Intersection Control Evaluation (ICE) Screening Evaluation

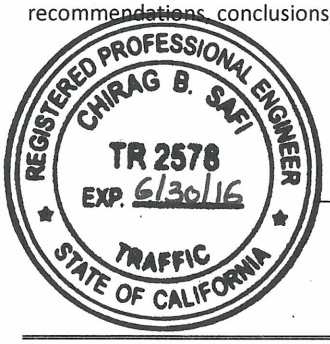
Olive Mill Road / Coast Village Road / US 101 Interchange

Santa Barbara, California

April 2016

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING

This Intersection Control Evaluation has been prepared under the direction of the following registered traffic engineer. The registered traffic engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.



Chirag B. Safi
Chirag B. Safi, T.E., Registered Traffic Engineer

5/2/16
DATE

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Olive Mill Road / Coast Village Road / US 101 Interchange

Santa Barbara, California

Prepared For:
City of Santa Barbara
630 Garden Street
Santa Barbara, CA 93101

Prepared By:
Kittelson & Associates, Inc.
428 J Street, Suite 500
Sacramento, California 95814
(916) 226-2190

Project Manager: Chirag Safi, T.E.
Project Principal: Lee A. Rodegerdts, P.E.
Project Analyst: Sara Muse

Project No. 17493

April 2016

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING / PLANNING
428 J Street, Suite 500, Sacramento, CA 95814 P 916.266.2190 F 916.266.2195

Olive Mill Road / Coast Village Road / US 101 Interchange

INTERSECTION CONTROL EVALUATION: SCREENING SUMMARY

Kittelson & Associates, Inc. (KAI) conducted an Intersection Control Evaluation (ICE) to objectively evaluate and screen intersection control and access alternatives at the following intersection(s):

- US 101 Northbound Off-Ramp Terminal / US 101 Southbound On-Ramp Terminal / Olive Mill Road / Coast Village Road / North Jameson Road

The control options include:

- Traffic signal control
- Roundabouts
- All-way Stop control (existing)

The City of Santa Barbara, County of Santa Barbara, and Caltrans jointly own and operate the intersection. Operationally, the roundabout configuration is the most likely, viable alternative to serve forecast traffic. The existing stop-control or, no project alternative, is a feasible traffic control alternative for the near term but will degrade over time. Additional analysis is needed to determine queues lengths for the 2040 all-way stop control design year scenario, and whether or not spillback would affect freeway mainline operations. Signal control is not a viable alternative considering the project constraints given for this evaluation. There may be other considerations, constraints, and project factors identified in future design evaluations that could affect the prioritization of a specific configuration.

The intersection evaluation considered year 2040 "build" condition traffic operations, geometrics, constraints, and other design considerations.

KEY FINDINGS:

Key findings for this review include the following:

- The Caltrans District 5 ICE coordinator has reviewed the initial roundabout concept and agrees the project is viable to move forward into further analysis. No fatal flaws have been identified in this phase.
- The roundabout alternative would provide superior AM/PM peak hour operations over either the stop-controlled or the signal-controlled alternatives.
- The roundabout alternative preserves the existing Olive Mill Road/US 101 overpass bridge, and the southbound US 101 on-ramp bridge
- The roundabout alternative would simplify the existing intersection and reduce the number of decision points.
- Traffic signal operations would likely require 5-way split phasing, due to the existing intersection geometry, that would result in long cycle lenths and delays. To reduce the number of phases, intersection and ramp realignment would be necessary.
- Traffic signal operations would not be acceptable for the existing nor 2040 design year. Stop-control operations would not be acceptable for the 2040 design year.
- Additional analysis is needed to determine queue lengths for the 2040 all-way stop design year scenario, and whether or not spillback would affect freeway mainline operations.
- The roundabout alternative would require minimal right-of-way acquisition; primarily to address design vehicle needs. The signal alternative is fatally flawed given the project constraints.

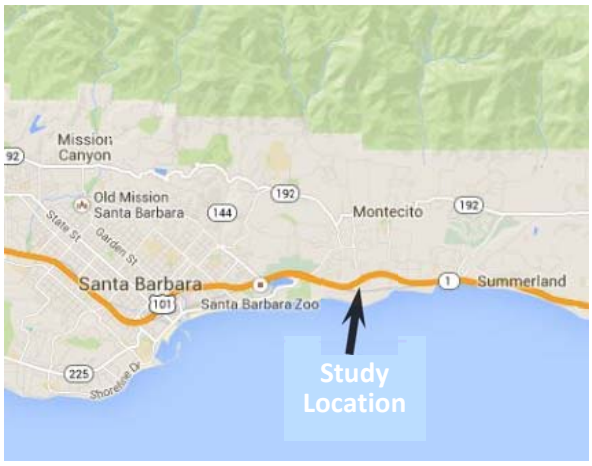

Figure 1. Site Vicinity Map

The roundabout would provide speed control and the required sight distance, as well as accommodate traffic movements for the California Truck, Bus 45, and emergency response design vehicles. Considering the current constraints, the roundabout alternative would also simplify manuevering through the intersection. Additionally, the roundabout alternative has better expected safety performance than the traffic signal and stop control alternatives.

KAI recommends the roundabout alternative be advanced as viable intersection control and access strategies for the Olive Mill Road / Coast Village Road / US 101 Intersection.

Table 1 summarizes the operations results and Table 2 provides a summary of operations comparison. Figure 2 displays the roundabout alternative concept design.

Table 1. Existing and 2040 Operations Results

Time Period	Existing All Way Stop Control [1,3]			Signal Control [2]			Roundabout Control [3]		
	Volume to Capacity Ratio [4]	Delay (seconds/ vehicle)	Queue Length (feet) [4]	Volume to Capacity Ratio	Delay (seconds/ vehicle)	Queue Length (feet)	Volume to Capacity Ratio	Delay (seconds/ vehicle)	Queue Length (feet)
Existing Traffic Volumes									
AM	NA	**31.3 (D)*** 15.4 (C)** 14.7 (B)***	NA	NA	NA	NA	0.36	4.9 (A)	50 (E)
PM	NA	16.6 (C)* 11.4 (B)** 14.4 (B)***	NA	NA	NA	NA	0.87	15.3 (C)	400 (W)
2040 (Build) Design Year Traffic Volumes [5]									
AM	NA	**37.9 (E)*** 20.1 (C)** 15.1 (C)***	NA	> 1.00	**124.4 (F)**	700 (S)	0.58	10.9 (B)	100 (E)
PM	NA	**47.9 (E)*** 16.7 (C)** **38.1 (E)***	NA	> 1.00	**209.4 (F)**	775 (S)	0.77	14.2 (B)	250 (W)

1 Results for all way stop control extracted from SC101 HOV EIR Traffic Study. The EIR analyzed the intersection as three distinct intersections. These three results are shown above.
2 Signal control was not analyzed for existing traffic volume conditions.
3 Overall intersection operations shown for all-way stop control and roundabout alternatives.
4 Volume to capacity ratios and queue lengths are not reported by the HCM all-way control method. Further analysis needed to quantify future queue lengths under all-way stop control.
5 Assumes Modified F configuration at the Cabrillo Boulevard interchange
* NB off ramp/Olive Mill Road intesecection
** N. Jameson Ln/Olive Mill Road intersection
*** SB on ramp/Olive Mill Road intersection
NA = Not Available
Bold indicates unacceptable operations

Table 2. Year 2040 Operations Comparison

Year 2040 Existing Stop Control	Year 2040 Signal Control	Year 2040 Roundabout Control
• Volume to capacity ratio not analyzed • **LOS F in the a.m. peak hour with highest delay of 56 seconds for northbound Olive Mill Road approach** • **LOS F in the p.m. peak hour with highest delay of 60 seconds for eastbound Coast Village Road approach** • Adequacy of queue storage not analyzed.	• **Over capacity** • **LOS F in the a.m. peak hour with average delay of 124 seconds** • **LOS F in the p.m. peak hour with average delay of 209 seconds** • **Inadequate queue storage**	• Under capacity • LOS B in the a.m. peak hour with average delay of 11 seconds • LOS B in the p.m. peak hour with average delay of 14 seconds • Adequate queue storage

Bold indicates unacceptable operations

Figure 2. Roundabout Alternative Concept Design

INTRODUCTION

PROJECT OVERVIEW

This Intersection Control Evaluation (ICE) objectively evaluates alternatives for the intersection control form at the Olive Mill Road / Coast Village Road / US 101 interchange.

Figure 3 displays the site vicinity map.

This document explores intersection control alternatives at the study intersection. Three project alternatives were analyzed as described in this ICE:

- All-way Stop-Control Intersection (Existing Condition)
- Signalized Intersection
- Roundabout Intersection

PROJECT CONTEXT

The project context identifies the transportation facilities and geometric characteristics of the roadways within the study area. Table 3 describes the study area roadways.

As seen in Figure 3, the Olive Mill Road / Coast Village Road / US 101 interchange is an interchange controlled by stop signs on all approach legs. The stop lines for the southbound and northbound Olive Mill Road approach are approximately 145 feet apart. The Coast Village Road, US 101 Off-Ramp, US 101 On-Ramp, and the N. Jameson Road approaches all are located within the intersection defined by the Olive Mill Road stop limit-lines.

The Coast Village Road leg is a gateway to the City of Santa Barbara and the Coast Village Business District.

All parcels in the immediate vicinity of the project are developed.

Table 3: Study Area Roadways

Roadway	Corridor Context				Multimodal Transportation		
					Transit Service	Active Transportation Links	
	Cross Section	Functional Classification	Speed Limit	Regional Context		Pedestrian Considerations	Bicycle Routes
Olive Mill Road **(City of Santa Barbara and County of Santa Barbara)**	Undivided two-lane	Local Street	40 mph North of US Hwy 101 30 mph south of US Hwy 101	Serves local communities to the north and south of the study area Serves tourist and recreation destinations to the south and west of the study area	Local transit service is operated by MTD Santa Barbara in the study area. Service is provided via the Line 14 – Montecito north of the study intersection. A bus stop is located just north of N. Jameson Road.	Sidewalks are provided along the west side of Olive Mill Road within the City of Santa Barbara. Consistent with Montecito Association guidelines, sidewalks are not provided within the County of Santa Barbara.	Class II bicycle lanes are provided north of N. Jameson Road

Roadway	Corridor Context				Multimodal Transportation		
					Transit Service	Active Transportation Links	
	Cross Section	Functional Classification	Speed Limit	Regional Context		Pedestrian Considerations	Bicycle Routes
Coast Village Road **(City of Santa Barbara)**	Undivided two-lane On-street angled parking	Commercial, shopping, entertainment. corridor	Not Posted	Serves local communities to the west. Gateway to Santa Barbara. Serves local and tourist shopping, entertainment, professional, and lodging services to the west. Alternate, parallel route to US 101	Local transit service is operated by MTD Santa Barbara in the study area. Service is provided via the Line 14 – Montecito. A bus stop is located just west of Olive Mill Road.	Sidewalks are provided along both sides	Class II bicycle lanes are provided
North Jameson Road **(County of Santa Barbara)**	Undivided two-lane	Local Street	40 mph	Serves local communities to the east. Serves local and tourist shopping, entertainment, professional, and lodging services to the west. Alternate, parallel route to US 101	None	None. Potential pedestrian destination limited to north of N. Jameson Road midblock. Consistent with Montecito Association guidelines, sidewalks are not provided within the County of Santa Barbara.	Class II bicycle lanes are provided
US 101	Four-lane divided highway	Highway	65 mph	Bisects the City of Santa Barbara to provide north-south service through the City and to regional destinations	None	None	None

