



Transportation Impact Study for the Tesla Service Center Project



Prepared for the City of Santa Rosa

Submitted by
W-Trans

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Executive Summary

As proposed, the project would include the repurposing of an existing 30,496 square foot building located at 3286 Airway Drive in the City of Santa Rosa from a furniture store to a Tesla Service Center. The site would be accessible via three existing driveways, including one off Airway Drive and two off Airway Court. Additionally, the proposed project includes the construction of a parking lot for storing vehicles awaiting sale at 3304 Industrial Drive, west of the project site. Based on application of standard trip generation rates, the project would be expected to generate an average of 61 net-new trips during the morning peak hour and 79 during the evening peak hour.

The study area included the intersections of Industrial Drive/Airway Drive, Airway Court/Airway Drive, Piner Road/Airway Drive, Piner Road/Range Avenue, and Bicentennial Way/Range Avenue. Three of these intersections experienced collisions at rates greater than the statewide averages for similar facilities. The City may wish to enhance enforcement in this part of the City or conduct a DUI outreach campaign in an attempt to reduce the number of crashes at the Piner Road/Range Avenue and Bicentennial Way/Range Avenue intersections.

A review of existing facilities for pedestrians, bicyclists and transit users indicates that the project site is adequately served by existing bicycle and transit infrastructure. To improve pedestrian facilities and connectivity to the surrounding sidewalk network, a sidewalk should be installed adjacent to the project frontage on Airway Court. It is also recommended that five long-term bicycle storage spaces be provided on-site to satisfy the City's Code requirements for bicycle storage.

The project is expected to have a less-than-significant impact on VMT as it is located in an area identified by the City of Santa Rosa that is generating at least 15 percent below the countywide average.

Sight distances along Airway Court are adequate for entering and exiting movements from the site. To provide adequate sight distance along Airway Drive, 40 feet of curb should be painted red to prohibit parking and the vegetation south of the project driveway should be maintained such that trees and hanging branches are trimmed to a minimum height of seven feet.

The existing stacking space in turn pockets at the study intersections is adequate to accommodate the queues anticipated for all scenarios evaluated. Turn lanes are not warranted at any of the project access points.

The project would have a less-than-significant impact on emergency response times. Site access and on-site circulation would adequately accommodate emergency response vehicles.

Under Existing and Baseline (Existing plus Approved Projects) conditions, all study intersections operate or are expected to operate at an acceptable Level of Service (LOS) of C or better during both the a.m. and p.m. peak hours. With the addition of project-related traffic, the study intersections are expected to continue operating acceptably, generally at the same service levels as without project traffic.

The proposed parking supply of 96 on-site parking spaces would satisfy the City's Code requirements for parking. The project would also include 127 off-site parking spaces at 3304 Industrial Drive, approximately 600 feet west of the project site, for use holding vehicles prior to sale.

Introduction

This report presents an analysis of the potential traffic impacts and adverse operational effects that would be associated with repurposing of an existing 30,496 square foot building from a furniture store to a Tesla Service Center. The project site is located at 3286 Airway Drive in the City of Santa Rosa. The traffic study was completed in accordance with the criteria established by the City 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. 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'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 following policies set forth by the City in Section 5.8, Transportation Goals & Policy, of the *City of Santa Rosa General Plan*, were used to assess the project.

T-D-2 Monitor level of service at intersections to assure that improvements or alterations to improve corridor level of service do not cause severe impacts at any single intersection.

General interpretation of Policy T-D-2. The impact to an intersection is considered adverse if the project related and/or future trips result in:

1. The level of service (LOS) at an intersection degrading from LOS D or better to LOS E or F, OR
2. An increase in average vehicle delay of greater than 5 seconds at a signalized intersection where the current LOS is either LOS E or F.
3. Queuing impacts based on a comparative analysis between the design queue length and the available queue storage capacity. Impacts include, but are not limited to, spillback queues at project access locations (both ingress and egress), turn lanes at intersections, lane drops, spill back that impacts upstream intersections or interchange ramps.
4. Exceptions may be granted under the following conditions:
 - a. Within downtown,
 - b. Where attainment would result in significant degradation,
 - c. Where topography or impacts makes the improvement impossible; or
 - d. Where attainment would ensure loss of an area's unique character.

T-H-3 Require new development to provide transit improvements, where a rough proportionality to demand from the project is established. Transit improvements may include:

- *Direct and paved pedestrian access to transit stops*
- *Bus turnouts and shelters*
- *Lane width to accommodate buses.*

General interpretation of Policy T-H-3. An impact is considered adverse if the project has the potential to disrupt existing transit operations or establishes transit facilities and equipment such that it creates a sight distance deficiency or vehicle conflict point.

T-J Provide attractive and safe streets for pedestrian and bicyclists.

General interpretation of Policy T-J. An impact is considered adverse if the project generates 20 pedestrians in any single hour at an unsignalized intersection, mid-block crossing or where no crossing has been established.

An impact is further considered significant if the project interrupts existing or proposed pedestrian, bicycle and transit facilities, path or travel, direct access resulting in excessive rerouting or creates a vehicle conflict condition which affects the safety of other roadway users.

Project Profile

The proposed project, to be located at 3286 Airway Drive, includes the conversion of space previously used to house a furniture store to instead be a Tesla auto sales and service center. The showroom gallery would have two vehicles with energy products on display. A fleet of up to six vehicles available for test drives would be located onsite. New vehicles would be held at an offsite parking lot at 3304 Industrial Drive, approximately 600 feet west of the project site. Standard service-work is anticipated to be performed on-site in one of the 16 repair bays or the dedicated wash bay. The location of the project site is shown in Figure 1.



Transportation Impact Study for the Tesla Service Center 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 generators. 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. Industrial Drive/Airway Drive
2. Airway Court/Airway Drive
3. Piner Road/Airway Drive
4. Piner Road/Range Avenue
5. Bicentennial Way/Range 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 Wednesday, February 15, 2023, while local schools were in session.

Study Intersections

Industrial Drive/Airway Drive is a four-legged intersection with stop controls on all approaches.

Airway Court/Airway Drive is a tee intersection with stop controls on the terminating Airway Court approach. Airway Drive flows freely at the intersection.

Piner Road/Airway Drive is a four-legged signalized intersection with Airway Drive terminating at the intersection. A driveway to a commercial shopping center makes up the south leg of the intersection. The northbound driveway approach and southbound Airway Drive approach have split phasing. Protected left-turn phasing exists for the eastbound and westbound approaches.

Piner Road/Range Avenue is a signalized tee intersection with Range Avenue terminating at the intersection. The westbound Piner Road approach has protected left-turn phasing.

Bicentennial Way/Range Avenue is a signalized tee intersection with Bicentennial Way terminating at the intersection. The southbound Range Avenue approach has protected left-turn phasing.

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

Study Roadways

Airway Drive is a two-lane road that runs north-south with a posted speed limit of 35 miles per hour (mph), from Piner Road and terminating approximately 900 feet north of Hopper Avenue. Airway Drive borders the project site to the west and is defined as a Regional/Arterial Street by the City's General Plan.

Airway Court is a two-lane local road that runs east-west along the northern project frontage 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 September 1, 2016, through August 31, 2021.

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 *2016 Collision Data on California State Highways*, California Department of Transportation (Caltrans). These average rates statewide are for intersections in the same urban environment, with the same number of approaches (three or four), and the same controls (all-way stop, two-way stop, or traffic signal). The collision rate calculations are provided in Appendix A. While two of the study intersections had collisions rates equal to or less than the statewide averages, three exceeded the average so further review was performed.

Table 1 – Collision Rates for the Study Intersections

Study Intersection	Number of Collisions (2017-2021)	Calculated Collision Rate (c/mve)	Statewide Average Collision Rate (c/mve)
1. Industrial Dr/Airway Dr	3	0.17	0.17
2. Airway Ct/Airway Dr	0	0.00	0.09
3. Piner Rd/Airway Dr	11	0.25	0.24
4. Piner Rd/Range Ave	15	0.34	0.20
5. Bicentennial Wy/Range Ave	10	0.21	0.20

Note: c/mve = collisions per million vehicles entering; **bold** text = rate is higher than statewide average

Of the 11 crashes at Piner Road/Airway Drive, four each were broadside and hit object types, two were sideswipes, and one was a rear-end. No clear trends could be identified, and the collision rate is only marginally above the statewide average, so no remedial action is suggested.

At Piner Road/Range Avenue, six collisions were hit object, four were rear-end, two each were broadside and vehicle-pedestrian collisions, and one was a sideswipe collision. Three of the hit object collisions were due to driving under the influence and two were due to improper turning. All four rear-end collisions were due to unsafe speeds. As the injury rate of 40.0 percent at this location was lower than the statewide average of 46.8 percent, the above-average collision rate does not appear to translate to a safety concern, so no remedial action is suggested.

Four out of the ten collisions at Bicentennial Way/Range Avenue were hit object and rear-end collisions and the remaining two were head-on and vehicle-pedestrian collisions. Three out of four hit object collisions were due to driving under the influence and three out of four rear-end collisions were due to unsafe speeds. While the collision rate was only marginally above the average, 60.0 percent of crashes resulted in injuries compared to 46.8 percent for similar intersections statewide, indicating a potential safety concern.

For both Piner Road/Range Avenue and Bicentennial Way/Range Avenue unsafe speeds and driving under the influence were contributing factors for the rear-end and hit object collisions. The City may wish to enhance enforcement in this part of the City or conduct a DUI outreach campaign in an attempt to reduce the number of crashes.

Project Data

The project consists of the re-use of an existing building that previously housed a furniture store to accommodate a Tesla Service Center. The proposed project site plan is shown in Figure 2.

Trip Generation

The anticipated trip generations for most recent site use as well as the proposed project were estimated using standard rates published by the Institute of Transportation Engineers (ITE) in *Trip Generation Manual*, 11th Edition, 2021, for Furniture Store (LU #890), and Automobile Care Center (LU #942) as the descriptions for these land uses most closely match the prior use and proposed project. Based on application of these rates, the proposed project is expected to generate an average of 69 a.m. peak hour trips and 95 trips during the p.m. peak hour. Compared to the furniture store that previously occupied the space, this is an increase of 61 a.m. peak hour trips and 79 p.m. peak hour trips. 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
Prior Use											
Furniture Store	30.496 ksf	6.32	192	0.26	8	6	2	0.52	16	7	9
Proposed											
Auto Service Center	30.496 ksf	n/a	n/a	2.25	69	45	24	3.11	95	46	49
Total				61	39	22		79	39	40	

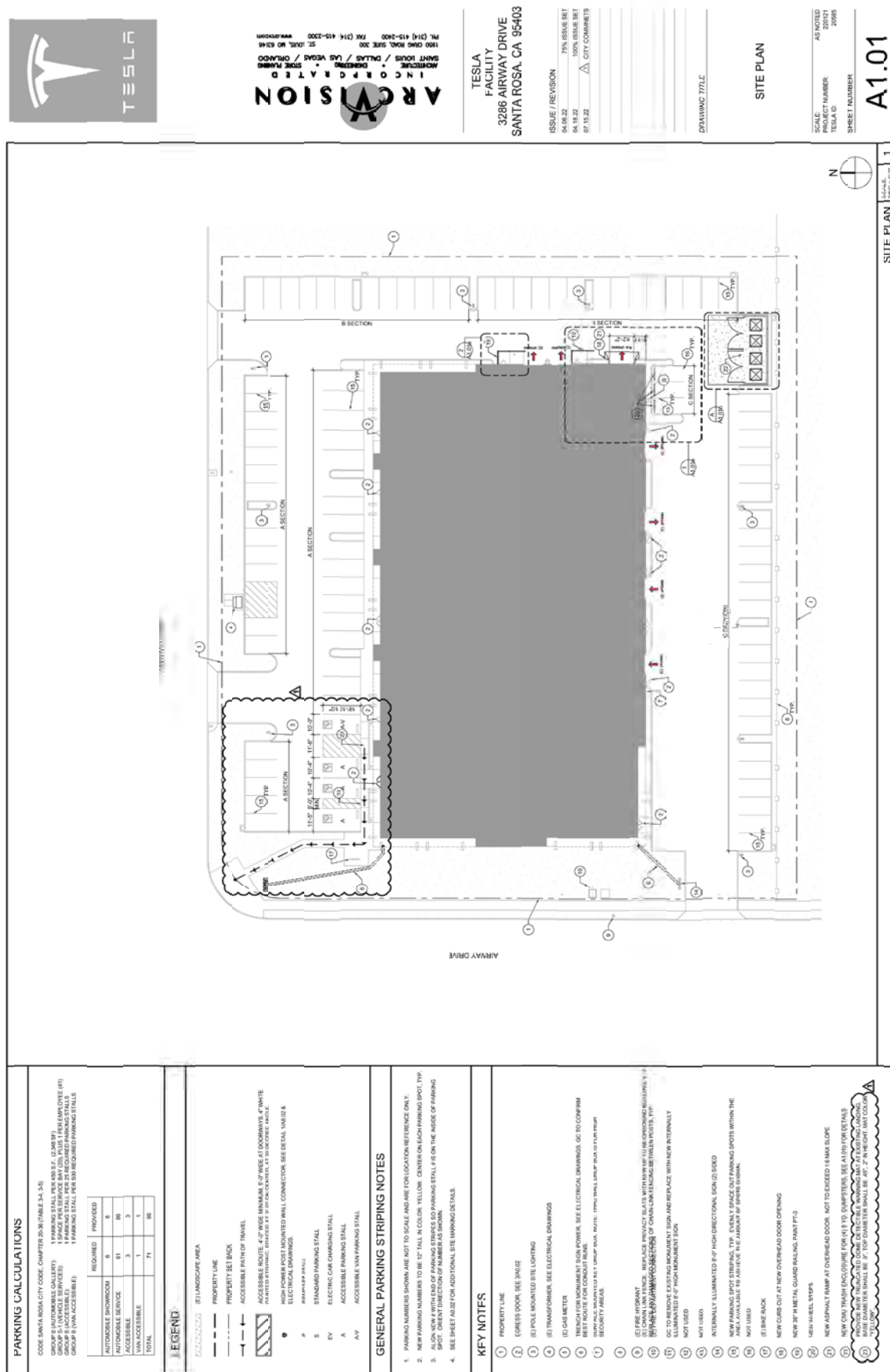
Note: ksf = 1,000 square feet

Trip Distribution

The pattern used to allocate new project trips to the street network was determined by reviewing existing turning movements at the study intersections as well as knowledge of the local road system. The assumptions shown in Table 3 were applied.

Table 3 – Trip Distribution Assumptions

Route	Percent
US 101 South of Mendocino OC	50%
US 101 North of Hopper Ave	15%
Hopper Ave West of Airway Dr	5%
Piner Rd West of Airway Dr	15%
Mendocino OC East of US 101	15%
TOTAL	100%



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 and Planned Pedestrian Facilities

Pedestrian facilities include sidewalks, crosswalks, pedestrian signal phases, curb ramps, curb extensions, and various streetscape amenities such as lighting, benches, etc. In general, a network of sidewalks, crosswalks, pedestrian signals, and curb ramps provide access for pedestrians in the vicinity of the proposed project site. Sidewalks exist along the major nearby streets, but gaps exist along Airway Court near the proposed project entrance. These existing gaps impact convenient and continuous access for pedestrians and present safety concerns in those locations where appropriate pedestrian infrastructure would address potential conflict points.

- **Airway Drive** – Sidewalks are provided on both sides of Airway Drive within the vicinity of the proposed project site. Curb ramps and crosswalks at side street approaches are generally provided, though no crosswalk is striped across Airway Court at Airway Drive. Lighting is provided by overhead streetlights located on both sides of the street.
- **Airway Court** – Sidewalks are provided on the north side of Airway Court, terminating approximately 175 feet east of Airway Drive. Sidewalks are not provided along the south side of the street, including along the project frontage.
- **Piner Road** – Continuous sidewalks are provided on both sides of Piner Road with curb ramps and crosswalks provided at side street approaches. There are streetlights along both sides of the street.
- **Hopper Avenue** – Continuous sidewalks are provided on both sides of Hopper Avenue. Curb ramps and crosswalks are provided at side street approaches. Lighting is provided by overhead streetlights.
- **Class I Multi-Use paths** – The Piner Creek Trail and Russel Creek Trail are planned future facilities in the project vicinity according to the *City of Santa Rosa Bicycle and Pedestrian Master Plan, Update 2018*.

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 previously stated. During the five-year study period there were three reported collisions involving pedestrians at the study intersections. Two occurred at Piner Road/Range Avenue and one occurred at Bicentennial Way/Range Avenue. All three collisions were reported as being the fault of the pedestrian. Therefore, no remedial actions are suggested.

Project Impacts on Pedestrian Facilities

Given the proximity of commercial and residential uses near the site as well as the planned use of off-site parking to store vehicles, it is reasonable to assume that some project patrons and employees will want to walk, bicycle, and/or use transit to reach the site. An existing sidewalk connection is provided from the northwest corner of the project building to the existing sidewalk at the southeast corner of Airway Court/ Airway Drive.

Project Site – Sidewalks exist along the surrounding streets but not along the project frontage on Airway Court.

Finding – Pedestrian facilities serving the project site are inadequate as a gap would remain along the project’s Airway Court frontage.

Recommendation – Sidewalk should be installed along the project site’s Airway Court frontage to provide a full and connected network.

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.

In the project area, Class II bike lanes exist on Piner Road, Range Avenue, and Bicentennial Way and extensions are proposed along Piner Road and Range Avenue. Bicyclists ride in the roadway and/or on sidewalks 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 *City of Santa Rosa Bicycle & Pedestrian Master Plan*, 2019.

Table 4 – Bicycle Facility Summary

Status Facility	Class	Length (miles)	Begin Point	End Point
Existing				
Piner Rd	II	2.10	Fulton Rd	Range Rd
Range Ave	II	0.69	Russell Ave	Guerneville Rd
Bicentennial Wy	II	0.50	Range Ave	Mendocino Ave
Hopper Ave	II	0.63	Coffey Ln	US-101 SB Ramps
Planned				
Piner Creek Trail	I	1.56	Marlow Rd	Hopper Rd
Russel Creek Trail	I	0.64	Piner Creek Trail	Range Ave
Piner Rd	II	0.09	Range Ave	Cleveland Ave
Range Ave	II	0.20	Piner Rd	Russell Ave

Source: *City of Santa Rosa Bicycle & Pedestrian Master Plan*, City of Santa Rosa, 2018

Bicyclist Safety

Collision records for the study area were reviewed to determine if there have been any bicyclist-involved crashes. During the five-year study period previously stated, there was one reported collision involving a bicyclist at Piner Road/Airway Drive. This collision was due to driving at unsafe speeds. Since there was only one crash involving a bicyclist and there are bike lanes on Piner Road, no remedial action is suggested.

Finding – Existing bicycle facilities, together with shared use of minor streets provide adequate access for bicyclists.

Bicycle Storage

Based on Section 20-36.040 of Santa Rosa’s Municipal Code, a minimum of one bicycle space for every 9,000 square feet of covered building area is required for Auto and Vehicle Sales and Rental land uses, and one bicycle space is required per every 10 full time employees for Vehicle Services – Minor and Major Repair/Body Work. Therefore, six total bicycle storage spaces would be required, one for the 2,348 square foot building used for Auto and Vehicle Sales and Rental and five for the 41 anticipated number of employees for Vehicle Services. Section 20-36.090 of the Code states “when part or all of the bicycle parking spaces required for a nonresidential land use is based on the number of employees, that portion shall be provided in long-term bicycle parking facilities.” Therefore, the five bicycle spaces that are required for Vehicle Services must be long-term spaces.

The proposed project makes use of an existing bicycle rack at the northwest corner of the site. The bicycle rack provides space for six bicycles in an outdoor area adjacent to the building. This bicycle rack would satisfy the requirements for short-term bicycle parking on-site. However, no long-term bicycle parking is provided for employees. According to Section 20-36.090 of the City’s Municipal Code, long-term bicycle parking facilities would protect the entire bicycle from vandalism, theft and weather and could be in the form of bicycle lockers or restricted-access bicycle enclosures. It is recommended that at least five long-term bicycle storage spaces be provided at the site.

Finding – A minimum of five long-term bicycle parking spaces and one short-term space must be provided on-site. The existing bicycle rack would satisfy the short-term bicycle parking requirement.

Recommendation – To satisfy the Santa Rosa Municipal Code, it is recommended that five long-term bicycle storage spaces be provided on-site.

Transit Facilities

Existing Transit Facilities

The Santa Rosa CityBus provides fixed route bus service in Santa Rosa. CityBus Route 10 provides loop service to destinations throughout the City and stops on Piner Road and Airway Drive, approximately 0.2 miles from the project site.

The Golden Gate Bridge Highway & Transportation District provide a regional and commute bus route to San Francisco as well as a local route in Santa Rosa. These routes stop near Piner Road and Industrial Drive, approximately 0.3 miles from the project site.

Existing transit routes and their operation are summarized in Table 5.

