Draft Report

Transportation Impact Study for the Dominican Valley Subdivision Project

Prepared for the
City of San Rafael

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Executive Summary

The project as proposed would construct 50 residential units in the Dominican/Black Canyon neighborhood in the City of San Rafael on a 20.79-acre site. The proposed units include 27 single family homes, 17 townhomes, and six duplex units, as well as 14 junior accessory dwelling units (JADUs). The proposed units would be located along the periphery of the site; five units would be accessed from Gold Hill Grade, while 35 units would be accessed from two driveways on Deer Park Ave and 10 units would be accessed via a driveway from Margarita/Highland.

The project is expected to generate an average of 421 new daily trips, including 30 a.m. peak hour trips and 38 p.m. peak hour trips.

Under Existing conditions, all three study intersections operate at an acceptable Level of Service (LOS) of C or better during both the a.m. and p.m. peak hours and would continue to do so upon the addition of project-generated traffic. Under Future conditions, all intersections are expected to operate acceptably without and with the project during both peak hours.

With respect to multimodal circulation, the site is located one-half mile from the nearest transit stops served by Marin Transit. The project is located in the hillside residential area, where sidewalks are not required. The Dominican University campus is located on the west side of Deer Park Avenue across from the site; sidewalks are present within the campus and along streets connecting the campus to central San Rafael. Bicycles are required to share the road with vehicle traffic along most streets in the vicinity of the project. Grand Avenue is designated as a Class III bike route, as is 4th Street, while sections of Point San Pedro Road are designated as Class II and Class III bicycle facilities.

The project would potentially have a significant impact with respect to vehicle miles traveled (VMT). Various measures are recommended to reduce the VMT associated with the project; however, it may not be feasible to fully mitigate these impacts.

The project frontage streets are currently substandard and would all be widened to 26 feet as required by the San Rafael Fire Department. The project would therefore meet emergency vehicle access requirements and would improve emergency vehicle access to properties in the surrounding neighborhoods.

Sight distances at the project access points were evaluated based on the proposed widenings of the frontage streets and the locations of the project driveways. Based on the slow vehicle speeds and low traffic volumes along these streets, the sight distances were determined to be adequate.

The proposed project would provide 169 parking spaces, which is more than the 100 spaces required under the San Rafael Municipal Code.

Introduction

This report presents an analysis of the potential traffic impacts and adverse operational effects that would be associated with development of a proposed 50-unit residential development in the Dominican/Black Valley neighborhood of San Rafael. The traffic study was completed in accordance with the criteria established by the City of San Rafael and is consistent with standard traffic engineering techniques.

Prelude

The purpose of a traffic impact study is to provide City staff and policy makers with data that they can use to make an informed decision regarding the potential transportation impacts of a proposed project, and any associated improvements that would be required to mitigate these impacts to an acceptable level under CEQA, the City's General Plan, or other policies. This report provides an analysis of those items that are identified as areas of environmental concern under the California Environmental Quality Act (CEQA) and that, if significant, require an EIR. Impacts associated with access for pedestrians, bicyclists, and to transit; the vehicle miles traveled (VMT) generated by the project; potential safety concerns such as increased queuing in dedicated turn lanes, adequacy of sight distance, need for turn lanes, and need for additional right-of-way controls; and emergency access are addressed in the context of the CEQA criteria. While no longer a part of the CEQA review process, vehicular traffic service levels at key intersections were evaluated for consistency with General Plan policies by determining the number of new trips that the proposed use would be expected to generate, distributing these trips to the surrounding street system based on anticipated travel patterns specific to the proposed project, then analyzing the effect the new traffic would be expected to have on the study intersections and need for improvements to maintain acceptable operation. The adequacy of parking is also addressed as a policy issue.

Applied Standards and Criteria

The report is organized to provide background data that supports the various aspects of the analysis, followed by the assessment of CEQA issues and then evaluation of policy-related issues. The CEQA criteria evaluated are as follows.

Would the project:

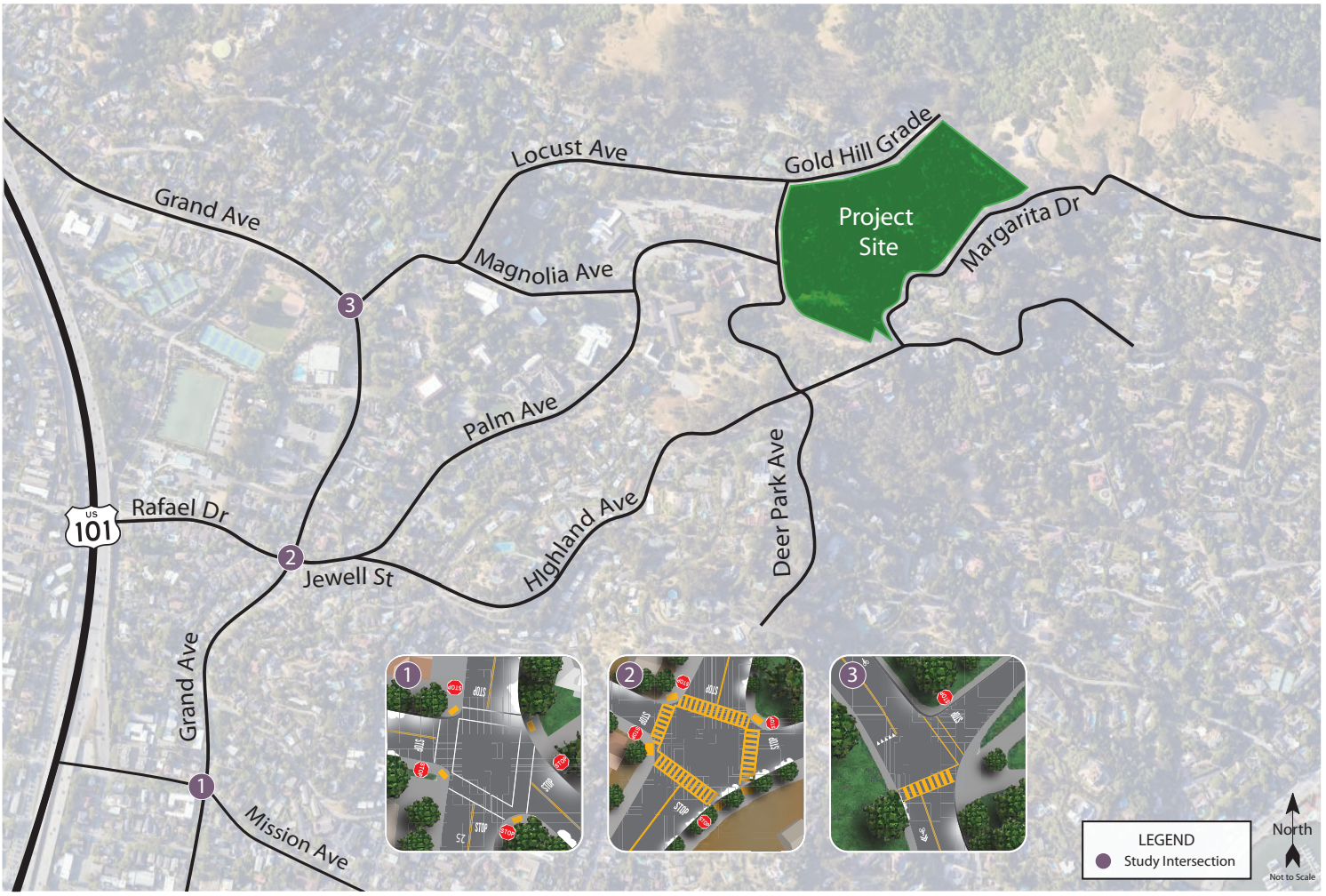
a. Conflict with a program, plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities?
b. Conflict or be inconsistent with CEQA Guidelines § 15064.3, subdivision (b)?
c. Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?
d. Result in inadequate emergency access?

The project was also evaluated against the City of San Rafael's policies, which provide guidance relative to traffic impacts for CEQA issues as well as the effects caused by traffic associated with new development. The *Transportation Impact Analysis Guidelines*, City of San Rafael, March 2021, detail mobility deficiency criteria for development projects. For intersection traffic control, the Guidelines refer to the Level of Service (LOS) standard published in the *San Rafael General Plan 2040*, City of San Rafael, August 2021. General Plan Policy M-2.5 outlines a general citywide standard of LOS D operation, with exemptions for intersections in the Downtown Precise Plan boundary and signalized freeway ramp intersections.

The Guidelines state that an adverse effect would occur If the addition of project traffic would cause a deficient level of delay at an intersection, or if the delay at an intersection operating deficiently without project traffic would increase by five seconds or more with the addition of project traffic.

Project Profile

The project as proposed is comprised of 50 residential units, including 27 single-family homes, 17 townhomes, and six duplex units. In addition, it includes 14 attached junior accessory dwelling units (JADUs). The property is a 20.79-acre site in the Dominican/Black Canyon neighborhood of San Rafael and is bounded by Deer Park Avenue, Gold Hill Grade, and Margarita Avenue. The proposed units would be clustered near the street frontages. The location of the project site is shown in Figure 1.



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Transportation Impact Study for the Dominican Valley Subdivision Project

Figure 1 – Study Area and Existing Lane Configurations

Transportation Setting

Study Area and Periods

The study area varies depending on the topic. For pedestrian trips it consists of all streets within a half-mile of the project site that would lie along primary routes of pedestrian travel, or those leading to nearby attractors. For bicycle trips it consists of all streets within one mile of the project site that would lie along primary routes of bicycle travel. For the safety and operational analyses, it consists of the project frontage and the following intersections:

1. Grand Avenue/Mission Avenue
2. Grand Avenue/ Jewell Street
3. Grand Avenue/Locust Avenue

Operating conditions during the a.m. and p.m. peak periods were evaluated to capture the highest potential impacts for the proposed project as well as the highest volumes on the local transportation network. The morning peak hour occurs between 7:00 and 9:00 a.m. and reflects conditions during the home to work or school commute, while the p.m. peak hour occurs between 4:00 and 6:00 p.m. and typically reflects the highest level of congestion during the homeward bound commute. Counts were obtained for the study intersections on February 15, 2024, and February 22, 2024.

Study Intersections

Grand Avenue/Mission Avenue is a four-way stop-controlled intersection with one travel lane in each direction at all approaches. On-street parking is permitted along both sides of Grand Avenue as well as along both sides of Mission Avenue. Crosswalks are provided on each leg, and all approaches have speed limits of 25 miles per hour (mph). Class III shared bike routes are signed along the north and south legs of Grand Avenue.

Grand Avenue/Jewell Street is a four-way stop-controlled intersection with a speed limit of 25 mph on all approaches. Parking is permitted along both sides of the south, east and west legs of the intersection. Parking is prohibited at bus stops on both sides of the north leg of the intersection. Yellow school crosswalks are provided on each leg and each approach consists of one lane per direction. Class III bike routes are designated along the north and south legs.

Grand Avenue/Locust Avenue is a three-way intersection with stop controls on the eastern Locust Avenue approach. A driveway is also present near the southeast corner of the intersection. Each approach has a 25-mph speed limit, and yellow school-zone crosswalks are provided on the south and east legs of the intersection. Grand Avenue is designated as a Class III bike route.

The locations of the study intersections and the existing lane configurations and controls are shown in Figure 1.

Study Roadways

Deer Park Avenue is generally a north-south roadway approximately 14 feet wide, serving traffic in both directions. It is classified as a local street with a *prima facie* speed limit of 25 mph.

Gold Hill Grade is a two-way east-west roadway approximately 18 feet wide. It is classified as a local street with a *prima facie* speed limit of 25 mph.

