

# **U.S. 101 / Linden Avenue / Casitas Pass Road Interchange Improvements Project**

*Supplemental Traffic Analysis Report*

Prepared for:  
City of Carpinteria  
Caltrans  
SBCAG

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WC12-2991

FEHR  PEERS

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## 1.0 EXECUTIVE SUMMARY

### 1.1 BACKGROUND

In its *Master Facility Plan* (July 1993) and *General Plan* (April 2001), the City of Carpinteria identified several interchange and bridge improvements designed to enhance access to U.S. 101. Among these were improvements to the Linden Avenue and Casitas Pass Road interchanges.

Funding for these two locations was programmed by the Santa Barbara County Association of Governments (SBCAG) in 1996, as part of a strategy of operational improvements for U.S. 101. Since that time, this project has been under project development, with a number of alternatives proposed through the community, the City of Carpinteria, SBCAG and Caltrans. In 2000, a State Transportation Improvement Program (STIP) amendment was approved to incorporate a separate local project, the Via Real Extension, into the scope and funding for the Linden Avenue/Casitas Pass Road project.

The U.S. 101/Linden Avenue and U.S. 101/Casitas Pass Road Interchange Improvements Project consists of reconfiguring the interchange ramps and constructing new local street connections and frontage road extensions. Four project alternatives were evaluated in this study.

The City of Carpinteria is working cooperatively with SBCAG and Caltrans to advance this project through the approval process. All three agencies have provided input during development of this traffic analysis report.

### 1.2 PURPOSE

The purpose of this traffic analysis report is to update existing and document future travel conditions associated with the U.S. 101/Linden Avenue and U.S. 101/Casitas Pass Road Interchange Improvements Project. Specifically, confirming the optimal overcrossing bridge width in terms of travel lanes for the Casitas Pass Road bridge and performing traffic signal warrants at the intersections located at both interchanges for the build year 2016 and design year 2036.. New intersection operation performance metrics, a road network systems evaluation, traffic safety discussion, graphics, and wider context of discussion presented in this report are intended to tell a more complete picture of the operational characteristics of the project and other alternatives that were considered.

Fehr & Peers performed a traffic analysis in August 2008 which included a traffic operations evaluation of geometric improvements at both the Linden Avenue and Casitas Pass Road interchanges. Due to the economic downturn between the previous analysis and 2012, a concern had been raised that the traffic volumes and projections for the intersection turn movement volumes and roadway segment counts may have decreased significantly, thus possibly changing the design of the project. This traffic analysis will



determine if the existing (2012) traffic volumes have been affected to any significant degree due to the economic recession. Furthermore, this analysis will analyze the forecast growth out to 2036 for consistency with the City of Carpinteria's general plan buildout.

### 1.3 SCENARIO EVALUATION APPROACH

Historic roadway segment traffic count data from preceding 10 years were used to develop a growth rate to project the 2006 turning movement data to develop turning movements for existing conditions (2012). The existing conditions counts were used to perform the traffic signal warrants and evaluate existing intersection performance and traffic operations conditions.

The geometric designs evaluated previously in 2008 included 5 and 6-lane bridge width alternatives for Casitas Pass Road and 3 and 4lane bridge widths for Linden Avenue. At this time, Caltrans is incorporating the 5 lane design for Casitas Pass Road and 3 lane design for Linden Avenue. The City of Carpinteria City Council recently requested an evaluation of 3 and 4-lane bridge configurations for the Casitas Pass Road Interchange. The Council also requested a re-evaluation of the 2008 traffic volumes used in the analysis, and had questions regarding the 2016 and 2036 forecasts.

Consistent with current industry practice, the previous traffic analysis was conducted using traffic simulation to capture the interaction of vehicles between the intersections and the level of service results for each intersection alone. Historic growth based on counts collected over 10 years for the intersections is negligible due to the interchange being at capacity and not allowing additional vehicles to travel through the intersections to be counted, as supported by deficient existing conditions level of service. For this report, the analysis began with the same process previously used but an evaluation of additional roadway system performance aspects of the interchange in combination was conducted. To present the results of the interchange operation as a system that travelers would encounter rather individual intersections, a new performance indicator of interchange system delay was added. This performance indicator represents the delay associated with traveling through the interchange as a system and is more comparable to the user experience. Level of service tables present individual intersection delay and interchange system delay side-by-side to better understand the interactions for each alternative.

This report presents the traffic operations and delay, queue on the freeway ramps and local streets, pedestrian and bicycle activity, and emergency response. Since each of these aspects of the project should be considered together to find a balance, graphics were created to show both intersection delay and queues relative to the freeway mainline and side streets/driveways.



This holistic approach to the evaluation of the interchange operation balances and optimizes the performance criteria of lane geometry, level of service, vehicular delays, vehicle queuing (stacking), freeway mainline operation impact, city street operation impact, with overall traffic safety being the primary goal.

## 1.4 SUMMARY OF FINDINGS

Based on the traffic operations analysis of the various improvement alternatives for the Casitas Pass Road and Linden Avenue interchanges, we offer the following conclusions and recommendations:

### Casitas Pass Road Interchange

- Traffic signals are warranted at the Casitas Pass Road intersections at Via Real and US 101 Southbound Ramps under existing conditions. Under future year 2016 and 2036 conditions, these intersections will continue to satisfy traffic signal warrants.
- Under Year 2016 conditions, all three study intersections at the Casitas Pass Road interchange are anticipated to operate at acceptable levels (LOS C or better) during both AM and PM peak hours when the Casitas Pass Road overcrossing provides 4 lanes or more; a 3-lane bridge would not provide sufficient capacity to meet the projected traffic demand.
- Under Year 2036 conditions, all three study intersections at the Casitas Pass Road interchange are anticipated to operate at acceptable levels (LOS C or better) during both AM and PM peak hours when the Casitas Pass Road overcrossing provides 5 lanes or more; a 4- or 3-lane bridge would not provide sufficient capacity to meet the projected traffic demand.
- Under both 2016 and 2036 conditions, vehicle queues at the US 101 Southbound off-ramp are anticipated to extend beyond the ramp and spill back onto the freeway mainline under the 3-lane Casitas Pass Road bridge scenario, and extend past adjacent driveways on Casitas Pass Road to Carpinteria Avenue. With the construction of a 4 lane bridge (or larger), vehicle queues can be contained within the ramp, but extend past some of the adjacent driveways on Casitas Pass Road.
- Vehicle queues along Via Real are not anticipated to spill back to upstream intersections under any of the design alternative scenarios.
- Vehicle queues at the US 101 Northbound off-ramp are not anticipated to spill back onto the freeway mainline under any of the design alternative scenarios.



### Linden Avenue Interchange

- Traffic signals are warranted at the Linden Avenue intersections with Ogan Road and US 101 Southbound off-ramp under existing conditions. Under future year 2016 and 2036 conditions, these intersections will continue to satisfy traffic signal warrants.
- Under both 2016 and 2036 conditions, signalization of the Linden Avenue intersections at Ogan Road and US 101 Southbound off-ramp would result in acceptable operations during both AM and PM peak hours. If these intersections were to remain side street stop controlled, one of these intersections would operate at unacceptable levels in 2016 and both would operate at unacceptable levels in 2036.
- Vehicle queues at the US 101 Southbound off-ramp are not anticipated to spill back onto the freeway mainline under either unsignalized or signalized scenarios.
- Vehicle queues along northbound Linden Avenue are anticipated to extend past Sawyer Avenue south of the US 101 interchange under the 2036 Stop Controlled scenarios; if the interchange intersections are signalized, northbound Linden Avenue queues will not spill back to Sawyer Avenue. Vehicle queues along southbound Linden Avenue are anticipated to extend past Nipomo Drive during the AM peak hour under all analysis scenarios.
- The proposed roundabout at Ogan Road/Via Real/US 101 Northbound On-ramp will operate at LOS E in 2016. Due to the anticipated reduction in traffic volumes at this intersection after 2016, when US 101 is assumed to be widened and trips are no longer expected to bypass freeway congestion by using Via Real, the roundabout will operate at acceptable levels in 2036.



## 2.0 METHODOLOGY AND APPROACH

This chapter presents the study area, methodology used to perform the traffic operations analysis, and the various scenarios analyzed as part of this study.

### 2.1 STUDY AREA

The study area falls within the City of Carpinteria and includes the Linden Avenue and Casitas Pass Road interchanges with U.S. 101, as shown on Figure 2-1. The study intersections at or adjacent to these interchanges include the following:

#### Casitas Pass Road Interchange

- Intersection #1 - Via Real / U.S. 101 Northbound Ramps (#23 in previous study)
- Intersection #2 - Via Real / Casitas Pass Road (#10 in previous study)
- Intersection #3 - Casitas Pass Road / U.S. 101 Southbound Ramps (#9 in previous study)

#### Linden Avenue Interchange

- Intersection #4 - Linden Avenue / Ogan Road (#4 in previous study)
- Intersection #5 - Linden Avenue / U.S. 101 Southbound Off-ramp (#3 in previous study)
- Intersection #6 - Ogan Road / Via Real / U.S. 101 Northbound On-ramp (#5 in previous study)





Figure 2-1.

**Project Study Area**

WC12-2991\_2-1\_StudyArea

## 2.2 ANALYSIS METHOD AND PERFORMANCE EVALUATION

### 2.2.1 TRAFFIC SIGNAL WARRANTS

To assess consideration for signalization of stop-controlled intersections, the *California Manual of Uniform Traffic Control Devices* (CA MUTCD), presents eight signal warrants. Generally, meeting one of the signal warrants could justify signalization of an intersection. However, an evaluation of all applicable warrants should be conducted and additional factors (e.g., congestion, approach conditions, driver confusion) should be considered before the decision to install a signal is made. The peak hour volume warrant (Warrant 3) for urban conditions was evaluated using the available data. Additionally, although the average daily traffic warrant per Figure 4C-103 of the CA MUTCD is typically evaluated in the absence of traffic count data, these warrants were included in the evaluation to supplement the peak hour warrant analysis.

### 2.2.2 INTERSECTION OPERATIONS

The operation performance of each study intersection was evaluated using Level of service (LOS) and vehicular queuing. Level of service is a description of the quality of an intersection's operation, ranging from LOS A (indicating free-flow traffic conditions with little or no delay) to LOS F (representing over-saturated conditions where traffic flows exceed design capacity, resulting in long queues and delays). Based on the City of Carpinteria General Plan, the City's policy is to maintain a service level of LOS C operations or better at all intersections.

At signalized and all-way stop controlled intersections, the LOS rating is based on the weighted average control delay of all movements measured in seconds per vehicle. Peak hour traffic volumes, lane configurations, and signal timing plans are used as inputs in the LOS calculations. The traffic analysis software, *Synchro/SimTraffic 7*, was used for this study. *Synchro* is based on procedures outlined in the Transportation Research Board's 2000 *Highway Capacity Manual* (HCM). Use of the *SimTraffic* simulation model allows the study area to be analyzed as an interconnected roadway network, which is needed to accurately analyze the vehicle interactions along study roadways to reflect potential vehicle queue impacts in the study area. Table 2-1 summarizes the relationship between the average control delay per vehicle and LOS for signalized and unsignalized intersections.



