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Final Traffic Analysis Report

U.S. 101 / Linden Avenue and U.S. 101 / Casitas Pass Road Interchange Improvement Project

Caltrans

SBCAG
santa barbara county association of governments

CITY OF CARPINTERIA, CALIFORNIA
INCORPORATED 1965

URS

Prepared for:
Caltrans
Santa Barbara County Association of Governments
City of Carpinteria
URS

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EXECUTIVE SUMMARY

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 when a proposed widening met community opposition. 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.

STUDY AREA

The study area falls within the City of Carpinteria and includes the Linden Avenue, Casitas Pass Road, Bailard Avenue, and State Route (SR) 150 interchanges with U.S. 101. In addition to the intersections associated with these interchanges, the study addresses project impacts at several locations along key local roadways including Carpinteria Avenue, Via Real, and Ogan Road. The following 20 intersections were evaluated as part of this study.

1) Linden Avenue/Carpinteria Avenue
2) Linden Avenue/Sawyer Avenue
3) Linden Avenue/U.S. 101 Southbound Off-Ramp
4) Linden Avenue/Ogan Road
5) U.S. 101 Northbound On-Ramp/Ogan Road
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17) State Route 150/U.S. 101 Southbound Ramps
18) State Route 150/U.S. 101 Northbound Ramps
19) State Route 150/Via Real
20) State Route 150/Casitas Pass Road

EXISTING INTERSECTION ANALYSIS

Based on the analysis, all of the study intersections operate at acceptable LOS C or better conditions during the AM and PM peak hour, except the following intersection approaches:

- *Linden Avenue/Sawyer Avenue* – The southbound approach currently operates at LOS D during the AM peak hour.
- *Linden Avenue/U.S. 101 Southbound Off-Ramp* – The southbound (off-ramp) approach currently operates at LOS D during the AM and PM peak hour.

- *Casitas Pass Road/Via Real/U.S. 101 Northbound Off-ramp* – This all-way stop-controlled intersection operates at LOS E during the AM peak hour.
- *Bailard Avenue/U.S. 101 Southbound Ramps* – The southbound (off-ramp) approach currently operates at LOS E during the PM peak hour.
- *Bailard Avenue/U.S. 101 Northbound Ramps* – The northbound (off-ramp) approach currently operates at LOS F during the AM peak hour.
- *SR 150/U.S. 101 Southbound Ramps* – The southbound (off-ramp) approach currently operates at LOS F during the PM peak hour.

IMPROVEMENT ALTERNATIVES

The Linden Avenue and Casitas Pass Road Interchange Improvements Project will provide additional capacity at the interchanges to minimize vehicle delay and provide acceptable levels of service in the future. Four interchange improvement alternative plans are proposed as part of the project. The primary difference between the alternatives is the proposed design of the Linden Avenue interchange. While Alternatives 1 and 4 propose the same design at the Linden Avenue interchange, they differ on the alignment of Via Real between Vallecito Road and Linden Avenue. From a traffic operations standpoint, Alternative 1 and 4 are identical. All four alternatives propose the same interchange improvements at the Casitas Pass Road interchange.

ALTERNATIVE 1 consists of reconfiguring the Linden Avenue and Casitas Pass Road interchanges and extending Via Real from its current terminus to Linden Avenue. Alternative 1 would provide a tight diamond configuration (Type L-1) on the north side of Linden Avenue. Access to and from the south on Linden Avenue would not be provided. At Casitas Pass Road, diagonal southbound on- and off-ramps would be provided on the west side of U.S. 101. In the northbound direction, on- and off-hook ramps would be provided on the new extension of Via Real.

ALTERNATIVE 2 is similar to Alternative 1 except that the Linden Avenue northbound on-ramp would be provided at Via Real.

ALTERNATIVE 3 is similar to Alternative 1 except that the Linden Avenue northbound on-ramp would be provided via a roundabout intersection at Via Real/Ogan Road.

ALTERNATIVE 4 is almost identical to Alternative 1. The only difference between Alternative 1 and 4 is the exact alignment of the Via Real extension near Linden Avenue. From a traffic operations standpoint, both alternatives would provide identical service levels.

TRAFFIC FORECASTS

The forecasting process was performed using a combination of the updated SBCAG regional travel demand model (developed in the TransCAD software) and VISUM modeling software. The SBCAG model is a newly expanded model calibrated for the entire Santa Barbara County. The model focuses on estimating regional travel for the entire county. Since the Linden Avenue and Casitas Pass Road Interchange Improvements Project focuses on one important localized area of the U.S. 101 corridor in the South Coast, the SBCAG model was supplemented by a more detailed sub-area model. VISUM was employed to facilitate the estimation of travel patterns in the project area on a more refined level of detail, including collectors, local streets, and new ramps with specific peak hour turning movements to capture the local-scale distributional effects of the interchange improvements.

Traffic forecasts were developed for years 2016 and 2036 and are based on year 2002 traffic counts. The following presents a general description of the traffic volume changes over time and between the No Project and With Project scenarios.

- Under Year 2016 conditions, traffic diversion from northbound U.S. 101 will continue to occur during the AM peak hour. Under No Project conditions, traffic will divert to Carpinteria Avenue while under Project conditions, traffic will divert to both Carpinteria Avenue and Via Real.

- Under Year 2016 conditions, southbound traffic on U.S. 101 was constrained to 4,000 vehicles per hour during the PM peak hour. High volumes on southbound U.S. 101 result in southbound local traffic using Carpinteria Avenue to bypass congestion on southbound U.S. 101 under No Project conditions. Similarly, Carpinteria Avenue and Via Real are used to bypass congestion on southbound U.S. 101 under With Project conditions.

- The Via Real extension provided under Alternatives 1 through 4 provides a local connection for the land uses located on the east side of U.S. 101. The Via Real extension would permit access between the uses without requiring freeway use, resulting in lower freeway volumes for the With Project conditions compared to the No Project conditions for both 2016 and 2036.

PROJECT IMPACTS AND MITIGATION

The table below identifies the project impacts and the mitigation to improve the intersections to acceptable levels of service. As shown, the Linden Avenue interchange requires mitigation under Alternatives 1 and 4, while the Casitas Pass Road interchange requires mitigation under all of the alternatives.

PROJECT IMPACTS AND MITIGATION SUMMARY

Project Impact Location	Alternative	Mitigation
4. Via Real / Linden Avenue	1 and 4	Stripe exclusive right-turn lane on Via Real as a shared left/right-turn lane.
9. Casitas Pass Road / U.S. 101 SB Ramps	1, 2, 3, and 4	Provide additional exclusive westbound left-turn lane from Casitas Pass Road to southbound on-ramp.
10. Casitas Pass Road / Via Real / U.S. 101 NB Off-Ramp	1, 2, 3, and 4	Convert southbound shared left/through/right-turn lane to an exclusive right and shared through/left-turn lane. Convert northbound shared left/through/right-turn lane to exclusive an exclusive left-turn lane, a shared left/through lane, and an exclusive right-turn lane. Convert the westbound shared left/through lane to an exclusive left-turn lane.
21. Linden Avenue / U.S. 101 NB On-Ramp	1 and 4	Convert one of the eastbound through lanes to an exclusive left-turn lane.
23. Via Real / U.S. 101 NB Ramps	1, 2, 3, and 4	Provide an exclusive left-turn lane at the off-ramp in addition to shared left/right-turn lane. Provide an exclusive southbound right-turn lane.

Source: Fehr & Peers, 2007.

YEAR 2016 AND 2036 TRAFFIC OPERATIONS

The table below summarizes the number of intersections operating at LOS D or worse, vehicle hours of network delay, number of positive benefits, and number of negative impacts to the study intersections with and without mitigation. Without any improvements (No Project Conditions), the number of intersections operating at LOS D or worse is projected to increase significantly when compared to Existing Conditions. In addition, under 2036 Design Year Conditions, vehicle hours of delay would increase substantially when compared to Opening Year Conditions.

Under all scenarios, Alternatives 1 through 4 provide improved traffic operations when compared to the No Project alternative. Furthermore, as the table shows, Alternatives 2 and 3 provide better traffic operations than Alternatives 1 and 4 without mitigation. Due to the 101 northbound on-ramp configuration at Linden Avenue, the right-of-way takes are substantially higher for Alternative 1 and 4. Both alternatives would impact 16 residential parcels for construction of the tight diamond north of Linden Avenue. Alternatives 2 and 3 have similar right-of-way takes and do not affect these residential properties.

Therefore, Alternatives 2 and 3 were determined to be acceptable based on Traffic Operations, Available Right-of-Way and No Impact to Existing Development. With mitigations to the Linden Avenue interchange, Alternatives 1, 2, 3, and 4 were determined to be acceptable based on Traffic Operations, Right-of-Way takes and Impact to Existing Development varies by alternative.

ALTERNATIVES COMPARISON WITH AND WITHOUT MITIGATION

Measure	Year	No Project		Alternative 1 & 4		Alternative 2		Alternative 3	
		AM	PM	AM	PM	AM	PM	AM	PM
Number of intersections at LOS D or worse [1]	2016	11	8	7 (6)	2 (2)	6 (6)	2 (2)	6 (6)	2 (2)
	2036	10	13	7 (6)	11 (8)	7 (6)	11 (8)	7 (6)	11 (8)
Vehicle Hours of Network Delay [2]	2016	15,538	15,079	-31% (-35%)	-57% (-59%)	-34% (-34%)	-55% (-55%)	-34% (-34%)	-55% (-55%)
	2036	121,796	65,318	-78% (-80%)	-67% (-69%)	-78% (-80%)	-67% (-69%)	-78% (-80%)	-67% (-69%)
Number of intersections with positive benefits when compared to No Project [1]	2016	n/a	n/a	7 (8)	8 (8)	8 (8)	8 (8)	8 (8)	8 (8)
	2036	n/a	n/a	4 (5)	6 (10)	4 (5)	6 (10)	4 (5)	6 (10)
Number of intersections with negative impacts when compared to No Project [1]	2016	n/a	n/a	2 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	2036	n/a	n/a	2 (0)	4 (0)	1 (0)	3 (0)	1 (0)	3 (0)

Notes:
[1] Intersections before mitigation (intersections after mitigation).
[2] Vehicle hours of delay at intersections only. Percent change for alternatives using the no project as the base condition.
Source: Fehr & Peers, 2007.

FORECASTED VOLUME SENSITIVITY ANALYSIS

The purpose of the forecasted volume sensitivity analysis is to document how changes in the 2003 General Plan update from the City of Carpinteria, and the associated changes anticipated and currently being circulated in SBCAG's *Draft Regional Growth Forecast 2005-2040* may allow refinements to the traffic volumes and capacity requirements at the Linden Avenue and Casitas Pass Road interchanges. Specifically, the sensitivity analysis is intended to address how changes in the 2007 Draft Regional Growth Forecast with regard to population and employment projections in the design year may affect traffic operations and interchange requirements. Year 2036 traffic operations were evaluated at the Linden Avenue and Casitas Pass Road interchanges to determine interchange improvements that would best serve the cumulative traffic growth in the area.

The forecasted volume sensitivity analysis results indicate that the same mitigation is necessary at the Linden Avenue interchange under the *Draft Regional Growth Forecast 2005-2040*. However, at the Casitas Pass Road interchange the Casitas Pass Road Bridge can be designed with a five lane cross section instead of a six lane cross section. Detailed discussion of the forecasted volume sensitivity analysis can be found in Chapter 7.

1. INTRODUCTION

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 when a proposed widening met community opposition. 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.

PURPOSE

The purpose of this traffic analysis report is to document existing and future travel conditions associated with the U.S. 101/Linden Avenue and U.S. 101/Casitas Pass Road Interchange Improvements Project. Traffic operations were analyzed for future conditions to determine improvements that would best serve the cumulative traffic growth in the area. The results contained in this report serve as the basis for the traffic operations section of the Project Report.

STUDY AREA

The study area falls within the City of Carpinteria and includes the Linden Avenue, Casitas Pass Road, Bailard Avenue, and State Route (SR) 150 interchanges with U.S. 101, as shown on Figure 1. In addition to the intersections associated with these interchanges, the study addresses project impacts at several locations along key local roadways including Carpinteria Avenue, Via Real, and Ogan Road. The following 20 intersections were evaluated as part of this study.

1) Linden Avenue/Carpinteria Avenue
2) Linden Avenue/Sawyer Avenue
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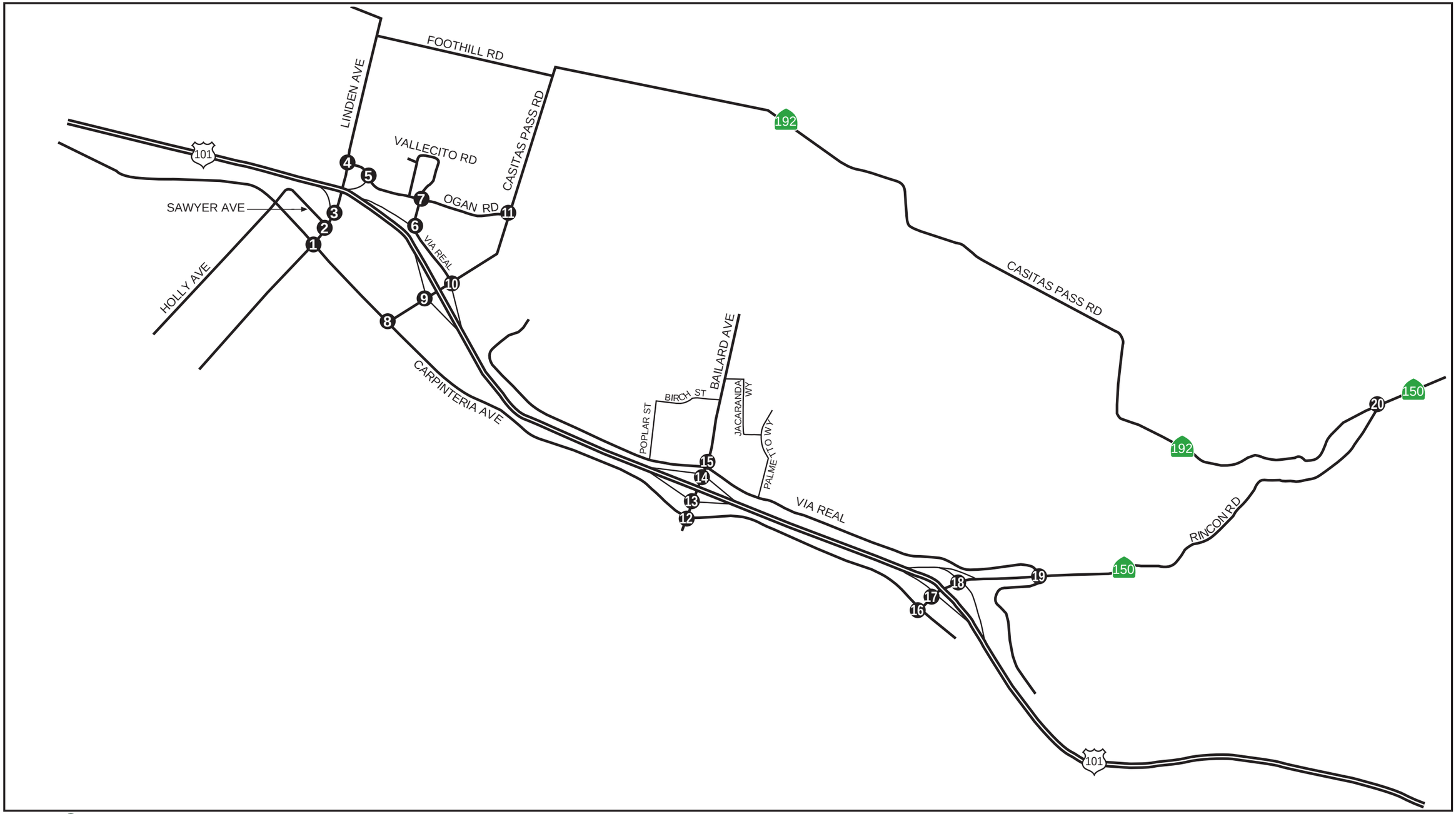
19) State Route 150/Via Real
20) State Route 150/Casitas Pass Road



Linden Avenue/Casitas Pass

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September 2006
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PROJECT STUDY AREA
FIGURE 1

FUTURE YEAR MAINLINE ASSUMPTIONS

As directed by Caltrans, the analysis presented in this study assumes that U.S. 101 has been widened from four lanes to four lanes plus high occupancy vehicle (HOV) lanes in both directions under Year 2036 conditions.

REPORT ORGANIZATION

The remainder of this report contains the following chapters.

- Chapter 2 – Existing Conditions
- Chapter 3 – Improvement Alternatives
- Chapter 4 – Traffic Forecasts
- Chapter 5 – Year 2016 Traffic Operations
- Chapter 6 – Year 2036 Traffic Operations
- Chapter 7 – Forecasted Volume Sensitivity Analysis Scenario

Chapter 2 presents the existing traffic operations in the study area. Chapter 3 presents the interchange improvement alternatives while Chapter 4 presents the traffic forecasts under each of the alternatives. Chapters 5 and 6 summarize the results of the traffic operations analysis under 2016 and 2036 conditions, respectively. Chapter 7 presents the forecasted volume sensitivity analysis 2036 traffic projections and traffic operations results for the Linden Avenue and Casitas Pass Road interchanges.

2. EXISTING CONDITIONS

The existing conditions analysis presents the physical and operational characteristics of the roadway system in the vicinity of the proposed project. This information provides part of the context for the purpose and need to construct improvements.

STUDY AREA

The study area is bound by the U.S. 101/Linden Avenue interchange to the north, the U.S. 101/SR 150 interchange to the south, the Pacific Ocean to the west, and SR 192 to the east. The following describes U.S. 101 and other key roadways in the study area.

U.S. 101 is a north-south freeway with two lanes in each direction north of Bailard Avenue in the City of Carpinteria. In the northbound direction, U.S. 101 provides three lanes between Bates Road and Bailard Avenue and two lanes south of Bates Road. In the southbound direction, auxiliary lanes are provided between Bailard Avenue and SR 150 and between SR 150 and Bates Road. U.S. 101 has an average daily traffic (ADT) of about 70,000 vehicles in the study area and has a posted speed limit of 65 miles per hour (mph).

The ***U.S. 101/Linden Avenue*** interchange is comprised of a single-lane northbound loop on-ramp and a single-lane southbound off-ramp. No other movements are presently accommodated at the interchange. The ramp terminal intersections are currently unsignalized.

The ***U.S. 101/Casitas Pass Road*** interchange is a tight-diamond configuration that provides full access to the freeway, although the northbound on-ramp is located north of Casitas Pass Road at Vallecito Road. With the exception of the northbound-on ramp at Vallecito Road which is side-street stop controlled, the ramp terminal intersections are all-way stop controlled.

The ***U.S. 101/Bailard Avenue*** interchange is a tight-diamond configuration that provides full access to the freeway. This interchange provides primary access to the surrounding residential neighborhoods. The ramp terminal intersections are currently unsignalized.

The ***U.S. 101/SR 150*** interchange is a tight-diamond configuration that provides full access to the freeway. The ramp terminal intersections are currently unsignalized.

Carpinteria Avenue is a two-lane, north-south arterial running parallel to U.S. 101 on the west side. Left-turn lanes are provided at several intersections, and the intersections with Linden Avenue and Casitas Pass Road are signalized.

Via Real is a two-lane, east-west arterial located parallel to the freeway on the east side. Within the project study area, Via Real is discontinuous between Bailard Avenue and Casitas Pass Road. Since no northbound off-ramp is provided at Linden Avenue, traffic coming from the south on U.S. 101 exits at Casitas Pass Road and utilizes Via Real in conjunction with Vallecito Road and Ogan Road to reach Linden Avenue, thereby traveling through residential neighborhoods.

Linden Avenue is a two-lane, north-south arterial extending from the beach across U.S. 101 to State Route 192 (SR 192). The Linden Avenue/Carpinteria Avenue intersection is signalized.

Casitas Pass Road is a two-lane, north-south arterial extending from Carpinteria Avenue to SR 192. The Casitas Pass Road/Carpinteria Avenue intersection is signalized.

Bailard Avenue is a two-lane, north-south arterial extending from the beach across U.S. 101 to the City limit. Bailard Avenue provides primary access to the residential neighborhoods located on the east side of U.S. 101.

SR 150, also known as Rincon Road in the project area, is a two-lane, east-west state route extending from the beach across U.S. 101 to east of SR 192 into Ventura County.

DATA COLLECTION

Morning and evening peak period data was collected to determine the analysis AM and PM peak hour and to evaluate traffic operations during the peak hour. The analysis AM and PM peak hour usually reflects the hour when traffic congestion is highest. In unusual cases when the peak hour on local streets differs from the freeway mainline peak hour, it is necessary to choose the local street or the mainline peak hour as the analysis peak hour for evaluation purposes. Deciding which peak hour to choose is often based on the project/study objectives.

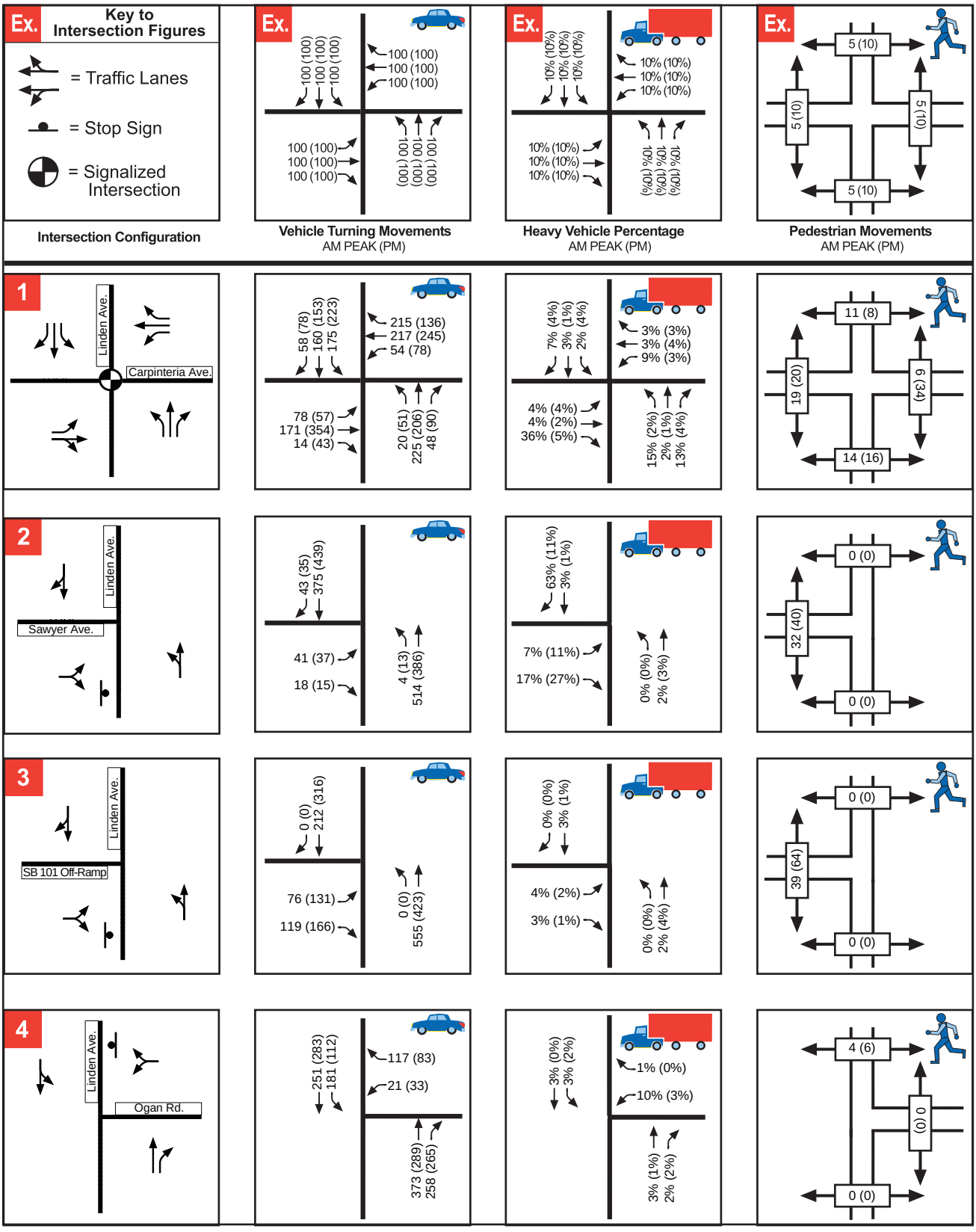
The purpose of the Linden Avenue and Casitas Pass Road interchange improvements study is to determine the required design and operational benefits of the proposed improvements during peak traffic volume conditions at the interchanges. Therefore, after consulting with Caltrans and other members of the project team, it was determined that existing traffic volumes and analysis for U.S. 101 should be based on the peak hours of the Linden Avenue and Casitas Pass Road interchanges. This approach will result in a consistent set of data and ensures that the peak traffic conditions at the two study interchanges are evaluated accurately.

Intersections

Peak period intersection counts were conducted during the morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) at the 20 study intersections during a typical weekday (Tuesday through Thursday) in late January 2006. The data that was collected includes peak hour intersection turning movements, heavy vehicle turning movements, and pedestrian volumes. The count data indicates that the AM peak hour occurs from 7:15 AM to 8:15 AM and the PM peak hour occurs from 4:30 PM to 5:30 PM.

During field reconnaissance, lane configurations, turning movement pocket lengths, speed limits, and signal timings were collected. Intersection lane configurations and peak hour volumes are shown on Figures 2A through 2E. The peak hour volumes presented reflect minor adjustments to the raw traffic counts to ensure balanced vehicle trips between adjacent intersections. All of the study intersections are unsignalized, except Linden Avenue/Carpinteria Avenue and Casitas Pass Road/Carpinteria Avenue.

Fehr & Peers compared the data collected in late January 2006 with data collected in September 2002 that was presented in the *Linden Avenue and Casitas Pass Road Interchange Improvements Project Study Report*. In general, the January 2006 AM peak hour volumes are lower than the volumes collected in September 2002. On Linden Avenue, volumes are about 20% lower and on Casitas Pass Road traffic volumes are about 25% lower. AM peak hour volumes on Bailard Avenue are also about 20% lower. The January 2006 PM peak hour volumes appear to closer to the September 2002 PM peak hour volumes. However, a few turning movements are lower by as much as 20%. The peak hour traffic volumes collected in September 2002 for the *Linden Avenue and Casitas Pass Road Interchange Improvements Project Study Report* are presented in the Technical Appendix.



Linden Avenue/Casitas Pass

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INTERSECTION CONFIGURATIONS AND PEAK HOUR VOLUMES, HEAVY VEHICLES, AND PEDESTRIANS

March 2006
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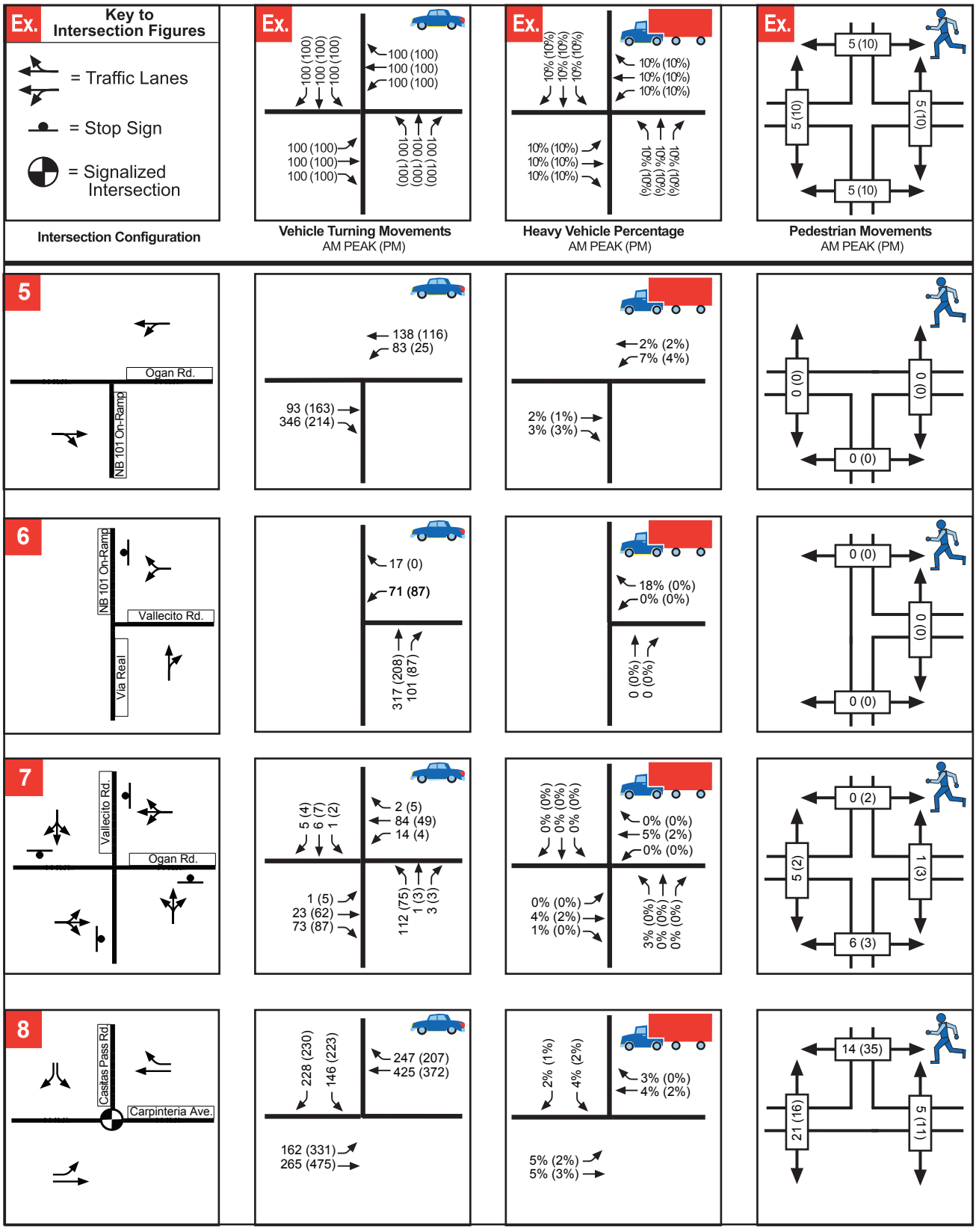
FIGURE 2A



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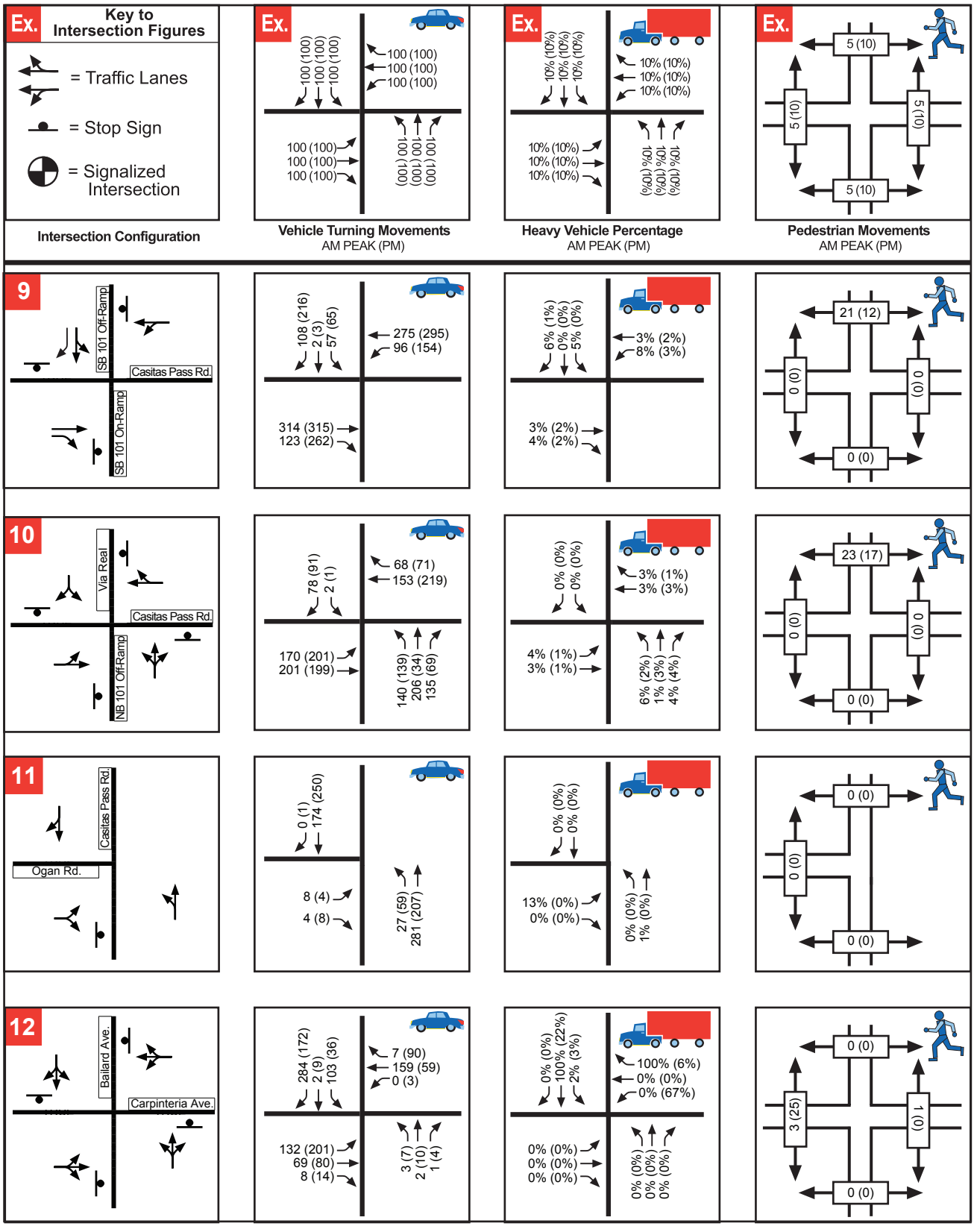
INTERSECTION CONFIGURATIONS AND PEAK HOUR VOLUMES, HEAVY VEHICLES, AND PEDESTRIANS

March 2006
2271-2B

FIGURE 2B



Linden Avenue/Casitas Pass

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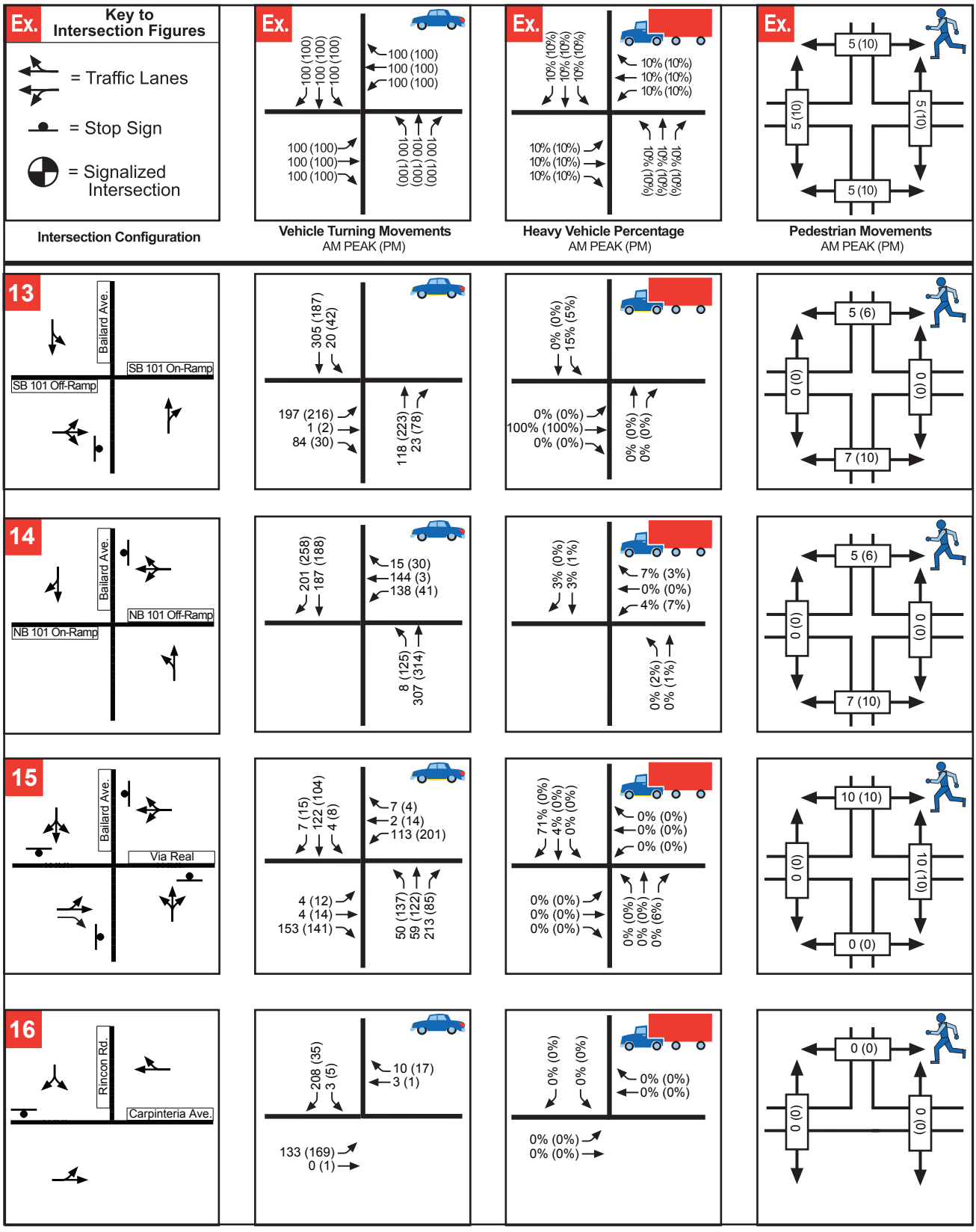
INTERSECTION CONFIGURATIONS AND PEAK HOUR VOLUMES, HEAVY VEHICLES, AND PEDESTRIANS

March 2006
2271-2C

FIGURE 2C



Linden Avenue/Casitas Pass

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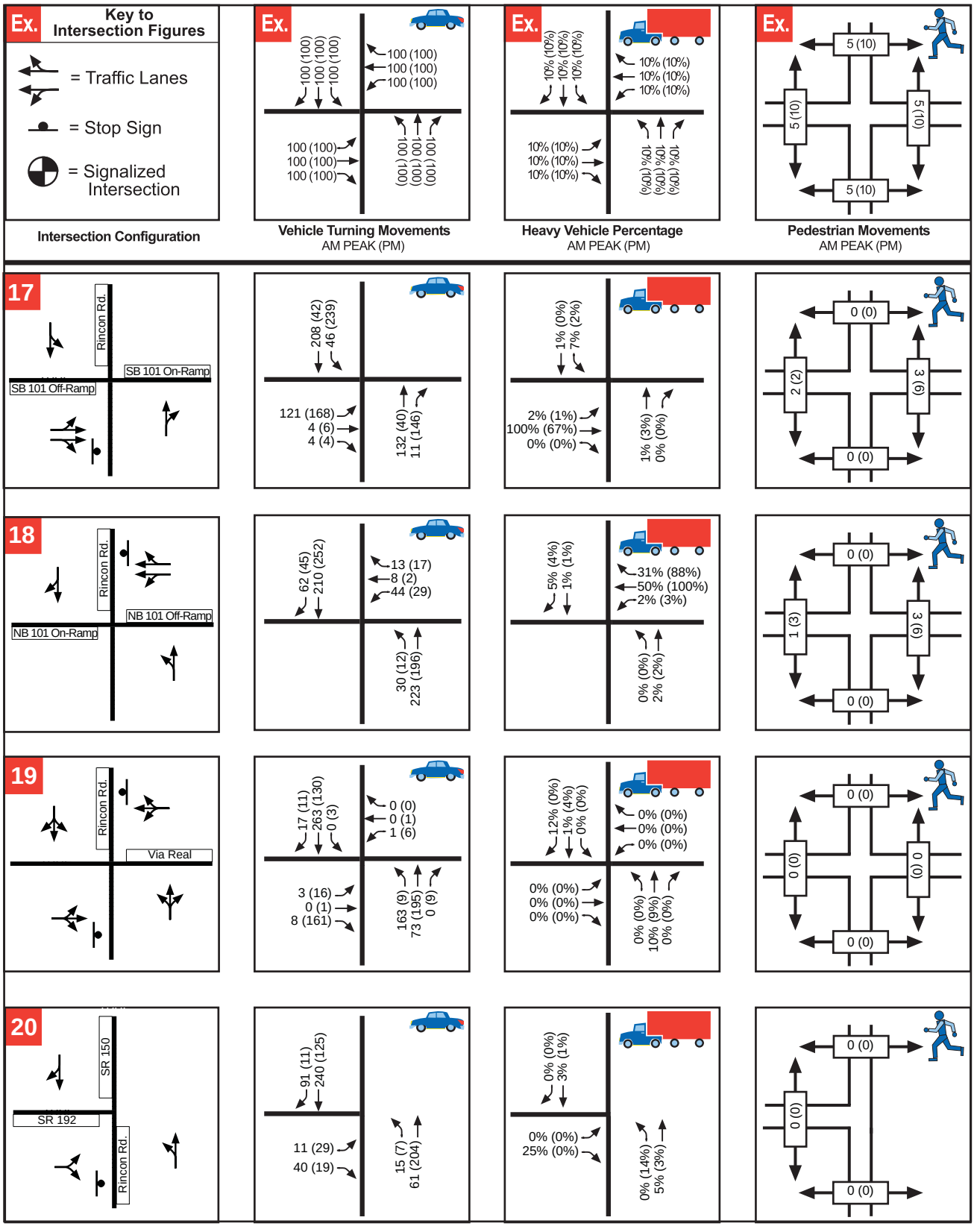
INTERSECTION CONFIGURATIONS AND PEAK HOUR VOLUMES, HEAVY VEHICLES, AND PEDESTRIANS

March 2006
2271-2D

FIGURE 2D



Linden Avenue/Casitas Pass

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INTERSECTION CONFIGURATIONS AND PEAK HOUR VOLUMES, HEAVY VEHICLES, AND PEDESTRIANS

March 2006
2271-2E

FIGURE 2E

The differences in intersection traffic volumes collected in September 2002 and January 2006 appear to be a result of seasonal traffic fluctuations in this area. Based on seasonal and historical traffic data provided by Caltrans, traffic volumes during the summer months are approximately 20 percent higher than traffic volumes during the winter months. After consulting with Caltrans, Fehr & Peers used the data collected in January 2006 to determine existing levels of service. However, the September 2002 intersection counts were used as the base for traffic forecasting because they reflect traffic during the peak summer months. Using the September 2002 counts as the base for traffic forecasting ensures that future year forecasts reflect peak summer conditions.

Freeway Mainline

A traffic count was conducted for the mainline (U.S. 101) south of the Bates Road interchange to supplement data provided by Caltrans. The traffic volumes indicated that the predominant travel direction is northbound during the AM peak period and southbound during the PM peak period. The data indicates that the AM peak hour of the mainline (6:30 AM to 7:30 AM) does not completely coincide with the AM peak hour of the interchanges (7:15 AM to 8:15 AM), while the PM peak hour of the mainline does generally coincide with the PM peak hour of the interchanges. Since the mainline and interchange peak hours do not coincide during the AM, the analysis peak hour for the mainline will be set at 7:15 AM to 8:15 AM to match the interchange's peak hour. U.S. 101 traffic volumes in the northbound direction from 7:15 AM to 8:15 AM are about 500 vehicles fewer than from 6:30 AM to 7:30 AM. It is anticipated that as traffic volumes continue to grow on U.S. 101 that traffic volumes between 7:15 AM and 8:15 AM will be similar to traffic volumes between 6:30 AM and 7:30 AM. Field observations indicate that although northbound AM volumes are highest between 6:30 AM and 7:30 AM, the heaviest congestion occurs from 6:45 to 7:45 AM.

Truck traffic on U.S. 101 was obtained from the 2004 Annual Average Daily Truck Traffic on the California State Highway System prepared by Caltrans. These counts indicate that heavy vehicles make up about four (4) percent of the total traffic on the freeway north of SR 150 and seven (7) percent south of SR 150.

The U.S. 101 mainline volumes are presented on Figure 3. These volumes were developed based on data collected in late January 2006, and 2005 data provided by Caltrans. The average daily traffic volumes (ADT) at key locations are shown on Figure 4.

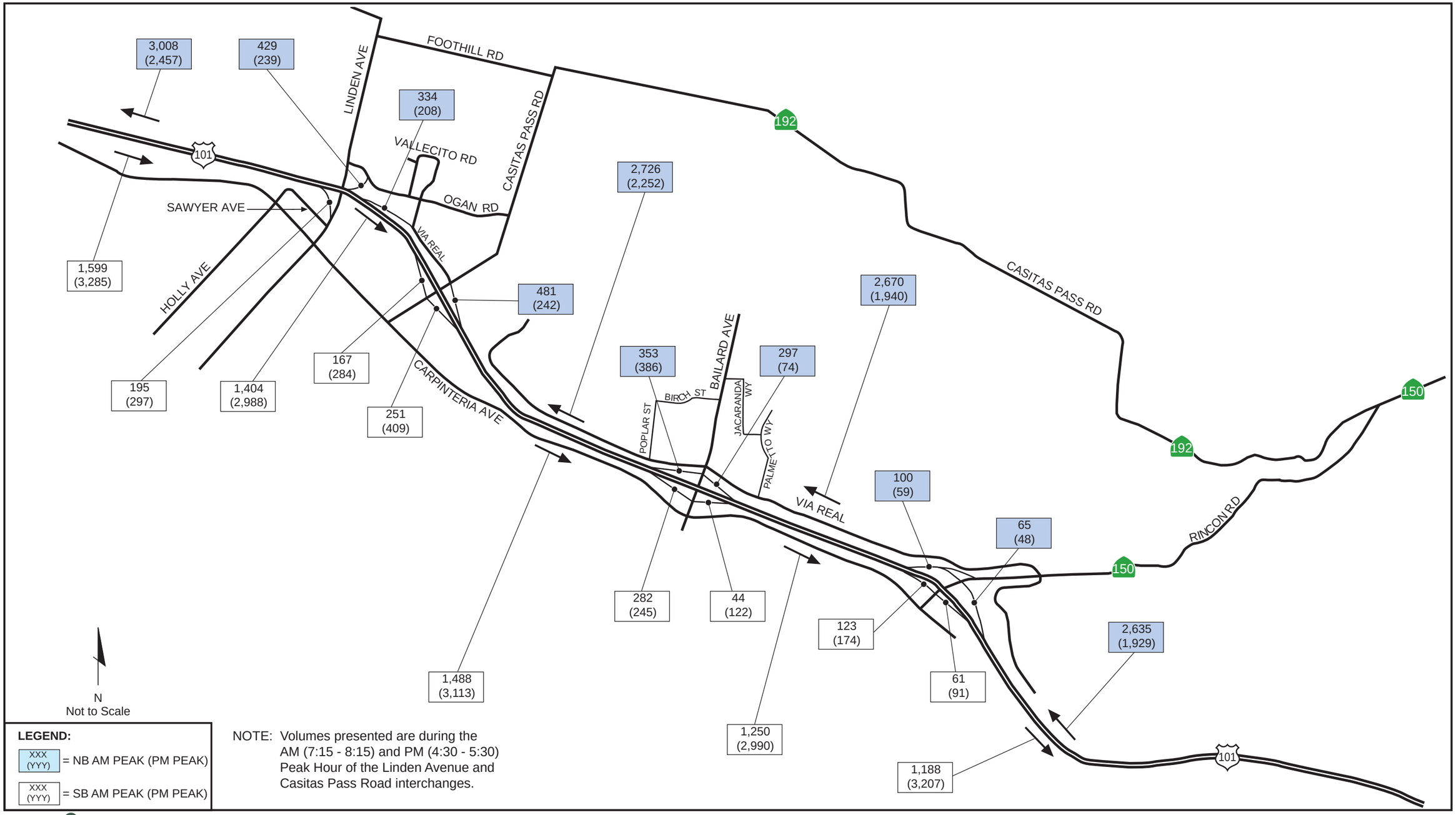
ANALYSIS METHODOLOGY AND KEY ASSUMPTIONS

The following presents the methodology and key assumptions used to evaluate the study facilities.

Intersections

Level of service (LOS) 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 signalized and all-way stop-controlled intersections. At side-street stop intersections, the policy is also to maintain LOS C operations or better[1].

[1] Based on a conversation with the City of Carpinteria Public Works Director on March 17, 2003.



Linden Avenue/Casitas Pass

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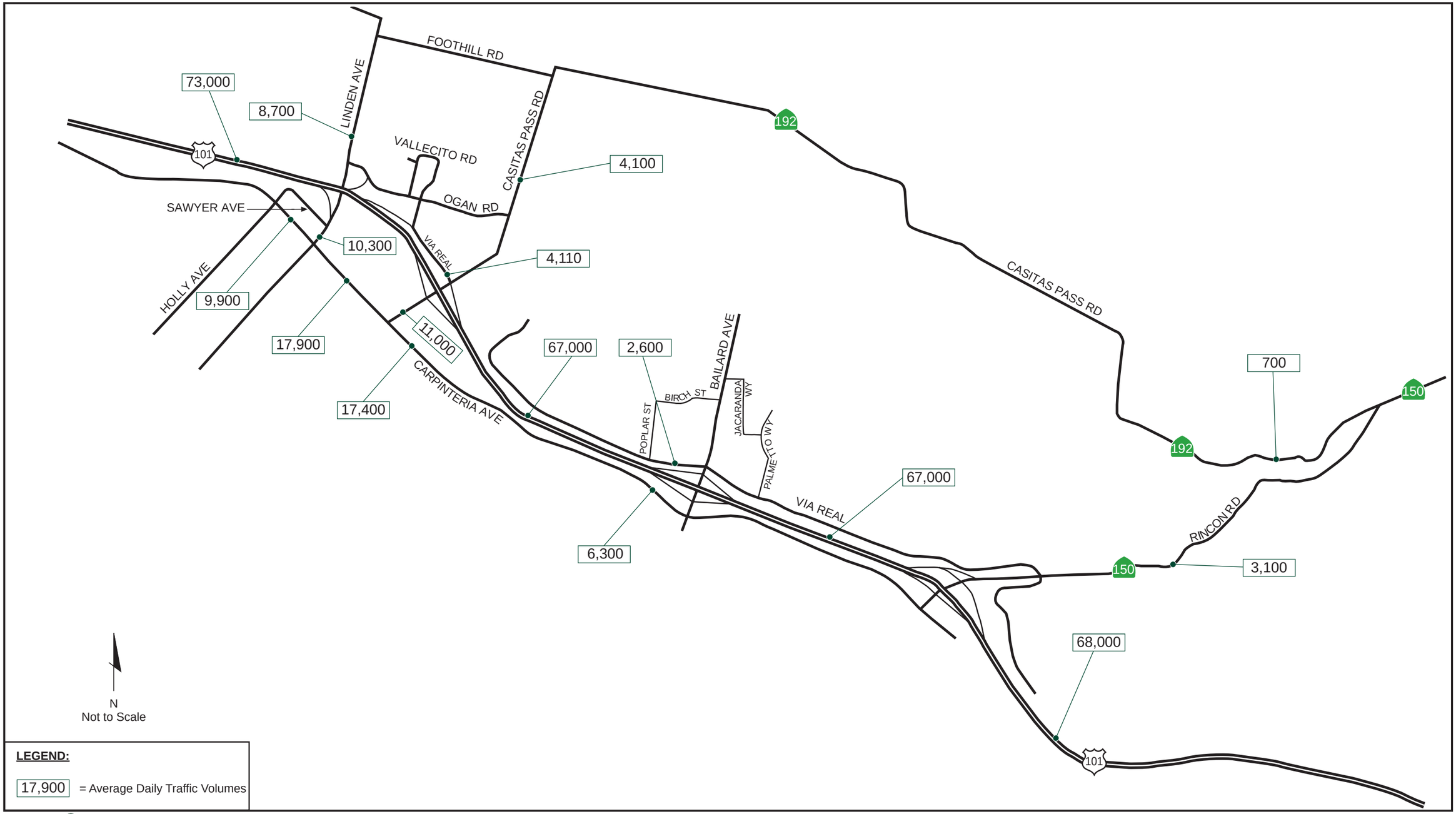
EXISTING MAINLINE AND RAMP PEAK HOUR VOLUMES

FIGURE 3



Linden Avenue/Casitas Pass

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2271-4

EXISTING AVERAGE DAILY TRAFFIC VOLUMES
FIGURE 4

At signalized 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. At side-street stop-controlled intersections, the LOS rating is based on the control delay for each minor movement. For all-way stop-controlled intersections, the LOS rating is based on the weighted average control delay of all movements. The traffic analysis software, Synchro 6.0, was used for this study. Synchro is based on procedures outlined in the Transportation Research Board's 2000 *Highway Capacity Manual* (HCM). Table 1 summarizes the relationship between the average control delay per vehicle and LOS for signalized and unsignalized intersections.

TABLE 1
INTERSECTION LEVEL OF SERVICE THRESHOLDS

Level of Service	Signalized Intersection Control Delay (sec/veh)[1]	Unsignalized Intersection Control Delay (sec/veh)[1]	General Description
A	0 – 10.0	0 – 10.0	Little to no congestion or delays.
B	10.1 – 20.0	10.1 – 15.0	Limited congestion. Short delays.
C	20.1 – 35.0	15.1 – 25.0	Some congestion with average delays.
D	35.1 – 55.0	25.1 – 35.0	Significant congestion and delays.
E	55.1 – 80.0	35.1 – 50.0	Severe congestion and delays.
F	> 80.0	> 50.0	Total breakdown with extreme delays.

Notes:
[1] Control delay includes initial deceleration delay, queue move-up time, stopped delay, and acceleration delay.
Source: *Highway Capacity Manual*, Chapter 16 (Signalized Intersections) and Chapter 17 (Unsignalized Intersections), Transportation Research Board, 2000.

Freeway Mainline and Ramp Junctions

The level of service for a freeway section is based on measures of density (passenger cars/ lane/ mile), while a secondary measure is travel speed (miles per hour [mph]). Freeway LOS is a qualitative description of traffic flow based on speed, travel time, delay, and freedom to maneuver. There are six levels, ranging from LOS A (i.e., the best operating conditions) to LOS F (i.e., the worst). LOS E represents "at-capacity" operation. When volumes exceed capacity, stop-and-go conditions result and operations are designated as LOS F. Caltrans' policy is to maintain freeway mainline and ramp operations at the LOS C/LOS D cusp threshold based on the *Guide for the Preparation of Traffic Impact Studies* (December 2002). Table 2 presents a summary of the relationship between LOS, density, and travel speed for freeway sections. The level of service for freeway ramp junctions is also based on density, as summarized in Table 3.

TABLE 2
FREEWAY MAINLINE LEVEL OF SERVICE CRITERIA

Level of Service	Maximum Density (Passenger cars / mile / lane)	Minimum Speed (MPH)
A	11	65
B	18	65
C	26	64.6
D	35	59.7
E	45	52.2
F	> 45	< 52.2

Notes:
Freeway mainline LOS based on a 65 MPH free-flow speed.
Source: *Highway Capacity Manual*, Chapter 23 (Basic Freeway Sections), Transportation Research Board, 2000.

TABLE 3
RAMP JUNCTION (MERGE AND DIVERGE) LEVEL OF SERVICE CRITERIA

Level of Service	Maximum Density (Passenger cars / mile / lane)
A	10
B	20
C	28
D	35
E	> 35
F	Demand Exceeds Capacity

Source: *Highway Capacity Manual*, Chapter 25 (Ramps and Ramp Junctions Methodology), Transportation Research Board, 2000.

Freeway Weaving Sections

Freeway weaving analysis was performed based on procedures outlined in Caltrans' *Highway Design Manual* (HDM; 5th Edition). The Leisch Method, shown on Figure 504.7A in the HDM, was used to determine the level of service for the weaving section.

Street Segments

Levels of service for street segments are based on the average through-vehicle travel speed for the street segment and classification. Average travel speed is determined by dividing the length of the street segment by the total time a vehicle spends on the street.

There are two principal components that comprise the total time a vehicle spends on a street segment: 1) running time, and 2) control delay at the signalized intersections. The current policy used by the City of Carpinteria is for all street segments to maintain LOS C operations or better. Street segments with no traffic signals are not applicable under this methodology since through traffic will not encounter any control delay at the intersections. Table 4 presents a summary of LOS and average travel speeds.

TABLE 4
STREET SEGMENT LEVEL OF SERVICE CRITERIA

Urban Street Class	**I**	**II**	**III**	**IV**
Range of free-flow speeds (FFS)	55 to 45 MPH	45 to 35 MPH	35 to 30 MPH	35 to 25 MPH
Typical FFS	50 MPH	40 MPH	35 MPH	30 MPH
LOS	**Average Travel Speed (MPH)**			
A	> 42	> 35	> 30	> 25
B	> 34-42	> 28-35	> 24-30	> 19-25
C	> 27-34	> 22-28	> 18-24	> 13-19
D	> 21-27	> 17-22	> 14-18	> 9-13
E	> 16-21	> 13-17	> 10-14	> 7-9
F	≤ 16	≤ 13	≤ 10	≤ 7

Source: *Highway Capacity Manual*, Chapter 15 (Urban Streets Methodology), Transportation Research Board, 2000.

Key Assumptions

- A peak hour truck percentage of 4 percent and 7 percent was used for U.S. 101 north and south of SR 150, respectively. A peak hour truck percentage of 2 percent was used for all ramps.
- A free flow speed of 65 mph was used for the freeway mainline and 45 mph for the ramps.
- Free flow speed on the local streets was based on the posted speed limit.
- Analysis peak hours are from 7:15 AM to 8:15 AM and 4:30 PM to 5:30 PM.

EXISTING OPERATIONS ANALYSIS

In order to determine the current operations, peak hour capacity analyses were performed for each intersection, ramp junction, and mainline freeway segment. The peak hour signal warrant was also evaluated for unsignalized intersections based on the 2003 *Manual on Uniform Traffic Control Devices* (MUTCD). The following summarizes the analysis results for existing conditions.

Intersection Operations

Existing intersection conditions were evaluated based on lane configurations and traffic volumes as shown on Figures 2A through 2E. Table 5 summarizes the intersection operation results. Detailed calculations are presented in the Technical Appendix. As shown, all of the study intersections operate at acceptable LOS C or better conditions during both peak hours, except the following:

- *Linden Avenue/Sawyer Avenue* – The southbound approach currently operates at LOS D during the AM peak hour.
- *Linden Avenue/U.S. 101 Southbound Off-Ramp* – The southbound (off-ramp) approach currently operates at LOS D during the AM and PM peak hour.
- *Casitas Pass Road/Via Real/U.S. 101 Northbound Off-ramp* – This all-way stop-controlled intersection operates at LOS E during the AM peak hour.
- *Bailard Avenue/U.S. 101 Southbound Ramps* – The southbound (off-ramp) approach currently operates at LOS E during the PM peak hour.
- *Bailard Avenue/U.S. 101 Northbound Ramps* – The northbound (off-ramp) approach currently operates at LOS F during the AM peak hour.
- *SR 150/U.S. 101 Southbound Ramps* – The southbound (off-ramp) approach currently operates at LOS F during the PM peak hour.

As noted earlier in the report, the study area experiences seasonal fluctuations where traffic volumes are generally higher during the summer months when compared to traffic volumes during the winter months. As a result, traffic operations would be worse during the summer months than presented in Table 5.

Traffic Signal Warrants

The peak hour traffic volume signal warrant was evaluated for each of the unsignalized study intersections based on the 2003 MUTCD (see Technical Appendix). All of the unsignalized intersections do not satisfy the peak hour traffic volume signal warrant except the following intersections:

- *Casitas Pass Road/U.S. 101 Southbound Ramps* – This intersection barely satisfies the peak hour traffic signal warrant during the PM peak hour; however, the intersection operates at acceptable LOS C conditions. A traffic signal is not recommended under Existing conditions.
- *Casitas Pass Road/U.S. 101 Northbound Off-Ramp* – This intersection satisfies the peak hour traffic signal warrant during the AM peak hour and operates at unacceptable LOS E conditions. With a traffic signal, this intersection would operate at acceptable service levels.

TABLE 5
EXISTING INTERSECTION ANALYSIS [1,2]

Intersection	Traffic Control	AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS
1. Linden Avenue / Carpinteria Avenue	Signal	25	C	32	C
2. Linden Avenue / Sawyer Avenue	Side-Street Stop	26 (EB)	D	20 (EB)	C
3. Linden Avenue / U.S. 101 SB Off-Ramp	Side-Street Stop	28 (SB)	D	35 (SB)	D
4. Linden Avenue / Ogan Road	Side-Street Stop	21 (WB)	C	14 (WB)	B
5. U.S. 101 NB On-Ramp / Ogan Road	Side-Street Stop	4 (WB)	A	2 (WB)	A
6. Vallecito Road / Via Real / U.S. 101 NB On-Ramp	Side-Street Stop	13 (SB)	B	11 (SB)	B
7. Vallecito Road / Ogan Road	All-Way Stop	8	A	8	A
8. Casitas Pass Road / Carpinteria Avenue	Signal	13	B	17	B
9. Casitas Pass Road / U.S. 101 SB Ramps	All-Way Stop	13	B	19	C
10. Casitas Pass Road / Via Real / U.S. 101 NB Off-Ramp	All-Way Stop	39	E	16	C
11. Casitas Pass Road / Ogan Road	Side-Street Stop	14 (EB)	B	11 (EB)	B
12. Bailard Avenue / Carpinteria Avenue	All-Way Stop	14	B	13	B
13. Bailard Avenue / U.S. 101 SB Ramps	Side-Street Stop	22 (SB)	C	40 (SB)	E
14. Bailard Avenue / U.S. 101 NB Ramps	Side-Street Stop	> 50 (NB)	F	23 (NB)	C
15. Bailard Avenue / Via Real	All-Way Stop	13	B	12	B
16. SR 150 / Carpinteria Avenue	Side-Street Stop	9 (WB)	A	9 (WB)	A
17. SR 150 / U.S. 101 Southbound Ramps	Side-Street Stop	16 (SB)	C	> 50 (SB)	F
18. SR 150 / U.S. 101 Northbound Ramps	Side-Street Stop	14 (NB)	B	13 (NB)	B
19. SR 150 / Via Real	Side-Street Stop	18 (NB)	C	16 (NB)	C
20. SR 150 / Casitas Pass Road	Side-Street Stop	12 (EB)	B	11 (EB)	B

Notes:
Shading denotes locations where level of service threshold is exceeded.
[1] Side-street stop intersection level of service based on worst approach control delay per vehicle, according to the *2000 Highway Capacity Manual*. All-way stop intersection level of service based on weighted average control delay per vehicle, according to the *2000 Highway Capacity Manual*.
[2] Signalized intersection level of service based on weighted average control delay per vehicle, according to the *2000 Highway Capacity Manual*.
Source: Fehr & Peers, 2007.

Mainline and Ramp Junction Operations

Field observations were conducted during the AM and PM peak periods to determine locations where high levels of congestion may render traditional freeway operations analysis techniques invalid. The HCM methodology does not apply at locations where demand exceeds capacity or take into consideration the effects of downstream blockages or queuing. Field observations indicate the heaviest congestion in the northbound direction from about 6:45 AM to 7:45 AM, which resulted in extensive vehicle queues and slow vehicle speeds between Bailard Avenue and Linden Avenue. It is important to note that the heaviest congestion on the mainline during the AM is slightly offset from the peak hour of the interchanges (7:15 AM to 8:15 AM). In several cases, vehicles were observed to exit at Bailard Avenue and Casitas Pass Road and use the off- and on-ramps to bypass mainline congestion and re-enter the freeway. Based on discussions with Caltrans traffic operations staff, the northbound direction during the AM peak period is fairly volatile and the extent of queuing can vary from day to day. Caltrans staff has observed the northbound AM peak period queue to extend past SR 150.

Travel time runs performed on U.S. 101 in January 2006 by Caltrans and Fehr & Peers indicate that vehicle speeds in the northbound direction between 6:45 AM and 7:45 AM averaged less than 30 mph from the SR 150 overcrossing to the Linden Avenue overcrossing. Because of heavy congestion in the northbound direction during the AM peak hour, traditional freeway operations analysis techniques are invalid. To address this issue, measured vehicle speeds were used to determine level of service.

Field observations also indicated that the non-standard design of two northbound on-ramps located within 700 feet of each other (Via Real on-ramp and Linden Avenue on-ramp) results in a reduction of mainline capacity as a result of concentrated vehicle friction from merging vehicles. Furthermore, these on-ramps provide substandard merging distance, further reducing mainline capacity.

Each mainline segment and ramp junction on U.S. 101 was analyzed based on the volumes shown on Figure 4. These results are summarized in Table 6. Detailed calculations are presented in the Technical Appendix.

As shown in Table 6, several mainline and ramp segments operate at unacceptable levels. During the AM peak hour, northbound U.S. 101 operates at LOS F based on measured vehicle speeds from Bailard Avenue to north of Linden Avenue. It is important to note that during the AM analysis peak hour (7:15 AM to 8:15 AM), LOS F conditions occur between 7:15 AM and 7:45 AM, while acceptable traffic operations occur for the remainder (7:45 AM to 8:15 AM) of the analysis peak hour. Based on the 2000 HCM, level of service is based on the peak 15 minutes of the peak hour; therefore, it is appropriate to refer to the entire AM peak hour as operating at LOS F between Bailard Avenue and Linden Avenue. During the PM peak hour, the peak southbound direction of U.S. 101 operates between LOS C and LOS D throughout the study area.

TABLE 6
EXISTING MAINLINE AND RAMP MERGE DIVERGE ANALYSIS

Mainline or Ramp	Number of Lanes	AM Peak Hour		PM Peak Hour	
		Density or [Speed][1]	LOS	Density or [Speed][1]	LOS
Mainline Analysis					
NB U.S. 101 Bates Road to SR 150	3	16	B	11	A
NB U.S. 101 SR 150 to Bailard Avenue	2	24	C	16	B
NB U.S. 101 Bailard Avenue to Casitas Pass Road	2	*[22]*	F	19	C
NB U.S. 101 Casitas Pass Road to Linden Avenue	2	*[19]*	F	18	C
NB U.S. 101 Linden Avenue to Santa Monica Road	2	*[19]*	F	20	C
SB U.S. 101 Reynolds Avenue to Linden Avenue	2	15	B	28	D
SB U.S. 101 Linden Avenue to Casitas Pass Road	2	13	B	25	C
SB U.S. 101 Casitas Pass Road to Bailard Avenue	2	14	B	26	C
SB U.S. 101 Bailard Avenue to SR 150	2 + Aux	weave	A	weave	C
SB U.S. 101 SR 150 to Bates Road	2 + Aux	weave	A	weave	C
Ramp Junction Analysis					
NB U.S. 101 SR 150 Off-Ramp	1	22	C	16	B
NB U.S. 101 SR 150 On-Ramp	1	26	C	18	B
NB U.S. 101 Bailard Avenue Off-Ramp	1	*[22]*	F	21	C
NB U.S. 101 Bailard Avenue On-Ramp	1	*[22]*	F	20	C
NB U.S. 101 Casitas Pass Road Off-Ramp	1	*[19]*	F	24	C
NB U.S. 101 Casitas Pass Road On-Ramp	1	*[19]*	F	22	C
NB U.S. 101 Linden Avenue On-Ramp	1	*[19]*	F	23	C
SB U.S. 101 Linden Avenue Off-Ramp	1	19	B	33	D
SB U.S. 101 Casitas Pass Road Off-Ramp	1	17	B	31	D
SB U.S. 101 Casitas Pass Road On-Ramp	1	16	B	28	C
SB U.S. 101 Bailard Avenue Off-Ramp	1	18	B	32	D
SB U.S. 101 Bailard Avenue On-Ramp	1	weave	A	weave	C
SB U.S. 101 SR 150 Off-Ramp	1	weave	A	weave	C
SB U.S. 101 SR 150 On-Ramp	1	weave	A	weave	C

Notes:

Shading denotes locations where level of service threshold is exceeded.

Mainline segment and ramp merge/diverge LOS based on vehicle density (passenger cars/mile/lane), according to the *2000 Highway Capacity Manual*. In cases where mainline congestion renders traditional analysis techniques invalid for mainline segments and ramps, LOS is based on vehicle speeds shown in italics and within brackets.

Source: Fehr & Peers, 2007.

Street Segment Operations

Currently, only Carpinteria Avenue between Linden Avenue and Casitas Pass Road can be evaluated under the street segment (urban street) methodology as it is the only corridor with signalized intersections. Table 7 summarizes the street segment level of service, while detailed calculations are presented in the Technical Appendix. Carpinteria Avenue, between Linden Avenue and Casitas Pass Road, operates at acceptable LOS C conditions during the AM and PM peak hour.

TABLE 7
EXISTING STREET SEGMENT LEVEL OF SERVICE

Street Segment	Direction	Arterial Class	AM Peak		PM Peak	
			Average Travel Speed (mph)	LOS	Average Travel Speed (mph)	LOS
Carpinteria Avenue (Casitas Pass Road to Linden Avenue)	Northwest	IV	17	C	16	C
	Southeast	IV	18	C	17	C

Source: Fehr & Peers, 2007.

3. IMPROVEMENT ALTERNATIVES

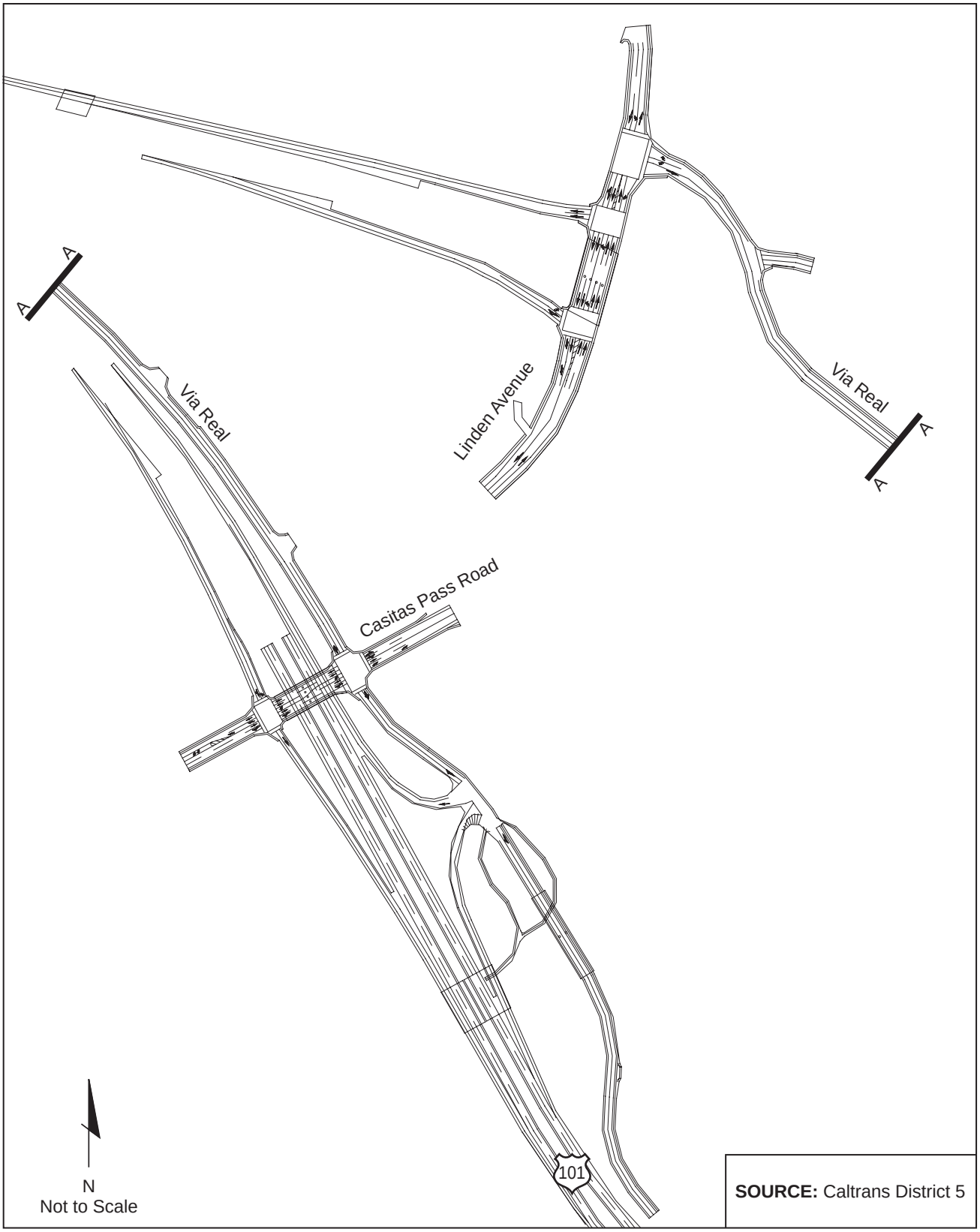
The Linden Avenue and Casitas Pass Road Interchange Improvements Project will provide additional capacity at the interchanges to continue to minimize vehicle delay and provide acceptable levels of service in the future. Four interchange improvement alternative plans are proposed as part of the project. The primary difference between the alternatives is the proposed design of the Linden Avenue interchange. While Alternatives 1 and 4 propose the same design at the Linden Avenue interchange, they differ on the alignment of Via Real between Vallecito Road and Linden Avenue. From a traffic operations standpoint, Alternatives 1 and 4 are identical. All four alternatives propose the same interchange improvements at the Casitas Pass Road interchange.

ALTERNATIVE 1 consists of reconfiguring the Linden Avenue and Casitas Pass Road interchanges and extending Via Real from its current terminus to Linden Avenue. Alternative 1 would provide a tight diamond configuration (Type L-1) on the north side of Linden Avenue. Access to and from the south on Linden Avenue would not be provided. At Casitas Pass Road, diagonal southbound on- and off-ramps would be provided on the west side of U.S. 101. In the northbound direction, on- and off-hook ramps would be provided on the new extension of Via Real. The draft geometric layout of Alternative 1 is presented on Figure 5.

ALTERNATIVE 2 is similar to Alternative 1 except that the Linden Avenue northbound on-ramp would be provided at Via Real. The draft geometric layout of Alternative 2 is presented on Figure 6.

ALTERNATIVE 3 is similar to Alternative 1 except that the Linden Avenue northbound on-ramp would be provided via a roundabout intersection at Via Real/Ogan Road. The draft geometric layout of Alternative 3 is presented on Figure 7.

ALTERNATIVE 4 is almost identical to Alternative 1. The only difference between Alternatives 1 and 4 is the exact alignment of the Via Real extension near Linden Avenue. From a traffic operations standpoint, both alternatives would provide the same level of service. The draft geometric layout of Alternative 4 is presented on Figure 8.



SOURCE: Caltrans District 5

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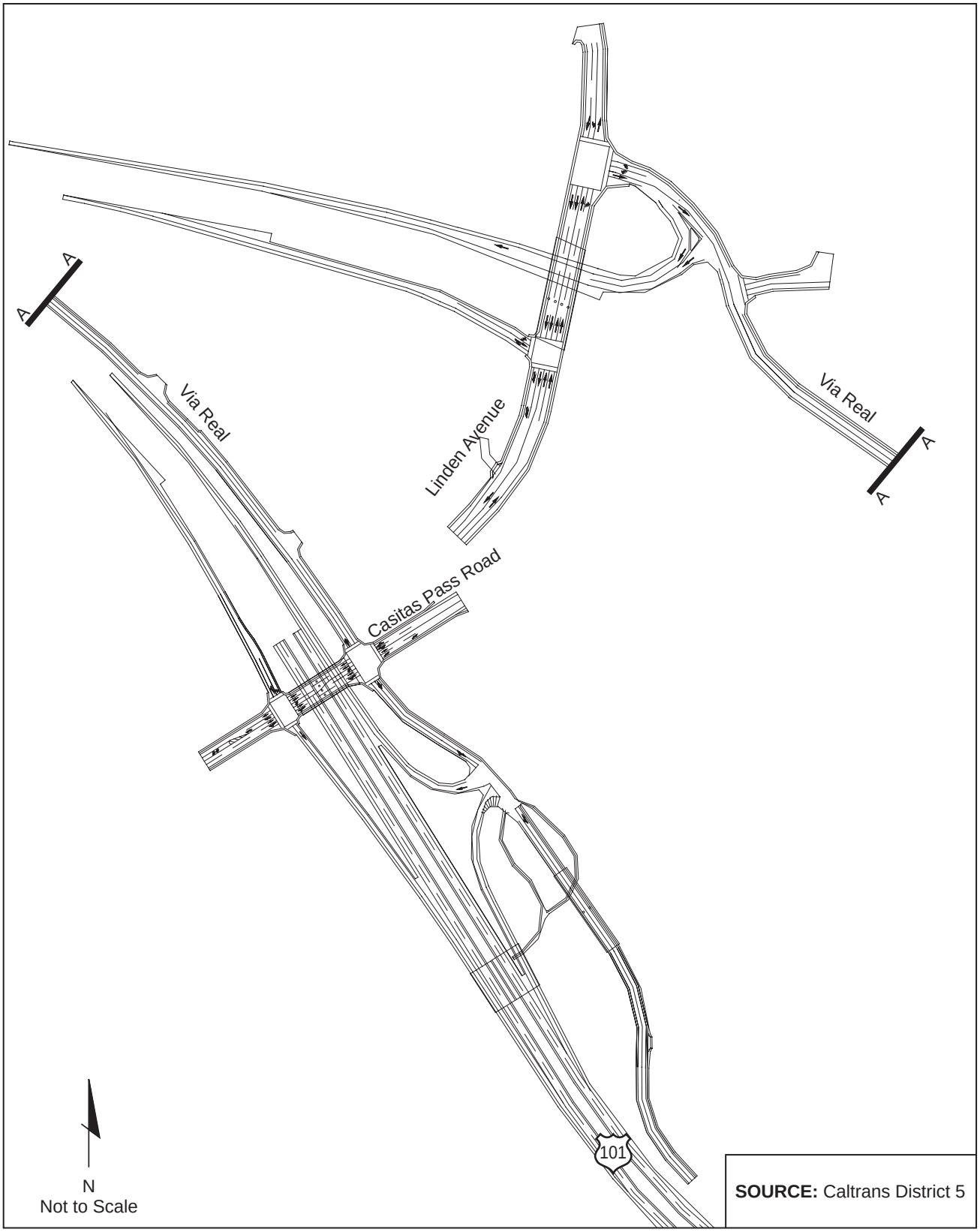
DRAFT ALTERNATIVE 1
GEOMETRIC LAYOUT

FIGURE 5



SOURCE: Caltrans District 5

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DRAFT ALTERNATIVE 2
GEOMETRIC LAYOUT

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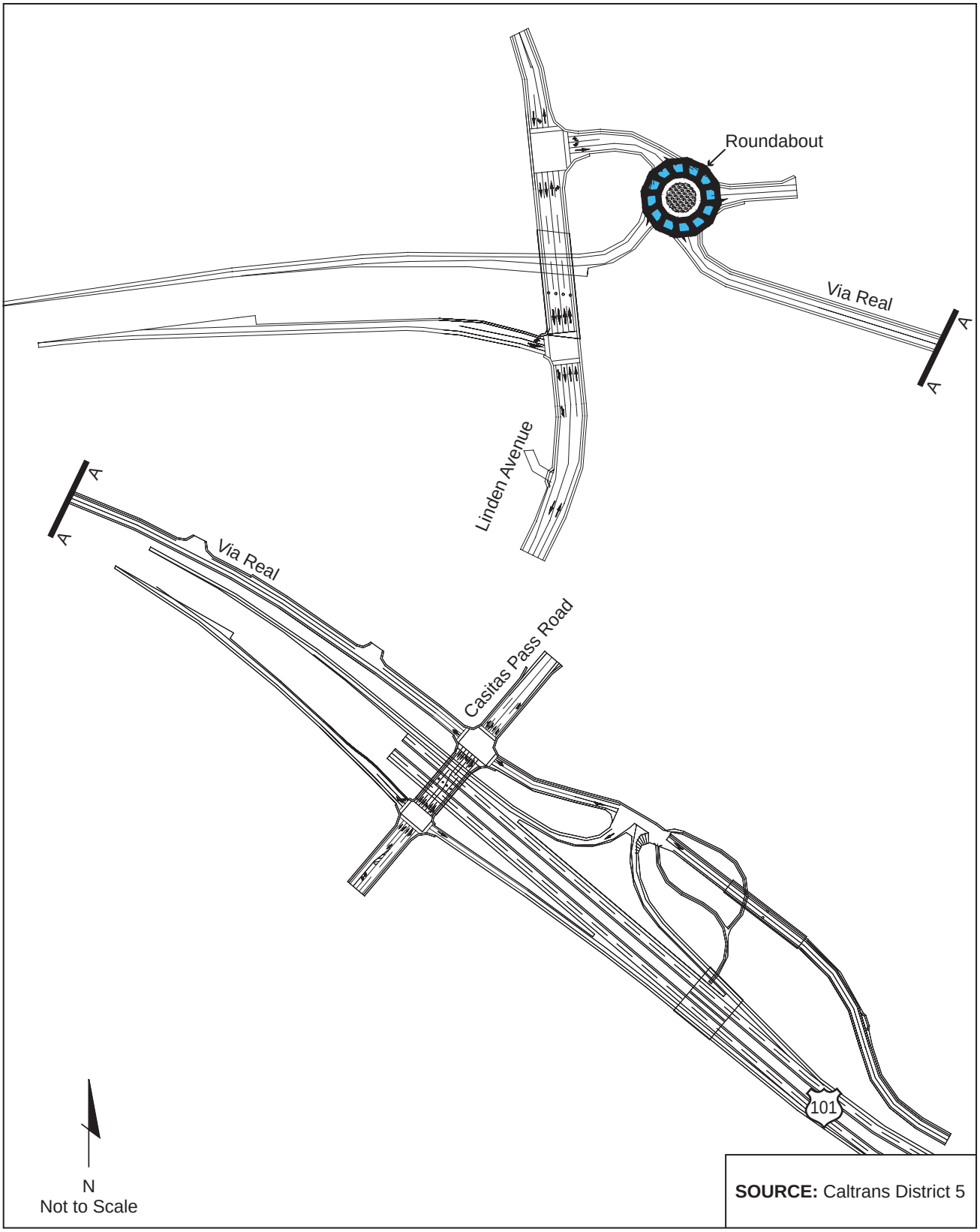
2271-6

FIGURE 6



Linden Avenue/Casitas Pass

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DRAFT ALTERNATIVE 3
GEOMETRIC LAYOUT

FIGURE 7

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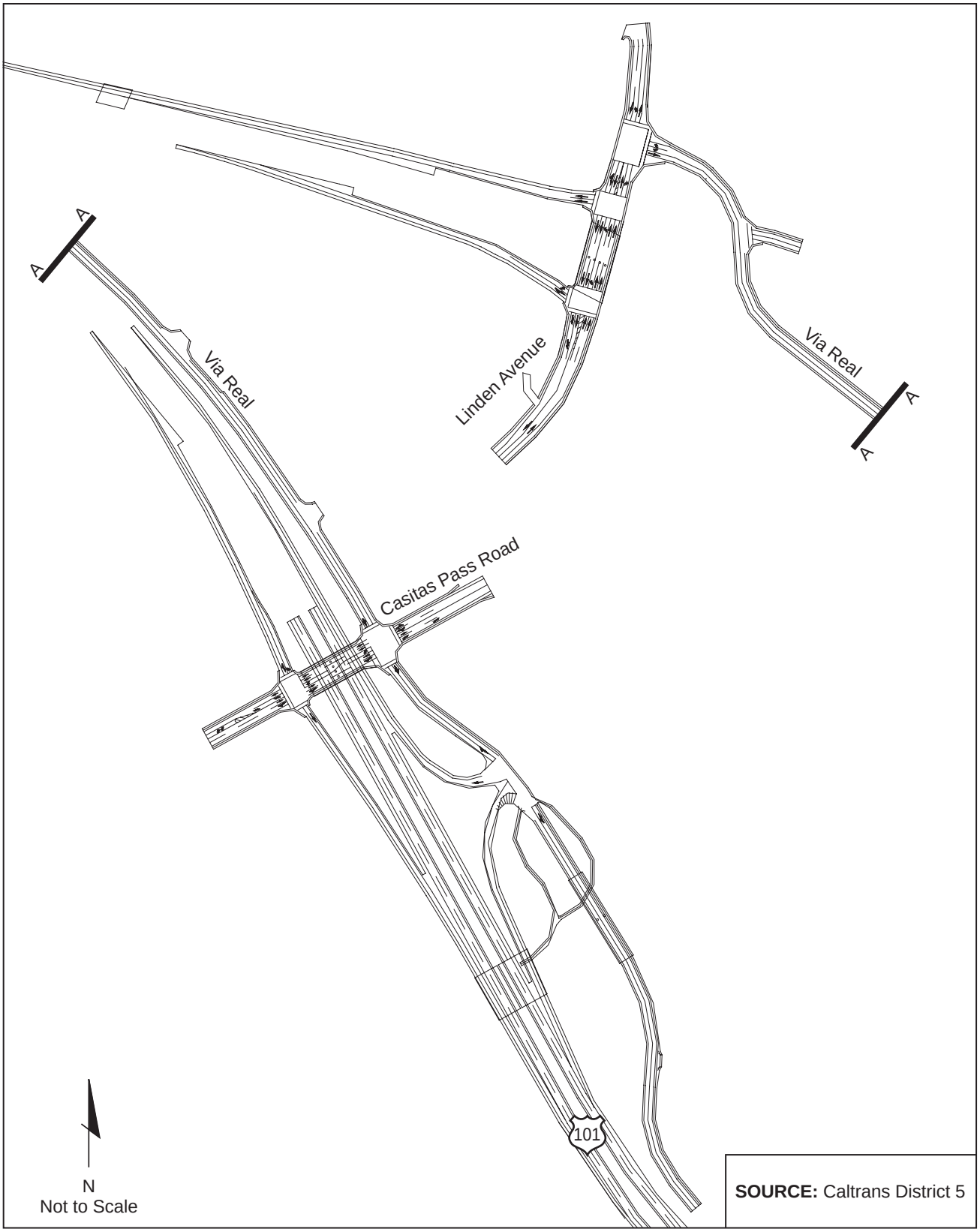

SOURCE: Caltrans District 5

Linden Avenue/Casitas Pass

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DRAFT ALTERNATIVE 4
GEOMETRIC LAYOUT

FIGURE 8

4. TRAFFIC FORECASTS

This chapter provides the methodology used to develop existing condition VISUM models, documents the calibration process and validation results, and presents the future traffic forecasts for U.S. 101 and associated study intersections. Figure 9 presents the roadway network and study intersections under No Project conditions, while Figure 10 presents Alternatives 1 and 4. The roadway network and study intersections for Alternative 2 are presented on Figure 11, while Figure 12 presents Alternative 3.

Traffic forecasts were developed for years 2016 and 2036 and are based on year 2002 traffic counts. Traffic forecasts are presented for the AM and PM peak hours for the following alternatives:

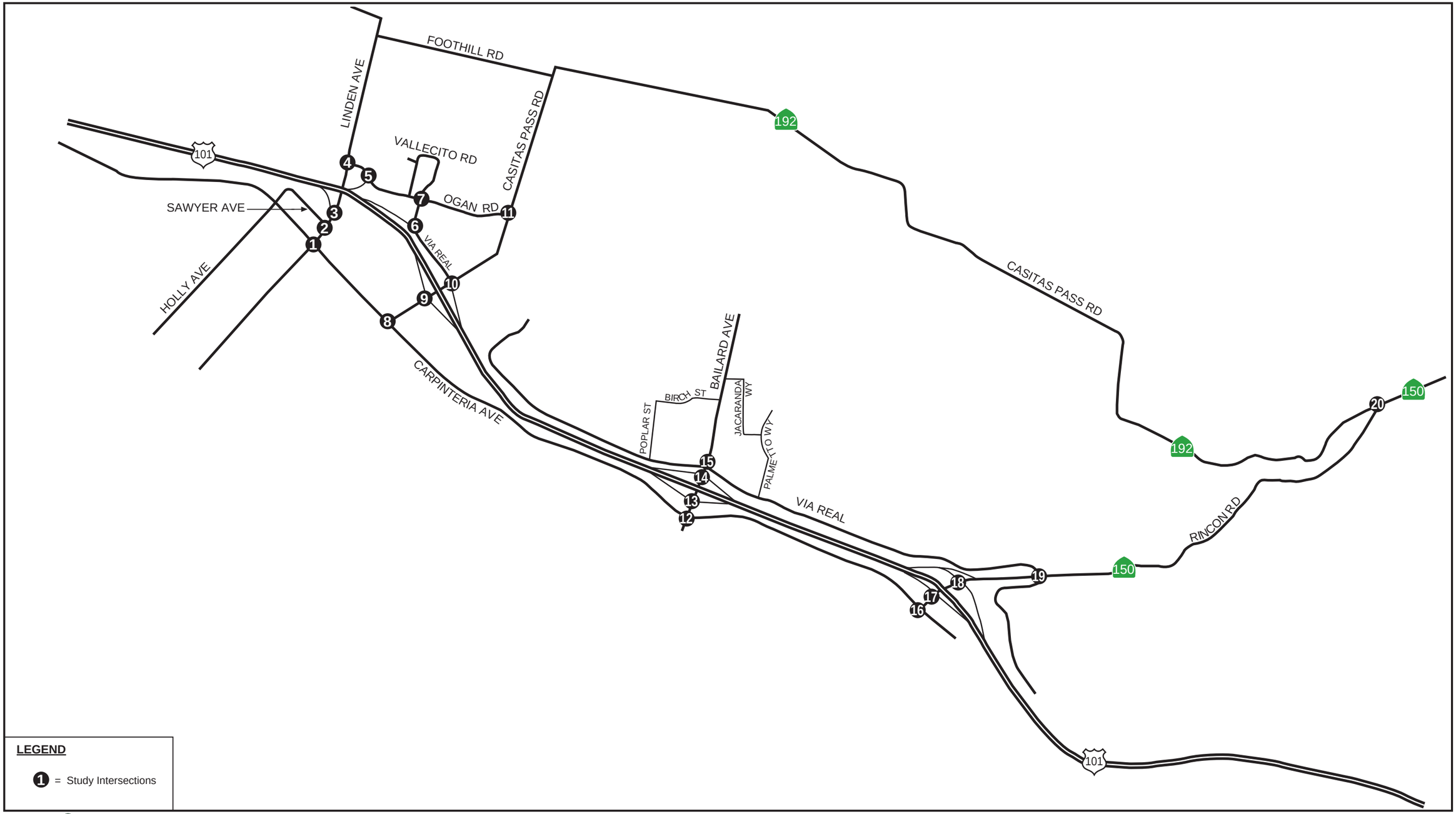
- Year 2016 and 2036 No Build
- Year 2016 and 2036 Alternative 1 Interchange Configuration
- Year 2016 and 2036 Alternative 2 Interchange Configuration
- Year 2016 and 2036 Alternative 3 Interchange Configuration
- Year 2016 and 2036 Alternative 4 Interchange Configuration (identical forecasts to Alternative 1)

FORECASTING TOOLS

The forecasting process was performed using a combination of the updated SBCAG regional travel demand model (developed in TransCAD software) and VISUM modeling software. The SBCAG model is a newly expanded model calibrated for the entire Santa Barbara County. The model focuses on estimating regional travel for the entire county. Since the Linden Avenue and Casitas Pass Road Interchange Improvements Project focuses on one important localized area of the U.S. 101 corridor in the South Coast, the SBCAG model was supplemented by a more detailed sub-area model. VISUM was employed to facilitate the estimation of travel patterns in the project area on a more refined level of detail, including collectors, local streets, and new ramps with specific peak hour turning movements to capture the local-scale distributional effects of the interchange improvements.

The SBCAG model employed for this project is based on an interim calibrated model completed in May 2005 for use in the 101 In-Motion Project. Since this is the latest version of the SBCAG model at this time, this version of model was used for the development of the 2016 and 2036 project forecasts. In addition, the 101 In-Motion "2030 Alternative C" model scenario (HOV South of Milpas Street) were employed for use in the 2036 traffic forecasts for year 2036 network consistency. The SBCAG model 2030 Alternative C scenario assumes that the U.S. 101 corridor would add one HOV lane on each direction south of the Milpas Street interchange. It is not expected that the construction of any of the project alternatives would preclude the implementation of the HOV lanes.

To improve upon the level of detail in the forecasting process, the VISUM modeling software was used to extract a sub-area of the regional SBCAG model and enhance its level of detail. VISUM has the same standard features as travel demand models as well as other features that allow a greater level of detail at the link and intersection level. Therefore, the SBCAG model was used as a macro-level planning tool for trip generation, trip distribution and mode split, while the VISUM model was used for detailed trip assignment within the project study area. Figure 13 presents the general process used to develop traffic forecasts, while a more detailed description of the process is presented below.



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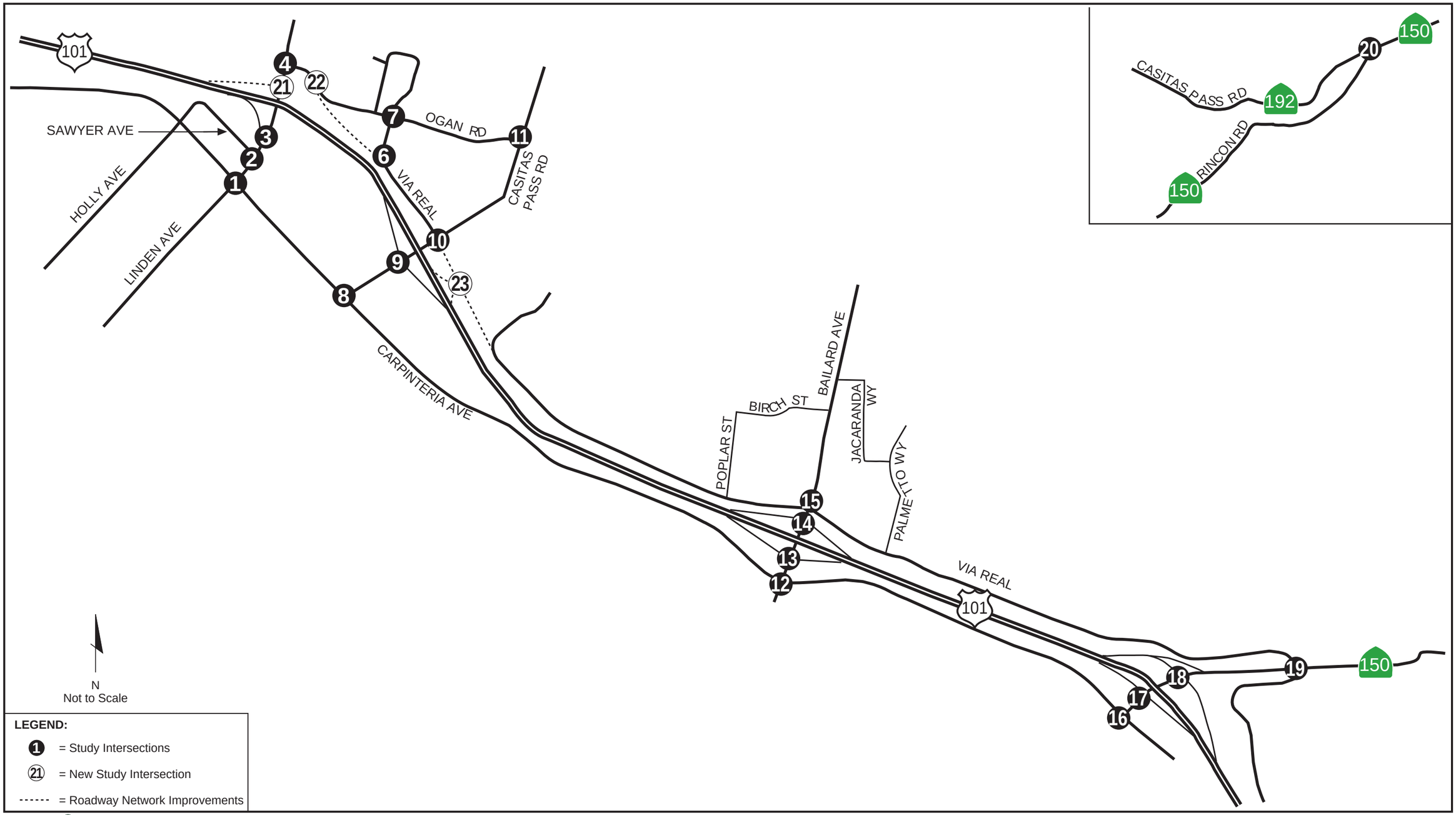
NO PROJECT ROADWAY TRAFFIC NETWORK AND STUDY INTERSECTIONS

FIGURE 9



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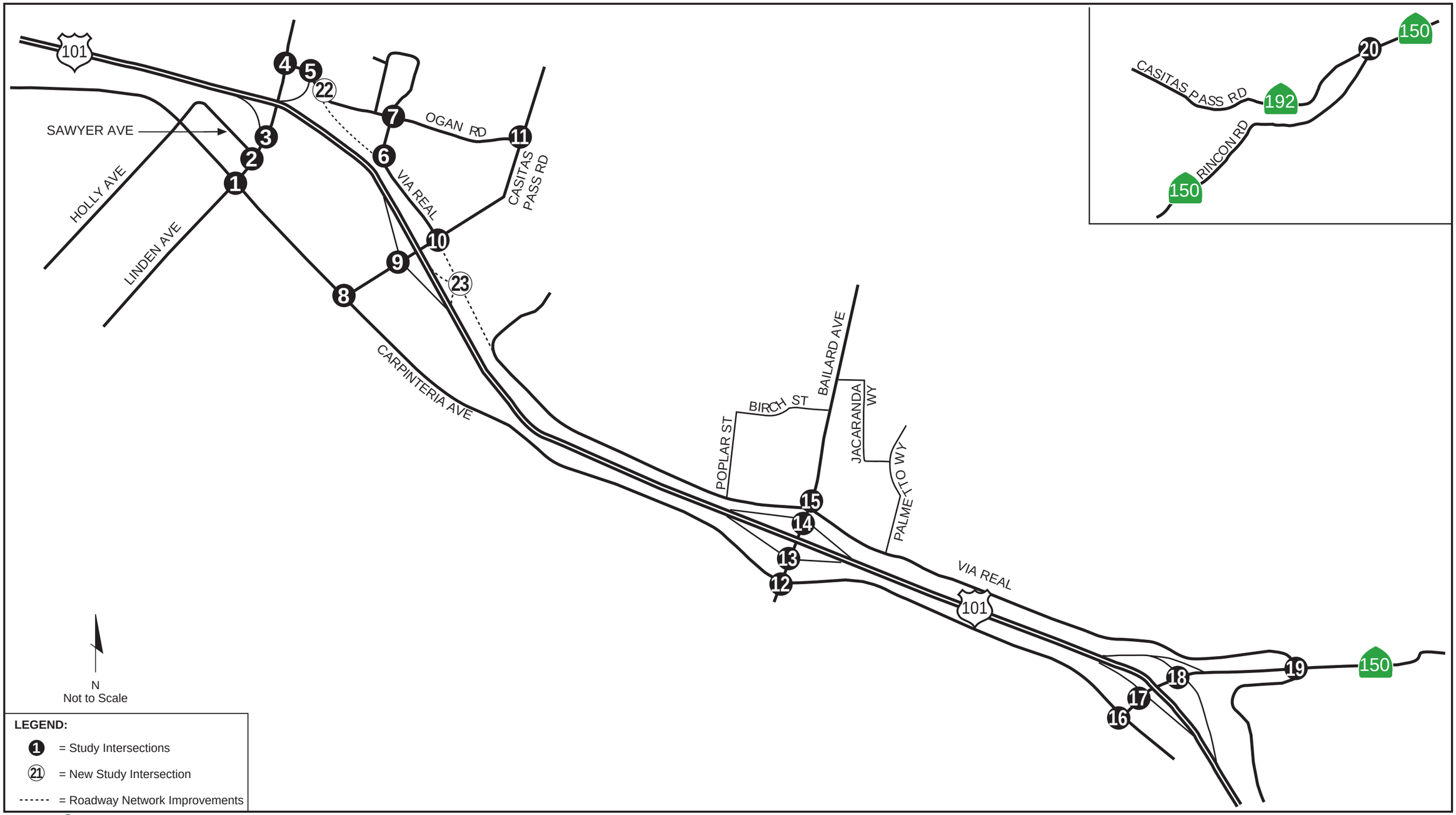
ALTERNATIVE 1 AND ALTERNATIVE 4 ROADWAY NETWORK AND STUDY INTERSECTIONS

FIGURE 10



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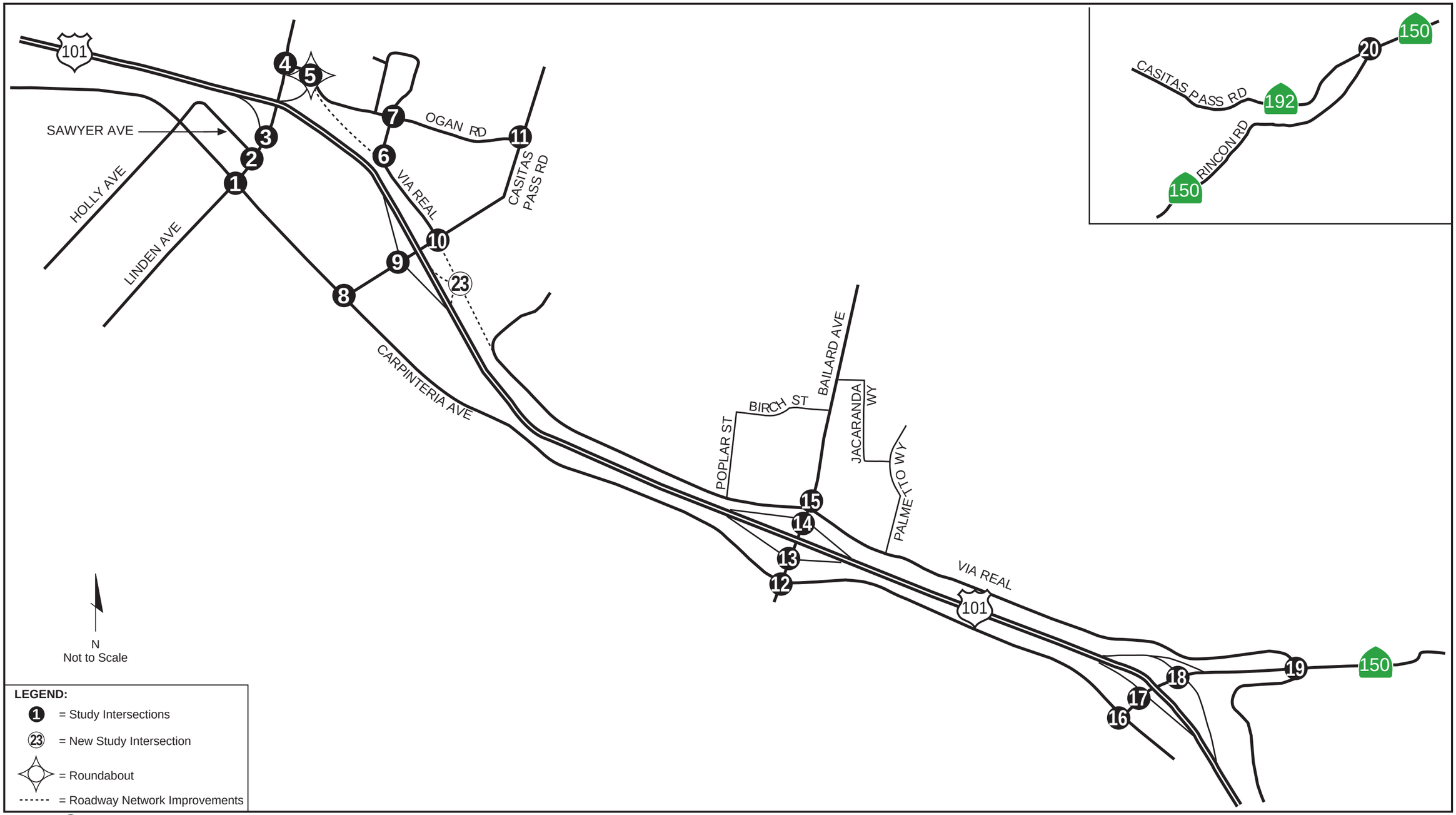
ALTERNATIVE 2 ROADWAY NETWORK AND STUDY INTERSECTIONS

FIGURE 11



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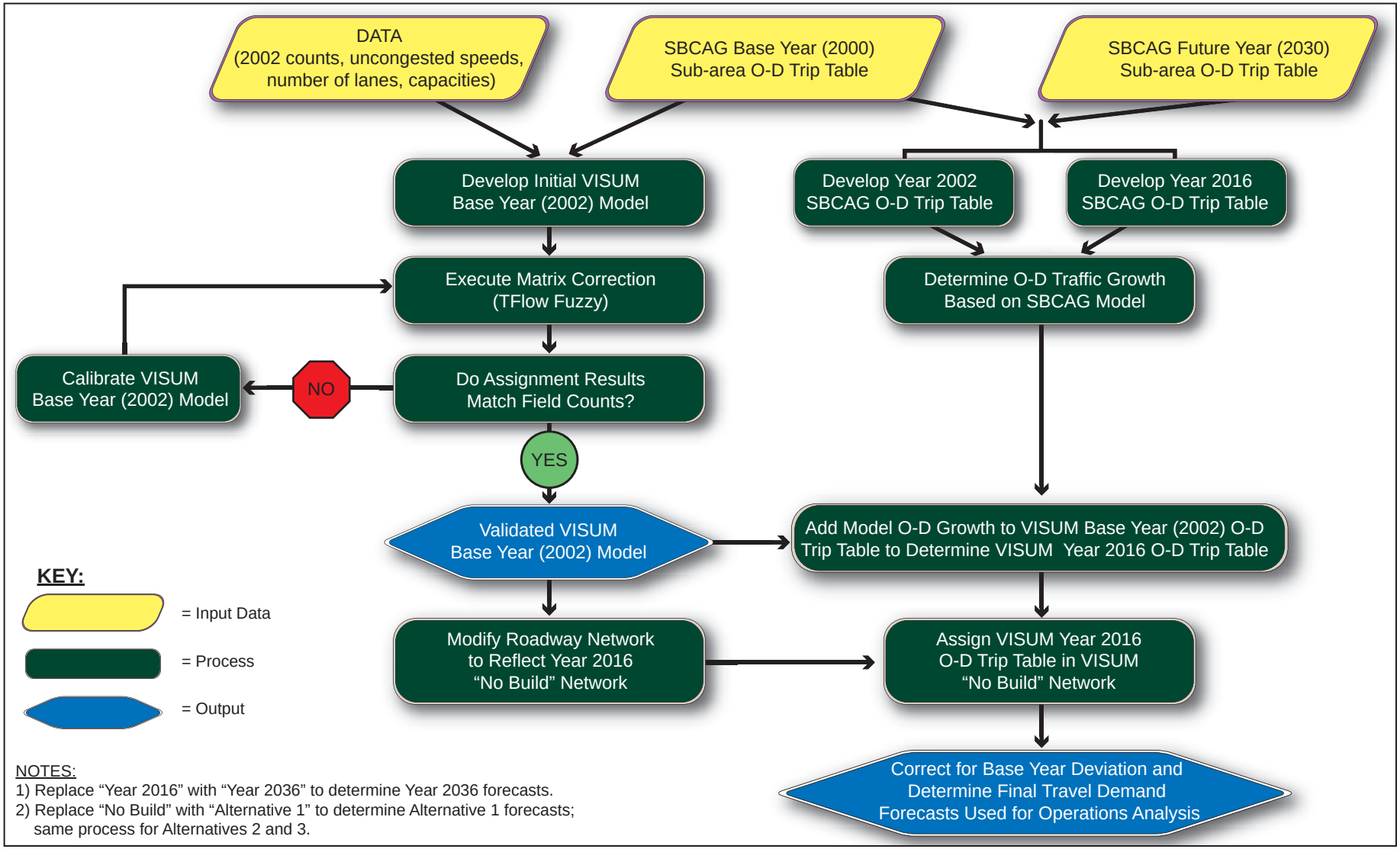
ALTERNATIVE 3 ROADWAY NETWORK AND STUDY INTERSECTIONS

FIGURE 12



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TRAFFIC FORECASTING PROCESS FLOW CHART

FIGURE 13

BASE YEAR (2002) VISUM MODEL DEVELOPMENT, CALIBRATION, AND VALIDATION

The first step in the forecasting process was to develop a base year AM and PM peak hour VISUM model. The information available to develop the VISUM model was the base year (2000) SBCAG model, year 2002 (September) intersection peak hour traffic counts, and year 2006 (January) intersection peak hour traffic counts. After discussing with Caltrans and other members of the project development team, it was determined that September 2002 intersection counts should be used as the base for traffic forecasting because they reflected traffic during the peak summer months. Using the September 2002 counts as the base for traffic forecasting would ensure that future year forecasts will reflect peak summer conditions.

Development, calibration, and validation of the VISUM base year (2002) AM and PM peak hour models involved a four-step process: 1) data collection; 2) SBCAG model sub-area extraction; 3) VISUM model development; and 4) VISUM model calibration and validation.

Step 1 - Data Collection

Year 2002 intersection peak hour volumes for 15 of the 20 study intersections were obtained from the *Traffic Analysis for the U.S. 101/Casitas Pass Road and U.S. 101/Linden Avenue Interchange Improvements Project* (May 2003). Intersection peak hour volumes were not collected in 2002 for the five study intersections on SR 150. Appropriate peak hour intersection volumes at the five study intersections on SR 150 were estimated based on year 2002 ramp volumes and 2003 intersection turning movement counts provided by Caltrans.

Year 2002 U.S. 101 mainline peak hour volumes were based on 2002 data provided by Caltrans for the months of June through September. Additional data collected in the field by Fehr & Peers included roadway geometrics, posted speed limits, and travel speeds on U.S. 101 during the peak hours.

Step 2 - Extract Base Year Origin-Destination Data from the SBCAG Model

Fehr & Peers extracted peak hour study area origin-destination (O-D) trip tables (AM and PM peak hour) from the SBCAG base year (2000) model. A detailed description of the sub-area extraction process including network modifications to the SBCAG model was presented in the technical memorandum entitled *Linden Avenue and Casitas Pass Road Interchange Improvements Project – SBCAG Model Input Checks and Modifications* (April 26, 2006). These trip tables are the source of the macro-level traffic patterns in the study area that is refined through the use of VISUM.

Step 3 - VISUM Model Development

Using aerial photography and field data, a VISUM model was developed for the project study area for year 2002 conditions. The VISUM model includes U.S. 101 between SR 150 and Linden Avenue and all of the 20 study intersections. The VISUM model was coded with the same attributes typically entered in a regional demand model such as roadway speeds and capacities. The initial roadway speeds and capacities were based on values coded in the SBCAG model. In addition to roadway speeds and capacities, detailed intersection characteristics (e.g., lane configurations, intersection control, and turn movement capacities) that are not typically specified in a regional demand model were also coded in the VISUM model. The additional detail in the VISUM model results in a greater understanding of traffic diversion from the freeway system onto local streets and greater confidence in the resulting forecasts. Finally, the existing peak hour traffic volumes (both intersection and freeway volumes) were imported into the VISUM model.

Similar to standard travel demand models, a traffic analysis zone (TAZ) structure was developed for the VISUM model that corresponds to the locations where traffic enters and exits the network. Figure 14 presents the roadway network and TAZ system for the VISUM model. In total, 30 TAZs were used to allow full representation of the freeways, local streets, and intermediate land uses within the study area.

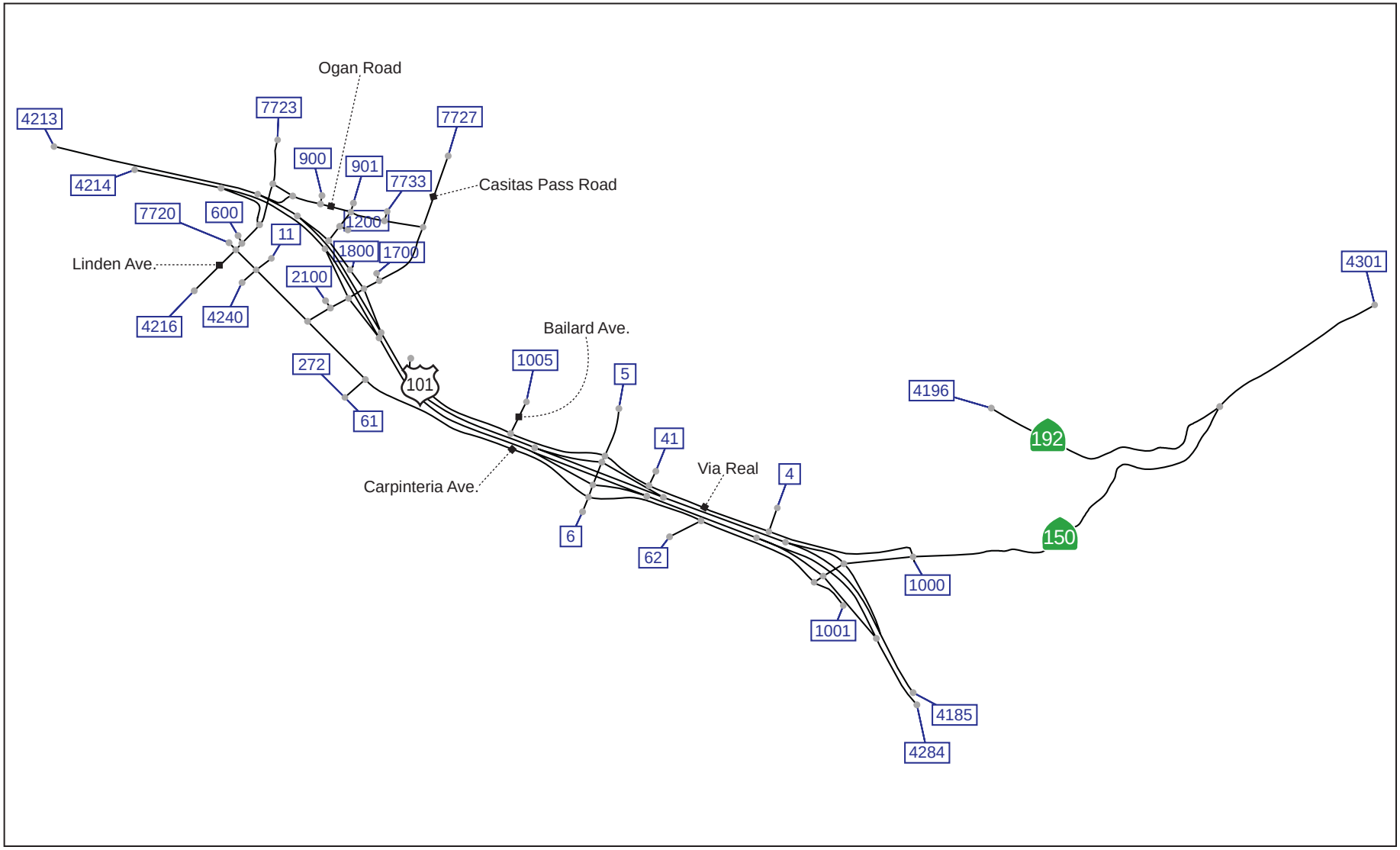
Intermediate "driveway" TAZs account for land uses and minor unsignalized intersections located between the study intersections. These TAZs accounted for traffic entering and exiting within the study area and helped maintain balanced traffic volumes, which are critical in the development of O-D trip tables for use in VISUM.

Unlike standard travel demand models, the VISUM model does not include zonal land use data as an input. Instead, the O-D trip table for the study area was imported into VISUM from the SBCAG year 2000 model. VISUM has the capability to adjust O-D trip tables from travel demand models to match field counts by utilizing the relation of intersection turning movements and the existing travel patterns in the demand model. The matrix adjustment module (TFlow Fuzzy) in VISUM was executed to refine the O-D trip tables from the SBCAG model. Prior to executing the TFlow Fuzzy module, the year 2000 SBCAG O-D trip table was disaggregated to increase the level of detail. A detailed description of the desegregation process was presented in the technical memorandum entitled *Linden Avenue and Casitas Pass Road Interchange Improvements Project – SBCAG Model Input Checks and Modifications* (April 26, 2006).

The TFlow Fuzzy process is based on matrix correction research by Zuylen/Willumsen, Bosserhoff, and Rosinowski. The matrix correction process recognizes that count data can vary and requests user input to determine the upper and lower bounds of output that are acceptable. The process uses complex vector analysis with the matrix values used as weights for the O-D relations and the upper and lower bounds of the traffic counts used to provide some slack in finding a solution to the matrix correction problem. It is important to note that solutions that match the counts exactly are preferred. Since the matrix correction procedure finds a solution to match the traffic counts it is not necessary that the traffic counts and the original O-D trip table represent the same year. For this project, the year 2000 matrix values from the SBCAG model were adjusted to year 2002 traffic counts during the matrix correction process using TFlow Fuzzy. The end result of this step is a refined year 2002 O-D trip table (AM and PM peak hour) that is based on the macro-level trip distribution results from the SBCAG model, as well as actual field counts.

Step 4 - Calibration and Validation

Traffic forecasting models are typically calibrated by adjusting model parameters until they are validated by applying a set of criteria that compare model link volumes to actual counts. Prior to calibration, the refined year 2002 O-D trip tables developed in Step 3 were assigned in the VISUM model to determine if the traffic volumes at the intersection approaches were within acceptable variation from the observed volume. Initial results indicated that traffic volumes at several of the study intersections were not within acceptable variation; therefore, model calibration was necessary. For this project, link capacities and speeds were used to calibrate the VISUM models, while the following model validation criteria for peak hour volumes, which are consistent with SBCAG validation criteria for freeway peak hour volumes, were used to validate the model.



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VISUM NETWORK ZONE STRUCTURE

FIGURE 14

Model Validation Criteria

1) Freeway Volumes – within 6% of counts
2) Ramp Volumes – see intersection volume criteria
3) Intersection Volumes – 90% of the intersections meet the following criteria:

If the Year 2002 approach volume is:	VISUM output volume should be within:
Fewer than 100 vehicles:	+/- 25 percent (75% to 125%)
Between 100 and 600:	+/- 20 percent (80% to 120%)
Between 600 and 1,000:	+/- 15 percent (85% to 115%)
Greater than 1,000:	+/- 10 percent (90% to 110%)

Year 2002 VISUM AM Peak Hour

The initial assignment of the year 2002 AM peak hour VISUM model produced turning movement volumes that fell within the validation criteria at most of the intersections. At a few locations, however, results did not meet the validation criteria. Since several intersections did not meet the validation criteria, Fehr & Peers compared the VISUM AM peak hour volumes to the observed volumes to determine what local calibration changes could be made to achieve validation at these intersections. It is important to note that the network parameters of speed and capacity for the SBCAG model are based upon functional classification and area type for the entire county. Because of the need for VISUM to more precisely replicate the distributional effects of traffic patterns in the project area, adjustments to the SBCAG's speed and capacity parameters for the project area were necessary to help estimate the localized traffic distribution and to help match peak hour VISUM results with observed traffic volumes and turning movements at crucial intersections. Table 8 summarizes the changes made to roadway capacities and speeds to improve the traffic assignment during the AM peak hour and better match AM peak hour VISUM results with observed traffic volumes.

With local calibration techniques, 92 percent (68 out of 74) of all approaches fell within the validation criteria for the AM peak hour. The six approaches that did not fall within the validation criteria were generally low-volume approaches (< 50 vehicles/hour). With respect to total intersection volume, all of the study intersections fell within the validation criteria for the AM peak hour. The freeway volumes also fell within the validation criteria and were validated to +/- 1%. Table 9 presents the AM peak hour validation results from the calibrated VISUM models for the total intersection volume. A complete comparison by intersection approach is provided in the Technical Appendix.

Year 2002 VISUM PM Peak Hour

Similar to the AM peak hour, local calibration was performed to help match PM peak hour VISUM results with observed traffic volumes. The same changes were made to the VISUM PM peak hour model that were made to the VISUM AM peak hour model except the capacity changes to northbound U.S. 101. There are no northbound bottlenecks during the PM peak hour.

With local calibration techniques, 97 percent (72 out of 74) of all approaches fell within the validation criteria for the PM peak hour. The two approaches that did not fall within the validation criteria were low-volume approaches (< 50 vehicles/hour). With respect to total intersection volume, all of the study intersections fell within the validation criteria for the PM peak hour. The freeway volumes also fell within the validation criteria and were validated to +/- 1%. Table 9 presents the PM peak hour validation results from the calibrated

VISUM models for the total intersection volume. A complete comparison by intersection approach is provided in the Technical Appendix.

TABLE 8
LOCAL CALIBRATION CHANGES

Location	SBCAG Model		VISUM Model		Reason for Change
	Capacity (veh/ln)	Free-flow Speed (mph)	Capacity (veh/ln)	Free-flow Speed (mph)	
Northbound U.S. 101 north of Bailard	1,900	65	1,500	65	These changes were made to reflect the congested conditions and the extent of queuing that was observed in the field during the AM peak hour in the northbound direction. It is important to recognize that the capacity reduction changes were not made to indicate that U.S. 101 actually has a lower capacity in this area than in other sections but instead to reflect the capacity reduction that occurs as a result of vehicle queue spillback from congestion that starts outside the study area north of Linden Avenue.
Northbound U.S. 101 between SR 150 and Bailard	1,900	65	1,700	65	The extent of queuing is generally just south of Bailard Avenue.
Carpinteria Avenue north of Casitas Pass	600	56	1,000	25	The capacity change was made based on the fact that existing volumes are above 800 vehicles in one direction. Based on field observations, the roadway segment did not appear to be at capacity. The speed change was made to reflect the posted speed limit.
Carpinteria Avenue south of Casitas Pass	600 - 800	54-56	1,200	35-45	The capacity change was made to reflect the general uninterrupted flow conditions that exist. The speed change was made to reflect the posted speed limit.
Linden Avenue	1,600	44-47	800	25	The capacity change was made to remain consistent with capacities for similar roadways. The speed change was made to reflect the posted speed limit.
Casitas Pass Road west of U.S. 101	1,200 – 1,600	54	1,000	25	The capacity change was made to remain consistent with capacities for similar roadways. The speed change was made to reflect the posted speed limit.
Casitas Pass Road east of U.S. 101	800	53	1,000	35	The capacity change was made to remain consistent with capacities for similar roadways. The speed change was made to reflect a more realistic speed for this section.
Bailard Avenue	600	25	1,000	25	The capacity change was made to remain consistent with capacities for similar roadways.
SR 150	1,600	40	1,200	40	The capacity change was made to remain consistent with capacities for similar roadways.
Via Real	800	45	1,200	40	The capacity change was made to remain consistent with capacities for similar roadways. The speed change was made to reflect a more realistic speed for this section.

TABLE 9
YEAR 2002 AM AND PM PEAK HOUR OBSERVED AND VISUM MODEL VOLUME COMPARISON BY TOTAL VOLUME

Intersection	AM Peak Hour			PM Peak Hour		
	Observed Count	VISUM Model	% Deviation	Observed Count	VISUM Model	% Deviation
1. Linden Avenue / Carpinteria Avenue	1,746	1,772	1%	1,776	1,787	1%
2. Linden Avenue / Sawyer Avenue	1,086	1,105	2%	929	949	2%
3. Linden Avenue / U.S. 101 Southbound Off-Ramp	1,161	1,156	0%	1,041	1,053	1%
4. Linden Avenue / Ogan Road	1,300	1,321	2%	1,066	1,091	2%
5. U.S. 101 Northbound On-Ramp / Ogan Road	765	770	1%	534	546	2%
6. Vallecito Road / Via Real	596	607	2%	408	401	-2%
7. Vallecito Road / Ogan Road	323	304	-6%	295	301	2%
8. Casitas Pass Road / Carpinteria Avenue	2,113	2,084	-1%	2,279	2,248	-1%
9. Casitas Pass Road / U.S. 101 Southbound Ramps	1,262	1,278	1%	1,559	1,531	-2%
10. Casitas Pass Road / Via Real / U.S. 101 Northbound Off-Ramp	1,278	1,296	1%	1,154	1,169	1%
11. Casitas Pass Road / Ogan Road	585	592	1%	545	512	-6%
12. Bailard Avenue / Carpinteria Avenue	946	946	0%	709	713	1%
13. Bailard Avenue / U.S. 101 Southbound Ramps	843	852	1%	781	765	-2%
14. Bailard Avenue / U.S. 101 Northbound Ramps	1,104	1,093	-1%	1,064	1,074	1%
15. Bailard Avenue / Via Real	937	979	4%	994	1,012	2%
16. SR 150 / Carpinteria Avenue	388	384	-1%	219	240	10%
17. SR 150 / U.S. 101 Southbound Ramps	470	464	-1%	623	638	2%
18. SR 150/U.S. 101 Northbound Ramps	740	763	3%	578	580	0%
19. SR 150 / Via Real	625	628	0%	567	563	-1%
20. SR 150 / Casitas Pass Road	407	423	4%	398	398	0%
All Intersections	18,675	18,881	1%	17,519	17,513	0%
Mainline	**Observed Count**	**VISUM Model**	**% Deviation**	**Observed Count**	**VISUM Model**	**% Deviation**
U.S. 101 South of Rincon Road	4,250	4,275	1%	5,051	5,058	0%
U.S. 101 between Rincon Road and Bailard Avenue	4,000	3,975	-1%	4,880	4,849	-1%
U.S. 101 between Bailard Avenue and Casitas Pass Road	4,390	4,367	-1%	3,090	3,060	-1%
U.S. 101 between Casitas Pass Road and Linden Avenue	4,332	4,309	-1%	3,167	3,155	0%
U.S. 101 North of Linden Avenue	5,092	5,050	-1%	2,128	2,130	0%
Total Mainline	22,064	21,976	0%	18,316	18,252	0%

Source: Fehr & Peers, 2007.

VISUM FUTURE YEAR NETWORK CHANGES

Two future year (2016 and 2036) VISUM networks were developed for No Build and Project conditions based on the 2002 calibrated/validated VISUM networks. The following presents the approach used develop these networks.

No Project Alternative

Year 2016

Since there are no planned roadway network changes in the study area by 2016, the year 2016 No Build VISUM network is the same as the year 2002 calibrated/validated VISUM network.

Year 2036

By 2036, HOV lanes are planned to be provided on U.S. 101. The year 2002 calibrated/validated VISUM network was modified to include HOV lanes on U.S. 101 starting at SR 150 (as represented in the SBCAG model). In addition to adding an HOV lane, the capacity of U.S. 101 was changed from 1,900 vehicles per lane to 2,000 vehicles per lane. This change was performed per the direction of Caltrans staff to remain consistent with the results of the *State Highway Congestion Monitoring Program Report* which uses a capacity of 2,000 vehicles per lane for most Caltrans Districts, including District 5.

Project Alternatives

Alternatives 1, 2, and 3 differ only with respect to the design of the northbound on-ramp at Linden Avenue. Alternative 1 would provide a diagonal northbound on-ramp from Linden Avenue. Alternative 2 would provide a northbound loop on-ramp from the Via Real extension, while Alternative 3, would provide a northbound loop on-ramp from the Via Real extension and a roundabout at the northbound loop on-ramp entrance. Since the design of Alternative 4 is almost identical to Alternative 1, the two alternatives are identical from a traffic forecasting perspective. Therefore, a VISUM network was developed for only Alternative 1, and manual reassignment of Alternative 1 peak hour volumes was performed to determine peak hour volumes for the other three alternatives.

Under the project alternatives, some existing intersections will be eliminated while new ones will also be created. Intersection 5 (*Ogan Road/101 Northbound On-Ramp*), does not exist under Alternative 1 or Alternative 4 with the addition of the directional northbound on ramp. Intersection 21 (*Linden Avenue/101 Northbound On-Ramp*) only exists for Alternative 1 and Alternative 4, and intersection 22 (Ogan Road/*Via Real*) does not exist under Alternative 3.

The following approach was used to develop the year 2016 and year 2036 Alternative 1 VISUM network.

Year 2016

The 2002 calibrated/validated VISUM network was modified to reflect geometric conditions for Alternative 1.

Year 2036

As discussed under No Project conditions, HOV lanes are planned to be provided on U.S. 101 by Year 2036. The year 2036 Alternative 1 VISUM network was developed by modifying the year 2016 Alternative 1 VISUM network to include HOV lanes on U.S. 101. The start and end points of the HOV lanes was assumed to be the same as No Project conditions. In addition to adding an HOV lane, the capacity of U.S. 101 was changed from 1,900 vehicles per lane to 2,000 vehicles per lane.

YEAR 2016 AND 2036 TRAFFIC FORECASTS

Three primary tasks were undertaken to develop traffic forecasts for the required analysis years. First, year 2016 and 2036 O-D trip tables were developed. Second, the year 2016 and 2036 O-D trip tables were assigned in VISUM. Finally, the year 2016 and 2036 VISUM traffic forecasts were adjusted to account for base year model deviation.

Year 2016 and 2036 O-D Trip Tables

The following three-step process was used to develop year 2016 and 2036 O-D trip tables to assign in VISUM.

Step 1 – Extract Base Year and Future Year Origin-Destination Data from the SBCAG Model

Base year (2000) and future year (2030) sub-area single occupant vehicle (SOV) O-D trip tables (AM and PM peak hour) were extracted from the SBCAG model. Since the future year model includes an HOV lane on U.S. 101, an HOV sub-area O-D trip table was also extracted from the SBCAG model. In summary, the following three sub-area O-D trip tables (AM and PM peak hour) were extracted:

- SBCAG base year (2000) O-D trip table (includes all vehicle classifications)
- SBCAG future year (2030) SOV O-D trip table
- SBCAG future year (2030) HOV O-D trip table

When the SBCAG future year (2030) SOV and HOV O-D trip tables are added they form a new O-D trip table that combines all vehicle trips (SBCAG combined future year).

Step 2 – Estimate SBCAG Year 2002, 2016, and 2036 O-D Trip Tables

SBCAG year 2002 and 2016 O-D trip tables (AM and PM peak hour) were estimated through linear interpolation of the SBCAG base year (2000) and SBCAG combined future year (2030) O-D trip tables from Step 1, while the SBCAG year 2036 O-D trip table was estimated through linear extrapolation. These estimated trip tables include all vehicle classifications (i.e., HOV and SOV).

Step 3 – Determine VISUM Year 2016 and 2036 O-D Trip Tables

A VISUM year 2016 O-D trip table was developed by adding the difference between the estimated SBCAG Year 2016 and SBCAG Year 2002 O-D trip tables (estimated in Step 2) to the refined VISUM base year (2002) O-D trip table developed during the model validation process. Therefore, the VISUM year 2016 O-D trip table reflects the anticipated growth in the study area by year 2016 as estimated by the SBCAG travel demand model.

The approach described above is very similar to other model adjustment techniques like the "delta method," which applies the following formula:

Adjusted Future Volume = Base Year Field Count + (Model Future Volume - Model Base Year Volume)

However, instead of applying this technique at the link level, the technique is applied at the O-D level to better reflect the model's growth predictions.

VISUM year 2036 O-D trip tables (AM and PM peak hour) were developed using a similar approach. However, instead of using the estimated SBCAG year 2016 O-D trip tables to determine growth, the estimated SBCAG year 2036 O-D trip tables were used. As discussed earlier, U.S. 101 will provide an HOV

lane in each direction by year 2036. To estimate HOV volumes in the future, the VISUM year 2036 O-D trip tables were disaggregated into two trip tables by vehicle classification (HOV and SOV) by using the ratio of HOV to SOV volumes from the SBCAG future year (2030) HOV and SOV O-D trip tables determined in Step 1.

The end result from this step was three O-D trip tables:

- VISUM year 2016 O-D trip table
- VISUM year 2036 HOV O-D trip table
- VISUM year 2036 SOV O-D trip table

VISUM Traffic Assignment

No Project Alternative

VISUM year 2016 No Project peak hour model forecasts were determined by assigning the VISUM 2016 O-D trip tables (AM and PM peak hour) to the VISUM 2016 No Project network. VISUM 2036 No Project peak hour model forecasts were determined by assigning the VISUM 2036 HOV and VISUM 2036 SOV trip tables simultaneously to the VISUM 2036 No Project network. Prior to assigning the O-D trip tables under both 2016 and 2036 scenarios, the traffic volume entering the study area on U.S. 101 was checked against the capacity (2,000 vehicles per lane). The traffic volume was constrained to 2,000 vehicles per lane in cases where the volume exceeded the capacity of U.S. 101 to ensure that a reasonable amount of traffic was projected in the study area. Under No Project conditions, it was necessary to constrain volumes at the following locations because they exceeded the capacity of the mainline:

- PM southbound direction under Year 2016 was constrained to 4,000 vehicles to reflect two mainline lanes at a maximum 2,000 vehicles per lane
- PM southbound direction under Year 2036 was constrained to 6,000 vehicles to reflect two mixed-flow lanes and one HOV lane at a maximum 2,000 vehicles per lane
- PM northbound direction under Year 2036 was constrained to 4,000 vehicles instead of 6,000 vehicles which would be the case with two mixed-flow lanes and one HOV lane because the constraining location on northbound U.S. 101 is actually south of the Bates Road interchange where only two mixed flow lanes are provided

Alternative 1

VISUM year 2016 and 2036 Alternative 1 peak hour model forecasts were determined using the same approach as No Project conditions except the O-D trip tables were assigned in the VISUM Alternative 1 networks. Traffic volumes were also constrained under Alternative 1 to 2,000 vehicles per lane on U.S 101. The same locations constrained under No Project conditions were constrained under Alternative 1 conditions.

Year 2016 and 2036 Peak Hour Traffic Volumes

As presented earlier in Table 9, the VISUM base year (2002) model does not replicate exactly every field count. Therefore, the traffic forecasts provided by the VISUM 2016 and 2036 models were adjusted for VISUM base year model deviation. For each VISUM 2016 intersection turning movement volume, the following adjustment was made:

Year 2016 Adjusted Turning Movement Volume =	*Year 2002 Field Turning Movement Count + (VISUM Year 2016 Turning Movement Volume – VISUM Year 2002 Turning Movement Volume)*

The same adjustment process was used for VISUM 2036 intersection turning movement volumes.

Year 2016 intersection peak hour traffic volumes under all project alternatives are presented on Figures 15A through 15E, while Year 2036 intersection peak hour traffic volumes are presented on Figures 16A though 16E. Figure 17 presents the Year 2016 No Project and Year 2016 With Project mainline and ramp peak hour forecasts, while the Year 2036 No Project and Year 2036 With Project mainline and ramp peak hour forecasts are presented on Figure 18. Due to the similarity of project Alternatives 1 through 4, the mainline and ramp peak hour forecasts are the same for these alternatives.

The following presents a general description of the traffic volume changes over time and between the No Project and With Project scenarios.

- Under Year 2016 conditions, traffic diversion from northbound U.S. 101 will continue to occur during the AM peak hour. Under No Project conditions, traffic will divert to Carpinteria Avenue while under Project conditions, traffic will divert to both Carpinteria Avenue and Via Real. The result of this diversion is reflected in higher westbound right turn volumes at intersection 14, northbound left turns at intersection 15, and volumes using the northbound on-ramp at intersections 5 (Alternatives 2 and 3) or 21 (Alternatives 1 and 4) on Figures 15C, 15A, and 15E, respectively.

- Under Year 2016 conditions, southbound traffic on U.S. 101 was constrained to 4,000 vehicles per hour during the PM peak hour. High volumes on southbound U.S. 101 result in southbound local traffic using Carpinteria Avenue to bypass congestion on southbound U.S. 101 under No Project conditions. Similarly, Carpinteria Avenue and Via Real are used to bypass congestion on southbound U.S. 101 under With Project conditions. The use of Via Real under the With Project conditions results in lower eastbound left turns at intersections 12 and 13, northbound through movements at intersection 14, and northbound right turns at intersection 15 compared to the No Project condition as shown on Figure 15C.

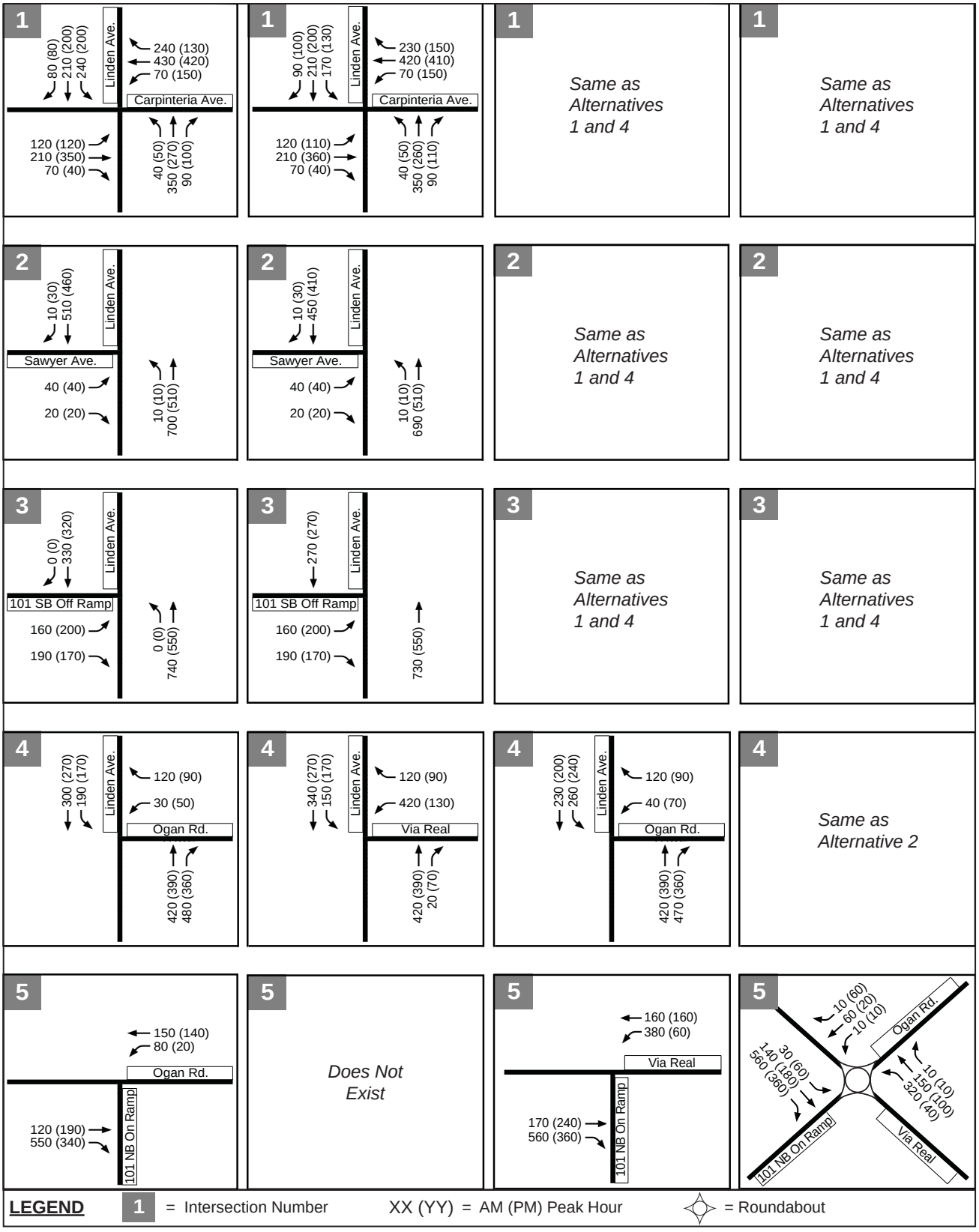
- Under Year 2036 conditions, northbound traffic on U.S. 101 was constrained to 4,000 vehicles per hour to provide a reasonable estimate of the actual amount of traffic that could arrive south of SR 150. The combination of constrained volumes entering northbound U.S. 101 and a northbound HOV lane would eliminate traffic diversion from U.S. 101 under No Project and With Project conditions, resulting in freeway volumes increasing while ramp volumes previously used for diversion decrease compared to 2016, as shown on Figures 17 and 18.

- Under Year 2036 conditions, southbound traffic on U.S. 101 was constrained to 6,000 vehicles per hour. Similar to Year 2016 conditions, Carpinteria Avenue will be used to bypass southbound congestion on U.S. 101 under No Project conditions and both Carpinteria Avenue and Via Real will be used to bypass southbound congestion on U.S. 101 under With Project conditions.

- The Via Real extension provided under Alternatives 1 through 4 provides a local connection for the land uses located on the east side of U.S. 101. The Via Real extension would permit access between the uses without requiring freeway use, resulting in lower freeway volumes for the With Project conditions compared to the No Project conditions for both 2016 (Figure 17) and 2036 (Figure 18).

101 IN-MOTION SBCAG TRAFFIC FORECASTS

As discussed at the beginning of this chapter, the SBCAG model employed for this project is based on an interim calibrated model completed in May 2005 for use in the 101 In-Motion Project. This was the latest version of the SBCAG model available when traffic forecasting began for this project. SBCAG has recently developed (September 2006) updated forecasts under a "2030 Plan" that includes the implementation of all the multi-modal alternative transportation consensus package measures including commuter rail, express bus, and TDM measures by 2030. Based on a traffic forecast comparison performed by SBCAG, the latest mainline forecasts for the 101 In-Motion Project are much lower than the mainline forecasts presented in this study due to implementation of the multi-modal alternatives. Caltrans and SBCAG have agreed that for purposes of evaluating the Linden Avenue and Casitas Pass Road interchange alternatives that no changes to the traffic forecasts presented in this report are to be made. However, the traffic forecasts presented in this report should be considered to be on the higher side when designing the facilities.



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YEAR 2016 INTERSECTION PEAK HOUR VOLUMES

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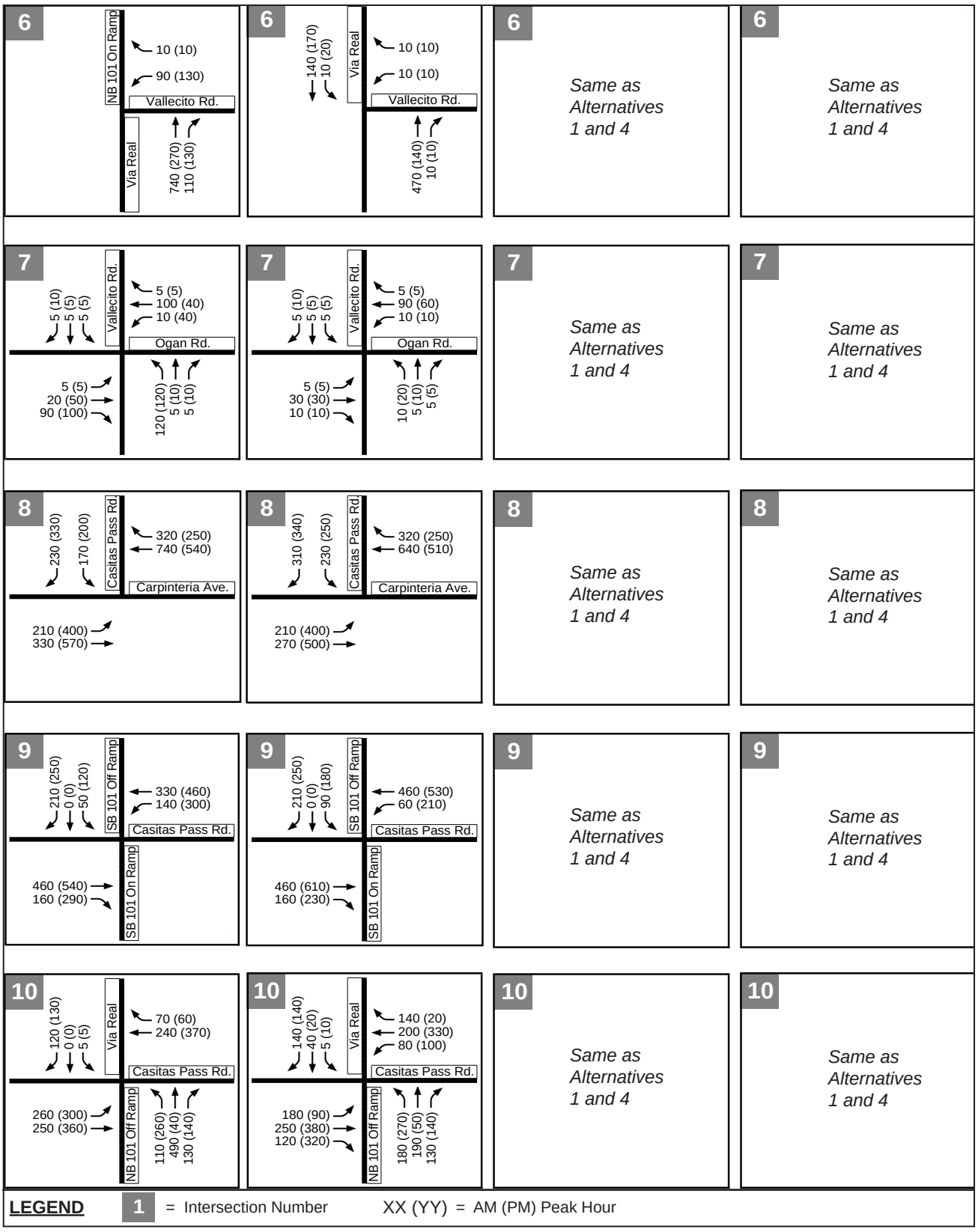
FIGURE 15A



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YEAR 2016 INTERSECTION PEAK HOUR VOLUMES

November 2006
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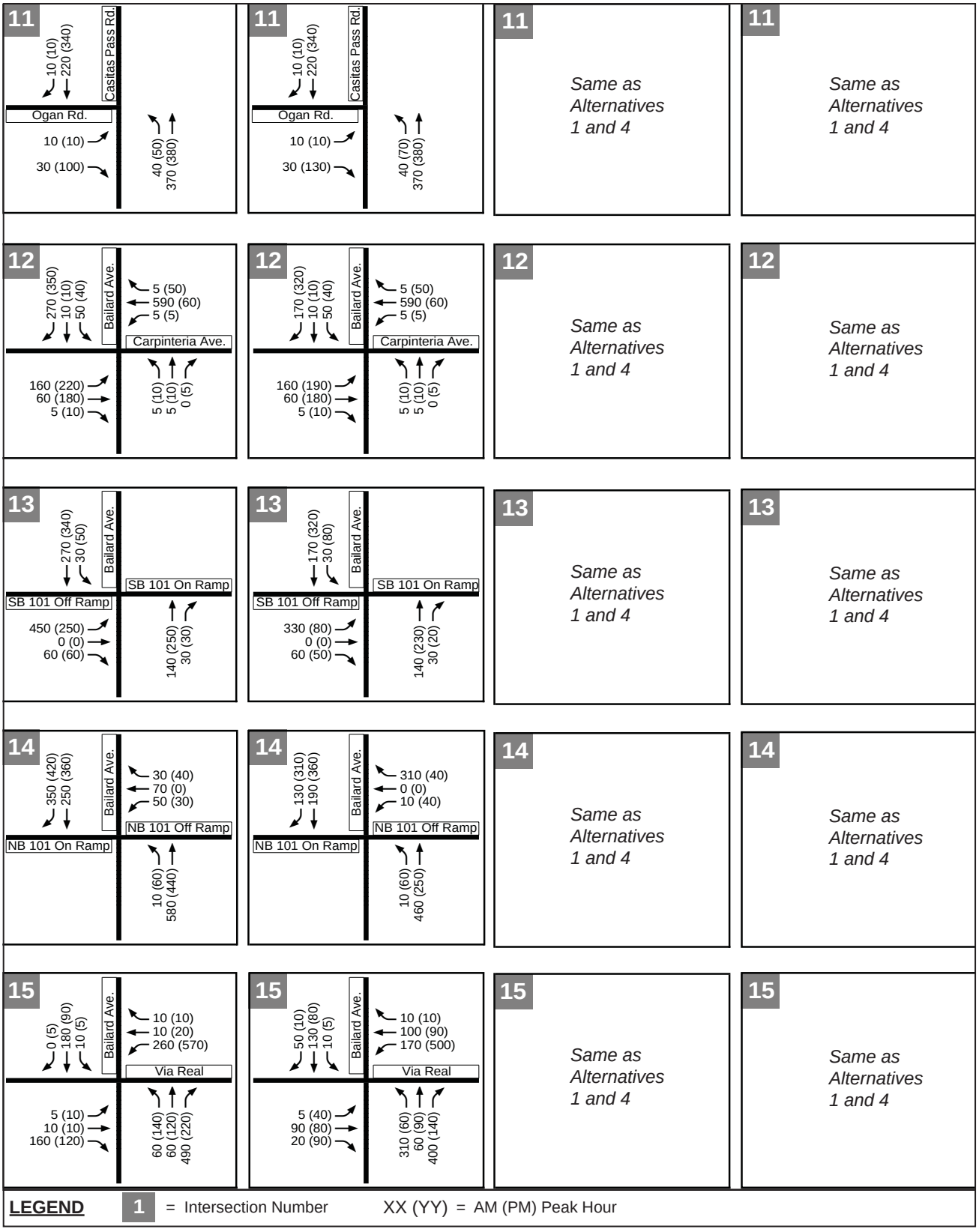
FIGURE 15B



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YEAR 2016 INTERSECTION PEAK HOUR VOLUMES

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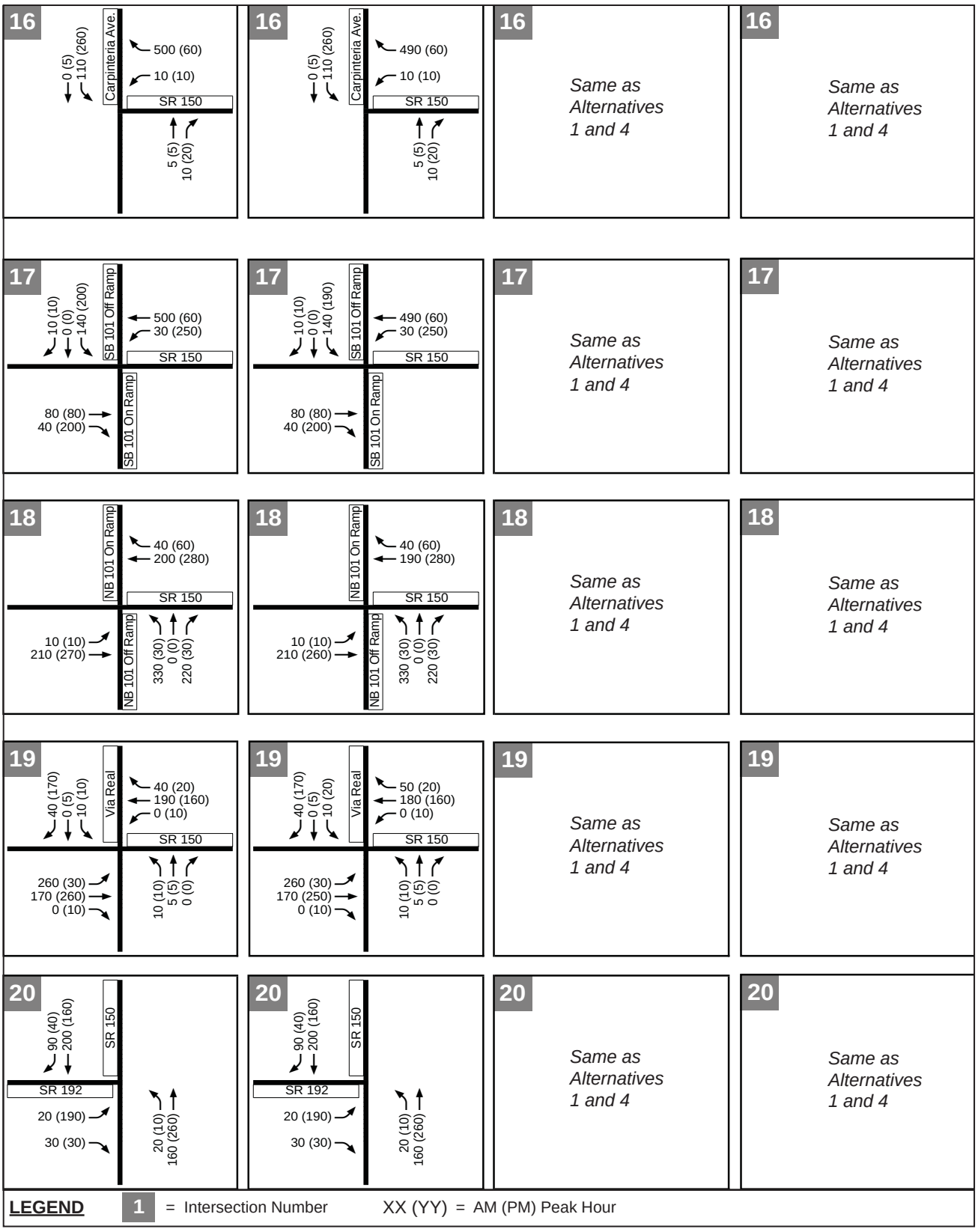
FIGURE 15C



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YEAR 2016 INTERSECTION PEAK HOUR VOLUMES

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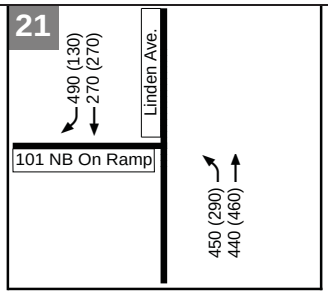
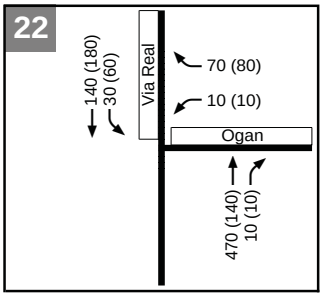
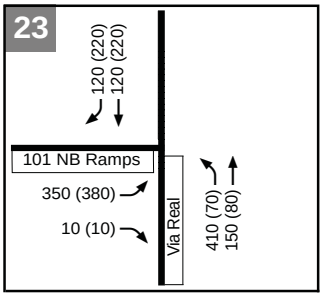
FIGURE 15D

No Project	Alternatives 1 and 4	Alternative 2	Alternative 3
21 *Does Not Exist*	21 	21 *Does Not Exist*	21 *Does Not Exist*
22 *Does Not Exist*	22 	22 *Same as Alternatives 1 and 4*	22 *Does Not Exist*
23 *Does Not Exist*	23 	23 *Same as Alternatives 1 and 4*	23 *Same as Alternatives 1 and 4*

LEGEND 1 = Intersection Number XX (YY) = AM (PM) Peak Hour

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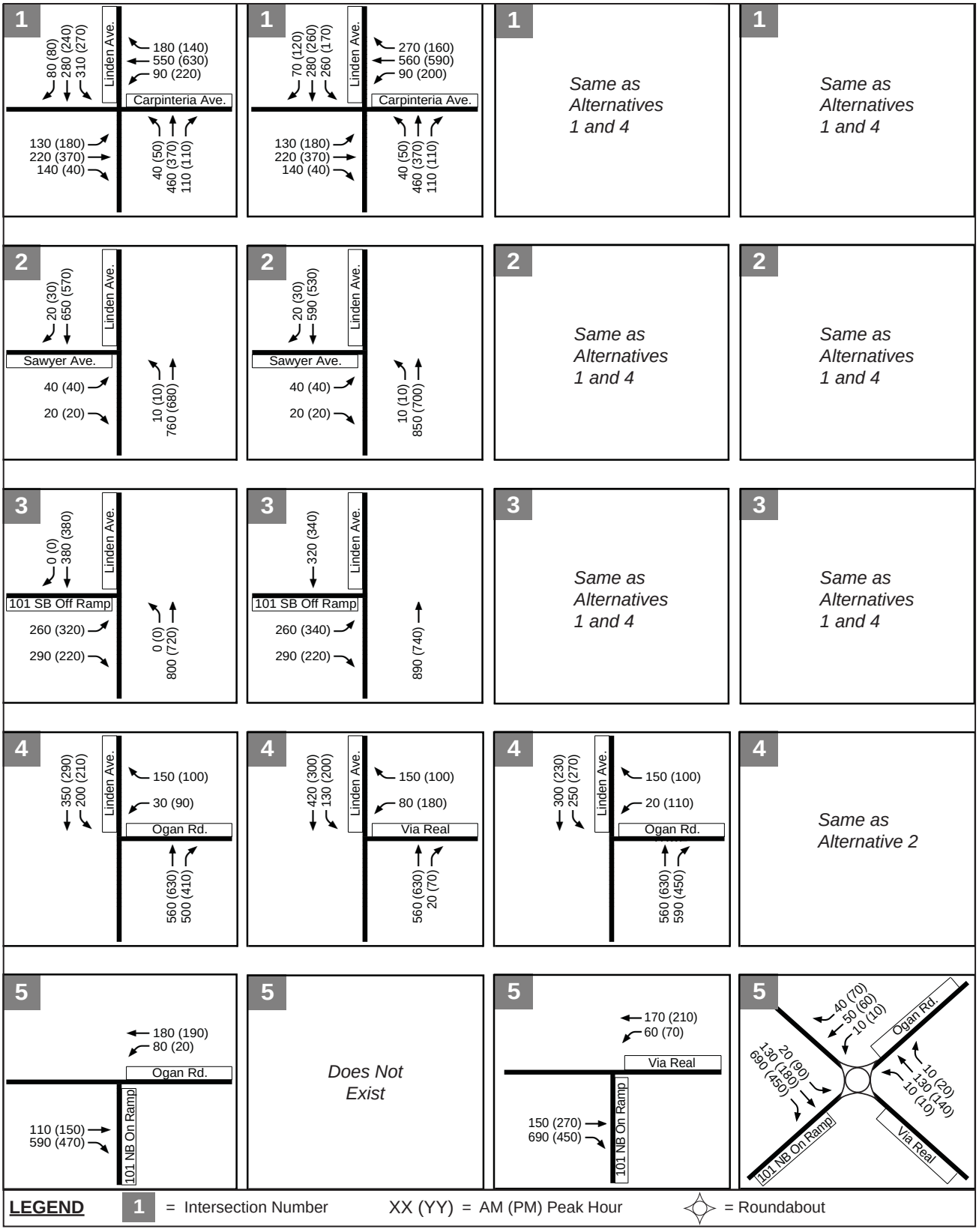
YEAR 2016 INTERSECTION PEAK HOUR VOLUMES

November 2006
Graphics\Nov 2006\WC05-2271_15E

FIGURE 15E



Linden Avenue/Casitas Pass

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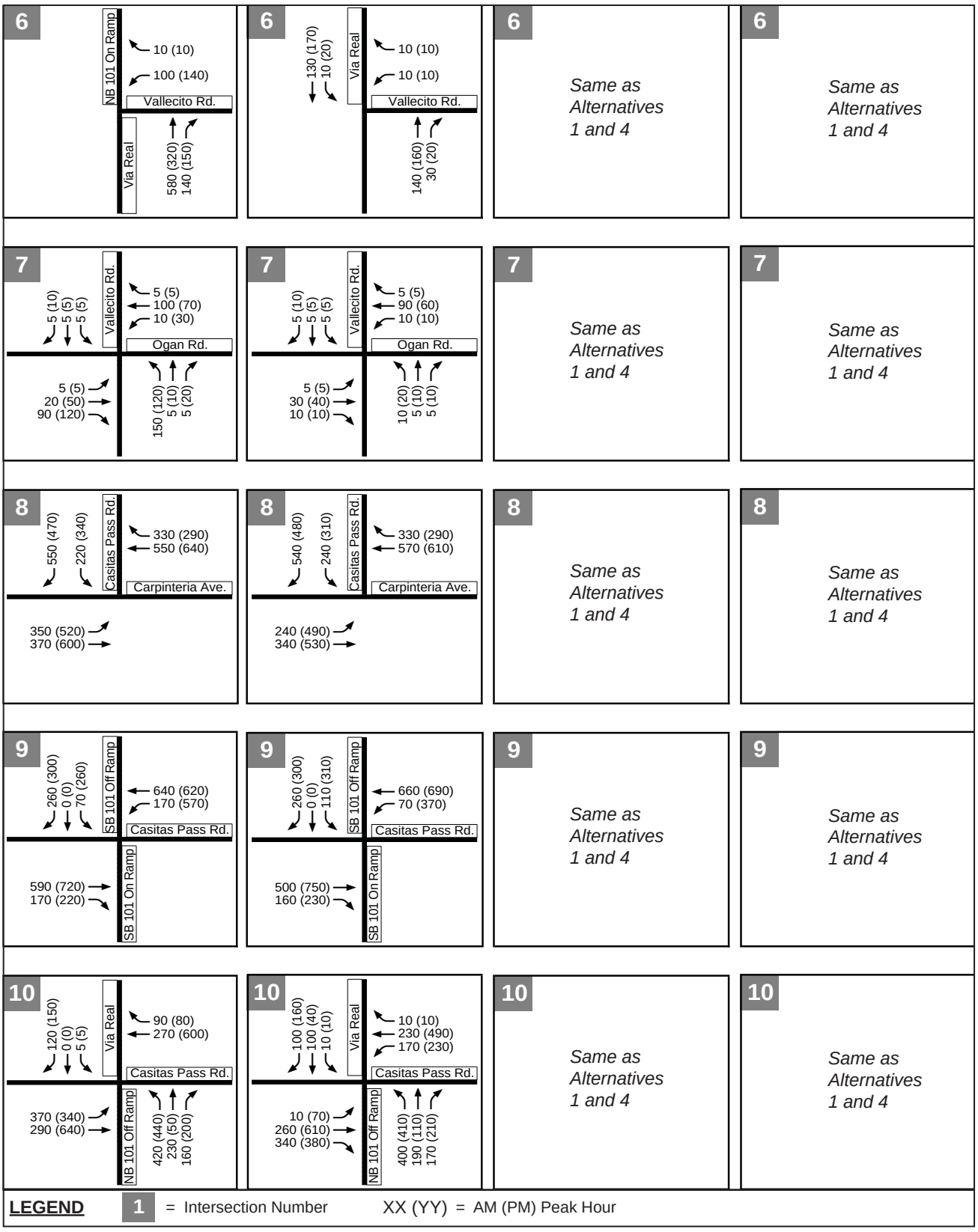
YEAR 2036 INTERSECTION PEAK HOUR VOLUMES

November 2006
Graphics\Nov 2006\WC05-2271_16A

FIGURE 16A



Linden Avenue/Casitas Pass

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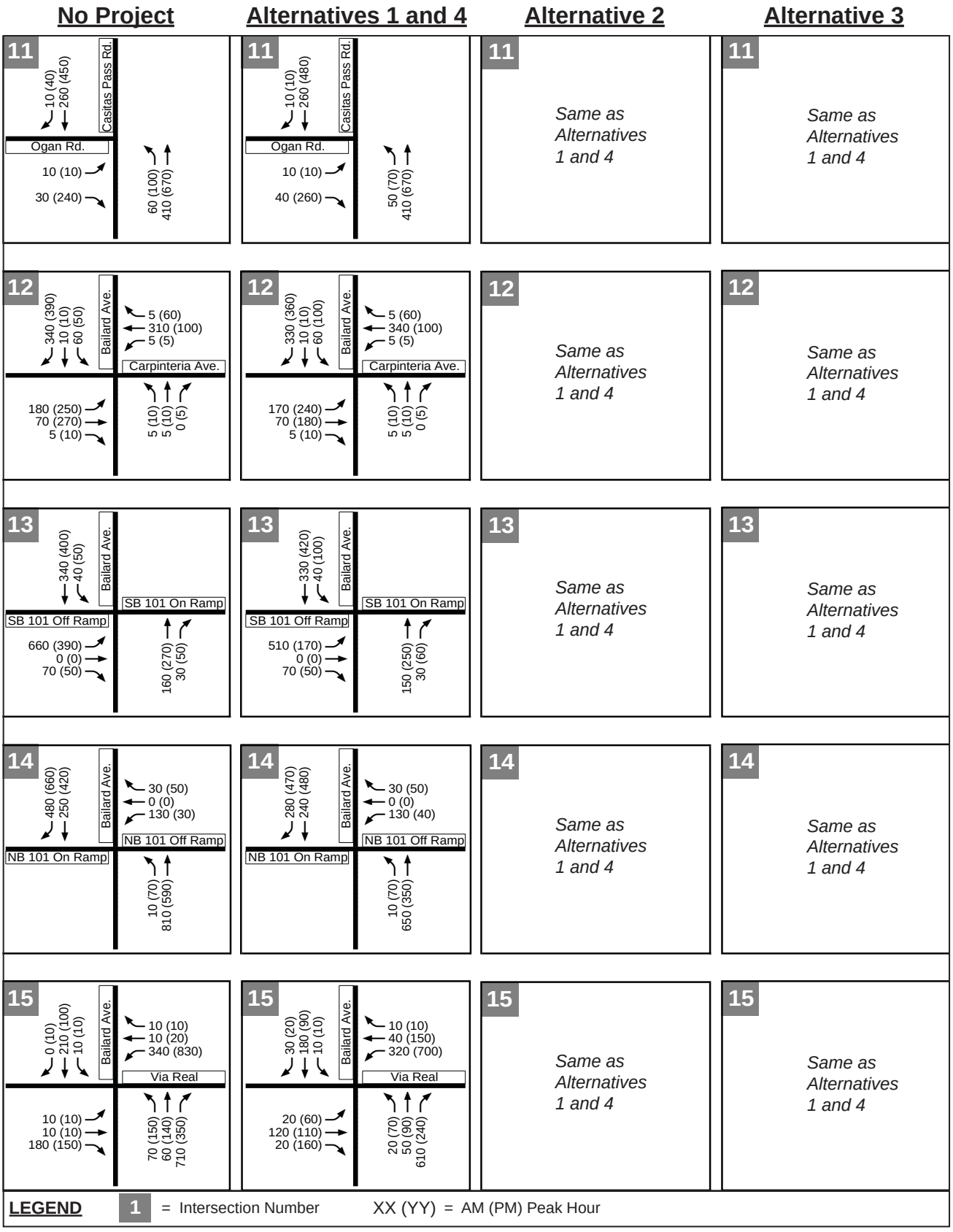
YEAR 2036 INTERSECTION PEAK HOUR VOLUMES

November 2006
Graphics\Nov 2006\WC05-2271_16B

FIGURE 16B



Linden Avenue/Casitas Pass

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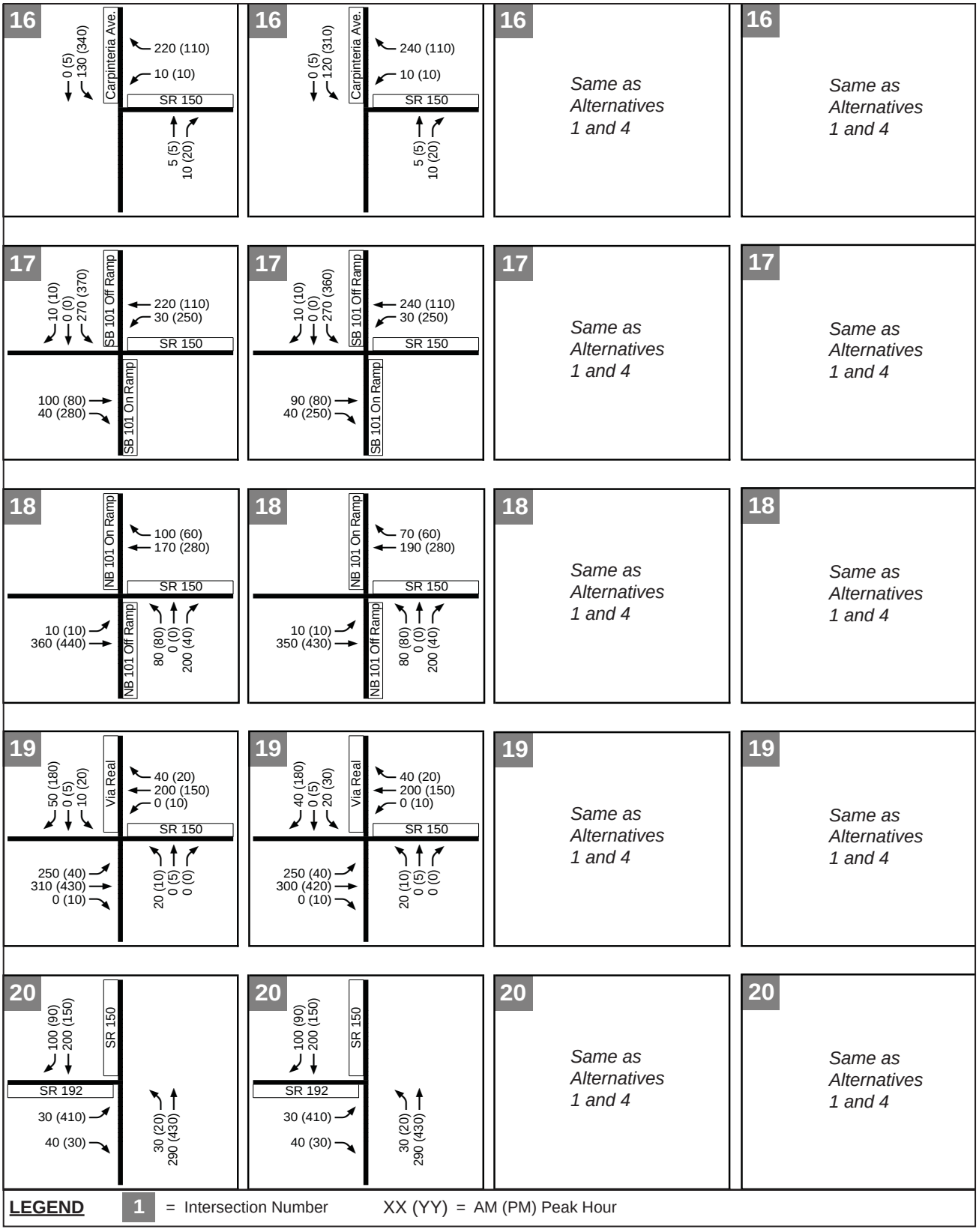
YEAR 2036 INTERSECTION PEAK HOUR VOLUMES

November 2006
Graphics\Nov 2006\WC05-2271_16C

FIGURE 16C



Linden Avenue/Casitas Pass

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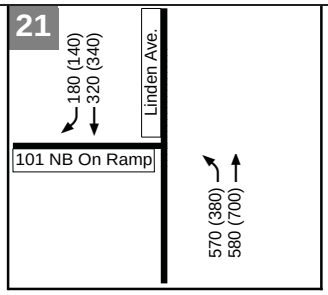
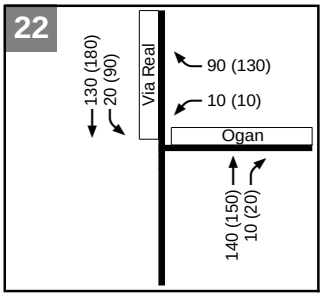
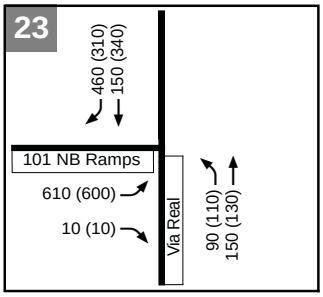
YEAR 2036 INTERSECTION PEAK HOUR VOLUMES

November 2006
Graphics\Nov 2006\WC05-2271_16D

FIGURE 16D

No Project	Alternatives 1 and 4	Alternative 2	Alternative 3
21 *Does Not Exist*	21 	21 *Does Not Exist*	21 *Does Not Exist*
22 *Does Not Exist*	22 	22 *Same as Alternatives 1 and 4*	22 *Does Not Exist*
23 *Does Not Exist*	23 	23 *Same as Alternatives 1 and 4*	23 *Same as Alternatives 1 and 4*

LEGEND 1 = Intersection Number XX (YY) = AM (PM) Peak Hour

Linden Avenue/Casitas Pass

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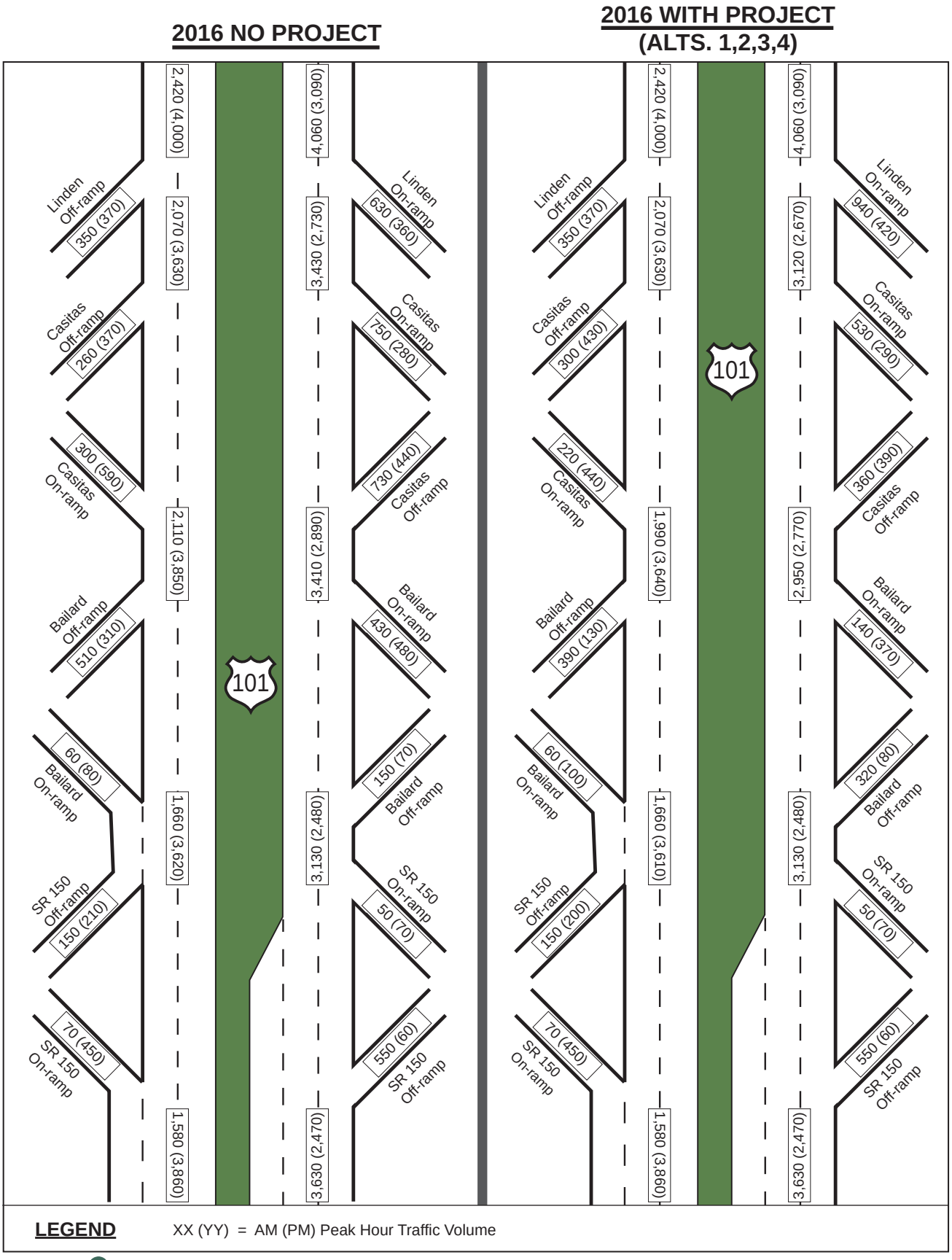
YEAR 2036 INTERSECTION PEAK HOUR VOLUMES

November 2006
Graphics\Nov 2006\WC05-2271_16E

FIGURE 16E



Linden Avenue/Casitas Pass

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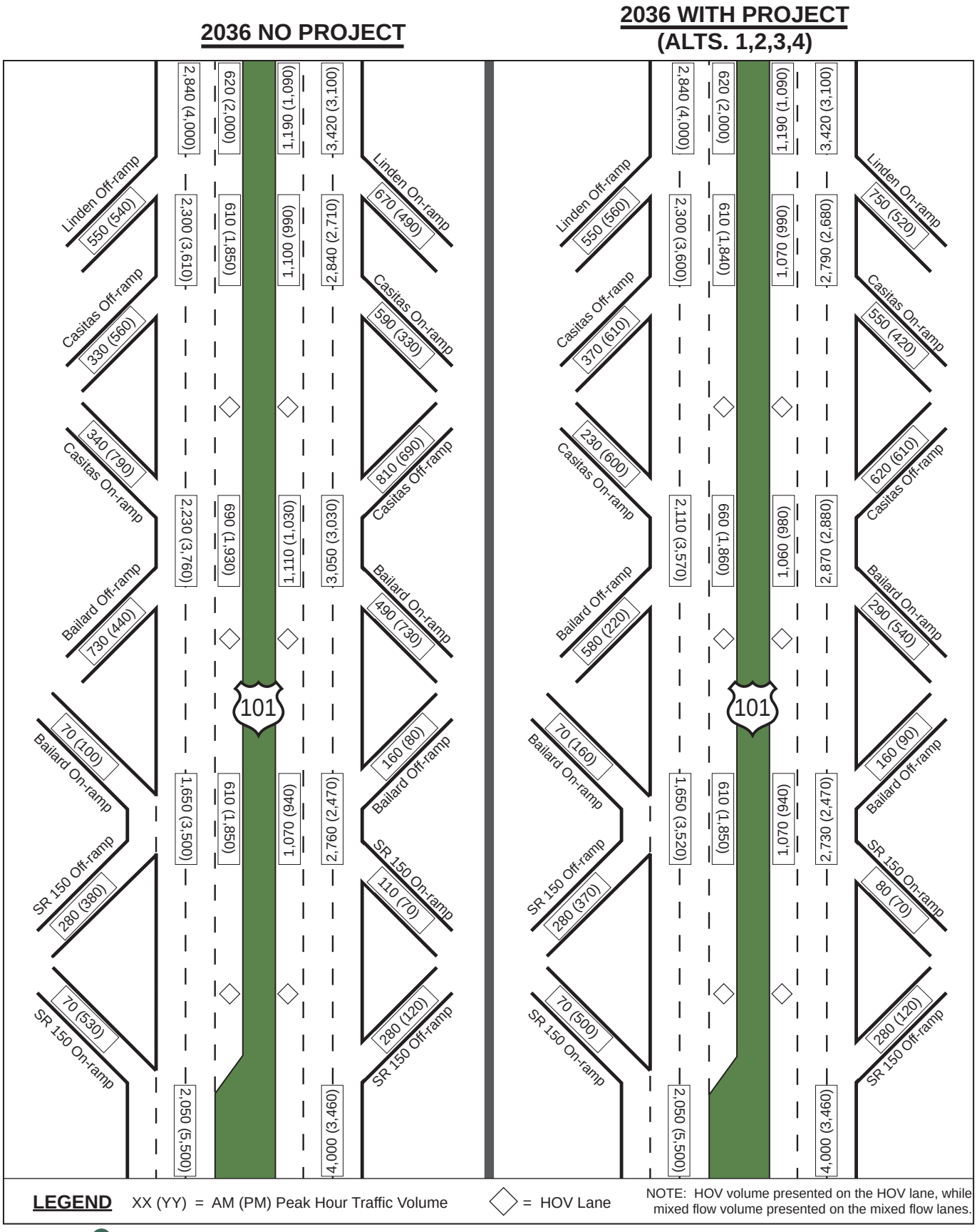
YEAR 2016 NO PROJECT AND WITH PROJECT MAINLINE AND RAMP PEAK HOUR VOLUMES

November 2006
Graphics\Nov 2006\WC05-2271_17

FIGURE 17



Linden Avenue/Casitas Pass

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YEAR 2036 NO PROJECT AND WITH PROJECT MAINLINE AND RAMP PEAK HOUR VOLUMES

November 2006
Graphics\Nov 2006\WC05-2271_18

FIGURE 18

5. YEAR 2016 TRAFFIC OPERATIONS

This chapter presents the results from traffic signal warrant evaluation, the intersection traffic control and lane configuration assumptions, and traffic operations analysis for Year 2016 under the various project alternatives.

TRAFFIC SIGNAL WARRANTS

The peak hour traffic volume signal warrant was evaluated for each of the unsignalized study intersections based on the 2003 MUTCD (see Technical Appendix). It is important to note that justification for a signal is not based solely on peak hour warrants, but also considers various factors such as delay, congestion, and potential driver confusion. To reflect the increase in capacity associated with any future widening or turn lanes, the peak hour traffic signal warrants were evaluated based on the design of the intersections at the time traffic signals would be installed. Table 10 summarizes the results for each project scenario under Year 2016.

INTERSECTION LANE CONFIGURATIONS AND TRAFFIC CONTROL

Figures 19A through 19E present the intersection lane configurations and traffic control assumptions. Under No Project conditions, the intersection lane configurations and traffic control were assumed to be the same as current conditions. Under Alternatives 1 through 4, the proposed project geometrics were assumed.

INTERSECTION OPERATIONS

All of study intersections were analyzed under Year 2016 conditions for each project scenario and the results are summarized in Tables 11 and 12. Detailed calculations are provided in the Technical Appendix. Year 2016 intersection conditions were evaluated based on lane configurations presented in Figures 19A through 19E and traffic volumes presented on Figures 15A through 15E. Due to the similarity of Alternatives 1 through 4, the intersection operations would be same for all of the study intersections.

No Project Conditions

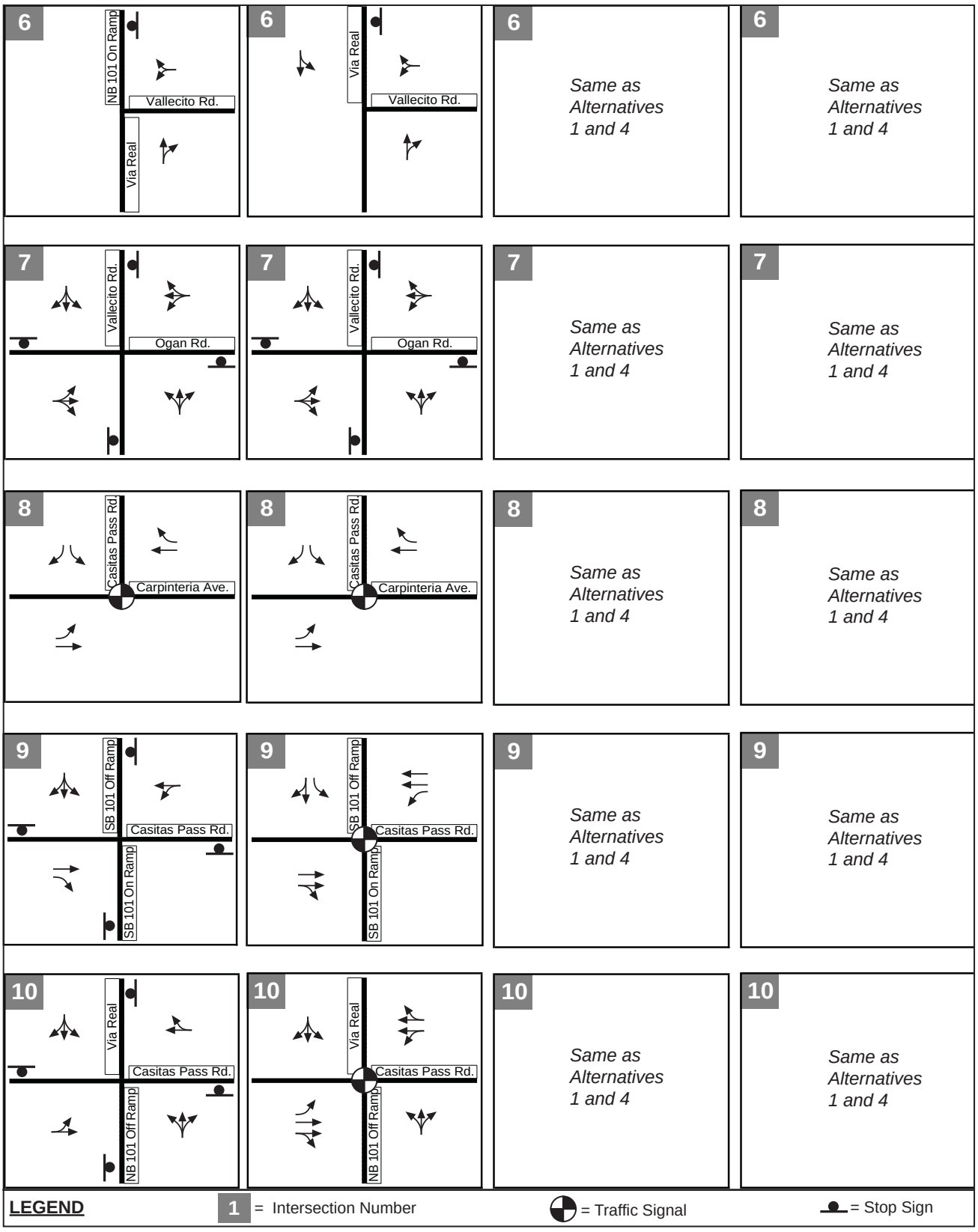
The following 12 study intersections are anticipated to operate at unacceptable LOS D conditions or worse during the AM and/or PM peak hour under Year 2016 No Project conditions:

- Linden Avenue/Carpinteria Avenue (AM and PM)
- Linden Avenue/Sawyer Avenue (AM and PM)
- Linden Avenue/U.S. 101 Southbound Off-Ramp (AM and PM)
- Linden Avenue/Ogan Road (AM)
- Casitas Pass Road/U.S. 101 Southbound Ramps (AM and PM)
- Casitas Pass Road/Via Real/U.S. 101 Northbound Off-Ramp (AM and PM)
- Bailard Avenue/Carpinteria Avenue (AM)
- Bailard Avenue/U.S. 101 Southbound Ramps (AM and PM)
- Bailard Avenue/U.S. 101 Northbound Ramps (AM)
- Bailard Avenue/Via Real (AM and PM)
- SR 150/U.S. 101 Southbound Ramps (PM)
- SR 150/Via Real (AM)

TABLE 10
YEAR 2016 TRAFFIC SIGNAL WARRANT ANALYSIS

Intersection	No Project		Alternative 1 and 4		Alternative 2		Alternative 3	
	AM	PM	AM	PM	AM	PM	AM	PM
2. Linden Avenue / Sawyer Avenue	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
3. Linden Avenue / U.S. 101 SB Off-Ramp	Met	Met	Met	Met	Met	Met	Met	Met
4. Linden Avenue / Ogan Road – No Project (Linden Avenue/Via Real – Alt. 1, 2, 3, & 4)	Met	Not Met	Met	Not Met	Met	Met	n/a (Roundabout)	
6. Vallecito Road / Via Real	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
7. Vallecito Road / Ogan Road	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
9. Casitas Pass Road / U.S. 101 SB Ramps	Met	Met	Met	Met	Met	Met	Met	Met
10. Casitas Pass Road / Via Real	Not Met	Met	Met	Met	Met	Met	Met	Met
11. Casitas Pass Road / Ogan Road	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
12. Bailard Avenue / Carpinteria Avenue	Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
13. Bailard Avenue / U.S. 101 SB Ramps	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
14. Bailard Avenue / U.S. 101 NB Ramps	Not Met	Not Met	Met	Not Met	Met	Not Met	Met	Not Met
15. Bailard Avenue / Via Real	Met	Met	Met	Met	Met	Met	Met	Met
16. SR 150 / Carpinteria Avenue	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
17. SR 150 / U.S. 101 Southbound Ramps	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
18. SR 150 / U.S. 101 Northbound Ramps	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
19. SR 150 / Via Real	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
20. SR 150 / Casitas Pass Road (SR 192)	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
21. Linden Avenue / U.S. 101 NB On-Ramp (Alt. 1 & 4)	n/a	n/a	Met	Met	n/a	n/a	n/a	n/a
22. Ogan Road / Via Real (Alt. 1, 2, & 4)	n/a	n/a	Not Met	Not Met	Not Met	Not Met	n/a	n/a
23. Via Real / U.S. 101 NB Ramps (Alt. 1, 2, 3, and 4)	n/a	n/a	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met

Source: Fehr & Peers Associates, 2007.



Linden Avenue/Casitas Pass

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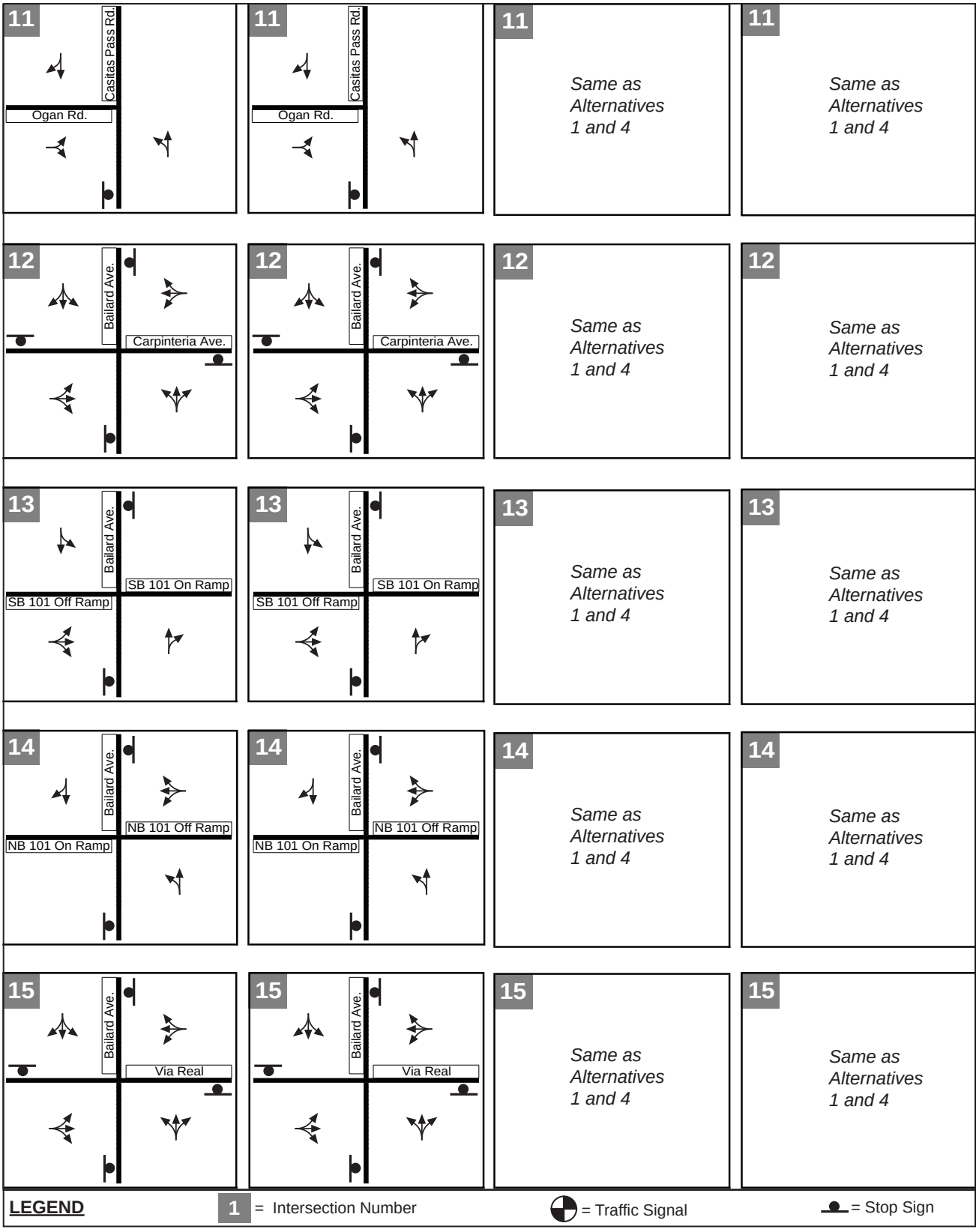
November 2006
2271-19B

YEAR 2016 AND 2036 INTERSECTION LANE CONFIGURATION AND TRAFFIC CONTROL

FIGURE 19B



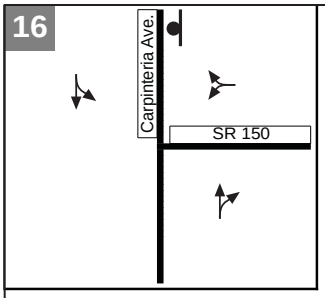
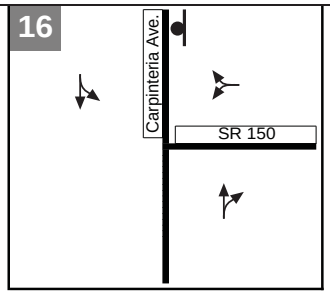
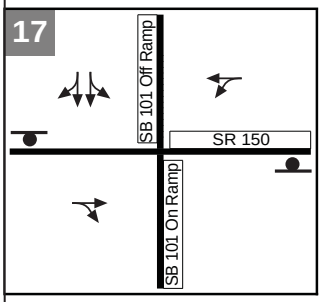
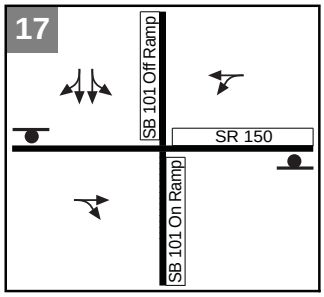
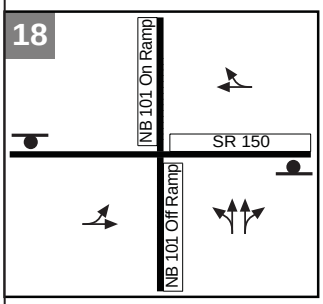
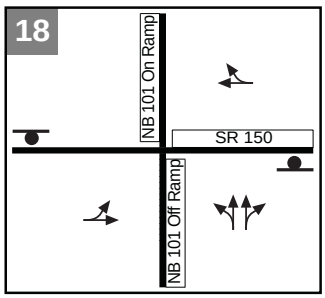
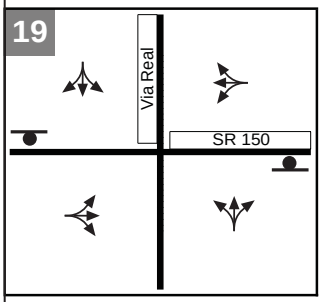
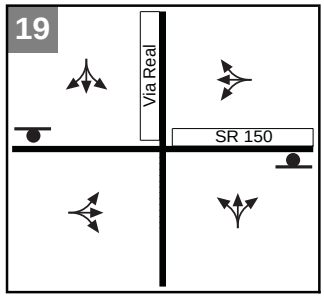
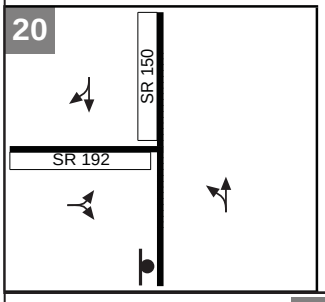
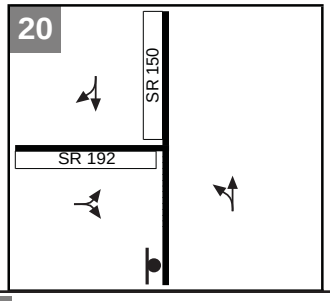
Linden Avenue/Casitas Pass

FEHR & PEERS
TRANSPORTATION CONSULTANTS

November 2006
2271-19C

YEAR 2016 AND 2036 INTERSECTION LANE CONFIGURATION AND TRAFFIC CONTROL

FIGURE 19C

No Project	Alternatives 1 and 4	Alternative 2	Alternative 3
16 	16 	16 *Same as Alternatives 1 and 4*	16 *Same as Alternatives 1 and 4*
17 	17 	17 *Same as Alternatives 1 and 4*	17 *Same as Alternatives 1 and 4*
18 	18 	18 *Same as Alternatives 1 and 4*	18 *Same as Alternatives 1 and 4*
19 	19 	19 *Same as Alternatives 1 and 4*	19 *Same as Alternatives 1 and 4*
20 	20 	20 *Same as Alternatives 1 and 4*	20 *Same as Alternatives 1 and 4*

LEGEND 1 = Intersection Number = Traffic Signal = Stop Sign

Linden Avenue/Casitas Pass

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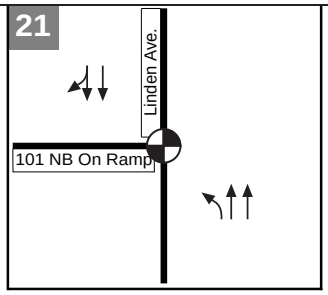
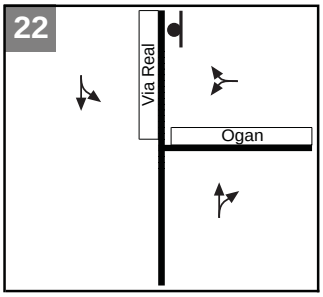
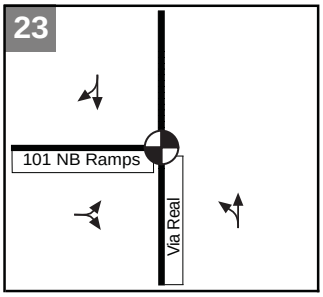
2271-19D

YEAR 2016 AND 2036 INTERSECTION LANE CONFIGURATION AND TRAFFIC CONTROL

FIGURE 19D

No Project	Alternatives 1 and 4	Alternative 2	Alternative 3
21 *Does Not Exist*	21 	21 *Does Not Exist*	21 *Does Not Exist*
22 *Does Not Exist*	22 	22 *Same as Alternatives 1 and 4*	22 *Does Not Exist*
23 *Does Not Exist*	23 	23 *Same as Alternatives 1 and 4*	23 *Same as Alternatives 1 and 4*

LEGEND 1 = Intersection Number = Traffic Signal = Stop Sign

Linden Avenue/Casitas Pass

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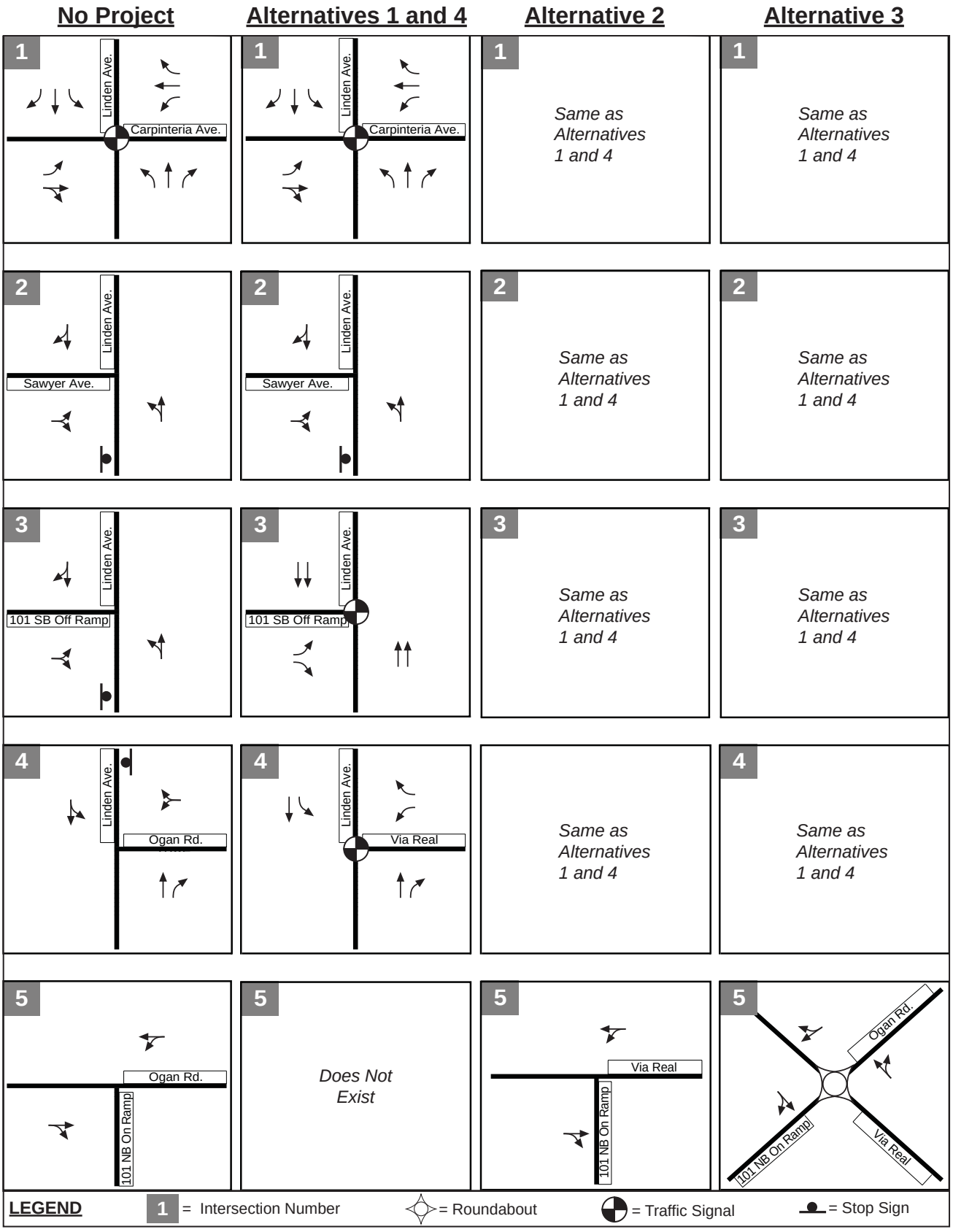
November 2006
2271-19E

YEAR 2016 AND 2036 INTERSECTION LANE CONFIGURATION AND TRAFFIC CONTROL

FIGURE 19E



Linden Avenue/Casitas Pass

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YEAR 2016 AND 2036 INTERSECTION LANE CONFIGURATION AND TRAFFIC CONTROL

November 2006
2271-7A

FIGURE 19A

Alternative 1 and 4

The following nine study intersections are anticipated to operate at unacceptable LOS D conditions or worse during the AM and/or PM peak hour under Year 2016 Alternative 1 and 4 Project conditions:

- Linden Avenue/Carpinteria Avenue (AM)
- Linden Avenue/Sawyer Avenue (AM)
- Linden Avenue and Via Real / U.S. 101 NB On-Ramp (AM)
- Bailard Avenue/Carpinteria Avenue (AM)
- Bailard Avenue/U.S. 101 Southbound Ramps (AM)
- Bailard Avenue/Via Real (AM and PM)
- SR 150/U.S. 101 Southbound Ramps (PM)
- SR 150/Via Real (AM)

The Linden Avenue/U.S. 101 Northbound On-Ramp intersection is anticipated to operate overall at LOS B; however, this intersection will have vehicle queue spillback impacts on the Linden Avenue/U.S. 101 Southbound Off-Ramp intersection due to insufficient left-turn vehicle storage. The eastbound Linden Avenue to northbound U.S. 101 left-turn vehicle queue will extend to the Linden Avenue/U.S. 101 Southbound Off-Ramp intersection and impact its operations. Furthermore, due to intersection spacing of less than 125 feet between the northbound ramps and Via Real, the intersections would likely need to operate as a single intersection with one traffic signal controller.

Alternative 2

The following seven study intersections are anticipated to operate at unacceptable LOS D conditions or worse during the AM and/or PM peak hour under Year 2016 Alternative 2 Project conditions:

- Linden Avenue/Carpinteria Avenue (AM)
- Linden Avenue/Sawyer Avenue (AM)
- Bailard Avenue/Carpinteria Avenue (AM)
- Bailard Avenue/U.S. 101 Southbound Ramps (AM)
- Bailard Avenue/Via Real (AM and PM)
- SR 150/U.S. 101 Southbound Ramps (PM)
- SR 150/Via Real (AM)

Alternative 3

The following seven study intersections are anticipated to operate at unacceptable LOS D conditions or worse during the AM and/or PM peak hour under Year 2016 Alternative 3 Project conditions:

- Linden Avenue/Carpinteria Avenue (AM)
- Linden Avenue/Sawyer Avenue (AM)
- Bailard Avenue/Carpinteria Avenue (AM)
- Bailard Avenue/U.S. 101 Southbound Ramps (AM)
- Bailard Avenue/Via Real (AM and PM)
- SR 150/U.S. 101 Southbound Ramps (PM)
- SR 150/Via Real (AM)

TABLE 11
YEAR 2016 AM INTERSECTION ANALYSIS [1,2]

Intersection	Traffic Control	No Project	Alternative 1 & 4	Alternative 2	Alternative 3
		Delay / LOS	Delay / LOS	Delay / LOS	Delay / LOS
1. Linden Avenue / Carpinteria Avenue	Signal	42 / D	36 / D	36 / D	36 / D
2. Linden Avenue / Sawyer Avenue	SSS	>50 / F (EB)	>50 / F (EB)	>50 / F (EB)	>50 / F (EB)
3. Linden Avenue / U.S. 101 SB Off-Ramp	SSS Signal	>50 / F (EB)	15 / B	15 / B	15 / B
4. Linden Avenue / Ogan Road (Vial Real with Project)	SSS Signal	31 / D (WB)	40 / D	19 / B	19 / B
5. U.S. 101 NB On-Ramp / Ogan Road [3]	SSS Roundabout	5 / A (WB)	n/a	7 / A (WB)	10 / A [8 / A]
6. Vallecito Road / Via Real / U.S. 101 NB On-Ramp	SSS	25 / C (WB)	14 / B (WB)	14 / B (WB)	14 / B (WB)
7. Vallecito Road / Ogan Road	AWS	8 / A	8 / A	8 / A	8 / A
8. Casitas Pass Road / Carpinteria Avenue	Signal	21 / C	22 / C	22 / C	22 / C
9. Casitas Pass Road / U.S. 101 SB Ramps	AWS Signal	31 / D	14 / B	14 / B	14 / B
10. Casitas Pass Road / Via Real / U.S. 101 NB Off-Ramp	AWS Signal	> 50 / F	26 / C	26 / C	26 / C
11. Casitas Pass Road / Ogan Road	SSS	12 / B (EB)	12 / B (EB)	12 / B (EB)	12 / B (EB)
12. Bailard Avenue / Carpinteria Avenue	AWS	>50 / F	45 / E	45 / E	45 / E
13. Bailard Avenue / U.S. 101 SB Ramps	SSS	>50 / F (EB)	26 / D (EB)	26 / D (EB)	26 / D (EB)
14. Bailard Avenue / U.S. 101 NB Ramps	SSS	>50 / F (WB)	21 / C (WB)	21 / C (WB)	21 / C (WB)
15. Bailard Avenue / Via Real	AWS	>50 / F	>50 / F	>50 / F	>50 / F
16. SR 150 / Carpinteria Avenue	SSS	12 / B (WB)	12 / B (WB)	12 / B (WB)	12 / B (WB)
17. SR 150 / U.S. 101 Southbound Ramps	SSS	25 / C (SB)	24 / C (SB)	24 / C (SB)	24 / C (SB)
18. SR 150 / U.S. 101 Northbound Ramps	SSS	22 / C (NB)	21 / C (NB)	21 / C (NB)	21 / C (NB)
19. SR 150 / Via Real	SSS	28 / D (NB)	28 / D (NB)	28 / D (NB)	28 / D (NB)
20. SR 150 / Casitas Pass Road	SSS	12 / B (EB)	12 / B (EB)	12 / B (EB)	12 / B (EB)
21. Linden Avenue / U.S. 101 NB On-Ramp (Alt. 1 & 4)	Signal	n/a	40 / D	n/a	n/a
22. Ogan Road / Via Real (Alt. 1, 2, & 4)	SSS	n/a	13 / B (WB)	13 / B (WB)	n/a
23. Via Real / U.S. 101 NB Ramps (Alt. 1, 2, 3, and 4)	Signal	n/a	23 / C	23 / C	23 / C

Notes: Shading denotes locations where level of service threshold is exceeded.

[1] Side-street stop intersection level of service based on worst approach control delay per vehicle, according to the 2000 *Highway Capacity Manual*. All-way stop intersection level of service based on weighted average control delay per vehicle, according to the 2000 *Highway Capacity Manual*.

[2] Signalized intersection level of service based on weighted average control delay per vehicle, according to the 2000 *Highway Capacity Manual*.

[3] Roundabout analysis denoted as: 2000 *Highway Capacity Manual* results [SIDRA results].

Source: Fehr & Peers, 2007.

TABLE 12
YEAR 2016 PM INTERSECTION ANALYSIS [1,2]

Intersection	Traffic Control	No Project	Alternative 1 & 4	Alternative 2	Alternative 3
		Delay / LOS	Delay / LOS	Delay / LOS	Delay / LOS
1. Linden Avenue / Carpinteria Avenue	Signal	35 / D	30 / C	30 / C	30 / C
2. Linden Avenue / Sawyer Avenue	SSS	26 / D (EB)	22 / C (EB)	22 / C (EB)	22 / C (EB)
3. Linden Avenue / U.S. 101 SB Off-Ramp	SSS Signal	>50 / F (EB)	18 / B	17 / B	17 / B
4. Linden Avenue / Ogan Road (Vial Real with Project)	SSS Signal	20 / C (WB)	24 / C	18 / B	18 / B
5. U.S. 101 NB On-Ramp / Ogan Road [3]	SSS Roundabout	1 / A (WB)	n/a	3 / A (WB)	6 / A [4 / A]
6. Vallecito Road / Via Real / U.S. 101 NB On-Ramp	SSS	12 / B (WB)	10 / B (WB)	10 / B (WB)	10 / B (WB)
7. Vallecito Road / Ogan Road	AWS	8 / A	7 / A	7 / A	7 / A
8. Casitas Pass Road / Carpinteria Avenue	Signal	23 / C	25 / C	25 / C	25 / C
9. Casitas Pass Road / U.S. 101 SB Ramps	AWS Signal	>50 / F	18 / B	18 / B	18 / B
10. Casitas Pass Road / Via Real / U.S. 101 NB Off-Ramp	AWS Signal	>50 / F	27 / C	27 / C	27 / C
11. Casitas Pass Road / Ogan Road	SSS	13 / B (EB)	13 / B (EB)	13 / B (EB)	13 / B (EB)
12. Bailard Avenue / Carpinteria Avenue	AWS	25 / C	20 / C	20 / C	20 / C
13. Bailard Avenue / U.S. 101 SB Ramps	SSS	>50 / F (EB)	24 / C (EB)	24 / C (EB)	24 / C (EB)
14. Bailard Avenue / U.S. 101 NB Ramps	SSS	25 / C (WB)	19 / C (WB)	19 / C (WB)	19 / C (WB)
15. Bailard Avenue / Via Real	AWS	>50 / F	42 / E	42 / E	42 / E
16. SR 150 / Carpinteria Avenue	SSS	10 / A (WB)	10 / A (WB)	10 / A (WB)	10 / A (WB)
17. SR 150 / U.S. 101 Southbound Ramps	SSS	>50 / F (SB)	>50 / F (SB)	>50 / F (SB)	>50 / F (SB)
18. SR 150 / U.S. 101 Northbound Ramps	SSS	13 / B (NB)	13 / B (NB)	13 / B (NB)	13 / B (NB)
19. SR 150 / Via Real	SSS	19 / C (NB)	18 / C (NB)	18 / C (NB)	18 / C (NB)
20. SR 150 / Casitas Pass Road	SSS	16 / C (EB)	16 / C (EB)	16 / C (EB)	16 / C (EB)
21. Linden Avenue / U.S. 101 NB On-Ramp (Alt. 1 & 4)	Signal	n/a	24 / C	n/a	n/a
22. Ogan Road / Via Real (Alt. 1, 2, & 4)	SSS	n/a	10 /A (WB)	10 /A (WB)	n/a
23. Via Real / U.S. 101 NB Ramps (Alt. 1, 2, 3, and 4)	Signal	n/a	21 / C	21 / C	21 / C

Notes: Shading denotes locations where level of service threshold is exceeded.

[1] Side-street stop intersection level of service based on worst approach control delay per vehicle, according to the 2000 *Highway Capacity Manual*. All-way stop intersection level of service based on weighted average control delay per vehicle, according to the 2000 *Highway Capacity Manual*.

[2] Signalized intersection level of service based on weighted average control delay per vehicle, according to the 2000 *Highway Capacity Manual*.

[3] Roundabout analysis denoted as: 2000 *Highway Capacity Manual* results [SIDRA results].

Source: Fehr & Peers, 2007.

PROJECT IMPACTS AND MITIGATION

Table 13 provides a summary of project impacts (positive, negative, or no impact). The following criteria were used to determine project impacts:

Positive Benefit – Improves traffic operations at the intersection by at least one level of service

Negative Impact – The following are considered negative project impacts

- Degrades traffic operations at the intersection from LOS C or better conditions to LOS D or worse
- Increases average delay at intersections already operating at LOS D or worse under No Project conditions
- Does not provide LOS C or better conditions at new intersections created or modified by the project
- Vehicle queue spillback impacts are greater than under No Project conditions

No Impact – Does not positively or negatively impact the intersection OR provides LOS C or better conditions at new intersections created or modified by the project

Alternative 1 Project Impacts and Mitigation

Alternative 1 has a total of 15 positive benefits (AM and PM peak hour total) and two negative impacts (AM and PM peak hour total). The relocation of the northbound on-ramp to Linden Avenue results in a high increase in left-turning volume from northbound Via Real to westbound Linden Avenue. This increase in volume results in LOS D operations at the Vial Real/Linden Avenue intersection during the AM peak hour. To help improve operations, it is recommended that the exclusive right-turn lane on Via Real be striped as a shared left/right-turn lane.

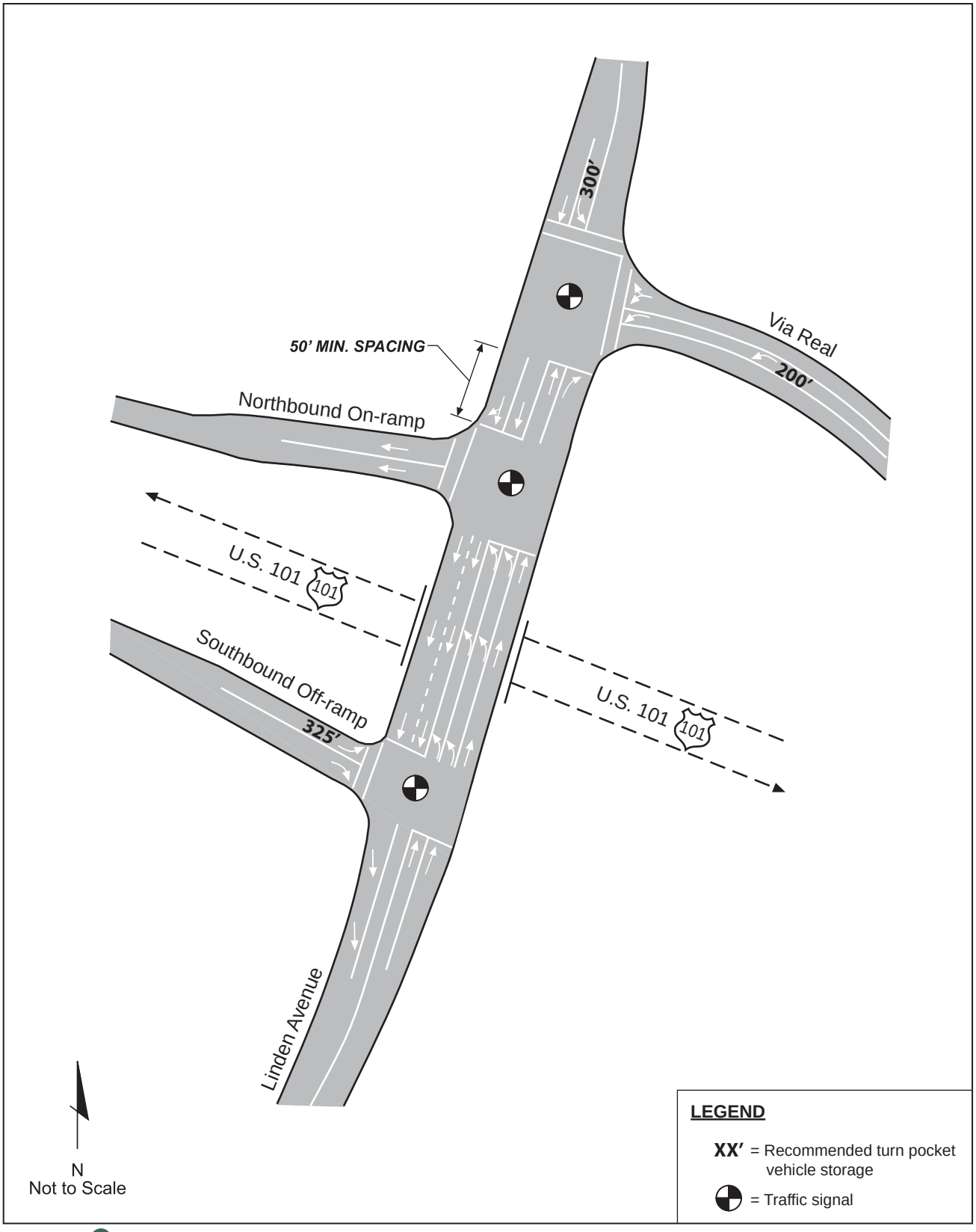
Although the new intersection of U.S. 101 Northbound On-Ramp/Linden Avenue will operate overall at LOS B based on isolated intersection analysis, the eastbound Linden Avenue to northbound U.S. 101 left-turn queue will consistently impact operations at the U.S. 101 Southbound Off-Ramp/Linden Avenue intersection. To eliminate queuing impacts, one eastbound through lane should be converted to a left-turn lane. Figure 20 provides the recommended geometric layout at the Linden Avenue interchange for Alternatives 1 and 4. Table 14 summarizes the intersection operations with the recommended improvements.

Alternative 2 Project Impacts and Mitigation

Alternative 2 has a total of 16 positive benefits (AM and PM peak hour total) and no negative impacts.

Alternative 3 Project Impacts and Mitigation

Alternative 3 has a total of 16 positive benefits (AM and PM peak hour total) and no negative impacts.



Linden Avenue/Casitas Pass

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ALTERNATIVE 1 AND ALTERNATIVE 4 RECOMMENDED GEOMETRIC LAYOUT AT LINDEN AVENUE INTERCHANGE

November 2006
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Figure 20

TABLE 13
YEAR 2016 PROJECT IMPACTS

Intersection	Alternative 1 & 4		Alternative 2		Alternative 3	
	AM	PM	AM	PM	AM	PM
1. Linden Avenue / Carpinteria Avenue	Ø	+	Ø	+	Ø	+
2. Linden Avenue / Sawyer Avenue	Ø	+	Ø	+	Ø	+
3. Linden Avenue / U.S. 101 SB Off-Ramp	+	+	+	+	+	+
4. Linden Avenue / Ogan Road	-	+	+	+	+	+
5. U.S. 101 NB On-Ramp / Ogan Road	n/a	n/a	Ø	Ø	Ø	Ø
6. Vallecito Road / Via Real / U.S. 101 NB On-Ramp	+	Ø	+	Ø	+	Ø
7. Vallecito Road / Ogan Road	Ø	Ø	Ø	Ø	Ø	Ø
8. Casitas Pass Road / Carpinteria Avenue	Ø	Ø	Ø	Ø	Ø	Ø
9. Casitas Pass Road / U.S. 101 SB Ramps	+	+	+	+	+	+
10. Casitas Pass Road / Via Real / U.S. 101 NB Off-Ramp	+	+	+	+	+	+
11. Casitas Pass Road / Ogan Road	Ø	Ø	Ø	Ø	Ø	Ø
12. Bailard Avenue / Carpinteria Avenue	+	Ø	+	Ø	+	Ø
13. Bailard Avenue / U.S. 101 SB Ramps	+	+	+	+	+	+
14. Bailard Avenue / U.S. 101 NB Ramps	+	Ø	+	Ø	+	Ø
15. Bailard Avenue / Via Real	Ø	+	Ø	+	Ø	+
16. SR 150 / Carpinteria Avenue	Ø	Ø	Ø	Ø	Ø	Ø
17. SR 150 / U.S. 101 Southbound Ramps	Ø	Ø	Ø	Ø	Ø	Ø
18. SR 150 / U.S. 101 Northbound Ramps	Ø	Ø	Ø	Ø	Ø	Ø
19. SR 150 / Via Real	Ø	Ø	Ø	Ø	Ø	Ø
20. SR 150 / Casitas Pass Road	Ø	Ø	Ø	Ø	Ø	Ø
21. Linden Avenue / U.S. 101 NB On-Ramp (Alt. 1 & 4)	-	Ø	n/a	n/a	n/a	n/a
22. Ogan Road / Via Real (Alt. 1, 2, & 4)	Ø	Ø	Ø	Ø	n/a	n/a
23. Via Real / U.S. 101 NB Ramps (Alt. 1, 2, 3, and 4)	Ø	Ø	Ø	Ø	Ø	Ø

Notes:
Shading denotes project negative impacts.

" + " = Positive Impact; " - " = Negative Impact; " Ø " = No Impact; n/a = not applicable

Source: Fehr & Peers, 2007.

TABLE 14
MITIGATED YEAR 2016 ALTERNATIVE 1 INTERSECTION ANALYSIS [1]

Intersection	Traffic Control	AM Peak Hour	PM Peak Hour
		Delay / LOS	Delay / LOS
4. Linden Avenue / Vial Real with Project	Signal	25 / C	19 / B
21. Linden Avenue / U.S. 101 NB On-Ramp	Signal	25 / C	19 / B

Notes:
[1] Signalized intersection level of service based on weighted average control delay per vehicle, according to the 2000 *Highway Capacity Manual*.
Source: Fehr & Peers, 2007.

ADDITIONAL IMPROVEMENTS TO CONSIDER

There are several intersections that are not negatively impacted by the project but that will operate at LOS D or worse with and without the project under Year 2016 conditions. For some of the intersections, there are potential improvements that could improve traffic operations. Each of the locations operating at LOS D or worse and potential improvements are discussed below. These suggested improvements should not be considered mitigation measures for the project.

Linden Avenue/Carpinteria Avenue

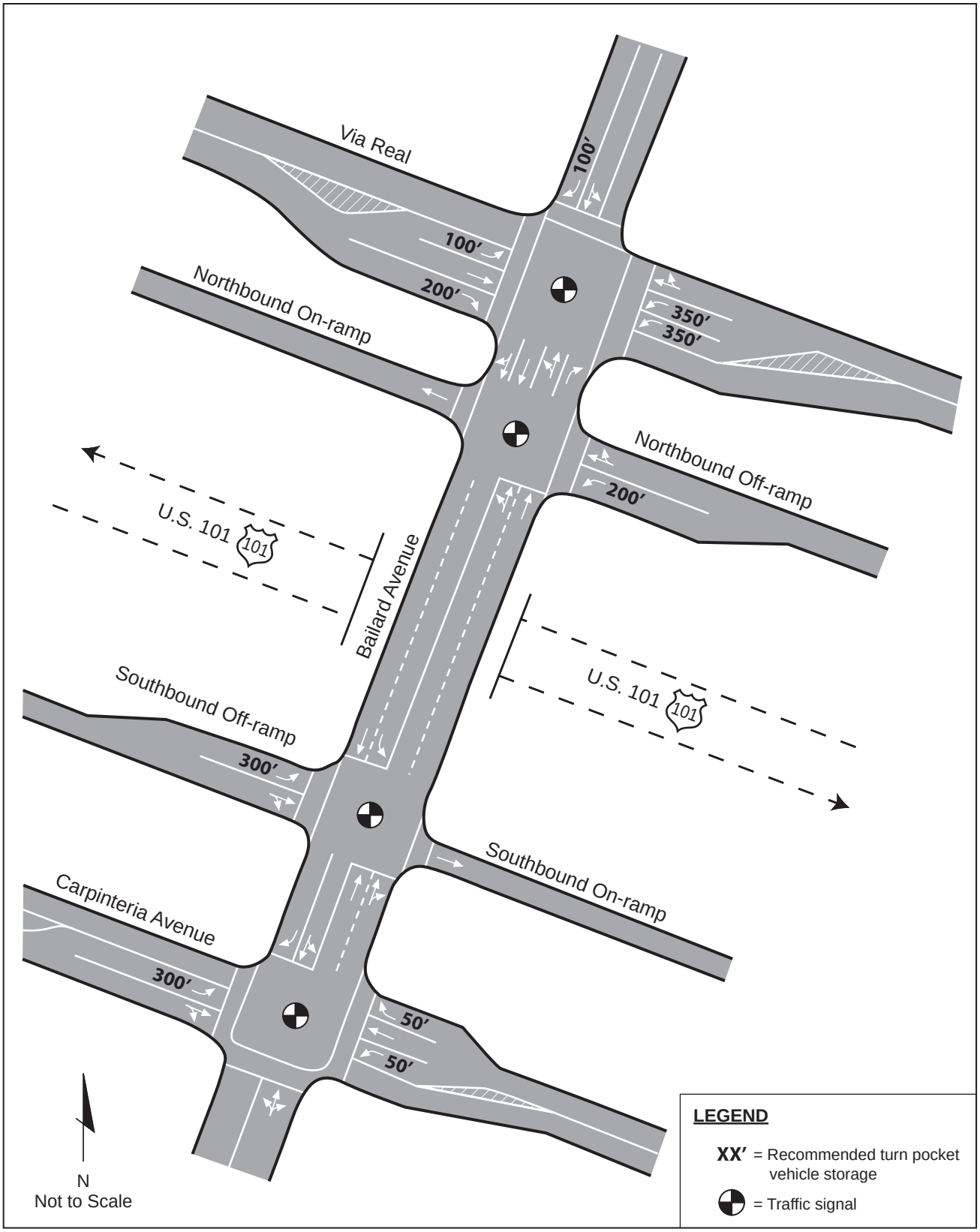
Traffic operations could be improved by retiming the traffic signal to reflect the changes in traffic volumes. Consideration should be given to providing a maximum cycle length of 120 seconds.

Linden Avenue/Sawyer

The side-street movements at the intersection of Linden Avenue/Sawyer Avenue are anticipated to operate at LOS F, but overall the intersection would operate at LOS C or better. The side-street volumes are about 60 vehicles during the AM and PM peak hour and this intersection does not satisfy the peak hour traffic signal warrant. No improvements are suggested.

Bailard Avenue Interchange

Several of the intersections along Bailard Avenue are anticipated to operate at LOS D or worse. Some of these intersections also meet the peak hour traffic signal warrant. Due to the close intersection spacing, the intersections along Bailard Avenue will operate as a tight system where the operations of one intersection will impact the operations of adjacent intersections. As such, consideration should be given to signalization of those intersections that do not meet the peak hour signal warrant if an adjacent intersection meets the warrant to avoid potential breakdown of the system. Furthermore, due to intersection spacing of less than 50 feet between the northbound ramps and Via Real, the intersections would likely need to operate as a single intersection with one traffic signal controller. Figure 21 presents the suggested geometric layout for the Bailard Avenue interchange to provide acceptable service levels.



Linden Avenue/Casitas Pass

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SUGGESTED GEOMETRIC LAYOUT FOR BAILARD AVENUE INTERCHANGE

November 2006
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Figure 21

SR 150 Interchange

The southbound off-ramp is anticipated to operate at LOS F and overall the intersection would operate at LOS E during the AM peak hour. The off-ramp volume is about 200 vehicles during the AM peak hour; however, the intersection does not satisfy the peak hour traffic signal warrant. The volumes are fairly balanced on all approaches and consideration should be given to installing all-way stop traffic control if any of the all-way stop warrants are satisfied in the future. With all-way stop control, this intersection would operate at LOS C or better.

SR 150/Via Real

The side-street movements at the intersection of SR 150/Via Real are anticipated to operate at LOS D, but overall the intersection would operate at LOS C or better during the AM peak hour. The side-street volumes are about 50 vehicles during the AM peak hour and this intersection does not satisfy the peak hour traffic signal warrant. No improvements are suggested.

MAINLINE AND RAMP JUNCTION OPERATIONS

Each mainline segment and ramp junction was evaluated under Year 2016 conditions with and without the project based on the volumes presented on Figure 17. The results are summarized in Tables 15 and 16. Since Alternatives 1 through 4 have the same mainline and ramp volumes the traffic operations would be the same for each of the alternatives. Detailed calculations are presented in the Technical Appendix.

No Project Conditions

Under Year 2016 conditions, the mainline would remain at its current configuration. Therefore, the existing northbound congestion during the AM peak hour would continue to occur and likely get worse as volumes increase. U.S. 101 would operate at LOS F in the northbound direction during the AM peak hour from SR 150 to north of the Linden Avenue interchange. In the southbound direction, traffic operations would degrade to LOS D or worse from Reynolds Avenue to SR 150 during the PM peak hour.

Project Conditions (Alternatives 1, 2, 3, and 4)

Similar to the No Project condition, the northbound direction would operate at LOS F from SR 150 to north of the Linden Avenue interchange during the AM peak hour. In the southbound direction, traffic operations would degrade to LOS D or worse from Reynolds Avenue to SR 150 during the PM peak hour. The project would not negatively impact the mainline or ramp junction operations.

TABLE 15
YEAR 2016 NO PROJECT MAINLINE AND RAMP MERGE DIVERGE ANALYSIS

Mainline or Ramp	Number of Lanes	AM Peak Hour		PM Peak Hour	
		Density Or *[Speed]*[1]	LOS	Density	Density Or *[Speed]*[1]
Mainline Analysis					
NB U.S. 101 Bates Road to SR 150	3	22	C	14	B
NB U.S. 101 SR 150 to Bailard Avenue	2	[<52.2]	F	21	C
NB U.S. 101 Bailard Avenue to Casitas Pass Road	2	[<52.2]	F	24	C
NB U.S. 101 Casitas Pass Road to Linden Avenue	2	[<52.2]	F	23	C
NB U.S. 101 Linden Avenue to Santa Monica Road	2	[<52.2]	F	26	C
SB U.S. 101 Reynolds Avenue to Linden Avenue	2	22	C	37	E
SB U.S. 101 Linden Avenue to Casitas Pass Road	2	19	C	31	D
SB U.S. 101 Casitas Pass Road to Bailard Avenue	2	19	C	34	D
SB U.S. 101 Bailard Avenue to SR 150	2 + Aux	weave	A	weave	D
SB U.S. 101 SR 150 to Bates Road	2 + Aux	weave	A	weave	D
Ramp Junction Analysis					
NB U.S. 101 SR 150 Off-Ramp	1	28	D	19	B
NB U.S. 101 SR 150 On-Ramp	1	[<52.2]	F	22	C
NB U.S. 101 Bailard Avenue Off-Ramp	1	[<52.2]	F	26	C
NB U.S. 101 Bailard Avenue On-Ramp	1	[<52.2]	F	26	C
NB U.S. 101 Casitas Pass Road Off-Ramp	1	[<52.2]	F	30	D
NB U.S. 101 Casitas Pass Road On-Ramp	1	[<52.2]	F	26	C
NB U.S. 101 Linden Avenue On-Ramp	1	[<52.2]	F	28	D
SB U.S. 101 Linden Avenue Off-Ramp	1	28	C	40	E
SB U.S. 101 Casitas Pass Road Off-Ramp	1	24	C	36	E
SB U.S. 101 Casitas Pass Road On-Ramp	1	21	C	34	D
SB U.S. 101 Bailard Avenue Off-Ramp	1	24	C	39	E
SB U.S. 101 Bailard Avenue On-Ramp	1	weave	A	weave	D
SB U.S. 101 SR 150 Off-Ramp	1	weave	A	weave	D
SB U.S. 101 SR 150 On-Ramp	1	weave	A	weave	D

Notes:

Shading denotes locations where level of service threshold is exceeded.

[1] Mainline segment and ramp merge/diverge LOS based on vehicle density (passenger cars/mile/lane), according to the 2000 *Highway Capacity Manual*. In cases where mainline congestion renders traditional analysis techniques invalid for mainline segments and ramps, LOS is based on vehicle speeds shown in italics and within brackets.

Source: Fehr & Peers, 2007.

TABLE 16
YEAR 2016 WITH PROJECT (ALT. 1, 2, 3, AND 4) MAINLINE AND RAMP MERGE DIVERGE ANALYSIS

Mainline or Ramp	Number of Lanes	AM Peak Hour		PM Peak Hour	
		Density Or *[Speed]*[1]	LOS	Density Or *[Speed]*[1]	LOS
Mainline Analysis					
NB U.S. 101 Bates Road to SR 150	3	22	C	14	B
NB U.S. 101 SR 150 to Bailard Avenue	2	[<52.2]	F	21	C
NB U.S. 101 Bailard Avenue to Casitas Pass Road	2	[<52.2]	F	23	C
NB U.S. 101 Casitas Pass Road to Linden Avenue	2	[<52.2]	F	22	C
NB U.S. 101 Linden Avenue to Santa Monica Road	2	[<52.2]	F	26	C
SB U.S. 101 Reynolds Avenue to Linden Avenue	2	22	C	37	E
SB U.S. 101 Linden Avenue to Casitas Pass Road	2	19	C	31	D
SB U.S. 101 Casitas Pass Road to Bailard Avenue	2	18	C	31	D
SB U.S. 101 Bailard Avenue to SR 150	2 + Aux	weave	A	weave	D
Ramp Junction Analysis					
NB U.S. 101 SR 150 Off-Ramp	1	28	D	19	B
NB U.S. 101 SR 150 On-Ramp	1	[<52.2]	F	22	C
NB U.S. 101 Bailard Avenue Off-Ramp	1	[<52.2]	F	26	C
NB U.S. 101 Bailard Avenue On-Ramp	1	[<52.2]	F	25	C
NB U.S. 101 Casitas Pass Road Off-Ramp	1	[<52.2]	F	29	D
NB U.S. 101 Casitas Pass Road On-Ramp	1	[<52.2]	F	26	C
NB U.S. 101 Linden Avenue On-Ramp	1	[<52.2]	F	28	C
SB U.S. 101 Linden Avenue Off-Ramp	1	28	C	40	E
SB U.S. 101 Casitas Pass Road Off-Ramp	1	24	C	36	E
SB U.S. 101 Casitas Pass Road On-Ramp	1	20	C	32	D
SB U.S. 101 Bailard Avenue Off-Ramp	1	23	C	37	E
SB U.S. 101 Bailard Avenue On-Ramp	1	weave	A	weave	D
SB U.S. 101 SR 150 Off-Ramp	1	weave	A	weave	D

Notes:

Shading denotes locations where level of service threshold is exceeded.

[1] Mainline segment and ramp merge/diverge LOS based on vehicle density (passenger cars/mile/lane), according to the 2000 *Highway Capacity Manual*. In cases where mainline congestion renders traditional analysis techniques invalid for mainline segments and ramps, LOS is based on vehicle speeds shown in italics and within brackets.

Source: Fehr & Peers, 2007.

STREET SEGMENT OPERATIONS

Table 17 summarizes the street segment level of service under Year 2016 conditions with and without the Project. Carpinteria Avenue is anticipated to operate at LOS C with and without the project in both directions. Linden Avenue is anticipated to operate at LOS D under Alternatives 1 and 4, primarily as a result of providing several traffic signals within a short distance. Alternatives 2 and 3 provide one less traffic signal on Linden Avenue and traffic operations are improved to LOS C except during the AM peak hour. Casitas Pass Road will operate at LOS C during the AM peak hour and LOS D during the PM peak hour. Once again, LOS D operations result during the PM peak hour as a result of several traffic signals within a short distance.

TABLE 17
YEAR 2016 STREET SEGMENT LEVEL OF SERVICE

Street Segment	Direction	Arterial Class	No Project				With Project [1] (Alt. 1, 2, 3, and 4)			
			AM Peak		PM Peak		AM Peak		PM Peak	
			Avg. Travel Speed	LOS	Avg. Travel Speed	LOS	Avg. Travel Speed	LOS	Avg. Travel Speed	LOS
Carpinteria Avenue (Casitas Pass Road to Linden Avenue)	Northwest	IV	13.4	C	14.5	C	14.4	C	14.9	C
	Southeast	IV	16.5	C	16.5	C	17.8	C	17.0	C
Linden Avenue (Carpinteria Avenue to Via Real)	Northbound	IV	N/A				11.3 [11.3]	D [D]	12.5 [14.7]	D [C]
	Southbound	IV					12.5 [13.0]	D [C]	12.2 [15.3]	D [C]
Casitas Pass Road (Carpinteria Avenue to Via Real)	Eastbound	IV					13.0	C	9.2	D
	Westbound	IV					15.0	C	12.8	D

N/A = Not Applicable

[1] The results presented are for all the project alternatives except at Linden Avenue where the results for Alternatives 2 and 3 are presented in brackets ([ ]). The analysis was performed assuming the recommended improvements at Linden Avenue under Alternative 1 and 4 conditions.

Source: Fehr & Peers, 2007.

6. YEAR 2036 TRAFFIC OPERATIONS

This chapter presents the results from traffic signal warrant evaluation, the intersection traffic control and lane configuration assumptions, and traffic operations analysis for Year 2036 under the various project alternatives.

TRAFFIC SIGNAL WARRANTS

The peak hour traffic volume signal warrant was evaluated for each of the unsignalized study intersections based on the 2003 MUTCD (see Technical Appendix). To reflect the increase in capacity associated with any future widening or turn lanes, the peak hour traffic signal warrants were evaluated based on the design of the intersections at the time traffic signals would be installed. Table 18 summarizes the results for each project scenario under Year 2036.

INTERSECTION LANE CONFIGURATIONS AND TRAFFIC CONTROL

The same lane configurations and traffic control assumed under Year 2016 conditions were assumed under Year 2036 conditions. The lane configurations and traffic control for each intersection were presented earlier in Figures 19A through E.

INTERSECTION OPERATIONS

All of study intersections were analyzed under Year 2036 conditions for each project scenario and the results are summarized in Tables 19 and 20. Detailed calculations are provided in the Technical Appendix. Year 2036 intersection conditions were evaluated based on lane configurations presented on Figures 19A through 19E and traffic volumes presented on Figures 16A through 16E. Due to the similarity of Alternatives 1 through 4, the intersection operations would be same for all of the study intersections.

No Project Conditions

The following 13 study intersections are anticipated to operate at unacceptable LOS D conditions or worse during the AM and/or PM peak hour under Year 2036 No Project conditions:

- Linden Avenue/Carpinteria Avenue (AM and PM)
- Linden Avenue/Sawyer Avenue (AM and PM)
- Linden Avenue/U.S. 101 Southbound Off-Ramp (AM and PM)
- Linden Avenue/Ogan Road (AM and PM)
- Casitas Pass Road/Carpinteria Avenue(PM)
- Casitas Pass Road/U.S. 101 Southbound Ramps (AM and PM)
- Casitas Pass Road/Via Real/U.S. 101 Northbound Off-Ramp (AM and PM)
- Bailard Avenue/Carpinteria Avenue (PM)
- Bailard Avenue/U.S. 101 Southbound Ramps (AM and PM)
- Bailard Avenue/U.S. 101 Northbound Ramps (AM and PM)
- Bailard Avenue/Via Real (AM and PM)
- SR 150/U.S. 101 Southbound Ramps (PM)
- SR 150/Via Real (AM)
- SR 150/Casitas Pass Road (PM)

TABLE 18
YEAR 2036 TRAFFIC SIGNAL WARRANT ANALYSIS

Intersection	No Project		Alternative 1 and 4		Alternative 2		Alternative 3	
	AM	PM	AM	PM	AM	PM	AM	PM
2. Linden Avenue / Sawyer Avenue	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
3. Linden Avenue / U.S. 101 SB Off-Ramp	Met	Met	Met	Met	Met	Met	Met	Met
4. Linden Avenue / Ogan Road – No Project (Linden Avenue/Via Real – Alt. 1, 2, 3, & 4)	Met	Met	Met	Met	Met	Met	n/a Roundabout	
6. Vallecito Road / Via Real	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
7. Vallecito Road / Ogan Road	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
9. Casitas Pass Road / U.S. 101 SB Ramps	Met	Met	Met	Met	Met	Met	Met	Met
10. Casitas Pass Road / Via Real	Met	Met	Met	Met	Met	Met	Met	Met
11. Casitas Pass Road / Ogan Road	Not Met	Met	Not Met	Met	Not Met	Met	Not Met	Met
12. Bailard Avenue / Carpinteria Avenue	Met	Met	Met	Met	Met	Met	Met	Met
13. Bailard Avenue / U.S. 101 SB Ramps	Met	Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
14. Bailard Avenue / U.S. 101 NB Ramps	Not Met	Not Met	Met	Not Met	Met	Not Met	Met	Not Met
15. Bailard Avenue / Via Real	Met	Met	Met	Met	Met	Met	Met	Met
16. SR 150 / Carpinteria Avenue	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
17. SR 150 / U.S. 101 Southbound Ramps	Not Met	Met	Not Met	Met	Not Met	Met	Not Met	Met
18. SR 150 / U.S. 101 Northbound Ramps	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
19. SR 150 / Via Real	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
20. SR 150 / Casitas Pass Road (SR 192)	Not Met	Met	Not Met	Met	Not Met	Met	Not Met	Met
21. Linden Avenue / U.S. 101 NB On-Ramp (Alt. 1 & 4)	n/a	n/a	Not Met	Not Met	n/a	n/a	n/a	n/a
22. Ogan Road / Via Real (Alt. 1, 2, & 4)	n/a	n/a	Not Met	Not Met	Not Met	Not Met	n/a	n/a
23. Via Real / U.S. 101 NB Ramps (Alt. 1, 2, 3, and 4)	n/a	n/a	Met	Met	Met	Met	Met	Met

Source: Fehr & Peers Associates, 2007.

Alternative 1 and 4

The following 11 study intersections are anticipated to operate at unacceptable LOS D conditions or worse during the AM and/or PM peak hour under Year 2036 Alternative 1 and 4 Project conditions:

- Linden Avenue/Carpinteria Avenue (AM and PM)
- Linden Avenue/Sawyer Avenue (AM and PM)
- Casitas Pass Road/Carpinteria Avenue(PM)
- Casitas Pass Road/Via Real (AM and PM)
- Bailard Avenue/Carpinteria Avenue (PM)
- Bailard Avenue/U.S. 101 Southbound Ramps (AM and PM)
- Bailard Avenue/U.S. 101 Northbound Ramps (AM and PM)
- Bailard Avenue/Via Real (AM and PM)
- SR 150/U.S. 101 Southbound Ramps (PM)
- SR 150/Via Real (AM)
- SR 150/Casitas Pass Road (PM)

Two of the study intersections (Linden Avenue/U.S. 101 Northbound On-Ramp and Casitas Pass Road/U.S. 101 Southbound Ramps) are anticipated to operate at LOS C or better. However, these intersections will have vehicle queue spillback impacts on adjacent intersections due to insufficient vehicle storage. At the intersection of Linden Avenue/U.S. 101 Northbound On-Ramp, the eastbound Linden Avenue to northbound U.S. 101 left-turn vehicle queue will extend to the Linden Avenue/U.S. 101 Southbound Off-Ramp intersection and impact its operations. Furthermore, due to intersection spacing of less than 200 feet between the northbound ramps and Via Real, the intersections would likely need to operate as a single intersection with one traffic signal controller.

At the intersection of Casitas Pass Road/U.S. 101 Southbound Ramps, the westbound Casitas Pass Road to southbound U.S. 101 left-turn vehicle queue will extend to the Casitas Pass Road/Via Real intersection and impact its operations.

Alternative 2

The same 11 study intersections as Alternative 1 are anticipated to operate at unacceptable LOS D conditions or worse during the AM and/or PM peak hour under Year 2036 Alternative 2 Project conditions. The vehicle queue spillback impacts from the Casitas Pass Road/U.S. 101 Southbound Ramps intersection would also occur under Alternative 2.

Alternative 3

The same 11 study intersections as Alternative 1 are anticipated to operate at unacceptable LOS D conditions or worse during the AM and/or PM peak hour under Year 2036 Alternative 3 Project conditions. The vehicle queue spillback impacts from the Casitas Pass Road/U.S. 101 Southbound Ramps intersection would also occur under Alternative 3.

TABLE 19
YEAR 2036 AM INTERSECTION ANALYSIS [1,2]

Intersection	Traffic Control	No Project	Alternative 1 & 4	Alternative 2	Alternative 3
		Delay / LOS	Delay / LOS	Delay / LOS	Delay / LOS
1. Linden Avenue / Carpinteria Avenue	Signal	64 / E	59 / E	59 / E	59 / E
2. Linden Avenue / Sawyer Avenue	SSS	>50 / F (EB)	>50 / F (EB)	>50 / F (EB)	>50 / F (EB)
3. Linden Avenue / U.S. 101 SB Off-Ramp	SSS Signal	>50 / F (EB)	20 / B	15 / B	15 / B
4. Linden Avenue / Ogan Road (Vial Real with Project)	SSS Signal	>50 / F (WB)	33 / C	14 / B	14 / B
5. U.S. 101 NB On-Ramp / Ogan Road [3]	SSS Roundabout	4 / A (WB)	n/a	2 / A (WB)	9 / A [4 / A]
6. Vallecito Road / Via Real / U.S. 101 NB On-Ramp	SSS	18 / C (WB)	10 / A (WB)	10 / A (WB)	10 / A (WB)
7. Vallecito Road / Ogan Road	AWS	8 / A	8 / A	8 / A	8 / A
8. Casitas Pass Road / Carpinteria Avenue	Signal	26 / C	22 / C	22 / C	22 / C
9. Casitas Pass Road / U.S. 101 SB Ramps	AWS Signal	>50 / F	14 / B	14 / B	14 / B
10. Casitas Pass Road / Via Real / U.S. 101 NB Off-Ramp	AWS Signal	>50 / F	67 / E	67 / E	67 / E
11. Casitas Pass Road / Ogan Road	SSS	13 / B (EB)	12 / B (EB)	12 / B (EB)	12 / B (EB)
12. Bailard Avenue / Carpinteria Avenue	AWS	17 / C	17 / C	17 / C	17 / C
13. Bailard Avenue / U.S. 101 SB Ramps	SSS	>50 / F (EB)	>50 / F (EB)	>50 / F (EB)	>50 / F (EB)
14. Bailard Avenue / U.S. 101 NB Ramps	SSS	>50 / F (WB)	>50 / F (WB)	>50 / F (WB)	>50 / F (WB)
15. Bailard Avenue / Via Real	AWS	>50 / F	>50 / F	>50 / F	>50 / F
16. SR 150 / Carpinteria Avenue	SSS	10 / A (WB)	10 / A (WB)	10 / A (WB)	10 / A (WB)
17. SR 150 / U.S. 101 Southbound Ramps	SSS	19 / C (SB)	20 / C (SB)	20 / C (SB)	20 / C (SB)
18. SR 150 / U.S. 101 Northbound Ramps	SSS	15 / B (NB)	15 / B (NB)	15 / B (NB)	15 / B (NB)
19. SR 150 / Via Real	SSS	35 / D (NB)	33 / D (NB)	33 / D (NB)	33 / D (NB)
20. SR 150 / Casitas Pass Road	SSS	13 / B (EB)	13 / B (EB)	13 / B (EB)	13 / B (EB)
21. Linden Avenue / U.S. 101 NB On-Ramp (Alt. 1 & 4)	Signal	n/a	33 / C	n/a	n/a
22. Ogan Road / Via Real (Alt. 1, 2, & 4)	SSS	n/a	10 / A (WB)	10 / A (WB)	n/a
23. Via Real / U.S. 101 NB Ramps (Alt. 1, 2, 3, and 4)	Signal	n/a	31 / C	31 / C	31 / C

Notes: Shading denotes locations where level of service threshold is exceeded.
[1] Side-street stop intersection level of service based on worst approach control delay per vehicle, according to the 2000 Highway Capacity Manual. All-way stop intersection level of service based on weighted average control delay per vehicle, according to the 2000 Highway Capacity Manual.
[2] Signalized intersection level of service based on weighted average control delay per vehicle, according to the 2000 Highway Capacity Manual.
[3] Roundabout analysis denoted as: 2000 Highway Capacity Manual results [SIDRA results].
Source: Fehr & Peers, 2007.

TABLE 20
YEAR 2036 PM INTERSECTION ANALYSIS [1,2]

Intersection	Traffic Control	No Project	Alternative 1 & 4	Alternative 2	Alternative 3
		Delay / LOS	Delay / LOS	Delay / LOS	Delay / LOS
1. Linden Avenue / Carpinteria Avenue	Signal	69 / E	50 / D	50 / D	50 / D
2. Linden Avenue / Sawyer Avenue	SSS	> 50 / F	36 / E (EB)	36 / E (EB)	36 / E (EB)
3. Linden Avenue / U.S. 101 SB Off-Ramp	SSS Signal	> 50 / F	21 / C	17 / B	17 / B
4. Linden Avenue / Ogan Road (Vial Real with Project)	SSS Signal	> 50 / F	30 / C	16 / B	16 / B
5. U.S. 101 NB On-Ramp / Ogan Road [3]	SSS Roundabout	1 / A (WB)	n/a	2 / A (WB)	7 / A [4 / A]
6. Vallecito Road / Via Real / U.S. 101 NB On-Ramp	SSS	13 / B (WB)	10 / B (WB)	10 / B (WB)	10 / B (WB)
7. Vallecito Road / Ogan Road	AWS	8 / A	7 / A	7 / A	7 / A
8. Casitas Pass Road / Carpinteria Avenue	Signal	50 / D	41 / D	41 / D	41 / D
9. Casitas Pass Road / U.S. 101 SB Ramps	AWS Signal	>50 / F	30 / C	30 / C	30 / C
10. Casitas Pass Road / Via Real / U.S. 101 NB Off-Ramp	AWS Signal	>50 / F	76 / E	76 / F	76 / F
11. Casitas Pass Road / Ogan Road	SSS	19 / C	20 / C (EB)	20 / C (EB)	20 / C (EB)
12. Bailard Avenue / Carpinteria Avenue	AWS	>50 / F	34 / D	34 / D	34 / D
13. Bailard Avenue / U.S. 101 SB Ramps	SSS	>50 / F (EB)	>50 / F (EB)	>50 / F (EB)	>50 / F (EB)
14. Bailard Avenue / U.S. 101 NB Ramps	SSS	48 / E (WB)	31 / D (WB)	31 / D (WB)	31 / D (WB)
15. Bailard Avenue / Via Real	AWS	>50 / F	> 50 / F	> 50 / F	> 50 / F
16. SR 150 / Carpinteria Avenue	SSS	10 / A (WB)	10 / A (WB)	10 / A (WB)	10 / A (WB)
17. SR 150 / U.S. 101 Southbound Ramps	SSS	> 50 / F (SB)	> 50 / F (SB)	> 50 / F (SB)	> 50 / F (SB)
18. SR 150 / U.S. 101 Northbound Ramps	SSS	20 / C (NB)	19 / C (NB)	19 / C (NB)	19 / C (NB)
19. SR 150 / Via Real	SSS	23 / C (NB)	22 / C (NB)	22 / C (NB)	22 / C (NB)
20. SR 150 / Casitas Pass Road	SSS	>50 / F (EB)	>50 / F (EB)	>50 / F (EB)	>50 / F (EB)
21. Linden Avenue / U.S. 101 NB On-Ramp (Alt. 1 & 4)	Signal	n/a	30 / C	n/a	n/a
22. Ogan Road / Via Real (Alt. 1, 2, & 4)	SSS	n/a	10 / B (WB)	10 / B (WB)	n/a
23. Via Real / U.S. 101 NB Ramps (Alt. 1, 2, 3, and 4)	Signal	n/a	40 / D	40 / D	40 / D

Notes: Shading denotes locations where level of service threshold is exceeded.
[1] Side-street stop intersection level of service based on worst approach control delay per vehicle, according to the 2000 Highway Capacity Manual. All-way stop intersection level of service based on weighted average control delay per vehicle, according to the 2000 Highway Capacity Manual.
[2] Signalized intersection level of service based on weighted average control delay per vehicle, according to the 2000 Highway Capacity Manual.
[3] Roundabout analysis denoted as: 2000 Highway Capacity Manual results [SIDRA results].
Source: Fehr & Peers, 2007.

PROJECT IMPACTS AND MITIGATION

Table 21 provides a summary of project impacts (positive, negative, or no impact). The same criteria that was used under Year 2016 was also used for Year 2036 to determine project impacts.

TABLE 21
YEAR 2036 PROJECT IMPACTS

Intersection	Alternative 1 & 4		Alternative 2		Alternative 3	
	AM	PM	AM	PM	AM	PM
1. Linden Avenue / Carpinteria Avenue	Ø	+	Ø	+	Ø	+
2. Linden Avenue / Sawyer Avenue	Ø	+	Ø	+	Ø	+
3. Linden Avenue / U.S. 101 SB Off-Ramp	+	+	+	+	+	+
4. Linden Avenue / Ogan Road	+	+	+	+	+	+
5. U.S. 101 NB On-Ramp / Ogan Road	n/a	n/a	Ø	Ø	Ø	Ø
6. Vallecito Road / Via Real / U.S. 101 NB On-Ramp	+	Ø	+	Ø	+	Ø
7. Vallecito Road / Ogan Road	Ø	Ø	Ø	Ø	Ø	Ø
8. Casitas Pass Road / Carpinteria Avenue	Ø	Ø	Ø	Ø	Ø	Ø
9. Casitas Pass Road / U.S. 101 SB Ramps	+	-	+	-	+	-
10. Casitas Pass Road / Via Real / U.S. 101 NB Off-Ramp	-	-	-	-	-	-
11. Casitas Pass Road / Ogan Road	Ø	Ø	Ø	Ø	Ø	Ø
12. Bailard Avenue / Carpinteria Avenue	Ø	+	Ø	+	Ø	+
13. Bailard Avenue / U.S. 101 SB Ramps	Ø	Ø	Ø	Ø	Ø	Ø
14. Bailard Avenue / U.S. 101 NB Ramps	Ø	+	Ø	+	Ø	+
15. Bailard Avenue / Via Real	Ø	Ø	Ø	Ø	Ø	Ø
16. SR 150 / Carpinteria Avenue	Ø	Ø	Ø	Ø	Ø	Ø
17. SR 150 / U.S. 101 Southbound Ramps	Ø	Ø	Ø	Ø	Ø	Ø
18. SR 150 / U.S. 101 Northbound Ramps	Ø	Ø	Ø	Ø	Ø	Ø
19. SR 150 / Via Real	Ø	Ø	Ø	Ø	Ø	Ø
20. SR 150 / Casitas Pass Road	Ø	Ø	Ø	Ø	Ø	Ø
21. Linden Avenue / U.S. 101 NB On-Ramp (Alt. 1 & 4)	-	-	n/a	n/a	n/a	n/a
22. Ogan Road / Via Real (Alt. 1, 2, & 4)	Ø	Ø	Ø	Ø	n/a	n/a
23. Via Real / U.S. 101 NB Ramps (Alt. 1, 2, 3, and 4)	Ø	-	Ø	-	Ø	-

Notes:
Shading denotes project negative impacts.

" + " = Positive Impact; " - " = Negative Impact; " Ø " = No Impact; n/a = not applicable

Source: Fehr & Peers, 2007.

Alternative 1 Project Impacts and Mitigation

Alternative 1 has a total of 10 positive benefits (AM and PM peak hour total) and six negative impacts (AM and PM peak hour total). The negative impacts occur at the Linden Avenue and Casitas Pass Road interchanges. The recommended geometric layout for the Linden Avenue interchange presented earlier on Figure 20 would improve traffic operations and eliminate vehicle queue spillback at the Linden Avenue interchange.

The recommended geometric layout for the Casitas Pass Road interchange is presented on Figure 22. All three intersections would improve to LOS C or better conditions. Table 22 summarizes the intersection operations with the recommended improvements.

TABLE 22
MITIGATED YEAR 2036 ALTERNATIVE 1 INTERSECTION ANALYSIS

Intersection	Traffic Control[1]	AM Peak Hour	PM Peak Hour
		Delay / LOS	Delay / LOS
4. Linden Avenue / Ogan Road (Vial Real with Project)	Signal	19 / B	23 / C
9. Casitas Pass Road / U.S. 101 SB Ramps	Signal	14 / B	25 / C
10. Casitas Pass Road / Via Real / U.S. 101 NB Off-Ramp	Signal	22 / C	26 / C
21. Linden Avenue / U.S. 101 NB On-Ramp (Alt. 1 & 4)	Signal	19 / B	23 / C
23. Via Real / U.S. 101 NB Ramps (Alt. 1, 2, 3, and 4)	Signal	22 / C	19 / B

Notes:

[1] Signalized intersection level of service based on weighted average control delay per vehicle, according to the 2000 *Highway Capacity Manual*.

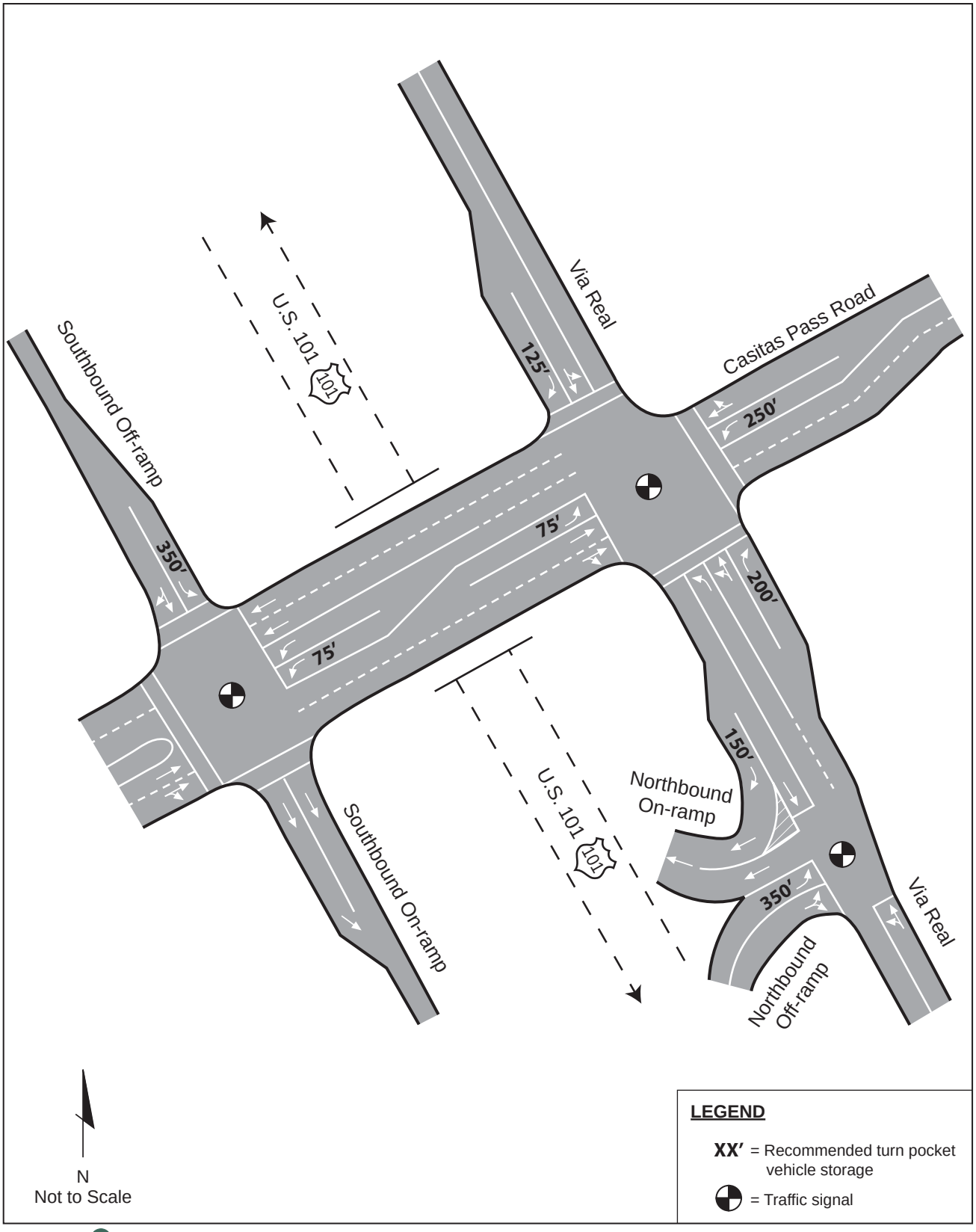
Source: Fehr & Peers, 2007.

Alternative 2 Project Impacts and Mitigation

Alternative 2 has a total of 10 positive benefits (AM and PM peak hour total) and four negative impacts (AM and PM peak hour total). The negative impacts occur at the Casitas Pass Road interchange. The recommended geometric layout for the Casitas Pass Road interchange is presented on Figure 22. The traffic operations after the improvements would be the same as Alternative 1.

Alternative 3 Project Impacts and Mitigation

The number of positive benefits and negative impacts, and the number of impacted locations would be the same as Alternative 2. Once again the negative impacts occur at the Casitas Pass Road interchange. The recommended geometric layout for the Casitas Pass Road interchange is presented on Figure 22. The traffic operations after the improvements would be the same as Alternative 1.



Linden Avenue/Casitas Pass

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ALL ALTERNATIVES RECOMMENDED GEOMETRIC LAYOUT AT CASITAS PASS ROAD INTERCHANGE

November 2006
Graphics\Nov 2006\WC05-2271_22

Figure 22

Vehicle Storage Recommendations

Although many of the signalized intersections are anticipated to operate at acceptable service levels, the analysis indicated that vehicle storage lengths need to be increased at several intersections to accommodate the demand and reduce queue impacts on traffic operations. Table 23 presents the vehicle storage recommendations for Alternatives 1 through 4. The only exception to the table below is that for Alternatives 2 and 3 at the Linden Avenue / Via Real intersection, the southbound-left and westbound-left storage length can be reduced to 280 feet and 130 feet, respectively.

TABLE 23
RECOMMENDED VEHICLE STORAGE (FEET)

Intersection	Alternatives 1 through 4 Intersection Approach							
	Northbound		Southbound		Eastbound		Westbound	
	Left	Right	Left	Right	Left	Right	Left	Right
1. Linden Avenue / Carpinteria Avenue	100	100	230	100	240	N/A	220	100
3. Linden Avenue / U.S. 101 SB Off-Ramp	N/A	N/A	N/A	N/A	320	100	N/A	N/A
4. Linden Avenue / Via Real	N/A	100	310	N/A	N/A	N/A	180	100
8. Casitas Pass Road / Carpinteria Avenue	N/A	N/A	330	100	430	N/A	N/A	150
9. Casitas Pass Road / U.S. 101 SB Ramps	N/A	N/A	200	200	N/A	N/A	160	N/A
10. Casitas Pass Road / Via Real / U.S. 101 NB Off-Ramp	260	100	N/A	100	100	275	300	N/A
12. Bailard Avenue / Carpinteria Avenue	N/A	N/A	N/A	100	300	N/A	N/A	100
13. Bailard Avenue / U.S. 101 SB Ramps	N/A	N/A	100	N/A	300	N/A	N/A	N/A
14. Bailard Avenue / U.S. 101 NB Ramps	N/A	N/A	N/A	N/A	N/A	N/A	200	N/A
15. Bailard Avenue / Via Real	N/A	N/A	N/A	100	100	200	350	N/A
21. Linden Avenue / U.S. 101 NB On-Ramp (Alt. 1 & 4)	240	N/A	N/A	N/A	N/A	N/A	N/A	N/A
23. Via Real / U.S. 101 NB Ramps (Alt. 1, 2, 3, and 4)	100	N/A	N/A	100	N/A	N/A	N/A	N/A

Note: Results based on 95th percentile queue results from Synchro.

N/A = Exclusive lane does not exist or existing vehicle storage is adequate to serve future demand or proposed vehicle storage length is adequate.

Fehr & Peers Associates, 2007.

ADDITIONAL IMPROVEMENTS TO CONSIDER

There are several intersections that are not negatively impacted by the project but that will operate at LOS D or worse with and without the project under Year 2036 conditions. For some of the intersections, there are potential improvements that could improve traffic operations. Each of the locations operating at LOS D or worse and potential improvements are discussed below. These suggested improvements should not be considered mitigation measures for the project.

Linden Avenue/Carpinteria Avenue

Traffic operations could be improved by retiming the traffic signal to reflect the changes in traffic volumes. Consideration should be given to providing a maximum cycle length of 120 seconds.

Linden Avenue/Sawyer

The side-street movements at the intersection of Linden Avenue/Sawyer Avenue are anticipated to operate at LOS F, but overall the intersection would operate at LOS C or better. The side-street volumes are about 60 vehicles during the AM and PM peak hour and this intersection does not satisfy the peak hour traffic signal warrant. No improvements are suggested.

Casitas Pass Road/Carpinteria Avenue

This intersection is anticipated to operate at LOS D during the PM peak hour under Year 2036 conditions. Intersection operations could be improved to LOS C by restriping the exclusive northbound right-turn lane on Carpinteria Avenue to a shared through/right-turn lane. There would be no need to widen on the departure leg because two acceptance lanes are already provided.

Bailard Avenue Interchange

All of the intersections along Bailard Avenue are anticipated to operate at LOS D or worse during either the AM or PM peak hour. The suggested geometric layout for Bailard Avenue was presented earlier on Figure 21.

SR 150 Interchange

The southbound off-ramp is anticipated to operate at LOS F and overall the intersection would operate at LOS F during the AM peak hour. The off-ramp volume is about 370 vehicles during the AM peak hour; however, the intersection does not satisfy the peak hour traffic signal warrant. The volumes are fairly balanced on all approaches and consideration should be given to installing all-way stop traffic control if any of the all-way stop warrants are satisfied in the future. With all-way stop control, this intersection would operate at LOS D or better.

SR 150/Via Real

The side-street movements at the intersection of SR 150/Via Real are anticipated to operate at LOS D, but overall the intersection would operate at LOS C or better during the AM peak hour. The side-street volumes are about 60 vehicles during the AM peak hour and this intersection does not satisfy the peak hour traffic signal warrant. No improvements are suggested.

SR 150/Casitas Pass Road

The side-street movements at the intersection of SR 150/Casitas Pass Road are anticipated to operate at LOS F and overall the intersection would operate at LOS E. The side-street volumes are about 440 vehicles during the PM peak hour; however, this intersection does not satisfy the peak hour traffic signal warrant. The volumes are fairly balanced on all approaches and consideration should be given to installing all-way stop traffic control if any of the all-way stop warrants are satisfied in the future. With all-way stop control, this intersection would operate at LOS D or better.

MAINLINE AND RAMP JUNCTION OPERATIONS

Each mainline segment and ramp junction was evaluated under Year 2036 conditions with and without the project based on the volumes presented on Figure 18. The results are summarized in Tables 24 and 25. Since Alternatives 1 through 4 have the same mainline and ramp volumes the traffic operations would be the same for each of the alternatives. Detailed calculations are presented in the Technical Appendix.

No Project Conditions

Under Year 2036 conditions, an HOV lane would be provided in each direction. The northbound direction will generally operate at LOS D or better during the AM peak hour and LOS C during the PM peak hour. The southbound direction will generally operate at LOS C or better during the AM peak hour and at LOS C or worse during the PM peak hour.

Project Conditions (Alternatives 1, 2, 3, and 4)

Similar to the No Project condition, the northbound direction will generally operate at LOS D or better during the AM peak hour and LOS C during the PM peak hour. The southbound direction will generally operate at LOS C or better during the AM peak hour and at LOS C or worse during the PM peak hour. The project would not negatively impact the mainline or ramp junction operations.

TABLE 24
YEAR 2036 NO PROJECT MAINLINE AND RAMP MERGE DIVERGE ANALYSIS

Mainline or Ramp	Number of Lanes	AM Peak Hour		PM Peak Hour	
		Density [1]	LOS	Density [1]	LOS
Mainline Analysis					
NB U.S. 101 Bates Road to SR 150	3	25	C	19	C
NB U.S. 101 SR 150 to Bailard Avenue	2	25	C	20	C
NB U.S. 101 Bailard Avenue to Casitas Pass Road	2	28	D	25	C
NB U.S. 101 Casitas Pass Road to Linden Avenue	2	26	D	22	C
NB U.S. 101 Linden Avenue to Santa Monica Road	2	33	D	26	C
SB U.S. 101 Reynolds Avenue to Linden Avenue	2	26	D	37	E
SB U.S. 101 Linden Avenue to Casitas Pass Road	2	21	C	31	D
SB U.S. 101 Casitas Pass Road to Bailard Avenue	2	20	C	33	D
SB U.S. 101 Bailard Avenue to SR 150	2 + Aux	weave	A	weave	C
SB U.S. 101 SR 150 to Bates	2 + Aux	weave	A	weave	F
Ramp Junction Analysis					
NB U.S. 101 SR 150 Off-Ramp	1	30	D	25	C
NB U.S. 101 SR 150 On-Ramp	1	27	C	22	C
NB U.S. 101 Bailard Avenue Off-Ramp	1	31	D	26	C
NB U.S. 101 Bailard Avenue On-Ramp	1	30	D	27	C
NB U.S. 101 Casitas Pass Road Off-Ramp	1	35	D	31	D
NB U.S. 101 Casitas Pass Road On-Ramp	1	29	D	26	C
NB U.S. 101 Linden Avenue On-Ramp	1	34	D	29	D
SB U.S. 101 Linden Avenue Off-Ramp	1	32	D	40	E
SB U.S. 101 Casitas Pass Road Off-Ramp	1	26	C	36	E
SB U.S. 101 Casitas Pass Road On-Ramp	1	23	C	34	D
SB U.S. 101 Bailard Avenue Off-Ramp	1	26	C	38	E
SB U.S. 101 Bailard Avenue On-Ramp	1	weave	A	weave	C
SB U.S. 101 SR 150 Off-Ramp	1	weave	A	weave	C
SB U.S. 101 SR 150 On-Ramp	1	weave	A	weave	F

Notes:

Shading denotes locations where level of service threshold is exceeded.

[1] Mainline segment and ramp merge/diverge LOS based on vehicle density (passenger cars/mile/lane), according to the 2000 *Highway Capacity Manual*.

Source: Fehr & Peers, 2007.

TABLE 25
YEAR 2036 WITH PROJECT MAINLINE AND RAMP MERGE DIVERGE ANALYSIS

Mainline or Ramp	Number of Lanes	AM Peak Hour		PM Peak Hour	
		Density [1]	LOS	Density [1]	LOS
Mainline Analysis					
NB U.S. 101 Bates Road to SR 150	3	25	C	19	C
NB U.S. 101 SR 150 to Bailard Avenue	2	25	C	20	C
NB U.S. 101 Bailard Avenue to Casitas Pass Road	2	26	D	24	C
NB U.S. 101 Casitas Pass Road to Linden Avenue	2	26	C	22	C
NB U.S. 101 Linden Avenue to Santa Monica Road	2	33	D	26	C
SB U.S. 101 Reynolds Avenue to Linden Avenue	2	26	D	37	E
SB U.S. 101 Linden Avenue to Casitas Pass Road	2	21	C	31	D
SB U.S. 101 Casitas Pass Road to Bailard Avenue	2	19	C	31	D
SB U.S. 101 Bailard Avenue to SR 150	2 + Aux	weave	A	weave	C
SB U.S. 101 SR 150 to Bates	2 + Aux	weave	A	weave	F
Ramp Junction Analysis					
NB U.S. 101 SR 150 Off-Ramp	1	30	D	25	C
NB U.S. 101 SR 150 On-Ramp	1	27	C	22	C
NB U.S. 101 Bailard Avenue Off-Ramp	1	31	D	26	C
NB U.S. 101 Bailard Avenue On-Ramp	1	28	C	26	C
NB U.S. 101 Casitas Pass Road Off-Ramp	1	33	D	30	D
NB U.S. 101 Casitas Pass Road On-Ramp	1	29	D	26	C
NB U.S. 101 Linden Avenue On-Ramp	1	35	D	29	D
SB U.S. 101 Linden Avenue Off-Ramp	1	32	D	40	E
SB U.S. 101 Casitas Pass Road Off-Ramp	1	26	C	36	E
SB U.S. 101 Casitas Pass Road On-Ramp	1	22	C	32	D
SB U.S. 101 Bailard Avenue Off-Ramp	1	24	C	36	E
SB U.S. 101 Bailard Avenue On-Ramp	1	weave	A	weave	C
SB U.S. 101 SR 150 Off-Ramp	1	weave	A	weave	C
SB U.S. 101 SR 150 On-Ramp	1	weave	A	weave	F

Notes:

Shading denotes locations where level of service threshold is exceeded.

[1] Mainline segment and ramp merge/diverge LOS based on vehicle density (passenger cars/mile/lane), according to the 2000 *Highway Capacity Manual*.

Source: Fehr & Peers, 2007.

STREET SEGMENT OPERATIONS

Table 26 summarizes the street segment level of service under Year 2036 conditions with and without the Project. Carpinteria Avenue is anticipated to operate slightly better with the project than without the project. Linden Avenue is anticipated to operate at LOS D under Alternatives 1 and 4, primarily as a result of providing several traffic signals within a short distance. Alternatives 2 and 3 would also provide LOS D conditions on Linden Avenue except during the AM peak hour where LOS E would be provided. At the Casitas Pass Road, the worst level of service (LOS E) will be during the PM peak hour in the eastbound direction.

TABLE 26
YEAR 2036 STREET SEGMENT LEVEL OF SERVICE

Street Segment	Direction	Arterial Class	No Project				With Project [1] (Alt. 1, 2, 3, and 4)			
			AM Peak		PM Peak		AM Peak		PM Peak	
			Avg. Travel Speed	LOS	Avg. Travel Speed	LOS	Avg. Travel Speed	LOS	Avg. Travel Speed	LOS
Carpinteria Avenue (Casitas Pass Road to Linden Avenue)	Northwest	IV	10.5	D	8.2	E	11.7	D	12.1	D
	Southeast	IV	14.7	C	14.0	C	16.2	C	16.2	C
Linden Avenue (Carpinteria Avenue to Via Real)	Northbound	IV	N/A				9.5 [8.8]	D [E]	10.2 [9.9]	D [D]
	Southbound	IV					11.5 [12.3]	D [D]	11.7 [11.4]	D [D]
Casitas Pass Road (Carpinteria Avenue to Via Real)	Eastbound	IV					11.8	D	8.4	E
	Westbound	IV					15.2	C	12.9	D

N/A = Not Applicable

[1] The results presented are for all the project alternatives except at Linden Avenue where the results for Alternatives 2 and 3 are presented in brackets ([ ]). The analysis was performed assuming the recommended improvements at Linden Avenue under Alternative 1 and 4 conditions.

Source: Fehr & Peers, 2007.

7. FORECASTED VOLUME SENSITIVITY ANALYSIS

The analysis results presented in the previous chapters utilize the currently adopted SBCAG social economic forecasts. SBCAG is currently updating their forecasts and this chapter supplements and refines the results of the traffic operations analysis at the Linden Avenue and Casitas Pass Road Interchanges presented in the previous chapters of this report to be consistent with the land use projections as defined in SBCAG's *Draft Regional Growth Forecast 2005-2040*. The *Draft Regional Growth Forecast 2005-2040* is consistent with the 2003 update of the City of Carpinteria General Plan.

PURPOSE

The purpose of the forecasted volume sensitivity analysis is to address how changes in the *Draft Regional Growth Forecast 2005-2040* with regard to population and employment projections in the design year may affect traffic operations and capacity requirements at the Linden Avenue and Casitas Pass Road interchanges. Traffic operations were evaluated for future conditions at the Linden Avenue and Casitas Pass Road interchanges to determine interchange improvements that would best serve the cumulative traffic growth in the area taking into consideration the *Draft Regional Growth Forecast 2005-2040*. Specifically, the bridge structure size at the Linden Avenue and Casitas Pass Road interchanges and associated intersections were analyzed.

TRAFFIC FORECASTS

The *Draft Regional Growth Forecast 2005-2040* shows less intense growth in the City of Carpinteria than the currently adopted SBCAG forecasts. To determine the appropriate improvements with the less intense development, the 2036 AM and PM peak hour turning movement forecasts presented in Chapter 4 were manually adjusted to reduce the turning movement volumes associated with the population and employment changes (the directional link volume changes associated with the modifications are presented in the Technical Appendix). The 2036 resulting traffic volumes are presented in Figure 23.

INTERSECTION OPERATIONS

Table 27 summarizes the analysis results for intersections at the Linden Avenue and Casitas Pass Road interchanges under Year 2036 conditions for each project scenario using the volumes presented on Figure 23. Detailed calculations are provided in the Technical Appendix. Year 2036 project intersection conditions were evaluated based on lane configurations presented on Figures 5 through 8. Due to the similarity of Alternatives 1 through 4, the intersection operations would be the same for all of the study intersections.

The Linden Avenue/U.S. 101 Northbound On-Ramp is anticipated to operate at LOS C or better; however, this intersection will have vehicle queue spillback impacts on adjacent intersections due to insufficient vehicle storage under Alternatives 1 and 4. The same issue occurs at the Casitas Pass Road/U.S. 101 Southbound Ramps under all of the Project Alternatives. At the intersection of Linden Avenue/U.S. 101 Northbound On-Ramp, the eastbound Linden Avenue to northbound U.S. 101 left-turn vehicle queue will extend to the Linden Avenue/U.S. 101 Southbound Off-Ramp intersection and impact its operations. At the intersection of Casitas Pass Road/U.S. 101 Southbound Ramps, the westbound Casitas Pass Road to southbound U.S. 101 left-turn vehicle queue will extend to the Casitas Pass Road/Via Real intersection and impact its operations.

The Casitas Pass Road/Via Real/ U.S. 101 Northbound Off-Ramp intersection is anticipated to operate at unacceptable LOS D conditions or worse during the PM peak hour under Year 2036 conditions.

TABLE 27
YEAR 2036 FORECASTED VOLUME SENSITIVITY INTERSECTION ANALYSIS

Intersection	Traffic Control[1]	Alternative 1 & 4		Alternative 2 & 3	
		AM	PM	AM	PM
3. Linden Avenue / U.S. 101 SB Off-Ramp	Signal	18 / B	19 / B	14 / B	15 / B
9. Casitas Pass Road / U.S. 101 SB Ramps	Signal	13 / B	22 / C	13 / B	22 / C
10. Casitas Pass Road / Via Real / U.S. 101 NB Off-Ramp	Signal	47 / D	77 / E	47 / D	77 / E
21. Linden Avenue / U.S. 101 NB On-Ramp	Signal	24 / C	22 / C	n/a	n/a
23. Via Real / U.S. 101 NB Ramps	Signal	28 / C	31 / C	28 / C	31 / C

Notes:
Shading denotes locations where level of service threshold is exceeded.
[1] Signalized intersection level of service based on weighted average control delay per vehicle, according to the *2000 Highway Capacity Manual*.
Source: Fehr & Peers, 2007.

Alternatives 1 and 4 Project Mitigation

The recommended geometric layout for the Linden Avenue interchange presented earlier on Figure 20 is still required under the forecasted volume sensitivity analysis scenario to improve traffic operations and eliminate vehicle queue spillback impacts. Table 28 summarizes the analysis results assuming mitigation at the Linden Avenue and Casitas Pass Road interchange. Detailed calculations are provided in the Technical Appendix.

Under the forecasted volume sensitivity analysis scenario the Casitas Pass Road Bridge can be reduced from a six lane cross section to a five lane cross section. Figure 24 presents the recommended geometric layout for the Casitas Pass Road interchange under the forecasted volume sensitivity analysis scenario.

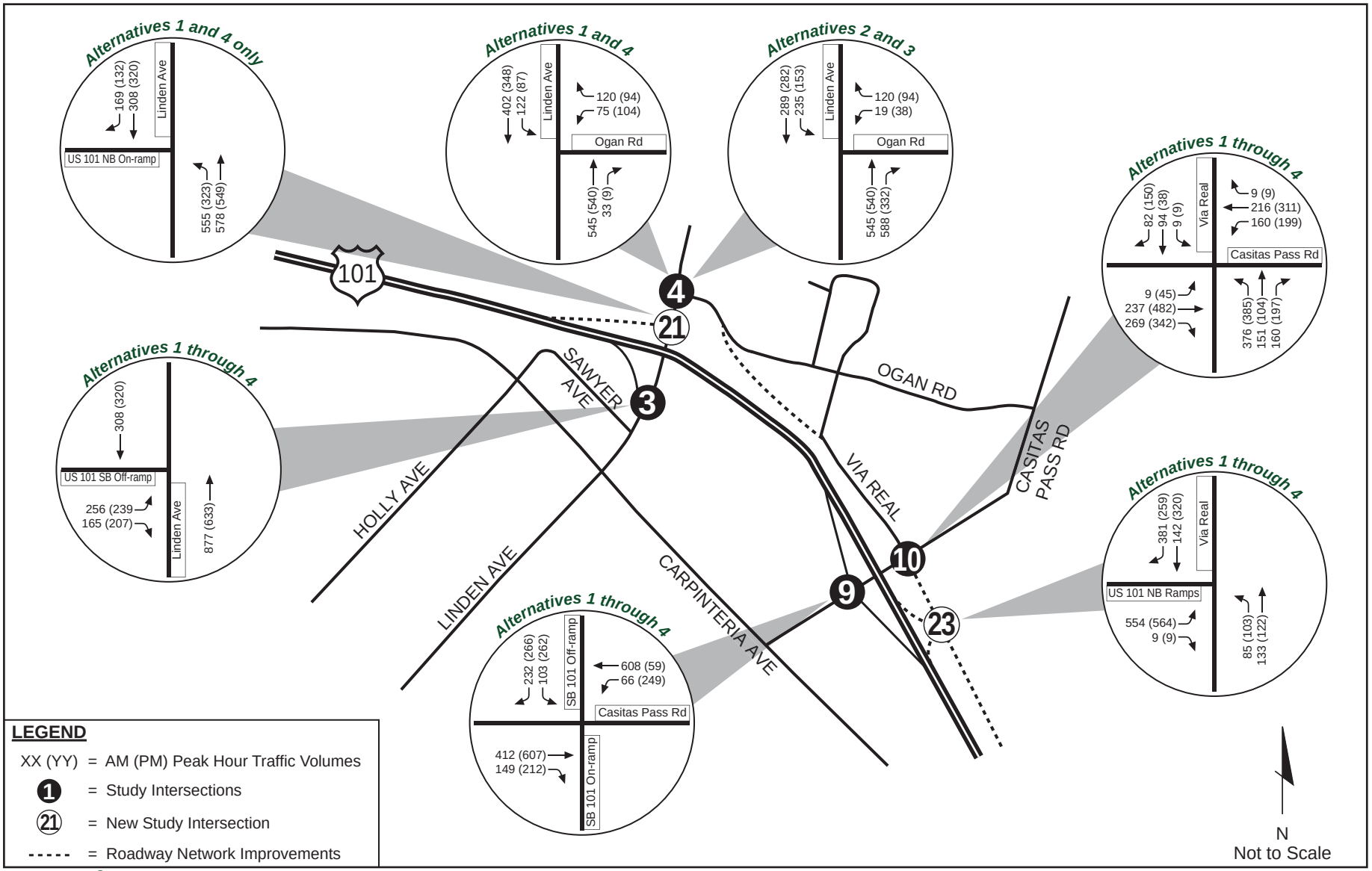
TABLE 28
YEAR 2036 FORECASTED VOLUME SENSITIVITY INTERSECTION ANALYSIS WITH MITIGATION

Intersection	Traffic Control[1]	Alternative 1 & 4		Alternative 2 & 3	
		AM	PM	AM	PM
3. Linden Avenue / U.S. 101 SB Off-Ramp	Signal	17 / B	17 / B	14 / B	15 / B
9. Casitas Pass Road / U.S. 101 SB Ramps	Signal	14 / B	24/ C	14 / B	24/ C
10. Casitas Pass Road / Via Real / U.S. 101 NB Off-Ramp	Signal	23 / C	24 / C	23 / C	24 / C
21. Linden Avenue / U.S. 101 NB On-Ramp	Signal	18/ B	18 / B	n/a	n/a
23. Via Real / U.S. 101 NB Ramps	Signal	24 / C	19 / B	24 / C	19 / B

Notes:
Shading denotes locations where level of service threshold is exceeded.
[1] Signalized intersection level of service based on weighted average control delay per vehicle, according to the *2000 Highway Capacity Manual*.
Source: Fehr & Peers, 2007.

Alternatives 2 and 3 Project Mitigation

The recommended geometric layout for the Casitas Pass Road interchange presented on Figure 24 would improve the operations at the interchange to LOS C or better conditions. The traffic operations after the improvements would be the same as Alternatives 1 and 4.



Linden Avenue / Casitas Pass

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YEAR 2036 FORECASTED VOLUME SENSITIVITY ANALYSIS
INTERSECTION PEAK HOUR VOLUMES

April 2007
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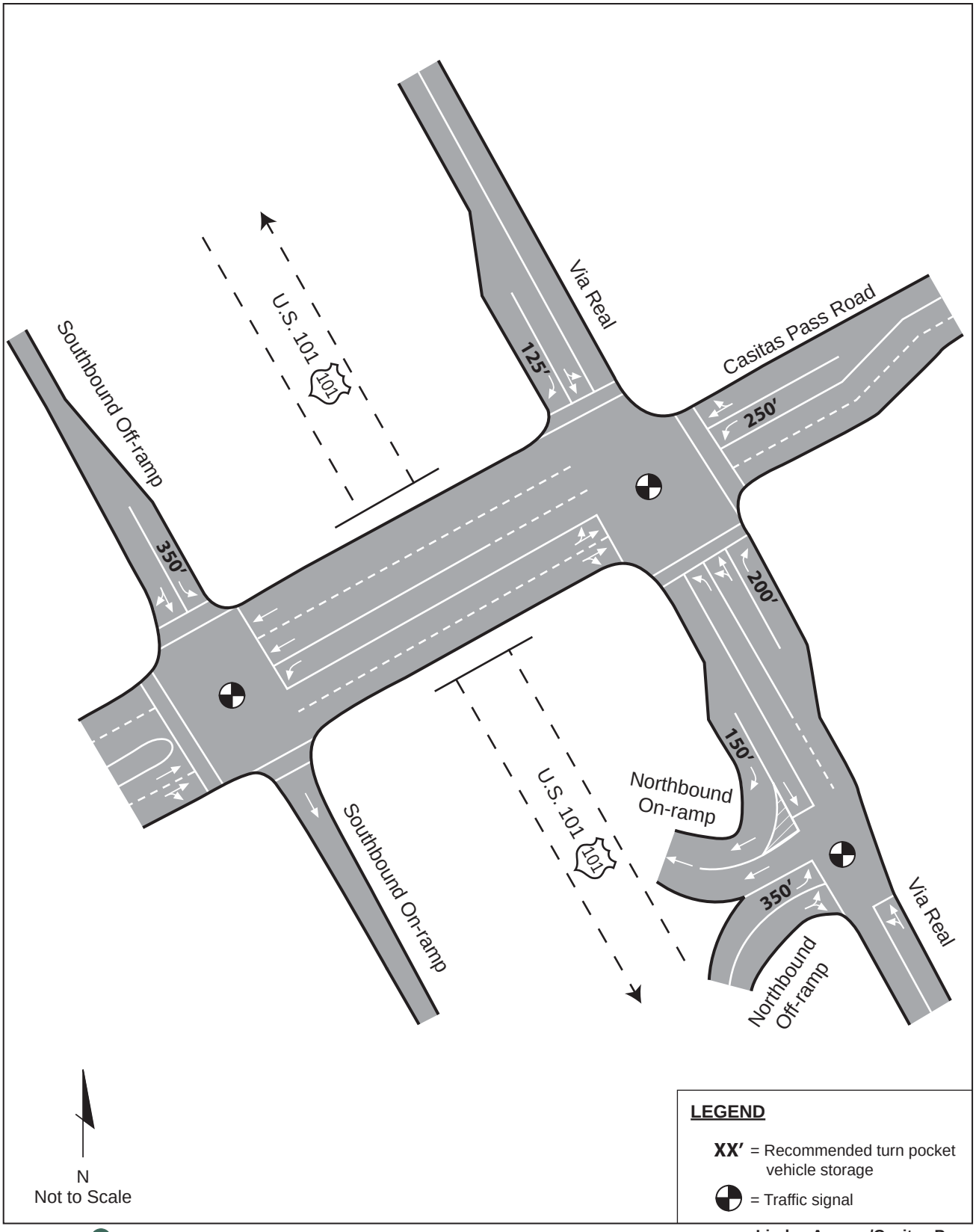
Figure 23



Linden Avenue/Casitas Pass

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FORECASTED VOLUME SENSITIVITY ANALYSIS RECOMMENDED GEOMETRIC LAYOUT AT CASITAS PASS ROAD INTERCHANGE FOR ALL ALTERNATIVES

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Figure 24