STATE ROUTE 227

Intersection Control Evaluation Between Farmhouse Lane and Biddle Ranch Road

Caltrans

SLOCOG
SAN LUIS OBISPO COUNCIL OF GOVERNMENTS

RICK
ENGINEERING COMPANY

COUNTY OF SAN LUIS OBISPO
1850
Not For Ourselves Alone

Kimley»Horn
Expect More. Experience Better.

Kimley»Horn

SR 227 Intersection Control Evaluation
Between Farmhouse Lane and Biddle Ranch Road

September 28, 2021

Prepared for:

County of San Luis Obispo

Prepared in partnership with:
Caltrans District 5
San Luis Obispo Council of Governments

Prepared by:
Kimley Horn & Associated, Inc.
555 Capitol Mall, Suite 300
Sacramento, California 95814

REGISTERED PROFESSIONAL ENGINEER
SEAN T. HOUCK
No. C59500
Exp.________
CIVIL
STATE OF CALIFORNIA

In association with Rick Engineering

CONTENTS

EXECUTIVE SUMMARY 4
INTRODUCTION 8
BENEFIT-COST METHODOLOGY AND MODEL CALIBRATION 8
NO-PROJECT CORRIDOR SCENARIO 12
 NO-PROJECT ANALYSIS 12
SCENARIO A – 5-LANE CORRIDOR 17
 SCENARIO A ANALYSIS 17
SCENARIO B – 2-LANE CORRIDOR 32
 SCENARIO B.1 – 2-LANE CORRIDOR PHASE 1 32
 SCENARIO B.2 – 2-LANE CORRIDOR PHASE 2 43
 SCENARIO B.3 – 2-LANE CORRIDOR PHASE 3 61
 SCENARIO B.4 – 2-LANE CORRIDOR PHASE 4 71
 RECOMMENDED SCENARIO B CORRIDOR 84
SCENARIO A VS SCENARIO B 86
RECOMMENDED CORRIDOR 91

EXECUTIVE SUMMARY

Congestion and safety issues on State Route 227 (SR 227) from Farmhouse Lane to Biddle Ranch Road have been raised by both residents living adjacent to SR 227 as well as motorists who regularly use SR 227 as a regional throughway between the City of San Luis Obispo and the Five Cities areas of San Luis Obispo County. As an important alternative parallel to US 101, the future role and functionality of SR 227 has been a key policy issue that is being jointly addressed by Caltrans, the San Luis Obispo Council of Government (SLOCOG), the City of San Luis Obispo, and County of San Luis Obispo. Particularly challenging is that SR 227 currently serves as the primary collector for several unincorporated area neighborhoods whose only access in or out is by side-street or driveway access directly onto SR 227.

Outreach efforts performed for SLOCOG's 2014 regional Transportation Plan & Sustainable Community Strategy (RTP/SCS) revealed that public expectations for action to remedy the operational issues causing congestion as well as safety issues being experienced on SR 227 have elevated to a high priority need for the region. In response, SLOCOG, in coordination with Caltrans, the City of San Luis Obispo, and County of San Luis Obispo, commissioned the State Route 227 Operations Study. The SR 227 Operations Study, dated December 2016, served as the first step towards identifying potential intersection improvements between Farmhouse Road and Los Ranchos Road. The SR 227 Operations Study identified two viable corridor alternatives:

1) 5 Lane Corridor with Traffic Signals
2) "Roundabout" Corridor

The Roundabout Corridor was identified as the highest performing alternative. In addition, a roundabout at Los Ranchos Road and SR 227 was identified as the first intersection for implementation of the corridor improvements.

In March of 2019, a public meeting led by County of San Luis Obispo was held at Los Ranchos School to kick off the implementation phase of the roundabout at Los Ranchos Road. Several concerns were expressed about the proposed implementation plan for the highest performing, "Roundabout" alternative identified in the SR 227 Operations Study. Issues such as safety, side-street and driveway access, future growth, multi-modal users, as well as the impact of the proposed Los Ranchos Road roundabout on the adjacent intersections of Crestmont Road and Biddle Ranch Road on SR 227. As a result of the meeting, County of San Luis Obispo, Caltrans, and SLOCOG commissioned a study to update and expand the SR 227 Operations Study.

The purpose of the expanded study is to identify a preferred corridor concept and associated infrastructure improvements that will best meet both the local and regional goals while providing the highest return on investment. The current study now includes Biddle Ranch Road and is focused on the impact sequenced improvements will have on adjacent intersections and when the improvements will be made.

Goals and Objectives

The County of San Luis Obispo, the lead agency on the project, has developed a corridor-wide intersection control evaluation of high priority intersections along SR 227 through this study. This ICE provides valuabele data to guide the decision-making process and framework to evaluate intersection control alternatives using a performance-based approach to engineering and investment decisions. The five intersections studied along SR 227 (from north to south) are Farmhouse Lane, Buckley Road, Crestmont Drive, Los Ranchos Road, and Biddle Ranch Road.

Kimley»Horn

Overall, the purpose of the ICE is to:

- Provide consistent documentation that improves transparency of transportation investment decisions;
- Identify effective intersection control strategies, alternative treatments, and configurations for particular conditions;
- Apply advanced data collection technology and resources to establish accurate baseline vehicular counts, vehicle queue lengths, vehicle speeds, travel behavior, and travel time trends along the corridor;
- Develop feasible corridor concept alternatives that: 1) maximize efficiency and safety; 2) achieve acceptable operating conditions relative to projected future demand; 3) accord with SR 227's rural and scenic character; 4) and minimize potential impacts to the natural environment; and,
- Perform an objective performance-based analysis to identify a preferred corridor concept using advanced intersection and highway analysis tools to calculate life-cycle benefit-costs that will support infrastructure investment decisions made by SLOCOG, Caltrans, and other stakeholders.

Corridor Concept Scenarios

Two feasible corridor concepts were developed and analyzed.

1) Scenario A: 5-Lane Corridor
2) Scenario B: 2-Lane Corridor

Both corridor concepts are projected to achieve acceptable vehicular operations under future year conditions. Descriptions of the scenarios are provided below.

Scenario A: 5-Lane Corridor

The 5-Lane Corridor concept consists of widening SR 227 from a two-lane corridor with intermittent two-way left-turn lane (TWLTL) to a four-lane corridor plus a TWLTL from Aero Drive to Los Ranchos Road. The roadway tapers back to the existing section prior to the Union Pacific Railroad bridge. The Farmhouse Lane intersection meets signal warrants and will be signalized in Scenario A. The Fire station Driveway is consolidated with Farmhouse Lane resulting in a four-leg intersection. Crestmont Drive does not meet signal warrants and therefore will remain as a side-street stop-control. Under this scenario, all improvements to the corridor are assumed to be completed at the same time. Exhibit 1 shows the analyzed intersection controls for Scenario A. Note Crestmont Drive and Biddle Ranch Road will remain side-street stop-controlled (SSSC).

Scenario B: 2-Lane Corridor

The 2-Lane Corridor concept focusses on providing additional capacity at only the most constrained locations within the corridor – at intersections. The ICE process compared traditional intersection control improvements such as stop-control and signal control as well as other control alternatives such as turn-restricted and roundabout control options at each study intersection. Each alternative was evaluated to determine which form of intersection control would provide the greatest return on investment (ROI). A combination of intersection control types including signal, roundabout, turn-restricted, and two-way-left-turn-lane were determined to have the greatest return on investment through the corridor. Exhibit 2 illustrates the intersection controls that have the highest return on investment and are included in the analysis for Scenario B.

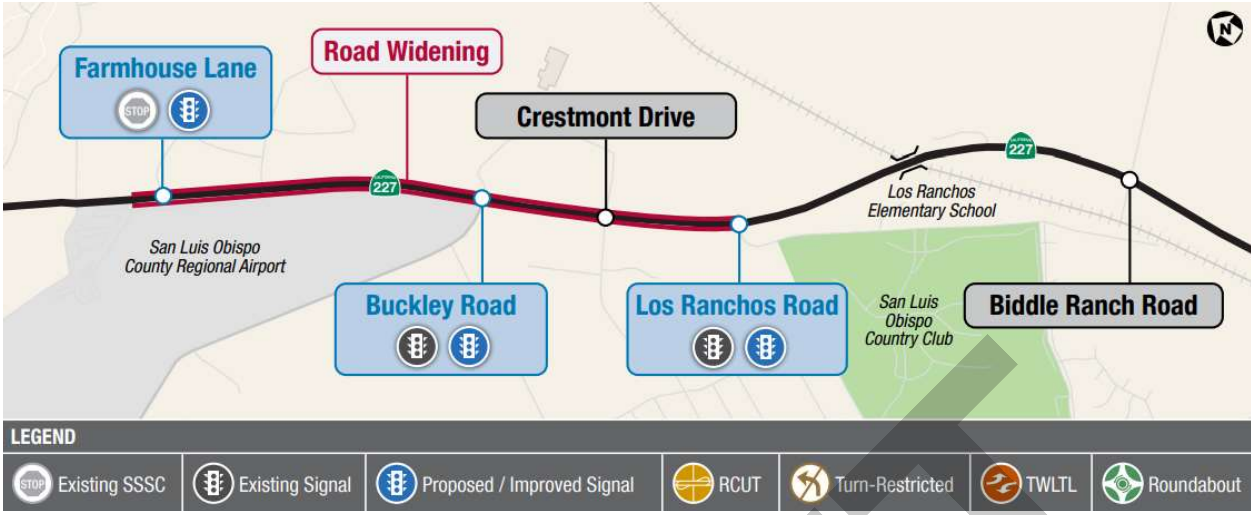


Exhibit 1 – Scenario A Corridor - Analyzed Intersection Controls

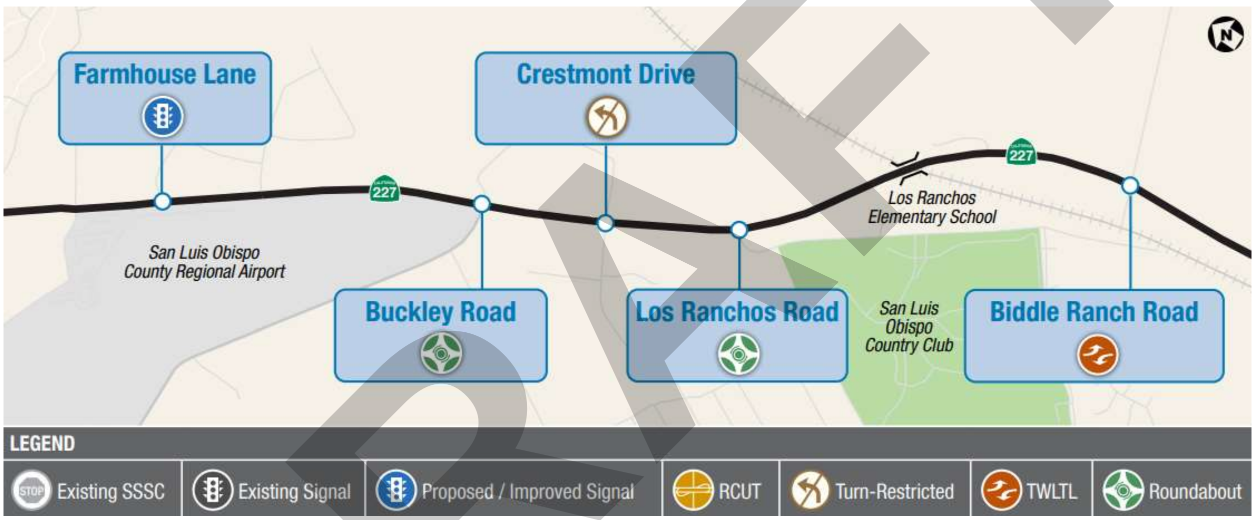


Exhibit 2 – Scenario B Corridor - Analyzed Intersection Controls

Preferred Corridor Concept

Based on the technical analyses performed as part of this study, the effectiveness of the corridor to accommodate existing and future vehicular demand was determined to be currently constrained by the inefficiency of the existing intersection control types. A detailed Benefit-Cost (B/C) analysis of the operational, safety, and costing characteristics of the proposed scenarios indicate that Scenario B, the 2-Lane Corridor, yields the greatest estimated return on investment (highest B/C). The B/C analysis was performed for the 25-year life-cycle of the corridor from 2020 to 2045.

Operational Results

Microsimulation software determined that both Scenario A and B will improve the travel time between Aero Drive and Price Canyon Road. Travel times for Scenario A are slightly faster than Scenario B; however, Scenario B experiences less overall delay. This means Scenario A will be marginally more efficient for vehicles traveling between San Luis Obispo and the Five Cities Area; Scenario B will be substantially more efficient for vehicles entering the corridor at one of the study intersections.

Safety Results
Crash prediction software determined that Scenario A will have a greater societal cost associated with the predicted number and severity of collisions compared to the existing conditions; Scenario B will have less societal cost associated compared to the existing conditions. This means Scenario B is estimated to improve safety, whereas Scenario A will worsen safety.

Operation & Maintenance (O&M)
Scenario A is predicted to have greater O&M costs compared to Scenario B because of the additional costs associated with operating signals: electricity, maintenance, retiming. Scenario A will have more costs associated with pavement rehabilitation compared to Scenario B because it is widened two extra lanes for more than a mile.

Initial Capital Costs (ICC)
The cost needed to plan, design, and construct the proposed improvements is more expensive for Scenario A due to the need to widen the road two extra lanes for more than a mile. All the improvements for Scenario A would need to be constructed at the same time, whereas improvements made in Scenario B can be phased in over time.

This document will provide:

- An objective assessment and evaluation of traffic control strategies and options
    - Refer to **Appendix A** for design-year traffic volumes
- Data driven engineering analysis of intersection Operations and Safety
    - Refer to **Appendix B** (Side-Street Stop-Control, Restricted Crossing U-Turn, Turn Restricted, and Two-Way Left-Turn Lane) and **Appendix C** (Signal) for Synchro operations analysis
    - Refer to **Appendix D** for Roundabout Sidra operations analysis
- A benefit-cost comparison of intersection control alternatives
    - Refer to **Appendix E** for Interactive Highway Safety Design Model (IHSDM) outputs and KABCO values
    - Refer to **Appendix F** for Caltrans benefit-cost values used in the analysis
- An in-depth look at traffic signal warrants
    - Refer to **Appendix G** for Crestmont Drive signal warrant analysis

INTRODUCTION

The State Route 227 (SR 227) Intersection Control Evaluation (ICE) examines the existing and future operational and safety performance of five key intersections along the corridor. The intersections evaluated are:

- Farmhouse Lane
- Buckley Road
- Crestmont Drive
- Los Ranchos Road
- Biddle Ranch Road

A performance-based analysis was performed to evaluate two proposed corridor scenarios, Scenario A and Scenario B. The purpose of this evaluation is to provide an objective analysis that allows the county of San Luis Obispo (the County) and Caltrans to make investment decisions based on traffic safety, intersection operations, construction costs, and maintenance costs.

No-Project Corridor

The studied corridor is a 2-lane road with an intermittent two-way left-turn lane (TWLTL) between Farmhouse Lane and Crestmont Drive. There are turn pockets at the study intersections. The Buckley Road and Los Ranchos Road intersections are signalized, the Farmhouse Lane, Crestmont Drive, and Biddle Ranch Road intersections are side-street stop-controlled (SSSC).

Scenario A: 5-Lane Corridor

The 5-Lane Corridor concept consists of widening SR 227 to a 4-lane corridor with a TWLTL from Aero Drive to Los Ranchos Road. Farmhouse Lane meets signal warrants. Crestmont Drive does not meet signal warrants. The Farmhouse Lane, Buckley Road, and Los Ranchos Road intersections are signalized, the Crestmont Drive and Biddle Ranch Road intersections are SSSC.

Scenario B: 2-Lane Corridor

The 2-Lane Corridor concept focusses on making improvements only at the studied intersections. The proposed intersection improvements were determined to have the greatest return on investment (ROI) at each intersection through the ICE process. The Farmhouse Lane intersection is signalized, the Buckley Road and Los Ranchos Road intersections are multi-lane roundabouts, the Crestmont Drive intersection is turn-restricted, and Biddle Ranch Road intersection has a TWLTL.

BENEFIT-COST METHODOLOGY AND MODEL CALIBRATION

Performance measures for safety, delay, operations and maintenance, and initial capital costs were used to calculate a Benefit-Cost (B/C) ratio for each proposed improvement to determine which control will provide the greatest return on investment (ROI) over the 25-year life-cycle of the corridor between 2020 and 2045 Descriptions of each of the four performance measures used to evaluate the proposed control types at each study location are:

Benefit Performance Measures:

Safety Benefits
Safety measures the societal cost associated with the predicted number and severity of collisions that may occur for each proposed intersection control type. The number and severity of predicted collisions were calculated using the *Highway Safety Manual* predictive methods. The societal costs of the different severities of collisions are based on Caltrans' life-cycle benefit-cost analysis parameters included in the *Cal B/C 2020 Value Comparison Table*.[1]

Delay Reduction Benefits
Delay measures the societal cost associated with the number of person-hours delayed in traffic. Overall societal costs are based on Caltrans' life-cycle benefit-cost analysis parameters included in the *Cal B/C 2020 Value Comparison Table.*

Cost Performance Measures:

Operations and Maintenance (O&M) Costs
The O&M performance measure incorporates common annualized costs associated with operating and maintaining the proposed type of intersection control. Common costs include signal timing and maintenance, power consumption for signal operations and intersection illumination, landscape maintenance, and pavement rehabilitation.

Initial Capital Costs (ICC)
The initial capital costs performance measure estimates the capital costs needed to plan, design, and construct the proposed intersection improvement. The capital costs include construction, capital support, and right of way.

The following equation illustrates the B/C ratio calculation:

$$\mathbf{B/C}\ \text{Ratio Score} = \frac{\sum \textbf{Benefit Performance Measures}}{\sum \textbf{Cost Performance Measures}}$$

B/C = 1.0: A B/C ratio of 1.0 is a neutral rating. This indicates that the return on investment is equal for each alternative.

B/C < 1.0: A B/C ratio less than 1.0 indicates that the return on investment for the proposed scenario would be less than the No-Project conditions. The No-Project conditions would be the preferred alternative.

B/C > 1.0: A B/C ratio greater 1.0 indicates that the return on investment the proposed scenario would be greater than the No-Project conditions. The proposed scenario would be the preferred alternative.

BC = N/A: A B/C ratio cannot be calculated if either the added benefits or costs are negative. Additional commentary is provided in these rare occasions.

[1] Cal B/C 2020 Value Comparison Table, Caltrans, January 2020.

Each performance measure was calculated for a design-life life period of 25 years. Appendix A contains the design-year peak-period traffic volumes. Appendices B (Side-Street Stop-Controlled), C (Signal), and D (Roundabout) include the intersection delay worksheets for the various traffic control conditions. Appendix E presents the Interactive Highway Safety Design Model (IHSDM) outputs and KABCO values used in the safety analysis. Appendix F presents the *Caltrans Life-Cycle Benefit-Cost Analysis Economic Parameters* used to calculate the costs and adjust to a net present value. Appendix G contains an in-depth look at Crestmont Drive traffic signal warrants.

Vissim Calibration and Verification

PTV Vissim ("Vissim" or "microsimulation software") is a microscopic traffic simulation tool used to recreate realistic traffic conditions. Vissim can incorporate vehicular, pedestrian, bicycle, and transit modes of transportation to simulate real-world conditions. The program can extract information such as vehicular travel time, overall intersection delay, and side-street delay once the model is calibrated.

The No-Project Corridor scenario was developed to calibrate the microsimulation model for the No-Project conditions. The No-Project AM and PM peak period conditions were calibrated using traffic counts, signal timing sheets from the City of San Luis Obispo and Caltrans, and speed and travel-time data from INRIX.[2] Virginia Department of Transportation (VDOT) calibration parameters were used to calibrate the No-Project AM and PM models. Table 1 below shows the calibration criteria and the corresponding AM and PM model values.

Table 1 – Calibration Criteria Summary

Item	Criteria	Target	Value (AM)	Value (PM)	Criteria Met
Simulated Vehicular Throughput (Intersection Approaches)	Within ± 20% for < 100 vph	85%	97%	97%	Yes
	Within ± 15% for ≥ 100 vph to < 1,000 vph				
	Within ± 10% for ≥ 1,000 vph to < 5,000 vph				
	Within ± 500 for ≥ 5,000 vph				
	GEH < 5 for individual link flows	85%	100%	100%	Yes
Simulated Vehicular Throughput (Network Wide)	GEH < 4 for total network volume	4.0	1.7	1.7	Yes
	Within ± 5% of total network volume	5%	1.2%	1.3%	Yes
Simulated Travel Time	Within ± 30% for observed travel times on arterials/highways	85%	100%	100%	Yes

All criteria for model calibration were met for both No-Project AM and PM models. The first item in the table compares Simulated Vehicular Throughput (Intersection Approaches) in the microsimulation model to field counts for the same approaches. Approaches with different vehicles per hour (vph) fall into different criteria. For example, the simulated model throughput needs to be within 20% of the actual count for approaches that have less than 100 vph. Whereas approaches with greater than 100 vph but less than 1,000 vph need to be within 15% of the actual count.

The *Value* columns on Table 1 indicate that all approaches of the model had met the 85% target threshold for each criteria of the Simulated Vehicular Throughput. The other calibration parameters such as network wide Simulated Vehicular Throughput, Geoffrey E. Havers Statistic (GEH) and Simulated Travel Time all met their respective criteria.

[2] INRIX provides location-based data and analytics such as travel times.

Exhibit 3 below shows the travel time comparison between the microsimulation model travel time and the travel time collected via INRIX. INRIX is a location-based data and analytics company that collects and provides travel time data that is used by transportation professionals as well as navigation applications such as Google Maps and Waze. The collected peak hour travel times were the average travel times during January and February of 2020. Travel times were measured just south of the intersection of Aero Drive to just south of the intersection of Canyon Drive. The thin black line illustrates the target threshold needed to validate the Vissim model. All simulated travel time on SR 227 was well within the 30% threshold of actual travel time on the corridor. The alignment of the bar charts illustrates the high level of confidence that the Vissim base-line simulation is representing the actual average travel times through the corridor.

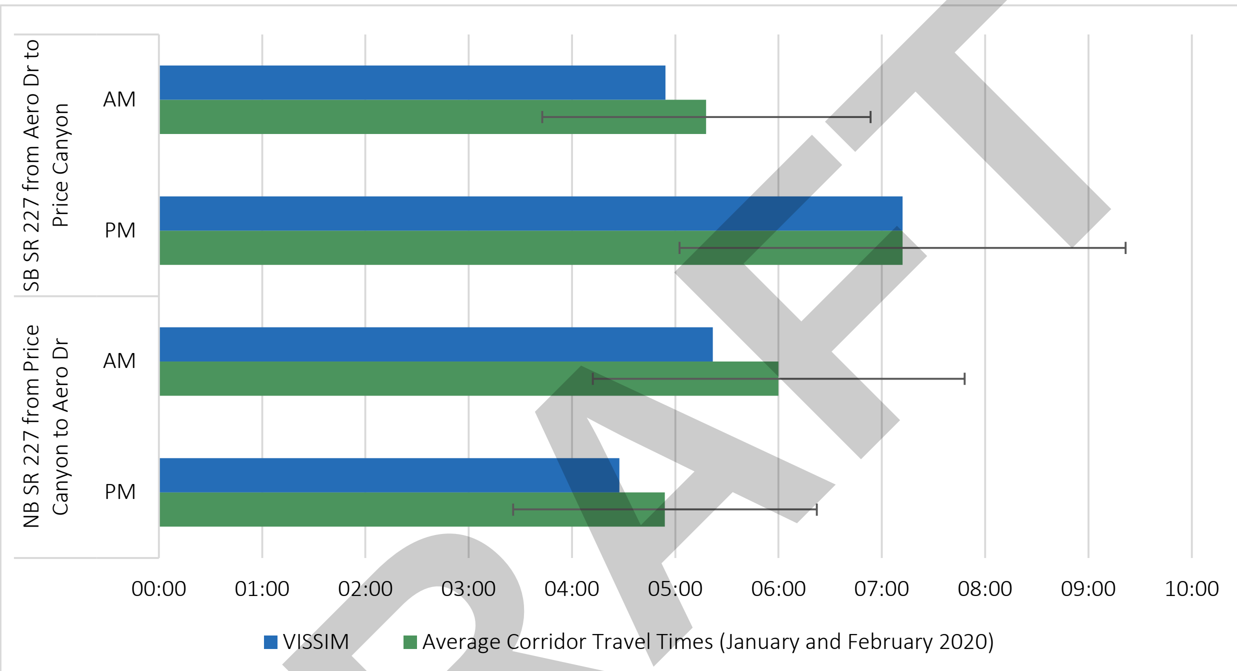


Exhibit 3 – Travel Time Comparison in Minutes Between Vissim and INRIX

NO-PROJECT CORRIDOR SCENARIO

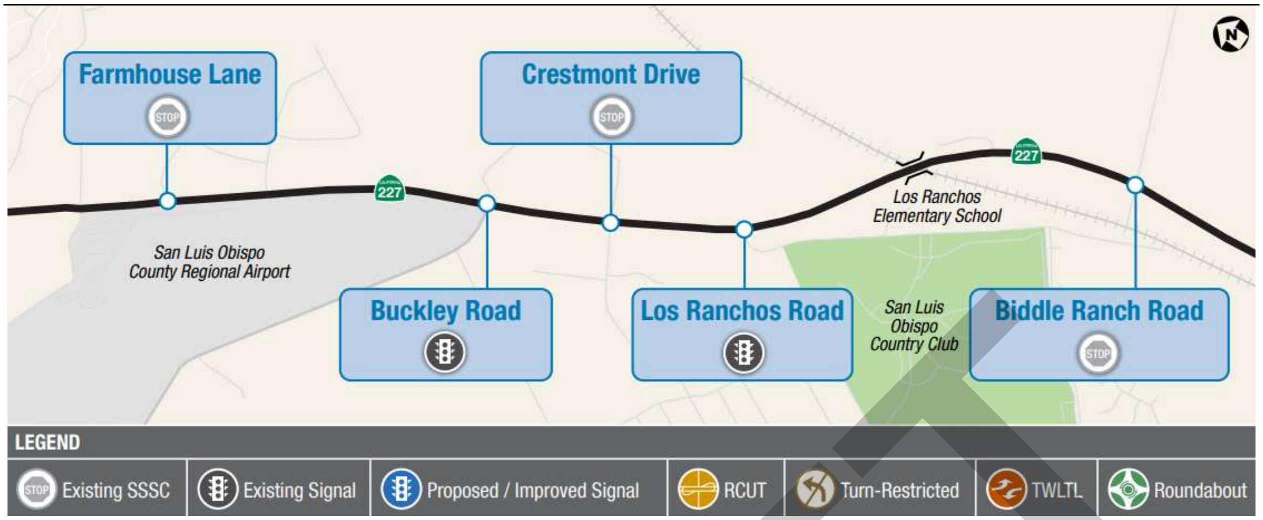


Exhibit 4 – No-Project Corridor – Intersection Controls

NO-PROJECT ANALYSIS

This section summarizes the performance measures of the No-Project condition of the five key intersections from Farmhouse Lane to Biddle Ranch Road along the corridor. Refer to *SR 227 Corridor Operations Synchro Transmittal Memorandum*[3] for No-Project Condition operational analysis results. The microsimulation analysis spans just south of Aero Drive to just south of Price Canyon Drive.

No-Project Corridor Operations at Isolated Intersections

The following performance measures were determined for each isolated intersection, meaning that upstream and downstream effects from adjacent intersections were not considered. The analysis was performed for the 25-year life-cycle of the corridor from 2020 to 2045.

Benefit Performance Measures:

Safety Benefits

Safety measures the societal cost associated with the predicted number and severity of collisions. The number of predictive collisions at signalized intersections are typically less than at side-street stop-control intersections mainly because of protected left-hand turns. Side-street and mainline traffic volumes also determine variances in predicted crashes.

[3] *SR 227 Corridor Operations Synchro Transmittal Memorandum*, Kimley-Horn, February 9, 2021.

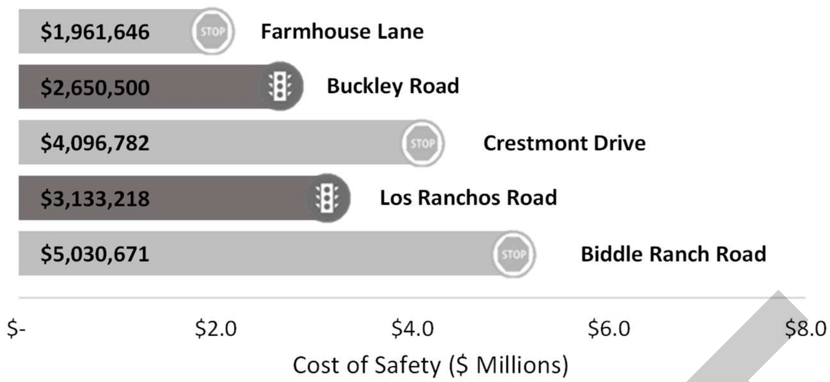


Exhibit 5 –Cost of Safety at the No-Project Intersections

Delay Reduction Benefits

Delay measures the societal cost associated with the number of person-hours of delay. Side-street stop-control intersections show hardly any delay costs because most of the vehicles do not experience any delay due to the uncontrolled mainline. The delay costs for the side-street stop-control intersections come primarily from the vehicles on the side-street because they must come to a stop and wait for a gap in oncoming traffic to enter the mainline. The delay is monetized using the average delay for the entire intersection which includes the negligeable delay experienced by vehicle traveling on SR 227; the negligeable delay on the mainline results in a minor delay for the entire intersection.

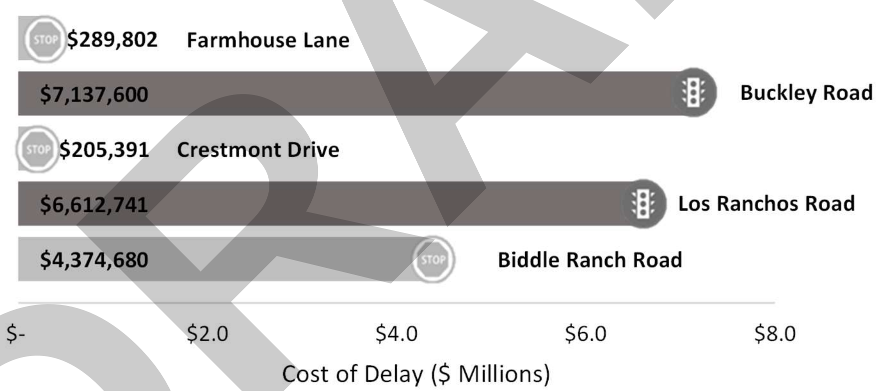


Exhibit 6 –Cost of Delay at the No-Project Intersections

Cost Performance Measures:

Operations and Maintenance (O&M) Costs

O&M costs incorporate common annualized costs associated with operating and maintaining the intersection control. The signals have higher operations and maintenance costs than the side-street stop-control intersections because of the added costs associated with signal power consumption, maintenance, and retiming.

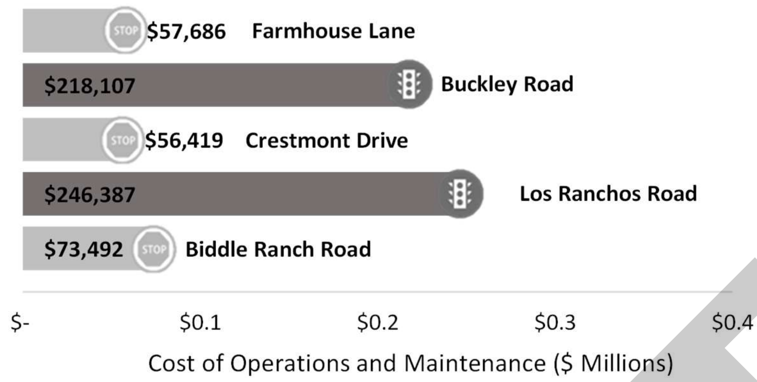


Exhibit 7 –O&M Costs at the No-Project Intersections

The following table lists the total discounted life-cycle costs for each performance measure along the corridor for the No-Project scenario.

Table 2 – No-Project Corridor Performance Values

PERFORMANCE MEASURE LIFE CYCLE COST (NET PRESENT VALUE) [4]					
Safety					
	Farmhouse Lane	**Buckley Road**	**Crestmont Drive**	**Los Ranchos Road**	**Biddle Ranch Road**
	No-Project (SSSC)	**No-Project (Signal)**	**No-Project (SSSC)**	**No-Project (Signal)**	**No-Project (SSSC)**
Annual Cost of Collisions	$ 125,569	$ 169,664	$ 262,243	$ 200,563	$ 322,023
Discounted Life Cycle Cost of Collisions	$ 1,961,646	$ 2,650,500	$ 4,096,782	$ 3,133,218	$ 5,030,671
Delay					
	Farmhouse Lane	**Buckley Road**	**Crestmont Drive**	**Los Ranchos Road**	**Biddle Ranch Road**
	No-Project (SSSC)	**No-Project (Signal)**	**No-Project (SSSC)**	**No-Project (Signal)**	**No-Project (SSSC)**
Annual Quantity (hours)	1,043	22,895	597	21,292	13,527
Annual Cost	$ 11,146	$ 274,523	$ 7,900	$ 254,336	$ 168,257
Total Discounted Life Cycle Cost	$ 289,802	$ 7,137,600	$ 205,391	$ 6,612,741	$ 4,374,680
Operations and Maintenance					
	Farmhouse Lane	**Buckley Road**	**Crestmont Drive**	**Los Ranchos Road**	**Biddle Ranch Road**
	No-Project (SSSC)	**No-Project (Signal)**	**No-Project (SSSC)**	**No-Project (Signal)**	**No-Project (SSSC)**
Annual O&M Costs	$ 450	$ 9,700	$ 600	$ 9,700	$ 600
Discounted Life Cycle O&M Costs	$ 7,030	$ 151,534	$ 9,373	$ 151,534	$ 9,373
Discounted Pavement Rehab Costs	$ 50,656	$ 66,573	$ 47,046	$ 94,853	$ 64,119
Total O&M Costs	$ 57,686	$ 218,107	$ 56,419	$ 246,387	$ 73,492

Microsimulation Results of No-Project Corridor

The No-Project conditions along SR 227 from Aero Drive to Price Canyon Road were modeled and analyzed using microsimulation traffic software. The No-Project condition models for the AM and PM peak hours were developed and calibrated using traffic counts, signal timing data, speed and travel time data, and performing visual verification of queues.

[4] Costs associated with 25-year life-cycle adjusted to a net present value using a discount rate of 4%.

General travel patterns showed that the heavier direction of travel was the northbound (NB) traffic in the AM and southbound (SB) traffic in the PM. The non-peak direction of travel experienced minimal delays according to the data analyzed. The travel times in the exhibit above show close to free flow travel times for the SB SR 227 movement in the AM peak hour. There are minor delays experienced along the corridor for the NB SR 227 movement during the AM peak hour.

For the PM peak hour, the SB SR 227 travel times are much longer than any other peak or direction. Queues in the models can be observed extending from the intersection of SR 227 and Los Ranchos Road all the way back to Farmhouse Lane. The NB direction of SR 227 was close to free flow for the PM peak hour.

Table 3 shows the travel time for NB and SB SR 227 for No-Project corridor for design years 2020 and 2045 conditions. Table 4 below shows the overall intersection results from the No-Project conditions models as well as the 2045 No-Project. The 2045 No-Project was developed by taking the calibrated No-Project condition models and updating the traffic volumes based on traffic projections.

Table 3 – No-Project Scenario Simulated Model Travel Time Results

Route	No-Project (2020)		No-Project (2045)	
	AM Peak (MM:SS)	PM Peak (MM:SS)	AM Peak (MM:SS)	PM Peak (MM:SS)
NB 227 from Price Canyon to Aero	05:22	04:28	05:40	04:31
SB 227 from Aero to Price Canyon	04:54	07:12	04:55	11:56

Table 4 – No-Project Scenario Intersection Delay and LOS Results

No	Intersection	No-Project (2020)				No-Project (2045)			
		AM Peak		PM Peak		AM Peak		PM Peak	
		DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS
1	SR 227 & Aero Dr	7.3	A	16.1	B	7.6	A	186.3	F
2	SR 227 & Airport Dr	0.7	A	7.8	A	1.0	A	40.7	E
3	SR 227 & Farmhouse Ln	0.7	A	2.7	A	4.0	A	43.4	E
4	SR 227 & Firestation Dwy	0.7	A	5.0	A	0.7	A	21.0	C
5	SR 227 & Kendall Rd	2.2	A	10.3	B	2.5	A	52.4	D
6	SR 227 & Buckley Rd	14.5	B	47.2	D	15.6	B	108.8	F
7	SR 227 & Crestmont Dr	3.6	A	22.7	C	4.5	A	41.4	E
8	SR 227 & Los Ranchos Rd	29.3	C	29.9	C	41.0	D	38.0	D
9	SR 227 & Biddle Ranch Rd	4.3	A	5.9	A	4.2	A	6.2	A
10	SR 227 & Price Canyon Rd	17.8	B	9.2	A	18.0	B	9.3	A

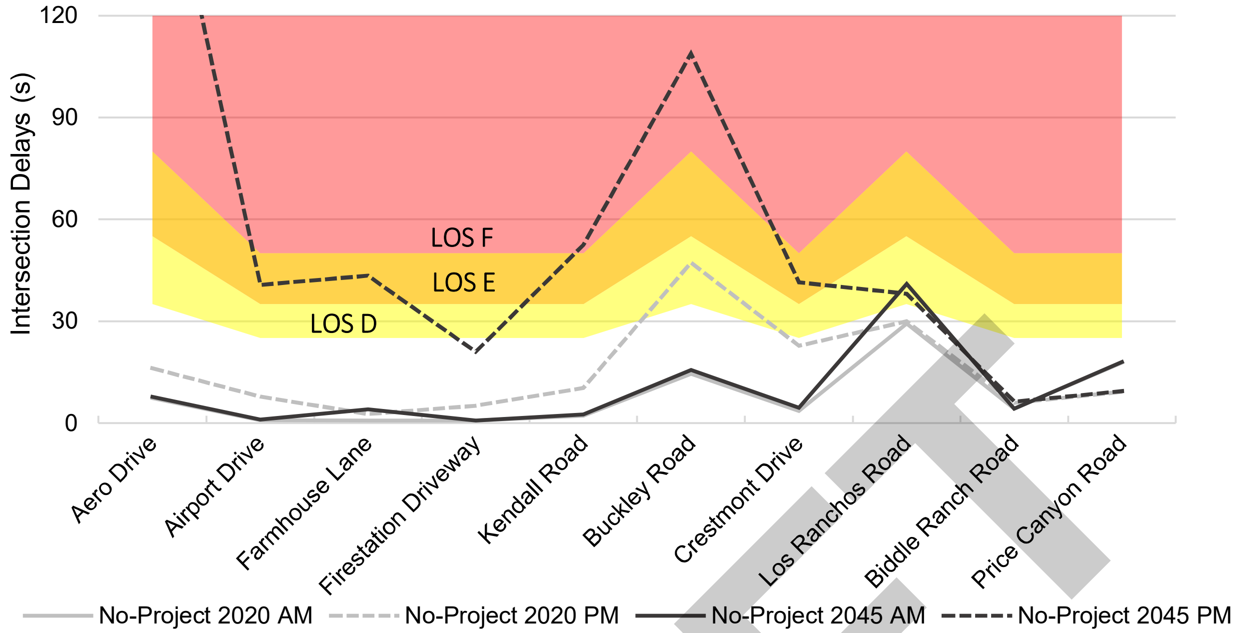


Exhibit 8 – No-Project Scenario Intersection Delay

For the AM period analysis, both No-Project 2020 and 2045 design year models had acceptable delays and Level of Service (LOS). In the 2045 No-Project model, long queues were observed for the intersections of Buckley Road, Crestmont Drive, and Los Ranchos Road; however, travel time for the corridor was still within reasonable delay and LOS. The AM peak-hour is from 7:45 – 8:45 AM and the PM peak-hour is from 4:45 – 5:45 PM.

For the PM period analysis, the No-Project 2020 design year model showed long queues that extended from Los Ranchos Road all the way back to Farmhouse Lane. Side-street delays were high due to limited gaps available as a result of the congestion. This was even worst in the year 2045. The 2045 No-Project model showed queues building as early as 3:00 PM and lasting all the way through the end of the simulation, which was 6:00 PM. Side-street delay was extremely high, and the queues extended from Los Ranchos Road all the way past Aero Drive.

SCENARIO A – 5-LANE CORRIDOR

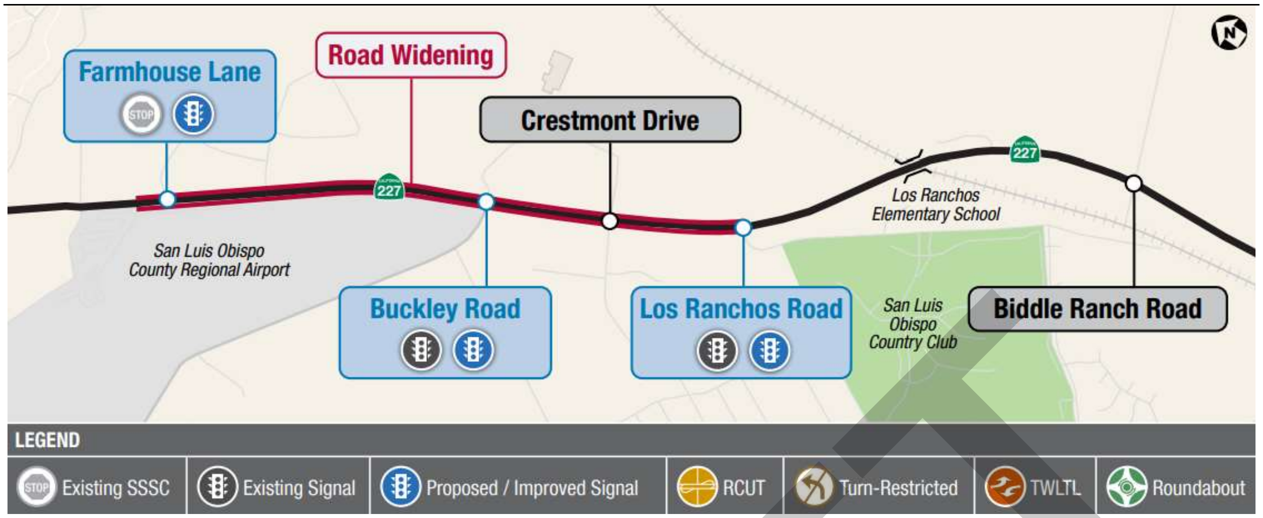


Exhibit 9 – Scenario A Corridor - Evaluated Intersection Controls

SCENARIO A ANALYSIS

Scenario A assumes the widening of SR 227 from a two-lane corridor plus a two-way left-turn lane (TWLTL) to a four-lane corridor plus a TWLTL from Aero Drive to Los Ranchos Road. The roadway tapers back to the No-Project section prior to the Union Pacific Railroad bridge. The Farmhouse Lane intersection meets signal warrants[5] and will be signalized in Scenario A. The Fire station Driveway is consolidated with Farmhouse Lane resulting in a four-leg intersection. Crestmont Drive does not meet signal warrants and therefore will remain as a side-street stop-control (SSSC).[6] All the improvements to the corridor need to be made at the same time.

Isolated Intersection Performance Measures Summary

The following performance measures were determined for each isolated intersection, meaning that upstream and downstream effects from adjacent intersections were not considered. The analysis was performed for the 25-year life-cycle of the corridor from 2020 to 2045.

Farmhouse Lane

In Scenario A, Farmhouse Lane is converted from a 3-legged SSSC to a 4-legged signalized intersection. The No-Project Fire Station Driveway will be relocated to the north as the west leg of the intersection.

Benefit Performance Measures

Safety Benefits

The safety benefit of the proposed improvement is realized when the cost of safety of the proposed improvement is less than the cost of safety for the existing intersection. There is less societal cost associated with the existing SSSC than there would be for a signal at Farmhouse Lane because there are fewer predicted crashes with less severities. This is because the signal would be 4-legged and have additional conflict points resulting in higher predictive angle and head-on collisions, whereas the existing SSSC is 3-legged.

---

[5] For more information regarding Farmhouse Lane signal warrants refer to *SR 227 Corridor Operations Memo*, Kimley-Horn, February 9, 2021.

[6] For more information regarding Crestmont Drive signal warrants refer to *Crestmont Drive Signal Warrant Analysis*, Kimley-Horn, June 22, 2021.

Exhibit 10 – Cost of Safety at Farmhouse Lane

Preferred Alternative:

Based on the lowest predicted life-cycle cost for safety, the preferred intersection control type for Farmhouse Lane is SSSC.

Delay Reduction Benefits

The delay reduction benefit of the proposed improvement is realized when the cost of delay of the proposed improvement is less than the cost of delay for the existing intersection. There is less societal cost associated with the SSSC because a majority of the vehicles do not experience delay due to the uncontrolled mainline. The delay costs for the SSSC intersection come primarily from the vehicles on the side-street because they have to come to a stop and wait for an opening to enter the mainline. The delay cost assumes the average delay for each driver through the intersection; therefore, the vehicles on the mainline for the SSSC bring down the average intersection delay.

Exhibit 11 – Cost of Delay at Farmhouse Lane

Preferred Alternative:

Based solely on the lowest predicted life-cycle cost for delay, the preferred intersection control type for Farmhouse Lane is SSSC.

Cost Performance Measures

Operations and Maintenance (O&M) Costs

O&M costs measure common annualized costs associated with operating and maintaining the intersection control. The signal alternative has higher operations and maintenance costs compared to the side-street stop-control alternative because of the added costs associated with signal power consumption, maintenance, and retiming.

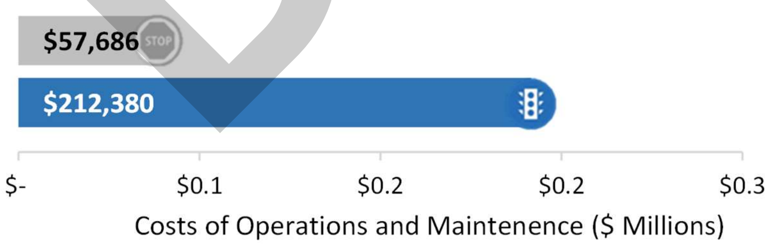


Exhibit 12 – O&M Costs at Farmhouse Lane

Preferred Alternative:

Based solely on lowest expected life-cycle O&M costs, the preferred intersection control type for Farmhouse Lane is SSSC.

Initial Capital Costs (ICC)

ICC estimate the capital needed to plan, design, and construct the proposed improvements. The side-street stop-control does not have any initial capital costs associated with it because it is the existing condition.

Exhibit 13 – Estimated ICC at Farmhouse Lane

Preferred Alternative:

Based solely on lowest expected range of Initial Capital Costs, the preferred intersection control type for Farmhouse Lane is SSSC.

In the following tables, please note that *No-Project (SSSC)* refers to the No-Project control and configuration and *Signal* refers to the proposed signal control for Alternative A. Table 5 depicts the performance measure costs associated with both intersection controls.

Table 5 – Performance Measure Life Cycle Costs for Farmhouse Lane

PERFORMANCE MEASURE LIFE CYCLE COST (NET PRESENT VALUE) [7]		
Safety		
	No-Project (SSSC)	**Signal**
Annual Cost of Collisions	$ 125,569	$ 145,068
Discounted Life Cycle Cost of Collisions	$ 1,961,646	$ 2,266,258
Delay		
	No-Project (SSSC)	**Signal**
Annual Quantity (hours)	1043	1928
Annual Cost	$ 11,146	$ 22,754
Total Discounted Life Cycle Cost	$ 289,802	$ 591,598
Operations and Maintenance		
	No-Project (SSSC)	**Signal**
Annual O&M Costs	$ 450	$ 9,550
Discounted Life Cycle O&M Costs	$ 7,030	$ 149,191
Discounted Pavement Rehab Costs	$ 50,656	$ 63,189
Total O&M Costs	$ 57,686	$ 212,380
Initial Capital		
	No-Project (SSSC)	**Signal**
High Approximation	$0	$3,600,000
Low Approximation	$0	$3,200,000

A B/C ratio was calculated for Farmhouse Lane to determine the expected return on investment based on the four performance measures. Table 6 depicts the values used to determine the B/C ratio of the intersection over its design-life. The added benefits were calculated by subtracting the discounted life-cycle costs of the proposed intersection control by the discounted life-cycle costs of the existing control. A positive value indicates that the proposed intersection will provide a benefit for that performance measure. The added benefits of safety and delay are summed to create the total added benefits for the proposed intersection. The added costs were calculated by subtracting the discounted life-cycle costs of the existing intersection by the discounted life-cycle costs of the proposed control. A positive value indicates that the proposed intersection will have additional costs associated with it. The added costs of O&M and ICC are

[7] Costs associated with 25-year life-cycle adjusted to a net present value using a discount rate of 4%.

summed to create the total added costs for the proposed intersection. The B/C ratio is calculated by dividing the total added benefits by the total added costs.

Table 6 – Scenario A Benefit-Cost Analysis for Farmhouse Lane

Benefits (B)		
Added Benefits Compared to No-Project Conditions	**No-Project (SSSC)**	**Signal**
Safety	$ -	$ (304,613)
Delay	$ -	$ (301,797)
Total Benefits	**$0**	**($606,409)**
Costs (C)		
Added Costs Compared to No-Project Conditions	**No-Project (SSSC)**	**Signal**
O&M	$ -	$ 154,694
Initial Capital	$ -	$ 3,400,000
Total Costs	**$0**	**$3,554,694**
B/C Ratio Compared to No-Project Conditions	**N/A**	**N/A**[8]

The proposed signal does not have a B/C greater than 1.0; therefore, the No-Project SSSC would provide the greater return on investment. However, the side-street approach vehicles for the No-Project condition will experience excessive delays in the future as shown in **Exhibit 14.** A signal was analyzed in Scenario A microsimulation model for Farmhouse Lane because the 2020 and 2045 intersection turning movements at the study intersection meet signal warrants and experiences excessive side-street delays. Signalizing the SR 227 approaches will increase the average delay of the intersection; however, it will significantly reduce the side-street delay. See **Exhibit 16** for a comparison of the No-Project SSSC and proposed signal side-street delay.

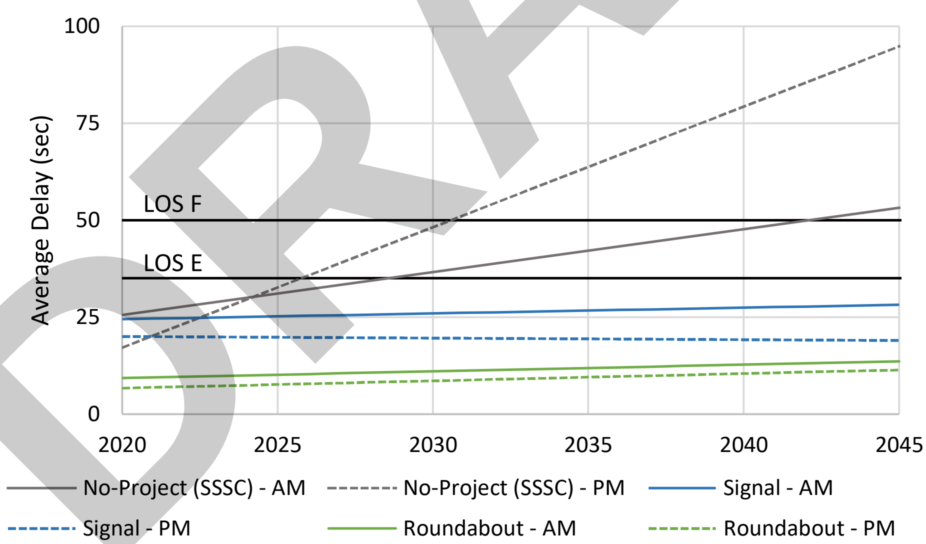


Exhibit 14 – Farmhouse Lane No-Project vs Signalized Side-Street Delays

Buckley Road

In Scenario A, Buckley Road has an additional through lane in the NB and SB directions. The side streets remain the same as they currently are.

---

8 A B/C ratio cannot be calculated because the added benefits for the Signal alternative are negative. This is because the No-Project (SSSC) has less societal costs associated with safety and delay.

Benefit Performance Measures:

Safety Benefits

The safety benefit of the proposed improvement is realized when the cost of safety of the proposed improvement is less than the cost of safety for the existing intersection. There is less societal cost associated with the existing signalized intersection because it only has one through lane on both sides of SR 227, resulting in a smaller footprint. Larger intersections tend to have higher predicted number of crashes.

Exhibit 15 – Cost of Safety at Buckley Road

Preferred Alternative:

Based on the lowest predicted life-cycle cost for safety, the preferred intersection control type for Buckley Road is the No-Project Signal.

Delay Reduction Benefits

The delay reduction benefit of the proposed improvement is realized when the cost of delay of the proposed improvement is less than the cost of delay for the existing intersection. A larger signalized intersection would provide additional capacity resulting in less delay.

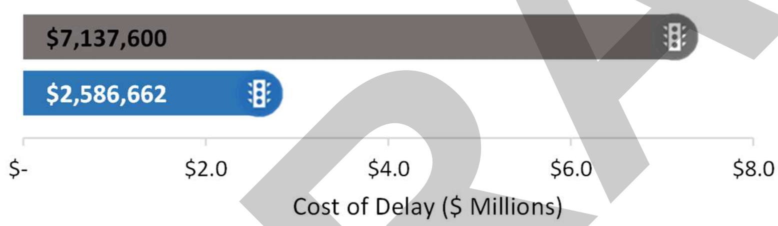


Exhibit 16 – Cost of Delay at Buckley Road

Preferred Alternative:

Based solely on the lowest predicted life-cycle cost for delay, the preferred intersection control type for Buckley Road is the Proposed Signal.

Cost Performance Measures:

Operations and Maintenance (O&M) Costs

O&M costs measure common annualized costs associated with operating and maintaining the intersection control. Both alternatives have similar O&M costs, but the widened signal is slightly greater because there are more costs associated with pavement rehabilitation due to its larger footprint.

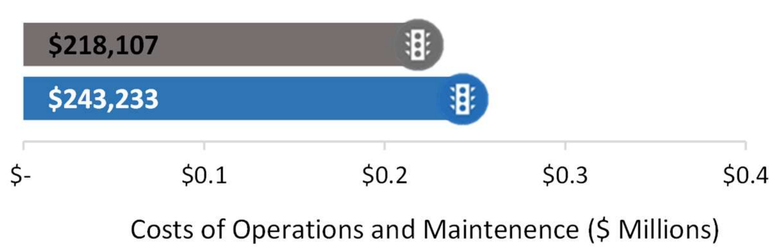


Exhibit 17 – O&M Costs at Buckley Road

Preferred Alternative:

Based solely on lowest expected life-cycle O&M costs, the preferred intersection control type for Buckley Road is the No-Project Signal.

Initial Capital Costs (ICC)

ICC estimate the capital needed to plan, design, and construct the proposed improvements. The No-Project signal does not have any initial capital costs associated with it because the existing condition will remain as is. The proposed signal ICC accounts for roadway widening along the corridor.

Exhibit 18 – Estimated ICC at Buckley Road

Preferred Alternative:

Based solely on lowest expected range of Initial Capital Costs, the preferred intersection control type for Buckley Road is the No-Project Signal.

In the following tables, please note that *No-Project (Signal)* refers to the No-Project control and configuration and *Proposed Signal* refers to the proposed signal layout for Alternative A. Table 7 depicts the performance measure costs associated with both intersection controls.

Table 7 – Performance Measure Life Cycle Costs for Buckley Road

PERFORMANCE MEASURE LIFE CYCLE COST (NET PRESENT VALUE)[9]		
Safety		
	No-Project (Signal)	**Proposed Signal**
Annual Cost of Collisions	$169,664	$239,662
Discounted Life Cycle Cost of Collisions	$2,650,500	$3,744,012
Delay		
	No-Project (Signal)	**Proposed Signal**
Annual Quantity (hours)	22895	7955
Annual Cost	$274,523	$99,487
Total Discounted Life Cycle Cost	$7,137,600	$2,586,662
Operations and Maintenance		
	No-Project (Signal)	**Proposed Signal**
Annual O&M Costs	$9,700	$9,700
Discounted Life Cycle O&M Costs	$151,534	$151,534
Discounted Pavement Rehab Costs	$66,573	$91,699
Total O&M Costs	$218,107	$243,233
Initial Capital		
	No-Project (Signal)	**Proposed Signal**
High Approximation	$0	$7,100,000
Low Approximation	$0	$6,700,000

A B/C ratio was calculated for Buckley Road to determine the expected return on investment based on the four performance measures. Table 8 depicts the values used to determine the B/C ratio of the intersection over its design-life. The added benefits were calculated by subtracting the discounted life-cycle costs of the proposed intersection control by the discounted life-cycle costs of the existing control. A positive value indicates that the proposed intersection will provide a benefit for that performance measure. The added benefits of safety and delay are summed to create the total added benefits for the proposed intersection. The added costs were calculated by subtracting the discounted life-cycle costs of the existing intersection by the discounted life-cycle costs of the proposed control. A positive value indicates that the proposed

[9] Costs associated with 25-year life-cycle adjusted to a net present value using a discount rate of 4%.

intersection will have additional costs associated with it. The added costs of O&M and ICC are summed to create the total added costs for the proposed intersection. The B/C ratio is calculated by dividing the total added benefits by the total added costs.

Table 8 – Scenario A Benefit-Cost Analysis for Buckley Road

Benefits (B)		
Added Benefits Compared to No-Project Conditions	**No-Project (SSSC)**	**Signal**
Safety	$ -	$ (1,093,512)
Delay	$ -	$ 4,550,938
Total Benefits	**$0**	**$3,457,426**
Costs (C)		
Added Costs Compared to No-Project Conditions	**No-Project (SSSC)**	**Signal**
O&M	$ -	$ 25,126
Initial Capital	$ -	$ 6,900,000
Total Costs	**$0**	**$6,925,126**
B/C Ratio Compared to No-Project Conditions	**N/A**	**0.50**

The B/C ratio for the proposed signal compared to the No-Project intersection is less than 1.0; therefore, the No-Project signal would provide a greater return on investment. The proposed signal shows a decrease in intersection delay but an increase in predicted crashes. There is an increase in predicted crashes because the proposed signal has a larger intersection footprint. A signal was analyzed in Scenario A microsimulation model to determine how a widened signalized corridor would operate.

Los Ranchos Road

In Scenario A, Los Ranchos Road has an additional through lane in the NB and SB directions. The side streets remain the same as they currently are.

<u>Benefit Performance Measures:</u>

<u>Safety Benefits</u>

The safety benefit of the proposed improvement is realized when the cost of safety of the proposed improvement is less than the cost of safety for the existing intersection. There is less societal cost associated with the existing signalized intersection because it only has one through lane on both sides of SR 227, resulting in a smaller footprint. Larger intersections tend to have higher predicted number of crashes.

Exhibit 19 – Cost of Safety at Los Ranchos Road

Preferred Alternative:

Based on the lowest predicted life-cycle cost for safety, the preferred intersection control type for Los Ranchos Road is the No-Project Signal.

Delay Reduction Benefits

The delay reduction benefit of the proposed improvement is realized when the cost of delay of the proposed improvement is less than the cost of delay for the existing intersection. A larger signalized intersection would provide additional capacity resulting in less delay.

Exhibit 20 – Cost of Delay at Los Ranchos Road

Preferred Alternative:

Based solely on the lowest predicted life-cycle cost for delay, the preferred intersection control type for Los Ranchos Road is the Proposed Signal.

Cost Performance Measures:

Operations and Maintenance (O&M) Costs

O&M costs measure common annualized costs associated with operating and maintaining the intersection control. Both alternatives have similar O&M costs, but the widened signal is slightly greater because there are more costs associated with pavement rehabilitation due to its larger footprint.

Exhibit 21 – O&M Costs at Los Ranchos Road

Preferred Alternative:

Based solely on lowest expected life-cycle O&M costs, the preferred intersection control type for Los Ranchos Road is the No-Project Signal.

Initial Capital Costs (ICC)

ICC estimate the capital needed to plan, design, and construct the proposed improvements. The No-Project signal does not have any initial capital costs associated with it because it is the existing condition. The proposed signal ICC accounts for roadway widening along the corridor.

Exhibit 22 – Estimated ICC at Los Ranchos Road

Preferred Alternative:

Based solely on lowest expected range of Initial Capital Costs, the preferred intersection control type for Los Ranchos Road is the No-Project Signal.

In the following tables, please note that *No-Project (Signal)* refers to the No-Project control and configuration and Proposed *Signal* refers to the proposed signal layout for Alternative A. Table 9 depicts the performance measure costs associated with both intersection controls.

Table 9 – Performance Measure Life Cycle Costs for Los Ranchos Road

PERFORMANCE MEASURE LIFE CYCLE COST (NET PRESENT VALUE)[10]		
Safety		
	No-Project (Signal)	**Proposed Signal**
Annual Cost of Collisions	$200,563	$213,491
Discounted Life Cycle Cost of Collisions	$3,133,218	$3,335,180
Delay		
	No-Project (Signal)	**Proposed Signal**
Annual Quantity (hours)	21292	7815
Annual Cost	$254,336	$96,227
Total Discounted Life Cycle Cost	$6,612,741	$2,501,910
Operations and Maintenance		
	No-Project (Signal)	**Proposed Signal**
Annual O&M Costs	$9,700	$9,700
Discounted Life Cycle O&M Costs	$151,534	$151,534
Discounted Pavement Rehab Costs	$94,853	$102,183
Total O&M Costs	$246,387	$253,717
Initial Capital		
	No-Project (Signal)	**Proposed Signal**
High Approximation	$0	$7,100,000
Low Approximation	$0	$6,700,000

A B/C ratio was calculated for Los Ranchos Road to determine the expected return on investment based on the four performance measures. Table 10 depicts the values used to determine the B/C ratio of the intersection over its design-life. The added benefits were calculated by subtracting the discounted life-cycle costs of the proposed intersection control by the discounted life-cycle costs of the existing control. A positive value indicates that the proposed intersection will provide a benefit for that performance measure. The added benefits of safety and delay are summed to create the total added benefits for the proposed intersection. The added costs were calculated by subtracting the discounted life-cycle costs of the existing intersection by the discounted life-cycle costs of the proposed control. A positive value indicates that the proposed intersection will have additional costs associated with it. The added costs of O&M and ICC are summed to create the total added costs for the proposed intersection. The B/C ratio is calculated by dividing the total added benefits by the total added costs.

Table 10 – Scenario A Benefit-Cost Analysis for Los Ranchos Road

Total Benefits (B)		
Added Benefits Compared to No-Project Conditions	**No-Project (SSSC)**	**Signal**
Safety	$ -	$ (201,962)
Delay	$ -	$ 4,110,831
Total Benefits	**$0**	**$ 3,908,869**
Total Costs (C)		
Added Costs Compared to No-Project Conditions	**No-Project (SSSC)**	**Signal**
O&M	$ -	$ 7,331
Initial Capital	$ -	$ 6,900,000
Total Costs	**$0**	**$ 6,907,331**
B/C Ratio Compared to No-Project Conditions	**N/A**	**0.57**

[10] Costs associated with 25-year life-cycle adjusted to a net present value using a discount rate of 4%.

The B/C ratio for the proposed signal compared to the No-Project intersection is less than 1.0; therefore, the No-Project signal would provide a greater return on investment. The proposed signal shows a decrease in intersection delay, but an increase is predicted crashes. There is an increase in predicted crashes because the proposed signal has a larger intersection footprint. A signal was analyzed in Scenario A microsimulation model to determine how a widened signalized corridor would operate.

Corridor Benefit-Cost Analysis

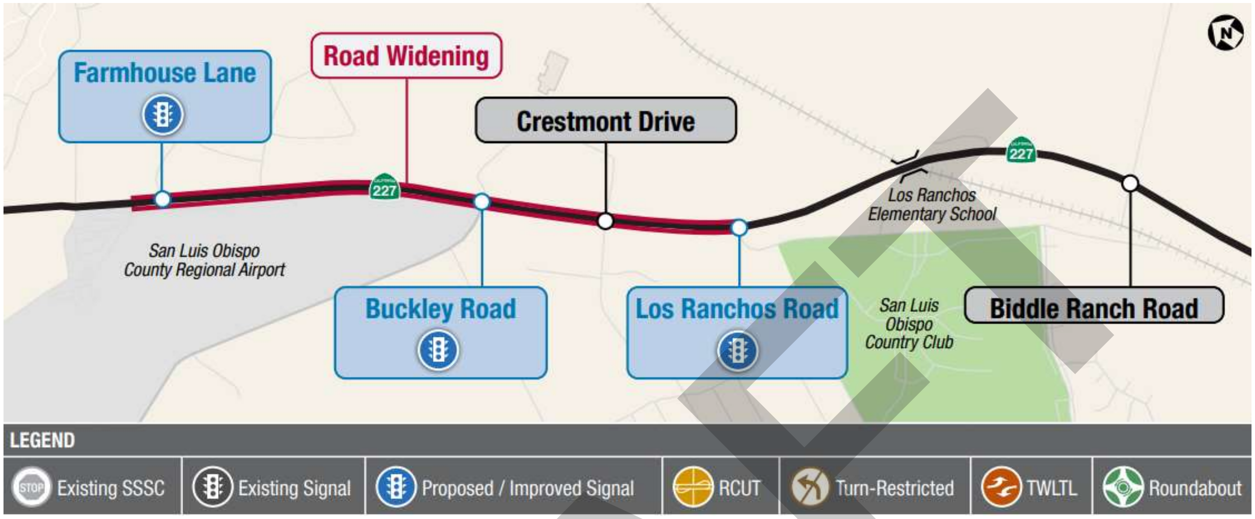


Exhibit 23 – Scenario A Corridor - Preferred Intersection Controls

The following section compares the performance measures for all five study intersections along the corridor between the No-Project condition and Scenario A.

Benefit Performance Measures:

Safety Benefits

The safety benefit of the proposed improvement is realized when the cost of safety of the proposed improvement is less than the cost of safety for the existing intersection. Scenario A has a higher safety societal cost because the intersections have a larger footprint. Larger intersections tend to have higher predicted number of crashes.

Exhibit 24 – Cost of Safety: No-Project vs Scenario A

Preferred Alternative:

NP

Based on the lowest predicted life-cycle cost for safety, the preferred scenario along SR 227 is the No-Project Corridor.

Delay Reduction Benefits

The delay reduction benefit of the proposed improvement is realized when the cost of delay of the proposed improvement is less than the cost of delay for the existing intersection. There is less societal cost associated with Scenario A because the proposed improvements at Los Ranchos Road and Buckley Road increase capacity at those intersections and reduce the average delay.

Exhibit 25 – Cost of Delay: No-Project vs Scenario A

Preferred Alternative:

A

Based solely on the lowest predicted life-cycle cost for delay, the preferred scenario along SR 227 is Scenario A.

Cost Performance Measures:

Operations and Maintenance (O&M) Costs

O&M costs measure common annualized costs associated with operating and maintaining the intersection control. Alternative A has higher O&M costs primarily because Farmhouse Lane has additional costs associated with being signalized. Other additional O&M costs are associated with additional pavement rehabilitation.

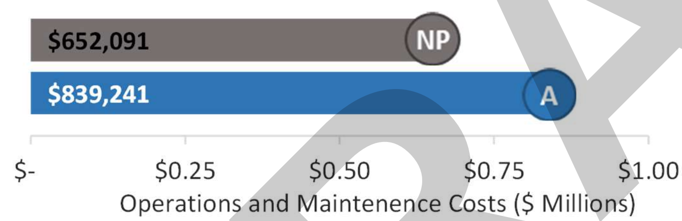


Exhibit 26 – O&M Costs: No-Project vs Scenario A

Preferred Alternative:

NP

Based solely on lowest expected life-cycle O&M costs, the preferred scenario along SR 227 is the No-Project Corridor.

Initial Capital Costs (ICC)

ICC estimate the capital needed to plan, design, and construct the proposed improvements. The No-Project alternative does not have any initial capital costs associated with it because it is the existing condition. The ICC for Scenario A includes roadway widening from Aero Drive through Los Ranchos Road, adding a signal at Farmhouse Lane, and improving the signals at Buckley Road and Los Ranchos Road.

Exhibit 27 – Estimated ICC: No-Project vs Scenario A

Preferred Alternative:

NP

Based solely on lowest expected range of Initial Capital Costs, the preferred intersection control type along SR 227 is the No-Project Corridor.

Table 11 lists the total discounted life-cycle costs for each performance measure along the corridor.

Table 11 – No-Project Corridor and Scenario A Performance Values

PERFORMANCE MEASURE LIFE CYCLE COST (NET PRESENT VALUE) [11]		
Safety		
Discounted Life Cycle Cost of Collisions	**No-Project**	**Scenario A**
Farmhouse Lane	$1,961,646	$2,266,258
Buckley Road	$2,650,500	$3,744,012
Crestmont Drive	$4,096,782	$4,096,782
Los Ranchos Road	$3,133,218	$3,335,180
Biddle Ranch Road	$5,030,671	$5,030,671
Total Discounted Life Cycle Cost of Collisions	**$16,872,816**	**$18,472,903**
Delay		
Discounted Life Cycle Cost of Delay	**No-Project**	**Scenario A**
Farmhouse Lane	$289,802	$591,598
Buckley Road	$7,137,600	$2,586,662
Crestmont Drive	$205,391	$205,391
Los Ranchos Road	$6,612,741	$2,501,910
Biddle Ranch Road	$4,374,680	$4,374,680
Total Discounted Life Cycle Cost	**$18,620,215**	**$10,260,242**
Operations and Maintenance		
Discounted Life Cycle Cost of O&M	**No-Project**	**Scenario A**
Farmhouse Lane	$57,686	$212,380
Buckley Road	$218,107	$243,233
Crestmont Drive	$56,419	$56,419
Los Ranchos Road	$246,387	$253,717
Biddle Ranch Road	$73,492	$73,492
Total O&M Costs	**$652,091**	**$839,241**
Initial Capital		
Discounted Life Cycle Cost of ICC	**No-Project**	**Scenario A**
Farmhouse Lane	$0	$3,000,000
Buckley Road	$0	$6,900,000
Crestmont Drive	$0	$0
Los Ranchos Road	$0	$6,900,000
Biddle Ranch Road	$0	$0
Total Average Approximation	**$0**	**$16,800,000**

A B/C ratio was calculated for Scenario A to determine the expected ROI based on the four performance measures. Table 12 depicts the values used to determine the B/C ratio of the corridor over its design-life. The added benefits were calculated by subtracting the discounted life-cycle costs of the proposed corridor by the discounted life-cycle costs of the existing corridor. A positive value indicates that the proposed corridor will provide a benefit for that performance measure. The added benefits of safety and delay are summed to create the total added benefits for the proposed corridor. The added costs were calculated by subtracting the discounted life-cycle costs of the existing corridor by the discounted life-cycle costs of the proposed corridor. A positive value indicates that the proposed corridor will have additional costs associated with it. The added costs of O&M and ICC are summed to create the total added costs for the proposed corridor. The B/C ratio is calculated by dividing the total added benefits by the total added costs.

[11] Costs associated with 25-year life-cycle adjusted to a net present value using a discount rate of 4%.

Table 12 – Benefit-Cost Analysis: No-Project Corridor vs Scenario A

LIFE CYCLE BENEFIT-COST RATIO		
Added Benefits (B)		
Added Benefits Compared to No-Project Conditions	**No-Project**	**Scenario A**
Safety	$ -	$ (1,600,087)
Delay	$ -	$ 8,359,973
Added Benefits	**$0**	**$6,759,886**
Added Costs (C)		
Total Costs Compared to No-Project Conditions	**No-Project**	**Scenario A**
O&M	$ -	$ 187,150
Initial Capital	$ -	$ 16,800,000
Added Costs	**$0**	**$16,987,150**
B/C Ratio Compared to No-Project Conditions	**N/A**	**0.40**

Scenario A has a B/C less than 1.0; therefore, the No-Project Conditions provide a greater return on investment.

Exhibit 28 shows the accumulated cost of all four performance measures for the No-Project conditions and Scenario A. Scenario A starts off with a greater accumulated cost because of the initial capital costs required to construct the improvements. The accumulated costs for the No-Project conditions increase faster than Scenario A because of the high annual societal cost of delay. The difference in the accumulated costs in the design year is $11.5 million in favor of the No-Project conditions.