**TABLE 2-1 INTERSECTION LOS CRITERIA**

Level of Service	Description	Signalized Intersection Control Delay (sec/veh)	Unsignalized Intersection Control Delay (sec/veh)
A	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.	< 10.0	< 10.0
B	Progression is good, cycle lengths are short, or both. More vehicles stop than with LOS A, causing higher levels of average delay.	> 10.0 to 20.0	> 10.0 to 15.0
C	Higher congestion may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, though many still pass through the intersection without stopping.	> 20.0 to 35.0	> 15.0 to 25.0
D	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	> 35.0 to 55.0	> 25.0 to 35.0
E	This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	> 55.0 to 80.0	> 35.0 to 50.0
F	This level is considered unacceptable with oversaturation, which is when arrival flow rates exceed the capacity of the intersection. This level may also occur at high V/C ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to such delay levels.	> 80.0	> 50.0

Source: 2010 Highway Capacity Manual.

Total systemwide delay was also evaluated as a performance measure that reflects the operation of the study intersections together instead of in isolation. For the purposes of this study, the total systemwide delay is the summation of the intersection control delay for each of the study intersections in the immediate vicinity of the interchanges.

Vehicle queuing was also included in the traffic operations analysis. The 95<sup>th</sup> percentile queue lengths were measured to account for fluctuations in traffic, and represents a conditions where 95 percent of the time during the peak period, traffic volumes and related queuing will be at, or less, than determined by the analysis. When queues exceed the available storage capacity on a roadway link, the operation of the upstream intersection may be impacted. When this occurs along a freeway off-ramp, resulting in queue spillback extending onto the freeway mainline, the freeway operations may be impacted. Queue spillback



and blockage of intersections and roadway facilities may raise safety concerns and also has the ability to hinder emergency vehicle access.

## 2.3 ANALYSIS SCENARIOS

### 2.3.1 EXISTING CONDITIONS

As part of the previously completed traffic operations analysis for this project, extensive data collection efforts were undertaken in January 2006 to determine vehicular and pedestrian peak hour traffic volumes as well as truck percentages. These 2006 traffic counts, along with more recent traffic count data from 2008 provided by the City of Carpinteria, were used to calculate annual growth rates for both AM and PM peak hours. These growth rates were then used to derive year 2012 turning movement volumes for the Existing Conditions intersection operations analysis performed for the study intersections at the Casitas Pass Road interchange.

### 2.3.2 FUTURE YEAR CONDITIONS

This study has included an analysis of two future year conditions, 2016 (year of opening) and 2036 (design year). This approach is entirely consistent with the two forecast years used in the *Final Traffic Analysis Report: U.S. 101 U.S. 101 / Linden Avenue and U.S. 101 /Casitas Pass Road Interchange Improvement Project (Fehr & Peers, June 2007)*. At the inception of this study it was decided by the project team to utilize the same volume set for 2016 and 2036 that was used in the 2007 effort.

In this case, however, we checked to see how the 2012 (existing) traffic data compared to the 2016 forecast volume set to assume reasonable growth during this short time period was assumed and based on recent growth trends from 2007 to 2012. The 2036 traffic volumes used in this study were identical to the volume set used in the 2007 Fehr & Peers study. That 2007 Fehr & Peers study used the SBCAG regional travel model and then performed a sensitivity to align growth beyond the horizon year of 2030 in both the regional travel model and the City's general plan. It was assumed no growth was occurring as a result of internal trip generation in those years between 2030 and 2036 since the City was at "build-out" at this time.

Under both future year conditions, proposed geometric improvements under consideration involve reconfiguring the Linden Avenue and Casitas Pass Road interchanges and extending Via Real from its current terminus to Linden Avenue. The proposed improvements are presented in the following sections.



### **2.3.2.1 Casitas Pass Road Interchange**

#### Previous Design Alternative (6-lane bridge)

The previous design alternative proposed diagonal southbound on- and off-ramps on the west side of U.S. 101 at the Casitas Pass Road interchange. In the northbound direction, on- and off-hook ramps would be provided on the new extension of Via Real. Under this alternative, the Casitas Pass Road overcrossing would provide six travel lanes. The proposed geometric layout of this alternative is presented on Figure 2-2.

#### Current design alternative (5-lane bridge)

The current design alternative is similar to the previous design except that the Casitas Pass Road overcrossing would provide five travel lanes. The proposed geometric layout of this alternative is presented on Figure 2-3. As shown, three westbound lanes (one left-turn lane and two through lanes) and two eastbound lanes (one shared left-turn/through lane and one shared through/right-turn lane) is proposed.

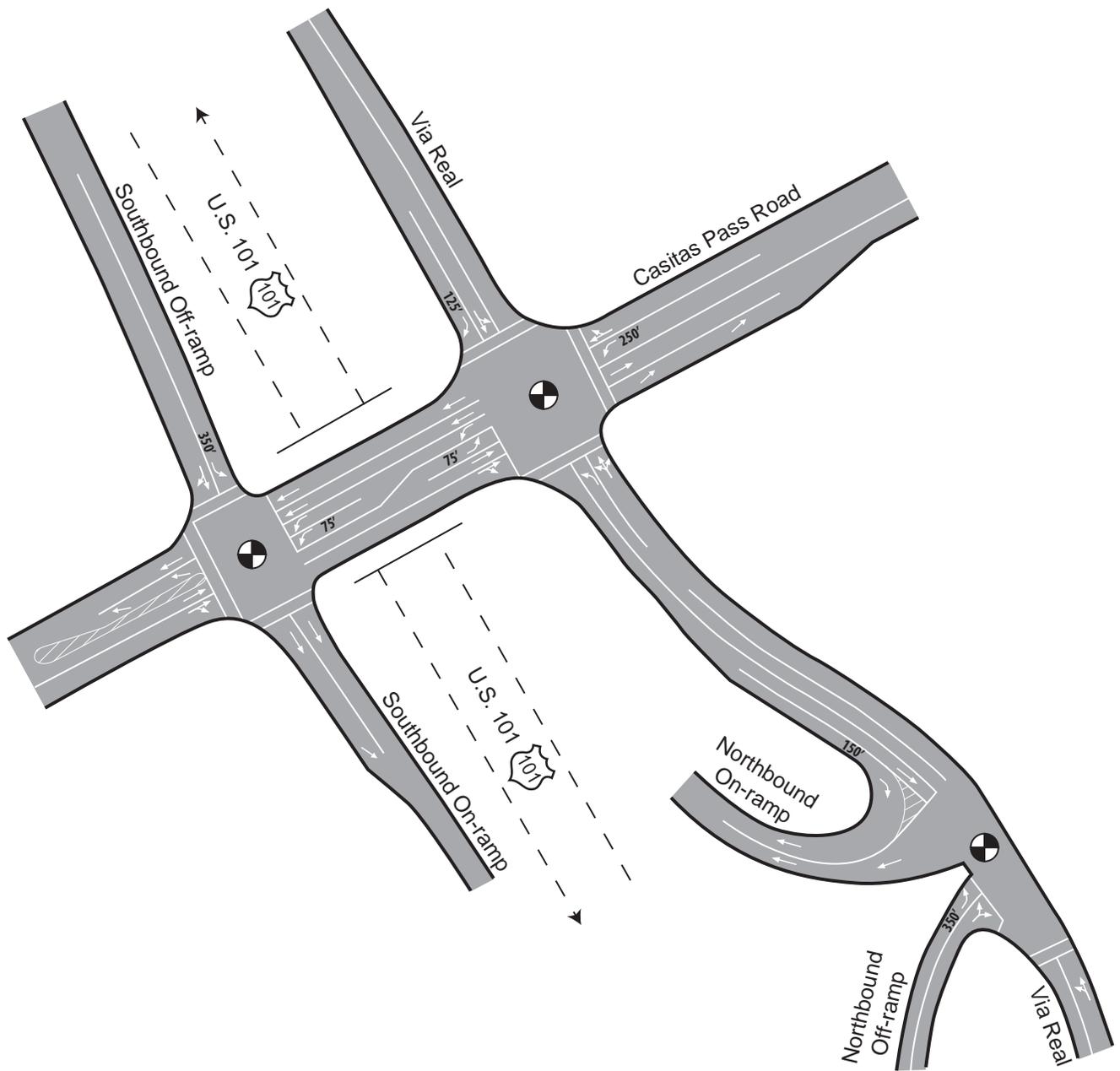
#### Reduced capacity alternatives (4- and 3-lane bridge)

The reduced capacity alternatives would provide less travel lanes on the Casitas Pass Road overcrossing as compared to the alternatives noted above. The proposed geometric layout of both 4- and 3-lane reduced capacity bridge alternatives are presented in Figures 2-4 and 2-5, respectively. As shown, the 4-lane bridge would provide two lanes in each direction while the 3-lane bridge would provide only one eastbound lane and two westbound lanes.

### **2.3.2.2 Linden Avenue Interchange**

The proposed improvements at the Linden Avenue interchange include the construction of a new roundabout intersection at Via Real/Ogan Road. The US-101 Northbound on-ramp is proposed to be the west leg of the roundabout intersection as illustrated in Figure 2-6. The US-101 Southbound Off-ramp is proposed to be relocated approximately 250 feet to the north of its existing terminus intersection. Access to and from the south on Linden Avenue would not be provided as currently configured.





**LEGEND**

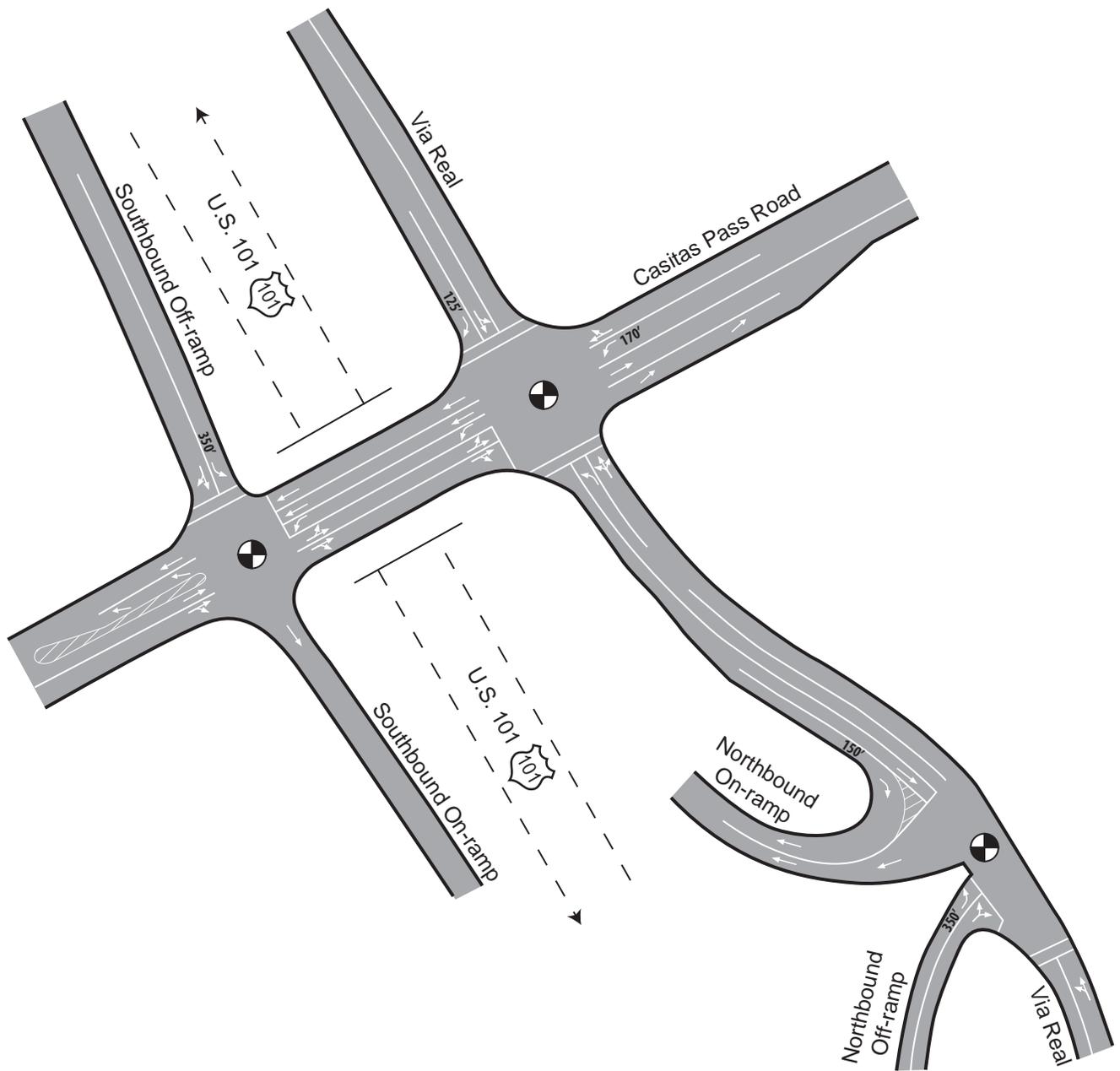
- XX'** Recommended Turn Pocket Vehicle Storage
-  Traffic Signal