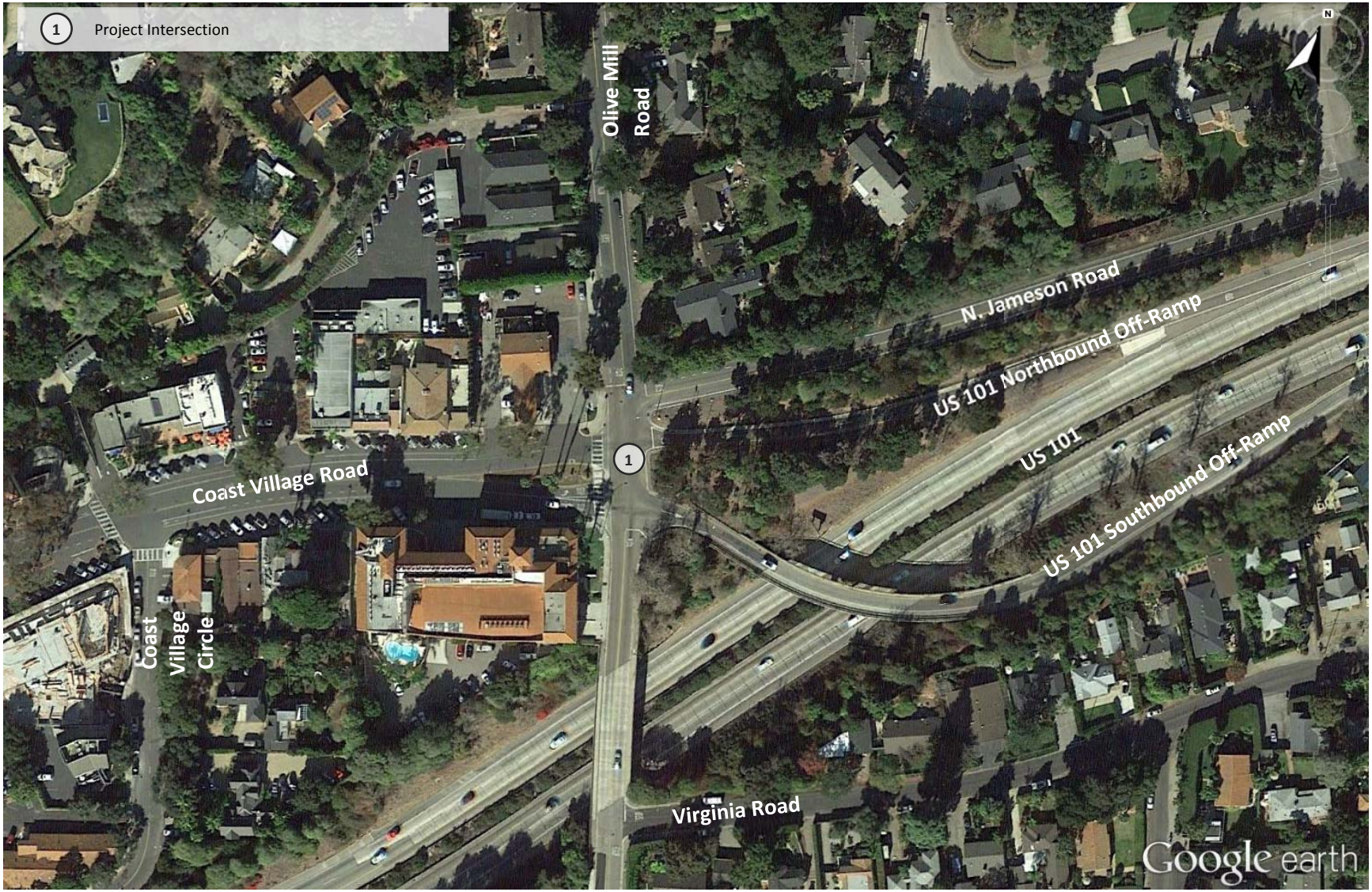

Figure 3. Study Area and Existing Study Intersection Lane Configuration

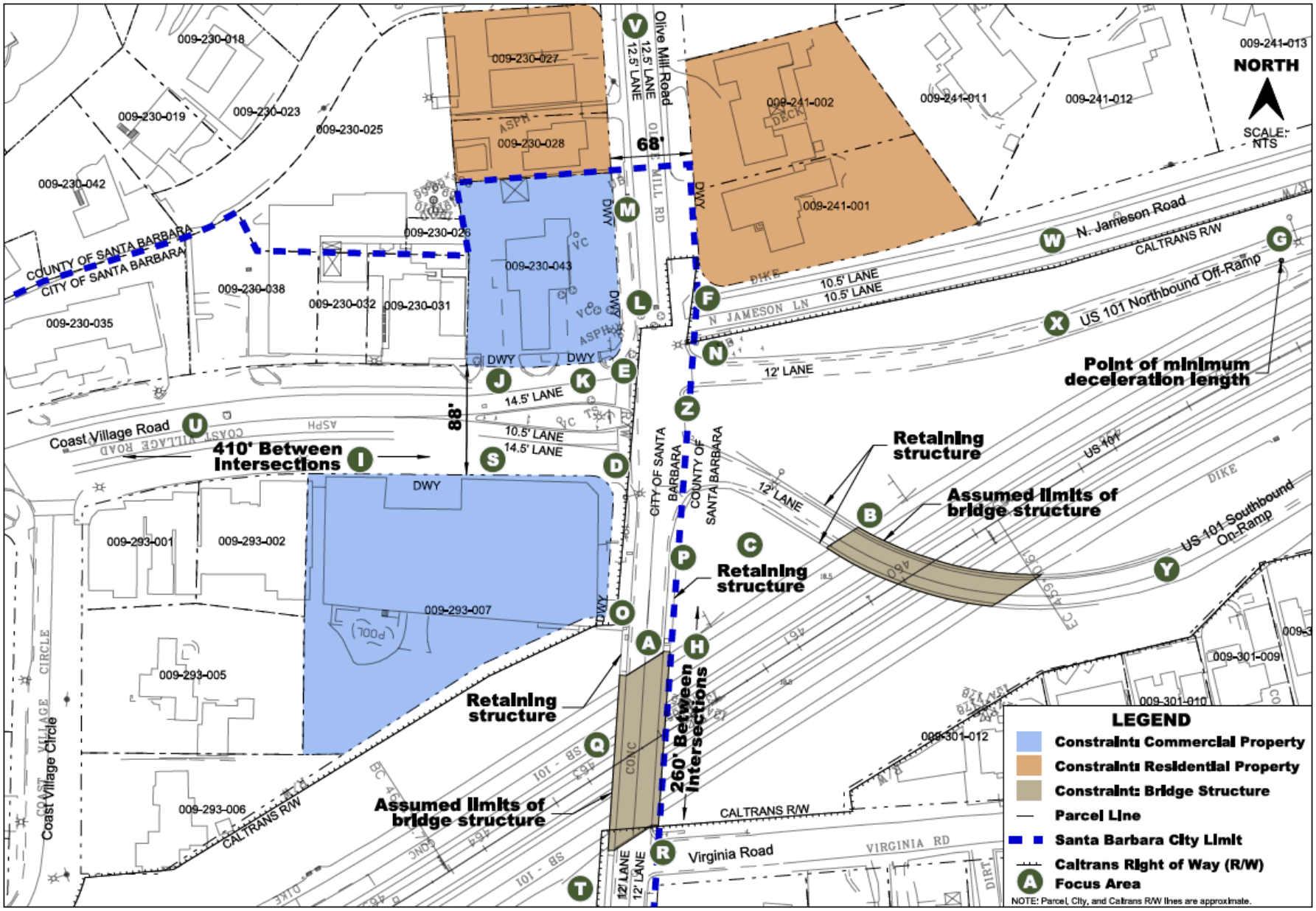

Figure 4: Existing Conditions and Constraints

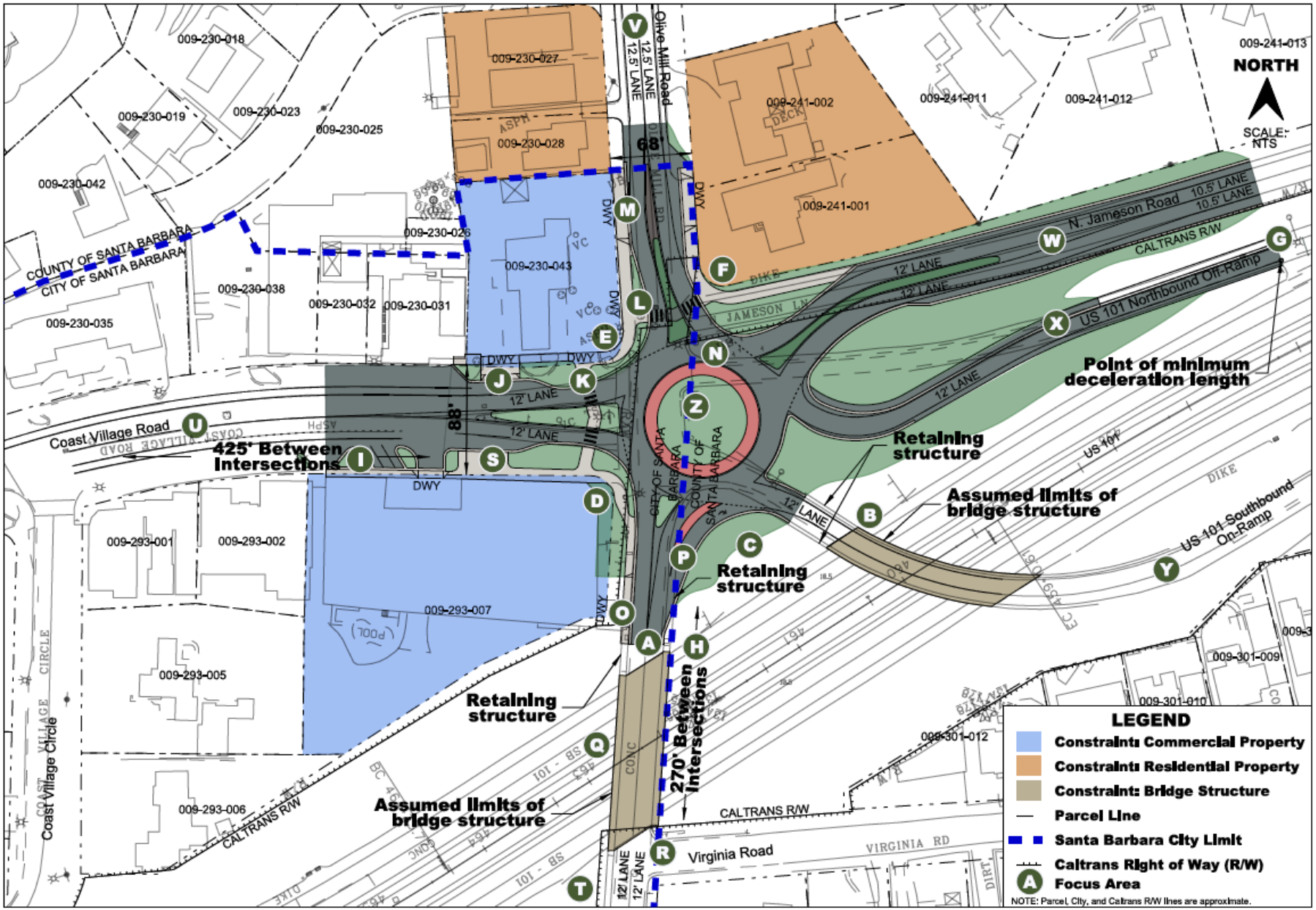

Figure 5: Conditions and Constraints with Proposed Project

PLANNING AND DESIGN FRAMEWORK

EXISTING CONDITIONS AND DESIGN CONSTRAINTS

The following section and Table 4 describe the existing conditions and constraints identified in Figure 4 and Figure 5.

RIGHT OF WAY

The project intersection is bisected by the City of Santa Barbara to the west and the County of Santa Barbara to the east. The centerline of Olive Mill Road is the approximate location of the jurisdictional boundary.

Caltrans right of way generally follows the southerly fence line of N. Jameson Road and the westerly back of sidewalk of Olive Mill Road. Right of extends to a portion of Olive Mill Road north of N. Jameson Road. The existing intersection is largely within Caltrans R/W.

Table 4: Existing Conditions and Design Constraints

BOLD indicates either a fatal flaw identified by the City of Santa Barbara or a deviation from Caltrans Highway Design Manual (HDM) advisory or mandatory design standards effective September 22, 2014.

Focus Area	Description	HDM Design Deviation Alt.1/Alt.2	Alt. 1 Existing (Figure 4)	Alt. 2 Proposed Roundabout (Figure 5)
A	Olive Mill Bridge	No/No	• **Potential Design Constraint / Fatal Flaw if altered**	• No Impact • Preserves existing bridge
B	US 101 Southbound On-Ramp Bridge	No/No	• **Potential Design Constraint / Fatal Flaw if altered**	• No Impact • Preserves existing bridge
C	Retaining Structure Easterly side of Olive Mill Road	No/No	• Cost consideration if modified	• New retaining structure will be required. The cost and magnitude of the structure will be influenced by Focus Area P.
D	Montecito Inn Parcel 009-293-007	No/No	• **Potential Right of Way Constraint / Fatal Flaw if additional Right of Way needed**	• Minimal Right of Way acquisition may be required to accommodate design vehicles • Landscape modifications may be needed to accommodate landscaping and sidewalk
E	76 Service Station Parcel 009-230-043	No/No	• **Potential Right of Way Constraint / Fatal Flaw if additional Right of Way needed**	• No substantial Right of Way impact • **Substantial access impact. Access for fuel trucks may be may be substantially impacted. Refer to Focus Areas K and L.** • Landscape modifications may be needed to accommodate landscaping and sidewalk. • Improvements will likely replace existing sidewalk within parcel.
F	Private Residence Parcel 009-241-001	No/No	• **Potential Right of Way Constraint / Fatal Flaw if additional Right of Way needed**	• No Impact • Improvements do not encroach

Focus Area	Description	HDM Design Deviation Alt.1/Alt.2	Alt. 1 Existing (Figure 4)	Alt. 2 Proposed Roundabout (Figure 5)
G	Northbound Off-Ramp Deceleration Length	No/Unlikely	• First curve radius = 650 feet (approx.) • Curve is approx. 420 feet from gore	• Design Deviation Unlikely • There is sufficient length to accommodate a variety of alignments to approach the roundabout. • As shown, the first curve radius is 500 feet with approx. 420 deceleration length. • Future studies should evaluate horizontal and vertical approach alignments that balance superelevation requirements, retaining structure costs, roundabout geometric guidance, intersection sight line angles, and ramp deceleration length.
H	Distance to Virginia Road from southbound US 101 on-ramp	**Yes/Yes**	• **Existing deviation from Mandatory Design Standard** for HDM Topic 504.3 (3) • Curb return to curb return distance is less than 400 feet	• **Maintains deviation from Mandatory Design Standard** with minor improvement over existing • Distance from ICD to curb return, measured at Olive Mill Road centerline is 270 feet. • Providing pedestrian access along across the south leg of the roundabout to the east side of Olive Mill Road will be challenging due to topography and south leg approach geometry. An alternative is to cross pedestrians to the west side of Olive Mill Road at Virginia Road.
I	Distance to Coast Village Circle from Olive Mill Road	**Yes/Yes**	• **Existing deviation from Advisory Design Standard** for HDM Topic 504.3 (3) • Curb return to curb return distance is less than 500 feet but greater than 400 feet.	• **Maintains deviation from Advisory Design Standard** with minor improvement over existing • Distance from ICD to curb return, measured at Coast Village Road centerline is 425 feet.
J	Driveway APN 009-230-043	**Yes/Yes**	• **Existing deviation from Advisory Design Standard** for HDM Topic 504.8 • Curb return to curb return distance is less than 100 feet but greater than 50 feet	• **Maintains deviation from Advisory Design Standard** • Distance from ICD to driveway, measured at Coast Village Road centerline is 80 feet.
K	Driveway APN 009-230-043	**Yes/**No	• **Existing deviation from Mandatory Design Standard** for HDM Topic 504.8 • Curb return to curb return distance is less than 50 feet	• Deviation from Mandatory Design Standard is not needed with this alternative. • Driveway is removed with this concept
L	Driveway APN 009-230-043	**Yes/**No	• **Existing deviation from Mandatory Design Standard** for HDM Topic 504.8 • Curb return to curb return distance is less than 50 feet	• Deviation from Mandatory Design Standard is not needed with this alternative. • Driveway is removed with this concept
M	Driveway APN 009-230-043	**Likely/**No	• May be an **Existing deviation from Advisory Design Standard** for HDM Topic 504.8 • Curb return to curb return distance may be less than 100 feet but is greater than 50 feet	• Either maintains existing deviation or a new deviation from Advisory Design Standard may be needed with this alternative. • Driveway location may be 85 feet from ICD to driveway measured along the proposed Olive Mill Road centerline.