Table 5 – Transit Routes

Transit Agency Route	Distance to Stop (mi) ¹	Service			Connection
		Days of Operation	Time	Frequency	
Santa Rosa CityBus					
Route #10	0.2	Mon – Fri	7:10 a.m. – 8:10 p.m.	1 hour	Piner/Industrial to Coddington Mall & Santa Rosa Plaza/ Downtown
		Sat	8:16 a.m. – 5:16 p.m.	1 hour	
		Sun	10:16 a.m. – 4:16 p.m.	1 hour	
Golden Gate Transit					
Route #101	0.3	Mon – Fri	3:52 a.m. – 9:56 p.m.	1 hour	Santa Rosa to San Francisco
		Sat – Sun	3:47 a.m. – 9:53 p.m.		
Route #172	0.3	Mon – Fri	4:12 a.m. – 7:12 p.m.	20 min – 1 hour	Santa Rosa to San Francisco

Note: ¹ Defined as the shortest walking distance between the project site and the nearest bus stop

Source: www.srcity.org, www.goldengate.org

Bicycles can be carried on all Santa Rosa CityBus routes. Bike rack space is on a first-come, first-served basis with a limit of two bicycles per bus at any time. Bicyclists must be able to load and unload their own bicycle and use the racks at their own risk. Additional bicycles are allowed inside if there is room in the wheelchair area.

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. The City of Santa Rosa Paratransit is designed to serve the needs of individuals with disabilities within Santa Rosa. This service is provided within three-quarters of a mile from existing CityBus routes.

Impact on Transit Facilities

Transit demand would be spread out across several routes and headways, so the proposed project would be expected to have an imperceptible impact on local transit service. Existing transit routes are adequate to accommodate project-generated transit trips. The CityBus stop and Golden Gate Transit stops are within an acceptable walking distance of the site.

Finding – Transit facilities serving the project site are adequate.

Significance Finding – The proposed project would be expected to have a less-than-significant impact on access for alternative mode users except that pedestrian access is incomplete.

Mitigation – To comply with City policies and plans, a sidewalk should be provided on the project site's Airway Court frontage. This would reduce the impact to less-than-significant.

Vehicle Miles Traveled (VMT)

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

The City of Santa Rosa issued guidelines for vehicle-miles-travelled (VMT) analysis, as outlined in *Vehicle Miles Traveled (VMT) Guidelines Final Draft*, dated June 5, 2020. Many of the VMT significance criteria in these guidelines are consistent with guidance provided by the California Governor's Office of Planning and Research (OPR) in the publication *Transportation Impacts (SB 743) CEQA Guidelines Update and Technical Advisory*, 2018. Under these guidelines a commercial project generating vehicle travel that is 15 percent or more below the existing countywide VMT per employee may be considered to have a less-than-significant impact on VMT. The City's guidance includes a screening map that shows the project site to be within a screened area. It is therefore reasonable to conclude that the project would be presumed to have a less-than-significant VMT impact.

Significance Finding – The proposed project is within an area generating VMT that is at least 15 percent below the countywide average and can therefore be presumed to have a less-than-significant impact.

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 as well as the adequacy of stacking space in dedicated turn lanes at the study intersections to accommodate additional queuing due to adding project-generated trips and need for additional right-of-way controls. 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 site would be accessible via three existing driveways: one on Airway Drive approximately 240 feet south of Airway Court and two on Airway Court approximately 100 feet and 300 feet east of Airway Drive, respectively. Along the project frontage, both Airway Drive and Airway Court have one lane per direction.

Sight Distance

Sight distance along Airway Drive and Airway Court at the project driveways was evaluated based on sight distance criteria contained in the *Highway Design Manual* published by Caltrans. The recommended sight distances for minor street approaches that are a driveway are based on stopping sight distance, with the approach travel speed used as the basis for determining the recommended sight distance. Additionally, the stopping sight distance needed for a following driver to stop if there is a vehicle waiting to turn into a side street or driveway is evaluated based on stopping sight distance criterion and the approach speed on the major street.

Field measurements were obtained at the proposed driveways on Airway Court and Airway Drive. Based on a posted speed limit of 35 mph on Airway Drive, the minimum stopping sight distance needed is 250 feet. According to field measurements, sight distances to and from the project driveway on Airway Drive exceed 300 feet for southbound approaches and 150 feet for northbound approaches. Sight lines south of the project driveway are blocked by trees and parked vehicles south of the project site. To improve sight distance, parking should be prohibited within 40 feet south of the project driveway via a painted red curb. It is also recommended that the vegetation south of the driveway be trimmed per guidance provided by the Federal Highway Administration in its guide on *Vegetation Control for Safety*, 2007, which recommends that bushes and shrubs be kept under three feet in height, and that trees and hanging branches be trimmed to a minimum height of seven feet.

Based on the *prima facie* speed limit of 25 mph on Airway Court, the minimum sight distance needed is 150 feet. Both project driveways on Airway Court have sight distances over 200 feet in both directions, satisfying the minimum sight distance requirement.

Finding – Stopping sight distances at the project driveways on Airway Court are adequate to meet the applied criteria for entering and exiting movements. Stopping sight distance at the project driveway on Airway Drive is not adequate for northbound approaches due to trees and parked vehicles blocking sight lines.

Recommendation – South of the project driveway on Airway Drive, 40 feet of curb should be painted red to prohibit parking. The vegetation south of the same project driveway should be maintained such that trees and hanging branches are trimmed to a minimum height of seven feet.

Access Analysis

Left-Turn Lane Warrants

The need for a left-turn lane on Airway Drive at Airway Court and at the approaches to the three project driveways was evaluated based on criteria contained in the *Intersection Channelization Design Guide*, National Cooperative

Highway Research Program (NCHRP) Report No. 279, Transportation Research Board, 1985, as well as an update of the methodology developed by the Washington State Department of Transportation and published in the *Method For Prioritizing Intersection Improvements*, January 1997. The NCHRP report references a methodology developed by M. D. Harmelink that includes equations that can be applied to expected or actual traffic volumes to determine the need for a left-turn pocket based on safety issues.

Under Baseline plus Project volumes, which represent worst-case conditions, a left-turn lane is not warranted on Airway Drive at Airway Court or any of the project driveways during either of the peak periods evaluated. Copies of the turn lane warrant spreadsheets are provided in Appendix B.

Queuing

The City prescribes thresholds of significance regarding queue lengths as part of the general interpretation of Policy T-D-2. Queuing impacts are to be evaluated based on a comparative analysis between the design queue length and the available queue storage capacity. Impacts include, but are not limited to, spillback queue at project access locations (both ingress and egress), turn lanes at intersections, lane drops, and spillback that impacts upstream intersections or interchange ramps.

Under each scenario, the projected maximum queues in left-turn pockets at the signalized study intersections were determined using Synchro queueing reports. Summarized in Table 6 are the predicted 95th percentile queue lengths for all dedicated turn lanes at the three signalized intersections. It is noted that only those locations where queuing can extend beyond the available storage capacity were evaluated. Where left-turn pockets transition into two-way left-turn lanes the storage capacity extends substantially beyond the turn pocket, so this condition was not evaluated. Similarly, on eastbound Piner Road approaching Range Avenue the right lane becomes a right-turn lane, so queuing was not checked. Copies of the Synchro queueing reports are contained in Appendix C.

Table 6 – Maximum Left-Turn Queues in Dedicated Turn Lanes

Study Intersection Approach	Pocket Length (feet)	Maximum Queues							
		AM Peak Hour				PM Peak Hour			
		E	E+P	B	B+P	E	E+P	B	B+P
3. Piner Rd/Airway Dr Southbound Right Turn	160	22	24	23	25	53	53	52	54
4. Piner Rd/Range Ave Northbound Right Turn	150	29	29	29	29	12	12	12	12
5. Bicentennial Wy/Range Ave Northbound Right Turn	80	152	152	152	152	74	77	75	77

Notes: E = existing conditions; E+P = existing plus project conditions; B = baseline conditions; B+P = baseline plus project conditions; **Bold** text = queue length exceeds available storage

Turn storage is expected to exceed the existing capacity of 80 feet for northbound right turns at Bicentennial Way/Range Ave during the a.m. peak hour for all scenarios; however, the queues already exceed available storage without project trips so the proposed project would not *cause* the condition. Further, there is no change to the projected queue length, indicating that the project would have no measurable effect on this queue.

Finding – The project does not cause any queues to exceed available storage, so the impact is considered less-than-significant.

Significance Finding – The proposed project would be expected to have a less-than-significant impact as it would not introduce any new hazards.

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.

Adequacy of Site Access

The project site would be accessible via two driveways on Airway Court and one driveway on Airway Drive.

According to the City of Santa Rosa's Municipal Code, Section 20-36.080, the minimum width of driveways is 12 feet for one-way traffic and 20 feet for two-way traffic. The Santa Rosa Fire Prevention Bureau Standards specify minimum roadway turning radii of 20 feet for the inside turn radius and 40 feet for the outside turn radius. Interior drive aisles and parking stalls appear to be in accordance with City design standards. Site access and circulation is therefore expected to function acceptably for emergency response vehicles.

It should also be noted that the project site has three vehicular access points. Therefore, should one access point be compromised during an emergency, responders would be able to access the site using one of the other two access points.

Off-Site Impacts

While the project would be expected to result in slight increases in delay for traffic at the various study intersections as detailed in the Capacity Analysis section of this report, emergency response vehicles can claim the right-of-way by using their lights and sirens; therefore, the project would be expected to have a nominal effect on emergency response times.

Significance Finding – The project would have a less-than-significant impact on emergency response as site access and on-site circulation would be adequate for fire trucks and the project would not be expected to impact emergency response times.

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, 6th Edition. 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 Airway Drive/Airway Court, which has side street stop controls, 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 study intersection at Airway Drive/Industrial Drive has stop signs on all approaches so was 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 remaining study intersections are controlled by a traffic signal and were evaluated using the signalized methodology from the HCM. This methodology is based on factors including traffic volumes, green time for each movement, phasing, whether the signals are coordinated or not, truck traffic, and pedestrian activity. Average stopped delay per vehicle in seconds is used as the basis for evaluation in this LOS methodology. For purposes of this study, delays were calculated using signal timing obtained from the City of Santa Rosa.

The ranges of delay associated with the various levels of service are indicated in Table 7.

Table 7 – Intersection Level of Service Criteria

LOS	Two-Way Stop-Controlled	All-Way Stop-Controlled	Signalized
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.	Delay of 0 to 10 seconds. Most vehicles arrive during the green phase, so do not stop at all.
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.	Delay of 10 to 20 seconds. More vehicles stop than with LOS A, but many drivers still do not have to 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.	Delay of 20 to 35 seconds. The number of vehicles stopping is significant, although many still pass through without stopping.
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.	Delay of 35 to 55 seconds. The influence of congestion is noticeable, and most vehicles have to stop.
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.	Delay of 55 to 80 seconds. Most, if not all, vehicles must stop and drivers consider the delay excessive.
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.	Delay of more than 80 seconds. Vehicles may wait through more than one cycle to clear the intersection.

Reference: *Highway Capacity Manual*, Transportation Research Board, 2016

Traffic Operation Standards

Section 5.8 Transportation Goals & Policy of the City of Santa Rosa General Plan provides the following policies relative to traffic operation.

T-D-1 *Maintain a Level of Service (LOS) D or better along all major corridors. Exceptions to meeting the standard include:*

- *Within downtown;*
- *Where attainment would result in significant degradation;*
- *Where topography or impacts makes the improvement impossible; or*
- *Where attainment would ensure loss of an area's unique character.*

The LOS is to be calculated using the average traffic demand over the highest 60-minute period.

T-D-2 *Monitor level of service at intersections to assure that improvements or alterations to improve corridor level of service do not cause severe impacts at any single intersection.*

General interpretation of Policy T-D-2. The impact to an intersection is considered adverse if the project related and/or future trips result in:

1. The level of service (LOS) at an intersection degrading from LOS D or better to LOS E or F; OR
2. An increase in average vehicle delay of greater than 5 seconds at a signalized intersection where the current LOS is either LOS E or F.
3. Queuing impacts based on a comparative analysis between the design queue length and the available queue storage capacity. Impacts include, but are not limited to, spillback queue at project access locations (both ingress and egress), turn lanes at intersections, lane drops, spill back that impacts upstream intersections or interchange ramps.
4. Exceptions may be granted under the following conditions:
 - a. Within downtown;
 - b. Where attainment would result in significant degradation;
 - c. Where topography or impacts makes the improvement impossible; or
 - d. Where attainment would ensure loss of an area's unique character.

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 on Wednesday, February 15, 2023, while local schools were in session. Under existing volumes, all intersections operate acceptably at LOS C or better. A summary of the intersection Level of Service calculations is contained in Table 8. The existing traffic volumes are shown in Figure 3, and copies of the calculations are provided in Appendix D.

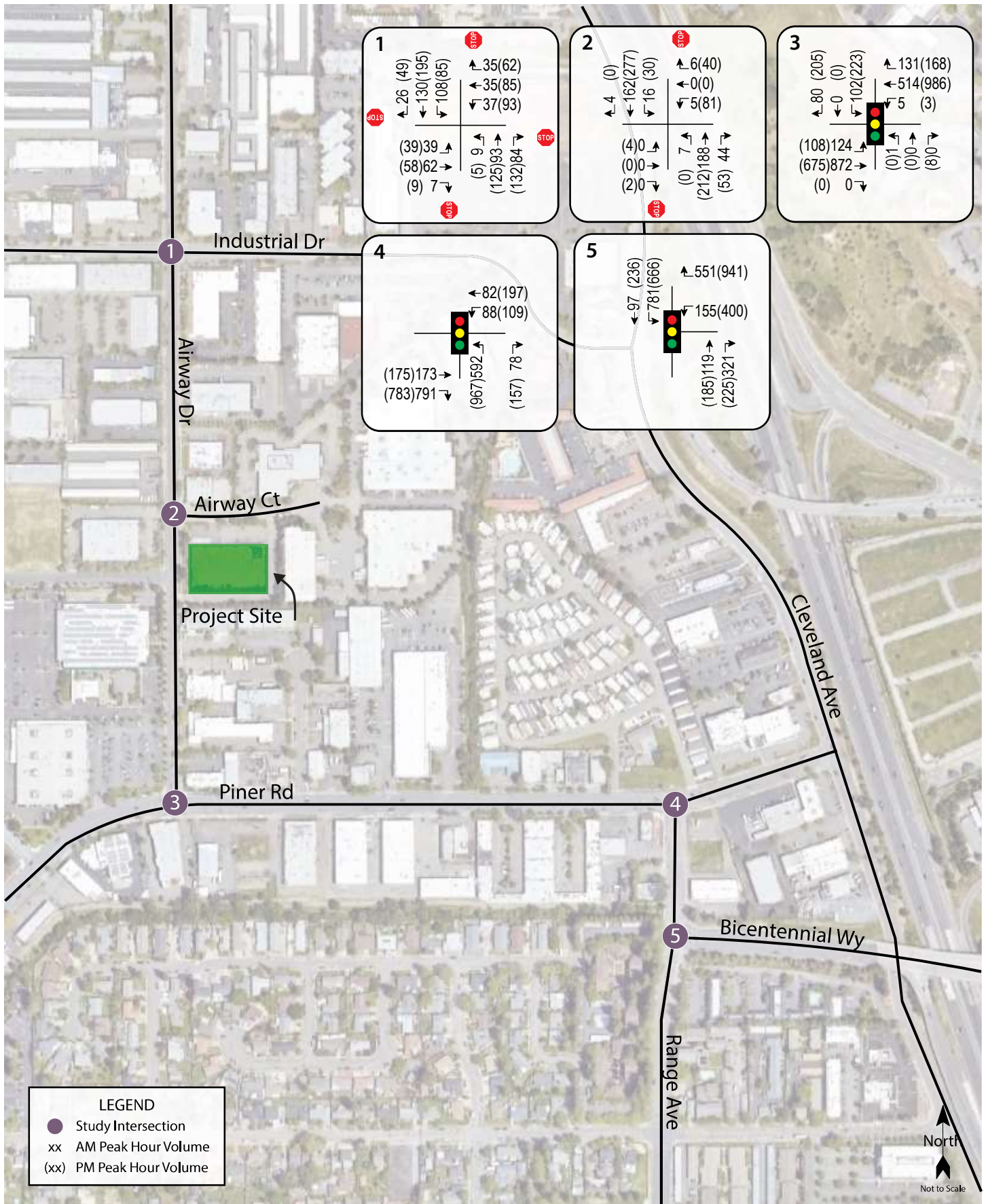
Table 8 – Existing Peak Hour Intersection Levels of Service

Study Intersection <i>Approach</i>	AM Peak		PM Peak	
	Delay	LOS	Delay	LOS
1. Industrial Dr/Airway Dr	9.6	A	12.1	B
2. Airway Ct/Airway Dr	0.7	A	3.0	A
<i>Westbound (Airway Dr) Approach</i>	<i>10.5</i>	<i>B</i>	<i>14.6</i>	<i>B</i>
3. Piner Rd/Airway Dr	7.9	A	11.0	B
4. Piner Rd/Range Ave	21.6	C	23.7	C
5. Bicentennial Wy/Range Ave	12.8	B	13.8	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*

Baseline Conditions

The Baseline Conditions scenario provides an evaluation of traffic operation in the short-term, considering traffic generated from nearby projects that are already approved or pending approval by the City but not yet constructed. Short-term operating conditions were determined with traffic from the following projects in the study area added to existing volumes.



Transportation Impact Study for the Tesla Service Center Project
Figure 3 – Existing Traffic Volumes

- **LMC Santa Rosa** and 3575 Mendocino Avenue are proposed multi-family housing developments that would consist of 260 units of multi-family market-rate dwellings and 162 affordable senior dwelling units. According to the “Addendum to the 3575 Mendocino Avenue Traffic Impact Analysis”, W-Trans, April 26, 2022, these projects would be expected to generate 1,705 daily trips, with 128 of these during the a.m. peak hour and 142 during the p.m. peak hour. After removing the trips generated from the previous land use as shown in the *3575 Mendocino Avenue Traffic Impact Analysis*, W-Trans, September 22, 2020, the project would be expected to generate 1,109 daily trips, with 96 of these during the a.m. peak hour and 100 during the p.m. peak hour. The trip distribution assumptions applied in the traffic study were applied in this analysis.
- **Fountaingrove Inn Multi-Family Rental Housing Project** at 3586 Mendocino Avenue is a proposed multi-family housing project that would consist of 239 multi-family dwelling units. Based on the “Updated Focused Traffic Study for the Fountaingrove Inn Redevelopment Project”, W-Trans, March 8, 2021, it would have the potential to generate 78 trips per day, including 27 during the morning peak hour and 11 during the evening peak hour. The trip distribution assumptions applied from the traffic study were applied in this analysis.
- **3737 Airway Drive** is a 90-unit senior care facility. Based on application of *Trip Generation Manual*, 11th Edition rates for Continuing Care Retirement Community (LU #255), the project would have an expected trip generation of 222 daily trips, with 14 trips during the a.m. peak hour and 17 trips during the p.m. peak hour. The trip distribution assumptions for the Tesla Service Center were applied for this project analysis.
- **Residence Inn by Marriott** is a 114-room hotel to be located at Round Barn Circle in the City of Santa Rosa. According to the *Residence Inn Traffic Impact Study Final Report*, W-Trans, August 9, 2018, it would be expected to generate an average of 931 net new trips per day, including 58 p.m. peak hour trips. The a.m. peak hour trips were not included in the traffic study, so application of rates for Hotel (LU #310) were applied. According to these rates, the project would be expected to generate 52 a.m. peak hour trips. The trip distribution assumptions applied in the traffic study were applied in this analysis.

Under Baseline Conditions that include trips from these four projects, all study intersections would be expected to operate acceptably at LOS C or better. These results are summarized in Table 9, and Baseline volumes are shown in Figure 4.

