

MEMORANDUM

Date: June 13, 2014
To: Kate Miller and Eliot Hurwitz, NCTPA
From: Dave Stanek and Steve Crosley, Fehr & Peers
Subject: SR 29 in American Canyon

SF 12-0651.01

Fehr & Peers has prepared a traffic microsimulation analysis of two options for the State Route 29 (SR 29) corridor in American Canyon:

- **Option 1 – Modified Boulevard.** This option includes three lanes in each direction on SR 29.
- **Option 2 – Boulevard.** This option includes two lanes in each direction on SR 29 (mainline) and one local access lane in each direction.

The purpose of this memorandum is to list the assumptions used to build the microsimulation models and to present the analysis results.

MODEL INPUTS

Forecasts

Traffic

SR 29 draws vehicular traffic from all across the region; therefore a multi-county model which tracks trips from the region and accounts for land use changes both in and outside of Napa County was best suited for the SR 29 Corridor Gateway Study. The Napa-Solano Travel Demand Model (N-STDM) was determined to be the appropriate tool to perform traffic forecasting for the SR 29 corridor. The memorandum Travel Demand Model Assumptions for the SR 29 Corridor Gateway Study (Fehr & Peers, May 2013) discussed the updates to the land use and circulation network in the N-STDM that was used to develop intersection turning movement forecasts.

The peak hour factor was assumed to be 0.95 based on congested conditions that would occur on the corridor.

Both options use the same total demand volume. The intersection turning movement volumes for the Modified Boulevard option are provided in the attachment. Direct movements that are prohibited in the Boulevard option – for example, the northbound left turn to Crawford Way – are diverted to U-turn movements at adjacent intersections. As a result, the intersection turning movement volumes vary slightly between the options.

Transit

In general, future public transit improvements discussed in county planning documents are at the policy level rather than identifying specific route additions, changes, or improvements. For the American Canyon Circulation Element Update, the Plan discusses building a multi-modal transit center on SR 29 within the designated Community Center or Town Center. In addition, it recommends providing transit linkages between the Community Center or Town Center and regionally-related transit such as BART, commuter railway and the Vallejo ferry.

Today, the corridor is served by VINE Transit and American Canyon Transit. VINE Route 11 provides local service between Napa and Vallejo Ferry Terminal via American Canyon and unincorporated Napa County. The route operates with 30 to 40 minute headways during peak weekday hours and one hour headways off-peak and on Saturday (the route does not run on Sunday). VINE Route 29 is an express route that offers service between Calistoga and the El Cerrito Del Norte BART Station via Napa, American Canyon, and Vallejo. The route operates with four AM outbound and four PM inbound trips each weekday to/from BART. The two routes that operate in American Canyon are deviated fixed route services. We have not assumed any changes to transit in the corridor under future conditions.

Pedestrian/Bicycle

The N-STDM does not include pedestrian or bicycle volume estimates. Our base case is the following: Pedestrian crossings are assumed to have 10 pedestrians per hour, 5 in each direction. The bicycle volume is assumed to be 10 bicyclists per hour, 5 in each direction.

Trucks

The Caltrans truck volume book lists the daily truck counts on SR 29 as 8 percent at SR 37 and 7 percent at SR 12 based on daily volumes. Given the higher non-truck volumes during peak hours, the truck percentage for SR 29 is assumed to be 6 percent for the analysis. The truck percentage for the local streets is 3 percent, which is the default recommended value in the *Highway Capacity Manual* (Transportation Research Board, 2010).

Design Options

The typical cross sections used to develop the option corridor layouts are shown in Figures 1 and 2. All improvements under the project options are assumed to occur north of American Canyon Road and south of the railroad overhead north of Napa Junction Road. Both options assume that a separate project would widen SR 29 to three lanes in each direction north of Napa Junction Road. Figures 3 through 5 show the side-by-side corridor layouts of the existing and the two proposed options.

Due to right-of-way considerations, the actual project layout may differ. When building the corridor model, the following convention was used. For the Modified Boulevard Option, the right edge of the southbound lanes (edge of traveled way) was assumed to be the same as under existing conditions. For the Boulevard Option, the left edge of the southbound lanes (edge of traveled way) was matched to the left edge of the southbound lanes in the Modified Boulevard Option.

For the Boulevard Option, the SR 29 mainline is assumed to only travel through at signalized intersections except at American Canyon Road: all turning movements are made from the frontage road. At signals,

the frontage road would have a 250-foot left-turn pocket. Access from the mainline to the frontage road via a 100-foot long slip ramp would occur 200 feet downstream of a signalized intersection. The conflicting frontage road traffic would have a stop sign at the junction with the slip ramp, and the slip ramp would be uncontrolled. Access from the frontage road to the mainline would occur at signalized intersections.

