establish bike share programs or systems.
h) Establish safe routes to school programs (for example: a walking school bus program)
i) Complete sidewalk systems and mixed-use pathways for non-motorized travel.
j) Implement bus rapid transit (BRT) systems along key corridors.
k) Encourage light rail stations and complimentary adjacent TOD.
l) Develop toll-funded TOD redevelopment incentive programs for high density residential corridors.
m) Integrate solar-power shade structures and electric vehicle charging stations with rideshare parking lots and transit-rail station planning.

It may also be useful for Districts to provide lead agencies with links to local/regional TDM program resources that serve those jurisdictions.

B. Safety Considerations

Generally, Districts should have minimal comments (or no comments) on Project Type 1-2 (Appendix A) because well-planned, well-located infill projects are presumed to have multiple community benefits that include increased access and safety for all users. Urban infill projects also tend to increase pedestrian and bicycling travel, which promotes livable and healthy communities. In cases where the Districts have specific substantial evidence that safety concerns exist, the Districts should work with the Lead Agency to identify the appropriate analysis needed, ways it can be provided, and how the safety concerns can be addressed. Appropriate multimodal mitigation can be suggested that advances safety for bicyclists, pedestrians, transit users, and motorists. Districts should coordinate with the SB 743 Program Implementation Manager when developing letters for Type 1 land use projects.

Districts should analyze how increased VMT from either planned development (particularly project types 3-5) or proposed infrastructure investments may cause traffic operational dynamics that exacerbate modal conflict in the transportation system. For example, increased traffic volumes from high-VMT development and/or high speeds can exacerbate safety concerns related to inadequate acceleration-deceleration lengths, sight-distance, and reaction-time that may affect adjacent pedestrian facilities. Similarly, increasing traffic volumes at uncontrolled turn-movement points or in locations without adequate modal separation/refuge can increase the vulnerability for all modes, especially pedestrians and bicyclists.

Highway intersections and interchanges are often a challenge for motorists, bicyclists, and pedestrians. This is due to higher volumes, variable speeds, complex or unique designs, numerous conflict points, a mix of vehicle types, and changes in land uses. Care must be employed to assure all system users perceive the design, operating conditions, and speed limits allow them to act and react in a safe manner.

This transition zone between free flow and metered flow is considered a “critical transition area”. Traffic design speeds near intersections and interchanges should be appropriate to the context. Where pedestrians and bicyclists are present, design speeds should be slower to help ensure the safety of all road users. For more guidance on intersections and interchanges, please see Caltrans Complete Intersections: A Guide to Reconstructing Intersections and Interchanges for Bicyclists and Pedestrians, 2010. Page 15 of the document states:

> *Any reduction in vehicle speed benefits pedestrian and bicyclist safety, since there is a direct link between impact speeds and the likelihood of fatality. Methods to reduce pedestrian and bicyclist exposure to vehicles improve safety by lessening the time that the user is in the likely path of a motor vehicle. These methods include the construction of physically separated facilities such as sidewalks, raised medians, refuge islands, and off-road paths and trails, or reductions in crossing distances through roadway narrowing.*
>
> *Pedestrian and bicyclist warning signage, flashing beacons, crosswalks, and other signage and striping should be used to indicate to motorists that they should expect to see and yield to pedestrians and bicyclists. Formal information from traffic control devices should be reinforced by informal sources of information such as lane widths, landscaping, street furniture, and other road design features.*

Other documents that should be referenced include the Caltrans Class IV Bikeway (Separated Bikeways/Cycletracks) Guidance, 2015 and the Highway Design Manual.

All discussions or comments should keep in mind Caltrans Strategic Management Plan goals, including to increase walking, biking, and transit use, and reduce per capita vehicle miles traveled. Suggested Operational Impact improvements must consider the most vulnerable roadway users (i.e., children and elderly pedestrians, children bicyclists, etc.).

Caltrans staff should be ready to provide a list of potential multimodal mitigation measures for specific concerns that might be raised. Listed below are a few resources to reference when making Operational Impact determinations for development projects and plans:

The American Association of State Highway and Transportation Officials (AASHTO) Highway Safety Manual (2010) can be found here.

The Caltrans Highway Design Manual (HDM) can be found at:
http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm

Topics contained within the California Manual on Uniform Traffic Control Devices (California MUTCD), such as pedestrian hybrid beacons, can be found at:
http://www.dot.ca.gov/hq/traffops/engineering/mutcd/ca_mutcd2014.htm

The Caltrans-endorsed National Association of City Transportation Officials (NACTO) guides on Urban Street Design and Urban Bikeways provide best practices and standards for pedestrian, bicycle, and transit features. The guides can be found in the Caltrans Library. More information about the guides can be found here: http://nacto.org/

More Caltrans resources related to Complete Streets and Smart Mobility can be found at: http://www.dot.ca.gov/hq/tpp/offices/ocp/smbr.html

C. Access Management

Access management is a particular concern at the interface between vehicular and bicycle-pedestrian use of roadways, shoulders, bike lanes, and sidewalks and the ingress-egress points for land use destinations. Avoiding operational impacts that may increase the likelihood of collisions is an integral and important part of multimodal access management. Significant speed differentials and travel volumes can result in a need for access management mitigation measures. These include efforts to limit modal conflicts and increase accessibility for vulnerable road users, reduce speed differentials between vehicles, modulate flow volumes for specific directions, control specific turning movements, and provide adequate stopping sight distance and decision site distance. These issues are amplified where large buses or trucks are involved. Where design features are recommended to mitigate pedestrian and/or bicycle safety concerns, various issues should be considered such as topography, ADA accessibility, maintenance, and seasonal factors (e.g. snow removal and/or storage, etc.). Access management efforts must also take into consideration of other state goals such as designing for motor vehicle speeds appropriate to the place setting, protection of vulnerable road users, reduction in motor vehicle travel, and adding features that increase driver attention.

Reviewers may also highlight the benefits of roundabouts because they facilitate road diets, produce narrower pedestrian crossing widths compared to signalized and stop-controlled intersections, and produce lower speeds and speed differential at and near pedestrian and bike conflict areas. Roundabouts may not be appropriate at some intersection contexts and locations. See the Intersection Control Evaluation guidance for more information.

Appendix F

Caltrans Analysis Worksheets

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

1 I-680 Northbound

north of Crow Canyon Road ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	5,784	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	10	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	V / (PHF x N x f_{HV}) *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,281	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity (v_p > c_{adj})? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \leq$ BP: FFS_{adj} *(Eq. 12-1)*

If BP < $v_p \leq$ c: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP)^a]}{(c_{adj} - BP)^a}$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* D: **23.3** pc/mi/ln

Level of Service (LOS): LOS: **C**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

1 I-680 Southbound

north of Crow Canyon Road — ***AM Peak Hour***

GEOMETRIC DATA INPUTS / DEMAND INPUTS

Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	8,118	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	12	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,797	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP)^a]}{(c_{adj} - BP)^a}$

S: **55.0** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **32.7** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

1 I-680 Northbound

north of Crow Canyon Road ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	7,833	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	10	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	V / (PHF x N x f_{HV}) *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,734	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity (v_p > c_{adj})? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S):
- If $v_p \le$ BP: FFS_{adj} *(Eq. 12-1)*
- If BP < $v_p \le$ c: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* D: **31.5** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

1 I-680 Southbound

north of Crow Canyon Road ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	6,865	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	12	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,520	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S):

If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* D: **27.6** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

2 I-680 Northbound

between Crow Canyon Road & Bollinger Canyon Road ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	5,629	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	9	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.0	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,246	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **22.7** pc/mi/ln

Level of Service (LOS): LOS: **C**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

2 I-680 Southbound

between Crow Canyon Road & Bollinger Canyon Road ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	8,151	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	11	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.0	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,805	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity (v_p > c_{adj})? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le$ BP: FFS_{adj} *(Eq. 12-1)*

If BP < $v_p \le$ c: $$FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP)^a]}{(c_{adj} - BP)^a}$$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* D: **32.8** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

2 I-680 Northbound

between Crow Canyon Road & Bollinger Canyon Road ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	7,148	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	9	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.0	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,583	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **28.8** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

EXISTING CONDITIONS (YEAR 2021)

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

2 I-680 Southbound

between Crow Canyon Road & Bollinger Canyon Road — ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	6,771	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	11	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.0	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,499	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP)^a]}{(c_{adj} - BP)^a}$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* — D: **27.3** pc/mi/ln

Level of Service (LOS): — LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

3 I-680 Northbound

south of Bollinger Canyon Road ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	5,749	veh/h
Mainline Lanes (N):	4	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	10	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	V / (PHF x N x f_{HV}) *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,591	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \leq$ BP: FFS_{adj} *(Eq. 12-1)*

If BP < $v_p \leq$ c: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* D: **28.9** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

3 I-680 Southbound

south of Bollinger Canyon Road — ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	7,334	veh/h
Mainline Lanes (N):	4	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	11	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	2,030	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **53.7** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* — D: **37.8** pc/mi/ln

Level of Service (LOS): — LOS: **E**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

3 I-680 Northbound

south of Bollinger Canyon Road — ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	6,841	veh/h
Mainline Lanes (N):	4	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	10	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,893	pc/h/ln
Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)?			NO	

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S):

If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $$FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$$

S: **54.8** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* — D: **34.5** pc/mi/ln

Level of Service (LOS): — LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

3 I-680 Southbound

south of Bollinger Canyon Road — ***PM Peak Hour***

GEOMETRIC DATA INPUTS

Measured Free Flow Speed (BFFS):	55.0	mi/h
Mainline Lanes (N):	4	lanes
Lane Widths:	12	ft
Right-Side Lateral Clearance:	11	ft
Total Ramp Density (TRD):	2.8	ramps/mi
Terrain Type:	Level	

DEMAND INPUTS

Hourly Demand Volume (V):	6,297	veh/h
Heavy Vehicle Percentage (P_T):	4.04	%
Peak Hour Factor (PHF):	0.940	
Capacity Adj. Factor (CAF):	1.00	
Speed Adj. Factor (SAF):	1.00	
Density at Capacity (D_c):	45.0	pc/mi/ln
Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
		[f_{HV}:	0.961]	
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	v_p:	1,743	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): *(Eq. 12-1)*

If $v_p \le BP$: FFS_{adj}

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP)^a]}{(c_{adj} - BP)^a}$

S: **55.0** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* — D: **31.7** pc/mi/ln

Level of Service (LOS): — LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

EXISTING WITH PROJECT CONDITIONS (YEAR 2021)

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

1 I-680 Northbound

north of Crow Canyon Road ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	5,819	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	10	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,288	pc/h/ln
Flow Rate > Adjusted Freeway Segment Capacity (v_p > c_{adj})?			NO	

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* D: **23.4** pc/mi/ln

Level of Service (LOS): LOS: **C**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

1 I-680 Southbound

north of Crow Canyon Road — ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	7,994	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	12	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	V / (PHF x N x f_{HV}) *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,770	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity (v_p > c_{adj})? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le$ BP: FFS_{adj} *(Eq. 12-1)*

If BP < $v_p \le$ c: $$FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) \wedge a]}{(c_{adj} - BP) \wedge a}$$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* — D: **32.2** pc/mi/ln

Level of Service (LOS): — LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

1 I-680 Northbound

north of Crow Canyon Road ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	7,722	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	10	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	V / (PHF x N x f_{HV}) *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,710	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le$ BP: FFS_{adj} *(Eq. 12-1)*

If BP < $v_p \le$ c: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* D: **31.1** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

1 I-680 Southbound

north of Crow Canyon Road — ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	6,901	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	12	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,528	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): *(Eq. 12-1)*

If $v_p \leq BP$: FFS_{adj}

If $BP < v_p \leq c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP)^a]}{(c_{adj} - BP)^a}$

S: **55.0** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **27.8** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

EXISTING WITH PROJECT CONDITIONS (YEAR 2021)

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

2 I-680 Northbound

between Crow Canyon Road & Bollinger Canyon Road — ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	5,629	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	9	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.0	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,246	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $$FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$$

S: **55.0** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **22.7** pc/mi/ln

Level of Service (LOS): LOS: **C**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

2 I-680 Southbound

between Crow Canyon Road & Bollinger Canyon Road — ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	8,151	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	11	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.0	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,805	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity (v_p > c_{adj})? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le$ BP: FFS_{adj} *(Eq. 12-1)*

If BP < $v_p \le$ c: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) \wedge a]}{(c_{adj} - BP) \wedge a}$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* — D: **32.8** pc/mi/ln

Level of Service (LOS): — LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

EXISTING WITH PROJECT CONDITIONS (YEAR 2021)

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

2 I-680 Northbound

between Crow Canyon Road & Bollinger Canyon Road ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	7,148	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	9	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.0	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	V / (PHF x N x f_{HV}) *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,583	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le$ BP: FFS_{adj} *(Eq. 12-1)*

If BP < $v_p \le$ c: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* D: **28.8** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

EXISTING WITH PROJECT CONDITIONS (YEAR 2021)

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

2 I-680 Southbound

between Crow Canyon Road & Bollinger Canyon Road — ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	6,771	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	11	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.0	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,499	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \leq BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \leq c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **27.3** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

3 I-680 Northbound

south of Bollinger Canyon Road — ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	5,584	veh/h
Mainline Lanes (N):	4	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	10	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	V / (PHF x N x f_{HV}) *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,545	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le$ BP: FFS_{adj} *(Eq. 12-1)*

If BP < $v_p \le$ c: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* D: **28.1** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

3 I-680 Southbound

south of Bollinger Canyon Road — ***AM Peak Hour***

GEOMETRIC DATA INPUTS

Measured Free Flow Speed (BFFS):	55.0	mi/h
Mainline Lanes (N):	4	lanes
Lane Widths:	12	ft
Right-Side Lateral Clearance:	11	ft
Total Ramp Density (TRD):	2.8	ramps/mi
Terrain Type:	Level	

DEMAND INPUTS

Hourly Demand Volume (V):	7,381	veh/h
Heavy Vehicle Percentage (P_T):	4.04	%
Peak Hour Factor (PHF):	0.940	
Capacity Adj. Factor (CAF):	1.00	
Speed Adj. Factor (SAF):	1.00	
Density at Capacity (D_c):	45.0	pc/mi/ln
Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	2,043	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity (v_p > c_{adj})? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): *(Eq. 12-1)*

If $v_p \le BP$: FFS_{adj}

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP)^a]}{(c_{adj} - BP)^a}$

S: **53.5** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* — D: **38.2** pc/mi/ln

Level of Service (LOS): — LOS: **E**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

3 I-680 Northbound

south of Bollinger Canyon Road ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	6,889	veh/h
Mainline Lanes (N):	4	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	10	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	V / (PHF x N x f_{HV}) *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,907	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity (v_p > c_{adj})? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le$ BP: FFS_{adj} *(Eq. 12-1)*

If BP < $v_p \le$ c: $$FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$$

S: **54.7** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* D: **34.9** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

3 I-680 Southbound

south of Bollinger Canyon Road ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	6,149	veh/h
Mainline Lanes (N):	4	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	11	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,702	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity (v_p > c_{adj})? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): *(Eq. 12-1)*

If $v_p \le$ BP: FFS_{adj}

If BP < $v_p \le$ c: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP)^a]}{(c_{adj} - BP)^a}$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* D: **30.9** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

1 I-680 Northbound

north of Crow Canyon Road — ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	6,890	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	10	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,525	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \leq BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \leq c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **27.7** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

1 I-680 Southbound

north of Crow Canyon Road — ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	8,061	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	12	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,785	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $$FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$$

S: **55.0** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **32.4** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

1 I-680 Northbound

north of Crow Canyon Road — ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	8,919	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	10	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,975	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **54.2** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* — D: **36.4** pc/mi/ln

