



January 20, 2025

Mr. Robert Armijo, PE
City Engineer
City of Richmond
450 Civic Center Plaza
Richmond, CA 94804-1630

DRAFT Traffic Safety Study for Dollar Tree Project Area - Phase 1

Dear Mr. Armijo;

As requested, W-Trans has prepared a safety study for the Dollar Tree Project Area. The purpose of this letter is to address the safety concerns expressed by City staff and residents. This is Phase 1 of a two phase study, to represent conditions prior to the store opening. Traffic conditions will be re-evaluated after the store is open, including traffic counts, speeds, and vehicle queues. Additional recommendations will be made with respect to safety and traffic using local neighborhood streets.

Project Description and Study Area

The former used car dealership at 12300 San Pablo Avenue (vacant since 2017) has been replaced with a 13,383 square foot Dollar Tree store and 10,800 square foot parking lot with 33 vehicle parking spaces and six bicycle parking spaces. This project has been built but is not yet occupied. Access will be provided via a single existing driveway on San Pablo Avenue approximately 140 feet north of Barrett Avenue with entering and exiting traffic restricted to right turns only, with the exception of delivery trucks.

The study area consists of San Pablo Avenue along the project site's frontage, McLaughlin Avenue, Key Boulevard, and the following two intersections:

1. San Pablo Avenue/Barrett Avenue
2. San Pablo Avenue/Roosevelt Avenue/I-80 North Ramps

Trip Generation

The anticipated trip generation for the proposed use was estimated using standard rates published by the Institute of Transportation Engineers (ITE) in *Trip Generation Manual*, 10th Edition, 2017. A review of available land use descriptions contained in the ITE manual identified the use most closely aligned with the proposed project would be "Free-Standing Discount Store" (ITE LU 815).

Pass-by Trips

Some portion of traffic associated with the proposed Dollar Tree Store would be drawn from existing traffic on San Pablo Avenue. These vehicle trips are not considered "new," but are instead comprised of drivers who are already driving on the adjacent street system and choose to make an interim stop and are referred to as "pass-by." According to the ITE *Trip Generation Manual* the average percentage of these pass-by trips for a "Free-Standing Discount Store" land use would be 17 percent. However, to provide a conservative estimate, a lower rate of 15 percent was applied as a deduction to the overall trips generated by the project. At the proposed project site, pass-by trips would in essence be "captured" from traffic on San Pablo Avenue.

Total Project Trip Generation

The expected trip generation potential for the proposed project is indicated in Table 1. The proposed Dollar Tree Store is expected to generate 604 net-new daily trips, including 14 trips during the a.m. peak hour and 55 trips during the p.m. peak hour.

Table 1 – Trip Generation Summary

Land Use	Units	Daily		AM Peak Hour			PM Peak Hour				
		Rate	Trips	Rate	Trips	In	Out	Rate	Trips	In	Out
Free-Standing Discount Store	13.383 ksf	53.12	711	1.17	16	11	5	4.83	65	32	33
<i>Pass-by (-15%)</i>			<i>-107</i>		<i>-2</i>	<i>-2</i>	<i>0</i>		<i>-10</i>	<i>-5</i>	<i>-5</i>
Net New Trips			604		14	9	5		55	27	28

Note: ksf = 1,000 square feet

Trip Distribution

The pattern used to allocate project trips to the surrounding street network was based on recent turning movement counts collected for the two study intersections. For both peak hours, the total arrivals (inbound) and departures (outbound) for the north, south, and west legs of San Pablo Avenue/Barrett Avenue were divided by the overall arrival and departure volumes of those legs to get the inbound and outbound percentages which were then rounded to the nearest five percent. Trip distribution assumptions and resulting trips are shown in Table 2.

Table 2 – Trip Distribution Assumptions

Route	Percent (In/Out)	AM Trips		PM Trips	
		Inbound	Outbound	Inbound	Outbound
San Pablo Ave (North)	30/60	3	3	8	17
San Pablo Ave (South)	35/30	3	2	10	8
Barrett Ave (West)	35/10	3	0	9	3
TOTAL	100/100	9	5	27	28

Collision History

The collision history for each study intersection was reviewed to determine any trends or patterns that may indicate a safety issue in the study area. 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 July 1, 2018, through June 30, 2023.

As presented in Table 3, the calculated collision rates for the study intersections were compared to average collision rates for similar facilities statewide, as indicated in *2022 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 (four or five), and the same controls (two-way stop or traffic signal). The collision rate calculations are enclosed.

Table 3 – Collision Rates for the Study Intersections

Study Intersection	Number of Collisions (2018-2023)	Calculated Collision Rate (c/mve)	Statewide Average Collision Rate (c/mve)
1. San Pablo Ave/Barrett Ave	11	0.25	0.33
2. San Pablo Ave/Roosevelt Ave/I-80 Ramps	21	0.46	0.33

Note: c/mve = collisions per million vehicles entering; **Bold** text = rates higher than statewide average

San Pablo Avenue/Barrett Avenue had a collision rate lower than the statewide average. The most common primary collision factors were unsafe speeds and improper turning. Out of the 11 collisions within the five-year study period, three were rear-end collisions, with two out of the three rear-end collisions involving both vehicles traveling east, and one collision involving a northbound vehicle making a left-turn and a northbound driver making a u-turn.

The collision rate at San Pablo Avenue/Roosevelt Ave/I-80 Ramps was higher than the statewide average. The most common primary collision factor listed was improper turning, followed by auto right-of-way violations and unsafe lane changes. There were eight sideswipe collisions, all attributable to improper turning and unsafe lane changes. There were also two rear-end collisions, both attributable to unsafe speeds. The middle northbound lane is currently marked on the pavement as a shared through-right lane, and the right most lane is marked on the pavement for those turning right onto Roosevelt Avenue or making a slight right onto I-80 eastbound.

It is recommended to differentiate the appropriate movements on northbound San Pablo Avenue that I-80 interstate shield symbols be added to the pavement in advance of the intersection, indicating proper lane use. In addition, regulatory signs (R3-8) should be added to the traffic signal mast arm facing northbound traffic indicating the lane assignments, These recommendations are intended to reduce the incidence of side swipe collisions.

This recommendation would have to be approved by Caltrans as this intersection is within their jurisdiction. It is noted that the addition of signs on the mast arm, if approved, may require modifications to the signal pole or mast arm.

Recommendation – The City should initiate a discussion with Caltrans regarding the addition of interstate shields on northbound San Pablo Avenue approaching the intersection as well as regulatory signs on the mast arm.

Site Access and Driveway Analysis

The proposed project would be accessed via an existing driveway on San Pablo Avenue located approximately 140 feet north of Barrett Avenue. All vehicle movements are currently allowed into and out of the driveway.

Speed data for northbound San Pablo Avenue between Barrett Avenue and Roosevelt Avenue was collected on Wednesday, December 11, 2024; a copy is enclosed. Northbound 85th percentile speeds were measured

to be 30 mph in the inside lane, 33 mph in the middle lane, and 32 mph in the outside lane. The measured critical speeds of the two outside lanes are close to the expected speeds when there is a posted speed limit of 30 mph. As such, no measures to reduce speed are warranted in this area.

Left turns into the project site may be challenging, however, due to the number of lanes drivers would need to cross, the location of the driveway within the left-turn lane for the intersection at Barrett Avenue (but without a dedicated left turn lane for the site driveway itself), and the availability of gaps in the northbound traffic flow on San Pablo Avenue. Restricting left turns would reduce the number of vehicles crossing San Pablo Avenue, which in turn would also decrease the number of conflicting movements between left-turning vehicles and vehicles traveling north on San Pablo Avenue.

Delivery trucks entering the project site, however, will need to turn left from southbound San Pablo Avenue to enter the parking lot and then make a right-angle turn to the left in order to back into the loading area. The existing driveway location and proposed parking lot layout accommodate the truck maneuvers completely on site. Trucks exiting the site would be able to pull straight out and turn right onto San Pablo Avenue. As such, the current driveway location is appropriate to maintain an efficient and adequate delivery truck operation, with turning movements accommodated within the site. Although there is a permitted southbound U-turn at the San Pablo Avenue/Barrett Avenue intersection, delivery trucks would not be able to easily make the U-turn maneuver in one motion, which in turn could result in delays at the intersection for other motorists. Therefore, left-turn inbound access from the north should be maintained for truck delivery trips only. Deliveries will be scheduled during off-peak hours when traffic demand on San Pablo Avenue is lower to prevent left turns during busy hours.