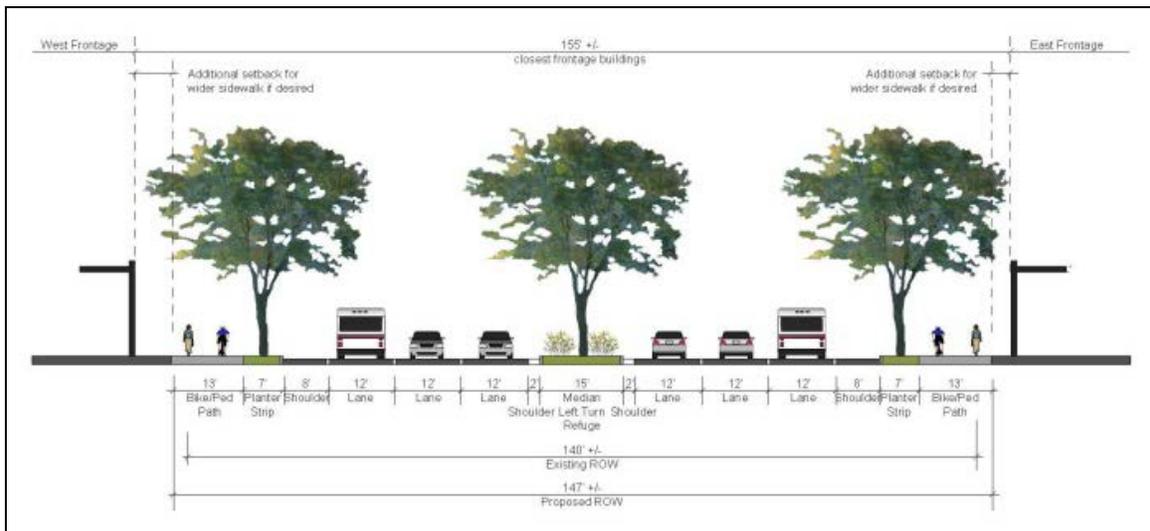


Figure 1. Modified Boulevard Option

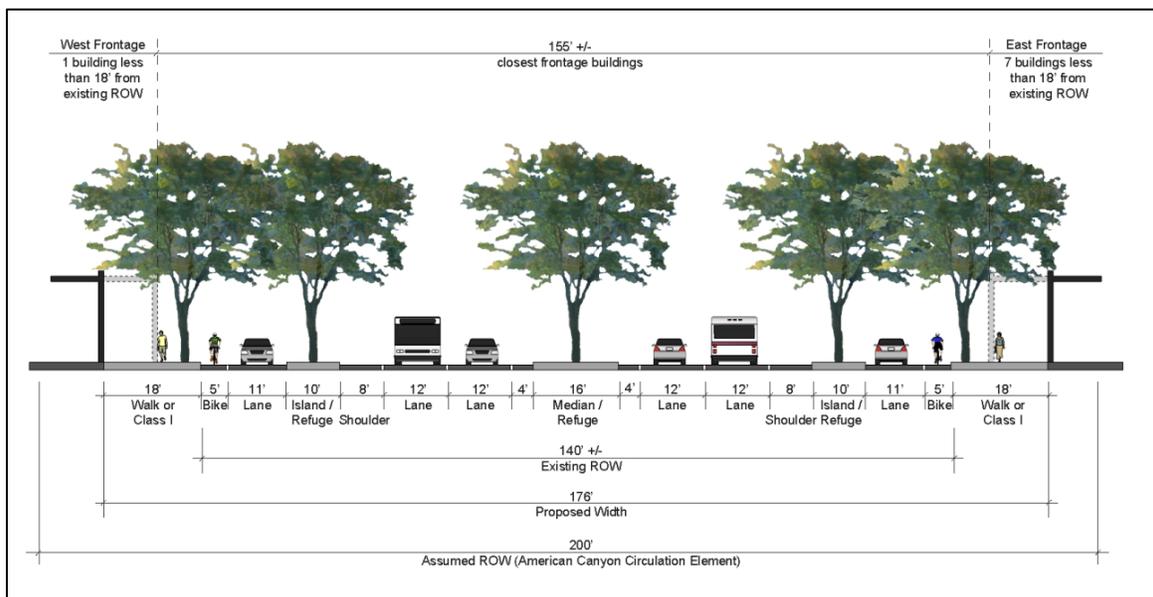


Figure 2. Boulevard Option

Travel Speed

In the study area, the current posted speed on SR 29 is 55 mph. Both proposed options would reduce the posted speed to 45 mph. For the Boulevard Option, the frontage road would have a posted speed of 25 mph.

Turn Pocket Lengths

The existing turn pocket lengths include deceleration lane length based on the existing design speed of 55 mph. Both options would have a lower design speed and design features characteristic of urban areas. As a result, the SR 29 pocket lengths (on the SR 29 mainline for the Boulevard Option) will be revised using the following approach. The pocket length is the sum of the storage and deceleration lengths. The storage length for the turn pocket will be calculated as 1 foot per vehicle in the PM peak hour. Table 205.2B in the Highway Design Manual is used to determine deceleration length. Assuming partial deceleration is permitted on the through lanes, the design speed for the deceleration distance can be reduced by 10 to 20 mph. The table shows 235 feet for a design speed of 30 mph and 315 feet for a design speed of 40 mph. For this planning exercise, the deceleration lane length will be set to 250 feet.

Driveways

For the Modified Boulevard Option, the existing driveways would be squared-up so that the right turn in and out movements would be performed at lower speed. This will improve safety for pedestrians and bicyclists that cross the driveways. The existing northbound right-turn pockets at the Doubletree Driveway, Antonina Avenue, and Napa Junction Driveway will be retained. At the City Hall and Canyon Plaza Driveways, a 250-foot right turn pocket would be provided. The existing acceleration lanes would be removed at all driveways.

For the Boulevard Option, all driveways will be right-in/right-out with access to and from the frontage road only. Access to the SR 29 mainline will occur only at signalized intersections or via slip ramps from the mainline to the frontage road.

Signal Timing

For the analysis, the signalized intersections are optimized and coordinated based on the cumulative year travel volume, the posted speed of 45 mph, and the lane configuration. Pedestrian clearance time was calculated using a walking speed of 3.5 feet per second and applied to each design option layout. In the Boulevard option, the frontage roads are served by exclusive signal phases (as described further in the next section). These additional phases cause the selected cycle length to be longer at 200 seconds, compared to 180 seconds for the Modified Boulevard option.

Intersections

American Canyon Road

For both options, an eastbound bike lane east of SR 29 is assumed to be added. And, a pedestrian crosswalk would be added for the north and east legs. The southbound left turn pocket would be shortened to 650 feet.

For both options, the eastbound and westbound approaches will have separate left turn phases. The current split phase operation is planned to be converted to separate left turn phases later in 2014. For the Boulevard Option, an additional exclusive phase would be added for the southbound approach from the frontage road.

For the Boulevard Option, the existing southbound left and right turn pockets would be retained. Due to the adjacent frontage road, the southbound right turn movement from the mainline would be prohibited on red. The northbound frontage road would begin from a slip ramp that starts 100 feet north of the intersection.

Crawford Way

This intersection is assumed to remain unsignalized with side-street stop control. For the Modified Boulevard Option, the southbound u-turn and the eastbound left turn would be prohibited. The pocket length for the northbound left-turn lane would be 350 feet. For the Boulevard Option, the southbound U-turn, the eastbound left turn, and the northbound left turn movements would be prohibited.

Donaldson Way

The existing signal control would remain under both options with no changes to the side-street approaches. The northbound left-turn pocket length would be 350 feet and the southbound left turn pocket length would be 500 feet. A crosswalk would be added to the north leg. The westbound right-turn lane planned for construction in 2014 is included in both options.

For the Modified Boulevard Option, the current signal phasing would be retained. For the Boulevard Option, the signal would have four phases: (1) northbound and southbound through on the mainline, (2) northbound frontage road, (3) southbound frontage road, and (4) eastbound and westbound. The frontage road approaches would not be able to go concurrently due to overlapping left-turn movements. With this phasing, the westbound and eastbound left turns would be converted from protected to permissive movements.

Poco Way / S Napa Junction Road

A signal would be added at this location under both options. Crosswalks would be added to all four legs. A 200-foot left-turn pocket is assumed to be added on both side-street approaches. On the SR 29 approaches, 250-foot right turn and 350-foot left-turn pockets are assumed.

For the Modified Boulevard Option, the signal phasing would be similar to the existing phasing at Donaldson Way. For the Boulevard Option, the signal would have four phases: (1) northbound and southbound through on the mainline, (2) northbound frontage road, (3) southbound frontage road, and (4) eastbound and westbound. The frontage road approaches would not be able to go concurrently due to overlapping left-turn movements. With this phasing, the westbound and eastbound left turns would be permissive.

Rio Del Mar

Under both options, the signal would be removed at this location. For the Modified Boulevard Option, the existing turning movements would be retained with no changes to the turn pocket lengths.

Eucalyptus Drive

Under both options, the fourth (west) leg would be constructed. The west leg would have one receiving lane, two left-turn pocket lanes (200 feet of storage), and a shared through/right-turn lane. Pedestrian crosswalks would be provided on all legs.

For the Modified Boulevard Option, the signal phasing will either be eight phase (separate left-turn phases on all approaches) or split phase for the eastbound and westbound approaches depending on the forecast volumes. For the Boulevard Option, the signal would have five phases: (1) northbound and southbound through on the mainline, (2) northbound frontage road, (3) southbound frontage road, (4) eastbound, and (5) westbound. The frontage road approaches would not be able to go concurrently due to overlapping left-turn movements. Permissive left turns would not be feasible for the eastbound and westbound approaches since double left-turn lanes are provided.

Napa Junction Road

Under both options, the existing signal and lane configuration for the side street would be retained. SR 29 would transition back to the existing roadway north of this intersection and before the railroad overhead. Both options include the planned widening of the eastbound and westbound approaches to have dual left turn lanes.

For the Modified Boulevard Option, the signal phasing will either be eight phase (separate left-turn phases on all approaches) or split phase for the eastbound and westbound approaches depending on the forecast volumes. For the Boulevard Option, the signal phasing would be similar except that an additional exclusive phase would be needed to serve the approach from the northbound frontage road.

ANALYSIS METHODOLOGY

The design options were analyzed using the Vissim (version 6) traffic microsimulation software. The analysis uses models of vehicle performance and driver behavior to model the interaction of agents (cars, bicycles, pedestrians, etc.), roadways, and traffic control. The software outputs various performance measures including throughput (volume served), delay, speed, and travel time. The software uses random seed values to generate vehicle entry time and vehicle characteristics. The results are an average of ten runs with different random seeds. Using the intersection delay results, the intersection LOS was assigned using the criteria shown in Table 1.