Figure 2-2.

**Geometric Layout at Casitas Pass Road Interchange  
Previous Design Alternative (6-Lane Bridge)**

WC12-2991\_2-2\_CasitasGeoPlane



**LEGEND**

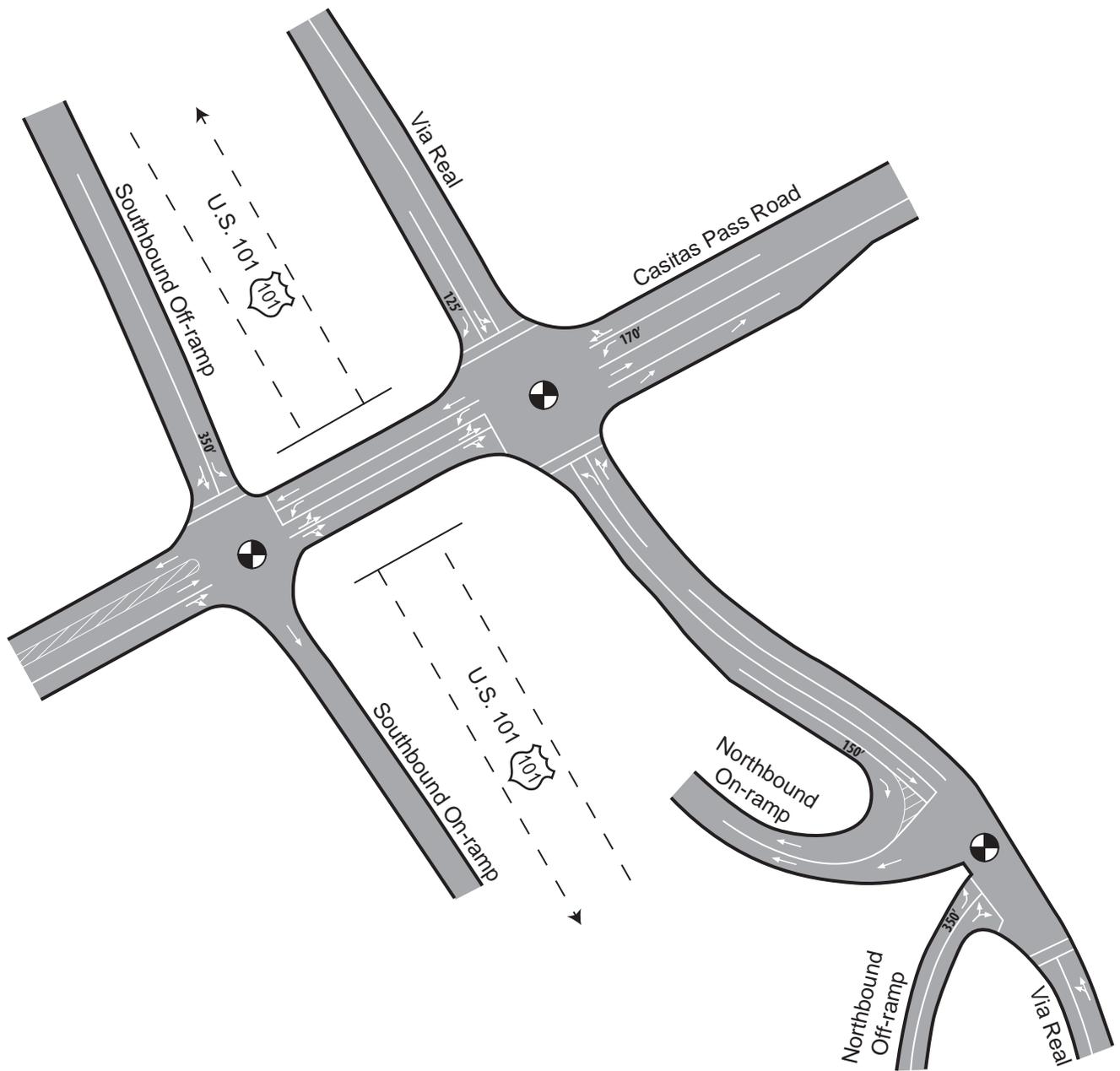
- XX'** Recommended Turn Pocket
-  Traffic Signal
-  Vehicle Storage



Figure 2-3.

**Geometric Layout at Casitas Pass Road Interchange  
Current Design Alternative (5-Lane Bridge)**

WC12-2991\_2-3\_CasitasGeo5lane



**LEGEND**

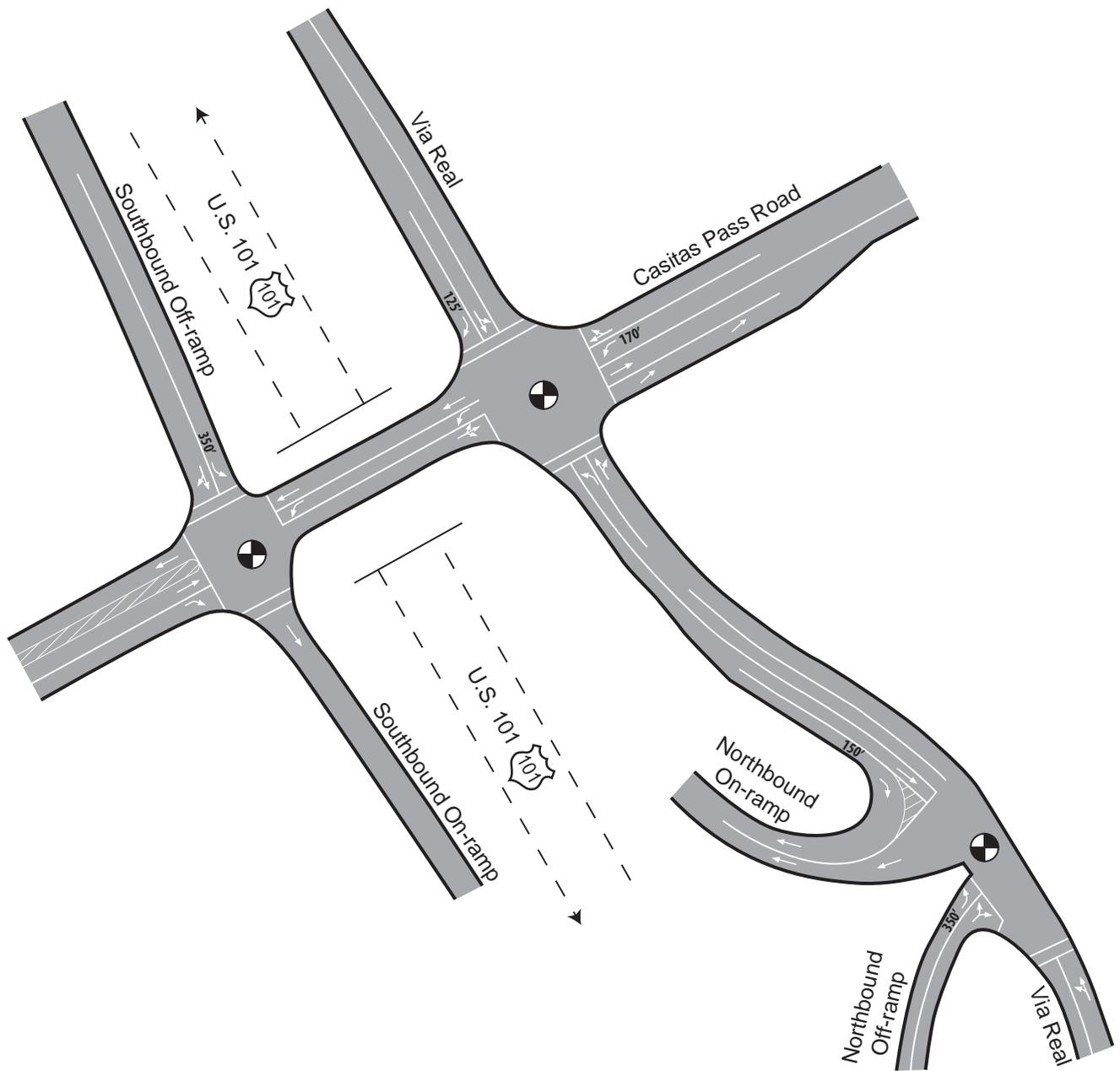
- XX'** Recommended Turn Pocket Vehicle Storage
-  Traffic Signal



Figure 2-4.

**Geometric Layout at Casitas Pass Road Interchange  
Reduced Capacity Alternative (4-Lane Bridge)**

WC12-2991\_2-4\_CasitasGeo4lane



**LEGEND**

- XX'** Recommended Turn Pocket Vehicle Storage
-  Traffic Signal



Figure 2-5.