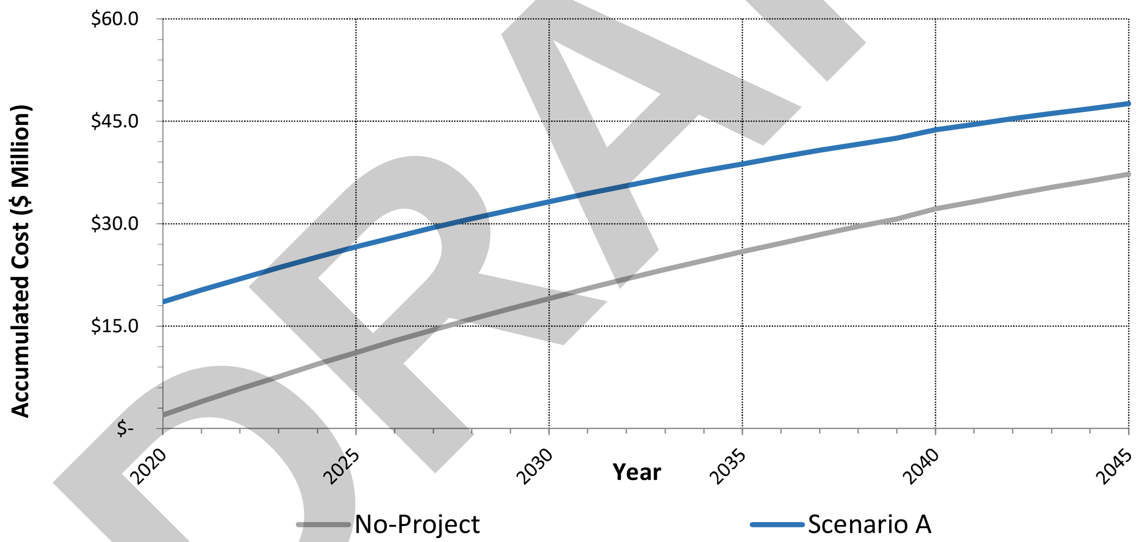


Exhibit 28 – Accumulated Costs: No-Project vs Scenario A

<u>Microsimulation Summary of Scenario A Corridor</u>

The intersection delay and LOS results from the microsimulation analysis of Scenario A are presented in

Table 13 and travel time results are presented in **Table 14**. **Exhibit 29** is a visual representation of the intersection delays and **Exhibits 30-33** compare the No-Project and Scenario A travel times and average travel speeds. The AM peak-hour is from 7:45 – 8:45 AM and the PM peak-hour is from 4:45 – 5:45 PM.

Table 13 – Scenario A Intersection Delay and LOS Results

No	Intersection	Scenario A (2020)				Scenario A (2045)			
		AM Peak		PM Peak		AM Peak		PM Peak	
		DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS
1	SR 227 & Aero Dr	6.7	A	9.4	A	6.6	A	8.4	A
2	SR 227 & Airport Dr	0.6	A	0.8	A	0.9	A	1.7	A
3	SR 227 & Farmhouse Ln	8.7	A	8.3	A	16.8	B	20.1	C
4	SR 227 & Firestation Dwy	-	-	-	-	-	-	-	-
5	SR 227 & Kendall Rd	1.5	A	1.5	A	1.6	A	1.6	A
6	SR 227 & Buckley Rd	10.4	B	13.9	B	11.0	B	15.1	B
7	SR 227 & Crestmont Dr	1.6	A	2.1	A	1.6	A	2.4	A
8	SR 227 & Los Ranchos Rd	12.6	B	10.7	B	16.2	B	13.9	B
9	SR 227 & Biddle Ranch Rd	4.2	A	6.4	A	4.4	A	10.1	B
10	SR 227 & Price Canyon Rd	17.0	B	9.6	A	17.3	B	12.8	B

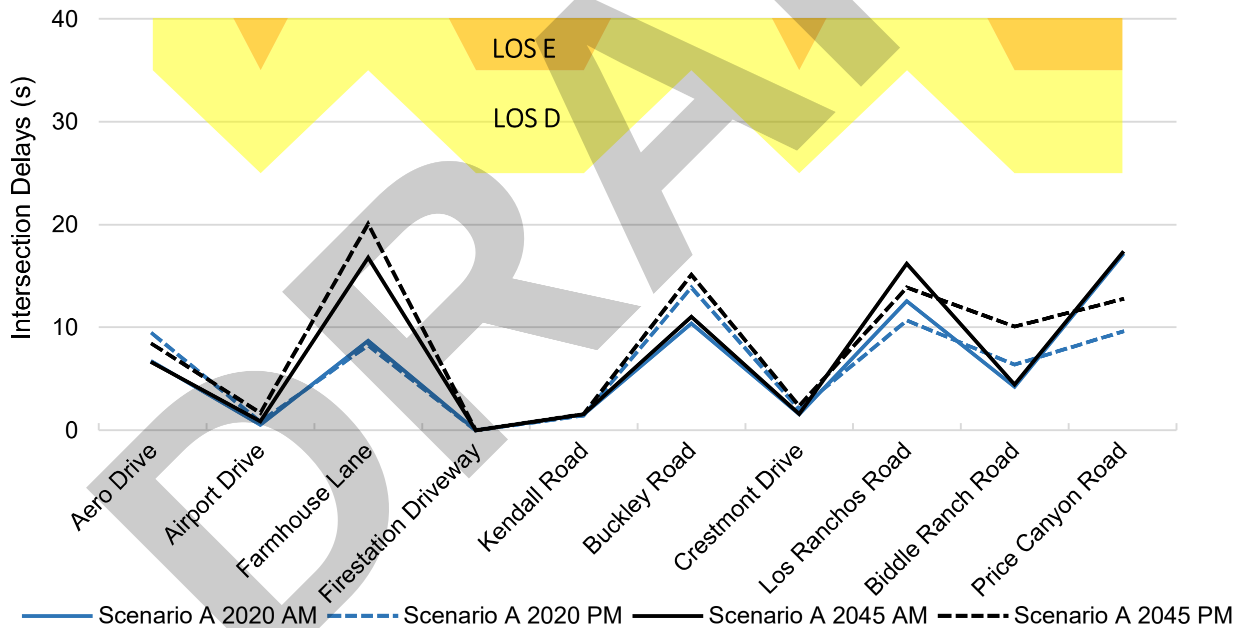
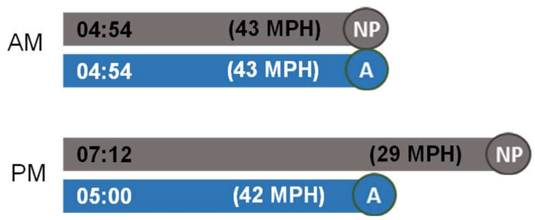


Exhibit 29 – Scenario A Intersection Delay

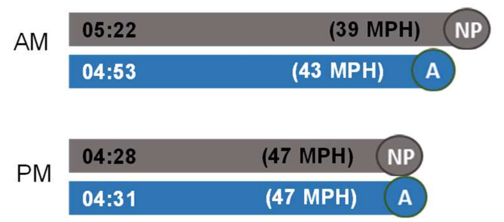
Table 14 – Scenario A Simulated Model Travel Time Results

Route	Scenario A (2020)		Scenario A (2045)	
	AM Peak (mm:ss)	PM Peak (mm:ss)	AM Peak (mm:ss)	PM Peak (mm:ss)
NB 227 from Price Canyon to Aero	04:53	04:31	05:06	04:45
SB 227 from Aero to Price Canyon	04:54	05:00	05:02	05:18



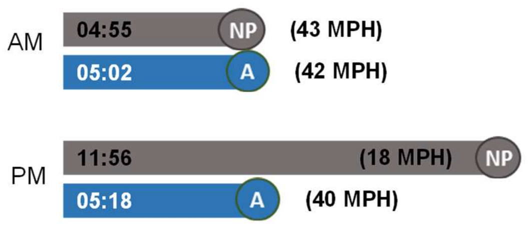
2020 Southbound

Exhibit 30 –2020 SB Travel Times



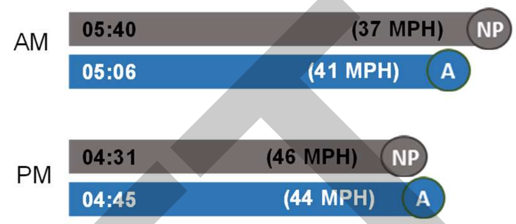
2020 Northbound

Exhibit 31 –2020 NB Travel Times



2045 Southbound

Exhibit 32 –2045 SB Travel Times



2045 Northbound

Exhibit 33 –2045 NB Travel Times

Overall, from a traffic and delay perspective, this scenario performed well for both 2020 and 2045. All intersections operated at LOS D or better and there was minimal congestion observed during the simulations for both the peak periods and years.

There are significant travel time savings for the peak direction of travel, SB, during the PM peak hour in both 2020 and 2045 compared to the No-Project condition. The travel time savings are 2 minutes and 12 seconds for 2020 and over 6 minutes for the 2045.

The travel times for the non-peak directions of travel, SB in the AM and NB in the PM, increased slightly. This increase in travel times are due to the new signal proposed at Farmhouse Lane which would control the NB and SB SR 227 traffic. The delay for Scenario A is negligible, ranging from 3 to 7 seconds, when compared to the benefit of the side streets.

SCENARIO B – 2-LANE CORRIDOR

Scenario B consists of improvements at the five study intersections. Scenario B is broken down into 4 separate corridor phases (B.1 through B.4). Each successive corridor phase builds upon the previous phase. This allows for improvements to be built over the course of the design life of the corridor. The improvements at each study intersection were determined using an individual intersection ICE analysis.

SCENARIO B.1 – 2-LANE CORRIDOR PHASE 1

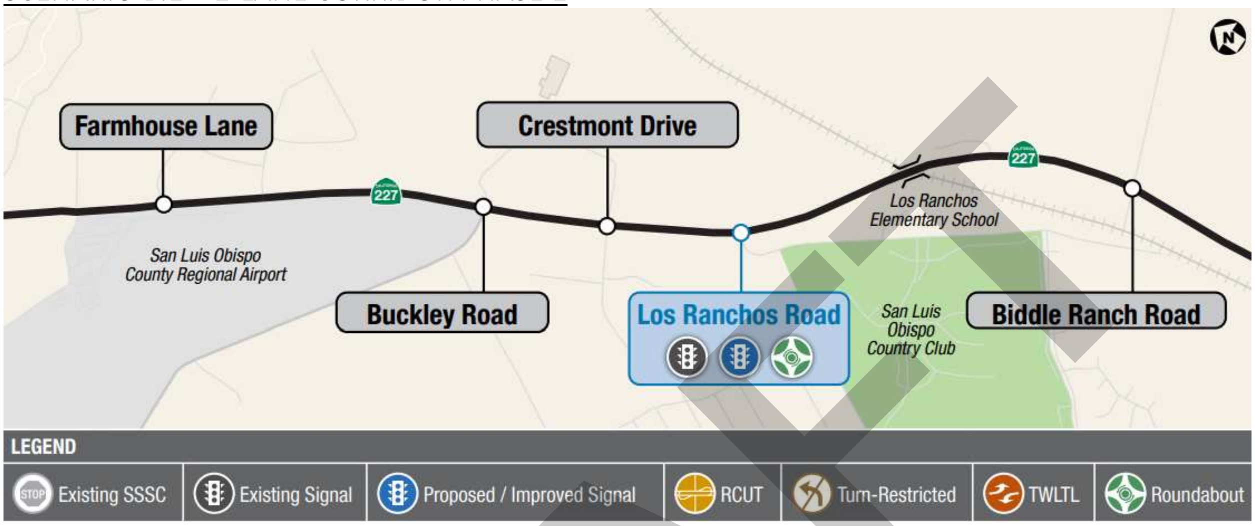


Exhibit 34 – Scenario B.1 Corridor - Evaluated Intersection Controls

Scenario B.1 assumes SR 227 will remain as a two-lane corridor plus a two-way left-turn lane (TWLTL) from Aero Drive to Los Ranchos Road. The No-Project intersection configuration and control will remain the same at all study intersections except for SR 227 at Los Ranchos Road.

Isolated Intersection Performance Measures Summary

The following performance measures for Los Ranchos Road were determined assuming it was an isolated intersection, meaning that upstream and downstream effects from adjacent intersections were not considered. The analysis was performed for the 25 year life-cycle of the corridor from 2020 to 2045.

Three (3) intersection control types were analyzed at the study intersection:

- No-Project signal
- Widened corridor signal
  - Assumes two travel lanes in each direction on SR 227 between Aero Drive and Los Ranchos Road
- Multi-lane roundabout

Benefit Performance Measures:

Safety Benefits

The safety benefit of the proposed improvement is realized when the cost of safety of the proposed improvement is less than the cost of safety for the existing intersection. There is less societal cost associated with a roundabout because the severity of the predicted crashes is less than signalized intersections.

Preferred Alternative:

Exhibit 35 – Cost of Safety at Los Ranchos Road

Based on the lowest predicted life-cycle cost for safety, the preferred intersection control type for Los Ranchos Road is a roundabout.

Delay Reduction Benefits

The delay reduction benefit of the proposed improvement is realized when the cost of delay of the proposed improvement is less than the cost of delay for the existing intersection. There is less societal cost associated with the widened signal and roundabout compared to the existing signal. Both alternatives will be more cost effective than the existing conditions.

Preferred Alternative:

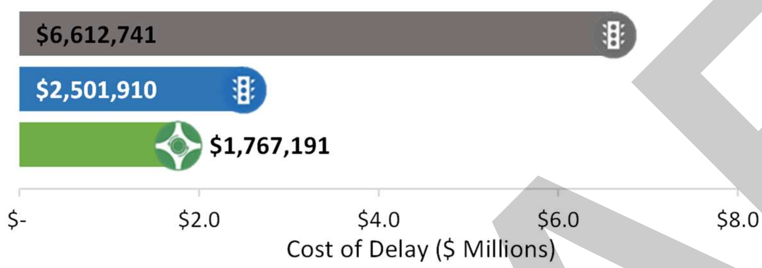


Exhibit 36 – Cost of Delay at Los Ranchos Road

Based solely on the lowest predicted life-cycle cost for delay, the preferred intersection control type for Los Ranchos Road is a roundabout.

Cost Performance Measures:

Operations and Maintenance (O&M) Costs

O&M costs measure common annualized costs associated with operating and maintaining the intersection control. Both signalized alternatives have similar O&M costs, but the widened signal is slightly greater because there are more costs associated with pavement rehabilitation due to its larger footprint. The roundabout has the least amount of O&M costs because it does not have added costs associated with signal power consumption, maintenance, and retiming.

Preferred Alternative:

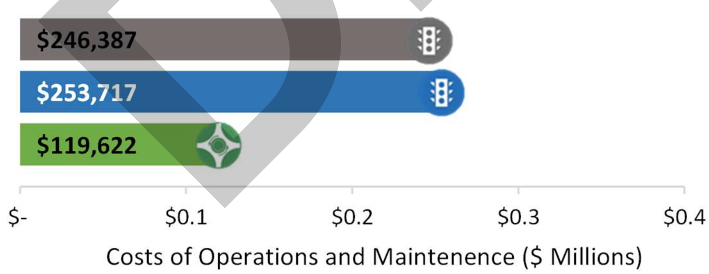


Exhibit 37 – O&M Costs at Los Ranchos Road

Based solely on lowest expected life-cycle O&M costs, the preferred intersection control type for Los Ranchos Road is a roundabout.

Initial Capital Costs (ICC)

ICC estimate the capital needed to plan, design, and construct the proposed improvements. The No-Project signal does not have any initial capital costs associated with it because it is the existing condition. The proposed signal ICC accounts for roadway widening along the corridor. The proposed roundabout includes anticipated right-of-way acquisition costs.

Exhibit 38 – Estimated ICC at Los Ranchos Road

Preferred Alternative:

Based solely on lowest expected range of Initial Capital Costs, the preferred intersection control type for Los Ranchos Road is the No-Project traffic signal.

In the following tables please note that *No-Project (Signal)* refers to the No-Project conditions, *Signal (5-Lane Corridor)* refers to the widened corridor signal, and *Roundabout* refers to the multi-lane roundabout alternative. **Table 15** depicts the performance measure costs associated with each intersection control.

Table 15 – Performance Measure Life Cycle Costs for Los Ranchos Road

PERFORMANCE MEASURE LIFE CYCLE COST (NET PRESENT VALUE)[12]			
Safety			
	No-Project (Signal)	**Signal (5-Lane Corridor)**	**Roundabout**
Annual Cost of Collisions	$ 200,563	$ 213,491	$ 67,819
Discounted Life Cycle Cost of Collisions	$ 3,133,218	$ 3,335,180	$ 1,059,470
Delay			
	No-Project (Signal)	**Signal (5-Lane Corridor)**	**Roundabout**
Annual Quantity (hours)	21,292	7,815	5,486
Annual Cost	$ 254,336	$ 96,227	$ 67,969
Total Discounted Life Cycle Cost	$ 6,612,741	$ 2,501,910	$ 1,767,191
O&M			
	No-Project (Signal)	**Signal (5-Lane Corridor)**	**Roundabout**
Annual O&M Costs	$ 9,700	$ 9,700	$ 1,356
Discounted Life Cycle O&M Costs	$ 151,534	$ 151,534	$ 21,177
Discounted Pavement Rehab Costs	$ 94,853	$ 102,183	$ 98,445
Total O&M Costs	$ 246,387	$ 253,717	$ 119,622
Initial Capital[13]			
	No-Project (Signal)	**Signal (5-Lane Corridor)**	**Roundabout**
High Approximation	$0	$7,100,000	$5,700,000
Low Approximation	$0	$6,700,000	$5,300,000

[12] Costs associated with 25-year life-cycle adjusted to a net present value using a discount rate of 4%.

[13] Initial Capital Costs (ICC) – measuring the capital costs needed to plan, design, and construct the proposed improvement in 2021 dollar value.

Benefit Cost Ratio Scoring

The first stage of B/C analysis involves comparing all proposed alternatives to the No-Project intersection control. Table 16 depicts the values used to determine the B/C ratio of the intersection over its design-life. The added benefits were calculated by subtracting the discounted life-cycle costs of the proposed intersection control by the discounted life-cycle costs of the existing control. A positive value indicates that the proposed intersection will provide a benefit for that performance measure. The added benefits of safety and delay are summed to create the total added benefits for the proposed intersection. The added costs were calculated by subtracting the discounted life-cycle costs of the existing intersection by the discounted life-cycle costs of the proposed control. A positive value indicates that the proposed intersection will have additional costs associated with it. The added costs of O&M and ICC are summed to create the total added costs for the proposed intersection. The B/C ratio is calculated by dividing the total added benefits by the total added costs.

Table 16 – Stage 1 Benefit-Cost Analysis for Los Ranchos Road

Added Benefits (B)			
Added Benefits Compared to No-Project Conditions	**No-Project (Signal)**	**Signal (5-Lane Corridor)**	**Roundabout**
Safety	$ -	$ (201,962)	$ 2,073,748
Delay	$ -	$ 4,110,831	$ 4,845,550
Added Benefits	**$ -**	**$ 3,908,869**	**$ 6,919,298**
Added Costs (C)			
Added Benefits Compared to No-Project Conditions	**No-Project (Signal)**	**Signal (5-Lane Corridor)**	**Roundabout**
O&M	$ -	$ 7,331	$ (126,765)
Initial Capital	$ -	$ 6,900,000	$ 5,500,000
Added Costs	**$ -**	**$ 6,907,331**	**$ 5,373,235**
B/C Ratio Compared to No-Project Conditions	**N/A**	**0.57**	**1.29**

There is only one proposed alternative that has a B/C greater than 1.0; therefore, the second stage of B/C analysis is not necessary. A roundabout is the preferred alternative because it has a B/C ratio larger than 1.0.

Table 17 is an estimation of the B/C values for the estimated range of ICC assuming safety and delay benefits are held constant. Also included in the table is an estimate of the added ICC costs of the roundabout needed to achieve a B/C equal to 1.0.

Table 17 – Benefit-Cost Ranges for Los Ranchos Road

Benefit-Cost Ratio Calculations for No-Build (Signal) (A) vs Roundabout (B)							
	Initial Capital Cost			Project Constraints			
B/C Target	No-Build (Signal) (A)	Roundabout (B)	Added Cost (C) = (B - A)	Added O&M Cost for (D)	Total Benefits (E)	Total Costs (F) = (C + D)	B/C (G) = (E / F)
High	$ -	$ 5,300,000	$ 5,300,000			$ 5,173,235	1.34
Low	$ -	$ 5,700,000	$ 5,700,000	$ (126,765)	$ 6,919,298	$ 5,573,235	1.24
RAB Budget	$ -	$ 7,046,063	$ 7,046,063			$ 6,919,298	1.00

Note: The 'High' value calculates the highest Roundabout B/C. Assuming the low Roundabout ICC. The 'Low' value calculates the lowest Roundabout B/C. Assuming the high Roundabout ICC.

Exhibit 39 shows the accumulated cost of all four performance measures for each alternative that was evaluated at Los Ranchos Road. The proposed signal starts off with a greater accumulated cost because of the initial capital costs required to construct the improvements. The accumulated costs for the No-Project conditions increase faster than the proposed signal and the roundabout because of the high annual societal cost of delay. The difference in the accumulated costs between the proposed roundabout and the proposed signal are about $4.5 million.

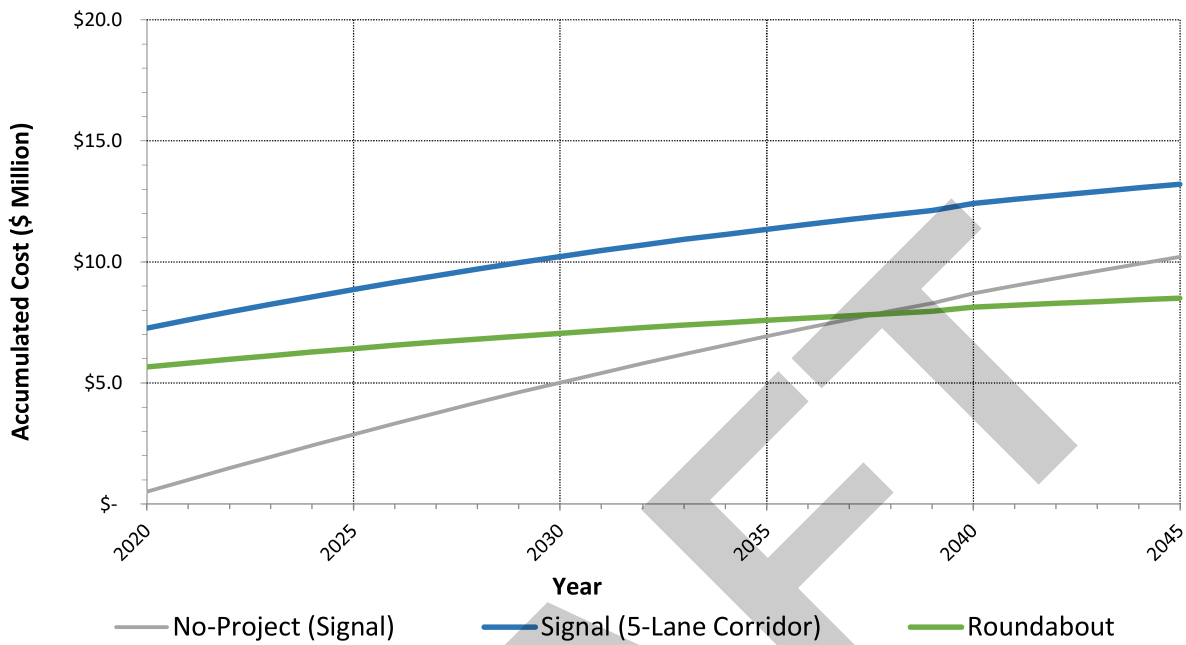


Exhibit 39 – Accumulated Costs: Los Ranchos Road

<u>Recommended Control Type</u>

The recommended alternative based on B/C ratio for Los Ranchos Road is roundabout control. The B.1 corridor microsimulation analysis models Los Ranchos Road as a multi-lane roundabout.

<u>Corridor Benefit-Cost Analysis</u>

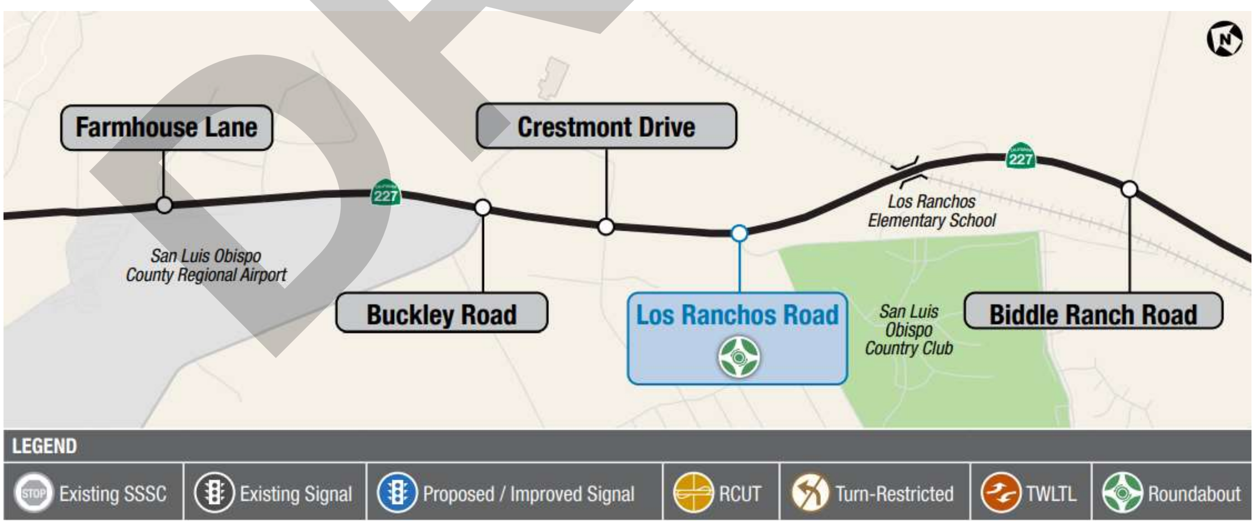


Exhibit 40 – Scenario B.1 Corridor – Preferred Intersection Controls

The following section compares the performance measures for all five study intersections along the corridor between the No-Project condition and Scenario B.1.

Benefit Performance Measures:

Safety Benefits

The safety benefit of the proposed improvement is realized when the cost of safety of the proposed improvement is less than the cost of safety for the existing intersection. Scenario B.1 has less societal cost associated with safety because the severity of the predicted crashes at Los Ranchos Road is less for a roundabout than the existing signal.

Preferred Alternative:

B.1

Based on the lowest predicted life-cycle cost for safety, the preferred scenario along SR 227 is B.1.

Exhibit 41 – Cost of Safety: No-Project vs Scenario B.1

Delay Reduction Benefits

The delay reduction benefit of the proposed improvement is realized when the cost of delay of the proposed improvement is less than the cost of delay for the existing intersection. There is less societal cost associated with Scenario B.1 because the improvements at Los Ranchos Road increase capacity and reduce the average delay compared to the No-Project conditions.

Preferred Alternative:

B.1

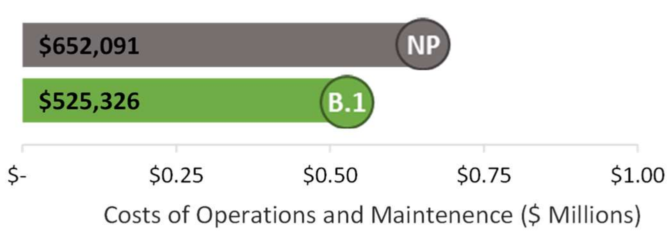
Based solely on the lowest predicted life-cycle cost for delay, the preferred scenario along SR 227 is B.1.

Exhibit 42 – Cost of Delay: No-Project vs Scenario B.1

Cost Performance Measures:

Operations and Maintenance (O&M) Costs

O&M costs measure common annualized costs associated with operating and maintaining the intersection control. Scenario B.1 has lower O&M costs primarily because Los Ranchos Road no longer requires additional costs associated with being signalized.



Preferred Alternative:

B.1

Based solely on lowest expected life-cycle O&M costs, the preferred scenario along SR 227 is B.1.

Exhibit 43 – O&M Costs: No-Project vs Scenario B.1

Initial Capital Costs (ICC)

ICC estimate the capital needed to plan, design, and construct the proposed improvements. The No-Project alternative does not have any initial capital costs associated with it because it is the existing condition. Scenario B.1 ICC includes the construction of a roundabout at Los Ranchos Road.

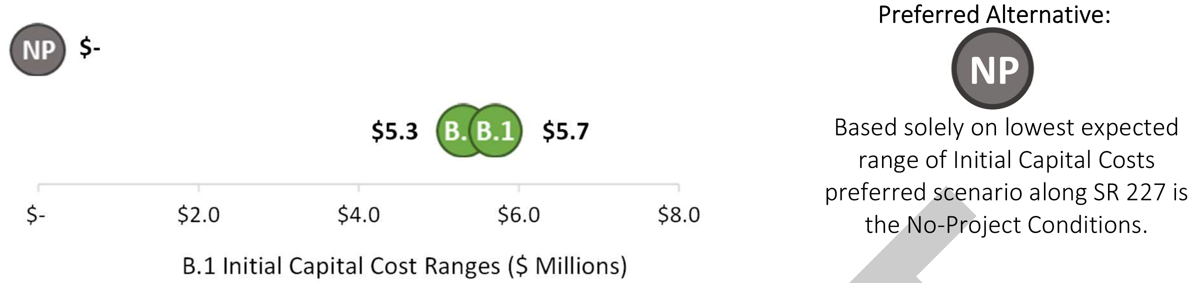


Exhibit 44 – Estimated ICC: No-Project vs Scenario B.1

The following table lists the total discounted life-cycle costs for each performance measure along the corridor for Scenario B.1.

Table 18 – No-Project Conditions and Scenario B.1 Performance Values

PERFORMANCE MEASURE LIFE CYCLE COST (NET PRESENT VALUE) [14]		
Safety		
Discounted Life Cycle Cost of Collisions	**No-Project**	**Scenario B.1**
Farmhouse Lane	$1,961,646	$1,961,646
Buckley Road	$2,650,500	$2,650,500
Crestmont Drive	$4,096,782	$4,096,782
Los Ranchos Road	$3,133,218	$1,059,470
Biddle Ranch Road	$5,030,671	$5,030,671
Total Discounted Life Cycle Cost of Collisions	**$16,872,816**	**$14,799,069**
Delay		
Discounted Life Cycle Cost of Delay	**No-Project**	**Scenario B.1**
Farmhouse Lane	$289,802	$289,802
Buckley Road	$7,137,600	$7,137,600
Crestmont Drive	$205,391	$205,391
Los Ranchos Road	$6,612,741	$1,767,191
Biddle Ranch Road	$4,374,680	$4,374,680
Total Discounted Life Cycle Cost of Delay	**$18,620,215**	**$13,774,665**
Operations and Maintenance		
Discounted Life Cycle Cost of O&M	**No-Project**	**Scenario B.1**
Farmhouse Lane	$57,686	$57,686
Buckley Road	$218,107	$218,107
Crestmont Drive	$56,419	$56,419
Los Ranchos Road	$246,387	$119,622
Biddle Ranch Road	$73,492	$73,492
Total O&M Costs	**$652,091**	**$525,326**
Initial Capital Costs		
Discounted Life Cycle Cost of ICC	**No-Project**	**Scenario B.1**
Farmhouse Lane	$0	$0
Buckley Road	$0	$0
Crestmont Drive	$0	$0
Los Ranchos Road	$0	$5,500,000
Biddle Ranch Road	$0	$0
Total Average Approximation	**$0**	**$5,500,000**

A B/C ratio was calculated for Scenario B.1 to determine the expected ROI based on the four performance measures. Table 19 depicts the values used to determine the B/C ratio of the corridor over its design-life. The added benefits were calculated by subtracting the discounted life-cycle costs of the proposed corridor control by the discounted life-cycle costs of the existing corridor. A positive value indicates that the proposed corridor will provide a benefit for that performance measure. The added benefits of safety and delay are summed to create the total added benefits for the proposed corridor. The added costs were calculated by subtracting the discounted life-cycle costs of the existing corridor by the discounted life-cycle costs of the proposed corridor. A positive value indicates that the proposed corridor will have additional costs associated with it. The added costs of O&M and ICC are summed to create the total added costs for the proposed corridor. The B/C ratio is calculated by dividing the total added benefits by the total added costs.

[14] Costs associated with 25-year life-cycle adjusted to a net present value using a discount rate of 4%. The green highlighted values represent changes in performance measures because of the improvements at Los Ranchos Road.

Table 19 – Benefit-Cost Analysis: No-Project Corridor vs Scenario B.1

LIFE CYCLE BENEFIT-COST RATIO		
Added Benefits (B)		
Added Benefits Compared to No-Project Conditions	**No-Project**	**Scenario B.1**
Safety	$ -	$ 2,073,748
Delay	$ -	$ 4,845,550
Added Benefits	**$0**	**$6,919,298**
Added Costs (C)		
Added Costs Compared to No-Project Conditions	**No-Project**	**Scenario B.1**
O&M	$ -	$ (126,765)
Initial Capital	$ -	$ 5,500,000
Added Costs	**$0**	**$5,373,235**
B/C Ratio Compared to No-Project Conditions	**N/A**	**1.29**

Scenario B.1 has a B/C greater than 1.0; therefore, the proposed roundabout at Los Ranchos Road and maintaining existing conditions at the other four intersections will provide a positive return on investment when compared to the No-Project scenario.

Exhibit 45 shows the accumulated cost of all four performance measures for No-Project conditions and corridor Scenario B.1. Scenario B.1 starts off with a greater accumulated cost because of the initial capital costs required to construct the roundabout at Los Ranchos Road. The accumulated costs for the No-Project conditions increase faster than Scenario B.1 because of the high annual societal costs of delay and safety. The difference in the accumulated costs in 2045 is $1.5 million in favor of Scenario B.1.

Exhibit 45 – Accumulated Costs: No-Project vs Scenario B.1

Kimley»Horn

Microsimulation Summary of Scenario B.1 Corridor

In Scenario B.1, the intersection of Los Ranchos is converted to a roundabout. Everything else remains the same as the No-Project conditions. The intersection delay and LOS results from the microsimulation analysis of Scenario B.1 are presented in **Table 20** and travel time results are presented in

Table 21 based on the Scenario B.1 microsimulation analysis. **Exhibit 46** is a visual representation of the intersection delays and **Exhibits 47-50** compare the No-Project and Scenario B.1 travel times and average travel speeds. The AM peak-hour is from 7:45 – 8:45 AM and the PM peak-hour is from 4:45 – 5:45 PM.

Table 20 – Scenario B.1 Intersection Delay and LOS Results

No	Intersection	Scenario B.1 (2020)				Scenario B.1 (2045)			
		AM Peak		PM Peak		AM Peak		PM Peak	
		DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS
1	SR 227 & Aero Dr	7.5	A	9.5	A	7.6	A	91.7	F
2	SR 227 & Airport Dr	0.7	A	3.3	A	1.0	A	29.0	D
3	SR 227 & Farmhouse Ln	0.7	A	0.9	A	3.2	A	33.9	D
4	SR 227 & Firestation Dwy	0.7	A	1.3	A	0.7	A	18.6	C
5	SR 227 & Kendall Rd	2.3	A	4.1	A	2.3	A	27.6	D
6	SR 227 & Buckley Rd	15.0	B	36.0	D	25.6	C	58.1	E
7	SR 227 & Crestmont Dr	5.7	A	4.7	A	11.7	B	4.3	A
8	SR 227 & Los Ranchos Rd	10.9	B	6.1	A	25.6	D	4.7	A
9	SR 227 & Biddle Ranch Rd	4.3	A	7.7	A	6.9	A	12.9	B
10	SR 227 & Price Canyon Rd	17.2	B	8.8	A	18.2	B	9.7	A

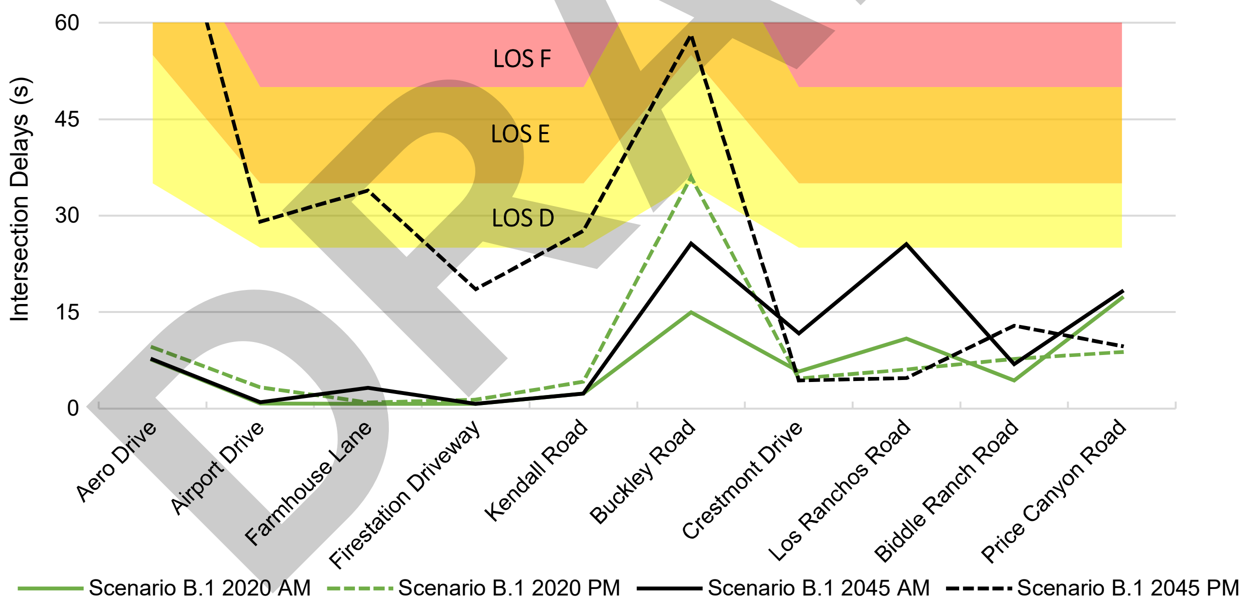


Exhibit 46 – Scenario B.1 Intersection Delay

Table 21 – Scenario B.1 Simulated Model Travel Time Results

Route	Scenario B.1 (2020)		Scenario B.1 (2045)	
	AM Peak (mm:ss)	PM Peak (mm:ss)	AM Peak (mm:ss)	PM Peak (mm:ss)
NB 227 from Price Canyon to Aero	05:22	04:36	06:17	04:40
SB 227 from Aero to Price Canyon	04:54	05:33	05:01	08:41

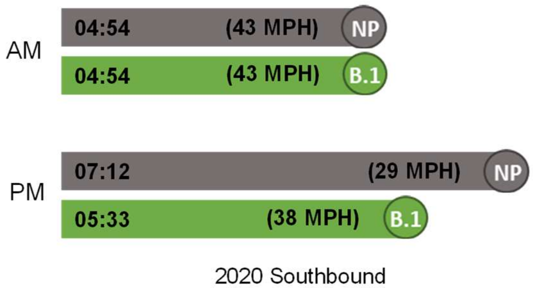


Exhibit 47 –2020 SB Travel Times

Exhibit 48 –2020 NB Travel Times

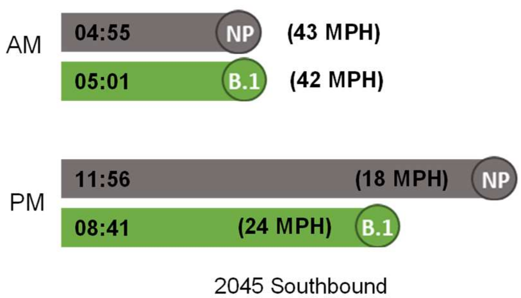


Exhibit 49 –2045 SB Travel Times

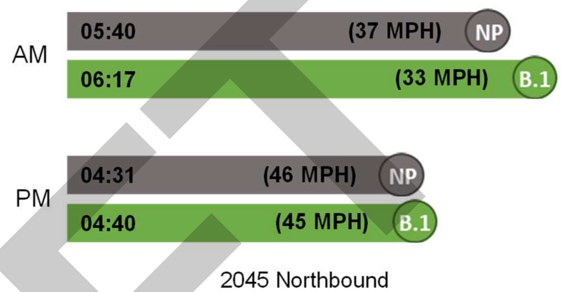


Exhibit 50 –2045 NB Travel Times

For the 2020 AM peak hour, the travel times and delays are similar to the No-Project conditions given that there is minimal delay during the AM peak hour. For the 2045 AM peak hour, the travel time in the NB direction increased compared to the 2045 No-Project scenario. This is because the eastbound (EB) approach of Los Ranchos has fewer conflicting vehicles as the major movement in the AM is NB. Lower number of conflicting vehicles allow for more EB vehicles to enter the roundabout thus reducing the gaps for the NB vehicles and slowing them down.

For the 2020 PM peak hour, the roundabout helps mitigate much of the delay currently experienced on the corridor in the SB direction. Travel time for SB SR 227 is decreased by 1 minute and 39 seconds when compared to the No-Project conditions. For the 2045 PM peak hour, the travel time savings are 3 minutes and 15 seconds when compared to 2045 PM No-Project. The intersection of SR 227 and Buckley Road becomes the chokepoint in the year 2045. This can be seen by looking at Exhibit 46 above. The intersections of Los Ranchos and Crestmont Drive are operating at acceptable LOS A in the SB direction at 2045 PM, while the intersection of Buckley Road is operating at LOS E, and each successive intersection upstream is at various levels of delay ranging from C to F. The queues from Buckley Road extend all the way back to Aero Drive.

SCENARIO B.2 – 2-LANE CORRIDOR PHASE 2

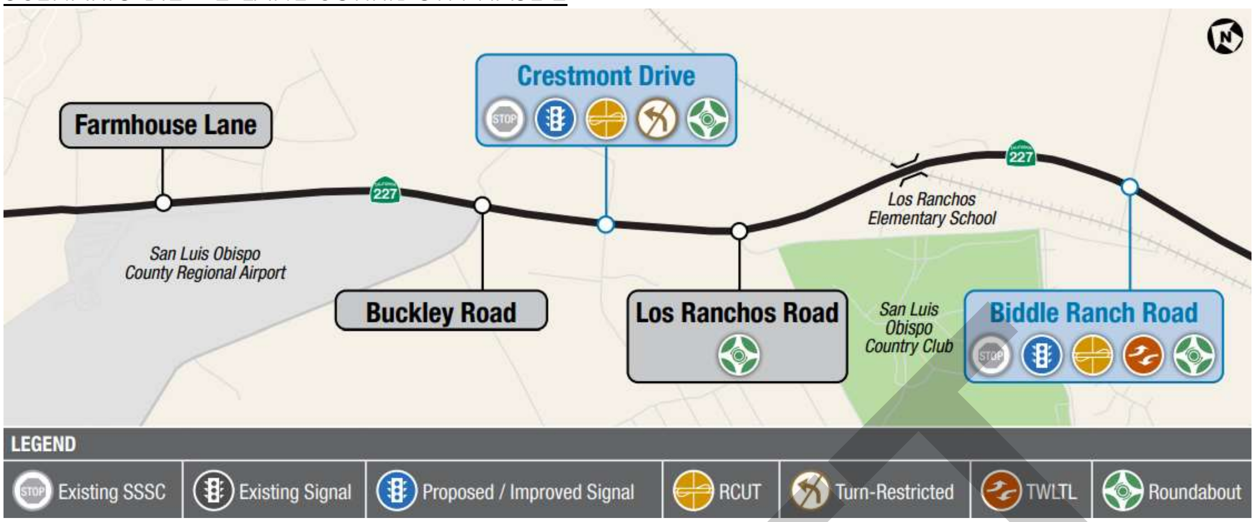


Exhibit 51 – Scenario B.2 Corridor - Evaluated Intersection Controls

Scenario B.2 builds on Scenario B.1, meaning Scenario B.2 assumes there is already a multi-lane roundabout at Los Ranchos Road. The No-Project intersection configuration and control will remain the same at all remaining study intersections except for SR 227 at Crestmont Drive and Biddle Ranch Road.

Isolated Intersection Performance Measures Summary

The following performance measures were determined for each isolated intersection, meaning that upstream and downstream effects from adjacent intersections were not considered. The analysis was performed for the 25-year life-cycle of the corridor from 2020 to 2045.

Crestmont Drive

Five (5) intersection control types were analyzed at the study intersection:

- No-Project Side-Street Stop-Control (SSSC)
- Restricted Crossing U-Turn (RCUT)
    - Full access on SR 227 approaches
    - Crestmont Drive approaches are turn-restricted (only allow right-hand turns)
    - U-turn facilities are constructed on either side of the study intersection to allow through and left-turn movements from Crestmont Drive
- Turn-Restricted
    - Same access-control as the RCUT
    - U-turns are made at neighboring intersections (Los Ranchos Road and Buckley Road)
        - Note: Buckley Road currently does not permit NB U-turns
- Signal
    - Crestmont Drive intersection does not meet signal warrant[15]
- Multi-lane Roundabout

[15] For more information regarding Crestmont Drive signal warrants refer to *Crestmont Drive Signal Warrant Analysis*, Kimley-Horn, June 22 2021.

Benefit Performance Measures:

Safety Benefits

The safety benefit of the proposed improvement is realized when the cost of safety of the proposed improvement is less than the cost of safety for the existing intersection. A roundabout would have the least societal cost of safety associated with it because there are fewer predicted crashes with less severities than the other alternatives. RCUT intersections experience more crashes than turn-restricted intersections because of the additional conflict points associated with U-turns.

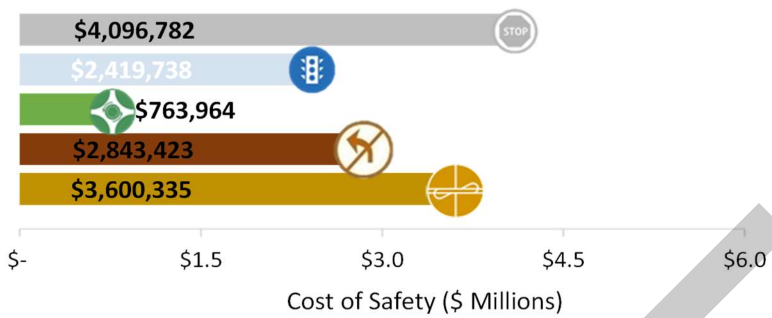


Exhibit 52 – Cost of Safety at Crestmont Drive

Preferred Alternative:

Based on the lowest predicted life-cycle cost for safety, the preferred intersection control type for Crestmont Drive is a roundabout.

Delay Reduction Benefits

The delay reduction benefit of the proposed improvement is realized when the cost of delay of the proposed improvement is less than the cost of delay for the existing intersection. There is the least societal cost associated with turn-restricted because the vehicles on the mainline do not experience any delay and the vehicles on the minor-streets are forced to turn right at the intersection. Right-turn movements experience less delay than left-turn movements because drivers only have to wait for a gap in one direction. Delay for vehicles turning left on the minor-street for the turn-restricted assumes the time it takes to turn onto SR 227, travel to a neighboring intersection, make a U-turn, and return to Crestmont Drive. The roundabout has the highest societal cost of delay because each vehicle approaching the intersection is required to yield to any circulating vehicle upstream. Intersections where the mainline does not have any control (SSSC, turn-restricted, RCUT) have less societal costs for delay because mainline vehicles bring down the average delay for the intersection.

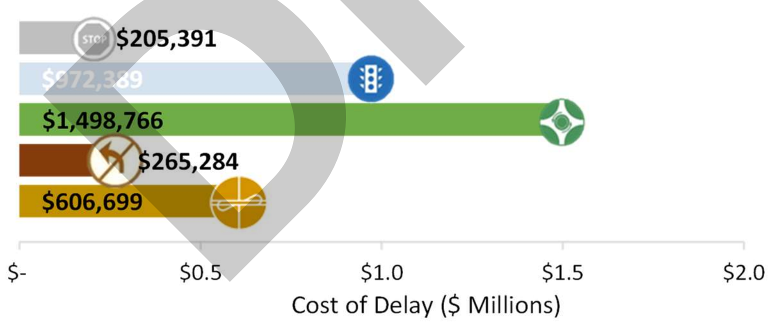


Exhibit 53 – Cost of Delay at Crestmont Drive

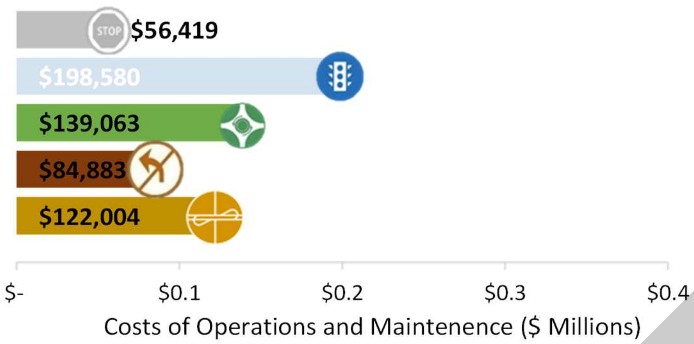
Preferred Alternative:

Based solely on the lowest predicted life-cycle cost for delay, the preferred intersection control type for Crestmont Drive is the No-Project (SSSC).

Cost Performance Measures:

Operations and Maintenance (O&M) Costs

O&M costs measure common annualized costs associated with operating and maintaining the intersection control. The difference in O&M costs for the viable alternatives has mostly to do with the amount of pavement rehabilitation and the number of light poles. Roundabouts require additional lighting compared to traditional intersections to provide better visibility at night.



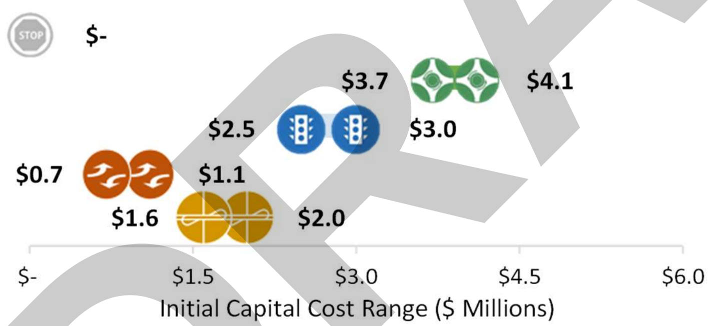
Preferred Alternative:

Based solely on lowest expected life-cycle O&M costs, the preferred intersection control type Crestmont Drive is the No-Project (SSSC).

Exhibit 54 – O&M Costs at Crestmont Drive

Initial Capital Costs (ICC)

ICC estimate the capital needed to plan, design, and construct the proposed improvements. The No-Project alternative does not have any initial capital costs associated with it because it is the existing condition. Costs associated with RCUT include constructing two U-turn facilities and making the intersection turn-restricted. The turn-restricted intersection ICC includes costs for medians to make it turn-restricted.



Preferred Alternative:

Based solely on lowest expected range of Initial Capital Costs, the preferred intersection control type for Crestmont Drive is the No-Project (SSSC).

Exhibit 55 – Estimated ICC at Crestmont Drive

In the following tables, please note that *No-Project (SSSC)* refers to the No-Project control and configuration, *Roundabout* refers to a multi-lane roundabout with two through-lanes, *RCUT* refers to the RCUT configuration for a 2-lane corridor, *Signal* refers to the proposed signal control, and *Turn-Restricted* refers to RCUT layout minus the U-turn facilities. Table 22 depicts the performance measure costs associated with each intersection control.

Table 22 – Performance Measure Life Cycle Costs for Crestmont Drive

PERFORMANCE MEASURE LIFE CYCLE COST (NET PRESENT VALUE)[16]					
Safety					
	No-Project (SSSC)	Signal[17]	**Roundabout**	**Turn-Restricted**	**RCUT**
Annual Cost of Collisions	$ 262,243	$ 154,892	$ 48,903	$ 182,013	$ 230,464
Discounted Life Cycle Cost of Collisions	$ 4,096,782	$ 2,419,738	$ 763,964	$2,843,423	$ 3,600,335
Delay					
	No-Project (SSSC)	Signal	**Roundabout**	**Turn-Restricted**	**RCUT**
Annual Quantity (hours)	597	2953	4678	813	1940
Annual Cost	$ 7,900	$ 37,400	$ 57,645	$ 10,203	$ 23,335
Total Discounted Life Cycle Cost	$ 205,391	$ 972,389	$ 1,498,766	$ 265,284	$ 606,699
Operations and Maintenance					
	No-Project (SSSC)	Signal	**Roundabout**	**Turn-Restricted**	**RCUT**
Annual O&M Costs	$ 600	$ 9,700	$ 2,600	$ 600	$ 600
Discounted Life Cycle O&M Costs	$ 9,373	$ 151,534	$ 40,617	$ 9,373	$ 9,373
Discounted Pavement Rehab Costs	$ 47,046	$ 47,046	$ 98,445	$ 75,510	$ 112,630
Total O&M Costs	$ 56,419	$ 198,580	$ 139,063	$ 84,883	$ 122,004
Initial Capital					
	No-Project (SSSC)	Signal	**Roundabout**	**Turn-Restricted**	**RCUT**
High Approximation	$ -	$ 4,100,000	$ 3,000,000	$1,100,000	$ 2,000,000
Low Approximation	$ -	$ 3,700,000	$ 2,500,000	$ 700,000	$ 1,600,000

Benefit Cost Ratio Scoring

The first stage of B/C analysis involves comparing all proposed alternatives to the No-Project intersection control. Table 23 depicts the values used to determine the B/C ratio of the intersection over its design-life. The added benefits were calculated by subtracting the discounted life-cycle costs of the proposed intersection control by the discounted life-cycle costs of the existing control. A positive value indicates that the proposed intersection will provide a benefit for that performance measure. The added benefits of safety and delay are summed to create the total added benefits for the proposed intersection. The added costs were calculated by subtracting the discounted life-cycle costs of the existing intersection by the discounted life-cycle costs of the proposed control. A positive value indicates that the proposed intersection will have additional costs associated with it. The added costs of O&M and ICC are summed to create the total added costs for the proposed intersection. The B/C ratio is calculated by dividing the total added benefits by the total added costs.

[16] Costs associated with 25-year life-cycle adjusted to a net present value using a discount rate of 4%.
[17] Signal warrants were not met at Crestmont Drive; therefore, a signal is not a viable option. For more information regarding Crestmont Drive signal warrants refer to *Crestmont Drive Signal Warrant Analysis*, Kimley-Horn, June 22 2021.

Table 23 – Stage 1 Benefit-Cost Analysis for Crestmont Drive

Added Benefits (B)					
Added Benefits Compared to No-Project Conditions	**No-Project (SSSC)**	Signal	**Roundabout**	**Turn-Restricted**	**RCUT**
Safety	$ -	$ 1,677,044	$ 3,332,818	$ 1,253,359	$ 496,447
Delay	$ -	$ (766,997)	$ (1,293,375)	$ (59,892)	$ (401,307)
Added Benefits	**$0**	$910,047	**$2,039,443**	**$1,193,467**	**$95,140**
Added Costs (C)					
Added Costs Compared to No-Project Conditions	**No-Project (SSSC)**	Signal	**Roundabout**	**Turn-Restricted**	**RCUT**
O&M	$ -	$ 142,161	$ 82,644	$ 28,464	$ 65,585
Initial Capital	$ -	$ 3,900,000	$ 2,750,000	$ 900,000	$ 1,800,000
Added Costs	**$0**	$4,042,161	**$2,832,644**	**$928,464**	**$1,865,585**
B/C Ratio Compared to No-Project Conditions	**N/A**	0.23	**0.72**	**1.29**	**0.05**

There is only one proposed alternative that has a B/C greater than 1.0; therefore, the second stage of B/C analysis is not necessary. Turn-restricted is the preferred alternative because it has a B/C larger than 1.0.

Table 24 is an estimation of the B/C values for the estimated range of ICC assuming safety and delay benefits are held constant. Also included in Table 24 is an estimate of the added ICC costs of the improvements needed to achieve a B/C equal to 1.0.

Table 24 – Benefit-Cost Ranges for Crestmont Drive

Benefit-Cost Ratio Calculations for No-Project (SSSC) (A) vs Turn-Restricted (B)							
	Initial Capital Cost			Project Constraints			
B/C Target	No-Project (SSSC) (A)	Turn-Restricted (B)	Added Cost (C) = (B - A)	Added O&M Cost for (D)	Total Benefits (E)	Total Costs (F) = (C + D)	B/C (G) = (E / F)
High	$ -	$ 700,000	$ 700,000			$ 728,464	1.64
Low	$ -	$ 1,100,000	$ 1,100,000	$ 28,464	$ 1,193,467	$ 1,128,464	1.06
RAB Budget	$ -	$ 1,165,003	$ 1,165,003			$ 1,193,467	1.00

Note: The 'High' value calculates the highest Roundabout B/C. Assuming the high Proposed Signal ICC and the low Roundabout ICC. The 'Low' value calculates the lowest Roundabout B/C. Assuming the low Proposed Signal ICC and the high Roundabout ICC.

Exhibit 56 shows the accumulated cost of all four performance measures for the No-Project scenario and each proposed alternative. The proposed signal starts off with the highest accumulated cost because of the initial capital costs required to construct the improvements. The difference in the accumulated costs between the proposed turn-restricted intersection and the No-Project conditions is $350,000 in favor of the turn-restricted intersection.

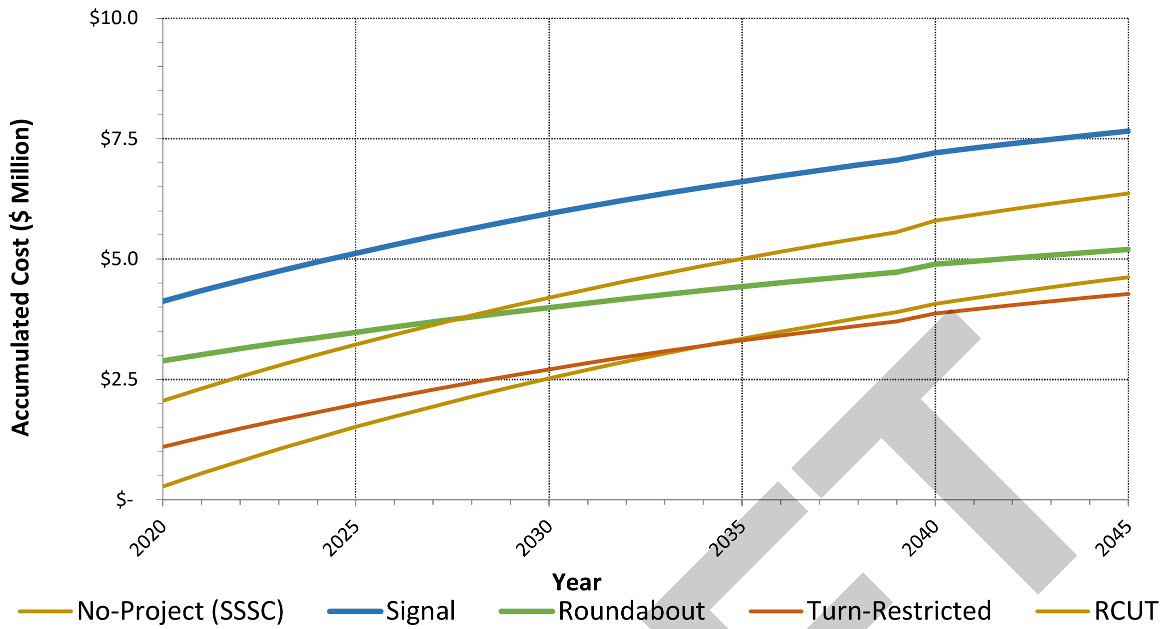


Exhibit 56 – Accumulated Costs: Crestmont Drive

<u>Recommended Control Type</u>

The recommended alternative based on B/C ratio Crestmont Drive is turn-restricted. The B.2 corridor microsimulation analysis models Crestmont Drive as turn-restricted.

Biddle Ranch Road

The following performance measures for Biddle Ranch Road were determined assuming it was an isolated intersection, meaning that upstream and downstream effects from adjacent intersections were not considered.

Five (5) intersection control types were analyzed at the study intersection:

- No-Project Side-Street Stop-Control (SSSC)
- Restricted Crossing U-Turn (RCUT)
    - SR 227 approaches have full access
    - Biddle Ranch Road approaches are turn-restricted (only allow right-hand turns)
    - U-turn facilities are constructed on either side of the study intersection to allow through and left-turn movements from Biddle Ranch Road
- Two-Way Left-Turn lane (TWLTL)
- Signal
    - Biddle Ranch Road intersection does not meet signal warrant[18]
- Multi-lane Roundabout

[18] Signal warrants were not met at Biddle Ranch Road; therefore, it is not a viable option.

Kimley»Horn

Benefit Performance Measures:

Safety Benefits

The safety benefit of the proposed improvement is realized when the cost of safety of the proposed improvement is less than the cost of safety for the existing intersection. A roundabout would have the least societal cost of safety associated with it because there are fewer predicted crashes with less severities than the other alternatives.

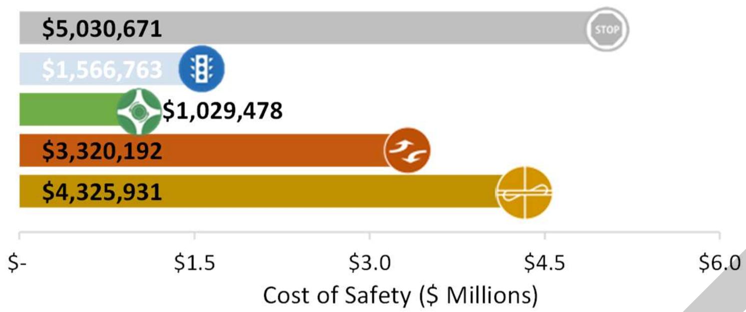


Exhibit 57 – Cost of Safety at Biddle Ranch Road

Preferred Alternative:

Based on the lowest predicted life-cycle cost for safety, the preferred intersection control type for Biddle Ranch Road is a Roundabout

Delay Reduction Benefits

The delay reduction benefit of the proposed improvement is realized when the cost of delay of the proposed improvement is less than the cost of delay for the existing intersection. There is the least societal cost associated with RCUT because the vehicles on the mainline do not experience any delay and the vehicles on the minor-streets are forced to turn right at the intersection. Right-turn movements experience less delay than left-turn movements because drivers have to wait for a gap in only one direction. Delay for vehicles turning left on the minor-street for the RCUT assumes the time it takes to turn onto SR 227, travel to the U-turn facility, make a U-turn, and return to Biddle Ranch Road. Intersections where the mainline does not have any control (SSSC, turn-restricted, RCUT) typically have less societal costs for delay because mainline vehicles bring down the average delay for the intersection. The existing SSSC has the highest societal cost of delay because the side-streets experience excessive delays.

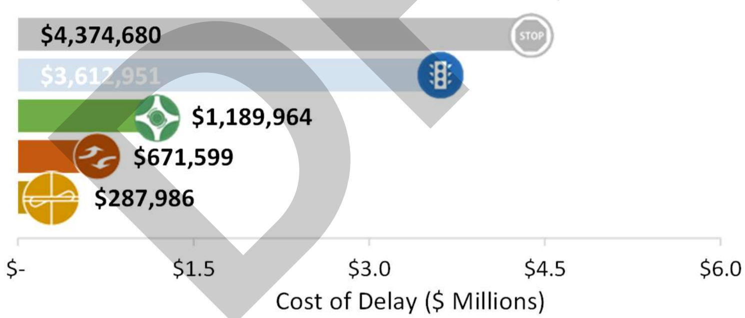


Exhibit 58 – Cost of Delay at Biddle Ranch Road

Preferred Alternative:

Based solely on the lowest predicted life-cycle cost for delay, the preferred intersection control type for Biddle Ranch Road is RCUT.

Cost Performance Measures:

Operations and Maintenance (O&M) Costs

O&M costs measure common annualized costs associated with operating and maintaining the intersection control. The difference in O&M costs for the viable alternatives has mostly to do with the amount of pavement rehabilitation and the number of light poles. Roundabouts require additional lighting compared to traditional intersections to provide better visibility at night.

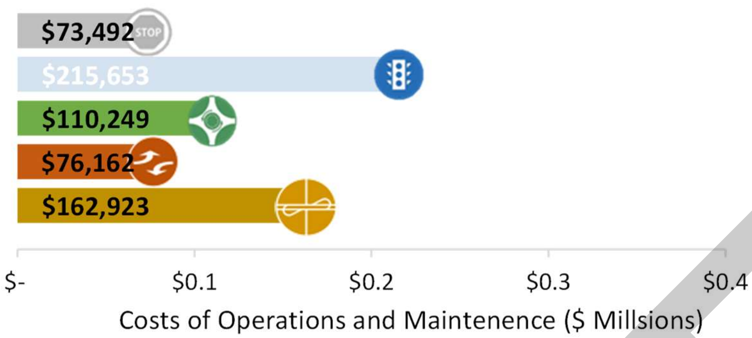


Exhibit 59 – O&M Costs at Biddle Ranch Road

Preferred Alternative:

Based solely on lowest expected life-cycle O&M costs, the preferred intersection control type for Biddle Ranch Road is the No-Project (SSSC).

Initial Capital Costs (ICC)

ICC estimate the capital needed to plan, design, and construct the proposed improvements. The No-Project alternative does not have any initial capital costs associated with it because it is the existing condition. Costs associated with RCUT include constructing two U-turn facilities and making the intersection turn-restricted.

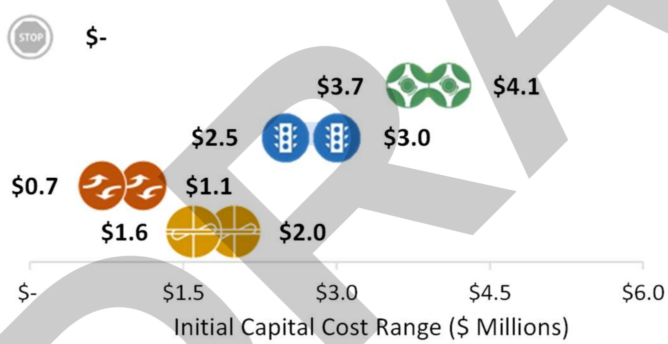


Exhibit 60 – Estimated ICC at Biddle Ranch Road

Preferred Alternative:

Based solely on lowest expected range of Initial Capital Costs, the preferred intersection control type for Biddle Ranch Road is the No-Project (SSSC).

In the following tables, please note that *No-Project (SSSC)* refers to the No-Project control and configuration, *Signal* refers to the proposed signal control, *Roundabout* refers to a multi-lane roundabout with two through-lanes, *TWLTL* refers to the TWLTL configuration for a 3-lane corridor, and *RCUT* refers to a turn-restricted intersection with U-turn facilities. Table 25 depicts the performance measure costs associated with each intersection control.

Table 25 – Performance Measure Life Cycle Costs for Biddle Ranch Road

PERFORMANCE MEASURE LIFE CYCLE COST (NET PRESENT VALUE)[19]					
Safety					
	No-Project (SSSC)	**Signal**	**Roundabout**	**TWLTL**	**RCUT**
Annual Cost of Collisions	$ 322,023	$ 100,292	$ 65,899	$ 212,532	$ 276,911
Discounted Life Cycle Cost of Collisions	$ 5,030,671	$1,566,763	$ 1,029,478	$3,320,192	$4,325,931
Delay					
	No-Project (SSSC)	**Signal**	**Roundabout**	**TWLTL**	**RCUT**
Annual Quantity (hours)	$ 13,527	$ 11,096	$ 3,656	$ 2,059	$ 906
Annual Cost	$ 168,257	$ 138,960	$ 45,768	$ 25,831	$ 11,076
Discounted Life Cycle Cost of Delay	$ 4,374,680	$3,612,951	$ 1,189,964	$ 671,599	$ 287,986
Operations and Maintenance					
	No-Project (SSSC)	**Signal**	**Roundabout**	**TWLTL**	**RCUT**
Annual O&M Costs	$ 600	$ 9,700	$ 756	$ 600	$ 600
Discounted Life Cycle O&M Costs	$ 9,373	$ 151,534	$ 11,803	$ 9,373	$ 9,373
Discounted Pavement Rehab Costs	$ 64,119	$ 64,119	$ 98,445	$ 66,789	$ 153,549
Total O&M Costs	$ 73,492	$ 215,653	$ 110,249	$ 76,162	$ 162,923
Initial Capital					
	No-Project (SSSC)	**Signal**	**Roundabout**	**TWLTL**	**RCUT**
High Approximation	$ -	$1,400,000	$ 5,000,000	$ 300,000	$3,500,000
Low Approximation	$ -	$1,000,000	$ 4,000,000	$ 200,000	$3,100,000
Average Initial Capital Cost	**$ -**	**$1,200,000**	**$ 4,500,000**	**$ 250,000**	**$3,300,000**

Benefit Cost Ratio Scoring

The first stage of B/C analysis involves comparing all proposed alternatives to the No-Project intersection control. Table 26 depicts the values used to determine the B/C ratio of the intersection over its design-life. The added benefits were calculated by subtracting the discounted life-cycle costs of the proposed intersection control by the discounted life-cycle costs of the existing control. A positive value indicates that the proposed intersection will provide a benefit for that performance measure. The added benefits of safety and delay are summed to create the total added benefits for the proposed intersection. The added costs were calculated by subtracting the discounted life-cycle costs of the existing intersection by the discounted life-cycle costs of the proposed control. A positive value indicates that the proposed intersection will have additional costs associated with it. The added costs of O&M and ICC are summed to create the total added costs for the proposed intersection. The B/C ratio is calculated by dividing the total added benefits by the total added costs.

[19] Costs associated with 25-year life-cycle adjusted to a net present value using a discount rate of 4%.

Table 26 – Stage 1 Benefit-Cost Analysis for Biddle Ranch Road

Added Benefits (B)					
Added Benefits Compared to No-Project Conditions	No-Project (SSSC)	Signal	Roundabout	TWLTL	RCUT
Safety	$ -	$ 3,463,907	$ 4,001,193	$ 1,710,478	$ 704,740
Delay	$ -	$ 761,729	$ 3,184,716	$ 3,703,082	$ 4,086,694
Added Benefits	**$ -**	**$ 4,225,637**	**$ 7,185,909**	**$ 5,413,560**	**$ 4,791,434**
Added Costs (C)					
Added Costs Compared to No-Project Conditions	**No-Project (SSSC)**	**Signal**	**Roundabout**	**TWLTL**	**RCUT**
O&M	$ -	$ 142,161	$ 36,757	$ 2,670	$ 89,431
Initial Capital	$ -	$ 1,200,000	$ 4,500,000	$ 250,000	$ 3,300,000
Added Costs	**$ -**	**$ 1,342,161**	**$ 4,536,757**	**$ 252,670**	**$ 3,389,431**
B/C Ratio Compared to No-Project Conditions	**N/A**	**3.15**[20]	**1.58**	**21.43**	**1.41**

All three viable proposed improvements have a B/C greater than 1.0; therefore, each alternative would provide a better return on investment than the No-Project intersection. A second stage B/C analysis was performed to determine the preferred alternative intersection control type between the top two proposed alternatives (Roundabout and TWLTL). Added benefits and costs were calculated by directly comparing the two proposed improvements to each other. Table 27 summarizes the comparison between the TWLTL and a roundabout for the stage 2 B/C analysis for Biddle Ranch Road.

Table 27 – Stage 2 Benefit-Cost Analysis for Biddle Ranch Road

Life Cycle Benefit Cost Ratio		
Added Benefits (B)		
Added Benefits Compared to Proposed TWLTL	**TWLTL**	**Roundabout**
Safety	$ -	$ 2,290,715
Delay	$ -	$ (518,365)
Added Benefits	**$ -**	**$ 1,772,349**
Added Costs (C)		
Added Cost Compared to Proposed TWLTL	**TWLTL**	**Roundabout**
O&M	$ -	$ 34,087
Initial Capital	$ -	$ 4,250,000
Added Costs	**$ -**	**$ 4,284,087**
B/C Ratio Compared to Proposed TWLTL	**N/A**	**0.41**

The B/C value for the roundabout compared to the TWLTL is less than 1.0; therefore, the TWLTL would provide a better return on investment.

Table 28 is an estimation of the B/C values for the estimated range of ICC assuming safety and delay benefits are held constant. Also included in

Table 28 is an estimate of the added ICC costs of the roundabout needed to achieve a B/C equal to 1.0. Exhibit 61 shows the cost sensitivity for the roundabout and TWLTL alternatives at Biddle Ranch Road. The black diagonal line represents a B/C ratio equal to 1.0. The rectangular box is the range of ICC for both

[20] Signal warrants were not met at Biddle Ranch Road; therefore, it is not a viable option.

proposed alternatives. The range of costs is located below the TWLTL, meaning the B/C ratio is less than 1.0 and a TWLTL would be the preferred alternative.