Focus Area	Description	HDM Design Deviation Alt.1/Alt.2	Alt. 1 Existing (Figure 4)	Alt. 2 Proposed Roundabout (Figure 5)
N	Distance to N. Jameson Road	**Yes/**No	• **Existing deviation from Mandatory Design Standard** for HDM Topic 504.3 (3) • Curb return to curb return distance is less than 400 feet	• Deviation from Mandatory Design Standard is not needed with this alternative • N. Jameson Road is realigned to become a part of the ramp terminal intersection
O	Driveway APN 009-293-007	**Yes/Yes**	• **Existing deviation from Advisory Design Standard** for HDM Topic 504.8 • Curb return to curb return distance is less than 100 feet but is greater than 50 feet	• **Maintains deviation from Advisory Design Standard** • Distance from ICD to driveway, measured at Coast Village Road centerline is approximately 90 feet.
P	Pedestrian access though easterly side of intersection	No/No	• Accessible pedestrian facilities are not provided along the easterly side of Olive Mill Road between the bridge and N. Jameson Road.	• No change in pedestrian route • Accessible pedestrian facilities are not proposed, as illustrated. • Accessible pedestrian facilities could be provided through intersection. If provided, cost of retaining structure identified in Focus Area C will likely increase. • Also see Focus Areas Q and R
Q	Pedestrian access on Olive Mill Road bridge	No/No	• Accessible pedestrian facilities exist on both sides of bridge	• No change
R	Pedestrian access at intersection of Virginia Road and Olive Mill Road	No/No	• Curb ramps and crosswalks are not present	• Refer to Focus Area P • Northbound pedestrians should be routed to the westerly side of Olive Mill Road if pedestrian facilities are not provided on the easterly side of the project intersection
S	Bus stop with turnout bay	No/No	• Consideration for all proposed improvements	• Bus stop with turnout bay is improved at existing location
T	Olive Mill Road, South Leg	No/No	• 12 foot lanes • 2 foot shoulders • 5 foot sidewalk along westerly side • No crosswalk at intersection	• No Change • No Change • No Change • No Change • Right turn lane with mountable channelization added at intersection • Splitter island
U	Coast Village Road, West Leg	No/No	• At intersection o Eastbound 10.5 foot left turn lane o Eastbound 14.5 foot through and right turn lane o Westbound 14.5 foot lane o Crosswalk o Variable width median with pedestrian refuge • 12 foot eastbound lane • 17 foot westbound lane • 6 foot bicycle lanes • On-street, angled parking • Sidewalks	• At intersection o Removed o 12 foot eastbound left-through-right lane o Westbound 12 foot lane o No change o No change • No change • No change • No change • No change • No change
V	Olive Mill Road, North Leg	No/No	• 12.5 foot lanes • 5 foot Class II bicycle lanes • Sidewalk along APN 009-230-043 only • No crosswalk at intersection	• 12 foot lanes • No change • Add 50 feet of sidewalk along easterly side, north of intersection • Add crosswalk • Add splitter island with mountable median at Focus Area M

Focus Area	Description	HDM Design Deviation Alt.1/Alt.2	Alt. 1 Existing (Figure 4)	Alt. 2 Proposed Roundabout (Figure 5)
W	N. Jameson Road, Northeast Leg	No/No	• 10.5 foot lanes • 5 foot Class II bicycle lanes • No sidewalks • No crosswalk at intersection	• 12 foot lanes • No Change • 110 foot sidewalk/path along northerly side, east of intersection • No Change • Splitter island
X	US 101 Northbound Off-Ramp, East Leg	Possible*/ No	• 12 foot lane • 8 foot right shoulder • 2 foot left shoulder* * Assumes concurrence for restrictive condition per Note (2), Table 302.1 in HDM	• No change • No change • 4 foot left shoulder
Y	US 101 Southbound On-Ramp, Southeast Leg	Possible*/ Possible*	• 12 foot lane • 8 foot right shoulder • 2 foot left shoulder* * Assumes concurrence for restrictive condition per Note (2), Table 302.1 in HDM	• No change • No change • No change*
Z	Design Vehicle (DV) Refer to Figures in Appendix A	No/No	• DV: CA Truck o Right turns: Limited - DV will encroach into oncoming traffic lane. o Left turns: Possible with 1 Limitation – Left turn from southbound Olive Mill Road to N. Jameson Road, trailer will track into westbound lane. o US 101 Northbound Off-Ramp to N. Jameson Road: Not Possible o Eastbound Olive Mill Road to N. Jameson Road: Limited – DV will track into opposing westbound N. Jameson lane	• DV: CA Truck o Right turns: Possible. DV from the westbound Coast Village to southbound Olive Mill would run over the splitter island. o Left turns: Possible. o US 101 Northbound Off-Ramp to N. Jameson Road: Possible if DV circulates through roundabout. o Eastbound Olive Mill Road to N. Jameson Road: Possible.

CRASH DATA AND OPERATING SPEEDS

Existing crash data was not reviewed as part of this effort. Vehicle speed data was not collected as part of this effort. If physical and operational constraints assessments presented herein do not inform the ICE process, these factors could be examined at a later time.

SPECIAL EVENTS

The Santa Barbara Triathlon course goes through this intersection from Olive Mill Road (south leg) to North Jameson Road.

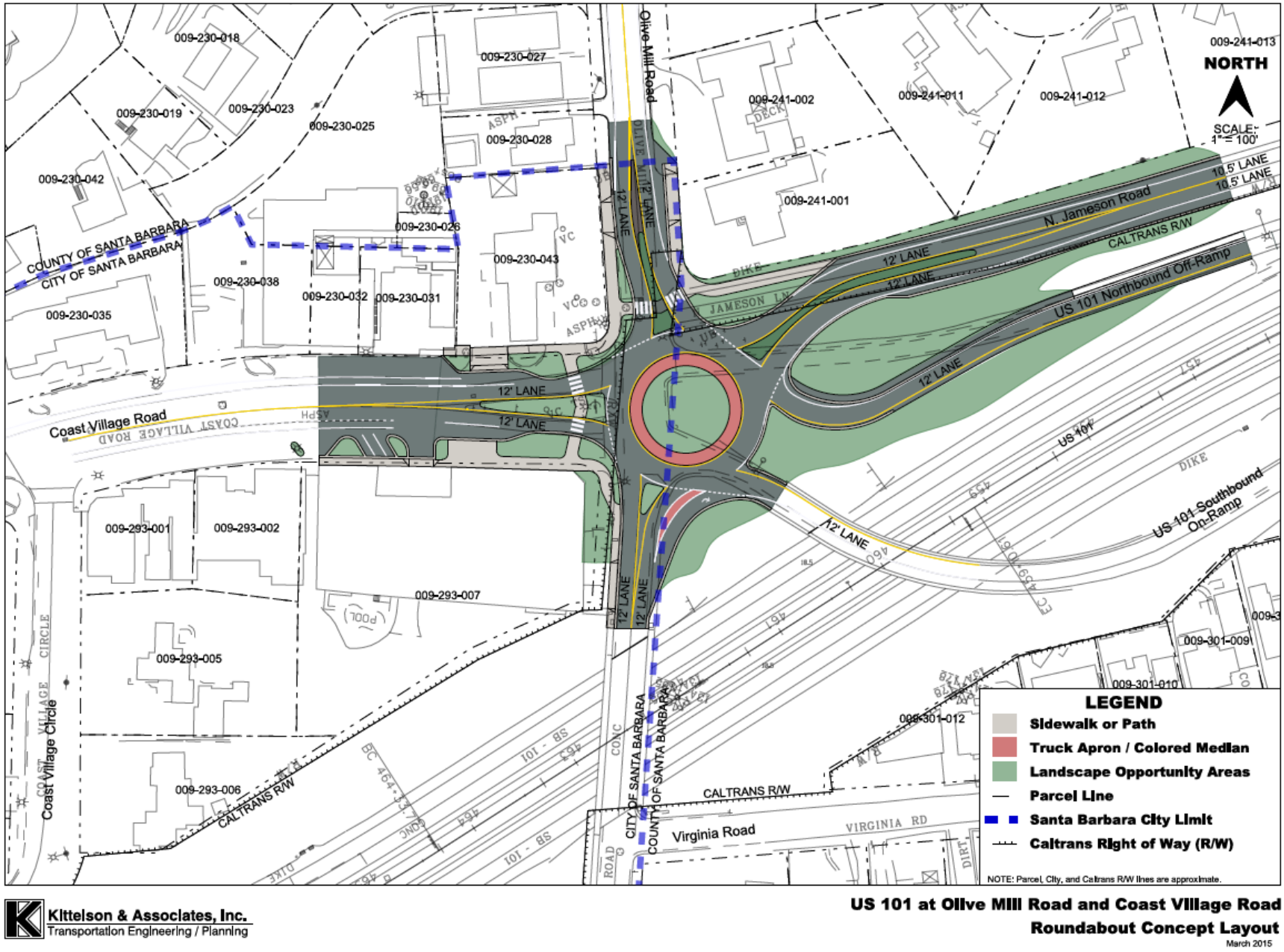

Figure 6: Proposed Roundabout Project

TRAFFIC CONTROL STRATEGIES, CONSIDERATIONS, AND PERFORMANCE ANALYSES

Traffic control alternatives evaluated as part of this ICE include:

- Retaining the existing intersection control and geometry. This alternative would retain all-way stop control (AWSC) at the intersection.
- Converting the intersection to signal control.
- Converting the intersection to a roundabout.

AWSC and signal alternatives with new geometric configurations are not identified in this study. Geometric modifications for AWSC and signal control are not considered feasible due to the intersection and ramp realignments that would be necessary to create an intersection with better entry/receiving lane alignment and a smaller intersection footprint that is more condusive to AWSC and signal control.

Using operations methodologies consistent with the *SC 101 HOV PA-ED* (dated December 2011) described in Appendix B, KAI evaluated the traffic control alternatives. The analysis results for each intersection are presented below. Supporting material, including more detailed operations results and the operations analysis worksheets can also be found in Appendix C.

ANALYSES RESULTS

All-Way Stop Control with Existing Geometry

Results for AWSC were extracted from the SC 101 HOV EIR Traffic study. In that study, a static analysis using SYNCHRO was applied which analyzed the Olive Mill interchange as three distinct and separate intersections (NB Off-Ramp/Olive Mill Road; North Jameson Lane/Olive Mill Road; and SB On-Ramp/Olive Mill Road). This analysis determined that the northbound Olive Mill Road approach of the interchange will fail (56s delay, LOS F) during the year 2040 AM peak, and the eastbound Coast Village Road approach will fail (60s delay, LOS F), during the 2040 PM peak. Detailed existing conditions results as documented in the SC 101 HOV traffic report is Appendix C.

The AWSC with existing geometry alternative assumes the existing lane configuration remains the same under year 2040 conditions. SC 101 HOV traffic study determined that under year 2040 conditions with Modified F alternative at the Cabrillo Boulevard interchange, the intersection is projected to operate at or over capacity

Further analysis is needed to quantify the queue lengths for the design year (2040), and to determine if spillback from the intersection will affect 101 mainline operations.

Signal Control with Existing Geometry

The signal control alternative with existing geometry alternative assumes the existing lane configuration remains the same under year 2040 conditions. Due to the existing intersection geometry, a traffic signal would likely require 5-way split phasing to serve the five approaches. This would result in long cycle lengths and long queues. Under year 2040 conditions, the intersection is projected to operate over capacity with significant queuing during the weekday a.m. and p.m. peak hours.

Roundabout Control

Under existing conditions, roundabout would operate well below capacity and at acceptable LOS. A roundabout configuration was evaluated to determine lane configurations needed to support the 2040 design year conditions. The proposed roundabout lane configuration is shown in Figure 7. The proposed roundabout is projected to operate with a volume to capacity (v/c) ratio of 0.77 or less on all approaches for year 2040 build conditions, with the US 101 Northbound Off-Ramp as the critical approach during the p.m. peak hour.

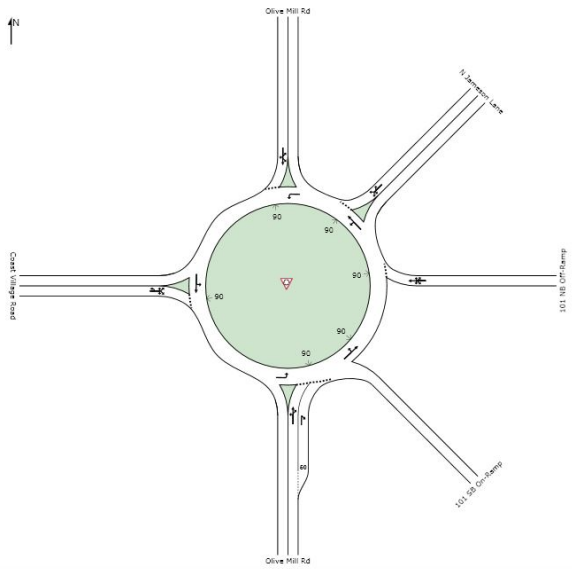

Figure 7. Proposed Roundabout Lane Configuration

Roundabout vs. AWSC and Signal Comparison

Table 5 and Table 6 provide a comparison of operational results for three alternatives under existing and 2040 conditions repsectively. Comparing these models to the existing and year 2040 intersection operations shows the roundabout to be the configuration with better predicted operational performance and no identified fatal flaws. Under AWSC and signalized conditions, the intersection is expected to experience higher delays than under the roundabout alternative. Further, any mitigated geometry alternatives to the AWSC and signal control options would exceed given right of way constraints, and likely require realignment of the ramps, and is considered fatally flawed.