TABLE 1: INTERSECTION LOS THRESHOLDS

LOS	Average Delay (sec/veh)		Description
	Stop Control and Roundabout	Signal Control	
A	≤ 10	< 10	Very low delay occurs due to little or no conflicting traffic.
B	> 10 to 15	> 10 to 20	Low delay occurs although conflicting traffic becomes noticeable.
C	> 15 to 25	> 20 to 35	Average delays result from increased conflicting traffic.
D	> 25 to 35	> 35 to 55	Longer delays occur due to a reduction in available gaps. At signals, individual cycle failures are noticeable.
E	> 35 to 50	> 55 to 80	High delays and extensive queues occur. This value indicates volume-to-capacity ratios. This is considered to be the limit of acceptable delay.
F	> 50	> 80	Delays are unacceptable to most drivers due to over-saturation.

Note: sec/veh = seconds per vehicle
 Source: *Highway Capacity Manual*, Transportation Research Board, 2010

PERFORMANCE MEASURES

Table 2 summarizes the network performance of the two design options.

TABLE 2: NETWORK PERFORMANCE

Performance Measure	Modified Boulevard	Boulevard
Percent Demand Volume Served	99%	76%
Total Delay ¹	All Traffic	386 hours
	Non-motorized	8 hours
Average Speed for Motorized Traffic	22.8 mph	10.9 mph
Number of Stops for Motorized Traffic	19,711 stops	42,220 stops
Travel Time/Speed ²	Northbound	5.8 minutes / 26.0 mph
	Southbound	6.3 minutes / 24.2 mph

Notes: 1. Delay to vehicles queued outside of the network (for example, north of South Kelly Road) are not measured.
 2. Travel time and speed are measured for vehicles traveling from Kimberly Drive to Green Island Road.
 Source: Fehr & Peers, 2014

The Modified Boulevard option has three through lanes in each direction at the study intersections. With the higher capacity, this option is able to serve nearly all of the cumulative year PM peak hour traffic demand during the peak hour. The Boulevard option, which has two through lanes, would only serve about three-fourths of the peak hour demand volume during the peak hour. As a result, the total delay measured in the analysis area for the Boulevard option is more than double the delay for the Modified Boulevard option. The network-wide average speed and number of stops show similar results: the Boulevard option has less than half the average speed and more than twice the number of stops as the Modified Boulevard option. Travel time between Kimberly Drive (south of American Canyon Road) and Green Island Road (north of Napa Junction Road) is 1.5 minutes faster in the northbound direction and nearly five minutes faster in the southbound direction for the Modified Boulevard option.

Table 3 shows the intersection level of service (LOS) and average delay for the signalized intersections. The detailed operations analysis results from the Vissim models are provided in an attachment.

TABLE 3: INTERSECTION OPERATIONS

Intersection	Modified Boulevard		Boulevard	
	LOS	Delay	LOS	Delay
1. Napa Junction Road	E	66	F	201
2. Eucalyptus Drive	E	58	F	95
3. Poco Way/S Napa Junction Road	C	29	D	39
4. Donaldson Way	C	28	D	45
5. American Canyon Road	E	61	F	181

Note: Average delay is reported in seconds per vehicle.
 Source: Fehr & Peers, 2014

The study intersections would operate at one LOS grade better under the Modified Boulevard compared to the Boulevard option. The fewer through lanes and higher signal cycle length in the Boulevard option provide lower corridor capacity. The lower capacity causes the higher average delays.

In the Boulevard option, the southbound queue at Napa Junction Road extends outside the model network boundary at South Kelley Road, which is about 5,000 feet north. For the Modified Boulevard option, the average maximum queue length for the southbound approach is 3,275 feet, which is less than the distance to Green Island Road (3,700 feet).

SUMMARY

The transportation analysis of cumulative year PM peak hour conditions shows that the Modified Boulevard option out-performs the Boulevard option with regard to motorized vehicle operations. The Modified Boulevard option has a higher throughput, lower total delay, and lower travel times on SR 29.

Although the Boulevard option would have higher non-motorized delay due to the longer cycle lengths, the level of pedestrian and bicycling comfort would likely be higher. The Boulevard option's cross section has multiple medians so that pedestrians crossing SR 29 would have less exposure to vehicle traffic. The north-south pedestrian phases at Eucalyptus Drive, Poco Way/South Napa Junction Road, and Donaldson Way would not have conflicting traffic since the phases are concurrent with the SR 29 mainline (for the Modified Boulevard option, northbound and southbound right-turning vehicles must yield to pedestrians and bicycles). Also, the frontage roads provide a barrier to the higher speed traffic on mainline lanes, which would improve comfort for pedestrians and bicyclists traveling along SR 29.

Vehicle performance for the Boulevard option could be improved with additional project features. For example, providing three through lanes for the mainline would provide additional capacity. Alternately, grade separation of the mainline lanes at the local street intersections would also increase through capacity for SR 29. These additional features may require additional right-of-way and would have higher construction cost (particularly for the grade separations).

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EXISTING CONDITIONS

MODIFIED BOULEVARD

BOULEVARD



Figure 3
SR 29 Improvement Options

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EXISTING CONDITIONS



MODIFIED BOULEVARD



BOULEVARD



Figure 4
SR 29 Improvement Options



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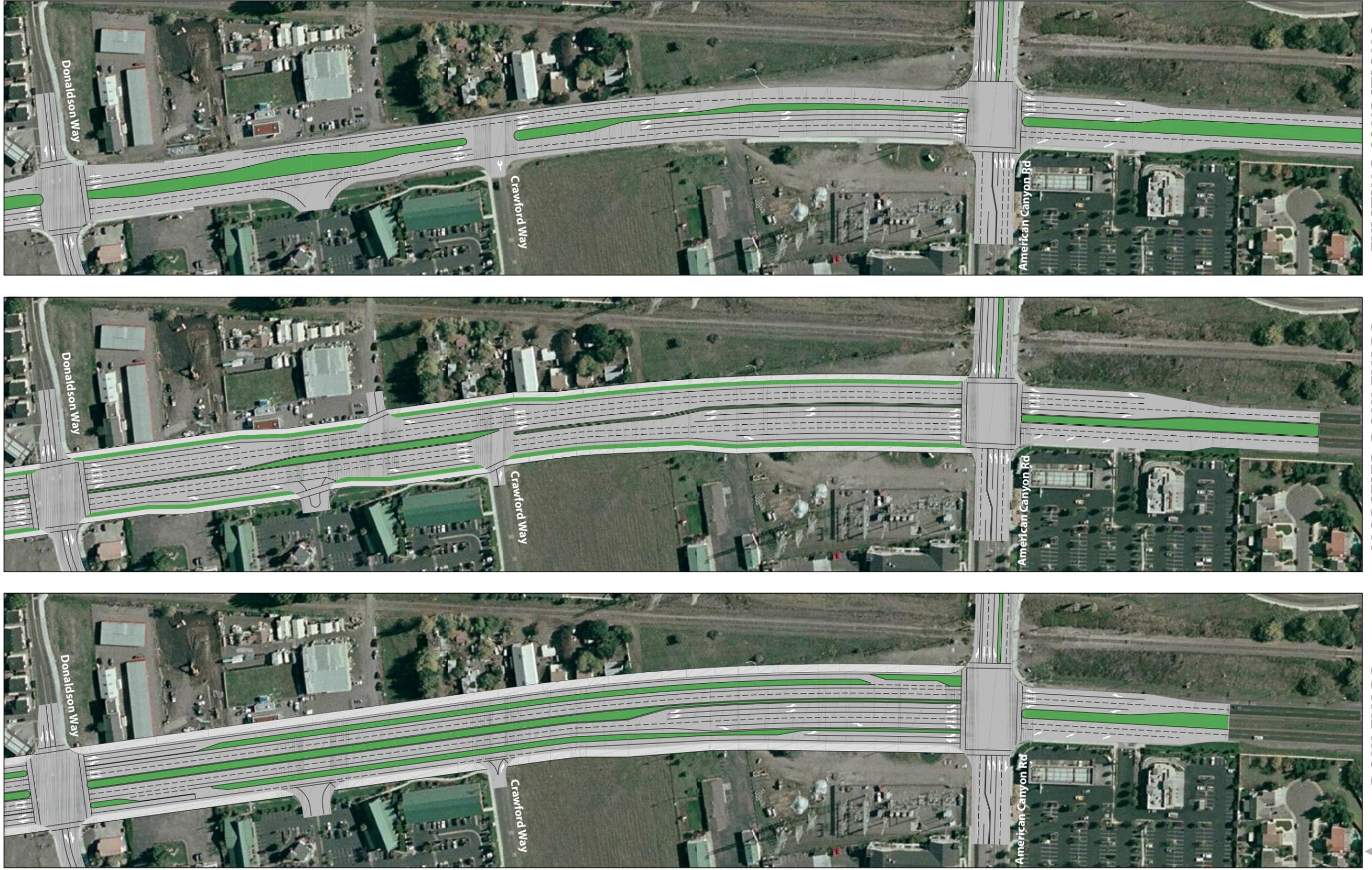


