US 101/San Luis Bay Drive

Intersection Control Evaluation (ICE)
Step 1

County of San Luis Obispo

Draft for Review

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US 101/San Luis Bay Drive

Intersection Control Evaluation (ICE)

Step 1

(Draft Document – For Discussion Only)

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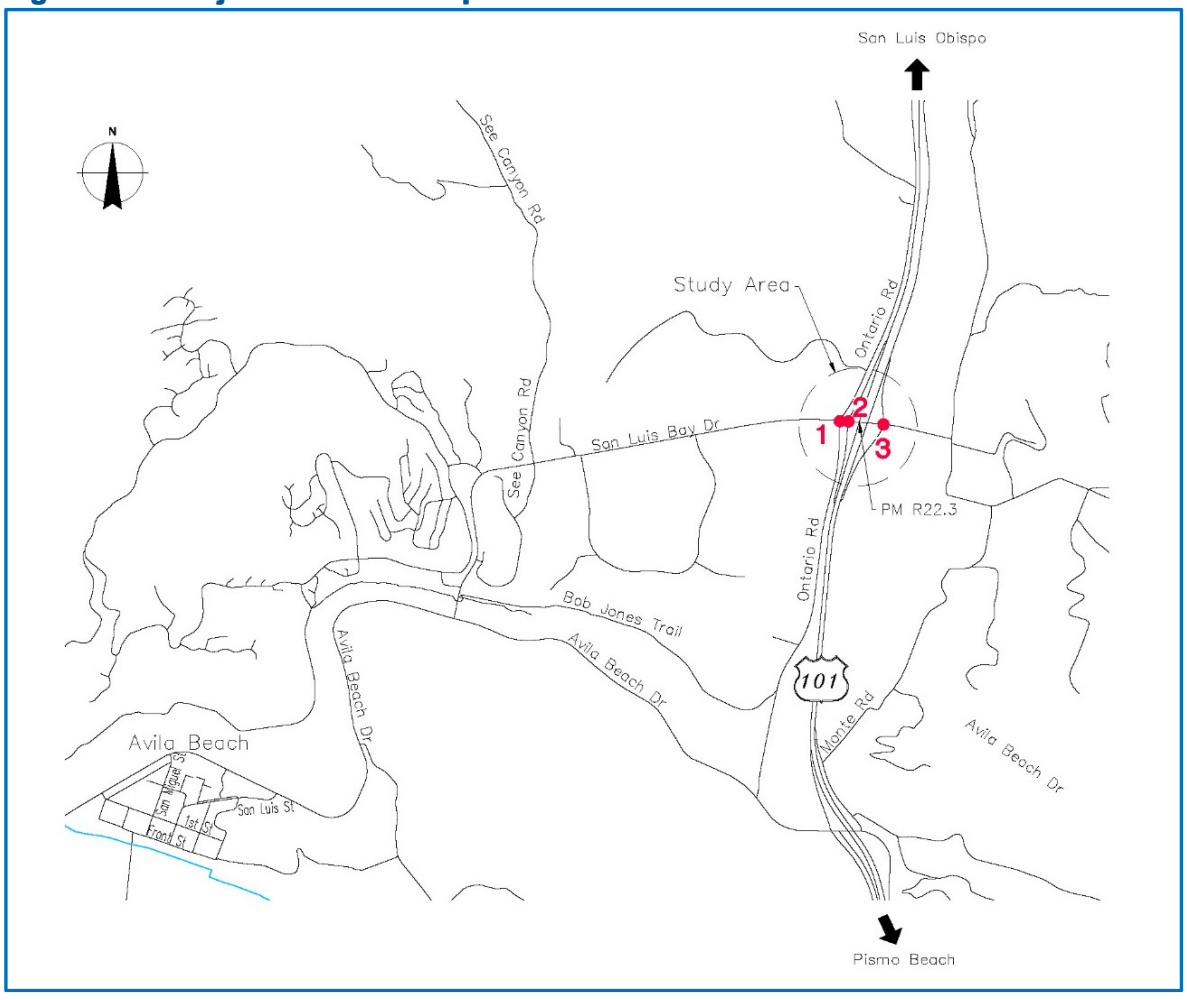
1. Introduction

This document has been prepared to present the results of conceptual alternatives analysis performed by GHD for the County of San Luis Obispo in support of the Intersection Control Evaluation (ICE) - Step I process. The analysis is consistent with the most recent Caltrans Traffic Operations Policy Directive for intersection improvements on the state highway system. The purpose of the study is to identify viable alternatives (project) to improve safety, reduce delay, and enhance mobility for all travel modes on San Luis Bay Drive at Ontario Road and at the interchange of San Luis Bay Drive with US 101.

The project location consisting of Route 101 (US 101)/San Luis Bay Drive interchange and Ontario Road/San Luis Bay Drive intersection are located south of City of San Luis Obispo in the County of San Luis Obispo. The project location is shown on Figure 1.1.

Figure 1.1 Project Location Map



The project study area includes US 101 which is a major north-south interstate that traverses along coastal California. US 101 serves as the principal inter-regional auto and truck travel route that connects San Luis Obispo County (and other portions of the Central Coast) with the Los Angeles

urban basin to the south, and the San Francisco Bay Area to the north. Within San Luis Obispo County, US 101 provides major connection between and through several cities, including the City of San Luis Obispo and the Five Cities Area. US 101 represents a major commuter travel route and, within the study area, forms a full access interchange with San Luis Bay Drive.

Other major roadways located within the study area include San Luis Bay Drive and Ontario Road. San Luis Bay Drive is a major east-west two-lane undivided arterial that begins at Monte Road to the east and terminates at Avila Beach Drive to the west. San Luis Bay Drive provides a full access interchange with US 101. Per the current County Bikeways Plan, a Class II Bike Lane is proposed on San Luis Bay Drive beginning at the Ontario Road intersection and extending west to Avila Beach Drive.

Ontario Road is a two-lane undivided roadway that primarily runs north-south from Avila Beach Drive to the south to South Higuera Street to the north. Ontario Road is a collector north of San Luis Bay Drive and serves as the frontage road west of US 101. Per the current County Bikeways Plan, Ontario Road is proposed to be upgraded from Class III to Class II.

For the purposes of this ICE Step 1 evaluation, the focus study intersections include the following:

1. San Luis Bay Drive at Ontario Road
2. San Luis Bay Drive at US 101 Southbound Ramps
3. San Luis Bay Drive at US 101 Northbound Ramps

This document contains a description of the following sections consistent with the Caltrans ICE document guidelines for the Step I process:

- Screening Objectives
- Screening Criteria
- Capacity Assessment/Analysis
- Footprint Development & Assessment
- Safety Considerations
- Recommendations & Documentation

2. Screening Objectives

2.1 Project Analysis Conditions

This section contains a brief description of the approximate time frames for which the traffic operations analysis was conducted. The project alternatives (discussed within the next section) were analyzed for the baseline (existing) condition and for two future design year conditions, interim design year (year 2030) and ultimate design year (year 2045) conditions.

2.1.1 Baseline Conditions

The distance between US 101 northbound and southbound ramps intersections on San Luis Bay Drive is approximately 530 feet while the distance between the southbound ramps and Ontario Road is approximately 115 feet. Due to the close intersection spacing between the US 101 southbound ramps and Ontario Road, the two intersections essentially operate as a single

intersection with five approaches and exits. Both ramp intersections are stop controlled on the off-ramp approaches at San Luis Bay Drive and Ontario Road is stop sign controlled at San Luis Bay Drive.

New weekday AM and PM peak hour intersection traffic counts were collected at the three study intersections on September 11, 2018 for a 2-hour AM (7:00-9:00 am) period and a 4-hour PM (2:00-6:00 pm) period. The observed AM and PM peak hours are shown in Table 1.

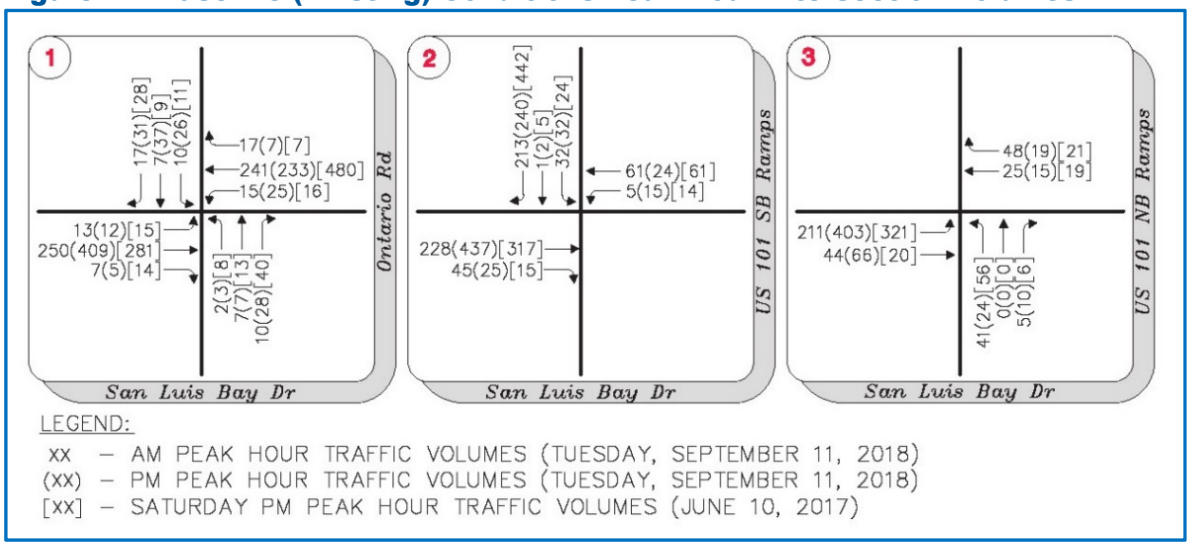
Table 1: Observed Weekday Peak Hours at Study Intersections

Intersections	AM Peak Hour	PM Peak Hour
San Luis Bay Drive at US 101 NB Ramps	8:00-9:00	4:45-5:45
San Luis Bay Drive at US 101 SB Ramps	8:00-9:00	4:30-5:30
San Luis Bay Drive at Ontario Road	8:00-9:00	4:30-5:30

The County also provided Saturday PM peak hour intersection traffic counts collected at the three study intersections on June 10, 2017. Counts were collected for the 4-hour period between 12:00-4:00 pm with the peak hour occurring between 1:15-2:15 pm. The Saturday PM peak hour is assumed to represent a peak summer weekend condition at the study intersections. Just as a disclosure, there was a concert with approximately 1,700 attendees on June 10, 2017 based on special event data collected in Avila Beach.

The AM and PM peak hour intersection traffic volumes obtained on September 11, 2018 and the Saturday PM peak hour intersection traffic volumes obtained on June 10, 2017 are presented below on Figure 2.1.

Figure 2.1 Baseline (Existing) Conditions Peak Hour Intersection Volumes



Based on the peak hour intersection volumes provided on Figure 2.1, the weekday AM peak hour link volumes is 530 vehicles, the weekday PM peak hour link volumes is 693 vehicles and the Saturday PM peak hour link volumes is 826 vehicles on San Luis Obispo Drive west of Ontario

Road. The EB/WB peak hour traffic distribution on this link is 51% / 49% during the weekday AM peak hour, 62% / 38% during the weekday PM peak hour, and 38% / 62% during the Saturday PM peak hour. As the weekday PM and Saturday PM peak hour volumes are significantly higher than the weekday AM peak hour and as the peak hour traffic distribution is opposite between these two peak hours, the County recommended that the weekday and Saturday PM peak hours represent the analysis peak hours for this study.

2.1.2 Design Year Conditions

The various intersection control alternatives are also evaluated for both an Interim Design Year (2030) and/or the Ultimate Design Year (2045).

2.1.2.1 Traffic Forecasts – Basis

The interim and ultimate design year traffic forecasts for the weekday peak hours are based on the year 2035 traffic forecasts presented in the 2015 Avila Circulation Study and Traffic Impact Fee Update. The Avila Circulation Study analyzed transportation facilities throughout the Avila Valley, including the three study intersections at the San Luis Bay Drive interchange. The 2035 forecasts from the Avila Circulation Study were developed utilizing the Avila Travel Demand Model (TDM), which was created as part of the Avila Circulation Study.

In order to derive interim and ultimate year traffic forecasts for the Saturday peak hour, year 2035 forecasts for the Saturday peak were derived as the basis, by applying the factor of existing Saturday to PM peak hour to the 2035 PM traffic forecasts. Therefore, year 2035 was utilized as the basis for all scenarios, and interim and ultimate year traffic forecasts were developed in a consistent manner.