Table 5: Existing (2014) Operations Analysis Results Comparison

Time Period	Existing All Way Stop Control [1,3]			Signal Control [2]			Roundabout Control [3]		
	Volume to Capacity Ratio [4]	Delay (seconds/ vehicle)	Queue Length (feet) [4]	Volume to Capacity Ratio	Delay (seconds/ vehicle)	Queue Length (feet)	Volume to Capacity Ratio	Delay (seconds/ vehicle)	Queue Length (feet)
AM	NA	**31.3 (D)*** 15.4 (C)** 14.7 (B)***	NA	NA	NA	NA	0.36	4.9 (A)	50 (E)
PM	NA	16.6 (C)* 11.4 (B)** 14.4 (B)***	NA	NA	NA	NA	0.87	15.3 (C)	400 (W)

1 Results for all way stop control extracted from SC101 HOV EIR Traffic Study. The EIR analyzed the intersection as three distinct intersections. These three results are shown above.
2 Signal control was not analyzed for existing traffic volume conditions.
3 Overall intersection operations shown for all-way stop control and roundabout alternatives.
4 Volume to capacity ratios and queue lengths are not reported by the HCM all-way control method. Further analysis needed to quantify future queue lengths under all-way stop control.
* NB off ramp/Olive Mill Road intesecection
** N. Jameson Ln/Olive Mill Road intersection
*** SB on ramp/Olive Mill Road intersection
NA = Not Available
Bold indicates unacceptable operations

Table 6. Year 2040 Operations Analysis Results Comparison

Time Period	Existing All Way Stop Control [1,2]			Signal Control [2]			Roundabout Control [2]		
	Volume to Capacity Ratio [3]	Delay (seconds/ vehicle)	Queue Length (feet) [3]	Volume to Capacity Ratio	Delay (seconds/ vehicle)	Queue Length (feet)	Volume to Capacity Ratio	Delay (seconds/ vehicle)	Queue Length (feet)
AM	NA	**37.9 (E)*** 20.1 (C)** 15.1 (C)***	NA	> 1.00	**124.4 (F)**	700 (S)	0.58	10.9 (B)	100 (E)
PM	NA	**47.9 (E)*** 16.7 (C)** **38.1 (E)***	NA	> 1.00	**209.4 (F)**	775 (S)	0.77	14.2 (B)	250 (W)

1 Results for all way stop control extracted from SC101 HOV EIR Traffic Study, Cabrillo Hot Springs Interchange Configuration Anaysis Technical Memorandums. The EIR analyzed the intersection as three distinct intersections. These three results are shown above.
2 Overall intersection operations shown for all-way stop control, signal and roundabout alternatives.
3 Volume to capacity ratios and queue lengths are not reported by the HCM all-way control method. Further analysis needed to quantify future queue lengths under all-way stop control.
Modified F configuration at the Cabrillo Boulevard interchange was assumed.
* NB off ramp/Olive Mill Road intesecection
** N. Jameson Ln/Olive Mill Road intersection
*** SB on ramp/Olive Mill Road intersection
NA = Not Available
Bold indicates unacceptable operations

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY

Kittelson & Associates, Inc. (KAI) conducted an Intersection Control Evaluation (ICE) to objectively evaluate and screen intersection control and access alternatives at the following intersection(s):

- US 101 Northbound Off-Ramp Terminal / US 101 Southbound On-Ramp Terminal / Olive Mill Road / Coast Village Road / North Jameson Road

The control options include:

- Traffic signal control
- Roundabouts
- All-way Stop control (existing)

The intersection evaluations considered year 2040 traffic operations, geometrics, constraints, and other design considerations.

INTERAGENCY COORDINATION

Review of the project concept geometry and operations were conducted with project stakeholders and KAI. Project stakeholders include City of Santa Barbara, County of Santa Barbara, Santa Barbara County Association of Governments (SBCAG), and Caltrans. The following reviews were conducted:

1. Meeting 1, July 9, 2014. Santa Barbara North County Public Works Conference Room, Orcutt, CA.
2. Meeting 2, November 12, 2014. City of Santa Barbara Public Works Main Conference Room, Santa Barbara, CA.
3. Draft ICE document review, January 2015.
4. Revised Draft ICE Document Review, May 2015

CONCLUSIONS

Key findings include:

- The Caltrans District 5 ICE coordinator has reviewed the initial roundabout concept and agrees the project is viable to move forward into further analysis. No fatal flaws have been identified in this phase.
- The roundabout alternative would provide superior AM/PM peak hour operations over either the stop-controlled or the signal-controlled alternatives.
- The roundabout alternative preserves the existing Olive Mill Road/US 101 overpass bridge, and the southbound US 101 on-ramp bridge
- The roundabout alternative would simplify the existing intersection and reduce the number of decision points.
- Traffic signal operations would likely require 5-way split phasing, due to the existing intersection geometry, that would result in long cycle lenths and delays. To reduce the number of phases, intersection and ramp realignment would be necessary.
- Traffic signal operations would not be acceptable for the existing nor 2040 design year. Stop-control operations would not be acceptable for the 2040 design year.
- Additional analysis is needed to determine queue lengths for the 2040 all-way stop design year scenario, and whether or not spillback would affect freeway mainline operations.
- The roundabout alternative would require minimal right-of-way acquisition; primarily to address design vehicle needs. The signal alternative is fatally flawed given the project constraints.

RECOMMENDATIONS

KAI recommends the roundabout alternative be advanced as a viable intersection control and access strategy for the Olive Mill Road/Coast Village Road/US-101 Interchange intersection.

The advancement of the above recommendation should be considered within the framework of the Caltrans Project Development and Procedures Manual (PDPM). Typical milestone studies include:

1. Project Initiation Document (PID) - Project Study Report – Project Development Support (PSR-PDS).
   Duration: 6-12 months.

2. Project Approval and Environmental Document (PA/ED) – Project Report (PR).
   Duration: 18-30 months.

3. Plans, Specifications, and Estimate (PS&E).
   Duration: 12-24 months.

The total duration based on typical milestone assumptions noted above is roughly 3 to 6 years before the start of construction, assuming continuous development of the project. Several factors that will contribute to the duration of the project approval process include environmental sensitivity and clearance, community support, right of way acquisition, number and complexity of deviations from mandatory and advisory design standards, and overall complexity of the project.

Opportunities may exist to streamline project approval based on this study and studies completed with the South Coast 101 HOV Project. Potential opportunities within the PDPM include preparation of a Combined Project Study Report – Project Report (PSR-PR) or a Permit Engineering Evaluation Report (PEER). These processes may not be suited for this project, depending on the alternative, based on complexity (roundabouts, structures, etc.), right of way, cost, funding, environmental impact, and location within the coastal zone. The potential to streamline this project should be discussed with Caltrans and other stakeholders to determine the feasibility of using the PSR-PR or PEER project approvals within the Caltrans approval framework.

Consideration should be given to expedite the roundabout alternative for opening prior to US 101 HOV project construction within the vicinity of the Olive Mill Road Interchange. Recommended roundabout intersection control improvements will increase intersection capacity and mitigate potential traffic diversions caused by US 101 mainline construction. The effectiveness of this mitigation is dependent on the work zone traffic control strategies for the corridor and cannot be determined at this time.

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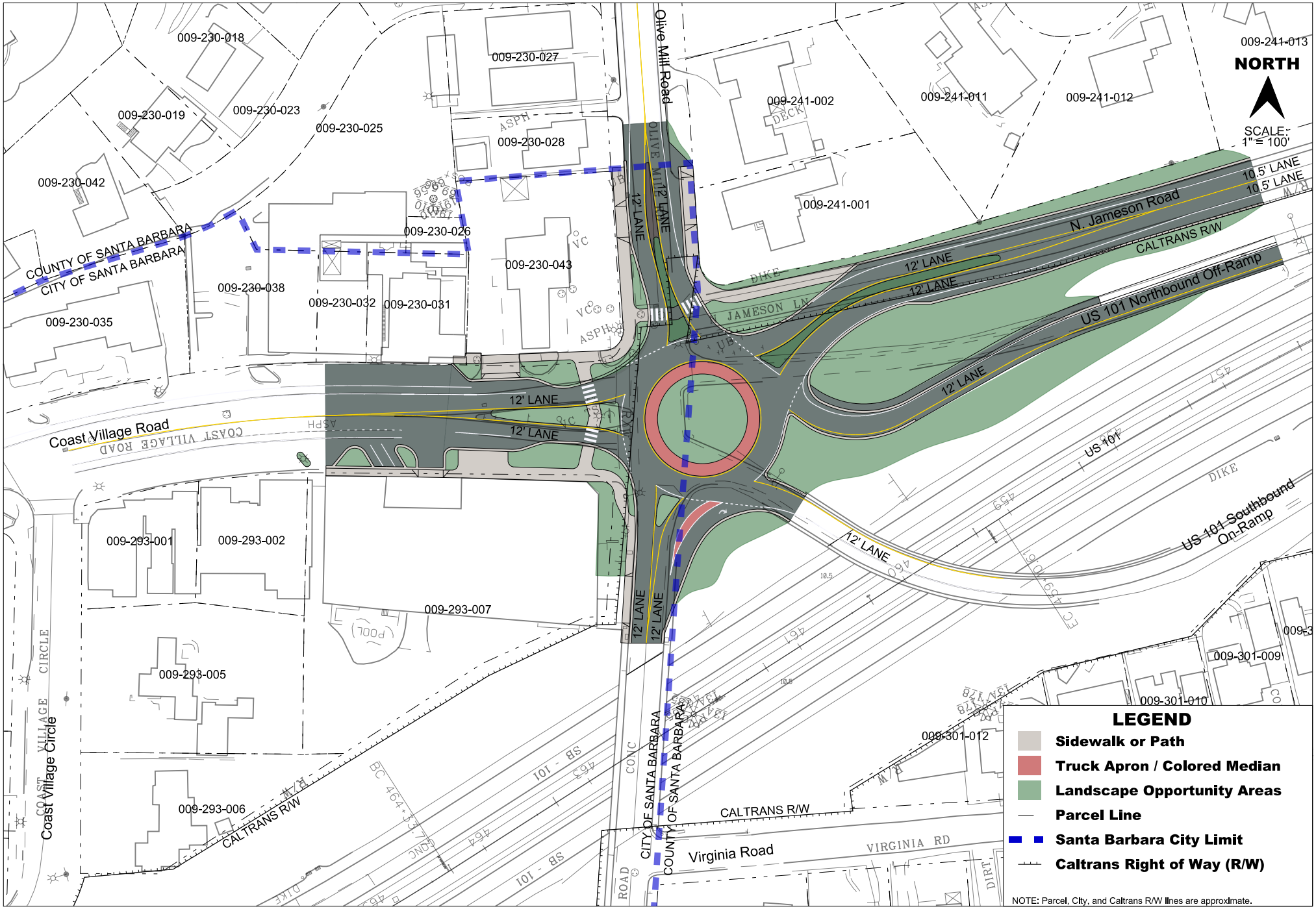
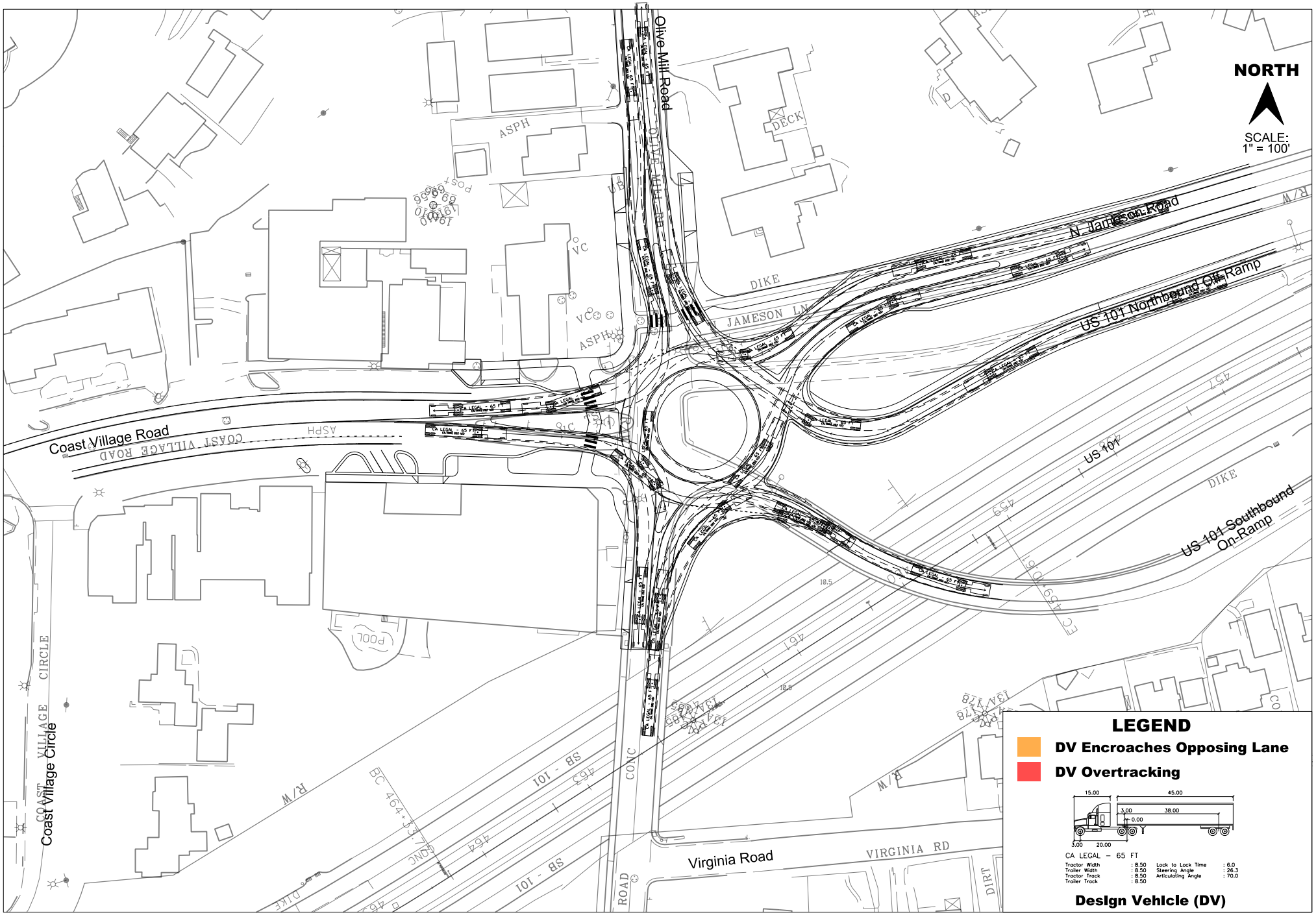
APPENDICES