Figure 5
SR 29 Improvement Options

VISSIM Post-Processor
Average Values from 10 Runs
Network Statistics

SR 29 American Canyon
Modified Boulevard (6 Lanes)
Cumulative PM Peak Hour

Performance Measure	Vehicle Types	Average	Std. Dev.	Minimum	Maximum
Average Delay (seconds)	All	135.4	6.53	125.2	146.6
Total Delay (hours)	All	386	21	354	421
Average Stopped Delay (seconds)	All	80.7	2.14	75.1	82.3
Total Stopped Delay (hours)	All	230	7	212	237
Total Distance Traveled (miles)	All	17,251	183	16,823	17,488
Average Speed (mph)	All	22.0	0.56	21.1	23.0
Average Number of Stops	All	2.0	0.11	1.8	2.1
Total Number of Stops	All	20,046	1,178	18,523	21,802
Total Travel Time (hours)	All	783.6	22.5	752.4	820.4
Vehicles Active	All	780	48	713	852
Vehicles Arrived	All	9,488	64	9,346	9,592
Average Delay (seconds)	Motorized	139.9	6.72	129.5	151.2
Total Delay (hours)	Motorized	378	21	347	411
Average Stopped Delay (seconds)	Motorized	82.2	2.14	76.5	83.7
Total Stopped Delay (hours)	Motorized	222	7	205	227
Total Distance Traveled (miles)	Motorized	17,188	182	16,763	17,426
Average Speed (mph)	Motorized	22.8	0.59	21.9	23.8
Average Number of Stops	Motorized	2.0	0.11	1.9	2.2
Total Number of Stops	Motorized	19,711	1,177	18,188	21,464
Total Travel Time (hours)	Motorized	753.3	22.1	723.8	791.0
Vehicles Active	Motorized	751	47	682	821
Vehicles Arrived	Motorized	8,966	62	8,821	9,066
Average Delay (seconds)	Non-motorized	55.3	4.67	49.6	65.0
Total Delay (hours)	Non-motorized	8	1	7	10
Average Stopped Delay (seconds)	Non-motorized	54.2	4.69	48.5	64.1
Total Stopped Delay (hours)	Non-motorized	8	1	7	10
Total Distance Traveled (miles)	Non-motorized	63	3	59	69
Average Speed (mph)	Non-motorized	2.1	0.06	2.0	2.2
Average Number of Stops	Non-motorized	0.6	0.03	0.6	0.7
Total Number of Stops	Non-motorized	335	13	308	357
Total Travel Time (hours)	Non-motorized	30.2	1.7	28.6	32.8
Vehicles Active	Non-motorized	29	3	23	33
Vehicles Arrived	Non-motorized	523	8	509	537

VISSIM Post-Processor
 Average Values from 10 Runs
 Peak Hour Travel Time

SR 29 American Canyon
 Modified Boulevard (6 Lanes)
 Cumulative PM Peak Hour

Mode	Description	Distance (ft)	Volume (vehicles)		Travel Time (minutes)		Speed (mph)
			Average	Std. Dev.	Average	Std. Dev.	Average
Motorized	Northbound SR 29	13,343	674	16	5.84	0.36	26.0
	Southbound SR 29	13,343	1293	21	6.26	0.65	24.2

VISSIM Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

SR 29 American Canyon
Modified Boulevard (6 Lanes)
Cumulative PM Peak Hour

Intersection 1

SR 29/Napa Junction Rd

Signal

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	U Turn	10	10	104.0%	78.1	43.6	E
	Second Left						
	Left Turn	70	66	94.7%	123.7	21.0	F
	Through	1,630	1,612	98.9%	19.9	4.8	B
	Right Turn	30	30	99.7%	9.1	5.1	A
	Second Right						
	Subtotal	1,740	1,719	98.8%	24.3	5.8	C
SB	U Turn						
	Second Left						
	Left Turn	240	240	99.8%	144.2	29.4	F
	Through	3,280	3,252	99.1%	84.1	35.6	F
	Right Turn	310	304	98.0%	63.0	35.4	E
	Second Right						
	Subtotal	3,830	3,795	99.1%	86.4	34.8	F
EB	U Turn						
	Second Left						
	Left Turn	70	69	98.3%	82.4	10.2	F
	Through	30	28	91.7%	60.2	31.6	E
	Right Turn	50	53	105.8%	49.3	7.4	D
	Second Right						
	Subtotal	150	149	99.5%	65.3	7.9	E
WB	U Turn						
	Second Left						
	Left Turn	60	59	98.2%	86.6	17.5	F
	Through	40	43	107.5%	54.5	16.4	D
	Right Turn	60	63	104.3%	30.6	9.1	C
	Second Right						
	Subtotal	160	165	102.8%	57.5	12.3	E
Total		5,880	5,828	99.1%	66.2	21.7	E

VISSIM Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

SR 29 American Canyon
Modified Boulevard (6 Lanes)
Cumulative PM Peak Hour

Intersection 2

SR 29/Eucalyptus Dr

Signal

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	U Turn						
	Second Left						
	Left Turn	75	65	86.5%	81.8	12.7	F
	Through	1,495	1,477	98.8%	37.2	3.8	D
	Right Turn	315	309	98.0%	20.3	4.4	C
	Second Right						
	Subtotal	1,885	1,850	98.2%	36.0	3.3	D
SB	U Turn	20	22	110.5%	90.3	24.1	F
	Second Left						
	Left Turn	155	154	99.6%	96.3	9.8	F
	Through	2,965	2,942	99.2%	46.7	4.8	D
	Right Turn	250	249	99.5%	24.3	5.4	C
	Second Right						
	Subtotal	3,390	3,367	99.3%	48.0	4.4	D
EB	U Turn						
	Second Left						
	Left Turn	175	173	99.0%	80.3	10.6	F
	Through	100	107	106.7%	68.3	12.0	E
	Right Turn	40	29	72.5%	55.6	9.6	E
	Second Right						
	Subtotal	315	309	98.1%	73.5	9.6	E
WB	U Turn						
	Second Left						
	Left Turn	335	324	96.8%	234.8	54.8	F
	Through	100	95	94.9%	124.3	49.8	F
	Right Turn	85	82	96.4%	111.1	49.9	F
	Second Right						
	Subtotal	520	501	96.4%	192.4	51.5	F
Total		6,110	6,028	98.6%	57.6	2.9	E