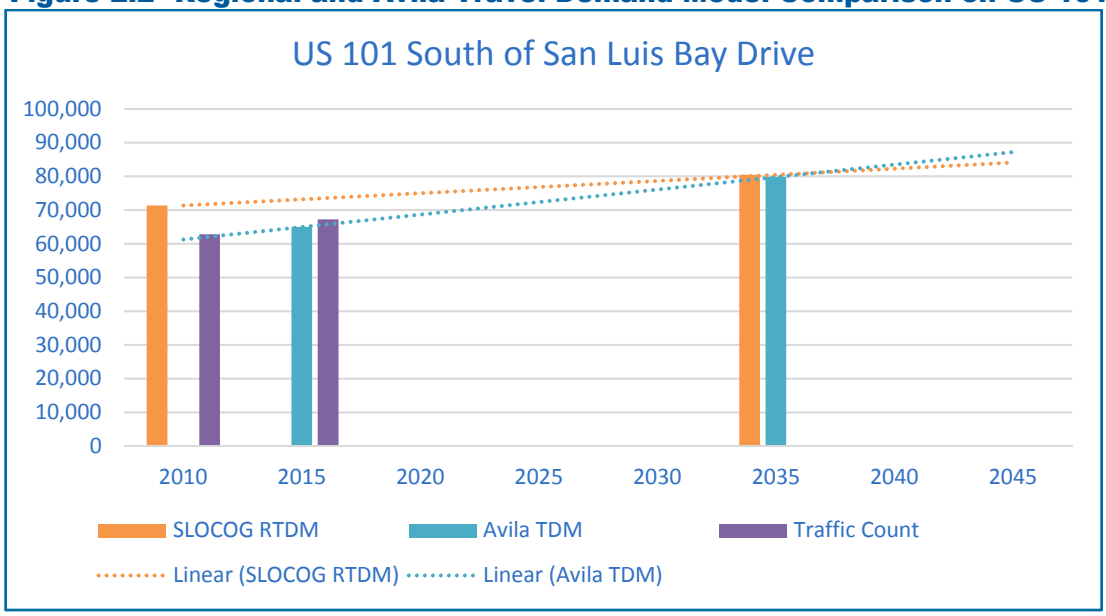
During development of the Avila TDM, land use inputs were vetted through the County to reflect existing local conditions. External gateways at the model's boundaries were validated against the SLOCOG Regional Travel Demand Model (SLOCOG RTDM) for existing and forecasted travel conditions. Table 2 presents a summary of transportation facilities in the vicinity of the study area, as represented in both the SLOCOG and Avila Travel Demand Models. As shown in Table 2, average daily traffic counts collected in September 2014 (for the Avila Circulation Study) along San Luis Bay Drive west of Ontario Road were 7,966 vehicles per day. Traffic counts on US 101 were obtained from the Caltrans Traffic Census Program. In 2015, US 101 north of San Luis Bay Drive had an AADT of 73,500 and south of San Luis Bay Drive the AADT was 67,200. US 101 within the vicinity of Avila's planning area has historically experienced approximately 0.5% compounded annual growth in AADT over a 10 year period (2005 through 2015).

Table 2: Transportation Facilities

	SLOCOG RTDM Daily Volume		Avila Travel Demand Model Daily Volume		Traffic Count	US 101 Projected 2035 Growth
Roadway/Location	2010	2035	2015	2035	2015	(0.5% annual)
US 101 North of Higuera St	68,226	78,618	65,704	80,126	69,300	76,400
US 101 North of San Luis Bay Dr	77,204	86,751	72,458	87,623	73,500	81,000
US 101 at San Luis Bay Dr	70,760	79,911	63,099	76,626	-	
US 101 South of San Luis Bay Dr	71,355	80,447	64,964	79,772	67,200	74,100
San Luis Bay Drive w of Ontario Rd	6,139	6,449	8,856	11,003	8,010	

Although the SLOCOG RTDM presents a lower growth rate between 2010 and 2035, the 2010 volumes on US 101 were higher than existing Caltrans traffic counts in 2010 (AADT of 62,800 south of San Luis Bay Drive). Therefore, the growth rate presented in the Avila model between 2015 and 2035 is higher than the SLOCOG model. Based on the Avila model, 2035 traffic volumes are projected to increase by approximately 1.0% per year. Figure 2.2 presents the correlation between the SLOCOG RTDM and the Avila TDM base and forecasted volumes along US 101 south of San Luis Bay Drive.

Figure 2.2 Regional and Avila Travel Demand Model Comparison on US 101



As shown in Figure 2.2, the 2035 projections from the Avila model are consistent with the SLOCOG RTDM. Additionally, the trend line for the Avila TDM forecasts closely follows the observed traffic counts on US 101. Assuming the growth rate continues as shown for the Avila TDM trend line also provides a conservative approach for developing 2045 forecasts. The Avila TDM and projected 2035 forecasts from the Avila Circulation Study was utilized as the basis for developing interim design year (2030) and ultimate design year (2045) forecasts for the San Luis Bay Drive ICE study.

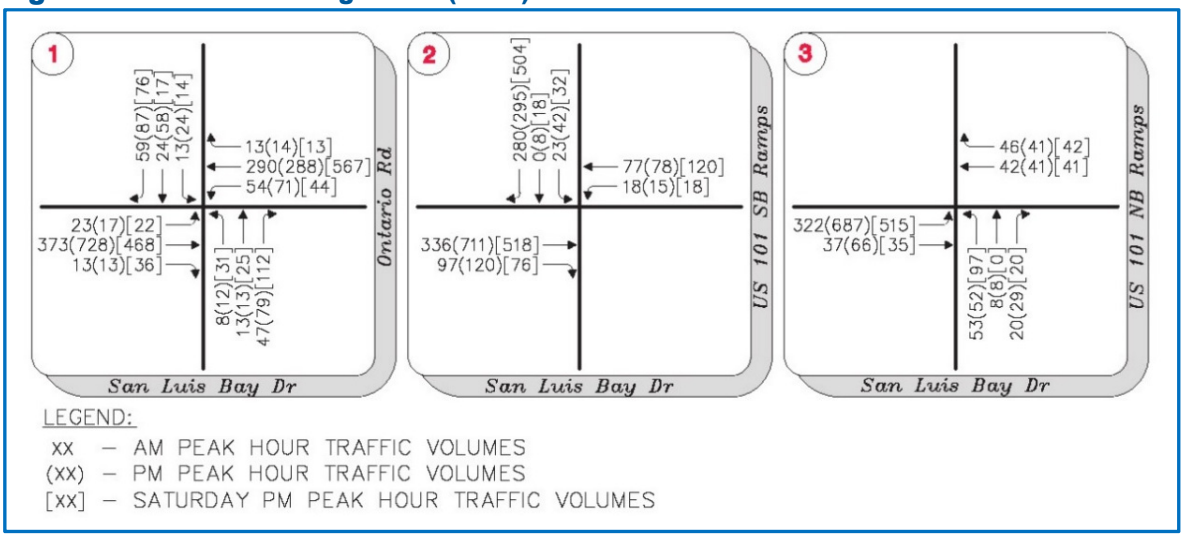
2.1.2.2 Traffic Forecasts – Assumptions & Methodologies

The interim design year (2030) and the ultimate design year (2045) forecasts for the study intersections were developed assuming a straight-line growth between the 2014 base and the 2035 forecasts in the Avila TDM. The delta methodology was utilized to derive the 2030 forecasts. To derive the 2045 forecasts, a 1.0% annual growth rate was utilized, based on the 2035 forecasts and projected over the ten-year period. The 1.0% annual growth rate is consistent with the Avila TDM forecasts along San Luis Bay Drive and US 101.

2.1.2.3 Interim Design Year (2030) Traffic Forecasts

The interim design year (2030) forecasts were developed utilizing the delta methodology assuming straight-line growth between the 2014 (base year) Avila TDM and the 2035 forecasted intersection volumes. The growth or 'delta' between 2014 and 2035 forecasts were factored to account for projected growth out to year 2030. Figure 2.3 presents the interim design year (2030) forecasted peak hour traffic volumes at the three study intersection. Again, only the weekday and Saturday PM peak hours represent the analysis peak hours for this study.

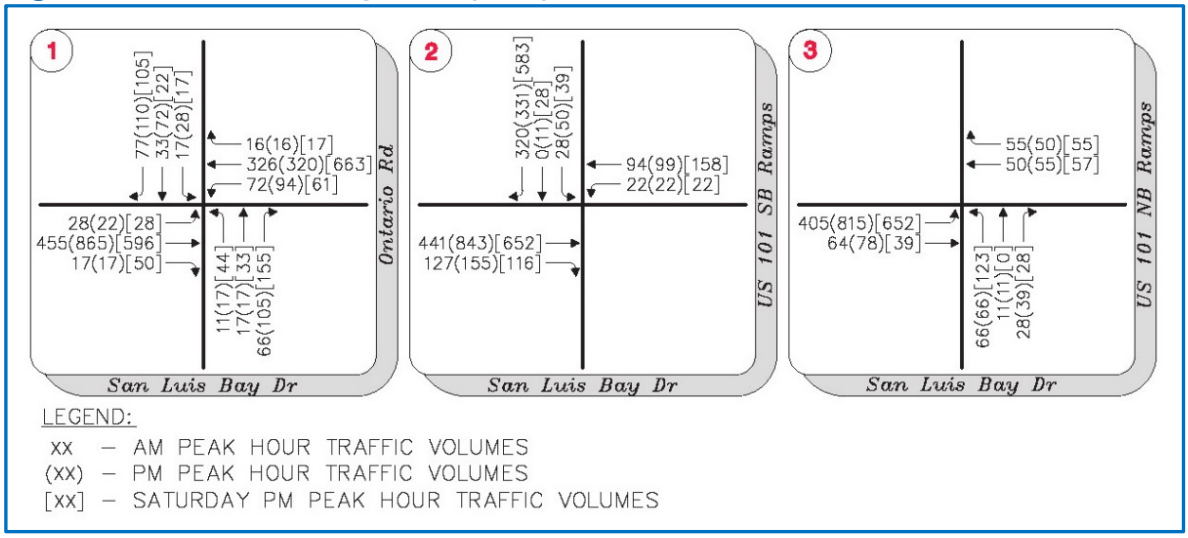
Figure 2.3 Interim Design Year (2030) Peak Hour Traffic Forecasts



2.1.2.4 Ultimate Design Year (2045) Traffic Forecasts

The ultimate design year (2045) forecasts were developed utilizing a 1.0% annual growth rate projected 10 years beyond year 2035. Figure 2.4 presents the ultimate design year (2045) forecasted peak hour traffic volumes at the three study intersection. Again, only the weekday and Saturday PM peak hours represent the analysis peak hours for this study.

Figure 2.4 Ultimate Design Year (2045) Peak Hour Traffic Forecasts



2.2 Project Alternatives

This study includes analysis of the following four alternatives:

- No Build
- All Way Stop Control (AWSC)
- Traffic Signal
- Roundabout (2045 Screening Assessment)

A description of each alternative is provided in the following sections.

2.2.1 No Build Alternative

The No Build Alternative assumes no changes to the existing intersection geometrics and controls. The capacity assessment/analysis (Level of Service (LOS), delay and queuing) for this alternative is provided in Section 4.1. Both the Ontario Road/San Luis Bay Drive and US 101 Northbound (NB) Ramps/San Luis Bay Drive intersections are projected to operate at peak hour LOS “F” during both the Interim Design Year (2030) and Ultimate Design Year (2045) and the No Build Alternative does not represent a viable alternative for these conditions.

2.2.2 All Way Stop Control (AWSC) Alternative

For the AWSC Alternative, each study intersection is evaluated as all way stop controlled. No changes in the intersection’s approach geometrics were assumed for this analysis. The capacity assessment/analysis (Level of Service (LOS), delay and queuing) for this alternative is provided in Section 4.2. Each of the three study intersections are projected to operate at peak hour LOS “E” or LOS “F” during both the Interim Design Year (2030) and Ultimate Design Year (2045) and the AWSC Alternative does not represent a viable alternative for these conditions.

2.2.3 Traffic Signal Alternative

For the Traffic Signal Alternative, the study intersection controls are converted from existing control to a coordinated signalized intersection system. For this alternative, one controller is assumed to

control the traffic signal system between the Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive intersections to provide for improved capacity and reduced delay between the two intersections. For this alternative, it is also assumed that traffic would be cleared between the two intersections. The Traffic Signal Alternative lane geometrics are shown in Section 5 in this report. The capacity assessment/analysis (Level of Service (LOS), delay and queuing) for this alternative is provided in Section 4.3. Based on the capacity assessment/analysis, the Traffic Signal Alternative represents a viable alternative for all study conditions.

2.2.4 Roundabout Alternative

The Roundabout Alternative features the construction of a six-leg roundabout combining the Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive intersections into a single roundabout intersection (also referred to as the “West Roundabout”). The preliminary layout and geometrics for this roundabout are shown on in Section 5 in this report. A smaller 4-leg roundabout is proposed at the US 101/San Luis Bay Drive intersection (also referred to as the “East Roundabout”). The preliminary layout and geometrics for this roundabout are also shown in Section 5 in this report. The capacity assessment/analysis (Level of Service (LOS), delay and queuing) for this alternative is only provided for the Ultimate Design Year (2045) and is provided in Section 4.4. Based on the capacity assessment/analysis, the Roundabout Alternative represents a viable alternative for the Ultimate Design Year (2045) condition.

Since this is Step 1 of the ICE process, only truck turns and fast paths were evaluated for this alternative. Based on this analysis and input from County and Caltrans staff, if the roundabout alternative appears to be viable, other roundabout design performance checks will need to be verified during the ICE Step 2 process.

3. Screening Criteria

The traffic operations for the No Build, AWSC and Traffic Signal Alternatives were analyzed for the weekday and Saturday PM peak hours in the Baseline (existing) Conditions, Interim Design Year (2030) and Ultimate Design Year (2045). The traffic operations for the Roundabout Alternative was analyzed for the weekday and Saturday PM peak hours only for the Ultimate Design Year (2045).

The No Build, AWSC and Traffic Signal Alternatives were analyzed using Synchro/Sim-Traffic analysis software, and the Roundabout Alternative was analyzed using SIDRA 8 analysis software based on the SIDRA standard Roundabout Capacity Model.