Level of Service (LOS): — LOS: **E**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

1 I-680 Southbound

north of Crow Canyon Road ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	8,159	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	12	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,806	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **32.8** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

FUTURE WITHOUT PROJECT CONDITIONS (YEAR 2040)

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

2 I-680 Northbound

between Crow Canyon Road & Bollinger Canyon Road — ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	6,551	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	9	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.0	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,450	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $$FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* — D: **26.4** pc/mi/ln

Level of Service (LOS): — LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

FUTURE WITHOUT PROJECT CONDITIONS (YEAR 2040)

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

2 I-680 Southbound

between Crow Canyon Road & Bollinger Canyon Road ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	7,967	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	11	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.0	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,764	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): *(Eq. 12-1)*

If $v_p \le BP$: FFS_{adj}

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **32.1** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

2 I-680 Northbound

between Crow Canyon Road & Bollinger Canyon Road — ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	7,824	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	9	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.0	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Item	Formula		Value	Unit
Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,732	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **31.5** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

2 I-680 Southbound

between Crow Canyon Road & Bollinger Canyon Road — ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	7,875	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	11	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.0	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,744	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity (v_p > c_{adj})? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le$ BP: FFS_{adj} *(Eq. 12-1)*

If BP < $v_p \le$ c: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP)^a]}{(c_{adj} - BP)^a}$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* — D: **31.7** pc/mi/ln

Level of Service (LOS): — LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

FUTURE WITHOUT PROJECT CONDITIONS (YEAR 2040)

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

3 I-680 Northbound

south of Bollinger Canyon Road ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	6,461	veh/h
Mainline Lanes (N):	4	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	10	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{PHF \times N \times f_{HV}}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,788	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity (v_p > c_{adj})? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le$ BP: FFS_{adj} *(Eq. 12-1)*

If BP < $v_p \le$ c: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* D: **32.5** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

3 I-680 Southbound

south of Bollinger Canyon Road — ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	7,513	veh/h
Mainline Lanes (N):	4	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	11	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	2,079	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity (v_p > c_{adj})? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **53.1** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* — D: **39.2** pc/mi/ln

Level of Service (LOS): — LOS: **E**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

3 I-680 Northbound

south of Bollinger Canyon Road ***PM Peak Hour***

GEOMETRIC DATA INPUTS / DEMAND INPUTS

Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	7,239	veh/h
Mainline Lanes (N):	4	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	10	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	V / (PHF x N x f_{HV}) *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	2,003	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity (v_p > c_{adj})? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le$ BP: FFS_{adj} *(Eq. 12-1)*

If BP < $v_p \le$ c: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **54.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* D: **37.1** pc/mi/ln

Level of Service (LOS): LOS: **E**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

FUTURE WITHOUT PROJECT CONDITIONS (YEAR 2040)

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

3 I-680 Southbound

south of Bollinger Canyon Road — ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	7,112	veh/h
Mainline Lanes (N):	4	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	11	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,968	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \leq$ BP: FFS_{adj} *(Eq. 12-1)*

If BP < $v_p \leq$ c: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **54.3** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* — D: **36.2** pc/mi/ln

Level of Service (LOS): — LOS: **E**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

1 I-680 Northbound

north of Crow Canyon Road — ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	6,925	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	10	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,533	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **27.9** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

1 I-680 Southbound

north of Crow Canyon Road — ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	7,937	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	12	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,757	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity (v_p > c_{adj})? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \leq BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \leq c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP)^a]}{(c_{adj} - BP)^a}$

S: **55.0** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **32.0** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

1 I-680 Northbound

north of Crow Canyon Road — ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	8,808	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	10	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,950	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP)^a]}{(c_{adj} - BP)^a}$

S: **54.4** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **35.8** pc/mi/ln

Level of Service (LOS): LOS: **E**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

1 I-680 Southbound

north of Crow Canyon Road — ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	8,195	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	12	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,814	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity (v_p > c_{adj})? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* — D: **33.0** pc/mi/ln

Level of Service (LOS): — LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

2 I-680 Northbound

between Crow Canyon Road & Bollinger Canyon Road — ***AM Peak Hour***

GEOMETRIC DATA INPUTS

Measured Free Flow Speed (BFFS):	55.0	mi/h
Mainline Lanes (N):	5	lanes
Lane Widths:	12	ft
Right-Side Lateral Clearance:	9	ft
Total Ramp Density (TRD):	2.0	ramps/mi
Terrain Type:	Level	

DEMAND INPUTS

Hourly Demand Volume (V):	6,551	veh/h
Heavy Vehicle Percentage (P_T):	4.04	%
Peak Hour Factor (PHF):	0.940	
Capacity Adj. Factor (CAF):	1.00	
Speed Adj. Factor (SAF):	1.00	
Density at Capacity (D_c):	45.0	pc/mi/ln
Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,450	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): *(Eq. 12-1)*

If $v_p \le BP$: FFS_{adj}

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* — D: **26.4** pc/mi/ln

Level of Service (LOS): — LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

2 I-680 Southbound

between Crow Canyon Road & Bollinger Canyon Road ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	7,967	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	11	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.0	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	V / (PHF x N x f_{HV}) *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,764	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \le$ BP: FFS_{adj} *(Eq. 12-1)*

If BP < $v_p \le$ c: $$FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^\wedge a]}{(c_{adj} - BP) ^\wedge a}$$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* D: **32.1** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

2 I-680 Northbound

between Crow Canyon Road & Bollinger Canyon Road ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	7,824	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	9	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.0	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,732	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): *(Eq. 12-1)*

If $v_p \le BP$: FFS_{adj}

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP)^a]}{(c_{adj} - BP)^a}$

S: **55.0** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **31.5** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

2 I-680 Southbound

between Crow Canyon Road & Bollinger Canyon Road ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	7,875	veh/h
Mainline Lanes (N):	5	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	11	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.0	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,744	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \leq BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \leq c$: $$FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$$

S: **55.0** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **31.7** pc/mi/ln

Level of Service (LOS): LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

3 I-680 Northbound

south of Bollinger Canyon Road — ***AM Peak Hour***

GEOMETRIC DATA INPUTS

Measured Free Flow Speed (BFFS):	55.0	mi/h
Mainline Lanes (N):	4	lanes
Lane Widths:	12	ft
Right-Side Lateral Clearance:	10	ft
Total Ramp Density (TRD):	2.8	ramps/mi
Terrain Type:	Level	

DEMAND INPUTS

Hourly Demand Volume (V):	6,296	veh/h
Heavy Vehicle Percentage (P_T):	4.04	%
Peak Hour Factor (PHF):	0.940	
Capacity Adj. Factor (CAF):	1.00	
Speed Adj. Factor (SAF):	1.00	
Density at Capacity (D_c):	45.0	pc/mi/ln
Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,742	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): *(Eq. 12-1)*

If $v_p \le BP$: FFS_{adj}

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **55.0** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* — D: **31.7** pc/mi/ln

Level of Service (LOS): — LOS: **D**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

3 I-680 Southbound

south of Bollinger Canyon Road ***AM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	7,560	veh/h
Mainline Lanes (N):	4	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	11	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	2,092	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): If $v_p \leq BP$: FFS_{adj} *(Eq. 12-1)*

If $BP < v_p \leq c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **52.9** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **39.6** pc/mi/ln

Level of Service (LOS): LOS: **E**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

3 I-680 Northbound

south of Bollinger Canyon Road — ***PM Peak Hour***

GEOMETRIC DATA INPUTS

Measured Free Flow Speed (BFFS):	55.0	mi/h
Mainline Lanes (N):	4	lanes
Lane Widths:	12	ft
Right-Side Lateral Clearance:	10	ft
Total Ramp Density (TRD):	2.8	ramps/mi
Terrain Type:	Level	

DEMAND INPUTS

Hourly Demand Volume (V):	7,287	veh/h
Heavy Vehicle Percentage (P_T):	4.04	%
Peak Hour Factor (PHF):	0.940	
Capacity Adj. Factor (CAF):	1.00	
Speed Adj. Factor (SAF):	1.00	
Density at Capacity (D_c):	45.0	pc/mi/ln
Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	V / (PHF x N x f_{HV}) *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	2,017	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): *(Eq. 12-1)*

If $v_p \leq$ BP: FFS_{adj}

If BP < $v_p \leq$ c: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP) ^ a]}{(c_{adj} - BP) ^ a}$

S: **53.8** mi/h

Density (D): D = v_p / S *(Eq. 12-11)* — D: **37.5** pc/mi/ln

Level of Service (LOS): — LOS: **E**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Bishop Ranch 6 Residential Project

Highway Capacity Manual 6th Edition - Basic Freeway Segments Worksheet

3 I-680 Southbound

south of Bollinger Canyon Road ***PM Peak Hour***

GEOMETRIC DATA INPUTS			DEMAND INPUTS		
Measured Free Flow Speed (BFFS):	55.0	mi/h	Hourly Demand Volume (V):	6,964	veh/h
Mainline Lanes (N):	4	lanes	Heavy Vehicle Percentage (P_T):	4.04	%
Lane Widths:	12	ft	Peak Hour Factor (PHF):	0.940	
Right-Side Lateral Clearance:	11	ft	Capacity Adj. Factor (CAF):	1.00	
Total Ramp Density (TRD):	2.8	ramps/mi	Speed Adj. Factor (SAF):	1.00	
Terrain Type:	Level		Density at Capacity (D_c):	45.0	pc/mi/ln
			Exponent Calibration Parameter (a):	2.00	

FREE FLOW SPEED, CAPACITY, & FLOW CALCULATIONS

Adjusted Free Flow Speed (FFS_{adj}):	FFS x SAF *(Eq. 12-5)*	FFS_{adj}:	55.0	mi/h
Basic Freeway Seg. Capacity (c):	2,200 + 10 x (FFS_{adj} - 50) *(Eq. 12-6)*	c:	2,250	pc/h/ln
Adj. Freeway Seg. Capacity (c_{adj}):	c x CAF *(Eq. 12-8)*	c_{adj}:	2,250	pc/h/ln
Breakpoint (BP):	[1,000 + 40 x (75 - FFS_{adj})] x CAF ^ 2 *(Ex. 12-6)*	BP:	1,800	pc/h/ln
Flow Rate (v_p):	$\frac{V}{(PHF \times N \times f_{HV})}$ *(Eq. 12-9)*	[f_{HV}:	0.961]	
		v_p:	1,927	pc/h/ln

Flow Rate > Adjusted Freeway Segment Capacity ($v_p > c_{adj}$)? NO

SPEED, DENSITY, & LEVEL OF SERVICE

Mean Speed (S): *(Eq. 12-1)*

If $v_p \le BP$: FFS_{adj}

If $BP < v_p \le c$: $FFS_{adj} - \frac{[(FFS_{adj} - c_{adj} / D_c) \times (v_p - BP)^a]}{(c_{adj} - BP)^a}$

S: **54.6** mi/h

Density (D): $D = v_p / S$ *(Eq. 12-11)* D: **35.3** pc/mi/ln

Level of Service (LOS): LOS: **E**

Notes: Methodology from *Highway Capacity Manual 6th Edition* , Transportation Research Board, 2016.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1150	9	0	685	0	0	0	50	910	5	238
Future Volume (veh/h)	0	1150	9	0	685	0	0	0	50	910	5	238
Initial Q (Qb), veh	0	20	0	0	15	0	0	0	0	7	7	7
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	0	2067	1870	0	2067	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	0	1250	10	0	745	0	0	0	54	993	0	259
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	0	2	2	2	2	2	2	2	2
Cap, veh/h	0	3714	29	0	2862		0	0	56	1142	0	1006
Arrive On Green	0.00	1.00	0.51	0.00	1.00	0.00	0.00	0.00	0.04	0.32	0.00	0.32
Sat Flow, veh/h	0	7621	59	0	6016	0	0	0	1585	3563	0	3170
Grp Volume(v), veh/h	0	909	351	0	745	0	0	0	54	993	0	259
Grp Sat Flow(s),veh/h/ln	0	1778	2057	0	1881	0	0	0	1585	1781	0	1585
Q Serve(g_s), s	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	5.1	39.7	0.0	9.1
Cycle Q Clear(g_c), s	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	5.1	39.7	0.0	9.1
Prop In Lane	0.00		0.03	0.00		0.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	0	2701	1043	0	2862		0	0	56	1142	0	1006
V/C Ratio(X)	0.00	0.34	0.34	0.00	0.26		0.00	0.00	0.97	0.87	0.00	0.26
Avail Cap(c_a), veh/h	0	2719	1049	0	2877		0	0	85	1401	0	1247
HCM Platoon Ratio	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.26	0.26	0.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	0.4	0.9	0.0	0.4	0.0	0.0	0.0	72.3	48.6	0.0	38.5
Incr Delay (d2), s/veh	0.0	0.1	0.2	0.0	0.2	0.0	0.0	0.0	71.8	5.3	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.3	0.2	0.0	0.3	0.0	0.0	0.0	0.0	2.1	0.0	0.5
%ile BackOfQ(95%),veh/ln	0.0	0.4	0.8	0.0	0.5	0.0	0.0	0.0	5.8	26.6	0.0	7.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.9	1.4	0.0	0.9	0.0	0.0	0.0	144.1	55.9	0.0	39.1
LnGrp LOS	A	A	A	A	A		A	A	F	E	A	D
Approach Vol, veh/h		1260			745	A		54			1252	
Approach Delay, s/veh		1.0			0.9			144.1			52.4	
Approach LOS		A			A			F			D	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		83.5		54.3		83.5		12.3				
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0				
Max Green Setting (Gmax), s		64.0		61.0		64.0		10.0				
Max Q Clear Time (g_c+I1), s		3.5		42.7		3.0		8.1				
Green Ext Time (p_c), s		15.8		6.6		8.0		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			22.7									
HCM 6th LOS			C									

Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1309	367	0	1291	731	339	0	1713	0	0	0
Future Volume (veh/h)	0	1309	367	0	1291	731	339	0	1713	0	0	0
Initial Q (Qb), veh	0	25	0	0	10	0	8	0	21			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	0	2067	1870	0	2067	1870	1870	0	1870			
Adj Flow Rate, veh/h	0	1423	0	0	1771	0	368	0	1314			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	0	2	2	0	2	2	2	0	2			
Cap, veh/h	0	2892		0	3239		683	0	1434			
Arrive On Green	0.00	1.00	0.00	0.00	1.00	0.00	0.38	0.00	0.38			
Sat Flow, veh/h	0	5830	1585	0	6202	1585	1781	0	3614			
Grp Volume(v), veh/h	0	1423	0	0	1771	0	368	0	1314			
Grp Sat Flow(s),veh/h/ln	0	1881	1585	0	2067	1585	1781	0	1205			
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	24.4	0.0	53.5			
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	0.0	0.0	24.4	0.0	53.5			
Prop In Lane	0.00		1.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	0	2892		0	3239		683	0	1434			
V/C Ratio(X)	0.00	0.49		0.00	0.55		0.54	0.00	0.92			
Avail Cap(c_a), veh/h	0	3000		0	3296		926	0	1879			
HCM Platoon Ratio	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.00	1.00	0.00	0.00	0.47	0.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	0.0	2.2	0.0	0.0	1.1	0.0	36.9	0.0	44.5			
Incr Delay (d2), s/veh	0.0	0.6	0.0	0.0	0.3	0.0	0.2	0.0	5.4			
Initial Q Delay(d3),s/veh	0.0	1.1	0.0	0.0	0.2	0.0	2.1	0.0	18.5			
%ile BackOfQ(95%),veh/ln	0.0	2.7	0.0	0.0	1.3	0.0	18.2	0.0	26.9			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	3.9	0.0	0.0	1.6	0.0	39.2	0.0	68.4			
LnGrp LOS	A	A		A	A		D	A	E			
Approach Vol, veh/h		1423	A		1771	A		1682				
Approach Delay, s/veh		3.9			1.6			62.0				
Approach LOS		A			A			E				
Timer - Assigned Phs		2				6		8				
Phs Duration (G+Y+Rc), s		86.7				86.7		63.3				
Change Period (Y+Rc), s		5.0				5.0		5.0				
Max Green Setting (Gmax), s		60.0				60.0		80.0				
Max Q Clear Time (g_c+I1), s		3.0				3.0		56.5				
Green Ext Time (p_c), s		33.6				43.0		1.7				