Table 28 – Benefit-Cost Ranges for Biddle Ranch Road

Benefit-Cost Ratio Calculations for TWLTL (A) vs Roundabout (B)							
	Initial Capital Cost			Project Constraints			
B/C Target	TWLTL (A)	Roundabout (B)	Added Cost (C) = (B - A)	Added O&M Cost for (D)	Total Benefits (E)	Total Costs (F) = (C + D)	B/C (G) = (E / F)
High	$ 300,000	$ 4,000,000	$ 3,700,000			$ 3,734,087	0.47
Low	$ 200,000	$ 5,000,000	$ 4,800,000	$ 34,087	$ 1,772,349	$ 4,834,087	0.37
Improvement Budget	$ 250,000	$ 1,988,262	$ 1,738,262			$ 1,772,349	1.00

Note: The 'High' value calculates the highest Roundabout B/C. Assuming the high Proposed TWLTL ICC and the low Roundabout ICC. The 'Low' value calculates the lowest Roundabout B/C. Assuming the low Proposed TWLTL ICC and the high Roundabout ICC.

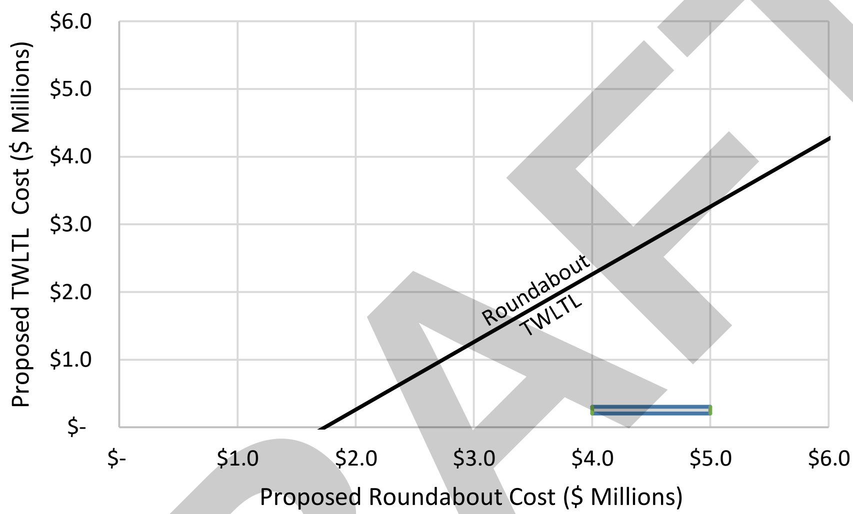


Exhibit 61 – Cost Sensitivity Chart: Biddle Ranch Road

Exhibit 62 shows the accumulated cost of all four performance measures for the No-Project scenario and each proposed alternative. The difference in the accumulated costs between the proposed TWLTL intersection and the No-Project conditions is $5.2 million in favor of the TWLTL. The difference in the accumulated costs between the TWLTL intersection and the proposed roundabout is $2.3 million in favor of the TWLTL.

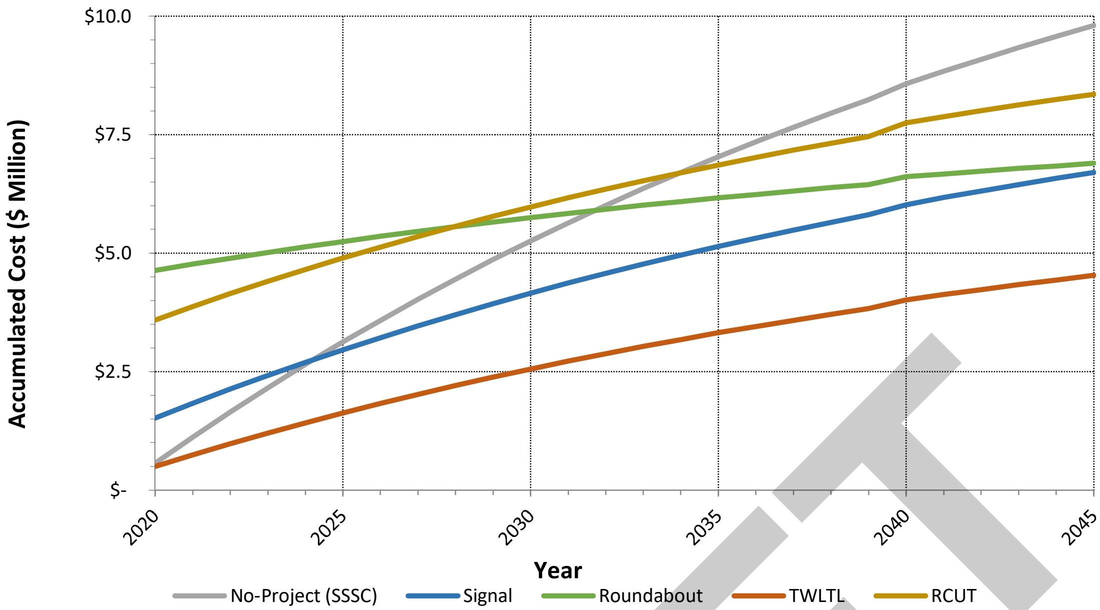


Exhibit 62 – Accumulated Costs: Biddle Ranch Road

Recommended Control Type

The recommended alternative based on B/C ratio for Biddle Ranch Road is TWLTL. The B.2 corridor microsimulation analysis models Biddle Ranch Road as a TWLTL.

Corridor Benefit-Cost Analysis

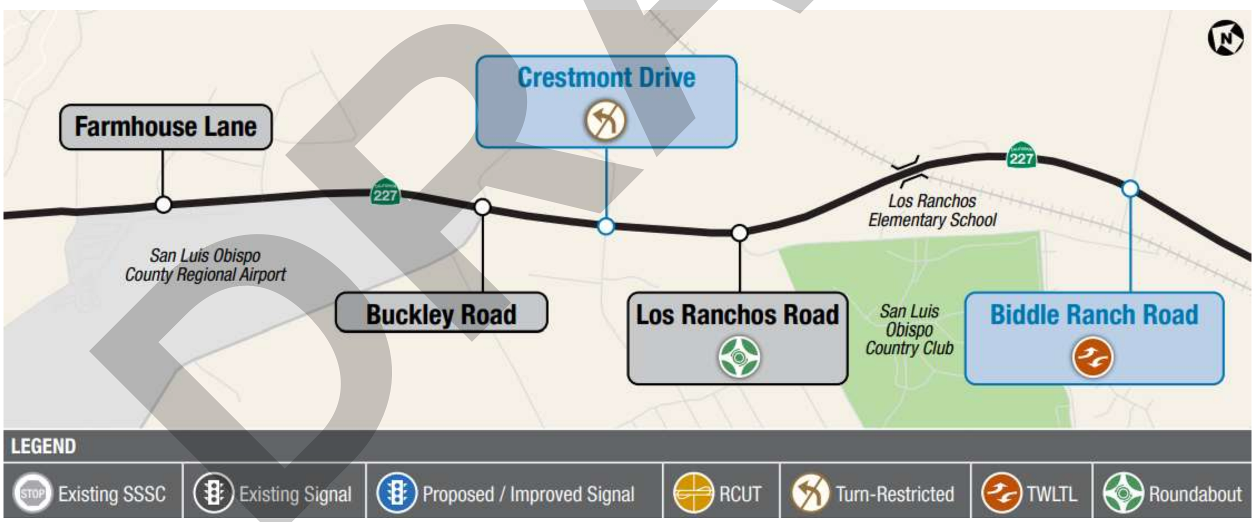


Exhibit 63 – Scenario B.2 Corridor - Preferred Intersection Controls

The following section compares the performance measures for all five study intersections along the corridor between the No-Project condition and Scenario B.2.

Benefit Performance Measures:

Safety Benefits

The safety benefit of the proposed improvement is realized when the cost of safety of the proposed improvement is less than the cost of safety for the existing intersection. Scenario B.2 has less societal cost associated with safety because the severity of the predicted crashes at Los Ranchos Road, Crestmont Drive, and Biddle Ranch Road are less for the improvements than the No-Project condition.

Exhibit 64 – Cost of Safety: No-Project vs Scenario B.2

Preferred Alternative:

B.2

Based on the lowest predicted life-cycle cost for safety, the preferred scenario along SR 227 is B.2.

Delay Reduction Benefits

The delay reduction benefit of the proposed improvement is realized when the cost of delay of the proposed improvement is less than the cost of delay for the existing intersection. There is less societal cost associated with Scenario B.2 because the improvements at Los Ranchos Road, Crestmont Drive, and Biddle Ranch Road increase capacity and reduce the average delay compared to the No-Project conditions.

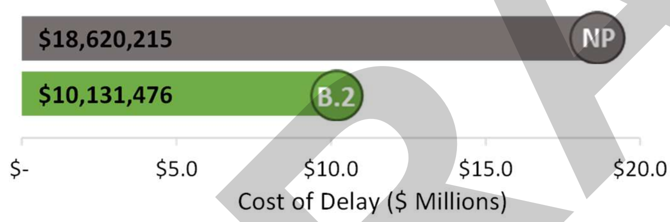


Exhibit 65 – Cost of Delay: No-Project vs Scenario B.2

Preferred Alternative:

B.2

Based solely on the lowest predicted life-cycle cost for delay, the preferred scenario along SR 227 is B.2.

Cost Performance Measures:

Operations and Maintenance (O&M) Costs

O&M costs measure common annualized costs associated with operating and maintaining the intersection control. Scenario B.2 has lower O&M costs primarily because Los Ranchos Road no longer requires additional costs associated with being signalized.

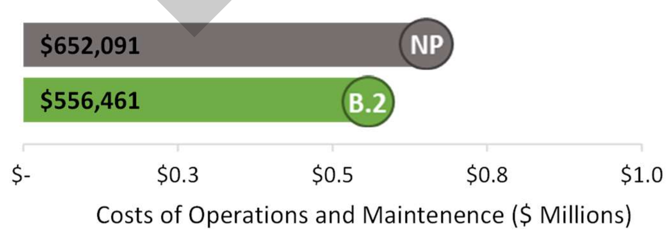


Exhibit 66 – O&M Costs: No-Project vs Scenario B.2

Preferred Alternative:

B.2

Based solely on lowest expected life-cycle O&M costs, the preferred scenario along SR 227 is B.2.

Kimley»Horn

<u>Initial Capital Costs (ICC)</u>

ICC estimate the capital needed to plan, design, and construct the proposed improvements. The No-Project alternative does not have any initial capital costs associated with it because it is the existing condition. Scenario B.2 ICC includes constructing a roundabout at Los Ranchos Road, turning Crestmont Drive into a turn-restricted intersection, and minor road widening and striping at Biddle Ranch Road to add a TWLTL.

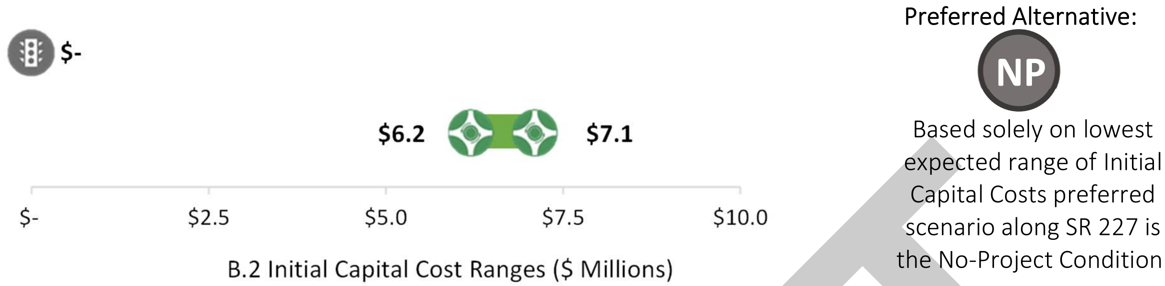


Exhibit 67 – Estimated ICC: No-Project vs Scenario B.2

The following table lists the total discounted life-cycle costs for each performance measure along the corridor for Scenario B.2.

Table 29 – No-Project Conditions and Scenario B.2 Performance Values

PERFORMANCE MEASURE LIFE CYCLE COST (NET PRESENT VALUE) [21]		
Safety		
Discounted Life Cycle Cost of Collisions	**No-Project**	**Scenario B.2**
Farmhouse Lane	$1,961,646	$1,961,646
Buckley Road	$2,650,500	$2,650,500
Crestmont Drive	$4,096,782	$2,843,423
Los Ranchos Road	$3,133,218	$1,059,470
Biddle Ranch Road	$5,030,671	$3,320,192
Total Discounted Life Cycle Cost of Collisions	**$16,872,816**	**$11,835,231**
Delay		
Discounted Life Cycle Cost of Delay	**No-Project**	**Scenario B.2**
Farmhouse Lane	$289,802	$289,802
Buckley Road	$7,137,600	$7,137,600
Crestmont Drive	$205,391	$265,284
Los Ranchos Road	$6,612,741	$1,767,191
Biddle Ranch Road	$4,374,680	$671,599
Total Discounted Life Cycle Cost of Delay	**$18,620,215**	**$10,131,476**
Operations and Maintenance		
Discounted Life Cycle Cost of O&M	**No-Project**	**Scenario B.2**
Farmhouse Lane	$57,686	$57,686
Buckley Road	$218,107	$218,107
Crestmont Drive	$56,419	$84,883
Los Ranchos Road	$246,387	$119,622
Biddle Ranch Road	$73,492	$76,162
Total O&M Costs	**$652,091**	**$556,461**
Initial Capital Costs		
Discounted Life Cycle Cost of ICC	**No-Project**	**Scenario B.2**
Farmhouse Lane	$0	$0
Buckley Road	$0	$0
Crestmont Drive	$0	$900,000
Los Ranchos Road	$0	$5,500,000
Biddle Ranch Road	$0	$250,000
Total Average Approximation	**$0**	**$6,650,000**

A B/C ratio was calculated for Scenario B.2 to determine the expected ROI based on the four performance measures. Table 30 depicts the values used to determine the B/C ratio of the corridor over its design-life. The added benefits were calculated by subtracting the discounted life-cycle costs of the proposed corridor control by the discounted life-cycle costs of the existing control. A positive value indicates that the proposed corridor will provide a benefit for that performance measure. The added benefits of safety and delay are summed to create the total added benefits for the proposed corridor. The added costs were calculated by subtracting the discounted life-cycle costs of the existing corridor by the discounted life-cycle costs of the proposed control. A positive value indicates that the proposed corridor will have additional costs associated with it. The added costs of O&M and ICC are summed to create the total added costs for the proposed corridor. The B/C ratio is calculated by dividing the total added benefits by the total added costs.

[21] Costs associated with 25-year life-cycle adjusted to a net present value using a discount rate of 4%. The green highlighted values represent changes in performance measures because of the improvements at Crestmont Drive and Biddle Ranch Road. Improvements at Los Ranchos Road are also assumed.

Table 30 – Benefit-Cost Analysis: No-Project Corridor vs Scenario B.2

LIFE CYCLE BENEFIT-COST RATIO		
Added Benefits (B)		
Added Benefits Compared to No-Project Conditions	**No-Project**	**Scenario B.2**
Safety	$ -	$ 5,037,586
Delay	$ -	$ 8,488,739
Added Benefits	**$0**	**$13,526,325**
Added Costs (C)		
Added Costs Compared to No-Project Conditions	**No-Project**	**Scenario B.2**
O&M	$ -	$ (95,631)
Initial Capital	$ -	$ 6,650,000
Added Costs	**$0**	**$6,554,369**
B/C Ratio Compared to No-Project Conditions	**N/A**	**2.06**

Scenario B.2 has a B/C greater than 1.0; therefore, the proposed improvements at Los Ranchos Road, Crestmont Drive, and Biddle Ranch Road would provide a positive return on investment along SR 227.

Exhibit 68 shows the accumulated cost of all four performance measures for No-Project conditions and corridor Scenario B.2. Scenario B.2 starts off with a greater accumulated cost because of the initial capital costs required to construct the improvements. The accumulated costs for the No-Project conditions increase faster than Scenario B.2 because of the high societal cost of delay and safety. The difference in the accumulated costs in the design year is $7.3 million in favor of Scenario B.2.

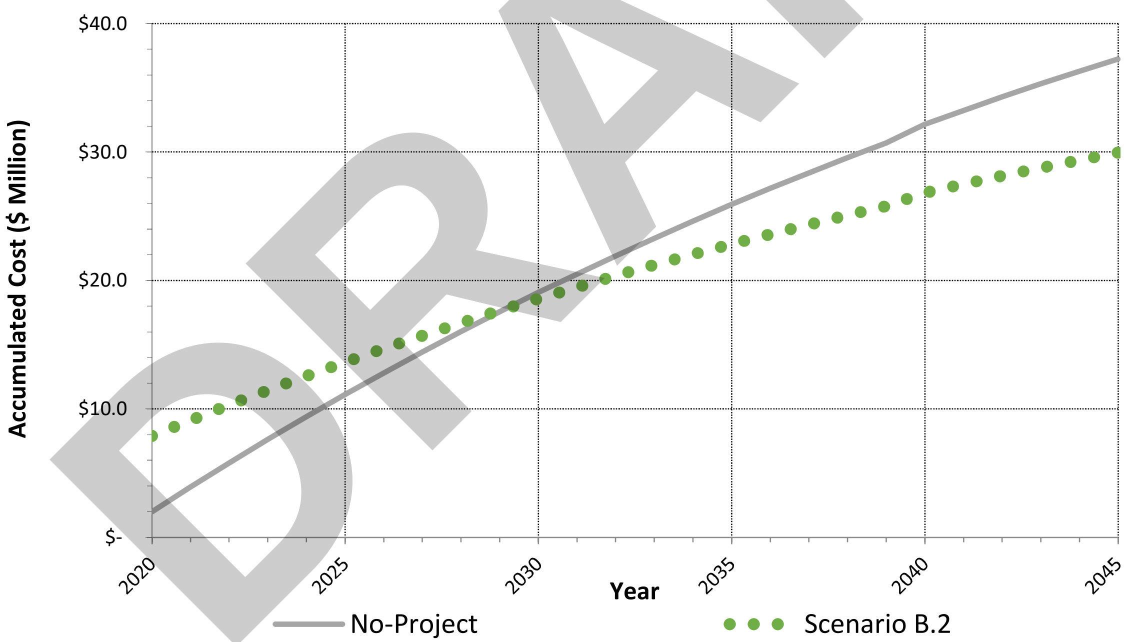


Exhibit 68 – Accumulated Costs: No-Project vs Scenario B.2

Microsimulation Summary of Scenario B.2 Corridor

Scenario B.2 builds on Scenario B.1, making Crestmont Drive turn-restricted and adding a TWLTL at Biddle Ranch Road to allow two-stage left-turns from the side streets. The intersection delay and LOS results from the microsimulation analysis of Scenario B.2 are presented in **Table 31** and travel time results are presented **Table 32. Exhibit 69** is a visual representation of the intersection delays and **Exhibits 70-73** compare the No-Project and Scenario B.2 travel times and average travel speeds. The AM peak-hour is from 7:45 – 8:45 AM and the PM peak-hour is from 4:45 – 5:45 PM.

Table 31 – Scenario B.2 Intersection Delay and LOS Results

No	Intersection	Scenario B.2 (2020)				Scenario B.2 (2045)			
		AM Peak		PM Peak		AM Peak		PM Peak	
		DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS
1	SR 227 & Aero Dr	7.4	A	10.0	B	7.5	A	89.0	F
2	SR 227 & Airport Dr	0.7	A	4.4	A	1.0	A	29.0	D
3	SR 227 & Farmhouse Ln	0.6	A	1.2	A	2.9	A	33.2	D
4	SR 227 & Firestation Dwy	0.7	A	2.0	A	0.7	A	18.8	C
5	SR 227 & Kendall Rd	2.2	A	5.2	A	2.4	A	27.5	D
6	SR 227 & Buckley Rd	14.2	B	37.1	D	18.3	B	57.1	E
7	SR 227 & Crestmont Dr	6.0	A	2.4	A	11.5	B	2.5	A
8	SR 227 & Los Ranchos Rd	12.7	B	5.7	A	27.6	D	6.5	A
9	SR 227 & Biddle Ranch Rd	4.2	A	2.2	A	7.6	A	2.4	A
10	SR 227 & Price Canyon Rd	17.4	B	9.2	A	18.0	B	9.7	A

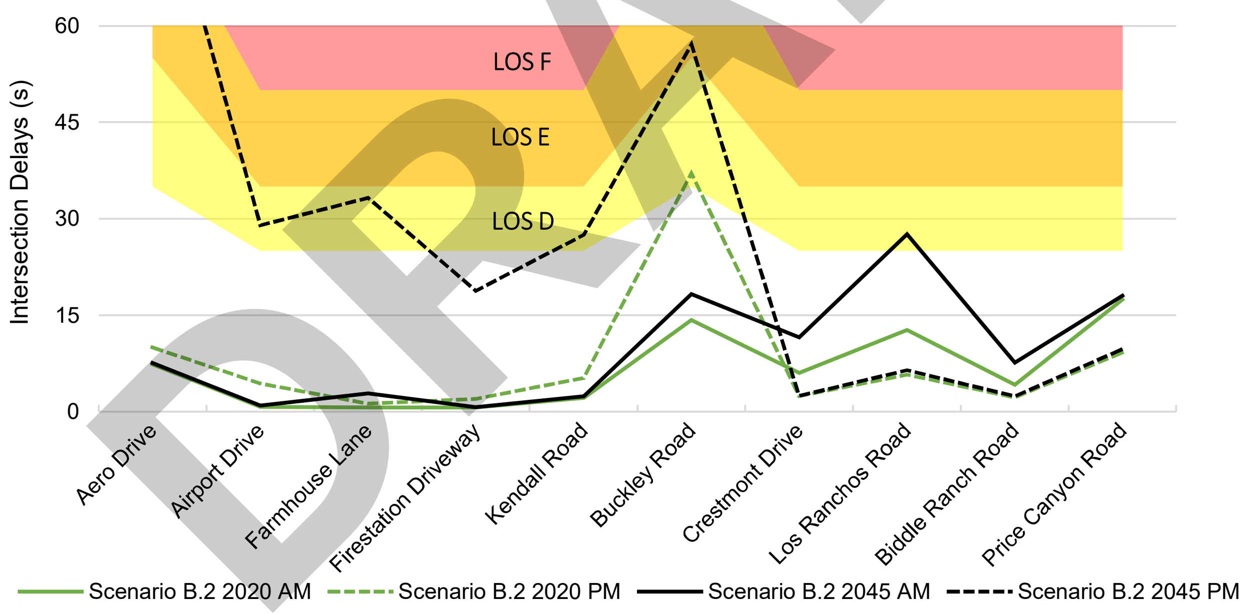


Exhibit 69 – Scenario B.2 Intersection Delay

Table 32 – Scenario B.2 Simulated Model Travel Time Results

Route	Scenario B.2 (2020)		Scenario B.2 (2045)	
	AM Peak (mm:ss)	PM Peak (mm:ss)	AM Peak (mm:ss)	PM Peak (mm:ss)
NB 227 from Price Canyon to Aero	05:23	04:37	06:21	04:41
SB 227 from Aero to Price Canyon	04:56	05:30	04:59	08:33

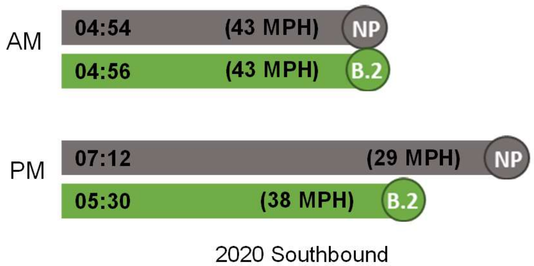


Exhibit 70 –2020 SB Travel Times

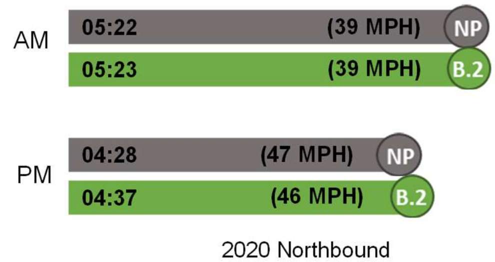


Exhibit 71 –2020 NB Travel Times

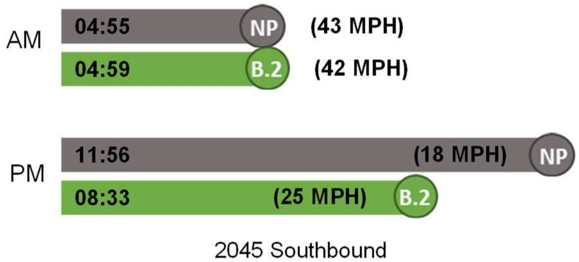


Exhibit 72 –2045 SB Travel Times

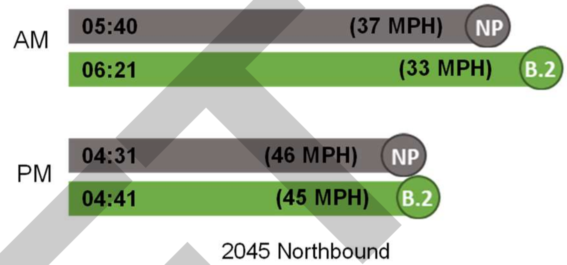


Exhibit 73 –2045 NB Travel Times

The results from Scenario B.2 are similar to the results from Scenario B.1. Issues that existed in Scenario B.2 such as higher delays for NB travel during the AM peak hour, and the intersection of Buckley Road becoming a chokepoint in 2045 for the PM peak hour are also observed in Scenario B.2. Both improvements made in Scenario B.2 were related to improving the safety and delays on the side streets and therefore did not improve the travel time on SR 227 when compared to Scenario B.1.

Improvements in delays can be seen for Scenario B.2 when comparing to No-Project conditions in design years 2020 and 2045. The most noticeable differences can be seen in the PM peak hour results when comparing scenarios B.1 and B.2, since that is when the network is most congested. Crestmont Drive operates at LOS C and LOS E during Scenario B.1 2020 and 2045 PM peak hours, respectively. Scenario B.1 improves Crestmont Drive to LOS A in both design year PM peak hours. The delay at Biddle Ranch Road is similar for Scenarios B.1 and B.2.

Implementation Strategy

The existing Buckley Road intersection does not allow U-turns; therefore, if Crestmont is turn-restricted improvements to the Buckley Road intersection will be needed to accommodate U-turning vehicles. Improvements will be needed to modify the signal phasing and potential construction would be required at Buckley Road to allow U-turns. These improvements can have significant impacts on intersection delays at Buckley Road.

SCENARIO B.3 – 2-LANE CORRIDOR PHASE 3

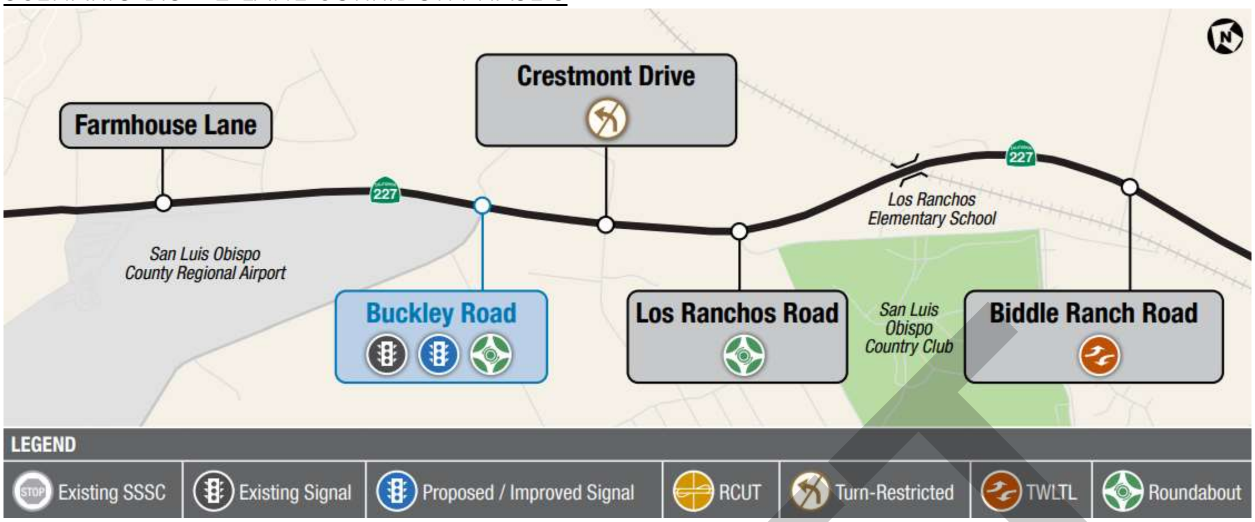


Exhibit 74 – Scenario B.3 Corridor - Evaluated Intersection Controls

Scenario B.3 builds on Scenario B.2, meaning Scenario B.3 assumes there are already improvements at Los Ranchos Road, Crestmont Drive, and Biddle Ranch Road. The remaining intersections will remain unchanged except for the study intersection, Buckley Road.

Buckley Road - Isolated Intersection Performance Measures Summary

The following performance measures for Buckley Road were determined assuming it was an isolated intersection, meaning that upstream and downstream effects from adjacent intersections were not considered. The analysis was performed for the 25-year life-cycle of the corridor from 2020 to 2045.

Three (3) intersection control types were analyzed at the study intersection:

- No-Project signal
- Widened corridor signal
  - Assumes two travel lanes in each direction on SR 227 between Aero Drive and Los Ranchos Road
- Multi-lane roundabout

Benefit Performance Measures:

Safety Benefits

The safety benefit of the proposed improvement is realized when the cost of safety of the proposed improvement is less than the cost of safety for the existing intersection. There is less societal cost associated with a roundabout than for signals because there are fewer predicted crashes with less severities.

Preferred Alternative:

Based on the lowest predicted life-cycle cost for safety, the preferred intersection control type for Buckley Road is a roundabout.

Exhibit 75 – Cost of Safety at Buckley Road

Delay Reduction Benefits

The delay reduction benefit of the proposed improvement is realized when the cost of delay of the proposed improvement is less than the cost of delay for the existing intersection. There is less societal cost associated with the widened signal and roundabout compared to the existing signal. Both proposed alternatives will be more efficient than the existing conditions.

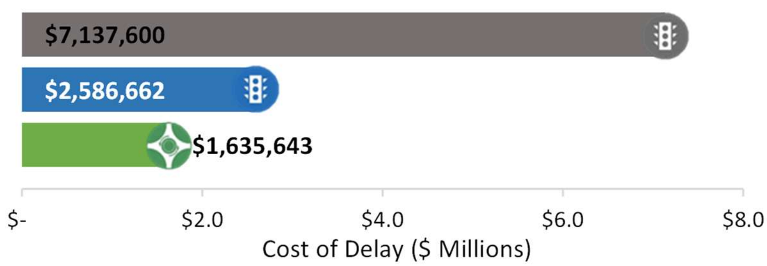


Exhibit 76 – Cost of Delay at Buckley Road

Preferred Alternative:

Based solely on the lowest predicted life-cycle cost for delay, the preferred intersection control type for Buckley Road is a roundabout.

Cost Performance Measures:

Operations and Maintenance (O&M) Costs

O&M costs measure common annualized costs associated with operating and maintaining the intersection control. Both signalized alternatives have similar O&M costs, but the widened signal is slightly greater because there are more costs associated with pavement rehabilitation due to its larger footprint. The roundabout has the least amount of O&M costs because it does not have added costs associated with signal power consumption, maintenance, and retiming.

Exhibit 77 – O&M Costs at Buckley Road

Preferred Alternative:

Based solely on lowest expected life-cycle O&M costs, the preferred intersection control type for Buckley Road is a roundabout.

Initial Capital Costs (ICC)

ICC estimate the capital needed to plan, design, and construct the proposed improvements. The No-Project signal does not have any initial capital costs associated with it because it is the existing condition. The proposed signal ICC accounts for roadway widening along the corridor.

Exhibit 78 – Estimated ICC at Buckley Road

Preferred Alternative:

Based solely on lowest expected range of Initial Capital Costs, the preferred intersection control type for Buckley Road is the No-Project traffic signal.

In the following tables please note that *No-Project (Signal)* refers to the No-Project conditions, *Signal (5-Lane Corridor)* refers to the widened corridor signal, and *Roundabout* refers to the multi-lane roundabout alternative. Table 33 depicts the performance measure costs associated with each intersection control.

Table 33 – Performance Measure Life Cycle Costs for Buckley Road

PERFORMANCE MEASURE LIFE CYCLE COST (NET PRESENT VALUE)[22]			
Safety			
	No-Project (Signal)	**Signal (5-Lane Corridor)**	**Roundabout**
Annual Cost of Collisions	$169,664	$239,662	$86,497
Discounted Life Cycle Cost of Collisions	$2,650,500	$3,744,012	$1,351,268
Delay			
	No-Project (Signal)	**Signal (5-Lane Corridor)**	**Roundabout**
Annual Quantity (hours)	22895	7955	5028
Annual Cost	$274,523	$99,487	$62,909
Discounted Life Cycle Cost of Delay	$7,137,600	$2,586,662	$1,635,643
Operations and Maintenance			
	No-Project (Signal)	**Signal (5-Lane Corridor)**	**Roundabout**
Annual O&M Costs	$9,700	$9,700	$1,056
Discounted Life Cycle O&M Costs	$151,534	$151,534	$16,490
Discounted Pavement Rehab Costs	$66,573	$91,699	$98,445
Total O&M Costs	$218,107	$243,233	$114,935
Initial Capital[23]			
	No-Project (Signal)	**Signal (5-Lane Corridor)**	**Roundabout**
High Approximation	$0	$7,100,000	$4,000,000
Low Approximation	$0	$6,700,000	$3,000,000

Benefit Cost Ratio Scoring

The first stage of B/C analysis involves comparing all proposed alternatives to the No-Project intersection control. Table 34 depicts the values used to determine the B/C ratio of the intersection over its design-life. The added benefits were calculated by subtracting the discounted life-cycle costs of the proposed intersection control by the discounted life-cycle costs of the existing control. A positive value indicates that the proposed intersection will provide a benefit for that performance measure. The added benefits of safety and delay are summed to create the total added benefits for the proposed intersection. The added costs were calculated by subtracting the discounted life-cycle costs of the existing intersection by the discounted life-cycle costs of the proposed control. A positive value indicates that the proposed intersection will have additional costs associated with it. The added costs of O&M and ICC are summed to create the total added costs for the proposed intersection. The B/C ratio is calculated by dividing the total added benefits by the total added costs.

[22] Costs associated with 25-year life-cycle adjusted to a net present value using a discount rate of 4%.

[23] Initial Capital Costs (ICC) – measuring the capital costs needed to plan, design, and construct the proposed improvement in 2021 dollar value.

Table 34 – Stage 1 Benefit-Cost Analysis for Buckley Road

Added Benefits (B)			
Added Benefits Compared to No-Project Conditions	**No-Project (Signal)**	**Signal (5-Lane Corridor)**	**Roundabout**
Safety	$ -	$ (1,093,512)	$ 1,299,232
Delay	$ -	$ 4,550,938	$ 5,501,957
Added Benefits	**$ -**	**$ 3,457,426**	**$ 6,801,189**
Added Costs (C)			
Added Cots Compared to No-Project Conditions	**No-Project (Signal)**	**Signal (5-Lane Corridor)**	**Roundabout**
O&M	$ -	$ 25,126	$ (103,171)
Initial Capital	$ -	$ 6,900,000	$ 3,500,000
Added Costs	**$ -**	**$ 6,925,126**	**$ 3,396,829**
B/C Ratio Compared to No-Project Conditions	**N/A**	**0.50**	**2.00**

There is only one proposed alternative that has a B/C greater than 1.0; therefore, the second stage of B/C analysis is not necessary. A roundabout is the preferred alternative at Buckley Road.

Table 35 is an estimation of the B/C values for the estimated range of ICC assuming safety and delay benefits are held constant. Also included in the table is an estimate of the added ICC costs of the roundabout needed to achieve a B/C equal to 1.0.

Table 35 – Benefit-Cost Ranges for Buckley Road

Benefit-Cost Ratio Calculations for (A) vs (B)							
	Initial Capital Cost			Project Constraints			
B/C Target	Existing (Signal) (A)	Roundabout (B)	Added Cost (C) = (B - A)	Added O&M Cost for (D)	Total Benefits (E)	Total Costs (F) = (C + D)	B/C (G) = (E / F)
High	$ -	$ 3,000,000	$ 3,000,000			$ 2,896,829	2.35
Low	$ -	$ 4,000,000	$ 4,000,000	$ (103,171)	$ 6,801,189	$ 3,896,829	1.75
RAB Budget	$ -	$ 6,904,360	$ 6,904,360			$ 6,801,189	1.00

Note: The 'High' value calculates the highest Roundabout B/C. Assuming the the low Roundabout ICC. The 'Low' value calculates the lowest Roundabout B/C. Assuming the high Roundabout ICC.

Exhibit 79 shows the accumulated cost of all four performance measures for each alternative. The proposed signal starts off with the greatest accumulated cost because of the initial capital costs required to construct the improvements. The accumulated costs for the No-Project conditions increase faster than the proposed signal and the roundabout because of the high annual societal cost of delay. The difference in the accumulated costs at 2045 between the proposed roundabout and signal are about $7 million.

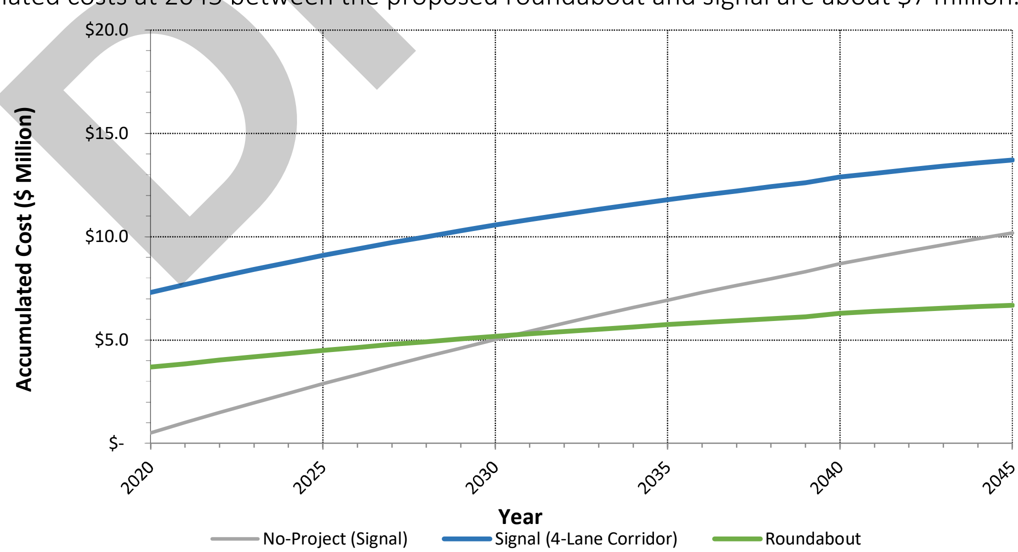


Exhibit 79 – Accumulated Costs: Buckley Road

Recommended Control Type

The recommended alternative based on B/C ratio for Buckley Road is roundabout control. The B.3 corridor microsimulation analysis models Buckley Road as a multi-lane roundabout.

Corridor Benefit-Cost Analysis

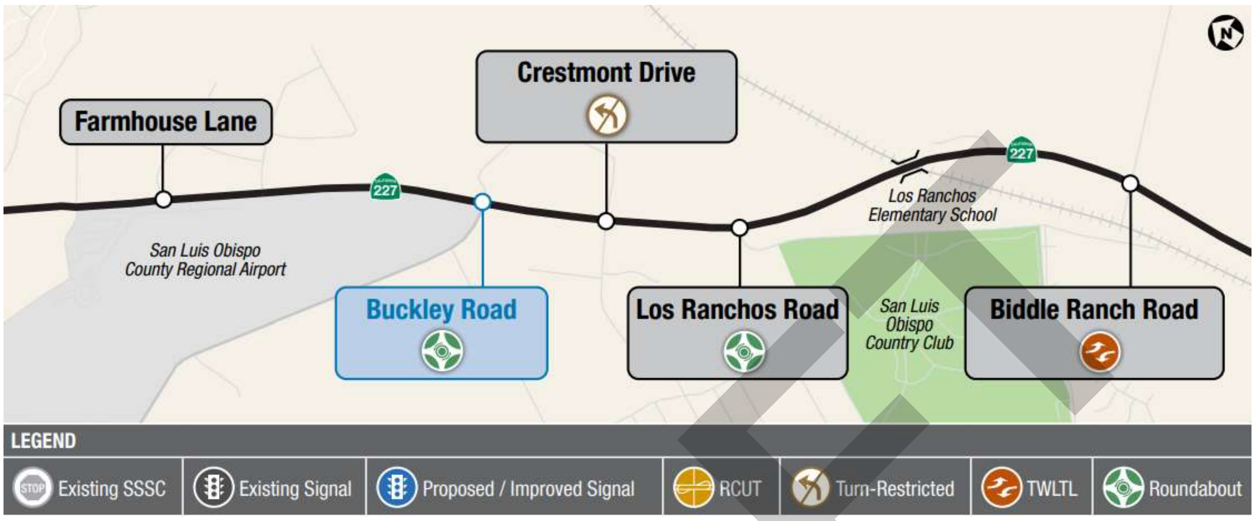


Exhibit 80 – Scenario B.3 Corridor – Preferred Intersection Controls

The following section compares the performance measures for all five study intersections along the corridor between the No-Project condition and Scenario B.3.

Benefit Performance Measures:

Safety Benefits

The safety benefit of the proposed improvement is realized when the cost of safety of the proposed improvement is less than the cost of safety for the existing intersection. Scenario B.3 has less societal cost associated with safety because the severity of the predicted crashes at the study intersections are less for the proposed control types compared to the No-Project conditions.

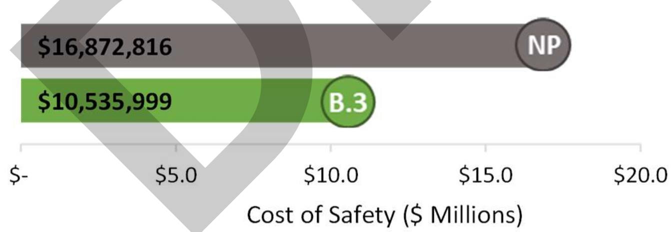


Exhibit 81 – Cost of Safety: No-Project vs Scenario B.3

Preferred Alternative:

B.3

Based on the lowest predicted life-cycle cost for safety, the preferred scenario along SR 227 is B.3.

Delay Reduction Benefits

The delay reduction benefit of the proposed improvement is realized when the cost of delay of the proposed improvement is less than the cost of delay for the existing intersection. There is less societal cost associated with Scenario B.3 because the improvements at the study intersections increase capacity and reduce the average delay compared to the No-Project conditions.

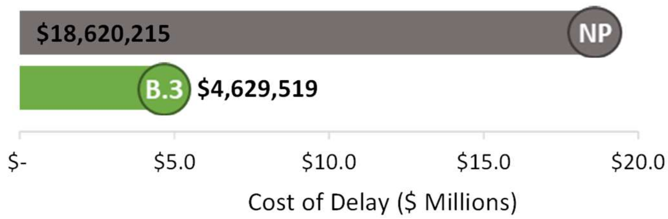


Exhibit 82 – Cost of Delay: No-Project vs Scenario B.3

Preferred Alternative:

B.3

Based solely on the lowest predicted life-cycle cost for delay, the preferred scenario along SR 227 is B.3.

Cost Performance Measures:

Operations and Maintenance (O&M) Costs

O&M costs measure common annualized costs associated with operating and maintaining the intersection control. Scenario B.3 has lower O&M costs primarily because Los Ranchos Road and Buckley Road no longer require additional costs associated with being signalized.

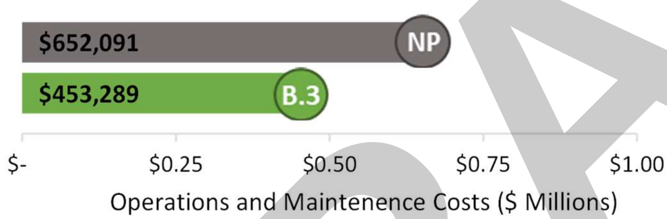


Exhibit 83 – O&M Costs: No-Project vs Scenario B.3

Preferred Alternative:

B.3

Based solely on lowest expected life-cycle O&M costs, the preferred scenario along SR 227 is B.3.

Initial Capital Costs (ICC)

ICC estimate the capital needed to plan, design, and construct the proposed improvements. The No-Project alternative does not have any initial capital costs associated with it because it is the existing condition. Scenario B.3 ICC includes the construction of the improvements at Los Ranchos Road, Crestmont Drive, Biddle Ranch Road, and Buckley Road.

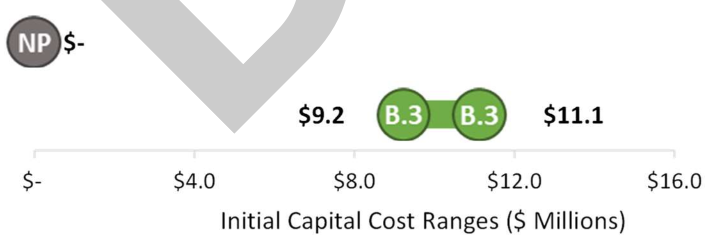


Exhibit 84 – Estimated ICC: No-Project vs Scenario B.3

Preferred Alternative:

NP

Based solely on lowest expected range of Initial Capital Costs preferred scenario along SR 227 is the No-Project Condition.

The following table lists the total discounted life-cycle costs for each performance measure along the corridor for Scenario B.3.

Table 36 – No-Project Conditions and Scenario B.3 Performance Values

PERFORMANCE MEASURE LIFE CYCLE COST (NET PRESENT VALUE) [24]		
Safety		
Discounted Life Cycle Cost of Collisions	**No-Project**	**Scenario B.3**
Farmhouse Lane	$1,961,646	$1,961,646
Buckley Road	$2,650,500	$1,351,268
Crestmont Drive	$4,096,782	$2,843,423
Los Ranchos Road	$3,133,218	$1,059,470
Biddle Ranch Road	$5,030,671	$3,320,192
Total Discounted Life Cycle Cost of Collisions	**$16,872,816**	**$10,535,999**
Delay		
Discounted Life Cycle Cost of Delay	**No-Project**	**Scenario B.3**
Farmhouse Lane	$289,802	$289,802
Buckley Road	$7,137,600	$1,635,643
Crestmont Drive	$205,391	$265,284
Los Ranchos Road	$6,612,741	$1,767,191
Biddle Ranch Road	$4,374,680	$671,599
Total Discounted Life Cycle Cost of Delay	**$18,620,215**	**$4,629,519**
Operations and Maintenance		
Discounted Life Cycle Cost of O&M	**No-Project**	**Scenario B.3**
Farmhouse Lane	$57,686	$57,686
Buckley Road	$218,107	$114,935
Crestmont Drive	$56,419	$84,883
Los Ranchos Road	$246,387	$119,622
Biddle Ranch Road	$73,492	$76,162
Total Discounted Life Cycle O&M Costs	**$652,091**	**$453,289**
Initial Capital Costs		
Discounted Life Cycle Cost of ICC	**No-Project**	**Scenario B.3**
Farmhouse Lane	$0	$0
Buckley Road	$0	$3,500,000
Crestmont Drive	$0	$900,000
Los Ranchos Road	$0	$5,500,000
Biddle Ranch Road	$0	$250,000
Total Average Approximation	**$0**	**$10,150,000**

A B/C ratio was calculated for Scenario B.3 to determine the expected ROI based on the four performance measures. Table 37 depicts the values used to determine the B/C ratio of the corridor over its design-life. The added benefits were calculated by subtracting the discounted life-cycle costs of the proposed corridor control by the discounted life-cycle costs of the existing control. A positive value indicates that the proposed corridor will provide a benefit for that performance measure. The added benefits of safety and delay are summed to create the total added benefits for the proposed corridor. The added costs were calculated by subtracting the discounted life-cycle costs of the existing corridor by the discounted life-cycle costs of the proposed control. A positive value indicates that the proposed corridor will have additional costs associated with it. The added costs of O&M and ICC are summed to create the total added costs for the proposed corridor. The B/C ratio is calculated by dividing the total added benefits by the total added costs.

[24] Costs associated with 25-year life-cycle adjusted to a net present value using a discount rate of 4%. The green highlighted values represent changes in performance measures because of the improvements at Buckley Road. Improvements at Los Ranchos Road, Crestmont Drive, and Biddle Ranch Road are also assumed.

Table 37 – Benefit-Cost Analysis: No-Project Corridor vs Scenario B.3

LIFE CYCLE BENEFIT-COST RATIO		
Added Benefits (B)		
Added Benefits Compared to No-Project Conditions	**No-Project**	**Scenario B.3**
Safety	$ -	$ 6,336,818
Delay	$ -	$ 13,990,696
Added Benefits	**$0**	**$ 20,327,514**
Added Costs (C)		
O&M	$ -	$ (198,802)
Initial Capital	$ -	$ 10,150,000
Added Costs	**$0**	**$ 9,951,198**
B/C Ratio Compared to No-Project Conditions	**N/A**	**2.04**

Scenario B.3 has a B/C greater than 1.0; therefore, the proposed improvements at Los Ranchos Road, Crestmont Drive, Biddle Ranch Road, and Buckley Road would provide a positive return on investment along SR 227.

Exhibit 85 shows the accumulated cost of all four performance measures for No-Project conditions and corridor Scenario B.3. Scenario B.3 starts off with a greater accumulated cost because of the initial capital costs required to construct the improvements. The accumulated costs for the No-Project conditions increase faster than Scenario B.3 because of the high annual societal costs of delay and safety. The difference in the accumulated costs in the design year is $7.3 million in favor of Scenario B.3.

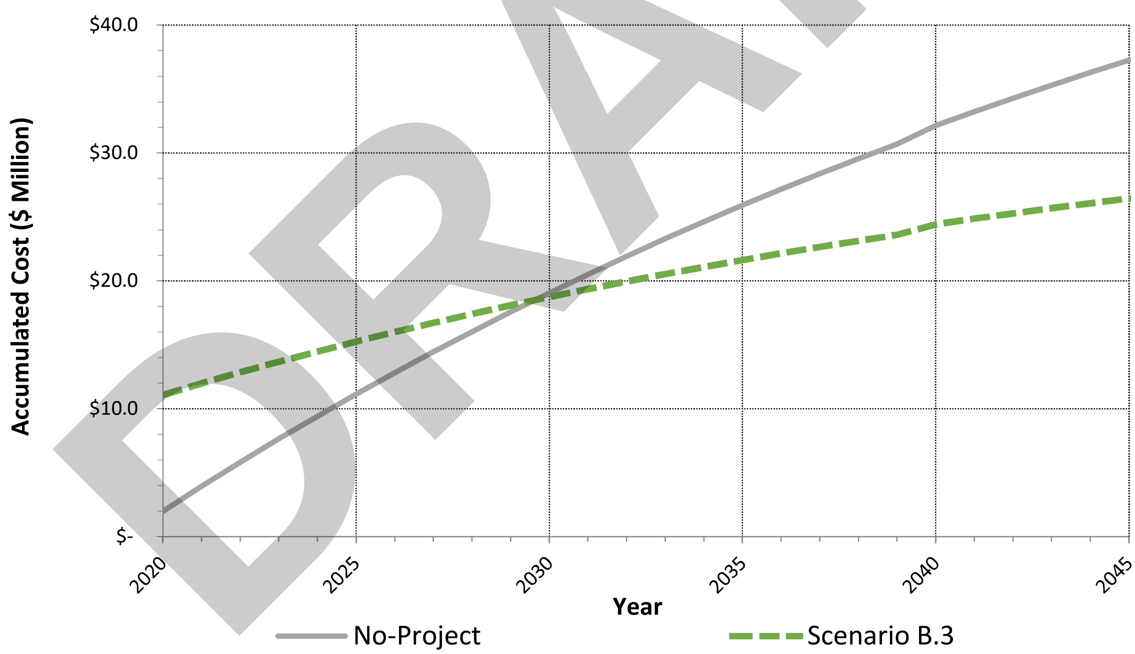


Exhibit 85 – Accumulated Costs: No-Project vs Scenario B.3

Microsimulation Summary of Scenario B.3 Corridor

All the improvements from Scenarios B.1 and B.2 are incorporated into Scenario B.3 plus the intersection of SR 227 and Buckley Road is converted into a roundabout. The intersection delay and LOS results from the microsimulation analysis of Scenario B.3 are presented in **Table 38** and travel time results are presented in **Table 39**. **Exhibit 86** is a visual representation of the intersection delays and **Exhibits 87-90** compare the No-Project and Scenario B.3 travel times and average travel speeds. The AM peak-hour is from 7:45 – 8:45 AM and the PM peak-hour is from 4:45 – 5:45 PM.

Table 38 – Scenario B.3 Intersection Delay and LOS Results

No	Intersection	Scenario B.3 (2020)				Scenario B.3 (2045)			
		AM Peak		PM Peak		AM Peak		PM Peak	
		DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS
1	SR 227 & Aero Dr	7.3	A	9.6	A	7.6	A	10.4	B
2	SR 227 & Airport Dr	0.7	A	3.1	A	1.2	A	4.9	A
3	SR 227 & Farmhouse Ln	0.7	A	0.7	A	5.1	A	14.4	B
4	SR 227 & Firestation Dwy	0.6	A	1.0	A	0.7	A	1.2	A
5	SR 227 & Kendall Rd	2.8	A	1.8	A	3.2	A	2.1	A
6	SR 227 & Buckley Rd	2.9	A	4.2	A	3.4	A	6.6	A
7	SR 227 & Crestmont Dr	2.4	A	2.9	A	3.2	A	5.4	A
8	SR 227 & Los Ranchos Rd	6.1	A	4.3	A	12.5	B	9.9	A
9	SR 227 & Biddle Ranch Rd	4.0	A	2.1	A	4.1	A	2.2	A
10	SR 227 & Price Canyon Rd	17.4	B	10.1	B	18.2	B	11.7	B

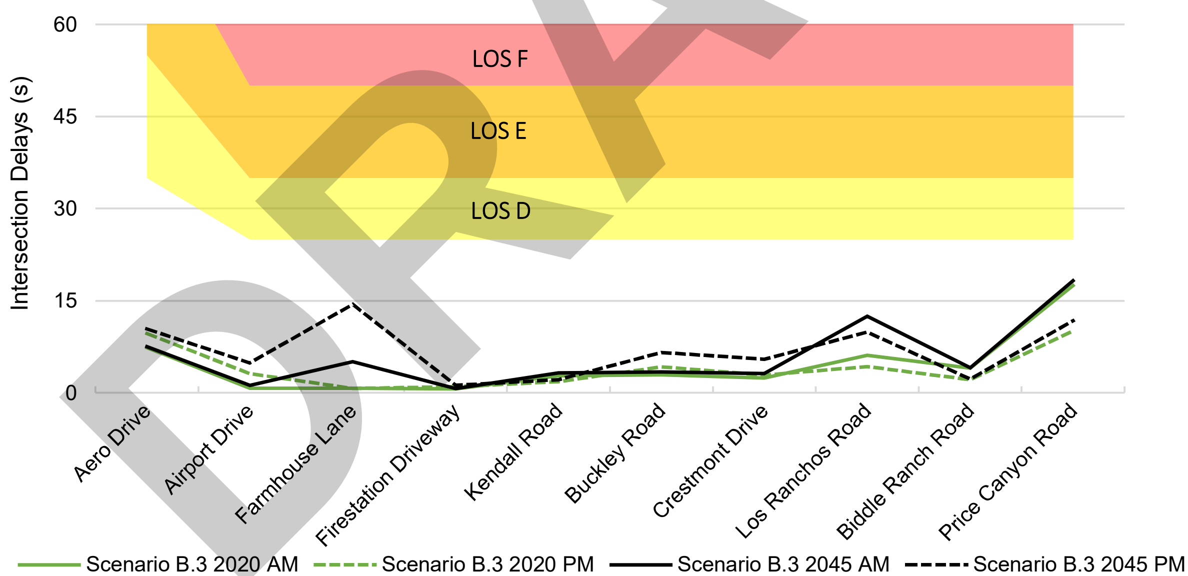


Exhibit 86 – Scenario B.3 Intersection Delay

Table 39 – Scenario B.3 Simulated Model Travel Time Results

Route	Scenario B.3 (2020)		Scenario B.3 (2045)	
	AM Peak (mm:ss)	PM Peak (mm:ss)	AM Peak (mm:ss)	PM Peak (mm:ss)
NB 227 from Price Canyon to Aero	05:08	04:41	05:24	04:45
SB 227 from Aero to Price Canyon	04:58	05:01	05:01	05:13

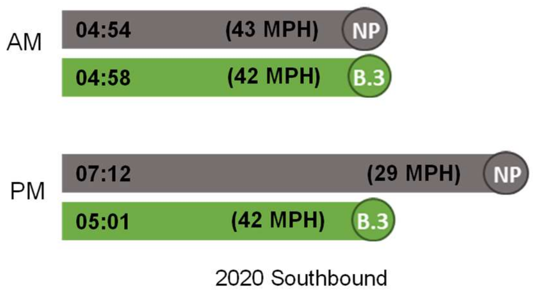


Exhibit 87 –2020 SB Travel Times

Exhibit 88 –2020 NB Travel Times

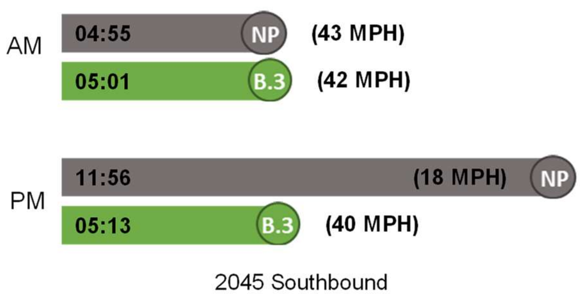


Exhibit 89 –2045 SB Travel Times

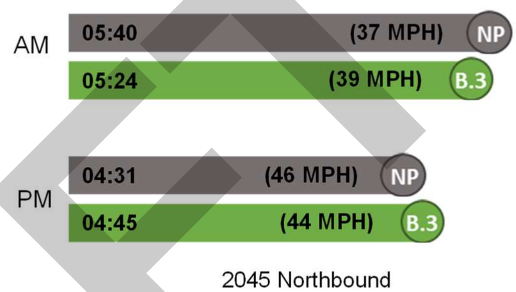


Exhibit 90 –2045 NB Travel Times

Converting the intersection of SR 227 and Buckley Road alleviates all the congestion that was observed in Scenarios B.1 and B.2 due to the intersection not being able to process the 2045 projected traffic volumes. The delays and travel times are comparable to Scenario A, and much improved when compared to the 2045 No-Project. Travel time savings for the PM peak hour is 6 minutes and 43 seconds.

SCENARIO B.4 – 2-LANE CORRIDOR PHASE 4

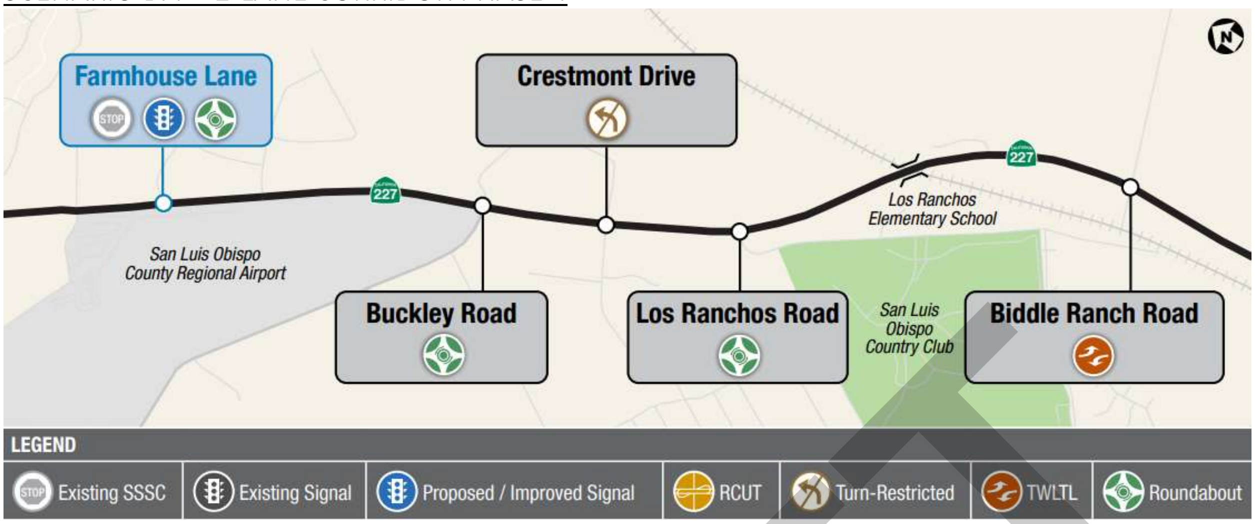


Exhibit 91 – Scenario B.4 Corridor - Evaluated Intersection Controls

Scenario B.4 builds on Scenario B.3, meaning Scenario B.4 assumes there are already improvements at Los Ranchos Road, Crestmont Drive, Biddle Ranch Road, and Buckley Road. The remaining intersections along SR 227 will remain unchanged except for the study intersection, Farmhouse Lane.

Farmhouse Lane - Isolated Intersection Performance Measures Summary

The following performance measures for Farmhouse Lane were determined assuming it was an isolated intersection, meaning that upstream and downstream effects from adjacent intersections were not considered. The analysis was performed for the 25-year life-cycle of the corridor from 2020 to 2045. Signal warrants for peak-hour volumes were met at Farmhouse Lane.[25]

Three (3) intersection control types were analyzed at the study intersection:

- No-Project Side-Street Stop-Control (SSSC)
- Signal
    - Assumes two travel lanes in each direction on SR 227 between Aero Drive and Farmhouse Lane, then tapers back to the No-Project cross section after Farmhouse Lane.
    - Future development plans to implement a signal at Farmhouse Lane.
- Multi-lane roundabout

Benefit Performance Measures:

Safety Benefits

The safety benefit of the proposed improvement is realized when the cost of safety of the proposed improvement is less than the cost of safety for the existing intersection. There is less societal cost associated with a roundabout than for signals because there are fewer predicted crashes with less severities.

[25] For more information regarding Farmhouse Lane signal warrants refer to *SR 227 Corridor Operations Memo*, Kimley-Horn, February 9, 2021.

Exhibit 92 – Cost of Safety at Farmhouse Lane

Preferred Alternative:

Based on the lowest predicted life-cycle cost for safety, the preferred intersection control type for Farmhouse Lane is a roundabout.

Delay Reduction Benefits

The delay reduction benefit of the proposed improvement is realized when the cost of delay of the proposed improvement is less than the cost of delay for the existing intersection. SSSC intersections tend to have less average delay than signals and roundabouts because vehicles traveling on the mainline to not experience any delay. The signal does not experience much delay either because most of the vehicles on the mainline will not experience any delay unless the side-street approach becomes actuated. The roundabout has the highest societal cost of delay because each vehicle experiences some amount of delay because each approach is yield control.

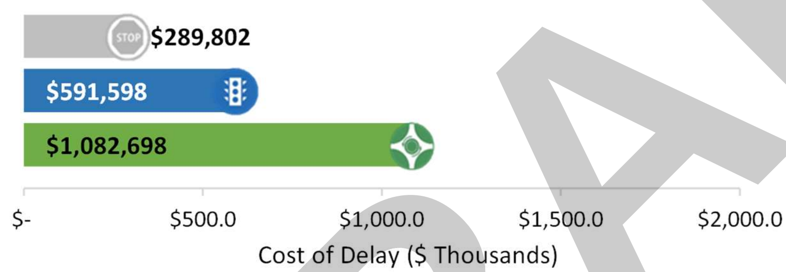


Exhibit 93 – Cost of Delay at Farmhouse Lane

Preferred Alternative:

Based solely on the lowest predicted life-cycle cost for delay, the preferred intersection control type for Farmhouse Lane is the No-Project SSSC.

Cost Performance Measures:

Operations and Maintenance (O&M) Costs

O&M costs measure common annualized costs associated with operating and maintaining the intersection control. The signal has the highest O&M value because of added costs associated with signal power consumption, maintenance, and retiming. The roundabout has a higher O&M value than the SSSC mostly because of additional costs associated with more light poles.

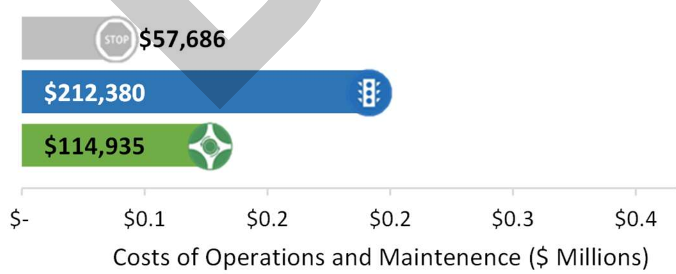


Exhibit 94 – O&M Costs at Farmhouse Lane

Preferred Alternative:

Based solely on lowest expected life-cycle O&M costs, the preferred intersection control type Farmhouse Lane is the No-Project SSSC.

Initial Capital Costs (ICC)

ICC estimate the capital needed to plan, design, and construct the proposed improvements. The No-Project SSSC does not have any initial capital costs associated with it because it is the existing condition. The proposed signal ICC accounts for roadway widening from Aero Drive to just south of Farmhouse Lane.

Exhibit 95 – Estimated ICC at Farmhouse Lane

Preferred Alternative:

Based solely on lowest expected range of Initial Capital Costs, the preferred intersection control type for Farmhouse lane is the No-Project SSSC.

In the following tables please note that *No-Project (SSSC)* refers to the No-Project conditions, *Signal* refers to the widened corridor signal, and *Roundabout* refers to the multi-lane roundabout alternative. Table 40 depicts the performance measure costs associated with each intersection control.

Table 40 – Performance Measure Life Cycle Costs for Farmhouse Lane

PERFORMANCE MEASURE LIFE CYCLE COST (NET PRESENT VALUE)[26]			
Safety			
	No-Project (SSSC)	**Signal**	**Roundabout**
Annual Cost of Collisions	$ 125,569	$ 145,068	$ 45,884
Discounted Life Cycle Cost of Collisions	$ 1,961,646	$ 2,266,258	$ 716,806
Delay			
	No-Project (SSSC)	**Signal**	**Roundabout**
Annual Quantity (hours)	1043	1928	3401
Annual Cost	$ 11,146	$ 22,754	$ 41,642
Discounted Life Cycle Cost of Delay	$ 289,802	$ 591,598	$ 1,082,698
Operations and Maintenance			
	No-Project (SSSC)	**Signal**	**Roundabout**
Annual O&M Costs	$ 450	$ 9,550	$ 1,056
Discounted Life Cycle O&M Costs	$ 7,030	$ 149,191	$ 16,490
Discounted Pavement Rehab Costs	$ 50,656	$ 63,189	$ 98,445
Total O&M Costs	$ 57,686	$ 212,380	$ 114,935
Initial Capital			
	No-Project (SSSC)	**Signal**	**Roundabout**
High Approximation	$0	$3,600,000	$4,600,000
Low Approximation	$0	$3,200,000	$4,000,000

[26] Costs associated with 25-year life-cycle adjusted to a net present value using a discount rate of 4%.

Benefit Cost Ratio Scoring

The first stage of B/C analysis involves comparing all proposed alternatives to the No-Project intersection control Table 41 depicts the values used to determine the B/C ratio of the intersection over its design-life. The added benefits were calculated by subtracting the discounted life-cycle costs of the proposed intersection control by the discounted life-cycle costs of the existing control. A positive value indicates that the proposed intersection will provide a benefit for that performance measure. The added benefits of safety and delay are summed to create the total added benefits for the proposed intersection. The added costs were calculated by subtracting the discounted life-cycle costs of the existing intersection by the discounted life-cycle costs of the proposed control. A positive value indicates that the proposed intersection will have additional costs associated with it. The added costs of O&M and ICC are summed to create the total added costs for the proposed intersection. The B/C ratio is calculated by dividing the total added benefits by the total added costs.

Table 41 – Stage 1 Benefit-Cost Analysis for Farmhouse Lane

Added Benefits (B)			
Added Benefits Compared to No-Project Conditions	**No-Project (SSSC)**	**Signal**	**Roundabout**
Safety	$ -	$ (304,613)	$ 1,244,840
Delay	$ -	$ (301,797)	$ (792,896)
Added Benefits	**$ -**	**$ (606,409)**	**$ 451,944**
Added Costs (C)			
Added Costs Compared to No-Project Conditions	**No-Project (SSSC)**	**Signal**	**Roundabout**
O&M	$ -	$ 154,694	$ 57,249
Initial Capital	$ -	$ 3,400,000	$ 4,300,000
Added Costs	**$ -**	**$ 3,554,694**	**$ 4,357,249**
B/C Ratio Compared to No-Project Conditions	**N/A**	**N/A**[27]	**0.10**

Neither proposed alternative has a B/C greater than 1.0; therefore, the No-Project SSSC would provide the greatest return on investment. However, the side-street approach vehicles will experience excessive delays in the future. The proposed signal and roundabout should also be considered at Farmhouse Lane because the side-street delays for the SSSC fail in both the AM and PM peak hours. See Exhibit 96 for the side-street delays for all the alternatives. Table 42 summarizes the comparison between the proposed signal and a roundabout for the stage 2 B/C analysis for Farmhouse Lane.

[27] A B/C ratio cannot be calculated because the added benefits for the Signal alternative are negative. This is because the No-Project (SSSC) has less societal costs associated with safety and delay.

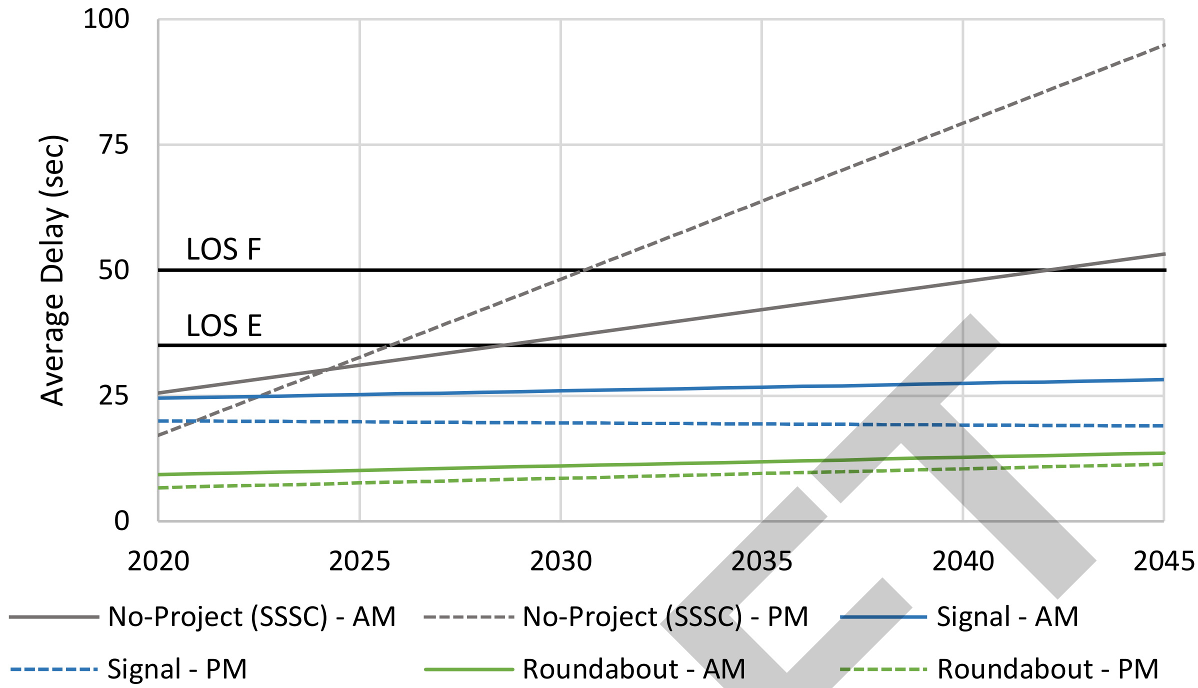


Exhibit 96 – Farmhouse Lane Side-Street Delays

Table 42 – Stage 2 Benefit-Cost Analysis for Farmhouse Lane

Life Cycle Benefit Cost Ratio				
Added Benefits (B)				
Added Benefits Compared to Proposed Signal		**Signal**		**Roundabout**
Safety	$	-	$	1,549,452
Delay	$	-	$	(491,099)
Added Benefits	**$**	-	**$**	**1,058,353**
Added Costs (C)				
Added Cost Compared to Proposed Signal		**Signal**		**Roundabout**
O&M	$	-	$	(97,445)
Initial Capital	$	-	$	900,000
Added Costs	**$**	-	**$**	**802,555**
B/C Ratio Compared to Proposed Signal		**N/A**		**1.32**

is an estimation of the B/C values for the estimated range of ICC assuming safety and delay benefits are held constant Also included in

Table 43 is an estimate of the added ICC costs of the roundabout needed to achieve a B/C equal to 1.0. Exhibit 97 is a visual representation of the sensitivity to initial capital costs. The grey box represents the range of probable ICC and the black line represents a B/C equal to 1.0. The B/C equal to 1.0 line runs through the probable range of ICC costs. This means that the B/C range is highly sensitive to the capital costs. Further refinement of concepts and opinion of probably construction costs (OPCCs) are required to determine a more definitive B/C ratio.