As accepted by Caltrans, the SIDRA analysis methodology was used for roundabouts to determine the LOS, V/C, delay and the 95th percentile queues.

3.1 Traffic Operations Analysis

Traffic operations have been quantified through the determination of Level of Service (LOS). LOS is a qualitative measure of traffic measuring conditions, whereby a letter grade "A" through "F" is assigned to an intersection or roadway segment representing progressively worsening traffic conditions. LOS was calculated for different intersection control types using the methods

documented in the Highway Capacity Manual 2000 (HCM 2000). LOS definitions for different types of intersection controls are outlined in Table A1 provided in Appendix A.

San Luis Obispo County has established LOS "C" as the threshold for the acceptable operation of roadways and interchanges in rural areas and LOS "D" in urban areas. For the 2015 Avila Circulation Study and Traffic Fee Update, the target LOS for the Ontario Road/San Luis Bay Drive intersection was identified as LOS "D". For this study, LOS "D" is considered as the threshold for acceptable intersection operations.

Caltrans also provides guidance on LOS policy on State facilities. Caltrans' Guide for the Preparation of Traffic Impact Studies indicates that Caltrans endeavors to maintain a target LOS at the transition between "C" and "D". However, Caltrans acknowledges that this may not always be feasible and recommends that the lead agency consult with Caltrans to determine the appropriate target LOS. Consistent with Caltrans policy, this study considers LOS "C" as the standard acceptable threshold for both the US 101 northbound (NB) and southbound (SB) ramp intersections with San Luis Bay Drive.

3.2 Analysis Criteria

The following criteria are incorporated in the analysis in order to most accurately reflect intersection operating conditions.

- PHF: 0.92 was used for all intersections
- Truck Percentages: from data counts
- 1.10 Environmental factor for Opening Year roundabout analysis
- 1.05 Environmental factor for Design Year roundabout analysis

4. Capacity Assessment/Analysis

4.1 No Build Alternative Analysis

The following section provides the traffic operations analysis and queuing results for the No Build Alternative. The No Build Alternative assumes no changes to the existing intersection geometrics and controls.

4.1.1 Baseline Conditions Analysis

Table 3A presents the Baseline Conditions weekday and Saturday PM peak hour intersection Level of Service (LOS) and delay. As indicated in Table 3A, each study intersection currently operates at an acceptable LOS during both the weekday and Saturday PM peak periods. Copies of the Baseline Conditions peak hour LOS worksheets are provided in Appendix B.

Table 3A: No Build - Baseline Conditions Peak Hour Intersection Level-of-Service (LOS)

#	Intersection	Control Type[1,2]	Target LOS	PM Peak Hour		Saturday PM Peak Hour	
				Delay	LOS	Delay	LOS
1	Ontario Road/ San Luis Bay Drive	TWSC	D	19.7	C	16.0	C
2	US 101 SB Ramps/ San Luis Bay Drive	TWSC	C	10.2	B	11.6	B
3	US 101 NB Ramps/ San Luis Bay Drive	TWSC	C	23.3	C	18.7	C

Notes:

1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout

2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT

Table 3B presents the Baseline Conditions weekday and Saturday PM peak hour intersection queuing analysis results. As indicated in Table 3B, sufficient storage exists at each study intersection to currently accommodate the 95th percentile queues. Copies of the Baseline Conditions peak hour queuing worksheets are provided in Appendix B.

Table 3B: No Build - Baseline Conditions Peak Hour Queuing Analysis

							Baseline Conditions	
Intersection							95th Percentile Queue/Lane (ft)	
ID	Location	Direction	Lane Config.	Movement	No. Lanes	Available Storage Per Lane (ft)	PM Peak Hour[1]	SAT Peak Hour[1]
1	***Ontario Road/San Luis Bay Drive***	EB	LTR	Eastbound Left/Through/Right	1	1060	9	11
		WB	LTR	Westbound Left/Through/Right	1	60	40	43
		NB	LTR	Northbound Left/Through/Right	1	1375	45	51
		SB	LTR	Southbound Left/Through/Right	1	770	45	28
2	***US 101 SB Ramps/ San Luis Bay Drive***	EB	TR	Eastbound Through/Right	1	60	0	7
		WB	LT	Westbound Left/Through	1	415	19	20
		SB	LT	Southbound Left/Through	1	120	45	40
		SB	R	Southbound Right	1	980	67	123
3	***US 101 NB Ramps/ San Luis Bay Drive***	EB	TR	Eastbound Left/Through	1	905	43	44
		WB	LT	Westbound Through/Right	1	415	0	0
		NB	LTR	Northbound Left/Through/Right	1	995	47	52

*Notes: 1. **Bolded** entries indicate queues projected to exceed available storage*

4.1.2 Interim Design Year (2030) Analysis

The Interim Design Year weekday and Saturday PM peak hour intersection traffic operations were quantified with the resulting LOS and delay provided in Table 4. As shown in Table 4, both the Ontario Road/San Luis Bay Drive and the US 101 NB Ramps/San Luis Bay Drive intersections are projected to operate at LOS "F" during both the weekday and Saturday PM peak periods with the current lane geometrics and traffic control. Based on the projected peak hour LOS presented in Table 4, the No Build Alternative does not represent a viable Interim Design Year (2030) alternate. Copies of the Interim Design Year peak hour LOS worksheets are provided in Appendix B.

Table 4: No Build - Interim Design Year (2030) Peak Hour Intersection Level-of-Service (LOS)

#	Intersection	Control Type[1,2]	Target LOS	PM Peak Hour		Saturday PM Peak Hour	
				Delay	LOS	Delay	LOS
1	Ontario Road/ San Luis Bay Drive	TWSC	D	**92.8**	**F**	**62.3**	**F**
2	US 101 SB Ramps/ San Luis Bay Drive	TWSC	C	12.0	B	14.7	B
3	US 101 NB Ramps/ San Luis Bay Drive	TWSC	C	**247.3**	**F**	**106.8**	**F**

Notes:

1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT

4.1.3 Ultimate Design Year (2045) Analysis

The Ultimate Design Year weekday and Saturday PM peak hour intersection traffic operations were quantified with the resulting LOS and delay provided in Table 5. As shown in Table 5, both the Ontario Road/San Luis Bay Drive and the US 101 NB Ramps/San Luis Bay Drive intersections are projected to operate at LOS "F" during both the weekday and Saturday PM peak periods with the current intersection geometrics and traffic control. Based on the projected peak hour LOS presented in Table 5, the No Build Alternative does not represent a viable Ultimate Design Year (2045) alternate. Copies of the Ultimate Design Year peak hour LOS worksheets are provided in Appendix B.

Table 5: No Build - Ultimate Design Year (2045) Peak Hour Intersection Level-of-Service (LOS)

#	Intersection	Control Type[1,2]	Target LOS	PM Peak Hour		Saturday PM Peak Hour	
				Delay	LOS	Delay	LOS
1	Ontario Road/ San Luis Bay Drive	TWSC	D	**645.6**	**F**	**558.4**	**F**
2	US 101 SB Ramps/ San Luis Bay Drive	TWSC	C	14.1	B	19.8	C
3	US 101 NB Ramps/ San Luis Bay Drive	TWSC	C	**1142.5**	**F**	**651.1**	**F**

Notes:

1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT

4.2 All Way Stop Control (AWSC) Alternative Analysis

The following section provides the traffic operations analysis and queuing results for the AWSC Alternative. For this alternative, only the Ontario Road/San Luis Bay Drive intersection is evaluated as all way stop controlled. No changes in the intersection's approach geometrics were assumed for this analysis.

4.2.1 Baseline Conditions Analysis

Table 6A presents the Baseline Conditions weekday and Saturday PM peak hour intersection Level of Service (LOS) and delay. As indicated in Table 6A, each study intersection currently operates at an acceptable LOS during both the weekday and Saturday PM peak periods. Copies of the Baseline Conditions peak hour LOS worksheets are provided in Appendix C.

Table 6A: AWSC - Baseline Conditions Peak Hour Intersection Level-of-Service (LOS)

#	Intersection	Control Type[1,2]	Target LOS	PM Peak Hour		Saturday PM Peak Hour	
				Delay	LOS	Delay	LOS
1	Ontario Road/ San Luis Bay Drive	AWSC	D	12.6	B	15.1	C
2	US 101 SB Ramps/ San Luis Bay Drive	AWSC	C	3.6	A	6.5	A
3	US 101 NB Ramps/ San Luis Bay Drive	AWSC	C	7.5	A	8.5	A

Notes:

1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT

Table 6B presents the Baseline Conditions weekday and Saturday PM peak hour intersection queuing analysis results. As indicated in Table 6B, sufficient storage generally exists at each study intersection to currently accommodate the 95th percentile queues. The exception though is the projected peak hour queues on the westbound San Luis Bay Drive approach to Ontario Road. The table shows that the peak hour queues on this approach are projected to exceed available storage by up to 5-feet. Copies of the Baseline Conditions peak hour queuing worksheets are provided in Appendix C.

Table 6B: AWSC - Baseline Conditions Peak Hour Queuing Analysis

							Existing - AWSC	
Intersection		Direction	Lane Config.	Movement	No. Lanes	Available Storage Per Lane (ft)	95th Percentile Queue/Lane (ft)	
ID	Location						PM Peak Hour[1]	SAT Peak Hour[1]
1	*Ontario Road/ San Luis Bay Drive*	EB	LTR	Eastbound Left/Through/Right	1	1060	105	86
		WB	LTR	Westbound Left/Through/Right	1	60	***65***	***61***
		NB	LTR	Northbound Left/Through/Right	1	1375	44	47
		SB	LTR	Southbound Left/Through/Right	1	770	38	27
2	*US 101 SB Ramps/ San Luis Bay Drive*	EB	TR	Eastbound Through/Right	1	60	0	3
		WB	LT	Westbound Left/Through	1	415	21	19
		SB	LT	Southbound Left/Through	1	120	46	69
		SB	R	Southbound Right	1	980	84	203
3	*US 101 NB Ramps/ San Luis Bay Drive*	EB	TR	Eastbound Left/Through	1	415	50	41
		WB	LT	Westbound Through/Right	1	910	0	0
		NB	LTR	Northbound Left/Through/Right	1	995	47	52

*Notes: 1. **Bolded** entries indicate queues projected to exceed available storage*

4.2.2 Interim Design Year (2030) Analysis

The Interim Design Year weekday and Saturday PM peak hour intersection traffic operations were quantified with the resulting LOS and delay provided in Table 7. As shown in Table 7, both the Ontario Road/San Luis Bay Drive and the US 101 SB Ramps/San Luis Bay Drive intersections are projected to operate at LOS "F" during both the weekday and Saturday PM peak periods under AWSC. As also shown, the US 101 NB Ramps/San Luis Bay Drive intersection is projected to operate at LOS "E" during the weekday PM peak hour period under AWSC. Based on the projected peak hour LOS presented in Table 7, the AWSC Alternative does not represent a viable Interim Design Year (2030) alternate. Copies of the Interim Design Year peak hour LOS worksheets are provided in Appendix C.

Table 7: AWSC - Interim Design Year (2030) Peak Hour Intersection Level-of-Service (LOS)

#	Intersection	Control Type[1,2]	Target LOS	PM Peak Hour		Saturday PM Peak Hour	
				Delay	LOS	Delay	LOS
1	Ontario Road/ San Luis Bay Drive	AWSC	D	**98.9**	**F**	**72.9**	**F**
2	US 101 SB Ramps/ San Luis Bay Drive	AWSC	C	**104.0**	**F**	**56.9**	**F**
3	US 101 NB Ramps/ San Luis Bay Drive	AWSC	C	**49.8**	**E**	17.7	C

Notes:

1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT

4.2.3 Ultimate Design Year (2045) Analysis

The Ultimate Design Year weekday and Saturday PM peak hour intersection traffic operations were quantified with the resulting LOS and delay provided in Table 8. As shown in Table 8, both the Ontario Road/San Luis Bay Drive and the US 101 SB Ramps/San Luis Bay Drive intersections are projected to operate at LOS "F" during both the weekday and Saturday PM peak periods under AWSC. As also shown, the US 101 NB Ramps/San Luis Bay Drive intersection is projected to operate at LOS "F" during the weekday and LOS "E" during the Saturday PM peak hour periods under AWSC. Based on the projected peak hour LOS presented in Table 8, the AWSC Alternative does not represent a viable Ultimate Design Year (2045) alternate. Copies of the Ultimate Design Year peak hour LOS worksheets are provided in Appendix C.

Table 8: AWSC - Ultimate Design Year (2045) Peak Hour Intersection Level-of-Service (LOS)

#	Intersection	Control Type[1,2]	Target LOS	PM Peak Hour		Saturday PM Peak Hour	
				Delay	LOS	Delay	LOS
1	Ontario Road/ San Luis Bay Drive	AWSC	D	**209.6**	**F**	**187.7**	**F**
2	US 101 SB Ramps/ San Luis Bay Drive	AWSC	C	**199.3**	**F**	**140.6**	**F**
3	US 101 NB Ramps/ San Luis Bay Drive	AWSC	C	**114.9**	**F**	**41.1**	**E**

Notes:

1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT

4.3 Traffic Signal Alternate Analysis

This section provides a summary of the intersection operations associated with the Traffic Signal Alternative. For this alternative, each of the study intersections are converted from stop sign controlled to traffic signal controlled. In addition, the traffic signals at the Ontario Road/San Luis Bay Drive and at the US 101 SB Ramps/San Luis Bay Drive intersections are proposed to operate as a single coordinated signalized intersection system. One controller is assumed to control the traffic signal system between the Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive intersections to provide improved circulation and to clear traffic between the two intersections.