Appendix A
Conceptual Roundabout Layouts



Kittelson & Associates, Inc.
Transportation Engineering / Planning

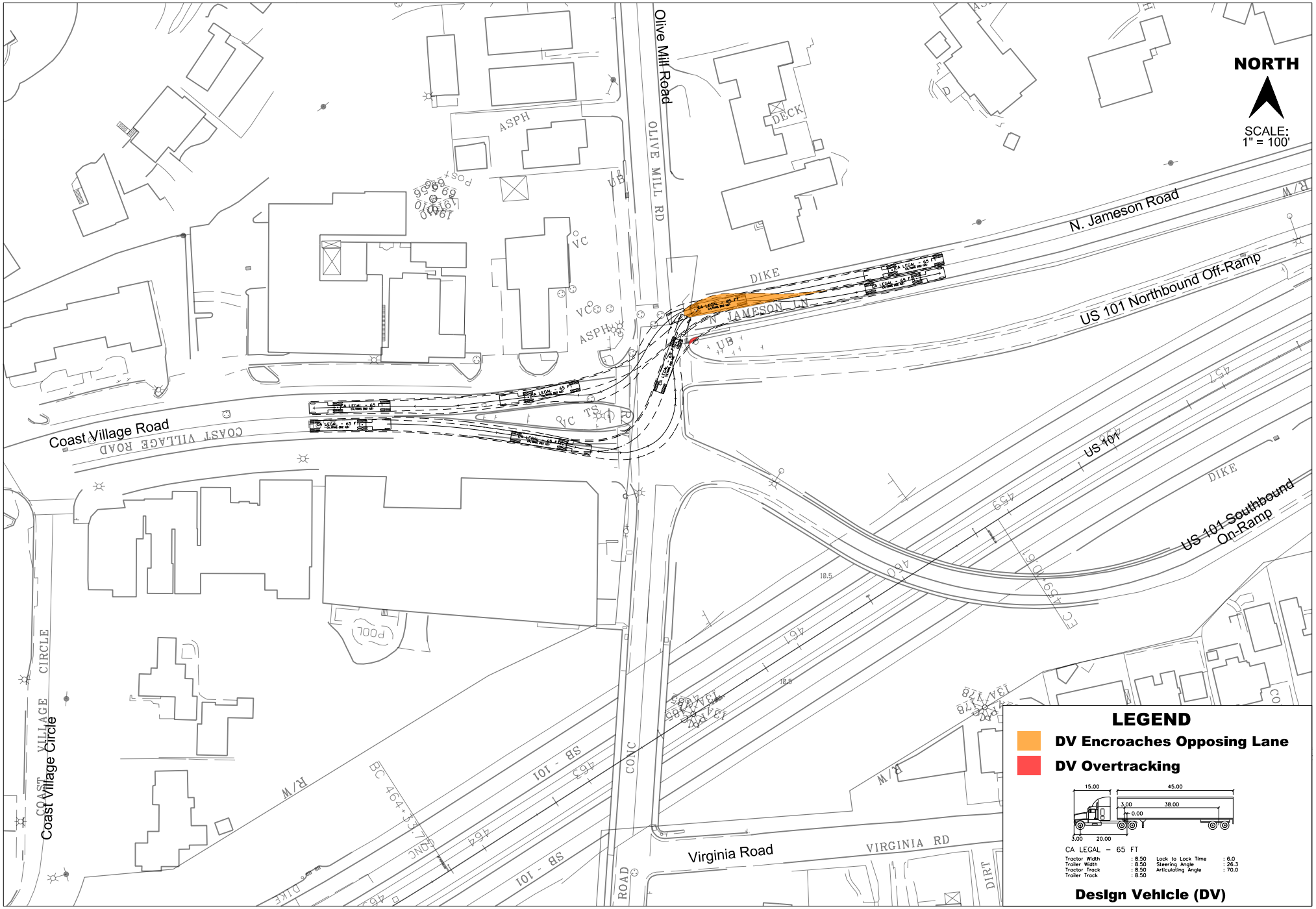
US 101 at Olive Mill Road and Coast Village Road
Roundabout Concept Layout
March 2015



Kittelson & Associates, Inc.
Transportation Engineering / Planning

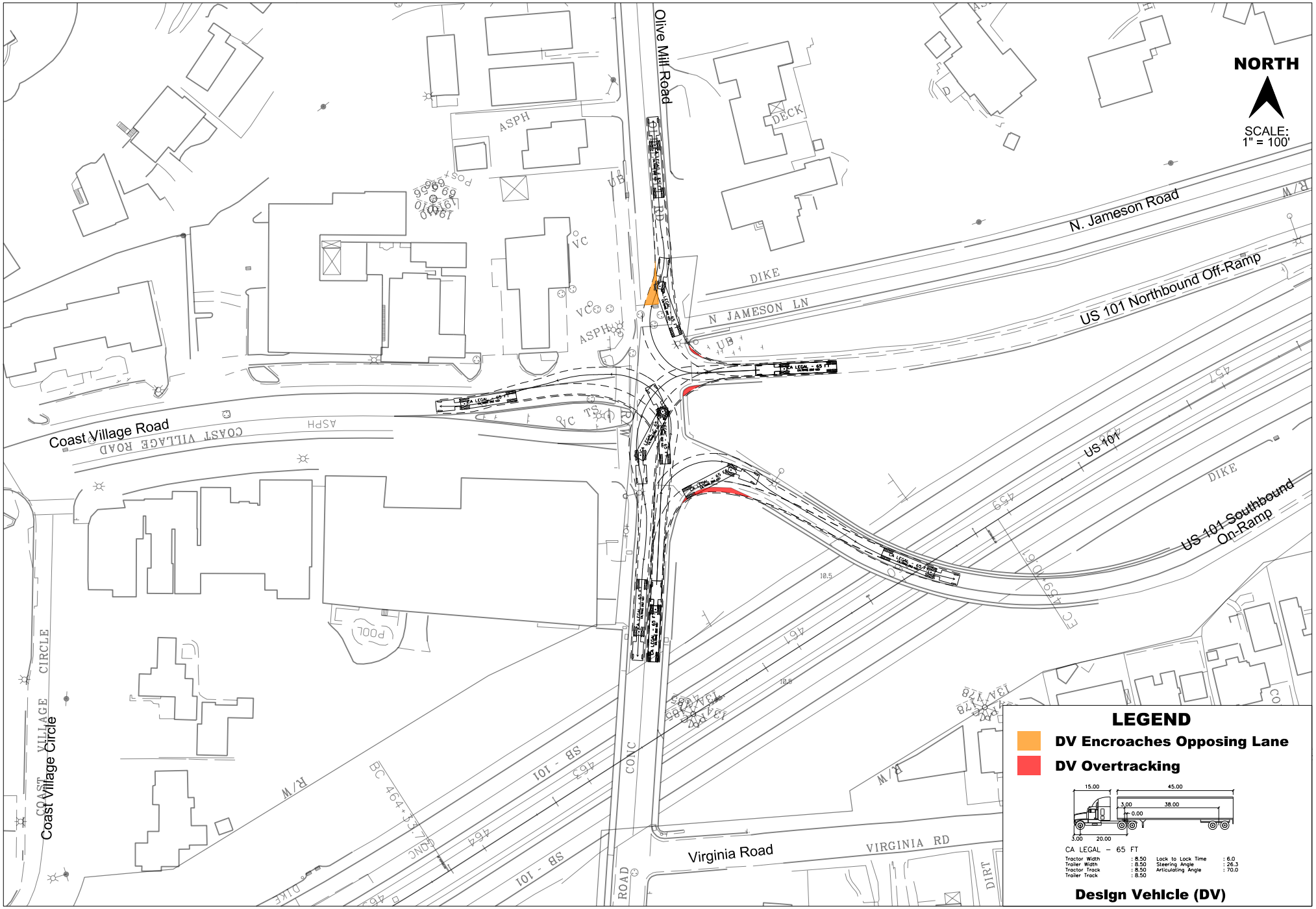
US 101 at Olive Mill Road and Coast Village Road
Design Vehicle Path - Roundabout Concept

January 2015



Kittelson & Associates, Inc.
Transportation Engineering / Planning

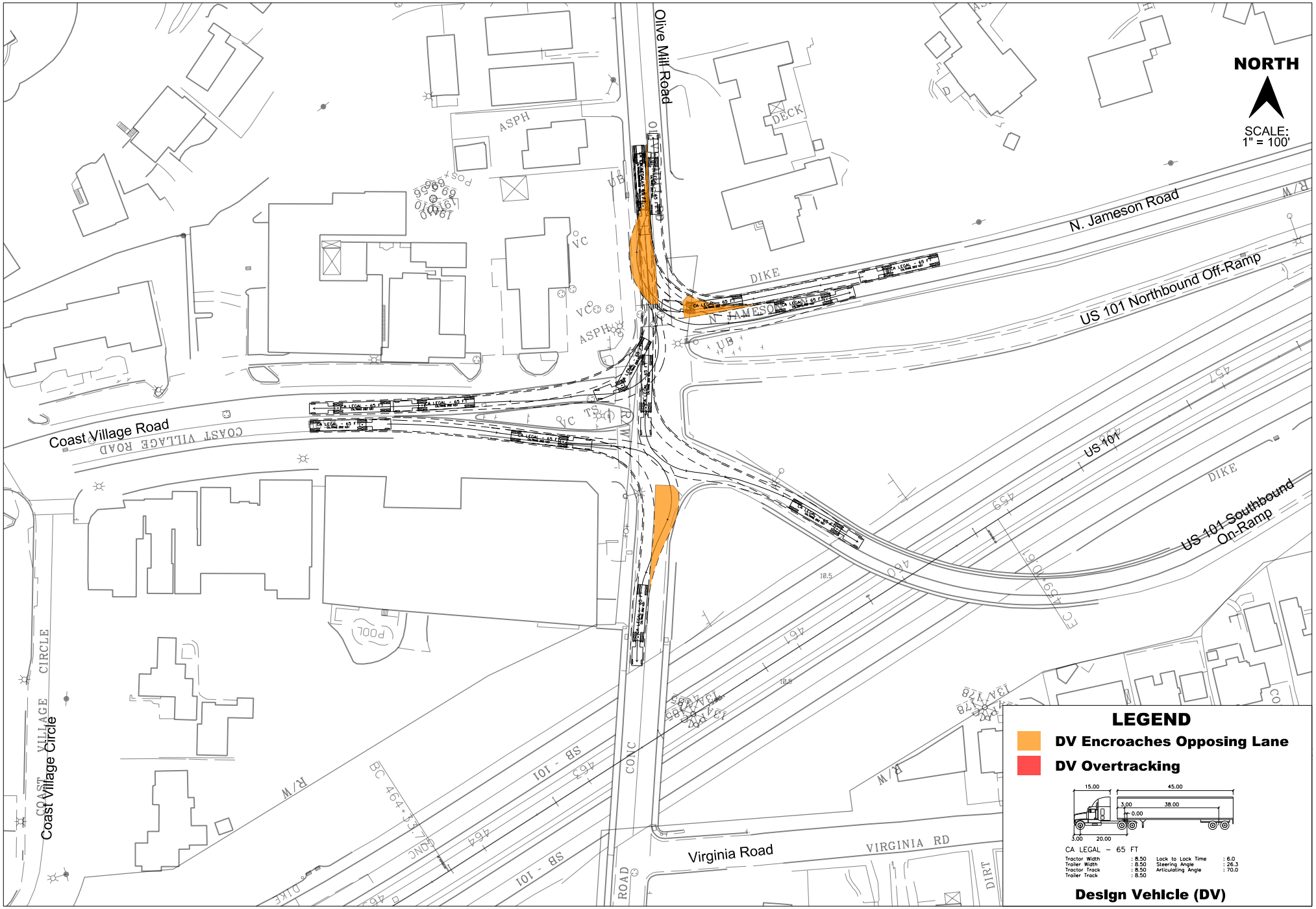
US 101 at Olive Mill Road and Coast Village Road
Design Vehicle Path - Exsiting East - West
January 2015



Kittelson & Associates, Inc.
Transportation Engineering / Planning

US 101 at Olive Mill Road and Coast Village Road
Design Vehicle Path - Exsiting NB - WB

January 2015



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US 101 at Olive Mill Road and Coast Village Road
Design Vehicle Path - Exsiting NB - WB
January 2015

Appendix B
Level-of-Service Concept

APPENDIX B LEVEL-OF-SERVICE CONCEPT

Level of service (LOS) is a concept developed to quantify the degree of comfort (including such elements as travel time, number of stops, total amount of stopped delay, and impediments caused by other vehicles) afforded to drivers as they travel through an intersection or roadway segment. Six grades are used to denote the various level of service from "A" to "F".

SIGNALIZED INTERSECTIONS

The six level-of-service grades are described qualitatively for signalized intersections in Table B1. Additionally, Table B2 identifies the relationship between level of service and average control delay per vehicle. Control delay is defined to include initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. Using this definition, Level of Service "D" is generally considered to represent the minimum acceptable design standard.

Table B-1: Level-of-Service Definitions (Signalized Intersections)

Level of Service	Average Delay per Vehicle
A	Very low average control delay, less than 10 seconds per vehicle. This occurs when progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.
B	Average control delay is greater than 10 seconds per vehicle and less than or equal to 20 seconds per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for a level of service A, causing higher levels of average delay.
C	Average control delay is greater than 20 seconds per vehicle and less than or equal to 35 seconds per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.
D	Average control delay is greater than 35 seconds per vehicle and less than or equal to 55 seconds per vehicle. The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle length, or high volume/capacity ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
E	Average control delay is greater than 55 seconds per vehicle and less than or equal to 80 seconds per vehicle. This is usually considered to be the limit of acceptable delay. These high delay values generally (but not always) indicate poor progression, long cycle lengths, and high volume/capacity ratios. Individual cycle failures are frequent occurrences.
F	Average control delay is in excess of 80 seconds per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with oversaturation. It may also occur at high volume/capacity ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also contribute to such high delay values.

1 Most of the material in this appendix is adapted from the Transportation Research Board, Highway Capacity Manual, (2000).

Table B-2: Level-of-Service Criteria for Signalized Intersections

Level of Service	Average Control Delay per Vehicle (Seconds)
A	<10.0
B	>10 and ≤20
C	>20 and ≤35
D	>35 and ≤55
E	>55 and ≤80
F	>80

UNSIGNALIZED INTERSECTIONS

Unsignalized intersections include two-way stop-controlled (TWSC) and all-way stop-controlled (AWSC) intersections. The 2000 Highway Capacity Manual (HCM) provides models for estimating control delay at both TWSC and AWSC intersections. A qualitative description of the various service levels associated with an unsignalized intersection is presented in Table B3. A quantitative definition of level of service for unsignalized intersections is presented in Table B4. Using this definition, Level of Service "E" is generally considered to represent the minimum acceptable design standard.

Table B3: Level-of-Service Criteria for Unsignalized Intersections

Level of Service	Average Delay per Vehicle to Minor Street
A	• Nearly all drivers find freedom of operation. • Very seldom is there more than one vehicle in queue.
B	• Some drivers begin to consider the delay an inconvenience. • Occasionally there is more than one vehicle in queue.
C	• Many times there is more than one vehicle in queue. • Most drivers feel restricted, but not objectionably so.
D	• Often there is more than one vehicle in queue. • Drivers feel quite restricted.
E	• Represents a condition in which the demand is near or equal to the probable maximum number of vehicles that can be accommodated by the movement. • There is almost always more than one vehicle in queue. • Drivers find the delays approaching intolerable levels.
F	• Forced flow. • Represents an intersection failure condition that is caused by geometric and/or operational constraints external to the intersection.