Table 43 – Benefit-Cost Ranges for Farmhouse Lane

Benefit-Cost Ratio Calculations for Signal (A) vs Roundabout (B)							
	Initial Capital Cost			Project Constraints			
	Signal	Roundabout	Added Cost	Added O&M Cost for	Total Benefits	Total Costs	B/C
B/C Target	(A)	(B)	(C) = (B - A)	(D)	(E)	(F) = (C + D)	(G) = (E / F)
High	$ 3,600,000	$ 4,000,000	$ 400,000			$ 302,555	3.50
Low	$ 3,200,000	$ 4,600,000	$ 1,400,000	$ (97,445)	$ 1,058,353	$ 1,302,555	0.81
RAB Budget	$ 3,400,000	$ 4,555,798	$ 1,155,798			$ 1,058,353	1.00

Note: The 'High' value calculates the highest Roundabout B/C. Assuming the high Proposed Signal ICC and the low Roundabout ICC. The 'Low' value calculates the lowest Roundabout B/C. Assuming the low Proposed Signal ICC and the high Roundabout ICC.

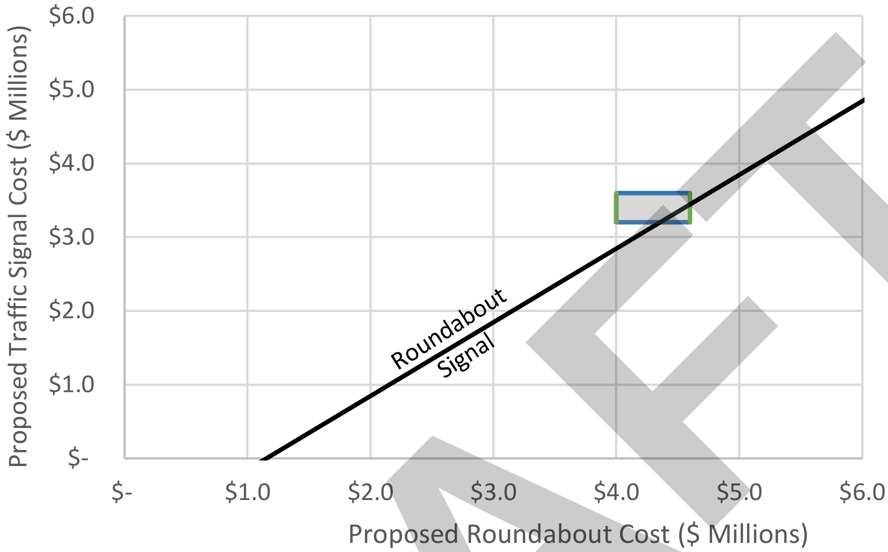


Exhibit 97 – Cost Sensitivity Chart: Farmhouse Lane

Exhibit 98 shows the accumulated cost of all four performance measures for each alternative. The difference in the accumulated costs between the proposed roundabout and the proposed signal in 2045 are about $350,000 in favor of the roundabout.

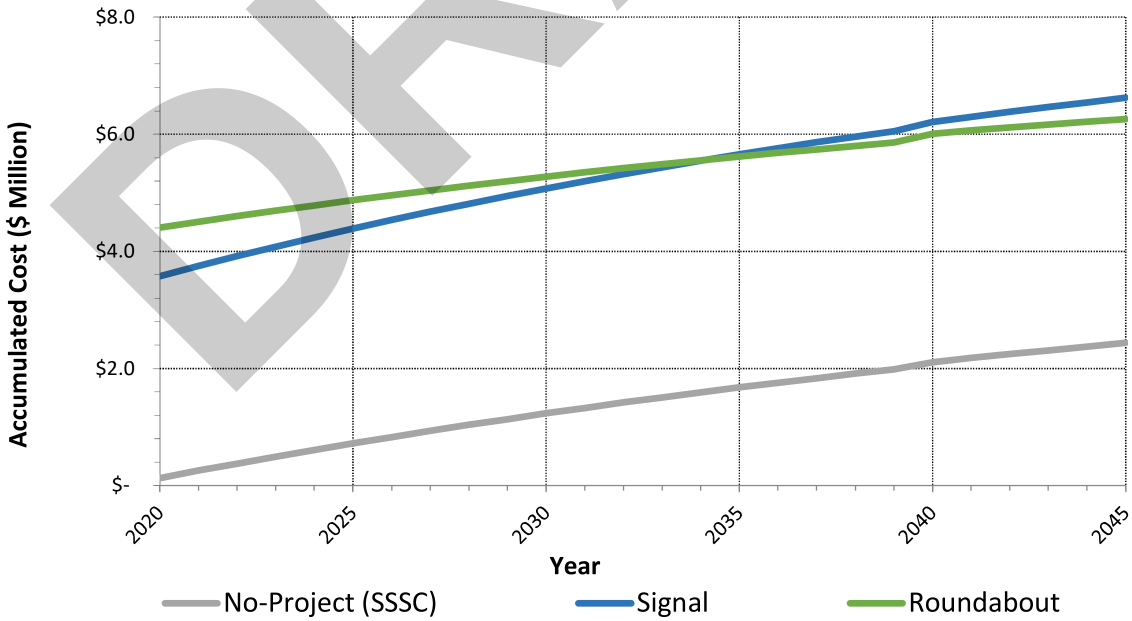


Exhibit 98 – Accumulated Costs: Farmhouse Lane

Recommended Control Type

A roundabout and signal would provide a similar ROI at Farmhouse Lane. The B/C ratio for Farmhouse Lane is cost sensitive, meaning unforeseen changes in initial capital costs can influence which alternative provides a greater ROI. Further analysis is required to determine which alternative would be more ideal for this intersection. The B.4 corridor microsimulation analysis will assume that Farmhouse Lane will be signalized. We decided to model a signal at Farmhouse Lane to maintain intersection control continuity along SR 227 near the airport.

Corridor Benefit-Cost Analysis

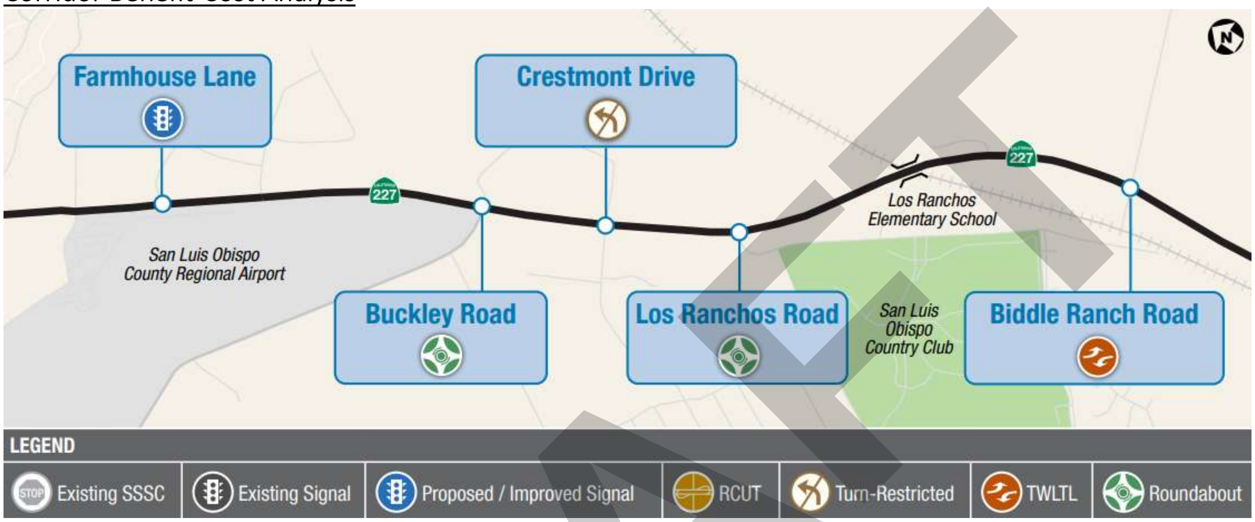


Exhibit 99 - Evaluated Intersection Controls on SR 227 for Scenario B.4 Corridor

The following section compares the performance measures for all five study intersections along the corridor between the No-Project condition and Scenario B.4.

Benefit Performance Measures:

Safety Benefits

The safety benefit of the proposed improvement is realized when the cost of safety of the proposed improvement is less than the cost of safety for the existing intersection. Scenario B.4 has less societal cost associated with safety because the severity of the predicted crashes at the study intersections are less for the proposed control types compared to the No-Project conditions.

Exhibit 100 – Cost of Safety: No-Project vs Scenario B.4

Preferred Alternative:

B.4

Based on the lowest predicted life-cycle cost for safety, the preferred scenario along SR 227 is B.4.

Delay Reduction Benefit

The delay reduction benefit of the proposed improvement is realized when the cost of delay of the proposed improvement is less than the cost of delay for the existing intersection. There is less societal cost associated with Scenario B.4 because the improvements at the study intersections increase capacity and reduce the average delay compared to the No-Project conditions.

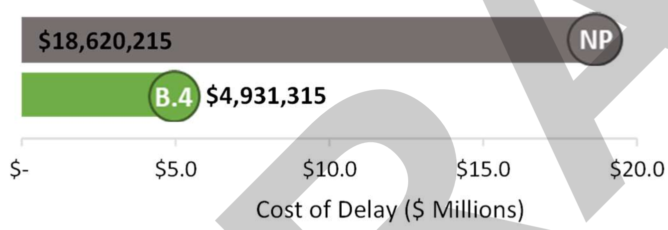


Exhibit 101 – Cost of Delay: No-Project vs Scenario B.4

Preferred Alternative:

B.4

Based solely on the lowest predicted life-cycle cost for delay, the preferred scenario along SR 227 is B.4.

Cost Performance Measures:

Operations and Maintenance Costs (O&M)

O&M costs measure common annualized costs associated with operating and maintaining the intersection control. Scenario B.4 has lower O&M costs primarily because Los Ranchos Road and Buckley Road no longer require additional costs associated with being signalized; however, Farmhouse Lane's O&M costs increase because it is signalized in Scenario B.4.

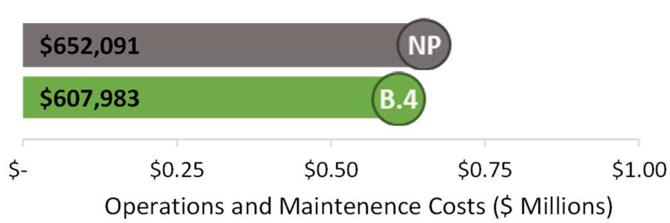


Exhibit 102 – O&M Costs: No-Project vs Scenario B.4

Preferred Alternative:

B.4

Based solely on lowest expected life-cycle O&M costs, the preferred scenario along SR 227 is B.4.

Initial Capital Costs (ICC)

ICC estimate the capital needed to plan, design, and construct the proposed improvements. The No-Project alternative does not have any initial capital costs associated with it because it is the existing condition. Scenario B.4 ICC includes the construction of the improvements at Los Ranchos Road, Crestmont Drive, Biddle Ranch Road, Buckley Road, and Farmhouse Lane.

Preferred Alternative:

Based solely on lowest expected range of Initial Capital Costs preferred scenario along SR 227 is the No-Project Condition.

Exhibit 103 – Estimated ICC: No-Project vs Scenario B.4

The following table lists the total discounted life-cycle costs for each performance measure along the corridor for Scenario B.4.

Table 44 – No-Project Conditions and Scenario B.4 Performance Values

PERFORMANCE MEASURE LIFE CYCLE COST (NET PRESENT VALUE) [28]		
Safety		
Discounted Life Cycle Cost of Collisions	**No-Project**	**Scenario B.4**
Farmhouse Lane	$1,961,646	$2,266,258
Buckley Road	$2,650,500	$1,351,268
Crestmont Drive	$4,096,782	$2,843,423
Los Ranchos Road	$3,133,218	$1,059,470
Biddle Ranch Road	$5,030,671	$3,320,192
Total Discounted Life Cycle Cost of Collisions	**$16,872,816**	**$10,840,612**
Delay		
Discounted Life Cycle Cost of Delay	**No-Project**	**Scenario B.4**
Farmhouse Lane	$289,802	$591,598
Buckley Road	$7,137,600	$1,635,643
Crestmont Drive	$205,391	$265,284
Los Ranchos Road	$6,612,741	$1,767,191
Biddle Ranch Road	$4,374,680	$671,599
Total Discounted Life Cycle Cost of Delay	**$18,620,215**	**$4,931,315**
Operations and Maintenance		
Discounted Life Cycle Cost of O&M	**No-Project**	**Scenario B.4**
Farmhouse Lane	$57,686	$212,380
Buckley Road	$218,107	$114,935
Crestmont Drive	$56,419	$84,883
Los Ranchos Road	$246,387	$119,622
Biddle Ranch Road	$73,492	$76,162
Total O&M Costs	**$652,091**	**$607,983**
Initial Capital Costs		
Discounted Life Cycle Cost of ICC	**No-Project**	**Scenario B.4**
Farmhouse Lane	$0	$3,400,000
Buckley Road	$0	$3,500,000
Crestmont Drive	$0	$900,000
Los Ranchos Road	$0	$5,500,000
Biddle Ranch Road	$0	$250,000
Total Average Approximation	**$0**	**$13,550,000**

A B/C ratio was calculated for Scenario B.4 to determine the expected ROI based on the four performance measures. Table 45 depicts the values used to determine the B/C ratio of the corridor over its design-life. The added benefits were calculated by subtracting the discounted life-cycle costs of the proposed corridor control by the discounted life-cycle costs of the existing control. A positive value indicates that the proposed corridor will provide a benefit for that performance measure. The added benefits of safety and delay are summed to create the total added benefits for the proposed corridor. The added costs were calculated by subtracting the discounted life-cycle costs of the existing corridor by the discounted life-cycle costs of the proposed control. A positive value indicates that the proposed corridor will have additional costs associated with it. The added costs of O&M and ICC are summed to create the total added costs for the proposed corridor. The B/C ratio is calculated by dividing the total added benefits by the total added costs.

[28] Costs associated with 25-year life-cycle adjusted to a net present value using a discount rate of 4%. The green highlighted values represent changes in performance measures because of the improvements at Farmhouse Lane. Improvements at Los Ranchos Road, Crestmont Drive, Biddle Ranch Road, and Buckley Road are also assumed.

Table 45 – Benefit-Cost Analysis: No-Project Corridor vs Scenario B.4

LIFE CYCLE BENEFIT-COST RATIO		
Added Benefits (B)		
Added Benefits Compared to No-Project Conditions	**No-Project**	**Scenario B.4**
Safety	$ -	$ 6,032,205
Delay	$ -	$ 13,688,900
Added Benefits	**$0**	**$19,721,104**
Added Costs (C)		
O&M	$ -	$ (44,109)
Initial Capital	$ -	$ 13,550,000
Added Costs	**$0**	**$13,505,891**
B/C Ratio Compared to No-Project Conditions	**N/A**	**1.46**

Scenario B.4 has a B/C greater than 1.0; therefore, the proposed improvements at Los Ranchos Road, Crestmont Drive, Biddle Ranch Road, Buckley Road, and Farmhouse Lane would provide a positive return on investment along SR 227.

Exhibit 104 shows the accumulated cost of all four performance measures for No-Project conditions and corridor Scenario B.4. Scenario B.4 starts off with a greater accumulated cost because of the initial capital costs required to construct the improvements. The accumulated costs for the No-Project conditions increase faster than Scenario B.4 because of the high annual societal cost of delay and safety. The difference in the accumulated costs in the design year is $6.6 million in favor of Scenario B.4.

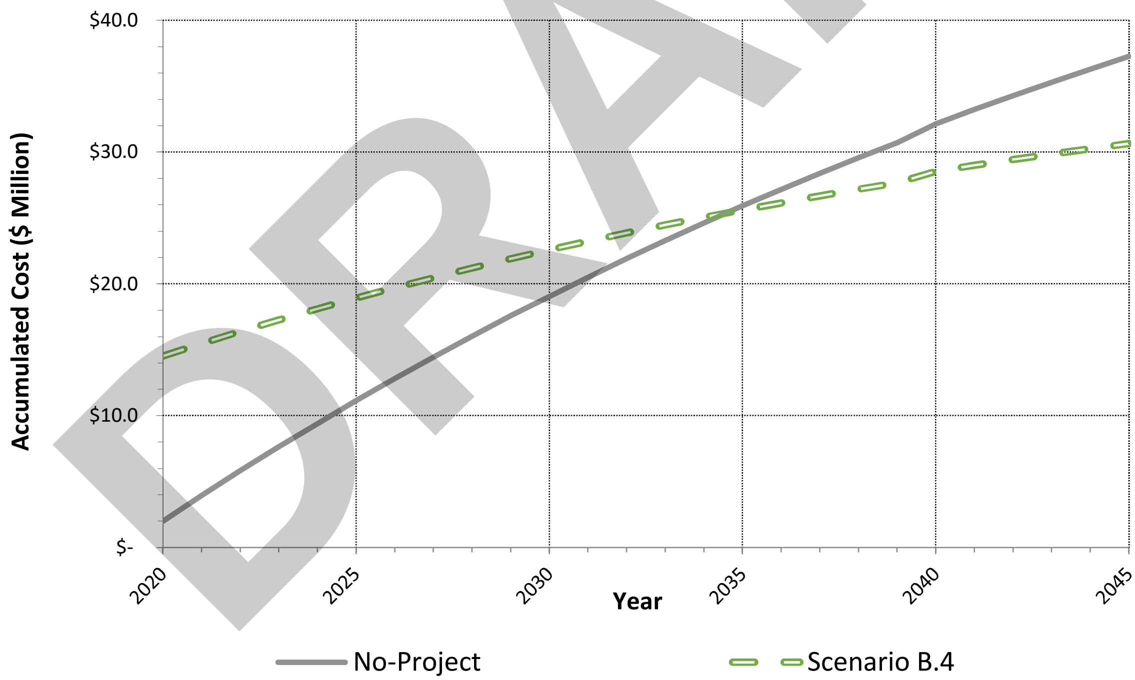


Exhibit 104 – Accumulated Costs: No-Project vs Scenario B.4

Microsimulation Summary of Scenario B.4 Corridor

Scenario B.4 includes all the improvements from the previous scenarios (scenarios B.1-B.3) and consolidating the Firestation Driveway with the intersection of Farmhouse Lane and adding a signal. The intersection delay and LOS results from the microsimulation analysis of Scenario B.4 are presented in **Table 46** and travel time results are presented in **Table 47**. **Exhibit 105** is a visual representation of the intersection delays and **Exhibits 106-109** compare the No-Project and Scenario B.4 travel times and average travel speeds. The AM peak-hour is from 7:45 – 8:45 AM and the PM peak-hour is from 4:45 – 5:45 PM.

Table 46 – Scenario B.4 Intersection Delay and LOS Results

No	Intersection	Scenario B.4 (2020)				Scenario B.4 (2045)			
		AM Peak		PM Peak		AM Peak		PM Peak	
		DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS
1	SR 227 & Aero Dr	7.4	A	9.1	A	7.6	A	8.8	A
2	SR 227 & Airport Dr	1.1	A	0.9	A	1.6	A	3.0	A
3	SR 227 & Farmhouse Ln	8.3	A	10.0	A	15.9	B	25.0	C
4	SR 227 & Firestation Dwy	-	-	-	-	-	-	-	-
5	SR 227 & Kendall Rd	3.1	A	5.3	A	4.0	A	9.5	A
6	SR 227 & Buckley Rd	3.2	A	4.6	A	3.8	A	7.7	A
7	SR 227 & Crestmont Dr	2.4	A	3.0	A	3.3	A	7.3	A
8	SR 227 & Los Ranchos Rd	5.9	A	4.3	A	12.2	B	10.3	B
9	SR 227 & Biddle Ranch Rd	4.1	A	2.2	A	4.1	A	2.2	A
10	SR 227 & Price Canyon Rd	17.8	B	9.2	A	18.2	B	11.7	B

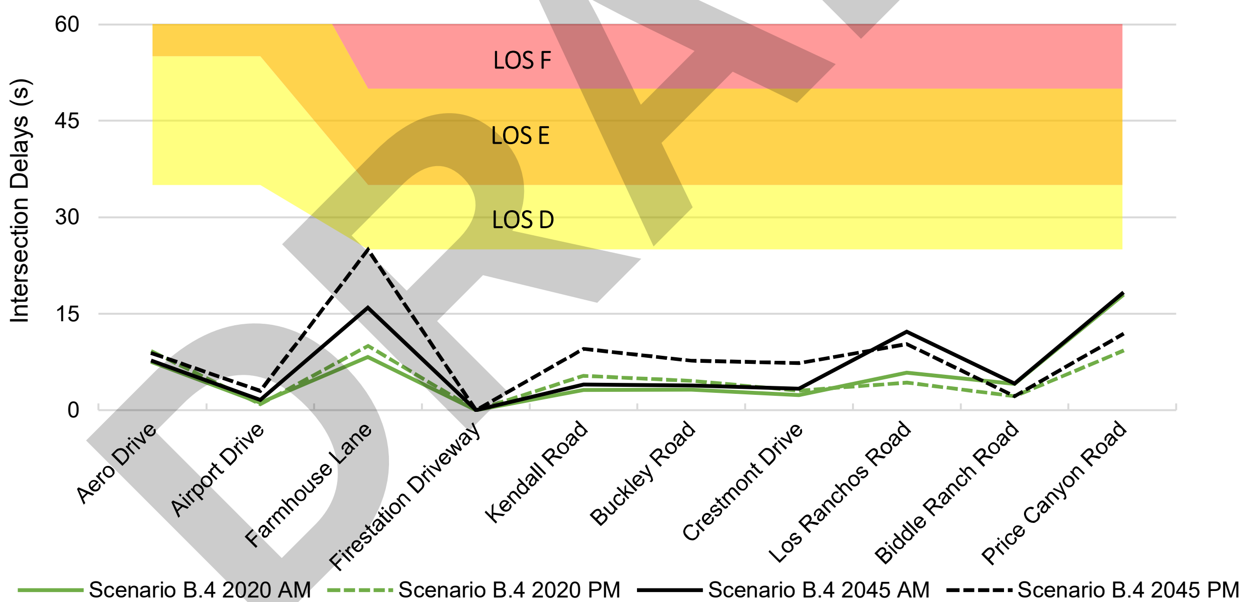


Exhibit 105 – Scenario B.4 Intersection Delay

Table 47 – Scenario B.4 Simulated Model Travel Time Results

Route	Scenario B.4 (2020)		Scenario B.4 (2045)	
	AM Peak (mm:ss)	PM Peak (mm:ss)	AM Peak (mm:ss)	PM Peak (mm:ss)
NB 227 from Price Canyon to Aero	05:14	04:42	05:37	04:56
SB 227 from Aero to Price Canyon	05:04	05:07	05:09	05:36

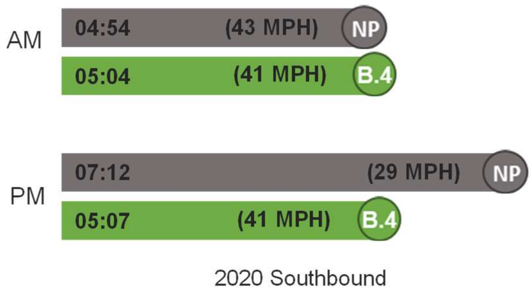


Exhibit 106 –2020 SB Travel Times

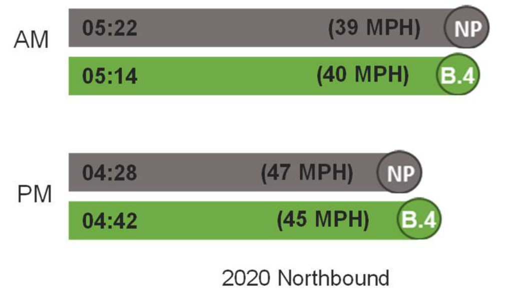


Exhibit 107 –2020 NB Travel Times

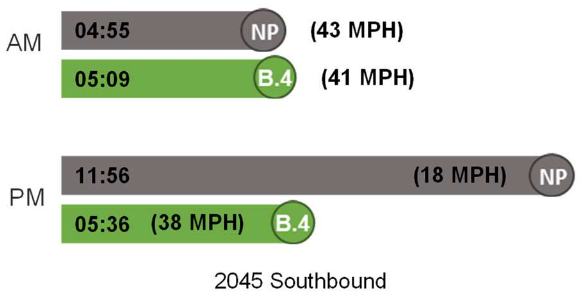


Exhibit 108 –2045 SB Travel Times

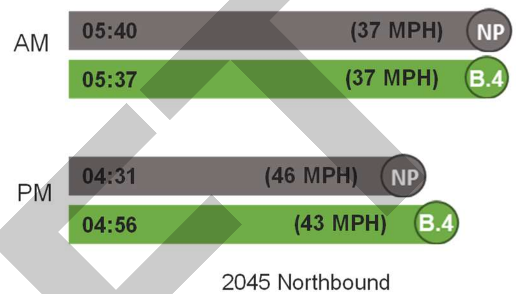


Exhibit 109 –2045 NB Travel Times

The results for this scenario are very similar to the results of Scenario B.3, with one caveat. The travel time for SR 227 is slightly higher for Scenario B.4 because of the Farmhouse Lane signal installation. This is similar to Scenario A, since this movements along SR 227 were previously free-flow and now is being controlled by a signal. The additional delay increase is minor compared to the overall improvements from 2045 No-Project.

RECOMMENDED SCENARIO B CORRIDOR

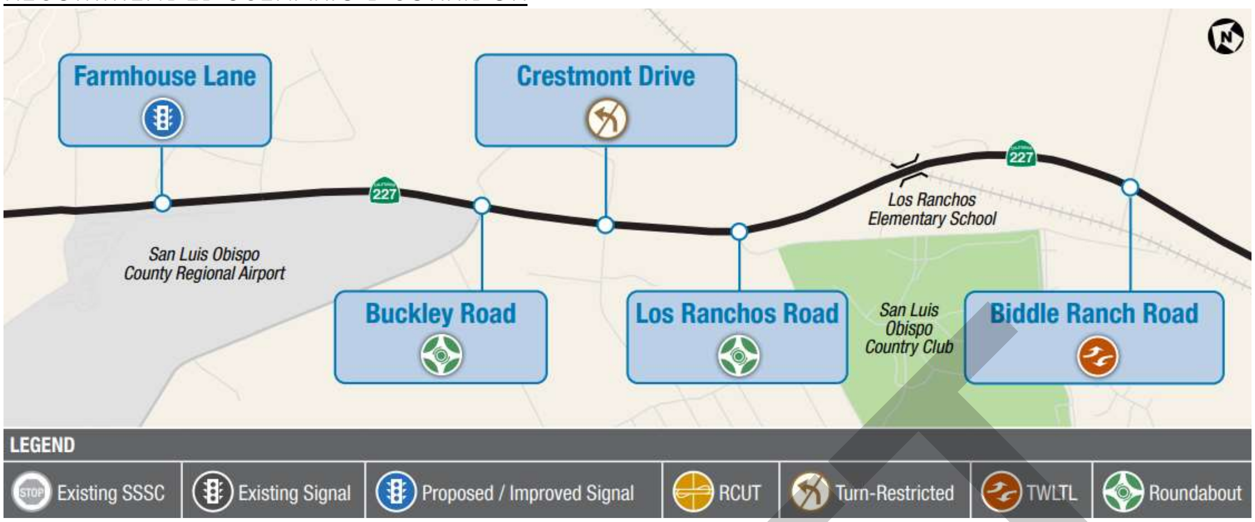


Exhibit 110 – Recommended Intersection Controls on SR 227 for Scenario B Corridor

A benefit of Scenario B is that improvements can be phased in as needed. This is beneficial because project spending can be spread out over time instead of all at once. We recommend the following implementation strategy:

1) Construct Scenario B.1 improvements at Los Ranchos Road
2) Construct Scenario B.3 improvements at Buckley Road as well as the B.2 improvements at Crestmont Drive and Biddle Ranch Road.

The construction of the roundabout at Buckley Road will accommodate northbound U-turn movements and allow for the implementation of Scenario B.2 improvements at Crestmont Drive. We also expect the improvements at Buckley Road will increase the flow of southbound traffic during the PM peak hour, accelerating the need for improvements at Crestmont Drive and Biddle Ranch Road.

If funding is possible, all the improvements should be made at the same time. If funding is not possible, the proposed phasing will be the most ideal. Constructing a roundabout at Los Ranchos Road will decrease travel times of the SB traffic in the PM peak hour by about two minutes compared to the No-Project Scenario. After four years, the overall delay at Buckley Road exceeds 40 seconds and should be addressed by constructing the proposed roundabout. The roundabout at Buckley Road will reduce the overall delay to less than 5 seconds.

A development proposal for the north-east lot of the Farmhouse Lane intersection is planning to install a signal at the intersection of Farmhouse Lane and SR 227. The only phase for Scenario B that includes a signal at Farmhouse Lane is B.4. **The phasing for the rest of this report will assume Scenario B.1 to be constructed at opening year, then Scenario B.4 to be constructed after four years.** Scenario B.4 was chosen to be phased in after four years based on the limited capacity of the existing signal at Buckley Road once the Los Ranchos roundabout is constructed.

Exhibit 111 shows the phasing accumulated cost for all four performance measures for No-Project conditions, Scenario B.1, Scenario B.4, and the preferred phasing path. The phasing path line follows Scenario B.1 for the first few years, jumps up in year four, then travels parallel to the Scenario B.4 accumulated costs. The sudden jump in year four is the additional costs associated with constructing the improvements at Crestmont Drive, Biddle Ranch Road, Buckley Road, and Farmhouse Lane. The preferred path line does not follow on top of Scenario B.4 because the added costs to construct the B.4 improvements are a future value based on a present value.[29]

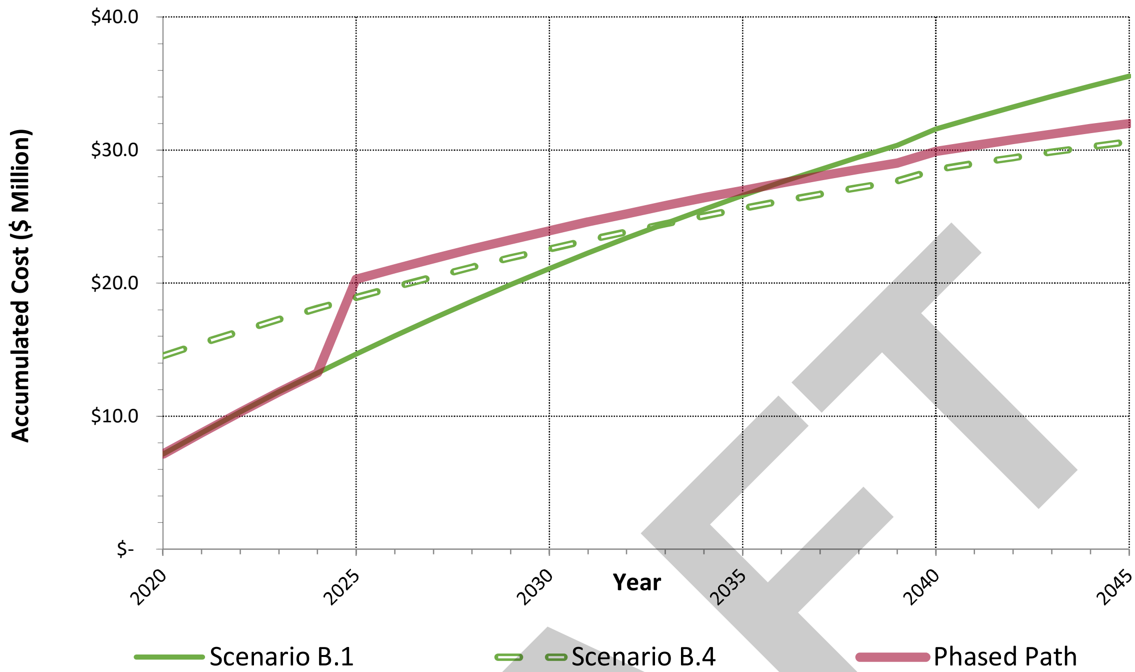


Exhibit 111 – Accumulated Costs: No-Project vs Phased Corridor

[29] Assumes interest rate of 4.0% to be consistent with other performance measures.

SCENARIO A vs SCENARIO B

Scenario A includes extensive roadway widening along SR 227 between Aero Drive and Los Ranchos Road, installing a new signal at Farmhouse Lane, and improving the existing signals at Los Ranchos Road and Buckley Road. The final phase of Scenario B includes constructing multi-lane roundabouts at Los Ranchos Road and Buckley Road, making Crestmont Drive turn-restricted, adding a two-way left-turn lane at Biddle Ranch Road, and installing a new signal at Farmhouse Lane. The Scenario A improvements have to be installed all at once; whereas the Scenario B improvements have the ability to be phased in over a period of time.

Corridor Benefit-Cost Analysis

The following section compares the performance measures for all five study intersections along the corridor between the Scenario A and the phased Scenario B. The analysis was performed for the 25-year life-cycle of the corridor from 2020 to 2045.

Benefit Performance Measures:

Safety Benefits

The safety benefit of the proposed improvement is realized when the cost of safety of the proposed improvement is less than the cost of safety for the existing intersection. Scenario B has less societal cost associated with safety because the severity of the predicted crashes at the study intersections are less for the proposed control types compared to Scenario A.

Exhibit 112 – Cost of Safety: Scenario A vs Scenario B

Preferred Alternative:

B

Based on the lowest predicted life-cycle cost for safety, the preferred scenario along SR 227 is B.

Delay Reduction Benefits

The delay reduction benefit of the proposed improvement is realized when the cost of delay of the proposed improvement is less than the cost of delay for the existing intersection. There is less societal cost associated with Scenario B because the proposed improvements at the study intersections increase capacity and reduce the average delay compared to Scenario A.

Exhibit 113 – Cost of Delay: Scenario A vs Scenario B

Preferred Alternative:

B

Based solely on the lowest predicted life-cycle cost for delay, the preferred scenario along SR 227 is B.

Cost Performance Measures:

Operations and Maintenance (O&M) Costs

O&M costs measure common annualized costs associated with operating and maintaining the intersection control. Scenario B has lower O&M costs primarily because Los Ranchos Road and Buckley no longer no longer require additional costs associated with being signalized.

Exhibit 114 – O&M Costs: Scenario A vs Scenario B

Preferred Alternative:

B

Based solely on lowest expected life-cycle O&M costs, the preferred scenario along SR 227 is B.

Initial Capital Costs (ICC)

ICC estimate the capital needed to plan, design, and construct the proposed improvements. Scenario B ICC includes the construction of the improvements at Los Ranchos Road, Crestmont Drive, Biddle Ranch Road, Buckley Road, and Farmhouse Lane.

Exhibit 115 – Estimated ICC: Scenario A vs Scenario B

Preferred Alternative:

B

Based solely on lowest expected range of Initial Capital Costs preferred scenario along SR 227 is B.

The following table lists the total discounted life-cycle costs for each performance measure along the corridor for Scenario A and the phased Scenario B.

Table 48 – Total Corridor Performance Measures

TOTAL PROJECT LIFE CYCLE SUMMARY FOR 25 YEARS		
	Scenario A	Scenario B
Safety	$ 18,472,903	$ 12,707,703
Delay	$ 10,260,242	$ 6,959,859
O&M	$ 839,241	$ 619,035
Initial Capital (Total)	$ 16,800,000	$ 13,550,000

A B/C ratio was calculated for Scenario B compared to Scenario A to determine the expected ROI based on the four performance measures. Table 49 depicts the values used to determine the B/C ratio of the corridor over its design-life. The added benefits were calculated by subtracting the discounted life-cycle costs of the proposed corridor control by the discounted life-cycle costs of the existing control. A positive value indicates that the proposed corridor will provide a benefit for that performance measure. The added benefits of safety and delay are summed to create the total added benefits for the proposed corridor. The added costs were calculated by subtracting the discounted life-cycle costs of the existing corridor by the discounted life-cycle costs of the proposed control. A positive value indicates that the proposed corridor will have additional costs associated with it. The added costs of O&M and ICC are summed to create the total added costs for the proposed corridor. The B/C ratio is calculated by dividing the total added benefits by the total added costs.

Table 49 – Benefit-Cost Analysis: Scenario A vs Scenario B

LIFE CYCLE BENEFIT-COST RATIO		
Added Benefits (B)		
Added Benefits Compared to Scenario A	**Scenario A**	**Scenario B**
Safety	$ -	$ 5,765,200
Delay	$ -	$ 3,300,383
Added Benefits	**$0**	**$9,065,583**
Added Costs (C)		
Added Costs Compared to Scenario A	**Scenario A**	**Scenario B**
O&M	$ -	$ (220,207)
Initial Capital	$ -	$ (2,650,000)
Added Costs	**$0**	**($2,870,207)**
B/C Ratio Compared to Scenario A	**N/A**	**N/A**[30]

A B/C ratio cannot be calculated for Scenario B because the added costs are negative, and the added benefits are positive. The added costs are negative because the cost to construct, operate, and maintain for Scenario A is more expensive than Scenario B. The added benefits are positive because Scenario B provides a more cost-effective corridor in terms of safety and delay when compared to Scenario A.

Exhibit 116 shows the accumulated cost of all four performance measures for the two scenarios. Scenario A starts off with a greater accumulated cost because of the higher initial capital costs to construct the improvements. The accumulated costs for Scenario A increase faster than Scenario B because of the higher annual societal cost of delay and safety. The jump in cost at year 4 for Scenario B is because of the additional improvements at Farmhouse Lane, Crestmont Drive, Buckley Road, and Biddle Ranch Road. The difference in the accumulated costs in the design year is $13.6 million in favor of Scenario B.

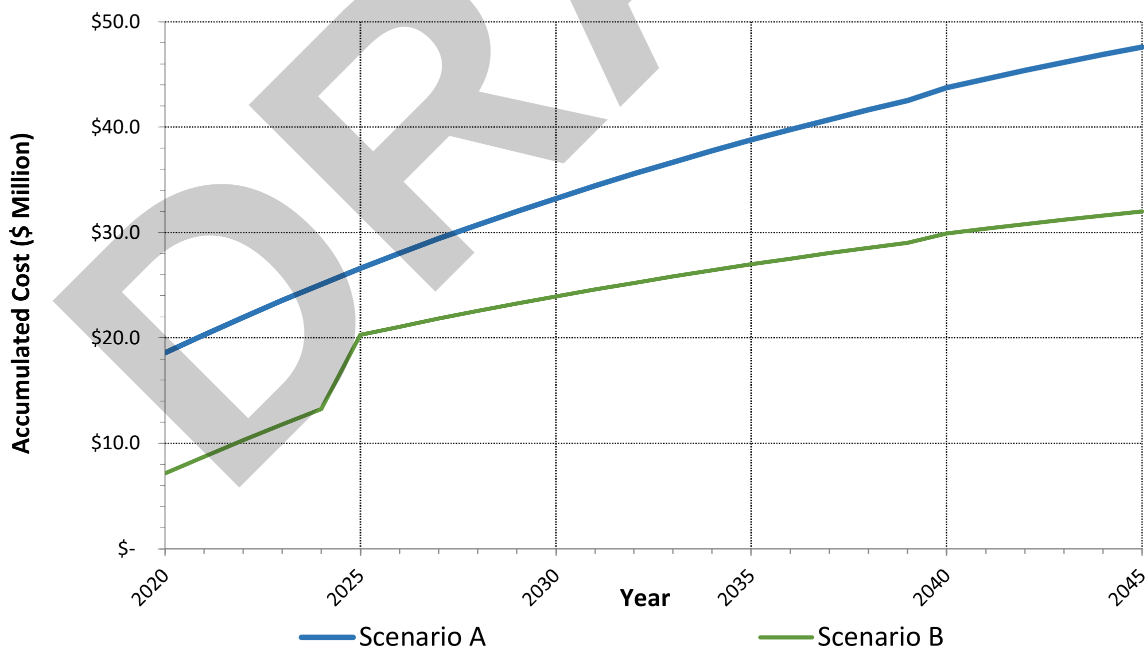


Exhibit 116 – Accumulated Costs: Scenario A vs Scenario B

[30] A B/C ratio cannot be calculated because the added costs for Scenario B alternative are negative. This is because the cost to construct, operate, and maintain Scenario A is more expensive than Scenario B.

Microsimulation of Scenario A vs. Scenario B Corridors

Scenario A and B both provide improvements along SR 227 to improve travel times through the corridor. **Exhibits 117-120** depict the microsimulation travel times and average travel speeds along the corridor during the 2020 and 2045 peak hours.

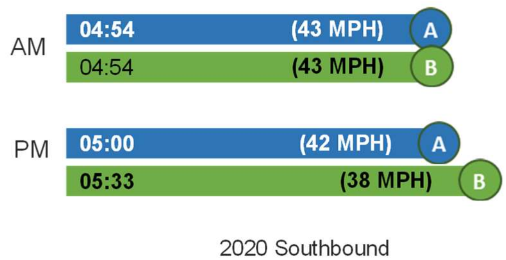


Exhibit 117 –2020 SB Travel Times

Exhibit 118 – 2020 NB Travel Times

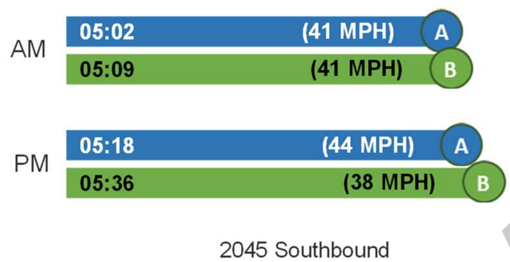


Exhibit 119 – 2045 SB Travel Times

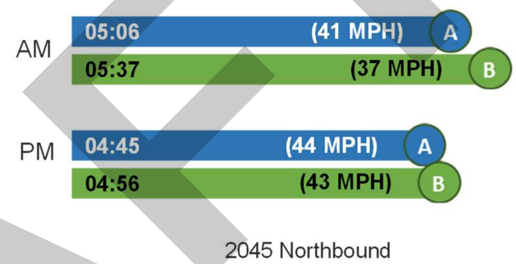


Exhibit 120 – 2045 NB Travel Times

Table 50 and **Table 51** show the NB and SB travel times through the corridor for Scenarios A and B, respectively.

Table 50 – Scenario A Simulated Model Travel Time Results

Route	Scenario A (2020)		Scenario A (2045)	
	AM Peak (mm:ss)	PM Peak (mm:ss)	AM Peak (mm:ss)	PM Peak (mm:ss)
NB 227 from Price Canyon to Aero	04:53	04:31	05:06	04:45
SB 227 from Aero to Price Canyon	04:54	05:00	05:02	05:18

Table 51 –Scenario B Simulated Model Travel Time Results

Route	Scenario B (2020)		Scenario B (2024)		Scenario B (2025)		Scenario B (2045)	
	AM Peak (mm:ss)	PM Peak (mm:ss)	AM Peak (mm:ss)	PM Peak (mm:ss)	AM Peak (mm:ss)	PM Peak (mm:ss)	AM Peak (mm:ss)	PM Peak (mm:ss)
NB 227 from Price Canyon to Aero	05:22	04:36	05:31	04:37	05:18	04:45	05:37	04:56
SB 227 from Aero to Price Canyon	04:54	05:33	04:55	06:03	05:05	05:13	05:09	05:36

The following exhibits depict the total delay experienced by every vehicle in the microsimulation during the AM and PM peak hours. The delay for Scenario B follows the total delay for Scenario B.1 then jumps to the total delay for Scenario B.4 because of the phasing.

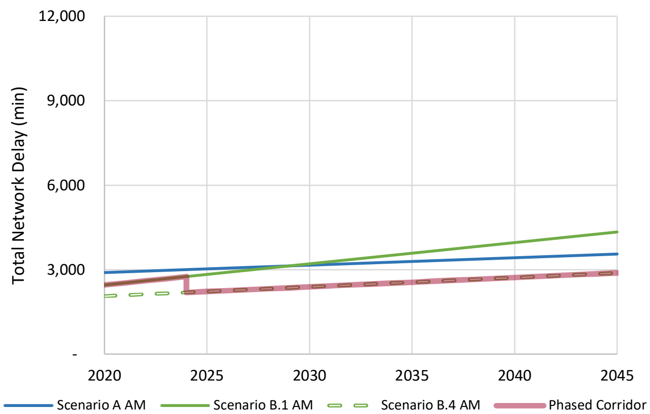


Exhibit 121 –Total Corridor Vehicle Delay

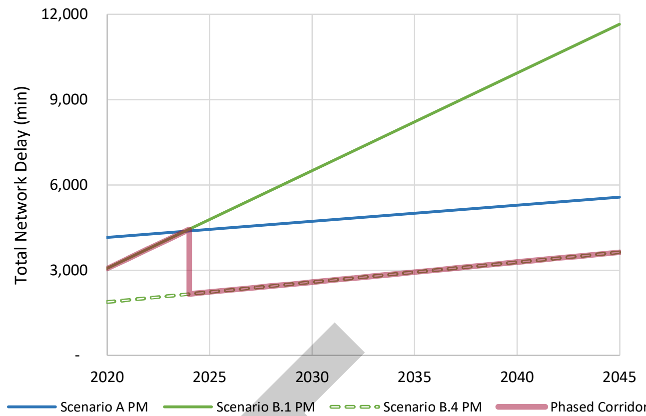


Exhibit 122 – Total Corridor Vehicle Delay

Exhibits 117 through 120 show that Scenario A has faster travel times through the corridor. This means vehicles traveling from Aero Drive through Price Canyon Road or vice versa will be able to get through faster with Scenario A. The largest difference in corridor travel times occurs during the 2020 PM peak hour; Scenario A is 33 seconds faster than Scenario B. **Exhibits 121 and 122** show that Scenario B has less total network delay. This means that the average delay for all vehicles navigating the corridor and the study intersections will experience less delay with Scenario B. Scenario B experiences 1,929 less total minutes of delay during the 2045 PM peak hour compared to Scenario A. **Exhibit 123** shows the total delay for all vehicles in the network during the 2045 design year.

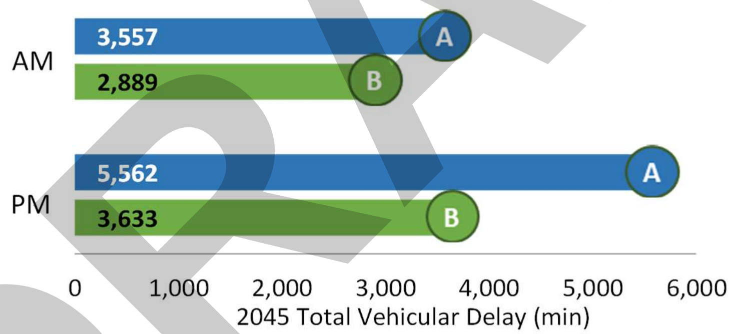


Exhibit 123 –2045 Total Corridor Vehicular Delay (min)

Exhibit 124 shows the accumulated safety costs for both Scenarios. Scenario B accounts for the phasing from Scenario B.1 to B.4 after 4 years. The accumulated costs are converted to a net present value using an interest rate of 4%.

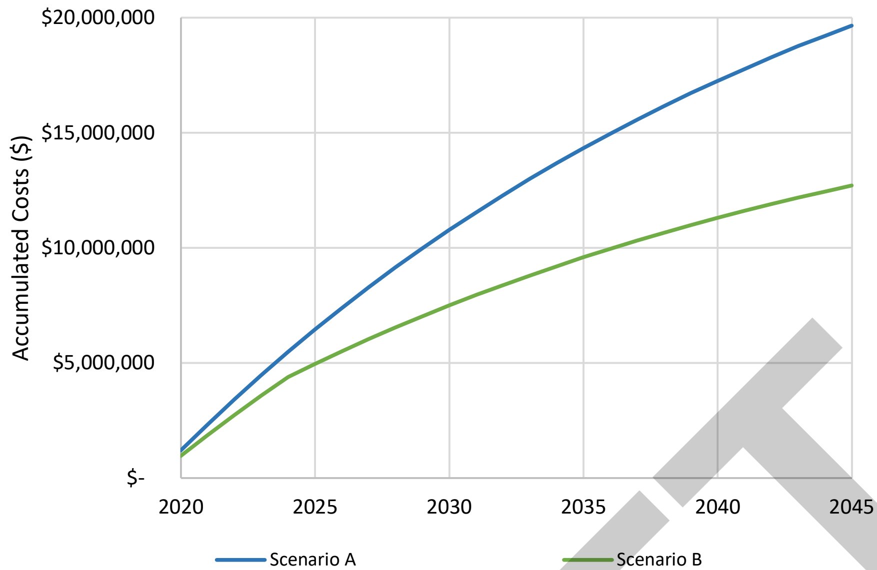


Exhibit 124 –Accumulated Safety Costs

Scenario A has an accumulated societal cost of safety $6.9 million more than Scenario B.

RECOMMENDED CORRIDOR

Both proposed scenarios provide added benefits for delay and will help alleviate congestion along the corridor during the peak hours. The microsimulation results indicate that the travel time for vehicles along SR 227 from Aero Drive through Price Canyon Road and vice versa are slightly faster in Scenario A, but total vehicular delay at study intersections is less in Scenario B. **Scenario B provides societal benefits for both safety and delay, while costing less to construct, operate, and maintain.**

- The societal cost of safety is less for Scenario B because the predicted crashes and crash severity at the study intersections is less.
- The societal cost of delay is less for Scenario B because the study intersections experience less average delay.
- The cost to construct Scenario A is more expensive than Scenario B due to widening the road an extra line in each direction between Aero Drive and Los Ranchos Road.
- Scenario B can be phased in as improvements are needed, whereas Scenario A needs to be constructed all at once. Phasing the construction can spread out the need for funding required to construct the improvements.

Appendices:

Appendix A – Design-Year Peak-Period Traffic Volumes
Appendix B – Side-Street Stop-Control Synchro Operations Analysis
Appendix C – Signal Synchro Operations Analysis
Appendix D – Roundabout Sidra Operations Analysis
Appendix E – Interactive Highway Safety Design Model (IHSDM) Reports and KABCO Values
Appendix F – Caltrans Benefit-Cost Values
Appendix G – Crestmont Drive Signal Warrant Analysis

Appendix A

Design-Year Peak-Period Traffic Volumes

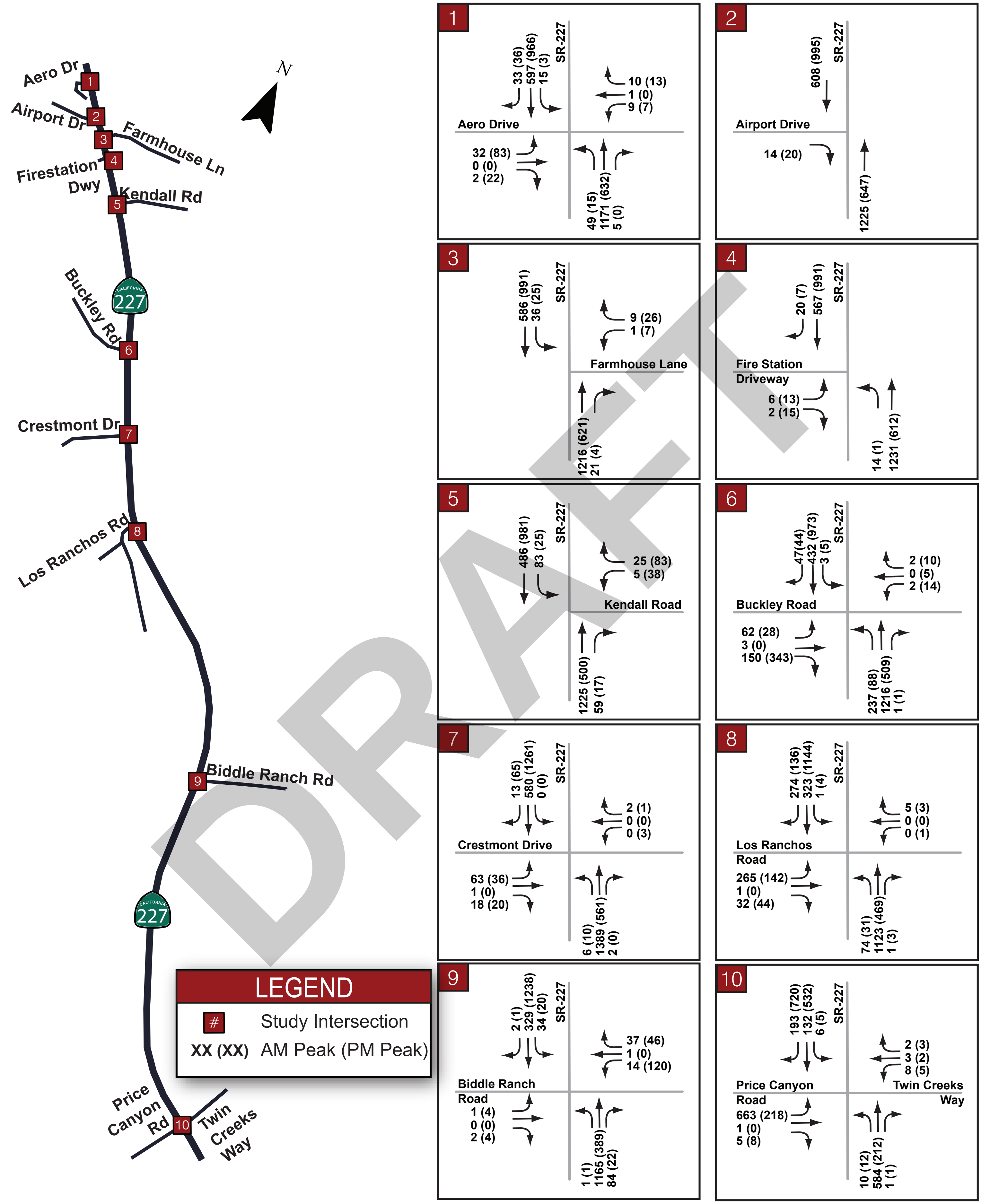
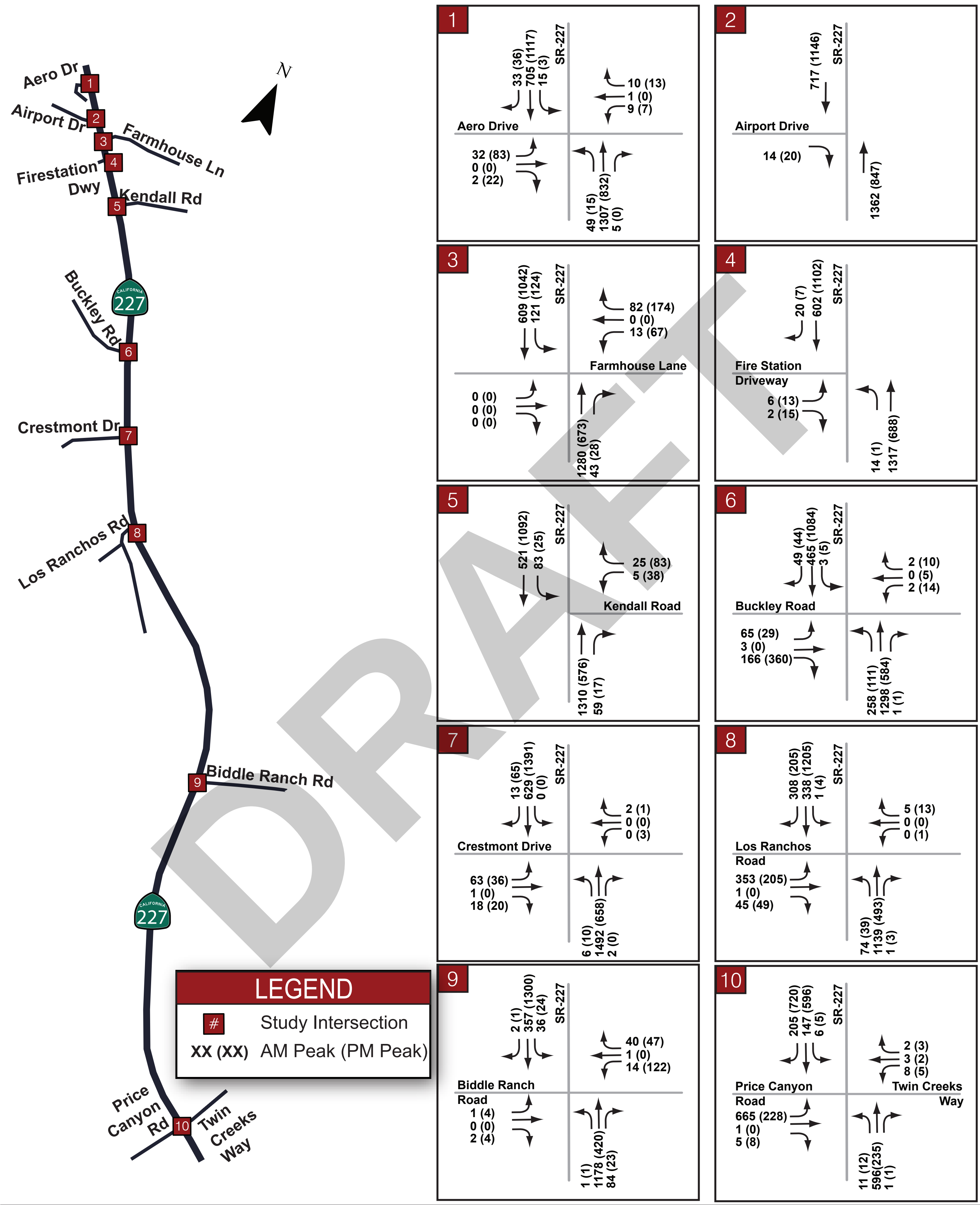


Exhibit 1

Current (2020) Peak-Hour Traffic Volumes



Kimley»Horn

Exhibit 2

Forecast (2045) Peak-Hour Traffic Volumes

Appendix B

Side-Street Stop-Control Synchro Operations Analysis

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	9	1216	21	36	586
Future Vol, veh/h	1	9	1216	21	36	586
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	0	145	-
Veh in Median Storage, #	2	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	70	70	91	91	86	86
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	1	13	1336	23	42	681

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2101	1336	0	0	1359	0
Stage 1	1336	-	-	-	-	-
Stage 2	765	-	-	-	-	-
Critical Hdwy	6.43	6.23	-	-	4.13	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	-	-	2.227	-
Pot Cap-1 Maneuver	56	187	-	-	503	-
Stage 1	244	-	-	-	-	-
Stage 2	458	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	51	187	-	-	503	-
Mov Cap-2 Maneuver	204	-	-	-	-	-
Stage 1	244	-	-	-	-	-
Stage 2	420	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	25.6	0	0.7
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	189	503	-
HCM Lane V/C Ratio	-	-	0.076	0.083	-
HCM Control Delay (s)	-	-	25.6	12.8	-
HCM Lane LOS	-	-	D	B	-
HCM 95th %tile Q(veh)	-	-	0.2	0.3	-

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	7	26	621	4	25	991
Future Vol, veh/h	7	26	621	4	25	991
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	0	145	-
Veh in Median Storage, #	2	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	82	82	90	90	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	32	690	4	28	1113

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1859	690	0	0	694	0
Stage 1	690	-	-	-	-	-
Stage 2	1169	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	81	445	-	-	901	-
Stage 1	498	-	-	-	-	-
Stage 2	295	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	78	445	-	-	901	-
Mov Cap-2 Maneuver	244	-	-	-	-	-
Stage 1	498	-	-	-	-	-
Stage 2	286	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.6	0	0.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	379	901	-
HCM Lane V/C Ratio	-	-	0.106	0.031	-
HCM Control Delay (s)	-	-	15.6	9.1	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	0.4	0.1	-

Intersection	
Int Delay, s/veh	3.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	13	82	1280	43	121	609
Future Vol, veh/h	13	82	1280	43	121	609
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	0	145	-
Veh in Median Storage, #	2	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	14	89	1391	47	132	662

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2317	1391	0	0	1438	0
Stage 1	1391	-	-	-	-	-
Stage 2	926	-	-	-	-	-
Critical Hdwy	6.43	6.23	-	-	4.13	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	-	-	2.227	-
Pot Cap-1 Maneuver	41	173	-	-	469	-
Stage 1	229	-	-	-	-	-
Stage 2	384	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	29	173	-	-	469	-
Mov Cap-2 Maneuver	167	-	-	-	-	-
Stage 1	229	-	-	-	-	-
Stage 2	276	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	53.2	0	2.6
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	172	469	-
HCM Lane V/C Ratio	-	-	0.6	0.28	-
HCM Control Delay (s)	-	-	53.2	15.6	-
HCM Lane LOS	-	-	F	C	-
HCM 95th %tile Q(veh)	-	-	3.3	1.1	-

Intersection						
Int Delay, s/veh	7.9					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	67	174	673	28	124	1042
Future Vol, veh/h	67	174	673	28	124	1042
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	0	145	-
Veh in Median Storage, #	2	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	73	189	732	30	135	1133

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2135	732	0	0	762	0
Stage 1	732	-	-	-	-	-
Stage 2	1403	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	~ 54	421	-	-	850	-
Stage 1	476	-	-	-	-	-
Stage 2	227	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 45	421	-	-	850	-
Mov Cap-2 Maneuver	170	-	-	-	-	-
Stage 1	476	-	-	-	-	-
Stage 2	191	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	64.2	0	1.1
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	298	850	-
HCM Lane V/C Ratio	-	-	0.879	0.159	-
HCM Control Delay (s)	-	-	64.2	10	-
HCM Lane LOS	-	-	F	B	-
HCM 95th %tile Q(veh)	-	-	7.9	0.6	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	63	1	18	0	0	2	6	1389	2	0	580	13
Future Vol, veh/h	63	1	18	0	0	2	6	1389	2	0	580	13
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	145	-	123	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	82	82	82	70	70	70	95	95	95	76	76	76
Heavy Vehicles, %	4	4	4	4	4	4	4	4	4	4	4	4
Mvmt Flow	77	1	22	0	0	3	6	1462	2	0	763	17

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2249	2248	772	2257	2254	1462	780	0	0	1464	0	0
Stage 1	772	772	-	1474	1474	-	-	-	-	-	-	-
Stage 2	1477	1476	-	783	780	-	-	-	-	-	-	-
Critical Hdwy	7.14	6.54	6.24	7.14	6.54	6.24	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.14	5.54	-	6.14	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.14	5.54	-	6.14	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.536	4.036	3.336	3.536	4.036	3.336	2.236	-	-	2.236	-	-
Pot Cap-1 Maneuver	~ 29	41	396	29	41	156	828	-	-	455	-	-
Stage 1	389	406	-	156	189	-	-	-	-	-	-	-
Stage 2	155	188	-	384	403	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 28	41	396	27	41	156	828	-	-	455	-	-
Mov Cap-2 Maneuver	134	163	-	27	41	-	-	-	-	-	-	-
Stage 1	386	406	-	155	188	-	-	-	-	-	-	-
Stage 2	151	187	-	362	403	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	61.3	28.5	0	0
HCM LOS	F	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	828	-	-	157	156	455	-	-
HCM Lane V/C Ratio	0.008	-	-	0.637	0.018	-	-	-
HCM Control Delay (s)	9.4	-	-	61.3	28.5	0	-	-
HCM Lane LOS	A	-	-	F	D	A	-	-
HCM 95th %tile Q(veh)	0	-	-	3.5	0.1	0	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	36	0	20	3	0	1	10	561	0	0	1261	65
Future Vol, veh/h	36	0	20	3	0	1	10	561	0	0	1261	65
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	145	-	123	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	70	70	70	70	70	70	87	87	87	95	95	95
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	51	0	29	4	0	1	11	645	0	0	1327	68

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2029	2028	1361	2043	2062	645	1395	0	0	645	0	0
Stage 1	1361	1361	-	667	667	-	-	-	-	-	-	-
Stage 2	668	667	-	1376	1395	-	-	-	-	-	-	-
Critical Hdwy	7.13	6.53	6.23	7.13	6.53	6.23	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.527	4.027	3.327	3.527	4.027	3.327	2.227	-	-	2.227	-	-
Pot Cap-1 Maneuver	~ 42	57	180	41	54	470	487	-	-	935	-	-
Stage 1	182	215	-	447	455	-	-	-	-	-	-	-
Stage 2	446	455	-	179	207	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 41	56	180	34	53	470	487	-	-	935	-	-
Mov Cap-2 Maneuver	158	188	-	34	53	-	-	-	-	-	-	-
Stage 1	178	215	-	437	445	-	-	-	-	-	-	-
Stage 2	435	445	-	151	207	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	45.8	98.7	0.2	0
HCM LOS	E	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	487	-	-	165	44	935	-	-
HCM Lane V/C Ratio	0.024	-	-	0.485	0.13	-	-	-
HCM Control Delay (s)	12.6	-	-	45.8	98.7	0	-	-
HCM Lane LOS	B	-	-	E	F	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	2.3	0.4	0	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	63	1	18	0	0	2	6	1492	2	0	629	13
Future Vol, veh/h	63	1	18	0	0	2	6	1492	2	0	629	13
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	145	-	-	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	68	1	20	0	0	2	7	1622	2	0	684	14

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1516	2329	349	1980	2335	812	698	0	0	1624	0	0
Stage 1	691	691	-	1637	1637	-	-	-	-	-	-	-
Stage 2	825	1638	-	343	698	-	-	-	-	-	-	-
Critical Hdwy	7.56	6.56	6.96	7.56	6.56	6.96	4.16	-	-	4.16	-	-
Critical Hdwy Stg 1	6.56	5.56	-	6.56	5.56	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.56	5.56	-	6.56	5.56	-	-	-	-	-	-	-
Follow-up Hdwy	3.53	4.03	3.33	3.53	4.03	3.33	2.23	-	-	2.23	-	-
Pot Cap-1 Maneuver	81	36	644	36	36	320	888	-	-	392	-	-
Stage 1	399	441	-	104	156	-	-	-	-	-	-	-
Stage 2	331	155	-	643	438	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	80	36	644	34	36	320	888	-	-	392	-	-
Mov Cap-2 Maneuver	250	139	-	34	36	-	-	-	-	-	-	-
Stage 1	396	441	-	103	155	-	-	-	-	-	-	-
Stage 2	326	154	-	622	438	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	23.2	16.3	0	0
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	888	-	-	286	320	392	-	-
HCM Lane V/C Ratio	0.007	-	-	0.312	0.007	-	-	-
HCM Control Delay (s)	9.1	-	-	23.2	16.3	0	-	-
HCM Lane LOS	A	-	-	C	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	1.3	0	0	-	-

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	36	0	20	3	0	1	10	658	0	0	1391	65
Future Vol, veh/h	36	0	20	3	0	1	10	658	0	0	1391	65
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	145	-	-	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	39	0	22	3	0	1	11	715	0	0	1512	71

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1928	2285	792	1493	2320	358	1583	0	0	715	0	0
Stage 1	1548	1548	-	737	737	-	-	-	-	-	-	-
Stage 2	380	737	-	756	1583	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	40	39	332	85	37	638	411	-	-	881	-	-
Stage 1	119	174	-	376	423	-	-	-	-	-	-	-
Stage 2	614	423	-	366	167	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 39	38	332	78	36	638	411	-	-	881	-	-
Mov Cap-2 Maneuver	109	154	-	78	36	-	-	-	-	-	-	-
Stage 1	116	174	-	366	412	-	-	-	-	-	-	-
Stage 2	597	412	-	342	167	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	47.7	42.6	0.2	0
HCM LOS	E	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	411	-	-	143	100	881	-	-
HCM Lane V/C Ratio	0.026	-	-	0.426	0.043	-	-	-
HCM Control Delay (s)	14	-	-	47.7	42.6	0	-	-
HCM Lane LOS	B	-	-	E	E	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	1.9	0.1	0	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s   +: Computation Not Defined   *: All major volume in platoon

Intersection	
Int Delay, s/veh	3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	2	14	1	37	1	1165	84	34	329	2
Future Vol, veh/h	1	0	2	14	1	37	1	1165	84	34	329	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	145	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	70	70	70	76	76	76	91	91	91	95	95	95
Heavy Vehicles, %	4	4	4	4	4	4	4	4	4	4	4	4
Mvmt Flow	1	0	3	18	1	49	1	1280	92	36	346	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1772	1793	347	1749	1748	1326	348	0	0	1372	0	0
Stage 1	419	419	-	1328	1328	-	-	-	-	-	-	-
Stage 2	1353	1374	-	421	420	-	-	-	-	-	-	-
Critical Hdwy	7.14	6.54	6.24	7.14	6.54	6.24	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.14	5.54	-	6.14	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.14	5.54	-	6.14	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.536	4.036	3.336	3.536	4.036	3.336	2.236	-	-	2.236	-	-
Pot Cap-1 Maneuver	64	80	692	66	85	188	1200	-	-	494	-	-
Stage 1	608	587	-	189	222	-	-	-	-	-	-	-
Stage 2	183	211	-	606	586	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	44	74	692	62	79	188	1200	-	-	494	-	-
Mov Cap-2 Maneuver	44	74	-	62	79	-	-	-	-	-	-	-
Stage 1	607	544	-	189	222	-	-	-	-	-	-	-
Stage 2	135	211	-	560	543	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	36.9	69.9	0	1.2
HCM LOS	E	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1200	-	-	117	119	494	-	-
HCM Lane V/C Ratio	0.001	-	-	0.037	0.575	0.072	-	-
HCM Control Delay (s)	8	-	-	36.9	69.9	12.9	-	-
HCM Lane LOS	A	-	-	E	F	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	2.8	0.2	-	-

Intersection	
Int Delay, s/veh	79.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	0	4	120	0	46	1	389	22	20	1238	1
Future Vol, veh/h	4	0	4	120	0	46	1	389	22	20	1238	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	145	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	70	70	70	84	84	84	96	96	96	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	6	0	6	143	0	55	1	405	23	22	1331	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1822	1806	1332	1798	1795	417	1332	0	0	428	0	0
Stage 1	1376	1376	-	419	419	-	-	-	-	-	-	-
Stage 2	446	430	-	1379	1376	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	60	79	189	~ 62	80	636	518	-	-	1131	-	-
Stage 1	179	213	-	612	590	-	-	-	-	-	-	-
Stage 2	591	583	-	179	213	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	54	77	189	~ 59	78	636	518	-	-	1131	-	-
Mov Cap-2 Maneuver	54	77	-	~ 59	78	-	-	-	-	-	-	-
Stage 1	179	209	-	611	589	-	-	-	-	-	-	-
Stage 2	539	582	-	170	209	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	54.5	$ 795.1	0	0.1
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	518	-	-	84	79	1131	-	-
HCM Lane V/C Ratio	0.002	-	-	0.136	2.502	0.019	-	-
HCM Control Delay (s)	12	-	-	54.5	$ 795.1	8.2	-	-
HCM Lane LOS	B	-	-	F	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.5	18.8	0.1	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	2	14	1	40	1	1178	84	36	357	2
Future Vol, veh/h	1	0	2	14	1	40	1	1178	84	36	357	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	145	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	1	0	2	15	1	43	1	1280	91	39	388	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1817	1840	389	1796	1796	1326	390	0	0	1371	0	0
Stage 1	467	467	-	1328	1328	-	-	-	-	-	-	-
Stage 2	1350	1373	-	468	468	-	-	-	-	-	-	-
Critical Hdwy	7.13	6.53	6.23	7.13	6.53	6.23	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.527	4.027	3.327	3.527	4.027	3.327	2.227	-	-	2.227	-	-
Pot Cap-1 Maneuver	60	75	657	62	80	189	1163	-	-	497	-	-
Stage 1	574	560	-	190	223	-	-	-	-	-	-	-
Stage 2	185	212	-	574	560	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	43	69	657	58	74	189	1163	-	-	497	-	-
Mov Cap-2 Maneuver	43	69	-	58	74	-	-	-	-	-	-	-
Stage 1	573	516	-	190	223	-	-	-	-	-	-	-
Stage 2	142	212	-	527	516	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	37.5	63.3	0	1.2
HCM LOS	E	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1163	-	-	114	118	497	-	-
HCM Lane V/C Ratio	0.001	-	-	0.029	0.507	0.079	-	-
HCM Control Delay (s)	8.1	-	-	37.5	63.3	12.9	-	-
HCM Lane LOS	A	-	-	E	F	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	2.3	0.3	-	-