**Geometric Layout at Casitas Pass Road Interchange  
Reduced Capacity Alternative (3-Lane Bridge)**

WC12-2991\_2-5\_CasitasGeo3lane

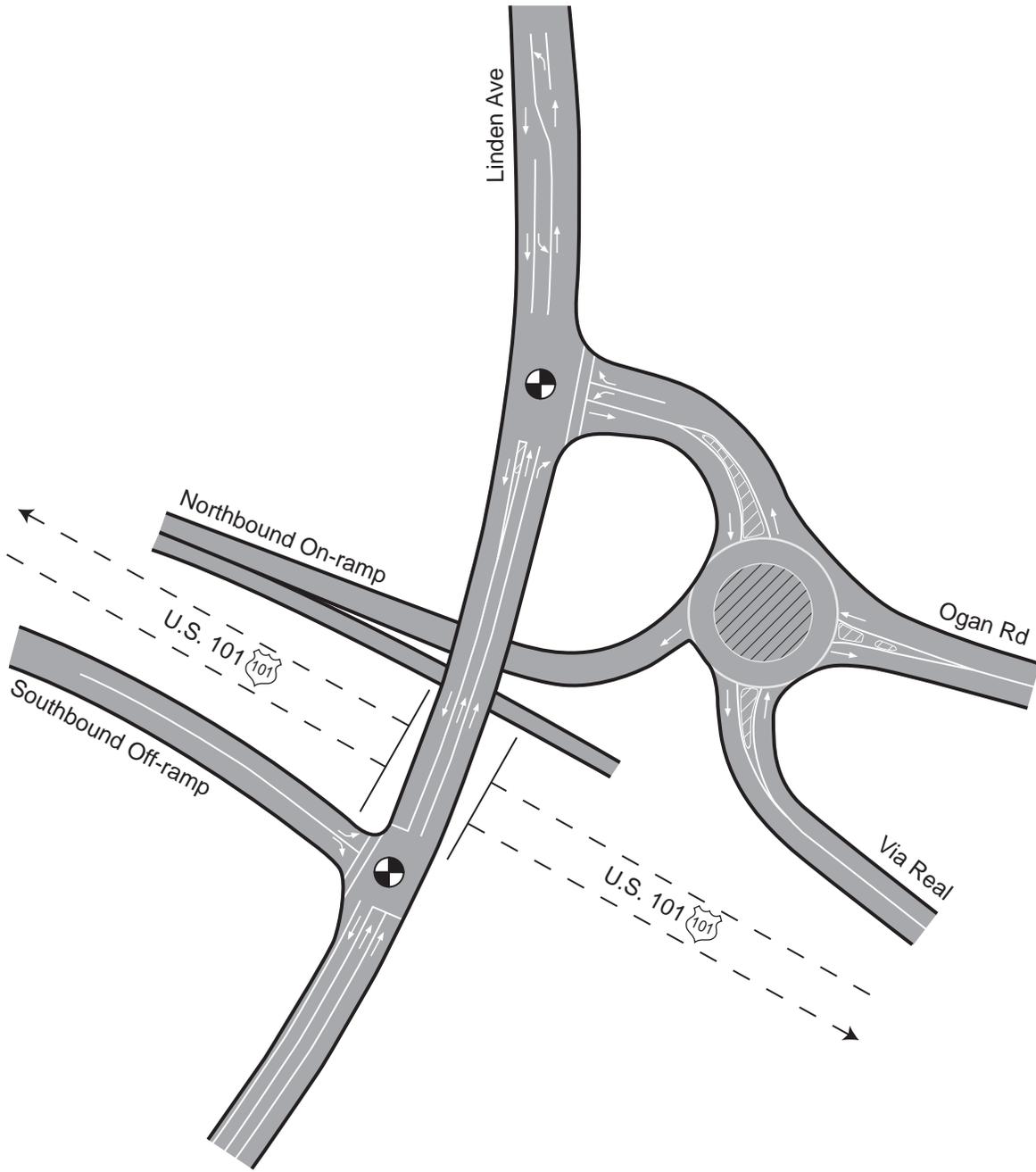


Figure 2-6.

Geometric Layout at Linden Avenue Interchange

WC12-2991\_2-6\_LindenGeo

## 3.0 CASITAS PASS ROAD INTERCHANGE

This section presents the results of the traffic operations analysis at the Casitas Pass Road Interchange under Existing Conditions, Year 2016, and Year 2036 scenarios. For both future year scenarios, various interchange configurations were evaluated.

### 3.1 EXISTING CONDITIONS

In order to determine the current operations, peak hour capacity analyses were performed for both U.S. 101 ramp terminal intersections at Casitas Pass Road as well as the Casitas Pass Road/Via Real intersection. The peak hour and average daily traffic signal warrants were also evaluated for unsignalized intersections based on the 2010 *California Manual on Uniform Traffic Control Devices* (CA MUTCD). The following summarizes the analysis results for existing conditions.

#### 3.1.1 TRAFFIC SIGNAL WARRANTS

The peak hour volume traffic signal warrant (Warrant 3) and average daily traffic volume warrant for urban conditions, as contained in Chapter 4C of the CA MUTCD, were evaluated for the unsignalized intersections in the study area. The results of the traffic signal warrant analyses are shown in Table 3-1.

**TABLE 3-1 PEAK HOUR SIGNAL WARRANT ANALYSIS**

Intersection	Existing Conditions	Year 2016	Year 2036
1. Via Real / U.S. 101 NB Ramps	<i>Does Not Exist</i>	Yes / No / Yes	Yes / Yes / Yes
2. Via Real / Casitas Pass Road	Yes / No / Yes	Yes / Yes / Yes	Yes / Yes / Yes
3. Casitas Pass Road / U.S. 101 SB Ramps	No / Yes / Yes	No / Yes / Yes	Yes / Yes / Yes

Note: Warrant results presented for AM peak hour / PM peak hour / Daily thresholds.  
 Source: Fehr & Peers.

As shown in the table, the urban peak hour signal warrant and average daily traffic warrant are satisfied at both of the existing unsignalized study intersections at the Casitas Pass Road Interchange. Detailed signal warrant calculations are provided in Appendix B.



### 3.1.2 INTERSECTION OPERATIONS

Existing intersection traffic operations were evaluated using the SimTraffic models developed as part of the previous traffic study. The intersection traffic control, lane configurations, and peak hour traffic volumes used in the analysis are presented in Figure 3-1. The simulation models were recorded for the peak hour. Table 3-2 present the simulated intersection level of service results for the existing study intersections at the Casitas Pass Road interchange. The queuing results are presented in Table 3-3. Detailed calculation worksheets are provided in Appendix A.

As shown, both existing study intersections are currently operating at LOS D or worse during one of the peak hours. Detailed calculation worksheets are provided in Appendix A.

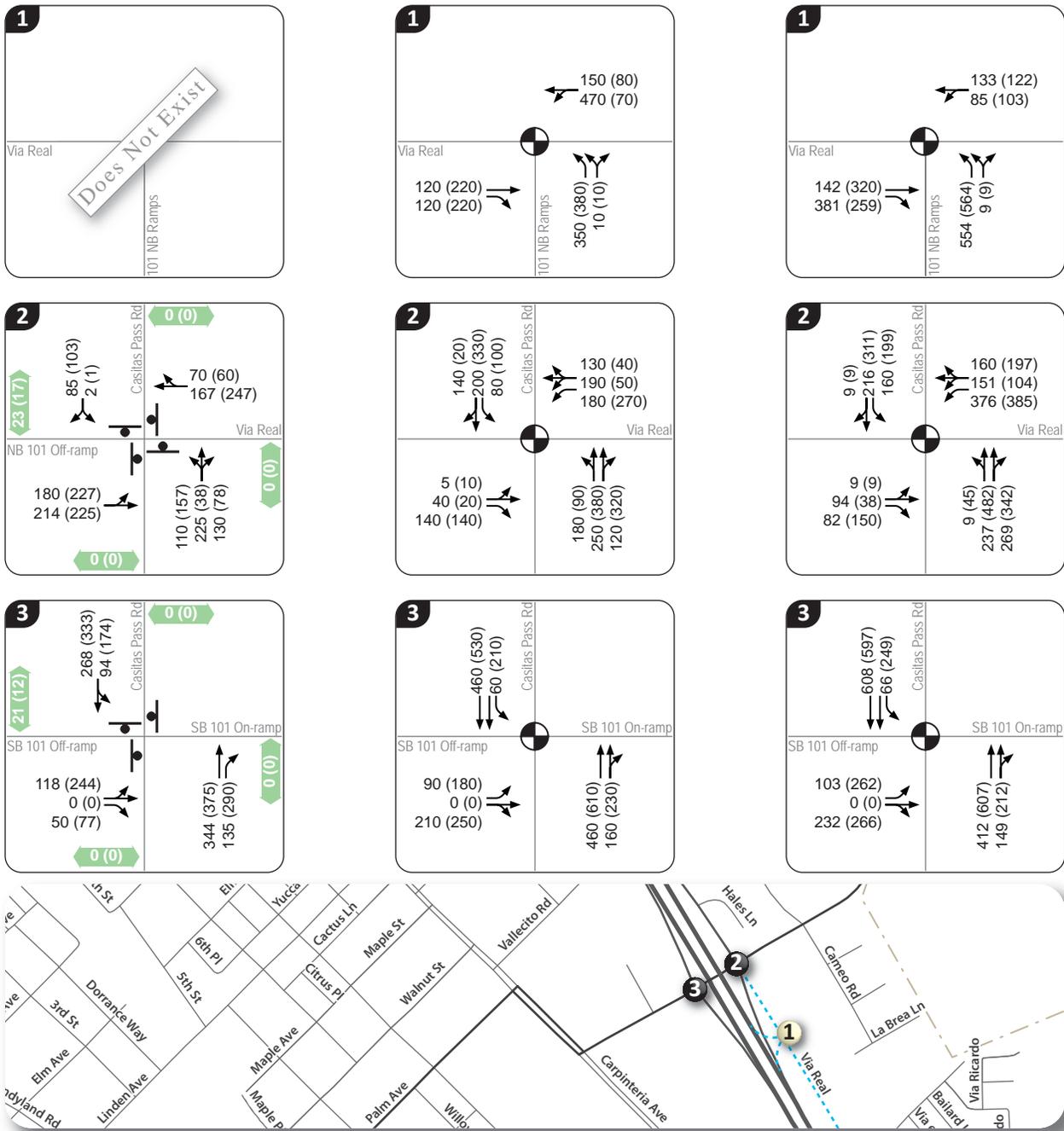
Based on peak hour roadway capacity thresholds contained in the HCM, 2-lane arterial roadways can accommodate up to 970 vehicles per hour to achieve LOS C conditions. Although the existing roadway traffic volumes along the Casitas Pass overcrossing is below this threshold, operations along this short segment is dictated by the US 101 ramp intersections, both of which are currently all-way stop controlled.



**Existing Volumes**

**Year 2016 Volumes**

**Year 2036 Volumes**



**VOLUMES KEY**

- XX (YY) AM (PM) Peak Hour Traffic Volumes
- # (#) AM (PM) Peak Hour Pedestrian Volumes

**MAP KEY**

- Stop Sign
- Traffic Signal
- Future Study Intersection
- Study Intersection
- Future Roadway

Figure 3-1.