As there are no physical barriers or signs preventing left turns, there is still a potential of left turns being made into and out of the project site. To prevent left turns out of the project site, a no left turn sign (MUTCD R3-2) should be placed to the right of the driveway, visible to drivers exiting the site. For drivers entering the project site, a no left turn sign and an "EXCEPT TRUCKS" (modified R118(CA)) plaque should be placed approximately 20 feet south of the beginning of the centerline within the raised median. Additionally, mountable curbs should be placed at the centerline on San Pablo Avenue for a length of 20 feet in front of the driveway.

Findings – Left turns into the project site should be restricted for all vehicles except for delivery trucks.

Recommendation – To discourage left-turn movements into and out of the project site, a no left turn (R3-2) sign should be placed to the north of the driveway, in addition to a no left turn sign and an "EXCEPT TRUCKS" (modified R118(CA)) plaque placed approximately 20 feet south of the beginning of the centerline barrier on San Pablo Avenue. Mountable curbs should be placed at the centerline on San Pablo Avenue for a length of 20 feet in front of the project driveway.

Sight Distance and Driveway Location

At driveways, a substantially clear line of sight should be maintained between the driver of a vehicle waiting on the driveway and the driver of an approaching vehicle. Sight distances along San Pablo Avenue at the project driveway were evaluated based on sight distance criteria contained in the *Highway Design Manual* published by Caltrans. Though there is no recommended sight distance for driveway approaches, the adequacy of sight lines was evaluated based on stopping sight distance using the approach travel speed as the basis for determining the recommended sight distance. Based on the measured 85th percentile speeds

on San Pablo Avenue near the project site, a design speed of 35 mph was used. Therefore, the minimum stopping sight distance needed is 250 feet.

Available sight lines were measured using aerial photographs and estimated to exceed 250 feet at the driveway for both directions of San Pablo Avenue, though sight lines only to the south are relevant given the left-turn restriction for outbound traffic. This exceeds the minimum sight distance requirements. Further, the nearby signalized intersection of San Pablo Avenue/Barrett Avenue would meter northbound vehicle arrivals to the area adjacent to the driveway and create regular gaps in the traffic flow, which would facilitate movements by vehicles exiting the project site.

The project driveway is located adjacent to an AC Transit bus stop that is just south of the driveway. Therefore, when buses are present drivers in the parking lot would have to temporarily wait to be able to see oncoming traffic from the south before exiting onto San Pablo Avenue. Also, drivers entering the site would wait behind the bus before turning into the parking lot. It is recommended that this bus stop be relocated outside of the vision triangle of a driver waiting on the driveway approach, which is denoted graphically in Plate 1.

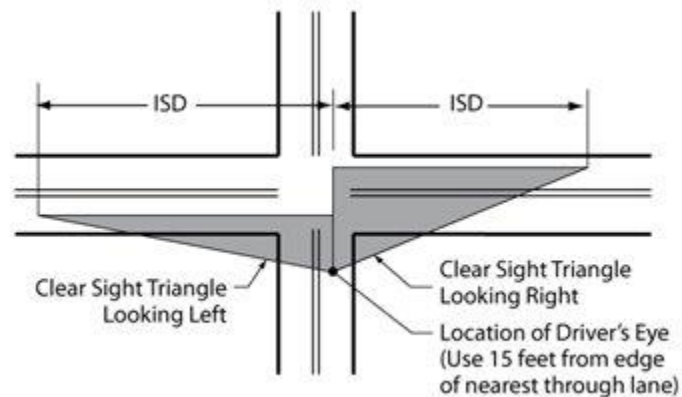


Plate 1 Vision Triangle Graphic

There have been recent discussions between City staff and AC Transit regarding the bus stop relocation, and further coordination is planned. It is noted, however, that the bus stop is located within a section where the cross-section is transitioning to three northbound lanes so there is currently sufficient width for a bus to stop without impeding northbound traffic. The bus stop should be moved as far south as possible without restricting through traffic flow, with consideration given to relocating the bus stop to the near (south) side of the San Pablo Avenue/Barrett Avenue intersection.

Findings – Site access and sight lines at the project driveway are adequate, although buses stopping at the existing AC Transit bus stop would temporarily obstruct sight lines.

Recommendation – The existing AC Transit bus stop should be relocated outside of the vision triangle of a driver waiting on the driveway approach if feasible without impeding through traffic.

San Pablo Avenue Pavement Delineation

The current lane configuration for northbound San Pablo Avenue in the vicinity of the project driveway is comprised of two 12-foot-wide travel lanes and a 16-foot-wide area that is part of the transition to a third northbound lane that begins just north of the project's driveway. Drivers making an eastbound left from the outer left-turn lane on Barrett Avenue have been observed making a wide turn into the shoulder area.

To clearly delineate vehicle pathways and separate routes for vehicles entering and exiting the proposed project's driveway, further study is recommended (such as a truck turning template analysis), which may include modifying the existing lane configuration to include three 10- to 12-foot-wide travel lanes in the immediate vicinity of the project driveway. It is noted that any changes to roadway striping and standards would require Caltrans design review and approval since San Pablo Avenue is under their jurisdiction.

Findings – The pavement striping along northbound San Pablo Avenue at the project driveway includes a travel lane and transition to a third northbound lane which lacks clear delineation.

Recommendation – Further study of the lane striping on San Pablo Avenue is recommended, which may include modifying the existing lane configuration to include three 10- to 12-foot-wide travel lanes in the immediate vicinity of the project driveway. It is noted that Caltrans involvement is necessary since San Pablo Avenue is under the jurisdiction of Caltrans.

Traffic on McLaughlin Street and Key Boulevard

Traffic volumes on McLaughlin Street and Key Boulevard were gathered to document the existing demand prior to the opening of the proposed store. To document any potential future change in traffic demand on these nearby streets, the existing daily traffic volumes were counted on McLaughlin Street and Key Boulevard between Barrett Avenue and Roosevelt Avenue on Wednesday, December 11, 2024.

The existing traffic volumes on these streets were observed to be 764 vehicles per day along McLaughlin Street and 3,209 vehicles per day along Key Boulevard. The traffic volumes on these same streets will be counted again after the store opens and has been operational for a while to document any potential change in traffic volumes on each street. Copies of these existing traffic counts are enclosed.

Concern has been raised about the potential for increased traffic on Roosevelt Avenue and McLaughlin Street that is associated with Dollar Tree patrons wanting to travel south upon exiting the store parking lot. In addition to measuring the potential change in traffic volumes on each street, a "Local Traffic Only" sign may discourage cut-through traffic. It is noted that all streets in the area are public and therefore legally accessible to all motorists.

Recommendation - It is recommended that a "Local Traffic Only" sign be installed on eastbound Roosevelt Avenue just east of San Pablo Avenue to discourage cut-through traffic.

Effect on Vehicle Queueing

The potential effect on queueing was assessed. An increase in queue length due to project traffic would be considered a significant traffic impact if the increase would cause the queue to extend out of a dedicated turn lane into a through traffic lane, or the back of queue into a visually restricted area, such as a blind corner. If queues would already be expected to extend past a dedicated turn lane or into a visually restricted

area without project traffic, the addition of project traffic would be considered a potentially significant impact only if it would cause new unacceptable conditions; in other words, if the queue were already beyond the turn lane and the project would cause it to stack into an adjacent intersection or a visually restricted area, and that would not occur without the project, then it would be considered an impact.

Under each scenario, the projected 95th-percentile queues in turn pockets at the study intersections were determined using the SIMTRAFFIC application of Synchro and averaging the 95th-percentile projected queue for each of ten runs. Summarized in Table 4 are the existing and predicted future queue lengths for all dedicated turn lanes. Copies of the queueing calculations are enclosed.