Intersection	
Int Delay, s/veh	87.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	0	4	122	0	47	1	420	23	24	1300	1
Future Vol, veh/h	4	0	4	122	0	47	1	420	23	24	1300	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	145	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	0	4	133	0	51	1	457	25	26	1413	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1963	1950	1414	1940	1938	470	1414	0	0	482	0	0
Stage 1	1466	1466	-	472	472	-	-	-	-	-	-	-
Stage 2	497	484	-	1468	1466	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	47	64	169	~ 49	65	594	482	-	-	1081	-	-
Stage 1	159	192	-	573	559	-	-	-	-	-	-	-
Stage 2	555	552	-	159	192	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	42	62	169	~ 47	63	594	482	-	-	1081	-	-
Mov Cap-2 Maneuver	42	62	-	~ 47	63	-	-	-	-	-	-	-
Stage 1	159	187	-	572	558	-	-	-	-	-	-	-
Stage 2	506	551	-	151	187	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	66.6	$ 1003.9	0	0.2
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	482	-	-	67	63	1081	-	-
HCM Lane V/C Ratio	0.002	-	-	0.13	2.916	0.024	-	-
HCM Control Delay (s)	12.5	-	-	66.6	$ 1003.9	8.4	-	-
HCM Lane LOS	B	-	-	F	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.4	18.8	0.1	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	82	0	0	2	6	1452	3	0	580	13
Future Vol, veh/h	0	0	82	0	0	2	6	1452	3	0	580	13
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	Yield	-	-	Free	-	-	Free
Storage Length	-	-	0	-	-	0	145	-	123	150	-	123
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	82	82	82	70	70	70	95	95	95	76	76	76
Heavy Vehicles, %	4	4	4	4	4	4	4	4	4	4	4	4
Mvmt Flow	0	0	100	0	0	3	6	1528	3	0	763	17

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	-	-	382	-	-	764	763	0	-	1528	0	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.98	-	-	6.98	4.18	-	-	4.18	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.34	-	-	3.34	2.24	-	-	2.24	-	-
Pot Cap-1 Maneuver	0	0	610	0	0	342	832	-	0	422	-	0
Stage 1	0	0	-	0	0	-	-	-	0	-	-	0
Stage 2	0	0	-	0	0	-	-	-	0	-	-	0
Platoon blocked, %								-			-	
Mov Cap-1 Maneuver	-	-	610	-	-	342	832	-	-	422	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	12.1	15.6	0	0
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	WBLn1	SBL	SBT
Capacity (veh/h)	832	-	610	342	422	-
HCM Lane V/C Ratio	0.008	-	0.164	0.008	-	-
HCM Control Delay (s)	9.4	-	12.1	15.6	0	-
HCM Lane LOS	A	-	B	C	A	-
HCM 95th %tile Q(veh)	0	-	0.6	0	0	-

7: SR-227 & Crestmont Dr Performance by movement

Movement	EBR	WBR	NBL	NBT	NBR	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.2	0.1	0.0	0.0	0.0	0.0	0.3	0.0
Total Delay (hr)	0.0	0.0	0.0	0.3	0.0	0.1	0.0	0.4
Total Del/Veh (s)	1.5	0.9	2.1	0.7	1.5	0.6	1.3	0.7
Stop Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0

14: SR-227 Performance by movement

Movement	NBT	SBT	All
Denied Delay (hr)	0.0	0.1	0.1
Denied Del/Veh (s)	0.0	0.5	0.1
Total Delay (hr)	0.4	0.1	0.5
Total Del/Veh (s)	0.9	0.5	0.8
Stop Delay (hr)	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.0

Control Delay
EB Delay: 12.1 sec
WB Delay: 15.6 sec

Travel Time
Link Length = 550' for both NBU and SBU
6.8 sec x 2 = **13.6 sec**

Movement delay
EB thru = SBU + NBR = 50.3 sec + 1.5 sec = **51.8 sec**

EB left = SBU + NBT = 50.3 sec+ 0.7 sec = **51.0 sec**

18: SR-227 Performance by movement

Movement	NBT	SBU	SBT	All
Denied Delay (hr)	0.9	0.0	0.0	0.9
Denied Del/Veh (s)	2.3	0.0	0.0	1.5
Total Delay (hr)	1.2	1.0	0.2	2.4
Total Del/Veh (s)	3.1	50.3	1.1	4.1
Stop Delay (hr)	0.0	1.0	0.0	1.0
Stop Del/Veh (s)	0.0	50.0	0.2	1.7

Total Network Performance

Denied Delay (hr)	1.0
Denied Del/Veh (s)	1.6
Total Delay (hr)	3.6
Total Del/Veh (s)	5.7
Stop Delay (hr)	1.1
Stop Del/Veh (s)	1.7

(Control Delay) + Travel Time + Movement Delay
EB Thru: 12.1 + 13.6 + 51.8 sec = 77.5 sec (for 1 AM trips)
EB Left: 12.1 + 18.6 + 51.0 sec = 81.7 sec (for 63 AM trip)

EB lane Delay = [(18 veh x 12.1 sec) + (63 veh x 81.7 sec) + (1 veh x 77.6 sec)]/82 veh = 66.3 sec/veh

WB lane Delay = 15.6 sec/veh

Overall intersection delay:
2.6 sec/veh
LOS A

Intersection: 7: SR-227 & Crestmont Dr

Movement	EB	NB
Directions Served	R	L
Maximum Queue (ft)	13	20
Average Queue (ft)	0	2
95th Queue (ft)	6	11
Link Distance (ft)	707	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		145
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 14: SR-227

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 18: SR-227

Movement	SB	SB	SB
Directions Served	U	T	T
Maximum Queue (ft)	113	142	77
Average Queue (ft)	46	13	4
95th Queue (ft)	100	96	53
Link Distance (ft)		504	504
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	100		
Storage Blk Time (%)	8		
Queuing Penalty (veh)	26		

Network Summary

Network wide Queuing Penalty: 26

Intersection												
Int Delay, s/veh	0.7											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	56	0	0	4	10	597	0	0	1264	65
Future Vol, veh/h	0	0	56	0	0	4	10	597	0	0	1264	65
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	Yield	-	-	Free	-	-	Free
Storage Length	-	-	0	-	-	0	145	-	123	150	-	123
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	70	70	70	70	70	70	87	87	87	95	95	95
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	0	80	0	0	6	11	686	0	0	1331	68

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	-	-	666	-	-	343	1331	0	-	686	0	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.96	-	-	6.96	4.16	-	-	4.16	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.33	-	-	3.33	2.23	-	-	2.23	-	-
Pot Cap-1 Maneuver	0	0	400	0	0	650	509	-	0	897	-	0
Stage 1	0	0	-	0	0	-	-	-	0	-	-	0
Stage 2	0	0	-	0	0	-	-	-	0	-	-	0
Platoon blocked, %								-			-	
Mov Cap-1 Maneuver	-	-	400	-	-	650	509	-	-	897	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	16.2	10.6	0.2	0
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	WBLn1	SBL	SBT
Capacity (veh/h)	509	-	400	650	897	-
HCM Lane V/C Ratio	0.023	-	0.2	0.009	-	-
HCM Control Delay (s)	12.2	-	16.2	10.6	0	-
HCM Lane LOS	B	-	C	B	A	-
HCM 95th %tile Q(veh)	0.1	-	0.7	0	0	-

RCUT

7: SR-227 & Crestmont Dr Performance by movement

Movement	EBR	WBR	NBL	NBT	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.1	0.0
Total Delay (hr)	0.0	0.0	0.0	0.0	0.3	0.0	0.5
Total Del/Veh (s)	1.4	1.1	8.2	0.2	0.9	1.6	0.8
Stop Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	7.8	0.0	0.0	0.0	0.1

Control Delay
EB Delay: 16.2 sec
WB Delay: 10.6 sec

Travel Time
Link Length = 550' for both NBU and SBU
6.8 sec x 2 = **13.6 sec**

Movement delay
EB left = SBU + NBT = 2.7 sec + 0.2 = **2.9 sec**

WB left = NBU + SBT = 13.7 sec + 0.9 sec = **14.6 sec**

14: SR-227 Performance by movement

Movement	NBU	NBT	SBT	All
Denied Delay (hr)	0.0	0.0	0.8	0.8
Denied Del/Veh (s)	0.0	0.0	2.0	1.4
Total Delay (hr)	0.0	0.1	0.6	0.7
Total Del/Veh (s)	13.7	0.5	1.7	1.3
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	14.0	0.0	0.0	0.0

18: SR-227 Performance by movement

Movement	NBT	SBU	SBT	All
Denied Delay (hr)	0.1	0.0	0.0	0.1
Denied Del/Veh (s)	0.4	0.0	0.0	0.1
Total Delay (hr)	0.1	0.0	0.3	0.5
Total Del/Veh (s)	0.8	2.7	0.8	0.9
Stop Delay (hr)	0.0	0.0	0.1	0.1
Stop Del/Veh (s)	0.0	2.6	0.2	0.1

Total Network Performance

Denied Delay (hr)	0.8
Denied Del/Veh (s)	1.5
Total Delay (hr)	2.0
Total Del/Veh (s)	3.5
Stop Delay (hr)	0.1
Stop Del/Veh (s)	0.2

(Control Delay) + Travel Time + Movement Delay
EB Left: 16.2 + 18.6 + 2.9 = 37.7 sec (for 36 AM trip)
WB Left: 10.6 + 18.6 + 14.6 = 43.8 sec (for 3 AM trips)

EB lane Delay = [(20 veh x 16.2 sec) + (36 veh x 37.7 sec)]/56 veh = 30.0 sec/veh

WB lane Delay = [(1 veh x 10.6 sec) + (3 veh x 43.8 sec)]/4 veh = 35.5 sec/veh

Overall intersection delay:
1.0 sec/veh
LOS A

Intersection: 7: SR-227 & Crestmont Dr

Movement	EB	NB
Directions Served	R	L
Maximum Queue (ft)	16	24
Average Queue (ft)	0	6
95th Queue (ft)	8	21
Link Distance (ft)	707	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		145
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 14: SR-227

Movement	NB
Directions Served	U
Maximum Queue (ft)	26
Average Queue (ft)	3
95th Queue (ft)	15
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	100
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 18: SR-227

Movement	SB
Directions Served	U
Maximum Queue (ft)	43
Average Queue (ft)	11
95th Queue (ft)	33
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	100
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 0

Intersection												
Int Delay, s/veh	0.4											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	82	0	0	2	6	1555	3	0	629	13
Future Vol, veh/h	0	0	82	0	0	2	6	1555	3	0	629	13
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	Yield	-	-	Free	-	-	Free
Storage Length	-	-	0	-	-	0	145	-	123	150	-	123
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	0	89	0	0	2	7	1690	3	0	684	14

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	-	-	342	-	-	845	684	0	-	1690	0	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.96	-	-	6.96	4.16	-	-	4.16	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.33	-	-	3.33	2.23	-	-	2.23	-	-
Pot Cap-1 Maneuver	0	0	651	0	0	304	898	-	0	369	-	0
Stage 1	0	0	-	0	0	-	-	-	0	-	-	0
Stage 2	0	0	-	0	0	-	-	-	0	-	-	0
Platoon blocked, %								-			-	
Mov Cap-1 Maneuver	-	-	651	-	-	304	898	-	-	369	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	11.4	16.9	0	0
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	WBLn1	SBL	SBT
Capacity (veh/h)	898	-	651	304	369	-
HCM Lane V/C Ratio	0.007	-	0.137	0.007	-	-
HCM Control Delay (s)	9	-	11.4	16.9	0	-
HCM Lane LOS	A	-	B	C	A	-
HCM 95th %tile Q(veh)	0	-	0.5	0	0	-

RCUT

7: SR-227 & Crestmont Dr Performance by movement

Movement	EBR	WBR	NBL	NBT	NBR	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	0.0	0.0	0.0	0.3	0.0	0.1	0.0	0.5
Total Del/Veh (s)	1.4	1.0	2.8	0.7	1.7	0.6	1.3	0.7
Stop Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0

14: SR-227 Performance by movement

Movement	NBT	SBT	All
Denied Delay (hr)	0.0	0.1	0.1
Denied Del/Veh (s)	0.0	0.5	0.1
Total Delay (hr)	0.4	0.1	0.5
Total Del/Veh (s)	0.9	0.6	0.8
Stop Delay (hr)	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	0.0

Control Delay
EB Delay: 11.4 sec
WB Delay: 16.9 sec

Travel Time
Link Length = 550' for both NBU and SBU
6.8 sec x 2 = **13.6 sec**

Movement delay
EB thru = SBU + NBR = 127.6 sec + 1.7 sec = **129.3 sec**

EB left = SBU + NBT = 127.6 sec + 0.7 sec =**128.3 sec**

18: SR-227 Performance by movement

Movement	NBT	SBU	SBT	All
Denied Delay (hr)	1.3	0.0	0.0	1.3
Denied Del/Veh (s)	3.1	0.5	0.0	2.1
Total Delay (hr)	1.8	2.6	0.2	4.5
Total Del/Veh (s)	4.2	127.6	1.3	7.3
Stop Delay (hr)	0.0	2.6	0.0	2.6
Stop Del/Veh (s)	0.0	127.8	0.2	4.2

Total Network Performance

Denied Delay (hr)	1.4
Denied Del/Veh (s)	2.2
Total Delay (hr)	5.8
Total Del/Veh (s)	9.0
Stop Delay (hr)	2.6
Stop Del/Veh (s)	4.1

(Control Delay) + Travel Time + Movement Delay
EB Thru: 11.4 + 13.6 + 110.4 = 110.4 sec (for 1 AM trips)
EB Left: 11.4 + 18.6 + 109.7 = 114.7 sec (for 63 AM trip)

EB lane Delay = [(18 veh x 11.4 sec) + (63 veh x 114.7 sec) + (1 veh x 110.4 sec)]/82 veh = 92.0 sec/veh

WB lane Delay = 16.9 sec/veh

Overall intersection delay:
3.3 sec/veh
LOS A

Intersection: 7: SR-227 & Crestmont Dr

Movement	EB	NB	SB
Directions Served	R	L	T
Maximum Queue (ft)	11	19	12
Average Queue (ft)	0	2	1
95th Queue (ft)	8	13	14
Link Distance (ft)	707		503
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		145	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 14: SR-227

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 18: SR-227

Movement	SB	SB	SB
Directions Served	U	T	T
Maximum Queue (ft)	119	235	136
Average Queue (ft)	60	46	9
95th Queue (ft)	120	241	106
Link Distance (ft)		504	504
Upstream Blk Time (%)		1	0
Queuing Penalty (veh)		2	0
Storage Bay Dist (ft)	100		
Storage Blk Time (%)	18		
Queuing Penalty (veh)	59		

Network Summary

Network wide Queuing Penalty: 62

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	56	0	0	4	10	694	0	0	1394	65
Future Vol, veh/h	0	0	56	0	0	4	10	694	0	0	1394	65
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	Yield	-	-	Free	-	-	Free
Storage Length	-	-	0	-	-	0	145	-	123	150	-	123
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	61	0	0	4	11	754	0	0	1515	71

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	-	-	758	-	-	377	1515	0	-	754	0	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.94	-	-	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.32	-	-	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	0	0	350	0	0	621	437	-	0	852	-	0
Stage 1	0	0	-	0	0	-	-	-	0	-	-	0
Stage 2	0	0	-	0	0	-	-	-	0	-	-	0
Platoon blocked, %								-			-	
Mov Cap-1 Maneuver	-	-	350	-	-	621	437	-	-	852	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	17.4	10.8	0.2	0
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	WBLn1	SBL	SBT
Capacity (veh/h)	437	-	350	621	852	-
HCM Lane V/C Ratio	0.025	-	0.174	0.007	-	-
HCM Control Delay (s)	13.4	-	17.4	10.8	0	-
HCM Lane LOS	B	-	C	B	A	-
HCM 95th %tile Q(veh)	0.1	-	0.6	0	0	-

RCUT

7: SR-227 & Crestmont Dr Performance by movement

Movement	EBR	WBR	NBL	NBT	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	0.0	0.0	0.0	0.0	0.4	0.0	0.5
Total Del/Veh (s)	1.3	1.1	12.5	0.2	1.0	1.6	0.9
Stop Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0	0.0	12.1	0.0	0.0	0.0	0.1

14: SR-227 Performance by movement

Movement	NBU	NBT	SBT	All
Denied Delay (hr)	0.0	0.0	1.1	1.1
Denied Del/Veh (s)	0.0	0.0	2.6	1.8
Total Delay (hr)	0.0	0.1	1.0	1.1
Total Del/Veh (s)	34.6	0.5	2.3	1.8
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	34.8	0.0	0.0	0.0

Control Delay
EB Delay: 17.4 sec
WB Delay: 10.8 sec

Travel Time
Link Length = 550' for both NBU and SBU
6.8 sec x 2 = **13.6 sec**

Movement delay
EB left = SBU + NBT = 3.5 sec + 0.2 sec = **3.7 sec**

WB left = NBU + SBT = 34.6 sec + 1.0 sec = **35.6 sec**

18: SR-227 Performance by movement

Movement	NBT	SBU	SBT	All
Denied Delay (hr)	0.1	0.0	0.0	0.1
Denied Del/Veh (s)	0.5	0.0	0.0	0.2
Total Delay (hr)	0.2	0.0	0.3	0.6
Total Del/Veh (s)	1.0	3.5	0.8	0.9
Stop Delay (hr)	0.0	0.0	0.1	0.1
Stop Del/Veh (s)	0.0	3.4	0.2	0.2

Total Network Performance

Denied Delay (hr)	1.2
Denied Del/Veh (s)	1.9
Total Delay (hr)	2.6
Total Del/Veh (s)	4.1
Stop Delay (hr)	0.2
Stop Del/Veh (s)	0.3

(Control Delay) + Travel Time + Movement Delay
EB Left: 17.4 + 18.6 + 3.7 = 39.7 sec (for 36 PM trip)
WB Left: 10.8 + 18.6 + 35.6= 65.0 sec (for 3 PM trips)

EB lane Delay = [(20 veh x 17.4 sec) + (36 veh x 39.7 sec)]/56 veh = 31.7 sec/veh

WB lane Delay = [(1 veh x 10.8 sec) + (3 veh x 65.0 sec)]/4 veh = 51.5 sec/veh

Overall intersection delay:
1.0 sec/veh
LOS A

Intersection: 7: SR-227 & Crestmont Dr

Movement	EB	NB	NB
Directions Served	R	L	T
Maximum Queue (ft)	11	27	4
Average Queue (ft)	0	5	0
95th Queue (ft)	8	20	4
Link Distance (ft)	707		504
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		145	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 14: SR-227

Movement	NB	NB
Directions Served	U	T
Maximum Queue (ft)	30	5
Average Queue (ft)	3	0
95th Queue (ft)	16	5
Link Distance (ft)		503
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	100	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 18: SR-227

Movement	SB
Directions Served	U
Maximum Queue (ft)	43
Average Queue (ft)	12
95th Queue (ft)	35
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	100
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 0

RCUT

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	3	0	0	52	1	1166	84	34	343	3
Future Vol, veh/h	0	0	3	0	0	52	1	1166	84	34	343	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	Yield	-	-	Yield	-	-	Yield
Storage Length	-	-	0	-	-	0	145	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	70	70	70	76	76	76	91	91	91	95	95	95
Heavy Vehicles, %	4	4	4	4	4	4	4	4	4	4	4	4
Mvmt Flow	0	0	4	0	0	68	1	1281	92	36	361	3

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	-	-	363	-	-	1327	361	0	0	1281	0	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.24	-	-	6.24	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.336	-	-	3.336	2.236	-	-	2.236	-	-
Pot Cap-1 Maneuver	0	0	677	0	0	188	1187	-	-	535	-	-
Stage 1	0	0	-	0	0	-	-	-	-	-	-	-
Stage 2	0	0	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	-	-	677	-	-	188	1187	-	-	535	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.4	34.7	0	1.1
HCM LOS	B	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1187	-	-	677	188	535	-	-
HCM Lane V/C Ratio	0.001	-	-	0.006	0.364	0.067	-	-
HCM Control Delay (s)	8	-	-	10.4	34.7	12.2	-	-
HCM Lane LOS	A	-	-	B	D	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0	1.6	0.2	-	-

2: SR-227 Performance by movement

Movement	NBT	SBU	SBT	All
Denied Delay (hr)	0.6	0.0	0.0	0.6
Denied Del/Veh (s)	1.7		0.0	1.3
Total Delay (hr)	2.3	0.0	0.0	2.4
Total Del/Veh (s)	6.5		0.4	5.2
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0		0.0	0.0

5: SR-227 Performance by movement

Movement	NBU	NBT	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.3	0.1
Total Delay (hr)	0.1	3.7	0.1	3.9
Total Del/Veh (s)	26.8	10.7	0.8	8.6
Stop Delay (hr)	0.1	2.0	0.0	2.1
Stop Del/Veh (s)	24.3	5.6	0.0	4.5

9: SR-227 & Biddle Ranch Rd Performance by movement

Movement	EBR	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1
Denied Del/Veh (s)	0.1	0.2		0.3	0.4	0.0	0.0	0.0	0.2
Total Delay (hr)	0.0	8.4	0.0	3.0	0.1	0.2	0.1	0.0	11.8
Total Del/Veh (s)	1.3	531.1		8.8	5.0	25.0	0.6	1.2	24.1
Stop Delay (hr)	0.0	8.4	0.0	0.1	0.0	0.2	0.0	0.0	8.7
Stop Del/Veh (s)	0.0	531.5		0.2	0.1	24.1	0.0	0.0	17.8

Total Network Performance

Denied Delay (hr)	0.7
Denied Del/Veh (s)	1.5
Total Delay (hr)	19.2
Total Del/Veh (s)	38.6
Stop Delay (hr)	10.8
Stop Del/Veh (s)	21.7

Intersection: 2: SR-227

Movement	NB	SB
Directions Served	T	UL
Maximum Queue (ft)	3	7
Average Queue (ft)	0	0
95th Queue (ft)	3	4
Link Distance (ft)	1500	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		200
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: SR-227

Movement	NB
Directions Served	UL
Maximum Queue (ft)	31
Average Queue (ft)	5
95th Queue (ft)	23
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	200
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9: SR-227 & Biddle Ranch Rd

Movement	WB	NB	SB	SB
Directions Served	R	TR	L	TR
Maximum Queue (ft)	473	177	68	18
Average Queue (ft)	250	24	19	1
95th Queue (ft)	617	112	51	11
Link Distance (ft)	1327	513		513
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			150	
Storage Blk Time (%)		0		
Queuing Penalty (veh)		0		

Network Summary

Network wide Queuing Penalty: 0

2: SR-227 Performance by movement

Movement	NBT	SBU	SBT	All
Denied Delay (hr)	0.6	0.0	0.0	0.6
Denied Del/Veh (s)	1.7		0.0	1.3
Total Delay (hr)	2.3	0.0	0.0	2.4
Total Del/Veh (s)	6.5		0.4	5.2
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0		0.0	0.0

5: SR-227 Performance by movement

Movement	NBU	NBT	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.3	0.1
Total Delay (hr)	0.1	3.7	0.1	3.9
Total Del/Veh (s)	26.8	10.7	0.8	8.6
Stop Delay (hr)	0.1	2.0	0.0	2.1
Stop Del/Veh (s)	24.3	5.6	0.0	4.5

9: SR-227 & Biddle Ranch Rd Performance by movement

Movement	EBR	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1
Denied Del/Veh (s)	0.1	0.2		0.3	0.4	0.0	0.0	0.0	0.2
Total Delay (hr)	0.0	8.4	0.0	3.0	0.1	0.2	0.1	0.0	11.8
Total Del/Veh (s)	1.3	531.1		8.8	5.0	25.0	0.6	1.2	24.1
Stop Delay (hr)	0.0	8.4	0.0	0.1	0.0	0.2	0.0	0.0	8.7
Stop Del/Veh (s)	0.0	531.5		0.2	0.1	24.1	0.0	0.0	17.8

Total Network Performance

Denied Delay (hr)	0.7
Denied Del/Veh (s)	1.5
Total Delay (hr)	19.2
Total Del/Veh (s)	38.6
Stop Delay (hr)	10.8
Stop Del/Veh (s)	21.7

Intersection: 2: SR-227

Movement	NB	SB
Directions Served	T	UL
Maximum Queue (ft)	3	7
Average Queue (ft)	0	0
95th Queue (ft)	3	4
Link Distance (ft)	1500	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		200
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: SR-227

Movement	NB
Directions Served	UL
Maximum Queue (ft)	31
Average Queue (ft)	5
95th Queue (ft)	23
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	200
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9: SR-227 & Biddle Ranch Rd

Movement	WB	NB	SB	SB
Directions Served	R	TR	L	TR
Maximum Queue (ft)	473	177	68	18
Average Queue (ft)	250	24	19	1
95th Queue (ft)	617	112	51	11
Link Distance (ft)	1327	513		513
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			150	
Storage Blk Time (%)		0		
Queuing Penalty (veh)		0		

Network Summary

Network wide Queuing Penalty: 0

RCUT

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	8	0	0	166	1	393	22	20	1358	1
Future Vol, veh/h	0	0	8	0	0	166	1	393	22	20	1358	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	Yield	-	-	Yield	-	-	Yield
Storage Length	-	-	0	-	-	0	145	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	70	70	70	84	84	84	96	96	96	93	93	93
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	0	11	0	0	198	1	409	23	22	1460	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	-	-	1461	-	-	421	1460	0	0	409	0	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.23	-	-	6.23	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.327	-	-	3.327	2.227	-	-	2.227	-	-
Pot Cap-1 Maneuver	0	0	157	0	0	630	460	-	-	1144	-	-
Stage 1	0	0	-	0	0	-	-	-	-	-	-	-
Stage 2	0	0	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	-	-	157	-	-	630	460	-	-	1144	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	29.7	13.3	0	0.1
HCM LOS	D	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	460	-	-	157	630	1144	-	-
HCM Lane V/C Ratio	0.002	-	-	0.073	0.314	0.019	-	-
HCM Control Delay (s)	12.8	-	-	29.7	13.3	8.2	-	-
HCM Lane LOS	B	-	-	D	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.2	1.3	0.1	-	-

2: SR-227 Performance by movement

Movement	NBT	SBU	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.3	0.1	0.0	0.1
Total Delay (hr)	0.2	0.0	0.8	1.0
Total Del/Veh (s)	1.5	4.0	2.0	1.9
Stop Delay (hr)	0.1	0.0	0.2	0.2
Stop Del/Veh (s)	0.5	3.7	0.4	0.4

5: SR-227 Performance by movement

Movement	NBU	NBT	SBT	All
Denied Delay (hr)	0.0	0.0	0.6	0.6
Denied Del/Veh (s)	0.2	0.1	1.8	1.2
Total Delay (hr)	2.3	0.9	1.6	4.7
Total Del/Veh (s)	66.1	6.8	4.4	9.1
Stop Delay (hr)	2.2	0.5	0.0	2.8
Stop Del/Veh (s)	65.3	4.3	0.0	5.3

9: SR-227 & Biddle Ranch Rd Performance by movement

Movement	EBR	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.2		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	0.0	0.3	0.0	0.6	0.0	0.0	0.8	0.0	1.8
Total Del/Veh (s)	1.3	6.2		5.2	3.3	3.6	2.2	1.4	3.2
Stop Delay (hr)	0.0	0.2	0.0	0.3	0.0	0.0	0.0	0.0	0.6
Stop Del/Veh (s)	0.0	4.4		2.8	1.4	2.1	0.1	0.0	1.0

Total Network Performance

Denied Delay (hr)	0.7
Denied Del/Veh (s)	1.3
Total Delay (hr)	8.6
Total Del/Veh (s)	15.8
Stop Delay (hr)	3.6
Stop Del/Veh (s)	6.6

Intersection: 2: SR-227

Movement	NB	SB
Directions Served	T	UL
Maximum Queue (ft)	48	27
Average Queue (ft)	3	1
95th Queue (ft)	63	11
Link Distance (ft)	1500	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		200
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: SR-227

Movement	NB	NB	SB
Directions Served	UL	T	T
Maximum Queue (ft)	171	136	2
Average Queue (ft)	84	36	0
95th Queue (ft)	177	254	2
Link Distance (ft)		513	1624
Upstream Blk Time (%)		2	
Queuing Penalty (veh)		14	
Storage Bay Dist (ft)	200		
Storage Blk Time (%)	5	0	
Queuing Penalty (veh)	24	0	

Intersection: 9: SR-227 & Biddle Ranch Rd

Movement	EB	WB	NB	NB	SB
Directions Served	R	R	L	TR	L
Maximum Queue (ft)	11	132	6	67	34
Average Queue (ft)	0	28	0	15	5
95th Queue (ft)	8	112	4	136	22
Link Distance (ft)	519	1327		513	
Upstream Blk Time (%)				0	
Queuing Penalty (veh)				2	
Storage Bay Dist (ft)			145		150
Storage Blk Time (%)				2	
Queuing Penalty (veh)				0	

Network Summary

Network wide Queuing Penalty: 40

2: SR-227 Performance by movement

Movement	NBT	SBU	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.3	0.1	0.0	0.1
Total Delay (hr)	0.2	0.0	0.8	1.0
Total Del/Veh (s)	1.5	4.0	2.0	1.9
Stop Delay (hr)	0.1	0.0	0.2	0.2
Stop Del/Veh (s)	0.5	3.7	0.4	0.4

5: SR-227 Performance by movement

Movement	NBU	NBT	SBT	All
Denied Delay (hr)	0.0	0.0	0.6	0.6
Denied Del/Veh (s)	0.2	0.1	1.8	1.2
Total Delay (hr)	2.3	0.9	1.6	4.7
Total Del/Veh (s)	66.1	6.8	4.4	9.1
Stop Delay (hr)	2.2	0.5	0.0	2.8
Stop Del/Veh (s)	65.3	4.3	0.0	5.3

9: SR-227 & Biddle Ranch Rd Performance by movement

Movement	EBR	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.2		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	0.0	0.3	0.0	0.6	0.0	0.0	0.8	0.0	1.8
Total Del/Veh (s)	1.3	6.2		5.2	3.3	3.6	2.2	1.4	3.2
Stop Delay (hr)	0.0	0.2	0.0	0.3	0.0	0.0	0.0	0.0	0.6
Stop Del/Veh (s)	0.0	4.4		2.8	1.4	2.1	0.1	0.0	1.0

Total Network Performance

Denied Delay (hr)	0.7
Denied Del/Veh (s)	1.3
Total Delay (hr)	8.6
Total Del/Veh (s)	15.8
Stop Delay (hr)	3.6
Stop Del/Veh (s)	6.6

Intersection: 2: SR-227

Movement	NB	SB
Directions Served	T	UL
Maximum Queue (ft)	48	27
Average Queue (ft)	3	1
95th Queue (ft)	63	11
Link Distance (ft)	1500	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		200
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: SR-227

Movement	NB	NB	SB
Directions Served	UL	T	T
Maximum Queue (ft)	171	136	2
Average Queue (ft)	84	36	0
95th Queue (ft)	177	254	2
Link Distance (ft)		513	1624
Upstream Blk Time (%)		2	
Queuing Penalty (veh)		14	
Storage Bay Dist (ft)	200		
Storage Blk Time (%)	5	0	
Queuing Penalty (veh)	24	0	

Intersection: 9: SR-227 & Biddle Ranch Rd

Movement	EB	WB	NB	NB	SB
Directions Served	R	R	L	TR	L
Maximum Queue (ft)	11	132	6	67	34
Average Queue (ft)	0	28	0	15	5
95th Queue (ft)	8	112	4	136	22
Link Distance (ft)	519	1327		513	
Upstream Blk Time (%)				0	
Queuing Penalty (veh)				2	
Storage Bay Dist (ft)			145		150
Storage Blk Time (%)				2	
Queuing Penalty (veh)				0	

Network Summary

Network wide Queuing Penalty: 40

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	3	0	0	55	1	1179	84	36	371	3
Future Vol, veh/h	0	0	3	0	0	55	1	1179	84	36	371	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	Yield	-	-	Yield	-	-	Yield
Storage Length	-	-	0	-	-	0	145	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	0	3	0	0	60	1	1282	91	39	403	3

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	-	-	405	-	-	1328	403	0	0	1282	0	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.23	-	-	6.23	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.327	-	-	3.327	2.227	-	-	2.227	-	-
Pot Cap-1 Maneuver	0	0	644	0	0	189	1150	-	-	538	-	-
Stage 1	0	0	-	0	0	-	-	-	-	-	-	-
Stage 2	0	0	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	-	-	644	-	-	189	1150	-	-	538	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	10.6			32.6			0			1.1		
HCM LOS	B			D								

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1150	-	-	644	189	538	-	-
HCM Lane V/C Ratio	0.001	-	-	0.005	0.316	0.073	-	-
HCM Control Delay (s)	8.1	-	-	10.6	32.6	12.2	-	-
HCM Lane LOS	A	-	-	B	D	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0	1.3	0.2	-	-

2: SR-227 Performance by movement

Movement	NBT	SBU	SBT	All
Denied Delay (hr)	0.6	0.0	0.0	0.6
Denied Del/Veh (s)	1.7		0.0	1.3
Total Delay (hr)	2.1	0.0	0.0	2.2
Total Del/Veh (s)	5.9		0.4	4.7
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0		0.0	0.0

5: SR-227 Performance by movement

Movement	NBU	NBT	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.3	0.1
Total Delay (hr)	0.1	3.5	0.1	3.6
Total Del/Veh (s)	13.6	10.0	0.8	7.8
Stop Delay (hr)	0.0	1.8	0.0	1.8
Stop Del/Veh (s)	11.2	5.2	0.0	4.0

9: SR-227 & Biddle Ranch Rd Performance by movement

Movement	EBR	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	0.0	2.8	0.0	2.8	0.1	0.3	0.1	0.0	5.9
Total Del/Veh (s)	1.0	183.3	4.2	8.3	4.8	24.5	0.6	1.4	12.1
Stop Delay (hr)	0.0	2.7	0.0	0.0	0.0	0.2	0.0	0.0	3.0
Stop Del/Veh (s)	0.0	181.9	1.4	0.1	0.0	23.5	0.0	0.0	6.2

Total Network Performance

Denied Delay (hr)	0.6
Denied Del/Veh (s)	1.3
Total Delay (hr)	12.9
Total Del/Veh (s)	26.1
Stop Delay (hr)	4.9
Stop Del/Veh (s)	9.9

Intersection: 2: SR-227

Movement	SB
Directions Served	UL
Maximum Queue (ft)	5
Average Queue (ft)	0
95th Queue (ft)	4
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	200
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 5: SR-227

Movement	NB
Directions Served	UL
Maximum Queue (ft)	34
Average Queue (ft)	7
95th Queue (ft)	28
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	200
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9: SR-227 & Biddle Ranch Rd

Movement	WB	NB	NB	SB	SB
Directions Served	R	L	TR	L	TR
Maximum Queue (ft)	251	5	166	77	26
Average Queue (ft)	111	0	25	20	1
95th Queue (ft)	287	4	102	55	13
Link Distance (ft)	1327		513		513
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		145		150	
Storage Blk Time (%)			0	0	
Queuing Penalty (veh)			0	0	

Network Summary

Network wide Queuing Penalty: 0

2: SR-227 Performance by movement

Movement	NBT	SBU	SBT	All
Denied Delay (hr)	0.6	0.0	0.0	0.6
Denied Del/Veh (s)	1.7		0.0	1.3
Total Delay (hr)	2.1	0.0	0.0	2.2
Total Del/Veh (s)	5.9		0.4	4.7
Stop Delay (hr)	0.0	0.0	0.0	0.0
Stop Del/Veh (s)	0.0		0.0	0.0

5: SR-227 Performance by movement

Movement	NBU	NBT	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.3	0.1
Total Delay (hr)	0.1	3.5	0.1	3.6
Total Del/Veh (s)	13.6	10.0	0.8	7.8
Stop Delay (hr)	0.0	1.8	0.0	1.8
Stop Del/Veh (s)	11.2	5.2	0.0	4.0

9: SR-227 & Biddle Ranch Rd Performance by movement

Movement	EBR	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	0.0	2.8	0.0	2.8	0.1	0.3	0.1	0.0	5.9
Total Del/Veh (s)	1.0	183.3	4.2	8.3	4.8	24.5	0.6	1.4	12.1
Stop Delay (hr)	0.0	2.7	0.0	0.0	0.0	0.2	0.0	0.0	3.0
Stop Del/Veh (s)	0.0	181.9	1.4	0.1	0.0	23.5	0.0	0.0	6.2

Total Network Performance

Denied Delay (hr)	0.6
Denied Del/Veh (s)	1.3
Total Delay (hr)	12.9
Total Del/Veh (s)	26.1
Stop Delay (hr)	4.9
Stop Del/Veh (s)	9.9

Intersection: 2: SR-227

Movement	SB
Directions Served	UL
Maximum Queue (ft)	5
Average Queue (ft)	0
95th Queue (ft)	4
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	200
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 5: SR-227

Movement	NB
Directions Served	UL
Maximum Queue (ft)	34
Average Queue (ft)	7
95th Queue (ft)	28
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	200
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9: SR-227 & Biddle Ranch Rd

Movement	WB	NB	NB	SB	SB
Directions Served	R	L	TR	L	TR
Maximum Queue (ft)	251	5	166	77	26
Average Queue (ft)	111	0	25	20	1
95th Queue (ft)	287	4	102	55	13
Link Distance (ft)	1327		513		513
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		145		150	
Storage Blk Time (%)			0	0	
Queuing Penalty (veh)			0	0	

Network Summary

Network wide Queuing Penalty: 0

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	8	0	0	169	1	424	23	24	1422	1
Future Vol, veh/h	0	0	8	0	0	169	1	424	23	24	1422	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	Yield	-	-	Yield	-	-	Yield
Storage Length	-	-	0	-	-	0	145	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	9	0	0	184	1	461	25	26	1546	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	-	-	1547	-	-	474	1546	0	0	461	0	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.22	-	-	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.318	-	-	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	0	0	141	0	0	590	429	-	-	1100	-	-
Stage 1	0	0	-	0	0	-	-	-	-	-	-	-
Stage 2	0	0	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	-	-	141	-	-	590	429	-	-	1100	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	32.2	13.8	0	0.1
HCM LOS	D	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	429	-	-	141	590	1100	-	-
HCM Lane V/C Ratio	0.003	-	-	0.062	0.311	0.024	-	-
HCM Control Delay (s)	13.4	-	-	32.2	13.8	8.4	-	-
HCM Lane LOS	B	-	-	D	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.2	1.3	0.1	-	-

2: SR-227 Performance by movement

Movement	NBT	SBU	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.4	0.0	0.0	0.1
Total Delay (hr)	1.4	0.0	0.8	2.2
Total Del/Veh (s)	11.3	5.0	2.0	4.2
Stop Delay (hr)	1.0	0.0	0.2	1.2
Stop Del/Veh (s)	8.4	5.1	0.4	2.3

5: SR-227 Performance by movement

Movement	NBU	NBT	SBT	All
Denied Delay (hr)	0.0	0.0	0.8	0.8
Denied Del/Veh (s)	0.0	0.0	2.1	1.5
Total Delay (hr)	5.0	2.7	2.0	9.7
Total Del/Veh (s)	145.2	20.5	5.2	17.7
Stop Delay (hr)	5.0	2.0	0.0	7.0
Stop Del/Veh (s)	144.5	15.5	0.0	12.8

9: SR-227 & Biddle Ranch Rd Performance by movement

Movement	EBR	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	0.0	0.9	0.0	2.8	0.1	0.0	1.0	0.0	4.8
Total Del/Veh (s)	1.1	18.9	11.8	23.6	18.9	4.7	2.4	1.4	8.2
Stop Delay (hr)	0.0	0.8	0.0	2.2	0.1	0.0	0.0	0.0	3.1
Stop Del/Veh (s)	0.0	17.3	11.1	18.4	15.5	3.3	0.1	0.1	5.3

Total Network Performance

Denied Delay (hr)	0.9
Denied Del/Veh (s)	1.6
Total Delay (hr)	18.0
Total Del/Veh (s)	32.0
Stop Delay (hr)	11.4
Stop Del/Veh (s)	20.1

Intersection: 2: SR-227

Movement	NB	SB
Directions Served	T	UL
Maximum Queue (ft)	214	23
Average Queue (ft)	38	2
95th Queue (ft)	293	12
Link Distance (ft)	1500	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		200
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: SR-227

Movement	NB	NB	SB
Directions Served	UL	T	T
Maximum Queue (ft)	216	451	4
Average Queue (ft)	133	159	0
95th Queue (ft)	253	560	3
Link Distance (ft)		513	1624
Upstream Blk Time (%)		13	
Queuing Penalty (veh)		81	
Storage Bay Dist (ft)	200		
Storage Blk Time (%)	27	0	
Queuing Penalty (veh)	128	0	

Intersection: 9: SR-227 & Biddle Ranch Rd

Movement	EB	WB	NB	NB	SB
Directions Served	R	R	L	TR	L
Maximum Queue (ft)	6	216	10	306	37
Average Queue (ft)	0	53	0	84	6
95th Queue (ft)	6	208	5	375	25
Link Distance (ft)	519	1327		513	
Upstream Blk Time (%)				5	
Queuing Penalty (veh)				22	
Storage Bay Dist (ft)			145		150
Storage Blk Time (%)				12	
Queuing Penalty (veh)				0	

Network Summary

Network wide Queuing Penalty: 231

2: SR-227 Performance by movement

Movement	NBT	SBU	SBT	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.4	0.0	0.0	0.1
Total Delay (hr)	1.4	0.0	0.8	2.2
Total Del/Veh (s)	11.3	5.0	2.0	4.2
Stop Delay (hr)	1.0	0.0	0.2	1.2
Stop Del/Veh (s)	8.4	5.1	0.4	2.3

5: SR-227 Performance by movement

Movement	NBU	NBT	SBT	All
Denied Delay (hr)	0.0	0.0	0.8	0.8
Denied Del/Veh (s)	0.0	0.0	2.1	1.5
Total Delay (hr)	5.0	2.7	2.0	9.7
Total Del/Veh (s)	145.2	20.5	5.2	17.7
Stop Delay (hr)	5.0	2.0	0.0	7.0
Stop Del/Veh (s)	144.5	15.5	0.0	12.8

9: SR-227 & Biddle Ranch Rd Performance by movement

Movement	EBR	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.1	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Total Delay (hr)	0.0	0.9	0.0	2.8	0.1	0.0	1.0	0.0	4.8
Total Del/Veh (s)	1.1	18.9	11.8	23.6	18.9	4.7	2.4	1.4	8.2
Stop Delay (hr)	0.0	0.8	0.0	2.2	0.1	0.0	0.0	0.0	3.1
Stop Del/Veh (s)	0.0	17.3	11.1	18.4	15.5	3.3	0.1	0.1	5.3

Total Network Performance

Denied Delay (hr)	0.9
Denied Del/Veh (s)	1.6
Total Delay (hr)	18.0
Total Del/Veh (s)	32.0
Stop Delay (hr)	11.4
Stop Del/Veh (s)	20.1

Intersection: 2: SR-227

Movement	NB	SB
Directions Served	T	UL
Maximum Queue (ft)	214	23
Average Queue (ft)	38	2
95th Queue (ft)	293	12
Link Distance (ft)	1500	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		200
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: SR-227

Movement	NB	NB	SB
Directions Served	UL	T	T
Maximum Queue (ft)	216	451	4
Average Queue (ft)	133	159	0
95th Queue (ft)	253	560	3
Link Distance (ft)		513	1624
Upstream Blk Time (%)		13	
Queuing Penalty (veh)		81	
Storage Bay Dist (ft)	200		
Storage Blk Time (%)	27	0	
Queuing Penalty (veh)	128	0	

Intersection: 9: SR-227 & Biddle Ranch Rd

Movement	EB	WB	NB	NB	SB
Directions Served	R	R	L	TR	L
Maximum Queue (ft)	6	216	10	306	37
Average Queue (ft)	0	53	0	84	6
95th Queue (ft)	6	208	5	375	25
Link Distance (ft)	519	1327		513	
Upstream Blk Time (%)				5	
Queuing Penalty (veh)				22	
Storage Bay Dist (ft)			145		150
Storage Blk Time (%)				12	
Queuing Penalty (veh)				0	

Network Summary

Network wide Queuing Penalty: 231

Turn-Restricted

Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	63	1	18	0	3	2	6	1389	2	0	583	13
Future Vol, veh/h	63	1	18	0	3	2	6	1389	2	0	583	13
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	145	-	123	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	82	82	82	70	70	70	95	95	95	76	76	76
Heavy Vehicles, %	4	4	4	4	4	4	4	4	4	4	4	4
Mvmt Flow	77	1	22	0	4	3	6	1462	2	0	767	17

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2255	2252	776	-	2258	1462	784	0	0	1464	0	0
Stage 1	776	776	-	-	1474	-	-	-	-	-	-	-
Stage 2	1479	1476	-	-	784	-	-	-	-	-	-	-
Critical Hdwy	7.14	6.54	6.24	-	6.54	6.24	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.14	5.54	-	-	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.14	5.54	-	-	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.536	4.036	3.336	-	4.036	3.336	2.236	-	-	2.236	-	-
Pot Cap-1 Maneuver	~ 29	41	394	0	41	156	826	-	-	455	-	-
Stage 1	387	405	-	0	189	-	-	-	-	-	-	-
Stage 2	155	188	-	0	401	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 26	41	394	-	41	156	826	-	-	455	-	-
Mov Cap-2 Maneuver	131	163	-	-	41	-	-	-	-	-	-	-
Stage 1	384	405	-	-	188	-	-	-	-	-	-	-
Stage 2	148	187	-	-	401	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	63.7	75.6	0	0
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	826	-	-	154	58	455	-	-
HCM Lane V/C Ratio	0.008	-	-	0.649	0.123	-	-	-
HCM Control Delay (s)	9.4	-	-	63.7	75.6	0	-	-
HCM Lane LOS	A	-	-	F	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	3.6	0.4	0	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	36	0	20	0	0	1	10	561	0	0	1264	65
Future Vol, veh/h	36	0	20	0	0	1	10	561	0	0	1264	65
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	145	-	123	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	70	70	70	70	70	70	87	87	87	95	95	95
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	51	0	29	0	0	1	11	645	0	0	1331	68

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2033	2032	1365	-	2066	645	1399	0	0	645	0	0
Stage 1	1365	1365	-	-	667	-	-	-	-	-	-	-
Stage 2	668	667	-	-	1399	-	-	-	-	-	-	-
Critical Hdwy	7.13	6.53	6.23	-	6.53	6.23	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.13	5.53	-	-	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	-	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.527	4.027	3.327	-	4.027	3.327	2.227	-	-	2.227	-	-
Pot Cap-1 Maneuver	~ 42	57	179	0	54	470	485	-	-	935	-	-
Stage 1	181	214	-	0	455	-	-	-	-	-	-	-
Stage 2	446	455	-	0	206	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 41	56	179	-	53	470	485	-	-	935	-	-
Mov Cap-2 Maneuver	157	187	-	-	53	-	-	-	-	-	-	-
Stage 1	177	214	-	-	445	-	-	-	-	-	-	-
Stage 2	435	445	-	-	206	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	46.2	12.7	0.2	0
HCM LOS	E	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	485	-	-	164	470	935	-	-
HCM Lane V/C Ratio	0.024	-	-	0.488	0.003	-	-	-
HCM Control Delay (s)	12.6	-	-	46.2	12.7	0	-	-
HCM Lane LOS	B	-	-	E	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	2.3	0	0	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	63	1	18	0	3	2	6	1492	2	0	632	13
Future Vol, veh/h	63	1	18	0	3	2	6	1492	2	0	632	13
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	145	-	123	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	68	1	20	0	3	2	7	1622	2	0	687	14

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2334	2332	694	-	2337	1622	701	0	0	1624	0	0
Stage 1	694	694	-	-	1636	-	-	-	-	-	-	-
Stage 2	1640	1638	-	-	701	-	-	-	-	-	-	-
Critical Hdwy	7.13	6.53	6.23	-	6.53	6.23	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.13	5.53	-	-	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	-	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.527	4.027	3.327	-	4.027	3.327	2.227	-	-	2.227	-	-
Pot Cap-1 Maneuver	~ 26	37	441	0	36	126	891	-	-	398	-	-
Stage 1	432	443	-	0	158	-	-	-	-	-	-	-
Stage 2	126	158	-	0	439	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 24	37	441	-	36	126	891	-	-	398	-	-
Mov Cap-2 Maneuver	110	142	-	-	36	-	-	-	-	-	-	-
Stage 1	429	443	-	-	157	-	-	-	-	-	-	-
Stage 2	120	157	-	-	439	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	75.9	85.6	0	0
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	891	-	-	132	50	398	-	-
HCM Lane V/C Ratio	0.007	-	-	0.675	0.109	-	-	-
HCM Control Delay (s)	9.1	-	-	75.9	85.6	0	-	-
HCM Lane LOS	A	-	-	F	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	3.7	0.3	0	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Turn-Restricted

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	36	0	20	0	0	1	10	658	0	0	1549	65
Future Vol, veh/h	36	0	20	0	0	1	10	658	0	0	1549	65
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	145	-	123	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	39	0	22	0	0	1	11	715	0	0	1684	71

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2458	2457	1720	-	2492	715	1755	0	0	715	0	0
Stage 1	1720	1720	-	-	737	-	-	-	-	-	-	-
Stage 2	738	737	-	-	1755	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	-	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	-	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	-	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	-	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	~ 21	31	111	0	29	431	356	-	-	885	-	-
Stage 1	114	144	-	0	425	-	-	-	-	-	-	-
Stage 2	410	425	-	0	139	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 20	30	111	-	28	431	356	-	-	885	-	-
Mov Cap-2 Maneuver	101	130	-	-	28	-	-	-	-	-	-	-
Stage 1	110	144	-	-	412	-	-	-	-	-	-	-
Stage 2	396	412	-	-	139	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	79.8	13.4	0.2	0
HCM LOS	F	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	356	-	-	104	431	885	-	-
HCM Lane V/C Ratio	0.031	-	-	0.585	0.003	-	-	-
HCM Control Delay (s)	15.4	-	-	79.8	13.4	0	-	-
HCM Lane LOS	C	-	-	F	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	2.8	0	0	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

TWLTL

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	2	14	1	37	1	1165	84	34	329	2
Future Vol, veh/h	1	0	2	14	1	37	1	1165	84	34	329	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	145	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	2	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	70	70	70	76	76	76	91	91	91	95	95	95
Heavy Vehicles, %	4	4	4	4	4	4	4	4	4	4	4	4
Mvmt Flow	1	0	3	18	1	49	1	1280	92	36	346	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1772	1793	347	1749	1748	1326	348	0	0	1372	0	0
Stage 1	419	419	-	1328	1328	-	-	-	-	-	-	-
Stage 2	1353	1374	-	421	420	-	-	-	-	-	-	-
Critical Hdwy	7.14	6.54	6.24	7.14	6.54	6.24	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.14	5.54	-	6.14	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.14	5.54	-	6.14	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.536	4.036	3.336	3.536	4.036	3.336	2.236	-	-	2.236	-	-
Pot Cap-1 Maneuver	64	80	692	66	85	188	1200	-	-	494	-	-
Stage 1	608	587	-	189	222	-	-	-	-	-	-	-
Stage 2	183	211	-	606	586	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	45	74	692	62	79	188	1200	-	-	494	-	-
Mov Cap-2 Maneuver	45	74	-	173	201	-	-	-	-	-	-	-
Stage 1	607	544	-	189	222	-	-	-	-	-	-	-
Stage 2	135	211	-	560	543	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	36.4	35.7	0	1.2
HCM LOS	E	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1200	-	-	119	184	494	-	-
HCM Lane V/C Ratio	0.001	-	-	0.036	0.372	0.072	-	-
HCM Control Delay (s)	8	-	-	36.4	35.7	12.9	-	-
HCM Lane LOS	A	-	-	E	E	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	1.6	0.2	-	-

TWLTL

Intersection	
Int Delay, s/veh	11.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	0	4	120	0	46	1	389	22	20	1238	1
Future Vol, veh/h	4	0	4	120	0	46	1	389	22	20	1238	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	145	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	2	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	70	70	70	84	84	84	96	96	96	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	6	0	6	143	0	55	1	405	23	22	1331	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1822	1806	1332	1798	1795	417	1332	0	0	428	0	0
Stage 1	1376	1376	-	419	419	-	-	-	-	-	-	-
Stage 2	446	430	-	1379	1376	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	60	79	189	~ 62	80	636	518	-	-	1131	-	-
Stage 1	179	213	-	612	590	-	-	-	-	-	-	-
Stage 2	591	583	-	179	213	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	54	77	189	~ 59	78	636	518	-	-	1131	-	-
Mov Cap-2 Maneuver	54	77	-	157	191	-	-	-	-	-	-	-
Stage 1	179	209	-	611	589	-	-	-	-	-	-	-
Stage 2	539	582	-	170	209	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	54.5	113.1	0	0.1
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	518	-	-	84	198	1131	-	-
HCM Lane V/C Ratio	0.002	-	-	0.136	0.998	0.019	-	-
HCM Control Delay (s)	12	-	-	54.5	113.1	8.2	-	-
HCM Lane LOS	B	-	-	F	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.5	8.6	0.1	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

TWLTL

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	2	14	1	40	1	1178	84	36	357	2
Future Vol, veh/h	1	0	2	14	1	40	1	1178	84	36	357	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	145	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	2	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	1	0	2	15	1	43	1	1280	91	39	388	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1817	1840	389	1796	1796	1326	390	0	0	1371	0	0
Stage 1	467	467	-	1328	1328	-	-	-	-	-	-	-
Stage 2	1350	1373	-	468	468	-	-	-	-	-	-	-
Critical Hdwy	7.13	6.53	6.23	7.13	6.53	6.23	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.527	4.027	3.327	3.527	4.027	3.327	2.227	-	-	2.227	-	-
Pot Cap-1 Maneuver	60	75	657	62	80	189	1163	-	-	497	-	-
Stage 1	574	560	-	190	223	-	-	-	-	-	-	-
Stage 2	185	212	-	574	560	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	43	69	657	58	74	189	1163	-	-	497	-	-
Mov Cap-2 Maneuver	43	69	-	173	201	-	-	-	-	-	-	-
Stage 1	573	516	-	190	223	-	-	-	-	-	-	-
Stage 2	142	212	-	527	516	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	37.5	33.5	0	1.2
HCM LOS	E	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1163	-	-	114	185	497	-	-
HCM Lane V/C Ratio	0.001	-	-	0.029	0.323	0.079	-	-
HCM Control Delay (s)	8.1	-	-	37.5	33.5	12.9	-	-
HCM Lane LOS	A	-	-	E	D	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	1.3	0.3	-	-

Intersection	
Int Delay, s/veh	11.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	0	4	122	0	47	1	420	23	24	1300	1
Future Vol, veh/h	4	0	4	122	0	47	1	420	23	24	1300	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	145	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	2	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	0	4	133	0	51	1	457	25	26	1413	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1963	1950	1414	1940	1938	470	1414	0	0	482	0	0
Stage 1	1466	1466	-	472	472	-	-	-	-	-	-	-
Stage 2	497	484	-	1468	1466	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	47	64	169	~ 49	65	594	482	-	-	1081	-	-
Stage 1	159	192	-	573	559	-	-	-	-	-	-	-
Stage 2	555	552	-	159	192	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	42	62	169	~ 47	63	594	482	-	-	1081	-	-
Mov Cap-2 Maneuver	42	62	-	139	171	-	-	-	-	-	-	-
Stage 1	159	187	-	572	558	-	-	-	-	-	-	-
Stage 2	506	551	-	151	187	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	66.6	131.7	0	0.2
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	482	-	-	67	177	1081	-	-
HCM Lane V/C Ratio	0.002	-	-	0.13	1.038	0.024	-	-
HCM Control Delay (s)	12.5	-	-	66.6	131.7	8.4	-	-
HCM Lane LOS	B	-	-	F	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.4	8.7	0.1	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Appendix C

Signal Synchro Operations Analysis

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	86	197	6	247	1268	4	547	59
v/c Ratio	0.58	0.31	0.04	0.69	0.85	0.06	0.51	0.06
Control Delay	71.5	5.2	0.5	58.3	17.1	63.3	17.9	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	71.5	5.2	0.5	58.3	17.1	63.3	17.9	2.2
Queue Length 50th (ft)	65	0	0	177	419	3	234	0
Queue Length 95th (ft)	112	24	0	#358	#1478	16	343	9
Internal Link Dist (ft)	2048		746		1299		2407	
Turn Bay Length (ft)		140		360		400		400
Base Capacity (vph)	371	631	306	356	1556	284	1484	1276
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.31	0.02	0.69	0.81	0.01	0.37	0.05

Intersection Summary

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

Existing Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	62	3	150	2	0	2	237	1216	1	3	432	47
Future Volume (veh/h)	62	3	150	2	0	2	237	1216	1	3	432	47
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	82	4	197	3	0	3	247	1267	1	4	547	59
Peak Hour Factor	0.76	0.76	0.76	0.70	0.70	0.70	0.96	0.96	0.96	0.79	0.79	0.79
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	212	10	442	6	0	6	275	1293	1	9	1019	863
Arrive On Green	0.13	0.13	0.13	0.01	0.00	0.01	0.16	0.70	0.70	0.01	0.55	0.55
Sat Flow, veh/h	1689	82	1572	832	0	832	1767	1854	1	1767	1856	1572
Grp Volume(v), veh/h	86	0	197	6	0	0	247	0	1268	4	547	59
Grp Sat Flow(s),veh/h/ln	1771	0	1572	1664	0	0	1767	0	1855	1767	1856	1572
Q Serve(g_s), s	5.0	0.0	11.5	0.4	0.0	0.0	15.3	0.0	72.8	0.3	21.0	2.0
Cycle Q Clear(g_c), s	5.0	0.0	11.5	0.4	0.0	0.0	15.3	0.0	72.8	0.3	21.0	2.0
Prop In Lane	0.95		1.00	0.50		0.50	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	222	0	442	13	0	0	275	0	1294	9	1019	863
V/C Ratio(X)	0.39	0.00	0.45	0.47	0.00	0.00	0.90	0.00	0.98	0.43	0.54	0.07
Avail Cap(c_a), veh/h	413	0	611	254	0	0	396	0	1647	317	1647	1396
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	44.8	0.0	32.9	55.1	0.0	0.0	46.2	0.0	16.1	55.3	16.1	11.8
Incr Delay (d2), s/veh	0.4	0.0	0.3	19.0	0.0	0.0	13.7	0.0	14.8	11.4	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.2	0.0	4.4	0.2	0.0	0.0	7.4	0.0	26.8	0.1	7.8	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	45.2	0.0	33.2	74.1	0.0	0.0	59.9	0.0	30.9	66.7	16.3	11.8
LnGrp LOS	D	A	C	E	A	A	E	A	C	E	B	B
Approach Vol, veh/h		283			6			1515			610	
Approach Delay, s/veh		36.9			74.1			35.7			16.2	
Approach LOS		D			E			D			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	20.9	67.6		18.2	4.3	84.2		4.8
Change Period (Y+Rc), s	3.5	6.4		* 4.2	3.7	6.4		4.0
Max Green Setting (Gmax), s	25.0	99.0		* 26	20.0	99.0		17.0
Max Q Clear Time (g_c+I1), s	17.3	23.0		13.5	2.3	74.8		2.4
Green Ext Time (p_c), s	0.1	0.8		0.5	0.0	2.9		0.0

Intersection Summary		
HCM 6th Ctrl Delay		31.0
HCM 6th LOS		C

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Existing Configuration

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	33	404	41	99	573	6	1201	54
v/c Ratio	0.38	0.97	0.42	0.42	0.37	0.10	0.97	0.05
Control Delay	84.4	69.6	69.4	66.5	5.8	79.2	45.0	1.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	84.4	69.6	69.4	66.5	5.8	79.2	45.0	1.3
Queue Length 50th (ft)	33	219	30	92	135	6	~1159	0
Queue Length 95th (ft)	69	306	55	159	289	21	#1399	7
Internal Link Dist (ft)	2048		746		1299		2407	
Turn Bay Length (ft)		140		360		400		400
Base Capacity (vph)	309	467	207	297	1530	237	1239	1077
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.87	0.20	0.33	0.37	0.03	0.97	0.05

Intersection Summary

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

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

Existing Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	28	0	343	14	5	10	88	509	1	5	973	44
Future Volume (veh/h)	28	0	343	14	5	10	88	509	1	5	973	44
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	33	0	404	20	7	14	99	572	1	6	1201	54
Peak Hour Factor	0.85	0.85	0.85	0.70	0.70	0.70	0.89	0.89	0.89	0.81	0.81	0.81
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	290	0	363	26	9	18	119	1264	2	13	1158	981
Arrive On Green	0.16	0.00	0.16	0.03	0.03	0.03	0.07	0.68	0.68	0.01	0.62	0.62
Sat Flow, veh/h	1767	0	1572	834	292	584	1767	1852	3	1767	1856	1572
Grp Volume(v), veh/h	33	0	404	41	0	0	99	0	573	6	1201	54
Grp Sat Flow(s),veh/h/ln	1767	0	1572	1709	0	0	1767	0	1855	1767	1856	1572
Q Serve(g_s), s	2.5	0.0	26.0	3.8	0.0	0.0	8.8	0.0	22.5	0.5	99.0	2.1
Cycle Q Clear(g_c), s	2.5	0.0	26.0	3.8	0.0	0.0	8.8	0.0	22.5	0.5	99.0	2.1
Prop In Lane	1.00		1.00	0.49		0.34	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	290	0	363	53	0	0	119	0	1266	13	1158	981
V/C Ratio(X)	0.11	0.00	1.11	0.78	0.00	0.00	0.83	0.00	0.45	0.46	1.04	0.06
Avail Cap(c_a), veh/h	290	0	363	183	0	0	278	0	1266	223	1158	981
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	56.5	0.0	61.0	76.3	0.0	0.0	73.1	0.0	11.6	78.4	29.8	11.6
Incr Delay (d2), s/veh	0.1	0.0	80.9	16.5	0.0	0.0	5.6	0.0	0.1	9.3	36.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	22.8	1.9	0.0	0.0	4.1	0.0	8.3	0.3	50.5	0.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	56.6	0.0	141.9	92.9	0.0	0.0	78.7	0.0	11.7	87.7	66.4	11.6
LnGrp LOS	E	A	F	F	A	A	E	A	B	F	F	B
Approach Vol, veh/h		437			41			672			1261	
Approach Delay, s/veh		135.4			92.9			21.5			64.2	
Approach LOS		F			F			C			E	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	14.2	105.4		30.2	4.9	114.7		8.9				
Change Period (Y+Rc), s	3.5	6.4		* 4.2	3.7	6.4		4.0				
Max Green Setting (Gmax), s	25.0	99.0		* 26	20.0	99.0		17.0				
Max Q Clear Time (g_c+I1), s	10.8	101.0		28.0	2.5	24.5		5.8				
Green Ext Time (p_c), s	0.0	0.0		0.0	0.0	0.9		0.1				

Intersection Summary		
HCM 6th Ctrl Delay		65.7
HCM 6th LOS		E

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Existing Configuration

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	74	180	4	280	1412	3	505	53
v/c Ratio	0.54	0.63	0.02	0.87	0.94	0.04	0.45	0.05
Control Delay	72.1	18.2	0.2	76.0	25.0	64.3	16.9	0.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	72.1	18.2	0.2	76.0	25.0	64.3	16.9	0.8
Queue Length 50th (ft)	57	0	0	216	592	2	193	0
Queue Length 95th (ft)	122	75	0	345	#1761	14	433	6
Internal Link Dist (ft)	2048		746		1299		2407	
Turn Bay Length (ft)		140		360		400		400
Base Capacity (vph)	281	401	170	510	1500	69	1132	996
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.45	0.02	0.55	0.94	0.04	0.45	0.05

Intersection Summary

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

Existing Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	65	3	166	2	0	2	258	1298	1	3	465	49
Future Volume (veh/h)	65	3	166	2	0	2	258	1298	1	3	465	49
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	71	3	180	2	0	2	280	1411	1	3	505	53
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	218	9	201	4	0	4	302	1356	1	7	1049	889
Arrive On Green	0.13	0.13	0.13	0.01	0.00	0.01	0.17	0.73	0.73	0.00	0.57	0.57
Sat Flow, veh/h	1699	72	1572	832	0	832	1767	1854	1	1767	1856	1572
Grp Volume(v), veh/h	74	0	180	4	0	0	280	0	1412	3	505	53
Grp Sat Flow(s),veh/h/ln	1771	0	1572	1664	0	0	1767	0	1855	1767	1856	1572
Q Serve(g_s), s	5.3	0.0	15.7	0.3	0.0	0.0	21.7	0.0	101.7	0.2	22.6	2.1
Cycle Q Clear(g_c), s	5.3	0.0	15.7	0.3	0.0	0.0	21.7	0.0	101.7	0.2	22.6	2.1
Prop In Lane	0.96		1.00	0.50		0.50	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	227	0	201	9	0	0	302	0	1357	7	1049	889
V/C Ratio(X)	0.33	0.00	0.89	0.47	0.00	0.00	0.93	0.00	1.04	0.43	0.48	0.06
Avail Cap(c_a), veh/h	255	0	226	60	0	0	463	0	1357	64	1049	889
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.2	0.0	59.7	69.0	0.0	0.0	56.8	0.0	18.7	69.1	18.0	13.6
Incr Delay (d2), s/veh	0.3	0.0	29.1	26.6	0.0	0.0	14.3	0.0	35.7	14.9	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.4	0.0	7.9	0.2	0.0	0.0	10.5	0.0	45.7	0.1	8.9	0.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	55.5	0.0	88.8	95.6	0.0	0.0	71.1	0.0	54.4	84.0	18.2	13.6
LnGrp LOS	E	A	F	F	A	A	E	A	F	F	B	B
Approach Vol, veh/h		254			4			1692			561	
Approach Delay, s/veh		79.1			95.6			57.2			18.1	
Approach LOS		E			F			E			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	27.3	85.1		22.0	4.2	108.1		4.7				
Change Period (Y+Rc), s	3.5	6.4		* 4.2	3.7	6.4		4.0				
Max Green Setting (Gmax), s	36.4	70.5		* 20	5.0	101.7		5.0				
Max Q Clear Time (g_c+I1), s	23.7	24.6		17.7	2.2	103.7		2.3				
Green Ext Time (p_c), s	0.1	0.7		0.1	0.0	0.0		0.0				

Intersection Summary			
HCM 6th Ctrl Delay			50.7
HCM 6th LOS			D

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	32	391	31	121	636	5	1178	48
v/c Ratio	0.13	1.06	0.44	1.04	0.47	0.08	0.99	0.05
Control Delay	59.1	95.4	71.0	160.4	10.2	73.2	48.4	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	59.1	95.4	71.0	160.4	10.2	73.2	48.4	0.2
Queue Length 50th (ft)	28	~270	20	~133	227	5	1055	0
Queue Length 95th (ft)	63	#484	#57	#271	376	21	#1442	1
Internal Link Dist (ft)	2048		746		1299		2407	
Turn Bay Length (ft)		140		360		400		400
Base Capacity (vph)	245	369	70	116	1376	61	1257	1096
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	1.06	0.44	1.04	0.46	0.08	0.94	0.04

Intersection Summary

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

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

Existing Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	0	360	14	5	10	111	584	1	5	1084	44
Future Volume (veh/h)	29	0	360	14	5	10	111	584	1	5	1084	44
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	32	0	391	15	5	11	121	635	1	5	1178	48
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	246	0	219	20	7	15	117	1302	2	11	1196	1013
Arrive On Green	0.14	0.00	0.14	0.02	0.02	0.02	0.07	0.70	0.70	0.01	0.64	0.64
Sat Flow, veh/h	1767	0	1572	825	275	605	1767	1852	3	1767	1856	1572
Grp Volume(v), veh/h	32	0	391	31	0	0	121	0	636	5	1178	48
Grp Sat Flow(s),veh/h/ln	1767	0	1572	1705	0	0	1767	0	1855	1767	1856	1572
Q Serve(g_s), s	2.3	0.0	20.0	2.6	0.0	0.0	9.5	0.0	22.3	0.4	88.9	1.6
Cycle Q Clear(g_c), s	2.3	0.0	20.0	2.6	0.0	0.0	9.5	0.0	22.3	0.4	88.9	1.6
Prop In Lane	1.00		1.00	0.48		0.35	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	246	0	219	42	0	0	117	0	1304	11	1196	1013
V/C Ratio(X)	0.13	0.00	1.79	0.74	0.00	0.00	1.04	0.00	0.49	0.45	0.99	0.05
Avail Cap(c_a), veh/h	246	0	219	59	0	0	117	0	1312	61	1257	1065
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.3	0.0	61.9	69.7	0.0	0.0	67.2	0.0	9.7	71.2	24.9	9.4
Incr Delay (d2), s/veh	0.1	0.0	372.4	20.3	0.0	0.0	93.5	0.0	0.1	10.2	21.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	30.6	1.4	0.0	0.0	7.2	0.0	7.7	0.2	40.0	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	54.4	0.0	434.3	89.9	0.0	0.0	160.6	0.0	9.8	81.4	46.1	9.4
LnGrp LOS	D	A	F	F	A	A	F	A	A	F	D	A
Approach Vol, veh/h		423			31			757			1231	
Approach Delay, s/veh		405.6			89.9			33.9			44.8	
Approach LOS		F			F			C			D	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.0	99.1		24.2	4.6	107.5		7.6				
Change Period (Y+Rc), s	3.5	6.4		* 4.2	3.7	6.4		4.0				
Max Green Setting (Gmax), s	9.5	97.4		* 20	5.0	101.7		5.0				
Max Q Clear Time (g_c+I1), s	11.5	90.9		22.0	2.4	24.3		4.6				
Green Ext Time (p_c), s	0.0	1.7		0.0	0.0	1.0		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			104.5									
HCM 6th LOS			F									
Notes												

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Existing Configuration

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	380	46	7	80	1209	1	431	365
v/c Ratio	0.86	0.10	0.03	0.65	1.02	0.01	0.42	0.27
Control Delay	71.2	2.1	0.2	91.9	57.9	75.0	21.8	0.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	71.2	2.1	0.2	91.9	57.9	75.0	21.8	0.9
Queue Length 50th (ft)	333	0	0	73	~1052	1	220	7
Queue Length 95th (ft)	384	0	0	148	#1909	8	328	12
Internal Link Dist (ft)	883		68		4421		1381	
Turn Bay Length (ft)		273		220		78		112
Base Capacity (vph)	564	556	328	311	1311	191	1185	1451
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.67	0.08	0.02	0.26	0.92	0.01	0.36	0.25

Intersection Summary

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

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

Existing Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	265	1	32	0	0	5	74	1123	1	1	323	274
Future Volume (veh/h)	265	1	32	0	0	5	74	1123	1	1	323	274
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841
Adj Flow Rate, veh/h	379	1	46	0	0	7	80	1208	1	1	431	365
Peak Hour Factor	0.70	0.70	0.70	0.70	0.70	0.70	0.93	0.93	0.93	0.75	0.75	0.75
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	401	1	358	0	0	16	102	1113	1	68	1079	1272
Arrive On Green	0.23	0.23	0.23	0.00	0.00	0.01	0.06	0.61	0.61	0.04	0.59	0.59
Sat Flow, veh/h	1749	5	1560	0	0	1560	1753	1839	2	1753	1841	1560
Grp Volume(v), veh/h	380	0	46	0	0	7	80	0	1209	1	431	365
Grp Sat Flow(s),veh/h/ln	1753	0	1560	0	0	1560	1753	0	1840	1753	1841	1560
Q Serve(g_s), s	33.1	0.0	3.6	0.0	0.0	0.7	7.0	0.0	94.0	0.1	19.7	8.8
Cycle Q Clear(g_c), s	33.1	0.0	3.6	0.0	0.0	0.7	7.0	0.0	94.0	0.1	19.7	8.8
Prop In Lane	1.00		1.00	0.00		1.00	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	402	0	358	0	0	16	102	0	1114	68	1079	1272
V/C Ratio(X)	0.94	0.00	0.13	0.00	0.00	0.45	0.79	0.00	1.09	0.01	0.40	0.29
Avail Cap(c_a), veh/h	531	0	472	0	0	161	294	0	1114	181	1114	1302
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	58.9	0.0	47.5	0.0	0.0	76.4	72.2	0.0	30.6	71.8	17.4	3.5
Incr Delay (d2), s/veh	20.2	0.0	0.1	0.0	0.0	14.0	5.0	0.0	53.2	0.0	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	17.0	0.0	1.4	0.0	0.0	0.3	3.2	0.0	53.2	0.0	7.8	6.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	79.1	0.0	47.6	0.0	0.0	90.4	77.1	0.0	83.8	71.8	17.5	3.5
LnGrp LOS	E	A	D	A	A	F	E	A	F	E	B	A
Approach Vol, veh/h		426			7			1289			797	
Approach Delay, s/veh		75.7			90.4			83.4			11.1	
Approach LOS		E			F			F			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	12.5	97.4		5.6	9.5	100.4		39.8				
Change Period (Y+Rc), s	3.5	6.4		4.0	3.5	6.4		4.2				
Max Green Setting (Gmax), s	26.0	94.0		16.0	16.0	94.0		47.0				
Max Q Clear Time (g_c+I1), s	9.0	21.7		2.7	2.1	96.0		35.1				
Green Ext Time (p_c), s	0.0	0.7		0.0	0.0	0.0		0.5				
Intersection Summary												
HCM 6th Ctrl Delay			59.2									
HCM 6th LOS			E									