Table B-4: Level-of-Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay per Vehicle (Seconds)
A	<10.0
B	>10.0 and ≤ 15.0
C	>15.0 and ≤ 25.0
D	>25.0 and ≤ 35.0
E	>35.0 and ≤ 50.0
F	>50.0

The level-of-service criteria for unsignalized intersections are somewhat different than the criteria used for signalized intersections. The primary reason for this difference is that drivers expect different levels of performance from different kinds of transportation facilities. The expectation is that a signalized intersection is designed to carry higher traffic volumes than an unsignalized intersection. Additionally, there are a number of driver behavior considerations that combine to make delays at signalized intersections less galling than at unsignalized intersections. For example, drivers at signalized intersections are able to relax during the red interval, while drivers on the minor street approaches to TWSC intersections must remain attentive to the task of identifying acceptable gaps and vehicle conflicts. Also, there is often much more variability in the amount of delay experienced by individual drivers at unsignalized intersections than signalized intersections. For these reasons, it is considered that the control delay threshold for any given level of service is less for an unsignalized intersection than for a signalized intersection. While overall intersection level of service is calculated for AWSC intersections, level of service is only calculated for the minor approaches and the major street left turn movements at TWSC intersections. No delay is assumed to the major street through movements. For TWSC intersections, the overall intersection level of service remains undefined: level of service is only calculated for each minor street lane.

In the performance evaluation of TWSC intersections, other measures of effectiveness (MOEs) in addition to delay, such as v/c ratios for individual movements, average queue lengths, and 95th-percentile queue lengths should be considered because of their impacts on the operational and safety performance of the intersection. By focusing on a single MOE for the worst movement only, such as delay for the minor-street left turn, users may make inappropriate traffic control decisions. The potential for making such inappropriate decisions is likely to be particularly pronounced when the HCM level-of-service thresholds are adopted as legal standards, as is the case in many public agencies.

ROUNDABOUT INTERSECTIONS

The levels of service (LOS) criteria for automobiles in roundabouts are given in Table B-5. As the table notes, LOS F is assigned if the volume-to-capacity ratio of a lane exceeds 1.0 regardless of the control delay. For assessment of LOS at the approach and intersection levels, LOS is based solely on control delay. The thresholds in Table B-5 are based on the considered judgment of the Transportation Research Board Committee on Highway Capacity and Quality of Service.

Table B-5: Level-of-Service Criteria for Roundabout Intersections

Control Delay (s/veh)	Level of Service by Volume-to-Capacity Ratio*	
	v/c ≤ 1.0	v/c > 1.0
0-10	A	F
>10-15	B	F
>15-25	C	F
>25-35	D	F
>35-50	E	F
>50	F	F

*For approaches and intersection-wide assessment, LOS is defined solely by control delay

Roundabouts share the same basic control delay formulation with two-way and all-way STOP-controlled intersections, adjusting for the effect of YIELD control. However, at the time of publication of 2010 edition of the Highway Capacity Manual (HCM), no research was available on traveler perception of quality of service at roundabouts. In the absence of such research, the service measure and thresholds have been made consistent with those for other unsignalized intersections, primarily on the basis of this similar control delay formulation.

Appendix C
Operations Methodology and Analysis Results

INTRODUCTION

Kittelson & Associates, Inc. (KAI) has completed an evaluation of the performance of existing and proposed intersection control alternatives at the intersection of US 101 and Olive Mill Road. The purpose of this analysis is to summarize the design year operations at this interchange assuming the following intersection control options: 1) all-way stop control; 2) signal control; and, 3) roundabout. This analysis was conducted in support of, and in accordance with, the Caltrans Traffic Operations Policy Directive 13-02 (TOPD 13-02) for Intersection Control Evaluations (ICE) effective August 30, 2013. The purpose of TOPD 13-02 is to apply a performance based assessment to test the full range of intersection control options to identify the most cost-effective solution. Analysis included herein is intended for the Step I evaluation process.The analysis tools and methodologies described herein were based on and are consistent with those documented in the *SC101 HOV PA-ED Traffic Study (Kittelson & Associates (formally Dowling Associates) December 2011).*

The analysis for the *SC101 HOV PA-ED Traffic Study* reflected a 2008 baseline and a 2040 design year. Hence, this intersection control analysis of the Olive Mill interchange at US 101 was also based on a 2040 design year. The existing and design year build operational results developed in the SC101 HOV PA-ED Traffic Study were used for the existing all-way stop configuration.

RESULTS SUMMARY

Based on the 2040 design year operations, this intersection control evaluation of the Olive Mill interchange with US 101 in the City of Santa Barbara has determined that a roundabout control type would provide superior AM/PM peak hour operations over either an all-way stop controlled or signalized alternative.

A modern roundabout achieves the best level of service (i.e., delay) for the entire intersection, including the US-101 NB off-ramp approach. If the existing stop control is maintained through year 2040, the highest delay during the AM peak will be 56.3 seconds (level of service F) and the highest delay during the PM peak will be 60.4 seconds (level of service F). A signalized intersection would result in a 124.4-second average delay (level of service F) in the AM peak period and a 209.4-second average delay (level of service F) in the PM peak period. A roundabout would result in a 10.9-second average delay (level of service A) in the AM peak period and a 14.2-second delay in the PM peak period.

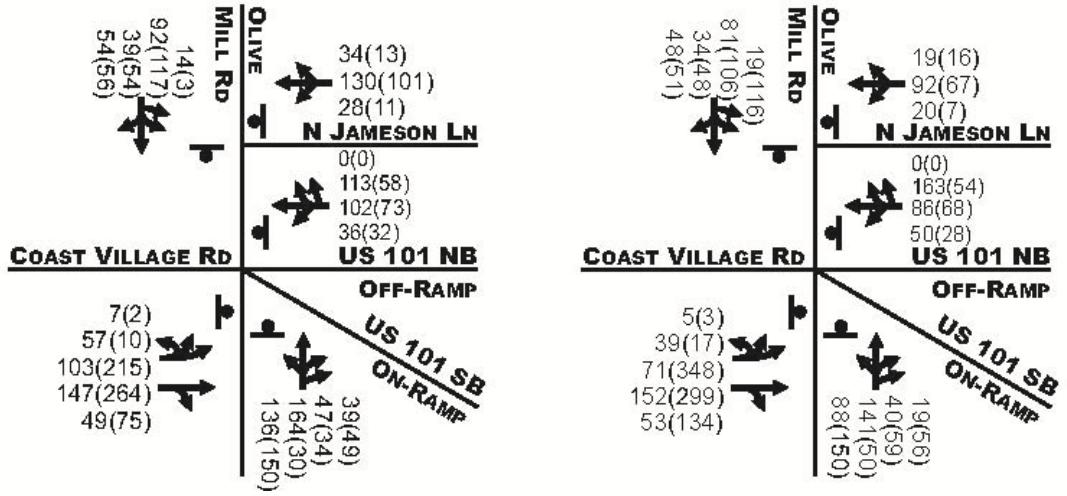
In addition to superior delay based performance, a roundabout will achieve acceptable queues for the intersection. Further analysis is needed to determine year 2040 queue lengths under AWSC, and to determine if spillback from queues will affect 101 mainline operations. For the signalized alternative, the 95^{th} percentile queues determined using SYNCHRO for the off-ramp will be 221 feet in the AM peak period and 286 feet in the PM peak period by year 2040. The proposed roundabout will result in a 99-foot queue in the AM peak period and a 59-foot queue in the PM peak period under 2040 conditions (using SIDRA) for the NB 101 off-ramp.

BASELINE CONDITION VOLUMES

Traffic counts performed as part of the *SC101 HOV PA-ED Traffic Study* were examined. These turning movement counts were collected in April 2008. Given that six years had transpired since this count was taken, a more recent 2014 turning movement count was performed. Similar to the 2008 traffic count, the 2014 count was performed during the 7:00 AM – 9:00 AM and 4:00 PM – 6:00 PM peak periods. The true AM/PM peak hour volumes were identified from this four hour count.

A graphical comparison between the 2008 and 2014 AM/PM peak hour turning movement counts is provided below in Figure C-1.

Figure C-1: 2008 Traffic Counts (left) and 2014 Traffic Counts (right)



LEGEND: XX (YY) – AM (PM) Peak Hour

From 2008 to 2014, an overall reduction in traffic volumes of 2% was experienced at this interchange in the AM peak hour and 0.7% increase was experienced in the PM peak hour.

Although overall traffic demand at this interchange has not significantly changed, inspection of specific movements show several significant differences. Of note, in the AM peak period, Olive Mill Road coming from Coast Village Road experienced 18 and 32 reduction in vehicle counts traveling left onto Olive Mill Road and left onto North Jameson Lane respectively. Additionally, in the AM peak period, vehicles traveling northbound right from Olive Mill onto the US-101 SB on-ramp experienced a 20 vehicle count reduction from 2008 volumes. Conversely, in the PM peak period, there were an additional 25 vehicles traveling northbound right from Olive Mill onto North Jameson Lane. Also in the PM peak period, there were approximately 100 additional vehicles traveling southbound on Olive Mill Road onto Coast Village Road.

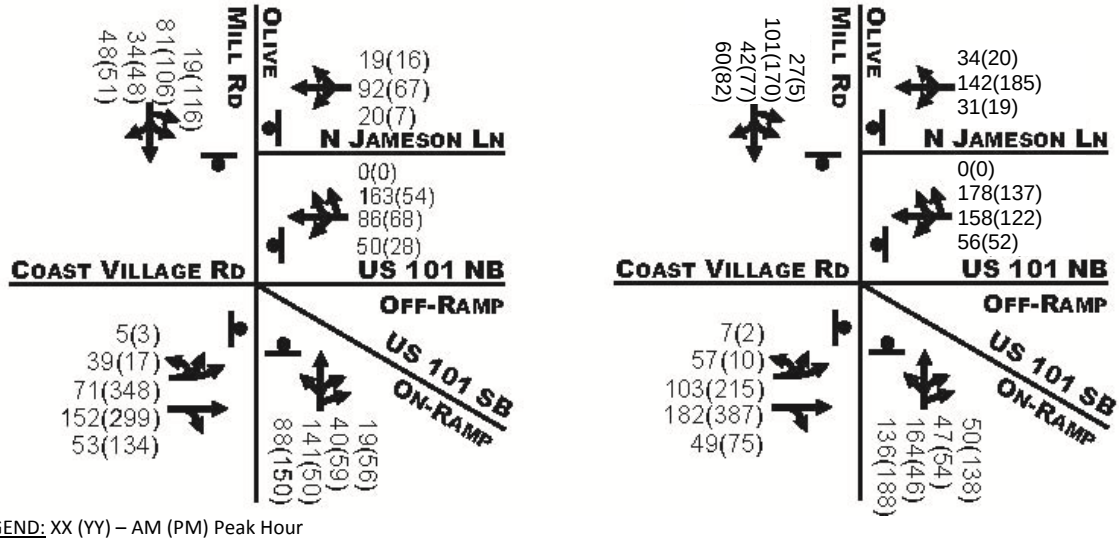
In summary, 2014 counts were generally similar to 2008 ocunts. Therefore, 2008 anlaysis results presented in the SC 101 HOV PA-ED traffic study can approximate existing operating conditions at Olive Mill interchange.

DESIGN YEAR CONDITION VOLUMES

The basis for the design year volume set were the traffic projections developed for the *SC101 HOV PA-ED Traffic Study (December 2011)* which were generated using the Santa Barbara County Association of Governments (SBCAG) travel demand model. The AM/PM peak hour models were used to forecast 2040 year volumes appropriate for peak hour operational analysis as seen in Figure C-2.

Given that the Olive Mill Interchange is be affected by operations at near-by adjacent interchanges, planned modifications to the Cabrillo-Hot Springs interchange are reflected in this analysis. Kittelson & Associates, Inc. (as Dowling and Associates, Inc.) prepared the Cabrillo Boulevard I/C Modified Configurations Analysis (July 19, 2011) included as part of the Cabrillo/Hot Springs Interchange Configuration Analysis Technical Memorandums (December 11, 2011). Based on these technical studies, the "Modified F" configuration has been advanced as the preferred configuration for the Cabrillo-Hot Springs interchange. This configuration is assumed as part of this US 101/Olive Mill interchange analysis.

Figure C-2: 2014 Traffic Counts (left) and 2040 Forecast Traffic Counts (right)



LEGEND: XX (YY) – AM (PM) Peak Hour

As seen in Figure 9 above, from 2014 to 2040, an annual average growth rate of 1% and 0.65% is projected in the AM and PM peak hours respectively.

TRAFFIC OPERATIONS ANALYSIS

This subsection summarizes operational analysis methodology and results at the study location.

Analysis Methodology

Site visits were performed and aerial imagery was also used to document the physical, geometric and operational characteristics of each of the study area intersections and roadway approach segments. This included observed queue lengths and back of queue distances at each approach.

The adjusted 2040 turn movement forecasts were input into the operational software SYNCHRO 8.0 and Sidra for signal and roundabout controls respectively. Further volume balancing adjustments were performed to ensure that conservation of traffic flow was maintained at adjacent intersections. For signalized intersection analysis, SYNCHRO analysis was performed to yield the intersection level of service and queue lengths results. Sidra analysis was performed for the roundabout option.

Stop Controlled and Signalized Intersections

Roadway operations are typically governed by, and most constrained at, intersections. The measure of effectiveness commonly used to determine the quality or level of service (LOS) experienced by motorists at intersections is average control delay. The methodology used to analyze intersection LOS is outlined in the Appendix B. A summary of LOS criteria for signalized and unsignalized intersections can also be found in Appendix B. The SYNCHRO 8.0 software package was used to perform LOS analysis for the signal control. Intersection geometrics were based on aerial imagery and field observations. Bicycle and pedestrian counts were not used.

Roundabouts

Roundabout operations were evaluated using SIDRA Intersection 6 software using the 2010 Highway Capacity Manual (HCM) capacity model. The 2010 HCM capacity model was calibrated to better reflect gap acceptance behavior of California drivers for critical headway and follow-up headway. The calibration factors, or HCM Parameters A and B, used in this analysis are recommended in the Caltrans document "Roundabout Geometric Design Guidance" dated June 2007. The A and B parameters were derived based on field observations to more accurately reflect operational performance of California roundabouts. The differences among the default parameters used in the 2010 HCM methodology and identified for California roundabouts are shown below in Table C-1.

Table C-1: Roundabout Model Parameters for Entry Capacity

	Default 2010 HCM Parameters		Modified HCM Parameters based on Caltrans guidance	
	A	B	A	B
Single-lane circulating stream (n_c=1)				
Single-lane entry (n_e=1, n_c=1)	1130	0.00100	1440	0.00100
Multi-lane entry (n_e> 1, n_c=1): apply to all lanes	1130	0.00100	1440	0.0010
Multi-lane circulating stream (n_c>1)				
Single-lane entry (n_e=1, n_c=1)	1130	0.00070		
Multi-lane entry (n_e> 1, n_c=1)				
Dominate lane (right lane)	1130	0.00070	1640	.00090
Subdominate lane (left lane)	1130	0.00075	1640	.00100

LOS criteria specified in the 2010 HCM is provided in Appendix B.