Margarita Drive is two-way east-west roadway approximately 16 feet wide. It is classified as a local street with a *prima facie* speed limit of 25 mph.

Collision History

The collision history for the study area was reviewed to determine any trends or patterns that may indicate a safety issue. Collision rates were calculated based on records available from the California Highway Patrol as published in their Statewide Integrated Traffic Records System (SWITRS) reports. The most current five-year period available is October 1, 2018, through September 30, 2023.

As presented in Table 1, the calculated collision rates for the study intersections were compared to average collision rates for similar facilities statewide, as indicated in *2021 Collision Data on California State Highways*, California Department of Transportation (Caltrans). These average rates statewide are for intersections in the same environment (urban), with the same number of approaches (three or four), and the same controls (all-way stop or two-way stop). The calculated collision rate for Grand Avenue/Mission Avenue is higher than the statewide average. Of the eight collisions recorded at this intersection during the analysis period, three were sideswipes, two were broadsides, two involved pedestrians, and one was a rear-end collision. While the injury rate was lower than the statewide average, the two injury collisions were both due to pedestrian right-of-way violations. The intersection has all-way stop controls, but vegetation is present in the vicinity of the crossings, so visibility of pedestrians may have been a factor at the time the collisions occurred. Otherwise, the collision history does not suggest any underlying safety concerns at this location. The collision rate calculations are provided in Appendix A.

Table 1 – Collision Rates for the Study Intersections

Study Intersection	Number of Collisions (2018-2023)	Calculated Collision Rate (c/mve)	Statewide Average Collision Rate (c/mve)
1. Grand Ave/Mission Ave	8	**0.40**	0.21
2. Grand Ave/Jewell St	1	0.10	0.21
3. Grand Ave/Locust Ave	1	0.13	0.13

Note: c/mve = collisions per million vehicles entering; **Bold** text = collision rate exceeds statewide average

One collision was recorded along each of the study segments during the analysis period. It is noted that Gold Hill Grade and Margarita Drive provide access to a small number of residences, and speeds are low due to the narrow street width and limited sight lines. The one collision recorded on Margarita Drive resulted from a head-on collision but resulted in no injuries. Deer Park Avenue provides access to Dominican University; however, few vehicles enter or exit the campus at this location. Based on the low volumes and physical conditions along these segments, there do not appear to be any underlying safety concerns.

Project Data

The project consists of 50 residential units, including 27 single-family homes, 17 townhomes and six duplex units, as well as 14 junior accessory dwelling units. The project units are proposed to be clustered around the periphery of the site, along Gold Hill Grade, Deer Park Avenue, and Margarita Drive. The Gold Hill Grade homes would have driveway access directly onto the street, while internal project roadways would be constructed at the other two locations. The segments of Gold Hill Grade, Deer Park Avenue, and Margarita Drive along the project frontages would be widened to 26 feet, and the internal access roads would also be 26 feet wide. The proposed project site plan is shown in Figure 2.

Trip Generation

The anticipated trip generation for the proposed project was estimated using standard rates published by the Institute of Transportation Engineers (ITE) in *Trip Generation Manual*, 11th Edition, 2021, for Single Family Detached Housing (LU #210) and Single Family Attached Housing (LU #215) as these descriptions most closely match the proposed project. Since accessory dwelling units can be built by right, they were not included in the trip generation estimate. Based on application of these rates, the proposed project is expected to generate an average of 421 trips per day, including 30 a.m. peak hour trips and 38 trips during the p.m. peak hour. These results are summarized in Table 2.

Table 2 – Trip Generation Summary

Land Use	Units	Daily		AM Peak Hour				PM Peak Hour			
		Rate	Trips	Rate	Trips	In	Out	Rate	Trips	In	Out
SF Detached Housing	27 du	9.43	255	0.70	19	5	14	0.94	25	16	9
SF Attached Housing	23 du	7.20	166	0.48	11	3	8	0.57	13	8	5
Total			**421**		**30**	**8**	**22**		**38**	**24**	**14**

Note: SF = Single Family; du = dwelling unit

Trip Distribution

The pattern used to allocate new project trips to the street network was determined in consideration of journey to work data included in the 2010 census, familiarity with the study area including nearby attractors, and review of existing traffic patterns in the vicinity. The assumptions applied are shown in Table 3.

Table 3 – Trip Distribution Assumptions

Route	Percent
To/From the South via Grand Ave	70%
To/From the North via Grand Ave	30%
TOTAL	**100%**

FAR CALCULATIONS					
LOT #	LOT AREA (SF)	UNIT TYPE	BUILDING AREA (NSF)	MAX BUILDING AREA (2,500 SF + 10% Lot Area)	FLOOR AREA RATIO
1	7,500	E	2,595	3,300	0.35
2	7,993	E	2,595	3,349	0.32
3	7,930	E	2,595	3,343	0.33
4	7,500	E	2,595	3,300	0.35
5	7,500	E	2,595	3,300	0.35
6	7,606	F	3,165	3,311	0.42
7	7,658	F	3,165	3,316	0.41
8	8,410	F	3,165	3,391	0.38
9	22,735	F	3,165	4,824	0.14
10	14,855	B	2,825	4,036	0.19
11	14,855	B	2,825	4,036	0.19
12	11,085	B	2,825	3,659	0.25
13	10,967	B	2,825	3,647	0.26
14	8,937	B	2,825	3,444	0.32
15	2,276	D2 (+ ADU)	1,380	2,778	0.61
16	1,207	D2 (+ ADU)	1,380	2,671	1.14
17	1,207	D2 (+ ADU)	1,380	2,671	1.14
18	1,207	D2 (+ ADU)	1,380	2,671	1.14
19	1,207	D2 (+ ADU)	1,380	2,671	1.14
20	1,207	D2 (+ ADU)	1,380	2,671	1.14
21	1,207	D2 (+ ADU)	1,380	2,671	1.14
22	1,207	D2 (+ ADU)	1,380	2,671	1.14
23	1,207	D2 (+ ADU)	1,380	2,671	1.14
24	1,207	D2 (+ ADU)	1,380	2,671	1.14
25	1,207	D2 (+ ADU)	1,380	2,671	1.14
26	1,207	D2 (+ ADU)	1,380	2,671	1.14
27	1,207	D2 (+ ADU)	1,380	2,671	1.14
28	1,207	D2 (+ ADU)	1,380	2,671	1.14
29	1,204	D1	1,150	2,670	0.96
30	1,122	D1	1,150	2,662	1.02
31	1,006	D1	1,150	2,651	1.14
32	11,210	F	3,165	3,671	0.28
33	7,571	F	3,165	3,307	0.42
34	7,500	F	3,165	3,300	0.42
35	7,500	F	3,165	3,300	0.42
36	7,500	F	3,165	3,300	0.42
37	7,500	F	3,165	3,300	0.42
38	7,650	F	3,165	3,315	0.41
39	9,300	F	3,165	3,480	0.34
40	7,502	F	3,165	3,300	0.42
41	7,133	C	3,030	3,263	0.42
42	7,759	C	3,030	3,326	0.39
43	7,893	C	3,030	3,339	0.38
44	7,737	C	3,030	3,324	0.39
45	3,509	A	1,805	2,901	0.51
46	4,818	A	1,805	3,032	0.37
47	3,344	A	1,805	2,884	0.54
48	3,443	A	1,805	2,894	0.52
49	4,407	A	1,805	2,991	0.41
50	7,030	A	1,805	3,253	0.26

SQUARE FOOTAGE DEFINITIONS:

NSF: Sum of all enclosed areas, measured to the interior of enclosing walls, excluding non conditioned areas. Stairs counted at one floor only.

GSF: "Hillside areas gross building square footage" means the sum of all enclosed or covered areas of each floor or all structures on the site, measured to the exterior of the enclosing walls, columns or posts including basement areas, unfinished attic or loft spaces and other areas capable of being finished into habitable space as determined by the California Building Code; garages and carport areas six feet (6') or more above the natural grade, measured to the exterior face of surrounding walls, column, or posts; other roofs or covered areas supported by walls, columns or posts and capable of being enclosed, measured to the exterior face of surrounding walls, columns or posts; roof penthouses; and accessory structures greater than one hundred twenty (120) square feet in floor area. Excluded are areas permanently open to the sky; exterior areas under roof eaves, trellises or cantilevered overhangs and attic spaces and underfloor spaces that are not capable of being finished into habitable space.

SITE P

NICAN VALLEY HOUSING | PLANNING SUBMITTAL
CA 94901 March 25, 2024
: 2023043

Scale: 1/64" = 1'-0"

BAR architects

Source: BAR Architects 3/22

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Transportation Impact Study for the Dominican Valley Subdivision Project
Figure 2 – Site Plan

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Circulation System

This section addresses the first transportation bullet point on the CEQA checklist, which relates to the potential for a project to conflict with a program, plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities.

Pedestrian Facilities

Existing Pedestrian Facilities

Pedestrian facilities include sidewalks, crosswalks, pedestrian signal phases, curb ramps, curb extensions, and various streetscape amenities such as lighting, benches, etc. There are no pedestrian facilities along the streets fronting the project, and sidewalks are not generally present or required by the City in the hillside residential area. Sidewalks are provided within the Dominican University campus and along streets connecting the University to central San Rafael. It is noted that the University is the primary generator of pedestrian trips near the project site; otherwise, the project area is characterized by single family residential development. Given the low traffic volumes, narrowness of the streets, and slow vehicle speeds along the project frontage streets, existing facilities adequately meet the needs of the nominal number of anticipated pedestrian trips that might be generated by the project.

Pedestrian Safety

The collision history for the study area was reviewed to determine any trends or patterns that may indicate a safety issue for pedestrians. Collision records available from the California Highway Patrol as published in their Statewide Integrated Traffic Records System (SWITRS) reports were reviewed for the most current five-year period available, which was October 1, 2018, through September 30, 2023, at the time of the analysis. During the five-year study period there were two reported collisions involving pedestrians at the study intersection of Grand Avenue/Mission Avenue with the primary collision factor being a pedestrian right-of-way violation. Each of these collisions resulted in one pedestrian injury. As previously noted, all-way stop controls are present at this location, but nearby vegetation could potentially have impacted visibility of pedestrians crossing at this intersection.

Project Impacts on Pedestrian Facilities

Pedestrian demand is expected to be minimal for trips to and from the project site, and the City does not require sidewalks in the hillside residential area as it is characterized by low density and challenging topography. The project therefore would not conflict with policies related to multimodal circulation.

Finding – Pedestrian facilities serving the project site are considered adequate for the project context and anticipated demand.

Bicycle Facilities

Existing and Planned Bicycle Facilities

The *Highway Design Manual*, Caltrans, 2020, classifies bikeways into four categories:

- **Class I Multi-Use Path** – a completely separated right-of-way for the exclusive use of bicycles and pedestrians with cross flows of motorized traffic minimized.
- **Class II Bike Lane** – a striped and signed lane for one-way bike travel on a street or highway.

- **Class III Bike Route** – signing only for shared use with motor vehicles within the same travel lane on a street or highway.
- **Class IV Bikeway** – also known as a separated bikeway, a Class IV Bikeway is for the exclusive use of bicycles and includes a separation between the bikeway and the motor vehicle traffic lane. The separation may include, but is not limited to, grade separation, flexible posts, inflexible physical barriers, or on-street parking.

While there are no bicycle facilities in the immediate project area, Grand Avenue is a Class III bike route between 4th Street and Newhall Drive-Belle Avenue and Class IV bikeways are currently under construction along Grand Avenue from 4th Street to 2nd Street. Bicyclists ride in the roadway along all other streets within the project study area. Table 4 summarizes the existing and planned bicycle facilities in the project vicinity, as contained in the *San Rafael Bicycle Pedestrian Master Plan 2018 Update*.