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	160	49	5	35	530	4	1230	146
v/c Ratio	0.80	0.20	0.03	0.37	0.37	0.05	0.90	0.10
Control Delay	83.6	6.8	0.5	73.7	6.8	66.2	26.8	0.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	83.6	6.8	0.5	73.7	6.8	66.2	26.8	0.9
Queue Length 50th (ft)	132	0	0	29	103	3	758	6
Queue Length 95th (ft)	228	19	0	71	299	17	#1547	15
Internal Link Dist (ft)	883		68		4421		1381	
Turn Bay Length (ft)		273		220		78		112
Base Capacity (vph)	275	307	269	220	1428	220	1364	1452
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.58	0.16	0.02	0.16	0.37	0.02	0.90	0.10

Intersection Summary

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

Existing Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	142	0	44	1	0	3	31	469	3	4	1144	136
Future Volume (veh/h)	142	0	44	1	0	3	31	469	3	4	1144	136
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	160	0	49	1	0	4	35	527	3	4	1230	146
Peak Hour Factor	0.89	0.89	0.89	0.70	0.70	0.70	0.89	0.89	0.89	0.93	0.93	0.93
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	190	0	169	2	0	10	92	1247	7	92	1255	1233
Arrive On Green	0.11	0.00	0.11	0.01	0.00	0.01	0.05	0.68	0.68	0.05	0.68	0.68
Sat Flow, veh/h	1767	0	1572	322	0	1286	1767	1843	10	1767	1856	1572
Grp Volume(v), veh/h	160	0	49	5	0	0	35	0	530	4	1230	146
Grp Sat Flow(s),veh/h/ln	1767	0	1572	1608	0	0	1767	0	1854	1767	1856	1572
Q Serve(g_s), s	10.3	0.0	3.3	0.4	0.0	0.0	2.2	0.0	15.0	0.2	73.5	2.6
Cycle Q Clear(g_c), s	10.3	0.0	3.3	0.4	0.0	0.0	2.2	0.0	15.0	0.2	73.5	2.6
Prop In Lane	1.00		1.00	0.20		0.80	1.00		0.01	1.00		1.00
Lane Grp Cap(c), veh/h	190	0	169	12	0	0	92	0	1254	92	1255	1233
V/C Ratio(X)	0.84	0.00	0.29	0.40	0.00	0.00	0.38	0.00	0.42	0.04	0.98	0.12
Avail Cap(c_a), veh/h	306	0	272	223	0	0	245	0	1507	245	1509	1447
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	50.7	0.0	47.6	57.1	0.0	0.0	53.0	0.0	8.5	52.1	17.9	3.0
Incr Delay (d2), s/veh	5.8	0.0	0.3	15.0	0.0	0.0	1.0	0.0	0.1	0.1	16.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.8	0.0	1.3	0.2	0.0	0.0	1.0	0.0	4.8	0.1	29.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	56.5	0.0	47.9	72.1	0.0	0.0	54.0	0.0	8.6	52.2	34.3	3.0
LnGrp LOS	E	A	D	E	A	A	D	A	A	D	C	A
Approach Vol, veh/h		209			5			565			1380	
Approach Delay, s/veh		54.5			72.1			11.4			31.0	
Approach LOS		D			E			B			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.5	84.6		4.9	9.5	84.6		16.6				
Change Period (Y+Rc), s	3.5	6.4		4.0	3.5	6.4		4.2				
Max Green Setting (Gmax), s	16.0	94.0		16.0	16.0	94.0		20.0				
Max Q Clear Time (g_c+I1), s	4.2	75.5		2.4	2.2	17.0		12.3				
Green Ext Time (p_c), s	0.0	2.7		0.0	0.0	0.8		0.1				
Intersection Summary												
HCM 6th Ctrl Delay			28.3									
HCM 6th LOS			C									

Existing Configuration

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	385	49	5	80	1239	1	367	335
v/c Ratio	0.85	0.11	0.02	0.66	1.05	0.01	0.36	0.35
Control Delay	70.5	2.8	0.2	92.6	67.9	75.0	20.9	10.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.5	2.8	0.2	92.6	67.9	75.0	20.9	10.8
Queue Length 50th (ft)	339	0	0	74	~1238	1	182	76
Queue Length 95th (ft)	#548	12	0	148	#1981	9	347	191
Internal Link Dist (ft)	883		68		4421		1381	
Turn Bay Length (ft)		273		220		78		112
Base Capacity (vph)	560	553	323	309	1302	190	1177	1060
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.09	0.02	0.26	0.95	0.01	0.31	0.32

Intersection Summary

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

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

Existing Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	353	1	45	0	0	5	74	1139	1	1	338	308
Future Volume (veh/h)	353	1	45	0	0	5	74	1139	1	1	338	308
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841
Adj Flow Rate, veh/h	384	1	49	0	0	5	80	1238	1	1	367	335
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	406	1	362	0	0	12	102	1113	1	68	1078	914
Arrive On Green	0.23	0.23	0.23	0.00	0.00	0.01	0.06	0.61	0.61	0.04	0.59	0.59
Sat Flow, veh/h	1749	5	1560	0	0	1560	1753	1839	1	1753	1841	1560
Grp Volume(v), veh/h	385	0	49	0	0	5	80	0	1239	1	367	335
Grp Sat Flow(s),veh/h/ln	1753	0	1560	0	0	1560	1753	0	1840	1753	1841	1560
Q Serve(g_s), s	33.6	0.0	3.9	0.0	0.0	0.5	7.0	0.0	94.0	0.1	16.0	17.6
Cycle Q Clear(g_c), s	33.6	0.0	3.9	0.0	0.0	0.5	7.0	0.0	94.0	0.1	16.0	17.6
Prop In Lane	1.00		1.00	0.00		1.00	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	407	0	362	0	0	12	102	0	1114	68	1078	914
V/C Ratio(X)	0.95	0.00	0.14	0.00	0.00	0.43	0.79	0.00	1.11	0.01	0.34	0.37
Avail Cap(c_a), veh/h	531	0	472	0	0	161	293	0	1114	181	1114	944
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	58.7	0.0	47.3	0.0	0.0	76.8	72.2	0.0	30.7	71.8	16.6	17.0
Incr Delay (d2), s/veh	20.7	0.0	0.1	0.0	0.0	17.3	5.0	0.0	63.4	0.0	0.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	17.3	0.0	1.5	0.0	0.0	0.3	3.2	0.0	56.4	0.0	6.4	5.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	79.3	0.0	47.3	0.0	0.0	94.0	77.2	0.0	94.0	71.9	16.7	17.1
LnGrp LOS	E	A	D	A	A	F	E	A	F	E	B	B
Approach Vol, veh/h		434			5			1319			703	
Approach Delay, s/veh		75.7			94.0			93.0			17.0	
Approach LOS		E			F			F			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	12.5	97.4		5.2	9.5	100.4		40.3
Change Period (Y+Rc), s	3.5	6.4		4.0	3.5	6.4		4.2
Max Green Setting (Gmax), s	26.0	94.0		16.0	16.0	94.0		47.0
Max Q Clear Time (g_c+I1), s	9.0	19.6		2.5	2.1	96.0		35.6
Green Ext Time (p_c), s	0.0	0.6		0.0	0.0	0.0		0.5

Intersection Summary	
HCM 6th Ctrl Delay	68.2
HCM 6th LOS	E

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	223	53	15	42	539	4	1310	223
v/c Ratio	0.87	0.18	0.11	0.45	0.40	0.05	1.04	0.20
Control Delay	89.8	7.3	1.5	80.5	8.7	69.0	58.2	7.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	89.8	7.3	1.5	80.5	8.7	69.0	58.2	7.2
Queue Length 50th (ft)	193	0	0	37	130	3	~1212	45
Queue Length 95th (ft)	#385	25	0	83	310	17	#1723	102
Internal Link Dist (ft)	883		68		4421		1381	
Turn Bay Length (ft)		273		220		78		112
Base Capacity (vph)	255	290	252	204	1357	204	1264	1093
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.87	0.18	0.06	0.21	0.40	0.02	1.04	0.20

Intersection Summary

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

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

Existing Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	205	0	49	1	0	13	39	493	3	4	1205	205
Future Volume (veh/h)	205	0	49	1	0	13	39	493	3	4	1205	205
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	223	0	53	1	0	14	42	536	3	4	1310	223
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	245	0	218	2	0	28	76	1236	7	76	1244	1054
Arrive On Green	0.14	0.00	0.14	0.02	0.00	0.02	0.04	0.67	0.67	0.04	0.67	0.67
Sat Flow, veh/h	1767	0	1572	106	0	1479	1767	1843	10	1767	1856	1572
Grp Volume(v), veh/h	223	0	53	15	0	0	42	0	539	4	1310	223
Grp Sat Flow(s),veh/h/ln	1767	0	1572	1584	0	0	1767	0	1854	1767	1856	1572
Q Serve(g_s), s	17.4	0.0	4.2	1.3	0.0	0.0	3.3	0.0	18.9	0.3	94.0	7.6
Cycle Q Clear(g_c), s	17.4	0.0	4.2	1.3	0.0	0.0	3.3	0.0	18.9	0.3	94.0	7.6
Prop In Lane	1.00		1.00	0.07		0.93	1.00		0.01	1.00		1.00
Lane Grp Cap(c), veh/h	245	0	218	30	0	0	76	0	1243	76	1244	1054
V/C Ratio(X)	0.91	0.00	0.24	0.50	0.00	0.00	0.56	0.00	0.43	0.05	1.05	0.21
Avail Cap(c_a), veh/h	252	0	224	181	0	0	202	0	1243	202	1244	1054
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	59.5	0.0	53.8	68.1	0.0	0.0	65.8	0.0	10.7	64.4	23.1	8.9
Incr Delay (d2), s/veh	32.3	0.0	0.2	9.2	0.0	0.0	2.4	0.0	0.1	0.1	40.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.0	0.0	1.7	0.6	0.0	0.0	1.5	0.0	6.7	0.1	47.5	2.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	91.8	0.0	54.0	77.4	0.0	0.0	68.2	0.0	10.8	64.5	63.8	8.9
LnGrp LOS	F	A	D	E	A	A	E	A	B	E	F	A
Approach Vol, veh/h		276			15			581			1537	
Approach Delay, s/veh		84.6			77.4			15.0			55.9	
Approach LOS		F			E			B			E	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.5	100.4		6.7	9.5	100.4		23.7
Change Period (Y+Rc), s	3.5	6.4		4.0	3.5	6.4		4.2
Max Green Setting (Gmax), s	16.0	94.0		16.0	16.0	94.0		20.0
Max Q Clear Time (g_c+I1), s	5.3	96.0		3.3	2.3	20.9		19.4
Green Ext Time (p_c), s	0.0	0.0		0.0	0.0	0.8		0.0

Intersection Summary			
HCM 6th Ctrl Delay			49.4
HCM 6th LOS			D

Lane Group	WBT	NBT	SBL	SBT
Lane Group Flow (vph)	14	1359	42	681
v/c Ratio	0.05	0.41	0.13	0.20
Control Delay	0.4	1.3	1.9	0.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	0.4	1.3	1.9	0.8
Queue Length 50th (ft)	0	0	0	0
Queue Length 95th (ft)	0	96	9	36
Internal Link Dist (ft)	680	251		224
Turn Bay Length (ft)			145	
Base Capacity (vph)	681	3325	333	3335
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.02	0.41	0.13	0.20

Intersection Summary

Proposed Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	1	0	9	0	1216	21	36	586	0
Future Volume (veh/h)	0	0	0	1	0	9	0	1216	21	36	586	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	0	0	0	1	0	13	0	1336	23	42	681	0
Peak Hour Factor	0.92	0.92	0.92	0.70	0.70	0.70	0.91	0.91	0.91	0.86	0.86	0.86
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	0	7	0	2	0	27	272	2276	39	441	2263	0
Arrive On Green	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.64	0.64	0.64	0.64	0.00
Sat Flow, veh/h	0	1856	0	113	0	1472	753	3546	61	397	3618	0
Grp Volume(v), veh/h	0	0	0	14	0	0	0	664	695	42	681	0
Grp Sat Flow(s),veh/h/ln	0	1856	0	1585	0	0	753	1763	1845	397	1763	0
Q Serve(g_s), s	0.0	0.0	0.0	0.2	0.0	0.0	0.0	5.7	5.7	1.8	2.3	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.2	0.0	0.0	0.0	5.7	5.7	7.5	2.3	0.0
Prop In Lane	0.00		0.00	0.07		0.93	1.00		0.03	1.00		0.00
Lane Grp Cap(c), veh/h	0	7	0	29	0	0	272	1131	1184	441	2263	0
V/C Ratio(X)	0.00	0.00	0.00	0.48	0.00	0.00	0.00	0.59	0.59	0.10	0.30	0.00
Avail Cap(c_a), veh/h	0	1261	0	1077	0	0	656	2029	2124	643	4059	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	12.9	0.0	0.0	0.0	2.7	2.7	4.9	2.1	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	11.6	0.0	0.0	0.0	0.5	0.5	0.1	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	0.0	24.5	0.0	0.0	0.0	3.2	3.2	5.0	2.2	0.0
LnGrp LOS	A	A	A	C	A	A	A	A	A	A	A	A
Approach Vol, veh/h		0			14			1359			723	
Approach Delay, s/veh		0.0			24.5			3.2			2.3	
Approach LOS					C			A			A	

Timer - Assigned Phs	2	4	6	8
Phs Duration (G+Y+Rc), s	21.5	0.0	21.5	5.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	30.5	18.0	30.5	18.0
Max Q Clear Time (g_c+I1), s	7.7	0.0	9.5	2.2
Green Ext Time (p_c), s	9.3	0.0	4.9	0.0

Intersection Summary	
HCM 6th Ctrl Delay	3.0
HCM 6th LOS	A

Proposed Configuration

Lane Group	WBT	NBT	SBL	SBT
Lane Group Flow (vph)	41	731	28	1280
v/c Ratio	0.15	0.33	0.13	0.56
Control Delay	1.3	5.9	23.4	7.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	1.3	5.9	23.4	7.1
Queue Length 50th (ft)	0	32	7	63
Queue Length 95th (ft)	0	101	28	186
Internal Link Dist (ft)	680	251		224
Turn Bay Length (ft)			145	
Base Capacity (vph)	644	2604	617	2606
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.06	0.28	0.05	0.49

Intersection Summary

Proposed Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	8	0	26	0	654	4	25	1139	0
Future Volume (veh/h)	0	0	0	8	0	26	0	654	4	25	1139	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	0	0	0	10	0	31	0	727	4	28	1280	0
Peak Hour Factor	0.92	0.92	0.92	0.83	0.83	0.83	0.90	0.90	0.90	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	0	6	0	19	0	59	6	1314	7	284	2364	0
Arrive On Green	0.00	0.00	0.00	0.05	0.00	0.05	0.00	0.36	0.36	0.16	0.67	0.00
Sat Flow, veh/h	0	1870	0	397	0	1232	1781	3624	20	1781	3647	0
Grp Volume(v), veh/h	0	0	0	41	0	0	0	356	375	28	1280	0
Grp Sat Flow(s),veh/h/ln	0	1870	0	1629	0	0	1781	1777	1867	1781	1777	0
Q Serve(g_s), s	0.0	0.0	0.0	0.8	0.0	0.0	0.0	5.0	5.0	0.4	5.9	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.8	0.0	0.0	0.0	5.0	5.0	0.4	5.9	0.0
Prop In Lane	0.00		0.00	0.24		0.76	1.00		0.01	1.00		0.00
Lane Grp Cap(c), veh/h	0	6	0	78	0	0	6	644	677	284	2364	0
V/C Ratio(X)	0.00	0.00	0.00	0.53	0.00	0.00	0.00	0.55	0.55	0.10	0.54	0.00
Avail Cap(c_a), veh/h	0	1073	0	934	0	0	1022	2152	2261	1022	4304	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	14.6	0.0	0.0	0.0	8.0	8.0	11.3	2.7	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	5.4	0.0	0.0	0.0	0.7	0.7	0.1	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.3	0.0	0.0	0.0	1.0	1.1	0.1	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	0.0	20.0	0.0	0.0	0.0	8.7	8.7	11.4	2.9	0.0
LnGrp LOS	A	A	A	B	A	A	A	A	A	B	A	A
Approach Vol, veh/h		0			41			731			1308	
Approach Delay, s/veh		0.0			20.0			8.7			3.1	
Approach LOS					B			A			A	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	0.0	25.4		0.0	9.5	15.9		6.0				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	18.0	38.0		18.0	18.0	38.0		18.0				
Max Q Clear Time (g_c+I1), s	0.0	7.9		0.0	2.4	7.0		2.8				
Green Ext Time (p_c), s	0.0	10.5		0.0	0.0	4.4		0.1				
Intersection Summary												
HCM 6th Ctrl Delay			5.4									
HCM 6th LOS			A									

Proposed Configuration

Lane Group	WBT	NBT	SBL	SBT
Lane Group Flow (vph)	103	1438	132	662
v/c Ratio	0.53	0.49	0.50	0.22
Control Delay	23.1	2.9	10.0	1.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	23.1	2.9	10.0	1.9
Queue Length 50th (ft)	9	84	15	28
Queue Length 95th (ft)	59	153	71	54
Internal Link Dist (ft)	680	251		224
Turn Bay Length (ft)			145	
Base Capacity (vph)	346	2955	266	2969
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.30	0.49	0.50	0.22

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	13	0	82	0	1280	43	121	609	0
Future Volume (veh/h)	0	0	0	13	0	82	0	1280	43	121	609	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	0	0	0	14	0	89	0	1391	47	132	662	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	0	4	0	18	0	116	167	2463	83	355	2495	0
Arrive On Green	0.00	0.00	0.00	0.08	0.00	0.08	0.00	0.71	0.71	0.71	0.71	0.00
Sat Flow, veh/h	0	1856	0	217	0	1379	767	3480	117	368	3618	0
Grp Volume(v), veh/h	0	0	0	103	0	0	0	704	734	132	662	0
Grp Sat Flow(s),veh/h/ln	0	1856	0	1596	0	0	767	1763	1834	368	1763	0
Q Serve(g_s), s	0.0	0.0	0.0	2.7	0.0	0.0	0.0	8.4	8.4	11.8	2.9	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	2.7	0.0	0.0	0.0	8.4	8.4	20.2	2.9	0.0
Prop In Lane	0.00		0.00	0.14		0.86	1.00		0.06	1.00		0.00
Lane Grp Cap(c), veh/h	0	4	0	134	0	0	167	1248	1298	355	2495	0
V/C Ratio(X)	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.56	0.57	0.37	0.27	0.00
Avail Cap(c_a), veh/h	0	772	0	665	0	0	1052	3282	3415	781	6564	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	19.4	0.0	0.0	0.0	3.1	3.1	8.0	2.3	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	8.8	0.0	0.0	0.0	0.4	0.4	0.6	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.1	0.1	0.5	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	0.0	28.2	0.0	0.0	0.0	3.5	3.5	8.6	2.3	0.0
LnGrp LOS	A	A	A	C	A	A	A	A	A	A	A	A
Approach Vol, veh/h		0			103			1438			794	
Approach Delay, s/veh		0.0			28.2			3.5			3.4	
Approach LOS					C			A			A	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		35.1		0.0		35.1		8.1				
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5				
Max Green Setting (Gmax), s		80.5		18.0		80.5		18.0				
Max Q Clear Time (g_c+I1), s		10.4		0.0		22.2		4.7				
Green Ext Time (p_c), s		13.4		0.0		8.4		0.4				
Intersection Summary												
HCM 6th Ctrl Delay			4.5									
HCM 6th LOS			A									

Proposed Configuration

Lane Group	WBT	NBT	SBL	SBT
Lane Group Flow (vph)	263	797	135	1300
v/c Ratio	0.68	0.48	0.49	0.67
Control Delay	25.4	15.3	33.6	14.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	25.4	15.3	33.6	14.2
Queue Length 50th (ft)	62	115	54	193
Queue Length 95th (ft)	137	210	105	307
Internal Link Dist (ft)	680	251		224
Turn Bay Length (ft)			145	
Base Capacity (vph)	504	1914	455	1935
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.52	0.42	0.30	0.67

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	68	0	174	0	706	28	124	1196	0
Future Volume (veh/h)	0	0	0	68	0	174	0	706	28	124	1196	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	0	0	0	74	0	189	0	767	30	135	1300	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	0	4	0	98	0	251	4	1202	47	222	2044	0
Arrive On Green	0.00	0.00	0.00	0.21	0.00	0.21	0.00	0.34	0.34	0.12	0.58	0.00
Sat Flow, veh/h	0	1870	0	460	0	1176	1781	3486	136	1781	3647	0
Grp Volume(v), veh/h	0	0	0	263	0	0	0	391	406	135	1300	0
Grp Sat Flow(s),veh/h/ln	0	1870	0	1636	0	0	1781	1777	1846	1781	1777	0
Q Serve(g_s), s	0.0	0.0	0.0	6.4	0.0	0.0	0.0	7.9	7.9	3.1	10.4	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	6.4	0.0	0.0	0.0	7.9	7.9	3.1	10.4	0.0
Prop In Lane	0.00		0.00	0.28		0.72	1.00		0.07	1.00		0.00
Lane Grp Cap(c), veh/h	0	4	0	349	0	0	4	613	637	222	2044	0
V/C Ratio(X)	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.64	0.64	0.61	0.64	0.00
Avail Cap(c_a), veh/h	0	792	0	692	0	0	754	1588	1649	754	3175	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	15.7	0.0	0.0	0.0	11.7	11.7	17.6	6.1	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	3.3	0.0	0.0	0.0	1.1	1.1	2.7	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	2.3	0.0	0.0	0.0	2.3	2.4	1.2	1.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	0.0	19.0	0.0	0.0	0.0	12.8	12.8	20.3	6.4	0.0
LnGrp LOS	A	A	A	B	A	A	A	B	B	C	A	A
Approach Vol, veh/h		0			263			797			1435	
Approach Delay, s/veh		0.0			19.0			12.8			7.7	
Approach LOS					B			B			A	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	0.0	29.0		0.0	9.8	19.2		13.6				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	18.0	38.0		18.0	18.0	38.0		18.0				
Max Q Clear Time (g_c+I1), s	0.0	12.4		0.0	5.1	9.9		8.4				
Green Ext Time (p_c), s	0.0	10.1		0.0	0.2	4.8		1.1				
Intersection Summary												
HCM 6th Ctrl Delay			10.5									
HCM 6th LOS			B									

Proposed Configuration

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	86	197	8	247	1268	4	547	59
v/c Ratio	0.31	0.47	0.02	0.59	0.65	0.02	0.60	0.11
Control Delay	24.0	8.7	0.0	26.2	11.0	25.7	18.9	0.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.0	8.7	0.0	26.2	11.0	25.7	18.9	0.4
Queue Length 50th (ft)	19	0	0	51	82	1	62	0
Queue Length 95th (ft)	61	30	0	#206	325	9	121	0
Internal Link Dist (ft)	2048		746		1299		2407	
Turn Bay Length (ft)		140		360		400		400
Base Capacity (vph)	787	811	367	529	2486	196	1835	901
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.24	0.02	0.47	0.51	0.02	0.30	0.07

Intersection Summary

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

Proposed Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	62	3	150	2	0	2	237	1216	1	3	432	47
Future Volume (veh/h)	62	3	150	2	0	2	237	1216	1	3	432	47
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	82	4	197	4	0	4	247	1267	1	4	547	59
Peak Hour Factor	0.76	0.76	0.76	0.50	0.50	0.50	0.96	0.96	0.96	0.79	0.79	0.79
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	287	14	267	9	0	9	304	1472	1	10	865	386
Arrive On Green	0.17	0.17	0.17	0.01	0.00	0.01	0.17	0.41	0.41	0.01	0.25	0.25
Sat Flow, veh/h	1689	82	1572	832	0	832	1767	3615	3	1767	3526	1572
Grp Volume(v), veh/h	86	0	197	8	0	0	247	618	650	4	547	59
Grp Sat Flow(s),veh/h/ln	1771	0	1572	1664	0	0	1767	1763	1855	1767	1763	1572
Q Serve(g_s), s	1.9	0.0	5.3	0.2	0.0	0.0	6.1	14.4	14.4	0.1	6.2	1.3
Cycle Q Clear(g_c), s	1.9	0.0	5.3	0.2	0.0	0.0	6.1	14.4	14.4	0.1	6.2	1.3
Prop In Lane	0.95		1.00	0.50		0.50	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	301	0	267	18	0	0	304	718	755	10	865	386
V/C Ratio(X)	0.29	0.00	0.74	0.45	0.00	0.00	0.81	0.86	0.86	0.42	0.63	0.15
Avail Cap(c_a), veh/h	787	0	699	185	0	0	530	1242	1307	196	1834	818
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.3	0.0	17.7	22.1	0.0	0.0	17.9	12.2	12.2	22.3	15.2	13.3
Incr Delay (d2), s/veh	0.2	0.0	1.5	13.0	0.0	0.0	2.0	1.2	1.2	10.4	0.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	1.8	0.1	0.0	0.0	2.0	3.5	3.6	0.1	1.8	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	16.5	0.0	19.2	35.1	0.0	0.0	19.9	13.4	13.3	32.7	15.5	13.4
LnGrp LOS	B	A	B	D	A	A	B	B	B	C	B	B
Approach Vol, veh/h		283			8			1515			610	
Approach Delay, s/veh		18.4			35.1			14.4			15.4	
Approach LOS		B			D			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.2	17.4		11.8	3.9	24.7		4.5
Change Period (Y+Rc), s	3.5	6.4		* 4.2	3.7	6.4		4.0
Max Green Setting (Gmax), s	13.5	23.4		* 20	5.0	31.7		5.0
Max Q Clear Time (g_c+I1), s	8.1	8.2		7.3	2.1	16.4		2.2
Green Ext Time (p_c), s	0.0	1.0		0.5	0.0	1.9		0.0

Intersection Summary		
HCM 6th Ctrl Delay		15.2
HCM 6th LOS		B

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	77	215	44	99	573	6	1396	54
v/c Ratio	0.34	0.59	0.28	0.54	0.27	0.04	0.87	0.07
Control Delay	33.8	15.4	31.5	46.4	7.9	35.8	22.8	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.8	15.4	31.5	46.4	7.9	35.8	22.8	0.5
Queue Length 50th (ft)	31	12	12	42	53	2	266	0
Queue Length 95th (ft)	71	65	35	#127	122	13	336	0
Internal Link Dist (ft)	2048		746		1299		2407	
Turn Bay Length (ft)		140		360		400		400
Base Capacity (vph)	582	641	155	188	2474	144	2341	1083
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.34	0.28	0.53	0.23	0.04	0.60	0.05

Intersection Summary

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

Proposed Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	62	3	183	16	5	10	88	509	1	5	1131	44
Future Volume (veh/h)	62	3	183	16	5	10	88	509	1	5	1131	44
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	73	4	215	23	7	14	99	572	1	6	1396	54
Peak Hour Factor	0.85	0.85	0.85	0.70	0.70	0.70	0.89	0.89	0.89	0.81	0.81	0.81
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	282	15	264	37	11	23	134	1827	3	14	1555	693
Arrive On Green	0.17	0.17	0.17	0.04	0.04	0.04	0.08	0.51	0.51	0.01	0.44	0.44
Sat Flow, veh/h	1680	92	1572	895	272	545	1767	3611	6	1767	3526	1572
Grp Volume(v), veh/h	77	0	215	44	0	0	99	279	294	6	1396	54
Grp Sat Flow(s),veh/h/ln	1772	0	1572	1713	0	0	1767	1763	1854	1767	1763	1572
Q Serve(g_s), s	2.5	0.0	8.7	1.7	0.0	0.0	3.6	6.2	6.2	0.2	24.3	1.3
Cycle Q Clear(g_c), s	2.5	0.0	8.7	1.7	0.0	0.0	3.6	6.2	6.2	0.2	24.3	1.3
Prop In Lane	0.95		1.00	0.52		0.32	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	298	0	264	72	0	0	134	892	938	14	1555	693
V/C Ratio(X)	0.26	0.00	0.81	0.61	0.00	0.00	0.74	0.31	0.31	0.43	0.90	0.08
Avail Cap(c_a), veh/h	535	0	475	129	0	0	173	1109	1167	133	2149	959
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.0	0.0	26.6	31.2	0.0	0.0	30.0	9.6	9.6	32.7	17.1	10.7
Incr Delay (d2), s/veh	0.2	0.0	2.3	6.2	0.0	0.0	7.5	0.1	0.1	7.6	3.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	3.3	0.8	0.0	0.0	1.6	1.7	1.8	0.1	8.0	0.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	24.1	0.0	28.9	37.4	0.0	0.0	37.5	9.7	9.7	40.3	20.5	10.7
LnGrp LOS	C	A	C	D	A	A	D	A	A	D	C	B
Approach Vol, veh/h		292			44			672			1456	
Approach Delay, s/veh		27.6			37.4			13.8			20.2	
Approach LOS		C			D			B			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.5	35.6		15.3	4.2	39.9		6.8				
Change Period (Y+Rc), s	3.5	6.4		* 4.2	3.7	6.4		4.0				
Max Green Setting (Gmax), s	6.5	40.4		* 20	5.0	41.7		5.0				
Max Q Clear Time (g_c+I1), s	5.6	26.3		10.7	2.2	8.2		3.7				
Green Ext Time (p_c), s	0.0	2.9		0.5	0.0	0.8		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			19.7									
HCM 6th LOS			B									
Notes												

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Proposed Configuration

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	74	180	4	280	1412	3	505	53
v/c Ratio	0.29	0.45	0.01	0.60	0.70	0.02	0.55	0.10
Control Delay	24.3	7.8	0.0	25.5	12.0	25.7	18.7	0.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.3	7.8	0.0	25.5	12.0	25.7	18.7	0.4
Queue Length 50th (ft)	17	0	0	56	95	1	60	0
Queue Length 95th (ft)	65	42	0	#236	#425	9	130	0
Internal Link Dist (ft)	2048		746		1299		2407	
Turn Bay Length (ft)		140		360		400		400
Base Capacity (vph)	747	780	358	513	2358	185	1718	855
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.23	0.01	0.55	0.60	0.02	0.29	0.06

Intersection Summary

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

Proposed Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	65	3	166	2	0	2	258	1298	1	3	465	49
Future Volume (veh/h)	65	3	166	2	0	2	258	1298	1	3	465	49
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	71	3	180	2	0	2	280	1411	1	3	505	53
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	265	11	245	5	0	5	337	1607	1	7	923	412
Arrive On Green	0.16	0.16	0.16	0.01	0.00	0.01	0.19	0.44	0.44	0.00	0.26	0.26
Sat Flow, veh/h	1699	72	1572	832	0	832	1767	3615	3	1767	3526	1572
Grp Volume(v), veh/h	74	0	180	4	0	0	280	688	724	3	505	53
Grp Sat Flow(s),veh/h/ln	1771	0	1572	1664	0	0	1767	1763	1855	1767	1763	1572
Q Serve(g_s), s	1.7	0.0	5.1	0.1	0.0	0.0	7.1	16.7	16.7	0.1	5.8	1.2
Cycle Q Clear(g_c), s	1.7	0.0	5.1	0.1	0.0	0.0	7.1	16.7	16.7	0.1	5.8	1.2
Prop In Lane	0.96		1.00	0.50		0.50	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	276	0	245	9	0	0	337	784	825	7	923	412
V/C Ratio(X)	0.27	0.00	0.74	0.44	0.00	0.00	0.83	0.88	0.88	0.42	0.55	0.13
Avail Cap(c_a), veh/h	755	0	671	177	0	0	520	1192	1254	188	1737	775
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.4	0.0	18.9	23.2	0.0	0.0	18.2	11.9	11.9	23.3	14.9	13.2
Incr Delay (d2), s/veh	0.2	0.0	1.6	23.4	0.0	0.0	3.7	3.5	3.3	13.5	0.2	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	1.7	0.1	0.0	0.0	2.5	4.4	4.6	0.1	1.7	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	17.6	0.0	20.5	46.6	0.0	0.0	22.0	15.3	15.2	36.8	15.1	13.3
LnGrp LOS	B	A	C	D	A	A	C	B	B	D	B	B
Approach Vol, veh/h		254			4			1692			561	
Approach Delay, s/veh		19.7			46.6			16.4			15.0	
Approach LOS		B			D			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	12.5	18.7		11.5	3.9	27.2		4.3				
Change Period (Y+Rc), s	3.5	6.4		* 4.2	3.7	6.4		4.0				
Max Green Setting (Gmax), s	13.8	23.1		* 20	5.0	31.7		5.0				
Max Q Clear Time (g_c+I1), s	9.1	7.8		7.1	2.1	18.7		2.1				
Green Ext Time (p_c), s	0.1	0.9		0.5	0.0	2.2		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			16.4									
HCM 6th LOS			B									
Notes												

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	71	380	33	121	636	5	1357	48
v/c Ratio	0.21	0.82	0.24	0.62	0.32	0.04	0.90	0.07
Control Delay	29.6	30.7	35.0	52.7	10.7	40.8	30.1	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.6	30.7	35.0	52.7	10.7	40.8	30.1	0.2
Queue Length 50th (ft)	32	92	11	63	83	3	334	0
Queue Length 95th (ft)	69	#228	42	#154	162	14	#510	0
Internal Link Dist (ft)	2048		746		1299		2407	
Turn Bay Length (ft)		140		360		400		400
Base Capacity (vph)	530	613	139	224	2334	132	2028	953
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.62	0.24	0.54	0.27	0.04	0.67	0.05

Intersection Summary

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

Proposed Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	63	3	350	16	5	10	111	584	1	5	1248	44
Future Volume (veh/h)	63	3	350	16	5	10	111	584	1	5	1248	44
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	68	3	380	17	5	11	121	635	1	5	1357	48
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	421	19	390	29	8	19	152	1783	3	12	1469	655
Arrive On Green	0.25	0.25	0.25	0.03	0.03	0.03	0.09	0.49	0.49	0.01	0.41	0.41
Sat Flow, veh/h	1709	75	1585	887	261	574	1781	3640	6	1781	3554	1585
Grp Volume(v), veh/h	71	0	380	33	0	0	121	310	326	5	1357	48
Grp Sat Flow(s),veh/h/ln	1785	0	1585	1723	0	0	1781	1777	1869	1781	1777	1585
Q Serve(g_s), s	2.5	0.0	19.3	1.5	0.0	0.0	5.4	8.8	8.8	0.2	29.4	1.5
Cycle Q Clear(g_c), s	2.5	0.0	19.3	1.5	0.0	0.0	5.4	8.8	8.8	0.2	29.4	1.5
Prop In Lane	0.96		1.00	0.52		0.33	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	439	0	390	56	0	0	152	870	915	12	1469	655
V/C Ratio(X)	0.16	0.00	0.97	0.59	0.00	0.00	0.80	0.36	0.36	0.43	0.92	0.07
Avail Cap(c_a), veh/h	439	0	390	106	0	0	186	912	959	110	1680	749
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.0	0.0	30.4	38.8	0.0	0.0	36.5	12.8	12.8	40.2	22.6	14.4
Incr Delay (d2), s/veh	0.1	0.0	38.4	7.3	0.0	0.0	14.2	0.1	0.1	8.9	7.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	11.2	0.8	0.0	0.0	2.8	2.8	3.0	0.1	11.7	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	24.1	0.0	68.8	46.0	0.0	0.0	50.6	12.9	12.9	49.1	30.4	14.4
LnGrp LOS	C	A	E	D	A	A	D	B	B	D	C	B
Approach Vol, veh/h		451			33			757			1410	
Approach Delay, s/veh		61.7			46.0			18.9			30.0	
Approach LOS		E			D			B			C	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.4	40.0		24.2	4.2	46.2		6.6				
Change Period (Y+Rc), s	3.5	6.4		* 4.2	3.7	6.4		4.0				
Max Green Setting (Gmax), s	8.5	38.4		* 20	5.0	41.7		5.0				
Max Q Clear Time (g_c+I1), s	7.4	31.4		21.3	2.2	10.8		3.5				
Green Ext Time (p_c), s	0.0	2.1		0.0	0.0	0.9		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			32.4									
HCM 6th LOS			C									

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Proposed Configuration

Lane Group	EBT	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	100	11	6	1464	780
v/c Ratio	0.36	0.06	0.03	0.59	0.46
Control Delay	24.8	24.2	27.3	7.9	11.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	24.8	24.2	27.3	7.9	11.9
Queue Length 50th (ft)	25	2	2	105	78
Queue Length 95th (ft)	70	13	13	331	152
Internal Link Dist (ft)	673	532		1381	1299
Turn Bay Length (ft)			145		
Base Capacity (vph)	599	601	601	2684	1886
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.17	0.02	0.01	0.55	0.41

Intersection Summary

Proposed Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	63	1	18	3	3	2	6	1389	2	0	580	13
Future Volume (veh/h)	63	1	18	3	3	2	6	1389	2	0	580	13
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841
Adj Flow Rate, veh/h	77	1	22	4	4	3	6	1462	2	0	763	17
Peak Hour Factor	0.82	0.82	0.82	0.70	0.70	0.70	0.95	0.95	0.95	0.76	0.76	0.76
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	108	1	31	9	9	7	209	2084	3	4	1241	28
Arrive On Green	0.08	0.08	0.08	0.01	0.01	0.01	0.12	0.58	0.58	0.00	0.35	0.35
Sat Flow, veh/h	1315	17	376	627	627	470	1753	3584	5	1753	3497	78
Grp Volume(v), veh/h	100	0	0	11	0	0	6	713	751	0	381	399
Grp Sat Flow(s),veh/h/ln	1707	0	0	1725	0	0	1753	1749	1840	1753	1749	1827
Q Serve(g_s), s	2.4	0.0	0.0	0.3	0.0	0.0	0.1	12.1	12.1	0.0	7.5	7.5
Cycle Q Clear(g_c), s	2.4	0.0	0.0	0.3	0.0	0.0	0.1	12.1	12.1	0.0	7.5	7.5
Prop In Lane	0.77		0.22	0.36		0.27	1.00		0.00	1.00		0.04
Lane Grp Cap(c), veh/h	140	0	0	25	0	0	209	1017	1070	4	620	648
V/C Ratio(X)	0.71	0.00	0.00	0.44	0.00	0.00	0.03	0.70	0.70	0.00	0.61	0.62
Avail Cap(c_a), veh/h	733	0	0	741	0	0	753	1711	1800	209	1168	1221
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	18.8	0.0	0.0	20.5	0.0	0.0	16.3	6.2	6.2	0.0	11.2	11.2
Incr Delay (d2), s/veh	6.6	0.0	0.0	12.0	0.0	0.0	0.1	0.9	0.8	0.0	1.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	0.0	0.2	0.0	0.0	0.0	1.3	1.4	0.0	1.9	2.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	25.3	0.0	0.0	32.5	0.0	0.0	16.4	7.1	7.1	0.0	12.2	12.1
LnGrp LOS	C	A	A	C	A	A	B	A	A	A	B	B
Approach Vol, veh/h		100			11			1470			780	
Approach Delay, s/veh		25.3			32.5			7.1			12.1	
Approach LOS		C			C			A			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	0.0	28.9		7.9	9.5	19.4		5.1				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	41.0		18.0	18.0	28.0		18.0				
Max Q Clear Time (g_c+I1), s	0.0	14.1		4.4	2.1	9.5		2.3				
Green Ext Time (p_c), s	0.0	10.3		0.4	0.0	3.9		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			9.7									
HCM 6th LOS			A									

Proposed Configuration

Lane Group	EBT	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	80	5	11	645	1395
v/c Ratio	0.28	0.02	0.07	0.24	0.54
Control Delay	6.3	0.0	28.8	3.3	6.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	6.3	0.0	28.8	3.3	6.9
Queue Length 50th (ft)	0	0	4	24	72
Queue Length 95th (ft)	5	0	20	77	333
Internal Link Dist (ft)	673	532		1381	1299
Turn Bay Length (ft)			145		
Base Capacity (vph)	651	660	167	2773	2666
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.12	0.01	0.07	0.23	0.52

Intersection Summary

Proposed Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	36	0	20	3	0	1	10	561	0	0	1261	65
Future Volume (veh/h)	36	0	20	3	0	1	10	561	0	0	1261	65
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	51	0	29	4	0	1	11	645	0	0	1327	68
Peak Hour Factor	0.70	0.70	0.70	0.70	0.70	0.70	0.87	0.87	0.87	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	74	0	42	9	0	2	25	2264	0	4	1821	93
Arrive On Green	0.07	0.00	0.07	0.01	0.00	0.01	0.01	0.64	0.00	0.00	0.53	0.53
Sat Flow, veh/h	1078	0	613	1380	0	345	1767	3618	0	1767	3412	175
Grp Volume(v), veh/h	80	0	0	5	0	0	11	645	0	0	684	711
Grp Sat Flow(s),veh/h/ln	1691	0	0	1724	0	0	1767	1763	0	1767	1763	1824
Q Serve(g_s), s	2.2	0.0	0.0	0.1	0.0	0.0	0.3	3.8	0.0	0.0	14.1	14.2
Cycle Q Clear(g_c), s	2.2	0.0	0.0	0.1	0.0	0.0	0.3	3.8	0.0	0.0	14.1	14.2
Prop In Lane	0.64		0.36	0.80		0.20	1.00		0.00	1.00		0.10
Lane Grp Cap(c), veh/h	116	0	0	12	0	0	25	2264	0	4	941	973
V/C Ratio(X)	0.69	0.00	0.00	0.43	0.00	0.00	0.44	0.28	0.00	0.00	0.73	0.73
Avail Cap(c_a), veh/h	641	0	0	654	0	0	189	3013	0	185	1503	1555
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	21.7	0.0	0.0	23.6	0.0	0.0	23.3	3.7	0.0	0.0	8.5	8.5
Incr Delay (d2), s/veh	7.1	0.0	0.0	23.3	0.0	0.0	11.5	0.1	0.0	0.0	1.1	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	0.0	0.1	0.0	0.0	0.2	0.3	0.0	0.0	2.7	2.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	28.9	0.0	0.0	47.0	0.0	0.0	34.9	3.8	0.0	0.0	9.6	9.6
LnGrp LOS	C	A	A	D	A	A	C	A	A	A	A	A
Approach Vol, veh/h		80			5			656			1395	
Approach Delay, s/veh		28.9			47.0			4.3			9.6	
Approach LOS		C			D			A			A	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	0.0	35.2		7.8	5.2	30.0		4.8				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	40.8		18.1	5.1	40.7		18.1				
Max Q Clear Time (g_c+I1), s	0.0	5.8		4.2	2.3	16.2		2.1				
Green Ext Time (p_c), s	0.0	4.1		0.3	0.0	9.3		0.0				

Intersection Summary		
HCM 6th Ctrl Delay		8.8
HCM 6th LOS		A

Lane Group	EBT	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	89	8	7	1624	698
v/c Ratio	0.38	0.05	0.05	0.60	0.27
Control Delay	31.3	30.0	34.7	7.3	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	31.3	30.0	34.7	7.3	5.9
Queue Length 50th (ft)	32	3	3	133	37
Queue Length 95th (ft)	81	17	16	382	156
Internal Link Dist (ft)	673	532		1381	1299
Turn Bay Length (ft)			145		
Base Capacity (vph)	476	477	132	2715	2707
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.19	0.02	0.05	0.60	0.26

Intersection Summary

Proposed Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	63	1	18	3	3	2	6	1492	2	0	629	13
Future Volume (veh/h)	63	1	18	3	3	2	6	1492	2	0	629	13
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	68	1	20	3	3	2	7	1622	2	0	684	14
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	96	1	28	7	7	5	16	2273	3	4	1852	38
Arrive On Green	0.07	0.07	0.07	0.01	0.01	0.01	0.01	0.63	0.63	0.00	0.52	0.52
Sat Flow, veh/h	1314	19	387	654	654	436	1767	3613	4	1767	3533	72
Grp Volume(v), veh/h	89	0	0	8	0	0	7	791	833	0	341	357
Grp Sat Flow(s),veh/h/ln	1720	0	0	1744	0	0	1767	1763	1855	1767	1763	1843
Q Serve(g_s), s	2.4	0.0	0.0	0.2	0.0	0.0	0.2	14.2	14.2	0.0	5.4	5.4
Cycle Q Clear(g_c), s	2.4	0.0	0.0	0.2	0.0	0.0	0.2	14.2	14.2	0.0	5.4	5.4
Prop In Lane	0.76		0.22	0.37		0.25	1.00		0.00	1.00		0.04
Lane Grp Cap(c), veh/h	126	0	0	18	0	0	16	1109	1167	4	924	966
V/C Ratio(X)	0.71	0.00	0.00	0.43	0.00	0.00	0.43	0.71	0.71	0.00	0.37	0.37
Avail Cap(c_a), veh/h	659	0	0	668	0	0	188	1912	2012	188	1912	1999
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	21.3	0.0	0.0	23.1	0.0	0.0	23.2	5.9	5.9	0.0	6.6	6.6
Incr Delay (d2), s/veh	7.1	0.0	0.0	15.3	0.0	0.0	16.5	0.9	0.8	0.0	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	0.0	0.2	0.0	0.0	0.1	1.5	1.5	0.0	1.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	28.4	0.0	0.0	38.4	0.0	0.0	39.7	6.7	6.7	0.0	6.8	6.8
LnGrp LOS	C	A	A	D	A	A	D	A	A	A	A	A
Approach Vol, veh/h		89			8			1631			698	
Approach Delay, s/veh		28.4			38.4			6.9			6.8	
Approach LOS		C			D			A			A	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	0.0	34.1	7.9	4.9	29.1	5.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.0	51.0	18.0	5.0	51.0	18.0
Max Q Clear Time (g_c+I1), s	0.0	16.2	4.4	2.2	7.4	2.2
Green Ext Time (p_c), s	0.0	13.4	0.3	0.0	3.9	0.0

Intersection Summary	
HCM 6th Ctrl Delay	7.7
HCM 6th LOS	A

Proposed Configuration

Lane Group	EBT	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	61	4	11	715	1751
v/c Ratio	0.27	0.02	0.09	0.25	0.62
Control Delay	5.6	0.2	36.5	2.6	7.0
Queue Delay	0.0	0.0	0.0	0.3	2.1
Total Delay	5.6	0.2	36.5	2.9	9.1
Queue Length 50th (ft)	0	0	5	27	108
Queue Length 95th (ft)	13	0	22	84	474
Internal Link Dist (ft)	673	532		240	218
Turn Bay Length (ft)			145		
Base Capacity (vph)	490	495	119	2916	2821
Starvation Cap Reductn	0	0	0	1485	882
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.12	0.01	0.09	0.50	0.90

Intersection Summary

Proposed Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	36	0	20	3	0	1	10	658	0	0	1546	65
Future Volume (veh/h)	36	0	20	3	0	1	10	658	0	0	1546	65
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	39	0	22	3	0	1	11	715	0	0	1680	71
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	58	0	33	7	0	2	25	2534	0	3	2165	91
Arrive On Green	0.05	0.00	0.05	0.01	0.00	0.01	0.01	0.71	0.00	0.00	0.62	0.62
Sat Flow, veh/h	1090	0	615	1296	0	432	1781	3647	0	1781	3475	146
Grp Volume(v), veh/h	61	0	0	4	0	0	11	715	0	0	855	896
Grp Sat Flow(s),veh/h/ln	1705	0	0	1728	0	0	1781	1777	0	1781	1777	1844
Q Serve(g_s), s	2.1	0.0	0.0	0.1	0.0	0.0	0.4	4.3	0.0	0.0	20.7	21.1
Cycle Q Clear(g_c), s	2.1	0.0	0.0	0.1	0.0	0.0	0.4	4.3	0.0	0.0	20.7	21.1
Prop In Lane	0.64		0.36	0.75		0.25	1.00		0.00	1.00		0.08
Lane Grp Cap(c), veh/h	91	0	0	9	0	0	25	2534	0	3	1107	1149
V/C Ratio(X)	0.67	0.00	0.00	0.43	0.00	0.00	0.44	0.28	0.00	0.00	0.77	0.78
Avail Cap(c_a), veh/h	521	0	0	528	0	0	153	3049	0	150	1522	1579
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	27.5	0.0	0.0	29.4	0.0	0.0	29.0	3.0	0.0	0.0	8.1	8.2
Incr Delay (d2), s/veh	8.2	0.0	0.0	28.5	0.0	0.0	11.8	0.1	0.0	0.0	1.7	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	0.0	0.1	0.0	0.0	0.2	0.3	0.0	0.0	4.2	4.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	35.7	0.0	0.0	57.8	0.0	0.0	40.8	3.1	0.0	0.0	9.8	9.9
LnGrp LOS	D	A	A	E	A	A	D	A	A	A	A	A
Approach Vol, veh/h		61			4			726			1751	
Approach Delay, s/veh		35.7			57.8			3.7			9.9	
Approach LOS		D			E			A			A	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	0.0	46.7		7.7	5.3	41.4		4.8				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	50.8		18.1	5.1	50.7		18.1				
Max Q Clear Time (g_c+I1), s	0.0	6.3		4.1	2.4	23.1		2.1				
Green Ext Time (p_c), s	0.0	4.7		0.2	0.0	13.8		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			8.8									
HCM 6th LOS			A									

Proposed Configuration

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	380	46	7	80	1209	1	796
v/c Ratio	0.71	0.08	0.02	0.34	0.79	0.00	0.66
Control Delay	29.0	0.2	0.2	32.9	19.9	33.0	15.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.0	0.2	0.2	32.9	19.9	33.0	15.3
Queue Length 50th (ft)	100	0	0	24	152	0	76
Queue Length 95th (ft)	223	0	0	88	#428	4	132
Internal Link Dist (ft)	883		68		4421		1381
Turn Bay Length (ft)		273		220		78	
Base Capacity (vph)	809	816	342	332	2419	203	2138
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.06	0.02	0.24	0.50	0.00	0.37

Intersection Summary

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

Proposed Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	265	1	32	0	0	5	74	1123	1	1	323	274
Future Volume (veh/h)	265	1	32	0	0	5	74	1123	1	1	323	274
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841
Adj Flow Rate, veh/h	379	1	46	0	0	7	80	1208	1	1	431	365
Peak Hour Factor	0.70	0.70	0.70	0.70	0.70	0.70	0.93	0.93	0.93	0.75	0.75	0.75
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	430	1	383	0	0	17	161	1345	1	161	675	569
Arrive On Green	0.25	0.25	0.25	0.00	0.00	0.01	0.09	0.38	0.38	0.09	0.38	0.38
Sat Flow, veh/h	1749	5	1560	0	0	1560	1753	3586	3	1753	1800	1517
Grp Volume(v), veh/h	380	0	46	0	0	7	80	589	620	1	419	377
Grp Sat Flow(s),veh/h/ln	1753	0	1560	0	0	1560	1753	1749	1840	1753	1749	1568
Q Serve(g_s), s	13.7	0.0	1.5	0.0	0.0	0.3	2.8	20.8	20.8	0.0	12.9	13.0
Cycle Q Clear(g_c), s	13.7	0.0	1.5	0.0	0.0	0.3	2.8	20.8	20.8	0.0	12.9	13.0
Prop In Lane	1.00		1.00	0.00		1.00	1.00		0.00	1.00		0.97
Lane Grp Cap(c), veh/h	431	0	383	0	0	17	161	656	690	161	656	588
V/C Ratio(X)	0.88	0.00	0.12	0.00	0.00	0.41	0.50	0.90	0.90	0.01	0.64	0.64
Avail Cap(c_a), veh/h	637	0	567	0	0	143	262	964	1015	161	863	773
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	23.8	0.0	19.2	0.0	0.0	32.2	28.3	19.3	19.3	27.0	16.8	16.8
Incr Delay (d2), s/veh	7.1	0.0	0.1	0.0	0.0	11.2	0.9	6.1	5.8	0.0	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.1	0.0	0.5	0.0	0.0	0.2	1.1	7.7	8.0	0.0	4.1	3.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.8	0.0	19.2	0.0	0.0	43.4	29.2	25.3	25.1	27.0	17.2	17.3
LnGrp LOS	C	A	B	A	A	D	C	C	C	C	B	B
Approach Vol, veh/h		426			7			1289			797	
Approach Delay, s/veh		29.6			43.4			25.4			17.2	
Approach LOS		C			D			C			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.5	31.0		4.7	9.5	31.0		20.3				
Change Period (Y+Rc), s	3.5	6.4		4.0	3.5	6.4		4.2				
Max Green Setting (Gmax), s	9.8	32.3		6.0	6.0	36.1		23.8				
Max Q Clear Time (g_c+I1), s	4.8	15.0		2.3	2.0	22.8		15.7				
Green Ext Time (p_c), s	0.0	1.3		0.0	0.0	1.8		0.4				
Intersection Summary												
HCM 6th Ctrl Delay			23.6									
HCM 6th LOS			C									

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	160	49	5	35	530	4	1376
v/c Ratio	0.51	0.13	0.02	0.17	0.27	0.02	0.74
Control Delay	30.4	0.7	0.0	32.1	7.9	32.0	14.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.4	0.7	0.0	32.1	7.9	32.0	14.9
Queue Length 50th (ft)	40	0	0	9	31	1	113
Queue Length 95th (ft)	137	0	0	47	125	12	427
Internal Link Dist (ft)	883		68		4421		1381
Turn Bay Length (ft)		273		220		78	
Base Capacity (vph)	687	695	309	207	2668	207	2603
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.07	0.02	0.17	0.20	0.02	0.53

Intersection Summary

Proposed Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	142	0	44	1	0	3	31	469	3	4	1144	136
Future Volume (veh/h)	142	0	44	1	0	3	31	469	3	4	1144	136
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	160	0	49	1	0	4	35	527	3	4	1230	146
Peak Hour Factor	0.89	0.89	0.89	0.70	0.70	0.70	0.89	0.89	0.89	0.93	0.93	0.93
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	215	0	191	3	0	10	191	1567	9	191	1384	164
Arrive On Green	0.12	0.00	0.12	0.01	0.00	0.01	0.11	0.44	0.44	0.11	0.44	0.44
Sat Flow, veh/h	1767	0	1572	322	0	1286	1767	3594	20	1767	3175	376
Grp Volume(v), veh/h	160	0	49	5	0	0	35	258	272	4	681	695
Grp Sat Flow(s),veh/h/ln	1767	0	1572	1608	0	0	1767	1763	1852	1767	1763	1788
Q Serve(g_s), s	4.9	0.0	1.6	0.2	0.0	0.0	1.0	5.4	5.4	0.1	19.7	19.9
Cycle Q Clear(g_c), s	4.9	0.0	1.6	0.2	0.0	0.0	1.0	5.4	5.4	0.1	19.7	19.9
Prop In Lane	1.00		1.00	0.20		0.80	1.00		0.01	1.00		0.21
Lane Grp Cap(c), veh/h	215	0	191	13	0	0	191	768	807	191	768	779
V/C Ratio(X)	0.74	0.00	0.26	0.39	0.00	0.00	0.18	0.34	0.34	0.02	0.89	0.89
Avail Cap(c_a), veh/h	643	0	573	174	0	0	194	1258	1322	194	1258	1276
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	23.5	0.0	22.1	27.4	0.0	0.0	22.5	10.3	10.3	22.1	14.4	14.4
Incr Delay (d2), s/veh	1.9	0.0	0.3	13.5	0.0	0.0	0.2	0.1	0.1	0.0	2.7	2.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.0	0.0	0.6	0.1	0.0	0.0	0.4	1.4	1.5	0.0	5.8	5.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	25.4	0.0	22.3	40.9	0.0	0.0	22.7	10.4	10.4	22.1	17.1	17.4
LnGrp LOS	C	A	C	D	A	A	C	B	B	C	B	B
Approach Vol, veh/h		209			5			565			1380	
Approach Delay, s/veh		24.7			40.9			11.2			17.2	
Approach LOS		C			D			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.5	30.6		4.4	9.5	30.6		11.0				
Change Period (Y+Rc), s	3.5	6.4		4.0	3.5	6.4		4.2				
Max Green Setting (Gmax), s	6.1	39.6		6.0	6.1	39.6		20.2				
Max Q Clear Time (g_c+I1), s	3.0	21.9		2.2	2.1	7.4		6.9				
Green Ext Time (p_c), s	0.0	2.3		0.0	0.0	0.7		0.2				
Intersection Summary												
HCM 6th Ctrl Delay			16.4									
HCM 6th LOS			B									

Proposed Configuration

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	385	49	5	80	1239	1	702
v/c Ratio	0.71	0.08	0.01	0.35	0.80	0.00	0.57
Control Delay	29.1	0.3	0.0	33.3	20.2	33.0	12.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.1	0.3	0.0	33.3	20.2	33.0	12.5
Queue Length 50th (ft)	104	0	0	24	160	0	57
Queue Length 95th (ft)	#356	0	0	88	#466	6	144
Internal Link Dist (ft)	883		68		4421		1381
Turn Bay Length (ft)		273		220		78	
Base Capacity (vph)	805	814	341	327	2426	202	2140
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.48	0.06	0.01	0.24	0.51	0.00	0.33

Intersection Summary

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

Proposed Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	353	1	45	0	0	5	74	1139	1	1	338	308
Future Volume (veh/h)	353	1	45	0	0	5	74	1139	1	1	338	308
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	384	1	49	0	0	5	80	1238	1	1	367	335
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	435	1	388	0	0	13	161	1375	1	161	671	598
Arrive On Green	0.25	0.25	0.25	0.00	0.00	0.01	0.09	0.38	0.38	0.09	0.38	0.38
Sat Flow, veh/h	1763	5	1572	0	0	1572	1767	3615	3	1767	1763	1572
Grp Volume(v), veh/h	385	0	49	0	0	5	80	604	635	1	367	335
Grp Sat Flow(s),veh/h/ln	1767	0	1572	0	0	1572	1767	1763	1855	1767	1763	1572
Q Serve(g_s), s	13.9	0.0	1.6	0.0	0.0	0.2	2.8	21.3	21.3	0.0	10.8	11.1
Cycle Q Clear(g_c), s	13.9	0.0	1.6	0.0	0.0	0.2	2.8	21.3	21.3	0.0	10.8	11.1
Prop In Lane	1.00		1.00	0.00		1.00	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	436	0	388	0	0	13	161	671	706	161	671	598
V/C Ratio(X)	0.88	0.00	0.13	0.00	0.00	0.40	0.50	0.90	0.90	0.01	0.55	0.56
Avail Cap(c_a), veh/h	637	0	567	0	0	143	260	964	1014	161	865	771
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.0	0.0	19.3	0.0	0.0	32.6	28.6	19.3	19.3	27.3	16.0	16.1
Incr Delay (d2), s/veh	7.4	0.0	0.1	0.0	0.0	14.5	0.9	6.6	6.3	0.0	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.3	0.0	0.6	0.0	0.0	0.1	1.1	8.0	8.3	0.0	3.5	3.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	31.4	0.0	19.4	0.0	0.0	47.1	29.5	25.9	25.6	27.3	16.3	16.4
LnGrp LOS	C	A	B	A	A	D	C	C	C	C	B	B
Approach Vol, veh/h		434			5			1319			703	
Approach Delay, s/veh		30.0			47.1			26.0			16.4	
Approach LOS		C			D			C			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.5	31.5		4.5	9.5	31.5		20.5				
Change Period (Y+Rc), s	3.5	6.4		4.0	3.5	6.4		4.2				
Max Green Setting (Gmax), s	9.7	32.4		6.0	6.0	36.1		23.8				
Max Q Clear Time (g_c+I1), s	4.8	13.1		2.2	2.0	23.3		15.9				
Green Ext Time (p_c), s	0.0	1.1		0.0	0.0	1.8		0.4				
Intersection Summary												
HCM 6th Ctrl Delay			24.0									
HCM 6th LOS			C									

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	223	53	15	42	539	4	1533
v/c Ratio	0.70	0.14	0.05	0.25	0.25	0.02	0.79
Control Delay	40.4	0.7	0.4	38.8	8.3	36.2	18.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.4	0.7	0.4	38.8	8.3	36.2	18.5
Queue Length 50th (ft)	94	0	0	18	38	2	257
Queue Length 95th (ft)	187	0	0	56	141	13	#608
Internal Link Dist (ft)	883		68		4421		1381
Turn Bay Length (ft)		273		220		78	
Base Capacity (vph)	556	588	275	166	2390	169	2180
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.09	0.05	0.25	0.23	0.02	0.70

Intersection Summary

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

Proposed Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	205	0	49	1	0	13	39	493	3	4	1205	205
Future Volume (veh/h)	205	0	49	1	0	13	39	493	3	4	1205	205
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	223	0	53	1	0	14	42	536	3	4	1310	223
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	273	0	243	2	0	32	157	1707	10	157	1433	242
Arrive On Green	0.15	0.00	0.15	0.02	0.00	0.02	0.09	0.47	0.47	0.09	0.47	0.47
Sat Flow, veh/h	1781	0	1585	106	0	1490	1781	3623	20	1781	3042	513
Grp Volume(v), veh/h	223	0	53	15	0	0	42	263	276	4	760	773
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1597	0	0	1781	1777	1867	1781	1777	1778
Q Serve(g_s), s	8.3	0.0	2.0	0.6	0.0	0.0	1.5	6.3	6.3	0.1	26.9	27.7
Cycle Q Clear(g_c), s	8.3	0.0	2.0	0.6	0.0	0.0	1.5	6.3	6.3	0.1	26.9	27.7
Prop In Lane	1.00		1.00	0.07		0.93	1.00		0.01	1.00		0.29
Lane Grp Cap(c), veh/h	273	0	243	35	0	0	157	837	879	157	837	838
V/C Ratio(X)	0.82	0.00	0.22	0.43	0.00	0.00	0.27	0.31	0.31	0.03	0.91	0.92
Avail Cap(c_a), veh/h	523	0	465	141	0	0	157	1038	1091	160	1041	1042
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	27.9	0.0	25.3	32.9	0.0	0.0	29.0	11.2	11.2	28.4	16.6	16.9
Incr Delay (d2), s/veh	2.3	0.0	0.2	6.2	0.0	0.0	0.3	0.1	0.1	0.0	8.8	10.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.5	0.0	0.7	0.3	0.0	0.0	0.6	1.9	2.0	0.1	10.0	10.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.2	0.0	25.4	39.1	0.0	0.0	29.3	11.3	11.3	28.4	25.4	27.3
LnGrp LOS	C	A	C	D	A	A	C	B	B	C	C	C
Approach Vol, veh/h		276			15			581			1537	
Approach Delay, s/veh		29.3			39.1			12.6			26.4	
Approach LOS		C			D			B			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.5	38.5		5.5	9.5	38.5		14.6				
Change Period (Y+Rc), s	3.5	6.4		4.0	3.5	6.4		4.2				
Max Green Setting (Gmax), s	6.0	39.9		6.0	6.1	39.8		20.0				
Max Q Clear Time (g_c+I1), s	3.5	29.7		2.6	2.1	8.3		10.3				
Green Ext Time (p_c), s	0.0	2.4		0.0	0.0	0.7		0.2				

Intersection Summary			
HCM 6th Ctrl Delay			23.4
HCM 6th LOS			C

Proposed Configuration

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	4	68	1	1372	36	348
v/c Ratio	0.03	0.47	0.01	0.93	0.50	0.22
Control Delay	0.3	32.7	58.0	26.3	81.1	3.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	0.3	32.7	58.0	26.3	81.1	3.4
Queue Length 50th (ft)	0	14	1	764	28	30
Queue Length 95th (ft)	0	47	8	#1578	#81	144
Internal Link Dist (ft)	263	1282		5815		4421
Turn Bay Length (ft)			145		150	
Base Capacity (vph)	309	286	74	1468	72	1567
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.24	0.01	0.93	0.50	0.22

Intersection Summary

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

Proposed Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	0	2	14	1	37	1	1165	84	34	329	2
Future Volume (veh/h)	1	0	2	14	1	37	1	1165	84	34	329	2
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841	1841
Adj Flow Rate, veh/h	1	0	3	18	1	49	1	1280	92	36	346	2
Peak Hour Factor	0.70	0.70	0.70	0.76	0.76	0.76	0.91	0.91	0.91	0.95	0.95	0.95
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	4	4	4
Cap, veh/h	2	0	6	23	1	62	2	1291	93	51	1442	8
Arrive On Green	0.01	0.00	0.01	0.05	0.05	0.05	0.00	0.76	0.76	0.03	0.79	0.79
Sat Flow, veh/h	401	0	1203	426	24	1161	1753	1697	122	1753	1828	11
Grp Volume(v), veh/h	4	0	0	68	0	0	1	0	1372	36	0	348
Grp Sat Flow(s),veh/h/ln	1604	0	0	1611	0	0	1753	0	1819	1753	0	1839
Q Serve(g_s), s	0.3	0.0	0.0	5.0	0.0	0.0	0.1	0.0	87.6	2.4	0.0	5.9
Cycle Q Clear(g_c), s	0.3	0.0	0.0	5.0	0.0	0.0	0.1	0.0	87.6	2.4	0.0	5.9
Prop In Lane	0.25		0.75	0.26		0.72	1.00		0.07	1.00		0.01
Lane Grp Cap(c), veh/h	8	0	0	87	0	0	2	0	1384	51	0	1450
V/C Ratio(X)	0.48	0.00	0.00	0.79	0.00	0.00	0.42	0.00	0.99	0.70	0.00	0.24
Avail Cap(c_a), veh/h	242	0	0	243	0	0	75	0	1387	73	0	1450
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	59.2	0.0	0.0	55.8	0.0	0.0	59.5	0.0	13.9	57.4	0.0	3.3
Incr Delay (d2), s/veh	37.0	0.0	0.0	14.4	0.0	0.0	87.3	0.0	22.0	16.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.0	2.4	0.0	0.0	0.1	0.0	30.4	1.3	0.0	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	96.2	0.0	0.0	70.1	0.0	0.0	146.8	0.0	35.9	73.5	0.0	3.4
LnGrp LOS	F	A	A	E	A	A	F	A	D	E	A	A
Approach Vol, veh/h		4			68			1373			384	
Approach Delay, s/veh		96.2			70.1			35.9			9.9	
Approach LOS		F			E			D			A	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.0	95.3		5.1	4.7	98.6		10.9				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	91.0		18.0	5.1	90.9		18.0				
Max Q Clear Time (g_c+I1), s	4.4	89.6		2.3	2.1	7.9		7.0				
Green Ext Time (p_c), s	0.0	1.2		0.0	0.0	1.9		0.2				
Intersection Summary												
HCM 6th Ctrl Delay			31.9									
HCM 6th LOS			C									

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	12	198	1	428	22	1332
v/c Ratio	0.08	0.76	0.01	0.31	0.26	0.94
Control Delay	1.1	51.5	62.0	7.6	66.8	28.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1.1	51.5	62.0	7.6	66.8	28.5
Queue Length 50th (ft)	0	86	1	66	16	570
Queue Length 95th (ft)	0	173	7	221	50	#1604
Internal Link Dist (ft)	263	1282		5815		4421
Turn Bay Length (ft)			145		150	
Base Capacity (vph)	312	317	71	1402	87	1419
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.62	0.01	0.31	0.25	0.94

Intersection Summary

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

Proposed Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	0	4	120	0	46	1	389	22	20	1238	1
Future Volume (veh/h)	4	0	4	120	0	46	1	389	22	20	1238	1
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	6	0	6	143	0	55	1	405	23	22	1331	1
Peak Hour Factor	0.70	0.70	0.70	0.84	0.84	0.84	0.96	0.96	0.96	0.93	0.93	0.93
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	11	0	11	161	0	62	2	1206	68	37	1322	1
Arrive On Green	0.01	0.00	0.01	0.13	0.00	0.13	0.00	0.69	0.69	0.02	0.71	0.71
Sat Flow, veh/h	832	0	832	1234	0	475	1767	1739	99	1767	1854	1
Grp Volume(v), veh/h	12	0	0	198	0	0	1	0	428	22	0	1332
Grp Sat Flow(s),veh/h/ln	1664	0	0	1708	0	0	1767	0	1838	1767	0	1855
Q Serve(g_s), s	0.9	0.0	0.0	14.5	0.0	0.0	0.1	0.0	11.9	1.6	0.0	91.0
Cycle Q Clear(g_c), s	0.9	0.0	0.0	14.5	0.0	0.0	0.1	0.0	11.9	1.6	0.0	91.0
Prop In Lane	0.50		0.50	0.72		0.28	1.00		0.05	1.00		0.00
Lane Grp Cap(c), veh/h	23	0	0	223	0	0	2	0	1274	37	0	1323
V/C Ratio(X)	0.53	0.00	0.00	0.89	0.00	0.00	0.41	0.00	0.34	0.59	0.00	1.01
Avail Cap(c_a), veh/h	235	0	0	241	0	0	69	0	1295	84	0	1323
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	62.5	0.0	0.0	54.5	0.0	0.0	63.7	0.0	7.8	61.9	0.0	18.3
Incr Delay (d2), s/veh	18.0	0.0	0.0	29.0	0.0	0.0	86.1	0.0	0.2	13.7	0.0	26.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	0.0	8.1	0.0	0.0	0.1	0.0	3.9	0.8	0.0	38.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	80.5	0.0	0.0	83.5	0.0	0.0	149.8	0.0	8.0	75.6	0.0	44.6
LnGrp LOS	F	A	A	F	A	A	F	A	A	E	A	F
Approach Vol, veh/h		12			198			429			1354	
Approach Delay, s/veh		80.5			83.5			8.3			45.1	
Approach LOS		F			F			A			D	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.2	93.0		6.2	4.7	95.5		21.2				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	6.1	89.9		18.0	5.0	91.0		18.0				
Max Q Clear Time (g_c+I1), s	3.6	13.9		2.9	2.1	93.0		16.5				
Green Ext Time (p_c), s	0.0	2.4		0.0	0.0	0.0		0.1				
Intersection Summary												
HCM 6th Ctrl Delay			41.2									
HCM 6th LOS			D									

Proposed Configuration

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	3	59	1	1371	39	390
v/c Ratio	0.02	0.43	0.01	0.92	0.53	0.25
Control Delay	0.3	32.6	58.0	24.5	83.4	3.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	0.3	32.6	58.0	24.5	83.4	3.4
Queue Length 50th (ft)	0	12	1	728	30	33
Queue Length 95th (ft)	0	58	7	#1552	#88	160
Internal Link Dist (ft)	263	1282		5815		4421
Turn Bay Length (ft)			145		150	
Base Capacity (vph)	313	284	74	1485	73	1586
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.21	0.01	0.92	0.53	0.25