Intersection Summary	
HCM 6th Ctrl Delay	23.1
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	1128	914	0	1046	862
Future Volume (veh/h)	0	1128	914	0	1046	862
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1870	1870	0	1870	1870
Adj Flow Rate, veh/h	0	1226	993	0	1137	937
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	0	2	2
Cap, veh/h	0	2497	2497		1432	1156
Arrive On Green	0.00	0.98	0.98	0.00	0.41	0.41
Sat Flow, veh/h	0	5443	5443	0	3456	2790
Grp Volume(v), veh/h	0	1226	993	0	1137	937
Grp Sat Flow(s),veh/h/ln	0	1702	1702	0	1728	1395
Q Serve(g_s), s	0.0	1.5	1.0	0.0	41.6	42.9
Cycle Q Clear(g_c), s	0.0	1.5	1.0	0.0	41.6	42.9
Prop In Lane	0.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	2497	2497		1432	1156
V/C Ratio(X)	0.00	0.49	0.40		0.79	0.81
Avail Cap(c_a), veh/h	0	2497	2497		1859	1501
HCM Platoon Ratio	1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.8	0.8	0.0	37.1	37.4
Incr Delay (d2), s/veh	0.0	0.7	0.5	0.0	1.9	2.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.8	0.6	0.0	24.9	21.4
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	1.5	1.3	0.0	38.9	40.1
LnGrp LOS	A	A	A		D	D
Approach Vol, veh/h		1226	993	A	2074	
Approach Delay, s/veh		1.5	1.3		39.4	
Approach LOS		A	A		D	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		77.9		67.1		77.9
Change Period (Y+Rc), s		5.0		5.0		5.0
Max Green Setting (Gmax), s		55.0		80.0		55.0
Max Q Clear Time (g_c+I1), s		4.5		45.9		4.0
Green Ext Time (p_c), s		7.2		16.1		5.4

Intersection Summary			
HCM 6th Ctrl Delay			19.8
HCM 6th LOS			B

Notes

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1541	0	0	1018	527	661
Future Volume (veh/h)	1541	0	0	1018	527	661
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	0	0	1870	1870	1870
Adj Flow Rate, veh/h	1675	0	0	1107	430	871
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	0	0	2	2	2
Cap, veh/h	2991	0	0	3770	566	1007
Arrive On Green	1.00	0.00	0.00	1.00	0.32	0.32
Sat Flow, veh/h	5443	0	0	6958	1781	3170
Grp Volume(v), veh/h	1675	0	0	1107	430	871
Grp Sat Flow(s),veh/h/ln	1702	0	0	1609	1781	1585
Q Serve(g_s), s	0.0	0.0	0.0	0.0	31.5	37.5
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	31.5	37.5
Prop In Lane		0.00	0.00		1.00	1.00
Lane Grp Cap(c), veh/h	2991	0	0	3770	566	1007
V/C Ratio(X)	0.56	0.00	0.00	0.29	0.76	0.87
Avail Cap(c_a), veh/h	2991	0	0	3770	762	1355
HCM Platoon Ratio	2.00	1.00	1.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	44.5	46.6
Incr Delay (d2), s/veh	0.8	0.0	0.0	0.2	3.1	4.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.4	0.0	0.0	0.1	20.7	21.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.8	0.0	0.0	0.2	47.6	51.2
LnGrp LOS	A	A	A	A	D	D
Approach Vol, veh/h	1675			1107	1301	
Approach Delay, s/veh	0.8			0.2	50.0	
Approach LOS	A			A	D	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		92.0		53.0		92.0
Change Period (Y+Rc), s		5.0		5.0		5.0
Max Green Setting (Gmax), s		71.0		64.0		71.0
Max Q Clear Time (g_c+I1), s		3.0		40.5		3.0
Green Ext Time (p_c), s		12.1		7.6		6.3

Intersection Summary			
HCM 6th Ctrl Delay			16.3
HCM 6th LOS			B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1194	6	0	1169	0	0	0	77	669	110	300
Future Volume (veh/h)	0	1194	6	0	1169	0	0	0	77	669	110	300
Initial Q (Qb), veh	0	20	0	0	15	0	0	0	0	7	7	7
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	0	2067	1870	0	2067	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	0	1298	7	0	1271	0	0	0	84	813	0	326
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	0	2	2	2	2	2	2	2	2
Cap, veh/h	0	4104	22	0	3148		0	0	85	898	0	790
Arrive On Green	0.00	1.00	0.56	0.00	1.00	0.00	0.00	0.00	0.05	0.25	0.00	0.25
Sat Flow, veh/h	0	7643	40	0	6016	0	0	0	1585	3563	0	3170
Grp Volume(v), veh/h	0	941	364	0	1271	0	0	0	84	813	0	326
Grp Sat Flow(s),veh/h/ln	0	1778	2060	0	1881	0	0	0	1585	1781	0	1585
Q Serve(g_s), s	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	7.9	33.3	0.0	12.9
Cycle Q Clear(g_c), s	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	7.9	33.3	0.0	12.9
Prop In Lane	0.00		0.02	0.00		0.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	0	2976	1150	0	3148		0	0	85	898	0	790
V/C Ratio(X)	0.00	0.32	0.32	0.00	0.40		0.00	0.00	0.99	0.91	0.00	0.41
Avail Cap(c_a), veh/h	0	2979	1151	0	3152		0	0	85	950	0	845
HCM Platoon Ratio	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.26	0.26	0.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	71.0	54.9	0.0	47.7
Incr Delay (d2), s/veh	0.0	0.1	0.2	0.0	0.4	0.0	0.0	0.0	95.7	11.7	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.3	0.2	0.0	0.3	0.0	0.0	0.0	0.0	4.6	0.0	1.0
%ile BackOfQ(95%),veh/ln	0.0	0.1	0.4	0.0	0.3	0.0	0.0	0.0	9.3	24.4	0.0	9.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.3	0.7	0.0	0.7	0.0	0.0	0.0	166.6	71.3	0.0	49.0
LnGrp LOS	A	A	A	A	A		A	A	F	E	A	D
Approach Vol, veh/h		1305			1271	A		84			1139	
Approach Delay, s/veh		0.4			0.7			166.6			64.9	
Approach LOS		A			A			F			E	

Timer - Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		90.8		44.2		90.8		15.0
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		83.0		42.0		83.0		10.0
Max Q Clear Time (g_c+I1), s		3.3		36.3		3.0		10.9
Green Ext Time (p_c), s		17.4		2.9		18.1		0.0

Intersection Summary	
HCM 6th Ctrl Delay	23.5
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1184	184	0	2100	668	426	0	1046	0	0	0
Future Volume (veh/h)	0	1184	184	0	2100	668	426	0	1046	0	0	0
Initial Q (Qb), veh	0	25	0	0	10	0	8	0	21			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	0	2067	1870	0	2067	1870	1870	0	1870			
Adj Flow Rate, veh/h	0	1287	0	0	2283	0	463	0	589			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	0	2	2	0	2	2	2	0	2			
Cap, veh/h	0	3571		0	3935		508	0	1010			
Arrive On Green	0.00	1.00	0.00	0.00	1.00	0.00	0.27	0.00	0.27			
Sat Flow, veh/h	0	5830	1585	0	6202	1585	1781	0	3614			
Grp Volume(v), veh/h	0	1287	0	0	2283	0	463	0	589			
Grp Sat Flow(s),veh/h/ln	0	1881	1585	0	2067	1585	1781	0	1205			
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	38.5	0.0	21.4			
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	0.0	0.0	38.5	0.0	21.4			
Prop In Lane	0.00		1.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	0	3571		0	3935		508	0	1010			
V/C Ratio(X)	0.00	0.36		0.00	0.58		0.91	0.00	0.58			
Avail Cap(c_a), veh/h	0	3600		0	3956		641	0	1301			
HCM Platoon Ratio	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.00	1.00	0.00	0.00	0.47	0.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	53.1	0.0	47.9			
Incr Delay (d2), s/veh	0.0	0.3	0.0	0.0	0.3	0.0	13.3	0.0	0.2			
Initial Q Delay(d3),s/veh	0.0	0.6	0.0	0.0	0.1	0.0	20.2	0.0	7.5			
%ile BackOfQ(95%),veh/ln	0.0	0.4	0.0	0.0	0.2	0.0	30.5	0.0	12.8			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.8	0.0	0.0	0.4	0.0	86.6	0.0	55.6			
LnGrp LOS	A	A		A	A		F	A	E			
Approach Vol, veh/h		1287	A		2283	A		1052				
Approach Delay, s/veh		0.8			0.4			69.2				
Approach LOS		A			A			E				
Timer - Assigned Phs		2				6		8				
Phs Duration (G+Y+Rc), s		102.7				102.7		47.3				
Change Period (Y+Rc), s		5.0				5.0		5.0				
Max Green Setting (Gmax), s		84.0				84.0		56.0				
Max Q Clear Time (g_c+I1), s		3.0				3.0		41.5				
Green Ext Time (p_c), s		34.2				71.3		0.8				
Intersection Summary												
HCM 6th Ctrl Delay			16.2									
HCM 6th LOS			B									

Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	1525	1105	0	605	799
Future Volume (veh/h)	0	1525	1105	0	605	799
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1870	1870	0	1870	1870
Adj Flow Rate, veh/h	0	1658	1201	0	658	868
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	0	2	2
Cap, veh/h	0	2743	2743		1266	1022
Arrive On Green	0.00	1.00	1.00	0.00	0.37	0.37
Sat Flow, veh/h	0	5443	5443	0	3456	2790
Grp Volume(v), veh/h	0	1658	1201	0	658	868
Grp Sat Flow(s),veh/h/ln	0	1702	1702	0	1728	1395
Q Serve(g_s), s	0.0	0.0	0.0	0.0	21.6	41.5
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	21.6	41.5
Prop In Lane	0.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	2743	2743		1266	1022
V/C Ratio(X)	0.00	0.60	0.44		0.52	0.85
Avail Cap(c_a), veh/h	0	2743	2743		1859	1501
HCM Platoon Ratio	1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	36.0	42.3
Incr Delay (d2), s/veh	0.0	1.0	0.5	0.0	0.3	3.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.5	0.2	0.0	14.2	21.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	1.0	0.5	0.0	36.3	45.5
LnGrp LOS	A	A	A		D	D
Approach Vol, veh/h		1658	1201	A	1526	
Approach Delay, s/veh		1.0	0.5		41.5	
Approach LOS		A	A		D	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		84.9		60.1		84.9
Change Period (Y+Rc), s		5.0		5.0		5.0
Max Green Setting (Gmax), s		55.0		80.0		55.0
Max Q Clear Time (g_c+I1), s		3.0		44.5		3.0
Green Ext Time (p_c), s		11.6		10.6		7.0

Intersection Summary			
HCM 6th Ctrl Delay			15.0
HCM 6th LOS			B

Notes

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1405	0	0	1521	423	769
Future Volume (veh/h)	1405	0	0	1521	423	769
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	0	0	1870	1870	1870
Adj Flow Rate, veh/h	1527	0	0	1653	432	866
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	0	0	2	2	2
Cap, veh/h	2999	0	0	3779	563	1002
Arrive On Green	1.00	0.00	0.00	1.00	0.32	0.32
Sat Flow, veh/h	5443	0	0	6958	1781	3170
Grp Volume(v), veh/h	1527	0	0	1653	432	866
Grp Sat Flow(s),veh/h/ln	1702	0	0	1609	1781	1585
Q Serve(g_s), s	0.0	0.0	0.0	0.0	31.8	37.3
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	31.8	37.3
Prop In Lane		0.00	0.00		1.00	1.00
Lane Grp Cap(c), veh/h	2999	0	0	3779	563	1002
V/C Ratio(X)	0.51	0.00	0.00	0.44	0.77	0.86
Avail Cap(c_a), veh/h	2999	0	0	3779	762	1355
HCM Platoon Ratio	2.00	1.00	1.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	44.8	46.7
Incr Delay (d2), s/veh	0.6	0.0	0.0	0.4	3.3	4.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.3	0.0	0.0	0.2	20.8	21.7
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.6	0.0	0.0	0.4	48.1	51.3
LnGrp LOS	A	A	A	A	D	D
Approach Vol, veh/h	1527			1653	1298	
Approach Delay, s/veh	0.6			0.4	50.2	
Approach LOS	A			A	D	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		92.2		52.8		92.2
Change Period (Y+Rc), s		5.0		5.0		5.0
Max Green Setting (Gmax), s		71.0		64.0		71.0
Max Q Clear Time (g_c+I1), s		3.0		40.3		3.0
Green Ext Time (p_c), s		10.3		7.6		11.8

Intersection Summary			
HCM 6th Ctrl Delay			14.9
HCM 6th LOS			B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1146	9	0	689	0	0	0	50	910	5	238
Future Volume (veh/h)	0	1146	9	0	689	0	0	0	50	910	5	238
Initial Q (Qb), veh	0	20	0	0	15	0	0	0	0	7	7	7
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	0	2067	1870	0	2067	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	0	1246	10	0	749	0	0	0	54	993	0	259
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	0	2	2	2	2	2	2	2	2
Cap, veh/h	0	3714	29	0	2862		0	0	56	1142	0	1006
Arrive On Green	0.00	1.00	0.51	0.00	1.00	0.00	0.00	0.00	0.04	0.32	0.00	0.32
Sat Flow, veh/h	0	7621	59	0	6016	0	0	0	1585	3563	0	3170
Grp Volume(v), veh/h	0	906	350	0	749	0	0	0	54	993	0	259
Grp Sat Flow(s),veh/h/ln	0	1778	2057	0	1881	0	0	0	1585	1781	0	1585
Q Serve(g_s), s	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	5.1	39.7	0.0	9.1
Cycle Q Clear(g_c), s	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	5.1	39.7	0.0	9.1
Prop In Lane	0.00		0.03	0.00		0.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	0	2701	1043	0	2862		0	0	56	1142	0	1006
V/C Ratio(X)	0.00	0.34	0.34	0.00	0.26		0.00	0.00	0.97	0.87	0.00	0.26
Avail Cap(c_a), veh/h	0	2719	1049	0	2877		0	0	85	1401	0	1247
HCM Platoon Ratio	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.26	0.26	0.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	0.4	0.9	0.0	0.4	0.0	0.0	0.0	72.3	48.6	0.0	38.5
Incr Delay (d2), s/veh	0.0	0.1	0.2	0.0	0.2	0.0	0.0	0.0	71.8	5.3	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.3	0.2	0.0	0.3	0.0	0.0	0.0	0.0	2.1	0.0	0.5
%ile BackOfQ(95%),veh/ln	0.0	0.4	0.8	0.0	0.5	0.0	0.0	0.0	5.8	26.6	0.0	7.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.9	1.4	0.0	0.9	0.0	0.0	0.0	144.1	55.9	0.0	39.1
LnGrp LOS	A	A	A	A	A		A	A	F	E	A	D
Approach Vol, veh/h		1256			749	A		54			1252	
Approach Delay, s/veh		1.0			0.9			144.1			52.4	
Approach LOS		A			A			F			D	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		83.5		54.3		83.5		12.3				
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0				
Max Green Setting (Gmax), s		64.0		61.0		64.0		10.0				
Max Q Clear Time (g_c+I1), s		3.5		42.7		3.0		8.1				
Green Ext Time (p_c), s		15.8		6.6		8.1		0.0				