**Casitas Pass Road Interchange  
Traffic Control, Lane Configurations and Traffic Volumes**

WC12-2991\_3-1\_CasitasVol



**TABLE 3-2 CASITAS PASS ROAD INTERCHANGE LEVEL OF SERVICE SUMMARY**

Scenario	Via Real / U.S. 101 NB Ramps (Intersection #1)		Via Real / Casitas Pass Rd (Intersection #2)		Casitas Pass Rd / U.S. 101 SB Ramps (Intersection #3)		System Total	
	Delay (sec.) <sup>1,2</sup>	LOS <sup>1,2</sup>	Delay (sec.) <sup>1,2</sup>	LOS <sup>1,2</sup>	Delay (sec.) <sup>1,2</sup>	LOS <sup>1,2</sup>	Delay (sec.) <sup>1</sup>	LOS
<b>Existing Conditions</b>	<i>Does not exist</i>		<b>41.3</b> (21.5)	E (C)	12.9 ( <b>29.2</b> )	B (D)	<b>54.2</b> (50.7)	D D
<b>Year 2016 Conditions</b>								
Previous design alternative (6-lane bridge)	24.8 (15.0)	C (B)	24.7 (21.6)	C (C)	9.4 (16.1)	A (B)	<b>58.9</b> (52.7)	E D
Current design alternative (5-lane bridge)	25.5 (13.5)	C (B)	25.0 (20.1)	C (C)	9.6 (18.0)	A (B)	<b>60.1</b> (51.6)	E D
Reduced capacity alternative (4-lane bridge)	26.3 (13.6)	C (B)	25.3 (19.3)	C (B)	12.3 (19.6)	B (B)	<b>63.9</b> (52.4)	E D
3-lane bridge alternative <sup>3</sup>	25.7 (14.2)	C (B)	33.5 (31.5)	C (C)	<b>&gt;120 (&gt;120)</b>	<b>F (F)</b>	<b>&gt;300</b> (>300)	F F
<b>Year 2036 Conditions</b>								
Previous design alternative (6-lane bridge)	15.2 (19.1)	B (B)	24.7 (29.9)	C (C)	9.7 (23.2)	A (C)	<b>49.6</b> (72.2)	D E
Current design alternative (5-lane bridge)	15.2 (18.4)	B (B)	25.0 (32.9)	C (C)	10.4 (24.5)	B (C)	<b>50.6</b> (75.8)	D E
Reduced capacity alternative (4-lane bridge)	15.3 (18.9)	B (B)	31.0 ( <b>35.5</b> )	C (D)	26.0 (31.5)	C (C)	<b>72.3</b> (76.2)	E E
3-lane bridge <sup>3</sup>	15.7 (18.9)	B (B)	<b>41.7 (38.7)</b>	<b>D (D)</b>	<b>&gt;120 (&gt;120)</b>	<b>F (F)</b>	<b>&gt;300</b> (>300)	F F

Notes:

1. Delay and Level of Service results presented for AM (PM) peak hours.
2. **Bold** denotes locations where level of service thresholds is exceeded.
3. Vehicles are being metered at the Casitas Pass Rd/US 101 Southbound Ramps intersection under this scenario. Full vehicle demand at downstream intersections are not being served and the actual vehicle delay is greater than shown.

Source: Fehr & Peers.



**TABLE 3-3 CASITAS PASS ROAD INTERCHANGE QUEUING SUMMARY**

Intersection	Movement	Storage Capacity (ft)	Peak Hour 95 <sup>th</sup> Percentile Queues (ft)							
			Year 2016				Year 2036			
			Previous Design (6-Lane)	Current Design (5-Lane)	Reduced Capacity (4-Lane)	Reduced Capacity (3-Lane) <sup>3</sup>	Previous Design (6-Lane)	Current Design (5-Lane)	Reduced Capacity (4-Lane)	Reduced Capacity (3-Lane) <sup>3</sup>
1. Via Real / U.S. 101 NB Ramps	NBL	900	110 (110)	120 (120)	100 (140)	100 (140)	180 (200)	200 (210)	210 (210)	210 (290)
	NBR	320	110 (110)	120 (120)	100 (140)	100 (140)	180 (200)	200 (210)	210 (210)	210 ( <b>370</b> )
	WBL/T	1,900	490 (110)	500 (110)	530 (120)	520 (110)	140 (160)	140 (160)	130 (180)	140 (160)
	EBT	420	110 (170)	110 (120)	110 (110)	90 (90)	70 (170)	70 (150)	80 (130)	70 (90)
	EBR	195	Free	Free	Free	Free	Free	Free	Free	Free
2. Via Real / Casitas Pass Road	NBL/T	220	120 (80)	<b>220</b> (200)	<b>240</b> (210)	<b>240</b> (240)	20 ( <b>240</b> )	150 ( <b>270</b> )	170 ( <b>290</b> )	<b>250</b> (240)
	NBT/R	220	210 (200)	210 ( <b>230</b> )	<b>220</b> (230)	<b>240</b> (240)	210 ( <b>270</b> )	<b>220</b> (270)	<b>240</b> (290)	<b>250</b> (240)
	SBL	170	100 (80)	90 (100)	100 (110)	80 (100)	140 ( <b>180</b> )	150 ( <b>210</b> )	<b>170</b> (250)	<b>190</b> (240)
	SBT/R	400	270 (170)	260 (240)	270 (260)	250 (230)	180 (240)	180 (250)	280 (310)	320 (290)
	WBL	420	90 (210)	80 (80)	130 (170)	140 (200)	170 (370)	160 ( <b>460</b> )	230 (320)	230 ( <b>440</b> )
	WBL/T/R	420	360 (280)	380 (250)	240 (90)	220 (90)	250 ( <b>470</b> )	270 ( <b>510</b> )	170 (380)	170 (180)
	EBL/T	370	60 (40)	70 (60)	70 (60)	70 (60)	120 (70)	130 (70)	130 (80)	150 (80)
EBR	125	50 (50)	50 (70)	70 (90)	70 (80)	60 (70)	60 (70)	90 (100)	100 (100)	
3. Casitas Pass Road / U.S. 101	NBT	700	120 (190)	120 (260)	140 (230)	<b>1,100</b> (1,530)	90 (280)	90 (300)	160 (330)	520 ( <b>1,060</b> )
	NBT/R	700	140 (280)	150 (370)	170 (360)	<b>1,200</b> (1,580)	190 (370)	190 (360)	250 (390)	270 ( <b>1,120</b> )



**TABLE 3-3 CASITAS PASS ROAD INTERCHANGE QUEUING SUMMARY**

Intersection	Movement	Storage Capacity (ft)	Peak Hour 95 <sup>th</sup> Percentile Queues (ft)							
			Year 2016				Year 2036			
			Previous Design (6-Lane)	Current Design (5-Lane)	Reduced Capacity (4-Lane)	Reduced Capacity (3-Lane) <sup>3</sup>	Previous Design (6-Lane)	Current Design (5-Lane)	Reduced Capacity (4-Lane)	Reduced Capacity (3-Lane) <sup>3</sup>
SB Ramps	SBL	220	70 (150)	90 (220)	90 ( <b>230</b> )	90 (210)	70 (150)	90 ( <b>230</b> )	100 ( <b>270</b> )	90 ( <b>240</b> )
	SBT	220	80 (110)	80 (100)	180 (170)	<b>250 (230)</b>	120 (160)	130 (150)	<b>270 (280)</b>	<b>250 (250)</b>
	EBL	350	120 (190)	120 (190)	150 (190)	<b>460 (450)</b>	130 (300)	130 (170)	200 (220)	<b>470 (480)</b>
	EBT/R	1,140	90 (90)	80 (110)	90 (130)	<b>1,560 (1,190)</b>	100 (120)	100 (320)	520 (380)	<b>1,510 (1,560)</b>

Notes:

1. Queue results presented for AM (PM) peak hours.
2. **Bold** denotes locations where queues are equal to or greater than available storage.
3. Vehicles are being metered at the Casitas Pass Rd/US 101 Southbound Ramps intersection under this scenario. Full vehicle demand at downstream intersections are not being served and the actual vehicle queues are greater than shown.

Source: Fehr & Peers.



### 3.1.3 BICYCLE, PEDESTRIAN, AND EMERGENCY VEHICLE CONSIDERATIONS

Pedestrian access along the Casitas Pass Road bridge is currently provided only along the west side of the bridge and is relatively narrow at four feet wide. There is a striped crosswalk across Casitas Pass Road at its intersection with the U.S. 101 Southbound Ramps. Pedestrian crossings for north-south traffic parallel to Casitas Pass Road exist across the Southbound Ramp intersection and Via Real along the west side of the roadway. No pedestrian access is accommodated along the east side of Casitas Pass Road over Highway 101.

While bike lanes are provided along Casitas Pass Road north and south of the U.S. 101 overcrossing, they are not provided along the narrow 2-lane bridge structure. Bicyclists commonly utilize the sidewalk to cross the bridge.

The Casitas Pass Road bridge currently provides one travel lane in each direction. As shown on Table 3-2, during both AM and PM peak hours, at least one of the intersections operate at unacceptable levels (LOS D or worse) under existing conditions. As the volume of traffic during the peak hours exist for more than six hours a day, emergency vehicles may experience increased delay due to the limited capacity along the bridge, vehicle queues stretching between intersections over the bridge, and because the intersections at both ends are unsignalized with stop-controlled approaches.

## 3.2 YEAR 2016 CONDITIONS

This chapter presents the results from traffic signal warrant evaluation and traffic operations analysis for Year 2016 with the proposed Project.

### 3.2.1 TRAFFIC SIGNAL WARRANTS

The peak hour volume traffic signal warrant (Warrant 3) and average daily traffic volume warrant for urban conditions were evaluated for the unsignalized intersections in the study area under Year 2016 conditions. The results of the traffic signal warrant analyses are shown in Table 3-1.

As shown in the table, the urban peak hour signal warrant and average daily traffic warrant are satisfied during at least one of the peak hours at all three of the unsignalized study intersections at the Casitas Pass Road Interchange under Year 2016 conditions. Additionally, the average daily traffic warrant is satisfied at all three study intersections. Detailed signal warrant calculations are provided in Appendix B.



### 3.2.2 INTERSECTION OPERATIONS

The intersection traffic operations were evaluated using the SimTraffic models developed as part of the previous study for this analysis scenario, which includes the proposed roadway improvements described in Section 2.3.2. Since all of the study intersections presented in Table 3-1 satisfy the peak hour signal warrants, the operations analysis was performed assuming that they are signalized as part of the proposed project improvements.

The intersection peak hour traffic volumes for Year 2016 conditions are presented in Figure 3-1. Table 3-2 presents the simulated intersection level of service results for the three study intersections at the Casitas Pass Road Interchange. The queuing results are presented in Table 3-3. The intersection level of service and queuing results for the various design alternatives are also presented in Figures 3-2 through 3-5. Detailed calculation worksheets are provided in Appendix A.

As shown on Table 3-2, the study intersections at the Casitas Pass Road interchange are anticipated to operate at LOS C or better during both AM and PM peak hours under all Year 2016 design alternatives with the exception of the Casitas Pass Road/US 101 Southbound Ramps intersection under the Reduced Capacity 3-lane bridge alternative.

A total systemwide delay, which is the sum of the intersection control delay for each of the three study intersections at the Casitas Pass Road interchange, was calculated for the various design alternatives for comparison. The total systemwide delay for the Previous design (6-lane bridge), Current design (5-lane bridge), and Reduced Capacity (4-lane bridge) alternatives are similar, while that of the 3-lane bridge alternative is significantly higher during both peak hours.