Table 4 – 95th-Percentile Queues in Dedicated Turn Lanes					
Study Intersection Approach	Available Storage	95th Percentile Queues			
		AM Peak Hour		PM Peak Hour	
		E	E+P	E	E+P
1. San Pablo Ave/Barrett Ave					
<i>NB Left Turn</i>	185	105	104	167	161
<i>SB Left Turn</i>	225	138	163	99	114
2. San Pablo Ave/Roosevelt Ave/1-80 Ramps					
<i>SB Left Turn</i>	170	174	170	83	95
<i>EB Left Turn</i>	250	167	149	323	320

Notes: 95th-Percentile Queues based on the average of the 95th-percentile queues from ten SIMTRAFFIC runs; all distances are measured in feet; E = Existing Conditions; E+P = Existing plus Project Conditions; **Bold** text = queue length exceeds available storage

In some cases, queues are predicted to decrease slightly with project traffic added to existing volumes compared to without-project conditions. This is attributed to the stochastic nature of the modeling wherein traffic is randomly seeded and the average of ten runs is reported, occasionally resulting in shorter queues with project traffic than without it. However, as these reductions are nominal, the practical impact of the project is projected to be negligible.

The addition of project-generated trips is not projected to result in any queues to extend past available storage. Therefore, its impact on queueing would be considered less than significant.

Finding – The project is not projected to result in any queues to exceed available storage. This will be re-measured after the store is open.

Intersection Impacts

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.

San Pablo Avenue/Barrett Avenue was evaluated using the signalized methodology from the *Highway Capacity Manual* (HCM), Transportation Research Board, 6th Edition. Because San Pablo Avenue/Roosevelt Avenue/I-80 Ramps has five approaches, it cannot be evaluated using the HCM 6th Edition signalized methodology, so it was evaluated using the HCM 2000 methodology. Actual signal timing from the City of Richmond was used for San Pablo Avenue/Barrett Avenue. A request for current traffic signal timing sheets for the intersection of San Pablo Avenue/Roosevelt Avenue/I-80 Ramps was submitted to Caltrans, but as timing sheets have not yet been received, this intersection was analyzed assuming "optimized" operation according to the default parameters contained in the Synchro software.

The City of Richmond has established criteria to determine the acceptability of effects on traffic operation based on standards set in the *West County Action Plan for Routes of Regional Significance* by the West Contra Costa Transportation Advisory Committee (WCCTAC) and the *Richmond General Plan 2030*. Based on these planning documents, the effect on traffic operation is considered to be adverse if the project is expected to cause any facilities to operate at an unacceptable LOS (LOS E or F). If an intersection is projected to operate at or over capacity (i.e., LOS E or F) without the project, and the project is expected to increase the average control delay by more than 5 seconds or deteriorates from LOS E to LOS F, the effect on operation would be considered adverse.

Intersection Levels of Service

The Existing Conditions scenario provides an evaluation of current operation based on existing traffic volumes during the a.m. and p.m. peak periods, while Existing plus Project Conditions includes project-generated traffic volumes. Volume data was collected on Wednesday, December 11, 2024, while local schools were in session. Under existing volumes, each study intersection would continue to operate at LOS D (or better) with and without the addition of project-generated trips. A summary of the intersection Level of Service calculations is contained in Table 5. The existing traffic volumes and copies of the calculations are enclosed.

Table 5 – Existing and Existing plus Project Peak Hour Intersection Levels of Service									
Study Intersection	Existing Conditions				Existing plus Project				
	AM Peak		PM Peak		AM Peak		PM Peak		
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	
1. San Pablo Ave/Barrett Ave	34.7	C	40.7	D	34.8	C	41.2	D	
2. San Pablo Ave/Roosevelt Ave/I-80 Ramps	8.7	A	17.1	B	8.6	A	16.8	B	

Note: Delay is measured in average seconds per vehicle; LOS = Level of Service

It should be noted that with the addition of project-related traffic volumes, average delay at San Pablo Avenue/Roosevelt Avenue/I-80 Ramps is projected to slightly decrease during both peak hours. 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. The project would add traffic predominantly to the northbound and southbound through movements, which have average delays that are lower than the average for the intersection as a whole, resulting in a slight reduction in the overall average delay. 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.

One of the conditions of approval for the Dollar Tree store is to place an additional tree well on the north side of eastbound Barrett Avenue just east of San Pablo Avenue. A field investigation of this location was conducted and concluded that any additional trees on Barrett Avenue in this area would obscure the visibility of the traffic signal heads as well as site distance at the corner of the intersection with San Pablo Avenue. This would potentially affect the intersection operations as well as safety for vehicles approaching the intersection. As such, no additional tree wells should be placed on the north side of eastbound Barrett Avenue near the intersection approaching San Pablo Avenue.

Finding – The study intersections are currently operating acceptably and are expected to continue doing so with the addition of project-generated traffic. This will be re-evaluated after the store is open.

Recommendation – It is recommended that no additional tree wells be placed on the north side of eastbound Barrett Avenue near the intersection approaching San Pablo Avenue.

Conclusions

- The Dollar Tree Store is expected to generate an average of 604 net-new daily trips, including 14 trips during the a.m. peak hour and 55 trips during the p.m. peak hour.
- The crash rate for the intersection of San Pablo Avenue/Roosevelt Ave/I-80 Ramps was higher than the statewide average for similar facilities. The crash rate for the intersection of San Pablo Avenue/Barrett Avenue was lower than the statewide average.
- Site access and sight lines at the project driveway are adequate, although buses stopping at the existing AC Transit bus stop would obstruct sight lines.
- The current lane configuration for northbound San Pablo Avenue in the vicinity of the project driveway is comprised of two 12-foot-wide travel lanes and a 16-foot-wide area that is part of the transition to a third northbound lane that begins just north of the project's driveway.
- The existing traffic volumes on nearby streets were observed to be 764 vehicles per day along McLaughlin Street and 3,209 vehicles per day along Key Boulevard.
- Vehicle queues are not expected to exceed available storage with the addition of project-generated traffic, so the project's impact on queueing is less than significant.
- The study intersections are currently operating acceptably and are expected to continue doing so upon the addition of project-generated traffic.

Recommendations

- All left-turn movements at the project driveway should be prohibited for all vehicles except for delivery trucks which operate only during off-peak periods. To discourage left turns into and out of the project site, a no left turn sign should be placed to the right of the driveway, in addition to a no left turn sign (R3-2) and an "EXCEPT TRUCKS" (modified R118(CA)) plaque that should be placed approximately 20 feet south of the beginning of the centerline barrier. Mountable curbs should be placed at the centerline on San Pablo Avenue for a length of 20 feet in front of the project driveway.
- The City should initiate a discussion with Caltrans regarding the addition of interstate shields on northbound San Pablo Avenue approaching the intersection as well as regulatory (R3-8) signs on the mast arm.
- The existing AC Transit bus stop should be relocated outside of the vision triangles of a driver waiting on the driveway approach to the extent feasible without blocking the path of through traffic. Consideration will be given to relocation of the bus stop to the south side of the San Pablo Avenue/Barrett Avenue intersection.
- Further study of the lane striping on San Pablo Avenue is recommended, which may include modifying the existing lane configuration to include three 10- to 12-foot-wide travel lanes in the immediate vicinity of the project driveway. It is noted that Caltrans involvement is necessary since San Pablo Avenue is under the jurisdiction of Caltrans.
- A "Local Traffic Only" sign should be installed on eastbound Roosevelt Avenue just east of San Pablo Avenue to discourage cut-through traffic.
- No additional tree wells be placed on the north side of eastbound Barrett Avenue near the intersection approaching San Pablo Avenue.
- Traffic conditions will be re-evaluated after the store is open, including traffic counts, speeds, and vehicle queues. Additional recommendations will be made with respect to safety and traffic using local neighborhood streets.

Thank you for giving W-Trans the opportunity to provide these services. Please call if you have any questions.