Table 4 – Bicycle Facility Summary

Status Location	Class	Length (miles)	Begin Point	End Point
Existing				
Grand Ave	III	0.80	4th St	Newhall Dr-Belle Ave
4th St	III	0.30	Irwin St	Union St
Pt San Pedro Rd	II/III	0.54	Montecito Dr	City Limits (East)
Planned				
3rd St	I	0.40	Grand Ave	City Limits (East)
4th St	TBD	1.39	2nd St	Union St
Grand Ave	IV	0.11	2nd St	4th St

Source: *San Rafael Bicycle Pedestrian Master Plan 2018 Update*, City of San Rafael, 2018

Bicyclist Safety

Collision records for the study area were reviewed to determine if there had been any bicyclist-involved crashes. During the five-year study period between October 1, 2018, and September 30, 2023, there were no reported collisions involving bicyclists at any of the study intersections or along the study roadway segments.

Project Impacts on Bicycle Facilities

Existing facilities together with shared use of minor streets provide adequate access for bicyclists around the project site. The City's adopted plans do not include bicycle facilities along any of the project frontage streets, and bicycle access is permitted on all streets throughout the project area. Therefore, the project would not conflict with City policy and would have a less-than-significant impact on bicycle circulation.

Bicycle Storage

The San Rafael Municipal Code, Section 14.18.090 includes bicycle parking requirements for multifamily residential projects, which are defined as buildings containing three or more attached dwelling units on a single lot. Since the proposed project would include only one dwelling unit per lot, including some lots with a JADU, bicycle parking is not required.

Finding – Bicycle storage is not required and is therefore adequate.

Transit Facilities

Existing Transit Facilities

The transit stop nearest the project site is located approximately one-half mile west at Grand Avenue/Acacia Way and is served by Marin Transit Routes 57 and 233.

Route 57 provides service to destinations between downtown San Rafael and Novato and stops on Grand Avenue, circling Dominican University. It operates Monday through Friday with headways of between approximately one-half-hour to one-hour between 6:25 a.m. and 9:45 p.m. On weekends, Route 57 does not serve San Rafael.

Route 233 services downtown San Rafael to Santa Venetia. It operates with one-hour headways between 6:30 a.m. and 7:25 p.m. on weekdays and between 8:00 a.m. and 5:25 p.m. on weekends.

Two bicycles can be carried on most Marin Transit buses. Bike rack space is on a first come, first served basis.

Dial-a-ride, also known as paratransit, or door-to-door service, is available for those who are unable to independently use the transit system due to a physical or mental disability. Marin Access Paratransit is designed to serve the needs of individuals with disabilities within three-quarters of a mile from regular fixed-routes in Marin County.

Impact on Transit Facilities

Transit service is not present along the streets fronting the project site. The nearest bus stop access to the project site is considered to be within an acceptable walking distance of one-half mile, but given the low-density residential uses a substantial number of transit trips to and from the proposed project is not anticipated. The project would not conflict with any policies relative to transit.

Finding – Transit facilities and service in the project area are adequate for the expected limited demand.

Significance Finding – The proposed project would not conflict with any plans or policies for transportation facilities. It would therefore have a less-than-significant impact on multimodal circulation.

Vehicle Miles Traveled (VMT)

The potential for the project to conflict or be inconsistent with CEQA Guidelines § 15064.3, subdivision (b) was evaluated based the project's anticipated Vehicle Miles Traveled (VMT).

The *City of San Rafael Transportation Analysis Guidelines*, 2021, includes procedures for analyzing VMT and thresholds of significance to assess project-related impacts. This document indicates that a residential project with VMT per capita that is greater than 15 percent below the nine-county Bay Area average would be considered to have a significant transportation impact.

In accordance with City guidelines, the project's potential VMT impact was assessed based on data from the Transportation Authority of Marin Demand Model (TAMDM). The TAMDM model includes traffic analysis zones (TAZ) covering geographic areas throughout Marin County, including 1,400 Micro Analysis Zones (MAZ) for which VMT is calculated. The 2019 version of the TAMDM was used for this analysis, and it includes updates made for the City of San Rafael General Plan. The nine-county Bay Area has a VMT per capita of 12.6, and 15 percent below this level is 10.7, which is the significance threshold. The project is located in MAZ 811769, which has a VMT per capita of 13.5. To reduce the VMT per capita from 13.5 to less than 10.7 and a less-than-significant impact would require a reduction of 20.7 percent.

Trip Reduction Strategies

Project Features

Since VMT is calculated by multiplying the number of vehicle trips by the trip length, project-related VMT is influenced by numerous factors such as the land use context, density, and inclusion of affordable housing.

Inclusion of Affordable Housing

As proposed, 20 percent of the proposed units in the Dominican Valley project would be designated as deed-restricted affordable housing. A methodology published in *Income, Location Efficiency, and VMT: Affordable Housing as a Climate Strategy*, The California Housing Partnership, 2015, was used to determine the VMT reductions associated with provision of onsite affordable housing (this method is also currently used by the City of San Jose). Applying the reductions for the proposed affordable units, the project's VMT would be reduced by 2.0 percent. This assumes that the residents would meet the "low income" criteria.

Pedestrian Infrastructure

While the lack of pedestrian infrastructure is consistent with existing development in the area, some residents of the project would have the ability to reach their destinations by walking; this would be especially true for residents living in units along Deer Park Avenue that work or study at Dominican University. Although there are few vehicles traveling along this segment, improvement of the infrastructure to allow for more comfortable pedestrian access from project site to the Dominican University campus would encourage additional walking trips. This would be expected to largely impact short trips, both to the University and the surrounding area, where a sidewalk network currently exists. While the number of vehicle trips would be reduced as a result, and there would be a reduction in VMT, the percentage reduction compared to the project VMT would be nominal.

Project Context

The land use context of the project should also support reduced VMT when compared with similar projects located farther away from a mixed-use downtown area like San Rafael. Since VMT is calculated by multiplying the number of vehicle trips by the trip length, project-related VMT is influenced by numerous factors. For example, the project is located approximately one-half mile from the nearest transit stop, which is considered an acceptable walking distance. However, there are numerous destinations within a relatively short distance of the project site. This includes the Downtown San Rafael SMART station, San Rafael Transit Center, and numerous grocery stores and other retail opportunities on the east side of US 101 that are within approximately 1.2 miles of the project site. The Transportation Authority of Marin (TAM) conducted an analysis of travel patterns throughout the County and determined that the average trip length in San Rafael is 8.2 miles. Therefore, while walking, bicycling and transit are not expected to be used for a high percentage of trips to destinations near the project site, the ability of residents to access nearby destinations via relatively short vehicle trips would have a beneficial impact on VMT in comparison with many other locations in Marin County.

Transportation Demand Management

Transportation Demand Management (TDM) measures have the potential to further reduce VMT by supporting use of non-vehicle transportation options. The project would establish a homeowner's association, which could serve as a mechanism to distribute transportation information to residents on a periodic basis and as new owners and tenants arrive. This would raise awareness of residents of Marin Commutes, which serves as a commuter information hub throughout Marin County, providing information about how to access a wide range of commuting options as well as incentive programs based on participation.

Ridesharing

Ridesharing can be a highly effective strategy for reducing vehicle trips and VMT. There are various options for carpooling in the Bay Area, through platforms including Marin Commutes and 511, which would enable local residents to identify ridesharing partners through a regional system. Ridesharing tends to have the lowest cost per passenger-mile of any motorized mode of transportation since it makes use of a vehicle seat that would otherwise be empty. It also provides financial savings for the consumer by decreasing fuel and parking costs. Further supporting the use of ridesharing and other nonvehicle transportation modes is the availability of the Emergency Ride Home (ERH) program administered through the Transportation Authority of Marin. This provides a greater level of security for people who use non-vehicle transportation options for commuting by offering reimbursement for a taxi or equivalent in case of an emergency.

The project would have a homeowner's association (HOA) to manage private streets and other facilities on the site. One option for encouraging ridesharing would be for the HOA to provide current and incoming project residents with information about how to take advantage of existing ridesharing options in the area. Encouragement of ridesharing is estimated to reduce VMT by approximately 2.0 percent.

Combined VMT Reduction Measures

The various strategies described are the most feasible options for reducing project VMT. As noted, the trip reduction for some measures can be quantified based on previous research. Other suggested measures are also expected to support VMT reductions but there is insufficient research available to estimate the magnitude of the reduction. The estimated VMT reduction for each measure is summarized in Table 5.

Table 5 – Summary of Potential Vehicle Miles Traveled (VMT) Reduction Measures

Project Feature/TDM Strategy	Assumption	Estimated VMT Reduction
Affordable Housing	20% of units	2.0%
Ridesharing	N/A	2.0%

Source: CAPCOA, 2021; TAMDM, 2022

Significance Finding – As currently proposed, the project would be expected to have a significant impact on VMT.

Safety Issues

The potential for the project to impact safety was evaluated in terms of the adequacy of sight distance and need for turn lanes at the project accesses. This section addresses the third transportation bullet on the CEQA checklist which is whether or not the project would substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment).

Site Access

The project includes frontages on Gold Hill Grade, Deer Park Avenue, and Margarita Drive, with the following access points.

- Gold Hill Grade: Five single family units would be accessed directly from Gold Hill Grade via individual driveways.
- Deer Park Avenue: Thirty-five (35) units would be accessed from an interior street that would connect to Deer Park Avenue, including 18 single family homes and 17 townhomes. Two access points are proposed along Deer Park Avenue, one at the existing Magnolia Avenue/Deer Park Avenue intersection and one approximately 360 feet south of that intersection.
- Margarita Drive: Ten (10) units, including four single family homes and six duplex units, would be accessed from a private street that would connect to Margarita Drive.

Gold Hill Grade, Deer Park Avenue, and Margarita Drive would all be widened to 26 feet along the project frontages. The private streets within the project would be 26 feet wide.

Sight Distance

Sight distances at the project access points and driveways were evaluated based on sight distance criteria contained in the *Guidelines for Geometric Design of Very Low-Volume Local Roads* published by AASHTO. Sight distance guidelines developed in this document are based on research that indicates increased sight distance on low-volume roadways would have minimal effect on crash frequency or severity, meaning that any work done to upgrade a low-volume roadway to the sight distance requirements contained in the Caltrans *Highway Design Manual* or the AASHTO *A Policy on Geometric Design of Highways and Streets* would likely not be economically beneficial. The guide provides recommended minimum stopping sight distance requirements using the approach travel speeds as the basis for determining the recommended sight distance appropriate for the case of roadways with volumes below 400 vehicles per day.

Sight distances at the project access points and driveways were evaluated using topographic survey and proposed site design data in AutoCAD format. Based on a design speed of 25 mph, the minimum stopping sight distance recommended is 125 feet in both directions at all access locations. Sight distances at all driveways on Gold Hill Grade, Deer Park Avenue, Margarita Drive, and the internal roadways would exceed 125 feet and therefore be adequate. Similarly, sight distances along Deer Park Avenue at the intersection of the western internal roadways and at the two connections to Deer Park Avenue would also exceed the minimum recommended distance.