VISSIM Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

SR 29 American Canyon
Modified Boulevard (6 Lanes)
Cumulative PM Peak Hour

Intersection 3

SR 29/Poco Way-S Napa Junction Rd

Signal

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	U Turn	10	9	88.0%	113.1	28.7	F
	Second Left						
	Left Turn	50	49	97.0%	100.5	14.6	F
	Through	1,815	1,796	98.9%	40.4	11.0	D
	Right Turn	15	14	90.7%	24.5	13.1	C
	Second Right						
	Subtotal	1,890	1,867	98.8%	42.2	10.6	D
SB	U Turn						
	Second Left						
	Left Turn	140	133	94.8%	106.6	7.8	F
	Through	2,955	2,904	98.3%	15.3	4.9	B
	Right Turn	150	150	99.8%	10.7	3.3	B
	Second Right						
	Subtotal	3,245	3,186	98.2%	18.9	4.6	B
EB	U Turn						
	Second Left						
	Left Turn	60	59	97.5%	80.1	7.4	F
	Through	15	16	104.0%	57.6	26.9	E
	Right Turn	20	20	100.5%	16.1	12.5	B
	Second Right						
	Subtotal	95	94	99.2%	62.4	5.8	E
WB	U Turn						
	Second Left						
	Left Turn	15	17	113.3%	87.6	31.6	F
	Through	15	15	100.0%	63.0	33.0	E
	Right Turn	40	28	69.5%	20.1	15.3	C
	Second Right						
	Subtotal	70	60	85.4%	51.3	22.8	D
Total		5,300	5,207	98.2%	28.5	6.2	C

VISSIM Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

SR 29 American Canyon
Modified Boulevard (6 Lanes)
Cumulative PM Peak Hour

Intersection 4

SR 29/Donaldson Way

Signal

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	U Turn	5	6	118.0%	75.7	52.9	E
	Second Left						
	Left Turn	55	54	98.4%	74.1	13.5	E
	Through	1,720	1,699	98.8%	24.8	3.6	C
	Right Turn	120	122	101.6%	7.5	2.2	A
	Second Right						
	Subtotal	1,900	1,881	99.0%	25.4	3.4	C
SB	U Turn	10	10	96.0%	122.6	55.3	F
	Second Left						
	Left Turn	210	217	103.1%	120.6	17.8	F
	Through	2,670	2,615	97.9%	16.0	2.6	B
	Right Turn	100	96	95.7%	14.2	5.0	B
	Second Right						
	Subtotal	2,990	2,937	98.2%	24.2	3.6	C
EB	U Turn						
	Second Left						
	Left Turn	60	58	96.8%	95.6	20.7	F
	Through	70	68	97.6%	58.4	14.4	E
	Right Turn	50	50	100.8%	44.8	9.5	D
	Second Right						
	Subtotal	180	177	98.2%	67.4	9.3	E
WB	U Turn						
	Second Left						
	Left Turn	80	80	99.9%	96.3	19.9	F
	Through	80	81	101.4%	59.3	13.8	E
	Right Turn	110	107	97.1%	14.7	5.0	B
	Second Right						
	Subtotal	270	268	99.2%	52.8	8.2	D
Total		5,340	5,262	98.5%	27.8	2.6	C

VISSIM Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

SR 29 American Canyon
Modified Boulevard (6 Lanes)
Cumulative PM Peak Hour

Intersection 5

SR 29/American Canyon Rd

Signal

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	U Turn	10	16	162.0%	110.5	46.8	F
	Second Left						
	Left Turn	180	184	102.3%	97.2	14.4	F
	Through	1,140	1,118	98.1%	58.1	3.1	E
	Right Turn	100	98	98.1%	21.0	3.6	C
	Second Right						
	Subtotal	1,430	1,416	99.0%	61.0	3.9	E
SB	U Turn						
	Second Left						
	Left Turn	905	887	98.0%	93.5	5.8	F
	Through	1,680	1,631	97.1%	41.4	8.5	D
	Right Turn	210	214	101.7%	11.6	2.9	B
	Second Right						
	Subtotal	2,795	2,732	97.7%	56.3	4.3	E
EB	U Turn						
	Second Left						
	Left Turn	150	154	102.9%	89.0	7.3	F
	Through	450	442	98.2%	61.7	4.0	E
	Right Turn	200	196	98.1%	61.2	12.8	E
	Second Right						
	Subtotal	800	793	99.1%	67.1	4.4	E
WB	U Turn						
	Second Left						
	Left Turn	110	111	101.3%	87.3	8.7	F
	Through	360	357	99.3%	58.6	7.6	E
	Right Turn	655	655	99.9%	68.1	18.6	E
	Second Right						
	Subtotal	1,125	1,123	99.9%	67.4	11.7	E
Total		6,150	6,064	98.6%	61.0	4.0	E

VISSIM Post-Processor
Average Results from 10 Runs
Queue Length

SR 29 American Canyon
Modified Boulevard (6 Lanes)
Cumulative PM Peak Hour

Intersection 1

SR 29/Napa Junction Rd

Signal

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn	350	53	11	39	75	200	41	130	267	NO
	Second Left										
	Left Turn	350	53	11	39	75	200	41	130	267	NO
	Through	1,660	55	9	44	68	639	135	438	803	NO
	Right Turn	300	0	0	0	1	32	13	21	51	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	500	171	65	106	323	1,435	1,065	372	2,799	MAX
	Through	3,700	1,059	371	717	1,760	3,274	496	2,723	4,410	NO
	Right Turn	500	6	1	5	9	160	59	96	297	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	150	25	4	20	33	113	20	92	151	NO
	Through	440	21	5	17	31	172	32	134	232	NO
	Right Turn	440	23	5	18	32	172	32	134	233	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	150	23	3	19	26	89	15	65	112	NO
	Through	425	24	5	18	35	190	38	128	240	NO
	Right Turn	425	25	5	18	35	189	38	128	240	NO
	Second Right										

VISSIM Post-Processor
Average Results from 10 Runs
Queue Length

SR 29 American Canyon
Modified Boulevard (6 Lanes)
Cumulative PM Peak Hour

Intersection 2

SR 29/Eucalyptus Dr

Signal

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn										
	Second Left										
	Left Turn	350	30	5	24	39	188	45	147	296	NO
	Through	1,800	95	16	63	119	740	253	511	1,309	NO
	Right Turn	575	14	3	9	20	235	60	131	354	NO
	Second Right										
SB	U Turn	450	86	9	73	96	346	46	296	434	NO
	Second Left										
	Left Turn	450	86	9	73	96	346	46	296	434	NO
	Through	1,660	321	24	287	357	1,416	13	1,403	1,442	NO
	Right Turn	500	7	2	5	9	159	50	110	250	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	760	53	5	48	63	214	62	140	342	NO
	Through	760	57	10	38	71	335	115	203	536	NO
	Right Turn	760	54	10	36	69	334	115	203	536	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	175	375	81	276	515	607	19	591	643	AVG
	Through	400	133	31	82	193	583	29	512	610	MAX
	Right Turn	400	134	29	81	192	583	29	512	610	MAX
	Second Right										