Intersection Summary

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

Proposed Configuration

SR-227 Corridor Operations | Forecast (2045)
9: SR-227 & Biddle Ranch Rd | Timing Plan: AM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	0	2	14	1	40	1	1178	84	36	357	2
Future Volume (veh/h)	1	0	2	14	1	40	1	1178	84	36	357	2
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	1	0	2	15	1	43	1	1280	91	39	388	2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	2	0	4	19	1	55	2	1309	93	54	1464	8
Arrive On Green	0.00	0.00	0.00	0.05	0.05	0.05	0.00	0.76	0.76	0.03	0.79	0.79
Sat Flow, veh/h	544	0	1088	412	27	1182	1767	1712	122	1767	1844	10
Grp Volume(v), veh/h	3	0	0	59	0	0	1	0	1371	39	0	390
Grp Sat Flow(s),veh/h/ln	1632	0	0	1622	0	0	1767	0	1834	1767	0	1854
Q Serve(g_s), s	0.2	0.0	0.0	4.2	0.0	0.0	0.1	0.0	81.4	2.6	0.0	6.4
Cycle Q Clear(g_c), s	0.2	0.0	0.0	4.2	0.0	0.0	0.1	0.0	81.4	2.6	0.0	6.4
Prop In Lane	0.33		0.67	0.25		0.73	1.00		0.07	1.00		0.01
Lane Grp Cap(c), veh/h	6	0	0	75	0	0	2	0	1402	54	0	1472
V/C Ratio(X)	0.46	0.00	0.00	0.78	0.00	0.00	0.41	0.00	0.98	0.72	0.00	0.26
Avail Cap(c_a), veh/h	252	0	0	250	0	0	77	0	1431	76	0	1472
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	57.9	0.0	0.0	55.0	0.0	0.0	58.2	0.0	12.8	56.0	0.0	3.1
Incr Delay (d2), s/veh	43.8	0.0	0.0	16.0	0.0	0.0	85.8	0.0	18.6	17.7	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.0	2.0	0.0	0.0	0.1	0.0	27.0	1.4	0.0	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	101.7	0.0	0.0	71.1	0.0	0.0	144.0	0.0	31.4	73.7	0.0	3.2
LnGrp LOS	F	A	A	E	A	A	F	A	C	E	A	A
Approach Vol, veh/h		3			59			1372			429	
Approach Delay, s/veh		101.7			71.1			31.5			9.6	
Approach LOS		F			E			C			A	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.1	93.6		5.0	4.7	97.1		9.9				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	91.0		18.0	5.1	90.9		18.0				
Max Q Clear Time (g_c+I1), s	4.6	83.4		2.2	2.1	8.4		6.2				
Green Ext Time (p_c), s	0.0	5.8		0.0	0.0	2.1		0.2				
Intersection Summary												
HCM 6th Ctrl Delay			27.8									
HCM 6th LOS			C									

Proposed Configuration

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	8	184	1	482	26	1414
v/c Ratio	0.05	0.74	0.01	0.35	0.28	0.96
Control Delay	0.7	48.2	60.0	7.5	64.9	29.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	0.7	48.2	60.0	7.5	64.9	29.5
Queue Length 50th (ft)	0	75	1	119	18	638
Queue Length 95th (ft)	0	175	7	257	56	#1746
Internal Link Dist (ft)	263	1282		5815		4421
Turn Bay Length (ft)			145		150	
Base Capacity (vph)	320	325	74	1450	95	1474
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.57	0.01	0.33	0.27	0.96

Intersection Summary

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

Proposed Configuration

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	0	4	122	0	47	1	420	23	24	1300	1
Future Volume (veh/h)	4	0	4	122	0	47	1	420	23	24	1300	1
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	4	0	4	133	0	51	1	457	25	26	1413	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	8	0	8	153	0	59	2	1232	67	42	1352	1
Arrive On Green	0.01	0.00	0.01	0.12	0.00	0.12	0.00	0.70	0.70	0.02	0.72	0.72
Sat Flow, veh/h	839	0	839	1245	0	477	1781	1757	96	1781	1869	1
Grp Volume(v), veh/h	8	0	0	184	0	0	1	0	482	26	0	1414
Grp Sat Flow(s),veh/h/ln	1677	0	0	1722	0	0	1781	0	1853	1781	0	1870
Q Serve(g_s), s	0.6	0.0	0.0	13.2	0.0	0.0	0.1	0.0	13.2	1.8	0.0	91.0
Cycle Q Clear(g_c), s	0.6	0.0	0.0	13.2	0.0	0.0	0.1	0.0	13.2	1.8	0.0	91.0
Prop In Lane	0.50		0.50	0.72		0.28	1.00		0.05	1.00		0.00
Lane Grp Cap(c), veh/h	16	0	0	211	0	0	2	0	1299	42	0	1353
V/C Ratio(X)	0.49	0.00	0.00	0.87	0.00	0.00	0.41	0.00	0.37	0.62	0.00	1.05
Avail Cap(c_a), veh/h	240	0	0	246	0	0	71	0	1320	91	0	1353
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	62.0	0.0	0.0	54.2	0.0	0.0	62.8	0.0	7.6	60.8	0.0	17.4
Incr Delay (d2), s/veh	21.2	0.0	0.0	24.5	0.0	0.0	84.7	0.0	0.2	13.6	0.0	37.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	7.2	0.0	0.0	0.1	0.0	4.3	1.0	0.0	41.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	83.2	0.0	0.0	78.7	0.0	0.0	147.5	0.0	7.8	74.5	0.0	54.6
LnGrp LOS	F	A	A	E	A	A	F	A	A	E	A	F
Approach Vol, veh/h		8			184			483			1440	
Approach Delay, s/veh		83.2			78.7			8.1			55.0	
Approach LOS		F			E			A			D	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.5	92.7		5.7	4.7	95.5		19.9				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	6.4	89.6		18.0	5.0	91.0		18.0				
Max Q Clear Time (g_c+I1), s	3.8	15.2		2.6	2.1	93.0		15.2				
Green Ext Time (p_c), s	0.0	2.8		0.0	0.0	0.0		0.2				
Intersection Summary												
HCM 6th Ctrl Delay			46.4									
HCM 6th LOS			D									

Appendix D

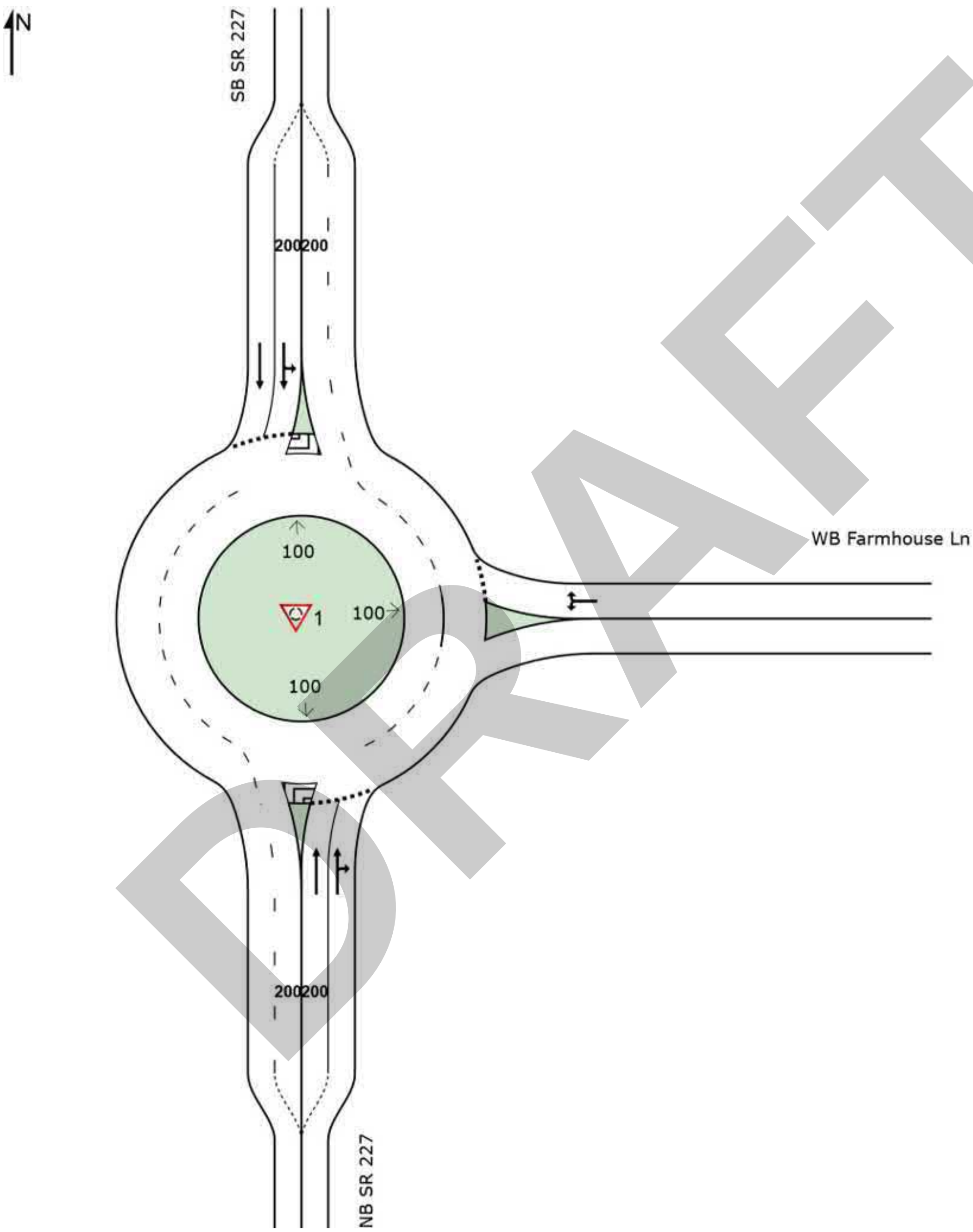
Roundabout Sidra Operations Analysis

SITE LAYOUT

Site: 1 [Int03_Farmhouse Ln_Alt02_2020PM (Site Folder: General)]

Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



LANE SUMMARY

Site: 1 [Int03_Farmhouse Ln_Alt02_2020AM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance													
	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: NB SR 227													
Lane 1	680	3.0	1333	0.510	100	17.4	LOS C	3.1	79.7	Short	200	0.0	NA
Lane 2[d]	680	3.0	1333	0.510	100	8.0	LOS A	3.1	79.7	Full	2000	0.0	0.0
Approach	1359	3.0		0.510		12.7	LOS B	3.1	79.7				
East: WB Farmhouse Ln													
Lane 1[d]	14	3.0	428	0.033	100	9.3	LOS A	0.1	2.6	Full	700	0.0	0.0
Approach	14	3.0		0.033		9.3	LOS A	0.1	2.6				
North: SB SR 227													
Lane 1	362	3.0	1377	0.263	100	8.6	LOS A	1.3	33.8	Short	200	0.0	NA
Lane 2[d]	362	3.0	1377	0.263	100	4.9	LOS A	1.3	33.8	Full	800	0.0	0.0
Approach	723	3.0		0.263		6.7	LOS A	1.3	33.8				
Intersection	2097	3.0		0.510		10.6	LOS B	3.1	79.7				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 1 [Int03_Farmhouse Ln_Alt02_2020PM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: NB SR 227													
Lane 1	347	2.0	1361	0.255	100	9.3	LOS A	1.1	27.9	Short	200	0.0	NA
Lane 2[d]	347	2.0	1361	0.255	100	4.8	LOS A	1.1	27.9	Full	2000	0.0	0.0
Approach	694	2.0		0.255		7.0	LOS A	1.1	27.9				
East: WB Farmhouse Ln													
Lane 1[d]	40	2.0	765	0.052	100	6.7	LOS A	0.2	4.5	Full	700	0.0	0.0
Approach	40	2.0		0.052		6.7	LOS A	0.2	4.5				
North: SB SR 227													
Lane 1	571	2.0	1381	0.413	100	13.1	LOS B	2.6	66.3	Short	200	0.0	NA
Lane 2[d]	571	2.0	1381	0.413	100	6.5	LOS A	2.6	66.3	Full	800	0.0	0.0
Approach	1142	2.0		0.413		9.8	LOS A	2.6	66.3				
Intersection	1876	2.0		0.413		8.7	LOS A	2.6	66.3				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 1 [Int03_Farmhouse Ln_Alt02_2045AM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance													
	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: NB SR 227													
Lane 1	719	3.0	1241	0.579	100	20.9	LOS C	3.8	96.3	Short	200	0.0	NA
Lane 2[d]	719	3.0	1241	0.579	100	9.7	LOS A	3.8	96.3	Full	2000	0.0	0.0
Approach	1438	3.0		0.579		15.3	LOS C	3.8	96.3				
East: WB Farmhouse Ln													
Lane 1[d]	103	3.0	408	0.253	100	13.6	LOS B	0.9	21.8	Full	700	0.0	0.0
Approach	103	3.0		0.253		13.6	LOS B	0.9	21.8				
North: SB SR 227													
Lane 1	397	3.0	1361	0.292	100	7.9	LOS A	1.5	38.7	Short	200	0.0	NA
Lane 2[d]	397	3.0	1361	0.292	100	5.2	LOS A	1.5	38.7	Full	800	0.0	0.0
Approach	793	3.0		0.292		6.6	LOS A	1.5	38.7				
Intersection	2335	3.0		0.579		12.3	LOS B	3.8	96.3				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 1 [Int03_Farmhouse Ln_Alt02_2045PM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance													
	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: NB SR 227													
Lane 1	381	2.0	1249	0.305	100	10.9	LOS B	1.4	35.6	Short	200	0.0	NA
Lane 2[d]	381	2.0	1249	0.305	100	5.7	LOS A	1.4	35.6	Full	2000	0.0	0.0
Approach	762	2.0		0.305		8.3	LOS A	1.4	35.6				
East: WB Farmhouse Ln													
Lane 1[d]	262	2.0	738	0.355	100	11.4	LOS B	1.6	39.9	Full	700	0.0	0.0
Approach	262	2.0		0.355		11.4	LOS B	1.6	39.9				
North: SB SR 227													
Lane 1	634	2.0	1301	0.487	100	13.8	LOS B	3.3	83.8	Short	200	0.0	NA
Lane 2[d]	634	2.0	1301	0.487	100	7.8	LOS A	3.3	83.8	Full	800	0.0	0.0
Approach	1267	2.0		0.487		10.8	LOS B	3.3	83.8				
Intersection	2291	2.0		0.487		10.0	LOS B	3.3	83.8				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

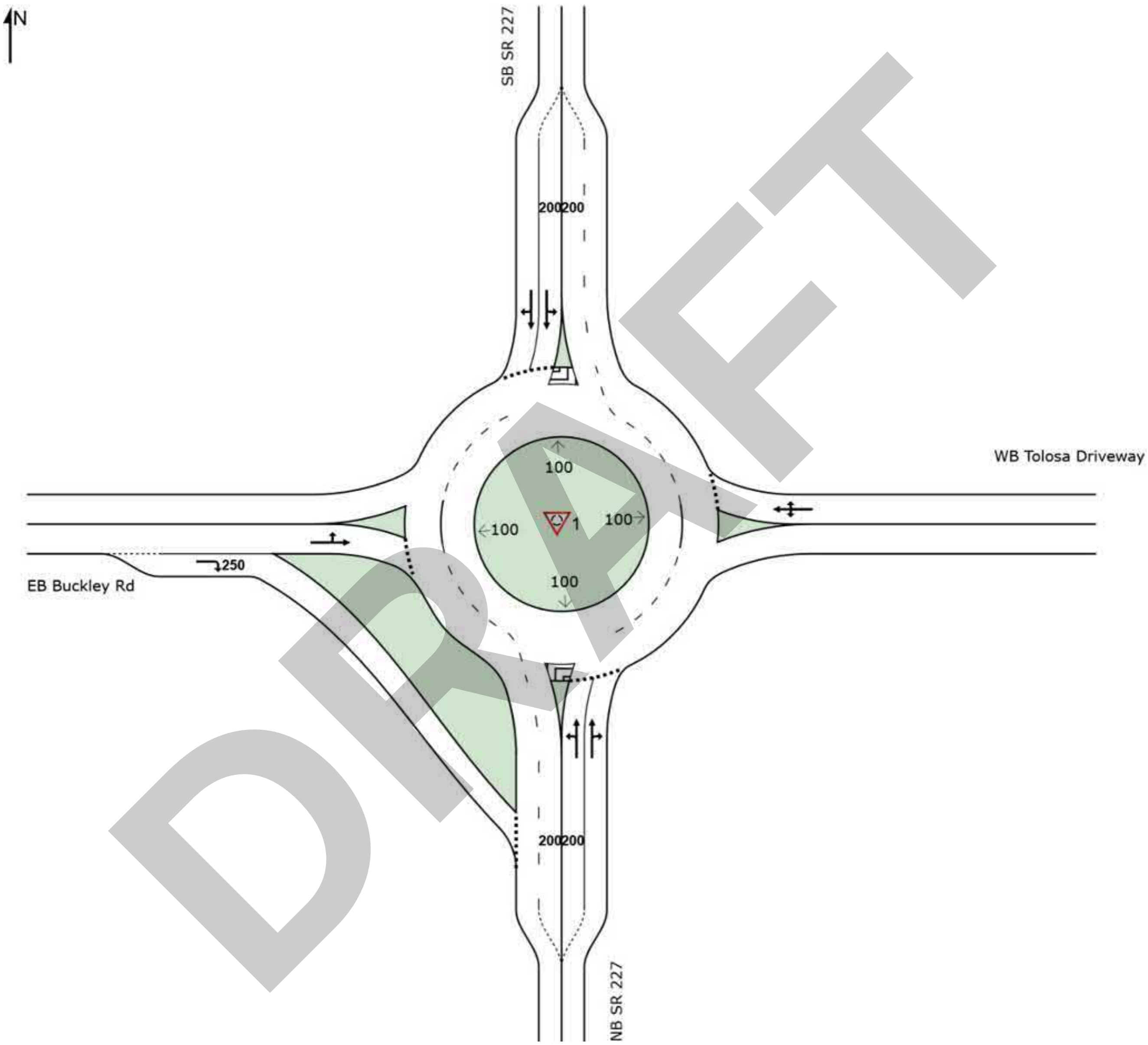
d Dominant lane on roundabout approach

SITE LAYOUT

Site: 1 [Int06_Buckley Rd_Alt02a.1_2020AM (Site Folder: General)]

Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Organisation: KIMLEY-HORN & ASSOCIATES INC | Licence: NETWORK / Enterprise | Created: Wednesday, February 3, 2021 7:53:40 AM
Project: K:\SAC_TPTO\SR 227 PS&E - Los Ranchos Roundabout - 197002002\10 Analysis and Design Calculations\SIDRA Files\Int06_SR227 at Buckley Rd.sip9

LANE SUMMARY

Site: 1 [Int06_Buckley Rd_Alt02a.1_2020AM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: NB SR 227													
Lane 1	757	3.0	1268	0.597	100	15.9	LOS C	4.7	121.4	Short	200	0.0	NA
Lane 2[d]	757	3.0	1268	0.597	100	9.9	LOS A	4.7	121.4	Full	1250	0.0	0.0
Approach	1515	3.0		0.597		12.9	LOS B	4.7	121.4				
East: WB Tolosa Driveway													
Lane 1[d]	7	3.0	341	0.021	100	12.6	LOS B	0.1	1.6	Full	1050	0.0	0.0
Approach	7	3.0		0.021		12.6	LOS B	0.1	1.6				
North: SB SR 227													
Lane 1	305	3.0	1089	0.280	100	10.3	LOS B	1.3	33.2	Short	200	0.0	NA
Lane 2[d]	305	3.0	1089	0.280	100	6.0	LOS A	1.3	33.2	Full	2300	0.0	0.0
Approach	610	3.0		0.280		8.2	LOS A	1.3	33.2				
West: EB Buckley Rd													
Lane 1[d]	86	3.0	849	0.101	100	13.7	LOS B	0.4	9.1	Full	575	0.0	0.0
Lane 2	197	3.0	852	0.232	100	6.7	LOS A	0.9	22.9	Short	250	0.0	NA
Approach	283	3.0		0.232		8.8	LOS A	0.9	22.9				
Intersection	2415	3.0		0.597		11.2	LOS B	4.7	121.4				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 1 [Int06_Buckley Rd_Alt02a.1_2020PM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: NB SR 227													
Lane 1	336	3.0	1328	0.253	100	7.7	LOS A	1.2	31.6	Short	200	0.0	NA
Lane 2[d]	336	3.0	1328	0.253	100	4.9	LOS A	1.2	31.6	Full	1250	0.0	0.0
Approach	672	3.0		0.253		6.3	LOS A	1.2	31.6				
East: WB Tolosa Driveway													
Lane 1[d]	41	3.0	745	0.056	100	11.5	LOS B	0.2	4.8	Full	1050	0.0	0.0
Approach	41	3.0		0.056		11.5	LOS B	0.2	4.8				
North: SB SR 227													
Lane 1	631	3.0	1225	0.515	100	21.2	LOS C	3.4	87.5	Short	200	0.0	NA
Lane 2[d]	631	3.0	1225	0.515	100	8.6	LOS A	3.4	87.5	Full	2300	0.0	0.0
Approach	1262	3.0		0.515		14.9	LOS B	3.4	87.5				
West: EB Buckley Rd													
Lane 1[d]	34	3.0	471	0.072	100	12.4	LOS B	0.2	5.9	Full	575	0.0	0.0
Lane 2	404	3.0	473	0.853	100	42.1	LOS E	7.8	200.6	Short	250	0.0	NA
Approach	438	3.0		0.853		39.8	LOS E	7.8	200.6				
Intersection	2413	3.0		0.853		16.9	LOS C	7.8	200.6				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 1 [Int06_Buckley Rd_Alt02a.1_2045AM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: NB SR 227													
Lane 1	846	3.0	1282	0.660	100	18.5	LOS C	6.1	155.1	Short	200	0.0	NA
Lane 2[d]	846	3.0	1282	0.660	100	11.4	LOS B	6.1	155.1	Full	1250	0.0	0.0
Approach	1692	3.0		0.660		14.9	LOS B	6.1	155.1				
East: WB Tolosa Driveway													
Lane 1[d]	5	3.0	295	0.018	100	14.2	LOS B	0.1	1.4	Full	1050	0.0	0.0
Approach	5	3.0		0.018		14.2	LOS B	0.1	1.4				
North: SB SR 227													
Lane 1	281	3.0	1057	0.266	100	10.1	LOS B	1.2	30.7	Short	200	0.0	NA
Lane 2[d]	281	3.0	1057	0.266	100	6.0	LOS A	1.2	30.7	Full	2300	0.0	0.0
Approach	562	3.0		0.266		8.0	LOS A	1.2	30.7				
West: EB Buckley Rd													
Lane 1[d]	74	3.0	881	0.084	100	15.0	LOS C	0.3	7.6	Full	575	0.0	0.0
Lane 2	180	3.0	884	0.204	100	6.1	LOS A	0.8	20.0	Short	250	0.0	NA
Approach	254	3.0		0.204		8.7	LOS A	0.8	20.0				
Intersection	2514	3.0		0.660		12.7	LOS B	6.1	155.1				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 1 [Int06_Buckley Rd_Alt02a.1_2045PM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance													
	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: NB SR 227													
Lane 1	378	2.0	1344	0.281	100	7.9	LOS A	1.4	36.7	Short	200	0.0	NA
Lane 2[d]	378	2.0	1344	0.281	100	5.1	LOS A	1.4	36.7	Full	1250	0.0	0.0
Approach	757	2.0		0.281		6.5	LOS A	1.4	36.7				
East: WB Tolosa Driveway													
Lane 1[d]	32	2.0	704	0.045	100	11.2	LOS B	0.2	3.8	Full	1050	0.0	0.0
Approach	32	2.0		0.045		11.2	LOS B	0.2	3.8				
North: SB SR 227													
Lane 1	616	2.0	1221	0.504	100	20.1	LOS C	3.3	84.1	Short	200	0.0	NA
Lane 2[d]	616	2.0	1221	0.504	100	8.4	LOS A	3.3	84.1	Full	2300	0.0	0.0
Approach	1232	2.0		0.504		14.2	LOS B	3.3	84.1				
West: EB Buckley Rd													
Lane 1[d]	33	2.0	492	0.066	100	12.1	LOS B	0.2	5.4	Full	575	0.0	0.0
Lane 2	391	2.0	495	0.791	100	33.5	LOS D	6.3	161.1	Short	250	0.0	NA
Approach	424	2.0		0.791		31.9	LOS D	6.3	161.1				
Intersection	2443	2.0		0.791		14.9	LOS B	6.3	161.1				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

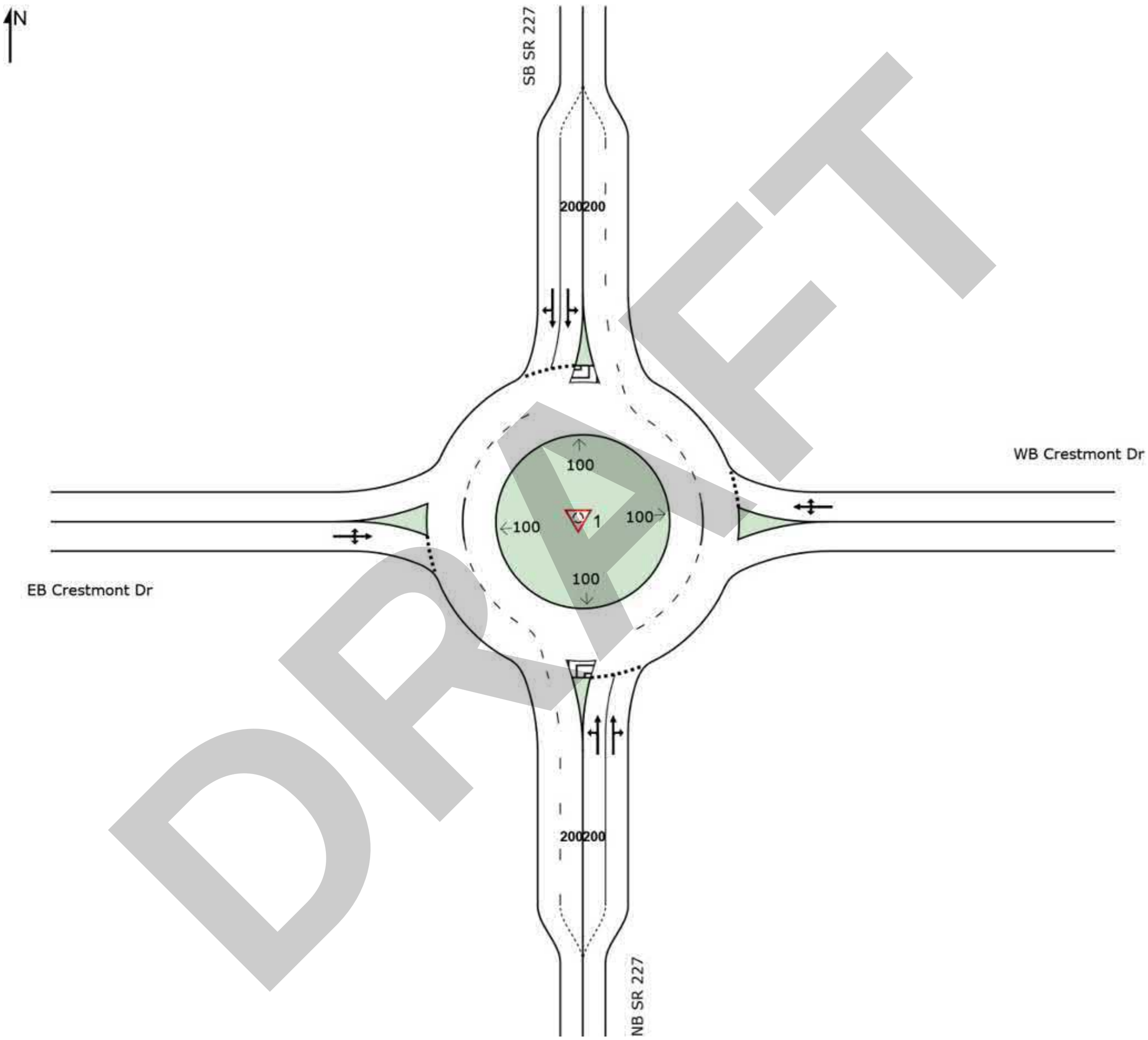
d Dominant lane on roundabout approach

SITE LAYOUT

Site: 1 [Int07_Crestmont Dr_Alt02_2020AM (Site Folder: General)]

Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



LANE SUMMARY

Site: 1 [Int07_Crestmont Dr_Alt02_2020AM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance													
	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: NB SR 227													
Lane 1	735	4.0	1267	0.581	100	22.6	LOS C	4.4	114.1	Short	200	0.0	NA
Lane 2[d]	735	4.0	1267	0.581	100	9.6	LOS A	4.4	114.1	Full	1375	0.0	0.0
Approach	1471	4.0		0.581		16.1	LOS C	4.4	114.1				
East: WB Crestmont Dr													
Lane 1[d]	6	4.0	348	0.016	100	11.8	LOS B	0.0	1.3	Full	1325	0.0	0.0
Approach	6	4.0		0.016		11.8	LOS B	0.0	1.3				
North: SB SR 227													
Lane 1	391	4.0	1354	0.289	100	10.0	LOS A	1.5	38.0	Short	200	0.0	NA
Lane 2[d]	391	4.0	1354	0.289	100	5.2	LOS A	1.5	38.0	Full	1250	0.0	0.0
Approach	782	4.0		0.289		7.6	LOS A	1.5	38.0				
West: EB Crestmont Dr													
Lane 1[d]	100	4.0	694	0.144	100	16.8	LOS C	0.5	12.9	Full	525	0.0	0.0
Approach	100	4.0		0.144		16.8	LOS C	0.5	12.9				
Intersection	2358	4.0		0.581		13.3	LOS B	4.4	114.1				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 1 [Int07_Crestmont Dr_Alt02_2020PM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: NB SR 227													
Lane 1	329	3.0	1311	0.251	100	9.2	LOS A	1.2	31.1	Short	200	0.0	NA
Lane 2[d]	329	3.0	1311	0.251	100	4.9	LOS A	1.2	31.1	Full	1375	0.0	0.0
Approach	657	3.0		0.251		7.1	LOS A	1.2	31.1				
East: WB Crestmont Dr													
Lane 1[d]	7	3.0	742	0.010	100	10.7	LOS B	0.0	0.8	Full	1325	0.0	0.0
Approach	7	3.0		0.010		10.7	LOS B	0.0	0.8				
North: SB SR 227													
Lane 1	698	3.0	1357	0.515	100	17.6	LOS C	3.8	96.9	Short	200	0.0	NA
Lane 2[d]	698	3.0	1357	0.515	100	8.0	LOS A	3.8	96.9	Full	1250	0.0	0.0
Approach	1397	3.0		0.515		12.8	LOS B	3.8	96.9				
West: EB Crestmont Dr													
Lane 1[d]	81	3.0	429	0.190	100	14.1	LOS B	0.6	15.8	Full	525	0.0	0.0
Approach	81	3.0		0.190		14.1	LOS B	0.6	15.8				
Intersection	2143	3.0		0.515		11.1	LOS B	3.8	96.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 1 [Int07_Crestmont Dr_Alt02_2045AM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: NB SR 227													
Lane 1	815	3.0	1290	0.632	100	28.1	LOS D	5.5	141.0	Short	200	0.0	NA
Lane 2[d]	815	3.0	1290	0.632	100	10.6	LOS B	5.5	141.0	Full	1375	0.0	0.0
Approach	1630	3.0		0.632		19.4	LOS C	5.5	141.0				
East: WB Crestmont Dr													
Lane 1[d]	4	3.0	312	0.014	100	12.9	LOS B	0.0	1.1	Full	1325	0.0	0.0
Approach	4	3.0		0.014		12.9	LOS B	0.0	1.1				
North: SB SR 227													
Lane 1	349	3.0	1367	0.256	100	9.2	LOS A	1.3	32.4	Short	200	0.0	NA
Lane 2[d]	349	3.0	1367	0.256	100	4.8	LOS A	1.3	32.4	Full	1250	0.0	0.0
Approach	699	3.0		0.256		7.0	LOS A	1.3	32.4				
West: EB Crestmont Dr													
Lane 1[d]	89	3.0	756	0.118	100	19.6	LOS C	0.4	10.6	Full	525	0.0	0.0
Approach	89	3.0		0.118		19.6	LOS C	0.4	10.6				
Intersection	2423	3.0		0.632		15.8	LOS C	5.5	141.0				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 1 [Int07_Crestmont Dr_Alt02_2045PM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance														
	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: NB SR 227													
Lane 1	364	2.0	1340	0.271	100	9.6	LOS A	1.4	34.9	Short	200	0.0	NA
Lane 2[d]	364	2.0	1340	0.271	100	5.0	LOS A	1.4	34.9	Full	1375	0.0	0.0
Approach	727	2.0		0.271		7.3	LOS A	1.4	34.9				
East: WB Crestmont Dr													
Lane 1[d]	5	2.0	717	0.008	100	12.7	LOS B	0.0	0.6	Full	1325	0.0	0.0
Approach	5	2.0		0.008		12.7	LOS B	0.0	0.6				
North: SB SR 227													
Lane 1	792	2.0	1373	0.577	100	21.6	LOS C	4.9	125.0	Short	200	0.0	NA
Lane 2[d]	792	2.0	1373	0.577	100	9.0	LOS A	4.9	125.0	Full	1250	0.0	0.0
Approach	1584	2.0		0.577		15.3	LOS C	4.9	125.0				
West: EB Crestmont Dr													
Lane 1[d]	62	2.0	374	0.166	100	15.3	LOS C	0.5	13.3	Full	525	0.0	0.0
Approach	62	2.0		0.166		15.3	LOS C	0.5	13.3				
Intersection	2378	2.0		0.577		12.9	LOS B	4.9	125.0				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

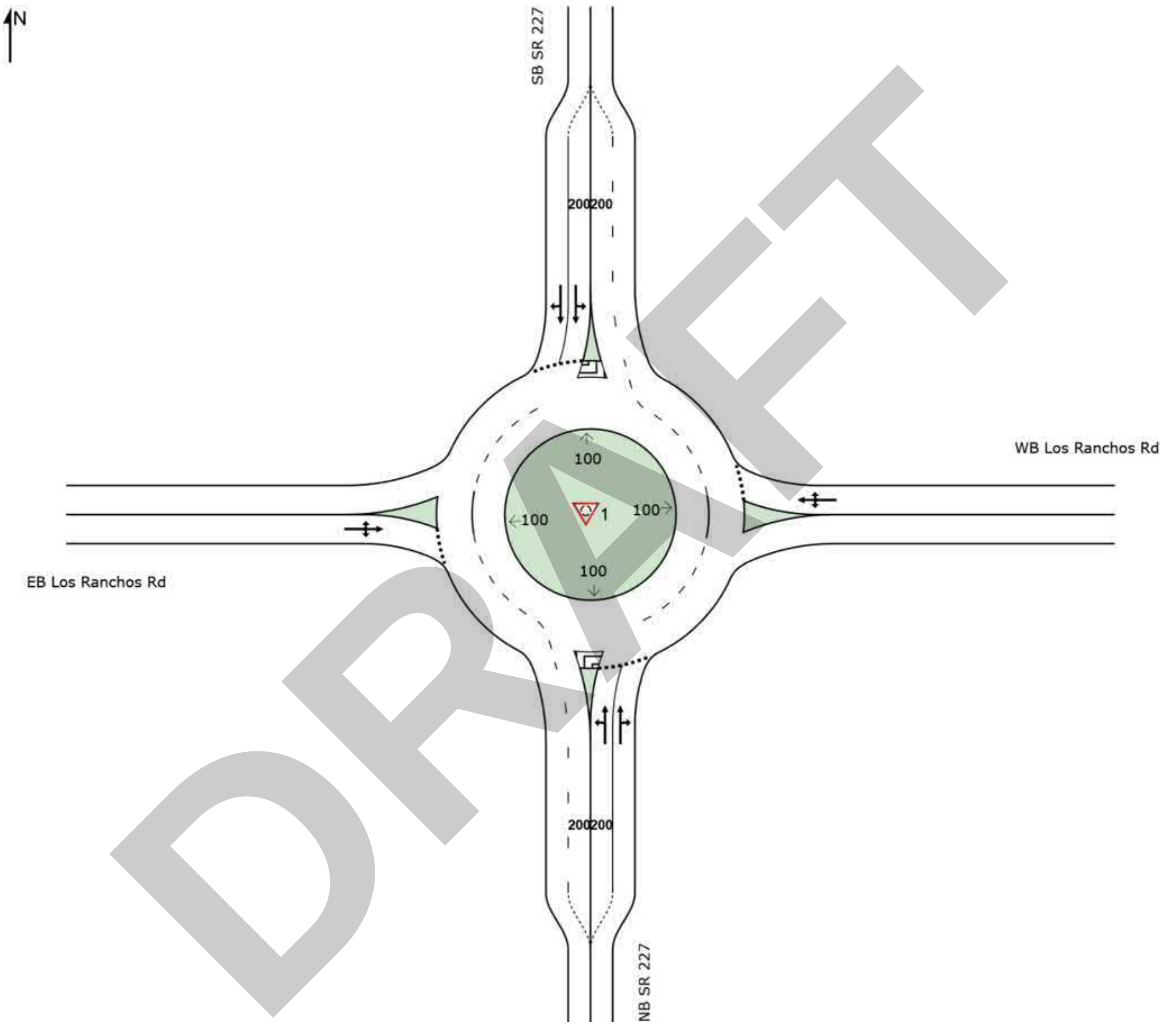
d Dominant lane on roundabout approach

SITE LAYOUT

Site: 1 [Int08_Los Ranchos_Alt02_2020AM (Site Folder: General)]

Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



LANE SUMMARY

Site: 1 [Int08_Los Ranchos_Alt02_2020AM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance														
	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: NB SR 227													
Lane 1	644	4.0	952	0.677	100	28.4	LOS D	8.4	216.0	Short	200	0.0	NA
Lane 2[d]	644	4.0	952	0.677	100	14.7	LOS B	8.4	216.0	Full	2000	0.0	0.0
Approach	1288	4.0		0.677		21.6	LOS C	8.4	216.0				
East: WB Los Ranchos Rd													
Lane 1[d]	10	4.0	313	0.032	100	12.6	LOS B	0.1	2.4	Full	900	0.0	0.0
Approach	10	4.0		0.032		12.6	LOS B	0.1	2.4				
North: SB SR 227													
Lane 1	399	4.0	1263	0.316	100	9.6	LOS A	1.6	41.6	Short	200	0.0	NA
Lane 2[d]	399	4.0	1263	0.316	100	5.7	LOS A	1.6	41.6	Full	1300	0.0	0.0
Approach	797	4.0		0.316		7.7	LOS A	1.6	41.6				
West: EB Los Ranchos Rd													
Lane 1[d]	426	4.0	931	0.457	100	23.3	LOS C	2.6	67.9	Full	320	0.0	0.0
Approach	426	4.0		0.457		23.3	LOS C	2.6	67.9				
Intersection	2521	4.0		0.677		17.4	LOS C	8.4	216.0				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 1 [Int08_Los Ranchos_Alt02_2020PM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: NB SR 227													
Lane 1	283	3.0	1181	0.239	100	9.2	LOS A	1.1	28.1	Short	200	0.0	NA
Lane 2[d]	283	3.0	1181	0.239	100	5.2	LOS A	1.1	28.1	Full	2000	0.0	0.0
Approach	565	3.0		0.239		7.2	LOS A	1.1	28.1				
East: WB Los Ranchos Rd													
Lane 1[d]	7	3.0	733	0.010	100	6.8	LOS A	0.0	0.8	Full	900	0.0	0.0
Approach	7	3.0		0.010		6.8	LOS A	0.0	0.8				
North: SB SR 227													
Lane 1	690	3.0	1331	0.519	100	16.9	LOS C	3.8	96.3	Short	200	0.0	NA
Lane 2[d]	690	3.0	1331	0.519	100	8.2	LOS A	3.8	96.3	Full	1300	0.0	0.0
Approach	1381	3.0		0.519		12.5	LOS B	3.8	96.3				
West: EB Los Ranchos Rd													
Lane 1[d]	210	3.0	467	0.450	100	19.5	LOS C	2.0	50.6	Full	320	0.0	0.0
Approach	210	3.0		0.450		19.5	LOS C	2.0	50.6				
Intersection	2163	3.0		0.519		11.8	LOS B	3.8	96.3				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 1 [Int08_Los Ranchos_Alt02_2045AM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: NB SR 227													
Lane 1	660	3.0	960	0.687	100	29.7	LOS D	8.9	227.6	Short	200	0.0	NA
Lane 2[d]	660	3.0	960	0.687	100	15.0	LOS B	8.9	227.6	Full	2000	0.0	0.0
Approach	1320	3.0		0.687		22.3	LOS C	8.9	227.6				
East: WB Los Ranchos Rd													
Lane 1[d]	8	3.0	311	0.024	100	12.5	LOS B	0.1	1.9	Full	900	0.0	0.0
Approach	8	3.0		0.024		12.5	LOS B	0.1	1.9				
North: SB SR 227													
Lane 1	352	3.0	1276	0.276	100	8.9	LOS A	1.4	34.8	Short	200	0.0	NA
Lane 2[d]	352	3.0	1276	0.276	100	5.3	LOS A	1.4	34.8	Full	1300	0.0	0.0
Approach	703	3.0		0.276		7.1	LOS A	1.4	34.8				
West: EB Los Ranchos Rd													
Lane 1[d]	434	3.0	998	0.435	100	23.3	LOS C	2.2	55.8	Full	320	0.0	0.0
Approach	434	3.0		0.435		23.3	LOS C	2.2	55.8				
Intersection	2464	3.0		0.687		18.1	LOS C	8.9	227.6				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 1 [Int08_Los Ranchos_Alt02_2045PM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance													
	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: NB SR 227													
Lane 1	291	2.0	1126	0.258	100	9.9	LOS A	1.2	30.4	Short	200	0.0	NA
Lane 2[d]	291	2.0	1126	0.258	100	5.6	LOS A	1.2	30.4	Full	2000	0.0	0.0
Approach	582	2.0		0.258		7.7	LOS A	1.2	30.4				
East: WB Los Ranchos Rd													
Lane 1[d]	16	2.0	695	0.023	100	6.1	LOS A	0.1	2.0	Full	900	0.0	0.0
Approach	16	2.0		0.023		6.1	LOS A	0.1	2.0				
North: SB SR 227													
Lane 1	768	2.0	1336	0.575	100	19.1	LOS C	4.7	119.8	Short	200	0.0	NA
Lane 2[d]	768	2.0	1336	0.575	100	9.2	LOS A	4.7	119.8	Full	1300	0.0	0.0
Approach	1537	2.0		0.575		14.1	LOS B	4.7	119.8				
West: EB Los Ranchos Rd													
Lane 1[d]	277	2.0	445	0.623	100	27.7	LOS D	3.4	85.6	Full	320	0.0	0.0
Approach	277	2.0		0.623		27.7	LOS D	3.4	85.6				
Intersection	2412	2.0		0.623		14.1	LOS B	4.7	119.8				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

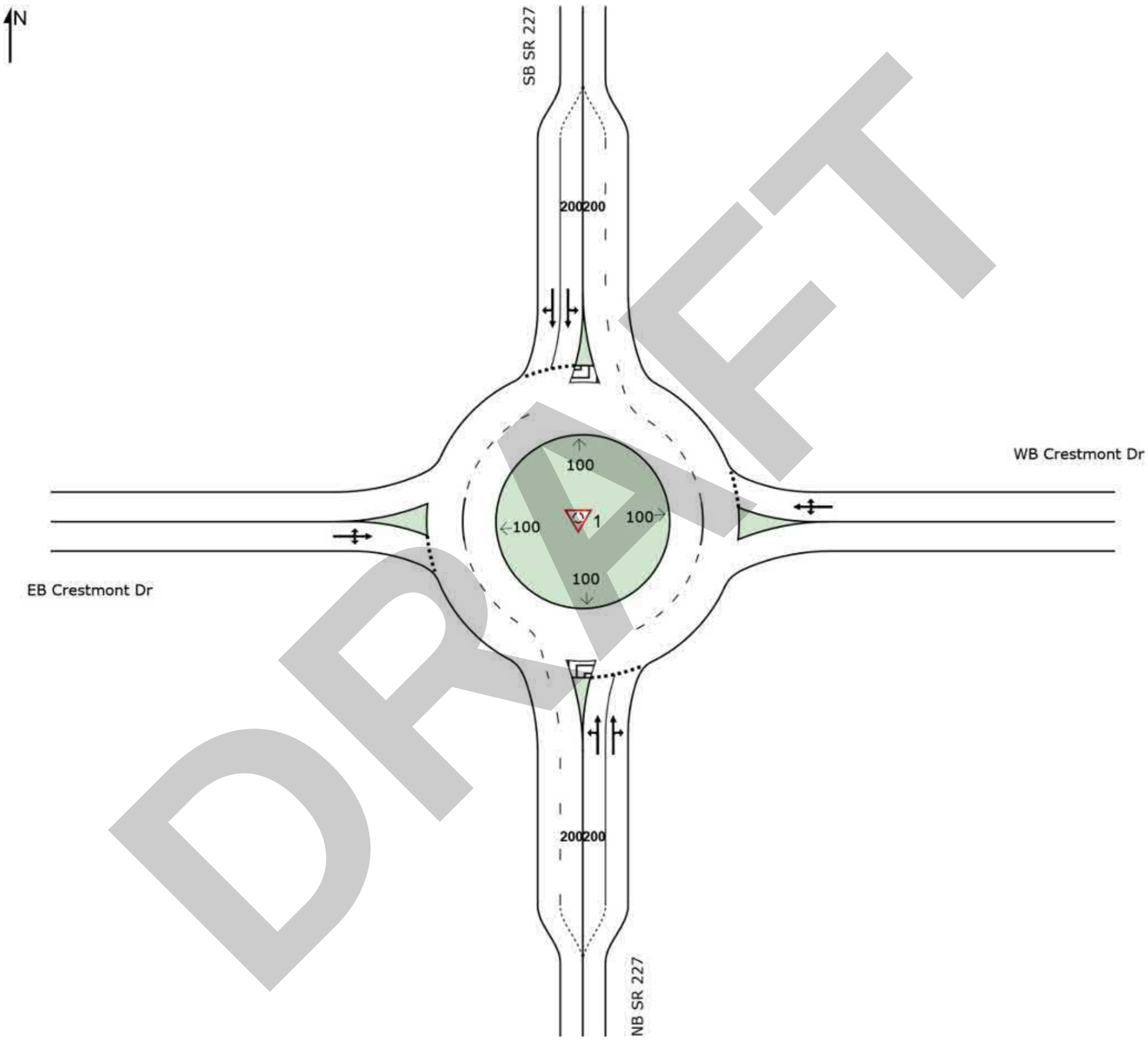
d Dominant lane on roundabout approach

SITE LAYOUT

Site: 1 [Int09_Biddle Ranch Rd_Alt02_2020AM (Site Folder: General)]

Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



LANE SUMMARY

Site: 1 [Int09_Biddle Ranch Rd_Alt02_2020AM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: NB SR 227													
Lane 1	687	4.0	1316	0.522	100	17.6	LOS C	3.7	96.2	Short	200	0.0	NA
Lane 2[d]	687	4.0	1316	0.522	100	8.3	LOS A	3.7	96.2	Full	1375	0.0	0.0
Approach	1374	4.0		0.522		12.9	LOS B	3.7	96.2				
East: WB Crestmont Dr													
Lane 1[d]	68	4.0	439	0.156	100	11.3	LOS B	0.5	12.8	Full	1325	0.0	0.0
Approach	68	4.0		0.156		11.3	LOS B	0.5	12.8				
North: SB SR 227													
Lane 1	192	4.0	1339	0.143	100	6.3	LOS A	0.6	15.8	Short	200	0.0	NA
Lane 2[d]	192	4.0	1339	0.143	100	3.9	LOS A	0.6	15.8	Full	1250	0.0	0.0
Approach	384	4.0		0.143		5.1	LOS A	0.6	15.8				
West: EB Crestmont Dr													
Lane 1[d]	6	4.0	958	0.006	100	6.1	LOS A	0.0	0.5	Full	525	0.0	0.0
Approach	6	4.0		0.006		6.1	LOS A	0.0	0.5				
Intersection	1832	4.0		0.522		11.2	LOS B	3.7	96.2				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 1 [Int09_Biddle Ranch Rd_Alt02_2020PM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: NB SR 227													
Lane 1	215	2.0	1356	0.158	100	7.3	LOS A	0.7	17.8	Short	200	0.0	NA
Lane 2[d]	215	2.0	1356	0.158	100	3.9	LOS A	0.7	17.8	Full	1375	0.0	0.0
Approach	429	2.0		0.158		5.6	LOS A	0.7	17.8				
East: WB Crestmont Dr													
Lane 1[d]	199	2.0	974	0.204	100	14.1	LOS B	0.8	20.5	Full	1325	0.0	0.0
Approach	199	2.0		0.204		14.1	LOS B	0.8	20.5				
North: SB SR 227													
Lane 1	677	2.0	1217	0.556	100	20.7	LOS C	4.0	100.4	Short	200	0.0	NA
Lane 2[d]	677	2.0	1217	0.556	100	9.4	LOS A	4.0	100.4	Full	1250	0.0	0.0
Approach	1354	2.0		0.556		15.1	LOS C	4.0	100.4				
West: EB Crestmont Dr													
Lane 1[d]	13	2.0	381	0.034	100	11.5	LOS B	0.1	2.6	Full	525	0.0	0.0
Approach	13	2.0		0.034		11.5	LOS B	0.1	2.6				
Intersection	1995	2.0		0.556		12.9	LOS B	4.0	100.4				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 1 [Int09_Biddle Ranch Rd_Alt02_2045AM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance														
	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: NB SR 227													
Lane 1	686	3.0	1326	0.518	100	17.3	LOS C	3.7	95.5	Short	200	0.0	NA
Lane 2[d]	686	3.0	1326	0.518	100	8.2	LOS A	3.7	95.5	Full	1375	0.0	0.0
Approach	1373	3.0		0.518		12.8	LOS B	3.7	95.5				
East: WB Crestmont Dr													
Lane 1[d]	60	3.0	449	0.133	100	10.7	LOS B	0.4	11.0	Full	1325	0.0	0.0
Approach	60	3.0		0.133		10.7	LOS B	0.4	11.0				
North: SB SR 227													
Lane 1	215	3.0	1356	0.158	100	6.5	LOS A	0.7	17.8	Short	200	0.0	NA
Lane 2[d]	215	3.0	1356	0.158	100	3.9	LOS A	0.7	17.8	Full	1250	0.0	0.0
Approach	429	3.0		0.158		5.2	LOS A	0.7	17.8				
West: EB Crestmont Dr													
Lane 1[d]	4	3.0	936	0.005	100	6.2	LOS A	0.0	0.4	Full	525	0.0	0.0
Approach	4	3.0		0.005		6.2	LOS A	0.0	0.4				
Intersection	1866	3.0		0.518		10.9	LOS B	3.7	95.5				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 1 [Int09_Biddle Ranch Rd_Alt02_2045PM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total	HV]	Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh	Dist]	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: NB SR 227													
Lane 1	241	2.0	1352	0.178	100	7.7	LOS A	0.8	20.6	Short	200	0.0	NA
Lane 2[d]	241	2.0	1352	0.178	100	4.1	LOS A	0.8	20.6	Full	1375	0.0	0.0
Approach	483	2.0		0.178		5.9	LOS A	0.8	20.6				
East: WB Crestmont Dr													
Lane 1[d]	185	2.0	933	0.198	100	15.3	LOS C	0.8	19.6	Full	1325	0.0	0.0
Approach	185	2.0		0.198		15.3	LOS C	0.8	19.6				
North: SB SR 227													
Lane 1	720	2.0	1228	0.586	100	22.6	LOS C	4.4	112.5	Short	200	0.0	NA
Lane 2[d]	720	2.0	1228	0.586	100	9.9	LOS A	4.4	112.5	Full	1250	0.0	0.0
Approach	1440	2.0		0.586		16.3	LOS C	4.4	112.5				
West: EB Crestmont Dr													
Lane 1[d]	10	2.0	356	0.027	100	12.1	LOS B	0.1	2.1	Full	525	0.0	0.0
Approach	10	2.0		0.027		12.1	LOS B	0.1	2.1				
Intersection	2117	2.0		0.586		13.8	LOS B	4.4	112.5				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Appendix E

Interactive Highway Safety Design Model (IHSDM) Reports and KABCO Values

SR-227 at Farmhouse Lane								
Control	Total	CMF		K	A	B	C	O
Existing (SSSC)	37.895	KABC	PDO	0.49%	1.71%	9.12%	24.89%	63.79%
		-	-	0.184	0.647	3.458	9.434	24.172
Signal	47.424	KABC	PDO	0.26%	2.47%	13.32%	36.58%	47.37%
		-	-	0.122	1.172	6.318	17.347	22.465
Multi-Lan Roundabout	38.366	KABC	PDO	0.09%	0.88%	4.74%	13.02%	81.26%
		0.288	1.388	0.035	0.338	1.820	4.996	31.178
SR-227 at Buckley Road								
Control	Total	CMF		K	A	B	C	O
Existing (Signal)	55.877	KABC	PDO	0.25%	2.45%	13.23%	36.33%	47.72%
		-	-	0.142	1.372	7.395	20.302	26.666
Proposed Signal	79.080	KABC	PDO	0.25%	2.45%	13.21%	36.26%	47.83%
		-	-	0.201	1.937	10.444	28.674	37.823
Signal w/ RT bypass to convert to Roundabout	85.714	KABC	PDO	0.29%	2.75%	13.78%	35.31%	47.88%
		-	-	0.245	2.357	11.810	30.263	41.041
Multi-Lane Roundabout	69.343	KABC	PDO	0.10%	0.98%	4.90%	12.57%	81.45%
		0.288	1.376	0.070	0.679	3.401	8.716	56.477
SR-227 at Crestmont Drive								
Control	Total	CMF		K	A	B	C	O
Existing (SSSC)	58.075	KABC	PDO	0.37%	8.28%	18.23%	26.16%	46.95%
		-	-	0.216	4.811	10.590	15.194	27.264
Proposed Signal	51.038	KABC	PDO	0.25%	2.45%	13.22%	36.30%	47.77%
		-	-	0.130	1.252	6.748	18.526	24.383
Multi-Lane Roundabout	41.289	KABC	PDO	0.09%	0.87%	4.71%	12.92%	81.41%
		0.288	1.379	0.037	0.360	1.943	5.335	33.613
Turn-Restricted	37.864	KABC	PDO	0.40%	8.75%	19.28%	28.71%	42.86%
		-	-	0.151	3.313	7.299	10.872	16.229
RCUT	51.106	KABC	PDO	0.37%	8.27%	18.21%	26.12%	47.02%
		0.860	0.860	0.190	4.228	9.305	13.351	24.033
SR-227 at Los Ranchos Road								
Control	Total	CMF		K	A	B	C	O
Existing (Signal)	66.085	KABC	PDO	0.25%	2.45%	13.23%	36.32%	47.75%
		-	-	0.168	1.622	8.741	24.000	31.554
Proposed Signal	70.368	KABC	PDO	0.25%	2.45%	13.22%	36.31%	47.76%
		-	-	0.179	1.726	9.306	25.550	33.606
Multi-Lane Roundabout	56.928	KABC	PDO	0.09%	0.87%	4.71%	12.93%	81.40%
		0.288	1.379	0.052	0.497	2.680	7.358	46.340
SR-227 at Biddle Ranch Rd								
Control	Total	CMF		K	A	B	C	O
Existing (SSSC)	73.093	KABC	PDO	0.36%	8.08%	17.77%	25.50%	48.29%
		-	-	0.265	5.902	12.992	18.640	35.294
Proposed Signal	33.151	KABC	PDO	0.25%	2.45%	13.19%	36.22%	47.89%
		-	-	0.084	0.811	4.373	12.006	15.877
Multi-Lane Roundabout	24.896	KABC	PDO	0.22%	2.12%	11.42%	31.35%	54.90%
		0.650	0.861	0.055	0.527	2.842	7.804	13.668
TWLTL	48.241	KABC	PDO	0.36%	8.08%	17.77%	25.50%	48.29%
		0.660	0.660	0.175	3.896	8.575	12.302	23.294
RCUT	62.860	KABC	PDO	0.36%	8.08%	17.77%	25.50%	48.29%
		0.860	0.860	0.228	5.076	11.173	16.030	30.353

Farmhouse Lane

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

February 15, 2021

Disclaimer

The Interactive Highway Design Model (IHSDM) software is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its content or use thereof. This document does not constitute a standard, specification, or regulation.

The United States Government does not endorse products or manufacturers. Trade and manufacturers' names may appear in this software and documentation only because they are considered essential to the objective of the software.

Limited Warranty and Limitations of Remedies

This software product is provided "as-is," without warranty of any kind-either expressed or implied (but not limited to the implied warranties of merchantability and fitness for a particular purpose). The FHWA do not warrant that the functions contained in the software will meet the end-user's requirements or that the operation of the software will be uninterrupted and error-free.

Under no circumstances will the FHWA be liable to the end-user for any damages or claimed lost profits, lost savings, or other incidental or consequential damages rising out of the use or inability to use the software (even if these organizations have been advised of the possibility of such damages), or for any claim by any other party.

Notice

The use of the IHSDM software is being done strictly on a voluntary basis. In exchange for provision of IHSDM, the user agrees that the Federal Highway Administration (FHWA), U.S. Department of Transportation and any other agency of the Federal Government shall not be responsible for any errors, damage or other liability that may result from any and all use of the software, including installation and testing of the software. The user further agrees to hold the FHWA and the Federal Government harmless from any resulting liability. The user agrees that this hold harmless provision shall flow to any person to whom or any entity to which the user provides the IHSDM software. It is the user's full responsibility to inform any person to whom or any entity to which it provides the IHSDM software of this hold harmless provision.

Table of Contents

Report Overview **1**

Disclaimer Regarding Crash Prediction Method 1

Section Types **3**

Urban Arterial Site Set CPM Evaluation 3

List of Tables

Table Evaluation and Crash Data (CSD) (if applicable) Intersection Sites 4

Table Predicted Crash Frequencies and Rates by Site 4

Table Predicted Crash Frequencies by Year (3ST) 5

Table Predicted 3ST Crash Type Distribution 6

Farmhouse Lane

Report Overview

Report Generated: Feb 15, 2021 8:34 AM
Report Template: System: Multi-Page [System] (sscpm2, Oct 12, 2020 9:15 AM)

Evaluation Date: Mon Feb 15 08:34:25 PST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: jared.calise
Organization Name:
Phone:
E-Mail:

Project Title: SR 227 - Farmhouse Lane
Project Comment: Created Thu Jan 07 15:26:35 PST 2021
Project Unit System: U.S. Customary

Site Set: Existing - SSSC
Site Set Comment: Created Thu Jan 07 15:27:33 PST 2021
Site Set Version: v1

Evaluation Title: Existing - SSSC
Evaluation Comment: Created Mon Feb 15 08:34:13 PST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2045
Empirical-Bayes Analysis: None

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

Farmhouse Lane

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Urban Arterial Site Set CPM Evaluation

Site Type

Type: 3ST
Calibration Factor: 1

Farmhouse Lane

Table 1. Evaluation and Crash Data (CSD) (if applicable) Intersection Sites

Site No.	Type	Highway	Site Description	Major AADT	Minor AADT	Number of Approaches with Left-Turn Lanes	Number of Approaches with Right-Turn Lanes	Presence of Lighting
1	3ST2x2le5	SR 227	at Farmhouse Lane	2020: 18472; 2021: 18570; 2022: 18668; 2023: 18766; 2024: 18864; 2025: 18962; 2026: 19060; 2027: 19158; 2028: 19256; 2029: 19354; 2030: 19452; 2031: 19550; 2032: 19648; 2033: 19747; 2034: 19845; 2035: 19943; 2036: 20041; 2037: 20139; 2038: 20237; 2039: 20335; 2040: 20433; 2041: 20531; 2042: 20629; 2043: 20727; 2044: 20825; 2045: 20924	2020: 674; 2021: 804; 2022: 935; 2023: 1066; 2024: 1196; 2025: 1327; 2026: 1458; 2027: 1589; 2028: 1719; 2029: 1850; 2030: 1981; 2031: 2111; 2032: 2242; 2033: 2373; 2034: 2504; 2035: 2634; 2036: 2765; 2037: 2896; 2038: 3026; 2039: 3157; 2040: 3288; 2041: 3419; 2042: 3549; 2043: 3680; 2044: 3811; 2045: 3942	1	1	no

Table 2. Predicted Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Intersection Travel Crash Rate (crashes/million veh)	Intersection Crash Rate (crashes/yr)
1	3ST	SR 227	at Farmhouse Lane	37.895	1.4575	0.5278	0.9297	0.19	1.4575
		Total	Total	37.895	1.4575	0.5278	0.9297	0.19	1.4575

Table 3. Predicted Crash Frequencies by Year (3ST)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	0.83	0.34	41.601	0.48	58.399
2021	0.90	0.37	40.805	0.53	59.195
2022	0.96	0.39	40.130	0.58	59.870
2023	1.02	0.40	39.547	0.62	60.453
2024	1.08	0.42	39.040	0.66	60.960
2025	1.13	0.44	38.584	0.69	61.416
2026	1.18	0.45	38.174	0.73	61.826
2027	1.23	0.47	37.801	0.77	62.199
2028	1.28	0.48	37.462	0.80	62.538
2029	1.33	0.49	37.146	0.83	62.854
2030	1.37	0.51	36.854	0.87	63.146
2031	1.42	0.52	36.583	0.90	63.417
2032	1.46	0.53	36.327	0.93	63.673
2033	1.51	0.54	36.087	0.96	63.913
2034	1.55	0.56	35.860	0.99	64.140
2035	1.59	0.57	35.647	1.02	64.353
2036	1.63	0.58	35.443	1.05	64.557
2037	1.67	0.59	35.249	1.08	64.751
2038	1.71	0.60	35.066	1.11	64.934
2039	1.75	0.61	34.889	1.14	65.111
2040	1.79	0.62	34.721	1.17	65.279
2041	1.83	0.63	34.558	1.20	65.442
2042	1.86	0.64	34.404	1.22	65.596
2043	1.90	0.65	34.254	1.25	65.746
2044	1.94	0.66	34.110	1.28	65.890
2045	1.98	0.67	33.971	1.30	66.029
Total	37.90	13.72	36.216	24.17	63.784
Average	1.46	0.53	36.216	0.93	63.784

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 4. Predicted 3ST Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Intersection	Collision with Animal	0.00	0.0	0.05	0.1	0.06	0.1
Intersection	Collision with Bicycle	0.58	1.5	0.00	0.0	0.58	1.5
Intersection	Collision with Fixed Object	0.95	2.5	2.36	6.2	3.31	8.7
Intersection	Non-Collision	0.13	0.3	0.09	0.2	0.21	0.6
Intersection	Collision with Other Object	0.11	0.3	0.26	0.7	0.37	1.0
Intersection	Other Single-vehicle Collision	0.05	0.1	0.07	0.2	0.11	0.3
Intersection	Collision with Parked Vehicle	0.00	0.0	0.01	0.0	0.01	0.0
Intersection	Collision with Pedestrian	0.77	2.0	0.00	0.0	0.77	2.0
Intersection	Total Intersection Single Vehicle Crashes	2.60	6.8	2.83	7.5	5.42	14.3
Intersection	Angle Collision	3.82	10.1	5.59	14.8	9.41	24.8
Intersection	Head-on Collision	0.50	1.3	0.49	1.3	0.99	2.6
Intersection	Other Multi-vehicle Collision	0.72	1.9	5.02	13.2	5.74	15.1
Intersection	Rear-end Collision	4.68	12.4	9.39	24.8	14.08	37.1
Intersection	Sideswipe	1.40	3.7	0.85	2.3	2.26	6.0
Intersection	Total Intersection Multiple Vehicle Crashes	11.13	29.4	21.34	56.3	32.47	85.7
Intersection	Total Intersection Crashes	13.72	36.2	24.17	63.8	37.90	100.0
	Total Crashes	13.72	36.2	24.17	63.8	37.90	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Farmhouse Lane

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

February 15, 2021

Disclaimer

The Interactive Highway Design Model (IHSDM) software is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its content or use thereof. This document does not constitute a standard, specification, or regulation.

The United States Government does not endorse products or manufacturers. Trade and manufacturers' names may appear in this software and documentation only because they are considered essential to the objective of the software.

Limited Warranty and Limitations of Remedies

This software product is provided "as-is," without warranty of any kind-either expressed or implied (but not limited to the implied warranties of merchantability and fitness for a particular purpose). The FHWA do not warrant that the functions contained in the software will meet the end-user's requirements or that the operation of the software will be uninterrupted and error-free.

Under no circumstances will the FHWA be liable to the end-user for any damages or claimed lost profits, lost savings, or other incidental or consequential damages rising out of the use or inability to use the software (even if these organizations have been advised of the possibility of such damages), or for any claim by any other party.

Notice

The use of the IHSDM software is being done strictly on a voluntary basis. In exchange for provision of IHSDM, the user agrees that the Federal Highway Administration (FHWA), U.S. Department of Transportation and any other agency of the Federal Government shall not be responsible for any errors, damage or other liability that may result from any and all use of the software, including installation and testing of the software. The user further agrees to hold the FHWA and the Federal Government harmless from any resulting liability. The user agrees that this hold harmless provision shall flow to any person to whom or any entity to which the user provides the IHSDM software. It is the user's full responsibility to inform any person to whom or any entity to which it provides the IHSDM software of this hold harmless provision.

Table of Contents

Report Overview **1**

Disclaimer Regarding Crash Prediction Method 1

Section Types **3**

Urban Arterial Site Set CPM Evaluation 3

List of Tables

Table Evaluation and Crash Data (CSD) (if applicable) Intersection Sites 4

Table Predicted Crash Frequencies and Rates by Site 4

Table Predicted Crash Frequencies by Year (4SG_GE6) 5

Table Predicted USA 4SG_GE6 Sites Crash Severity 6

Table Predicted 4SG_GE6 Crash Type Distribution 6

Report Overview

Report Generated: Feb 15, 2021 8:36 AM
Report Template: System: Multi-Page [System] (sscpm2, Oct 12, 2020 9:15 AM)

Evaluation Date: Mon Feb 15 08:36:30 PST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: jared.calise
Organization Name:
Phone:
E-Mail:

Project Title: SR 227 - Farmhouse Lane
Project Comment: Created Thu Jan 07 15:26:35 PST 2021
Project Unit System: U.S. Customary

Site Set: Proposed - Signalized 4-Lane Section
Site Set Comment: Created Thu Jan 07 15:35:35 PST 2021
Site Set Version: v1

Evaluation Title: Proposed - Signalized_2021.02.15
Evaluation Comment: Created Mon Feb 15 08:36:11 PST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2045
Empirical-Bayes Analysis: None

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Farmhouse Lane

Section Types

Urban Arterial Site Set CPM Evaluation

Site Type

Type: 4SG_GE6
Calibration Factor: 1

Farmhouse Lane

Table 1. Evaluation and Crash Data (CSD) (if applicable) Intersection Sites

Site No.	Type	Highway	Site Description	Major AADT	Minor AADT	Presence of Lighting	Number of Approaches with Permissive Left-Turn Phasing	Number of Approaches with Permissive/Protected or Protected/Permissive Left-Turn Phasing	Number of Approaches with Protected Left-Turn Phasing	Number of Approaches on which Right Turn on Red is Prohibited	Presence of Red-Light Cameras	Pedestrian Volumes Crossing all Intersection Legs (crossings/day)	Max. Number of Lanes Crossed by Pedestrians	Number of Bus Stops within 1000 ft of Intersection	Number of Schools within 1000 ft of Intersection	Number of Alcohol Sales Establishments within 1000 ft of Intersection
1	4SG2x2ge6	SR 227	at Farmhouse Lane	2020: 18472; 2021: 18570; 2022: 18668; 2023: 18766; 2024: 18864; 2025: 18962; 2026: 19060; 2027: 19158; 2028: 19256; 2029: 19354; 2030: 19452; 2031: 19550; 2032: 19648; 2033: 19747; 2034: 19845; 2035: 19943; 2036: 20041; 2037: 20139; 2038: 20237; 2039: 20335; 2040: 20433; 2041: 20531; 2042: 20629; 2043: 20727; 2044: 20825; 2045: 20924	2020: 674; 2021: 804; 2022: 935; 2023: 1066; 2024: 1196; 2025: 1327; 2026: 1458; 2027: 1589; 2028: 1719; 2029: 1850; 2030: 1981; 2031: 2111; 2032: 2242; 2033: 2373; 2034: 2504; 2035: 2634; 2036: 2765; 2037: 2896; 2038: 3026; 2039: 3157; 2040: 3288; 2041: 3419; 2042: 3549; 2043: 3680; 2044: 3811; 2045: 3942	yes	0	0	4	0	no	240	5	0	0	2

Table 2. Predicted Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Intersection Travel Crash Rate (crashes/million veh)	Intersection Crash Rate (crashes/yr)
1	4SG	SR 227	at Farmhouse Lane	47.424	1.8240	0.9599	0.8640	0.23	1.8240
		Total	Total	47.424	1.8240	0.9599	0.8640	0.23	1.8240

Table 3. Predicted Crash Frequencies by Year (4SG_GE6)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	1.27	0.67	52.503	0.60	47.497
2021	1.33	0.70	52.512	0.63	47.488
2022	1.40	0.73	52.521	0.66	47.479
2023	1.45	0.76	52.530	0.69	47.470
2024	1.50	0.79	52.539	0.71	47.461
2025	1.55	0.82	52.548	0.74	47.452
2026	1.60	0.84	52.557	0.76	47.443
2027	1.65	0.86	52.567	0.78	47.433
2028	1.69	0.89	52.576	0.80	47.424
2029	1.73	0.91	52.585	0.82	47.415
2030	1.77	0.93	52.595	0.84	47.405
2031	1.80	0.95	52.604	0.85	47.396
2032	1.84	0.97	52.614	0.87	47.386
2033	1.88	0.99	52.623	0.89	47.377
2034	1.91	1.00	52.632	0.91	47.368
2035	1.94	1.02	52.642	0.92	47.358
2036	1.98	1.04	52.651	0.94	47.349
2037	2.01	1.06	52.660	0.95	47.340
2038	2.04	1.07	52.670	0.96	47.330
2039	2.07	1.09	52.679	0.98	47.321
2040	2.10	1.11	52.688	0.99	47.312
2041	2.13	1.12	52.698	1.01	47.302
2042	2.16	1.14	52.707	1.02	47.293
2043	2.19	1.15	52.716	1.03	47.284
2044	2.21	1.17	52.726	1.05	47.274
2045	2.24	1.18	52.735	1.06	47.265
Total	47.42	24.96	52.629	22.46	47.371
Average	1.82	0.96	52.629	0.86	47.371

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 4. Predicted USA 4SG_GE6 Sites Crash Severity

Site No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1216	1.1720	6.3181	17.3470	22.4649
Total	0.1216	1.1720	6.3181	17.3470	22.4649

Table 5. Predicted 4SG_GE6 Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Intersection	Angle Collision	17.28	36.4	12.40	26.1	29.68	62.5
Intersection	Collision with Bicycle	0.87	1.8	0.00	0.0	0.87	1.8
Intersection	Head-on Collision	2.15	4.5	1.03	2.2	3.19	6.7
Intersection	Other Multi-vehicle Collision	0.67	1.4	0.49	1.0	1.17	2.5
Intersection	Other Single-vehicle Collision	0.28	0.6	1.37	2.9	1.65	3.5
Intersection	Collision with Pedestrian	0.93	2.0	0.00	0.0	0.93	2.0
Intersection	Rear-end Collision	1.92	4.1	3.33	7.0	5.25	11.1
Intersection	Sideswipe	0.88	1.9	3.84	8.1	4.72	10.0
Intersection	Total Intersection Total Vehicle Crashes	24.98	52.7	22.46	47.3	47.45	100.0
Intersection	Total Intersection Crashes	24.98	52.7	22.46	47.3	47.45	100.0
	Total Crashes	24.98	52.7	22.46	47.3	47.45	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Buckley Road

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

February 15, 2021

Buckley Road

Disclaimer

The Interactive Highway Design Model (IHSDM) software is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its content or use thereof. This document does not constitute a standard, specification, or regulation.

The United States Government does not endorse products or manufacturers. Trade and manufacturers' names may appear in this software and documentation only because they are considered essential to the objective of the software.

Limited Warranty and Limitations of Remedies

This software product is provided "as-is," without warranty of any kind-either expressed or implied (but not limited to the implied warranties of merchantability and fitness for a particular purpose). The FHWA do not warrant that the functions contained in the software will meet the end-user's requirements or that the operation of the software will be uninterrupted and error-free.

Under no circumstances will the FHWA be liable to the end-user for any damages or claimed lost profits, lost savings, or other incidental or consequential damages rising out of the use or inability to use the software (even if these organizations have been advised of the possibility of such damages), or for any claim by any other party.

Notice

The use of the IHSDM software is being done strictly on a voluntary basis. In exchange for provision of IHSDM, the user agrees that the Federal Highway Administration (FHWA), U.S. Department of Transportation and any other agency of the Federal Government shall not be responsible for any errors, damage or other liability that may result from any and all use of the software, including installation and testing of the software. The user further agrees to hold the FHWA and the Federal Government harmless from any resulting liability. The user agrees that this hold harmless provision shall flow to any person to whom or any entity to which the user provides the IHSDM software. It is the user's full responsibility to inform any person to whom or any entity to which it provides the IHSDM software of this hold harmless provision.