Sight distances along Highland Drive at the Margarita Drive/Highland Drive intersection would exceed the minimum recommended distance of 125 feet to the north. To the south, only approximately 70 feet of sight distance would be available, which is appropriate for low-volume roadways with approach speeds of 15 mph or less. Given the steep grade, curvature, and paved width of Highland Avenue approaching the intersection from this direction, drivers on Highland Drive are likely traveling at speeds of 15 mph or less as they approach the intersection. This would make the available sight distance adequate. Further, drivers would be able to and are expected to creep into the intersection slightly to get a better vantage of traffic approaching from the opposite

lane. This creeping would extend the available sight distance to over 125 feet, which would satisfy the minimum recommendation for the *prima facie* speed limit of the roadway even if drivers are traveling much slower.

The connection of the new roadway, Margarita Drive, and Highland Avenue creates a six-legged intersection with complex sight line requirements, especially between the new roadway and Margarita Drive since they would come in at almost the same angle and directly adjacent to one another. There would be a large grade difference between Margarita Drive and the proposed roadway which would necessitate a retaining wall. However, the wall ends far enough back from the intersection and the pavement is wide enough that two drivers who arrive from these approaches at the same time would have sufficient pavement width and time to allow them to observe one another and yield as is required at uncontrolled intersections. The merging point of these two approaches is also set back from the intersection with Highland Avenue so drivers would only have to be concerned about merging with one stream of traffic at a time.

Significance Finding – The project would not introduce any hazards as a result of its design as sightlines are adequate at all proposed connections to the public street system.

Emergency Access

The final transportation bullet on the CEQA checklist requires an evaluation as to whether the project would result in inadequate emergency access or not.

The project is subject to the San Rafael's street design requirements for hillside development, as described in Section 15.07.030(a) of the City's municipal code. The minimum street width for hillside areas is 25 feet, although the existing frontage roadways are less than 20 feet wide. The San Rafael Fire Department access requirements exceed the minimum widths specified in the hillside development requirements, as they have established a minimum of 26 feet to allow for adequate emergency vehicle access. As indicated in the site plan, interior project roadways would be constructed to be 26 feet wide, and turnaround areas for fire trucks are included along the interior project roadways and along Gold Hill Grade. In addition, the segments of Gold Hill Grade, Deer Park Avenue, and Margarita Drive along the project frontages would be widened as part of the project to meet the Fire Department's minimum street width requirement.

Off-Site Impacts

In addition to enabling emergency vehicles to adequately serve the project, the widening of the frontage roads would provide improved emergency vehicle access to existing development in the area and would therefore be expected to improve emergency response times to the surrounding neighborhood.

Significance Finding – The proposed project would be designed to accommodate emergency response vehicles and would not impede emergency responders, resulting in a less-than-significant impact on emergency response.

Capacity Analysis

Intersection Level of Service Methodologies

Level of Service (LOS) is used to rank traffic operation on various types of facilities based on traffic volumes and roadway capacity using a series of letter designations ranging from A to F. Generally, Level of Service A represents free flow conditions and Level of Service F represents forced flow or breakdown conditions. A unit of measure that indicates a level of delay generally accompanies the LOS designation.

The study intersections were analyzed using methodologies published in the *Highway Capacity Manual* (HCM), Transportation Research Board, 2010. This source contains methodologies for various types of intersection control, all of which are related to a measurement of delay in average number of seconds per vehicle.

The Levels of Service for the intersection of Grand Avenue/Locust Avenue, which has stop controls only on Locust Avenue, were analyzed using the "Two-Way Stop-Controlled" intersection capacity method from the HCM. This methodology determines a level of service for each minor turning movement by estimating the level of average delay in seconds per vehicle. Results are presented for individual movements together with the weighted overall average delay for the intersection.

The remaining two study intersections have stop signs on all approaches and were analyzed using the "All-Way Stop-Controlled" Intersection methodology from the HCM. This methodology evaluates delay for each approach based on turning movements, opposing and conflicting traffic volumes, and the number of lanes. Average vehicle delay is computed for the intersection as a whole and is then related to a Level of Service.

The ranges of delay associated with the various levels of service are indicated in Table 6.

Table 6 – Intersection Level of Service Criteria

LOS	Two-Way Stop-Controlled	All-Way Stop-Controlled
A	Delay of 0 to 10 seconds. Gaps in traffic are readily available for drivers exiting the minor street.	Delay of 0 to 10 seconds. Upon stopping, drivers are immediately able to proceed.
B	Delay of 10 to 15 seconds. Gaps in traffic are somewhat less readily available than with LOS A, but no queuing occurs on the minor street.	Delay of 10 to 15 seconds. Drivers may wait for one or two vehicles to clear the intersection before proceeding from a stop.
C	Delay of 15 to 25 seconds. Acceptable gaps in traffic are less frequent, and drivers may approach while another vehicle is already waiting to exit the side street.	Delay of 15 to 25 seconds. Drivers will enter a queue of one or two vehicles on the same approach, and wait for vehicle to clear from one or more approaches prior to entering the intersection.
D	Delay of 25 to 35 seconds. There are fewer acceptable gaps in traffic, and drivers may enter a queue of one or two vehicles on the side street.	Delay of 25 to 35 seconds. Queues of more than two vehicles are encountered on one or more approaches.
E	Delay of 35 to 50 seconds. Few acceptable gaps in traffic are available, and longer queues may form on the side street.	Delay of 35 to 50 seconds. Longer queues are encountered on more than one approach to the intersection.
F	Delay of more than 50 seconds. Drivers may wait for long periods before there is an acceptable gap in traffic for exiting the side streets, creating long queues.	Delay of more than 50 seconds. Drivers enter long queues on all approaches.

Reference: *Highway Capacity Manual,* Transportation Research Board, 2010

Traffic Operation Standards

San Rafael General Plan Policy M-2.5 outlines a general citywide standard of LOS D operation, with exemptions for intersections in the Downtown Precise Plan boundary and signalized freeway ramp intersections.

Existing Conditions

The Existing Conditions scenario provides an evaluation of current operation based on existing traffic volumes during the a.m. and p.m. peak periods. This condition does not include project-generated traffic volumes. Volume data was collected at the study intersections on February 15 and February 22, 2024, while local schools were in session.

Under existing conditions all of the study intersections are operating acceptably. The existing traffic volumes are shown in Figure 3. A summary of the intersection Level of Service calculations is contained in Table 7, and copies of the calculations are provided in Appendix B.

Table 7 – Existing Peak Hour Intersection Levels of Service

Study Intersection ***Approach***	**AM Peak**		**PM Peak**	
	Delay	**LOS**	**Delay**	**LOS**
1. Grand Ave/Mission Ave	12.1	B	16.4	C
2. Grand Ave/Jewell St	8.9	A	9.6	A
3. Grand Ave/Locust Ave	1.9	A	2.2	A
Westbound (Locust Ave) Approach	*10.5*	*B*	*11.5*	*B*

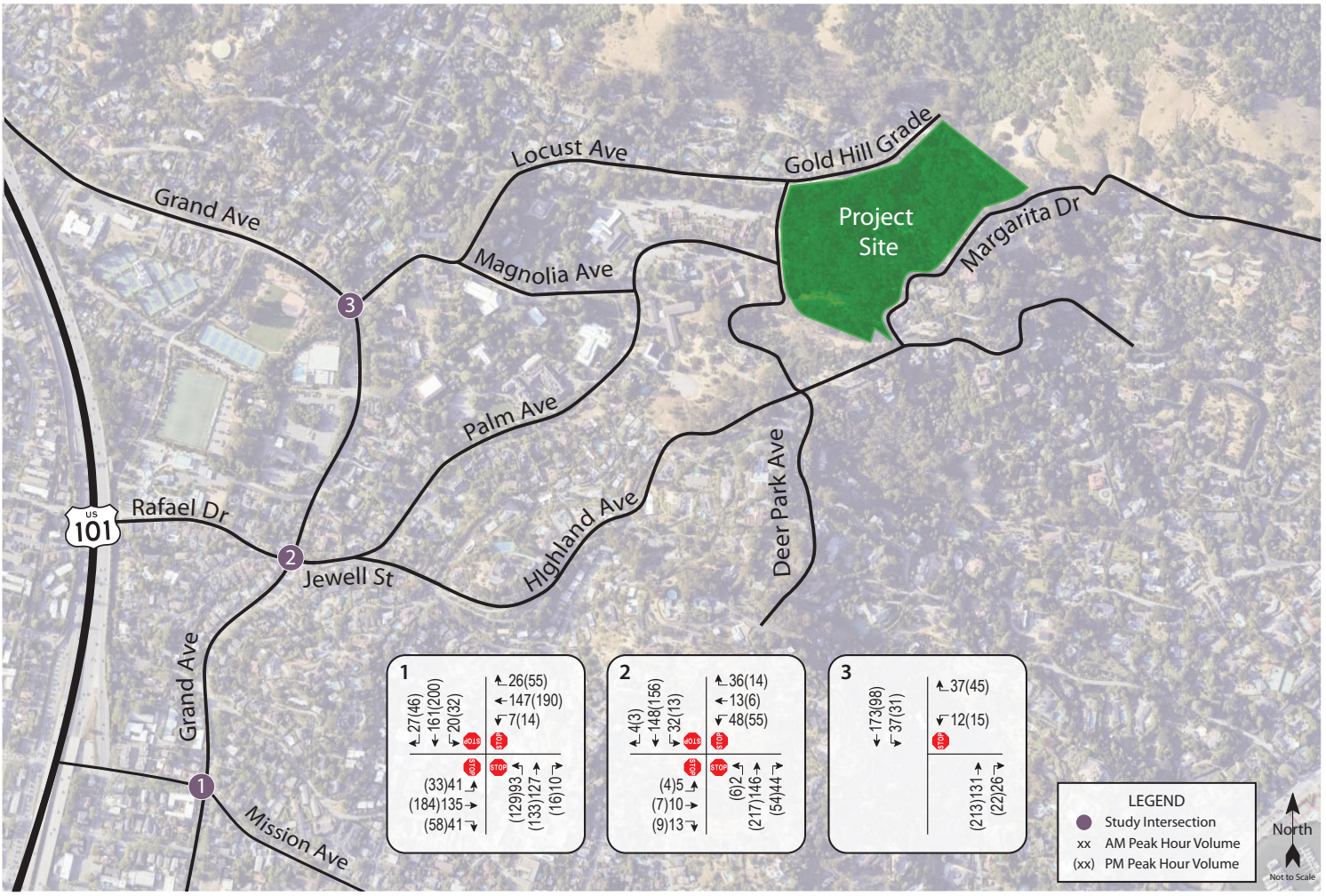
Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*

Future Conditions

Segment volumes for the base and future years of 2019 and 2040, respectively, were obtained from TAMDM and translated to calculated growth factors. Future traffic volumes were developed based on these growth factors. The increment of new traffic projected was added to the actual counts used in the Existing Conditions scenario.

The model projected traffic volume decreases at the minor legs of the study intersections, and minimal volume decreases were observed elsewhere in the model. Such decreases are attributable to assumed infrastructure improvements and forecast changes in demographic data throughout the region. Rather than assume volume decreases, growth factors for the p.m. peak hours were calculated solely based on the major road volumes along Grand Avenue. For the a.m. peak hours, growth factors were calculated using all intersection arrival and departure volumes. This approach was used to ensure that the projections of future traffic volumes are conservative.

Under the anticipated Future volumes, all three study intersections are expected to operate at acceptable service levels. Future volumes are shown in Figure 4 and operating conditions are summarized in Table 8.