Intersection Summary		
HCM 6th Ctrl Delay		22.7
HCM 6th LOS		C

Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1305	367	0	1341	731	339	0	1548	0	0	0
Future Volume (veh/h)	0	1305	367	0	1341	731	339	0	1548	0	0	0
Initial Q (Qb), veh	0	25	0	0	10	0	8	0	21			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	0	2067	1870	0	2067	1870	1870	0	1870			
Adj Flow Rate, veh/h	0	1418	0	0	1806	0	368	0	1135			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	0	2	2	0	2	2	2	0	2			
Cap, veh/h	0	3137		0	3524		599	0	1255			
Arrive On Green	0.00	1.00	0.00	0.00	1.00	0.00	0.33	0.00	0.33			
Sat Flow, veh/h	0	5830	1585	0	6202	1585	1781	0	3614			
Grp Volume(v), veh/h	0	1418	0	0	1806	0	368	0	1135			
Grp Sat Flow(s),veh/h/ln	0	1881	1585	0	2067	1585	1781	0	1205			
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	26.3	0.0	46.3			
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	0.0	0.0	26.3	0.0	46.3			
Prop In Lane	0.00		1.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	0	3137		0	3524		599	0	1255			
V/C Ratio(X)	0.00	0.45		0.00	0.51		0.61	0.00	0.90			
Avail Cap(c_a), veh/h	0	3281		0	3605		926	0	1879			
HCM Platoon Ratio	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.00	1.00	0.00	0.00	0.47	0.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	0.0	2.2	0.0	0.0	1.1	0.0	42.6	0.0	48.2			
Incr Delay (d2), s/veh	0.0	0.5	0.0	0.0	0.3	0.0	0.4	0.0	3.4			
Initial Q Delay(d3),s/veh	0.0	0.8	0.0	0.0	0.1	0.0	3.3	0.0	21.0			
%ile BackOfQ(95%),veh/ln	0.0	2.6	0.0	0.0	1.4	0.0	19.4	0.0	24.1			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	3.5	0.0	0.0	1.5	0.0	46.3	0.0	72.7			
LnGrp LOS	A	A		A	A		D	A	E			
Approach Vol, veh/h		1418	A		1806	A		1503				
Approach Delay, s/veh		3.5			1.5			66.2				
Approach LOS		A			A			E				
Timer - Assigned Phs		2				6		8				
Phs Duration (G+Y+Rc), s		94.2				94.2		55.8				
Change Period (Y+Rc), s		5.0				5.0		5.0				
Max Green Setting (Gmax), s		60.0				60.0		80.0				
Max Q Clear Time (g_c+I1), s		3.0				3.0		49.3				
Green Ext Time (p_c), s		33.4				43.9		1.5				

Intersection Summary		
HCM 6th Ctrl Delay		22.7
HCM 6th LOS		C

Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	1129	916	0	984	800
Future Volume (veh/h)	0	1129	916	0	984	800
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1870	1870	0	1870	1870
Adj Flow Rate, veh/h	0	1227	996	0	1070	870
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	0	2	2
Cap, veh/h	0	2631	2631		1341	1083
Arrive On Green	0.00	1.00	1.00	0.00	0.39	0.39
Sat Flow, veh/h	0	5443	5443	0	3456	2790
Grp Volume(v), veh/h	0	1227	996	0	1070	870
Grp Sat Flow(s),veh/h/ln	0	1702	1702	0	1728	1395
Q Serve(g_s), s	0.0	0.0	0.0	0.0	39.8	40.2
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	39.8	40.2
Prop In Lane	0.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	2631	2631		1341	1083
V/C Ratio(X)	0.00	0.47	0.38		0.80	0.80
Avail Cap(c_a), veh/h	0	2631	2631		1859	1501
HCM Platoon Ratio	1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	39.3	39.4
Incr Delay (d2), s/veh	0.0	0.6	0.4	0.0	1.7	2.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.3	0.2	0.0	24.0	20.3
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	0.6	0.4	0.0	41.0	41.7
LnGrp LOS	A	A	A		D	D
Approach Vol, veh/h		1227	996	A	1940	
Approach Delay, s/veh		0.6	0.4		41.3	
Approach LOS		A	A		D	
Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		81.7		63.3		81.7
Change Period (Y+Rc), s		5.0		5.0		5.0
Max Green Setting (Gmax), s		55.0		80.0		55.0
Max Q Clear Time (g_c+I1), s		3.0		43.2		3.0
Green Ext Time (p_c), s		7.2		15.1		5.4
Intersection Summary						
HCM 6th Ctrl Delay			19.5			
HCM 6th LOS			B			
Notes						

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1471	0	0	1020	527	661
Future Volume (veh/h)	1471	0	0	1020	527	661
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	0	0	1870	1870	1870
Adj Flow Rate, veh/h	1599	0	0	1109	430	871
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	0	0	2	2	2
Cap, veh/h	2991	0	0	3770	566	1007
Arrive On Green	1.00	0.00	0.00	1.00	0.32	0.32
Sat Flow, veh/h	5443	0	0	6958	1781	3170
Grp Volume(v), veh/h	1599	0	0	1109	430	871
Grp Sat Flow(s),veh/h/ln	1702	0	0	1609	1781	1585
Q Serve(g_s), s	0.0	0.0	0.0	0.0	31.5	37.5
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	31.5	37.5
Prop In Lane		0.00	0.00		1.00	1.00
Lane Grp Cap(c), veh/h	2991	0	0	3770	566	1007
V/C Ratio(X)	0.53	0.00	0.00	0.29	0.76	0.87
Avail Cap(c_a), veh/h	2991	0	0	3770	762	1355
HCM Platoon Ratio	2.00	1.00	1.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	44.5	46.6
Incr Delay (d2), s/veh	0.7	0.0	0.0	0.2	3.1	4.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.3	0.0	0.0	0.1	20.7	21.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.7	0.0	0.0	0.2	47.6	51.2
LnGrp LOS	A	A	A	A	D	D
Approach Vol, veh/h	1599			1109	1301	
Approach Delay, s/veh	0.7			0.2	50.0	
Approach LOS	A			A	D	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		92.0		53.0		92.0
Change Period (Y+Rc), s		5.0		5.0		5.0
Max Green Setting (Gmax), s		71.0		64.0		71.0
Max Q Clear Time (g_c+I1), s		3.0		40.5		3.0
Green Ext Time (p_c), s		11.1		7.6		6.3

Intersection Summary		
HCM 6th Ctrl Delay		16.6
HCM 6th LOS		B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1195	6	0	1158	0	0	0	77	669	110	300
Future Volume (veh/h)	0	1195	6	0	1158	0	0	0	77	669	110	300
Initial Q (Qb), veh	0	20	0	0	15	0	0	0	0	7	7	7
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	0	2067	1870	0	2067	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	0	1299	7	0	1259	0	0	0	84	813	0	326
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	0	2	2	2	2	2	2	2	2
Cap, veh/h	0	4104	22	0	3148		0	0	85	898	0	790
Arrive On Green	0.00	1.00	0.56	0.00	1.00	0.00	0.00	0.00	0.05	0.25	0.00	0.25
Sat Flow, veh/h	0	7643	40	0	6016	0	0	0	1585	3563	0	3170
Grp Volume(v), veh/h	0	942	364	0	1259	0	0	0	84	813	0	326
Grp Sat Flow(s),veh/h/ln	0	1778	2060	0	1881	0	0	0	1585	1781	0	1585
Q Serve(g_s), s	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	7.9	33.3	0.0	12.9
Cycle Q Clear(g_c), s	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	7.9	33.3	0.0	12.9
Prop In Lane	0.00		0.02	0.00		0.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	0	2976	1150	0	3148		0	0	85	898	0	790
V/C Ratio(X)	0.00	0.32	0.32	0.00	0.40		0.00	0.00	0.99	0.91	0.00	0.41
Avail Cap(c_a), veh/h	0	2979	1151	0	3152		0	0	85	950	0	845
HCM Platoon Ratio	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.26	0.26	0.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	71.0	54.9	0.0	47.7
Incr Delay (d2), s/veh	0.0	0.1	0.2	0.0	0.4	0.0	0.0	0.0	95.7	11.7	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.3	0.2	0.0	0.3	0.0	0.0	0.0	0.0	4.6	0.0	1.0
%ile BackOfQ(95%),veh/ln	0.0	0.1	0.4	0.0	0.3	0.0	0.0	0.0	9.3	24.4	0.0	9.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.3	0.7	0.0	0.7	0.0	0.0	0.0	166.6	71.3	0.0	49.0
LnGrp LOS	A	A	A	A	A		A	A	F	E	A	D
Approach Vol, veh/h		1306			1259	A		84			1139	
Approach Delay, s/veh		0.4			0.7			166.6			64.9	
Approach LOS		A			A			F			E	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		90.8		44.2		90.8		15.0				
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0				
Max Green Setting (Gmax), s		83.0		42.0		83.0		10.0				
Max Q Clear Time (g_c+I1), s		3.3		36.3		3.0		10.9				
Green Ext Time (p_c), s		17.4		2.9		17.8		0.0				

Intersection Summary			
HCM 6th Ctrl Delay			23.6
HCM 6th LOS			C

Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1185	184	0	1941	668	426	0	1094	0	0	0
Future Volume (veh/h)	0	1185	184	0	1941	668	426	0	1094	0	0	0
Initial Q (Qb), veh	0	25	0	0	10	0	8	0	21			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	0	2067	1870	0	2067	1870	1870	0	1870			
Adj Flow Rate, veh/h	0	1288	0	0	2136	0	463	0	641			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	0	2	2	0	2	2	2	0	2			
Cap, veh/h	0	3569		0	3936		508	0	1014			
Arrive On Green	0.00	1.00	0.00	0.00	1.00	0.00	0.27	0.00	0.27			
Sat Flow, veh/h	0	5830	1585	0	6202	1585	1781	0	3614			
Grp Volume(v), veh/h	0	1288	0	0	2136	0	463	0	641			
Grp Sat Flow(s),veh/h/ln	0	1881	1585	0	2067	1585	1781	0	1205			
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	38.5	0.0	23.6			
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	0.0	0.0	38.5	0.0	23.6			
Prop In Lane	0.00		1.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	0	3569		0	3936		508	0	1014			
V/C Ratio(X)	0.00	0.36		0.00	0.54		0.91	0.00	0.63			
Avail Cap(c_a), veh/h	0	3598		0	3954		641	0	1301			
HCM Platoon Ratio	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.00	1.00	0.00	0.00	0.47	0.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	53.0	0.0	48.6			
Incr Delay (d2), s/veh	0.0	0.3	0.0	0.0	0.3	0.0	13.3	0.0	0.2			
Initial Q Delay(d3),s/veh	0.0	0.6	0.0	0.0	0.1	0.0	19.9	0.0	8.4			
%ile BackOfQ(95%),veh/ln	0.0	0.4	0.0	0.0	0.2	0.0	30.5	0.0	13.8			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.8	0.0	0.0	0.4	0.0	86.2	0.0	57.2			
LnGrp LOS	A	A		A	A		F	A	E			
Approach Vol, veh/h		1288	A		2136	A		1104				
Approach Delay, s/veh		0.8			0.4			69.4				
Approach LOS		A			A			E				
Timer - Assigned Phs		2				6		8				
Phs Duration (G+Y+Rc), s		102.6				102.6		47.4				
Change Period (Y+Rc), s		5.0				5.0		5.0				
Max Green Setting (Gmax), s		84.0				84.0		56.0				
Max Q Clear Time (g_c+I1), s		3.0				3.0		41.5				
Green Ext Time (p_c), s		34.2				67.7		0.9				
Intersection Summary												
HCM 6th Ctrl Delay			17.3									
HCM 6th LOS			B									

Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	1498	1098	0	623	817
Future Volume (veh/h)	0	1498	1098	0	623	817
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1870	1870	0	1870	1870
Adj Flow Rate, veh/h	0	1628	1193	0	677	888
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	0	2	2
Cap, veh/h	0	2701	2701		1294	1044
Arrive On Green	0.00	1.00	1.00	0.00	0.37	0.37
Sat Flow, veh/h	0	5443	5443	0	3456	2790
Grp Volume(v), veh/h	0	1628	1193	0	677	888
Grp Sat Flow(s),veh/h/ln	0	1702	1702	0	1728	1395
Q Serve(g_s), s	0.0	0.0	0.0	0.0	22.1	42.4
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	22.1	42.4
Prop In Lane	0.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	2701	2701		1294	1044
V/C Ratio(X)	0.00	0.60	0.44		0.52	0.85
Avail Cap(c_a), veh/h	0	2701	2701		1859	1501
HCM Platoon Ratio	1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	35.3	41.6
Incr Delay (d2), s/veh	0.0	1.0	0.5	0.0	0.3	3.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.5	0.2	0.0	14.5	21.4
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	1.0	0.5	0.0	35.6	45.0
LnGrp LOS	A	A	A		D	D
Approach Vol, veh/h		1628	1193	A	1565	
Approach Delay, s/veh		1.0	0.5		40.9	
Approach LOS		A	A		D	
Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		83.7		61.3		83.7
Change Period (Y+Rc), s		5.0		5.0		5.0
Max Green Setting (Gmax), s		55.0		80.0		55.0
Max Q Clear Time (g_c+I1), s		3.0		45.4		3.0
Green Ext Time (p_c), s		11.3		10.9		6.9

Intersection Summary		
HCM 6th Ctrl Delay		15.1
HCM 6th LOS		B

Notes

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1426	0	0	1514	423	769
Future Volume (veh/h)	1426	0	0	1514	423	769
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	0	0	1870	1870	1870
Adj Flow Rate, veh/h	1550	0	0	1646	432	866
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	0	0	2	2	2
Cap, veh/h	2999	0	0	3779	563	1002
Arrive On Green	1.00	0.00	0.00	1.00	0.32	0.32
Sat Flow, veh/h	5443	0	0	6958	1781	3170
Grp Volume(v), veh/h	1550	0	0	1646	432	866
Grp Sat Flow(s),veh/h/ln	1702	0	0	1609	1781	1585
Q Serve(g_s), s	0.0	0.0	0.0	0.0	31.8	37.3
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	31.8	37.3
Prop In Lane		0.00	0.00		1.00	1.00
Lane Grp Cap(c), veh/h	2999	0	0	3779	563	1002
V/C Ratio(X)	0.52	0.00	0.00	0.44	0.77	0.86
Avail Cap(c_a), veh/h	2999	0	0	3779	762	1355
HCM Platoon Ratio	2.00	1.00	1.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	44.8	46.7
Incr Delay (d2), s/veh	0.6	0.0	0.0	0.4	3.3	4.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.3	0.0	0.0	0.2	20.8	21.7
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.6	0.0	0.0	0.4	48.1	51.3
LnGrp LOS	A	A	A	A	D	D
Approach Vol, veh/h	1550			1646	1298	
Approach Delay, s/veh	0.6			0.4	50.2	
Approach LOS	A			A	D	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		92.2		52.8		92.2
Change Period (Y+Rc), s		5.0		5.0		5.0
Max Green Setting (Gmax), s		71.0		64.0		71.0
Max Q Clear Time (g_c+I1), s		3.0		40.3		3.0
Green Ext Time (p_c), s		10.5		7.6		11.7