Sincerely,

Valerie Haines, EIT
Assistant Engineer

Kenny Jeong, PE (Traffic)
Senior Engineer

Mark E. Spencer, PE (Traffic)
Senior Principal, President

MES/kbj-vrh/RIC900-14.L1-9

Enclosures: Speed Data, Daily Traffic Volumes, Collision Rate Calculations, Queueing Calculations,
Intersection Level of Service Calculations

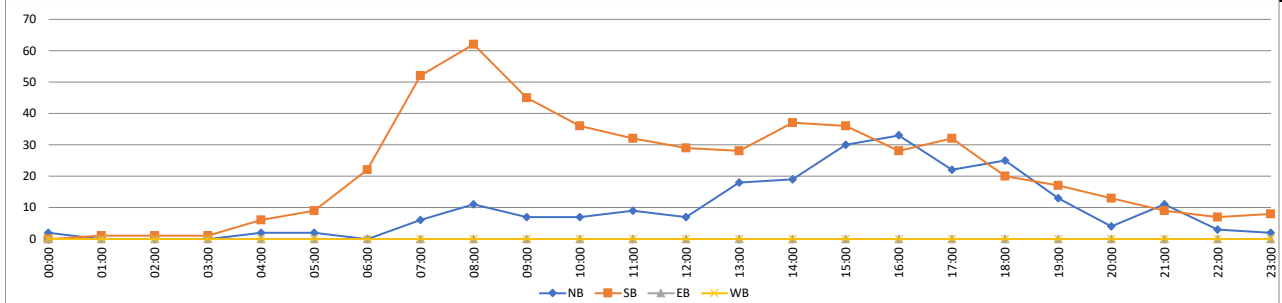
VOLUME

McLaughlin St Bet Barrett Ave & Roosevelt Ave

Day: Wednesday
Date: 12/11/2024

City: Richmond
Project #: CA24_080401_002

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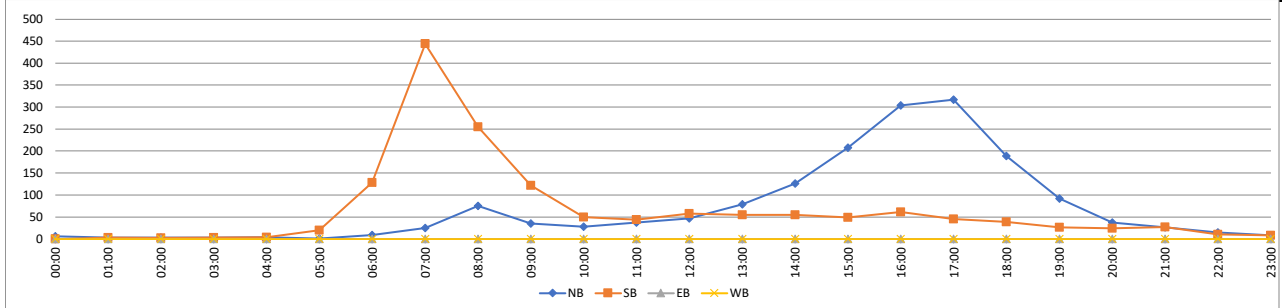
VOLUME

Key Blvd Bet Barrett Ave & Roosevelt Ave

Day: Wednesday
Date: 12/11/2024

City: Richmond
Project #: CA24_080401_003

DAILY TOTALS						NB	SB	EB	WB	Total	DAILY TOTALS						
						1,677	1,532	0	0	3,209							
15-Minutes Interval											Hourly Intervals						
TIME	NB	SB	EB	WB	TOTAL	TIME	NB	SB	EB	WB	TOTAL	TIME	NB	SB	EB	WB	TOTAL
0:00	1	0			1	12:00	8	10			18	00:00	01:00	6	0		6
0:15	3	0			3	12:15	10	13			23	01:00	02:00	3	3		6
0:30	1	0			1	12:30	15	17			32	02:00	03:00	3	2		5
0:45	1	0			1	12:45	14	18			32	03:00	04:00	3	3		6
1:00	0	2			2	13:00	16	11			27	04:00	05:00	4	4		8
1:15	2	0			2	13:15	13	14			27	05:00	06:00	1	20		21
1:30	0	1			1	13:30	18	15			33	06:00	07:00	9	128		137
1:45	1	0			1	13:45	32	15			47	07:00	08:00	25	444		469
2:00	0	1			1	14:00	21	11			32	08:00	09:00	75	255		330
2:15	1	0			1	14:15	32	15			47	09:00	10:00	35	122		157
2:30	1	0			1	14:30	38	17			55	10:00	11:00	28	50		78
2:45	1	1			2	14:45	35	12			47	11:00	12:00	37	44		81
3:00	0	0			0	15:00	46	12			58	12:00	13:00	47	58		105
3:15	2	1			3	15:15	44	17			61	13:00	14:00	79	55		134
3:30	0	2			2	15:30	64	12			76	14:00	15:00	126	55		181
3:45	1	0			1	15:45	54	8			62	15:00	16:00	208	49		257
4:00	1	1			2	16:00	61	14			75	16:00	17:00	304	61		365
4:15	0	1			1	16:15	81	18			99	17:00	18:00	317	45		362
4:30	2	1			3	16:30	79	12			91	18:00	19:00	189	39		228
4:45	1	1			2	16:45	83	17			100	19:00	20:00	92	26		118
5:00	0	3			3	17:00	83	8			91	20:00	21:00	37	24		61
5:15	0	5			5	17:15	88	14			102	21:00	22:00	26	27		53
5:30	0	8			8	17:30	65	11			76	22:00	23:00	15	10		25
5:45	1	4			5	17:45	81	12			93	23:00	00:00	8	8		16
6:00	3	11			14	18:00	75	10			85	STATISTICS					
6:15	1	17			18	18:15	51	6			57						
6:30	2	26			28	18:30	40	12			52	Peak Period	00:00	to	12:00		
6:45	3	74			77	18:45	23	11			34	Volume	229	1075			1304
7:00	4	93			97	19:00	29	1			30	Peak Hour	8:00	7:00			7:15
7:15	5	114			119	19:15	24	8			32	Peak Volume	75	444			477
7:30	6	113			119	19:30	22	7			29	Peak Hour Factor	0.694	0.895			0.890
7:45	10	124			134	19:45	17	10			27	Peak Period	12:00	to	00:00		
8:00	13	92			105	20:00	10	8			18	Volume	1448	457			1905
8:15	19	87			106	20:15	8	6			14	Peak Hour	16:30	16:00			16:30
8:30	27	35			62	20:30	11	5			16	Peak Volume	333	61			384
8:45	16	41			57	20:45	8	5			13	Peak Hour Factor	0.946	0.847			0.941
9:00	10	43			53	21:00	7	13			20	Peak Period	07:00	to	09:00		
9:15	11	38			49	21:15	11	3			14	Volume	100	699			799
9:30	7	21			28	21:30	6	5			11	Peak Hour	8:00	7:00			7:15
9:45	7	20			27	21:45	2	6			8	Peak Volume	75	444			477
10:00	5	13			18	22:00	3	4			7	Peak Hour Factor	0.694	0.895			0.890
10:15	5	17			22	22:15	4	4			8	Peak Period	16:00	to	18:00		
10:30	6	9			15	22:30	5	1			6	Volume	621	106			727
10:45	12	11			23	22:45	3	1			4	Peak Hour	16:30	16:00			16:30
11:00	4	13			17	23:00	3	2			5	Peak Volume	333	61			384
11:15	14	16			30	23:15	2	1			3	Peak Hour Factor	0.946	0.847			0.941
11:30	11	8			19	23:30	2	2			4						
11:45	8	7			15	23:45	1	3			4						
TOTALS	229	1075	0	0	1304	TOTALS	1448	457	0	0	1905						
SPLIT %	18%	82%	0%	0%	41%	SPLIT %	76%	24%	0%	0%	59%						



Intersection Collision Rate Worksheet

Traffic Safety Study for the Dollar Tree Project Area

Intersection # 1: San Pablo Avenue & Barrett Avenue
Date of Count: Wednesday, December 11, 2024

Number of Collisions: 11
Number of Injuries: 5
Number of Fatalities: 0
Average Daily Traffic (ADT): 24500
Start Date: July 1, 2018
End Date: June 30, 2023
Number of Years: 5