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Transportation Impact Study for the Dominican Valley Subdivision Project

Figure 3 – Existing Traffic Volumes

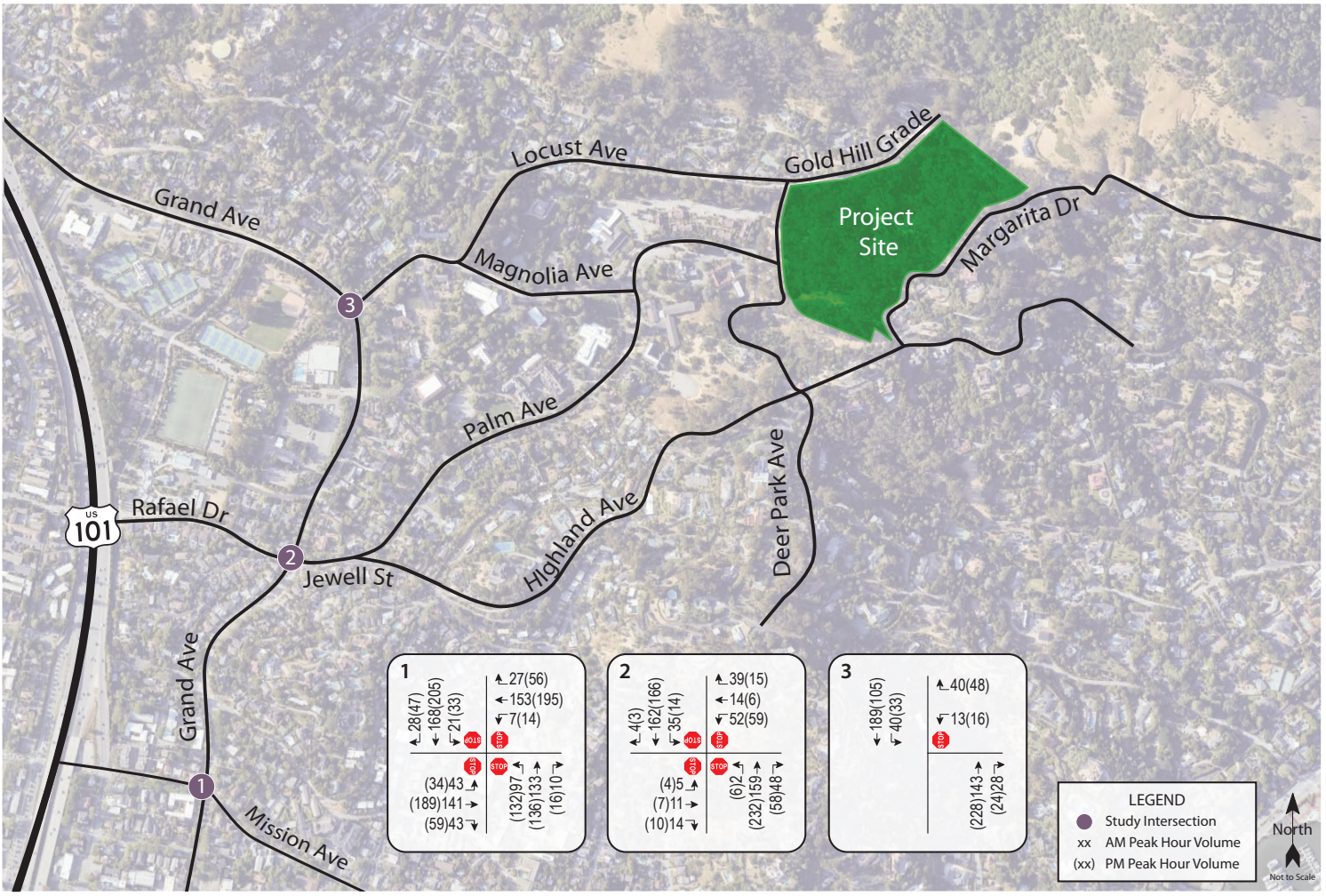

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Figure 4 – Future Traffic Volumes

Table 8 – Future Peak Hour Intersection Levels of Service					
Study Intersection ***Approach***		**AM Peak**		**PM Peak**	
		Delay	**LOS**	**Delay**	**LOS**
1.	Grand Ave/Mission Ave	12.6	B	17.3	C
2.	Grand Ave/Jewell St	9.1	A	9.9	A
3.	Grand Ave/Locust Ave	2.0	A	2.2	A
	Westbound (Locust Ave) Approach	*10.8*	*B*	*11.8*	*B*

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*

Project Conditions

Existing plus Project Conditions

Upon the addition of project-related traffic to the existing volumes, the study intersections are expected to operate acceptably. These results are summarized in Table 9. Project traffic volumes are shown in Figure 5.

Table 9 – Existing and Existing plus Project Peak Hour Intersection Levels of Service									
Study Intersection ***Approach***		**Existing Conditions**				**Existing plus Project**			
		AM Peak		**PM Peak**		**AM Peak**		**PM Peak**	
		Delay	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
1.	Grand Ave/Mission Ave	12.1	B	16.4	C	12.4	B	17.3	C
2.	Grand Ave/Jewell St	8.9	A	9.6	A	9.0	A	9.9	A
3.	Grand Ave/Locust Ave	1.9	A	2.2	A	2.1	A	2.4	A
	Westbound (Locust Ave) Approach	*10.5*	*B*	*11.5*	*B*	*10.5*	*B*	*11.6*	*B*

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*

It should be noted that with the addition of project-related traffic volumes, average delay at each intersection increases slightly during the a.m. and p.m. peak hours. However, these nominal increases in delay do not affect the overall Levels of Service at any of the three study intersections.

Finding – The study intersections are expected to continue operating acceptably at the same Levels of Service upon the addition of project-generated traffic as without it.

Future plus Project Conditions

Upon the addition of project-generated traffic to the anticipated future volumes, the study intersections are expected to operate acceptably. Future plus Project volumes are shown in Figure 6, and operating conditions are summarized in Table 10.

Finding – The study intersections are expected to continue operating acceptably with project traffic added to anticipated future volumes, at the same service levels as without it.

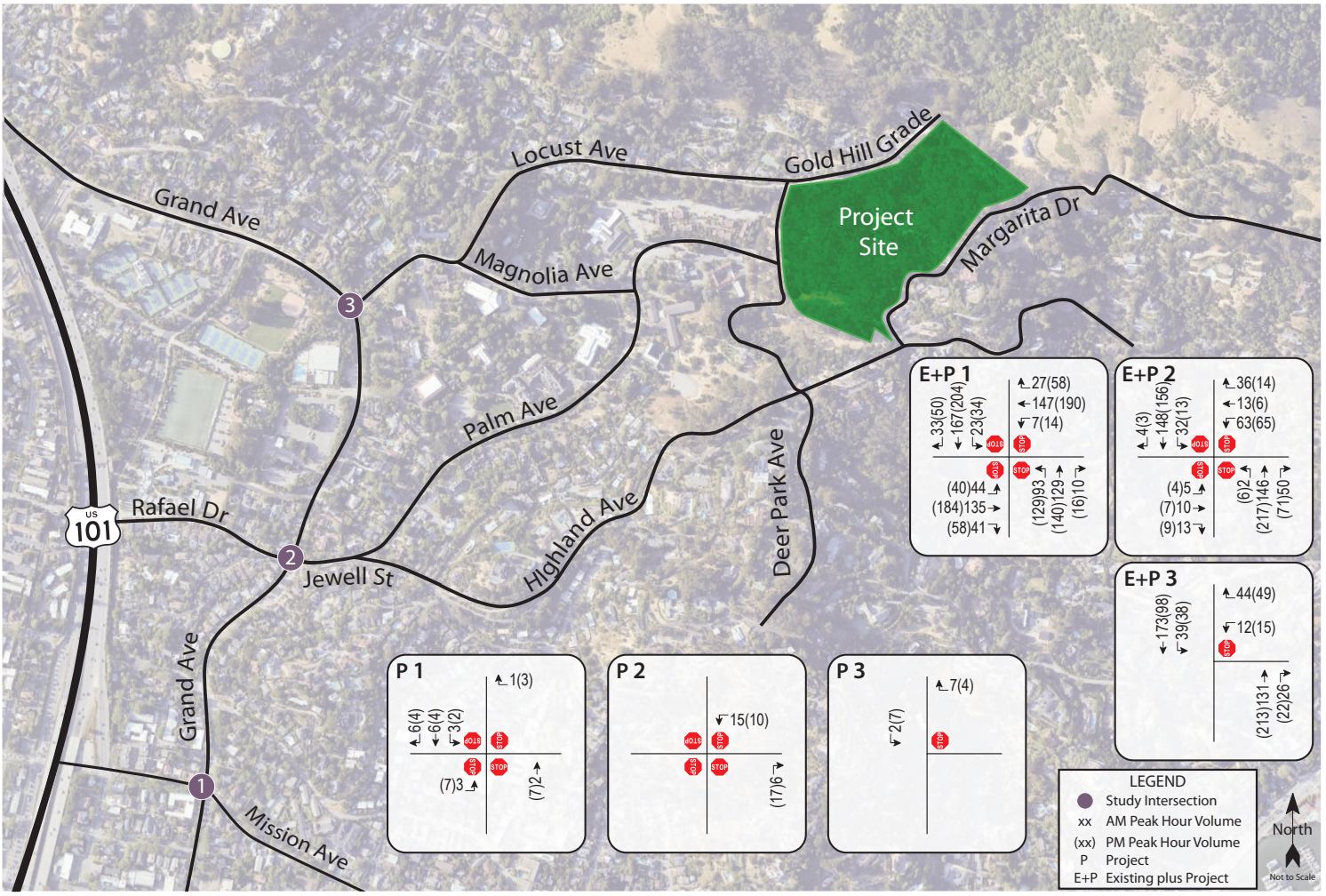

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Figure 5 – Project Traffic Volumes and Existing plus Project Traffic Volumes

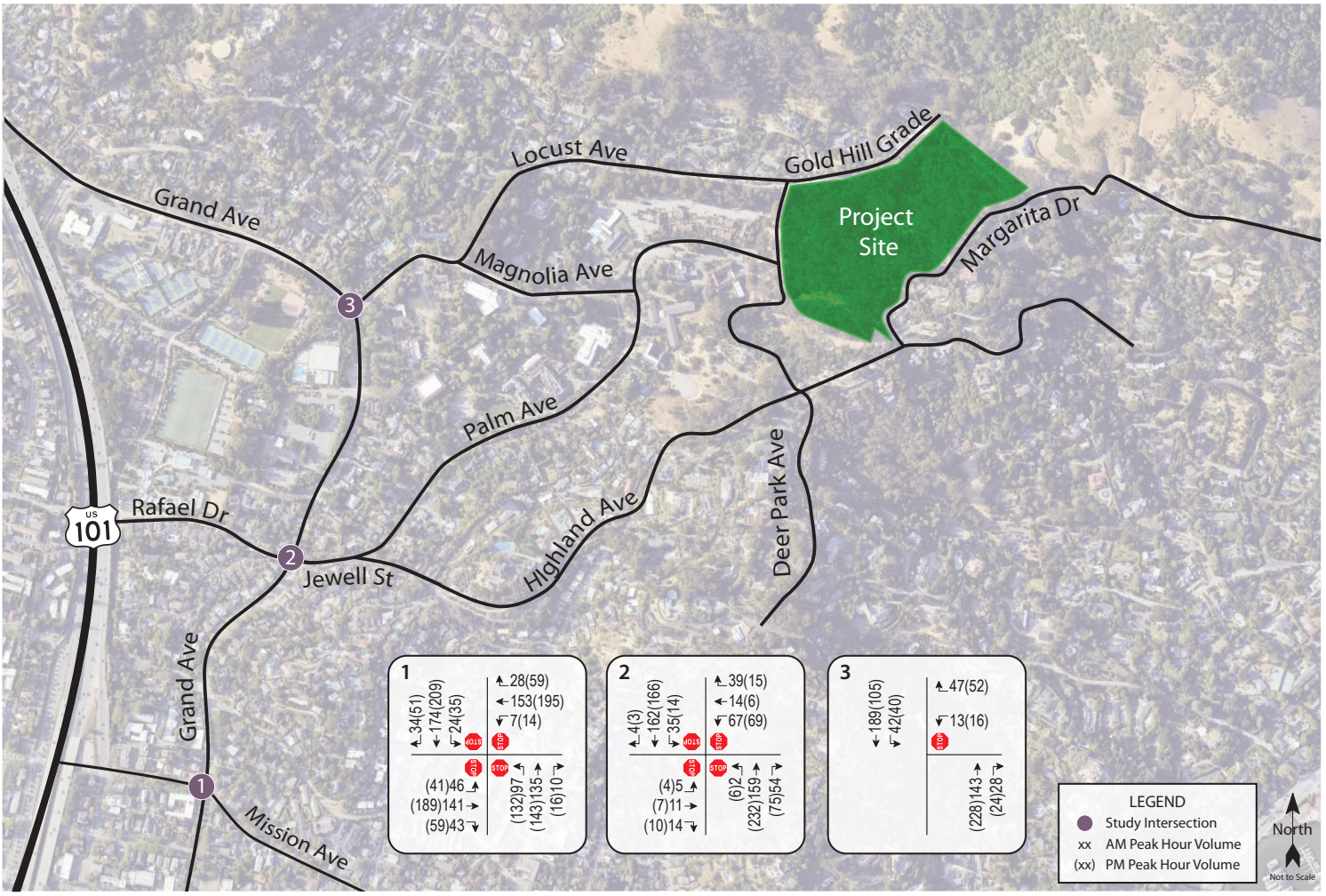

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Figure 6 – Future plus Project Traffic Volumes