As shown on Table 3-3, queues at the US-101 Southbound Off-ramps are anticipated to spill back onto the freeway mainline under the Reduced Capacity 3-lane design alternative. Additionally, under this design alternative, queues along northbound Casitas Pass Road are anticipated to extend back to Carpinteria Avenue during at least one of the peak hours, thus blocking access to all of the driveways south of the interchange. Vehicle queues along Via Real are not anticipated to spill back to upstream intersections under any of the design alternative scenarios.





Figure 3-2.  
 Casitas Pass Road Interchange Queueing Summary  
 2016 Previous Design Alternative (6-Lane Bridge)

WC12-2991\_3-2\_CasitasQueue\_6Lane



Figure 3-3.  
 Casitas Pass Road Interchange Queueing Summary  
 2016 Current Design Alternative (5-Lane Bridge)

WC12-2991\_3-3\_CasitasQueue\_5Lane



Figure 3-4.  
 Casitas Pass Road Interchange Queueing Summary  
 2016 Reduced Capacity Alternative (4-Lane Bridge)

WC12-2991\_3-4\_CasitasQueue\_4Lane

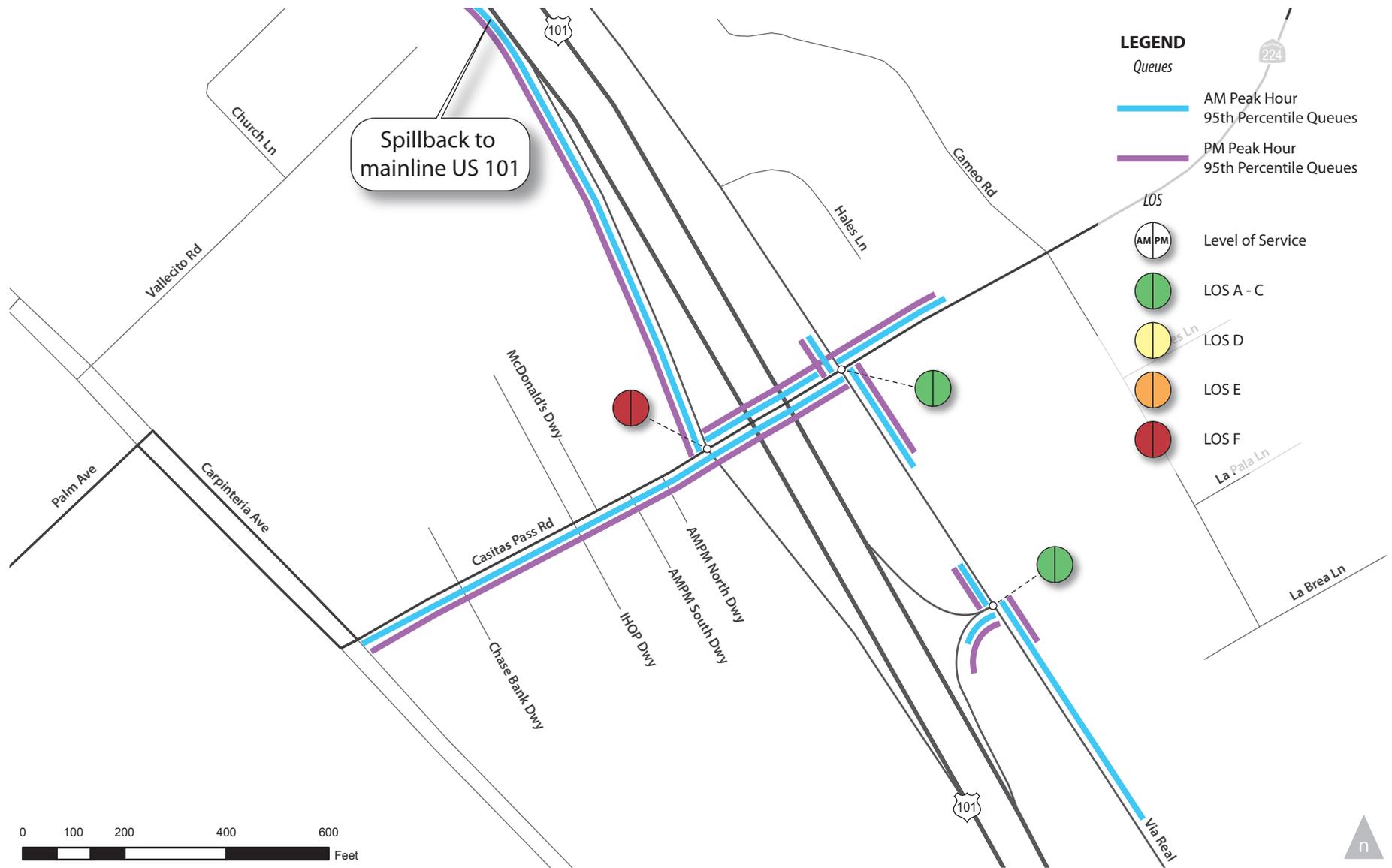


Figure 3-5.

**Casitas Pass Road Interchange Queueing Summary  
2016 Reduced Capacity Alternative (3-Lane Bridge)**

WC12-2991\_3-5\_CasitasQueue\_3Lane

## 3.3 YEAR 2036 CONDITIONS

This chapter presents the results from traffic signal warrant evaluation and traffic operations analysis for Year 2036 with the proposed Project.

### 3.3.1 TRAFFIC SIGNAL WARRANTS

The peak hour volume traffic signal warrant (Warrant 3) and average daily traffic volume warrant for urban conditions were evaluated for the unsignalized intersections in the study area under Year 2036 conditions. The results of the traffic signal warrant analyses are shown in Table 3-1.

As shown in the table, the urban peak hour signal warrant and average daily traffic warrant are satisfied during both AM and PM peak hours at all three of the unsignalized study intersections at the Casitas Pass Road Interchange under Year 2036 conditions. Additionally, the average daily traffic warrant is satisfied for all three study intersections. Detailed signal warrant calculations are provided in Appendix B.

### 3.3.2 INTERSECTION OPERATIONS

The intersection traffic operations were evaluated using the SimTraffic models developed as part of the previous study for this analysis scenario, which includes the proposed roadway improvements described in Section 2.3.2. Since all of the study intersections presented in Table 3-1 satisfy the peak hour signal warrants, the operations analysis was performed assuming that they are signalized as part of the proposed project improvements.

The intersection peak hour traffic volumes for Year 2016 conditions are presented in Figure 3-1. Table 3-2 presents the simulated intersection level of service results for the three study intersections at the Casitas Pass Road Interchange. The queuing results are presented in Table 3-3. The intersection level of service and queuing results for the various design alternatives are also presented in Figures 3-6 through 3-9. Detailed calculation worksheets are provided in Appendix A.

As shown on Table, 3-2, the study intersections at the Casitas Pass Road interchange are anticipated to operate at LOS C or better during both AM and PM peak hours under all Year 2036 design alternatives except for both Reduced Capacity 4- and 3-lane bridge alternatives. Under the 4-lane bridge alternative, the Via Real/Casitas Pass Road intersection is anticipated to operate at LOS D during the PM peak hour. Under the 3-lane bridge alternative, the Via Real/Casitas Pass Road intersection is anticipated to operate at LOS D during both AM and PM peak hours, and the Casitas Pass Road/US-101 Southbound Ramps



intersection is anticipated to operate at LOS F during both AM and PM peak hours; the significant delay experienced at the Casitas Pass Road/US-101 Southbound Ramps intersection would meter traffic through the corridor and result in demand at downstream intersections to not be completely served.

The total systemwide delay for the previous design (6-lane bridge) and current design (5-lane bridge) alternatives are similar, while that of both Reduced Capacity (4- and 3-lane bridge) alternatives are significantly higher during at least one of the peak hours.

As shown on Table 3-3, queues at the US-101 Southbound Off-ramps are anticipated to spill back onto the freeway mainline under the Reduced Capacity 3-lane design alternative. Additionally, under this design alternative, queues along northbound Casitas Pass Road are anticipated to extend back to Carpinteria Avenue during at least one of the peak hours, thus blocking access to all of the driveways south of the interchange. Vehicle queues along Via Real are not anticipated to spill back to upstream intersections under any of the design alternative scenarios.





Figure 3-6.  
 Casitas Pass Road Interchange Queueing Summary  
 2036 Previous Design Alternative (6-Lane Bridge)

WC12-2991\_3-6\_CasitasQueue\_2036-6Lane



Figure 3-7.

**Casitas Pass Road Interchange Queueing Summary  
2036 Current Design Alternative (5-Lane Bridge)**

WC12-2991\_3-7\_CasitasQueue\_2036-5Lane



Figure 3-8.  
 Casitas Pass Road Interchange Queueing Summary  
 2036 Reduced Capacity Alternative (4-Lane Bridge)

WC12-2991\_3-8\_CasitasQueue\_2036-4Lane

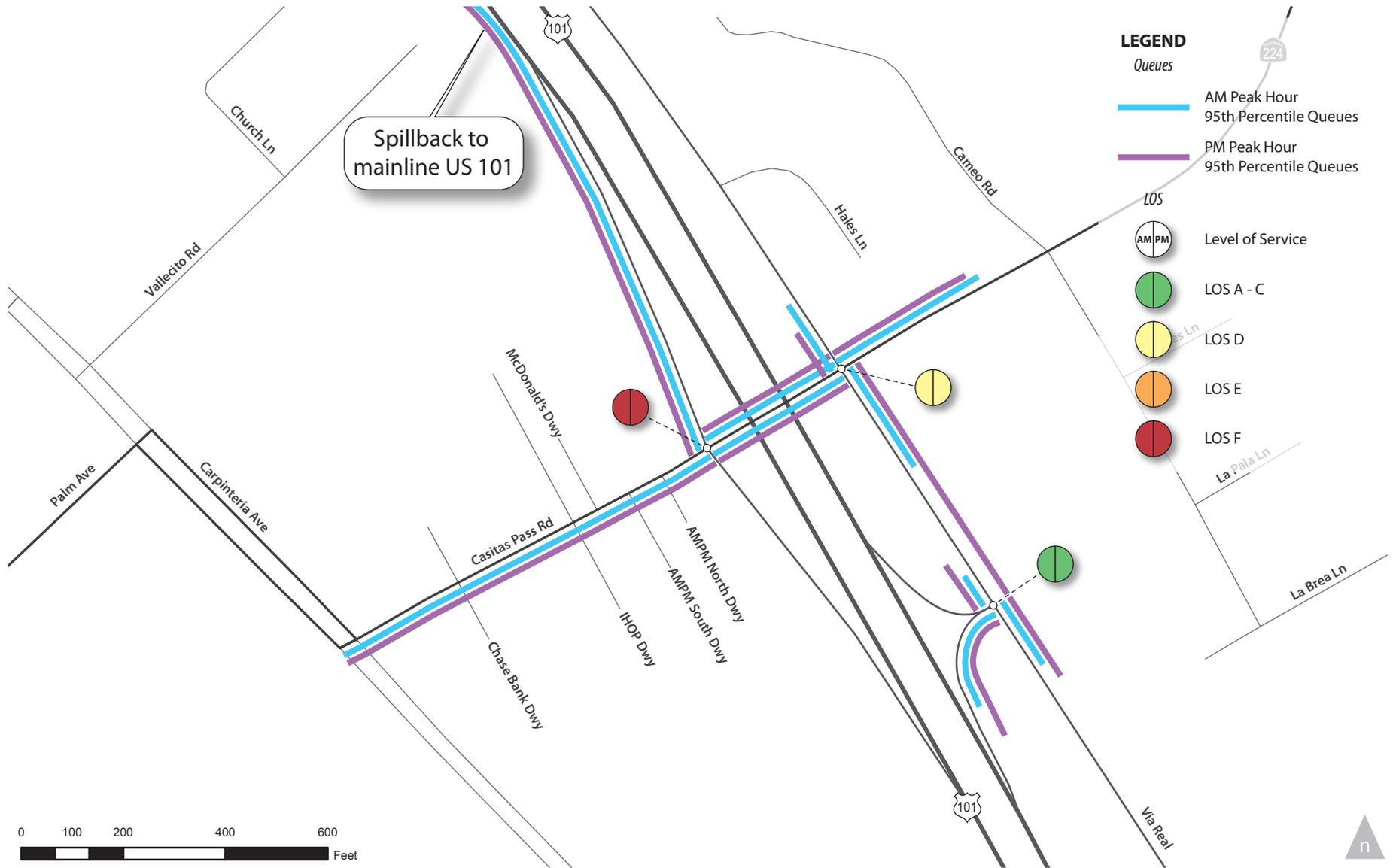


Figure 3-9.  
 Casitas Pass Road Interchange Queueing Summary  
 2036 Reduced Capacity Alternative (3-Lane Bridge)