Table 9 – Baseline Peak Hour Intersection Levels of Service

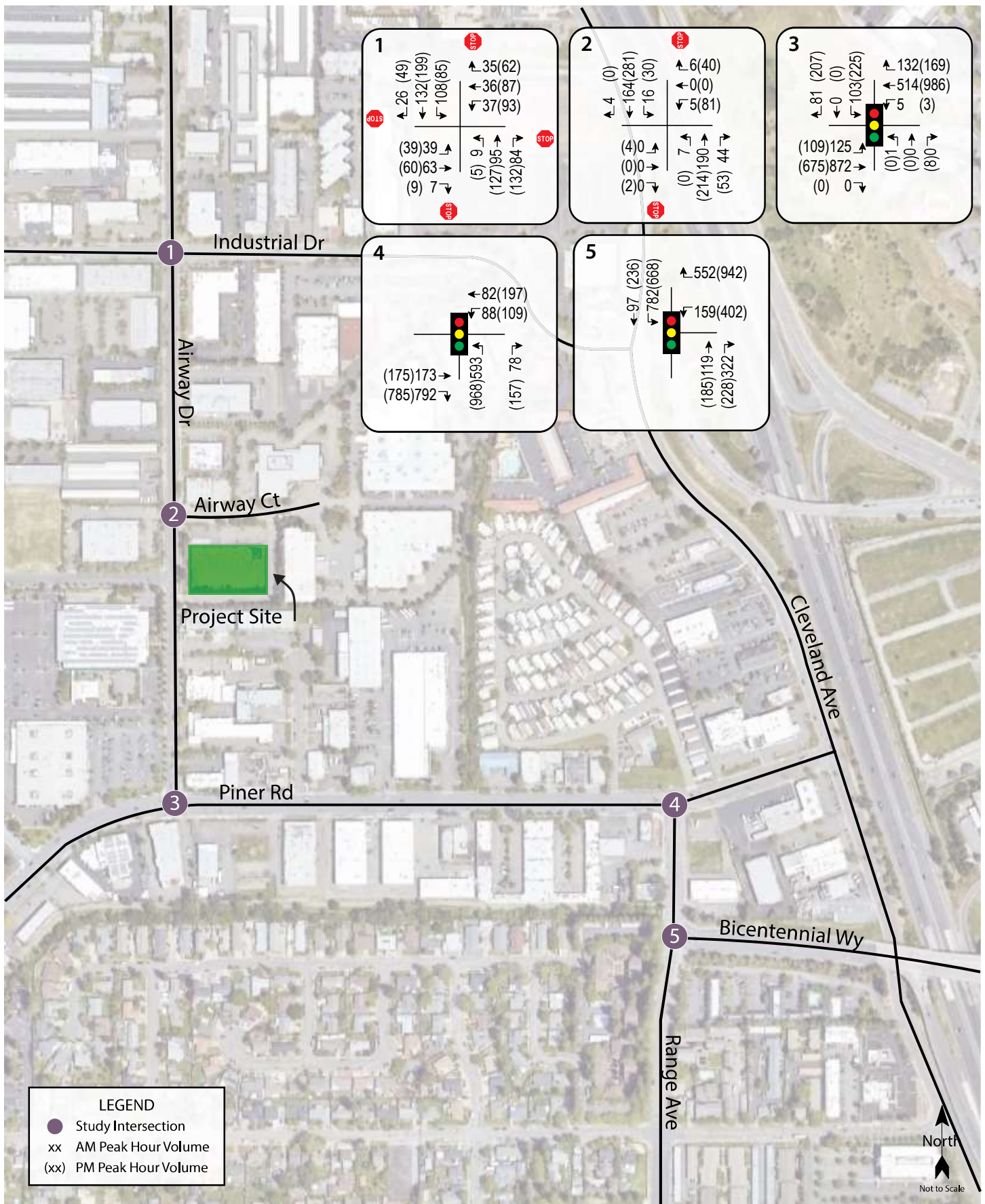
Study Intersection <i>Approach</i>	AM Peak		PM Peak	
	Delay	LOS	Delay	LOS
1. Industrial Dr/Airway Dr	9.7	A	12.2	B
2. Airway Ct/Airway Dr	0.7	A	3.0	A
Westbound (Airway Dr) Approach	10.6	B	14.7	B
3. Piner Rd/Airway Dr	7.9	A	11.1	B
4. Piner Rd/Range Ave	21.6	C	23.7	C
5. Bicentennial Wy/Range Ave	12.8	B	13.9	B

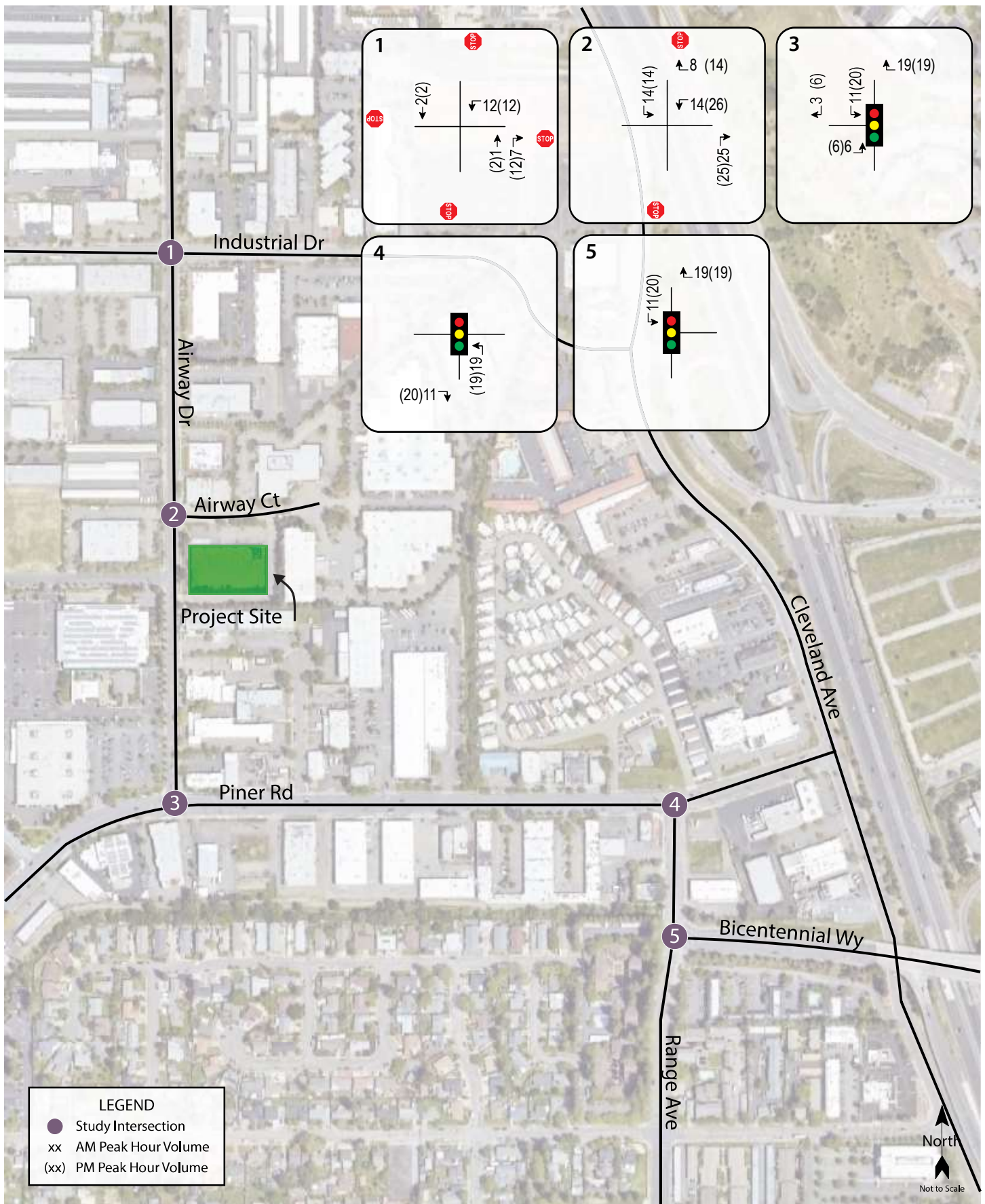
Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*

Project Conditions

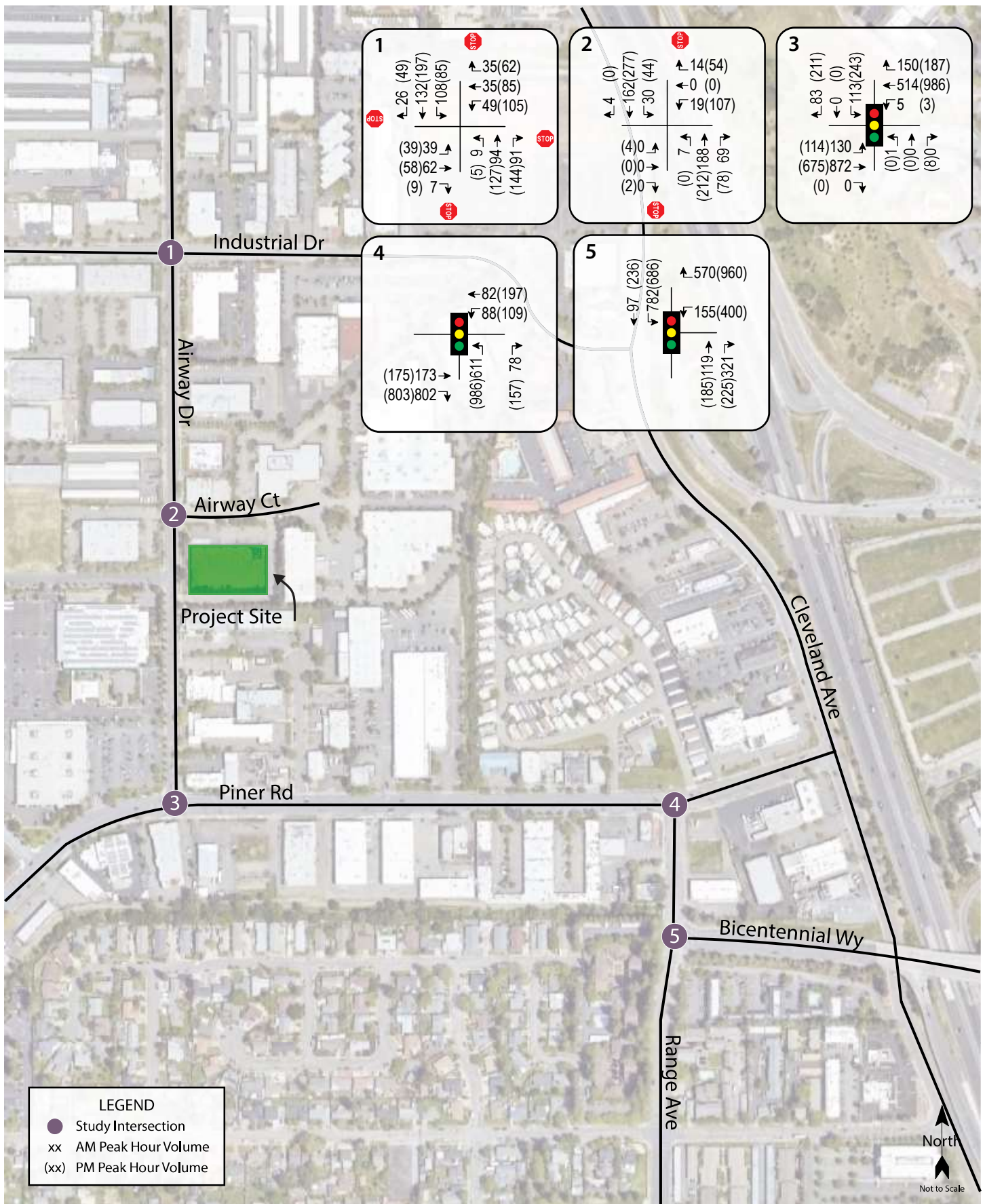
Existing plus Project Conditions

Upon the addition of project-related traffic to the existing volumes, the study intersections are expected to operate acceptably and, with only one exception, at the same Levels of Service as without project trips. Project traffic volumes are shown in Figure 5 and Existing plus Project volumes in Figure 6. These results are summarized in Table 10.





Transportation Impact Study for the Tesla Service Center Project
Figure 5 – Project Traffic Volumes



Transportation Impact Study for the Tesla Service Center Project
Figure 6 – Existing plus Project Traffic Volumes

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

Study Intersection <i>Approach</i>	Existing Conditions				Existing plus Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1. Industrial Dr/Airway Dr	9.6	A	12.1	B	9.8	A	12.5	B
2. Airway Ct/Airway Dr <i>Westbound (Airway Dr) Approach</i>	0.7 <i>10.5</i>	A <i>B</i>	3.0 <i>14.6</i>	A <i>B</i>	1.3 <i>11.4</i>	A <i>B</i>	4.0 <i>16.7</i>	A <i>C</i>
3. Piner Rd/Airway Dr	7.9	A	11.0	B	8.1	A	11.6	B
4. Piner Rd/Range Ave	21.6	C	23.7	C	21.6	C	23.6	C
5. Bicentennial Wy/Range Ave	12.8	B	13.8	B	12.7	B	13.8	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*

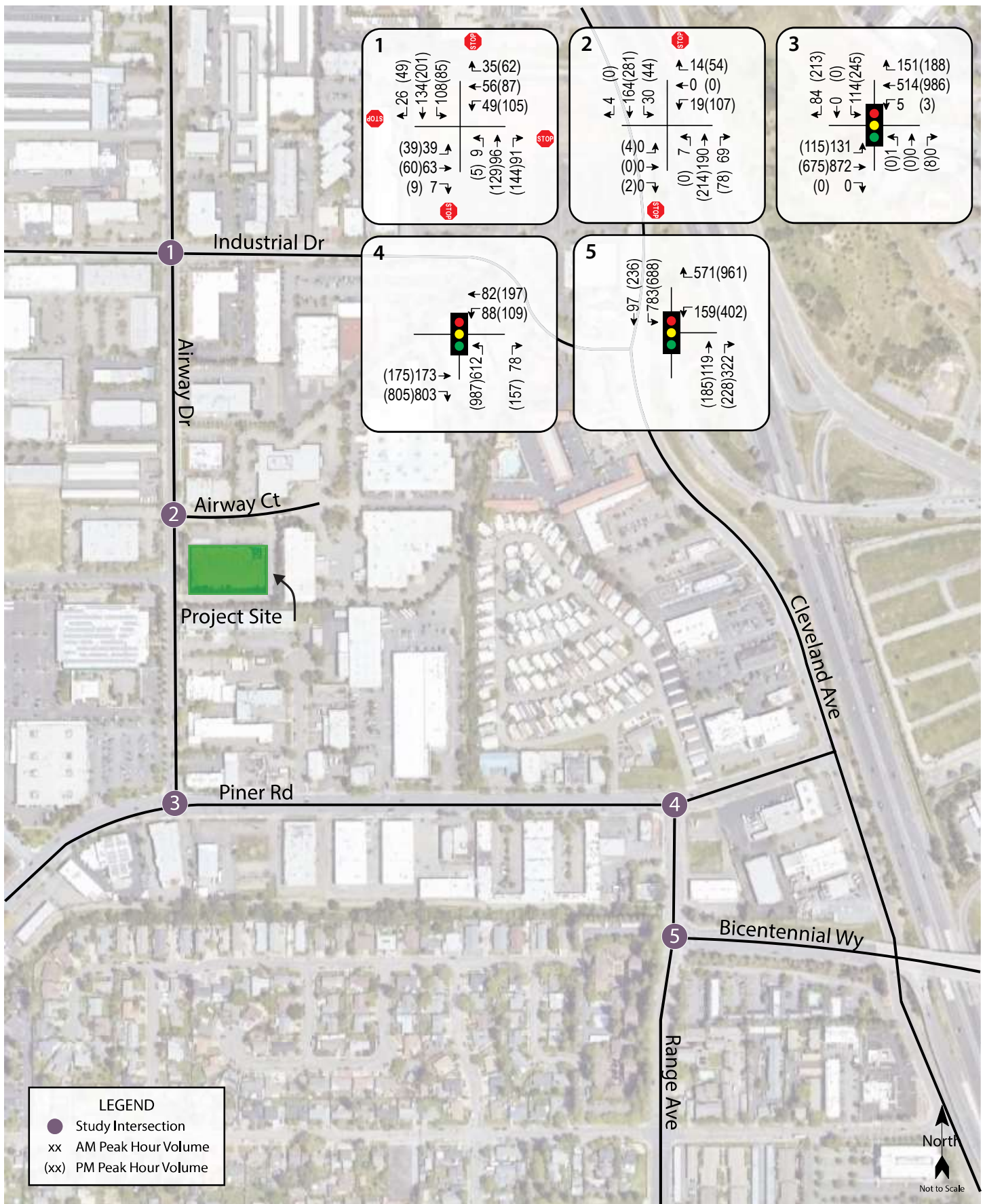
It should be noted that with the addition of project-related traffic volumes, average delay at Piner Road/ Range Avenue decreases during the p.m. peak hour and average delay at Bicentennial Way/Range Avenue decreases during the a.m. peak hour. While this is counter-intuitive, this condition occurs when a project adds trips to movements that are currently underutilized or have delays that are below the intersection average, resulting in a better balance between approaches and lower overall average delay. At Piner Road/ Range Avenue, the project adds traffic predominantly to the eastbound right-turn movements and at Bicentennial Way/Range Avenue, the project adds traffic predominantly to the southbound left-turn and westbound right-turn movements. These movements have average delays lower than the average for the intersections as a whole, which results in a slight reduction in the overall average delays.

The conclusion could incorrectly be drawn that the project actually improves operation based on this data alone; however, it is more appropriate to conclude that the project trips are expected to make use of excess capacity, so drivers will experience little, if any, change in conditions as a result of the project.

Finding – The study intersections are expected to continue operating acceptably at the same overall levels of service upon the addition of project-generated traffic.

Baseline plus Project Conditions

With project-related traffic added to baseline volumes the study intersections are expected to operate acceptably at the same Levels of Service as without the project, with the same one exception. Baseline plus Project volumes are shown in Figure 7, and these results are summarized in Table 11.



Transportation Impact Study for the Tesla Service Center Project
Figure 7 – Baseline plus Project Traffic Volumes

Table 11 – Baseline and Baseline plus Project Peak Hour Intersection Levels of Service

Study Intersection <i>Approach</i>	Baseline Conditions				Baseline plus Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1. Industrial Dr/Airway Dr	9.7	A	12.2	B	9.8	A	12.6	B
2. Airway Ct/Airway Dr <i>Westbound (Airway Dr) Approach</i>	0.7 <i>10.6</i>	A <i>B</i>	3.0 <i>14.7</i>	A <i>B</i>	1.3 <i>11.5</i>	A <i>B</i>	4.0 <i>16.8</i>	A <i>C</i>
3. Piner Rd/Airway Dr	7.9	A	11.1	B	8.1	A	11.7	B
4. Piner Rd/Range Ave	21.6	C	23.7	C	21.6	C	23.6	C
5. Bicentennial Wy/Range Ave	12.8	B	13.9	B	12.8	B	13.8	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*

Similar to the Existing Plus Project scenario and for the same reasons, with the addition of project-related traffic volumes, average delay at the intersections of Piner Road/Range Avenue and Bicentennial Way/Range Avenue decrease during the p.m. peak hour.

Finding – The study intersections are expected to continue operating acceptably at the same overall Levels of Service upon the addition of project-generated traffic.

Parking

The project was analyzed to determine whether the proposed parking supply would be sufficient for the anticipated parking demand. The project site as proposed would provide a total of 96 standard parking spaces.

Section 20-36.040 of the Santa Rosa City Code requires vehicle parking at a rate of one space for every 450 square feet of floor area for auto and vehicle sales and rental uses, which will be applied to the 2,348 square foot automobile gallery. For the remainder of the project, rates for the vehicle services land use are applied, which require one space for each service bay and one space per employee. Additionally, 1 disabled parking space is required for every 25 required parking spaces and a minimum of one must be van accessible.

The site plan shows that out of the 96 spaces proposed, three would be disabled/accessible parking spaces and one would be van accessible. The City of Santa Rosa Municipal Code, Chapter 20-36.060; Parking requirements for the disabled, requires that disabled/accessible parking spaces must be located on the shortest accessible route of travel from adjacent parking to an accessible entrance. The proposed parking supply of 96 total parking spaces, including four disabled/accessible parking spaces, would meet the vehicle parking requirements contained in the City Municipal Code.

The proposed parking supply and City requirements are shown in Table 12.

Table 12 – Parking Analysis Summary

Land Use	Units	Supply (spaces)	City Requirements	
			Rate	Spaces Required
Auto and Vehicle Sales and Rental	2,348 sf	6	1 per 450 sf	6
Vehicle Services – Minor and Major Repair/Body Work	20 Service Bays 41 Employees	86	1 per Service Bay 1 per Employee	20 41
Parking Stalls (Non-disabled)		92		67
<i>Disabled/Accessible Parking</i>		4	1 per 25 Spaces	4
Total (On-site)		96		71

Note: sf = square feet

In addition to the on-site parking spaces provided, the proposed project would include 127 off-site parking spaces at 3304 Industrial Drive, west of the project site. This area would be used for storage of vehicles to be sold. These 127 spaces would be in addition to the parking provided on-site.

Finding – The proposed parking supply of 96 on-site parking spaces would satisfy the City’s Code requirements. To hold vehicles prior to sale, the project would also include 127 off-site parking spaces at 3304 Industrial Drive, approximately 600 feet west of the project site.

Conclusions and Recommendations

Conclusions

- The proposed project is expected to generate an average of 61 a.m. peak hour trips and 79 p.m. peak hour trips.
- Pedestrian, bicycle, and transit facilities serving the project site are generally adequate, though sidewalk is lacking along the site's Airway Court frontage.
- The project would be expected to have a less-than-significant transportation impact on vehicle miles traveled.
- The proposed site access and on-site circulation are expected to function acceptably for emergency response vehicles, and the proposed project would have a less-than-significant impact on emergency response.
- Sight lines at the project driveways on Airway Court are adequate. However, stopping sight distance at the project driveway on Airway Drive is not adequate for northbound approaches due to trees and parked vehicles.
- Left-turn lanes would not be warranted on Airway Drive at Airway Court or at any of the project driveways.
- The proposed project would have a less-than-significant impact on queuing since the addition of project-generated volumes would not cause any queues to exceed available turn lane storage that would not already be exceeded without the project.
- The project would have a less-than-significant impact on emergency access and response times.
- The study intersections are expected to operate acceptably at LOS C or better under Existing and Baseline Conditions with or without the addition of project-generated trips; therefore, the project's effect on operating conditions would be considered acceptable.
- The proposed parking supply of 96 on-site parking spaces would satisfy the City's Code requirement for vehicular parking.

Recommendations

- Sidewalk should be installed along the project frontage on Airway Court to connect to the surrounding sidewalk network and comply with City policies and plans.
- Five long-term bicycle storage spaces should be provided on-site to satisfy the Santa Rosa Municipal Code requirement for bicycle parking.
- South of the project driveway on Airway Drive, the curb should be painted red for a distance of 40 feet to eliminate parking and provide adequate visibility.
- Vegetation south of the project driveway on Airway Drive should be maintained such that trees and vegetation are trimmed to a minimum height of seven feet.