Table 10 – Future and Future plus Project Peak Hour Intersection Levels of Service

Study Intersection *Approach*	Future Conditions				Future plus Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1. Grand Ave/Mission Ave	12.6	B	17.3	C	12.9	B	18.3	C
2. Grand Ave/Jewell St	9.1	A	9.9	A	9.3	A	10.3	B
3. Grand Ave/Locust Ave	2.0	A	2.2	A	2.1	A	2.4	A
Westbound (Locust) Approach	*10.8*	*B*	*11.8*	*B*	*10.8*	*B*	*11.9*	*B*

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*

Parking

The project was analyzed to determine whether the proposed parking supply would be sufficient for the anticipated parking demand. The project as proposed would provide a total of 169 standard parking spaces for the proposed 50 single-family housing units.

Jurisdiction parking supply requirements are provided in the San Rafael Municipal Code, Chapter 14.18; Parking Standards. Table 14.48.040 defines the minimum parking requirements for each land use; the proposed project falls under the "Single-family residential, hillside" classification. Typical single-family residential land uses typically require two covered parking spaces per unit. For hillside housing, residences on streets less than 26 feet wide are required to provide a minimum of two additional parking spaces for each housing unit. However, the project frontages and the interior project streets would all be 26 feet wide, so guest spaces are not required. It is noted that per Table 14.16.285 of the code no parking spaces are required for JADUs.

The project would provide 86 covered spaces and uncovered spaces. All of the units would include two covered spaces, with the exception of 14 of the townhomes, which would include one covered space. While guest parking is not required, all units would include at least one guest space. As a result, all units would meet or exceed the number of required parking spaces; however, not all spaces would meet the requirement for the spaces to be covered. The proposed parking supply and City requirements are shown in Table 11.

Table 11 – Parking Analysis Summary

Land Use	Units	City Requirements		Proposed Supply
		Rate	Spaces Required	
Single-Family Housing	27 du	2 covered spaces/unit	54 covered spaces	54 covered spaces, 54 guest spaces
Townhomes	17 du	2 covered spaces/unit	34 covered spaces	20 covered spaces, 17 guest spaces
Duplexes	6 du	2 covered spaces/unit	12 covered spaces	12 covered spaces, 12 guest spaces
Total	**50 du**		**100 covered spaces**	**86 covered spaces, 83 guest spaces**
Total Proposed Parking Supply				169 spaces

Notes: du = dwelling unit

Finding – The proposed parking supply would exceed the City requirements based on capacity, but the project would not provide the required number of covered spaces.

Conclusions and Recommendations

Conclusions

- The proposed project is expected to generate an average of 421 trips per day, including 30 a.m. peak hour trips and 38 p.m. peak hour trips.
- The project would be consistent with City policies regarding pedestrian, bicycle, and transit facilities and would therefore have a less-than-significant impact on multimodal circulation.
- The project would have a VMT per capita that exceeds the City's significance threshold, so as currently proposed, the project's VMT impact is deemed significant.
- Emergency vehicle access would be adequate, and frontage improvements would result in improved access for emergency vehicles to properties in the surrounding neighborhood. Therefore, the impact of the project on emergency vehicle access is less than significant.
- The study intersections operate acceptably overall during both peak hours under existing conditions and would be expected to continue doing so with the addition of project trips.
- Under future volumes, all three study intersections are expected to continue to operate acceptably during the a.m. and p.m. peak hours, without and with the addition of project trips.
- The proposed parking supply would exceed the number of spaces specified in the City's requirements but would not include the required number of covered spaces for all units.

Recommendations

- Transportation demand management measures should be implemented through the project's homeowner's association to encourage use of non-vehicle transportation and reduce the VMT associated with project trips.

Study Participants and References

Study Participants

Principal in Charge	Dalene J. Whitlock, PE (Civil, Traffic), PTOE
Senior Traffic Engineer	Kenny Jeong, PE (Traffic)
Transportation Planner	Barry Bergman, AICP
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Graphics	Jessica Bender
Editing/Formatting	Jessica Bender
Quality Control	Dalene J. Whitlock, PE (Civil, Traffic), PTOE

References

2019 Collision Data on California State Highways, California Department of Transportation, 2021
City of San Jose VMT Evaluation Tool, City of San Jose, 2023.
City of San Rafael Transportation Impact Analysis Guidelines, Fehr & Peers, March 2021
Guide for the Preparation of Traffic Impact Studies, California Department of Transportation, 2002
Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT ≤ 400), American Association of State Highway and Transportation Officials, 2001
Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity: Designed for Local Governments, Communities, and Project Developers, California Air Pollution Control Officers Association (CAPCOA), 2021
Highway Capacity Manual, Transportation Research Board, 2016
Highway Design Manual, 7th Edition, California Department of Transportation, 2022
Hillside Design Guidelines to All Hillside Residential Development Projects, City of San Rafael, 2016
Marin Transit, https://marintransit.org/
San Rafael Bicycle & Pedestrian Master Plan, Alta Planning + Design, 2018
San Rafael, California Municipal Code, Municipal Code Corporation, 2017
San Rafael General Plan 2040, City of San Rafael, 2021
Statewide Integrated Traffic Records System (SWITRS), California Highway Patrol, 2018-2023
Transportation Authority of Marin Demand Model (TAMDM), Transportation Authority of Marin, 2023
Trip Generation Manual, 11th Edition, Institute of Transportation Engineers, 2021

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Appendix A

Collision Rate Calculations

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Intersection Collision Rate Worksheet

Dominican Valley Subdivision Project

Intersection # 1: Grand Avenue & Mission Avenue
Date of Count: Thursday, February 22, 2024

Number of Collisions: 8
Number of Injuries: 2
Number of Fatalities: 0
Average Daily Traffic (ADT): 10900
Start Date: October 1, 2018
End Date: September 30, 2023
Number of Years: 5

Intersection Type: Four-Legged
Control Type: 4 Way Stop
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x Days per Year x Number of Years}}$$

$$\text{Collision Rate} = \frac{8 \times 1{,}000{,}000}{10{,}900 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.40 c/mve**	**0.0%**	**25.0%**
Statewide Average*	**0.21 c/mve**	**2.5%**	**25.6%**

Notes
ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2021 Collision Data on California State Highways, Caltrans

Intersection # 2: Grand Avenue & Jewell Street
Date of Count: Thursday, February 15, 2024

Number of Collisions: 1
Number of Injuries: 0
Number of Fatalities: 0
Average Daily Traffic (ADT): 5400
Start Date: October 1, 2018
End Date: September 30, 2023
Number of Years: 5

Intersection Type: Four-Legged
Control Type: 4 Way Stop
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x Days per Year x Number of Years}}$$

$$\text{Collision Rate} = \frac{1 \times 1{,}000{,}000}{5{,}400 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.10 c/mve**	**0.0%**	**0.0%**
Statewide Average*	**0.21 c/mve**	**2.5%**	**25.6%**

Notes
ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2021 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Worksheet

Dominican Valley Subdivision Project

Intersection # 3: Grand Avenue & Locust Avenue
Date of Count: Thursday, February 15, 2024

Number of Collisions: 1
Number of Injuries: 1
Number of Fatalities: 0
Average Daily Traffic (ADT): 4200
Start Date: October 1, 2018
End Date: September 30, 2023
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x Days per Year x Number of Years}}$$

$$\text{Collision Rate} = \frac{1 \times 1{,}000{,}000}{4{,}200 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.13 c/mve**	**0.0%**	**100.0%**
Statewide Average*	**0.13 c/mve**	**1.3%**	**47.3%**

Notes
ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2021 Collision Data on California State Highways, Caltrans

Appendix B

Intersection Level of Service Calculations

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Intersection	
Intersection Delay, s/veh	12.1
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	41	135	41	7	147	26	93	127	10	20	161	27
Future Vol, veh/h	41	135	41	7	147	26	93	127	10	20	161	27
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	46	152	46	8	165	29	104	143	11	22	181	30
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	12.1	11.5	12.6	11.9
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	40%	19%	4%	10%
Vol Thru, %	55%	62%	82%	77%
Vol Right, %	4%	19%	14%	13%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	230	217	180	208
LT Vol	93	41	7	20
Through Vol	127	135	147	161
RT Vol	10	41	26	27
Lane Flow Rate	258	244	202	234
Geometry Grp	1	1	1	1
Degree of Util (X)	0.407	0.381	0.32	0.364
Departure Headway (Hd)	5.674	5.623	5.696	5.611
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	631	636	627	638
Service Time	3.737	3.686	3.763	3.676
HCM Lane V/C Ratio	0.409	0.384	0.322	0.367
HCM Control Delay	12.6	12.1	11.5	11.9
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	2	1.8	1.4	1.7

Intersection	
Intersection Delay, s/veh	8.9
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	10	13	48	13	36	2	146	44	32	148	4
Future Vol, veh/h	5	10	13	48	13	36	2	146	44	32	148	4
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	11	14	53	14	40	2	160	48	35	163	4
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8	8.6	8.9	9.1
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	1%	18%	49%	17%
Vol Thru, %	76%	36%	13%	80%
Vol Right, %	23%	46%	37%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	192	28	97	184
LT Vol	2	5	48	32
Through Vol	146	10	13	148
RT Vol	44	13	36	4
Lane Flow Rate	211	31	107	202
Geometry Grp	1	1	1	1
Degree of Util (X)	0.255	0.041	0.141	0.254
Departure Headway (Hd)	4.355	4.758	4.772	4.514
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	825	751	750	795
Service Time	2.384	2.799	2.808	2.543
HCM Lane V/C Ratio	0.256	0.041	0.143	0.254
HCM Control Delay	8.9	8	8.6	9.1
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1	0.1	0.5	1

HCM 6th TWSC
3: Grand Ave & Locust Ave 03/11/2024

Intersection	
Int Delay, s/veh	1.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	12	37	131	26	37	173
Future Vol, veh/h	12	37	131	26	37	173
Conflicting Peds, #/hr	19	11	0	19	11	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	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	14	43	152	30	43	201

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	492	197	0	0	201	0
Stage 1	186	-	-	-	-	-
Stage 2	306	-	-	-	-	-
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	536	844	-	-	1371	-
Stage 1	846	-	-	-	-	-
Stage 2	747	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	498	820	-	-	1346	-
Mov Cap-2 Maneuver	498	-	-	-	-	-
Stage 1	831	-	-	-	-	-
Stage 2	707	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.5	0	1.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	- 708	1346	-
HCM Lane V/C Ratio	-	- 0.08	0.032	-
HCM Control Delay (s)	-	- 10.5	7.8	0
HCM Lane LOS	-	- B	A	A
HCM 95th %tile Q(veh)	-	- 0.3	0.1	-

HCM 6th AWSC
1: Grand Ave & Mission Ave 03/11/2024

Intersection	
Intersection Delay, s/veh	16.4
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	33	184	58	14	190	55	129	133	16	32	200	46
Future Vol, veh/h	33	184	58	14	190	55	129	133	16	32	200	46
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	35	196	62	15	202	59	137	141	17	34	213	49
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	16.4	15.7	17	16.5
HCM LOS	C	C	C	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	46%	12%	5%	12%
Vol Thru, %	48%	67%	73%	72%
Vol Right, %	6%	21%	21%	17%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	278	275	259	278
LT Vol	129	33	14	32
Through Vol	133	184	190	200
RT Vol	16	58	55	46
Lane Flow Rate	296	293	276	296
Geometry Grp	1	1	1	1
Degree of Util (X)	0.537	0.522	0.494	0.527
Departure Headway (Hd)	6.534	6.421	6.448	6.412
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	550	559	557	559
Service Time	4.611	4.494	4.524	4.488
HCM Lane V/C Ratio	0.538	0.524	0.496	0.53
HCM Control Delay	17	16.4	15.7	16.5
HCM Lane LOS	C	C	C	C
HCM 95th-tile Q	3.2	3	2.7	3.1

HCM 6th AWSC
2: Grand Ave & Jewell St

03/11/2024

Intersection	
Intersection Delay, s/veh	9.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	7	9	55	6	14	6	217	54	13	156	3
Future Vol, veh/h	4	7	9	55	6	14	6	217	54	13	156	3
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	8	11	65	7	16	7	255	64	15	184	4
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.2	9	10.2	9.2
HCM LOS	A	A	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	2%	20%	73%	8%
Vol Thru, %	78%	35%	8%	91%
Vol Right, %	19%	45%	19%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	277	20	75	172
LT Vol	6	4	55	13
Through Vol	217	7	6	156
RT Vol	54	9	14	3
Lane Flow Rate	326	24	88	202
Geometry Grp	1	1	1	1
Degree of Util (X)	0.393	0.033	0.127	0.257
Departure Headway (Hd)	4.337	5.006	5.167	4.573
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	831	712	692	785
Service Time	2.365	3.06	3.214	2.606
HCM Lane V/C Ratio	0.392	0.034	0.127	0.257
HCM Control Delay	10.2	8.2	9	9.2
HCM Lane LOS	B	A	A	A
HCM 95th-tile Q	1.9	0.1	0.4	1

HCM 6th TWSC
3: Grand Ave & Locust Ave

03/11/2024

Intersection	
Int Delay, s/veh	2.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	15	45	213	22	31	98
Future Vol, veh/h	15	45	213	22	31	98
Conflicting Peds, #/hr	30	17	0	30	17	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	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	18	53	251	26	36	115

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	511	311	0	0	307	0
Stage 1	294	-	-	-	-	-
Stage 2	217	-	-	-	-	-
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	523	729	-	-	1254	-
Stage 1	756	-	-	-	-	-
Stage 2	819	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	477	697	-	-	1218	-
Mov Cap-2 Maneuver	477	-	-	-	-	-
Stage 1	734	-	-	-	-	-
Stage 2	770	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.5	0	1.9
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	625	1218	-
HCM Lane V/C Ratio	-	-	0.113	0.03	-
HCM Control Delay (s)	-	-	11.5	8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0.1	-

Intersection	
Intersection Delay, s/veh	12.6
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	43	141	43	7	153	27	97	133	10	21	168	28
Future Vol, veh/h	43	141	43	7	153	27	97	133	10	21	168	28
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	48	158	48	8	172	30	109	149	11	24	189	31
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	12.7	11.9	13.3	12.4
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	40%	19%	4%	10%
Vol Thru, %	55%	62%	82%	77%
Vol Right, %	4%	19%	14%	13%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	240	227	187	217
LT Vol	97	43	7	21
Through Vol	133	141	153	168
RT Vol	10	43	27	28
Lane Flow Rate	270	255	210	244
Geometry Grp	1	1	1	1
Degree of Util (X)	0.433	0.406	0.339	0.388
Departure Headway (Hd)	5.784	5.734	5.816	5.725
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	618	622	614	624
Service Time	3.857	3.809	3.896	3.799
HCM Lane V/C Ratio	0.437	0.41	0.342	0.391
HCM Control Delay	13.3	12.7	11.9	12.4
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	2.2	2	1.5	1.8

Intersection	
Intersection Delay, s/veh	9.1
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	11	14	52	14	39	2	159	48	35	162	4
Future Vol, veh/h	5	11	14	52	14	39	2	159	48	35	162	4
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	12	15	57	15	43	2	175	53	38	178	4
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.1	8.8	9.2	9.4
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	1%	17%	50%	17%
Vol Thru, %	76%	37%	13%	81%
Vol Right, %	23%	47%	37%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	209	30	105	201
LT Vol	2	5	52	35
Through Vol	159	11	14	162
RT Vol	48	14	39	4
Lane Flow Rate	230	33	115	221
Geometry Grp	1	1	1	1
Degree of Util (X)	0.281	0.045	0.156	0.281
Departure Headway (Hd)	4.412	4.86	4.865	4.572
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	813	734	735	784
Service Time	2.447	2.912	2.908	2.607
HCM Lane V/C Ratio	0.283	0.045	0.156	0.282
HCM Control Delay	9.2	8.1	8.8	9.4
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1.2	0.1	0.6	1.2

HCM 6th TWSC
3: Grand Ave & Locust Ave

03/11/2024

Intersection	
Int Delay, s/veh	2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	13	40	143	28	40	189
Future Vol, veh/h	13	40	143	28	40	189
Conflicting Peds, #/hr	19	11	0	19	11	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	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	15	47	166	33	47	220

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	535	213	0	0	218	0
Stage 1	202	-	-	-	-	-
Stage 2	333	-	-	-	-	-
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	506	827	-	-	1352	-
Stage 1	832	-	-	-	-	-
Stage 2	726	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	469	804	-	-	1328	-
Mov Cap-2 Maneuver	469	-	-	-	-	-
Stage 1	817	-	-	-	-	-
Stage 2	685	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.8	0	1.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	- 684	1328	-
HCM Lane V/C Ratio	-	- 0.09	0.035	-
HCM Control Delay (s)	-	- 10.8	7.8	0
HCM Lane LOS	-	- B	A	A
HCM 95th %tile Q(veh)	-	- 0.3	0.1	-

HCM 6th AWSC
1: Grand Ave & Mission Ave

03/11/2024

Intersection	
Intersection Delay, s/veh	17.3
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	34	189	59	14	195	56	132	136	16	33	205	47
Future Vol, veh/h	34	189	59	14	195	56	132	136	16	33	205	47
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	36	201	63	15	207	60	140	145	17	35	218	50
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	17.3	16.5	17.9	17.4
HCM LOS	C	C	C	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	46%	12%	5%	12%
Vol Thru, %	48%	67%	74%	72%
Vol Right, %	6%	21%	21%	16%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	284	282	265	285
LT Vol	132	34	14	33
Through Vol	136	189	195	205
RT Vol	16	59	56	47
Lane Flow Rate	302	300	282	303
Geometry Grp	1	1	1	1
Degree of Util (X)	0.558	0.545	0.514	0.55
Departure Headway (Hd)	6.651	6.534	6.565	6.525
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	538	549	544	549
Service Time	4.738	4.618	4.653	4.612
HCM Lane V/C Ratio	0.561	0.546	0.518	0.552
HCM Control Delay	17.9	17.3	16.5	17.4
HCM Lane LOS	C	C	C	C
HCM 95th-tile Q	3.4	3.3	2.9	3.3

HCM 6th AWSC
2: Grand Ave & Jewell St

03/11/2024

Intersection	
Intersection Delay, s/veh	9.9
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	7	10	59	6	15	6	232	58	14	166	3
Future Vol, veh/h	4	7	10	59	6	15	6	232	58	14	166	3
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	8	12	69	7	18	7	273	68	16	195	4
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.3	9.1	10.6	9.4
HCM LOS	A	A	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	2%	19%	74%	8%
Vol Thru, %	78%	33%	7%	91%
Vol Right, %	20%	48%	19%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	296	21	80	183
LT Vol	6	4	59	14
Through Vol	232	7	6	166
RT Vol	58	10	15	3
Lane Flow Rate	348	25	94	215
Geometry Grp	1	1	1	1
Degree of Util (X)	0.423	0.035	0.137	0.276
Departure Headway (Hd)	4.372	5.081	5.248	4.621
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	822	700	680	775
Service Time	2.406	3.144	3.303	2.659
HCM Lane V/C Ratio	0.423	0.036	0.138	0.277
HCM Control Delay	10.6	8.3	9.1	9.4
HCM Lane LOS	B	A	A	A
HCM 95th-tile Q	2.1	0.1	0.5	1.1

HCM 6th TWSC
3: Grand Ave & Locust Ave

03/11/2024

Intersection	
Int Delay, s/veh	2.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	16	48	228	24	33	105
Future Vol, veh/h	16	48	228	24	33	105
Conflicting Peds, #/hr	30	17	0	30	17	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	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	19	56	268	28	39	124

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	544	329	0	0	326	0
Stage 1	312	-	-	-	-	-
Stage 2	232	-	-	-	-	-
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	500	712	-	-	1234	-
Stage 1	742	-	-	-	-	-
Stage 2	807	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	455	680	-	-	1199	-
Mov Cap-2 Maneuver	455	-	-	-	-	-
Stage 1	720	-	-	-	-	-
Stage 2	756	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.8	0	1.9
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	605	1199	-
HCM Lane V/C Ratio	-	-	0.124	0.032	-
HCM Control Delay (s)	-	-	11.8	8.1	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0.1	-

Intersection	
Intersection Delay, s/veh	12.4
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	44	135	41	7	147	27	93	129	10	23	167	33
Future Vol, veh/h	44	135	41	7	147	27	93	129	10	23	167	33
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	49	152	46	8	165	30	104	145	11	26	188	37
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	12.4	11.6	12.9	12.4
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	40%	20%	4%	10%
Vol Thru, %	56%	61%	81%	75%
Vol Right, %	4%	19%	15%	15%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	232	220	181	223
LT Vol	93	44	7	23
Through Vol	129	135	147	167
RT Vol	10	41	27	33
Lane Flow Rate	261	247	203	251
Geometry Grp	1	1	1	1
Degree of Util (X)	0.415	0.391	0.326	0.393
Departure Headway (Hd)	5.736	5.698	5.772	5.64
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	623	628	618	634
Service Time	3.805	3.77	3.847	3.709
HCM Lane V/C Ratio	0.419	0.393	0.328	0.396
HCM Control Delay	12.9	12.4	11.6	12.4
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	2	1.9	1.4	1.9