VISSIM Post-Processor
Average Results from 10 Runs
Queue Length

SR 29 American Canyon
Modified Boulevard (6 Lanes)
Cumulative PM Peak Hour

Intersection 3

SR 29/Poco Way-S Napa Junction Rd

Signal

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn	350	27	6	19	35	147	31	85	189	NO
	Second Left										
	Left Turn	350	27	6	19	35	147	31	85	189	NO
	Through	2,650	172	24	136	218	938	142	730	1,185	NO
	Right Turn	250	0	0	0	0	24	6	20	40	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	400	83	7	75	97	303	45	241	364	NO
	Through	1,800	71	20	43	115	1,180	288	743	1,518	NO
	Right Turn	400	0	0	0	1	51	16	20	78	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	200	29	8	22	47	149	30	117	220	NO
	Through	720	7	2	4	10	88	23	46	134	NO
	Right Turn	720	9	2	6	12	92	23	50	137	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	230	8	2	4	10	61	16	42	96	NO
	Through	800	8	3	3	15	90	15	73	116	NO
	Right Turn	800	8	3	2	15	89	15	72	115	NO
	Second Right										

VISSIM Post-Processor
Average Results from 10 Runs
Queue Length

SR 29 American Canyon
Modified Boulevard (6 Lanes)
Cumulative PM Peak Hour

Intersection 4

SR 29/Donaldson Way

Signal

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn	350	27	5	18	36	156	34	112	233	NO
	Second Left										
	Left Turn	350	27	5	18	36	156	34	112	233	NO
	Through	2,510	87	4	80	96	447	42	379	511	NO
	Right Turn	350	2	1	1	3	73	14	53	99	NO
	Second Right										
SB	U Turn	500	161	24	124	199	552	184	395	1,025	MAX
	Second Left										
	Left Turn	500	161	24	124	199	552	184	395	1,025	MAX
	Through	2,650	48	19	24	89	1,022	321	536	1,462	NO
	Right Turn	350	0	0	0	1	42	15	21	65	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	225	32	5	26	39	168	37	112	245	NO
	Through	1,040	39	5	33	50	235	36	166	293	NO
	Right Turn	1,040	39	5	33	49	234	36	165	292	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	300	44	14	21	71	194	79	85	359	NO
	Through	580	27	5	18	34	171	60	105	272	NO
	Right Turn	125	6	1	4	8	85	17	46	108	NO
	Second Right										

VISSIM Post-Processor
Average Results from 10 Runs
Queue Length

SR 29 American Canyon
Modified Boulevard (6 Lanes)
Cumulative PM Peak Hour

Intersection 5

SR 29/American Canyon Rd

Signal

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn	250	117	26	79	159	442	116	290	656	MAX
	Second Left										
	Left Turn	250	117	26	79	159	442	116	290	656	MAX
	Through	3,050	151	13	134	170	612	126	484	912	NO
	Right Turn	275	8	2	5	12	117	23	75	161	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	650	289	18	269	326	1,017	354	646	1,408	MAX
	Through	1,320	203	27	158	245	1,019	316	567	1,405	NO
	Right Turn	500	7	2	5	11	137	31	102	211	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	450	130	16	105	147	476	72	380	629	MAX
	Through	850	139	10	123	150	477	71	386	630	NO
	Right Turn	850	138	10	122	148	476	71	385	628	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	450	60	7	50	69	265	33	188	308	NO
	Through	830	67	6	57	76	251	32	200	314	NO
	Right Turn	600	78	92	27	327	618	200	427	1,072	MAX
	Second Right										

VISSIM Post-Processor
Average Values from 10 Runs
Network Statistics

SR 29 American Canyon
Boulevard (4 Lanes)
Cumulative PM Peak Hour

Performance Measure	Vehicle Types	Average	Std. Dev.	Minimum	Maximum
Average Delay (seconds)	All	366.6	12.68	349.5	388.4
Total Delay (hours)	All	905	29	872	952
Average Stopped Delay (seconds)	All	144.3	6.50	138.1	156.5
Total Stopped Delay (hours)	All	357	17	333	384
Total Distance Traveled (miles)	All	13,006	117	12,806	13,193
Average Speed (mph)	All	10.7	0.29	10.3	11.0
Average Number of Stops	All	4.8	0.24	4.4	5.2
Total Number of Stops	All	42,534	2,085	39,105	46,317
Total Travel Time (hours)	All	1,219.1	28.7	1,187.1	1,265.5
Vehicles Active	All	1,238	59	1,120	1,347
Vehicles Arrived	All	7,655	63	7,563	7,749
Average Delay (seconds)	Motorized	386.5	13.89	367.3	410.9
Total Delay (hours)	Motorized	896	29	862	942
Average Stopped Delay (seconds)	Motorized	149.7	7.14	142.7	163.0
Total Stopped Delay (hours)	Motorized	347	17	324	374
Total Distance Traveled (miles)	Motorized	12,942	117	12,746	13,129
Average Speed (mph)	Motorized	10.9	0.31	10.5	11.3
Average Number of Stops	Motorized	5.1	0.26	4.6	5.5
Total Number of Stops	Motorized	42,220	2,089	38,792	46,012
Total Travel Time (hours)	Motorized	1,187.2	28.7	1,155.4	1,232.7
Vehicles Active	Motorized	1,207	55	1,096	1,306
Vehicles Arrived	Motorized	7,136	66	7,022	7,252
Average Delay (seconds)	Non-motorized	64.9	3.36	59.4	68.2
Total Delay (hours)	Non-motorized	10	1	9	11
Average Stopped Delay (seconds)	Non-motorized	63.9	3.36	58.4	67.3
Total Stopped Delay (hours)	Non-motorized	10	1	9	11
Total Distance Traveled (miles)	Non-motorized	64	2	60	67
Average Speed (mph)	Non-motorized	2.0	0.03	2.0	2.1
Average Number of Stops	Non-motorized	0.6	0.02	0.5	0.6
Total Number of Stops	Non-motorized	314	12	296	333
Total Travel Time (hours)	Non-motorized	31.9	1.2	30.3	33.9
Vehicles Active	Non-motorized	32	7	19	41
Vehicles Arrived	Non-motorized	519	15	496	544

VISSIM Post-Processor
 Average Values from 10 Runs
 Peak Hour Travel Time

SR 29 American Canyon
 Boulevard (4 Lanes)
 Cumulative PM Peak Hour

Mode	Description	Distance (ft)	Volume (vehicles)		Travel Time (minutes)		Speed (mph)
			Average	Std. Dev.	Average	Std. Dev.	Average
Motorized	Northbound SR 29	13,344	659	14	7.30	0.82	20.8
	Southbound SR 29	13,347	815	29	11.24	0.79	13.5

VISSIM Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

SR 29 American Canyon
Boulevard (4 Lanes)
Cumulative PM Peak Hour

Intersection 1

SR 29/Napa Junction Rd

Signal

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	U Turn	10	11	105.0%	111.1	38.8	F
	Second Left	70	62	88.0%	93.3	12.1	F
	Left Turn						
	Through	1,610	1,527	94.9%	15.2	3.3	B
	Right Turn	20	22	108.0%	102.3	19.3	F
	Second Right	30	29	97.0%	50.6	30.8	D
	Subtotal	1,740	1,650	94.8%	21.8	3.7	C
SB	U Turn						
	Second Left						
	Left Turn	240	153	63.8%	385.9	20.7	F
	Through	3,282	2,043	62.2%	344.0	19.1	F
	Right Turn	310	192	61.9%	280.0	15.4	F
	Second Right						
	Subtotal	3,832	2,388	62.3%	342.0	18.2	F
EB	U Turn						
	Second Left						
	Left Turn	70	68	97.6%	94.1	10.9	F
	Through	30	28	94.7%	72.3	18.4	E
	Right Turn	50	52	104.0%	33.5	14.7	C
	Second Right						
	Subtotal	150	149	99.1%	70.5	6.8	E
WB	U Turn						
	Second Left						
	Left Turn	60	0	0.0%	0.0	0.0	A
	Through	40	1	1.8%	0.0	0.0	A
	Right Turn	60	1	1.3%	0.0	0.0	A
	Second Right						
	Subtotal	160	2	0.9%	0.0	0.0	A
Total		5,882	4,188	71.2%	201.3	9.3	F