Study Participants and References

Study Participants

Principal in Charge	Dalene J. Whitlock, PE, PTOE
Associate Engineer	Nick Brunetto, PE
Assistant Engineer	Valerie Haines, EIT, William Andrews, EIT
Graphics	Cameron Wong
Editing/Formatting	Jessica Bender
Quality Control	Dalene J. Whitlock, PE, PTOE

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Appendix A

Collision Rate Calculations



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Intersection Collision Rate Worksheet

TIS for the Tesla Service Center Project

Intersection # 1: Industrial Dr & Airway Dr
Date of Count: Wednesday, February 15, 2023

Number of Collisions: 3
Number of Injuries: 2
Number of Fatalities: 0
Average Daily Traffic (ADT): 9400
Start Date: September 1, 2016
End Date: August 31, 2021
Number of Years: 5

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

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

$$\text{Collision Rate} = \frac{3}{9,400} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.17 c/mve	0.0%	66.7%
Statewide Average*	0.17 c/mve	0.4%	26.8%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2019 Collision Data on California State Highways, Caltrans

Intersection # 2: Airway Dr & Airway Ct
Date of Count: Wednesday, February 15, 2023

Number of Collisions: 0
Number of Injuries: 0
Number of Fatalities: 0
Average Daily Traffic (ADT): 7000
Start Date: September 1, 2016
End Date: August 31, 2021
Number of Years: 5

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

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

$$\text{Collision Rate} = \frac{0}{7,000} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.00 c/mve	0.0%	0.0%
Statewide Average*	0.09 c/mve	1.2%	46.9%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2019 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Worksheet

TIS for the Tesla Service Center Project

Intersection # 3: Piner Rd & Airway Dr
Date of Count: Wednesday, February 15, 2023

Number of Collisions: 11
Number of Injuries: 6
Number of Fatalities: 0
Average Daily Traffic (ADT): 23800
Start Date: September 1, 2016
End Date: August 31, 2021
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

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

$$\text{Collision Rate} = \frac{11}{23,800} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.25 c/mve	0.0%	54.5%
Statewide Average*	0.24 c/mve	0.5%	46.9%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2019 Collision Data on California State Highways, Caltrans

Intersection # 4: Piner Rd & Range Ave
Date of Count: Wednesday, February 15, 2023

Number of Collisions: 15
Number of Injuries: 6
Number of Fatalities: 0
Average Daily Traffic (ADT): 23900
Start Date: September 1, 2016
End Date: August 31, 2021
Number of Years: 5

Intersection Type: Tee
Control Type: Signals
Area: Urban

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

$$\text{Collision Rate} = \frac{15}{23,900} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.34 c/mve	0.0%	40.0%
Statewide Average*	0.20 c/mve	0.5%	46.8%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2019 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Worksheet

TIS for the Tesla Service Center Project

Intersection # 5: Bicentennial Way & Range Ave

Date of Count: Wednesday, February 15, 2023

Number of Collisions: 10

Number of Injuries: 6

Number of Fatalities: 0

Average Daily Traffic (ADT): 26500

Start Date: September 1, 2016

End Date: August 31, 2021

Number of Years: 5

Intersection Type: Tee

Control Type: Signals

Area: Urban

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

$$\text{Collision Rate} = \frac{10}{26,500} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.21 c/mve	0.0%	60.0%
Statewide Average*	0.20 c/mve	0.5%	46.8%

Notes

ADT = average daily total vehicles entering intersection

c/mve = collisions per million vehicles entering intersection

* 2019 Collision Data on California State Highways, Caltrans



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Appendix B

Turn Lane Warrant Spreadsheets



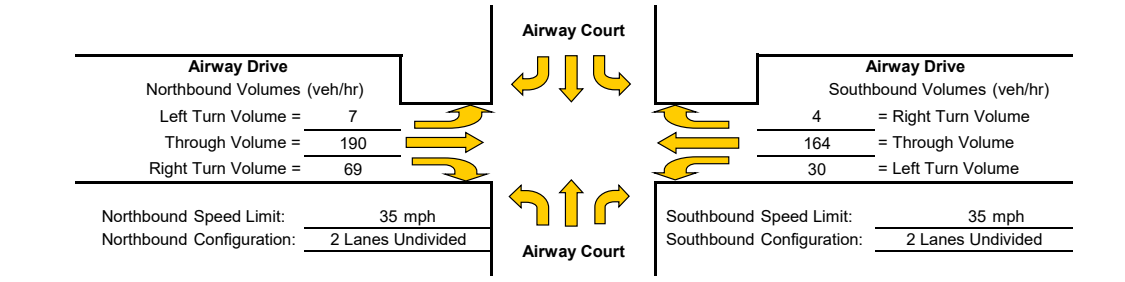
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Turn Lane Warrant Analysis - 4 Legged Intersections

Study Intersection: Airway Drive/Airway Court

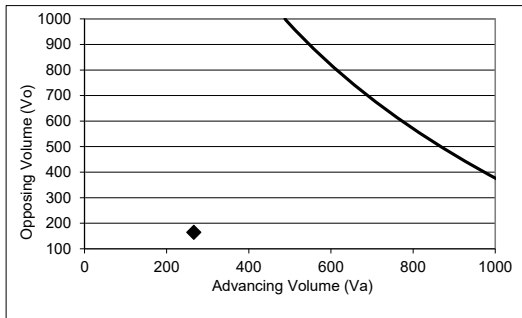
Study Scenario: Baseline plus Project AM

Direction of Analysis Street: North/South



Northbound Left Turn Lane Warrants

Percentage Left Turns %lt 2.6 %
 Advancing Volume Threshold AV 1277 veh/hr
 If $AV < V_a$ then warrant is met



◆ Study Intersection

Two lane roadway warrant threshold for: 35 mph

Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: NO

Note: If one direction has a left turn lane warranted, a left turn lane should be installed on the other side as well

Northbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold: AV = 793.8

Advancing Volume V_a = 266

If $AV < V_a$ then warrant is met No

Right Turn Lane Warranted: NO

Northbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for taper

Advancing Volume Threshold AV = -966.7

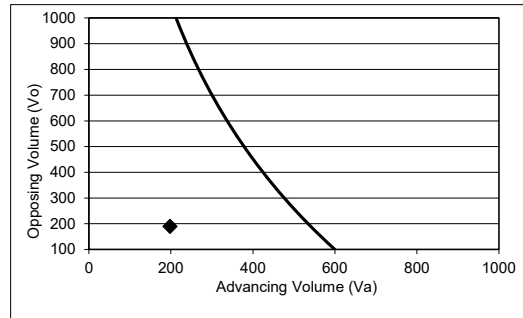
Advancing Volume V_a = 266

If $AV < V_a$ then warrant is met Yes

Right Turn Taper Warranted: YES

Southbound Left Turn Lane Warrants

Percentage Left Turns %lt 15.2 %
 Advancing Volume Threshold AV 541 veh/hr
 If $AV < V_a$ then warrant is met



◆ Study Intersection

Two lane roadway warrant threshold for: 35 mph

Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: NO

Southbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold: AV = 1020.1

Advancing Volume V_a = 198

If $AV < V_a$ then warrant is met No

Right Turn Lane Warranted: NO

Southbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 20 vehicles

2. Check advance volume threshold criteria for taper

Advancing Volume Threshold AV = -

Advancing Volume V_a = 198

If $AV < V_a$ then warrant is met -

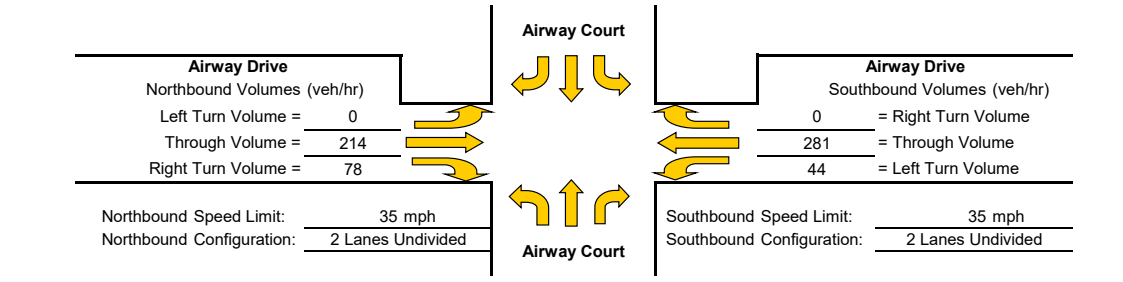
Right Turn Taper Warranted: NO

Methodology based on Washington State Transportation Center Research Report *Method For Prioritizing Intersection Improvements*, Jan. 1997.
 The right turn lane and taper analysis is based on work conducted by Cottrell in 1981. The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroborty in 1991.

Turn Lane Warrant Analysis - 4 Legged Intersections

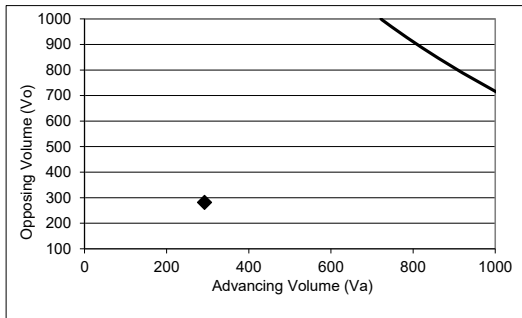
Study Intersection: Airway Drive/Airway Court
Study Scenario: Baseline plus Project PM

Direction of Analysis Street: North/South



Northbound Left Turn Lane Warrants

Percentage Left Turns %lt 0.0 %
Advancing Volume Threshold AV 1651 veh/hr
If $AV < V_a$ then warrant is met



◆ Study Intersection

Two lane roadway warrant threshold for: 35 mph
Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: NO

Note: If one direction has a left turn lane warranted, a left turn lane should be installed on the other side as well

Northbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold: AV = 667.8

Advancing Volume V_a = 292

If $AV < V_a$ then warrant is met No

Right Turn Lane Warranted: NO

Northbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for taper

Advancing Volume Threshold AV = -1267

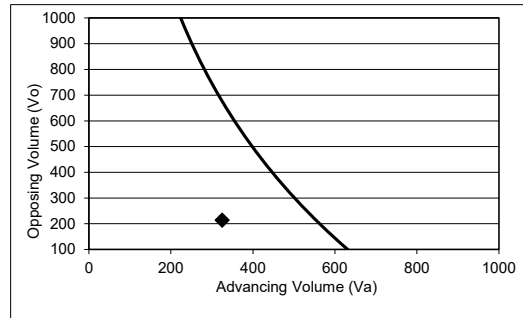
Advancing Volume V_a = 292

If $AV < V_a$ then warrant is met Yes

Right Turn Taper Warranted: YES

Southbound Left Turn Lane Warrants

Percentage Left Turns %lt 13.5 %
Advancing Volume Threshold AV 554 veh/hr
If $AV < V_a$ then warrant is met



◆ Study Intersection

Two lane roadway warrant threshold for: 35 mph
Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: NO

Southbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold: AV = 1050.1

Advancing Volume V_a = 325

If $AV < V_a$ then warrant is met No

Right Turn Lane Warranted: NO

Southbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 20 vehicles

2. Check advance volume threshold criteria for taper

Advancing Volume Threshold AV = -

Advancing Volume V_a = 325

If $AV < V_a$ then warrant is met -

Right Turn Taper Warranted: NO

Methodology based on Washington State Transportation Center Research Report *Method For Prioritizing Intersection Improvements*, Jan. 1997.
The right turn lane and taper analysis is based on work conducted by Cottrell in 1981. The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroborty in 1991.

Appendix C

Queuing Calculations



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Queues

3: Piner Rd & Airway Dr

03/28/2023

							
Lane Group	EBL	EBT	WBL	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	124	872	5	645	1	102	80
v/c Ratio	0.35	0.38	0.02	0.40	0.00	0.27	0.20
Control Delay	21.9	7.7	25.6	13.2	26.0	18.7	5.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.9	7.7	25.6	13.2	26.0	18.7	5.0
Queue Length 50th (ft)	22	34	1	51	0	18	0
Queue Length 95th (ft)	100	218	12	180	5	74	22
Internal Link Dist (ft)		483		1520	155	860	
Turn Bay Length (ft)	100		150				
Base Capacity (vph)	787	3265	324	2948	787	1009	930
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.27	0.02	0.22	0.00	0.10	0.09
Intersection Summary							

Queues

4: Range Ave & Piner Rd

03/28/2023

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	173	791	88	82	592	78
v/c Ratio	0.18	0.58	0.43	0.04	0.69	0.12
Control Delay	12.6	2.5	38.6	5.4	34.8	7.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.6	2.5	38.6	5.4	34.8	7.3
Queue Length 50th (ft)	46	11	42	6	142	7
Queue Length 95th (ft)	92	42	82	14	192	29
Internal Link Dist (ft)	1520			361	356	
Turn Bay Length (ft)			140		170	
Base Capacity (vph)	984	1383	376	2337	961	777
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.57	0.23	0.04	0.62	0.10
Intersection Summary						

Queues

5: Range Ave & Bicentennial Way

03/28/2023

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	155	551	119	321	781	97
v/c Ratio	0.27	0.24	0.24	0.70	0.40	0.07
Control Delay	30.4	0.8	30.2	29.5	13.5	4.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.4	0.8	30.2	29.5	13.5	4.4
Queue Length 50th (ft)	35	0	29	126	117	16
Queue Length 95th (ft)	62	18	42	152	213	m24
Internal Link Dist (ft)	783		501			356
Turn Bay Length (ft)	440			100	130	
Base Capacity (vph)	1017	2344	1021	660	1966	1363
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.24	0.12	0.49	0.40	0.07

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Queues

3: Piner Rd & Airway Dr

03/28/2023

							
Lane Group	EBL	EBT	WBL	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	108	675	3	1154	8	223	205
v/c Ratio	0.43	0.30	0.02	0.67	0.02	0.58	0.41
Control Delay	34.7	7.2	36.0	16.5	0.1	31.7	7.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.7	7.2	36.0	16.5	0.1	31.7	7.1
Queue Length 50th (ft)	38	42	1	158	0	77	0
Queue Length 95th (ft)	106	157	10	376	0	180	53
Internal Link Dist (ft)		483		1520	155	860	
Turn Bay Length (ft)	100		150				
Base Capacity (vph)	521	2703	214	2181	667	668	725
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.25	0.01	0.53	0.01	0.33	0.28

Intersection Summary

Queues

4: Range Ave & Piner Rd

03/28/2023

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	175	783	109	197	967	157
v/c Ratio	0.25	0.61	0.55	0.11	0.73	0.18
Control Delay	21.3	4.0	46.1	11.3	24.2	1.3
Queue Delay	0.0	0.0	0.0	0.0	0.2	0.0
Total Delay	21.3	4.0	46.1	11.3	24.4	1.3
Queue Length 50th (ft)	65	49	55	26	235	0
Queue Length 95th (ft)	123	89	107	49	275	12
Internal Link Dist (ft)	1520			361	356	
Turn Bay Length (ft)			140		170	
Base Capacity (vph)	709	1365	218	1871	1550	884
Starvation Cap Reductn	0	0	0	0	119	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.57	0.50	0.11	0.68	0.18
Intersection Summary						

Queues

5: Range Ave & Bicentennial Way

03/28/2023

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	400	941	185	225	666	236
v/c Ratio	0.64	0.43	0.37	0.41	0.36	0.18
Control Delay	36.8	1.5	33.7	13.5	13.7	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.8	1.5	33.7	13.5	13.7	3.9
Queue Length 50th (ft)	103	7	49	58	88	28
Queue Length 95th (ft)	139	40	66	74	183	59
Internal Link Dist (ft)	783		501			356
Turn Bay Length (ft)	440			100	130	
Base Capacity (vph)	876	2214	961	663	1831	1344
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.46	0.43	0.19	0.34	0.36	0.18
Intersection Summary						

Queues

3: Piner Rd & Airway Dr

03/28/2023

							
Lane Group	EBL	EBT	WBL	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	125	872	5	646	1	103	81
v/c Ratio	0.35	0.37	0.02	0.40	0.00	0.28	0.20
Control Delay	21.9	7.7	25.6	13.1	27.0	18.8	5.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.9	7.7	25.6	13.1	27.0	18.8	5.0
Queue Length 50th (ft)	22	34	1	51	0	18	0
Queue Length 95th (ft)	102	218	12	181	5	75	23
Internal Link Dist (ft)		483		1520	155	860	
Turn Bay Length (ft)	100		150				
Base Capacity (vph)	786	3264	324	2943	786	1008	928
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.27	0.02	0.22	0.00	0.10	0.09
Intersection Summary							

Queues

4: Range Ave & Piner Rd

03/28/2023

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	173	792	88	82	593	78
v/c Ratio	0.18	0.58	0.43	0.04	0.69	0.12
Control Delay	12.6	2.5	38.6	5.4	34.8	7.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.6	2.5	38.6	5.4	34.8	7.3
Queue Length 50th (ft)	46	11	42	6	142	7
Queue Length 95th (ft)	92	42	82	14	193	29
Internal Link Dist (ft)	1520			361	356	
Turn Bay Length (ft)			140		170	
Base Capacity (vph)	984	1383	376	2337	961	777
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.57	0.23	0.04	0.62	0.10
Intersection Summary						

Queues

5: Range Ave & Bicentennial Way

03/28/2023



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	159	552	119	322	782	97
v/c Ratio	0.28	0.24	0.24	0.70	0.40	0.07
Control Delay	30.4	0.8	30.2	29.4	13.5	4.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.4	0.8	30.2	29.4	13.5	4.4
Queue Length 50th (ft)	36	0	29	126	118	16
Queue Length 95th (ft)	63	18	42	152	213	m24
Internal Link Dist (ft)	783		501			356
Turn Bay Length (ft)	440			100	130	
Base Capacity (vph)	1017	2344	1021	660	1963	1362
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.24	0.12	0.49	0.40	0.07

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Queues

3: Piner Rd & Airway Dr

03/28/2023



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	109	675	3	1155	8	225	207
v/c Ratio	0.43	0.30	0.02	0.67	0.02	0.59	0.41
Control Delay	34.7	7.2	36.3	16.6	0.1	31.9	7.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.7	7.2	36.3	16.6	0.1	31.9	7.1
Queue Length 50th (ft)	39	42	1	159	0	78	0
Queue Length 95th (ft)	107	157	10	377	0	182	52
Internal Link Dist (ft)		483		1520	155	860	
Turn Bay Length (ft)	100		150				
Base Capacity (vph)	519	2697	213	2172	665	665	724
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.25	0.01	0.53	0.01	0.34	0.29

Intersection Summary

Queues

4: Range Ave & Piner Rd

03/28/2023

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	175	785	109	197	968	157
v/c Ratio	0.25	0.61	0.55	0.11	0.73	0.18
Control Delay	21.3	4.0	46.1	11.3	24.2	1.3
Queue Delay	0.0	0.0	0.0	0.0	0.2	0.0
Total Delay	21.3	4.0	46.1	11.3	24.4	1.3
Queue Length 50th (ft)	65	50	55	26	235	0
Queue Length 95th (ft)	123	90	107	49	275	12
Internal Link Dist (ft)	1520			361	356	
Turn Bay Length (ft)			140		170	
Base Capacity (vph)	709	1365	218	1870	1550	885
Starvation Cap Reductn	0	0	0	0	120	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.58	0.50	0.11	0.68	0.18
Intersection Summary						

Queues

5: Range Ave & Bicentennial Way

03/28/2023

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	402	942	185	228	668	236
v/c Ratio	0.64	0.43	0.37	0.41	0.37	0.18
Control Delay	36.7	1.5	33.7	13.6	13.8	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.7	1.5	33.7	13.6	13.8	3.9
Queue Length 50th (ft)	104	7	49	59	89	28
Queue Length 95th (ft)	140	40	66	75	185	59
Internal Link Dist (ft)	783		501			356
Turn Bay Length (ft)	440			100	130	
Base Capacity (vph)	876	2214	961	663	1829	1343
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.46	0.43	0.19	0.34	0.37	0.18
Intersection Summary						

Queues

3: Piner Rd & Airway Dr

03/28/2023

							
Lane Group	EBL	EBT	WBL	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	130	872	5	664	1	113	83
v/c Ratio	0.36	0.37	0.02	0.41	0.00	0.30	0.20
Control Delay	22.3	7.6	26.2	13.3	27.0	19.4	5.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.3	7.6	26.2	13.3	27.0	19.4	5.3
Queue Length 50th (ft)	24	35	1	54	0	21	0
Queue Length 95th (ft)	105	218	12	186	5	83	24
Internal Link Dist (ft)		483		1520	155	860	
Turn Bay Length (ft)	100		150				
Base Capacity (vph)	771	3258	317	2888	771	989	913
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.27	0.02	0.23	0.00	0.11	0.09
Intersection Summary							

Queues

4: Range Ave & Piner Rd

03/28/2023

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	173	802	88	82	611	78
v/c Ratio	0.18	0.59	0.43	0.04	0.70	0.12
Control Delay	12.8	2.6	38.6	5.5	34.4	7.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.8	2.6	38.6	5.5	34.4	7.2
Queue Length 50th (ft)	48	12	42	7	145	7
Queue Length 95th (ft)	92	44	82	14	199	29
Internal Link Dist (ft)	1520			361	356	
Turn Bay Length (ft)			140		170	
Base Capacity (vph)	972	1378	376	2314	961	787
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.58	0.23	0.04	0.64	0.10
Intersection Summary						

Queues

5: Range Ave & Bicentennial Way

03/28/2023

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	155	570	119	321	792	97
v/c Ratio	0.27	0.24	0.24	0.70	0.40	0.07
Control Delay	30.4	0.8	30.2	29.5	13.5	4.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.4	0.8	30.2	29.5	13.5	4.4
Queue Length 50th (ft)	35	0	29	126	119	16
Queue Length 95th (ft)	62	18	42	152	216	m23
Internal Link Dist (ft)	783		501			356
Turn Bay Length (ft)	440			100	130	
Base Capacity (vph)	1017	2348	1021	660	1964	1362
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.24	0.12	0.49	0.40	0.07
Intersection Summary						
m Volume for 95th percentile queue is metered by upstream signal.						