For roundabouts, v/c ratios in the range of 0.85 to 0.90 represent an approximate threshold for satisfactory operations. Individual lanes with v/c ratios near this threshold should be evaluated to determine the sensitivity of the lane to varying traffic conditions and/or driver behavior.

BASELINE CONDITION ANALYSIS RESULTS

Table C-2 provides the results for existing operations at the study intersections. These results are extracted from the SC 101 HOV PA-ED traffic report (Dowling Associates, December 2011). Northbound Olive Mill Road operated at LOS exceeding the threshold during AM peak hour.

Table C-2: Existing (2014) Operations Results – All-way Stop Control

Approach	Movement*	Delay (LOS) [1]	
		AM	**PM**
Northbound – Olive Mill Road	L/T/R	**48 (E)**	21 (C)
Westbound – US-101 NB-Off Ramp	L/T/R	16.4 (C)	11.3 (B)
Westbound – Jameson Lane	L/T/R	12.3 (B)	10.2 (B)
Southbound – Olive Mill Road	L/T/R	15.9 (C)	12.9 (B)
Eastbound – Coast Village Road	L	13.1 (B)	13.6 (B)
	T/R	12.4 (B)	16.3 (C)

*Movement Key: L=Left turn, T=Through, R=Right turn.
1. Delays reported in seconds per vehicles
Bold and shaded indicates inadequate condition

Table C-3 provides the results for roundabout operations at the study intersections. All the turning movements operate within LOS threshold during both peak hours, with exception to the westbound Coast Village Road in PM peak hour.

Table C-3: Existing Operations – Roundabout Control

Approach	Movement	Level of Service (LOS)		Volume to Capacity Ratio[1]		Delay (seconds/vehicle)[1]		95th % Queue (feet)[1]		Storage (feet)[2]	Adequate Storage (Yes/No)
		AM	PM	AM	PM	AM	PM	AM	PM		
Northbound – Olive Mill Road	*L/T/R*	A	C	0.32	0.55	7.3	17.7	39.6	75.6	275	Yes
	R	A	A	0.02	0.12	4.1	8.4	2.3	11.1	85	Yes
Westbound – US-101 NB-Off Ramp	L/T/R	A	A	0.36	0.26	7.9	9.1	46.4	28	700	Yes
Westbound – North Jameson Lane	L/T/R	A	A	0.19	0.10	6.7	4.7	20.3	11.2	670	Yes
Southbound – Olive Mill Road	L/T/R	A	B	0.21	0.36	5.9	7.5	24.4	47.7	735	Yes
Eastbound – Coast Village Road	L/T/R	A	**D**	0.31	0.87	6.2	26.3	42.4	386.6	425	Yes

1. Based on calculation in SIDRA
2. Available storage to the nearest local street intersection or distance to ramp gore point
Italics represent mitigated lane configuration changes
Bold and shaded indicates inadequate condition

DESIGN YEAR ANALYSIS RESULTS

Level of Service (LOS) and 95th percentile queue (feet) results for each control type are provided in this section. As shown, the proposed roundabout is expected to perform at an acceptable LOS through the 2040 forecast year.

For the stop control, the 2040 no-build operational results are reported in the SC 101 HOV PA-ED Traffic Study and Cabrillo Boulevard Interchange Configuration Study, as mentioned earlier. Table C-4 provides results for the no-build conditions (i.e. existing control) with Modified F configuration at Cabrillo Boulevard interchange.

Table C-4: Year 2040 US 101 at Olive Mill Road All Way Stop Control with Existing Lane Configuration

Approach	Movement*	Delay (LOS) [1]	
		AM	PM
Northbound – Olive Mill Road	L/T/R	**56.3 (F)**	**57.7 (F)**
Westbound – US-101 NB-Off Ramp	L/T/R	**28 (D)**	21.5 (C)
Westbound – Jameson Lane	L/T/R	12.8 (B)	13.7 (B)
Southbound – Olive Mill Road	L/T/R	23.1 (C)	**53.8 (F)**
Eastbound – Coast Village Road	L	12.4 (B)	17.6 (C)
	T/R	12.9 (B)	**60.4 (F)**

*Movement Key: L=Left turn, T=Through, R=Right turn.
1. Delays reported in seconds per vehicles
Bold and shaded indicates inadequate condition

Table C-5 and Table C-6 provide the results for traffic operations under year 2040 for signal control, and roundabout control, respectively.

Table C-5: Year 2040 US 101 at Olive Mill Road Signalized Intersection Control with Existing Lane Configuration

Approach	Movement	Level of Service (LOS)		Volume to Capacity Ratio[1]		Delay (seconds/vehicle)[1]		Max Queue (feet)[1]		Storage (feet)[2]	Adequate Storage (Yes/No)
		AM	PM	AM	PM	AM	PM	AM	PM		
Northbound – Olive Mill Road	L/T/R	**F**	**F**	1.06	1.22	120.1	179.5	**681**	**775**	275	**No**
Westbound – US-101 NB-Off Ramp	L/T/R	**F**	**F**	0.79	1.39	108.9	320.9	221	286	750	Yes
Westbound – North Jameson Lane	L/T/R	**F**	**F**	1.08	1.35	125.5	246.0	680	633	710	Yes
Southbound – Olive Mill Road	L/T/R	**F**	**F**	1.06	1.16	141.3	164.2	448	626	720	Yes
Eastbound – Coast Village Road	Left	**F**	**E**	0.88	0.70	95.9	62.5	321	330	410	Yes
	T/R	**F**	**F**	1.08	1.42	147.6	263.2	**451**	**889**	150	**No**

1. Based on calculation in SYNCHRO
2. Available storage to the nearest local street intersection or distance to ramp gore point
Bold and shaded indicates inadequate condition (LOS D or worse / queue exceeds storage)

Table C-6: Year 2040 US 101 at Olive Mill Road Proposed Roundabout Alternative

Approach	Movement	Level of Service (LOS)		Volume to Capacity Ratio[1]		Delay (seconds/vehicle)[1]		95th % Queue (feet)[1]		Storage (feet)[2]	Adequate Storage (Yes/No)
		AM	PM	AM	PM	AM	PM	AM	PM		
Northbound – Olive Mill Road	*L/T*	B	C	0.450	0.56	11.9	16.9	75.5	81.1	275	Yes
	R	A	A	0.07	0.26	5.2	9.9	6.9	27.3	85	Yes
Westbound – US-101 NB-Off Ramp	L/T/R	B	A	0.58	0.43	14.3	9.9	99.3	58.8	700	Yes
Westbound – North Jameson Lane	L/T/R	B	A	0.38	0.32	11.5	8.3	45.2	36.9	670	Yes
Southbound – Olive Mill Road	L/T/R	A	B	0.33	0.50	8.5	12.2	38.1	74.2	735	Yes
Coast Village Road	*L/T/R*	A	C	0.43	0.77	8.4	18.9	62.2	239.1	425	Yes

1. Based on calculation in SIDRA
2. Available storage to the nearest local street intersection or distance to ramp gore point
Italics and shaded represent mitigated lane configuration changes

ATTACHMENTS

1. Traffic Data
2. Synchro Reports
3. Sidra Reports

ATTACHMENT 1: TRAFFIC DATA

Detailed 2014 Traffic Counts

2014																					
AM	NB Olive Mill Rd				WB (NB US 101 Ramp)				WB N Jameson Ln				SB Olive Mill Rd				EB Coast Village Rd				
2014	L	T	TR	R	L	T	R	RR	LT	LL	LR	R	L	TL	T	TR	U	LT	LR	T	R
Vehicles	88	141	40	19	50	86	163	0	20	0	92	19	19	81	34	48	5	39	71	152	53
PHF	0.74	0.65	0.48	0.75	0.75	0.80	0.79		0.72		0.75	0.69	0.59	0.78	0.73	0.71	0.42	0.64	0.85	0.78	0.71
Truck %	2%	9%	5%	0%	2%	5%	3%		0%		2%	0%	0%	4%	0%	6%	0%	15%	11%	4%	4%

PM	NB Olive Mill Rd				WB (NB US 101 Ramp)				WB N Jameson Ln				SB Olive Mill Rd				EB Coast Village Rd				
2014	L	T	TR	R	L	T	R	RR	LT	LL	LR	R	L	TL	T	TR	U	LT	LR	T	R
Vehicles	150	51	59	56	28	68	54	0	7	0	67	16	116	106	48	51	3	17	348	299	134
PHF	0.87	0.70	0.68	0.75	0.67	0.85	0.73		0.45		0.81	0.61	0.79	0.89	0.76	0.81	0.50	0.53	0.91	0.91	0.88
Truck %	3%	4%	2%	2%	4%	1%	0%		0%		0%	0%	0%	7%	0%	6%	0%	0%	1%	4%	1%

Source: Quality Counts data, 4/9/2014

Allocation of movements for intersection O/D

	NB				US101 Off-Ramp WB				N Jameson Ln WB				SB				EB				
	L	T		R	L	T	R		L			R	L	T			L			T	R
	L	T	TR	R	L	T	R	RR	LT	LL	LR	R	L	TL	T	TR	U	LT	LR	T	R
AM Allocation	100%	78%	22%	100%	100%	100%	100%	0%	18%	0%	82%	100%	100%	50%	21%	29%	4%	34%	62%	100%	100%
PM Allocation	100%	46%	54%	100%	100%	100%	100%	0%	9%	0%	91%	100%	100%	52%	23%	25%	1%	5%	95%	100%	100%

Allocated Values (Based on 2014 splits)

2008																					
AM	NB Olive Mill Rd				WB (NB US 101 Ramp)				WB N Jameson Ln				SB Olive Mill Rd				EB Coast Village Rd				
2008	L	T	TR	R	L	T	R	RR	LT	LL	LR	R	L	TL	T	TR	U	LT	LR	T	R
Vehicles	136	164	47	39	36	102	113	0	28	0	130	34	14	92	39	54	7	57	103	147	49

PM	NB Olive Mill Rd				WB (NB US 101 Ramp)				WB N Jameson Ln				SB Olive Mill Rd				EB Coast Village Rd				
2008	L	T	TR	R	L	T	R	RR	LT	LL	LR	R	L	TL	T	TR	U	LT	LR	T	R
Vehicles	150	30	34	49	32	73	58	0	11	0	101	13	3	117	53	56	2	10	215	264	75

2040 Modified F																					
AM	NB Olive Mill Rd				WB (NB US 101 Ramp)				WB N Jameson Ln				SB Olive Mill Rd				EB Coast Village Rd				
2040 Modified F	L	T	TR	R	L	T	R	RR	LT	LL	LR	R	L	TL	T	TR	U	LT	LR	T	R
Vehicles	136	164	47	50	56	158	178	0	31	0	142	34	27	101	42	60	7	57	103	182	49
PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Truck %	2%	9%	5%	0%	2%	5%	3%	0%	0%	0%	2%	0%	0%	4%	0%	6%	0%	15%	11%	4%	4%

PM	NB Olive Mill Rd				WB (NB US 101 Ramp)				WB N Jameson Ln				SB Olive Mill Rd				EB Coast Village Rd				
2040 Modified F	L	T	TR	R	L	T	R	RR	LT	LL	LR	R	L	TL	T	TR	U	LT	LR	T	R
Vehicles	188	46	54	138	52	122	137	0	19	0	185	20	5	170	77	82	2	10	215	387	75
PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Truck %	3%	4%	2%	2%	4%	1%	0%	0%	0%	0%	0%	0%	0%	7%	0%	6%	0%	0%	1%	4%	1%

2020 Modified F																					
AM	NB Olive Mill Rd				WB (NB US 101 Ramp)				WB N Jameson Ln				SB Olive Mill Rd				EB Coast Village Rd				
2020 Modified F	L	T	TR	R	L	T	R	RR	LT	LL	LR	R	L	TL	T	TR	U	LT	LR	T	R
Vehicles	136	164	47	43	44	123	137	0	29	0	135	34	19	95	40	57	7	57	103	160	49
PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Truck %	100%	46%	54%	100%	100%	100%	100%	0%	9%	0%	91%	100%	100%	52%	23%	25%	1%	5%	95%	100%	100%

PM	NB Olive Mill Rd				WB (NB US 101 Ramp)				WB N Jameson Ln				SB Olive Mill Rd				EB Coast Village Rd				
2020 Modified F	L	T	TR	R	L	T	R	RR	LT	LL	LR	R	L	TL	T	TR	U	LT	LR	T	R
Vehicles	164	36	42	138	40	91	88	0	14	0	133	16	4	137	62	66	2	10	215	310	75
PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Truck %	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Original counts and forecasts

2008

AM	NB Olive Mill Rd				WB (NB US 101 Ramp)				WB N Jameson Ln				SB Olive Mill Rd				EB Coast Village Rd				
	L	T		R	L	T	R		L			R	L	T			L			T	R
2008	L	T	TR	R	L	T	R	RR	LT	LL	LR	R	L	TL	T	TR	U	LT	LR	T	R
Vehicles	136	211		39	36	102	113		158			34	14	185			167			147	49

PM	NB Olive Mill Rd				WB (NB US 101 Ramp)				WB N Jameson Ln				SB Olive Mill Rd				EB Coast Village Rd				
	L	T		R	L	T	R		L			R	L	T			L			T	R
2008	L	T	TR	R	L	T	R	RR	LT	LL	LR	R	L	TL	T	TR	U	LT	LR	T	R
Vehicles	150	64		49	32	73	58		112			13	3	226			227			264	75

Source: SC101HOV Traffic Study: Existing Conditions Operations Analysis, 12/15/2008

2040 Modified F

AM	NB Olive Mill Rd				WB (NB US 101 Ramp)				WB N Jameson Ln				SB Olive Mill Rd				EB Coast Village Rd				
	L	T		R	L	T	R		L			R	L	T			L			T	R
2040 Modified F	L	T	TR	R	L	T	R	RR	LT	LL	LR	R	L	TL	T	TR	U	LT	LR	T	R
Vehicles	136	211		50	56	158	178		173			34	27	203			167			182	49

PM	NB Olive Mill Rd				WB (NB US 101 Ramp)				WB N Jameson Ln				SB Olive Mill Rd				EB Coast Village Rd				
	L	T		R	L	T	R		L			R	L	T			L			T	R
2040 Modified F	L	T	TR	R	L	T	R	RR	LT	LL	LR	R	L	TL	T	TR	U	LT	LR	T	R
Vehicles	188	100		138	52	122	137		204			20	5	329			227			387	75

Source: SC101HOV Traffic Study: Forecast Operations Report, 10/19/2009

2020 Modified F

AM	NB Olive Mill Rd				WB (NB US 101 Ramp)				WB N Jameson Ln				SB Olive Mill Rd				EB Coast Village Rd				
	L	T		R	L	T	R		L			R	L	T			L			T	R
2020 Modified F	L	T	TR	R	L	T	R	RR	LT	LL	LR	R	L	TL	T	TR	U	LT	LR	T	R
Vehicles	136	211		43	44	123	137		164			34	19	192			167			160	49

PM	NB Olive Mill Rd				WB (NB US 101 Ramp)				WB N Jameson Ln				SB Olive Mill Rd				EB Coast Village Rd				
	L	T		R	L	T	R		L			R	L	T			L			T	R
2020 Modified F	L	T	TR	R	L	T	R	RR	LT	LL	LR	R	L	TL	T	TR	U	LT	LR	T	R
Vehicles	164	78		138	40	91	88		147			16	4	265			227			310	75

Source: SC101HOV Traffic Study: Forecast Operations Report, 10/19/2009

ATTACHMENT 2: SYNCHRO REPORTS

2040 EXISTING ALL-WAY STOP CONTROL

Refer to the technical studies and appendices for the SC 101 HOV EIR Traffic Study.