VISSIM Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

SR 29 American Canyon
Boulevard (4 Lanes)
Cumulative PM Peak Hour

Intersection 2

SR 29/Eucalyptus Dr

Signal

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	U Turn	25	24	94.0%	149.9	48.7	F
	Second Left	65	64	98.0%	147.0	59.7	F
	Left Turn	1	0	0.0%	0.0	0.0	A
	Through	1,498	1,430	95.4%	48.0	6.7	D
	Right Turn	1	0	10.0%	0.0	0.0	A
	Second Right	316	300	94.8%	14.7	4.2	B
	Subtotal	1,906	1,817	95.3%	48.3	9.1	D
SB	U Turn	20	14	69.0%	112.7	46.1	F
	Second Left	155	98	63.3%	115.0	22.3	F
	Left Turn	4	4	90.0%	46.7	58.5	D
	Through	2,963	1,830	61.8%	80.2	8.2	F
	Right Turn	1	0	30.0%	1.9	5.9	A
	Second Right	250	152	60.6%	8.5	2.6	A
	Subtotal	3,393	2,098	61.8%	77.4	7.7	E
EB	U Turn						
	Second Left						
	Left Turn	175	174	99.3%	95.9	9.0	F
	Through	100	105	104.7%	70.5	11.6	E
	Right Turn	27	27	98.5%	75.0	25.4	E
	Second Right	3	3	83.3%	25.8	35.9	C
	Subtotal	305	308	100.8%	85.0	6.8	F
WB	U Turn						
	Second Left						
	Left Turn	336	215	64.0%	465.7	12.0	F
	Through	100	66	66.2%	268.6	43.9	F
	Right Turn	79	54	68.7%	263.3	47.6	F
	Second Right	5	3	56.0%	122.3	112.2	F
	Subtotal	520	338	65.1%	385.5	21.2	F
Total		6,124	4,560	74.5%	95.4	5.5	F

VISSIM Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

SR 29 American Canyon
Boulevard (4 Lanes)
Cumulative PM Peak Hour

Intersection 3

SR 29/Poco Way-S Napa Junction Rd

Signal

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	U Turn	10	8	82.0%	102.1	43.7	F
	Second Left	50	48	95.2%	64.6	9.8	E
	Left Turn	4	3	85.0%	76.8	76.2	E
	Through	1,809	1,718	94.9%	49.9	6.0	D
	Right Turn	1	1	90.0%	0.6	1.8	A
	Second Right	15	12	80.7%	4.1	3.7	A
	Subtotal	1,889	1,790	94.7%	50.2	5.7	D
SB	U Turn	1	0	0.0%	0.0	0.0	A
	Second Left	130	84	64.5%	90.8	11.0	F
	Left Turn	8	9	110.0%	76.5	46.1	E
	Through	2,935	1,834	62.5%	20.8	5.3	C
	Right Turn	1	1	60.0%	2.6	4.6	A
	Second Right	150	97	64.9%	7.9	1.2	A
	Subtotal	3,225	2,025	62.8%	24.0	5.1	C
EB	U Turn						
	Second Left						
	Left Turn	60	59	98.3%	111.2	47.5	F
	Through	15	15	100.0%	58.1	26.7	E
	Right Turn	18	17	96.7%	73.6	30.4	E
	Second Right	2	2	95.0%	9.5	18.4	A
	Subtotal	95	93	98.2%	92.2	26.5	F
WB	U Turn						
	Second Left						
	Left Turn	15	17	110.7%	103.6	30.2	F
	Through	15	15	98.0%	60.6	30.4	E
	Right Turn	24	23	96.3%	76.6	22.0	E
	Second Right	6	6	96.7%	24.0	31.8	C
	Subtotal	60	60	100.3%	72.6	12.0	E
Total		5,269	3,968	75.3%	38.5	4.8	D

VISSIM Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

SR 29 American Canyon
Boulevard (4 Lanes)
Cumulative PM Peak Hour

Intersection 4

SR 29/Donaldson Way

Signal

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	U Turn	50	47	93.4%	145.1	50.7	F
	Second Left	55	50	91.1%	157.7	67.2	F
	Left Turn	8	8	98.8%	133.2	92.1	F
	Through	1,710	1,623	94.9%	36.4	10.1	D
	Right Turn	1	0	40.0%	1.1	3.4	A
	Second Right	120	117	97.2%	18.8	21.5	B
	Subtotal	1,944	1,845	94.9%	42.2	13.1	D
SB	U Turn	10	6	60.0%	74.4	62.4	E
	Second Left	210	141	67.0%	97.5	22.2	F
	Left Turn	3	3	110.0%	51.3	67.3	D
	Through	2,669	1,672	62.6%	35.7	9.7	D
	Right Turn	1	0	20.0%	1.3	4.3	A
	Second Right	100	63	63.3%	16.2	13.7	B
	Subtotal	2,993	1,886	63.0%	40.4	8.0	D
EB	U Turn						
	Second Left						
	Left Turn	60	61	101.2%	117.4	48.3	F
	Through	70	69	98.0%	71.0	12.8	E
	Right Turn	48	51	105.2%	79.2	16.1	E
	Second Right	2	2	75.0%	22.6	47.1	C
	Subtotal	180	181	100.7%	87.1	13.4	F
WB	U Turn						
	Second Left						
	Left Turn	80	77	96.0%	121.8	29.4	F
	Through	80	78	97.5%	63.8	10.1	E
	Right Turn	105	102	97.2%	69.8	15.2	E
	Second Right	5	4	86.0%	10.4	13.6	B
	Subtotal	270	261	96.7%	82.3	12.3	F
Total		5,387	4,173	77.5%	45.3	8.1	D

VISSIM Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

SR 29 American Canyon
Boulevard (4 Lanes)
Cumulative PM Peak Hour

Intersection 5

SR 29/Frontage Rd/American Canyon Rd

Signal

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	U Turn	15	15	101.3%	212.4	52.9	F
	Second Left						
	Left Turn	180	176	97.5%	232.9	42.2	F
	Through	1,135	1,095	96.4%	143.1	43.7	F
	Right Turn	100	96	95.6%	103.9	49.3	F
	Second Right						
	Subtotal	1,430	1,381	96.6%	153.5	43.2	F
SB	U Turn						
	Second Left						
	Left Turn	855	556	65.0%	41.7	3.0	D
	Through	1,635	1,045	63.9%	20.6	4.5	C
	Right Turn	210	138	65.8%	19.4	9.9	B
	Second Right						
	Subtotal	2,700	1,738	64.4%	27.0	3.9	C
SE	U Turn	34	35	103.8%	99.4	16.1	F
	Second Left						
	Left Turn	16	15	94.4%	90.7	33.0	F
	Through	42	38	91.4%	92.8	15.6	F
	Right Turn	1	1	70.0%	10.7	34.0	B
	Second Right						
	Subtotal	93	90	96.2%	95.3	9.1	F
EB	U Turn						
	Second Left						
	Left Turn	185	146	79.1%	213.5	89.5	F
	Through	465	442	95.1%	95.4	36.7	F
	Right Turn						
	Second Right						
	Subtotal	650	588	90.5%	125.7	47.4	F
WB	U Turn						
	Second Left						
	Left Turn	110	103	93.7%	233.7	24.9	F
	Through	360	337	93.6%	175.7	24.9	F
	Right Turn	620	563	90.9%	283.3	24.9	F
	Second Right						
	Subtotal	1,090	1,004	92.1%	243.4	21.4	F
Total		5,963	4,801	80.5%	180.7	26.6	F