4.3.1 Baseline Conditions Analysis

In addition to traffic signal control, this analysis assumes existing approach geometrics at each of the study intersections. Table 9A presents the Baseline Conditions weekday and Saturday PM peak hour intersection Level of Service (LOS) and delay. As indicated in Table 9A, each study intersection currently operates at an acceptable LOS during both the weekday and Saturday PM peak periods. Copies of the Baseline Conditions peak hour LOS worksheets are provided in Appendix D.

Table 9A: Traffic Signal - Baseline Conditions Peak Hour Intersection Level-of-Service (LOS)

#	Intersection	Control Type[1,2]	Target LOS	PM Peak Hour		Saturday Peak Hour	
				Delay[3]	LOS	Delay[3]	LOS
1	Ontario Road/ San Luis Bay Drive	Signal	D	31.8	C	29.3	C
2	US 101 SB Ramps/ San Luis Bay Drive	Signal	C	12.2	B	16.4	B
3	US 101 NB Ramps/ San Luis Bay Drive	Signal	C	8.6	A	9.1	A

Notes:

1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT
3. Intersections 1 and 2 were ran as clustered intersections. Synchro methodology was used for the analysis.

Table 9B presents the Baseline Conditions weekday and Saturday PM peak hour intersection queuing analysis results. As indicated in Table 9B, sufficient storage exists at each study intersection to currently accommodate the 95th percentile queues. Copies of the Baseline Conditions peak hour queuing worksheets are provided in Appendix D.

Table 9B: Traffic Signal - Baseline Conditions Peak Hour Queuing Analysis

							Existing Signal	
Intersection							95th Percentile Queue/Lane (ft)	
ID	Location	Direction	Lane Config.	Movement	No. Lanes	Available Storage Per Lane (ft)	Exist PM Peak Hour[1]	Exist SAT Peak
1	*Ontario Road/ San Luis Bay Drive*	EB	LTR	Eastbound Left/Through/Right	1	1060	335	364
		NB	LTR	Northbound Left/Through/Right	1	1375	50	73
		SB	LTR	Southbound Left/Through/Right	1	770	104	59
2	*US 101 SB Ramps/ San Luis Bay Drive*	WB	LT	Westbound Left/Through	1	415	77	138
		SB	LT	Southbound Left/Through	1	120	56	332
		SB	R	Southbound Right	1	980	225	650
3	*US 101 NB Ramps/ San Luis Bay Drive*	EB	LT	Eastbound Left/Through	1	415	150	168
		WB	TR	Westbound Through/Right	1	910	52	60
		NB	LTR	Northbound Left/Through/Right	1	995	45	73

*Notes: 1. **Bolded** entries indicate queues projected to exceed available storage.*

4.3.2 Interim Design Year (2030) Analysis

The Interim Design Year analysis assumes traffic signal control with existing approach geometrics at each of the study intersections with the resulting LOS and delay provided in Table 10A. As shown in Table 10A, the Ontario Road/San Luis Bay Drive intersection is projected to operate at LOS "E" during both the weekday and Saturday PM peak hours. As also shown in the table, both San Luis Bay Drive intersections with the US 101 SB Ramps and with the US 101 NB Ramps are

projected to operate at LOS "C" or better during both PM peak hour periods. Copies of the Interim Design Year peak hour LOS worksheets are provided in Appendix D.

Table 10A: Traffic Signal - Interim Design Year (2030) Peak Hour Intersection Level-of-Service (LOS)

#	Intersection	Control Type[1,2]	Target LOS	PM Peak Hour		Saturday PM Peak Hour	
				Delay[3]	LOS	Delay[3]	LOS
1	Ontario Road/ San Luis Bay Drive	Signal	D	**68.1**	**E**	**62.4**	**E**
2	US 101 SB Ramps/ San Luis Bay Drive	Signal	C	25.7	C	32.2	C
3	US 101 NB Ramps/ San Luis Bay Drive	Signal	C	18.6	B	22.4	C

Notes:

1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT
3. Intersections 1 and 2 were ran as clustered intersections. Synchro methodology was used for the analysis.

Table 10B presents the Interim Design Year weekday and Saturday PM peak hour intersection queuing analysis results. Copies of the Interim Design Year peak hour queuing worksheets are provided in Appendix D.

Table 10B: Traffic Signal - Interim Design Year (2030) Peak Hour Queuing Analysis

							2030 Signal	
Intersection							95th Percentile Queue/Lane (ft)	
ID	Location	Direction	Lane Config.	Movement	No. Lanes	Available Storage Per Lane (ft)	2030 PM Peak Hour[1]	2030 SAT Peak Hour[1]
1	*Ontario Road/ San Luis Bay Drive*	EB	LTR	Eastbound Left/Through/Right	1	1060	436	461
		NB	LTR	Northbound Left/Through/Right	1	1375	248	724
		SB	LTR	Southbound Left/Through/Right	1	770	450	146
2	*US 101 SB Ramps/ San Luis Bay Drive*	WB	LT	Westbound Left/Through	1	415	185	260
		SB	LT	Southbound Left/Through	1	120	**321**	**289**
		SB	R	Southbound Right	1	980	787	679
3	*US 101 NB Ramps/ San Luis Bay Drive*	EB	LT	Eastbound Left/Through	1	415	366	369
		WB	TR	Westbound Through/Right	1	910	110	107
		NB	LTR	Northbound Left/Through/Right	1	995	123	128

*Notes: 1. **Bolded** entries indicate queues projected to exceed available storage.*

As indicated in Table 10B, the 95th percentile queues are projected to exceed available storage during both PM peak hours on the US 101 SB off-ramp shared through plus left-turn lane at the intersection with San Luis Bay Drive. Based on the projected queues on this approach, it is recommended to extend the shared through plus left-turn lane to provide a minimum of 325 feet of storage. This recommendation is shown on Figure 5.1 provided in Section 5.

Though the Ontario Road/San Luis Bay Drive intersection is projected to operate at LOS "E" during both the weekday and Saturday PM peak hours, the queuing analysis indicates that this intersection will still provide sufficient storage to accommodate the projected queues. The signal system as a whole is also projected to provide sufficient storage to accommodate the projected queues except as noted above.

4.3.3 Ultimate Design Year (2045) Analysis

The Ultimate Design Year analysis initially assumed the traffic signal control with the intersection approach geometrics shown on Figure 5.1. The weekday and Saturday PM peak hour analysis based on these assumptions projected that the Ontario Road/San Luis Bay Drive and San Luis Bay Drive/US 101 SB Ramps intersections would generally operate at LOS "F" during both peak hour periods. As these projected LOS were worse than the target LOS, an improvement to provide a second eastbound San Luis Bay Drive lane from the intersection with Ontario Road to the intersection with the US 101 NB Ramps, and an improvement to provide a second westbound lane between the Ontario Road/San Luis Bay Drive and the US 101 SB Ramps/San Luis Bay Drive intersections was identified to provide improved intersection operations. The recommended Ultimate Design Year improvements are shown on Figure 5.2 provided in Section 5.

Ultimate Design Year weekday and Saturday PM peak hour intersection traffic operations were again quantified based on the recommended improvement with the resulting LOS and delay provided in Table 11A. As shown in Table 11A, each study intersection is projected to operate at an acceptable LOS during both the weekday and Saturday PM peak periods. Copies of the Ultimate Design Year peak hour LOS worksheets are provided in Appendix D.

Table 11A: Traffic Signal - Ultimate Design Year (2045) Peak Hour Intersection Level-of-Service (LOS)

#	Intersection	Control Type[1,2]	Target LOS	PM Peak Hour		Saturday Peak Hour	
				Delay[3]	LOS	Delay[3]	LOS
1	Ontario Road/ San Luis Bay Drive	Signal	D	36.6	D	37.4	D
2	US 101 SB Ramps/ San Luis Bay Drive	Signal	C	15.1	B	34.7	C
3	US 101 NB Ramps/ San Luis Bay Drive	Signal	C	20.5	C	17.7	B

Notes:

1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT
3. Intersections 1 and 2 were ran as clustered intersections. Synchro methodology was used for the analysis.

Table 11B presents the Ultimate Design Year weekday and Saturday PM peak hour intersection queuing analysis results. Copies of the Ultimate Design Year peak hour queuing worksheets are provided in Appendix D.

Table 11B: Traffic Signal - Ultimate Design Year (2045) Peak Hour Queuing Analysis

							2045 Signal	
Intersection							95th Percentile Queue/Lane (ft)	
ID	Location	Direction	Lane Config.	Movement	No. Lanes	Available Storage Per Lane (ft)	2045 PM Peak Hour[1]	2045 SAT Peak Hour[1]
1	Ontario Road/ San Luis Bay Drive	EB	LT	Eastbound Left/Through	1	1060	289	297
		EB	TR	Eastbound Through/Right	1	1060	601	546
		NB	LTR	Northbound Left/Through/Right	1	1375	137	292
		SB	LTR	Southbound Left/Through/Right	1	770	238	110
2	US 101 SB Ramps/ San Luis Bay Drive	WB	LT	Westbound Left/Through	1	415	204	336
		SB	LT	Southbound Left/Through	1	325	167	**459**
		SB	R	Southbound Right	1	980	462	747
3	US 101 NB Ramps/ San Luis Bay Drive	EB	L	Eastbound Left	1	415	387	313
		EB	T	Eastbound Through	1	415	74	43
		WB	TR	Westbound Through/Right	1	910	118	123
		NB	LTR	Northbound Left/Through/Right	1	995	123	159

*Notes: 1. **Bolded** entries indicate queues projected to exceed available storage.*

As indicated in Table 11B, the 95th percentile queues are projected to exceed available storage during the Saturday PM peak hour on the US 101 SB off-ramp shared through plus left-turn lane at the intersection with San Luis Bay Drive. Based on the projected queues on this approach, it is recommended to extend the shared through plus left-turn lane to provide a minimum of 475 feet of storage. This recommendation is shown on Figure 5.2 provided in Section 5.

4.4 Roundabout Alternative Analysis

This alternative features the construction of a six-leg roundabout combining the Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive intersections into a single roundabout intersection (also referred to as the "West Roundabout"). The preliminary geometrics for the proposed combined San Luis Bay Drive/Ontario Road/US 101 SB Ramps roundabout is shown on Figure 5.3 in Section 5. A smaller 4-leg roundabout is proposed at the US 101 NB Ramps/San Luis Bay Drive intersection (also referred to as the "East Roundabout"). The preliminary geometrics for the proposed US 101 NB Ramps/San Luis Bay Drive roundabout is shown on Figure 5.4 in Section 5.

The following capacity assessment/analysis (Level of Service (LOS), delay and queuing) for this alternative is only provided for the Ultimate Design Year (2045).

4.4.1 Ultimate Design Year (2045) Analysis

The Ultimate Design Year weekday and Saturday PM peak hour roundabout traffic operations were quantified with the resulting LOS and delay provided in Table 12A. As shown in Table 12A, each study intersection is projected to operate at an acceptable LOS during both the weekday and Saturday PM peak periods. Copies of the Ultimate Design Year peak hour LOS worksheets are provided in Appendix E.

Table 12A: Roundabout - Ultimate Design Year (2045) Peak Hour Intersection Level-of-Service (LOS)

#	Intersection	Control Type[1,2]	Target LOS	PM Peak Hour		Saturday Peak Hour	
				Delay	LOS	Delay	LOS
1	Ontario Road/ US 101 SB Ramps/ San Luis Bay	RNDBT	C	10.2	B	7.2	A
2	US 101 NB Ramps/ San Luis Bay Drive	RNDBT	C	11.1	B	11.0	B

Notes:

1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT

Table 12B presents the Ultimate Design Year weekday and Saturday PM peak hour intersection queuing analysis results. As indicated in Table 12B, sufficient storage will be provided at both roundabouts to accommodate the 95th percentile queues. Copies of the Ultimate Design Year peak hour queuing worksheets are provided in Appendix E.

Table 12B: Roundabout- Ultimate Design Year (2045) Peak Hour Queuing Analysis

							2045 - Roundabout	
Intersection							95th Percentile Queue/Lane (ft)	
ID	Location	Direction	Lane Config.	Movement	No. Lanes	Available Storage Per Lane (ft)	PM Peak Hour[1]	SAT Peak Hour[1]
1	Ontario Road/ US 101 SB Ramps/ San Luis Bay Drive	EB	LTR	Eastbound Left/Through/Right	1	1060	149.6	52.6
		WB	LTR	Westbound Left/Through/Right	1	421	5.6	9.2
		NB	LTR	Northbound Left/Through/Right	1	592	32.4	27.3
		SB	LTR	Southwestbound Left/Through/Right (Off-Ramp)	1	976	22.0	57.6
		SB	LTR	Southbound Left/Through/Right (Ontario Road)	1	696	16.1	20.0
2	US 101 NB Ramps/ San Luis Bay Drive	EB	LTR	Eastbound Left/Through/Right	1	423	0.0	0.0
		WB	LTR	Westbound Left/Through/Right	1	918	11.2	10.4
		NB	LTR	Northbound Left/Through/Right	1	941	11.9	12

*Notes: 1. **Bolded** entries indicate queues projected to exceed available storage*

5. Footprint Development & Assessment

The following four alternatives have been evaluated within this report:

- No Build
- All Way Stop Control (AWSC)
- Traffic Signal
- Roundabout (2045 Screening Assessment)

The capacity assessment/analysis provided in Section 4 identified that both the No Build Alternative and the AWSC Alternative were projected to operate at peak hour LOS worse than the target LOS thresholds for both Interim Design Year (2030) and Ultimate Design Year (2045) conditions. The conclusion was that neither alternative represents a viable alternative for these conditions.