Queues

3: Piner Rd & Airway Dr

03/28/2023

							
Lane Group	EBL	EBT	WBL	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	114	675	3	1173	8	243	211
v/c Ratio	0.45	0.30	0.02	0.68	0.02	0.62	0.41
Control Delay	35.9	7.3	36.7	17.2	0.1	33.5	7.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.9	7.3	36.7	17.2	0.1	33.5	7.0
Queue Length 50th (ft)	43	44	1	169	0	89	0
Queue Length 95th (ft)	111	157	10	388	0	197	53
Internal Link Dist (ft)		483		1520	155	860	
Turn Bay Length (ft)	100		150				
Base Capacity (vph)	499	2634	205	2087	644	640	707
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.26	0.01	0.56	0.01	0.38	0.30
Intersection Summary							

Queues

4: Range Ave & Piner Rd

03/28/2023

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	175	805	109	197	987	157
v/c Ratio	0.25	0.63	0.56	0.11	0.73	0.18
Control Delay	21.5	4.2	47.1	11.5	23.9	1.2
Queue Delay	0.0	0.0	0.0	0.0	0.2	0.0
Total Delay	21.5	4.2	47.1	11.5	24.2	1.2
Queue Length 50th (ft)	65	53	55	26	239	0
Queue Length 95th (ft)	123	98	107	49	284	12
Internal Link Dist (ft)	1520			361	356	
Turn Bay Length (ft)			140		170	
Base Capacity (vph)	701	1359	214	1847	1550	890
Starvation Cap Reductn	0	0	0	0	120	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.59	0.51	0.11	0.69	0.18
Intersection Summary						

Queues

5: Range Ave & Bicentennial Way

03/28/2023

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	402	961	185	228	688	236
v/c Ratio	0.64	0.43	0.37	0.42	0.38	0.18
Control Delay	36.7	1.5	33.7	14.2	14.0	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.7	1.5	33.7	14.2	14.0	3.9
Queue Length 50th (ft)	104	8	49	62	94	29
Queue Length 95th (ft)	140	43	66	77	194	59
Internal Link Dist (ft)	783		501			356
Turn Bay Length (ft)	440			100	130	
Base Capacity (vph)	876	2214	961	660	1829	1343
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.46	0.43	0.19	0.35	0.38	0.18
Intersection Summary						

Queues

3: Piner Rd & Airway Dr

03/28/2023

							
Lane Group	EBL	EBT	WBL	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	131	872	5	665	1	114	84
v/c Ratio	0.36	0.37	0.02	0.42	0.00	0.30	0.21
Control Delay	22.4	7.6	26.2	13.3	27.0	19.5	5.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.4	7.6	26.2	13.3	27.0	19.5	5.4
Queue Length 50th (ft)	24	35	1	54	0	21	0
Queue Length 95th (ft)	107	218	13	186	5	83	25
Internal Link Dist (ft)		483		1520	155	860	
Turn Bay Length (ft)	100		150				
Base Capacity (vph)	770	3257	317	2888	770	987	911
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.27	0.02	0.23	0.00	0.12	0.09
Intersection Summary							

Queues

4: Range Ave & Piner Rd

03/28/2023

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	173	803	88	82	612	78
v/c Ratio	0.18	0.59	0.43	0.04	0.70	0.12
Control Delay	12.8	2.6	38.6	5.6	34.4	7.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.8	2.6	38.6	5.6	34.4	7.2
Queue Length 50th (ft)	48	12	42	7	145	7
Queue Length 95th (ft)	92	44	82	14	199	29
Internal Link Dist (ft)	1520			361	356	
Turn Bay Length (ft)			140		170	
Base Capacity (vph)	972	1377	376	2313	961	787
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.58	0.23	0.04	0.64	0.10
Intersection Summary						

Queues

5: Range Ave & Bicentennial Way

03/28/2023

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	159	571	119	322	793	97
v/c Ratio	0.28	0.24	0.24	0.70	0.40	0.07
Control Delay	30.4	0.8	30.2	29.5	13.5	4.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.4	0.8	30.2	29.5	13.5	4.4
Queue Length 50th (ft)	35	0	29	126	119	16
Queue Length 95th (ft)	63	19	42	152	217	m23
Internal Link Dist (ft)	783		501			356
Turn Bay Length (ft)	440			100	130	
Base Capacity (vph)	1017	2348	1021	660	1962	1361
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.24	0.12	0.49	0.40	0.07
Intersection Summary						
m Volume for 95th percentile queue is metered by upstream signal.						

Queues

3: Piner Rd & Airway Dr

03/28/2023

							
Lane Group	EBL	EBT	WBL	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	115	675	3	1174	8	245	213
v/c Ratio	0.45	0.30	0.02	0.68	0.02	0.63	0.41
Control Delay	35.9	7.3	36.7	17.3	0.1	33.6	7.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.9	7.3	36.7	17.3	0.1	33.6	7.0
Queue Length 50th (ft)	43	45	1	171	0	90	0
Queue Length 95th (ft)	111	157	10	389	0	199	54
Internal Link Dist (ft)		483		1520	155	860	
Turn Bay Length (ft)	100		150				
Base Capacity (vph)	498	2628	205	2082	642	638	707
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.26	0.01	0.56	0.01	0.38	0.30
Intersection Summary							

Queues

4: Range Ave & Piner Rd

03/28/2023

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	175	805	109	197	987	157
v/c Ratio	0.25	0.63	0.56	0.11	0.73	0.18
Control Delay	21.5	4.2	47.1	11.5	23.9	1.2
Queue Delay	0.0	0.0	0.0	0.0	0.2	0.0
Total Delay	21.5	4.2	47.1	11.5	24.2	1.2
Queue Length 50th (ft)	65	53	55	26	239	0
Queue Length 95th (ft)	123	98	107	49	284	12
Internal Link Dist (ft)	1520			361	356	
Turn Bay Length (ft)			140		170	
Base Capacity (vph)	701	1359	214	1847	1550	890
Starvation Cap Reductn	0	0	0	0	120	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.59	0.51	0.11	0.69	0.18
Intersection Summary						

Queues

5: Range Ave & Bicentennial Way

03/28/2023

	↘	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	402	961	185	228	688	236
v/c Ratio	0.64	0.43	0.37	0.42	0.38	0.18
Control Delay	36.7	1.5	33.7	14.2	14.0	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.7	1.5	33.7	14.2	14.0	3.9
Queue Length 50th (ft)	104	8	49	62	94	29
Queue Length 95th (ft)	140	43	66	77	194	59
Internal Link Dist (ft)	783		501			356
Turn Bay Length (ft)	440			100	130	
Base Capacity (vph)	876	2214	961	660	1829	1343
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.46	0.43	0.19	0.35	0.38	0.18
Intersection Summary						

Appendix D

Intersection Level of Service Calculations



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HCM 6th AWSC
1: Airway Dr & Industrial Dr

03/28/2023

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	39	62	7	37	55	35	9	93	84	108	130	26
Future Vol, veh/h	39	62	7	37	55	35	9	93	84	108	130	26
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	39	62	7	37	55	35	9	93	84	108	130	26
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	9.2			9.2			9.1			10.4		
HCM LOS	A			A			A			B		
Lane	NBLn1	EBLn1	WBLn1	SBLn1								
Vol Left, %	5%	36%	29%	41%								
Vol Thru, %	50%	57%	43%	49%								
Vol Right, %	45%	6%	28%	10%								
Sign Control	Stop	Stop	Stop	Stop								
Traffic Vol by Lane	186	108	127	264								
LT Vol	9	39	37	108								
Through Vol	93	62	55	130								
RT Vol	84	7	35	26								
Lane Flow Rate	186	108	127	264								
Geometry Grp	1	1	1	1								
Degree of Util (X)	0.237	0.156	0.177	0.35								
Departure Headway (Hd)	4.59	5.19	5.025	4.768								
Convergence, Y/N	Yes	Yes	Yes	Yes								
Cap	776	685	707	750								
Service Time	2.656	3.268	3.102	2.829								
HCM Lane V/C Ratio	0.24	0.158	0.18	0.352								
HCM Control Delay	9.1	9.2	9.2	10.4								
HCM Lane LOS	A	A	A	B								
HCM 95th-tile Q	0.9	0.6	0.6	1.6								

HCM 6th TWSC
2: Airway Dr & Airway Ct

03/28/2023

Intersection												
Int Delay, s/veh	0.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	0	0	0	5	0	6	7	188	44	16	162	4
Future Vol, veh/h	0	0	0	5	0	6	7	188	44	16	162	4
Conflicting Peds, #/hr	1	0	1	1	0	1	1	0	1	1	0	1
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	5	0	6	7	188	44	16	162	4
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	425	444	166	422	424	212	167	0	0	233	0	0
Stage 1	197	197	-	225	225	-	-	-	-	-	-	-
Stage 2	228	247	-	197	199	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	540	508	878	542	522	828	1411	-	-	1335	-	-
Stage 1	805	738	-	778	718	-	-	-	-	-	-	-
Stage 2	775	702	-	805	736	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	528	497	876	533	511	826	1410	-	-	1334	-	-
Mov Cap-2 Maneuver	528	497	-	533	511	-	-	-	-	-	-	-
Stage 1	799	728	-	773	713	-	-	-	-	-	-	-
Stage 2	764	697	-	794	726	-	-	-	-	-	-	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			10.5			0.2			0.7		
HCM LOS	A			B								
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR				
Capacity (veh/h)	1410	-	-	-	661	1334	-	-				
HCM Lane V/C Ratio	0.005	-	-	-	0.017	0.012	-	-				
HCM Control Delay (s)	7.6	0	-	0	10.5	7.7	0	-				
HCM Lane LOS	A	A	-	A	B	A	A	-				
HCM 95th %tile Q(veh)	0	-	-	-	0.1	0	-	-				

HCM 6th Signalized Intersection Summary 3: Piner Rd & Airway Dr

03/28/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱			↱		↰	↱	↰
Traffic Volume (veh/h)	124	872	0	5	514	131	1	0	0	102	0	80
Future Volume (veh/h)	124	872	0	5	514	131	1	0	0	102	0	80
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	124	872	0	5	514	112	1	0	0	102	0	39
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	159	1490	0	10	973	211	7	0	0	190	0	167
Arrive On Green	0.09	0.42	0.00	0.01	0.34	0.34	0.00	0.00	0.00	0.11	0.00	0.11
Sat Flow, veh/h	1781	3647	0	1781	2901	629	1781	0	0	1781	0	1572
Grp Volume(v), veh/h	124	872	0	5	314	312	1	0	0	102	0	39
Grp Sat Flow(s), veh/h/ln	1781	1777	0	1781	1777	1754	1781	0	0	1781	0	1572
Q Serve(g_s), s	1.9	5.2	0.0	0.1	3.9	3.9	0.0	0.0	0.0	1.5	0.0	0.6
Cycle Q Clear(g_c), s	1.9	5.2	0.0	0.1	3.9	3.9	0.0	0.0	0.0	1.5	0.0	0.6
Prop In Lane	1.00		0.00	1.00		0.36	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	159	1490	0	10	596	588	7	0	0	190	0	167
V/C Ratio(X)	0.78	0.59	0.00	0.51	0.53	0.53	0.15	0.00	0.00	0.54	0.00	0.23
Avail Cap(c_a), veh/h	1108	4732	0	456	2366	2335	1108	0	0	1420	0	1254
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.2	6.1	0.0	13.6	7.3	7.3	13.6	0.0	0.0	11.6	0.0	11.2
Incr Delay (d2), s/veh	3.1	0.1	0.0	14.8	0.3	0.3	4.0	0.0	0.0	0.9	0.0	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	0.6	0.8	0.0	0.1	0.8	0.8	0.0	0.0	0.0	0.4	0.0	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	15.3	6.2	0.0	28.3	7.6	7.6	17.6	0.0	0.0	12.5	0.0	11.5
LnGrp LOS	B	A	A	C	A	A	B	A	A	B	A	B
Approach Vol, veh/h		996			631			1			141	
Approach Delay, s/veh		7.4			7.8			17.6			12.2	
Approach LOS		A			A			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	3.1	15.1		6.1	5.4	12.8		3.0				
Change Period (Y+Rc), s	3.0	3.6		3.2	3.0	3.6		3.0				
Max Green Setting (Gmax), s	7.0	36.4		21.8	17.0	36.4		17.0				
Max Q Clear Time (g_c+I), s	2.1	7.2		3.5	3.9	5.9		2.0				
Green Ext Time (p_c), s	0.0	4.3		0.3	0.1	2.5		0.0				
Intersection Summary												
HCM 6th Ctrl Delay				7.9								
HCM 6th LOS				A								

HCM 6th Signalized Intersection Summary 4: Range Ave & Piner Rd

03/28/2023

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱	↱	↰	↱	↰	↱
Traffic Volume (veh/h)	173	791	88	82	592	78
Future Volume (veh/h)	173	791	88	82	592	78
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		0.98	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	173	739	88	82	592	66
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	987	1149	115	2239	720	433
Arrive On Green	0.53	0.53	0.06	0.63	0.21	0.21
Sat Flow, veh/h	1870	1551	1781	3647	3456	1585
Grp Volume(v), veh/h	173	739	88	82	592	66
Grp Sat Flow(s), veh/h/ln	1870	1551	1781	1777	1728	1585
Q Serve(g_s), s	3.8	19.2	3.9	0.7	13.1	2.5
Cycle Q Clear(g_c), s	3.8	19.2	3.9	0.7	13.1	2.5
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	987	1149	115	2239	720	433
V/C Ratio(X)	0.18	0.64	0.76	0.04	0.82	0.15
Avail Cap(c_a), veh/h	987	1149	379	2239	968	546
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.93	0.93	1.00	1.00	0.98	0.98
Uniform Delay (d), s/veh	9.8	5.3	36.8	5.6	30.2	22.1
Incr Delay (d2), s/veh	0.4	2.6	10.0	0.0	10.0	0.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	5	11.6	2.0	0.2	6.3	1.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	10.2	7.9	46.9	5.6	40.3	22.8
LnGrp LOS	B	A	D	A	D	C
Approach Vol, veh/h		912		170	658	
Approach Delay, s/veh		8.3		27.0	38.5	
Approach LOS		A		C	D	
Timer - Assigned Phs	1	2		6	8	
Phs Duration (G+Y+Rc), s		45.8			54.0	20.3
Change Period (Y+Rc), s		3.6			3.6	3.6
Max Green Setting (Gmax), s		30.4			50.4	22.4
Max Q Clear Time (g_c+I), s		21.2			2.7	15.1
Green Ext Time (p_c), s		0.1	3.0		0.5	1.6
Intersection Summary						
HCM 6th Ctrl Delay				21.6		
HCM 6th LOS				C		
Notes						
User approved pedestrian interval to be less than phase max green.						

HCM 6th Signalized Intersection Summary
5: Range Ave & Bicentennial Way

03/28/2023

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	155	551	119	321	781	97
Future Volume (veh/h)	155	551	119	321	781	97
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.96	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No	No	No	No	No	No
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	155	455	119	193	781	97
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	386	1940	545	411	2017	1470
Arrive On Green	0.11	0.11	0.15	0.15	0.58	0.79
Sat Flow, veh/h	3456	2790	3647	1524	3456	1870
Grp Volume(v), veh/h	155	455	119	193	781	97
Grp Sat Flow(s), veh/h/ln	1728	1395	1777	1524	1728	1870
Q Serve(g_s), s	3.3	4.7	2.3	8.5	9.7	0.9
Cycle Q Clear(g_c), s	3.3	4.7	2.3	8.5	9.7	0.9
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	386	1940	545	411	2017	1470
V/C Ratio(X)	0.40	0.23	0.22	0.47	0.39	0.07
Avail Cap(c_a), veh/h	1024	2455	1026	617	2017	1470
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.80	0.80
Uniform Delay (d), s/veh	33.0	4.4	29.7	24.7	9.0	1.9
Incr Delay (d2), s/veh	0.7	0.1	0.2	0.8	0.0	0.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	4	6.6	1.0	3.6	3.2	0.2
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	33.7	4.5	29.9	25.6	9.0	2.0
LnGrp LOS	C	A	C	C	A	A
Approach Vol, veh/h	610		312		878	
Approach Delay, s/veh	11.9		27.2		8.2	
Approach LOS	B		C		A	

Intersection Summary						
HCM 6th Ctrl Delay		12.8				
HCM 6th LOS		B				

Notes
User approved pedestrian interval to be less than phase max green.

HCM 6th AWSC
1: Airway Dr & Industrial Dr

03/28/2023

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	39	58	9	93	85	62	5	125	132	85	195	49
Future Vol, veh/h	39	58	9	93	85	62	5	125	132	85	195	49
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	39	58	9	93	85	62	5	125	132	85	195	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	10.3	12	11.3	13.3
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	2%	37%	39%	26%
Vol Thru, %	48%	55%	35%	59%
Vol Right, %	50%	8%	26%	15%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	262	106	240	329
LT Vol	5	39	93	85
Through Vol	125	58	85	195
RT Vol	132	9	62	49
Lane Flow Rate	262	106	240	329
Geometry Grp	1	1	1	1
Degree of Util (X)	0.376	0.176	0.374	0.485
Departure Headway (Hd)	5.164	5.974	5.609	5.309
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	694	598	638	678
Service Time	3.215	4.037	3.661	3.356
HCM Lane V/C Ratio	0.378	0.177	0.376	0.485
HCM Control Delay	11.3	10.3	12	13.3
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	1.8	0.6	1.7	2.7

HCM 6th TWSC
2: Airway Dr & Airway Ct

03/28/2023

Intersection												
Int Delay, s/veh	3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	0	2	81	0	40	0	212	53	30	277	0
Future Vol, veh/h	4	0	2	81	0	40	0	212	53	30	277	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	0	2	81	0	40	0	212	53	30	277	0

Major/Minor	Minor2	Minor1	Major1	Major2								
Conflicting Flow All	596	602	277	577	576	239	277	0	0	265	0	0
Stage 1	337	337	-	239	239	-	-	-	-	-	-	-
Stage 2	259	265	-	338	337	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	415	414	762	428	428	800	1286	-	-	1299	-	-
Stage 1	677	641	-	764	708	-	-	-	-	-	-	-
Stage 2	746	689	-	676	641	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	386	403	762	418	416	800	1286	-	-	1299	-	-
Mov Cap-2 Maneuver	386	403	-	418	416	-	-	-	-	-	-	-
Stage 1	677	624	-	764	708	-	-	-	-	-	-	-
Stage 2	709	689	-	656	624	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	12.9	14.6	0	0.8
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1286	-	-	462	496	1299	-	-
HCM Lane V/C Ratio	-	-	-	0.013	0.244	0.023	-	-
HCM Control Delay (s)	0	-	-	12.9	14.6	7.8	0	-
HCM Lane LOS	A	-	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.9	0.1	-	-

HCM 6th Signalized Intersection Summary
3: Piner Rd & Airway Dr

03/28/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↕		↔	↕			↕		↔	↕	↔
Traffic Volume (veh/h)	108	675	0	3	986	168	0	0	8	223	0	205
Future Volume (veh/h)	108	675	0	3	986	168	0	0	8	223	0	205
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	108	675	0	3	986	149	0	0	3	223	0	145
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	140	1809	0	6	1339	202	0	0	4	327	0	291
Arrive On Green	0.08	0.51	0.00	0.00	0.43	0.43	0.00	0.00	0.00	0.18	0.00	0.18
Sat Flow, veh/h	1781	3647	0	1781	3085	466	0	0	1585	1781	0	1585
Grp Volume(v), veh/h	108	675	0	3	568	567	0	0	3	223	0	145
Grp Sat Flow(s), veh/h/ln	1781	1777	0	1781	1777	1774	0	0	1585	1781	0	1585
Q Serve(g_s), s	2.5	4.9	0.0	0.1	11.2	11.3	0.0	0.0	0.1	4.9	0.0	3.5
Cycle Q Clear(g_c), s	2.5	4.9	0.0	0.1	11.2	11.3	0.0	0.0	0.1	4.9	0.0	3.5
Prop In Lane	1.00		0.00	1.00		0.26	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	140	1809	0	6	771	770	0	0	4	327	0	291
V/C Ratio(X)	0.77	0.37	0.00	0.51	0.74	0.74	0.00	0.00	0.80	0.68	0.00	0.50
Avail Cap(c_a), veh/h	715	3055	0	295	1528	1525	0	0	636	917	0	816
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	19.1	6.3	0.0	21.1	10.0	10.0	0.0	0.0	21.1	16.1	0.0	15.5
Incr Delay (d2), s/veh	3.4	0.0	0.0	23.6	0.5	0.5	0.0	0.0	81.4	0.9	0.0	0.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	1.0	1.1	0.0	0.1	3.1	3.1	0.0	0.0	0.1	1.7	0.0	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	22.6	6.3	0.0	44.7	10.5	10.5	0.0	0.0	102.5	17.1	0.0	16.0
LnGrp LOS	C	A	A	D	B	B	A	A	F	B	A	B
Approach Vol, veh/h	783			1138			3			368		
Approach Delay, s/veh	8.6			10.6			102.5			16.7		
Approach LOS	A			B			F			B		
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	3.1	25.2		11.0	6.3	22.0		3.1				
Change Period (Y+Rc), s	3.0	3.6		3.2	3.0	3.6		3.0				
Max Green Setting (Gmax), s	7.0	36.4		21.8	17.0	36.4		17.0				
Max Q Clear Time (g_c+I1), s	2.1	6.9		6.9	4.5	13.3		2.1				
Green Ext Time (p_c), s	0.0	3.1		0.9	0.1	5.1		0.0				