VISSIM Post-Processor
Average Results from 10 Runs
Queue Length

SR 29 American Canyon
Boulevard (4 Lanes)
Cumulative PM Peak Hour

Intersection 1

SR 29/Napa Junction Rd

Signal

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn	250	40	9	30	61	204	34	161	256	NO
	Second Left										
	Left Turn										
	Through	1,660	69	10	52	92	579	296	290	1,147	NO
	Right Turn	715	18	3	13	23	123	21	90	160	NO
	Second Right	715	18	3	13	23	123	21	89	160	NO
SB	U Turn										
	Second Left										
	Left Turn	500	99	6	88	109	346	41	307	407	NO
	Through	3,700	4,837	55	4,728	4,892	5,073	0	5,073	5,074	AVG
	Right Turn	475	4,837	55	4,729	4,893	5,073	0	5,073	5,074	AVG
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	150	28	4	22	33	116	22	92	171	NO
	Through	440	19	5	9	25	169	48	106	237	NO
	Right Turn	440	20	5	10	26	169	48	106	236	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	150	469	15	439	478	495	11	476	507	AVG
	Through	425	0	1	0	3	14	29	0	69	NO
	Right Turn	425	1	1	0	3	14	29	0	70	NO
	Second Right										

VISSIM Post-Processor
Average Results from 10 Runs
Queue Length

SR 29 American Canyon
Boulevard (4 Lanes)
Cumulative PM Peak Hour

Intersection 2

SR 29/Eucalyptus Dr

Signal

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn	250	74	21	45	108	294	125	179	551	MAX
	Second Left	250	74	21	45	108	294	125	179	551	MAX
	Left Turn	250	74	21	45	108	294	125	179	551	MAX
	Through	1,800	246	34	198	303	1,117	147	920	1,464	NO
	Right Turn										
	Second Right										
SB	U Turn	250	82	15	60	114	325	61	246	404	MAX
	Second Left	250	82	15	60	114	325	61	246	404	MAX
	Left Turn	250	82	15	60	114	325	61	246	404	MAX
	Through	1,660	689	27	634	738	1,437	10	1,421	1,459	NO
	Right Turn	1,220	3	1	1	5	132	50	65	212	NO
	Second Right	1,220	3	1	1	5	132	50	66	213	NO
EB	U Turn										
	Second Left										
	Left Turn	175	64	15	50	100	304	128	162	551	MAX
	Through	760	57	7	43	72	349	100	209	550	NO
	Right Turn	760	57	7	43	72	349	100	209	550	NO
	Second Right	760	57	7	43	72	349	100	208	549	NO
WB	U Turn										
	Second Left										
	Left Turn	400	551	4	546	559	622	16	601	652	AVG
	Through	400	238	121	63	433	608	15	594	637	MAX
	Right Turn	400	238	121	63	433	608	15	594	637	MAX
	Second Right	400	238	121	63	434	609	15	595	638	MAX

VISSIM Post-Processor
Average Results from 10 Runs
Queue Length

SR 29 American Canyon
Boulevard (4 Lanes)
Cumulative PM Peak Hour

Intersection 3

SR 29/Poco Way-S Napa Junction Rd

Signal

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn	250	26	5	17	33	155	26	121	211	NO
	Second Left	250	26	5	17	33	155	26	121	211	NO
	Left Turn	250	26	5	17	33	155	26	121	211	NO
	Through	2,650	311	28	273	356	1,100	413	813	2,151	NO
	Right Turn	920	0	0	0	0	34	16	21	66	NO
	Second Right	920	0	0	0	0	33	16	20	66	NO
SB	U Turn	250	48	7	37	58	244	49	170	326	NO
	Second Left	250	48	7	37	58	244	49	170	326	NO
	Left Turn	250	48	7	37	58	244	49	170	326	NO
	Through	1,800	109	21	88	156	1,019	511	356	1,502	NO
	Right Turn	885	1	1	1	3	82	25	50	126	NO
	Second Right	885	2	1	1	3	82	25	50	126	NO
EB	U Turn										
	Second Left										
	Left Turn	200	38	18	25	87	169	46	121	279	NO
	Through	720	14	5	6	24	106	36	69	197	NO
	Right Turn	720	14	5	6	24	106	36	69	197	NO
	Second Right	720	14	5	6	24	107	36	69	198	NO
WB	U Turn										
	Second Left										
	Left Turn	230	9	3	6	14	70	18	44	97	NO
	Through	800	17	2	13	21	114	15	92	144	NO
	Right Turn	800	17	2	13	21	114	15	92	144	NO
	Second Right	800	17	2	13	21	115	15	93	144	NO

VISSIM Post-Processor
Average Results from 10 Runs
Queue Length

SR 29 American Canyon
Boulevard (4 Lanes)
Cumulative PM Peak Hour

Intersection 4

SR 29/Donaldson Way

Signal

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn	250	96	36	58	166	325	123	213	589	MAX
	Second Left	250	96	36	58	166	325	123	213	589	MAX
	Left Turn	250	96	36	58	166	325	123	213	589	MAX
	Through	2,510	172	42	141	285	741	292	545	1,550	NO
	Right Turn	870	2	1	1	4	78	30	51	146	NO
	Second Right	870	2	1	1	4	79	30	51	147	NO
SB	U Turn	250	90	15	69	114	402	62	304	478	MAX
	Second Left	250	90	15	69	114	402	62	304	478	MAX
	Left Turn	250	90	15	69	114	402	62	304	478	MAX
	Through	2,650	216	80	139	378	1,333	458	628	1,874	NO
	Right Turn	1,410	1	0	0	1	62	19	43	110	NO
	Second Right	1,410	1	0	1	1	62	19	43	110	NO
EB	U Turn										
	Second Left										
	Left Turn	225	41	8	30	53	187	45	146	290	NO
	Through	1,040	51	7	37	62	252	42	206	322	NO
	Right Turn	1,040	51	7	37	62	252	42	206	322	NO
	Second Right	1,040	48	7	35	57	252	42	206	322	NO
WB	U Turn										
	Second Left										
	Left Turn	300	65	38	30	156	223	128	106	556	NO
	Through	580	29	4	25	36	162	46	112	244	NO
	Right Turn	125	42	6	29	49	208	33	155	256	MAX
	Second Right	125	42	6	29	50	208	33	155	256	MAX

VISSIM Post-Processor
Average Results from 10 Runs
Queue Length

SR 29 American Canyon
Boulevard (4 Lanes)
Cumulative PM Peak Hour

Intersection 5

SR 29/Frontage Rd/American Canyon Rd

Signal

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn	250	449	239	160	893	1,647	471	909	2,354	AVG
	Second Left										
	Left Turn	250	449	239	160	893	1,647	471	909	2,354	AVG
	Through	3,050	682	246	284	1,048	1,703	461	966	2,353	NO
	Right Turn	275	9	3	5	13	128	37	68	196	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	650	68	6	60	77	351	41	296	409	NO
	Through	2,550	48	5	39	56	379	132	194	640	NO
	Right Turn	550	12	4	7	20	106	39	66	193	NO
	Second Right										
SE	U Turn	325	29	6	18	37	136	31	89	172	NO
	Second Left										
	Left Turn	325	29	6	18	37	136	31	89	172	NO
	Through	1,310	22	6	15	32	109	21	75	138	NO
	Right Turn	1,310	18	6	10	28	109	21	75	138	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	450	205	78	131	391	600	84	496	730	MAX
	Through	850	225	70	161	392	602	84	497	731	NO
	Right Turn	850	225	70	161	393	603	84	498	732	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	450	205	78	131	391	600	84	496	730	MAX
	Through	830	225	70	161	392	602	84	497	731	NO
	Right Turn	600	225	70	161	393	603	84	498	732	MAX
	Second Right										