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

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

$$\text{Collision Rate} = \frac{11}{24,500} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.25 c/mve	0.0%	45.5%
Statewide Average*	0.33 c/mve	0.6%	47.7%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2022 Collision Data on California State Highways, Caltrans

Intersection # 2: San Pablo Avenue & Roosevelt Avenue/I-80 N Ramps
Date of Count: Wednesday, December 11, 2024

Number of Collisions: 21
Number of Injuries: 3
Number of Fatalities: 0
Average Daily Traffic (ADT): 24800
Start Date: July 1, 2018
End Date: June 30, 2023
Number of Years: 5

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

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

$$\text{Collision Rate} = \frac{21}{24,800} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.46 c/mve	0.0%	14.3%
Statewide Average*	0.33 c/mve	0.6%	47.7%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2022 Collision Data on California State Highways, Caltrans

Queuing and Blocking Report
Baseline

01/10/2025

Intersection: 1: San Pablo Ave & Barrett Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB	
Directions Served	L	L	TR	L	T	TR	L	T	TR	L	T	TR	
Maximum Queue (ft)	225	454	311	98	176	204	147	289	344	188	261	264	
Average Queue (ft)	133	219	121	38	88	80	47	108	177	70	146	158	
95th Queue (ft)	258	367	240	79	148	155	105	227	292	138	233	245	
Link Distance (ft)		769	769	567	567	567		704	704		480	480	
Upstream Blk Time (%)													
Queuing Penalty (veh)													
Storage Bay Dist (ft)	200						185				225		
Storage Blk Time (%)	1	14					0	1				0	1
Queuing Penalty (veh)	1	32					0	0				0	1

Intersection: 2: San Pablo Ave & I-80 NB Ramps & Roosevelt Ave

Movement	EB	EB	EB	NB	NB	NB	SB	SB	SB	
Directions Served	<	<LT	R	T	TR	R>	<L	T	T	
Maximum Queue (ft)	223	296	61	113	172	189	182	289	255	
Average Queue (ft)	49	128	45	29	61	66	93	59	34	
95th Queue (ft)	167	245	77	79	141	157	174	191	150	
Link Distance (ft)		641		480	480	480		765	765	
Upstream Blk Time (%)								0		
Queuing Penalty (veh)								0		
Storage Bay Dist (ft)	250			35				170		
Storage Blk Time (%)	0	47	5				4	0		
Queuing Penalty (veh)	0	101	9				13	0		

Network Summary

Network wide Queuing Penalty: 159

Intersection: 1: San Pablo Ave & Barrett Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB	
Directions Served	L	L	TR	L	T	TR	L	T	TR	L	T	TR	
Maximum Queue (ft)	225	480	296	88	179	234	200	420	466	128	223	226	
Average Queue (ft)	166	252	116	27	96	96	76	203	249	46	116	119	
95th Queue (ft)	271	396	243	66	157	181	167	348	397	99	199	202	
Link Distance (ft)		769	769	567	567	567		704	704		480	480	
Upstream Blk Time (%)													
Queuing Penalty (veh)													
Storage Bay Dist (ft)	200						185						225
Storage Blk Time (%)	1	19					0	8					0
Queuing Penalty (veh)	3	47					1	6					0

Intersection: 2: San Pablo Ave & I-80 NB Ramps & Roosevelt Ave

Movement	EB	EB	EB	NB	NB	NB	SB	SB	SB	
Directions Served	<	<LT	R	T	TR	R>	<L	T	T	
Maximum Queue (ft)	275	545	61	291	326	319	117	158	123	
Average Queue (ft)	199	296	33	154	184	180	35	65	27	
95th Queue (ft)	323	458	75	270	295	298	89	131	83	
Link Distance (ft)		641		480	480	480		765	765	
Upstream Blk Time (%)	0									
Queuing Penalty (veh)	0									
Storage Bay Dist (ft)	250			35				170		
Storage Blk Time (%)	0	58	2				0	0		
Queuing Penalty (veh)	2	185	9				0	0		

Network Summary

Network wide Queuing Penalty: 252

Intersection: 1: San Pablo Ave & Barrett Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB	
Directions Served	L	L	TR	L	T	TR	L	T	TR	L	T	TR	
Maximum Queue (ft)	224	418	294	110	180	176	152	254	317	218	304	301	
Average Queue (ft)	136	223	124	40	91	78	48	101	173	79	160	169	
95th Queue (ft)	264	347	239	89	153	146	104	205	279	163	264	268	
Link Distance (ft)		769	769	567	567	567		704	704		480	480	
Upstream Blk Time (%)													
Queuing Penalty (veh)													
Storage Bay Dist (ft)	200						185				225		
Storage Blk Time (%)	1	14							1		0	2	
Queuing Penalty (veh)	2	32							0		0	2	

Intersection: 2: San Pablo Ave & I-80 NB Ramps & Roosevelt Ave

Movement	EB	EB	EB	NB	NB	NB	SB	SB	SB	
Directions Served	<	<LT	R	T	TR	R>	<L	T	T	
Maximum Queue (ft)	216	268	65	110	171	177	177	201	134	
Average Queue (ft)	41	127	49	31	59	65	93	59	29	
95th Queue (ft)	149	226	75	81	137	147	170	165	107	
Link Distance (ft)		641		480	480	480		765	765	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	250			35				170		
Storage Blk Time (%)	0	44	5				3	0		
Queuing Penalty (veh)	0	95	10				9	0		

Network Summary

Network wide Queuing Penalty: 150

Intersection: 1: San Pablo Ave & Barrett Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB	
Directions Served	L	L	TR	L	T	TR	L	T	TR	L	T	TR	
Maximum Queue (ft)	225	498	281	105	196	200	196	413	446	163	243	242	
Average Queue (ft)	169	253	115	37	97	95	74	208	256	52	122	129	
95th Queue (ft)	267	412	232	82	164	173	161	353	399	114	208	211	
Link Distance (ft)		769	769	567	567	567		704	704		480	480	
Upstream Blk Time (%)													
Queuing Penalty (veh)													
Storage Bay Dist (ft)	200						185						225
Storage Blk Time (%)	2	19						0	9				1
Queuing Penalty (veh)	4	48						0	7				0

Intersection: 2: San Pablo Ave & I-80 NB Ramps & Roosevelt Ave

Movement	EB	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	<	<LT	R	T	TR	R>	<L	T	T
Maximum Queue (ft)	275	559	62	330	350	358	119	168	128
Average Queue (ft)	195	291	36	156	185	179	38	67	25
95th Queue (ft)	320	460	75	279	313	319	95	137	84
Link Distance (ft)		641		480	480	480		765	765
Upstream Blk Time (%)	0								
Queuing Penalty (veh)	0								
Storage Bay Dist (ft)	250	35					170		
Storage Blk Time (%)	0	57	2				0	0	
Queuing Penalty (veh)	2	184	10				0	0	