Intersection Summary												
HCM 6th Ctrl Delay	11.0											
HCM 6th LOS	B											

HCM 6th Signalized Intersection Summary
4: Range Ave & Piner Rd

03/28/2023

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (veh/h)	175	783	109	197	967	157
Future Volume (veh/h)	175	783	109	197	967	157
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No	No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	175	748	109	197	967	145
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	655	1067	139	1647	1142	648
Arrive On Green	0.35	0.35	0.08	0.46	0.33	0.33
Sat Flow, veh/h	1870	1550	1781	3647	3456	1585
Grp Volume(v), veh/h	175	748	109	197	967	145
Grp Sat Flow(s), veh/h/ln	1870	1550	1781	1777	1728	1585
Q Serve(g_s), s	5.7	25.3	5.1	2.7	22.1	5.1
Cycle Q Clear(g_c), s	5.7	25.3	5.1	2.7	22.1	5.1
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	655	1067	139	1647	1142	648
V/C Ratio(X)	0.27	0.70	0.79	0.12	0.85	0.22
Avail Cap(c_a), veh/h	655	1067	210	1647	1561	840
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.96	0.96	1.00	1.00	0.91	0.91
Uniform Delay (d), s/veh	19.8	8.4	38.5	12.9	26.4	16.4
Incr Delay (d2), s/veh	1.0	3.7	10.6	0.1	7.2	0.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	16.6	2.6	1.1	9.8	1.9	
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	20.7	12.1	49.1	13.1	33.6	17.1
LnGrp LOS	C	B	D	B	C	B
Approach Vol, veh/h	923			306	1112	
Approach Delay, s/veh	13.7			25.9	31.5	
Approach LOS	B			C	C	
Timer - Assigned Phs	1	2			6	8
Phs Duration (G+Y+Rc), s	33.4				43.0	31.7
Change Period (Y+Rc), s	3.0	3.6			3.6	3.6
Max Green Setting (Gmax), s	26.4				39.4	38.4
Max Q Clear Time (g_c+I1), s	27.3				4.7	24.1
Green Ext Time (p_c), s	0.1	0.0			1.3	4.0

Intersection Summary

HCM 6th Ctrl Delay	23.7
HCM 6th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th Signalized Intersection Summary
5: Range Ave & Bicentennial Way

03/28/2023

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (veh/h)	400	941	185	225	666	236
Future Volume (veh/h)	400	941	185	225	666	236
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	400	826	185	122	666	236
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	613	2098	375	443	1986	1358
Arrive On Green	0.18	0.18	0.11	0.11	0.57	0.73
Sat Flow, veh/h	3456	2790	3647	1533	3456	1870
Grp Volume(v), veh/h	400	826	185	122	666	236
Grp Sat Flow(s), veh/h/ln	1728	1395	1777	1533	1728	1870
Q Serve(g_s), s	9.2	8.9	4.2	5.3	8.6	3.4
Cycle Q Clear(g_c), s	9.2	8.9	4.2	5.3	8.6	3.4
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	613	2098	375	443	1986	1358
V/C Ratio(X)	0.65	0.39	0.49	0.28	0.34	0.17
Avail Cap(c_a), veh/h	882	2316	966	698	1986	1358
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.77	0.77
Uniform Delay (d), s/veh	32.5	3.7	35.9	23.7	9.5	3.6
Incr Delay (d2), s/veh	1.2	0.1	1.0	0.3	0.0	0.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	12.2	1.8	2.5	3.0	1.0	
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	33.7	3.8	36.9	24.1	9.5	3.9
LnGrp LOS	C	A	D	C	A	A
Approach Vol, veh/h	1226		307		902	
Approach Delay, s/veh	13.6		31.8		8.1	
Approach LOS	B		C		A	
Timer - Assigned Phs			4		6	7 8
Phs Duration (G+Y+Rc), s			65.6		19.4	52.8 12.9
Change Period (Y+Rc), s			3.9		4.3	3.9 3.9
Max Green Setting (Gmax), s			55.1		21.7	28.1 23.1
Max Q Clear Time (g_c+I1), s			5.4		11.2	10.6 7.3
Green Ext Time (p_c), s			1.5		3.9	1.3 1.4

Intersection Summary

HCM 6th Ctrl Delay	13.8
HCM 6th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th AWSC
1: Airway Dr & Industrial Dr

03/28/2023

Intersection												
Intersection Delay, s/veh	9.7											
Intersection LOS	A											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	39	63	7	37	56	35	9	95	84	108	132	26
Future Vol, veh/h	39	63	7	37	56	35	9	95	84	108	132	26
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	39	63	7	37	56	35	9	95	84	108	132	26
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	9.3			9.2			9.1			10.5		
HCM LOS	A			A			A			B		
Lane	NBLn1	EBLn1	WBLn1	SBLn1								
Vol Left, %	5%	36%	29%	41%								
Vol Thru, %	51%	58%	44%	50%								
Vol Right, %	45%	6%	27%	10%								
Sign Control	Stop	Stop	Stop	Stop								
Traffic Vol by Lane	188	109	128	266								
LT Vol	9	39	37	108								
Through Vol	95	63	56	132								
RT Vol	84	7	35	26								
Lane Flow Rate	188	109	128	266								
Geometry Grp	1	1	1	1								
Degree of Util (X)	0.24	0.158	0.179	0.353								
Departure Headway (Hd)	4.604	5.203	5.04	4.779								
Convergence, Y/N	Yes	Yes	Yes	Yes								
Cap	775	683	705	747								
Service Time	2.67	3.282	3.116	2.84								
HCM Lane V/C Ratio	0.243	0.16	0.182	0.356								
HCM Control Delay	9.1	9.3	9.2	10.5								
HCM Lane LOS	A	A	A	B								
HCM 95th-tile Q	0.9	0.6	0.6	1.6								

HCM 6th TWSC
2: Airway Dr & Airway Ct

03/28/2023

Intersection												
Int Delay, s/veh	0.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	EBL EBT EBR WBL WBT WBR NBL NBT NBR SBL SBT SBR											
Traffic Vol, veh/h	0	0	0	5	0	6	7	190	44	16	164	4
Future Vol, veh/h	0	0	0	5	0	6	7	190	44	16	164	4
Conflicting Peds, #/hr	1	0	1	1	0	1	1	0	1	1	0	1
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	5	0	6	7	190	44	16	164	4
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	429	448	168	426	428	214	169	0	0	235	0	0
Stage 1	199	199	-	227	227	-	-	-	-	-	-	-
Stage 2	230	249	-	199	201	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	536	506	876	539	519	826	1409	-	-	1332	-	-
Stage 1	803	736	-	776	716	-	-	-	-	-	-	-
Stage 2	773	701	-	803	735	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	524	495	874	530	508	824	1408	-	-	1331	-	-
Mov Cap-2 Maneuver	524	495	-	530	508	-	-	-	-	-	-	-
Stage 1	797	726	-	771	711	-	-	-	-	-	-	-
Stage 2	762	696	-	792	725	-	-	-	-	-	-	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			10.6			0.2			0.7		
HCM LOS	A			B								
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR				
Capacity (veh/h)	1408	-	-	-	658	1331	-	-				
HCM Lane V/C Ratio	0.005	-	-	-	0.017	0.012	-	-				
HCM Control Delay (s)	7.6	0	-	0	10.6	7.7	0	-				
HCM Lane LOS	A	A	-	A	B	A	A	-				
HCM 95th %tile Q(veh)	0	-	-	-	0.1	0	-	-				

HCM 6th Signalized Intersection Summary
3: Piner Rd & Airway Dr

03/28/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↶		↰	↶			↶		↰	↶	↰
Traffic Volume (veh/h)	125	872	0	5	514	132	1	0	0	103	0	81
Future Volume (veh/h)	125	872	0	5	514	132	1	0	0	103	0	81
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	125	872	0	5	514	113	1	0	0	103	0	40
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	160	1489	0	10	970	212	7	0	0	191	0	169
Arrive On Green	0.09	0.42	0.00	0.01	0.33	0.33	0.00	0.00	0.00	0.11	0.00	0.11
Sat Flow, veh/h	1781	3647	0	1781	2896	634	1781	0	0	1781	0	1572
Grp Volume(v), veh/h	125	872	0	5	314	313	1	0	0	103	0	40
Grp Sat Flow(s), veh/h/ln	1781	1777	0	1781	1777	1753	1781	0	0	1781	0	1572
Q Serve(g_s), s	1.9	5.2	0.0	0.1	3.9	4.0	0.0	0.0	0.0	1.5	0.0	0.6
Cycle Q Clear(g_c), s	1.9	5.2	0.0	0.1	3.9	4.0	0.0	0.0	0.0	1.5	0.0	0.6
Prop In Lane	1.00		0.00	1.00		0.36	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	160	1489	0	10	595	587	7	0	0	191	0	169
V/C Ratio(X)	0.78	0.59	0.00	0.51	0.53	0.53	0.15	0.00	0.00	0.54	0.00	0.24
Avail Cap(c_a), veh/h	1106	4726	0	456	2363	2331	1106	0	0	1419	0	1252
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.2	6.1	0.0	13.6	7.4	7.4	13.6	0.0	0.0	11.6	0.0	11.2
Incr Delay (d2), s/veh	3.2	0.1	0.0	14.8	0.3	0.3	4.0	0.0	0.0	0.9	0.0	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	0.7	0.8	0.0	0.1	0.8	0.8	0.0	0.0	0.0	0.5	0.0	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	15.4	6.3	0.0	28.4	7.6	7.7	17.6	0.0	0.0	12.5	0.0	11.5
LnGrp LOS	B	A	A	C	A	A	B	A	A	B	A	B
Approach Vol, veh/h		997			632			1			143	
Approach Delay, s/veh		7.4			7.8			17.6			12.2	
Approach LOS		A			A			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	3.1	15.1		6.1	5.5	12.8		3.0				
Change Period (Y+Rc), s	3.0	3.6		3.2	3.0	3.6		3.0				
Max Green Setting (Gmax), s	7.0	36.4		21.8	17.0	36.4		17.0				
Max Q Clear Time (g_c+I1), s	2.1	7.2		3.5	3.9	6.0		2.0				
Green Ext Time (p_c), s	0.0	4.3		0.3	0.1	2.5		0.0				
Intersection Summary												
HCM 6th Ctrl Delay				7.9								
HCM 6th LOS				A								

HCM 6th Signalized Intersection Summary
4: Range Ave & Piner Rd

03/28/2023

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↶	↷	↰	↶	↰	↷
Traffic Volume (veh/h)	173	792	88	82	593	78
Future Volume (veh/h)	173	792	88	82	593	78
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		0.98	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	173	740	88	82	593	66
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	987	1149	115	2239	721	433
Arrive On Green	0.53	0.53	0.06	0.63	0.21	0.21
Sat Flow, veh/h	1870	1551	1781	3647	3456	1585
Grp Volume(v), veh/h	173	740	88	82	593	66
Grp Sat Flow(s), veh/h/ln	1870	1551	1781	1777	1728	1585
Q Serve(g_s), s	3.8	19.2	3.9	0.7	13.1	2.5
Cycle Q Clear(g_c), s	3.8	19.2	3.9	0.7	13.1	2.5
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	987	1149	115	2239	721	433
V/C Ratio(X)	0.18	0.64	0.76	0.04	0.82	0.15
Avail Cap(c_a), veh/h	987	1149	379	2239	968	546
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.93	0.93	1.00	1.00	0.98	0.98
Uniform Delay (d), s/veh	9.8	5.3	36.8	5.6	30.2	22.0
Incr Delay (d2), s/veh	0.4	2.6	10.0	0.0	10.0	0.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	1.5	11.6	2.0	0.2	6.3	1.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	10.2	7.9	46.9	5.6	40.3	22.8
LnGrp LOS	B	A	D	A	D	C
Approach Vol, veh/h	913			170	659	
Approach Delay, s/veh	8.3			27.0	38.5	
Approach LOS	A			C	D	
Timer - Assigned Phs	1	2			6	8
Phs Duration (G+Y+Rc), s	3.1	15.1			54.0	20.3
Change Period (Y+Rc), s	3.0	3.6			3.6	3.6
Max Green Setting (Gmax), s	7.0	36.4			50.4	22.4
Max Q Clear Time (g_c+I1), s	2.1	7.2			2.7	15.1
Green Ext Time (p_c), s	0.0	4.3			0.5	1.6
Intersection Summary						
HCM 6th Ctrl Delay				21.6		
HCM 6th LOS				C		
Notes						
User approved pedestrian interval to be less than phase max green.						

HCM 6th Signalized Intersection Summary
5: Range Ave & Bicentennial Way

03/28/2023

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔↔	↔↔	↑↑	↑↑	↔↔	↑
Traffic Volume (veh/h)	159	552	119	322	782	97
Future Volume (veh/h)	159	552	119	322	782	97
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.96	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No	No	No	No	No	No
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	159	456	119	194	782	97
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	388	1939	546	412	2014	1469
Arrive On Green	0.11	0.11	0.15	0.15	0.58	0.79
Sat Flow, veh/h	3456	2790	3647	1524	3456	1870
Grp Volume(v), veh/h	159	456	119	194	782	97
Grp Sat Flow(s), veh/h/ln	1728	1395	1777	1524	1728	1870
Q Serve(g_s), s	3.4	4.8	2.3	8.6	9.8	0.9
Cycle Q Clear(g_c), s	3.4	4.8	2.3	8.6	9.8	0.9
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	388	1939	546	412	2014	1469
V/C Ratio(X)	0.41	0.24	0.22	0.47	0.39	0.07
Avail Cap(c_a), veh/h	1024	2452	1026	618	2014	1469
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.80	0.80
Uniform Delay (d), s/veh	33.0	4.4	29.6	24.7	9.0	1.9
Incr Delay (d2), s/veh	0.7	0.1	0.2	0.8	0.0	0.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	4	6.6	1.0	3.6	3.2	0.2
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	33.7	4.5	29.8	25.5	9.0	2.0
LnGrp LOS	C	A	C	C	A	A
Approach Vol, veh/h	615		313		879	
Approach Delay, s/veh	12.1		27.2		8.3	
Approach LOS	B		C		A	
Timer - Assigned Phs			4		6	7 8
Phs Duration (G+Y+Rc), s			66.7		13.3	50.5 16.2
Change Period (Y+Rc), s			3.9		4.3	3.9 3.9
Max Green Setting (Gmax), s			48.1		23.7	21.1 23.1
Max Q Clear Time (g_c+I), s			2.9		6.8	11.8 10.6
Green Ext Time (p_c), s			0.6		2.2	1.3 1.1

Intersection Summary	
HCM 6th Ctrl Delay	12.8
HCM 6th LOS	B

Notes
User approved pedestrian interval to be less than phase max green.

HCM 6th AWSC
1: Airway Dr & Industrial Dr

03/28/2023

Intersection												
Intersection Delay, s/veh	12.2											
Intersection LOS	B											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	39	60	9	93	87	62	5	127	132	85	199	49
Future Vol, veh/h	39	60	9	93	87	62	5	127	132	85	199	49
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	39	60	9	93	87	62	5	127	132	85	199	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	10.4			12.1			11.4			13.5		
HCM LOS	B			B			B			B		
Lane	NBLn1	EBLn1	WBLn1	SBLn1								
Vol Left, %	2%	36%	38%	26%								
Vol Thru, %	48%	56%	36%	60%								
Vol Right, %	50%	8%	26%	15%								
Sign Control	Stop	Stop	Stop	Stop								
Traffic Vol by Lane	264	108	242	333								
LT Vol	5	39	93	85								
Through Vol	127	60	87	199								
RT Vol	132	9	62	49								
Lane Flow Rate	264	108	242	333								
Geometry Grp	1	1	1	1								
Degree of Util (X)	0.381	0.18	0.379	0.493								
Departure Headway (Hd)	5.194	6.002	5.635	5.332								
Convergence, Y/N	Yes	Yes	Yes	Yes								
Cap	689	595	636	673								
Service Time	3.245	4.069	3.691	3.38								
HCM Lane V/C Ratio	0.383	0.182	0.381	0.495								
HCM Control Delay	11.4	10.4	12.1	13.5								
HCM Lane LOS	B	B	B	B								
HCM 95th-tile Q	1.8	0.7	1.8	2.7								

HCM 6th TWSC
2: Airway Dr & Airway Ct

03/28/2023

Intersection												
Int Delay, s/veh	3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	0	2	81	0	40	0	214	53	30	281	0
Future Vol, veh/h	4	0	2	81	0	40	0	214	53	30	281	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	0	2	81	0	40	0	214	53	30	281	0

Major/Minor	Minor2	Minor1	Major1	Major2								
Conflicting Flow All	602	608	281	583	582	241	281	0	0	267	0	0
Stage 1	341	341	-	241	241	-	-	-	-	-	-	-
Stage 2	261	267	-	342	341	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	412	410	758	424	425	798	1282	-	-	1297	-	-
Stage 1	674	639	-	762	706	-	-	-	-	-	-	-
Stage 2	744	688	-	673	639	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	383	399	758	414	414	798	1282	-	-	1297	-	-
Mov Cap-2 Maneuver	383	399	-	414	414	-	-	-	-	-	-	-
Stage 1	674	622	-	762	706	-	-	-	-	-	-	-
Stage 2	707	688	-	653	622	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	12.9	14.7	0	0.8
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1282	-	-	459	492	1297	-	-
HCM Lane V/C Ratio	-	-	-	0.013	0.246	0.023	-	-
HCM Control Delay (s)	0	-	-	12.9	14.7	7.8	0	-
HCM Lane LOS	A	-	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	1	0.1	-	-

HCM 6th Signalized Intersection Summary
3: Piner Rd & Airway Dr

03/28/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↕		↔	↕			↕		↔	↕	↔
Traffic Volume (veh/h)	109	675	0	3	986	169	0	0	8	225	0	207
Future Volume (veh/h)	109	675	0	3	986	169	0	0	8	225	0	207
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	109	675	0	3	986	150	0	0	3	225	0	147
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	141	1811	0	6	1336	203	0	0	4	328	0	292
Arrive On Green	0.08	0.51	0.00	0.00	0.43	0.43	0.00	0.00	0.00	0.18	0.00	0.18
Sat Flow, veh/h	1781	3647	0	1781	3081	468	0	0	1585	1781	0	1585
Grp Volume(v), veh/h	109	675	0	3	568	568	0	0	3	225	0	147
Grp Sat Flow(s), veh/h/ln	1781	1777	0	1781	1777	1773	0	0	1585	1781	0	1585
Q Serve(g_s), s	2.6	4.9	0.0	0.1	11.3	11.4	0.0	0.0	0.1	5.0	0.0	3.5
Cycle Q Clear(g_c), s	2.6	4.9	0.0	0.1	11.3	11.4	0.0	0.0	0.1	5.0	0.0	3.5
Prop In Lane	1.00		0.00	1.00		0.26	0.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	141	1811	0	6	771	769	0	0	4	328	0	292
V/C Ratio(X)	0.77	0.37	0.00	0.51	0.74	0.74	0.00	0.00	0.81	0.69	0.00	0.50
Avail Cap(c_a), veh/h	712	3040	0	293	1520	1516	0	0	633	912	0	812
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	19.2	6.3	0.0	21.2	10.0	10.0	0.0	0.0	21.2	16.2	0.0	15.6
Incr Delay (d2), s/veh	3.4	0.0	0.0	23.7	0.5	0.5	0.0	0.0	82.6	1.0	0.0	0.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	1.0	1.1	0.0	0.1	3.1	3.1	0.0	0.0	0.1	1.8	0.0	1.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	22.6	6.4	0.0	44.8	10.6	10.6	0.0	0.0	103.8	17.2	0.0	16.1
LnGrp LOS	C	A	A	D	B	B	A	A	F	B	A	B
Approach Vol, veh/h	784				1139			3		372		
Approach Delay, s/veh	8.6				10.7			103.8		16.7		
Approach LOS	A				B			F		B		
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	3.1	25.3		11.0	6.4	22.1		3.1				
Change Period (Y+Rc), s	3.0	3.6		3.2	3.0	3.6		3.0				
Max Green Setting (Gmax), s	7.0	36.4		21.8	17.0	36.4		17.0				
Max Q Clear Time (g_c+1), s	2.1	6.9		7.0	4.6	13.4		2.1				
Green Ext Time (p_c), s	0.0	3.1		0.9	0.1	5.1		0.0				

Intersection Summary												
HCM 6th Ctrl Delay	11.1											
HCM 6th LOS	B											