WC12-2991\_3-9\_CasitasQueue\_2036-3Lane

## 4.0 LINDEN AVENUE INTERCHANGE

This section presents the results of the traffic operations analysis at the Linden Avenue Interchange under Existing Conditions, Year 2016, and Year 2036 scenarios. For both future year scenarios, two separate design alternatives were evaluated; one alternative assumes that the US 101/Linden Avenue ramp intersections remain side street stop controlled and the other alternative assumes that they are signalized.

### 4.1 EXISTING CONDITIONS

In order to determine the current operations, peak hour capacity analyses were performed for Linden Avenue/Ogan Road and Linden Avenue/US 101 Southbound Off-ramp intersections. The peak hour and average daily traffic signal warrants were also evaluated for unsignalized intersections based on the 2010 *California Manual on Uniform Traffic Control Devices* (CA MUTCD). The following summarizes the analysis results for existing conditions.

#### 4.1.1 TRAFFIC SIGNAL WARRANTS

The peak hour volume traffic signal warrant (Warrant 3) and average daily traffic volume warrant for urban conditions, as contained in Chapter 4C of the CA MUTCD, were evaluated for the unsignalized intersections in the study area. The results of the traffic signal warrant analyses are shown in Table 4-1.

**TABLE 4-1 YEAR 2016 PEAK HOUR SIGNAL WARRANT ANALYSIS**

Intersection	Existing Conditions	Year 2016	Year 2036
4. Linden Avenue / Ogan Road	No / No / Yes	Yes / Yes / Yes	Yes / Yes / Yes
5. Linden Avenue / U.S. 101 SB Off-ramp	No / No / Yes	Yes / Yes / Yes	Yes / Yes / Yes

Note: Warrant results presented for AM peak hour / PM peak hour / Daily thresholds.  
 Source: Fehr & Peers.

As shown in the table, both Linden Avenue/Ogan Road and Linden Avenue/US101 Southbound Off-ramp intersections currently satisfy the average daily traffic signal warrant. Detailed peak hour signal warrant calculations are provided in Appendix B.



#### 4.1.2 INTERSECTION OPERATIONS

Existing intersection traffic operations were evaluated using the SimTraffic models developed as part of the previous traffic study. The intersection traffic control, lane configurations, and peak hour traffic volumes for the Linden Avenue interchange study intersections are presented in Figure 4-1. The simulation models were recorded for the peak hour. Table 4-2 present the simulated intersection level of service results for the existing study intersections at the Linden Avenue interchange. The queuing results are presented in Table 4-3. Detailed calculation worksheets are provided in Appendix A.

**TABLE 4-2 LINDEN AVENUE INTERCHANGE LEVEL OF SERVICE SUMMARY**

Scenario	Linden Avenue / Ogan Road (Intersection #4)		Linden Avenue / U.S. 101 SB Off-ramp (Intersection #5)		Ogan Road / Via Real / U.S. 101 NB On-ramp (Intersection #6) <sup>2</sup>	
	Delay (sec.) <sup>3,4</sup>	LOS <sup>3,4</sup>	Delay (sec.) <sup>3,4</sup>	LOS <sup>3,4</sup>	V/C <sup>3,4</sup>	LOS <sup>3,4</sup>
<b>Existing Conditions<sup>1</sup></b>	20.7 (13.7)	C (B)	<b>25.5 (31.6)</b>	<b>D (D)</b>	N/A	N/A
<b>Year 2016 Conditions</b>						
Stop Controlled <sup>1,2</sup>	<b>25.5 (27.1)</b>	<b>D (D)</b>	19.8 (18.0)	C (C)	<b>0.84</b> (0.50)	<b>E</b> (A)
Signalized <sup>2</sup>	34.5 (18.4)	C (B)	10.5 (11.7)	B (B)	<b>0.84</b> (0.50)	<b>E</b> (A)
<b>Year 2036 Conditions</b>						
Stop Controlled <sup>1,2</sup>	<b>31.4 (181.7)</b>	<b>D (F)</b>	<b>64.6 (81.8)</b>	<b>F (F)</b>	0.68 (0.69)	C (C)
Signalized <sup>2</sup>	16.4 (12.2)	B (B)	13.4 (12.5)	B (B)	0.65 (0.51)	C (A)

Notes:

- Linden Ave/Ogan Rd and Linden Ave/US 101 SB Off-ramp intersections are Side Street Stop Controlled (SSSC) under these conditions; delay and LOS are reflective of side street approach operations.
- Ogan Rd/Via Real/US 101 NB On-ramp intersection is uncontrolled under Existing Conditions and a roundabout under 2016 and 2036 conditions; results are presented as V/C for roundabout.
- Delay, V/C and Level of Service results presented for AM (PM) peak hours.
- Bold** denotes locations where level of service thresholds is exceeded.

Source: Fehr & Peers.



As shown, the Linden Avenue/US 101 Southbound Off-ramp intersection currently operates at LOS D during both AM and PM peak hours. The Linden Avenue/Ogan Road intersection currently operates at LOS C and B during the AM and PM peak hours, respectively. The roundabout operates at LOS E under 2016 conditions due to mainline diversion traveling from Via Real to the Northbound On-ramp until US 101 is widened.

**TABLE 4-3 LINDEN AVENUE INTERCHANGE QUEUING SUMMARY**

Intersection	Movement	Storage Capacity (ft)	Peak Hour 95 <sup>th</sup> Percentile Queues (ft)			
			Year 2016		Year 2036	
			Stop Controlled	Signalized	Stop Controlled	Signalized
4. Linden Avenue / Ogan Road	WBL	70	50 (50)	70 ( <b>100</b> )	40 (60)	50 (60)
	WBR	230	70 (40)	70 (70)	80 (50)	80 (60)
	NBT	360	360 (140)	310 (260)	<b>470 (460)</b>	350 (290)
	NBR	360	<b>410 (140)</b>	340 (180)	<b>480 (480)</b>	320 (130)
	SBL	140	130 (90)	<b>200 (200)</b>	110 (110)	<b>200 (170)</b>
	SBT	240	150 (80)	<b>630 (310)</b>	100 (90)	<b>370 (140)</b>
5. Linden Avenue / U.S. 101 SB Off-ramp	EBL	290	90 (80)	180 (200)	200 ( <b>310</b> )	250 (220)
	EBR	930	70 (70)	70 (70)	230 (800)	170 (100)
	NBT	440	190 (90)	170 (150)	<b>650 (930)</b>	230 (190)
	SBT	360	90 (90)	160 (130)	140 (150)	170 (170)
6. Ogan Road / Via Real / U.S. 101 NB On-ramp	WBT	150	50 (30)	40 (30)	30 (30)	30 (20)
	NBT	1,000	80 (30)	80 (30)	20 (30)	10 (20)
	SBT	230	<b>280 (50)</b>	<b>280 (110)</b>	60 (60)	140 (80)

Notes:

1. Queue results presented for AM (PM) peak hours.
2. **Bold** denotes locations where queues are equal to or greater than available storage.

Source: Fehr & Peers.

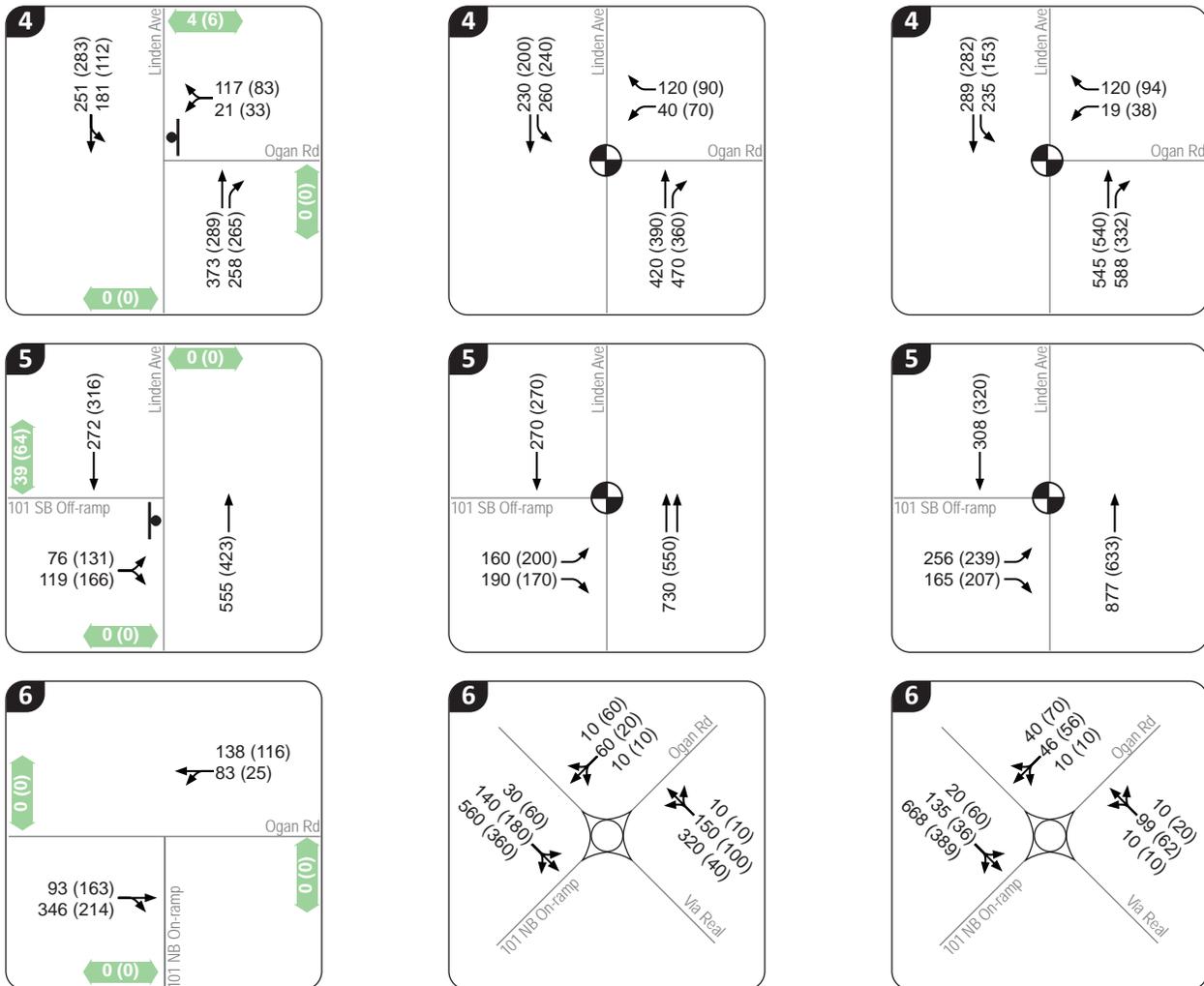
As shown, queues at the US-101 Southbound Off-ramp at Linden Avenue are not anticipated to spill back onto the freeway mainline.