Network Summary

Network wide Queuing Penalty: 256

HCM 6th Signalized Intersection Summary

1: San Pablo Ave & Barrett Ave

01/10/2025



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↔		↔	↔↔		↔	↔↔		↔	↔↔	
Traffic Volume (veh/h)	416	116	166	44	136	152	50	463	22	93	512	75
Future Volume (veh/h)	416	116	166	44	136	152	50	463	22	93	512	75
Initial Q (Qb), veh	1	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.97	1.00		0.98
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	462	129	184	49	151	169	56	514	24	103	569	83
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	538	169	242	97	256	229	73	1648	77	129	1581	230
Arrive On Green	0.16	0.24	0.24	0.05	0.14	0.14	0.04	0.48	0.48	0.10	0.68	0.68
Sat Flow, veh/h	3456	690	984	1781	1777	1585	1781	3452	161	1781	3106	452
Grp Volume(v), veh/h	462	0	313	49	151	169	56	264	274	103	325	327
Grp Sat Flow(s),veh/h/ln	1728	0	1674	1781	1777	1585	1781	1777	1836	1781	1777	1780
Q Serve(g_s), s	14.3	0.0	19.1	2.9	8.7	11.2	3.4	10.0	10.1	6.2	8.6	8.6
Cycle Q Clear(g_c), s	14.3	0.0	19.1	2.9	8.7	11.2	3.4	10.0	10.1	6.2	8.6	8.6
Prop In Lane	1.00		0.59	1.00		1.00	1.00		0.09	1.00		0.25
Lane Grp Cap(c), veh/h	538	0	411	97	256	229	73	848	877	129	905	907
V/C Ratio(X)	0.86	0.00	0.76	0.50	0.59	0.74	0.77	0.31	0.31	0.80	0.36	0.36
Avail Cap(c_a), veh/h	644	0	517	186	412	367	219	849	878	251	906	908
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.33
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.98	0.98
Uniform Delay (d), s/veh	45.3	0.0	38.5	50.6	44.0	45.1	52.2	17.6	17.7	48.9	10.1	10.1
Incr Delay (d2), s/veh	9.8	0.0	7.5	4.0	4.5	9.6	15.6	1.0	0.9	10.4	1.1	1.1
Initial Q Delay(d3),s/veh	0.2	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	6.9	0.0	8.6	1.4	4.2	5.0	1.8	4.3	4.4	3.1	3.2	3.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	55.3	0.0	46.0	54.6	48.6	54.6	67.9	18.6	18.6	59.3	11.2	11.2
LnGrp LOS	E	A	D	D	D	D	E	B	B	E	B	B
Approach Vol, veh/h		775			369			594			755	
Approach Delay, s/veh		51.5			52.1			23.2			17.7	
Approach LOS		D			D			C			B	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	11.5	57.1	9.5	31.9	8.0	60.6	20.6	20.9				
Change Period (Y+Rc), s	3.5	4.5	3.5	5.0	3.5	4.5	3.5	* 5				
Max Green Setting (Gmax), s	15.5	32.5	11.5	34.0	13.5	34.5	20.5	* 26				
Max Q Clear Time (g_c+I1), s	8.2	12.1	4.9	21.1	5.4	10.6	16.3	13.2				
Green Ext Time (p_c), s	0.1	5.8	0.0	2.7	0.1	7.8	0.7	2.6				

Intersection Summary

HCM 6th Ctrl Delay	34.7
HCM 6th LOS	C

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM Signalized Intersection Capacity Analysis
 2: San Pablo Ave & I-80 NB Ramps & Roosevelt Ave

01/10/2025



Movement	EBL2	EBL	EBT	EBR	NBT	NBR	NBR2	SBL2	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	165	4	20	120	314	726	11	147	21	570
Future Volume (vph)	165	4	20	120	314	726	11	147	21	570
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5	4.5	4.5	4.5			4.5	4.5
Lane Util. Factor	0.95		0.95	1.00	0.91	0.91			1.00	0.95
Frbp, ped/bikes	1.00		1.00	0.98	0.99	0.97			1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00		1.00	0.85	0.92	0.85			1.00	1.00
Flt Protected	0.95		0.96	1.00	1.00	1.00			0.95	1.00
Satd. Flow (prot)	1681		1702	1557	3088	1392			1762	3539
Flt Permitted	0.95		0.96	1.00	1.00	1.00			0.36	1.00
Satd. Flow (perm)	1681		1702	1557	3088	1392			663	3539
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	174	4	21	126	331	764	12	155	22	600
RTOR Reduction (vph)	0	0	0	110	0	0	0	0	0	0
Lane Group Flow (vph)	99	0	100	16	721	386	0	0	177	600
Confl. Peds. (#/hr)				4		3	3	3	3	
Confl. Bikes (#/hr)						2	2			
Turn Type	Perm	Perm	NA	Perm	NA	Perm		Perm	Perm	NA
Protected Phases			4		2					6
Permitted Phases	4	4		4		2		6	6	
Actuated Green, G (s)	14.3		14.3	14.3	86.7	86.7			86.7	86.7
Effective Green, g (s)	14.3		14.3	14.3	86.7	86.7			86.7	86.7
Actuated g/C Ratio	0.13		0.13	0.13	0.79	0.79			0.79	0.79
Clearance Time (s)	4.5		4.5	4.5	4.5	4.5			4.5	4.5
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	218		221	202	2433	1097			522	2789
v/s Ratio Prot					0.23					0.17
v/s Ratio Perm	c0.06		0.06	0.01		c0.28			0.27	
v/c Ratio	0.45		0.45	0.08	0.30	0.35			0.34	0.22
Uniform Delay, d1	44.2		44.2	42.1	3.2	3.4			3.4	3.0
Progression Factor	1.00		1.00	1.00	0.40	0.37			1.00	1.00
Incremental Delay, d2	1.5		1.5	0.2	0.3	0.8			1.8	0.2
Delay (s)	45.7		45.7	42.2	1.6	2.0			5.1	3.1
Level of Service	D		D	D	A	A			A	A
Approach Delay (s)			44.4		1.7					3.6
Approach LOS			D		A					A
Intersection Summary										
HCM 2000 Control Delay			8.7		HCM 2000 Level of Service				A	
HCM 2000 Volume to Capacity ratio			0.37							
Actuated Cycle Length (s)			110.0		Sum of lost time (s)				9.0	
Intersection Capacity Utilization			58.9%		ICU Level of Service				B	
Analysis Period (min)			15							
c Critical Lane Group										

HCM 6th Signalized Intersection Summary

1: San Pablo Ave & Barrett Ave

01/10/2025



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↔		↔	↔↔		↔	↔↔		↔	↔↔	
Traffic Volume (veh/h)	475	126	152	34	143	176	74	786	19	54	350	65
Future Volume (veh/h)	475	126	152	34	143	176	74	786	19	54	350	65
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.99	1.00		0.97	1.00		0.98
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	495	131	158	35	149	183	77	819	20	56	365	68
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	574	183	220	82	212	186	98	1939	47	72	1591	293
Arrive On Green	0.17	0.24	0.24	0.05	0.12	0.12	0.06	0.55	0.55	0.08	1.00	1.00
Sat Flow, veh/h	3456	764	921	1781	1777	1563	1781	3542	86	1781	2986	550
Grp Volume(v), veh/h	495	0	289	35	149	183	77	411	428	56	216	217
Grp Sat Flow(s),veh/h/ln	1728	0	1685	1781	1777	1563	1781	1777	1852	1781	1777	1759
Q Serve(g_s), s	18.1	0.0	20.5	2.5	10.5	15.2	5.5	17.7	17.7	4.0	0.0	0.0
Cycle Q Clear(g_c), s	18.1	0.0	20.5	2.5	10.5	15.2	5.5	17.7	17.7	4.0	0.0	0.0
Prop In Lane	1.00		0.55	1.00		1.00	1.00		0.05	1.00		0.31
Lane Grp Cap(c), veh/h	574	0	403	82	212	186	98	972	1014	72	947	937
V/C Ratio(X)	0.86	0.00	0.72	0.43	0.70	0.98	0.78	0.42	0.42	0.78	0.23	0.23
Avail Cap(c_a), veh/h	837	0	454	158	212	186	226	972	1014	226	947	937
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.99
Uniform Delay (d), s/veh	52.8	0.0	45.4	60.3	55.0	57.1	60.7	17.3	17.3	59.2	0.0	0.0
Incr Delay (d2), s/veh	6.4	0.0	6.6	3.5	12.5	60.8	12.7	1.3	1.3	15.9	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.4	0.0	9.3	1.2	5.4	9.1	2.9	7.6	7.9	2.1	0.1	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	59.2	0.0	52.0	63.8	67.6	117.9	73.4	18.7	18.6	75.1	0.6	0.6
LnGrp LOS	E	A	D	E	E	F	E	B	B	E	A	A
Approach Vol, veh/h		784			367			916			489	
Approach Delay, s/veh		56.5			92.3			23.2			9.1	
Approach LOS		E			F			C			A	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	8.8	75.7	9.5	36.1	10.7	73.8	25.1	20.5				
Change Period (Y+Rc), s	3.5	4.5	3.5	5.0	3.5	4.5	3.5	* 5				
Max Green Setting (Gmax), s	16.5	50.5	11.5	35.0	16.5	50.5	31.5	* 16				
Max Q Clear Time (g_c+I1), s	6.0	19.7	4.5	22.5	7.5	2.0	20.1	17.2				
Green Ext Time (p_c), s	0.1	11.7	0.0	2.4	0.1	5.9	1.5	0.0				