Intersection Summary	
HCM 6th Ctrl Delay	14.9
HCM 6th LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1464	12	0	742	0	0	0	49	1125	6	294
Future Volume (veh/h)	0	1464	12	0	742	0	0	0	49	1125	6	294
Initial Q (Qb), veh	0	20	0	0	15	0	0	0	0	7	7	7
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	0	2067	1870	0	2067	0	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	0	1591	13	0	807	0	0	0	53	1228	0	320
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	0	2	0	2	2	2	2	2	2
Cap, veh/h	0	3067	24	0	1631		0	0	54	1421	0	1255
Arrive On Green	0.00	0.86	0.43	0.00	0.86	0.00	0.00	0.00	0.03	0.39	0.00	0.39
Sat Flow, veh/h	0	7619	60	0	4134	0	0	0	1585	3563	0	3170
Grp Volume(v), veh/h	0	1158	446	0	807	0	0	0	53	1228	0	320
Grp Sat Flow(s),veh/h/ln	0	1778	2056	0	1964	0	0	0	1585	1781	0	1585
Q Serve(g_s), s	0.0	7.8	8.4	0.0	7.1	0.0	0.0	0.0	5.0	47.9	0.0	10.2
Cycle Q Clear(g_c), s	0.0	7.8	8.4	0.0	7.1	0.0	0.0	0.0	5.0	47.9	0.0	10.2
Prop In Lane	0.00		0.03	0.00		0.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	0	2230	865	0	1631		0	0	54	1421	0	1255
V/C Ratio(X)	0.00	0.52	0.52	0.00	0.49		0.00	0.00	0.97	0.86	0.00	0.25
Avail Cap(c_a), veh/h	0	2306	889	0	1698		0	0	85	1829	0	1627
HCM Platoon Ratio	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.26	0.26	0.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	8.9	9.1	0.0	9.4	0.0	0.0	0.0	72.4	41.9	0.0	30.8
Incr Delay (d2), s/veh	0.0	0.2	0.6	0.0	1.1	0.0	0.0	0.0	72.0	3.7	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.7	0.5	0.0	1.2	0.0	0.0	0.0	0.0	1.3	0.0	0.3
%ile BackOfQ(95%),veh/ln	0.0	5.0	5.7	0.0	7.6	0.0	0.0	0.0	5.6	30.3	0.0	8.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	9.8	10.1	0.0	11.7	0.0	0.0	0.0	144.4	46.8	0.0	31.2
LnGrp LOS	A	A	B	A	B		A	A	F	D	A	C
Approach Vol, veh/h		1604			807	A		53			1548	
Approach Delay, s/veh		9.9			11.7			144.4			43.6	
Approach LOS		A			B			F			D	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		71.9		66.0		71.9		12.1				
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0				
Max Green Setting (Gmax), s		46.0		79.0		46.0		10.0				
Max Q Clear Time (g_c+I1), s		11.4		50.9		10.1		8.0				
Green Ext Time (p_c), s		18.5		10.1		8.4		0.0				

Intersection Summary			
HCM 6th Ctrl Delay			25.0
HCM 6th LOS			C

Notes

User approved volume balancing among the lanes for turning movement.
Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1583	444	0	428	863	339	0	1834	0	0	0
Future Volume (veh/h)	0	1583	444	0	428	863	339	0	1834	0	0	0
Initial Q (Qb), veh	0	25	0	0	10	0	8	0	21			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	0	2067	1870	0	2067	1870	1870	0	1870			
Adj Flow Rate, veh/h	0	1721	0	0	465	0	368	0	1445			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	0	2	2	0	2	2	2	0	2			
Cap, veh/h	0	2352		0	1917		747	0	1566			
Arrive On Green	0.00	0.99	0.00	0.00	0.99	0.00	0.41	0.00	0.41			
Sat Flow, veh/h	0	5830	1585	0	4031	1585	1781	0	3614			
Grp Volume(v), veh/h	0	1721	0	0	465	0	368	0	1445			
Grp Sat Flow(s),veh/h/ln	0	1881	1585	0	1964	1585	1781	0	1205			
Q Serve(g_s), s	0.0	1.2	0.0	0.0	0.2	0.0	23.0	0.0	58.8			
Cycle Q Clear(g_c), s	0.0	1.2	0.0	0.0	0.2	0.0	23.0	0.0	58.8			
Prop In Lane	0.00		1.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	0	2352		0	1917		747	0	1566			
V/C Ratio(X)	0.00	0.73		0.00	0.24		0.49	0.00	0.92			
Avail Cap(c_a), veh/h	0	2794		0	1945		1009	0	2048			
HCM Platoon Ratio	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.00	1.00	0.00	0.00	0.47	0.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	0.0	12.3	0.0	0.0	1.5	0.0	32.7	0.0	41.8			
Incr Delay (d2), s/veh	0.0	2.1	0.0	0.0	0.1	0.0	0.2	0.0	5.5			
Initial Q Delay(d3),s/veh	0.0	3.0	0.0	0.0	0.3	0.0	1.6	0.0	16.8			
%ile BackOfQ(95%),veh/ln	0.0	12.4	0.0	0.0	1.4	0.0	17.2	0.0	28.7			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	17.4	0.0	0.0	1.9	0.0	34.5	0.0	64.1			
LnGrp LOS	A	B		A	A		C	A	E			
Approach Vol, veh/h		1721	A		465	A		1813				
Approach Delay, s/veh		17.4			1.9			58.1				
Approach LOS		B			A			E				
Timer - Assigned Phs		2				6		8				
Phs Duration (G+Y+Rc), s		81.3				81.3		68.7				
Change Period (Y+Rc), s		5.0				5.0		5.0				
Max Green Setting (Gmax), s		53.0				53.0		87.0				
Max Q Clear Time (g_c+I1), s		4.2				3.2		61.8				
Green Ext Time (p_c), s		37.2				7.6		1.9				

Intersection Summary		
HCM 6th Ctrl Delay		34.0
HCM 6th LOS		C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	1136	959	0	1170	965
Future Volume (veh/h)	0	1136	959	0	1170	965
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1870	1870	0	1870	1870
Adj Flow Rate, veh/h	0	1235	1042	0	1272	1049
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	0	2	2
Cap, veh/h	0	2289	2289		1573	1270
Arrive On Green	0.00	0.90	0.90	0.00	0.46	0.46
Sat Flow, veh/h	0	5443	5443	0	3456	2790
Grp Volume(v), veh/h	0	1235	1042	0	1272	1049
Grp Sat Flow(s),veh/h/ln	0	1702	1702	0	1728	1395
Q Serve(g_s), s	0.0	7.0	5.2	0.0	46.0	47.6
Cycle Q Clear(g_c), s	0.0	7.0	5.2	0.0	46.0	47.6
Prop In Lane	0.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	2289	2289		1573	1270
V/C Ratio(X)	0.00	0.54	0.46		0.81	0.83
Avail Cap(c_a), veh/h	0	2289	2289		1859	1501
HCM Platoon Ratio	1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	4.5	4.4	0.0	34.1	34.5
Incr Delay (d2), s/veh	0.0	0.9	0.7	0.0	2.4	3.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	3.1	2.6	0.0	27.0	23.3
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	5.4	5.1	0.0	36.4	37.9
LnGrp LOS	A	A	A		D	D
Approach Vol, veh/h		1235	1042	A	2321	
Approach Delay, s/veh		5.4	5.1		37.1	
Approach LOS		A	A		D	
Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		72.0		73.0		72.0
Change Period (Y+Rc), s		5.0		5.0		5.0
Max Green Setting (Gmax), s		55.0		80.0		55.0
Max Q Clear Time (g_c+I1), s		10.0		50.6		8.2
Green Ext Time (p_c), s		7.2		17.4		5.7
Intersection Summary						
HCM 6th Ctrl Delay			21.3			
HCM 6th LOS			C			

Notes

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1813	0	0	1096	606	759
Future Volume (veh/h)	1813	0	0	1096	606	759
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	0	0	1870	1870	1870
Adj Flow Rate, veh/h	1971	0	0	1191	495	1001
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	0	0	2	2	2
Cap, veh/h	2783	0	0	3507	638	1136
Arrive On Green	1.00	0.00	0.00	1.00	0.36	0.36
Sat Flow, veh/h	5443	0	0	6958	1781	3170
Grp Volume(v), veh/h	1971	0	0	1191	495	1001
Grp Sat Flow(s),veh/h/ln	1702	0	0	1609	1781	1585
Q Serve(g_s), s	0.0	0.0	0.0	0.0	35.8	42.9
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	35.8	42.9
Prop In Lane		0.00	0.00		1.00	1.00
Lane Grp Cap(c), veh/h	2783	0	0	3507	638	1136
V/C Ratio(X)	0.71	0.00	0.00	0.34	0.78	0.88
Avail Cap(c_a), veh/h	2783	0	0	3507	762	1355
HCM Platoon Ratio	2.00	1.00	1.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	41.3	43.6
Incr Delay (d2), s/veh	1.6	0.0	0.0	0.3	4.2	6.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.7	0.0	0.0	0.1	23.2	24.7
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	1.6	0.0	0.0	0.3	45.5	49.8
LnGrp LOS	A	A	A	A	D	D
Approach Vol, veh/h	1971			1191	1496	
Approach Delay, s/veh	1.6			0.3	48.4	
Approach LOS	A			A	D	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		86.0		59.0		86.0
Change Period (Y+Rc), s		5.0		5.0		5.0
Max Green Setting (Gmax), s		71.0		64.0		71.0
Max Q Clear Time (g_c+I1), s		3.0		45.9		3.0
Green Ext Time (p_c), s		16.7		8.0		6.9

Intersection Summary			
HCM 6th Ctrl Delay			16.3
HCM 6th LOS			B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1454	7	0	1201	0	0	0	75	917	151	411
Future Volume (veh/h)	0	1454	7	0	1201	0	0	0	75	917	151	411
Initial Q (Qb), veh	0	20	0	0	15	0	0	0	0	7	7	7
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	0	2067	1870	0	2067	0	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	0	1580	8	0	1305	0	0	0	82	1114	0	447
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	0	2	0	2	2	2	2	2	2
Cap, veh/h	0	3140	15	0	1246		0	0	89	1316	0	1164
Arrive On Green	0.00	0.88	0.44	0.00	0.88	0.00	0.00	0.00	0.06	0.36	0.00	0.36
Sat Flow, veh/h	0	7646	37	0	4134	0	0	0	1585	3563	0	3170
Grp Volume(v), veh/h	0	1145	443	0	1305	0	0	0	82	1114	0	447
Grp Sat Flow(s),veh/h/ln	0	1778	2061	0	1964	0	0	0	1585	1781	0	1585
Q Serve(g_s), s	0.0	6.8	7.2	0.0	17.8	0.0	0.0	0.0	7.7	43.4	0.0	15.7
Cycle Q Clear(g_c), s	0.0	6.8	7.2	0.0	17.8	0.0	0.0	0.0	7.7	43.4	0.0	15.7
Prop In Lane	0.00		0.02	0.00		0.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	0	2276	883	0	1246		0	0	89	1316	0	1164
V/C Ratio(X)	0.00	0.50	0.50	0.00	1.05		0.00	0.00	0.92	0.85	0.00	0.38
Avail Cap(c_a), veh/h	0	2347	907	0	1729		0	0	106	1734	0	1543
HCM Platoon Ratio	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.26	0.26	0.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	7.8	7.9	0.0	27.4	0.0	0.0	0.0	70.5	43.9	0.0	35.4
Incr Delay (d2), s/veh	0.0	0.2	0.5	0.0	38.7	0.0	0.0	0.0	58.8	3.2	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.6	0.5	0.0	43.3	0.0	0.0	0.0	0.0	1.3	0.0	0.4
%ile BackOfQ(95%),veh/ln	0.0	4.6	5.2	0.0	37.3	0.0	0.0	0.0	8.1	27.9	0.0	11.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	8.7	8.9	0.0	109.4	0.0	0.0	0.0	129.3	48.4	0.0	36.0
LnGrp LOS	A	A	A	A	F		A	A	F	D	A	D
Approach Vol, veh/h		1588			1305	A		82			1561	
Approach Delay, s/veh		8.7			109.4			129.3			44.9	
Approach LOS		A			F			F			D	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		73.0		61.6		73.0		15.4				
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0				
Max Green Setting (Gmax), s		48.0		75.0		46.0		12.0				
Max Q Clear Time (g_c+I1), s		10.2		46.4		20.8		10.7				
Green Ext Time (p_c), s		19.1		10.2		13.4		0.0				

Intersection Summary	
HCM 6th Ctrl Delay	52.3
HCM 6th LOS	D

Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1464	227	0	869	751	433	0	1404	0	0	0
Future Volume (veh/h)	0	1464	227	0	869	751	433	0	1404	0	0	0
Initial Q (Qb), veh	0	25	0	0	10	0	8	0	21			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	0	2067	1870	0	2067	1870	1870	0	1870			
Adj Flow Rate, veh/h	0	1591	0	0	945	0	471	0	978			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	0	2	2	0	2	2	2	0	2			
Cap, veh/h	0	2493		0	1859		553	0	1141			
Arrive On Green	0.00	0.98	0.00	0.00	0.98	0.00	0.30	0.00	0.30			
Sat Flow, veh/h	0	5830	1585	0	4031	1585	1781	0	3614			
Grp Volume(v), veh/h	0	1591	0	0	945	0	471	0	978			
Grp Sat Flow(s),veh/h/ln	0	1881	1585	0	1964	1585	1781	0	1205			
Q Serve(g_s), s	0.0	0.9	0.0	0.0	0.7	0.0	16.5	0.0	17.0			
Cycle Q Clear(g_c), s	0.0	0.9	0.0	0.0	0.7	0.0	16.5	0.0	17.0			
Prop In Lane	0.00		1.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	0	2493		0	1859		553	0	1141			
V/C Ratio(X)	0.00	0.64		0.00	0.51		0.85	0.00	0.86			
Avail Cap(c_a), veh/h	0	2759		0	1920		795	0	1612			
HCM Platoon Ratio	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.00	1.00	0.00	0.00	0.47	0.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	0.0	3.6	0.0	0.0	1.4	0.0	21.5	0.0	21.6			
Incr Delay (d2), s/veh	0.0	1.3	0.0	0.0	0.5	0.0	4.4	0.0	2.5			
Initial Q Delay(d3),s/veh	0.0	2.0	0.0	0.0	0.4	0.0	10.1	0.0	17.1			
%ile BackOfQ(95%),veh/ln	0.0	3.0	0.0	0.0	1.1	0.0	13.4	0.0	10.5			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	6.8	0.0	0.0	2.3	0.0	36.0	0.0	41.2			
LnGrp LOS	A	A		A	A		D	A	D			
Approach Vol, veh/h		1591	A		945	A		1449				
Approach Delay, s/veh		6.8			2.3			39.5				
Approach LOS		A			A			D				
Timer - Assigned Phs		2				6		8				
Phs Duration (G+Y+Rc), s		38.8				38.8		26.2				
Change Period (Y+Rc), s		5.0				5.0		5.0				
Max Green Setting (Gmax), s		24.0				24.0		31.0				
Max Q Clear Time (g_c+I1), s		3.9				3.7		20.0				
Green Ext Time (p_c), s		16.9				11.8		1.2				
Intersection Summary												
HCM 6th Ctrl Delay			17.6									
HCM 6th LOS			B									