HCM 6th Signalized Intersection Summary
4: Range Ave & Piner Rd

03/28/2023

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (veh/h)	175	785	109	197	968	157
Future Volume (veh/h)	175	785	109	197	968	157
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No	No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	175	750	109	197	968	145
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	655	1067	139	1647	1143	648
Arrive On Green	0.35	0.35	0.08	0.46	0.33	0.33
Sat Flow, veh/h	1870	1550	1781	3647	3456	1585
Grp Volume(v), veh/h	175	750	109	197	968	145
Grp Sat Flow(s), veh/h/ln	1870	1550	1781	1777	1728	1585
Q Serve(g_s), s	5.7	25.4	5.1	2.7	22.1	5.1
Cycle Q Clear(g_c), s	5.7	25.4	5.1	2.7	22.1	5.1
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	655	1067	139	1647	1143	648
V/C Ratio(X)	0.27	0.70	0.79	0.12	0.85	0.22
Avail Cap(c_a), veh/h	655	1067	210	1647	1561	840
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.96	0.96	1.00	1.00	0.91	0.91
Uniform Delay (d), s/veh	19.8	8.4	38.5	12.9	26.4	16.4
Incr Delay (d2), s/veh	1.0	3.7	10.6	0.1	7.2	0.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	16.6	2.6	1.1	9.8	1.9	
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	20.7	12.1	49.1	13.1	33.6	17.1
LnGrp LOS	C	B	D	B	C	B
Approach Vol, veh/h	925			306	1113	
Approach Delay, s/veh	13.7			25.9	31.4	
Approach LOS	B			C	C	
Timer - Assigned Phs	1	2			6	8
Phs Duration (G+Y+Rc), s	33.4				43.0	31.7
Change Period (Y+Rc), s	3.6				3.6	3.6
Max Green Setting (Gmax), s	26.4				39.4	38.4
Max Q Clear Time (g_c+I1), s	27.4				4.7	24.1
Green Ext Time (p_c), s	0.1	0.0			1.3	4.0

Intersection Summary

HCM 6th Ctrl Delay	23.7
HCM 6th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th Signalized Intersection Summary
5: Range Ave & Bicentennial Way

03/28/2023

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (veh/h)	402	942	185	228	668	236
Future Volume (veh/h)	402	942	185	228	668	236
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	402	827	185	125	668	236
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	614	2094	381	446	1979	1357
Arrive On Green	0.18	0.18	0.11	0.11	0.57	0.73
Sat Flow, veh/h	3456	2790	3647	1533	3456	1870
Grp Volume(v), veh/h	402	827	185	125	668	236
Grp Sat Flow(s), veh/h/ln	1728	1395	1777	1533	1728	1870
Q Serve(g_s), s	9.2	8.9	4.2	5.4	8.7	3.4
Cycle Q Clear(g_c), s	9.2	8.9	4.2	5.4	8.7	3.4
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	614	2094	381	446	1979	1357
V/C Ratio(X)	0.65	0.39	0.49	0.28	0.34	0.17
Avail Cap(c_a), veh/h	882	2310	966	699	1979	1357
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.76	0.76
Uniform Delay (d), s/veh	32.5	3.8	35.7	23.7	9.6	3.7
Incr Delay (d2), s/veh	1.2	0.1	1.0	0.3	0.0	0.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	12.2	1.8	2.5	3.0	1.1	
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	33.7	3.9	36.7	24.0	9.6	3.9
LnGrp LOS	C	A	D	C	A	A
Approach Vol, veh/h	1229		310		904	
Approach Delay, s/veh	13.6		31.6		8.1	
Approach LOS	B		C		A	
Timer - Assigned Phs			4		6	7 8
Phs Duration (G+Y+Rc), s			65.6		19.4	52.6 13.0
Change Period (Y+Rc), s			3.9		4.3	3.9 3.9
Max Green Setting (Gmax), s			55.1		21.7	28.1 23.1
Max Q Clear Time (g_c+I1), s			5.4		11.2	10.7 7.4
Green Ext Time (p_c), s			1.5		3.9	1.3 1.4

Intersection Summary

HCM 6th Ctrl Delay	13.9
HCM 6th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th AWSC
1: Airway Dr & Industrial Dr

03/28/2023

Intersection												
Intersection Delay, s/veh	9.8											
Intersection LOS	A											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	EBL EBT EBR WBL WBT WBR NBL NBT NBR SBL SBT SBR											
Traffic Vol, veh/h	39	62	7	49	55	35	9	94	91	108	132	26
Future Vol, veh/h	39	62	7	49	55	35	9	94	91	108	132	26
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	39	62	7	49	55	35	9	94	91	108	132	26
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	9.3			9.4			9.2			10.6		
HCM LOS	A			A			A			B		
Lane	NBLn1	EBLn1	WBLn1	SBLn1								
Vol Left, %	5%	36%	35%	41%								
Vol Thru, %	48%	57%	40%	50%								
Vol Right, %	47%	6%	25%	10%								
Sign Control	Stop	Stop	Stop	Stop								
Traffic Vol by Lane	194	108	139	266								
LT Vol	9	39	49	108								
Through Vol	94	62	55	132								
RT Vol	91	7	35	26								
Lane Flow Rate	194	108	139	266								
Geometry Grp	1	1	1	1								
Degree of Util (X)	0.249	0.157	0.196	0.356								
Departure Headway (Hd)	4.621	5.238	5.081	4.814								
Convergence, Y/N	Yes	Yes	Yes	Yes								
Cap	770	678	699	742								
Service Time	2.692	3.324	3.163	2.881								
HCM Lane V/C Ratio	0.252	0.159	0.199	0.358								
HCM Control Delay	9.2	9.3	9.4	10.6								
HCM Lane LOS	A	A	A	B								
HCM 95th-tile Q	1	0.6	0.7	1.6								

HCM 6th TWSC
2: Airway Dr & Airway Ct

03/28/2023

Intersection												
Int Delay, s/veh	1.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	EBL EBT EBR WBL WBT WBR NBL NBT NBR SBL SBT SBR											
Traffic Vol, veh/h	0	0	0	19	0	14	7	188	69	30	162	4
Future Vol, veh/h	0	0	0	19	0	14	7	188	69	30	162	4
Conflicting Peds, #/hr	1	0	1	1	0	1	1	0	1	1	0	1
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None	-	-	None	-
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	19	0	14	7	188	69	30	162	4
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	470	497	166	463	465	225	167	0	0	258	0	0
Stage 1	225	225	-	238	238	-	-	-	-	-	-	-
Stage 2	245	272	-	225	227	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	504	475	878	509	495	814	1411	-	-	1307	-	-
Stage 1	778	718	-	765	708	-	-	-	-	-	-	-
Stage 2	759	685	-	778	716	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	483	459	876	496	479	812	1410	-	-	1306	-	-
Mov Cap-2 Maneuver	483	459	-	496	479	-	-	-	-	-	-	-
Stage 1	773	699	-	760	703	-	-	-	-	-	-	-
Stage 2	741	680	-	758	697	-	-	-	-	-	-	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			11.4			0.2			1.2		
HCM LOS	A			B								
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR				
Capacity (veh/h)	1410	-	-	-	594	1306	-	-				
HCM Lane V/C Ratio	0.005	-	-	-	0.056	0.023	-	-				
HCM Control Delay (s)	7.6	0	-	0	11.4	7.8	0	-				
HCM Lane LOS	A	A	-	A	B	A	A	-				
HCM 95th %tile Q(veh)	0	-	-	-	0.2	0.1	-	-				

HCM 6th Signalized Intersection Summary 3: Piner Rd & Airway Dr

03/28/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱			↰	↱		↰	↱
Traffic Volume (veh/h)	130	872	0	5	514	150	1	0	0	113	0	83
Future Volume (veh/h)	130	872	0	5	514	150	1	0	0	113	0	83
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	130	872	0	5	514	131	1	0	0	113	0	42
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	167	1484	0	10	924	234	6	0	0	200	0	176
Arrive On Green	0.09	0.42	0.00	0.01	0.33	0.33	0.00	0.00	0.00	0.11	0.00	0.11
Sat Flow, veh/h	1781	3647	0	1781	2804	711	1781	0	0	1781	0	1572
Grp Volume(v), veh/h	130	872	0	5	325	320	1	0	0	113	0	42
Grp Sat Flow(s), veh/h/ln	1781	1777	0	1781	1777	1739	1781	0	0	1781	0	1572
Q Serve(g_s), s	2.0	5.2	0.0	0.1	4.1	4.2	0.0	0.0	0.0	1.7	0.0	0.7
Cycle Q Clear(g_c), s	2.0	5.2	0.0	0.1	4.1	4.2	0.0	0.0	0.0	1.7	0.0	0.7
Prop In Lane	1.00		0.00	1.00		0.41	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	167	1484	0	10	586	573	6	0	0	200	0	176
V/C Ratio(X)	0.78	0.59	0.00	0.51	0.55	0.56	0.15	0.00	0.00	0.57	0.00	0.24
Avail Cap(c_a), veh/h	1098	4691	0	452	2346	2295	1098	0	0	1408	0	1243
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.2	6.2	0.0	13.7	7.6	7.6	13.7	0.0	0.0	11.6	0.0	11.2
Incr Delay (d2), s/veh	3.0	0.1	0.0	14.8	0.3	0.3	4.1	0.0	0.0	0.9	0.0	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	0.7	0.8	0.0	0.1	0.9	0.8	0.0	0.0	0.0	0.5	0.0	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	15.2	6.3	0.0	28.5	7.9	7.9	17.8	0.0	0.0	12.5	0.0	11.4
LnGrp LOS	B	A	A	C	A	A	B	A	A	B	A	B
Approach Vol, veh/h	1002			650			1			155		
Approach Delay, s/veh	7.5			8.1			17.8			12.2		
Approach LOS	A			A			B			B		
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	3.2	15.1		6.3	5.6	12.7		3.0				
Change Period (Y+Rc), s	3.0	3.6		3.2	3.0	3.6		3.0				
Max Green Setting (Gmax), s	7.0	36.4		21.8	17.0	36.4		17.0				
Max Q Clear Time (g_c+I1), s	2.1	7.2		3.7	4.0	6.2		2.0				
Green Ext Time (p_c), s	0.0	4.3		0.4	0.1	2.6		0.0				
Intersection Summary												
HCM 6th Ctrl Delay	8.1											
HCM 6th LOS	A											

HCM 6th Signalized Intersection Summary 4: Range Ave & Piner Rd

03/28/2023

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	173	802	88	82	611	78
Future Volume (veh/h)	173	802	88	82	611	78
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		0.98	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	173	750	88	82	611	66
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	987	1157	115	2239	738	441
Arrive On Green	0.53	0.53	0.06	0.63	0.21	0.21
Sat Flow, veh/h	1870	1551	1781	3647	3456	1585
Grp Volume(v), veh/h	173	750	88	82	611	66
Grp Sat Flow(s), veh/h/ln	1870	1551	1781	1777	1728	1585
Q Serve(g_s), s	3.8	19.4	3.9	0.7	13.5	2.5
Cycle Q Clear(g_c), s	3.8	19.4	3.9	0.7	13.5	2.5
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	987	1157	115	2239	738	441
V/C Ratio(X)	0.18	0.65	0.76	0.04	0.83	0.15
Avail Cap(c_a), veh/h	987	1157	379	2239	968	546
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.93	0.93	1.00	1.00	0.98	0.98
Uniform Delay (d), s/veh	9.8	5.2	36.8	5.6	30.0	21.7
Incr Delay (d2), s/veh	0.4	2.6	10.0	0.0	10.1	0.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	1.5	11.9	2.0	0.2	6.5	1.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	10.2	7.8	46.9	5.6	40.2	22.4
LnGrp LOS	B	A	D	A	D	C
Approach Vol, veh/h	923		170		677	
Approach Delay, s/veh	8.2		27.0		38.5	
Approach LOS	A		C		D	
Timer - Assigned Phs	1	2		6		8
Phs Duration (G+Y+Rc), s	45.8			54.0		20.7
Change Period (Y+Rc), s	3.0	3.6		3.6		3.6
Max Green Setting (Gmax), s	30.4			50.4		22.4
Max Q Clear Time (g_c+I1), s	21.4			2.7		15.5
Green Ext Time (p_c), s	0.1	3.1		0.5		1.6
Intersection Summary						
HCM 6th Ctrl Delay	21.6					
HCM 6th LOS	C					
Notes						
User approved pedestrian interval to be less than phase max green.						

HCM 6th Signalized Intersection Summary
5: Range Ave & Bicentennial Way

03/28/2023

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	155	570	119	321	792	97
Future Volume (veh/h)	155	570	119	321	792	97
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.96	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No	No	No	No	No	No
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	155	474	119	193	792	97
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	400	1941	543	416	2005	1462
Arrive On Green	0.12	0.12	0.15	0.15	0.58	0.78
Sat Flow, veh/h	3456	2790	3647	1524	3456	1870
Grp Volume(v), veh/h	155	474	119	193	792	97
Grp Sat Flow(s), veh/h/ln	1728	1395	1777	1524	1728	1870
Q Serve(g_s), s	3.3	5.0	2.3	8.5	10.0	1.0
Cycle Q Clear(g_c), s	3.3	5.0	2.3	8.5	10.0	1.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	400	1941	543	416	2005	1462
V/C Ratio(X)	0.39	0.24	0.22	0.46	0.39	0.07
Avail Cap(c_a), veh/h	1024	2445	1026	623	2005	1462
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.80	0.80
Uniform Delay (d), s/veh	32.8	4.5	29.7	24.5	9.1	2.0
Incr Delay (d2), s/veh	0.6	0.1	0.2	0.8	0.0	0.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	4	6.9	1.0	3.6	3.3	0.2
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	33.4	4.5	29.9	25.3	9.2	2.1
LnGrp LOS	C	A	C	C	A	A
Approach Vol, veh/h	629		312		889	
Approach Delay, s/veh	11.6		27.1		8.4	
Approach LOS	B		C		A	
Timer - Assigned Phs			4		6	7 8
Phs Duration (G+Y+Rc), s			66.5		13.5	50.3 16.1
Change Period (Y+Rc), s			3.9		4.3	3.9 3.9
Max Green Setting (Gmax), s			48.1		23.7	21.1 23.1
Max Q Clear Time (g_c+I1), s			3.0		7.0	12.0 10.5
Green Ext Time (p_c), s			0.6		2.3	1.3 1.1
Intersection Summary						
HCM 6th Ctrl Delay			12.7			
HCM 6th LOS			B			
Notes						
User approved pedestrian interval to be less than phase max green.						

HCM 6th AWSC
1: Airway Dr & Industrial Dr

03/28/2023

Intersection													
Intersection Delay, s/veh	12.5												
Intersection LOS	B												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Vol, veh/h	39	58	9	105	85	62	5	127	144	85	197	49	
Future Vol, veh/h	39	58	9	105	85	62	5	127	144	85	197	49	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	39	58	9	105	85	62	5	127	144	85	197	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	10.5			12.5			11.7			13.7			
HCM LOS	B			B			B			B			
Lane	NBLn1	EBLn1	WBLn1	SBLn1									
Vol Left, %	2%	37%	42%	26%									
Vol Thru, %	46%	55%	34%	60%									
Vol Right, %	52%	8%	25%	15%									
Sign Control	Stop	Stop	Stop	Stop									
Traffic Vol by Lane	276	106	252	331									
LT Vol	5	39	105	85									
Through Vol	127	58	85	197									
RT Vol	144	9	62	49									
Lane Flow Rate	276	106	252	331									
Geometry Grp	1	1	1	1									
Degree of Util (X)	0.4	0.179	0.398	0.495									
Departure Headway (Hd)	5.214	6.066	5.681	5.383									
Convergence, Y/N	Yes	Yes	Yes	Yes									
Cap	687	588	630	665									
Service Time	3.273	4.138	3.74	3.439									
HCM Lane V/C Ratio	0.402	0.18	0.4	0.498									
HCM Control Delay	11.7	10.5	12.5	13.7									
HCM Lane LOS	B	B	B	B									
HCM 95th-tile Q	1.9	0.6	1.9	2.8									

HCM 6th TWSC
2: Airway Dr & Airway Ct

03/28/2023

Intersection												
Int Delay, s/veh	4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	0	2	107	0	54	0	212	78	44	277	0
Future Vol, veh/h	4	0	2	107	0	54	0	212	78	44	277	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	0	2	107	0	54	0	212	78	44	277	0

Major/Minor	Minor2	Minor1	Major1	Major2								
Conflicting Flow All	643	655	277	617	616	251	277	0	0	290	0	0
Stage 1	365	365	-	251	251	-	-	-	-	-	-	-
Stage 2	278	290	-	366	365	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	386	386	762	402	406	788	1286	-	-	1272	-	-
Stage 1	654	623	-	753	699	-	-	-	-	-	-	-
Stage 2	728	672	-	653	623	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	348	370	762	388	389	788	1286	-	-	1272	-	-
Mov Cap-2 Maneuver	348	370	-	388	389	-	-	-	-	-	-	-
Stage 1	654	597	-	753	699	-	-	-	-	-	-	-
Stage 2	678	672	-	625	597	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13.6	16.7	0	1.1
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1286	-	-	425	468	1272	-	-
HCM Lane V/C Ratio	-	-	-	0.014	0.344	0.035	-	-
HCM Control Delay (s)	0	-	-	13.6	16.7	7.9	0	-
HCM Lane LOS	A	-	-	B	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	1.5	0.1	-	-

HCM 6th Signalized Intersection Summary
3: Piner Rd & Airway Dr

03/28/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↕		↔	↕		↔	↕		↔	↕	
Traffic Volume (veh/h)	114	675	0	3	986	187	0	0	8	243	0	211
Future Volume (veh/h)	114	675	0	3	986	187	0	0	8	243	0	211
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No	No	No	No	No	No	No	No	No	No	No	No
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	114	675	0	3	986	168	0	0	3	243	0	151
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	148	1828	0	6	1315	224	0	0	4	344	0	306
Arrive On Green	0.08	0.51	0.00	0.00	0.43	0.43	0.00	0.00	0.00	0.19	0.00	0.19
Sat Flow, veh/h	1781	3647	0	1781	3025	515	0	0	1585	1781	0	1585
Grp Volume(v), veh/h	114	675	0	3	579	575	0	0	3	243	0	151
Grp Sat Flow(s), veh/h/ln	1781	1777	0	1781	1777	1763	0	0	1585	1781	0	1585
Q Serve(g_s), s	2.8	5.1	0.0	0.1	12.2	12.2	0.0	0.0	0.1	5.7	0.0	3.8
Cycle Q Clear(g_c), s	2.8	5.1	0.0	0.1	12.2	12.2	0.0	0.0	0.1	5.7	0.0	3.8
Prop In Lane	1.00	1.00	0.00	1.00	0.29	0.00	1.00	1.00	1.00	1.00	0.00	1.00
Lane Grp Cap(c), veh/h	148	1828	0	6	772	766	0	0	4	344	0	306
V/C Ratio(X)	0.77	0.37	0.00	0.51	0.75	0.75	0.00	0.00	0.84	0.71	0.00	0.49
Avail Cap(c_a), veh/h	680	2903	0	280	1452	1440	0	0	605	872	0	775
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	20.0	6.5	0.0	22.2	10.6	10.6	0.0	0.0	22.2	16.8	0.0	16.0
Incr Delay (d2), s/veh	3.2	0.0	0.0	23.7	0.6	0.6	0.0	0.0	93.8	1.0	0.0	0.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	1.1	1.2	0.0	0.1	3.4	3.4	0.0	0.0	0.1	2.0	0.0	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	23.2	6.5	0.0	45.9	11.1	11.1	0.0	0.0	116.0	17.8	0.0	16.5
LnGrp LOS	C	A	A	D	B	B	A	A	F	B	A	B
Approach Vol, veh/h	789			1157			3			394		
Approach Delay, s/veh	8.9			11.2			116.0			17.3		
Approach LOS	A			B			F			B		
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	3.1	26.5		11.8	6.7	23.0		3.1				
Change Period (Y+Rc), s	3.0	3.6		3.2	3.0	3.6		3.0				
Max Green Setting (Gmax), s	7.0	36.4		21.8	17.0	36.4		17.0				
Max Q Clear Time (g_c+I), s	2.1	7.1		7.7	4.8	14.2		2.1				
Green Ext Time (p_c), s	0.0	3.1		1.0	0.1	5.2		0.0				
Intersection Summary												
HCM 6th Ctrl Delay	11.6											
HCM 6th LOS	B											

HCM 6th Signalized Intersection Summary
4: Range Ave & Piner Rd

03/28/2023

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (veh/h)	175	805	109	197	987	157
Future Volume (veh/h)	175	805	109	197	987	157
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No	No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	175	770	109	197	987	145
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	655	1076	139	1647	1162	657
Arrive On Green	0.35	0.35	0.08	0.46	0.34	0.34
Sat Flow, veh/h	1870	1550	1781	3647	3456	1585
Grp Volume(v), veh/h	175	770	109	197	987	145
Grp Sat Flow(s), veh/h/ln	1870	1550	1781	1777	1728	1585
Q Serve(g_s), s	5.7	26.3	5.1	2.7	22.6	5.0
Cycle Q Clear(g_c), s	5.7	26.3	5.1	2.7	22.6	5.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	655	1076	139	1647	1162	657
V/C Ratio(X)	0.27	0.72	0.79	0.12	0.85	0.22
Avail Cap(c_a), veh/h	655	1076	210	1647	1561	840
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.96	0.96	1.00	1.00	0.91	0.91
Uniform Delay (d), s/veh	19.8	8.3	38.5	12.9	26.2	16.1
Incr Delay (d2), s/veh	1.0	3.9	10.6	0.1	7.2	0.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	17.1	2.6	1.1	10.0	1.9	
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	20.7	12.2	49.1	13.1	33.4	16.8
LnGrp LOS	C	B	D	B	C	B
Approach Vol, veh/h	945			306	1132	
Approach Delay, s/veh	13.8			25.9	31.3	
Approach LOS	B			C	C	
Timer - Assigned Phs	1	2			6	8
Phs Duration (G+Y+Rc), s	33.4				43.0	32.2
Change Period (Y+Rc), s	3.6				3.6	3.6
Max Green Setting (Gmax), s	26.4				39.4	38.4
Max Q Clear Time (g_c+I1), s	28.3				4.7	24.6
Green Ext Time (p_c), s	0.1	0.0			1.3	4.0