The following sections provide schematics for the Traffic Signal and Roundabout Alternatives. The lane geometry at the three study intersections for the Traffic Signal Alternative is based on the capacity assessment/analysis conducted in Section 4 for the Baseline, Interim Design Year (2030) and Ultimate Design Year (2045) analysis conditions. The lane geometries for the Roundabout

Alternative is specific to the Ultimate Design Year (2045) condition only and is based on the capacity assessment/analysis conducted in Section 4.

5.1 Traffic Signal Alternative

For the Traffic Signal Alternative, each of the study intersections are converted from stop sign controlled to traffic signal controlled. In addition, the traffic signals at the Ontario Road/San Luis Bay Drive and at the US 101 SB Ramps/San Luis Bay Drive intersections are proposed to operate as a single coordinated signalized intersection system. One controller is assumed to control the traffic signal system between the Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive intersections to provide improved circulation and to clear traffic between the two intersections.

The Baseline Conditions capacity assessment/analysis conducted in Section 4 concluded that acceptable peak hour intersection operations and queueing would occur with just the installation of the traffic signals. Both the Interim Design Year and Ultimate Design Year capacity assessments/ analysis, however, identified roadway improvements that would be required for these conditions.

5.1.1 Interim Design Year (2030) Traffic Signal Alternative

In addition to installation of traffic signals, the Interim Design Year queueing analysis provided in Section identified that the 95th percentile queues are projected to exceed available storage on the US 101 SB off-ramp shared through plus left-turn lane at the intersection with San Luis Bay Drive. The recommendation was to extend this lane to provide a minimum of 325 feet of storage. These recommended improvement are shown conceptually on Figure 5.1.

Truck turns within and through each intersection were checked using the California Legal 65' truck (Cal-Legal 65 Truck) design vehicle. The truck turn exhibits for this alternative are provided in Appendix F. The limit lines on both the San Luis Bay Drive westbound approach to the US 101 SB Ramps intersection and the eastbound approach to the US 101 NB Ramps intersection will need to be set back to accommodate truck turns as shown on the exhibits. Though this will reduce the available storage on San Luis Bay Drive, sufficient storage should be available to accommodate the peak hour queues.

At this time, the recommended Interim Design Year improvements shown conceptually on Figure 5.1 can be provided within existing County and State right-of-way.

5.1.2 Ultimate Design Year (2045) Traffic Signal Alternative

In addition to installation of traffic signals, the Ultimate Design Year capacity assessment/analysis recommended that a second eastbound San Luis Bay Drive lane be provided from just west of Ontario Road extending east over US 101 to the intersection with the US 10 NB ramps. This recommended improvement is shown conceptually on Figure 5.2.

A shown on Figure 5.2, providing the second eastbound San Luis Bay Drive lane will require widening the south side of the existing overcrossing structure (OC) over US 101 by approximately 26' to the south side. At this time, it is assumed that the existing OC can be widened and that a full

Interim Traffic Signal Alternative

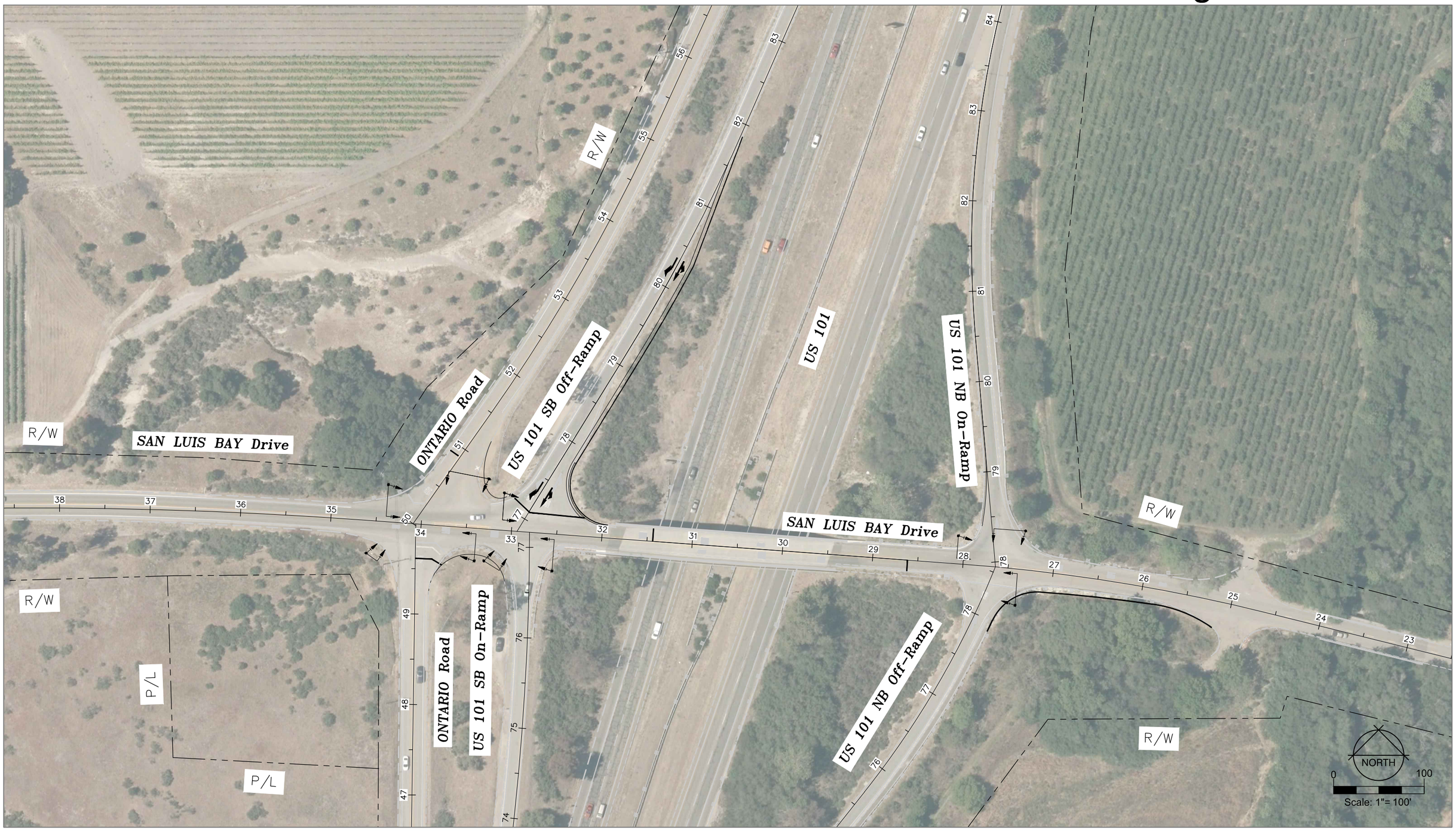


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Figure 5.1

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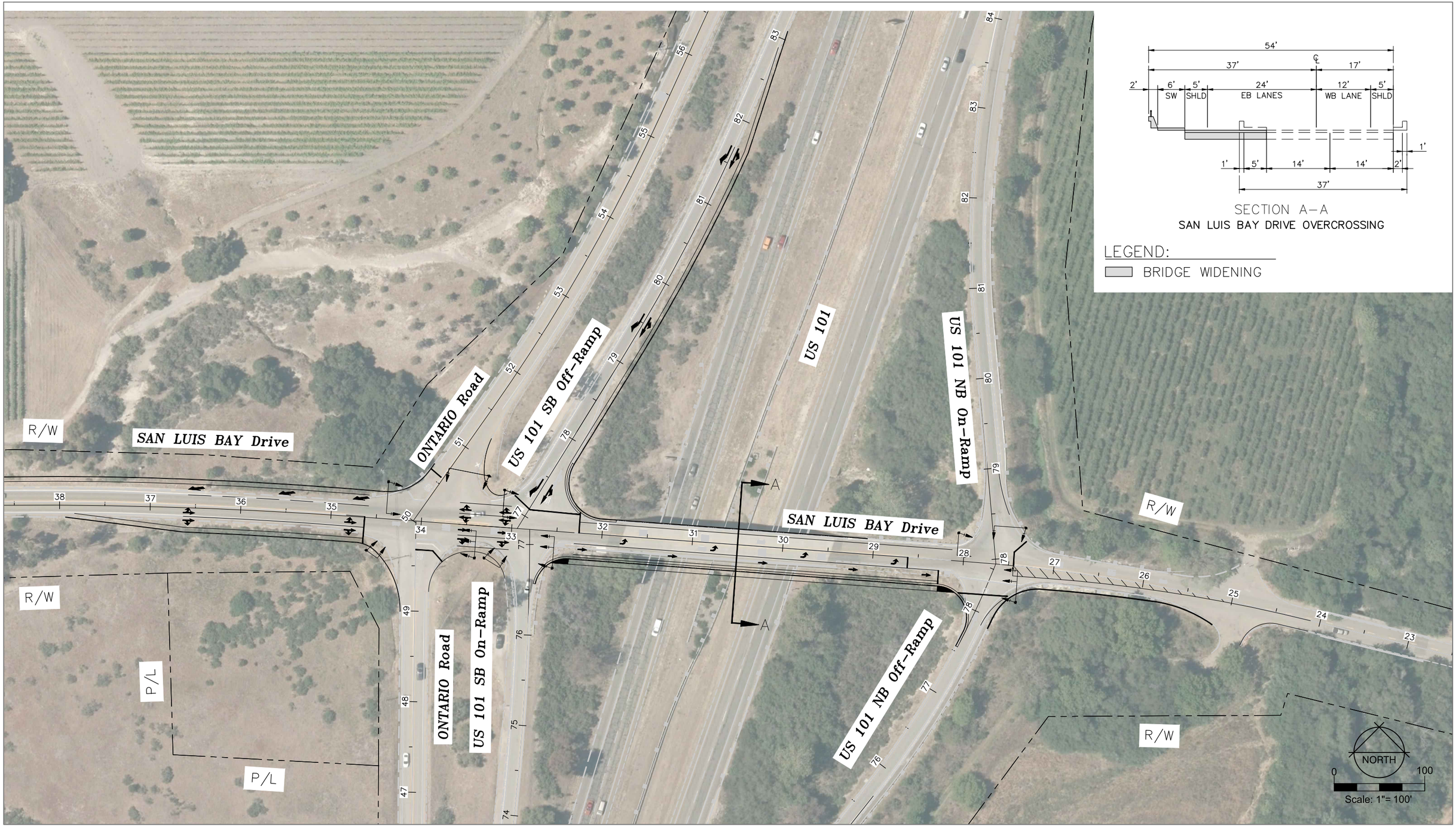
Ultimate Traffic Signal Alternative



SECTION A–A
SAN LUIS BAY DRIVE OVERCROSSING

LEGEND:
BRIDGE WIDENING

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Figure 5.2

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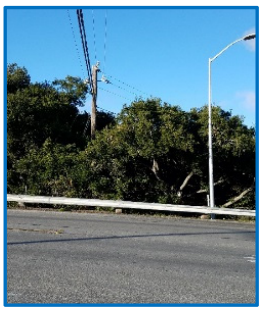
bridge replacement will not be needed. Section A-A provided on Figure 5.2 illustrates the preliminary cross section for the OC. As shown on the cross section, three 12' lanes are proposed (two eastbound and one westbound), with 5' shoulders and a 6' sidewalk along the south side of the OC.

For the Ultimate Design Year condition it was also identified that a second westbound lane between the Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive intersections was required to meet the target LOS. The second westbound lane would transition back to existing San Luis Bay Drive west of the intersection with Ontario Road. This recommended improvement is also shown conceptually on Figure 5.2. The truck turn exhibits for this alternative are provided in Appendix G.

Utility mapping has been obtained and the utilities currently known to be within the study area are shown on an exhibit provided in Appendix H. The additional eastbound San Luis Bay Drive improvements shown conceptually on Figure 5.2 may impact and require the relocation of one joint use utility pole located on the SW corner of the San Luis Bay Drive/Ontario Road intersection (shown in adjacent photo). There is also underground water transmission lines and electrical conduit located adjacent to and within this intersection that will need to be verified during future project phases.

The additional westbound San Luis Bay Drive improvements may require the relocation of one joint use utility pole located on the NW corner of the San Luis Bay Drive/Ontario Road intersection (shown in adjacent photo).



The addition of the second eastbound San Luis Bay Drive through lane to the east of Ontario Road as shown conceptually on Figure 5.2 will also require encroaching into the adjacent drainage area (shown in the adjacent photo). The extent of the encroachment into this drainage area and any potential environmental impacts will need to be evaluated during future project phases.

Transitioning the second westbound lane back to existing San Luis Bay Drive west of the intersection with Ontario Road will also require encroaching into the adjacent drainage area (shown in adjacent photo). The extent of the encroachment into this drainage area and any potential environmental impacts will need to be evaluated during future project phases.

There may also be additional environmental impacts that will be evaluated during future project phases.

At this time, the recommended Ultimate Design Year improvements shown conceptually on Figure 5.2 can be provided within existing County and State right-of-ways.