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	1636	1178	0	688	909
Future Volume (veh/h)	0	1636	1178	0	688	909
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1870	1870	0	1870	1870
Adj Flow Rate, veh/h	0	1778	1280	0	748	988
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	0	2	2
Cap, veh/h	0	2506	2506		1426	1151
Arrive On Green	0.00	0.98	0.98	0.00	0.41	0.41
Sat Flow, veh/h	0	5443	5443	0	3456	2790
Grp Volume(v), veh/h	0	1778	1280	0	748	988
Grp Sat Flow(s),veh/h/ln	0	1702	1702	0	1728	1395
Q Serve(g_s), s	0.0	3.1	1.3	0.0	23.5	46.7
Cycle Q Clear(g_c), s	0.0	3.1	1.3	0.0	23.5	46.7
Prop In Lane	0.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	2506	2506		1426	1151
V/C Ratio(X)	0.00	0.71	0.51		0.52	0.86
Avail Cap(c_a), veh/h	0	2506	2506		1859	1501
HCM Platoon Ratio	1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.7	0.7	0.0	31.9	38.7
Incr Delay (d2), s/veh	0.0	1.7	0.7	0.0	0.3	4.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	1.4	0.8	0.0	15.1	23.2
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	2.4	1.4	0.0	32.2	42.8
LnGrp LOS	A	A	A		C	D
Approach Vol, veh/h		1778	1280	A	1736	
Approach Delay, s/veh		2.4	1.4		38.3	
Approach LOS		A	A		D	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		78.2		66.8		78.2
Change Period (Y+Rc), s		5.0		5.0		5.0
Max Green Setting (Gmax), s		55.0		80.0		55.0
Max Q Clear Time (g_c+I1), s		6.1		49.7		4.3
Green Ext Time (p_c), s		13.1		12.1		7.7

Intersection Summary	
HCM 6th Ctrl Delay	15.1
HCM 6th LOS	B

Notes

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑			↑↑↑↑	↰↰	↱
Traffic Volume (veh/h)	1493	0	0	1580	490	890
Future Volume (veh/h)	1493	0	0	1580	490	890
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	0	0	1870	1870	1870
Adj Flow Rate, veh/h	1623	0	0	1717	500	1002
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	0	0	2	2	2
Cap, veh/h	2781	0	0	3504	639	1138
Arrive On Green	1.00	0.00	0.00	1.00	0.36	0.36
Sat Flow, veh/h	5443	0	0	6958	1781	3170
Grp Volume(v), veh/h	1623	0	0	1717	500	1002
Grp Sat Flow(s),veh/h/ln	1702	0	0	1609	1781	1585
Q Serve(g_s), s	0.0	0.0	0.0	0.0	36.3	43.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	36.3	43.0
Prop In Lane		0.00	0.00		1.00	1.00
Lane Grp Cap(c), veh/h	2781	0	0	3504	639	1138
V/C Ratio(X)	0.58	0.00	0.00	0.49	0.78	0.88
Avail Cap(c_a), veh/h	2781	0	0	3504	762	1355
HCM Platoon Ratio	2.00	1.00	1.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	41.4	43.6
Incr Delay (d2), s/veh	0.9	0.0	0.0	0.5	4.5	6.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.4	0.0	0.0	0.2	23.4	24.7
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.9	0.0	0.0	0.5	45.9	49.8
LnGrp LOS	A	A	A	A	D	D
Approach Vol, veh/h	1623			1717	1502	
Approach Delay, s/veh	0.9			0.5	48.5	
Approach LOS	A			A	D	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		86.0		59.0		86.0
Change Period (Y+Rc), s		5.0		5.0		5.0
Max Green Setting (Gmax), s		71.0		64.0		71.0
Max Q Clear Time (g_c+I1), s		3.0		46.0		3.0
Green Ext Time (p_c), s		11.4		8.1		12.7

Intersection Summary	
HCM 6th Ctrl Delay	15.5
HCM 6th LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1460	12	0	746	0	0	0	49	1125	6	294
Future Volume (veh/h)	0	1460	12	0	746	0	0	0	49	1125	6	294
Initial Q (Qb), veh	0	20	0	0	15	0	0	0	0	7	7	7
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	0	2067	1870	0	2067	0	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	0	1587	13	0	811	0	0	0	53	1228	0	320
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	0	2	0	2	2	2	2	2	2
Cap, veh/h	0	2152	16	0	1152		0	0	85	1829	0	1627
Arrive On Green	0.00	0.59	0.29	0.00	0.59	0.00	0.00	0.00	0.05	0.51	0.00	0.51
Sat Flow, veh/h	0	7619	60	0	4134	0	0	0	1585	3563	0	3170
Grp Volume(v), veh/h	0	1155	445	0	811	0	0	0	53	1228	0	320
Grp Sat Flow(s),veh/h/ln	0	1778	2056	0	1964	0	0	0	1585	1781	0	1585
Q Serve(g_s), s	0.0	23.7	23.9	0.0	21.8	0.0	0.0	0.0	4.9	38.4	0.0	8.2
Cycle Q Clear(g_c), s	0.0	23.7	23.9	0.0	21.8	0.0	0.0	0.0	4.9	38.4	0.0	8.2
Prop In Lane	0.00		0.03	0.00		0.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	0	1564	604	0	1152		0	0	85	1829	0	1627
V/C Ratio(X)	0.00	0.74	0.74	0.00	0.70		0.00	0.00	0.63	0.67	0.00	0.20
Avail Cap(c_a), veh/h	0	1564	603	0	1152		0	0	85	1829	0	1627
HCM Platoon Ratio	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.26	0.26	0.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	27.4	27.9	0.0	27.2	0.0	0.0	0.0	69.5	27.5	0.0	20.1
Incr Delay (d2), s/veh	0.0	0.8	2.1	0.0	3.6	0.0	0.0	0.0	13.7	1.0	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	2.5	1.9	0.0	4.1	0.0	0.0	0.0	0.0	0.3	0.0	0.2
%ile BackOfQ(95%),veh/ln	0.0	10.9	12.7	0.0	14.8	0.0	0.0	0.0	4.2	24.2	0.0	6.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	30.8	31.9	0.0	35.0	0.0	0.0	0.0	83.3	28.8	0.0	20.3
LnGrp LOS	A	C	C	A	C		A	A	F	C	A	C
Approach Vol, veh/h		1600			811	A		53			1548	
Approach Delay, s/veh		31.1			35.0			83.3			27.1	
Approach LOS		C			C			F			C	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		65.8		70.7		65.8		13.5				
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0				
Max Green Setting (Gmax), s		46.0		79.0		46.0		10.0				
Max Q Clear Time (g_c+I1), s		26.9		41.4		24.8		7.9				
Green Ext Time (p_c), s		12.6		11.0		7.1		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			31.0									
HCM 6th LOS			C									

Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1579	444	0	478	863	339	0	1669	0	0	0
Future Volume (veh/h)	0	1579	444	0	478	863	339	0	1669	0	0	0
Initial Q (Qb), veh	0	25	0	0	10	0	8	0	21			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	0	2067	1870	0	2067	1870	1870	0	1870			
Adj Flow Rate, veh/h	0	1716	0	0	520	0	368	0	1266			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	0	2	2	0	2	2	2	0	2			
Cap, veh/h	0	1919		0	1335		1009	0	2048			
Arrive On Green	0.00	0.68	0.00	0.00	0.68	0.00	0.57	0.00	0.57			
Sat Flow, veh/h	0	5830	1585	0	4031	1585	1781	0	3614			
Grp Volume(v), veh/h	0	1716	0	0	520	0	368	0	1266			
Grp Sat Flow(s),veh/h/ln	0	1881	1585	0	1964	1585	1781	0	1205			
Q Serve(g_s), s	0.0	37.2	0.0	0.0	8.6	0.0	16.9	0.0	35.0			
Cycle Q Clear(g_c), s	0.0	37.2	0.0	0.0	8.6	0.0	16.9	0.0	35.0			
Prop In Lane	0.00		1.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	0	1919		0	1335		1009	0	2048			
V/C Ratio(X)	0.00	0.89		0.00	0.39		0.36	0.00	0.62			
Avail Cap(c_a), veh/h	0	1919		0	1335		1009	0	2048			
HCM Platoon Ratio	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.00	1.00	0.00	0.00	0.47	0.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	0.0	22.9	0.0	0.0	17.6	0.0	18.5	0.0	22.8			
Incr Delay (d2), s/veh	0.0	6.9	0.0	0.0	0.4	0.0	0.1	0.0	0.4			
Initial Q Delay(d3),s/veh	0.0	11.6	0.0	0.0	0.7	0.0	0.7	0.0	2.0			
%ile BackOfQ(95%),veh/ln	0.0	20.6	0.0	0.0	6.2	0.0	13.4	0.0	17.4			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	41.4	0.0	0.0	18.6	0.0	19.3	0.0	25.2			
LnGrp LOS	A	D		A	B		B	A	C			
Approach Vol, veh/h		1716	A		520	A		1634				
Approach Delay, s/veh		41.4			18.6			23.9				
Approach LOS		D			B			C				

Timer - Assigned Phs		2				6		8				
Phs Duration (G+Y+Rc), s		81.6				81.6		68.4				
Change Period (Y+Rc), s		5.0				5.0		5.0				
Max Green Setting (Gmax), s		53.0				53.0		87.0				
Max Q Clear Time (g_c+I1), s		40.2				11.6		38.0				
Green Ext Time (p_c), s		11.6				8.4		1.7				

Intersection Summary			
HCM 6th Ctrl Delay			30.9
HCM 6th LOS			C

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	1137	961	0	1108	903
Future Volume (veh/h)	0	1137	961	0	1108	903
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1870	1870	0	1870	1870
Adj Flow Rate, veh/h	0	1236	1045	0	1204	982
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	0	2	2
Cap, veh/h	0	1866	1866		1859	1501
Arrive On Green	0.00	0.73	0.73	0.00	0.54	0.54
Sat Flow, veh/h	0	5443	5443	0	3456	2790
Grp Volume(v), veh/h	0	1236	1045	0	1204	982
Grp Sat Flow(s),veh/h/ln	0	1702	1702	0	1728	1395
Q Serve(g_s), s	0.0	18.3	13.5	0.0	35.8	36.4
Cycle Q Clear(g_c), s	0.0	18.3	13.5	0.0	35.8	36.4
Prop In Lane	0.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	1866	1866		1859	1501
V/C Ratio(X)	0.00	0.66	0.56		0.65	0.65
Avail Cap(c_a), veh/h	0	1866	1866		1859	1501
HCM Platoon Ratio	1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	14.8	14.2	0.0	23.8	23.9
Incr Delay (d2), s/veh	0.0	1.9	1.2	0.0	0.8	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	8.2	6.8	0.0	21.0	17.8
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	16.7	15.4	0.0	24.5	24.9
LnGrp LOS	A	B	B		C	C
Approach Vol, veh/h		1236	1045	A	2186	
Approach Delay, s/veh		16.7	15.4		24.7	
Approach LOS		B	B		C	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		70.9		74.1		70.9
Change Period (Y+Rc), s		5.0		5.0		5.0
Max Green Setting (Gmax), s		55.0		80.0		55.0
Max Q Clear Time (g_c+I1), s		21.3		39.4		16.5
Green Ext Time (p_c), s		7.0		18.8		5.7

Intersection Summary		
HCM 6th Ctrl Delay		20.3
HCM 6th LOS		C

Notes

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1743	0	0	1098	606	759
Future Volume (veh/h)	1743	0	0	1098	606	759
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	0	0	1870	1870	1870
Adj Flow Rate, veh/h	1895	0	0	1193	495	1001
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	0	0	2	2	2
Cap, veh/h	2430	0	0	3062	762	1355
Arrive On Green	0.95	0.00	0.00	0.95	0.43	0.43
Sat Flow, veh/h	5443	0	0	6958	1781	3170
Grp Volume(v), veh/h	1895	0	0	1193	495	1001
Grp Sat Flow(s),veh/h/ln	1702	0	0	1609	1781	1585
Q Serve(g_s), s	10.1	0.0	0.0	2.1	31.9	38.3
Cycle Q Clear(g_c), s	10.1	0.0	0.0	2.1	31.9	38.3
Prop In Lane		0.00	0.00		1.00	1.00
Lane Grp Cap(c), veh/h	2430	0	0	3062	762	1355
V/C Ratio(X)	0.78	0.00	0.00	0.39	0.65	0.74
Avail Cap(c_a), veh/h	2430	0	0	3062	762	1355
HCM Platoon Ratio	2.00	1.00	1.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	2.1	0.0	0.0	1.9	32.9	34.7
Incr Delay (d2), s/veh	2.6	0.0	0.0	0.4	2.0	2.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.0	0.0	0.0	1.0	20.4	21.5
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	4.6	0.0	0.0	2.3	34.9	36.9
LnGrp LOS	A	A	A	A	C	D
Approach Vol, veh/h	1895			1193	1496	
Approach Delay, s/veh	4.6			2.3	36.2	
Approach LOS	A			A	D	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		82.9		62.1		82.9
Change Period (Y+Rc), s		5.0		5.0		5.0
Max Green Setting (Gmax), s		71.0		64.0		71.0
Max Q Clear Time (g_c+I1), s		13.1		41.3		5.1
Green Ext Time (p_c), s		15.1		8.9		7.0

Intersection Summary						
HCM 6th Ctrl Delay			14.3			
HCM 6th LOS			B			

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1455	7	0	1190	0	0	0	75	917	151	411
Future Volume (veh/h)	0	1455	7	0	1190	0	0	0	75	917	151	411
Initial Q (Qb), veh	0	20	0	0	15	0	0	0	0	7	7	7
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	0	2067	1870	0	2067	0	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	0	1582	8	0	1293	0	0	0	82	1114	0	447
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	0	2	0	2	2	2	2	2	2
Cap, veh/h	0	3140	15	0	1246		0	0	89	1316	0	1164
Arrive On Green	0.00	0.88	0.44	0.00	0.88	0.00	0.00	0.00	0.06	0.36	0.00	0.36
Sat Flow, veh/h	0	7646	37	0	4134	0	0	0	1585	3563	0	3170
Grp Volume(v), veh/h	0	1147	443	0	1293	0	0	0	82	1114	0	447
Grp Sat Flow(s),veh/h/ln	0	1778	2061	0	1964	0	0	0	1585	1781	0	1585
Q Serve(g_s), s	0.0	6.8	7.2	0.0	17.3	0.0	0.0	0.0	7.7	43.4	0.0	15.7
Cycle Q Clear(g_c), s	0.0	6.8	7.2	0.0	17.3	0.0	0.0	0.0	7.7	43.4	0.0	15.7
Prop In Lane	0.00		0.02	0.00		0.00	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	0	2275	883	0	1246		0	0	89	1316	0	1164
V/C Ratio(X)	0.00	0.50	0.50	0.00	1.04		0.00	0.00	0.92	0.85	0.00	0.38
Avail Cap(c_a), veh/h	0	2347	907	0	1729		0	0	106	1734	0	1543
HCM Platoon Ratio	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.26	0.26	0.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	7.9	7.9	0.0	27.4	0.0	0.0	0.0	70.5	43.9	0.0	35.4
Incr Delay (d2), s/veh	0.0	0.2	0.5	0.0	35.7	0.0	0.0	0.0	58.8	3.2	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.6	0.5	0.0	43.3	0.0	0.0	0.0	0.0	1.3	0.0	0.4
%ile BackOfQ(95%),veh/ln	0.0	4.6	5.2	0.0	36.5	0.0	0.0	0.0	8.1	27.9	0.0	11.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	8.7	8.9	0.0	106.4	0.0	0.0	0.0	129.3	48.4	0.0	36.0
LnGrp LOS	A	A	A	A	F		A	A	F	D	A	D
Approach Vol, veh/h		1590			1293	A		82			1561	
Approach Delay, s/veh		8.7			106.4			129.3			44.9	
Approach LOS		A			F			F			D	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		73.0		61.6		73.0		15.4				
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0				
Max Green Setting (Gmax), s		48.0		75.0		46.0		12.0				
Max Q Clear Time (g_c+I1), s		10.2		46.4		20.3		10.7				
Green Ext Time (p_c), s		19.1		10.2		13.4		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			51.3									
HCM 6th LOS			D									

Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1465	227	0	710	751	433	0	1452	0	0	0
Future Volume (veh/h)	0	1465	227	0	710	751	433	0	1452	0	0	0
Initial Q (Qb), veh	0	25	0	0	10	0	8	0	21			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	0	2067	1870	0	2067	1870	1870	0	1870			
Adj Flow Rate, veh/h	0	1592	0	0	772	0	471	0	1030			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	0	2	2	0	2	2	2	0	2			
Cap, veh/h	0	2436		0	1825		576	0	1192			
Arrive On Green	0.00	0.95	0.00	0.00	0.95	0.00	0.31	0.00	0.31			
Sat Flow, veh/h	0	5830	1585	0	4031	1585	1781	0	3614			
Grp Volume(v), veh/h	0	1592	0	0	772	0	471	0	1030			
Grp Sat Flow(s),veh/h/ln	0	1881	1585	0	1964	1585	1781	0	1205			
Q Serve(g_s), s	0.0	2.1	0.0	0.0	1.1	0.0	16.1	0.0	17.9			
Cycle Q Clear(g_c), s	0.0	2.1	0.0	0.0	1.1	0.0	16.1	0.0	17.9			
Prop In Lane	0.00		1.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	0	2436		0	1825		576	0	1192			
V/C Ratio(X)	0.00	0.65		0.00	0.42		0.82	0.00	0.86			
Avail Cap(c_a), veh/h	0	2678		0	1864		795	0	1612			
HCM Platoon Ratio	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.00	1.00	0.00	0.00	0.47	0.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	0.0	3.9	0.0	0.0	1.6	0.0	20.7	0.0	21.1			
Incr Delay (d2), s/veh	0.0	1.4	0.0	0.0	0.3	0.0	3.4	0.0	3.1			
Initial Q Delay(d3),s/veh	0.0	2.2	0.0	0.0	0.4	0.0	7.6	0.0	16.5			
%ile BackOfQ(95%),veh/ln	0.0	3.3	0.0	0.0	1.1	0.0	12.7	0.0	10.8			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	7.5	0.0	0.0	2.3	0.0	31.7	0.0	40.7			
LnGrp LOS	A	A		A	A		C	A	D			
Approach Vol, veh/h		1592	A		772	A		1501				
Approach Delay, s/veh		7.5			2.3			37.8				
Approach LOS		A			A			D				
Timer - Assigned Phs		2				6		8				
Phs Duration (G+Y+Rc), s		37.8				37.8		27.2				
Change Period (Y+Rc), s		5.0				5.0		5.0				
Max Green Setting (Gmax), s		24.0				24.0		31.0				
Max Q Clear Time (g_c+I1), s		5.1				4.1		20.9				
Green Ext Time (p_c), s		16.0				9.6		1.3				
Intersection Summary												
HCM 6th Ctrl Delay			18.2									
HCM 6th LOS			B									

Notes

Unsignalized Delay for [EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	1609	1171	0	706	927
Future Volume (veh/h)	0	1609	1171	0	706	927
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	0	1870	1870	0	1870	1870
Adj Flow Rate, veh/h	0	1749	1273	0	767	1008
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	0	2	2
Cap, veh/h	0	2467	2467		1452	1172
Arrive On Green	0.00	0.97	0.97	0.00	0.42	0.42
Sat Flow, veh/h	0	5443	5443	0	3456	2790
Grp Volume(v), veh/h	0	1749	1273	0	767	1008
Grp Sat Flow(s),veh/h/ln	0	1702	1702	0	1728	1395
Q Serve(g_s), s	0.0	5.3	2.4	0.0	24.0	47.6
Cycle Q Clear(g_c), s	0.0	5.3	2.4	0.0	24.0	47.6
Prop In Lane	0.00			0.00	1.00	1.00
Lane Grp Cap(c), veh/h	0	2467	2467		1452	1172
V/C Ratio(X)	0.00	0.71	0.52		0.53	0.86
Avail Cap(c_a), veh/h	0	2467	2467		1859	1501
HCM Platoon Ratio	1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	1.3	1.3	0.0	31.3	38.2
Incr Delay (d2), s/veh	0.0	1.8	0.8	0.0	0.3	4.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	1.9	1.2	0.0	15.4	23.6
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	3.1	2.1	0.0	31.6	42.4
LnGrp LOS	A	A	A		C	D
Approach Vol, veh/h		1749	1273	A	1775	
Approach Delay, s/veh		3.1	2.1		37.8	
Approach LOS		A	A		D	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		77.1		67.9		77.1
Change Period (Y+Rc), s		5.0		5.0		5.0
Max Green Setting (Gmax), s		55.0		80.0		55.0
Max Q Clear Time (g_c+I1), s		8.3		50.6		5.4
Green Ext Time (p_c), s		12.6		12.4		7.6

Intersection Summary			
HCM 6th Ctrl Delay			15.7
HCM 6th LOS			B

Notes

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1514	0	0	1573	490	890
Future Volume (veh/h)	1514	0	0	1573	490	890
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	0	0	1870	1870	1870
Adj Flow Rate, veh/h	1646	0	0	1710	500	1002
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	0	0	2	2	2
Cap, veh/h	2781	0	0	3504	639	1138
Arrive On Green	1.00	0.00	0.00	1.00	0.36	0.36
Sat Flow, veh/h	5443	0	0	6958	1781	3170
Grp Volume(v), veh/h	1646	0	0	1710	500	1002
Grp Sat Flow(s),veh/h/ln	1702	0	0	1609	1781	1585
Q Serve(g_s), s	0.0	0.0	0.0	0.0	36.3	43.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	36.3	43.0
Prop In Lane		0.00	0.00		1.00	1.00
Lane Grp Cap(c), veh/h	2781	0	0	3504	639	1138
V/C Ratio(X)	0.59	0.00	0.00	0.49	0.78	0.88
Avail Cap(c_a), veh/h	2781	0	0	3504	762	1355
HCM Platoon Ratio	2.00	1.00	1.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	41.4	43.6
Incr Delay (d2), s/veh	0.9	0.0	0.0	0.5	4.5	6.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.4	0.0	0.0	0.2	23.4	24.7
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.9	0.0	0.0	0.5	45.9	49.8
LnGrp LOS	A	A	A	A	D	D
Approach Vol, veh/h	1646			1710	1502	
Approach Delay, s/veh	0.9			0.5	48.5	
Approach LOS	A			A	D	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		86.0		59.0		86.0
Change Period (Y+Rc), s		5.0		5.0		5.0
Max Green Setting (Gmax), s		71.0		64.0		71.0
Max Q Clear Time (g_c+I1), s		3.0		46.0		3.0
Green Ext Time (p_c), s		11.7		8.1		12.6

Intersection Summary	
HCM 6th Ctrl Delay	15.5
HCM 6th LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

Appendix G

CCTA Model Traffic Forecast Methodology

2150 Trade Zone Blvd
Suite 105-A
San José, CA 95131
(408) 477-2131 **P**
www.chsconsulting.net

Memorandum

Date: December 19, 2019

To: Deborah Fehr, City of San Ramon

Copy To: Pat Gibson, Gibson Transportation Consultants

From: Jill Hough

Re: Bishop Ranch Master Plan Update Travel Forecast Methodology

---

1.0 Background

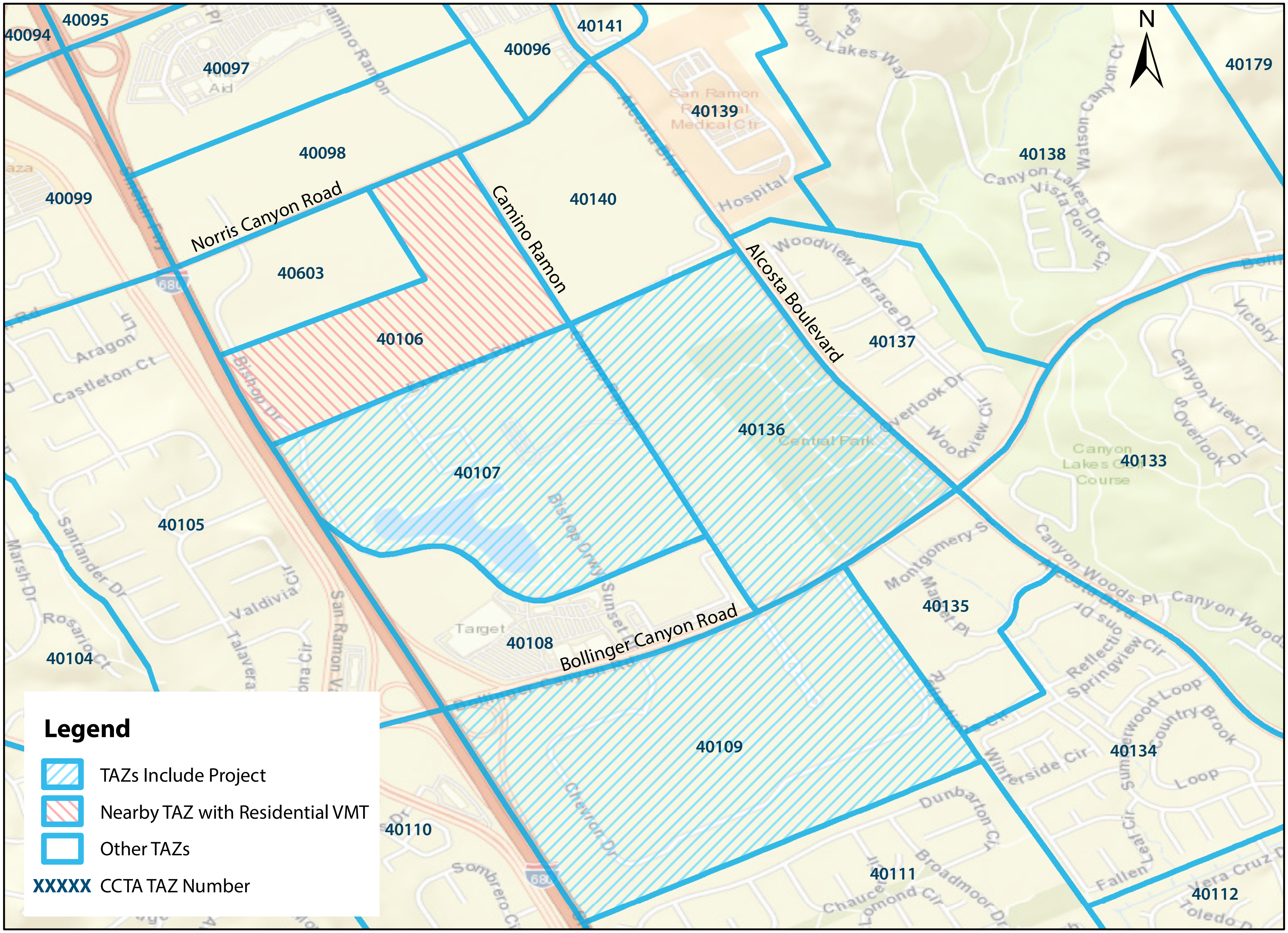
CHS prepared traffic forecasts for the Bishop Ranch Master Plan Update (BRMPU). CHS coordinated with staff from Contra Costa Transportation Authority (CCTA) to obtain model data files; and used the data files to create a model based in the CUBE transportation planning software, which were used to generate forecasts both with and without the BRMPU project. The purpose of this memorandum is to describe how this work was performed and to provide some information on how the forecasts from the CUBE version of the model compare to the CCTA-Transcad model.

2.0 Approach to Developing Forecast Volumes

As mentioned, CHS met with CCTA staff on several occasions, and initially to discuss an approach to using the CCTA model for the BRMPU forecasting work. An approach was agreed to in which CHS would obtain transportation networks (by time period) and vehicular trip tables by time periods and vehicular mode; as well as key modeling assumptions and extensive model documentation. The approach also included CHS converting the networks to CUBE formats; converting the trip tables to CUBE formats; and implementing scripted procedures to create traffic assignments in CUBE, which utilize the same parameters and assumptions as the CCTA Transcad assignment procedures. For purposes of establishing consistency between the two models, CHS prepared assignments with the above-outlined process and compared the results to assignment results that were obtained from CCTA directly from the Transcad model (The CCTA forecast results were from mid-July 2019). Model plots showing the 2040 AM and PM peak hour volumes generated from the CUBE model are included as an appendix to this memorandum.

3.0 Trip Generation and Trip Distribution

The trip generation for the BRMPU project was provided by Gibson Transportation Consultants and was based on ITE trip generation rates (documented in traffic report from Gibson Transportation Consultants). These trip generation estimates for the project were used instead of modifying 2040 model land use and running the trip generation model. An important part of the modeling methodology was to assume the same distribution for the BRMPU project as the CCTA model trip distribution for the year 2040. This was done by identifying the CCTA Traffic Analysis Zones (TAZs) in which the BRMPU project components resided. The TAZ map in the vicinity of the BRMPU project is presented on Figure 1 (and is essentially the same TAZ structure as the CCTA model). The BRMPU project components reside within three (3) CCTA TAZs, as shown in Table 1.



Consulting Group

Bishop Ranch VMT Analysis

Figure 1

Bishop Ranch TAZs in the Contra Costa County Transportation Authority Model

Table 1
Correspondence of Bishop Ranch Master Plan Project Elements to CCTA TAZs

Bishop Ranch Project Element	CCTA Traffic Analysis Zone
2600 NW	40107
2600 NE	40107
2600 SE	40107
3A	40136
1A	40109

The distribution of vehicle trips for each of the zones 40107, 40136, and 40109 was applied to the ITE trip generation estimates for the appropriate BRMPU project portions. The project trip tables were added to the 2040 vehicular trip tables to yield the 2040 With Project scenario trip tables. In addition, the 2040 CCTA vehicular trip tables had reflected some growth in trips to and from Bishop Ranch zones. This growth was associated with CCTA's assumptions about allocating land use growth throughout Contra Costa County by the year 2040 (as compared with 2018). CHS subtracted the previously-assumed growth in vehicle trips for the Bishop Ranch zones from the 2040 With Project trip tables, in order to avoid double-counting the project trips. Lastly, for purposes of developing a 2040 Without Project scenario, CHS subtracted the growth in vehicle trips for the Bishop Ranch zones from the CCTA 2040 vehicular trip tables. Discussions with Matt Kelley and Martin Engelmann indicated that this approach was reasonable.

Traffic assignments of the 2040 Without Project scenario and 2040 With Project Scenario were completed; as well as traffic assignments of the 2018 base year; for both the AM and PM peak hours. For purposes of reporting link volumes entering and exiting each study intersection approach, CHS developed adjusted forecast volumes that were based on actual counted traffic on each link, as well as model-estimated growth for each link (where the model-estimated growth of each link was the ratio of the forecast link volume to the 2018 base-year link volume). Adjusted forecast volumes for roadway links were developed in this manner, for both the 2040 Without Project scenario and 2040 With Project scenario.