Intersection Summary


















HCM 6th Ctrl Delay	40.7
HCM 6th LOS	D

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM Signalized Intersection Capacity Analysis
 2: San Pablo Ave & I-80 NB Ramps & Roosevelt Ave

01/10/2025

										
Movement	EBL2	EBL	EBT	EBR	NBT	NBR	NBR2	SBL2	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	392	35	77	102	710	702	37	30	13	378
Future Volume (vph)	392	35	77	102	710	702	37	30	13	378
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5	4.5	4.5	4.5			4.5	4.5
Lane Util. Factor	0.95		0.95	1.00	0.91	0.91			1.00	0.95
Frpb, ped/bikes	1.00		1.00	0.99	0.99	0.94			1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00	1.00			0.99	1.00
Frt	1.00		1.00	0.85	0.96	0.85			1.00	1.00
Flt Protected	0.95		0.97	1.00	1.00	1.00			0.95	1.00
Satd. Flow (prot)	1681		1710	1560	3218	1355			1759	3362
Flt Permitted	0.95		0.97	1.00	1.00	1.00			0.22	1.00
Satd. Flow (perm)	1681		1710	1560	3218	1355			400	3362
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	422	38	83	110	763	755	40	32	14	406
RTOR Reduction (vph)	0	0	0	31	0	0	0	0	0	0
Lane Group Flow (vph)	270	0	273	79	1080	478	0	0	46	406
Confl. Peds. (#/hr)				2		8	7	7	8	
Confl. Bikes (#/hr)						4	4			
Parking (#/hr)										0
Turn Type	Perm	Perm	NA	Perm	NA	Perm		Perm	Perm	NA
Protected Phases			4		2					6
Permitted Phases	4	4		4		2		6	6	
Actuated Green, G (s)	27.4		27.4	27.4	93.6	93.6			93.6	93.6
Effective Green, g (s)	27.4		27.4	27.4	93.6	93.6			93.6	93.6
Actuated g/C Ratio	0.21		0.21	0.21	0.72	0.72			0.72	0.72
Clearance Time (s)	4.5		4.5	4.5	4.5	4.5			4.5	4.5
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	354		360	328	2316	975			288	2420
v/s Ratio Prot					0.34					0.12
v/s Ratio Perm	c0.16		0.16	0.05		c0.35			0.11	
v/c Ratio	0.76		0.76	0.24	0.47	0.49			0.16	0.17
Uniform Delay, d1	48.2		48.2	42.7	7.7	7.9			5.8	5.8
Progression Factor	1.00		1.00	1.00	0.44	0.47			1.00	1.00
Incremental Delay, d2	9.4		8.9	0.4	0.6	1.6			1.2	0.1
Delay (s)	57.6		57.0	43.0	4.0	5.2			6.9	5.9
Level of Service	E		E	D	A	A			A	A
Approach Delay (s)			54.9		4.4					6.0
Approach LOS			D		A					A
Intersection Summary										
HCM 2000 Control Delay			17.1		HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.55							
Actuated Cycle Length (s)			130.0		Sum of lost time (s)				9.0	
Intersection Capacity Utilization			61.3%		ICU Level of Service				B	
Analysis Period (min)			15							
c Critical Lane Group										

HCM 6th Signalized Intersection Summary

1: San Pablo Ave & Barrett Ave

01/10/2025



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↔		↔	↔↔		↔	↔↔		↔	↔↔	
Traffic Volume (veh/h)	420	115	166	46	136	152	50	466	22	96	512	75
Future Volume (veh/h)	420	115	166	46	136	152	50	466	22	96	512	75
Initial Q (Qb), veh	1	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.97	1.00		0.98
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	467	128	184	51	151	169	56	518	24	107	569	83
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	543	169	244	97	256	229	73	1636	76	134	1577	229
Arrive On Green	0.16	0.25	0.25	0.05	0.14	0.14	0.04	0.47	0.47	0.10	0.68	0.68
Sat Flow, veh/h	3456	687	987	1781	1777	1585	1781	3454	160	1781	3106	452
Grp Volume(v), veh/h	467	0	312	51	151	169	56	266	276	107	325	327
Grp Sat Flow(s),veh/h/ln	1728	0	1674	1781	1777	1585	1781	1777	1836	1781	1777	1780
Q Serve(g_s), s	14.5	0.0	19.0	3.1	8.7	11.2	3.4	10.2	10.2	6.5	8.6	8.7
Cycle Q Clear(g_c), s	14.5	0.0	19.0	3.1	8.7	11.2	3.4	10.2	10.2	6.5	8.6	8.7
Prop In Lane	1.00		0.59	1.00		1.00	1.00		0.09	1.00		0.25
Lane Grp Cap(c), veh/h	543	0	413	97	256	229	73	842	870	134	902	904
V/C Ratio(X)	0.86	0.00	0.76	0.52	0.59	0.74	0.77	0.32	0.32	0.80	0.36	0.36
Avail Cap(c_a), veh/h	644	0	517	186	412	367	219	843	871	251	904	905
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.33
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.98	0.98
Uniform Delay (d), s/veh	45.2	0.0	38.4	50.6	44.0	45.1	52.2	17.9	17.9	48.7	10.2	10.2
Incr Delay (d2), s/veh	10.0	0.0	7.2	4.3	4.5	9.6	15.6	1.0	1.0	10.2	1.1	1.1
Initial Q Delay(d3),s/veh	0.2	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	7.0	0.0	8.6	1.5	4.2	5.0	1.8	4.4	4.5	3.2	3.2	3.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	55.4	0.0	45.6	54.9	48.6	54.6	67.9	18.9	18.9	58.9	11.3	11.3
LnGrp LOS	E	A	D	D	D	D	E	B	B	E	B	B
Approach Vol, veh/h		779			371			598			759	
Approach Delay, s/veh		51.5			52.2			23.5			18.0	
Approach LOS		D			D			C			B	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	11.8	56.7	9.5	32.1	8.0	60.4	20.7	20.9				
Change Period (Y+Rc), s	3.5	4.5	3.5	5.0	3.5	4.5	3.5	* 5				
Max Green Setting (Gmax), s	15.5	32.5	11.5	34.0	13.5	34.5	20.5	* 26				
Max Q Clear Time (g_c+I1), s	8.5	12.2	5.1	21.0	5.4	10.7	16.5	13.2				
Green Ext Time (p_c), s	0.1	5.9	0.0	2.7	0.1	7.8	0.7	2.6				

Intersection Summary

HCM 6th Ctrl Delay	34.8
HCM 6th LOS	C

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM Signalized Intersection Capacity Analysis