**Existing Volumes**

**Year 2016 Volumes**

**Year 2036 Volumes**



**VOLUMES KEY**

XX (YY) AM (PM) Peak Hour Traffic Volumes  
 # (#) AM (PM) Peak Hour Pedestrian Volumes

Stop Sign  
 Traffic Signal  
 Roundabout

**MAP KEY**

1 Future Study Intersection  
 2 Study Intersection  
 Future Roadway

Figure 4-1.

**Linden Avenue Interchange  
 Traffic Control, Lane Configurations and Traffic Volumes**

WC12-2991\_4-1\_LindenVol



## 4.2 YEAR 2016 CONDITIONS

This chapter presents the results from traffic signal warrant evaluation and traffic operations analysis for Year 2016 with the proposed Project.

### 4.2.1 TRAFFIC SIGNAL WARRANTS

The peak hour volume traffic signal warrant (Warrant 3) and average daily traffic volume warrant for urban conditions were evaluated for the unsignalized intersections in the study area under Year 2016 conditions. The results of the traffic signal warrant analyses are shown in Table 4-1.

As shown in the table, both Linden Avenue/Ogan Road and Linden Avenue/US101 Southbound Off-ramp intersections satisfy the peak hour and average daily traffic signal warrants under this analysis scenario. Detailed peak hour signal warrant calculations are provided in Appendix B.

### 4.2.2 INTERSECTION OPERATIONS

The intersection traffic control, lane configurations, and peak hour traffic volumes for the Linden Avenue interchange study intersections are presented in Figure 4-1. The simulation models were recorded for the peak hour. Table 4-2 present the simulated intersection level of service results for the study intersections at the Linden Avenue interchange. The queuing results are presented in Table 4-3. The intersection level of service and queuing results for both stop controlled and signalized intersection alternatives are also presented in Figures 4-2 and 4-3, respectively. Detailed calculation worksheets are provided in Appendix A.

As shown in Table 4-2, the Linden Avenue/Ogan Road intersection is anticipated to operate at LOS D during both peak hours if assumed to remain side street stop controlled. However, if signalized, the intersection would operate at LOS C or better during both peak hours. The side street delay at Linden Avenue/US 101 Southbound Off-ramp is lower under Year 2016 conditions than as compared to Existing conditions. This is primarily due to the increased capacity assumed to be in place by 2016 as part of the proposed interchange improvements.

As shown on Table 4-3, queues at the US-101 Southbound Off-ramp at Linden Avenue are not anticipated to spill back onto the freeway mainline. Vehicle queues along southbound Linden Avenue are anticipated to extend past Nipomo Drive during the AM peak hour under both analysis scenarios.





Figure 4-2.  
 Linden Avenue Interchange Queueing Summary  
 2016 Stop-Controlled Intersection Alternative

WC12-2991\_4-2\_LindenQueue\_2016SC



Figure 4-3.  
 Linden Avenue Interchange Queueing Summary  
 2016 Signalized Intersection Alternative

WC12-2991\_4-3\_LindenQueue\_2016SI

## 4.3 YEAR 2036 CONDITIONS

This chapter presents the results from traffic signal warrant evaluation and traffic operations analysis for Year 2036 with the proposed Project.

### 4.3.1 TRAFFIC SIGNAL WARRANTS

The peak hour volume traffic signal warrant (Warrant 3) and average daily traffic volume warrant for urban conditions were evaluated for the unsignalized intersections in the study area under Year 2036 conditions. The results of the traffic signal warrant analyses are shown in Table 4-1.

As shown in the table, both Linden Avenue/Ogan Road and Linden Avenue/US101 Southbound Off-ramp intersections satisfy the peak hour and average daily traffic signal warrants under this analysis scenario. Detailed peak hour signal warrant calculations are provided in Appendix B.

### 4.3.2 INTERSECTION OPERATIONS

The intersection traffic control, lane configurations, and peak hour traffic volumes for the Linden Avenue interchange study intersections are presented in Figure 4-1. The simulation models were recorded for the peak hour. Table 4-2 present the simulated intersection level of service results for the study intersections at the Linden Avenue interchange. The queuing results are presented in Table 4-3. The intersection level of service and queuing results for both stop controlled and signalized intersection alternatives are also presented in Figures 4-4 and 4-5, respectively. Detailed calculation worksheets are provided in Appendix A.

As shown in Table 4-2, the Linden Avenue/Ogan Road and Linden Avenue/US 101 Southbound Off-ramp intersections are anticipated to operate at unacceptable levels during both peak hours if assumed to remain side street stop controlled. The side street delay experienced at the US 101 Southbound off-ramp approach at Linden Avenue is expected to increase significantly as compared to Year 2016 conditions. However, if the Linden Avenue/Ogan Road and Linden Avenue/US 101 Southbound Off-ramp intersections are signalized, both would operate at LOS B during the AM and PM peak hours.

At the Ogan Road/Via Real/US 101 Northbound On-ramp intersection, the proposed roundabout is anticipated to operate at LOS E during the AM peak hour under Year 2016 conditions. Currently, vehicles use the local streets to bypass congestion along the US 101 and an increasing number divert in 2016. Once the US 101 is widened, which is planned to be prior to 2036, the vehicles using the local streets will



no longer divert from the freeway mainline and, therefore, operations at the Ogan Road/Via Real/US 101 Northbound On-ramp intersection is expected to improve.

As shown on Table 4-3, queues at the US-101 Southbound Off-ramp at Linden Avenue are not anticipated to spill back onto the freeway mainline. Vehicle queues along northbound Linden Avenue are anticipated to extend past Sawyer Avenue south of the US 101 interchange under the 2036 Stop Controlled scenario; if the interchange intersections are signalized, northbound Linden Avenue queues will not spill back to Sawyer Avenue. Vehicle queues along southbound Linden Avenue are anticipated to extend past Nipomo Drive during the AM peak hour under both scenarios.



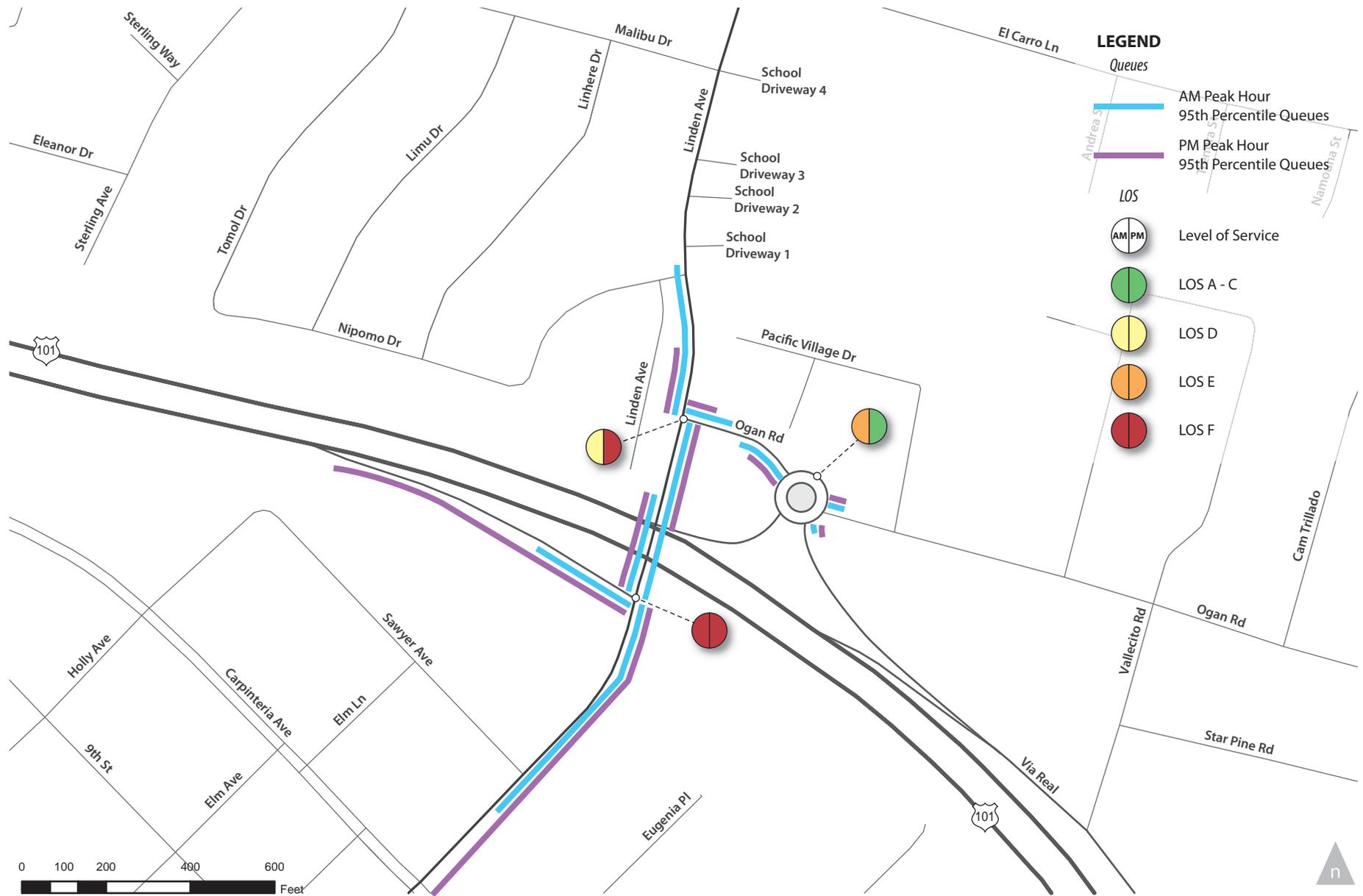


Figure 4-4.  
 Linden Avenue Interchange Queueing Summary  
 2036 Stop-Controlled Intersection Alternative

WC12-2991\_4-4\_LindenQueue\_2036SC



Figure 4-5.  
 Linden Avenue Interchange Queueing Summary  
 2036 Signalized Intersection Alternative

WC12-2991\_4-5\_LindenQueue\_2036SI

**APPENDIX A: SIMTRAFFIC LOS AND QUEUING OUTPUT SHEETS**



**APPENDIX B: SIGNAL WARRANT SHEETS**