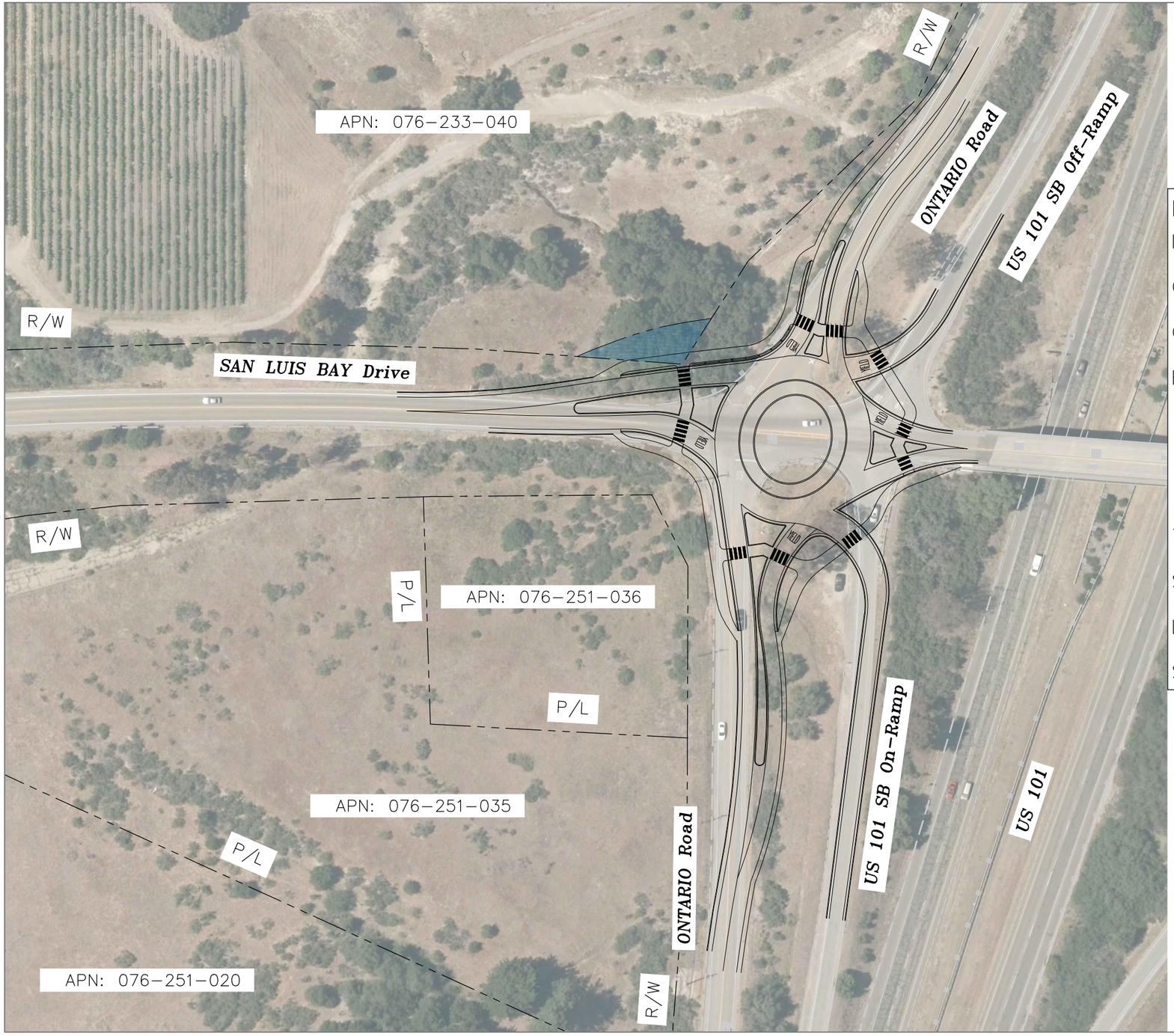
5.2 Roundabout Alternative

5.2.1 West Roundabout Conceptual Design

Due to the close intersection spacing (approximately 115') between the Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive intersections, the Roundabout Alternative features the construction of a six-leg roundabout combining the two intersections into a single roundabout intersection. For the purposes of this evaluation, this roundabout is referred to as the "West Roundabout". The preliminary layout and geometrics for the West Roundabout are shown conceptually on Figure 5.3.

As shown on Figure 5.3, pedestrian crossings connected by shared-use pathways are proposed on all legs of the roundabout. Per the current County Bikeways Plan, a Class II Bike Lane is proposed on San Luis Bay Drive beginning at the Ontario Road intersection and extending west to Avila Beach Drive while Ontario Road is proposed to be upgraded from Class III to Class II. As bicyclist need to be accommodated, bicycles are accommodated by navigating through the roundabout in two ways. Cyclists may choose to take the travel lane and travel through the roundabout as a vehicle or may choose to take the separated bike ramp/shared use path and travel around the roundabout as a pedestrian.

Roundabout Alternative (West Roundabout)



PRELIMINARY ROW REQUIREMENT

KEY	APN	PRELIMINARY ROW ESTIMATE (SQFT)
	076-233-040	2350

ROUNDABOUT GEOMETRICS:

INSCRIBED CIRCLE DIAMETER: 139'–152'

CENTER ISLAND DIAMETER: 67'–78'

CIRCULATORY ROADWAY WIDTH: 21'

ENTRY RADIUS:
- NB ONTARIO Road – 91'
- SB ONTARIO Road – 80'
- US 101 SB Off–Ramp – 87'
- EB SAN LUIS BAY Drive – 105'
- WB SAN LUIS BAY Drive – 129'

TRUCK APRON WIDTH: 12'

SHARED USE PATH WIDTH: 10'

LANDSCAPE STRIP WIDTH: 2' MIN

SPLITTER ISLAND: 2.8' MIN WITH 6' MIN AT PED CROSSINGS

NORTH

0 100

Scale: 1"= 100'

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Figure 5.3

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Figure 5.3 also shows that the West Roundabout's conceptual layout and geometrics are mostly located within existing County and State right-of-ways. Additional right-of-way will though be required in the NW quadrant of the roundabout as shown on the figure.

Potential utility impacts are similar to those described with the Traffic Signal Alternative. Provision of this roundabout will require encroaching into the adjacent drainage area on the south side of San Luis Bay Drive at the approach to Ontario Road. The extent of the encroachment into this drainage area and any potential environmental impacts will need to be evaluated during future project phases. Provision of this roundabout will also require encroaching significantly into the existing drainage area (shown in adjacent photo) located in the NW quadrant of the roundabout, adjacent to both San Luis Bay Drive and Ontario Road. The extent of the encroachment into this drainage area and any potential environmental impacts will need to be evaluated during future project phases. There may also be additional environmental impacts that will be evaluated during future project phases.

5.2.2 East Roundabout Conceptual Design

A smaller 4-leg roundabout is proposed at the US 101/San Luis Bay Drive intersection. For the purposes of this evaluation, this roundabout is referred to as the "East Roundabout". The preliminary layout and geometrics for the East Roundabout are shown conceptually on Figure 5.4.

At this time the recommended East Roundabout footprint shown on Figure 5.4 can be provided within existing County and State right-of-way. The utility mapping exhibit provided in Appendix H identifies an existing underground gas line located on the outside of and runs parallel to the US 101 northbound ramps. This gas line will need to be verified during future project phases. Provision of the roundabout will require modifications to the existing drainage system. The extent of the encroachment into the drainage areas and any potential environmental impacts will need to be evaluated during future project phases

Roundabout Alternative (East Roundabout)

ROUNDABOUT GEOMETRICS:

INSCRIBED CIRCLE DIAMETER: 121'–124'

CENTER ISLAND DIAMETER: 46'–49'

CIRCULATORY ROADWAY WIDTH: 21'

ENTRY RADIUS:
- US 101 NB Off–Ramp – 108'
- EB SAN LUIS BAY Drive – 70'
- WB SAN LUIS BAY Drive – 108'

TRUCK APRON WIDTH: 12'

SHARED USE PATH WIDTH: 10'

SPLITTER ISLAND: 2' MIN

NORTH

0 100

Scale: 1"= 100'

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Figure 5.4

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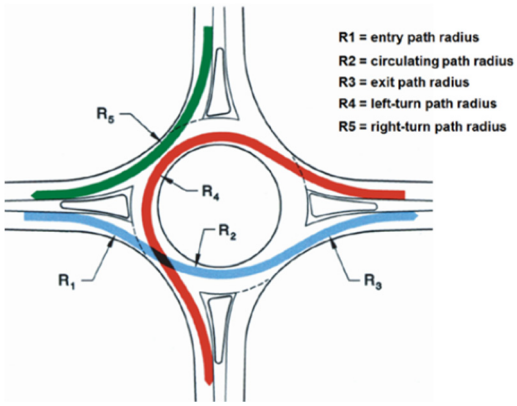
5.2.3 Roundabout Performance Checks

For this ICE Step 1 evaluation, two performance checks were conducted for each roundabout to verify the roundabout's feasibility. These performance checks include design vehicle (CA-Legal 65 Truck) and, fastest path and vehicle speed checks. Truck turns are checked at both roundabouts based on the CA-Legal 65 truck design vehicle. Truck turn exhibits for both roundabouts are provided in Appendix G.

Fastest Path and Vehicle Speed Checks

The “Fastest Path” represents the path that the most aggressive drivers could take through the roundabout and assumes no other traffic to be within the intersection. NCHRP Report 672 indicates that the recommended maximum vehicle entry speeds along the fastest path should be less than 25 mph at single-lane roundabouts and less than 30 mph at multi-lane roundabouts. NCHRP Report 672 also indicates that the differential speed between consecutive or conflicting projected fast path speeds should be less than 15 mph.

Fastest path speeds are determined for five locations per approach. These include entry speeds (referred to as V1); through movement circulating speeds (V2); exiting speeds (V3); left turn movement circulating speeds (V4); and right turn speeds (V5). A diagram of the described locations is shown in the following exhibit.



Fast Path Critical Speed Locations

Fastest path speeds for the Roundabout Alternative are shown in Table 13A (West Roundabout) and Table 13B (East Roundabout). Exhibits illustrating the fastest path analysis for each roundabout can be found in Appendix G.

Table 13A: West Roundabout Fastest Path Speeds (MPH)

MOVEMENT	Northbound Ontario Road (N#)	Southbound Ontario Road (S#)	Southbound US 101 SB Off-Ramp (s#)	Eastbound to San Luis Bay Drive (E#)	Westbound San Luis Bay Drive (W#)
ENTERING (V1)	20.9	24.5	22.2	22.3	23.3*
CIRCULATING (V2)	15.4	17.6	18.6	15.4	18.3
EXITING (V3)	23.4	30.8	31.4	28.3	31.2
LEFT TURN (V4)	15.3	15.2	15.2	15.0	14.6
RIGHT TURN (V5)	26.8	19.7		18.7	17.6

Notes:
All values are in miles per hour
V3 exiting speeds are derived from vehicle acceleration formulas in NCHRP 672
V3 fast path speed measured at exit crosswalk or 100 feet downstream from V2.
N/A = Fastest path speed does not exist for this approach
2% cross-slope assumed for determining Fastest path
* Based on approximately 20% realized reduction in entry speed for raised crosswalk Per NCHRP 674

As shown in Table 13A, the fastest path entering speeds are less than the desired maximum speeds for a single-lane approach. NCHRP 674 identifies that provision of raised crosswalks can realize up to a 20% reduction in entry speed. The westbound San Luis Bay Drive entry speed was calculated at 27.9 MPH. Then entry speed of 23.3 MPH shown in Table 13A is based on provision of a raised crosswalk across this approach. Finally, the speed differential between consecutive or conflicting fast path speeds shown in the table are less than the maximum of 15 mph.

Table 13B: East Roundabout Fastest Path Speeds (MPH)

MOVEMENT	Northbound US 101 NB Off-Ramp (N#)	Eastbound San Luis Bay Drive (E#)	Westbound San Luis Bay Drive (W#)
ENTERING (V1)	22.0	22.9	23.4
CIRCULATING (V2)	22.7	20.8	11.5
EXITING (V3)	34.0	25.8	27.7
LEFT TURN (V4)	13.7	14.3	
RIGHT TURN (V5)	20.4		18.8

Notes:
All values are in miles per hour
V3 exiting speeds are derived from vehicle acceleration formulas in NCHRP 672
V3 fast path speed measured at exit crosswalk or 100 feet downstream from V2.
N/A = Fastest path speed does not exist for this approach
2% cross-slope assumed for determining Fastest path

As shown in Table 13B, the fastest path entering speeds are less than the desired maximum speeds for a single-lane approach. The speed differential between consecutive or conflicting fast path speeds shown in the table are also less than the maximum of 15 mph.

6. Safety Considerations

Safety is a key evaluation factor brought forth in the Directive, and one of the goals of the ICE process is to identify projects that will ensure a reasonable level of safety and operational performance for all users

6.1 Historic Collision Data

Recent 5-year collision data was obtained from the Statewide Integrated Traffic Records System for the most recent 5-year period, dated from January 1, 2013 to December 31, 2017. Table 14 provides the summary of the type of collisions that occurred at the study intersections during this five-year period.