Intersection	
Intersection Delay, s/veh	9
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	10	13	63	13	36	2	146	50	32	148	4
Future Vol, veh/h	5	10	13	63	13	36	2	146	50	32	148	4
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	11	14	69	14	40	2	160	55	35	163	4
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.1	8.8	9	9.2
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	1%	18%	56%	17%
Vol Thru, %	74%	36%	12%	80%
Vol Right, %	25%	46%	32%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	198	28	112	184
LT Vol	2	5	63	32
Through Vol	146	10	13	148
RT Vol	50	13	36	4
Lane Flow Rate	218	31	123	202
Geometry Grp	1	1	1	1
Degree of Util (X)	0.265	0.041	0.165	0.257
Departure Headway (Hd)	4.392	4.802	4.835	4.571
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	818	742	740	785
Service Time	2.422	2.851	2.875	2.601
HCM Lane V/C Ratio	0.267	0.042	0.166	0.257
HCM Control Delay	9	8.1	8.8	9.2
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1.1	0.1	0.6	1

HCM 6th TWSC
3: Grand Ave & Locust Ave 03/11/2024

Intersection	
Int Delay, s/veh	2.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	12	44	131	26	39	173
Future Vol, veh/h	12	44	131	26	39	173
Conflicting Peds, #/hr	19	11	0	19	11	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	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	14	51	152	30	45	201

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	496	197	0	0	201	0
Stage 1	186	-	-	-	-	-
Stage 2	310	-	-	-	-	-
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	533	844	-	-	1371	-
Stage 1	846	-	-	-	-	-
Stage 2	744	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	495	820	-	-	1346	-
Mov Cap-2 Maneuver	495	-	-	-	-	-
Stage 1	831	-	-	-	-	-
Stage 2	703	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.5	0	1.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	- 719	1346	-
HCM Lane V/C Ratio	-	- 0.091	0.034	-
HCM Control Delay (s)	-	- 10.5	7.8	0
HCM Lane LOS	-	- B	A	A
HCM 95th %tile Q(veh)	-	- 0.3	0.1	-

HCM 6th AWSC
1: Grand Ave & Mission Ave 03/11/2024

Intersection	
Intersection Delay, s/veh	17.3
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	40	184	58	14	190	58	129	140	16	34	204	50
Future Vol, veh/h	40	184	58	14	190	58	129	140	16	34	204	50
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	43	196	62	15	202	62	137	149	17	36	217	53
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	17.3	16.4	18	17.5
HCM LOS	C	C	C	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	45%	14%	5%	12%
Vol Thru, %	49%	65%	73%	71%
Vol Right, %	6%	21%	22%	17%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	285	282	262	288
LT Vol	129	40	14	34
Through Vol	140	184	190	204
RT Vol	16	58	58	50
Lane Flow Rate	303	300	279	306
Geometry Grp	1	1	1	1
Degree of Util (X)	0.56	0.545	0.509	0.554
Departure Headway (Hd)	6.646	6.545	6.573	6.515
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	540	549	544	551
Service Time	4.731	4.629	4.66	4.599
HCM Lane V/C Ratio	0.561	0.546	0.513	0.555
HCM Control Delay	18	17.3	16.4	17.5
HCM Lane LOS	C	C	C	C
HCM 95th-tile Q	3.4	3.3	2.9	3.4

HCM 6th AWSC
2: Grand Ave & Jewell St

03/11/2024

Intersection	
Intersection Delay, s/veh	9.9
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	7	9	65	6	14	6	217	71	13	156	3
Future Vol, veh/h	4	7	9	65	6	14	6	217	71	13	156	3
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	8	11	76	7	16	7	255	84	15	184	4
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.3	9.2	10.5	9.3
HCM LOS	A	A	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	2%	20%	76%	8%
Vol Thru, %	74%	35%	7%	91%
Vol Right, %	24%	45%	16%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	294	20	85	172
LT Vol	6	4	65	13
Through Vol	217	7	6	156
RT Vol	71	9	14	3
Lane Flow Rate	346	24	100	202
Geometry Grp	1	1	1	1
Degree of Util (X)	0.418	0.033	0.145	0.26
Departure Headway (Hd)	4.346	5.071	5.23	4.629
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	827	702	683	775
Service Time	2.376	3.134	3.284	2.667
HCM Lane V/C Ratio	0.418	0.034	0.146	0.261
HCM Control Delay	10.5	8.3	9.2	9.3
HCM Lane LOS	B	A	A	A
HCM 95th-tile Q	2.1	0.1	0.5	1

HCM 6th TWSC
3: Grand Ave & Locust Ave

03/11/2024

Intersection	
Int Delay, s/veh	2.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	15	49	213	22	38	98
Future Vol, veh/h	15	49	213	22	38	98
Conflicting Peds, #/hr	30	17	0	30	17	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	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	18	58	251	26	45	115

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	529	311	0	0	307	0
Stage 1	294	-	-	-	-	-
Stage 2	235	-	-	-	-	-
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	510	729	-	-	1254	-
Stage 1	756	-	-	-	-	-
Stage 2	804	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	462	697	-	-	1218	-
Mov Cap-2 Maneuver	462	-	-	-	-	-
Stage 1	734	-	-	-	-	-
Stage 2	751	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.6	0	2.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	623	1218	-
HCM Lane V/C Ratio	-	-	0.121	0.037	-
HCM Control Delay (s)	-	-	11.6	8.1	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0.1	-

Intersection	
Intersection Delay, s/veh	12.9
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	46	141	43	7	153	28	97	135	10	24	174	34
Future Vol, veh/h	46	141	43	7	153	28	97	135	10	24	174	34
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	52	158	48	8	172	31	109	152	11	27	196	38
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	13	12.1	13.5	12.9
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	40%	20%	4%	10%
Vol Thru, %	56%	61%	81%	75%
Vol Right, %	4%	19%	15%	15%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	242	230	188	232
LT Vol	97	46	7	24
Through Vol	135	141	153	174
RT Vol	10	43	28	34
Lane Flow Rate	272	258	211	261
Geometry Grp	1	1	1	1
Degree of Util (X)	0.442	0.417	0.346	0.417
Departure Headway (Hd)	5.848	5.811	5.894	5.755
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	612	615	604	620
Service Time	3.931	3.896	3.985	3.838
HCM Lane V/C Ratio	0.444	0.42	0.349	0.421
HCM Control Delay	13.5	13	12.1	12.9
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	2.3	2.1	1.5	2.1

Intersection	
Intersection Delay, s/veh	9.3
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	11	14	67	14	39	2	159	54	35	162	4
Future Vol, veh/h	5	11	14	67	14	39	2	159	54	35	162	4
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	12	15	74	15	43	2	175	59	38	178	4
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.2	9.1	9.3	9.5
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	1%	17%	56%	17%
Vol Thru, %	74%	37%	12%	81%
Vol Right, %	25%	47%	33%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	215	30	120	201
LT Vol	2	5	67	35
Through Vol	159	11	14	162
RT Vol	54	14	39	4
Lane Flow Rate	236	33	132	221
Geometry Grp	1	1	1	1
Degree of Util (X)	0.292	0.045	0.18	0.284
Departure Headway (Hd)	4.448	4.907	4.926	4.628
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	806	725	725	775
Service Time	2.486	2.966	2.974	2.667
HCM Lane V/C Ratio	0.293	0.046	0.182	0.285
HCM Control Delay	9.3	8.2	9.1	9.5
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1.2	0.1	0.7	1.2

HCM 6th TWSC
3: Grand Ave & Locust Ave

03/11/2024

Intersection	
Int Delay, s/veh	2.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	13	47	143	28	42	189
Future Vol, veh/h	13	47	143	28	42	189
Conflicting Peds, #/hr	19	11	0	19	11	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	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	15	55	166	33	49	220

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	539	213	0	0	218	0
Stage 1	202	-	-	-	-	-
Stage 2	337	-	-	-	-	-
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	503	827	-	-	1352	-
Stage 1	832	-	-	-	-	-
Stage 2	723	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	465	804	-	-	1328	-
Mov Cap-2 Maneuver	465	-	-	-	-	-
Stage 1	817	-	-	-	-	-
Stage 2	680	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.8	0	1.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	- 694	1328	-
HCM Lane V/C Ratio	-	- 0.101	0.037	-
HCM Control Delay (s)	-	- 10.8	7.8	0
HCM Lane LOS	-	- B	A	A
HCM 95th %tile Q(veh)	-	- 0.3	0.1	-

HCM 6th AWSC
1: Grand Ave & Mission Ave

03/11/2024

Intersection	
Intersection Delay, s/veh	18.3
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	41	189	59	14	195	59	132	143	16	35	209	51
Future Vol, veh/h	41	189	59	14	195	59	132	143	16	35	209	51
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	44	201	63	15	207	63	140	152	17	37	222	54
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	18.3	17.2	19	18.5
HCM LOS	C	C	C	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	45%	14%	5%	12%
Vol Thru, %	49%	65%	73%	71%
Vol Right, %	5%	20%	22%	17%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	291	289	268	295
LT Vol	132	41	14	35
Through Vol	143	189	195	209
RT Vol	16	59	59	51
Lane Flow Rate	310	307	285	314
Geometry Grp	1	1	1	1
Degree of Util (X)	0.582	0.569	0.53	0.578
Departure Headway (Hd)	6.768	6.663	6.697	6.633
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	529	538	533	540
Service Time	4.865	4.76	4.796	4.731
HCM Lane V/C Ratio	0.586	0.571	0.535	0.581
HCM Control Delay	19	18.3	17.2	18.5
HCM Lane LOS	C	C	C	C
HCM 95th-tile Q	3.7	3.5	3.1	3.6

HCM 6th AWSC
2: Grand Ave & Jewell St

03/11/2024

Intersection	
Intersection Delay, s/veh	10.3
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	7	10	69	6	15	6	232	75	14	166	3
Future Vol, veh/h	4	7	10	69	6	15	6	232	75	14	166	3
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	8	12	81	7	18	7	273	88	16	195	4
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.4	9.4	11	9.6
HCM LOS	A	A	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	2%	19%	77%	8%
Vol Thru, %	74%	33%	7%	91%
Vol Right, %	24%	48%	17%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	313	21	90	183
LT Vol	6	4	69	14
Through Vol	232	7	6	166
RT Vol	75	10	15	3
Lane Flow Rate	368	25	106	215
Geometry Grp	1	1	1	1
Degree of Util (X)	0.449	0.035	0.156	0.28
Departure Headway (Hd)	4.386	5.148	5.311	4.681
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	821	690	671	764
Service Time	2.422	3.224	3.375	2.724
HCM Lane V/C Ratio	0.448	0.036	0.158	0.281
HCM Control Delay	11	8.4	9.4	9.6
HCM Lane LOS	B	A	A	A
HCM 95th-tile Q	2.3	0.1	0.6	1.1

HCM 6th TWSC
3: Grand Ave & Locust Ave

03/11/2024

Intersection	
Int Delay, s/veh	2.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	16	52	228	24	40	105
Future Vol, veh/h	16	52	228	24	40	105
Conflicting Peds, #/hr	30	17	0	30	17	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	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	19	61	268	28	47	124

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	560	329	0	0	326	0
Stage 1	312	-	-	-	-	-
Stage 2	248	-	-	-	-	-
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	489	712	-	-	1234	-
Stage 1	742	-	-	-	-	-
Stage 2	793	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	442	680	-	-	1199	-
Mov Cap-2 Maneuver	442	-	-	-	-	-
Stage 1	720	-	-	-	-	-
Stage 2	738	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.9	0	2.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	604	1199	-
HCM Lane V/C Ratio	-	-	0.132	0.039	-
HCM Control Delay (s)	-	-	11.9	8.1	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.5	0.1	-