Intersection Summary

HCM 6th Ctrl Delay	23.6
HCM 6th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th Signalized Intersection Summary
5: Range Ave & Bicentennial Way

03/28/2023

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (veh/h)	402	961	185	228	688	236
Future Volume (veh/h)	402	961	185	228	688	236
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	402	846	185	125	688	236
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	618	2094	380	448	1976	1355
Arrive On Green	0.18	0.18	0.11	0.11	0.57	0.72
Sat Flow, veh/h	3456	2790	3647	1533	3456	1870
Grp Volume(v), veh/h	402	846	185	125	688	236
Grp Sat Flow(s), veh/h/ln	1728	1395	1777	1533	1728	1870
Q Serve(g_s), s	9.2	9.2	4.2	5.4	9.0	3.4
Cycle Q Clear(g_c), s	9.2	9.2	4.2	5.4	9.0	3.4
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	618	2094	380	448	1976	1355
V/C Ratio(X)	0.65	0.40	0.49	0.28	0.35	0.17
Avail Cap(c_a), veh/h	882	2307	966	700	1976	1355
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.75	0.75
Uniform Delay (d), s/veh	32.4	3.8	35.8	23.6	9.7	3.7
Incr Delay (d2), s/veh	1.2	0.1	1.0	0.3	0.0	0.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	12.5	1.8	2.5	3.1	1.1	
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	33.6	3.9	36.7	23.9	9.8	3.9
LnGrp LOS	C	A	D	C	A	A
Approach Vol, veh/h	1248		310		924	
Approach Delay, s/veh	13.5		31.6		8.3	
Approach LOS	B		C		A	
Timer - Assigned Phs			4		6	7 8
Phs Duration (G+Y+Rc), s			65.5		19.5	52.5 13.0
Change Period (Y+Rc), s			3.9		4.3	3.9 3.9
Max Green Setting (Gmax), s			55.1		21.7	28.1 23.1
Max Q Clear Time (g_c+I1), s			5.4		11.2	11.0 7.4
Green Ext Time (p_c), s			1.5		4.0	1.3 1.4

Intersection Summary

HCM 6th Ctrl Delay	13.8
HCM 6th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th AWSC
1: Airway Dr & Industrial Dr

03/28/2023

Intersection												
Intersection Delay, s/veh	9.8											
Intersection LOS	A											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	39	63	7	49	56	35	9	96	91	108	134	26
Future Vol, veh/h	39	63	7	49	56	35	9	96	91	108	134	26
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	39	63	7	49	56	35	9	96	91	108	134	26
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	9.3			9.5			9.3			10.6		
HCM LOS	A			A			A			B		
Lane	NBLn1	EBLn1	WBLn1	SBLn1								
Vol Left, %	5%	36%	35%	40%								
Vol Thru, %	49%	58%	40%	50%								
Vol Right, %	46%	6%	25%	10%								
Sign Control	Stop	Stop	Stop	Stop								
Traffic Vol by Lane	196	109	140	268								
LT Vol	9	39	49	108								
Through Vol	96	63	56	134								
RT Vol	91	7	35	26								
Lane Flow Rate	196	109	140	268								
Geometry Grp	1	1	1	1								
Degree of Util (X)	0.252	0.159	0.198	0.359								
Departure Headway (Hd)	4.634	5.249	5.093	4.825								
Convergence, Y/N	Yes	Yes	Yes	Yes								
Cap	768	676	697	740								
Service Time	2.706	3.338	3.177	2.892								
HCM Lane V/C Ratio	0.255	0.161	0.201	0.362								
HCM Control Delay	9.3	9.3	9.5	10.6								
HCM Lane LOS	A	A	A	B								
HCM 95th-tile Q	1	0.6	0.7	1.6								

HCM 6th TWSC
2: Airway Dr & Airway Ct

03/28/2023

Intersection												
Int Delay, s/veh	1.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	EBL EBT EBR WBL WBT WBR NBL NBT NBR SBL SBT SBR											
Traffic Vol, veh/h	0	0	0	19	0	14	7	190	69	30	164	4
Future Vol, veh/h	0	0	0	19	0	14	7	190	69	30	164	4
Conflicting Peds, #/hr	1	0	1	1	0	1	1	0	1	1	0	1
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None	-	None	-	None	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	19	0	14	7	190	69	30	164	4
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	474	501	168	467	469	227	169	0	0	260	0	0
Stage 1	227	227	-	240	240	-	-	-	-	-	-	-
Stage 2	247	274	-	227	229	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	501	472	876	506	492	812	1409	-	-	1304	-	-
Stage 1	776	716	-	763	707	-	-	-	-	-	-	-
Stage 2	757	683	-	776	715	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	480	456	874	493	476	810	1408	-	-	1303	-	-
Mov Cap-2 Maneuver	480	456	-	493	476	-	-	-	-	-	-	-
Stage 1	771	697	-	758	702	-	-	-	-	-	-	-
Stage 2	739	678	-	756	696	-	-	-	-	-	-	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			11.5			0.2			1.2		
HCM LOS	A			B								
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR				
Capacity (veh/h)	1408	-	-	-	591	1303	-	-				
HCM Lane V/C Ratio	0.005	-	-	-	0.056	0.023	-	-				
HCM Control Delay (s)	7.6	0	-	0	11.5	7.8	0	-				
HCM Lane LOS	A	A	-	A	B	A	A	-				
HCM 95th %tile Q(veh)	0	-	-	-	0.2	0.1	-	-				

HCM 6th Signalized Intersection Summary 3: Piner Rd & Airway Dr

03/28/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱			↱		↰	↱	↰
Traffic Volume (veh/h)	131	872	0	5	514	151	1	0	0	114	0	84
Future Volume (veh/h)	131	872	0	5	514	151	1	0	0	114	0	84
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	131	872	0	5	514	132	1	0	0	114	0	43
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	168	1483	0	10	919	235	6	0	0	202	0	178
Arrive On Green	0.09	0.42	0.00	0.01	0.33	0.33	0.00	0.00	0.00	0.11	0.00	0.11
Sat Flow, veh/h	1781	3647	0	1781	2799	715	1781	0	0	1781	0	1572
Grp Volume(v), veh/h	131	872	0	5	325	321	1	0	0	114	0	43
Grp Sat Flow(s),veh/h/ln	1781	1777	0	1781	1777	1738	1781	0	0	1781	0	1572
Q Serve(g_s), s	2.0	5.2	0.0	0.1	4.2	4.2	0.0	0.0	0.0	1.7	0.0	0.7
Cycle Q Clear(g_c), s	2.0	5.2	0.0	0.1	4.2	4.2	0.0	0.0	0.0	1.7	0.0	0.7
Prop In Lane	1.00		0.00	1.00		0.41	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	168	1483	0	10	584	571	6	0	0	202	0	178
V/C Ratio(X)	0.78	0.59	0.00	0.51	0.56	0.56	0.16	0.00	0.00	0.57	0.00	0.24
Avail Cap(c_a), veh/h	1096	4683	0	451	2341	2290	1096	0	0	1406	0	1241
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.2	6.2	0.0	13.7	7.6	7.6	13.8	0.0	0.0	11.6	0.0	11.2
Incr Delay (d2), s/veh	3.0	0.1	0.0	14.8	0.3	0.3	4.1	0.0	0.0	0.9	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.8	0.0	0.1	0.9	0.9	0.0	0.0	0.0	0.5	0.0	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	15.2	6.4	0.0	28.5	7.9	8.0	17.8	0.0	0.0	12.5	0.0	11.4
LnGrp LOS	B	A	A	C	A	A	B	A	A	B	A	B
Approach Vol, veh/h	1003			651			1			157		
Approach Delay, s/veh	7.5			8.1			17.8			12.2		
Approach LOS	A			A			B			B		
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	3.2	15.1		6.3	5.6	12.7		3.0				
Change Period (Y+Rc), s	3.0	3.6		3.2	3.0	3.6		3.0				
Max Green Setting (Gmax), s	7.0	36.4		21.8	17.0	36.4		17.0				
Max Q Clear Time (g_c+I), s	2.1	7.2		3.7	4.0	6.2		2.0				
Green Ext Time (p_c), s	0.0	4.3		0.4	0.1	2.6		0.0				
Intersection Summary												
HCM 6th Ctrl Delay	8.1											
HCM 6th LOS	A											

HCM 6th Signalized Intersection Summary 4: Range Ave & Piner Rd

03/28/2023

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱	↱	↰	↱	↰	↱
Traffic Volume (veh/h)	173	803	88	82	612	78
Future Volume (veh/h)	173	803	88	82	612	78
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		0.98	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	173	751	88	82	612	66
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	987	1158	115	2239	739	441
Arrive On Green	0.53	0.53	0.06	0.63	0.21	0.21
Sat Flow, veh/h	1870	1551	1781	3647	3456	1585
Grp Volume(v), veh/h	173	751	88	82	612	66
Grp Sat Flow(s),veh/h/ln	1870	1551	1781	1777	1728	1585
Q Serve(g_s), s	3.8	19.4	3.9	0.7	13.5	2.5
Cycle Q Clear(g_c), s	3.8	19.4	3.9	0.7	13.5	2.5
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	987	1158	115	2239	739	441
V/C Ratio(X)	0.18	0.65	0.76	0.04	0.83	0.15
Avail Cap(c_a), veh/h	987	1158	379	2239	968	546
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.93	0.93	1.00	1.00	0.98	0.98
Uniform Delay (d), s/veh	9.8	5.2	36.8	5.6	30.0	21.7
Incr Delay (d2), s/veh	0.4	2.6	10.0	0.0	10.1	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5	11.9	2.0	0.2	6.5	1.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	10.2	7.8	46.9	5.6	40.2	22.4
LnGrp LOS	B	A	D	A	D	C
Approach Vol, veh/h	924		170		678	
Approach Delay, s/veh	8.2		27.0		38.5	
Approach LOS	A		C		D	
Timer - Assigned Phs	1	2		6		8
Phs Duration (G+Y+Rc), s	45.8		54.0		20.7	
Change Period (Y+Rc), s	3.6		3.6		3.6	
Max Green Setting (Gmax), s	30.4		50.4		22.4	
Max Q Clear Time (g_c+I), s	21.4		2.7		15.5	
Green Ext Time (p_c), s	0.1	3.1	0.5		1.6	
Intersection Summary						
HCM 6th Ctrl Delay	21.6					
HCM 6th LOS	C					

HCM 6th Signalized Intersection Summary
5: Range Ave & Bicentennial Way

03/28/2023

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	159	571	119	322	793	97
Future Volume (veh/h)	159	571	119	322	793	97
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.96	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No	No	No	No	No	No
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	159	475	119	194	793	97
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	401	1940	545	418	2002	1462
Arrive On Green	0.12	0.12	0.15	0.15	0.58	0.78
Sat Flow, veh/h	3456	2790	3647	1524	3456	1870
Grp Volume(v), veh/h	159	475	119	194	793	97
Grp Sat Flow(s), veh/h/ln	1728	1395	1777	1524	1728	1870
Q Serve(g_s), s	3.4	5.0	2.3	8.5	10.0	1.0
Cycle Q Clear(g_c), s	3.4	5.0	2.3	8.5	10.0	1.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	401	1940	545	418	2002	1462
V/C Ratio(X)	0.40	0.24	0.22	0.46	0.40	0.07
Avail Cap(c_a), veh/h	1024	2443	1026	624	2002	1462
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.80	0.80
Uniform Delay (d), s/veh	32.8	4.5	29.7	24.5	9.2	2.0
Incr Delay (d2), s/veh	0.6	0.1	0.2	0.8	0.0	0.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	4	6.9	1.0	3.6	3.3	0.2
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	33.4	4.5	29.9	25.3	9.2	2.1
LnGrp LOS	C	A	C	C	A	A
Approach Vol, veh/h	634		313		890	
Approach Delay, s/veh	11.8		27.0		8.4	
Approach LOS	B		C		A	

Intersection Summary						
HCM 6th Ctrl Delay		12.8				
HCM 6th LOS		B				

Notes
User approved pedestrian interval to be less than phase max green.

HCM 6th AWSC
1: Airway Dr & Industrial Dr

03/28/2023

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	39	60	9	105	87	62	5	129	144	85	201	49
Future Vol, veh/h	39	60	9	105	87	62	5	129	144	85	201	49
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	39	60	9	105	87	62	5	129	144	85	201	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	10.5	12.6	11.9	13.9
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	2%	36%	41%	25%
Vol Thru, %	46%	56%	34%	60%
Vol Right, %	52%	8%	24%	15%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	278	108	254	335
LT Vol	5	39	105	85
Through Vol	129	60	87	201
RT Vol	144	9	62	49
Lane Flow Rate	278	108	254	335
Geometry Grp	1	1	1	1
Degree of Util (X)	0.405	0.183	0.403	0.503
Departure Headway (Hd)	5.244	6.096	5.709	5.408
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	684	585	627	663
Service Time	3.303	4.17	3.769	3.464
HCM Lane V/C Ratio	0.406	0.185	0.405	0.505
HCM Control Delay	11.9	10.5	12.6	13.9
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	2	0.7	1.9	2.8

HCM 6th TWSC
2: Airway Dr & Airway Ct

03/28/2023

Intersection												
Int Delay, s/veh	4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	0	2	107	0	54	0	214	78	44	281	0
Future Vol, veh/h	4	0	2	107	0	54	0	214	78	44	281	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	0	2	107	0	54	0	214	78	44	281	0

Major/Minor	Minor2	Minor1	Major1	Major2								
Conflicting Flow All	649	661	281	623	622	253	281	0	0	292	0	0
Stage 1	369	369	-	253	253	-	-	-	-	-	-	-
Stage 2	280	292	-	370	369	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	383	383	758	398	403	786	1282	-	-	1270	-	-
Stage 1	651	621	-	751	698	-	-	-	-	-	-	-
Stage 2	727	671	-	650	621	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	345	367	758	384	386	786	1282	-	-	1270	-	-
Mov Cap-2 Maneuver	345	367	-	384	386	-	-	-	-	-	-	-
Stage 1	651	596	-	751	698	-	-	-	-	-	-	-
Stage 2	677	671	-	622	596	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13.7	16.8	0	1.1
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1282	-	-	422	464	1270	-	-
HCM Lane V/C Ratio	-	-	-	0.014	0.347	0.035	-	-
HCM Control Delay (s)	0	-	-	13.7	16.8	7.9	0	-
HCM Lane LOS	A	-	-	B	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	1.5	0.1	-	-

HCM 6th Signalized Intersection Summary
3: Piner Rd & Airway Dr

03/28/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	115	675	0	3	986	188	0	0	8	245	0	213
Future Volume (veh/h)	115	675	0	3	986	188	0	0	8	245	0	213
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No	No	No	No	No	No	No	No	No	No	No	No
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	115	675	0	3	986	169	0	0	3	245	0	153
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	149	1830	0	6	1313	225	0	0	4	346	0	308
Arrive On Green	0.08	0.51	0.00	0.00	0.43	0.43	0.00	0.00	0.00	0.19	0.00	0.19
Sat Flow, veh/h	1781	3647	0	1781	3022	517	0	0	1585	1781	0	1585
Grp Volume(v), veh/h	115	675	0	3	579	576	0	0	3	245	0	153
Grp Sat Flow(s), veh/h/ln	1781	1777	0	1781	1777	1763	0	0	1585	1781	0	1585
Q Serve(g_s), s	2.8	5.1	0.0	0.1	12.3	12.3	0.0	0.0	0.1	5.8	0.0	3.9
Cycle Q Clear(g_c), s	2.8	5.1	0.0	0.1	12.3	12.3	0.0	0.0	0.1	5.8	0.0	3.9
Prop In Lane	1.00	1.00	0.00	1.00	0.29	0.00	1.00	1.00	1.00	1.00	0.00	1.00
Lane Grp Cap(c), veh/h	149	1830	0	6	772	766	0	0	4	346	0	308
V/C Ratio(X)	0.77	0.37	0.00	0.51	0.75	0.75	0.00	0.00	0.85	0.71	0.00	0.50
Avail Cap(c_a), veh/h	676	2888	0	278	1444	1433	0	0	602	867	0	771
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	20.1	6.5	0.0	22.3	10.6	10.6	0.0	0.0	22.3	16.9	0.0	16.1
Incr Delay (d2), s/veh	3.2	0.0	0.0	23.7	0.6	0.6	0.0	0.0	95.1	1.0	0.0	0.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	1.1	1.2	0.0	0.1	3.5	3.5	0.0	0.0	0.1	2.1	0.0	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	23.3	6.6	0.0	46.0	11.2	11.2	0.0	0.0	117.5	17.9	0.0	16.6
LnGrp LOS	C	A	A	D	B	B	A	A	F	B	A	B
Approach Vol, veh/h	790			1158			3			398		
Approach Delay, s/veh	9.0			11.3			117.5			17.4		
Approach LOS	A			B			F			B		
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	3.1	26.7		11.9	6.8	23.1		3.1				
Change Period (Y+Rc), s	3.0	3.6		3.2	3.0	3.6		3.0				
Max Green Setting (Gmax), s	7.0	36.4		21.8	17.0	36.4		17.0				
Max Q Clear Time (g_c+I), s	2.1	7.1		7.8	4.8	14.3		2.1				
Green Ext Time (p_c), s	0.0	3.1		1.0	0.1	5.2		0.0				

Intersection Summary												
HCM 6th Ctrl Delay	11.7											
HCM 6th LOS	B											

HCM 6th Signalized Intersection Summary 4: Range Ave & Piner Rd

03/28/2023

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (veh/h)	175	805	109	197	987	157
Future Volume (veh/h)	175	805	109	197	987	157
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	175	770	109	197	987	145
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	655	1076	139	1647	1162	657
Arrive On Green	0.35	0.35	0.08	0.46	0.34	0.34
Sat Flow, veh/h	1870	1550	1781	3647	3456	1585
Grp Volume(v), veh/h	175	770	109	197	987	145
Grp Sat Flow(s), veh/h/ln	1870	1550	1781	1777	1728	1585
Q Serve(g_s), s	5.7	26.3	5.1	2.7	22.6	5.0
Cycle Q Clear(g_c), s	5.7	26.3	5.1	2.7	22.6	5.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	655	1076	139	1647	1162	657
V/C Ratio(X)	0.27	0.72	0.79	0.12	0.85	0.22
Avail Cap(c_a), veh/h	655	1076	210	1647	1561	840
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.96	0.96	1.00	1.00	0.91	0.91
Uniform Delay (d), s/veh	19.8	8.3	38.5	12.9	26.2	16.1
Incr Delay (d2), s/veh	1.0	3.9	10.6	0.1	7.2	0.7
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	17.1	2.6	1.1	10.0	1.9	
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	20.7	12.2	49.1	13.1	33.4	16.8
LnGrp LOS	C	B	D	B	C	B
Approach Vol, veh/h	945			306	1132	
Approach Delay, s/veh	13.8			25.9	31.3	
Approach LOS	B			C	C	
Timer - Assigned Phs	1	2			6	8
Phs Duration (G+Y+Rc), s	33.4				43.0	32.2
Change Period (Y+Rc), s	3.0	3.6			3.6	3.6
Max Green Setting (Gmax), s	26.4				39.4	38.4
Max Q Clear Time (g_c+I1), s	28.3				4.7	24.6
Green Ext Time (p_c), s	0.1	0.0			1.3	4.0
Intersection Summary						
HCM 6th Ctrl Delay			23.6			
HCM 6th LOS			C			
Notes						
User approved pedestrian interval to be less than phase max green.						

HCM 6th Signalized Intersection Summary 5: Range Ave & Bicentennial Way

03/28/2023

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (veh/h)	402	961	185	228	688	236
Future Volume (veh/h)	402	961	185	228	688	236
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	402	846	185	125	688	236
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	618	2094	380	448	1976	1355
Arrive On Green	0.18	0.18	0.11	0.11	0.57	0.72
Sat Flow, veh/h	3456	2790	3647	1533	3456	1870
Grp Volume(v), veh/h	402	846	185	125	688	236
Grp Sat Flow(s), veh/h/ln	1728	1395	1777	1533	1728	1870
Q Serve(g_s), s	9.2	9.2	4.2	5.4	9.0	3.4
Cycle Q Clear(g_c), s	9.2	9.2	4.2	5.4	9.0	3.4
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	618	2094	380	448	1976	1355
V/C Ratio(X)	0.65	0.40	0.49	0.28	0.35	0.17
Avail Cap(c_a), veh/h	882	2307	966	700	1976	1355
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.75	0.75
Uniform Delay (d), s/veh	32.4	3.8	35.8	23.6	9.7	3.7
Incr Delay (d2), s/veh	1.2	0.1	1.0	0.3	0.0	0.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	12.5	1.8	2.5	3.1	1.1	
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	33.6	3.9	36.7	23.9	9.8	3.9
LnGrp LOS	C	A	D	C	A	A
Approach Vol, veh/h	1248		310		924	
Approach Delay, s/veh	13.5		31.6		8.3	
Approach LOS	B		C		A	
Timer - Assigned Phs			4		6	7 8
Phs Duration (G+Y+Rc), s			65.5		19.5	52.5 13.0
Change Period (Y+Rc), s			3.9		4.3	3.9 3.9
Max Green Setting (Gmax), s			55.1		21.7	28.1 23.1
Max Q Clear Time (g_c+I1), s			5.4		11.2	11.0 7.4
Green Ext Time (p_c), s			1.5		4.0	1.3 1.4
Intersection Summary						
HCM 6th Ctrl Delay			13.8			
HCM 6th LOS			B			
Notes						
User approved pedestrian interval to be less than phase max green.						