Table 14: Intersection Collision Data

#	Intersection	Total Collisions	Property Damage Only (PTO)	Fatal	Injury (Severe)	Injury (Other Visible)	Injury (Compliant of Pain)	Predominant Collision Factor	Predominant Collision Type
1	Ontario Road/ San Luis Bay Drive	21	12	0	1	3	5	Right of Way Violation (62%)	Broadside (57%)
2	US 101 SB Ramps/ San Luis Bay Drive	5	0	0	0	1	4	Right of Way Violation (80%)	Broadside (80%)
3	US 101 NB Ramps/ San Luis Bay Drive	1	0	0	1	0	0	Making Left Turn (100%)	Other (100%)

As shown in Table 14, there were no fatal collisions reported during the five-year period. There was one severe injury collision reported at both the Ontario Road/San Luis Bay Drive and US 101 NB Ramps/San Luis Bay Drive intersections. Nine of the collisions at the Ontario Road/San Luis Bay Drive intersection involved a reported injury while all five collisions at the US 101 SB Ramps/San Luis Bay Drive intersection involved a reported injury. The predominant primary collision factor at both intersections was “Auto Violation of Right of Way” (62% and 80% respectively) while the predominant collision type was “Broadside” (57% and 80% respectively).

6.2 Safety Analysis

6.2.1 Collision Cost Analysis

Caltrans provides a Safety Performance/Collision Cost Analysis Tool on their website (http://www.dot.ca.gov/trafficops/ice.html) that is used to calculate the collision costs and projected savings for various intersection improvements. The Collision Costs are based on the existing intersection configuration, ADT, and existing collision data. The file has historical Crash Modification Factors (CMF) for conversion of an all-way stop control and two-way stop control to a roundabout and traffic signal control.

Ontario Road/San Luis Bay Drive

This intersection was analyzed as an existing two-way stop controlled intersection. Conversion of the intersection to traffic signal control results in a CMF of 0.8 and an average reduction of $68,600 (36%) per collision. A 20% reduction in collisions is also predicted with conversion of the intersection to traffic signal control.

Conversion of the intersection to a single-lane roundabout results in a CMF of 0.61 and an average reduction of $156,200 (81%) per collision. A 39% reduction in collisions is also predicted with conversion of the intersection to roundabout control.

US 101 SB Ramps/San Luis Bay Drive

This intersection was analyzed as an existing two-way stop controlled intersection. Conversion of the intersection to traffic signal control results in a CMF of 0.8 and an average reduction of $68,600 (36%) per collision. A 20% reduction in collisions is also predicted with conversion of the intersection to traffic signal control.

Conversion of the intersection to a single-lane roundabout results in a CMF of 0.61 and an average reduction of $156,200 (81%) per collision. A 39% reduction in collisions is also predicted with conversion of the intersection to roundabout control.

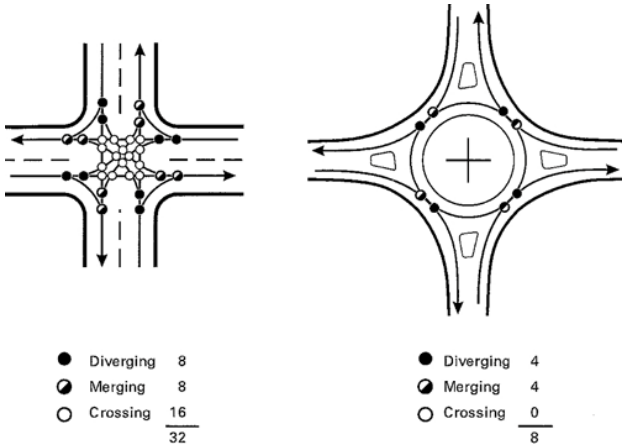
US 101 NB Ramps/San Luis Bay Drive

This intersection was analyzed as an existing two-way stop controlled intersection. Conversion of the intersection to traffic signal control results in a CMF of 0.8 and an average reduction of $68,600 (36%) per collision. A 25% reduction in collisions is also predicted with conversion of the intersection to traffic signal control.

Conversion of the intersection to a single-lane roundabout results in a CMF of 0.61 and an average reduction of $156,200 (81%) per collision. A 38% reduction in collisions is also predicted with conversion of the intersection to roundabout control.

6.2.2 Number of Conflicting Points

The number of conflicting points within an intersection directly correlates to the risk of an incident, especially at intersections. Conflict points are locations at which a roadway user can cross, merge, and diverge, etc. with another roadway user. A diagram of conflict locations at typical intersections are provided below.



The Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive intersections are closely spaced intersections. The number of combined conflict points between these two

intersections for both the Traffic Signal Alternative (based on the proposed combined intersection control) and for the Roundabout Alternative are provided below:

Traffic Signal Alternative = **40** Conflicts
Roundabout Alternative = **10** Conflicts

For the US 101 NB Ramps/San Luis Bay Drive intersection, the number conflict points for both the Traffic Signal Alternative and for the Roundabout Alternative are provided below:

Traffic Signal Alternative = **14** Conflicts
Roundabout Alternative = **6** Conflicts

The above analysis illustrates the advantages that the Roundabout Alternative would provide by significantly reducing the number of conflict points between vehicles.

6.2.2 Reduced Speed Potential

Typically the roundabout geometric design requires the driver to reduce the speed in the intersection to 15-25 MPH. Conversely, drivers can travel through a signalized intersection at speeds higher than posted speed limits due to lack of geometric constraints. Due to reduced travel speeds through the intersection and expected reduction in crashes, the roundabout alternative is likely to eliminate most severe crash types.

6.2.3 Pedestrian and Bike Safety

A key component of roundabout design focuses on non-motorized vehicle facilities through shared-use paths and two-stage crossings. The shared-use path provides the opportunity for cyclists to ride with vehicle traffic through the roundabout or to exit the roadway via a bike ramp and navigate the intersection on the shared-use path. Crosswalks are split into two separate crossings through the provision of pedestrian refuges at the splitter islands. These two-stage crossings reduce the amount of sustained time a pedestrian is in potential conflict with motorized vehicles by limiting the length of each crossing, and limit each crossing to one direction of vehicle travel at a time.

7. Preliminary Capital Cost Estimates

A preliminary opinion or probable capital costs (construction and right of way) has been estimated for the Interim Design Phase Traffic Signal Alternative based on the identified improvements. This preliminary cost estimate is provided in the Appendix I and the preliminary opinion of probable capital costs is provided below:

- Traffic Signal Alternative – Interim Design Year: $1.21 Million

Preliminary opinion or probable capital costs (construction and right of way) have also been estimated for both the Traffic Signal Alternative and the Roundabout Alternative (both the West Roundabout and the East Roundabout) based on the identified Ultimate Design Phase improvements. The costs to install the three (3) traffic signals have also been included within the

Traffic Signal Alternative cost estimate. These preliminary cost estimates are provided in Appendix I.

The preliminary Ultimate Design Phase opinion of probable capital costs for each alternative are provided below:

- Traffic Signal Alternative: $4.86 Million
- Roundabout Alternative: $5.23 Million
  - *West Roundabout: $3.82 Million*
  - *East Roundabout: $1.41 Million*

As shown, the estimated Ultimate Design Phase capital costs are lower for the Traffic Signal Alternative when compared to the Roundabout Alternative.

8. Alternatives Comparison

The capacity assessment/analysis provided in Section 4 identified that both the No Build Alternative and the AWSC Alternative were projected to operate at peak hour LOS worse than the target LOS thresholds for both Interim Design Year (2030) and Ultimate Design Year (2045) conditions. The conclusion was that neither alternative represents a viable alternative for these conditions.

For the Traffic Signal Alternative, the Baseline Conditions capacity assessment/analysis conducted in Section 4 concluded that acceptable peak hour intersection operations and queueing would occur with just the installation of the traffic signals. Both the Interim Design Year (2030) and Ultimate Design Year (2045) capacity assessments/ analysis, however, identified required roadway improvements. Finally, the capacity assessment/analysis for the Roundabout Alternative was only conducted for the Ultimate Design Year (2045).

As the capacity assessment/analysis was only conducted for the Ultimate Design Year for the Roundabout Alternative, Table 15 provides a comparative summary for both this alternative and the Traffic Signal Alternative for the Ultimate Design Year condition. For reference, the 6-legged roundabout proposed for the combined Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive intersections is referred to as the West Roundabout while the 4-legged roundabout proposed for the US 101 NB Ramps/San Luis Bay Drive intersection is referred to as the East Roundabout.

Table 15: Alternative Comparison Summary – Ultimate Design Year (2045)

Intersections	Traffic Signal Alternative (also refer to Figure 5.2)	Roundabout Alternative (also refer to Figures 5.3 & 5.4)
Traffic Operations	**Ontario Road/San Luis Bay Drive:** • LOS D projected for both the weekday and Saturday PM peak hours. Vehicle storage available to accommodate projected 95% percentile queue for both peak hours. **US 101 SB Ramps/San Luis Bay Drive:** • LOS B and C projected for both the weekday and Saturday PM peak hours. SB off-ramp shared through plus left-turn lane is extended to accommodate projected 95th percentile queue. **US 101 SB Ramps/San Luis Bay Drive:** • LOS C and B projected for both the weekday and Saturday PM peak hours. Vehicle storage available to accommodate projected 95% percentile queues for both peak hours.	**West Roundabout:** • LOS B projected for the weekday PM peak hours and LOS A projected for the Saturday PM peak hour. Vehicle storage available to accommodate projected 95% percentile queues for both peak hour periods. **East Roundabout:** • LOS B projected for both the weekday and Saturday PM peak hours. Vehicle storage available to accommodate projected 95% percentile queues for both peak hour periods.
Pedestrian/ Bicycle Access	**Pedestrian Access:** • Similar to No Build Conditions, pedestrian access is only provided across the south side of the San Luis Bay over crossing of US 101. Due to minimal pedestrian activity, no pedestrian crosswalks are provided. **Bicycle Access:** • Per the current County Bikeways Plan, a Class II Bike Lane is proposed on San Luis	**Pedestrian Access:** • Similar to No Build Conditions, pedestrian access is only provided across the south side of the San Luis Bay over crossing of US 101. A pedestrian crossing connected by a shared use path is currently proposed at the East Roundabout. Pedestrian crossings connected by shared-use pathways are proposed on all legs of the West Roundabout (also refer to the following "Bicycle Access" discussion). **Bicycle Access:** • Per the current County Bikeways Plan, a Class II Bike Lane is proposed on San Luis

Intersections	Traffic Signal Alternative (also refer to Figure 5.2)	Roundabout Alternative (also refer to Figures 5.3 & 5.4)
	Bay Drive beginning at the Ontario Road intersection and extending west to Avila Beach Drive while Ontario Road is proposed to be upgraded from Class III to Class II. Minimum of 5' shoulders are proposed along the widened sections of San Luis Bay Drive to within the study area to accommodate bicyclist.	Bay Drive beginning at the Ontario Road intersection and extending west to Avila Beach Drive while Ontario Road is proposed to be upgraded from Class III to Class II. As bicyclist need to be accommodated, bicycles are accommodated at the West Roundabout by navigating through the roundabout in two ways. Cyclists may choose to take the travel lane and travel through the roundabout as a vehicle or may choose to take the separated bike ramp/shared use path and travel around the roundabout as a pedestrian.
San Luis Bay Drive OC	• This alternative will require widening the south side of the existing OC of US 101 by 26'. Full structure replacement is not assumed at this time.	• This alternative assumes that both roundabouts can be provided without modifying the existing OC.
Potential Right-of-way Impacts	• Right-of-way impacts are not anticipated.	• Would likely involve right-of-way take in the NW quadrant at the Ontario Road/San Luis Bay Drive intersection.
Potential Utility Impacts	• Would likely require the relocation of overhead joint use utility poles along Ontario Road at San Luis Bay Drive.	• Would likely require the relocation of overhead joint use utility poles along Ontario Road at San Luis Bay Drive.
Safety	**Collision Cost Analysis** Combined Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive Intersections: • CMF – 0.8 • Average Collision Cost Reduction – 36% • Reduction in Collisions – 20% US 101 SB Ramps/San Luis Bay Drive: • CMF – 0.8 • Average Collision Cost Reduction – 36%	**Collision Cost Analysis** West Roundabout: • CMF – 0.61 • Average Collision Cost Reduction – 81% • Reduction in Collisions – 39% East Roundabout: • CMF – 0.61 • Average Collision Cost Reduction – 81% • Reduction in Collisions – 39%

Intersections	Traffic Signal Alternative (also refer to Figure 5.2)	Roundabout Alternative (also refer to Figures 5.3 & 5.4)
	• Reduction in Collisions – 25% **Number of Conflict Points** Combined Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive Intersections: • 40 Conflict Points US 101 SB Ramps/San Luis Bay Drive: • 14 Conflict Points	**Number of Conflict Points** Combined Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive Intersections: • 10 Conflict Points US 101 SB Ramps/San Luis Bay Drive: • 6 Conflict Points
Preliminary Capital Costs	• Approximately $4.86 Million	• Approximately $5.23 Million (both West & East Roundabouts)

9. Phasing Potential

The capacity assessment/analysis provided in Section 4 identified that both the No Build Alternative and the AWSC Alternative were projected to operate at peak hour LOS worse than the target LOS thresholds for both Interim Design Year (2030) and Ultimate Design Year (2045) conditions. The conclusion was that neither alternative represents a viable alternative for these conditions. The study intersection delay and LOS for both the Baseline and Interim Design Year conditions are provided in Table 16.

For the Traffic Signal Alternative capacity assessment/analysis, the study intersection controls are converted from existing control to a coordinated signalized intersection system between the three study intersections. For this alternative, one controller is assumed to control the traffic signal system between the Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive intersections to provide for improved capacity, reduced delay and clear traffic between the two intersections. The Interim Design Year analysis initially assumed traffic signal control with existing approach geometrics at each of the study intersections. The weekday and Saturday PM peak hour analysis based on these assumptions projected that the Ontario Road/San Luis Bay Drive intersection would operate at LOS “E” during both peak hour periods as shown in Table 16. The analysis also projected that the US 101 SB Ramps/San Luis Bay Drive intersection would operate at LOS “D” during the Saturday PM peak hour as also shown in the table.