4.0 Conclusion

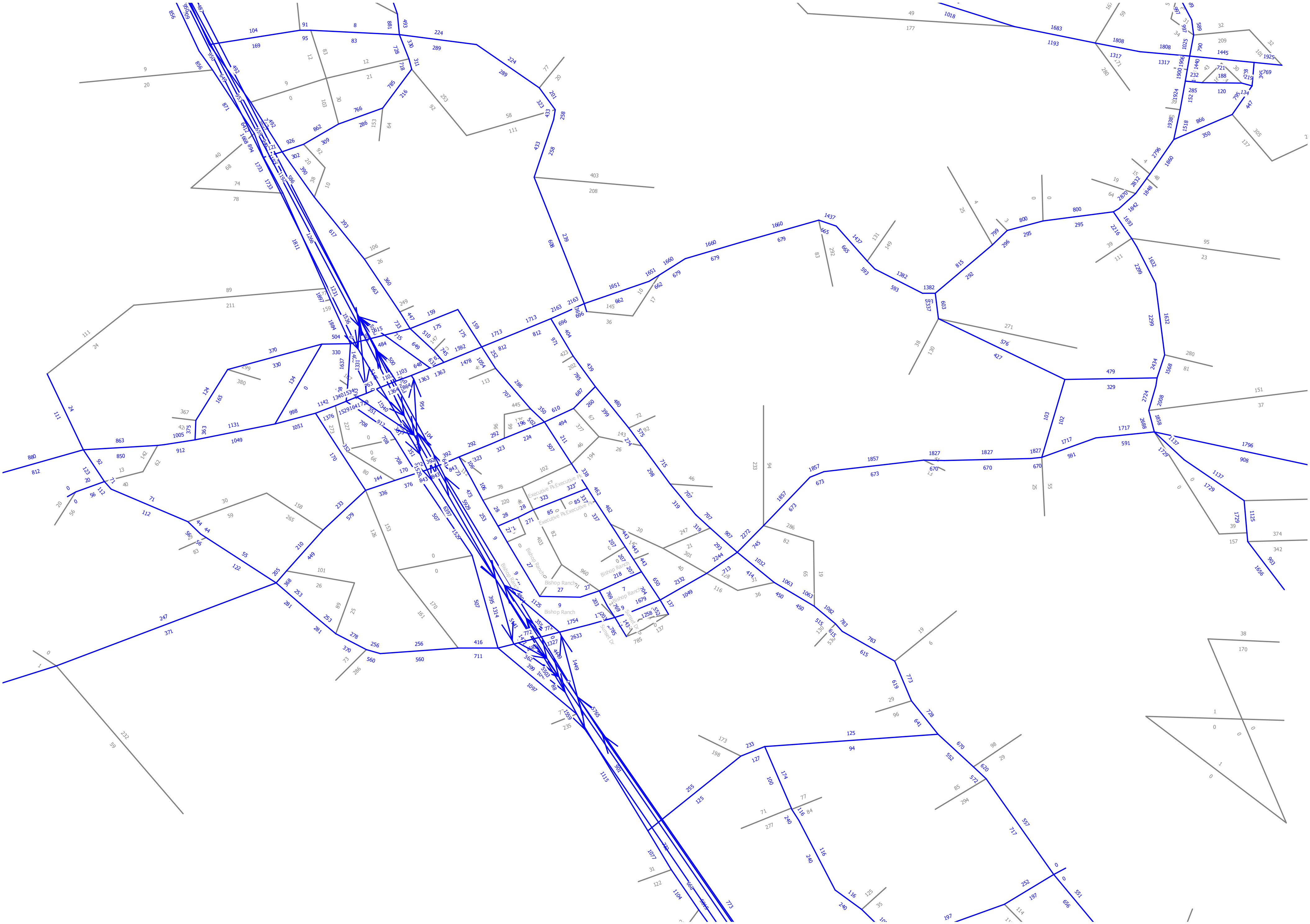
The above methodology resulted in a straight-forward way of using the same TAZ structure and assumptions about trip distribution and traffic assignment that were consistent with the CCTA modeling procedures. While the trip generation estimates were based on ITE rather than the CCTA model estimates of trip generation, the latter tend to be lower overall than those from ITE. Prior to implementing the methodology for developing forecasts with and without the BRMPU project, a comparison was made of the CUBE 2040 traffic assignment of the converted CCTA trip table with the converted 2040 CCTA network to the 2040 assignment result obtained from CCTA. The comparison showed that overall, the assignment from CUBE compared reasonably closely with the assignment result from Transcad.

Appendix

2040 AM & PM Peak Hour Assignment Result (CCTA Trip Table)

CCTA-BRMP Model Forecast Volumes on Roadway Links - AM Peak 1 Hour

2040 No Project



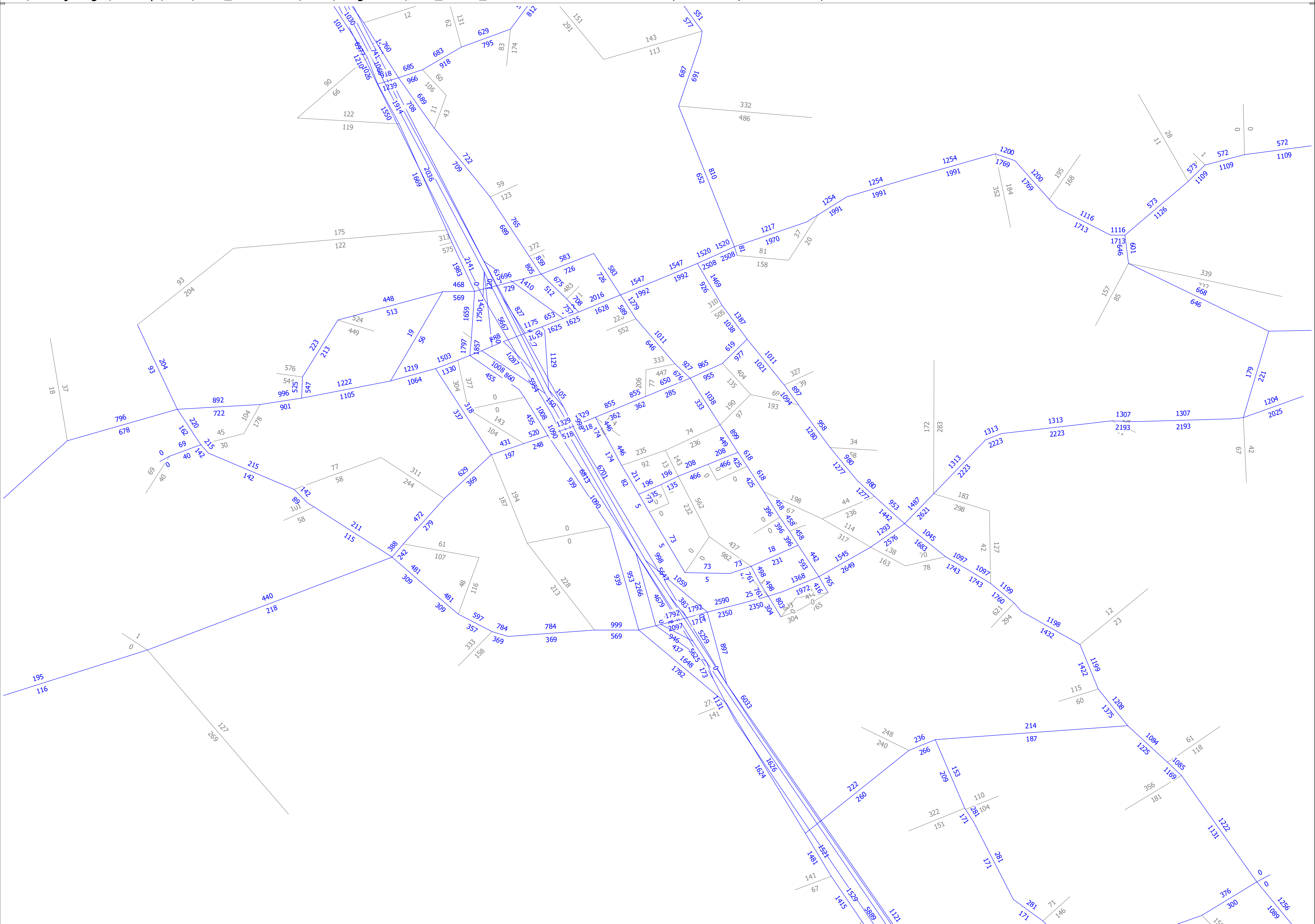
C:\Users\jhough\Desktop\Files\CCTA_CubeModel\2040\Assignment\2040_AM1HR_NP.NET 7/26/2019 X=101924.55,102783.99,Y=97122.499,97744.853

cube

Bishop Ranch 07/26/2019

BRMP 1 hr vols [blue]

C:\Users\jhough\Desktop\Files\CCTA_CubeModel\2040\Assignment\2040_PM4Br_CC.Net - Window X=101873.94,102648.64,Y=97128.792,97687.616 Scale 1 inch=72.199485 coordinate units



Appendix H

Signal Warrant Analysis Worksheets

FUTURE WITH PROJECT CONDITIONS - YEAR 2040 - PM PEAK

Bishop Ranch 6 Residential Project

Traffic Signal Warrant Analysis
Warrant 3, Peak Hour

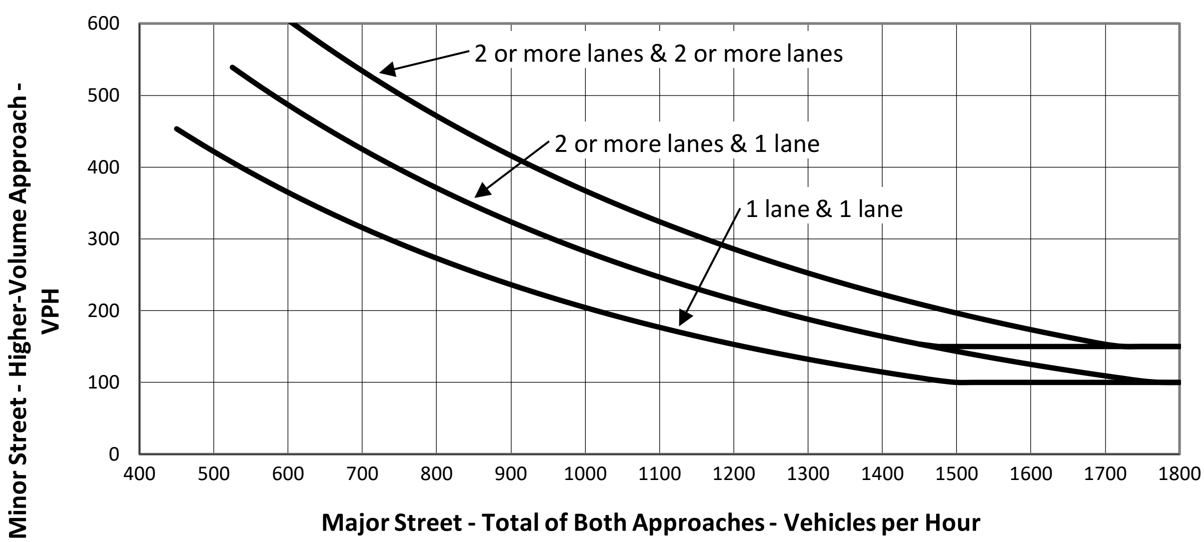
4. CAMINO RAMON & F STREET PROJECT DRIVEWAY

Major Street Name:	Camino Ramon	Vehicles per Hour (Peak Hour)	
Minor Street Name:	F Street Project Driveway	Major Street (Approach 1):	1,521
		Major Street (Approach 2):	1,080
Major Street Lanes:	2	[a] Major Street Left-Turns:	0
Minor Street Lanes:	1	Minor Street (Higher Volume):	73
[b] Urban/Rural:	Urban		

Vehicles per Hour (Peak Hour)

Major Street (Approach 1):	1,521	Minimum Major Street Volume:	510
Major Street (Approach 2):	1,080	Satisfied?	YES
Total Major Street Volume:	2,601		
		Minimum Minor Street Volume:	100
Major Street Left Turns:	0	Satisfied?	NO
Minor Street (Higher Volume):	73		
Total Minor Street Volume:	73	Warrant 3 Satisfied?	**NO**

Figure 4C-3. Warrant 3, Peak Hour [c]



[a] Major street left-turn volume is added to minor street volume if a protected left-turn signal phase is proposed.

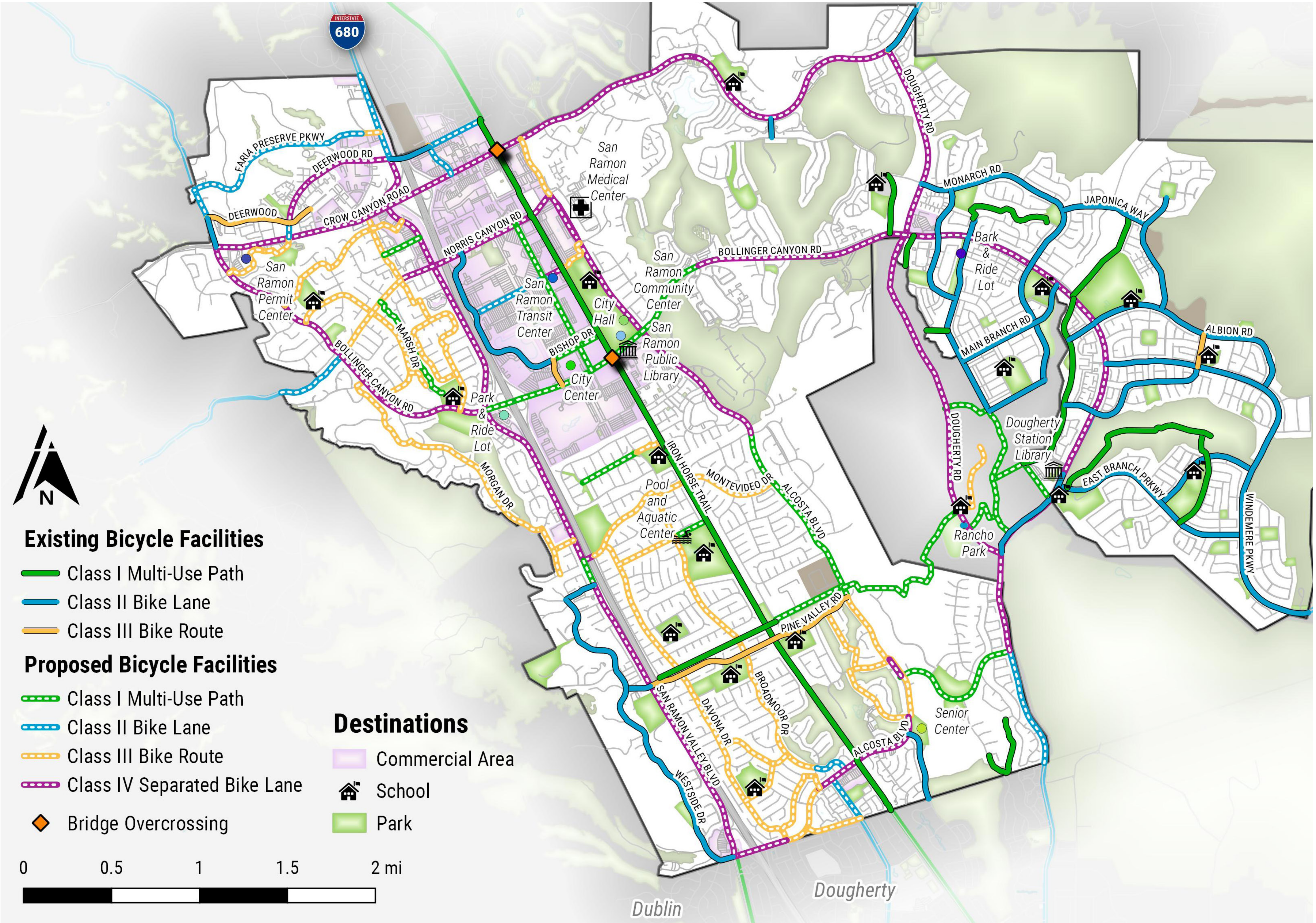
[b] Setting to "Rural" reduces minimum test volumes to approximately 70% of "Urban" test volumes. This may be used when major street speed exceeds 40 mph or in an isolated community of less than 10,000 residents.

[c] From *California Manual on Uniform Traffic Control Devices, 2014 Edition;* Caltrans.

Appendix I

City Bicycle Master Plan

Figure 3.2. Proposed Bicycle Network for San Ramon



THIS PAGE INTENTIONALLY LEFT BLANK