2: San Pablo Ave & I-80 NB Ramps & Roosevelt Ave

01/10/2025



Movement	EBL2	EBL	EBT	EBR	NBT	NBR	NBR2	SBL2	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	165	4	20	120	317	726	14	147	21	573
Future Volume (vph)	165	4	20	120	317	726	14	147	21	573
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5	4.5	4.5	4.5			4.5	4.5
Lane Util. Factor	0.95		0.95	1.00	0.91	0.91			1.00	0.95
Frbp, ped/bikes	1.00		1.00	0.98	0.99	0.97			1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00		1.00	0.85	0.92	0.85			1.00	1.00
Flt Protected	0.95		0.96	1.00	1.00	1.00			0.95	1.00
Satd. Flow (prot)	1681		1702	1557	3089	1392			1762	3539
Flt Permitted	0.95		0.96	1.00	1.00	1.00			0.36	1.00
Satd. Flow (perm)	1681		1702	1557	3089	1392			660	3539
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	174	4	21	126	334	764	15	155	22	603
RTOR Reduction (vph)	0	0	0	110	0	0	0	0	0	0
Lane Group Flow (vph)	99	0	100	16	724	389	0	0	177	603
Confl. Peds. (#/hr)				4		3	3	3	3	
Confl. Bikes (#/hr)						2	2			
Turn Type	Perm	Perm	NA	Perm	NA	Perm		Perm	Perm	NA
Protected Phases			4		2					6
Permitted Phases	4	4		4		2		6	6	
Actuated Green, G (s)	14.3		14.3	14.3	86.7	86.7			86.7	86.7
Effective Green, g (s)	14.3		14.3	14.3	86.7	86.7			86.7	86.7
Actuated g/C Ratio	0.13		0.13	0.13	0.79	0.79			0.79	0.79
Clearance Time (s)	4.5		4.5	4.5	4.5	4.5			4.5	4.5
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	218		221	202	2434	1097			520	2789
v/s Ratio Prot					0.23					0.17
v/s Ratio Perm	c0.06		0.06	0.01		c0.28			0.27	
v/c Ratio	0.45		0.45	0.08	0.30	0.35			0.34	0.22
Uniform Delay, d1	44.2		44.2	42.1	3.2	3.4			3.4	3.0
Progression Factor	1.00		1.00	1.00	0.40	0.36			1.00	1.00
Incremental Delay, d2	1.5		1.5	0.2	0.3	0.8			1.8	0.2
Delay (s)	45.7		45.7	42.2	1.6	2.0			5.1	3.2
Level of Service	D		D	D	A	A			A	A
Approach Delay (s)			44.4		1.7					3.6
Approach LOS			D		A					A
Intersection Summary										
HCM 2000 Control Delay			8.6		HCM 2000 Level of Service				A	
HCM 2000 Volume to Capacity ratio			0.37							
Actuated Cycle Length (s)			110.0		Sum of lost time (s)				9.0	
Intersection Capacity Utilization			59.0%		ICU Level of Service				B	
Analysis Period (min)			15							

c Critical Lane Group

HCM 6th Signalized Intersection Summary

1: San Pablo Ave & Barrett Ave

01/10/2025



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↔		↔	↔↔		↔	↔↔		↔	↔↔	
Traffic Volume (veh/h)	486	124	152	43	146	176	74	796	19	63	349	65
Future Volume (veh/h)	486	124	152	43	146	176	74	796	19	63	349	65
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.99	1.00		0.97	1.00		0.98
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	506	129	158	45	152	183	77	829	20	66	364	68
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	585	183	225	82	212	186	98	1904	46	84	1580	292
Arrive On Green	0.17	0.24	0.24	0.05	0.12	0.12	0.06	0.54	0.54	0.09	1.00	1.00
Sat Flow, veh/h	3456	757	927	1781	1777	1563	1781	3543	85	1781	2984	551
Grp Volume(v), veh/h	506	0	287	45	152	183	77	416	433	66	215	217
Grp Sat Flow(s),veh/h/ln	1728	0	1684	1781	1777	1563	1781	1777	1852	1781	1777	1759
Q Serve(g_s), s	18.5	0.0	20.2	3.2	10.7	15.2	5.5	18.4	18.4	4.7	0.0	0.0
Cycle Q Clear(g_c), s	18.5	0.0	20.2	3.2	10.7	15.2	5.5	18.4	18.4	4.7	0.0	0.0
Prop In Lane	1.00		0.55	1.00		1.00	1.00		0.05	1.00		0.31
Lane Grp Cap(c), veh/h	585	0	408	82	212	186	98	955	995	84	941	931
V/C Ratio(X)	0.87	0.00	0.70	0.55	0.72	0.98	0.78	0.44	0.44	0.78	0.23	0.23
Avail Cap(c_a), veh/h	837	0	453	158	212	186	226	955	995	226	941	931
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.99
Uniform Delay (d), s/veh	52.6	0.0	45.0	60.7	55.1	57.1	60.7	18.2	18.2	58.2	0.0	0.0
Incr Delay (d2), s/veh	6.8	0.0	6.1	5.6	13.6	60.8	12.7	1.4	1.4	14.3	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.6	0.0	9.2	1.6	5.6	9.1	2.9	7.9	8.2	2.4	0.1	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	59.3	0.0	51.1	66.2	68.7	117.9	73.4	19.6	19.6	72.5	0.6	0.6
LnGrp LOS	E	A	D	E	E	F	E	B	B	E	A	A
Approach Vol, veh/h		793			380			926			498	
Approach Delay, s/veh		56.3			92.1			24.1			10.1	
Approach LOS		E			F			C			B	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	9.7	74.3	9.5	36.5	10.7	73.3	25.5	20.5				
Change Period (Y+Rc), s	3.5	4.5	3.5	5.0	3.5	4.5	3.5	* 5				
Max Green Setting (Gmax), s	16.5	50.5	11.5	35.0	16.5	50.5	31.5	* 16				
Max Q Clear Time (g_c+I1), s	6.7	20.4	5.2	22.2	7.5	2.0	20.5	17.2				
Green Ext Time (p_c), s	0.1	11.7	0.0	2.4	0.1	5.9	1.5	0.0				

Intersection Summary

HCM 6th Ctrl Delay	41.2
HCM 6th LOS	D

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM Signalized Intersection Capacity Analysis

2: San Pablo Ave & I-80 NB Ramps & Roosevelt Ave

01/10/2025



Movement	EBL2	EBL	EBT	EBR	NBT	NBR	NBR2	SBL2	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	392	35	77	102	727	702	51	30	13	387
Future Volume (vph)	392	35	77	102	727	702	51	30	13	387
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5	4.5	4.5	4.5			4.5	4.5
Lane Util. Factor	0.95		0.95	1.00	0.91	0.91			1.00	0.95
Frbp, ped/bikes	1.00		1.00	0.99	0.99	0.94			1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00	1.00			0.99	1.00
Frt	1.00		1.00	0.85	0.96	0.85			1.00	1.00
Flt Protected	0.95		0.97	1.00	1.00	1.00			0.95	1.00
Satd. Flow (prot)	1681		1710	1560	3221	1355			1759	3362
Flt Permitted	0.95		0.97	1.00	1.00	1.00			0.21	1.00
Satd. Flow (perm)	1681		1710	1560	3221	1355			390	3362
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	422	38	83	110	782	755	55	32	14	416
RTOR Reduction (vph)	0	0	0	31	0	0	0	0	0	0
Lane Group Flow (vph)	270	0	273	79	1099	493	0	0	46	416
Confl. Peds. (#/hr)				2		8	7	7	8	
Confl. Bikes (#/hr)						4	4			
Parking (#/hr)										0
Turn Type	Perm	Perm	NA	Perm	NA	Perm		Perm	Perm	NA
Protected Phases			4		2					6
Permitted Phases	4	4		4		2		6	6	
Actuated Green, G (s)	27.4		27.4	27.4	93.6	93.6			93.6	93.6
Effective Green, g (s)	27.4		27.4	27.4	93.6	93.6			93.6	93.6
Actuated g/C Ratio	0.21		0.21	0.21	0.72	0.72			0.72	0.72
Clearance Time (s)	4.5		4.5	4.5	4.5	4.5			4.5	4.5
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	354		360	328	2319	975			280	2420
v/s Ratio Prot					0.34					0.12
v/s Ratio Perm	c0.16		0.16	0.05		c0.36			0.12	
v/c Ratio	0.76		0.76	0.24	0.47	0.51			0.16	0.17
Uniform Delay, d1	48.2		48.2	42.7	7.7	8.0			5.8	5.8
Progression Factor	1.00		1.00	1.00	0.43	0.45			1.00	1.00
Incremental Delay, d2	9.4		8.9	0.4	0.6	1.6			1.3	0.2
Delay (s)	57.6		57.0	43.0	3.9	5.3			7.0	6.0
Level of Service	E		E	D	A	A			A	A
Approach Delay (s)			54.9		4.3					6.1
Approach LOS			D		A					A
Intersection Summary										
HCM 2000 Control Delay			16.8		HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.56							
Actuated Cycle Length (s)			130.0		Sum of lost time (s)				9.0	
Intersection Capacity Utilization			61.9%		ICU Level of Service				B	
Analysis Period (min)			15							
c Critical Lane Group										