Table 16: Phasing Potential – Alternatives LOS Comparison

Baseline Conditions														
			No Build Alternative				AWSC Alternative				Traffic Signal Alternative[1]			
			PM Peak Hour		Saturday PM Peak Hour		PM Peak Hour		Saturday PM Peak Hour		PM Peak Hour		Saturday PM Peak Hour	
#	Intersection	Target LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Ontario Road/ San Luis Bay Drive	D	19.7	C	16.0	C	12.6	B	15.1	C	31.8	C	29.3	C
2	US 101 SB Ramps/ San Luis Bay Drive	C	10.2	B	11.6	B	3.6	A	6.5	A	12.2	B	16.4	B
3	US 101 NB Ramps/ San Luis Bay Drive	C	23.3	C	18.7	C	7.5	A	8.5	A	8.6	A	9.1	A
Interim Design Year (2030)														
			No Build Alternative				**AWSC Alternative**				**Traffic Signal Alternative[1]**			
			PM Peak Hour		Saturday PM Peak Hour		PM Peak Hour		Saturday PM Peak Hour		PM Peak Hour		Saturday PM Peak Hour	
#	Intersection	Target LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Ontario Road/ San Luis Bay Drive	D	92.8	**F**	62.3	**F**	98.9	**F**	72.9	**F**	68.1	**E**	62.4	**E**
2	US 101 SB Ramps/ San Luis Bay Drive	C	12.0	B	14.7	B	104.0	**F**	56.9	**F**	25.7	C	32.2	C
3	US 101 NB Ramps/ San Luis Bay Drive	C	247.3	**F**	106.8	**F**	49.8	**E**	17.7	C	18.6	B	22.4	C

1. Peak hour "Delay" and "LOS" with provision of traffic signals only with existing intersection geometrics.

Bold = LOS worse than "Target LOS"

As shown in Table 16, provision of AWSC (with existing intersection geometrics) at the three study intersections will not provide for acceptable intersection operations for the Interim Design Year conditions. Though the AWSC Alternative will not provide acceptable intersection operations, provision of AWSC is projected to operate at acceptable LOS based on the "Target LOS" at the study intersections as follows:

- Ontario Road/San Luis Bay Drive – Exceeds Target LOS D
  - Weekday PM Peak Hour – between 2025 and 2026
  - Saturday PM Peak Hour – between 2024 and 2025
- US 101 SB Ramps/San Luis Bay Drive – Exceeds Target LOS C
  - Weekday PM Peak Hour – between 2022 and 2023
  - Saturday PM Peak Hour – between 2023 and 2024
- US 101 NB Ramps/San Luis Bay Drive – Exceeds Target LOS C
  - Weekday PM Peak Hour – between 2025 and 2026
  - Saturday PM Peak Hour – through 2030

Provision of AWSC would be cost effective at the Ontario Road/San Luis Bay Drive intersection in the short-term (up to 5-years) and would be expected to improve safety while longer term improvements are further analyzed and a preferred project is identified. A collision cost analysis was conducted based on AWSC which results in a CMF of 0.3 and an average reduction of $98,500 (51%) per collision. A 69% reduction in collisions is also predicted with conversion of the intersection to AWSC.

As also shown in Table 16, provision of traffic signal control (with existing intersection geometrics) will provide for acceptable Interim Design Year intersection operations at both San Luis Bay Drive intersections with the US 101 SB Ramps and with the US 101 NB Ramps. The Ontario Road/San Luis Bay Drive intersection is projected to operate at LOS "E" during both PM peak hour periods, however, provision of the traffic signal is projected to operate acceptably as follows:

- Ontario Road/San Luis Bay Drive – Exceeds Target LOS D
  - Weekday PM Peak Hour – between 2028 and 2029
  - Saturday PM Peak Hour – between 2028 and 2029

The queuing analysis provided in Section 4 also indicated that this intersection will still provide sufficient storage to accommodate the projected queues and the signal system as a whole along San Luis Bay Drive is also projected to generally provide sufficient storage to accommodate the projected queues.

Because of the close spacing between the Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive intersections, the Traffic Signal Alternative assumes that one controller will control the traffic signal system between these two intersections to provide for improved capacity and reduced delay. Installation of traffic signals at both the Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive intersections would likely occur at the same time and would provide improved operations and safety through the Interim Design Year. A collision cost analysis was conducted for the Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive intersections. Conversion of the intersection to traffic signal control results in a CMF of 0.8 and an average reduction of $68,600 (36%) per collision. A 20% reduction in collisions is also predicted with conversion of the intersection to traffic signal control.

Provision of a traffic signal at the US 101 NB Ramps/San Luis Bay Drive could probably be deferred to a later construction phase.

10. Conclusions and Recommendation

The following four alternatives have been evaluated within this report:

- No Build
- All Way Stop Control (AWSC)
- Traffic Signal
- Roundabout (2045 Screening Assessment)

10.1 Baseline and Interim Design Year (2030) Conditions

The capacity assessment/analysis provided in Section 4 identified that both the No Build Alternative and the AWSC Alternative currently operate at acceptable LOS for the Baseline Condition. Both the No Build Alternative and the AWSC Alternative were, however, projected to operate at peak hour LOS worse than the target LOS thresholds for the Interim Design Year (2030) Condition. The conclusion was that neither alternative represents a viable alternative for this condition. A phasing analysis provided in Section 9 however identified that provision of AWSC would operate acceptably at the Ontario Road/San Luis Bay Drive intersection through 2024/2025.

Provision of traffic signal control (Traffic Signal Alternative) was also evaluated for the Interim Design Year condition assuming existing intersection geometrics at the three study intersections. The capacity assessment/analysis provided in Section 4 identified that acceptable Interim Design Year intersection operations would be provided at both San Luis Bay Drive intersections with the US 101 SB Ramps and with the US 101 NB Ramps. The Ontario Road/San Luis Bay Drive intersection is projected to operate at LOS "E" during both PM peak hour period.

The phasing analysis provided in Section 9, however, identified that a traffic signal at the Ontario Road/San Luis Bay Drive is projected to operate at LOS "D" through 2028. The queuing analysis provided in Section 4 also indicated that this intersection will still provide sufficient storage to accommodate the projected queues and the signal system as a whole along San Luis Bay Drive is also projected to generally provide sufficient storage to accommodate the projected queues through the Interim Design Year. Because of the close spacing between the Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive intersections, the Traffic Signal Alternative assumes that one controller will control the traffic signal system between these two intersections. Installation of traffic signals at both the Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive intersections provided at the same time would improve operations and safety through the Interim Design Year.

Based on the analysis and conclusions provided in the report, it is recommended that provision of AWSC be provided at the Ontario Road/San Luis Bay Drive intersection as a cost effective, short-term improvement. Providing AWSC at this intersection would be expected to improve safety while viable longer term improvements are further analyzed and a preferred project is identified. A collision cost analysis was conducted based on AWSC which results in a CMF of 0.3 and an average reduction of $98,500 (51%) per collision. A 69% reduction in collisions is also predicted with conversion of the intersection to AWSC.

10.2 Ultimate Design Year (2045) Conditions

The capacity assessment/analysis provided in Section 4 also identified that both the No Build Alternative and the AWSC Alternative were projected to operate at peak hour LOS worse than the target LOS thresholds for the Ultimate Design Year (2045) conditions. The conclusion was that neither alternative represents a viable alternative for this condition.

Two viable Ultimate Design Year build alternatives, Traffic Signal Alternative and Roundabout Alternative, were identified and evaluated both of which improved safety and provided additional capacity and improved operations for this condition. For the Traffic Signal Alternative, the capacity assessments/ analysis identified that significant roadway improvements would be required in addition to traffic signals to meet the target LOS and accommodate projected 95th percentile queues. For the Roundabout Alternative, the capacity assessment/analysis concluded that the identified roundabout geometrics were projected to provide acceptable peak hour operations.

The collision cost analysis provided in Section 6 identified that both alternatives would provide significant reductions in both the average cost per collision and number of collisions. The preliminary opinion or probable capital costs provided in Section 7 also indicate that there would be approximately a 10% difference in projected capital costs between the alternatives. In addition to

calculating collision costs and projected saving for various intersection improvements. Caltrans Safety Performance/Collision Cost Analysis Tool also calculates Benefit/Cost (B/C) for various intersection improvements based on estimated capital costs.

Table 17A provides the calculated combined B/C ratio for both the Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive intersections using Caltrans Safety Performance/ Collision Cost Analysis Tool. The B/C ratios were calculated based on existing and forecasted traffic volumes, the historic intersection collision data provided in Section 6 and the preliminary opinion of probable capital costs. As shown in Table 17A, the Roundabout Alternative realizes a B/C ratio of 8.72 which is over twice the B/C ratio of 4.13 realized by the Traffic Signal Alternative.

Table 17A: Ultimate Design Year - Ontario Road/San Luis Bay Drive and US 101 SB Ramps/San Luis Bay Drive Intersections Combined Collision Cost Analysis and B/C

Intersection Control Evaluation
Collision Cost Analysis and B/C
-- Fill in tan boxes along with 'Area' --

County	Rte	Postmile	Location Description
SLO	Local		Ontario Rd & US 101 SB Ramps

Area: ○ Rural ○ Suburban ◉ Urban

Intersection Types: F - Four-Legged; M - Multi-Legged; S - Offsett -Tee; Y - "Y" Wye; Z - Others

Existing Condition	# of Years for Analysis	Rate Group
Stop Control (Minor Leg), Type F, M or S	25	I12

Existing ADT (x1000)		Future ADT (x1000)			
Mainline	Cross St	Mainline	Cross St	Average ADT	VCF
6.0	2.0	12.4	3.7	12.1	1.51

Est. Capital Cost (x1000) for Desired Improvement			
Desired Improvement	Const	R/W	Total
Yield Control (Roundabout 1-Lane)	$ 3,563	$ 259	$ 3,822
Yield Control (Roundabout 2-Lane)	N/A		$ -
Traffic Signal, Type F, M or S	$ 4,330	$ 100	$ 4,430

Existing Collision Data			
Number of Years	5	Total Collisions	26
Injury	14	PDO	12
Fatal	0	Fat + Inj	14

	Collision Cost (x1000)					B/C
	Existing Condition		Desired Improvement		Projected Savings	
1	Stop Control (Minor Leg), Type F, M or S	$37,612	Yield Control (Roundabout 1-Lane)	$4,268	$33,344	8.72
2	Stop Control (Minor Leg), Type F, M or S	$37,612	Traffic Signal, Type F, M or S	$19,333	$18,279	4.13

NOTE: Only average collision costs are used for calculation purposes.

Table 17B provides the calculated combined B/C ratio for the US 101 NB Ramps/San Luis Bay Drive intersection. As shown in Table 17B, the Roundabout Alternative realizes a B/C ratio of 0.48 while the Traffic Signal Alternative realizes a B/C ratio of -1.58. The negative B/C ratio is based on projected savings being less than the capital cost.

Table 17B: Ultimate Design Year - US 101 NB Ramps/San Luis Bay Drive Intersection Collision Cost Analysis and B/C

Intersection Control Evaluation
Collision Cost Analysis and B/C
-- Fill in tan boxes along with 'Area' --

County	Rte	Postmile	Location Description
Slo	101		I/S of NB Ramps/San Luis Bay Dr.

Area: ○ Rural ○ Suburban ◉ Urban

Intersection Types: F - Four-Legged; M - Multi-Legged; S - Offsett -Tee; Y - "Y" Wye; Z - Others

Existing Condition	# of Years for Analysis	Rate Group
Stop Control (Minor Leg), Type F, M or S	25	I12

Existing ADT (x1000)		Future ADT (x1000)			
Mainline	Cross St	Mainline	Cross St	Average ADT	VCF
5.0	0.4	10.0	1.2	8.3	1.54

Est. Capital Cost (x1000) for Desired Improvement				Existing Collision Data			
Desired Improvement	Const	R/W	Total	Number of Years	5	Total Collisions	1
Yield Control (Roundabout 1-Lane)	$ 1,385	$ 25	$ 1,410	Injury	1	PDO	0
Yield Control (Roundabout 2-Lane)	N/A		$ -	Fatal	0	Fat + Inj	1
Traffic Signal, Type F, M or S	$ 432	$ -	$ 432				

	Collision Cost (x1000)					B/C
	Existing Condition		Desired Improvement		Projected Savings	
1	Stop Control (Minor Leg), Type F, M or S	$1,535	Yield Control (Roundabout 1-Lane)	$857	$678	0.48
2	Stop Control (Minor Leg), Type F, M or S	$1,535	Traffic Signal, Type F, M or S	$2,219	($684)	-1.58

NOTE: Only average collision costs are used for calculation purposes.

Based on the calculated B/C ratios, the Roundabout Alternative would represent the preferred Ultimate Design Year alternative.

An ICE Step 2 evaluation will need to be performed for each alternative to arrive at a more affirmative recommendation that the Roundabout Alternative represents the preferred Ultimate

Design Year alternative. Under this step, additional analysis that will assist with providing this recommendation will be performed including, but not limited to, the following:

- Signal warrant analysis for the three study intersections
- Life-cycle cost analysis for each alternative
- Stopping and intersection sight distance checks for the Roundabout Alternative
- View and entry angle check for the Roundabout Alternative

Appendix Index