3: Coast Village Rd & Olive Mill Rd & N Jameson Ln 5/28/2015

Lane Group	EBL	EBT	WBT	NBT	SBT	SWL
Lane Group Flow (vph)	182	251	426	431	250	225
v/c Ratio	0.88	1.08	1.08	1.07	1.06	0.93
Control Delay	101.2	138.7	120.9	117.0	135.0	61.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	101.2	138.7	120.9	117.0	135.0	61.7
Queue Length 50th (ft)	178	~266	~463	~464	~268	57
Queue Length 95th (ft)	#321	#451	#680	#681	#448	#221
Internal Link Dist (ft)		380	499	368	318	462
Turn Bay Length (ft)						
Base Capacity (vph)	207	233	395	404	236	242
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.88	1.08	1.08	1.07	1.06	0.93

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

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HCM Signalized Intersection Capacity Analysis
3: Coast Village Rd & Olive Mill Rd & N Jameson Ln

5/28/2015

Movement	EBU	EBL2	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	NBR2
Lane Configurations												
Volume (vph)	7	57	103	182	49	56	158	178	136	164	47	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			6.5	6.5			6.5			6.5		
Lane Util. Factor			1.00	1.00			1.00			1.00		
Frt			1.00	0.97			0.94			0.97		
Flt Protected			0.95	1.00			0.99			0.98		
Satd. Flow (prot)			1613	1769			1709			1721		
Flt Permitted			0.95	1.00			0.99			0.98		
Satd. Flow (perm)			1613	1769			1709			1721		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	8	62	112	198	53	61	172	193	148	178	51	54
RTOR Reduction (vph)	0	0	0	6	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	182	245	0	0	426	0	0	431	0	0
Heavy Vehicles (%)	0%	15%	11%	4%	4%	2%	5%	3%	2%	9%	5%	0%
Turn Type	Split	Split	Split	NA		Split	NA		Split	NA		
Protected Phases	4	4	4	4		8	8		2	2		
Permitted Phases												
Actuated Green, G (s)			19.3	19.3			34.7			35.3		
Effective Green, g (s)			19.3	19.3			34.7			35.3		
Actuated g/C Ratio			0.13	0.13			0.23			0.24		
Clearance Time (s)			6.5	6.5			6.5			6.5		
Vehicle Extension (s)			3.0	3.0			3.0			3.0		
Lane Grp Cap (vph)			207	227			395			405		
v/s Ratio Prot			0.11	c0.14			c0.25			c0.25		
v/s Ratio Perm												
v/c Ratio			0.88	1.08			1.08			1.06		
Uniform Delay, d1			64.2	65.3			57.6			57.4		
Progression Factor			1.00	1.00			1.00			1.00		
Incremental Delay, d2			31.7	82.3			67.9			62.8		
Delay (s)			95.9	147.6			125.5			120.1		
Level of Service			F	F			F			F		
Approach Delay (s)				125.9			125.5			120.1		
Approach LOS				F			F			F		

Intersection Summary			
HCM 2000 Control Delay	124.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	32.5
Intersection Capacity Utilization	92.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Olive Mill ICE 7/7/2014 2040 AM - 101 HOV with Mod F - Signalized
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HCM Signalized Intersection Capacity Analysis
3: Coast Village Rd & Olive Mill Rd & N Jameson Ln

5/28/2015

Movement	SBL2	SBL	SBT	SBR	SWL2	SWL	SWR	SWR2
Lane Configurations								
Volume (vph)	27	101	42	60	31	0	142	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			6.5			6.5		
Lane Util. Factor			1.00			1.00		
Frt			0.96			0.89		
Flt Protected			0.97			0.99		
Satd. Flow (prot)			1726			1647		
Flt Permitted			0.97			0.99		
Satd. Flow (perm)			1726			1647		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	29	110	46	65	34	0	154	37
RTOR Reduction (vph)	0	0	0	0	0	158	0	0
Lane Group Flow (vph)	0	0	250	0	0	67	0	0
Heavy Vehicles (%)	0%	4%	0%	6%	0%	0%	2%	0%
Turn Type	Split	Split	NA		Prot	Prot		
Protected Phases	6	6	6		12	12		
Permitted Phases								
Actuated Green, G (s)			20.5			7.7		
Effective Green, g (s)			20.5			7.7		
Actuated g/C Ratio			0.14			0.05		
Clearance Time (s)			6.5			6.5		
Vehicle Extension (s)			3.0			3.0		
Lane Grp Cap (vph)			235			84		
v/s Ratio Prot			c0.14			c0.04		
v/s Ratio Perm								
v/c Ratio			1.06			0.79		
Uniform Delay, d1			64.8			70.4		
Progression Factor			1.00			1.00		
Incremental Delay, d2			76.6			38.6		
Delay (s)			141.3			108.9		
Level of Service			F			F		
Approach Delay (s)			141.3			108.9		
Approach LOS			F			F		

Intersection Summary

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Queues
3: Coast Village Rd & Olive Mill Rd & N Jameson Ln

5/28/2015

Lane Group	EBL	EBT	WBT	NBT	SBT	SWL
Lane Group Flow (vph)	247	503	339	463	363	244
v/c Ratio	0.70	1.41	1.35	1.22	1.16	1.10
Control Delay	68.2	242.2	228.3	169.0	155.0	111.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	68.2	242.2	228.3	169.0	155.0	111.1
Queue Length 50th (ft)	228	~657	~433	~554	~420	~103
Queue Length 95th (ft)	330	#889	#633	#775	#626	#286
Internal Link Dist (ft)		380	499	368	318	462
Turn Bay Length (ft)						
Base Capacity (vph)	351	357	251	379	312	221
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.70	1.41	1.35	1.22	1.16	1.10

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
3: Coast Village Rd & Olive Mill Rd & N Jameson Ln

5/28/2015

Movement	EBU	EBL2	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	NBR2
Lane Configurations												
Volume (vph)	2	10	215	387	75	52	122	137	188	46	54	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			6.5	6.5			6.5			6.5		
Lane Util. Factor			1.00	1.00			1.00			1.00		
Frt			1.00	0.98			0.94			0.94		
Flt Protected			0.95	1.00			0.99			0.98		
Satd. Flow (prot)			1788	1791			1754			1701		
Flt Permitted			0.95	1.00			0.99			0.98		
Satd. Flow (perm)			1788	1791			1754			1701		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	11	234	421	82	57	133	149	204	50	59	150
RTOR Reduction (vph)	0	0	0	5	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	247	498	0	0	339	0	0	463	0	0
Heavy Vehicles (%)	0%	0%	1%	4%	1%	4%	1%	0%	3%	4%	2%	2%
Turn Type	Split	Split	Split	NA		Split	NA		Split	NA		
Protected Phases	4	4	4	4		8	8		2	2		
Permitted Phases												
Actuated Green, G (s)			29.5	29.5			21.5			33.5		
Effective Green, g (s)			29.5	29.5			21.5			33.5		
Actuated g/C Ratio			0.20	0.20			0.14			0.22		
Clearance Time (s)			6.5	6.5			6.5			6.5		
Vehicle Extension (s)			3.0	3.0			3.0			3.0		
Lane Grp Cap (vph)			351	352			251			379		
v/s Ratio Prot			0.14	c0.28			c0.19			c0.27		
v/s Ratio Perm												
v/c Ratio			0.70	1.42			1.35			1.22		
Uniform Delay, d1			56.2	60.2			64.2			58.2		
Progression Factor			1.00	1.00			1.00			1.00		
Incremental Delay, d2			6.3	202.9			181.7			121.3		
Delay (s)			62.5	263.2			246.0			179.5		
Level of Service			E	F			F			F		
Approach Delay (s)				197.1			246.0			179.5		
Approach LOS				F			F			F		

Intersection Summary			
HCM 2000 Control Delay	209.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.29		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	32.5
Intersection Capacity Utilization	106.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

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HCM Signalized Intersection Capacity Analysis
3: Coast Village Rd & Olive Mill Rd & N Jameson Ln

5/28/2015

Movement	SBL2	SBL	SBT	SBR	SWL2	SWL	SWR	SWR2
Lane Configurations								
Volume (vph)	5	170	77	82	19	0	185	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			6.5			6.5		
Lane Util. Factor			1.00			1.00		
Frt			0.97			0.88		
Flt Protected			0.97			1.00		
Satd. Flow (prot)			1704			1658		
Flt Permitted			0.97			1.00		
Satd. Flow (perm)			1704			1658		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	185	84	89	21	0	201	22
RTOR Reduction (vph)	0	0	0	0	0	161	0	0
Lane Group Flow (vph)	0	0	363	0	0	83	0	0
Heavy Vehicles (%)	0%	7%	0%	6%	0%	0%	0%	0%
Turn Type	Split	Split	NA		Prot	Prot		
Protected Phases	6	6	6		12	12		
Permitted Phases								
Actuated Green, G (s)			27.5			5.5		
Effective Green, g (s)			27.5			5.5		
Actuated g/C Ratio			0.18			0.04		
Clearance Time (s)			6.5			6.5		
Vehicle Extension (s)			3.0			3.0		
Lane Grp Cap (vph)			312			60		
v/s Ratio Prot			c0.21			c0.05		
v/s Ratio Perm								
v/c Ratio			1.16			1.39		
Uniform Delay, d1			61.2			72.2		
Progression Factor			1.00			1.00		
Incremental Delay, d2			102.9			248.6		
Delay (s)			164.2			320.9		
Level of Service			F			F		
Approach Delay (s)			164.2			320.9		
Approach LOS			F			F		

Intersection Summary

ATTACHMENT 3: SIDRA REPORTS

LANE SUMMARY

Site: 2040mF AM Alt 0.1

US 101 at Olive Mill Road
Santa Barbara, CA
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: Olive Mill Rd													
Lane 1[d]	377	5.7	757	0.498	100	11.9	LOS B	2.9	75.5	Full	1600	0.0	0.0
Lane 2	54	0.0	800	0.068	100	5.2	LOS A	0.3	6.9	Short	50	0.0	0.0
Approach	432	5.0		0.498		11.0	LOS B	2.9	75.5				
East: 101 NB Off-Ramp													
Lane 1[d]	428	3.6	739	0.579	100	14.3	LOS B	3.9	99.3	Full	1600	0.0	0.0
Approach	428	3.6		0.579		14.3	LOS B	3.9	99.3				
NorthEast: N Jameson Lane													
Lane 1[d]	226	1.4	597	0.379	100	11.5	LOS B	1.8	45.2	Full	1600	0.0	0.0
Approach	226	1.4		0.379		11.5	LOS B	1.8	45.2				
North: Olive Mill Rd													
Lane 1[d]	250	3.3	769	0.325	100	8.5	LOS A	1.5	38.1	Full	1600	0.0	0.0
Approach	250	3.3		0.325		8.5	LOS A	1.5	38.1				
West: Coast Village Road													
Lane 1[d]	433	7.3	1007	0.430	100	8.4	LOS A	2.3	62.2	Full	1600	0.0	0.0
Approach	433	7.3		0.430		8.4	LOS A	2.3	62.2				
Intersection	1768	4.5		0.579		10.9	LOS B	3.9	99.3				

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Processed: Thursday, May 28, 2015 2:56:09 PM
SIDRA INTERSECTION 6.0.18.4502
Project: H:\projfile\17493 - US 101 at Olive Mill ICE\Sidra\17493 Olive Mill ICE_modF.sip6
8001045, KITTELSON AND ASSOCIATES INC, PLUS / Floating

SIDRA INTERSECTION 6

LANE SUMMARY

Site: 2040mF PM Alt 0.1

US 101 at Olive Mill Road
Santa Barbara, CA
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: Olive Mill Rd													
Lane 1[d]	313	3.0	562	0.557	100	16.9	LOS C	3.2	81.1	Full	1600	0.0	0.0
Lane 2	150	2.0	567	0.264	100	9.9	LOS A	1.1	27.3	Short	50	0.0	0.0
Approach	463	2.7		0.557		14.7	LOS B	3.2	81.1				
East: 101 NB Off-Ramp													
Lane 1[d]	340	1.1	800	0.425	100	9.9	LOS A	2.3	58.8	Full	1600	0.0	0.0
Approach	340	1.1		0.425		9.9	LOS A	2.3	58.8				
NorthEast: N Jameson Lane													
Lane 1[d]	245	0.0	776	0.315	100	8.3	LOS A	1.5	36.9	Full	1600	0.0	0.0
Approach	245	0.0		0.315		8.3	LOS A	1.5	36.9				
North: Olive Mill Rd													
Lane 1[d]	363	5.0	731	0.497	100	12.2	LOS B	2.9	74.2	Full	1600	0.0	0.0
Approach	363	5.0		0.497		12.2	LOS B	2.9	74.2				
West: Coast Village Road													
Lane 1[d]	749	2.7	970	0.772	100	18.9	LOS C	9.4	239.1	Full	1600	0.0	0.0
Approach	749	2.7		0.772		18.9	LOS C	9.4	239.1				
Intersection	2160	2.5		0.772		14.2	LOS B	9.4	239.1				

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach