

# TRAFFIC OPERATIONS ANALYSIS REPORT

## Pacheco Boulevard Alignment Study and Alternatives Analysis

PREPARED FOR:

CITY OF MARTINEZ AND CONTRA COSTA COUNTY



OCTOBER 2016 | FINAL REPORT

Prepared By:

**Kimley»»Horn** under contract to LCC  
Engineering & Surveying, Inc.

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## 1. INTRODUCTION AND STUDY OBJECTIVE

Kimley-Horn and Associates, Inc. (Kimley-Horn) was retained by LCC Engineering & Surveying, Inc. (LCC) to develop alignment and roadway improvement alternatives on Pacheco Boulevard. The proposed project (Project) improvements limits along Pacheco Boulevard are from Blum Road to Morello Avenue.

Pacheco Boulevard is classified as a Route of Regional Significance because of its high importance to the adjacent street network. It is a primary connector to the City of Martinez from other Contra Costa County destinations. Pacheco Boulevard is located parallel to Interstate 680 to the west, and becomes Contra Costa Boulevard south of 2<sup>nd</sup> Avenue. Within the study area, Pacheco Boulevard is a two-lane north-south arterial roadway. North of Arthur Road, there is a two-way left-turn lane (TWLTL) along the entire length of the study corridor. Within the study area, Pacheco Boulevard serves industrial, retail, and residential land uses. There are intermittent sidewalks and bicycle facilities along Pacheco Boulevard throughout the study corridor. Pacheco Boulevard goes underneath the Burlington Northern Santa Fe Railway tracks north of Falling Star Drive. This crossing has been reviewed for relocation due to the narrow road width and horizontal curves approaching and exiting the crossing.

This report documents the results of the traffic operations analysis conducted for the existing traffic operations and proposed improvements along Pacheco Boulevard within the study corridor. For simplicity of the traffic operations, the study corridor is divided into the following four segments:

- Segment 1 – Pacheco Boulevard between Blum Road and Arnold Drive
- Segment 2 – Pacheco Boulevard between Arnold Drive and Arthur Road
- Segment 3 – Pacheco Boulevard between Arthur Road and Camino Del Sol
- Segment 4 – Pacheco Boulevard between Camino Del Sol and Morello Avenue

This study includes intersection level of service (LOS), queuing analyses, and roadway segment LOS of the AM and PM peak hour traffic conditions for five (5) intersections and four (4) roadway segments. This study evaluates the traffic operations of the Pacheco Boulevard corridor to assist the City and County in determining proposed improvements to the study corridor and develop implementation plan for the proposed improvements.

## REPORT ORGANIZATION

The remainder of the report is divided into the following chapters:

- Chapter 2: Study Purpose and Need – describes the purpose for the study.
- Chapter 3: Methodology – describes the process and assumptions used for the traffic analysis.
- Chapter 4: Existing Conditions – describes existing conditions on the roadway, transit system, pedestrian facilities, bicycle facilities, parking, and collision history.
- Chapter 5: No Build Condition – Year 2015 and 2040 No project conditions.
- Chapter 6: Alternatives Description and Analysis – Year 2015 and 2040 Project Conditions for two alternatives.
- Chapter 7: Recommendations and Next Steps – describes next steps for the project.

## 2. STUDY PURPOSE AND NEED

### PURPOSE AND NEED

The purpose of this study is to review the operations of Pacheco Boulevard between Blum Road and Morello Avenue. The study will determine the existing (2015) and future (2040) levels of congestion, regional mobility, safety characteristics, and multi-modal aspects of the study corridor. The roadway improvements that were considered include:

- Widening of Pacheco Boulevard for Segment 1 between Blum Road and Arnold Drive to include additional through lanes, a two-way left-turn lane (TWLTL), bicycle lanes, and sidewalks.
- Signalization and lane striping at the intersection of Pacheco Boulevard and Arnold Drive
- Realignment of Pacheco Boulevard at the Burlington Northern Santa Fe Railway tracks
- Intersection improvements at the intersection of Pacheco Boulevard and Arthur Road, including the addition of an eastbound left turn lane and a northbound right turn lane
- Widening of Pacheco Boulevard for Segment 3 between Arthur Road and Camino Del Sol
- Widening of Pacheco Boulevard for Segment 4 between Camino Del Sol and Morello Avenue

Advantages and disadvantages will be discussed for each identified improvement to determine the most appropriate improvements for Pacheco Boulevard that satisfy the needs of pedestrians and cyclists, as well as improve vehicular and transit operations through the corridor.

### 3. METHODOLOGY

This chapter describes the process and assumptions that were used to evaluate the existing and proposed traffic operations on the study corridor.

#### STUDY AREA

The project study area along Pacheco Boulevard is between Morello Drive and Blum Road. The traffic operations analysis for each proposed alternative includes components of Pacheco Boulevard and local cross-street intersections connected to Pacheco Boulevard within the study limits. The following intersections in **Table 1** were analyzed during weekday AM and PM peak hours. The study intersections are illustrated in **Figure 1**.

**Table 1 - Study Intersections**

#	Intersection
1	Pacheco Boulevard / Blum Road – SR-4 WB Ramps
2	Pacheco Boulevard / Arnold Drive
3	Pacheco Boulevard / Arthur Road
4	Pacheco Boulevard / Camino Del Sol
5	Pacheco Boulevard / Morello Avenue

#### TRAFFIC CONDITIONS

To evaluate the impacts of the proposed project improvements, traffic analyses were based on the following traffic conditions:

- Existing (2015), No Build Conditions – Based on traffic counts collected in June 2015. Existing roadway geometry and traffic control (June 2015) was used for this scenario.
- Cumulative (2040), No Build Conditions – Based on future year traffic forecasts from the Contra Costa Transportation Authority (CCTA) 2040 model. This scenario assumes existing roadway geometry and traffic control with no planned roadway improvements along the study corridor. The existing intersection of Pacheco Boulevard / Blum Road – SR-4 WB Ramps is being studied separately under the on-going I-680/SR-4 interchange improvement project. This intersection will be improved by CCTA/Caltrans and hence not included in the Pacheco Boulevard corridor study.
- Alternative 1 Conditions – Each proposed roadway improvement was analyzed in the scenario in which the improvement is needed.
- Additional Alternative Conditions – Additional alternatives for each proposed roadway improvement were analyzed, if necessary.



**Figure 1 - Project Location and Study Intersections**

## INTERSECTION LEVEL OF SERVICE (LOS)

Analysis of traffic operations at intersections is based on the concept of level of service (LOS). The LOS of an intersection is a qualitative measure used to describe operational conditions. LOS ranges from A (best), which represents minimal delay, to F (worst), which represents heavy delay and a facility that is operating at or near its functional capacity. Levels of service for this study were determined using methods defined in the *Highway Capacity Manual, 2010* (HCM) and appropriate traffic analysis software. It should be noted that CCTA previously determined LOS based on volume to capacity (v/c), but this has been updated to follow HCM methodology which is governed by average signal delay.

The HCM includes procedures for analyzing unsignalized intersections, side-street stop-controlled (SSSC) or all-way stop-controlled (AWSC), and signalized intersections. The SSSC procedure defines LOS as a function of average control delay for each minor street approach movement and major street left-turns. Conversely, the AWSC and signalized intersection procedures define LOS as a function of average control delay for the intersection as a whole. **Table 2** relates the operational characteristics associated with each LOS category for signalized and unsignalized intersections<sup>1</sup>.

**Table 2 - Intersection Level of Service Definitions**

Level of Service	Description	Signalized (Avg. control delay per vehicle sec/veh.)	Unsignalized (Avg. control delay per vehicle sec/veh.)	V/C Definitions for Comparison Purposes
<b>A</b>	Free flow with no delays. Users are virtually unaffected by others in the traffic stream	[ 10	[ 10	≤ 0.6
<b>B</b>	Stable traffic. Traffic flows smoothly with few delays.	∃ 10 – 20	∃ 10 – 15	0.61 – 0.70
<b>C</b>	Stable flow but the operation of individual users becomes affected by other vehicles. Modest delays.	∃ 20 – 35	∃ 15 – 25	0.71 – 0.80
<b>D</b>	Approaching unstable flow. Operation of individual users becomes significantly affected by other vehicles. Delays may be more than one cycle during peak hours.	∃ 35 – 55	∃ 25 – 35	0.81 – 0.90
<b>E</b>	Unstable flow with operating conditions at or near the capacity level. Long delays and vehicle queuing.	∃ 55 – 80	∃ 35 – 50	0.91 – 1.00
<b>F</b>	Forced or breakdown flow that causes reduced capacity. Stop and go traffic conditions. Excessive long delays and vehicle queuing.	∃ 80	∃ 50	> 1.00

<sup>1</sup> *Highway Capacity Manual 2010*, National Research Council, 2010 and Contra Costa Transportation Authority Technical Procedures 2013.

Traffic operations were analyzed for the no build scenarios and proposed improvement alternatives. The LOS standard for County urban intersections is LOS D as stated in the County's General Plan. The City does not have a LOS threshold.

## SIGNAL WARRANTS

Traffic signals may be justified when traffic operations fall below acceptable thresholds and when one or more signal warrants are satisfied. Traffic volumes at the unsignalized study intersections were compared against the peak hour warrant in the 2014 California Manual on Uniform Traffic Control Devices (CA MUTCD)<sup>2</sup>. *Traffic Signal Warrant #3 – Peak Hour Volume Warrant* is satisfied when traffic volumes on the major and minor approaches exceed volume thresholds for one hour of the day. The Peak Hour Warrant is generally the first warrant to be satisfied. Other warrants such as those for minimum vehicle volumes, interruption of continuous traffic, and traffic progression were not evaluated because they generally require higher traffic volumes to be satisfied.

## QUEUING

The effects of vehicle queuing were also analyzed and the 95th percentile queue is reported for all study intersections. The 95th percentile queue length represents a condition where 95 percent of the time during the peak hour, traffic volumes will be less than or equal to the queue length determined by the analysis. This is referred to as the "95th percentile queue."

Queues that exceed the turn pocket length can create potentially hazardous conditions by blocking or disrupting through traffic in adjacent travel lanes. However, these potentially hazardous queues are generally associated with left turn movements. Locations where the right turn pocket storage is exceeded are not typically considered potentially hazardous because the right turn movement progresses at the same time as the through movement and the additional vehicles that spill out of the turn pocket will likely not hinder nor disrupt the adjacent through traffic.

## ROADWAY SEGMENT LEVEL OF SERVICE

Roadway segment level of service (LOS) was performed based on the Highway Capacity Manual standards and the LOS tables from the Florida Department of Transportation (DOT)<sup>3</sup>, which are slightly modified HCM standards. The Highway Capacity Manual methodology is based on average speed, which is a sum of the mid-block travel time and the downstream intersection signal delay. Since these average speeds are dependent on the intersection signal delay, the results can be misleading if the intersection signal delay is excessive. Therefore, the Florida LOS tables were also used for comparison. Both methodologies are commonly used in the transportation industry.

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## HIGHWAY CAPACITY MANUAL METHODOLOGY

The HCM method determines the LOS based on travel speed as a percentage of base free-flow speed for the corridor by urban street class. **Table 3** shows the comparison of LOS by class to the average travel speed.

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<sup>2</sup> *California Manual on Uniform Traffic Control Devices*, (FHWA's MUTCD 2009 Edition, as amended for use in California), November 7, 2014

<sup>3</sup> 2012 FDOT Quality/Level of Service Handbook tables, Florida Department of Transportation, 2012.

**Table 3 – Roadway Segment Level of Service Definitions (HCM Methodology)**

Travel Speed as a % of Base Free Flow Speed	LOS by Critical v/c	
	≤ 1.0	> 1.0
> 85%	A	F
> 67%-85%	B	F
> 50%-67%	C	F
> 40%-50%	D	F
> 30%-40%	E	F
≤ 30%	F	F

## FLORIDA LOS TABLES METHODOLOGY

The other methodology is the Florida LOS Tables methodology. These tables consider capacity of individual roadway segments based on various roadway characteristics, including speed, signalized intersection density, number of lanes, and if there is a raised median. The analysis was performed for each segment of Pacheco Boulevard. **Table 4** shows the relevant portions of the LOS tables from the Florida DOT that apply to the study segments of Pacheco Boulevard.

**Table 4 – Roadway Segment Level of Service Definitions (Florida LOS Tables Methodology)**

Roadway Type	Volume Threshold (vehicles)		
	LOS C	LOS D	LOS E
Urban Non-State Signalized Class I Arterial – 2 Lanes	1,359	1,440	-
Urban Non-State Signalized Class I Arterial – 4 Lanes	3,078	3,222	-
Urban Non-State Signalized Class II Arterial – 2 Lanes	594	1,197	1,269
Urban Non-State Signalized Class II Arterial – 4 Lanes	1,179	2,628	2,736

Note: The volumes shown are peak hour two-way volumes. Volumes also include a 10% non-state signalized roadway adjustment from the base volume capacities.

In addition, the volume capacities were adjusted based on the following geometric conditions:

- Increase by 5% for segments with two lanes, a divided median, exclusive left turn lanes, and no exclusive right turn lanes
- Increase by 5% for segments with exclusive right turn lanes

The LOS standard for urban areas is LOS D for the roadway segments as stated in the County's General Plan.

## ROUTES OF REGIONAL SIGNIFICANCE ANALYSIS

There are performance standards or multi-modal transportation service objectives (MTSO)'s for routes of regional significance. The *Central County Action Plan for Routes of Regional Significance*<sup>4</sup> identifies Pacheco Boulevard as a Route of Regional Significance. The MTSO's for Pacheco Boulevard are stated based on the local jurisdiction:

<sup>4</sup> Central County Action Plan for Routes of Regional Significance, CCTA, July 2009.

- City of Martinez: 15 mph average speed in both directions in the AM and PM peak hours
- Contra Costa County:  $v/c = 1.5$  for all intersections

## 4. EXISTING CONDITIONS

This chapter describes the existing conditions of the roadway network, transit service, pedestrian facilities, and bicycle facilities within the vicinity of the study area.

### EXISTING ROADWAY NETWORK

This section provides a description of the principal roadways included in this study.

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#### PACHECO BOULEVARD

Pacheco Boulevard is located parallel to I-680 to the west and within the study area, Pacheco Boulevard is a two-lane north-south arterial roadway. North of Arthur Road, there is a two-way left-turn lane (TWLTL) throughout the length of the corridor. Outside of the study limits, Pacheco Boulevard connects to Pine Street to the north and Concord Avenue to the south. South of Concord Avenue, Pacheco Boulevard becomes Contra Costa Boulevard. Pacheco Boulevard connects to I-680 at the intersection of Arthur Road/Pacheco Boulevard and connects to SR-4 at the intersection of Pacheco Boulevard/Blum Road.

Within the study area, Pacheco Boulevard serves industrial, retail, and residential land uses. The posted speed limit on Pacheco Boulevard is 35 miles per hour north of Arnold Drive and 40 miles per hour south of Arnold Drive. Pacheco Boulevard is a Route of Regional Significance.

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#### ARNOLD DRIVE

Arnold Drive is a two-lane northeast-southwest collector roadway serving residential and industrial land uses. Arnold Drive connects to Pacheco Boulevard to the east and Howe Road to the west. Arnold Drive runs parallel to SR-4 and can be used as an alternate route. The speed limit on Arnold Drive is 40 miles per hour.

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#### ARTHUR ROAD

Arthur Road is a two-lane north-south collector serving residential land uses. Arthur Road has on-street parking on both sides between Pacheco Boulevard and Karen Lane. Arthur Road provides access to northbound I-680, receives a southbound I-680 off-ramp, and has a posted speed limit of 25 miles per hour within the study area.

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#### BLUM ROAD

Blum Road is a two-lane north-south collector roadway with on-street parking on both sides near Pacheco Boulevard. Blum Road connects Explorer Way to the north and Pacheco Boulevard to the south. Blum Road provides access to residential and industrial lane uses. The posted speed limit on Blum Road is 30 miles per hour. The intersection of Pacheco Boulevard and Blum Road includes the westbound SR-4 on- and off-ramp terminals.

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#### CAMINO DEL SOL

Camino Del Sol is a two-lane north-south local roadway within the study area. Camino Del Sol connects Via Estrella to the north and Pacheco Boulevard to the south. Camino Del Sol provides access to residential land uses. The speed limit on Camino Del Sol is 25 miles per hour.

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## MORELLO AVENUE

Morello Avenue is a two lane north-south arterial roadway with bicycle lanes within the study area. Morello Avenue begins at Pacheco Boulevard to the north and extends south until Taylor Boulevard. Morello Avenue provides access to residential land uses and access to SR-4 south of the study area. The speed limit on Morello Avenue is 25 miles per hour.

## EXISTING TRANSIT FACILITIES

Western Contra Costa Transit Authority (WestCAT), County Connection, and Tri Delta Transit provide transit services within Martinez and other cities in Contra Costa County.

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## WESTERN CONTRA COSTA TRANSIT AUTHORITY (WESTCAT)

Western Contra Costa Transit Authority (WestCAT) provides transit services that connects cities primarily in western Contra Costa County such as El Cerrito, Richmond, El Sobrante, and Hercules, but also Martinez.

WestCAT currently does not have any routes that run within the study area, however, the 30Z line provides connection between western Contra Costa County and Martinez.

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## COUNTY CONNECTION

County Connection provides transit services throughout central Contra Costa County serving cities such as Martinez, Concord, Clayton, Pleasant Hill, Walnut Creek, Danville, and San Ramon.

Route 19 operates between the Martinez Amtrak station and the Concord BART station. Route 19 operates along Pacheco Boulevard, extending north and south of the study limits, and there are several bus stops within the study limits.

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## TRI DELTA TRANSIT

Tri Delta Transit provides transit services mostly throughout eastern Contra Costa County serving cities such as Pittsburg, Antioch, Oakley, and Brentwood.

Route 200, operating between the Martinez Amtrak Station and the Pittsburg/ Bay Point BART station, provides connection between eastern Contra Costa County and the City of Martinez. Within the study area, Route 200 operates along Pacheco Boulevard between SR-4 EB Ramps and Arnold Road.

## EXISTING PEDESTRIAN FACILITIES

There are portions of sidewalks and crosswalks provided throughout the study area to allow pedestrian to access nearby transit stops, residential uses and commercial uses. In the northern section of the study area, sidewalks are present on both sides of Pacheco Boulevard between Morello Avenue and Arthur Road. However, there are gaps in the sidewalk network. In the southern section, there are limited sidewalks present on Pacheco Boulevard. Near the on-going residential developments south of the railroad tracks, there are sidewalks on both sides of Pacheco Boulevard, and there are sidewalks near the intersection of Pacheco Boulevard and Blum Road.

The *Countywide Bicycle and Pedestrian Plan, 2009 Update*<sup>5</sup> lists pedestrian and bicycle improvement projects throughout Contra Costa County. The document lists the Comprehensive Transportation Project List (CTPL) for local transportation projects throughout the County. The relevant pedestrian facility projects for Pacheco Boulevard are listed below:

- CTPL #1211 - Pacheco Boulevard Bike and Pedestrian Project (from Camino Del Sol to Morello Avenue)

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#### EXISTING DEFICIENCY

There are many pedestrian connectivity gaps along the study corridor.

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#### PROPOSED IMPROVEMENTS

Construct sidewalk to fill in gaps along the study corridor, as well as provide accessible curb ramps at intersections.

#### EXISTING BICYCLE FACILITIES

Within the study area, there are existing and future proposed bicycle facilities. Bicycle facilities are outlined in the City's General Plan Circulation Element. Class II bicycle lanes exist on:

- Pacheco Boulevard between Windover Way and Las Juntas Elementary School
- Arnold Drive from Pacheco Boulevard to Howe Road

Class II bicycle lanes are being proposed on Arthur Road east of Pacheco Boulevard. Class III bicycle routes exist on Pacheco Boulevard between Blum Road and Morello Avenue within the study limits. There are no Class I bicycle paths.

The *Countywide Bicycle and Pedestrian Plan, 2009 Update*<sup>6</sup> shows that there are existing bicycle facilities along Pacheco Boulevard from Morello Avenue to Sunrise Drive and proposed bicycle facilities from Sunrise Drive to Blum Road, within the study area. The Plan also lists the CTPL for local transportation projects throughout the County. The relevant bicycle facility projects for Pacheco Boulevard are listed below:

- CTPL #0589 - Pacheco Boulevard Bike Lanes, Arnold Drive to Muir Road

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#### EXISTING DEFICIENCY

There are many bicycle connectivity gaps along the study corridor.

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#### PROPOSED IMPROVEMENTS

Construct bicycle facilities along the length of the study corridor.

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<sup>5</sup> 2009 Contra Costa Countywide Bicycle and Pedestrian Plan, CCTA, October 2009.

<sup>6</sup> 2009 Contra Costa Countywide Bicycle and Pedestrian Plan, CCTA, October 2009.



## EXISTING PARKING

A parking occupancy survey was conducted in June 2015. The study evaluated existing on-street parking along the project corridor. Details on the parking occupancy study are documented in the Draft Parking Inventory and Analysis Technical Memorandum (see Appendix).

**Table 5** lists the number of available on-street parking spaces, time of peak occupancy, and peak percent occupancy for the four (4) segments and the total corridor along Pacheco Boulevard. The study identified approximately 366 on-street parking spaces along the study corridor. The peak parking occupancy for the study corridor occurred between 10:00 AM and 11:00 AM with 47 percent of spaces occupied. It should be noted that different segments along Pacheco Boulevard may vary in time of peak occupancy and peak occupancy as shown in **Table 5** due to adjacent land uses.

**Table 5 – Parking Summary**

#	Segment	Available Spaces	Time of Peak Occupancy	Peak Occupancy
1	Between Blum Road and Arnold Drive	44	10:00 AM – 11:00 AM	73%
2	Between Arnold Drive and Arthur Road	211	7:00 AM – 8:00 AM	32%
3	Between Arthur Road and Camino Del Sol	80	11:00 AM – 12:00 PM	60%
4	Between Camino Del Sol and Morello Avenue	31	7:00 AM – 8:00 AM	90%
<b>Total Corridor</b>		366	10:00 AM – 11:00 AM	47%

## EXISTING DEFICIENCY

There are no striped or marked parking spaces along Pacheco Boulevard which results in numerous vehicles parking in the shoulder along the corridor, particularly within Segment 2. There are several locations where vehicles use the existing wide, flat, gravel area outside of the roadway like a parking lot with vehicles stacked behind one another. These vehicles are assumed to be employee parking associated with several of the business along Segment 2.

## PROPOSED IMPROVEMENTS

Construct curb and gutter and sidewalk throughout the entire segment and provide additional right-of-way for on-site parking where appropriate.

## COLLISION ANALYSIS

A review of the collision data along the study corridor was conducted to identify any collision patterns that may be reduced with the proposed roadway improvements. Collision history was collected and provided by the County through the Statewide Integrated Traffic Records System (SWITRS) database for collisions occurring along the project corridor between January 1, 2010 and December 31, 2014.

Collision rates were calculated for roadway segments and each of the study intersections based on total number of collisions, traffic volume, and roadway geometry characteristics. The calculated collision rates were then compared to state averages<sup>7</sup>. **Table 6** and **Table 7** list the calculated and State collision rates for studied roadway segments and intersections, respectively. As shown in **Table 6** and **Table 7**, all

<sup>7</sup> 2012 Collision Data on California State Highway (road miles, travel, collisions, collision rates), Caltrans, 2015

roadway segments and study intersections have collision rates less than the state average. Collision data is shown in the **Appendix**.

The severity of the collisions are shown in **Table 6** and **Table 7**. For the roadway segments, there are 36 total collisions, with nine involving an injury and no fatalities. This equates to a rate of 0.03 injury/fatality collisions per million vehicle-miles (mvm). The average Statewide facility is 0.42 injury/fatality collisions per mvm. Therefore, this segment is well below the average Statewide facility.

For the study intersections, there are 37 total collisions, with 13 involving an injury and no fatalities. This equates to a rate of 0.05 injury/fatality collisions per million vehicle-miles (mvm). The average Statewide intersection is 0.19 injury/fatality collisions per mvm. Therefore, this segment is well below the average Statewide intersection.

**Table 6 – Roadway Segment Collision Summary**

#	Segment Limits	Calculated Collision Rate	State Average Collision Rate	Total Collisions	Injury Involved	Fatality Involved
1	Between Blum Road and Arnold Drive	0.21	0.93	2	1	0
2	Between Arnold Drive and Author Road	0.50	0.93	10	1	0
3	Between Arthur Road and Camino Del Sol	0.62	0.93	11	4	0
4	Between Camino Del Sol and Morello Avenue	0.74	0.93	13	3	0

**Table 7 – Study Intersection Collision Summary**

#	Intersection	Calculated Collision Rate	State Average Collision Rate	Total Collisions	Injury Involved	Fatality Involved
1	Pacheco Boulevard / Blum Road – SR-4 WB Ramps	0.25	0.50	11	3	0
2	Pacheco Boulevard / Arnold Drive	0.04	0.16	1	1	0
3	Pacheco Boulevard / Arthur Road	0.17	0.50	12	4	0
4	Pacheco Boulevard / Camino Del Sol	0.18	0.50	9	4	0
5	Pacheco Boulevard / Morello Avenue	0.07	0.50	4	1	0

## 5. NO BUILD CONDITION

This chapter presents the turning movement volumes and analysis results for the Existing (2015), No Build and Cumulative (2040).

### EXISTING (2015), NO BUILD CONDITION

The Existing (2015), No Build Condition is based off of existing peak hour turning movement volumes and lane geometry under the No Build scenario. The results for the LOS, warrants, and queuing analysis for the Existing (2015), No Build Conditions are described in this section.

### LANE CONFIGURATION AND TRAFFIC CONTROL

The Existing (2015), No Build condition assumes existing intersection lane configuration and traffic controls, as illustrated in **Figure 2**. **Table 8** lists the traffic control for each study intersection under the Existing (2015), No Build condition.

**Table 8 – Study Intersections and Traffic Control for Existing (2015), No Build Scenario**

#	Intersection	Existing Traffic Control
1	Pacheco Boulevard / Blum Road – SR-4 WB Ramps	Signal
2	Pacheco Boulevard / Arnold Drive	SSSC
3	Pacheco Boulevard / Arthur Road	Signal
4	Pacheco Boulevard / Camino Del Sol	Signal
5	Pacheco Boulevard / Morello Avenue	Signal

Note: SSSC – Side Street Stop Control

### PEAK-HOUR TURNING MOVEMENT VOLUMES

Weekday intersection turning movement volumes for the study intersections were collected in June 2015. Volumes were collected during the AM (7:00-9:00 AM) peak period and PM (4:00-6:00 PM) peak period on a typical weekday while local schools were still in session. It should be noted that the I-680 and Marina Vista Avenue interchange was under construction while the counts were taken. However, this should not have significantly affected the study area because the detour routes were not along the study corridor. The detour route directed drivers to exit at Arthur Road and make a left to go northbound on I-680, and exit back at Waterfront Road.

**Figure 3** shows the peak hour turning movement volumes. Intersection volume data sheets for all traffic counts are provided in the **Appendix**.

### AVERAGE DAILY TRAFFIC VOLUMES

Average daily traffic (ADT) counts for the roadway segments were collected in June 2015. Volumes were collected for 24 hours on three separate days on a typical weekday while local schools were still in session. **Table 9** shows the ADT volume summary.

**Figure 2 – No Build Scenario Lane Geometry and Traffic Control**

**Figure 3 – Existing (2015) Condition Peak Hour Turning Movement Volume**

**Table 9 – ADT Count Summary**

#	Roadway Segment	Daily Volume
1	Pacheco Boulevard between Blum Road and Arnold Drive	8,710
2	Pacheco Boulevard between Arnold Drive and Arthur Road	5,530
3	Pacheco Boulevard between Arthur Road and Camino Del Sol	15,370
4	Pacheco Boulevard between Camino Del Sol and Morello Avenue	14,550

The ADT volumes along Pacheco Boulevard north of Arthur Road are much higher than south of Arthur Road. Many of the vehicles north of Arthur Road use the I-680 ramps at Arthur Road.

## INTERSECTION LEVEL OF SERVICE

Traffic operations were evaluated at the study intersections under existing traffic conditions. Results of the analysis are presented in **Table 10**. The following intersections do not function within acceptable standards:

- #1 Pacheco Boulevard / Blum Road (PM Peak)
- #2 Pacheco Boulevard / Arnold Drive (PM Peak)

Analysis sheets are provided in the Appendix.

**Table 10 – Existing (2015), No Build Condition Level of Service Summary**

#	Intersection	LOS Criteria	Intersection Control <sup>1</sup>	Existing (2015), No Build			
				AM Peak		PM Peak	
				LOS	Delay	LOS	Delay
1	Pacheco Blvd / Blum Rd-WB SR-4 Ramps	D	Signal	C	25.2	<b>E</b>	<b>72.0</b>
2	Pacheco Blvd / Arnold Dr	D	SSSC	A	3.7	<b>E</b>	<b>35.4</b>
	<i>Worst Approach (EB Approach)</i>			<b>B</b>	13.5	<b>F</b>	<b>82.7</b>
3	Pacheco Blvd / Arthur Rd	D	Signal	C	27.2	D	35.8
4	Pacheco Blvd / Camino Del Sol	D	Signal	B	13.0	A	10.0
5	Pacheco Blvd / Morello Ave	D	Signal	B	18.2	C	32.2

<sup>1</sup> Each study intersection is controlled by a traffic signal or a side-street stop-controlled (SSSC).

Note: Intersections that are operating below acceptable levels are shown in **BOLD**.

It should be noted that calculations of delay at saturated conditions (i.e., LOS F) are less reliable than at LOS E or better. Therefore, delay in excess of 80 seconds is reported in the table to allow a relative comparison of without and with project conditions and should not be interpreted as an exact representation of actual delay.

All intersections were analyzed using HCM 2010 methodology which determines LOS based on delay.

## SIGNAL WARRANTS

Intersection #2 – Pacheco Boulevard / Arnold Drive meets the peak hour signal warrant for the Existing, No Build Scenario in the PM peak. Analysis sheets are provided in the **Appendix**.

## QUEUING

**Table 11** summarizes the queues during the Existing conditions. The queues exceed the storage length except for the following left-turn movements:

- Intersection #1 – Pacheco Boulevard / Blum Road
  - Northbound Left (PM Peak)
  - Southbound Left (PM Peak)
- Intersection #2 – Pacheco Boulevard / Arnold Drive
  - Eastbound Left (PM Peak)
- Intersection #3 – Pacheco Boulevard / Arthur Road
  - Eastbound Left (AM and PM Peaks)
  - Westbound Left (AM and PM Peaks)
  - Northbound Left (AM and PM Peaks)
  - Southbound Left (AM and PM Peaks)
- Intersection #4 – Pacheco Boulevard / Camino Del Sol
  - Southbound Left (PM Peak)
- Intersection #5 – Pacheco Boulevard / Morello Avenue
  - Northbound Left (PM Peak)

It should be noted that the southbound left turn queue at the intersection of Pacheco Boulevard / Camino Del Sol can extend into the existing TWLTL. The northbound left turn queue at the intersection of Pacheco Boulevard / Morello Avenue can extend into the existing TWLTL as well.

Analysis sheets are provided in the **Appendix**.

**Table 11 – Existing (2015), No Build Condition Queuing Summary**

Scenarios Analyzed	Turning Movement	Pacheco Boulevard														
		Blum Rd #1			Arnold Dr #2			Arthur Rd #3			Camino Del Sol #4			Morello Ave #5		
		Link	AM	PM	Link	AM	PM	Link	AM	PM	Link	AM	PM	Link	AM	PM
Existing (2015), No Build	EBL	/	/	/	165	<25	255	190	234	643	/	/	/	/	/	/
	EBR	180	72	330	/	/	/	145	78	75	/	/	/	105	104	55
	WBL	/	/	/	/	/	/	115	157	153	/	/	/	/	/	/
	WBR	270	<25	<25	/	/	/	115	26	54	/	/	/	/	/	/
	NBL	230	157	333	/	/	/	60	247	229	/	/	/	195	137	234
	NBR	/	/	/	/	/	/	/	/	/	155	<25	<25	/	/	/
	SBL	100	107	531	/	/	/	80	264	159	80	69	114	/	/	/
	SBR	65	<25	<25	/	/	/	85	<25	<25	/	/	/	/	/	/

Note: Locations where the queue length exceeds the link storage by 25 feet or more are shown in shaded cells.

## ROADWAY SEGMENT LEVEL OF SERVICE

The roadway segment LOS was analyzed for each of the study segments along Pacheco Boulevard using the HCM methodology. The HCM methodology is based on average speed, which includes the mid-block travel time and the intersection signal delay. **Table 12** summarizes the roadway segment

analysis under the Existing (2015), No Build Condition using the HCM methodology. Each roadway segment for each peak period meets the LOS criteria of LOS D, except segment #1, Pacheco Boulevard between Blum Road and Arnold Drive in the southbound direction in the PM peak hour.

Since this is a Route of Regional Significance, the City’s requirement is the arterial speed be greater than 15 mph for each segment. Each roadway segment for each peak period meets the speed criteria, except segment #1, Pacheco Boulevard between Blum Road and Arnold Drive in the southbound direction in the PM peak hour.

**Table 12 – Existing (2015), No Build Condition Roadway Segment Level of Service Summary (HCM)**

#	Roadway Segment	Direction	LOS Criteria	AM Peak		PM Peak	
				LOS	% of Base FF Speed	LOS	% of Base FF Speed
1	Pacheco Blvd between Blum Rd and Arnold Dr	Northbound	D	A	1.00	A	1.00
		Southbound	D	D	0.42	<b>E</b>	<b>0.34</b>
2	Pacheco Blvd between Arnold Dr and Arthur Rd	Northbound	D	C	0.60	C	0.62
		Southbound	D	A	0.92	A	0.92
3	Pacheco Blvd between Arthur Rd and Camino Del Sol	Northbound	D	C	0.66	C	0.55
		Southbound	D	C	0.66	B	0.70
4	Pacheco Blvd between Camino Del Sol and Morello Ave	Northbound	D	C	0.65	B	0.76
		Southbound	D	B	0.80	B	0.71

Segments operating below acceptable levels are shown in **BOLD**.

The roadway segment analysis was also conducted using the Florida LOS Tables methodology, which is based on the volume and capacity of the roadway segment. **Table 13** summarizes the roadway segment analysis under the Existing (2015), No Build Condition. The following roadway segments do not function within acceptable standards:

- #1 - Pacheco Boulevard between Blum Road and Arnold Drive (PM peak hour)
- #3 - Pacheco Boulevard between Arthur Road and Camino Del Sol (AM and PM peak hours)
- #4 - Pacheco Boulevard between Camino Del Sol and Morello Avenue (AM and PM peak hours)

As a Route of Regional Significance, the County’s requirement is the v/c be less than 1.5 for each segment. Each roadway segment for each peak period meets the v/c criteria, except for the following segments:

- #3 - Pacheco Boulevard between Arthur Road and Camino Del Sol (AM and PM peak hours)
- #4 - Pacheco Boulevard between Camino Del Sol and Morello Avenue (PM peak hour)

Analysis sheets are provided in the **Appendix**.



**Table 13 – Existing (2015), No Build Condition Roadway Segment Level of Service Summary (Florida LOS Tables)**

#	Roadway Segment	# of Lanes (Two-Way)	AM Peak			PM Peak		
			Volume	Capacity	LOS	Volume	Capacity	LOS
1	Pacheco Blvd between Blum Rd and Arnold Dr	2	743	1,440	C	<b>1,450</b>	<b>1,440</b>	<b>F</b>
2	Pacheco Blvd between Arnold Dr and Arthur Rd	2	680	1,440	C	898	1,440	C
3	Pacheco Blvd between Arthur Rd and Camino Del Sol	2	<b>2,102</b>	<b>1,332</b>	<b>F</b>	<b>2,132</b>	<b>1,332</b>	<b>F</b>
4	Pacheco Blvd between Camino Del Sol and Morello Ave	2	<b>1,698</b>	<b>1,332</b>	<b>F</b>	<b>2,026</b>	<b>1,332</b>	<b>F</b>

Segments operating below acceptable levels are shown in **BOLD**.

## EXISTING DEFICIENCIES

The following are the operational deficiencies as determined from the traffic analysis:

- Intersection #1 – Pacheco Boulevard / Blum Road:
  - PM peak: Exceeds LOS D threshold
  - PM peak: Northbound left turn queue exceeds existing turn pocket
  - PM peak: Southbound left turn queue exceeds existing turn pocket
- Intersection #2 – Pacheco Boulevard / Arnold Drive:
  - PM peak: Exceeds LOS D threshold
  - PM peak: Eastbound left turn queue exceeds existing turn pocket
- Intersection #3 – Pacheco Boulevard / Arthur Road:
  - AM and PM peaks: Eastbound left turn queue exceeds existing turn pocket
  - AM and PM peaks: Westbound left turn queue exceeds existing turn pocket
  - AM and PM peaks: Northbound left turn queue exceeds existing turn pocket
  - AM and PM peaks: Southbound left turn queue exceeds existing turn pocket
- Intersection #4 – Pacheco Boulevard / Camino Del Sol:
  - PM peak: Southbound left turn queue exceeds existing turn pocket
- Intersection #5 – Pacheco Boulevard / Morello Avenue:
  - PM peak: Northbound left turn queue exceeds existing turn pocket
- Roadway Segment #1 – Pacheco Boulevard between Blum Road and Arnold Drive
  - PM peak: Southbound direction exceeds the LOS D threshold based on percent of base free flow speed
  - PM peak: Average speed less than threshold of 15 mph
  - PM peak: Exceeds the LOS D threshold based on volume and capacity
- Roadway Segment #3 – Pacheco Boulevard between Arthur Road and Camino Del Sol
  - AM and PM peaks: Exceeds the LOS D threshold based on volume and capacity
  - AM and PM peaks: Exceeds the v/c ratio of 1.5
- Roadway Segment #4 – Pacheco Boulevard between Camino Del Sol and Morello Avenue
  - AM and PM peaks: Exceeds the LOS D threshold based on volume and capacity
  - PM peak: Exceeds the v/c ratio of 1.5

## POTENTIAL IMPROVEMENTS

The following are the potential improvements for the operational deficiencies listed above:

- Intersection #1 – Pacheco Boulevard / Blum Road:

- No proposed improvements since the intersection is under Caltrans jurisdiction and there is a major freeway improvement planned in the future.
- Intersection #2 – Pacheco Boulevard / Arnold Drive:
  - Signalize the intersection
- Intersection #3 – Pacheco Boulevard / Arthur Road:
  - Modify the lane geometry to reduce the existing queuing deficiencies
  - Install a roundabout
- Intersection #4 – Pacheco Boulevard / Camino Del Sol:
  - Modify the lane geometry to reduce the existing queuing deficiencies
- Intersection #5 – Pacheco Boulevard / Morello Avenue:
  - Modify the lane geometry to reduce the existing queuing deficiencies
- Roadway Segment #1 – Pacheco Boulevard between Blum Road and Arnold Drive
  - Improve the intersection operations at the intersection of Pacheco Boulevard / Blum Road
  - Widen the roadway to add additional northbound and/or southbound lanes
- Roadway Segment #3 – Pacheco Boulevard between Arthur Road and Camino Del Sol
  - Widen the roadway to add additional northbound and/or southbound lanes
- Roadway Segment #4 – Pacheco Boulevard between Camino Del Sol and Morello Avenue
  - Widen the roadway to add additional northbound and/or southbound lanes

Each of these roadway improvements will be discussed in more detail in the Alternatives section.

## CUMULATIVE (2040), NO BUILD CONDITION

The Cumulative (2040), No Build Condition is based off of peak hour turning movement volumes for the year 2040 and No Build condition lane geometry. The results level of services, warrants, and queuing analysis for the Cumulative (2040), No Build Conditions are described in this section.

### LANE CONFIGURATION AND TRAFFIC CONTROL

The Cumulative (2040), No Build condition assumes the same intersection lane configuration and traffic controls as Existing (2015), No Build conditions. There are proposed improvements for the intersection of Pacheco Boulevard / Blum Road that will be completed by Caltrans as part of the I-680/SR-4 Interchange Project.

The I-680/SR-4 interchange project is a planned improvement in the study area that would construct a flyover ramp to be the east leg on the existing intersection of Pacheco Boulevard/SR-4 WB ramps/Blum Road. This project is planned to be constructed in five phases:

- Phase 1: NB I-680 to WB SR-4 flyover and Pacheco Boulevard – This phase will include the construction of a flyover connector ramp from NB I-680 to WB SR-4 and a ramp that goes to Pacheco Boulevard. In addition, the project includes the removal of the existing NB I-680 connector loop ramp to WB SR-4. Phase 1 improvements directly affect Pacheco Boulevard. The proposed flyover from NB I-680 would connect to the east leg of the intersection of Pacheco Boulevard/Blum Road.
- Phase 2: EB SR-4 to SB I-680 connector ramp and Pacheco Boulevard to SB I-680 ramp – This phase will include the construction of a new connector ramp from EB SR-4 to SB I-680. This connector ramp will begin earlier than the existing connector ramp. The existing connector ramp

will be demolished. In addition, an on-ramp will be constructed from Pacheco Boulevard to SB I-680, which will become the east leg at the intersection of Pacheco Boulevard / Muir Road.

- Phase 3: EB SR-4 improvements – This phase will include construction improvements for EB SR-4 between the connector ramp to SB I-680 and east of SR-242.
- Phase 4: SB I-680 to EB SR-4 connector ramp – This phase will include the construction of a new connector ramp from SB I-680 to EB SR-4. This phase will also include the demolition of the existing SB I-680 to EB SR-4 connector loop ramp.
- Phase 5: WB SR-4 to NB I-680 connector ramp; WB SR-4 to SB I-680 connector loop ramp; and NB I-680 to EB SR-4 connector ramp – This phase will include the construction of three connector ramps. There will be a new WB SR-4 to NB I-680 connector ramp that will be west of the existing connector ramp. A WB SR-4 to SB I-680 connector loop ramp will also be constructed. Lastly, there will be a new NB I-680 to EB SR-4 connector ramp.

For the Pacheco Boulevard corridor study, only Phase 1 improvements will affect the corridor. However, due to lack of available funding, Phase 1 is indefinitely postponed. Based on discussions with CCTA, it was determined that the Phase I improvements should not be assumed to be completed for this corridor study. Therefore, the analysis for the intersection of Pacheco Boulevard/Blum Road only accounts for the projected volumes as determined from the existing volumes and CCTA model.

For the purposes of this study, the intersection of Pacheco Boulevard/Blum Road will be assumed to have the same intersection configuration as the existing lane geometry. The No Build intersection operations will be analyzed but no proposed improvements will be developed as a part of this study.

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## PEAK-HOUR TURNING MOVEMENT VOLUMES

To achieve Cumulative traffic conditions, roadway link volumes from the CCTA Travel Demand Forecast model were obtained. The model shows the bi-directional AM and PM peak hour traffic volumes on each segment along roadways within the study area. Model outputs were used to compare 2010 base year volumes and year 2040 model forecast volumes to determine the annual incremental growth in traffic volumes at study intersections. Year 2040 turning movement volumes were calculated by adding the growth increment to existing traffic counts to calculate the final adjusted roadway link forecast volume. Final adjusted forecast volumes were then converted to Cumulative (2040) intersection turning movement volumes using a traffic modeling standard process commonly referred to as the Furness method. The Furness method uses an iterative process to derive future turning movement volumes based on future year roadway link volumes and an initial estimate of turning percentages (obtained from the existing intersection turning movement counts). It should be noted that the model volumes for the intersection of Pacheco Boulevard/Blum Road did not assume the interchange project was completed. No other lane geometry information was provided in the model plots from CCTA.

The Cumulative (2040) peak hour turning movement volumes are shown in **Figure 4**.

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## AVERAGE DAILY TRAFFIC VOLUMES

Average daily traffic (ADT) counts for the roadway segments in Cumulative (2040) were calculated based on the CCTA Travel Demand Forecast model and the existing proportion between the peak hour volume and the daily volume. **Table 14** shows the ADT volume summary for Cumulative (2040).

**Table 14 – ADT Volume Summary for Cumulative (2040)**

#	Roadway Segment	Daily Volume
1	Pacheco Boulevard between Blum Road and Arnold Drive	21,210
2	Pacheco Boulevard between Arnold Drive and Arthur Road	15,810
3	Pacheco Boulevard between Arthur Road and Camino Del Sol	32,300
4	Pacheco Boulevard between Camino Del Sol and Morello Avenue	27,950

The ADT volumes along Pacheco Boulevard north of Arthur Road are much higher than south of Arthur Road. Many of the vehicles north of Arthur Road use the I-680 ramps at Arthur Road.

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#### INTERSECTION LEVEL OF SERVICE

Traffic operations were evaluated at the study intersections under Cumulative (2040), No Build traffic conditions. Results of the analysis are presented in **Table 15**. The following study intersection does not function within acceptable standards:

- #2 Pacheco Boulevard / Arnold Drive (AM and PM Peaks)
- #3 Pacheco Boulevard / Arthur Road (AM and PM Peaks)

Analysis sheets are provided in the **Appendix**.

**Figure 4 – Cumulative (2040) Condition Peak Hour Turning Movement Volume**

**Table 15 – Cumulative (2040), No Build Condition Intersection Level of Service Summary**

#	Intersection	LOS Criteria	Intersection Control <sup>1</sup>	Cumulative (2040), No Build			
				AM Peak		PM Peak	
				LOS	Delay	LOS	Delay
1	Pacheco Blvd / Blum Rd-WB SR-4 Ramps	D	Signal	<b>E</b>	<b>72.8</b>	<b>F</b>	<b>268.9</b>
2	Pacheco Blvd / Arnold Dr	D	SSSC	<b>F</b>	<b>71.7</b>	<b>F</b>	<b>OVRFL</b>
	<i>Worst Approach (EB Approach)</i>			<b>F</b>	<b>OVRFL</b>	<b>F</b>	<b>OVRFL</b>
3	Pacheco Blvd / Arthur Rd	D	Signal	<b>E</b>	<b>69.7</b>	<b>E</b>	<b>74.7</b>
4	Pacheco Blvd / Camino Del Sol	D	Signal	B	17.4	B	15.7
5	Pacheco Blvd / Morello Ave	D	Signal	D	48.2	D	42.7

<sup>1</sup> Each study intersection is controlled by a traffic signal or a side-street stop-controlled (SSSC).

Note: Intersections that are operating below acceptable levels are shown in **BOLD**.

It should be noted that calculations of delay at saturated conditions (i.e., LOS F) are less reliable than at LOS E or better. Therefore, delay in excess of 80 seconds is reported in the table to allow a relative comparison of without and with project conditions and should not be interpreted as an exact representation of actual delay.

OVRFL represents an intersection that operates with a delay exceeding 300 seconds.

All intersections were analyzed using HCM 2010 methodology which determines LOS based on delay.

## SIGNAL WARRANTS

Intersection #2 – Pacheco Boulevard / Arnold Drive meets the peak hour signal warrant for the Cumulative (2040), No Build condition in the AM and PM peaks. Analysis sheets are provided in the **Appendix**.

## QUEUING

**Table 16** summarizes the queues during Cumulative (2040), No Build Condition. The queues exceed the storage lengths for the following left-turn movements:

- Intersection #1 – Pacheco Boulevard / Blum Road
  - Northbound Left (PM Peak)
  - Southbound Left (PM Peak)
- Intersection #2 – Pacheco Boulevard / Arnold Drive
  - Eastbound Left (AM and PM Peaks)
- Intersection #3 – Pacheco Boulevard / Arthur Road
  - Eastbound Left (AM and PM Peaks)
  - Westbound Left (AM and PM Peaks)
  - Northbound Left (AM and PM Peaks)
  - Southbound Left (AM and PM Peaks)
- Intersection #4 – Pacheco Boulevard / Camino Del Sol
  - Southbound Left (AM and PM Peaks)
- Intersection #5 – Pacheco Boulevard / Morello Avenue
  - Northbound Left (PM Peak)

Analysis sheets are provided in the **Appendix**.

**Table 16 – Cumulative (2040), No Build Condition Queuing Summary**

Scenarios Analyzed	Turning Movement	Pacheco Boulevard														
		Blum Rd #1			Arnold Dr #2			Arthur Rd #3			Camino Del Sol #4			Morello Ave #5		
		Link	AM	PM	Link	AM	PM	Link	AM	PM	Link	AM	PM	Link	AM	PM
Cumulative (2040), No Build	EBL	/	/	/	165	325	708	190	234	643	/	/	/	/	/	/
	EBR	180	95	512	/	/	/	145	117	149	/	/	/	105	192	86
	WBL	/	/	/	/	/	/	115	301	225	/	/	/	/	/	/
	WBR	270	219	<25	/	/	/	115	26	54	/	/	/	/	/	/
	NBL	230	189	354	/	/	/	60	318	253	/	/	/	195	144	238
	NBR	/	/	/	/	/	/	/	/	/	155	<25	26	/	/	/
	SBL	100	122	1184	/	/	/	80	259	159	80	186	175	/	/	/
	SBR	65	<25	<25	/	/	/	85	<25	<25	/	/	/	/	/	/

Note: Locations where the queue length exceeds the link storage by 25 feet or more are shown in shaded cells.  
<sup>1</sup>Future improvements at Intersection #1 - Pacheco Boulevard / Blum Road will be completed by Caltrans. However, it is unknown what these improvements will be and therefore no analysis was conducted.

**ROADWAY SEGMENT LEVEL OF SERVICE**

The roadway segment LOS was analyzed for each of the study segments along Pacheco Boulevard using the HCM methodology. **Table 17** summarizes the roadway segment analysis under the Cumulative (2040), No Build Condition using the HCM methodology. Each roadway segment for each peak period meets the LOS criteria of LOS D, except segment #1, Pacheco Boulevard between Blum Road and Arnold Drive in the AM and PM peak hours.

**Table 17 – Cumulative (2040), No Build Condition Roadway Segment Level of Service Summary (HCM)**

#	Roadway Segment	Direction	LOS Criteria	AM Peak		PM Peak	
				LOS	% of Base FF Speed	LOS	% of Base FF Speed
1	Pacheco Blvd between Blum Rd and Arnold Dr	Northbound	D	A	1.00	A	1.00
		Southbound	D	<b>E</b>	<b>0.36</b>	<b>E</b>	<b>0.37</b>
2	Pacheco Blvd between Arnold Dr and Arthur Rd	Northbound	D	C	0.61	C	0.65
		Southbound	D	A	0.92	A	0.92
3	Pacheco Blvd between Arthur Rd and Camino Del Sol	Northbound	D	C	0.60	D	0.47
		Southbound	D	C	0.64	C	0.67
4	Pacheco Blvd between Camino Del Sol and Morello Ave	Northbound	D	C	0.61	B	0.75
		Southbound	D	B	0.80	C	0.61

Segments operating below acceptable levels are shown in **BOLD**.

The roadway segment analysis was also conducted using the Florida LOS Tables methodology. **Table 18** summarizes the roadway segments under the Cumulative (2040), No Build Condition. The following roadway segments do not function within acceptable standards:

- #1 - Pacheco Boulevard between Blum Road and Arnold Drive (AM and PM peak hours)
- #2 - Pacheco Boulevard between Arnold Drive and Arthur Road (PM peak hour)
- #3 - Pacheco Boulevard between Arthur Road and Camino Del Sol (AM and PM peak hours)
- #4 – Pacheco Boulevard between Camino Del Sol and Morello Avenue (AM and PM peak hours)

Analysis sheets are provided in the **Appendix**.

**Table 18 – Cumulative (2040), No Build Condition Roadway Segment Level of Service Summary (Florida LOS Tables)**

#	Roadway Segment	# of Lanes (Two-Way)	AM Peak			PM Peak		
			Volume	Capacity	LOS	Volume	Capacity	LOS
1	Pacheco Blvd between Blum Rd and Arnold Dr	2	<b>1,504</b>	<b>1,440</b>	<b>F</b>	<b>2,137</b>	<b>1,440</b>	<b>F</b>
2	Pacheco Blvd between Arnold Dr and Arthur Rd	2	1,392	1,440	D	<b>1,527</b>	<b>1,440</b>	<b>F</b>
3	Pacheco Blvd between Arthur Rd and Camino Del Sol	2	<b>2,254</b>	<b>1,332</b>	<b>F</b>	<b>2,364</b>	<b>1,332</b>	<b>F</b>
4	Pacheco Blvd between Camino Del Sol and Morello Ave	2	<b>1,797</b>	<b>1,332</b>	<b>F</b>	<b>2,189</b>	<b>1,332</b>	<b>F</b>

Segments operating below acceptable levels are shown in **BOLD**.

## CUMULATIVE (2040) DEFICIENCIES

The following are the operational deficiencies as determined from the traffic analysis:

- Intersection #1 – Pacheco Boulevard / Blum Road:
  - AM and PM peaks: Exceeds LOS D threshold
  - PM peak: Northbound left turn queue exceeds existing turn pocket
  - PM peak: Southbound left turn queue exceeds existing turn pocket
- Intersection #2 – Pacheco Boulevard / Arnold Drive:
  - AM and PM peaks: Exceeds LOS D threshold
  - AM and PM peaks: Eastbound left turn queue exceeds existing turn pocket
- Intersection #3 – Pacheco Boulevard / Arthur Road:
  - AM and PM peaks: Exceeds LOS D threshold
  - AM and PM peaks: Eastbound left turn queue exceeds existing turn pocket
  - AM and PM peaks: Westbound left turn queue exceeds existing turn pocket
  - AM and PM peaks: Northbound left turn queue exceeds existing turn pocket
  - AM and PM peaks: Southbound left turn queue exceeds existing turn pocket
- Intersection #4 – Pacheco Boulevard / Camino Del Sol:
  - AM and PM peaks: Southbound left turn queue exceeds existing turn pocket
- Intersection #5 – Pacheco Boulevard / Morello Avenue:
  - PM peak: Northbound left turn queue exceeds existing turn pocket
- Roadway Segment #1 – Pacheco Boulevard between Blum Road and Arnold Drive
  - AM and PM peaks: Southbound direction exceeds the LOS D threshold based on percent of free flow speed
  - AM and PM peaks: Exceeds the LOS D threshold based on volume and capacity
- Roadway Segment #2 – Pacheco Boulevard between Arnold Drive and Arthur Road
  - PM peak: Exceeds the LOS D threshold based on volume and capacity
- Roadway Segment #3 – Pacheco Boulevard between Arthur Road and Camino Del Sol
  - AM and PM peaks: Exceeds the LOS D threshold based on volume and capacity
- Roadway Segment #4 – Pacheco Boulevard between Camino Del Sol and Morello Avenue



- AM and PM peaks: Exceeds the LOS D threshold based on volume and capacity

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## POTENTIAL IMPROVEMENTS

The following are the potential improvements for the operational deficiencies listed above:

- Intersection #1 – Pacheco Boulevard / Blum Road:
  - No proposed improvements since the intersection is under Caltrans jurisdiction and there is a major freeway improvement planned in the future.
- Intersection #2 – Pacheco Boulevard / Arnold Drive:
  - Signalize the intersection
- Intersection #3 – Pacheco Boulevard / Arthur Road:
  - Modify the lane geometry to reduce the queuing deficiencies
  - Install a roundabout
- Intersection #4 – Pacheco Boulevard / Camino Del Sol:
  - Modify the lane geometry to reduce the queuing deficiencies
- Intersection #5 – Pacheco Boulevard / Morello Avenue:
  - Modify the lane geometry to reduce the queuing deficiencies
- Roadway Segment #1 – Pacheco Boulevard between Blum Road and Arnold Drive
  - Improve the intersection operations at the intersection of Pacheco Boulevard / Blum Road
  - Widen the roadway to add additional northbound and/or southbound lanes
- Roadway Segment #2 – Pacheco Boulevard between Arnold Drive and Arthur Road
  - Widen the roadway to add additional northbound and/or southbound lanes
- Roadway Segment #3 – Pacheco Boulevard between Arthur Road and Camino Del Sol
  - Widen the roadway to add additional northbound and/or southbound lanes
- Roadway Segment #4 – Pacheco Boulevard between Camino Del Sol and Morello Avenue
  - Widen the roadway to add additional northbound and/or southbound lanes

Each of these roadway improvements will be discussed in more detail in the Alternatives section.

## 6. ALTERNATIVES DESCRIPTION AND ANALYSIS

The chapter presents the potential roadway improvements for the deficiencies described in the Existing and No Build Sections by intersection or roadway segment. The roadway improvements were initially analyzed in the same year that the No Build Condition fails. For example, if the deficiency occurred in the existing (2015) condition, then the proposed improvement would be analyzed with this scenario.

### INTERSECTION #1 – PACHECO BOULEVARD AND BLUM ROAD/WB SR-4 RAMPS

#### NO BUILD DEFICIENCY:

The intersection of Pacheco Boulevard/Blum Road/WB SR-4 Ramps has an existing LOS of LOS E, with 72.0 seconds of delay in the PM peak hour. This exceeds the LOS D threshold and therefore the intersection operates deficiently. **Table 19** shows the existing no build operations. It should be noted that in the Long-term (2040) scenario, this intersection will operate at LOS E in the AM peak hour and LOS F in the PM peak hour. This also exceeds the LOS D threshold and therefore the intersection operates deficiently in the Long-term as well.

**Table 19 – Intersection #1 LOS Summary**

Year	Study Alternative	LOS Criteria	Intersection			
			#1 - Pacheco Blvd and Blum Rd/WB SR-4 Ramps			
			AM Peak		PM Peak	
		LOS	Delay	LOS	Delay	
Existing (2015)	No Build	D	C	25.2	E	72.0
	<i>No Future Improvements - Caltrans to Improve</i>		C	25.2	E	72.0
Long-term (2040)	No Build		E	72.8	F	268.9
	<i>No Future Improvements - Caltrans to Improve</i>		E	72.8	F	268.9

The intersection queuing is shown in **Table 20**. The intersection of Pacheco Boulevard/Blum Road/WB SR-4 Ramps has queuing deficiencies for the northbound left turn movement and the southbound left turn movement in the PM peak hour. The northbound left turn queue of 333 feet exceeds the existing 230-foot turn pocket. The southbound left turn queue of 531 feet exceeds the existing 100-foot turn pocket.

#### POTENTIAL IMPROVEMENTS:

There are no potential improvements that will be proposed as a part of the Pacheco Boulevard Improvements Project. This intersection is planned to be improved through the I-680/SR-4 interchange project. Since that project will require its own traffic analysis, this report and project will not be proposing improvements.

**Table 20 – Intersection #1 Queue Summary**

Year	Study Alternative	Intersection Queue Lengths															
		#1 - Pacheco Blvd and Blum Rd/WB SR-4 Ramps															
		AM Peak								PM Peak							
		EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR	EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR
	Storage Length	N/A	180	N/A	270	230	-	100	65	N/A	180	N/A	270	230	-	100	65
Existing (2015)	No Build	-	72	-	<25	157	-	107	<25	-	<b>330</b>	-	<25	<b>333</b>	-	<b>531</b>	<25
	<i>No Future Improvements - Caltrans to Improve</i>	-	72	-	<25	157	-	107	<25	-	<b>330</b>	-	<25	<b>333</b>	-	<b>531</b>	<25
Long-term (2040)	No Build	-	95	-	219	189	-	122	<25	-	<b>512</b>	-	<25	<b>354</b>	-	<b>1184</b>	<25
	<i>No Future Improvements - Caltrans to Improve</i>	-	95	-	219	189	-	122	<25	-	<b>512</b>	-	<25	<b>354</b>	-	<b>1184</b>	<25

## INTERSECTION #2 – PACHECO BOULEVARD AND ARNOLD DRIVE

### EXISTING DEFICIENCY:

The intersection of Pacheco Boulevard/Arnold Drive has an existing LOS of LOS F, with 82.7 seconds of delay in the PM peak hour. This exceeds the LOS D threshold and therefore the intersection operates deficiently. **Table 21** shows the existing no build operations.

**Table 21 – Intersection #2 LOS Summary**

Year	Study Alternative	LOS Criteria	Intersection			
			#2 - Pacheco Blvd and Arnold Drive			
			AM Peak		PM Peak	
			LOS	Delay	LOS	Delay
Existing (2015)	No Build	D	B	13.5	F	82.7
	Alternative 1 - Signalize and One NBL turn lane		B	12.1	B	13.6
Long-term (2040)	No Build		F	OVRFL	F	OVRFL
	Alternative 1 - Signalize and One NBL turn lane		B	19.2	C	24.5

The intersection queuing is shown in **Table 22**. The intersection of Pacheco Boulevard/Arnold Drive has queuing deficiencies for the eastbound left turn movement in the PM peak hour. The eastbound left turn queue of 255 feet exceeds the existing 165-foot turn pocket.

### POTENTIAL IMPROVEMENTS:

To improve the traffic operations at the intersection of Pacheco Boulevard and Arnold Drive, the intersection should be signalized. The intersection meets the peak hour signal warrant in the PM peak hour. In addition, a northbound left turn lane should be installed (200-foot pocket with trap lane in Alternative 1, and 275-foot pocket with TWLTL overflow in Alternative 2), as well as a 160-foot southbound left turn lane (both alternatives). These separate turn lanes would provide storage for left-turning vehicles and not block the through movements. A 160-foot southbound right-turn lane is also proposed for both alternatives. The conceptual layouts for this intersection are included in the **Appendix**.

**Table 22** shows the improved operations for this intersection. In the AM and PM peak hours, the intersection operates as a LOS B, which meets the LOS D threshold. The eastbound left turn queue, as well as all other left turn movements, are contained within the available storage lengths.

These improvements will continue to operate acceptably in the Cumulative (2040) condition, as shown in **Table 21**. In the AM peak hour, the intersection operates as a LOS B and in the PM peak hour, the intersection operates as a LOS C. The queues in the Long-term scenario with the improvements, are all contained in the available storage pockets. The northbound left turn queue is 276 feet, which can be contained in the proposed 275-foot turn pocket. In addition, if the queue were to spill out of the turn pocket, the queue can store in the trap lane for Alternative 1 or the TWLTL leading into the intersection for Alternative 2.

**Table 22 – Intersection #2 Queue Summary**

Year	Study Alternative	Intersection Queue Lengths															
		#2 - Pacheco Blvd and Arnold Drive															
		AM Peak								PM Peak							
		EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR	EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR
	Storage Length	165	N/A	N/A	N/A	N/A	N/A	N/A	N/A	165	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Existing (2015)	No Build	<25	-	-	-	-	-	-	-	<b>255</b>	-	-	-	-	-	-	-
	Alternative 1 - Signalize and One NBL turn lane	<25	-	-	-	90	-	<25	<25	85	-	-	-	126	-	<25	<25
Long-term (2040)	No Build	<b>325</b>	-	-	-	-	-	-	-	<b>708</b>	-	-	-	-	-	-	-
	Alternative 1 - Signalize and One NBL turn lane	91	-	-	-	144	-	<25	<25	135	-	-	-	276	-	<25	<25

## INTERSECTION #3 – PACHECO BOULEVARD AND ARTHUR ROAD

### NO BUILD DEFICIENCY:

The intersection of Pacheco Boulevard/Arthur Road has an existing level of service of LOS C in the AM peak hour and LOS D in the PM peak hour. This meets the LOS D threshold and therefore the intersection operates acceptably for level of service. **Table 23** shows the existing no build operations.

It was determined that by the Cumulative (2040) scenario, there would be the need for improvements at this intersection for LOS operations. The intersection will operate at LOS E in the AM and PM peak hours, which do not meet the LOS D threshold. Volumes for the intersection were grown annually based on the growth shown in the CCTA model outputs. Option 1 and Option 2 would each improve the level of service to LOS D or better.

**Table 23 – Intersection #3 LOS Summary**

Year	Study Alternative	LOS Criteria	Intersection			
			#3 - Pacheco Blvd and Arthur Road			
			AM Peak		PM Peak	
			LOS	Delay	LOS	Delay
Existing (2015)	No Build	D	C	27.2	D	35.8
	Option 1 - 1 EBL and add NBT		C	26.0	C	34.5
	Option 2 - 2 EBL and add NBT		C	33.0	C	28.9
	Option 3 - 2 EBL and add NBT & SBR T		<b>E</b>	<b>75.7</b>	C	30.9
	Option 4 - Install a Roundabout		C	17.5	C	23.5
Long-term (2040)	No Build		<b>E</b>	<b>69.7</b>	<b>E</b>	<b>74.7</b>
	Option 1 - 1 EBL and add NBT		D	36.2	D	44.0
	Option 2 - 2 EBL and add NBT		D	52.7	D	39.6
	Option 3 - 2 EBL and add NBT & SBR T		<b>F</b>	<b>92.7</b>	D	42.9
	Option 4 - Install a Roundabout		<b>E</b>	<b>37.9</b>	<b>F</b>	<b>63.0</b>

Intersection queuing was also evaluated and is shown in **Table 24**. The intersection of Pacheco Boulevard/Arnold Drive has queuing deficiencies for each left turn movement in the AM and PM peak hours. The left turn queues exceed the available storage lengths. These queuing issues worsen as the volumes increase to the Cumulative (2040) scenario.

Another concern is pedestrian safety with the southbound right turn movement operating as a yield. The traffic counts did not show any pedestrians using the intersection during the AM or PM peak hour, but there were a few pedestrians counted in the AM period. Pedestrian safety is of particular concern with the Las Juntas Elementary School being less than 1,000 feet to the west of this intersection.

**Table 24 – Intersection #3 Queue Summary**

Year	Study Alternative	Intersection Queue Lengths															
		#3 - Pacheco Blvd and Arthur Road															
		AM Peak								PM Peak							
		EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR	EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR
	Storage Length	190	145	115	115	60	N/A	80	85	190	145	115	115	60	N/A	80	85
Existing (2015)	No Build	<b>234</b>	78	<b>157</b>	26	<b>247</b>	-	<b>264</b>	<25	<b>643</b>	75	<b>153</b>	54	<b>229</b>	-	<b>159</b>	<25
	Option 1 - 1 EBL and add NBT	<b>220</b>	50	<b>146</b>	<25	<b>181</b>	-	<b>215</b>	<b>118</b>	<b>473</b>	44	110	25	<b>160</b>	-	<b>146</b>	58
	Option 2 - 2 EBL and add NBT	94	68	<b>170</b>	25	<b>181</b>	-	<b>268</b>	<b>207</b>	182	70	<b>140</b>	<25	<b>160</b>	-	<b>146</b>	58
	Option 3 - 2 EBL and add NBT & SBR T	94	68	<b>170</b>	25	<b>181</b>	-	<b>268</b>	<b>207</b>	182	70	<b>140</b>	<25	<b>160</b>	-	<b>146</b>	58
	Option 4 - Roundabout	94	90	67	64	33	23	81	91	168	160	108	104	62	61	33	25
Long-term (2040)	No Build	<b>234</b>	117	<b>301</b>	26	<b>318</b>	-	<b>259</b>	<b>273</b>	<b>643</b>	149	<b>225</b>	54	<b>253</b>	-	<b>159</b>	64
	Option 1 - 1 EBL and add NBT	<b>245</b>	103	<b>236</b>	36	<b>259</b>	-	<b>230</b>	<b>211</b>	<b>524</b>	66	<b>194</b>	26	<b>173</b>	-	<b>163</b>	60
	Option 2 - 2 EBL and add NBT	107	147	<b>283</b>	31	<b>259</b>	-	<b>293</b>	<b>294</b>	208	<b>173</b>	<b>230</b>	25	<b>173</b>	-	<b>163</b>	60
	Option 3 - 2 EBL and add NBT & SBR T	107	147	<b>283</b>	31	<b>259</b>	-	<b>293</b>	<b>294</b>	208	<b>173</b>	<b>230</b>	25	<b>173</b>	-	<b>163</b>	60
	Option 4 - Roundabout	164	159	<b>141</b>	137	<b>132</b>	128	<b>211</b>	<b>133</b>	<b>477</b>	<b>465</b>	<b>306</b>	<b>308</b>	<b>422</b>	<b>434</b>	40	26

POTENTIAL IMPROVEMENTS:

To improve the traffic operations at the intersection of Pacheco Boulevard and Arthur Road, there are four options.

Option 1 is to only add the northbound through lane. This will increase the capacity of the intersection, but as shown in **Table 24**, the queuing deficiencies for the left turn movements still remain. The only queuing deficiency to go away is the westbound left turn lane in the PM peak.

Option 2 is to add the northbound through lane and convert one of the eastbound through lanes into an eastbound left turn lane. This will increase the capacity of the intersection, but as shown in **Table 24**, the queuing deficiencies for the left turn movements still remain, except for the eastbound left turn movement in the AM and PM peak hours, and the westbound left turn lane. Due to the existing roadway constraints, the westbound left turn pocket, southbound left turn pocket, and northbound left turn pocket cannot be lengthened.

Option 3 is to remove the porkchop for the southbound right turn movement to make the southbound right turn movement not have a yield. This should create a safer crossing for pedestrians at this intersection. Option 3 results in the intersection operating at LOS E in the AM peak hour and LOS C in the PM peak hour. The high southbound right turn movement volume is the cause for this increase in overall delay. The queuing did not change with this option from Option 2.

Option 4 is to install a roundabout at this intersection. The intersection would be a two-lane roundabout throughout and have a 204-foot inscribed diameter. The roundabout was analyzed in SIDRA software, which is per industry standards. SIDRA takes accounts for the lane geometry, roundabout measurements, and volumes to determine the LOS for a roundabout. The roundabout would operate at a LOS C in the AM and PM peak hours in the existing scenario. The queues for the roundabout would also decrease to less than the existing storage. This option would meet the LOS and queuing thresholds in the existing scenario. However, in the Long-term (2040) scenario, the LOS will degrade to LOS F in the PM peak hour, which does not meet the LOS threshold.

The conceptual layouts for this intersection, with the exception of Option #4, are included in the **Appendix**.

INTERSECTION #4 – PACHECO BOULEVARD AND CAMINO DEL SOL

NO BUILD DEFICIENCY:

The intersection of Pacheco Boulevard/Camino Del Sol has an existing level of service of LOS B in the AM peak hour and LOS A in the PM peak hour. **Table 25** shows the existing no build operations. The intersection operates at LOS B in the AM and PM peak hours in the Long-term (2040) scenario.

**Table 25 – Intersection #4 LOS Summary**

Year	Study Alternative	LOS Criteria	Intersection			
			#4 - Pacheco Blvd and Camino Del Sol			
			AM Peak		PM Peak	
			LOS	Delay	LOS	Delay
Existing (2015)	No Build	D	B	13.0	A	10.0
Long-term (2040)	No Build		B	17.4	B	15.7



Intersection queuing was also evaluated and is shown in **Table 26**. There are no existing queuing deficiencies for the intersection of Pacheco Boulevard/Camino Del Sol in the AM and PM peak hours. There are queuing deficiencies for the southbound left turn movement in the AM and PM peak hours. However, the TWLTL between Camino Del Sol and Morello Avenue will provide additional storage for the southbound left turn movement.

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#### POTENTIAL IMPROVEMENTS:

No operational improvements will be necessary because this intersection operates acceptably in the No Build scenario in the Existing and Cumulative (2040) conditions. Improvement to this intersection will be included with the segment alternatives discussed below.

The conceptual layouts for this intersection are included in the **Appendix**.

**Table 26 – Intersection #4 Queue Summary**

Year	Study Alternative	Intersection Queue Lengths															
		#4 - Pacheco Blvd and Camino Del Sol															
		AM Peak								PM Peak							
		EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR	EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR
Storage Length		N/A	N/A	N/A	N/A	N/A	155	80	N/A	N/A	N/A	N/A	N/A	N/A	155	80	N/A
Existing (2015)	No Build	-	-	-	-	-	<25	69	-	-	-	-	-	-	<25	114	-
Long-term (2040)	No Build	-	-	-	-	-	<25	<b>186</b>	-	-	-	-	-	-	26	<b>175</b>	-

## INTERSECTION #5 – PACHECO BOULEVARD AND MORELLO AVENUE

### NO BUILD DEFICIENCY:

The intersection of Pacheco Boulevard/Morello Avenue has an existing level of service of LOS B in the AM peak hour and LOS C in the PM peak hour. **Table 27** shows the existing no build operations. The intersection operates at LOS D in the AM and PM peak hours in the Long-term (2040) scenario.

**Table 27 – Intersection #5 LOS Summary**

Year	Study Alternative	LOS Criteria	Intersection			
			#5 - Pacheco Blvd and Morello Avenue			
			AM Peak		PM Peak	
			LOS	Delay	LOS	Delay
Existing (2015)	No Build	D	B	18.2	C	32.2
	Modify the SBR lane to a SBT lane		B	15.8	B	18.4
Long-term (2040)	No Build		D	48.2	D	42.7
	Modify the SBR lane to a SBT lane		C	32.9	C	21.1

Intersection queuing was also evaluated and is shown in **Table 28**. There are queuing deficiencies for the northbound left turn movement in the PM peak hour. However, the TWLTL between Camino Del Sol and Morello Avenue will provide additional storage for the northbound left turn movement. It should be noted that the southbound through queue is shown since this is an issue. The southbound through movement queue is 645 feet in the AM peak hour and 1,311 feet in the PM peak hour. There is a storage capacity of 1,100 feet back to the intersection of Pacheco Boulevard/Wygal Drive. In the Cumulative (2040) scenario, the southbound through queue extends to 1,611 feet in the PM peak hour.

### POTENTIAL IMPROVEMENTS:

Improvements are recommended at this intersection to help reduce the southbound through queue. The southbound right turn lane should be converted to a southbound shared through-right turn lane. This will add additional capacity to the southbound through movement. The queue will be reduced to 465 feet in the existing PM peak hour and reduced to 620 feet in the Cumulative (2040) PM peak hour.

The conceptual layouts for this intersection are included in the **Appendix**.

**Table 28 – Intersection #5 Queue Summary**

Year	Study Alternative	Intersection Queue Lengths															
		#5 - Pacheco Blvd and Morello Avenue															
		AM Peak								PM Peak							
		EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBT	EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBT
	Storage Length	N/A	105	N/A	N/A	195	N/A	N/A	1100	N/A	105	N/A	N/A	195	N/A	N/A	1100
Existing (2015)	No Build	-	104	-	-	137	-	-	645	-	55	-	-	<b>234</b>	-	-	1311
	Modify the SBR lane to a SBT lane	-	76	-	-	106	-	-	312	-	50	-	-	183	-	-	465
Long-term (2040)	No Build	-	<b>192</b>	-	-	144	-	-	720	-	86	-	-	<b>238</b>	-	-	1611
	Modify the SBR lane to a SBT lane	-	<b>133</b>	-	-	114	-	-	357	-	81	-	-	<b>223</b>	-	-	620

## ROADWAY SEGMENT #1 – PACHECO BOULEVARD BETWEEN BLUM ROAD AND ARNOLD DRIVE

### NO BUILD DEFICIENCY:

The roadway segment LOS was calculated along Pacheco Boulevard between Blum Road and Arnold Drive using the HCM methodology, which uses average speed to calculate LOS, and the Florida LOS Tables methodology, which uses volume and capacity. The HCM methodology is based on the average speed, which is calculated based on the midblock travel time and the delay at the intersection. When applying this methodology, the LOS did not change when additional lanes were added to the roadway segment because the intersection delay did not change. Therefore, the Florida LOS Tables methodology was used to calculate the change in LOS.

The roadway segment along Pacheco Boulevard between Blum Road and Arnold Drive has an existing level of service of LOS C in the AM peak hour and LOS F in the PM peak hour. **Table 29** shows the existing no build operations. The roadway segment worsens to LOS F in the AM and PM peak hours in the Long-term (2040) scenario.

**Table 29 – Roadway Segment #1 LOS Summary**

Roadway Segment #1 - Pacheco Boulevard between Blum Road and Arnold Drive								
Year	Alternative	# of Lanes (Two-Way)	AM Peak			PM Peak		
			LOS	Volume	Capacity	LOS	Volume	Capacity
Existing (2015)	No Build	2	C	743	1,440	<b>F</b>	<b>1,450</b>	<b>1,440</b>
	Alternative 1 - Two NB Lanes & 2 SB Lanes Plus a TWLTL	4	C	743	3,383	C	1,450	3,383
	Alternative 2 - One Lane in Each Direction Plus a TWLTL	2	C	743	1,512	D	1,450	1,512
	Alternative 3 - One NB Lane & 2 SB Lanes Plus a TWLTL	3	C	743	2,634	C	1,450	2,634
Cumulative (2040)	No Build	2	<b>F</b>	<b>1,504</b>	<b>1,440</b>	<b>F</b>	<b>2,137</b>	<b>1,440</b>
	Alternative 1 - Two NB Lanes & 2 SB Lanes Plus a TWLTL	4	C	1,504	3,383	C	2,137	3,383
	Alternative 2 - One Lane in Each Direction Plus a TWLTL	2	D	1,504	1,512	<b>F</b>	<b>2,137</b>	<b>1,512</b>
	Alternative 3 - One NB Lane & 2 SB Lanes Plus a TWLTL	3	C	1,504	2,634	C	2,137	2,634

Segments operating below acceptable levels are shown in **BOLD**.

### POTENTIAL IMPROVEMENTS:

Multiple options were considered to help improve the operations of the segment of Pacheco Boulevard between Blum Road and Arnold Drive.

Alternative 1 proposes to add an additional northbound lane, southbound lane, and add a center TWLTL. This will increase the two-way capacity of the roadway segment to 3,383 vph. In the existing scenario, the roadway segment operates at LOS C in the AM and PM peak hours. This alternative improves the traffic operations to acceptable levels in the existing condition. In the Cumulative (2040) scenario, the roadway segment operates at LOS C in the AM and PM peak hours, as well. This alternative improves the roadway conditions to acceptable levels for the existing and future scenarios.

Alternative 2 proposes to keep the existing one lane in each direction, but add a center TWLTL. This will slightly increase the two-way capacity of the roadway segment to 1,512 vph. In the existing scenario, the roadway segment operates at LOS C in the AM peak hour and LOS D in the PM peak hour. This alternative improves the traffic operations to acceptable levels in the existing condition. This improvement will continue to be acceptable until 2018. By year 2018, the segment will exceed the

capacity in the PM peak hour and further improvements will be required. In the Cumulative (2040) scenario, the PM peak hour level of service remains at LOS F, which is unacceptable.

Alternative 3 proposes to add an additional southbound lane and add a center TWLTL. This will increase the two-way capacity of the roadway segment to 2,634 vph. In the existing scenario, the roadway segment operates at LOS C in the AM and PM peak hours. This alternative improves the traffic operations to acceptable levels in the existing condition. In the Cumulative (2040) scenario, the roadway segment operates at LOS C in the AM and PM peak hours, as well. This alternative improves the roadway conditions to acceptable levels for the existing and future scenarios.

The conceptual layouts for this segment are included in the **Appendix**.

## ROADWAY SEGMENT #2 – PACHECO BOULEVARD BETWEEN ARNOLD DRIVE AND ARTHUR ROAD

### NO BUILD DEFICIENCY:

The roadway segment LOS was calculated along Pacheco Boulevard between Arnold Drive and Arthur Road using the HCM methodology, which uses average speed to calculate LOS.

The roadway segment along Pacheco Boulevard between Arnold Drive and Arthur Road has an existing level of service of LOS C or better in the AM and PM peak hours for each direction. **Table 30** shows the existing no build operations. The roadway segment continues to operate at LOS C or better in the AM and PM peak hours in the Long-term (2040) scenario for each direction. These are acceptable levels of service.

**Table 30 – Roadway Segment #2 LOS Summary**

Roadway Segment #2 - Pacheco Boulevard between Arnold Drive and Arthur Road							
Year	Alternative	LOS Criteria	Direction	AM Peak		PM Peak	
				LOS	% of Base FF	LOS	% of Base FF
Existing (2015)	No Build	D	Northbound	C	0.60	C	0.62
		D	Southbound	A	0.92	A	0.92
Cumulative (2040)	No Build	D	Northbound	C	0.61	C	0.65
		D	Southbound	A	0.92	A	0.92

### POTENTIAL IMPROVEMENTS:

No operational improvements are necessary since the No Build conditions operate acceptably. Improvements to enhance the pedestrian and bicycle connectivity and safety are shown in the conceptual layouts in the **Appendix**.

## ROADWAY SEGMENT #3 – PACHECO BOULEVARD BETWEEN ARTHUR ROAD AND CAMINO DEL SOL

### NO BUILD DEFICIENCY:

The roadway segment LOS was calculated along Pacheco Boulevard between Arthur Road and Camino Del Sol using the HCM methodology, which uses average speed to calculate LOS, and the Florida LOS Tables methodology using volume and capacity.

Using the HCM methodology, the roadway segment along Pacheco Boulevard between Arthur Road and Camino Del Sol has an existing level of service of LOS C or better in the AM and PM peak hours for each direction. **Table 31** shows the existing no build operations using the HCM methodology. The roadway segment operates at LOS D or better in the AM and PM peak hours in the Long-term (2040) scenario in each direction. These are acceptable levels of service.

**Table 31 – Roadway Segment #3 LOS Summary (HCM Methodology)**

Roadway Segment #3 - Pacheco Boulevard between Arthur Road and Camino Del Sol							
Year	Alternative	LOS Criteria	Direction	AM Peak		PM Peak	
				LOS	% of Base FF	LOS	% of Base FF
Existing (2015)	No Build	D	Northbound	C	0.66	C	0.55
		D	Southbound	C	0.66	B	0.70
Cumulative (2040)	No Build	D	Northbound	C	0.60	D	0.47
		D	Southbound	C	0.64	C	0.67

Using the Florida LOS Tables methodology, the roadway segment along Pacheco Boulevard between Arthur Road and Camino Del Sol has an existing level of service of LOS F in the AM and PM peak hours for each direction, which is unacceptable. **Table 32** shows the existing no build operations using the Florida LOS Tables methodology. The roadway segment continues to operate at LOS F in the AM and PM peak hours in the Long-term (2040) scenario in each direction. These are unacceptable levels of service.

**Table 32 – Roadway Segment #3 LOS Summary (Florida LOS Tables Methodology)**

Roadway Segment #3 - Pacheco Boulevard between Arthur Road and Camino Del Sol								
Year	Alternative	# of Lanes (Two-Way)	AM Peak			PM Peak		
			LOS	Volume	Capacity	LOS	Volume	Capacity
Existing (2015)	No Build	2	<b>F</b>	<b>2,102</b>	<b>1,332</b>	<b>F</b>	<b>2,132</b>	<b>1,332</b>
	Alternative 1 - Two Lanes in each Direction Plus a TWLTL; Ped, Bike, and Parking Improvements	4	D	2,102	2,873	D	2,132	2,873
	Alternative 2 - One Lane in each Direction Plus a TWLTL; Ped, Bike, and Parking Improvements	2	<b>F</b>	<b>2,102</b>	<b>1,332</b>	<b>F</b>	<b>2,132</b>	<b>1,332</b>
Cumulative (2040)	No Build	2	<b>F</b>	<b>2,254</b>	<b>1,332</b>	<b>F</b>	<b>2,364</b>	<b>1,332</b>
	Alternative 1 - Two Lanes in each Direction Plus a TWLTL; Ped, Bike, and Parking Improvements	4	D	2,254	2,873	D	2,364	2,873
	Alternative 2 - One Lane in each Direction Plus a TWLTL; Ped, Bike, and Parking Improvements	2	<b>F</b>	<b>2,254</b>	<b>1,332</b>	<b>F</b>	<b>2,364</b>	<b>1,332</b>

Note: Alternative 2 adds no additional roadway capacity for vehicles compared to No Build.

Segments operating below acceptable levels are shown in **BOLD**.

#### POTENTIAL IMPROVEMENTS:

No operational improvements are necessary if the HCM methodology is used since the No Build conditions operate acceptably.

Using the Florida LOS Tables methodology, only one alternative was considered to help improve the operations of the segment of Pacheco Boulevard between Arthur Road and Camino Del Sol.

Alternative 1 proposes to add a lane in each direction, and a TWLTL in the center of the roadway. This will increase the two-way capacity of the roadway segment to 2,873 vph. In the existing scenario, the roadway segment operates at LOS D in the AM and PM peak hours. The traffic operations improve to acceptable levels in the existing condition. In the Cumulative (2040) scenario, the AM and PM peak hour levels of service improve to LOS D as well. This alternative improves the roadway conditions to acceptable levels for the existing and future scenarios. In addition, the v/c improves to less than 1.5.

Alternative 2 proposes to keep the roadway as one lane in each direction with a TWLTL in the center of the roadway. The improvement would entail adding a bicycle lane, sidewalk gap closures, and parking. These improvements do not affect the roadway capacity based on the Florida LOS Tables methodology.

Alternatives 1 and 2 would require additional right-of-way along Pacheco Boulevard and would also impact the existing parking supply along Pacheco Boulevard. In addition, some adjacent properties may lose on-site parking.

Improvements to enhance the pedestrian and bicycle connectivity and safety are included in the conceptual layouts in the **Appendix**.



## ROADWAY SEGMENT #4 – PACHECO BOULEVARD BETWEEN CAMINO DEL SOL AND MORELLO AVENUE

### NO BUILD DEFICIENCY:

The roadway segment LOS was calculated along Pacheco Boulevard between Camino Del Sol and Morello Avenue using the HCM methodology, which uses average speed to calculate LOS, and the Florida LOS Tables methodology using volume and capacity.

Using the HCM methodology, the roadway segment along Pacheco Boulevard between Camino Del Sol and Morello Avenue has an existing level of service of LOS C or better in the AM and PM peak hours for each direction. **Table 33** shows the existing no build operations. The roadway segment continues to operate at LOS C or better in the AM and PM peak hours in the Long-term (2040) scenario in each direction. These are acceptable levels of service.

Using the Florida LOS Tables methodology, the roadway segment along Pacheco Boulevard between Camino Del Sol and Morello Avenue has an existing level of service of LOS F in the AM and PM peak hours for each direction, which is unacceptable. **Table 34** shows the existing no build operations using the Florida LOS Tables methodology. The roadway segment continues to operate at LOS F in the AM and PM peak hours in the Long-term (2040) scenario in each direction. These are unacceptable levels of service.

**Table 33 – Roadway Segment #4 LOS Summary (HCM Methodology)**

Roadway Segment #4 - Pacheco Boulevard between Camino Del Sol and Morello Avenue							
Year	Alternative	LOS Criteria	Direction	AM Peak		PM Peak	
				LOS	% of Base FF	LOS	% of Base FF
Existing (2015)	No Build	D	Northbound	C	0.65	B	0.76
		D	Southbound	B	0.80	B	0.71
Cumulative (2040)	No Build	D	Northbound	C	0.61	B	0.75
		D	Southbound	B	0.80	B	0.72

**Table 34 – Roadway Segment #4 LOS Summary (Florida LOS Tables Methodology)**

Roadway Segment #4 - Pacheco Boulevard between Camino Del Sol and Morello Avenue								
Year	Alternative	# of Lanes (Two-Way)	AM Peak			PM Peak		
			LOS	Volume	Capacity	LOS	Volume	Capacity
Existing (2015)	No Build	2	<b>F</b>	<b>1,698</b>	<b>1,332</b>	<b>F</b>	<b>2,026</b>	<b>1,332</b>
	Alternative 1 - Two Lanes in each Direction Plus a TWLTL; Ped, Bike, and Parking Improvements	4	D	1,698	2,873	D	2,026	2,873
	Alternative 2 - One Lane in each Direction Plus a TWLTL; Ped, Bike, and Parking Improvements	2	<b>F</b>	<b>1,698</b>	<b>1,332</b>	<b>F</b>	<b>2,026</b>	<b>1,332</b>
Cumulative (2040)	No Build	2	<b>F</b>	<b>1,797</b>	<b>1,332</b>	<b>F</b>	<b>2,189</b>	<b>1,332</b>
	Alternative 1 - Two Lanes in each Direction Plus a TWLTL; Ped, Bike, and Parking Improvements	4	D	1,797	2,873	D	2,189	2,873
	Alternative 2 - One Lane in each Direction Plus a TWLTL; Ped, Bike, and Parking Improvements	2	<b>F</b>	<b>1,797</b>	<b>1,332</b>	<b>F</b>	<b>2,189</b>	<b>1,332</b>

Note: Alternative 2 adds no additional roadway capacity for vehicles compared to No Build. Segments operating below acceptable levels are shown in **BOLD**.

#### POTENTIAL IMPROVEMENTS:

No operational improvements are necessary if the HCM methodology is used since the No Build conditions operate acceptably.

Using the Florida LOS Tables methodology, only one alternative was considered to help improve the operations of the segment of Pacheco Boulevard between Camino Del Sol and Morello Avenue.

Alternative 1 proposes to add a lane in each direction, and a TWLTL in the center of the roadway. This will increase the two-way capacity of the roadway segment to 2,873 vph. In the existing scenario, the roadway segment operates at LOS D in the AM and PM peak hours. The traffic operations improve to acceptable levels in the existing condition. In the Cumulative (2040) scenario, the AM and PM peak hour levels of service improve to LOS D as well. This alternative improves the roadway conditions to acceptable levels for the existing and future scenarios. In addition, the v/c improves to less than 1.5.

Alternative 2 proposes to keep the roadway as one lane in each direction with a TWLTL in the center of the roadway. The improvement would entail adding a bicycle lane, sidewalk gap closures, and parking. These improvements do not affect the roadway capacity based on the Florida LOS Tables methodology.

Alternatives 1 and 2 would require additional right-of-way along Pacheco Boulevard and would also impact the existing parking supply along Pacheco Boulevard. In addition, some adjacent properties may lose on-site parking.

Improvements to enhance the pedestrian and bicycle connectivity and safety are included in the conceptual layouts in the **Appendix**.

## PARKING IMPACTS

The parking impacts are documented in the Draft Parking Inventory and Analysis Technical Memorandum (see **Appendix**). Each alternative was reviewed to determine the parking impacts from the proposed widening. **Table 35** summarizes the parking impacts.

**Table 35 – Parking Impacts for Each Alternative**

Segment	Side	Type	Existing Supply	Alternative #1		Alternative #2		Alternative #3	
				Spaces Displaced	Spaces Remaining	Spaces Displaced	Spaces Remaining	Spaces Displaced	Spaces Remaining
1 - Pacheco Blvd between Blum Road and Arnold Drive	West	On-road Total	0	0	0	0	0	0	0
		Off-road Total	21	21	0	21	0	21	0
	East	On-road Total	11	11	0	4	7	11	0
		Off-road Total	12	12	0	12	0	12	0
2 - Pacheco Blvd between Arnold Drive and Arthur Road	West	On-road Total	18	0	18	0	18		
		Off-road Total	129	129	0	129	0		
	East	On-road Total	14	0	14	0	14		
		Off-road Total	50	14	36	14	36		
3 - Pacheco Blvd between Arthur Road and Camino del Sol	West	On-road Total	46	40	6	33	13		
		Off-road Total	5	5	0	1	4		
	East	On-road Total	27	0	27	0	27		
		Off-road Total	2	0	2	0	2		
4 - Pacheco Blvd between Camino del Sol and Morello Avenue	West	On-road Total	19	19	0	14	5		
		Off-road Total	0	0	0	0	0		
	East	On-road Total	12	12	0	0	12		
		Off-road Total	0	0	0	0	0		
<b>Total</b>			<b>366</b>	<b>263</b>	<b>103</b>	<b>228</b>	<b>138</b>		

For Alternative #1, approximately 263 parking spaces will be displaced, leaving 103 spaces available for use. For Alternative #2, approximately 228 parking spaces will be displaced, leaving 138 spaces available for use. Alternative #3 only effected Segment #1, and therefore the results are similar to Alternative #1.

The majority of the displaced parking spaces are off-road parking spaces, or spaces in the shoulder. These spaces are located in the existing public right-of-way and were not meant for parking. A significant number of on-road parking spaces would be displaced along Segment #3 and #4. In addition, there are parking spaces that are being displaced in parking lots. Parking spaces displaced in parking lots on private property would require right-of-way negotiation. The City and County may use the existing right-of-way for the widening of Pacheco Boulevard, which provides a public benefit. Off-street parking spaces within the existing right-of-way would not need to be acquired.

Between Arnold Drive and Sunset Drive, for both Alternatives #1 and #2, the roadway has been shifted to the west. This may provide an opportunity for the City to vacate a strip of public right-of-way on the east side of the road to adjacent property owners for use as private parking. Vacation of existing public right-of-way requires a public process under the California Streets and Highways Code.

## 7. RECOMMENDATIONS AND NEXT STEPS

This chapter will discuss the recommendations and next steps that should be taken for the project.

### RECOMMENDATIONS

The recommended improvements for this portion of Pacheco Boulevard entails phasing the improvements for when the additional roadway operational capacity is required. The following improvements are recommended for the Pacheco Boulevard Alignment project:

- **Intersection #1 – Pacheco Boulevard and Blum Road/WB SR-4 Ramps:** No improvements proposed. These improvements will be completed as part of the I-680/SR-4 interchange project.
- **Intersection #2 – Pacheco Boulevard and Arnold Drive:** Signalize the intersection and provide a northbound left turn lane of 275 feet, as well as a southbound left- and right turn lane of 160 feet. This intersection improvement addresses an existing deficiency and should be constructed as soon as feasible. See Alternative 1, 2, or 3 exhibits in the **Appendix**.
- **Intersection #3 – Pacheco Boulevard and Arthur Road:** Install a northbound through lane and convert one of the existing eastbound through lanes to a left turn lane. This intersection improvement addresses an existing deficiency and should be constructed as soon as feasible. See Alternative 1 or 2 exhibits in the **Appendix**.
- **Intersection #4 – Pacheco Boulevard and Camino Del Sol:** Due to satisfactory operations of the existing intersection, no intersection improvements are proposed.
- **Intersection #5 – Pacheco Boulevard and Morello Avenue:** The southbound right turn lane should be converted to a shared through-right turn lane. This intersection improvement addresses an existing deficiency and should be constructed as soon as feasible. See Alternative 1 or 2 exhibits in the **Appendix**.
- **Segment #1 – Pacheco Boulevard between Blum Road and Arnold Drive:** Widen the roadway to add a center TWLTL (keeping one lane in each direction) and facilities for bicycles, as well as provide sidewalks for pedestrians. These improvements will be sufficient for the existing roadway demand, but should be completed as soon as feasible. The Alternative #3 roadway geometry will include one northbound lane, two southbound lanes, a center TWLTL, bike lanes and sidewalks. These proposed improvements will address the existing deficiencies as well as the future demand. See Alternative 3 exhibit in the **Appendix**.
- **Segment #2 – Pacheco Boulevard between Arnold Drive and Arthur Road:** Widen the existing roadway to add a center TWLTL with one lane in each direction, Class II facilities for bicycles, and sidewalks. These improvements will be sufficient for the existing and future roadway demand. There are also two alternatives that improve the traffic operations of this segment:
  - **Alternative #1:** Install a raised median with breaks for a TWLTL where existing businesses/residences require access and realign Pacheco Boulevard with a new crossing under the BNSF rail tracks.
  - **Alternative #2:** Create a couplet roadway at the BNSF rail tracks by utilizing the existing rail crossing and constructing a new, single lane northbound crossing. Install a raised median with breaks for a TWLTL where existing businesses/residences require access.
- **Segment #3 – Pacheco Boulevard between Arthur Road and Camino Del Sol:** Restripe the roadway to add bicycle lanes and parking, and construct sidewalk to close the existing gaps. These improvements will be sufficient for the existing roadway demand and the future demand based on the HCM methodology. To satisfy the existing and future deficiency based on the

Florida LOS Tables methodology, the roadway should be restriped (or widened where necessary) for two lanes in each direction, a TWLTL, bicycle facilities and sidewalk gap closures.

- **Segment #4 – Pacheco Boulevard between Camino Del Sol and Morello Avenue:** Restripe the roadway to add bicycle lanes and parking, and construct sidewalk to close the existing gaps. These improvements will be sufficient for the existing roadway demand and the future demand based on the HCM methodology. To satisfy the existing and future deficiency based on the Florida LOS Tables methodology, the roadway should be restriped (or widened where necessary) for two lanes in each direction, TWLTL, bicycle facilities and sidewalk gap closures.

## NEXT STEPS

The following tasks still remain:

- The project team will review the proposed recommendations and alternatives for the study corridor.
- Once the project team has confirmed this recommendation, a final, recommended conceptual layout will be presented at the Public Outreach meeting, along with the other Alternatives developed to date.
- Once public comments have been collected, the project team will produce the final set of conceptual layouts and analyses for the project.

## APPENDIX

PARKING INVENTORY AND ANALYSIS TECHNICAL MEMORANDUM

COLLISION DATA

TURNING MOVEMENT COUNTS

TRAFFIC ANALYSIS OUTPUTS

SIGNAL WARRANTS

ALTERNATIVE 1 CONCEPTUAL LAYOUTS

ALTERNATIVE 2 CONCEPTUAL LAYOUTS

ALTERNATIVE 3 CONCEPTUAL LAYOUTS

# Parking Inventory and Analysis Technical Memorandum



# Collision Data





# Turning Movement Counts



# Traffic Analysis Outputs



# Signal Warrants



# Alternative 1 Conceptual Layouts



# Alternative 2 Conceptual Layouts



# Alternative 3 Conceptual Layouts