Table of Contents

Report Overview **1**

Disclaimer Regarding Crash Prediction Method 1

Section Types **3**

Urban Arterial Site Set CPM Evaluation 3

List of Tables

Table Evaluation and Crash Data (CSD) (if applicable) Intersection Sites 4

Table Predicted Crash Frequencies and Rates by Site 5

Table Predicted Crash Frequencies by Year (4SG_GE6) 6

Table Predicted USA 4SG_GE6 Sites Crash Severity 7

Table Predicted 4SG_GE6 Crash Type Distribution 7

Buckley Road

Report Overview

Report Generated: Feb 15, 2021 8:44 AM
Report Template: System: Multi-Page [System] (sscpm2, Oct 12, 2020 9:15 AM)

Evaluation Date: Mon Feb 15 08:44:36 PST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: jared.calise
Organization Name:
Phone:
E-Mail:

Project Title: SR 227 - Buckley Road
Project Comment: Created Thu Jan 07 16:37:06 PST 2021
Project Unit System: U.S. Customary

Site Set: Existing - Signalized
Site Set Comment: Created Thu Jan 07 16:37:30 PST 2021
Site Set Version: v1

Evaluation Title: Existing - Signalized_2021.02.15
Evaluation Comment: Created Mon Feb 15 08:44:18 PST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2045
Empirical-Bayes Analysis: None

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Urban Arterial Site Set CPM Evaluation

Site Type

Type: 4SG_GE6

Calibration Factor: 1

Buckley Road

Table 1. Evaluation and Crash Data (CSD) (if applicable) Intersection Sites

Site No.	Type	Highway	Site Description	Major AADT	Minor AADT	Presence of Lighting	Number of Approaches with Permissive Left-Turn Phasing	Number of Approaches with Permissive/Protected or Protected/Permissive Left-Turn Phasing	Number of Approaches with Protected Left-Turn Phasing	Number of Approaches on which Right Turn on Red is Prohibited	Presence of Red-Light Cameras	Pedestrian Volumes Crossing all Intersection Legs (crossings/day)	Max. Number of Lanes Crossed by Pedestrians	Number of Bus Stops within 1000 ft of Intersection	Number of Schools within 1000 ft of Intersection	Number of Alcohol Sales Establishments within 1000 ft of Intersection
1	4SG2x2ge6	SR 227	at Buckley Road	2020: 20377; 2021: 20437; 2022: 20498; 2023: 20559; 2024: 20620; 2025: 20680; 2026: 20741; 2027: 20802; 2028: 20863; 2029: 20923; 2030: 20984; 2031: 21045; 2032: 21106; 2033: 21166; 2034: 21227; 2035: 21288; 2036: 21349; 2037: 21409; 2038: 21470; 2039: 21531; 2040: 21592; 2041: 21652; 2042: 21713; 2043: 21774; 2044: 21835; 2045: 21896	2020: 5078; 2021: 5094; 2022: 5110; 2023: 5127; 2024: 5143; 2025: 5159; 2026: 5176; 2027: 5192; 2028: 5208; 2029: 5225; 2030: 5241; 2031: 5257; 2032: 5274; 2033: 5290; 2034: 5307; 2035: 5323; 2036: 5339; 2037: 5356; 2038: 5372; 2039: 5388; 2040: 5405; 2041: 5421; 2042: 5437; 2043: 5454; 2044: 5470; 2045: 5487	yes	0	0	4	0	no	50	4	0	0	0
2	4SG2x2ge6	SR 227	at Buckley Road (for RCUT Analysis)	2020: 20377; 2021: 20437; 2022: 20498; 2023: 20559; 2024: 20620; 2025: 20680; 2026: 20741; 2027: 20802; 2028: 20863; 2029: 20923; 2030: 20984; 2031: 21045; 2032: 21106; 2033: 21166; 2034: 21227; 2035: 21288; 2036: 21349; 2037: 21409; 2038: 21470; 2039: 21531; 2040: 21592; 2041: 21652; 2042: 21713; 2043: 21774; 2044: 21835; 2045: 21896	2020: 5078; 2021: 5094; 2022: 5110; 2023: 5127; 2024: 5143; 2025: 5159; 2026: 5176; 2027: 5192; 2028: 5208; 2029: 5225; 2030: 5241; 2031: 5257; 2032: 5274; 2033: 5290; 2034: 5307; 2035: 5323; 2036: 5339; 2037: 5356; 2038: 5372; 2039: 5388; 2040: 5405; 2041: 5421; 2042: 5437; 2043: 5454; 2044: 5470; 2045: 5487	yes	0	0	4	0	no	50	4	0	0	0

Buckley Road

Table 2. Predicted Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Intersection Travel Crash Rate (crashes/million veh)	Intersection Crash Rate (crashes/yr)
1	4SG	SR 227	at Buckley Road	55.877	2.1491	1.1235	1.0256	0.22	2.1491
2	4SG	SR 227	at Buckley Road (for RCUT Analysis)	58.183	2.2378	1.1695	1.0683	0.23	2.2378
		Total	Total	114.059	4.3869	2.2930	2.0939	0.23	4.3869

Table 3. Predicted Crash Frequencies by Year (4SG_GE6)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	4.29	2.24	52.191	2.05	47.809
2021	4.30	2.24	52.197	2.05	47.803
2022	4.30	2.25	52.204	2.06	47.796
2023	4.31	2.25	52.210	2.06	47.790
2024	4.32	2.26	52.216	2.06	47.784
2025	4.33	2.26	52.222	2.07	47.778
2026	4.34	2.27	52.228	2.07	47.772
2027	4.34	2.27	52.235	2.08	47.765
2028	4.35	2.27	52.241	2.08	47.759
2029	4.36	2.28	52.247	2.08	47.753
2030	4.37	2.28	52.253	2.08	47.747
2031	4.38	2.29	52.259	2.09	47.741
2032	4.38	2.29	52.265	2.09	47.735
2033	4.39	2.29	52.271	2.10	47.729
2034	4.40	2.30	52.277	2.10	47.723
2035	4.41	2.30	52.283	2.10	47.717
2036	4.41	2.31	52.289	2.11	47.711
2037	4.42	2.31	52.295	2.11	47.705
2038	4.43	2.32	52.301	2.11	47.699
2039	4.44	2.32	52.307	2.12	47.693
2040	4.45	2.33	52.313	2.12	47.687
2041	4.45	2.33	52.319	2.12	47.681
2042	4.46	2.33	52.325	2.13	47.675
2043	4.47	2.34	52.331	2.13	47.669
2044	4.48	2.34	52.337	2.13	47.663
2045	4.48	2.35	52.342	2.14	47.658
Total	114.06	59.62	52.268	54.44	47.732
Average	4.39	2.29	52.268	2.09	47.732

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 4. Predicted USA 4SG_GE6 Sites Crash Severity

Site No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1423	1.3717	7.3945	20.3024	26.6657
2	0.1481	1.4278	7.6971	21.1330	27.7768
Total	0.2904	2.7994	15.0916	41.4354	54.4425

Table 5. Predicted 4SG_GE6 Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Intersection	Angle Collision	42.12	36.9	30.05	26.3	72.17	63.2
Intersection	Collision with Bicycle	2.11	1.8	0.00	0.0	2.11	1.8
Intersection	Head-on Collision	5.25	4.6	2.50	2.2	7.75	6.8
Intersection	Other Multi-vehicle Collision	1.64	1.4	1.20	1.1	2.83	2.5
Intersection	Other Single-vehicle Collision	0.68	0.6	3.32	2.9	4.00	3.5
Intersection	Collision with Pedestrian	1.05	0.9	0.00	0.0	1.05	0.9
Intersection	Rear-end Collision	4.69	4.1	8.06	7.1	12.74	11.2
Intersection	Sideswipe	2.15	1.9	9.31	8.2	11.46	10.0
Intersection	Total Intersection Total Vehicle Crashes	59.67	52.3	54.44	47.7	114.12	100.0
Intersection	Total Intersection Crashes	59.67	52.3	54.44	47.7	114.12	100.0
	Total Crashes	59.67	52.3	54.44	47.7	114.12	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Buckley Road

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

January 7, 2021

Buckley Road

Disclaimer

The Interactive Highway Design Model (IHSDM) software is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its content or use thereof. This document does not constitute a standard, specification, or regulation.

The United States Government does not endorse products or manufacturers. Trade and manufacturers' names may appear in this software and documentation only because they are considered essential to the objective of the software.

Limited Warranty and Limitations of Remedies

This software product is provided "as-is," without warranty of any kind-either expressed or implied (but not limited to the implied warranties of merchantability and fitness for a particular purpose). The FHWA do not warrant that the functions contained in the software will meet the end-user's requirements or that the operation of the software will be uninterrupted and error-free.

Under no circumstances will the FHWA be liable to the end-user for any damages or claimed lost profits, lost savings, or other incidental or consequential damages rising out of the use or inability to use the software (even if these organizations have been advised of the possibility of such damages), or for any claim by any other party.

Notice

The use of the IHSDM software is being done strictly on a voluntary basis. In exchange for provision of IHSDM, the user agrees that the Federal Highway Administration (FHWA), U.S. Department of Transportation and any other agency of the Federal Government shall not be responsible for any errors, damage or other liability that may result from any and all use of the software, including installation and testing of the software. The user further agrees to hold the FHWA and the Federal Government harmless from any resulting liability. The user agrees that this hold harmless provision shall flow to any person to whom or any entity to which the user provides the IHSDM software. It is the user's full responsibility to inform any person to whom or any entity to which it provides the IHSDM software of this hold harmless provision.

Table of Contents

Report Overview 1
Disclaimer Regarding Crash Prediction Method 1
Section Types 3
Urban Arterial Site Set CPM Evaluation 3

List of Tables

Table Evaluation and Crash Data (CSD) (if applicable) Intersection Sites 4
Table Predicted Crash Frequencies and Rates by Site 4
Table Predicted Crash Frequencies by Year (4SG_GE6) 5
Table Predicted USA 4SG_GE6 Sites Crash Severity 6
Table Predicted 4SG_GE6 Crash Type Distribution 6

Report Overview

Report Generated: Jan 7, 2021 4:45 PM
Report Template: System: Multi-Page [System] (sscpm2, Oct 12, 2020 9:15 AM)

Evaluation Date: Thu Jan 07 16:45:09 PST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: jared.calise
Organization Name:
Phone:
E-Mail:

Project Title: SR 227 - Buckley Road
Project Comment: Created Thu Jan 07 16:37:06 PST 2021
Project Unit System: U.S. Customary

Site Set: Proposed - Roundabout
Site Set Comment: Created Thu Jan 07 16:41:53 PST 2021
Site Set Version: v1

Evaluation Title: Proposed - Signalized
Evaluation Comment: Created Thu Jan 07 16:44:54 PST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2045
Empirical-Bayes Analysis: None

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Urban Arterial Site Set CPM Evaluation

Site Type

Type: 4SG_GE6
Calibration Factor: 1

Buckley Road

Table 1. Evaluation and Crash Data (CSD) (if applicable) Intersection Sites

Site No.	Type	Highway	Site Description	Major AADT	Minor AADT	Presence of Lighting	Number of Approaches with Permissive Left-Turn Phasing	Number of Approaches with Permissive/Protected or Protected/Permissive Left-Turn Phasing	Number of Approaches with Protected Left-Turn Phasing	Number of Approaches on which Right Turn on Red is Prohibited	Presence of Red-Light Cameras	Pedestrian Volumes Crossing all Intersection Legs (crossings/day)	Max. Number of Lanes Crossed by Pedestrians	Number of Bus Stops within 1000 ft of Intersection	Number of Schools within 1000 ft of Intersection	Number of Alcohol Sales Establishments within 1000 ft of Intersection
1	4SG2x2ge6	SR 227	at Buckley Road	2020: 20377; 2021: 20485; 2022: 20594; 2023: 20703; 2024: 20812; 2025: 20921; 2026: 21029; 2027: 21138; 2028: 21247; 2029: 21356; 2030: 21465; 2031: 21573; 2032: 21682; 2033: 21791; 2034: 21900; 2035: 22009; 2036: 22117; 2037: 22226; 2038: 22335; 2039: 22444; 2040: 22553; 2041: 22661; 2042: 22770; 2043: 22879; 2044: 22988; 2045: 23097	2020: 4987; 2021: 5017; 2022: 5048; 2023: 5079; 2024: 5110; 2025: 5141; 2026: 5171; 2027: 5202; 2028: 5233; 2029: 5264; 2030: 5295; 2031: 5325; 2032: 5356; 2033: 5387; 2034: 5418; 2035: 5449; 2036: 5479; 2037: 5510; 2038: 5541; 2039: 5572; 2040: 5603; 2041: 5633; 2042: 5664; 2043: 5695; 2044: 5726; 2045: 5757	yes	0	0	4	0	no	50	6	0	0	0

Table 2. Predicted Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Intersection Travel Crash Rate (crashes/million veh)	Intersection Crash Rate (crashes/yr)
1	4SG	SR 227	at Buckley Road	80.070	3.0796	1.6085	1.4711	0.31	3.0796
		Total	Total	80.070	3.0796	1.6085	1.4711	0.31	3.0796

Table 3. Predicted Crash Frequencies by Year (4SG_GE6)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	2.96	1.54	52.093	1.42	47.907
2021	2.97	1.55	52.104	1.42	47.896
2022	2.98	1.55	52.115	1.43	47.885
2023	2.99	1.56	52.127	1.43	47.873
2024	3.00	1.56	52.138	1.43	47.862
2025	3.01	1.57	52.149	1.44	47.851
2026	3.02	1.57	52.160	1.44	47.840
2027	3.03	1.58	52.171	1.45	47.829
2028	3.04	1.58	52.182	1.45	47.818
2029	3.05	1.59	52.193	1.46	47.807
2030	3.06	1.59	52.203	1.46	47.797
2031	3.06	1.60	52.214	1.47	47.786
2032	3.08	1.61	52.225	1.47	47.775
2033	3.08	1.61	52.236	1.47	47.764
2034	3.10	1.62	52.246	1.48	47.754
2035	3.10	1.62	52.257	1.48	47.743
2036	3.11	1.63	52.267	1.49	47.733
2037	3.12	1.63	52.278	1.49	47.722
2038	3.13	1.64	52.288	1.50	47.712
2039	3.14	1.64	52.298	1.50	47.702
2040	3.15	1.65	52.309	1.50	47.691
2041	3.16	1.66	52.319	1.51	47.681
2042	3.17	1.66	52.329	1.51	47.671
2043	3.18	1.67	52.339	1.52	47.661
2044	3.19	1.67	52.349	1.52	47.651
2045	3.20	1.68	52.359	1.52	47.641
Total	80.07	41.82	52.231	38.25	47.769
Average	3.08	1.61	52.231	1.47	47.769

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Buckley Road

Table 4. Predicted USA 4SG_GE6 Sites Crash Severity

Site No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.2037	1.9638	10.5866	29.0667	38.2487
Total	0.2037	1.9638	10.5866	29.0667	38.2487

Table 5. Predicted 4SG_GE6 Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Intersection	Angle Collision	29.66	37.0	21.11	26.4	50.78	63.4
Intersection	Collision with Bicycle	1.48	1.9	0.00	0.0	1.48	1.9
Intersection	Head-on Collision	3.70	4.6	1.76	2.2	5.46	6.8
Intersection	Other Multi-vehicle Collision	1.15	1.4	0.84	1.1	2.00	2.5
Intersection	Other Single-vehicle Collision	0.48	0.6	2.33	2.9	2.81	3.5
Intersection	Collision with Pedestrian	0.58	0.7	0.00	0.0	0.58	0.7
Intersection	Rear-end Collision	3.30	4.1	5.66	7.1	8.96	11.2
Intersection	Sideswipe	1.51	1.9	6.54	8.2	8.05	10.1
Intersection	Total Intersection Total Vehicle Crashes	41.86	52.3	38.25	47.7	80.11	100.0
Intersection	Total Intersection Crashes	41.86	52.3	38.25	47.7	80.11	100.0
	Total Crashes	41.86	52.3	38.25	47.7	80.11	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

February 15, 2021

Crestmont Drive

Disclaimer

The Interactive Highway Design Model (IHSDM) software is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its content or use thereof. This document does not constitute a standard, specification, or regulation.

The United States Government does not endorse products or manufacturers. Trade and manufacturers' names may appear in this software and documentation only because they are considered essential to the objective of the software.

Limited Warranty and Limitations of Remedies

This software product is provided "as-is," without warranty of any kind-either expressed or implied (but not limited to the implied warranties of merchantability and fitness for a particular purpose). The FHWA do not warrant that the functions contained in the software will meet the end-user's requirements or that the operation of the software will be uninterrupted and error-free.

Under no circumstances will the FHWA be liable to the end-user for any damages or claimed lost profits, lost savings, or other incidental or consequential damages rising out of the use or inability to use the software (even if these organizations have been advised of the possibility of such damages), or for any claim by any other party.

Notice

The use of the IHSDM software is being done strictly on a voluntary basis. In exchange for provision of IHSDM, the user agrees that the Federal Highway Administration (FHWA), U.S. Department of Transportation and any other agency of the Federal Government shall not be responsible for any errors, damage or other liability that may result from any and all use of the software, including installation and testing of the software. The user further agrees to hold the FHWA and the Federal Government harmless from any resulting liability. The user agrees that this hold harmless provision shall flow to any person to whom or any entity to which the user provides the IHSDM software. It is the user's full responsibility to inform any person to whom or any entity to which it provides the IHSDM software of this hold harmless provision.

Table of Contents

Report Overview **1**

Disclaimer Regarding Crash Prediction Method 1

Section Types **3**

Urban Arterial Site Set CPM Evaluation 3

List of Tables

Table Evaluation and Crash Data (CSD) (if applicable) Intersection Sites 4

Table Predicted Crash Frequencies and Rates by Site 5

Table Predicted Crash Frequencies by Year (4ST_GE6) 6

Table Predicted USA 4ST_GE6 Sites Crash Severity 7

Table Predicted 4ST_GE6 Crash Type Distribution 7

Crestmont Drive

Report Overview

Report Generated: Feb 15, 2021 8:14 AM
Report Template: System: Multi-Page [System] (sscpm2, Oct 12, 2020 9:15 AM)

Evaluation Date: Mon Feb 15 08:14:18 PST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: jared.calise
Organization Name:
Phone:
E-Mail:

Project Title: SR 227 - Crestmont Drive(Copy 1)
Project Comment: Created Fri Jan 08 08:28:24 PST 2021
Project Unit System: U.S. Customary

Site Set: Existing - SSSC
Site Set Comment: Created Fri Jan 08 08:28:46 PST 2021
Site Set Version: v1

Evaluation Title: Existing - SSSC_2021.02.15
Evaluation Comment: Created Mon Feb 15 08:13:54 PST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2045
Empirical-Bayes Analysis: None

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Urban Arterial Site Set CPM Evaluation

Site Type

Type: 4ST_GE6
Calibration Factor: 1

Crestmont Drive

Table 1. Evaluation and Crash Data (CSD) (if applicable) Intersection Sites

Site No.	Type	Highway	Site Description	Major AADT	Minor AADT	Presence of Lighting
1	4ST2x2ge6	SR 227	at Crestmont Drive	2020: 20468; 2021: 20529; 2022: 20590; 2023: 20651; 2024: 20712; 2025: 20773; 2026: 20834; 2027: 20895; 2028: 20956; 2029: 21017; 2030: 21078; 2031: 21139; 2032: 21200; 2033: 21261; 2034: 21322; 2035: 21383; 2036: 21444; 2037: 21505; 2038: 21566; 2039: 21627; 2040: 21688; 2041: 21749; 2042: 21810; 2043: 21871; 2044: 21932; 2045: 21993	2020-2045: 1308	no
2	4ST2x2ge6	SR 227	at Crestmont Drive (RCUT Analysis)	2020: 21228; 2021: 21288; 2022: 21349; 2023: 21410; 2024: 21471; 2025: 21532; 2026: 21593; 2027: 21654; 2028: 21715; 2029: 21775; 2030: 21836; 2031: 21897; 2032: 21958; 2033: 22019; 2034: 22080; 2035: 22141; 2036: 22202; 2037: 22262; 2038: 22323; 2039: 22384; 2040: 22445; 2041: 22506; 2042: 22567; 2043: 22628; 2044: 22689; 2045: 22750	2020-2045: 1310	no

Crestmont Drive

Table 2. Predicted Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Intersection Travel Crash Rate (crashes/million veh)	Intersection Crash Rate (crashes/yr)
1	4ST	SR 227	at Crestmont Drive	58.075	2.2336	1.1850	1.0486	0.27	2.2336
2	4ST	SR 227	at Crestmont Drive (RCUT Analysis)	59.426	2.2856	1.2108	1.0748	0.27	2.2856
		Total	Total	117.501	4.5193	2.3958	2.1234	0.27	4.5193

Crestmont Drive

Table 3. Predicted Crash Frequencies by Year (4ST_GE6)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	4.42	2.35	53.088	2.07	46.912
2021	4.43	2.35	53.082	2.08	46.918
2022	4.43	2.35	53.076	2.08	46.924
2023	4.44	2.36	53.070	2.08	46.930
2024	4.45	2.36	53.064	2.09	46.936
2025	4.46	2.37	53.058	2.09	46.942
2026	4.47	2.37	53.052	2.10	46.948
2027	4.47	2.37	53.046	2.10	46.954
2028	4.48	2.38	53.040	2.10	46.960
2029	4.49	2.38	53.035	2.11	46.965
2030	4.50	2.39	53.029	2.11	46.971
2031	4.51	2.39	53.023	2.12	46.977
2032	4.51	2.39	53.017	2.12	46.983
2033	4.52	2.40	53.011	2.13	46.989
2034	4.53	2.40	53.005	2.13	46.995
2035	4.54	2.41	52.999	2.13	47.001
2036	4.55	2.41	52.994	2.14	47.006
2037	4.55	2.41	52.988	2.14	47.012
2038	4.56	2.42	52.982	2.15	47.018
2039	4.57	2.42	52.977	2.15	47.023
2040	4.58	2.43	52.971	2.15	47.029
2041	4.59	2.43	52.965	2.16	47.035
2042	4.59	2.43	52.959	2.16	47.041
2043	4.60	2.44	52.954	2.17	47.046
2044	4.61	2.44	52.948	2.17	47.052
2045	4.62	2.44	52.942	2.17	47.058
Total	117.50	62.29	53.014	55.21	46.986
Average	4.52	2.40	53.014	2.12	46.986

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Crestmont Drive

Table 4. Predicted USA 4ST_GE6 Sites Crash Severity

Site No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.2162	4.8111	10.5896	15.1936	27.2642
2	0.2209	4.9158	10.8201	15.5243	27.9448
Total	0.4371	9.7269	21.4098	30.7180	55.2090

Table 5. Predicted 4ST_GE6 Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Intersection	Angle Collision	42.55	36.2	39.03	33.2	81.58	69.4
Intersection	Collision with Bicycle	4.21	3.6	0.00	0.0	4.21	3.6
Intersection	Head-on Collision	1.58	1.3	0.66	0.6	2.25	1.9
Intersection	Other Multi-vehicle Collision	1.27	1.1	1.32	1.1	2.59	2.2
Intersection	Other Single-vehicle Collision	0.32	0.3	2.04	1.7	2.36	2.0
Intersection	Collision with Pedestrian	5.29	4.5	0.00	0.0	5.29	4.5
Intersection	Rear-end Collision	4.17	3.5	5.41	4.6	9.58	8.2
Intersection	Sideswipe	2.90	2.5	6.74	5.7	9.64	8.2
Intersection	Total Intersection Total Vehicle Crashes	62.29	53.0	55.21	47.0	117.50	100.0
Intersection	Total Intersection Crashes	62.29	53.0	55.21	47.0	117.50	100.0
	Total Crashes	62.29	53.0	55.21	47.0	117.50	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Crestmont Drive

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

February 15, 2021

Disclaimer

The Interactive Highway Design Model (IHSDM) software is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its content or use thereof. This document does not constitute a standard, specification, or regulation.

The United States Government does not endorse products or manufacturers. Trade and manufacturers' names may appear in this software and documentation only because they are considered essential to the objective of the software.

Limited Warranty and Limitations of Remedies

This software product is provided "as-is," without warranty of any kind-either expressed or implied (but not limited to the implied warranties of merchantability and fitness for a particular purpose). The FHWA do not warrant that the functions contained in the software will meet the end-user's requirements or that the operation of the software will be uninterrupted and error-free.

Under no circumstances will the FHWA be liable to the end-user for any damages or claimed lost profits, lost savings, or other incidental or consequential damages rising out of the use or inability to use the software (even if these organizations have been advised of the possibility of such damages), or for any claim by any other party.

Notice

The use of the IHSDM software is being done strictly on a voluntary basis. In exchange for provision of IHSDM, the user agrees that the Federal Highway Administration (FHWA), U.S. Department of Transportation and any other agency of the Federal Government shall not be responsible for any errors, damage or other liability that may result from any and all use of the software, including installation and testing of the software. The user further agrees to hold the FHWA and the Federal Government harmless from any resulting liability. The user agrees that this hold harmless provision shall flow to any person to whom or any entity to which the user provides the IHSDM software. It is the user's full responsibility to inform any person to whom or any entity to which it provides the IHSDM software of this hold harmless provision.

Table of Contents

Report Overview **1**

Disclaimer Regarding Crash Prediction Method 1

Section Types **3**

Rural MultiLane Site Set CPM Evaluation 3

List of Tables

Table Evaluation and Crash Data (CSD) (if applicable) Segment - Homogeneous Sites 4

Table Predicted Crash Frequencies and Rates by Site 5

Table Predicted Crash Frequencies by Year (4D) 6

Table Predicted 4D Crash Type Distribution 7

Crestmont Drive

Report Overview

Report Generated: Feb 15, 2021 8:28 AM
Report Template: System: Multi-Page [System] (sscpm2, Oct 12, 2020 9:15 AM)

Evaluation Date: Mon Feb 15 08:28:29 PST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: jared.calise
Organization Name:
Phone:
E-Mail:

Project Title: SR 227 - Crestmont Drive(Copy 1)
Project Comment: Created Fri Jan 08 08:28:24 PST 2021
Project Unit System: U.S. Customary

Site Set: Corridor - RCUT Analysis
Site Set Comment: Created Thu Jan 14 16:21:41 PST 2021
Site Set Version: v1

Evaluation Title: Corridor - RCUT Analysis_2021.02.15
Evaluation Comment: Created Mon Feb 15 08:28:11 PST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2045
Empirical-Bayes Analysis: None

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Rural MultiLane Site Set CPM Evaluation

Site Type

Type: 4D
Calibration Factor: 1

Crestmont Drive

Table 1. Evaluation and Crash Data (CSD) (if applicable) Segment - Homogeneous Sites

Site No.	Type	Highway	Site Description	Length (mi)	AADT	Left Side Lane Width (ft)	Right Side Lane Width (ft)	Left Side Outside Paved Shoulder Width (ft)	Right Side Outside Paved Shoulder Width (ft)	Effective Median Width (ft)	Median Type	Lighting	Automated Speed Enforcement
1	4D	SR 227	Crestmont to Los Ranchos (RCUT Values)	0.2460	2020: 21228; 2021: 21288; 2022: 21349; 2023: 21410; 2024: 21471; 2025: 21532; 2026: 21593; 2027: 21654; 2028: 21715; 2029: 21775; 2030: 21836; 2031: 21897; 2032: 21958; 2033: 22019; 2034: 22080; 2035: 22141; 2036: 22202; 2037: 22262; 2038: 22323; 2039: 22384; 2040: 22445; 2041: 22506; 2042: 22567; 2043: 22628; 2044: 22689; 2045: 22750	13.00	12.00	1.00	8.00	14.00	Non-Traversable Median	no	no
2	4D	SR 227	Crestmont to Buckley (RCUT Values)	0.2270	2020: 20471; 2021: 20531; 2022: 20592; 2023: 20653; 2024: 20714; 2025: 20775; 2026: 20836; 2027: 20897; 2028: 20958; 2029: 21018; 2030: 21079; 2031: 21140; 2032: 21201; 2033: 21262; 2034: 21323; 2035: 21384; 2036: 21445; 2037: 21505; 2038: 21566; 2039: 21627; 2040: 21688; 2041: 21749; 2042: 21810; 2043: 21871; 2044: 21932; 2045: 21993	13.00	12.00	1.00	8.00	14.00	Non-Traversable Median	no	no
3	4D	SR 227	Crestmont to Los Ranchos	0.2460	2020: 19945; 2021: 20006; 2022: 20067; 2023: 20128; 2024: 20189; 2025: 20250; 2026: 20311; 2027: 20372; 2028: 20433; 2029: 20494; 2030: 20555; 2031: 20616; 2032: 20677; 2033: 20738; 2034: 20799; 2035: 20860; 2036: 20921; 2037: 20982; 2038: 21043; 2039: 21104; 2040: 21165; 2041: 21226; 2042: 21287; 2043: 21348; 2044: 21409; 2045: 21470	13.00	12.00	1.00	8.00	14.00	Non-Traversable Median	no	no
4	4D	SR 227	Crestmont to Buckley	0.2270	2020: 20468; 2021: 20529; 2022: 20590; 2023: 20651; 2024: 20712; 2025: 20773; 2026: 20834; 2027: 20895; 2028: 20956; 2029: 21017; 2030: 21078; 2031: 21139; 2032: 21200; 2033: 21261; 2034: 21322; 2035: 21383; 2036: 21444; 2037: 21505; 2038: 21566; 2039: 21627; 2040: 21688; 2041: 21749; 2042: 21810; 2043: 21871; 2044: 21932; 2045: 21993	13.00	12.00	1.00	8.00	14.00	Non-Traversable Median	no	no

Crestmont Drive

Table 2. Predicted Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	4D	SR 227	Crestmont to Los Ranchos (RCUT Values)	0.2460	29.770	1.1450	0.5563	0.3348	0.5887	4.6546	0.58
2	4D	SR 227	Crestmont to Buckley (RCUT Values)	0.2270	26.480	1.0185	0.4964	0.2996	0.5221	4.4866	0.58
3	4D	SR 227	Crestmont to Los Ranchos	0.2460	27.954	1.0751	0.5252	0.3177	0.5499	4.3705	0.58
4	4D	SR 227	Crestmont to Buckley	0.2270	26.479	1.0184	0.4964	0.2996	0.5220	4.4864	0.58
		Total	Total	0.9460	110.683	4.2570	2.0743	1.2516	2.1828	4.5000	0.58

Crestmont Drive

Table 3. Predicted Crash Frequencies by Year (4D)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	4.10	2.00	48.889	2.09	51.111
2021	4.11	2.01	48.876	2.10	51.124
2022	4.12	2.02	48.862	2.11	51.138
2023	4.14	2.02	48.849	2.12	51.151
2024	4.15	2.03	48.836	2.12	51.164
2025	4.16	2.03	48.823	2.13	51.177
2026	4.17	2.04	48.810	2.14	51.190
2027	4.19	2.04	48.797	2.14	51.203
2028	4.20	2.05	48.785	2.15	51.215
2029	4.21	2.05	48.772	2.16	51.228
2030	4.22	2.06	48.759	2.17	51.241
2031	4.24	2.07	48.746	2.17	51.254
2032	4.25	2.07	48.733	2.18	51.267
2033	4.26	2.08	48.721	2.19	51.279
2034	4.28	2.08	48.708	2.19	51.292
2035	4.29	2.09	48.696	2.20	51.304
2036	4.30	2.09	48.683	2.21	51.317
2037	4.31	2.10	48.670	2.21	51.330
2038	4.33	2.11	48.658	2.22	51.342
2039	4.34	2.11	48.645	2.23	51.355
2040	4.35	2.12	48.633	2.24	51.367
2041	4.37	2.12	48.621	2.24	51.379
2042	4.38	2.13	48.608	2.25	51.392
2043	4.39	2.13	48.596	2.26	51.404
2044	4.40	2.14	48.584	2.26	51.416
2045	4.42	2.15	48.572	2.27	51.428
Total	110.68	53.93	48.726	56.75	51.274
Average	4.26	2.07	48.726	2.18	51.274

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 4. Predicted 4D Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Single	39.21	35.4	44.95	40.6	85.00	76.8
Highway Segment	Total Single Vehicle Crashes	39.21	35.4	44.95	40.6	85.00	76.8
Highway Segment	Angle Collision	2.59	2.3	2.33	2.1	4.76	4.3
Highway Segment	Head-on Collision	0.70	0.6	0.11	0.1	0.66	0.6
Highway Segment	Rear-end Collision	8.79	7.9	4.99	4.5	12.84	11.6
Highway Segment	Sideswipe	1.46	1.3	3.01	2.7	4.76	4.3
Highway Segment	Total Multiple Vehicle Crashes	13.54	12.2	10.44	9.4	23.02	20.8
Highway Segment	Total Highway Segment Crashes	53.93	48.7	56.75	51.3	110.68	100.0
Highway Segment	Other Collision	1.19	1.1	1.36	1.2	2.66	2.4
	Total Crashes	53.93	48.7	56.75	51.3	110.68	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Crestmont Drive

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

January 8, 2021

Disclaimer

The Interactive Highway Design Model (IHSDM) software is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its content or use thereof. This document does not constitute a standard, specification, or regulation.

The United States Government does not endorse products or manufacturers. Trade and manufacturers' names may appear in this software and documentation only because they are considered essential to the objective of the software.

Limited Warranty and Limitations of Remedies

This software product is provided "as-is," without warranty of any kind-either expressed or implied (but not limited to the implied warranties of merchantability and fitness for a particular purpose). The FHWA do not warrant that the functions contained in the software will meet the end-user's requirements or that the operation of the software will be uninterrupted and error-free.

Under no circumstances will the FHWA be liable to the end-user for any damages or claimed lost profits, lost savings, or other incidental or consequential damages rising out of the use or inability to use the software (even if these organizations have been advised of the possibility of such damages), or for any claim by any other party.

Notice

The use of the IHSDM software is being done strictly on a voluntary basis. In exchange for provision of IHSDM, the user agrees that the Federal Highway Administration (FHWA), U.S. Department of Transportation and any other agency of the Federal Government shall not be responsible for any errors, damage or other liability that may result from any and all use of the software, including installation and testing of the software. The user further agrees to hold the FHWA and the Federal Government harmless from any resulting liability. The user agrees that this hold harmless provision shall flow to any person to whom or any entity to which the user provides the IHSDM software. It is the user's full responsibility to inform any person to whom or any entity to which it provides the IHSDM software of this hold harmless provision.

Table of Contents

Report Overview **1**
Disclaimer Regarding Crash Prediction Method 1
Section Types **3**
Urban Arterial Site Set CPM Evaluation 3

List of Tables

Table Evaluation and Crash Data (CSD) (if applicable) Intersection Sites 4
Table Predicted Crash Frequencies and Rates by Site 4
Table Predicted Crash Frequencies by Year (4SG_GE6) 5
Table Predicted USA 4SG_GE6 Sites Crash Severity 6
Table Predicted 4SG_GE6 Crash Type Distribution 6

Crestmont Drive

Report Overview

Report Generated: Jan 8, 2021 8:56 AM
Report Template: System: Multi-Page [System] (sscpm2, Oct 12, 2020 9:15 AM)

Evaluation Date: Fri Jan 08 08:55:58 PST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: jared.calise
Organization Name:
Phone:
E-Mail:

Project Title: SR 227 - Crestmont Drive
Project Comment: Created Fri Jan 08 08:28:24 PST 2021
Project Unit System: U.S. Customary

Site Set: Proposed - Signalized
Site Set Comment: Created Fri Jan 08 08:36:41 PST 2021
Site Set Version: v1

Evaluation Title: Proposed - Signalized
Evaluation Comment: Created Fri Jan 08 08:55:39 PST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2045
Empirical-Bayes Analysis: None

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Crestmont Drive

Section Types

Urban Arterial Site Set CPM Evaluation

Site Type

Type: 4SG_GE6
Calibration Factor: 1

Crestmont Drive

Table 1. Evaluation and Crash Data (CSD) (if applicable) Intersection Sites

Site No.	Type	Highway	Site Description	Major AADT	Minor AADT	Presence of Lighting	Number of Approaches with Permissive Left-Turn Phasing	Number of Approaches with Permissive/ Protected or Protected/ Permissive Left-Turn Phasing	Number of Approaches with Protected Left-Turn Phasing	Number of Approaches on which Right Turn on Red is Prohibited	Presence of Red-Light Cameras	Pedestrian Volumes Crossing all Intersection Legs (crossings/day)	Max. Number of Lanes Crossed by Pedestrians	Number of Bus Stops within 1000 ft of Intersection	Number of Schools within 1000 ft of Intersection	Number of Alcohol Sales Establishments within 1000 ft of Intersection
1	4SG2x2ge6	SR 227	at Crestmont Drive	2020: 20468; 2021: 20571; 2022: 20675; 2023: 20779; 2024: 20882; 2025: 20986; 2026: 21090; 2027: 21193; 2028: 21297; 2029: 21401; 2030: 21504; 2031: 21608; 2032: 21712; 2033: 21815; 2034: 21919; 2035: 22023; 2036: 22126; 2037: 22230; 2038: 22334; 2039: 22437; 2040: 22541; 2041: 22645; 2042: 22748; 2043: 22852; 2044: 22956; 2045: 23060	2020-2045: 1308	yes	0	0	4	0	no	50	6	0	0	1

Table 2. Predicted Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Intersection Travel Crash Rate (crashes/million veh)	Intersection Crash Rate (crashes/yr)
1	4SG	SR 227	at Crestmont Drive	51.401	1.9770	1.0335	0.9434	0.23	1.9770
		Total	Total	51.401	1.9770	1.0335	0.9434	0.23	1.9770

Table 3. Predicted Crash Frequencies by Year (4SG_GE6)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	1.94	1.01	52.149	0.93	47.851
2021	1.95	1.01	52.159	0.93	47.841
2022	1.95	1.02	52.170	0.93	47.830
2023	1.95	1.02	52.181	0.93	47.819
2024	1.95	1.02	52.191	0.93	47.809
2025	1.96	1.02	52.202	0.94	47.798
2026	1.96	1.02	52.212	0.94	47.788
2027	1.96	1.02	52.222	0.94	47.778
2028	1.97	1.03	52.233	0.94	47.767
2029	1.97	1.03	52.243	0.94	47.757
2030	1.97	1.03	52.253	0.94	47.747
2031	1.97	1.03	52.264	0.94	47.736
2032	1.98	1.03	52.274	0.94	47.726
2033	1.98	1.03	52.284	0.94	47.716
2034	1.98	1.04	52.294	0.94	47.706
2035	1.98	1.04	52.304	0.95	47.696
2036	1.99	1.04	52.314	0.95	47.686
2037	1.99	1.04	52.324	0.95	47.676
2038	1.99	1.04	52.334	0.95	47.666
2039	2.00	1.04	52.343	0.95	47.657
2040	2.00	1.05	52.353	0.95	47.647
2041	2.00	1.05	52.363	0.95	47.637
2042	2.00	1.05	52.373	0.95	47.627
2043	2.00	1.05	52.382	0.95	47.618
2044	2.01	1.05	52.392	0.96	47.608
2045	2.01	1.05	52.402	0.96	47.598
Total	51.40	26.87	52.278	24.53	47.722
Average	1.98	1.03	52.278	0.94	47.722

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 4. Predicted USA 4SG_GE6 Sites Crash Severity

Site No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1309	1.2618	6.8024	18.6766	24.5296
Total	0.1309	1.2618	6.8024	18.6766	24.5296

Table 5. Predicted 4SG_GE6 Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Intersection	Angle Collision	19.02	37.0	13.54	26.3	32.56	63.3
Intersection	Collision with Bicycle	0.95	1.8	0.00	0.0	0.95	1.8
Intersection	Head-on Collision	2.37	4.6	1.13	2.2	3.50	6.8
Intersection	Other Multi-vehicle Collision	0.74	1.4	0.54	1.0	1.28	2.5
Intersection	Other Single-vehicle Collision	0.31	0.6	1.50	2.9	1.80	3.5
Intersection	Collision with Pedestrian	0.42	0.8	0.00	0.0	0.42	0.8
Intersection	Rear-end Collision	2.12	4.1	3.63	7.1	5.75	11.2
Intersection	Sideswipe	0.97	1.9	4.20	8.2	5.16	10.0
Intersection	Total Intersection Total Vehicle Crashes	26.90	52.3	24.53	47.7	51.43	100.0
Intersection	Total Intersection Crashes	26.90	52.3	24.53	47.7	51.43	100.0
	Total Crashes	26.90	52.3	24.53	47.7	51.43	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Los Ranchos Road

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

February 15, 2021

Los Ranchos Road

Disclaimer

The Interactive Highway Design Model (IHSDM) software is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its content or use thereof. This document does not constitute a standard, specification, or regulation.

The United States Government does not endorse products or manufacturers. Trade and manufacturers' names may appear in this software and documentation only because they are considered essential to the objective of the software.

Limited Warranty and Limitations of Remedies

This software product is provided "as-is," without warranty of any kind-either expressed or implied (but not limited to the implied warranties of merchantability and fitness for a particular purpose). The FHWA do not warrant that the functions contained in the software will meet the end-user's requirements or that the operation of the software will be uninterrupted and error-free.

Under no circumstances will the FHWA be liable to the end-user for any damages or claimed lost profits, lost savings, or other incidental or consequential damages rising out of the use or inability to use the software (even if these organizations have been advised of the possibility of such damages), or for any claim by any other party.

Notice

The use of the IHSDM software is being done strictly on a voluntary basis. In exchange for provision of IHSDM, the user agrees that the Federal Highway Administration (FHWA), U.S. Department of Transportation and any other agency of the Federal Government shall not be responsible for any errors, damage or other liability that may result from any and all use of the software, including installation and testing of the software. The user further agrees to hold the FHWA and the Federal Government harmless from any resulting liability. The user agrees that this hold harmless provision shall flow to any person to whom or any entity to which the user provides the IHSDM software. It is the user's full responsibility to inform any person to whom or any entity to which it provides the IHSDM software of this hold harmless provision.

Table of Contents

Report Overview **1**

Disclaimer Regarding Crash Prediction Method 1

Section Types **3**

Urban Arterial Site Set CPM Evaluation 3

List of Tables

Table Evaluation and Crash Data (CSD) (if applicable) Intersection Sites 4

Table Predicted Crash Frequencies and Rates by Site 5

Table Predicted Crash Frequencies by Year (4SG_GE6) 6

Table Predicted USA 4SG_GE6 Sites Crash Severity 7

Table Predicted 4SG_GE6 Crash Type Distribution 7

Los Ranchos Road

Report Overview

Report Generated: Feb 15, 2021 9:10 AM
Report Template: System: Multi-Page [System] (sscpm2, Oct 12, 2020 9:15 AM)

Evaluation Date: Mon Feb 15 09:10:52 PST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: jared.calise
Organization Name:
Phone:
E-Mail:

Project Title: SR 227 - Los Ranchos
Project Comment: Created Fri Jan 08 09:49:50 PST 2021
Project Unit System: U.S. Customary

Site Set: Existing - Signalized
Site Set Comment: Created Fri Jan 08 09:50:01 PST 2021
Site Set Version: v1

Evaluation Title: Existing - Signalized_2021.02.15
Evaluation Comment: Created Mon Feb 15 09:10:34 PST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2045
Empirical-Bayes Analysis: None

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Urban Arterial Site Set CPM Evaluation

Site Type

Type: 4SG_GE6

Calibration Factor: 1

Los Ranchos Road

Table 1. Evaluation and Crash Data (CSD) (if applicable) Intersection Sites

Site No.	Type	Highway	Site Description	Major AADT	Minor AADT	Presence of Lighting	Number of Approaches with Permissive Left-Turn Phasing	Number of Approaches with Permissive/Protected or Protected/Permissive Left-Turn Phasing	Number of Approaches with Protected Left-Turn Phasing	Number of Approaches on which Right Turn on Red is Prohibited	Presence of Red-Light Cameras	Pedestrian Volumes Crossing all Intersection Legs (crossings/day)	Max. Number of Lanes Crossed by Pedestrians	Number of Bus Stops within 1000 ft of Intersection	Number of Schools within 1000 ft of Intersection	Number of Alcohol Sales Establishments within 1000 ft of Intersection
1	4SG2x2ge6	SR 227	at Los Ranchos Road	2020: 19905; 2021: 19966; 2022: 20027; 2023: 20088; 2024: 20149; 2025: 20211; 2026: 20272; 2027: 20333; 2028: 20394; 2029: 20455; 2030: 20517; 2031: 20578; 2032: 20639; 2033: 20700; 2034: 20761; 2035: 20823; 2036: 20884; 2037: 20945; 2038: 21006; 2039: 21067; 2040: 21129; 2041: 21190; 2042: 21251; 2043: 21312; 2044: 21373; 2045: 21435	2020: 6465; 2021: 6518; 2022: 6572; 2023: 6626; 2024: 6680; 2025: 6734; 2026: 6788; 2027: 6841; 2028: 6895; 2029: 6949; 2030: 7003; 2031: 7057; 2032: 7111; 2033: 7164; 2034: 7218; 2035: 7272; 2036: 7326; 2037: 7380; 2038: 7434; 2039: 7487; 2040: 7541; 2041: 7595; 2042: 7649; 2043: 7703; 2044: 7757; 2045: 7811	yes	0	0	4	0	no	50	4	0	0	2
2	4SG2x2ge6	SR 227	at Los Ranchos Road (RCUT Analysis)	2020: 20545; 2021: 20606; 2022: 20667; 2023: 20728; 2024: 20789; 2025: 20851; 2026: 20912; 2027: 20973; 2028: 21034; 2029: 21095; 2030: 21157; 2031: 21218; 2032: 21279; 2033: 21340; 2034: 21401; 2035: 21463; 2036: 21524; 2037: 21585; 2038: 21646; 2039: 21707; 2040: 21769; 2041: 21830; 2042: 21891; 2043: 21952; 2044: 22013; 2045: 22075	2020: 6465; 2021: 6518; 2022: 6572; 2023: 6626; 2024: 6680; 2025: 6734; 2026: 6788; 2027: 6841; 2028: 6895; 2029: 6949; 2030: 7003; 2031: 7057; 2032: 7111; 2033: 7164; 2034: 7218; 2035: 7272; 2036: 7326; 2037: 7380; 2038: 7434; 2039: 7487; 2040: 7541; 2041: 7595; 2042: 7649; 2043: 7703; 2044: 7757; 2045: 7811	yes	0	0	4	0	no	50	4	0	0	2

Los Ranchos Road

Table 2. Predicted Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Intersection Travel Crash Rate (crashes/million veh)	Intersection Crash Rate (crashes/yr)
1	4SG	SR 227	at Los Ranchos Road	66.085	2.5417	1.3281	1.2136	0.25	2.5417
2	4SG	SR 227	at Los Ranchos Road (RCUT Analysis)	66.375	2.5529	1.3356	1.2173	0.25	2.5529
		Total	Total	132.460	5.0946	2.6637	2.4309	0.25	5.0946

Table 3. Predicted Crash Frequencies by Year (4SG_GE6)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	4.85	2.53	52.209	2.32	47.791
2021	4.87	2.54	52.215	2.33	47.785
2022	4.89	2.56	52.221	2.34	47.779
2023	4.91	2.57	52.227	2.35	47.773
2024	4.93	2.58	52.233	2.36	47.767
2025	4.95	2.59	52.239	2.37	47.761
2026	4.97	2.60	52.245	2.37	47.755
2027	4.99	2.61	52.252	2.38	47.748
2028	5.01	2.62	52.258	2.39	47.742
2029	5.03	2.63	52.264	2.40	47.736
2030	5.05	2.64	52.270	2.41	47.730
2031	5.07	2.65	52.276	2.42	47.724
2032	5.09	2.66	52.282	2.43	47.718
2033	5.11	2.67	52.287	2.44	47.713
2034	5.12	2.68	52.293	2.44	47.707
2035	5.14	2.69	52.299	2.45	47.701
2036	5.16	2.70	52.305	2.46	47.695
2037	5.18	2.71	52.311	2.47	47.689
2038	5.20	2.72	52.317	2.48	47.683
2039	5.22	2.73	52.323	2.49	47.677
2040	5.24	2.74	52.329	2.50	47.671
2041	5.26	2.75	52.334	2.50	47.666
2042	5.28	2.76	52.340	2.51	47.660
2043	5.29	2.77	52.346	2.52	47.654
2044	5.31	2.78	52.352	2.53	47.648
2045	5.33	2.79	52.358	2.54	47.642
Total	132.46	69.26	52.285	63.20	47.715
Average	5.09	2.66	52.285	2.43	47.715

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 4. Predicted USA 4SG_GE6 Sites Crash Severity

Site No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1682	1.6215	8.7413	24.0002	31.5539
2	0.1692	1.6306	8.7906	24.1356	31.6492
Total	0.3374	3.2521	17.5320	48.1357	63.2030

Table 5. Predicted 4SG_GE6 Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Intersection	Angle Collision	48.86	36.9	34.89	26.3	83.75	63.2
Intersection	Collision with Bicycle	2.44	1.8	0.00	0.0	2.44	1.8
Intersection	Head-on Collision	6.09	4.6	2.91	2.2	9.00	6.8
Intersection	Other Multi-vehicle Collision	1.90	1.4	1.39	1.0	3.29	2.5
Intersection	Other Single-vehicle Collision	0.79	0.6	3.85	2.9	4.64	3.5
Intersection	Collision with Pedestrian	1.31	1.0	0.00	0.0	1.31	1.0
Intersection	Rear-end Collision	5.44	4.1	9.35	7.1	14.79	11.2
Intersection	Sideswipe	2.49	1.9	10.81	8.2	13.30	10.0
Intersection	Total Intersection Total Vehicle Crashes	69.32	52.3	63.20	47.7	132.53	100.0
Intersection	Total Intersection Crashes	69.32	52.3	63.20	47.7	132.53	100.0
	Total Crashes	69.32	52.3	63.20	47.7	132.53	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Los Ranchos Road

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

February 15, 2021

Disclaimer

The Interactive Highway Design Model (IHSDM) software is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its content or use thereof. This document does not constitute a standard, specification, or regulation.

The United States Government does not endorse products or manufacturers. Trade and manufacturers' names may appear in this software and documentation only because they are considered essential to the objective of the software.

Limited Warranty and Limitations of Remedies

This software product is provided "as-is," without warranty of any kind-either expressed or implied (but not limited to the implied warranties of merchantability and fitness for a particular purpose). The FHWA do not warrant that the functions contained in the software will meet the end-user's requirements or that the operation of the software will be uninterrupted and error-free.

Under no circumstances will the FHWA be liable to the end-user for any damages or claimed lost profits, lost savings, or other incidental or consequential damages rising out of the use or inability to use the software (even if these organizations have been advised of the possibility of such damages), or for any claim by any other party.

Notice

The use of the IHSDM software is being done strictly on a voluntary basis. In exchange for provision of IHSDM, the user agrees that the Federal Highway Administration (FHWA), U.S. Department of Transportation and any other agency of the Federal Government shall not be responsible for any errors, damage or other liability that may result from any and all use of the software, including installation and testing of the software. The user further agrees to hold the FHWA and the Federal Government harmless from any resulting liability. The user agrees that this hold harmless provision shall flow to any person to whom or any entity to which the user provides the IHSDM software. It is the user's full responsibility to inform any person to whom or any entity to which it provides the IHSDM software of this hold harmless provision.

Table of Contents

Report Overview 1
Disclaimer Regarding Crash Prediction Method 1
Section Types 3
Urban Arterial Site Set CPM Evaluation 3

List of Tables

Table Evaluation and Crash Data (CSD) (if applicable) Intersection Sites 4
Table Predicted Crash Frequencies and Rates by Site 5
Table Predicted Crash Frequencies by Year (4SG_GE6) 6
Table Predicted USA 4SG_GE6 Sites Crash Severity 7
Table Predicted 4SG_GE6 Crash Type Distribution 7

Report Overview

Report Generated: Feb 15, 2021 9:14 AM
Report Template: System: Multi-Page [System] (sscpm2, Oct 12, 2020 9:15 AM)

Evaluation Date: Mon Feb 15 09:14:34 PST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: jared.calise
Organization Name:
Phone:
E-Mail:

Project Title: SR 227 - Los Ranchos
Project Comment: Created Fri Jan 08 09:49:50 PST 2021
Project Unit System: U.S. Customary

Site Set: Proposed - Signalized 4 Lane Section
Site Set Comment: Created Fri Jan 08 09:58:08 PST 2021
Site Set Version: v1

Evaluation Title: Proposed - Signalized 4 Lane Section_2021.02.15
Evaluation Comment: Created Mon Feb 15 09:14:14 PST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2045
Empirical-Bayes Analysis: None

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Urban Arterial Site Set CPM Evaluation

Site Type

Type: 4SG_GE6

Calibration Factor: 1

Los Ranchos Road

Table 1. Evaluation and Crash Data (CSD) (if applicable) Intersection Sites

Site No.	Type	Highway	Site Description	Major AADT	Minor AADT	Presence of Lighting	Number of Approaches with Permissive Left-Turn Phasing	Number of Approaches with Permissive/Protected or Protected/Permissive Left-Turn Phasing	Number of Approaches with Protected Left-Turn Phasing	Number of Approaches on which Right Turn on Red is Prohibited	Presence of Red-Light Cameras	Pedestrian Volumes Crossing all Intersection Legs (crossings/day)	Max. Number of Lanes Crossed by Pedestrians	Number of Bus Stops within 1000 ft of Intersection	Number of Schools within 1000 ft of Intersection	Number of Alcohol Sales Establishments within 1000 ft of Intersection
1	4SG2x2ge6	SR 227	at Los Ranchos Road	2020: 19905; 2021: 19966; 2022: 20027; 2023: 20088; 2024: 20149; 2025: 20211; 2026: 20272; 2027: 20333; 2028: 20394; 2029: 20455; 2030: 20517; 2031: 20578; 2032: 20639; 2033: 20700; 2034: 20761; 2035: 20823; 2036: 20884; 2037: 20945; 2038: 21006; 2039: 21067; 2040: 21129; 2041: 21190; 2042: 21251; 2043: 21312; 2044: 21373; 2045: 21435	2020: 6465; 2021: 6518; 2022: 6572; 2023: 6626; 2024: 6680; 2025: 6734; 2026: 6788; 2027: 6841; 2028: 6895; 2029: 6949; 2030: 7003; 2031: 7057; 2032: 7111; 2033: 7164; 2034: 7218; 2035: 7272; 2036: 7326; 2037: 7380; 2038: 7434; 2039: 7487; 2040: 7541; 2041: 7595; 2042: 7649; 2043: 7703; 2044: 7757; 2045: 7811	yes	0	0	4	0	no	50	5	0	0	2
2	4SG2x2ge6	SR 227	at Los Ranchos (RCUT Analysis)	2020: 20545; 2021: 20606; 2022: 20667; 2023: 20728; 2024: 20789; 2025: 20851; 2026: 20912; 2027: 20973; 2028: 21034; 2029: 21095; 2030: 21157; 2031: 21218; 2032: 21279; 2033: 21340; 2034: 21401; 2035: 21463; 2036: 21524; 2037: 21585; 2038: 21646; 2039: 21707; 2040: 21769; 2041: 21830; 2042: 21891; 2043: 21952; 2044: 22013; 2045: 22075	2020: 6465; 2021: 6518; 2022: 6572; 2023: 6626; 2024: 6680; 2025: 6734; 2026: 6788; 2027: 6841; 2028: 6895; 2029: 6949; 2030: 7003; 2031: 7057; 2032: 7111; 2033: 7164; 2034: 7218; 2035: 7272; 2036: 7326; 2037: 7380; 2038: 7434; 2039: 7487; 2040: 7541; 2041: 7595; 2042: 7649; 2043: 7703; 2044: 7757; 2045: 7811	yes	0	0	4	0	no	50	5	0	0	2

Los Ranchos Road

Table 2. Predicted Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Intersection Travel Crash Rate (crashes/million veh)	Intersection Crash Rate (crashes/yr)
1	4SG	SR 227	at Los Ranchos Road	70.368	2.7065	1.4139	1.2926	0.27	2.7065
2	4SG	SR 227	at Los Ranchos (RCUT Analysis)	70.871	2.7258	1.4258	1.3001	0.26	2.7258
		Total	Total	141.239	5.4323	2.8397	2.5926	0.26	5.4323

Los Ranchos Road

Table 3. Predicted Crash Frequencies by Year (4SG_GE6)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	5.20	2.72	52.195	2.49	47.805
2021	5.22	2.73	52.201	2.50	47.799
2022	5.24	2.74	52.208	2.50	47.792
2023	5.26	2.75	52.214	2.51	47.786
2024	5.28	2.76	52.220	2.52	47.780
2025	5.30	2.77	52.227	2.53	47.773
2026	5.32	2.78	52.233	2.54	47.767
2027	5.33	2.79	52.239	2.55	47.761
2028	5.35	2.80	52.245	2.56	47.755
2029	5.37	2.81	52.252	2.56	47.748
2030	5.39	2.82	52.258	2.57	47.742
2031	5.41	2.83	52.264	2.58	47.736
2032	5.42	2.84	52.270	2.59	47.730
2033	5.44	2.85	52.276	2.60	47.724
2034	5.46	2.85	52.282	2.61	47.718
2035	5.48	2.87	52.288	2.61	47.712
2036	5.50	2.87	52.295	2.62	47.705
2037	5.51	2.88	52.301	2.63	47.699
2038	5.53	2.89	52.307	2.64	47.693
2039	5.55	2.90	52.313	2.65	47.687
2040	5.57	2.91	52.319	2.65	47.681
2041	5.58	2.92	52.325	2.66	47.675
2042	5.60	2.93	52.331	2.67	47.669
2043	5.62	2.94	52.337	2.68	47.663
2044	5.64	2.95	52.343	2.69	47.657
2045	5.66	2.96	52.349	2.69	47.651
Total	141.24	73.83	52.274	67.41	47.726
Average	5.43	2.84	52.274	2.59	47.726

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 4. Predicted USA 4SG_GE6 Sites Crash Severity

Site No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1791	1.7262	9.3059	25.5502	33.6064
2	0.1806	1.7407	9.3839	25.7645	33.8016
Total	0.3597	3.4669	18.6898	51.3146	67.4081

Table 5. Predicted 4SG_GE6 Crash Type Distribution

Element Type	Crash Type	Fatal and Injury Crashes	Fatal and Injury Crashes (%)	Property Damage Only Crashes	Property Damage Only Crashes (%)	Total Crashes	Total Crashes (%)
Intersection	Angle Collision	52.11	36.9	37.21	26.3	89.32	63.2
Intersection	Collision with Bicycle	2.61	1.8	0.00	0.0	2.61	1.8
Intersection	Head-on Collision	6.50	4.6	3.10	2.2	9.60	6.8
Intersection	Other Multi-vehicle Collision	2.03	1.4	1.48	1.0	3.51	2.5
Intersection	Other Single-vehicle Collision	0.84	0.6	4.11	2.9	4.95	3.5
Intersection	Collision with Pedestrian	1.37	1.0	0.00	0.0	1.37	1.0
Intersection	Rear-end Collision	5.80	4.1	9.98	7.1	15.78	11.2
Intersection	Sideswipe	2.65	1.9	11.53	8.2	14.18	10.0
Intersection	Total Intersection Total Vehicle Crashes	73.90	52.3	67.41	47.7	141.31	100.0
Intersection	Total Intersection Crashes	73.90	52.3	67.41	47.7	141.31	100.0
	Total Crashes	73.90	52.3	67.41	47.7	141.31	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Biddle Ranch Road

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

February 10, 2021

Biddle Ranch Road

Table of Contents

Report Overview **1**
Disclaimer Regarding Crash Prediction Method 1
Section Types **3**
Urban Arterial Site Set CPM Evaluation 3

List of Tables

Table Evaluation and Crash Data (CSD) (if applicable) Intersection Sites 4
Table Predicted Crash Frequencies and Rates by Site 4
Table Predicted Crash Frequencies by Year (4ST_GE6) 5
Table Predicted USA 4ST_GE6 Sites Crash Severity 6
Table Predicted 4ST_GE6 Crash Type Distribution 6

Biddle Ranch Road

Report Overview

Report Generated: Feb 10, 2021 8:26 AM
Report Template: System: Multi-Page [System] (sscpm2, Oct 12, 2020 9:15 AM)

Evaluation Date: Wed Feb 10 08:25:55 PST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: jared.calise
Organization Name:
Phone:
E-Mail:

Project Title: SR-227 - Biddle Ranch Rd
Project Comment: Created Fri Jan 08 10:37:07 PST 2021
Project Unit System: U.S. Customary

Site Set: Existing - SSSC
Site Set Comment: Created Fri Jan 08 11:04:50 PST 2021
Site Set Version: v1

Evaluation Title: Existing_2021.02.10
Evaluation Comment: Created Wed Feb 10 08:25:37 PST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2045
Empirical-Bayes Analysis: None

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Biddle Ranch Road

Section Types

Urban Arterial Site Set CPM Evaluation

Site Type

Type: 4ST_GE6
Calibration Factor: 1

Biddle Ranch Road

Table 1. Evaluation and Crash Data (CSD) (if applicable) Intersection Sites

Site No.	Type	Highway	Site Description	Major AADT	Minor AADT	Presence of Lighting
1	4ST2x2ge6	SR 227	at Biddle Ranch Rd	2020: 17740; 2021: 17778; 2022: 17816; 2023: 17854; 2024: 17892; 2025: 17931; 2026: 17969; 2027: 18007; 2028: 18045; 2029: 18083; 2030: 18122; 2031: 18160; 2032: 18198; 2033: 18236; 2034: 18274; 2035: 18313; 2036: 18351; 2037: 18389; 2038: 18427; 2039: 18465; 2040: 18504; 2041: 18542; 2042: 18580; 2043: 18618; 2044: 18656; 2045: 18695	2020: 2078; 2021: 2081; 2022: 2084; 2023: 2087; 2024: 2090; 2025: 2093; 2026: 2096; 2027: 2099; 2028: 2102; 2029: 2105; 2030: 2108; 2031: 2111; 2032: 2114; 2033: 2117; 2034: 2120; 2035: 2123; 2036: 2126; 2037: 2129; 2038: 2132; 2039: 2135; 2040: 2138; 2041: 2141; 2042: 2144; 2043: 2147; 2044: 2150; 2045: 2153	no

Table 2. Predicted Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Intersection Travel Crash Rate (crashes/million veh)	Intersection Crash Rate (crashes/yr)
1	4ST	SR 227	at Biddle Ranch Rd	73.093	2.8113	1.4538	1.3575	0.38	2.8113
		Total	Total	73.093	2.8113	1.4538	1.3575	0.38	2.8113

Table 3. Predicted Crash Frequencies by Year (4ST_GE6)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	2.73	1.42	51.831	1.32	48.169
2021	2.74	1.42	51.822	1.32	48.178
2022	2.74	1.42	51.812	1.32	48.188
2023	2.75	1.43	51.803	1.33	48.197
2024	2.76	1.43	51.793	1.33	48.207
2025	2.76	1.43	51.784	1.33	48.216
2026	2.77	1.43	51.775	1.34	48.225
2027	2.78	1.44	51.766	1.34	48.234
2028	2.78	1.44	51.756	1.34	48.244
2029	2.79	1.44	51.747	1.35	48.253
2030	2.79	1.45	51.738	1.35	48.262
2031	2.80	1.45	51.728	1.35	48.272
2032	2.81	1.45	51.719	1.36	48.281
2033	2.81	1.46	51.710	1.36	48.290
2034	2.82	1.46	51.701	1.36	48.299
2035	2.83	1.46	51.692	1.37	48.308
2036	2.83	1.46	51.682	1.37	48.318
2037	2.84	1.47	51.673	1.37	48.327
2038	2.85	1.47	51.664	1.38	48.336
2039	2.85	1.47	51.655	1.38	48.345
2040	2.86	1.48	51.646	1.38	48.354
2041	2.87	1.48	51.637	1.39	48.363
2042	2.87	1.48	51.628	1.39	48.372
2043	2.88	1.49	51.619	1.39	48.381
2044	2.88	1.49	51.610	1.40	48.390
2045	2.89	1.49	51.601	1.40	48.399
Total	73.09	37.80	51.714	35.29	48.286
Average	2.81	1.45	51.714	1.36	48.286

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Biddle Ranch Road

Table 4. Predicted USA 4ST_GE6 Sites Crash Severity

Site No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.2652	5.9024	12.9917	18.6400	35.2937
Total	0.2652	5.9024	12.9917	18.6400	35.2937

Table 5. Predicted 4ST_GE6 Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Intersection	Angle Collision	25.70	35.2	24.95	34.1	50.65	69.3
Intersection	Collision with Bicycle	2.62	3.6	0.00	0.0	2.62	3.6
Intersection	Head-on Collision	0.96	1.3	0.42	0.6	1.38	1.9
Intersection	Other Multi-vehicle Collision	0.77	1.0	0.85	1.2	1.61	2.2
Intersection	Other Single-vehicle Collision	0.19	0.3	1.31	1.8	1.50	2.0
Intersection	Collision with Pedestrian	3.29	4.5	0.00	0.0	3.29	4.5
Intersection	Rear-end Collision	2.52	3.4	3.46	4.7	5.98	8.2
Intersection	Sideswipe	1.75	2.4	4.31	5.9	6.06	8.3
Intersection	Total Intersection Total Vehicle Crashes	37.80	51.7	35.29	48.3	73.09	100.0
Intersection	Total Intersection Crashes	37.80	51.7	35.29	48.3	73.09	100.0
	Total Crashes	37.80	51.7	35.29	48.3	73.09	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Biddle Ranch Road

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

February 10, 2021

Biddle Ranch Road

Disclaimer

The Interactive Highway Design Model (IHSDM) software is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its content or use thereof. This document does not constitute a standard, specification, or regulation.

The United States Government does not endorse products or manufacturers. Trade and manufacturers' names may appear in this software and documentation only because they are considered essential to the objective of the software.

Limited Warranty and Limitations of Remedies

This software product is provided "as-is," without warranty of any kind-either expressed or implied (but not limited to the implied warranties of merchantability and fitness for a particular purpose). The FHWA do not warrant that the functions contained in the software will meet the end-user's requirements or that the operation of the software will be uninterrupted and error-free.

Under no circumstances will the FHWA be liable to the end-user for any damages or claimed lost profits, lost savings, or other incidental or consequential damages rising out of the use or inability to use the software (even if these organizations have been advised of the possibility of such damages), or for any claim by any other party.

Notice

The use of the IHSDM software is being done strictly on a voluntary basis. In exchange for provision of IHSDM, the user agrees that the Federal Highway Administration (FHWA), U.S. Department of Transportation and any other agency of the Federal Government shall not be responsible for any errors, damage or other liability that may result from any and all use of the software, including installation and testing of the software. The user further agrees to hold the FHWA and the Federal Government harmless from any resulting liability. The user agrees that this hold harmless provision shall flow to any person to whom or any entity to which the user provides the IHSDM software. It is the user's full responsibility to inform any person to whom or any entity to which it provides the IHSDM software of this hold harmless provision.

Table of Contents

Report Overview 1

Disclaimer Regarding Crash Prediction Method 1

Section Types 3

Urban Arterial Site Set CPM Evaluation 3

List of Tables

Table Evaluation and Crash Data (CSD) (if applicable) Intersection Sites 4

Table Predicted Crash Frequencies and Rates by Site 4

Table Predicted Crash Frequencies by Year (4SG_GE6) 5

Table Predicted USA 4SG_GE6 Sites Crash Severity 6

Table Predicted 4SG_GE6 Crash Type Distribution 6

Biddle Ranch Road

Report Overview

Report Generated: Feb 10, 2021 8:26 AM
Report Template: System: Multi-Page [System] (sscpm2, Oct 12, 2020 9:15 AM)

Evaluation Date: Wed Feb 10 08:26:20 PST 2021
IHSDM Version: v16.0.0 (Sep 30, 2020)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: jared.calise
Organization Name:
Phone:
E-Mail:

Project Title: SR-227 - Biddle Ranch Rd
Project Comment: Created Fri Jan 08 10:37:07 PST 2021
Project Unit System: U.S. Customary

Site Set: Proposed - Signalized
Site Set Comment: Created Fri Jan 08 11:05:12 PST 2021
Site Set Version: v1

Evaluation Title: Proposed - Signalized_2021.02.10
Evaluation Comment: Created Wed Feb 10 08:26:03 PST 2021
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2045
Empirical-Bayes Analysis: None

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Biddle Ranch Road

Section Types

Urban Arterial Site Set CPM Evaluation

Site Type

Type: 4SG_GE6
Calibration Factor: 1

Biddle Ranch Road

Table 1. Evaluation and Crash Data (CSD) (if applicable) Intersection Sites

Site No.	Type	Highway	Site Description	Major AADT	Minor AADT	Presence of Lighting	Number of Approaches with Permissive Left-Turn Phasing	Number of Approaches with Permissive/Protected or Protected/Permissive Left-Turn Phasing	Number of Approaches with Protected Left-Turn Phasing	Number of Approaches on which Right Turn on Red is Prohibited	Presence of Red-Light Cameras	Pedestrian Volumes Crossing all Intersection Legs (crossings/day)	Max. Number of Lanes Crossed by Pedestrians	Number of Bus Stops within 1000 ft of Intersection	Number of Schools within 1000 ft of Intersection	Number of Alcohol Sales Establishments within 1000 ft of Intersection
1	4SG2x2ge6	SR 227	at Biddle Ranch Rd	2020: 17740; 2021: 17778; 2022: 17816; 2023: 17854; 2024: 17892; 2025: 17931; 2026: 17969; 2027: 18007; 2028: 18045; 2029: 18083; 2030: 18122; 2031: 18160; 2032: 18198; 2033: 18236; 2034: 18274; 2035: 18313; 2036: 18351; 2037: 18389; 2038: 18427; 2039: 18465; 2040: 18504; 2041: 18542; 2042: 18580; 2043: 18618; 2044: 18656; 2045: 18695	2020: 2078; 2021: 2081; 2022: 2084; 2023: 2087; 2024: 2090; 2025: 2093; 2026: 2096; 2027: 2099; 2028: 2102; 2029: 2105; 2030: 2108; 2031: 2111; 2032: 2114; 2033: 2117; 2034: 2120; 2035: 2123; 2036: 2126; 2037: 2129; 2038: 2132; 2039: 2135; 2040: 2138; 2041: 2141; 2042: 2144; 2043: 2147; 2044: 2150; 2045: 2153	yes	0	0	4	0	no	50	3	0	0	1

Table 2. Predicted Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Intersection Travel Crash Rate (crashes/million veh)	Intersection Crash Rate (crashes/yr)
1	4SG	SR 227	at Biddle Ranch Rd	33.151	1.2750	0.6644	0.6106	0.17	1.2750
		Total	Total	33.151	1.2750	0.6644	0.6106	0.17	1.2750

Biddle Ranch Road

Table 3. Predicted Crash Frequencies by Year (4SG_GE6)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	1.26	0.66	52.052	0.60	47.948
2021	1.26	0.66	52.057	0.60	47.943
2022	1.26	0.66	52.061	0.60	47.939
2023	1.26	0.66	52.066	0.61	47.934
2024	1.26	0.66	52.070	0.61	47.930
2025	1.27	0.66	52.074	0.61	47.926
2026	1.27	0.66	52.079	0.61	47.921
2027	1.27	0.66	52.083	0.61	47.917
2028	1.27	0.66	52.088	0.61	47.912
2029	1.27	0.66	52.092	0.61	47.908
2030	1.27	0.66	52.096	0.61	47.904
2031	1.27	0.66	52.101	0.61	47.899
2032	1.27	0.66	52.105	0.61	47.895
2033	1.28	0.67	52.109	0.61	47.891
2034	1.28	0.67	52.114	0.61	47.886
2035	1.28	0.67	52.118	0.61	47.882
2036	1.28	0.67	52.123	0.61	47.877
2037	1.28	0.67	52.127	0.61	47.873
2038	1.28	0.67	52.131	0.61	47.869
2039	1.28	0.67	52.136	0.61	47.864
2040	1.28	0.67	52.140	0.61	47.860
2041	1.29	0.67	52.144	0.61	47.856
2042	1.29	0.67	52.148	0.62	47.852
2043	1.29	0.67	52.153	0.62	47.847
2044	1.29	0.67	52.157	0.62	47.843
2045	1.29	0.67	52.161	0.62	47.839
Total	33.15	17.27	52.107	15.88	47.893
Average	1.27	0.66	52.107	0.61	47.893

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 4. Predicted USA 4SG_GE6 Sites Crash Severity

Site No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0842	0.8111	4.3728	12.0060	15.8769
Total	0.0842	0.8111	4.3728	12.0060	15.8769

Table 5. Predicted 4SG_GE6 Crash Type Distribution

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Intersection	Angle Collision	12.12	36.5	8.76	26.4	20.88	63.0
Intersection	Collision with Bicycle	0.61	1.8	0.00	0.0	0.61	1.8
Intersection	Head-on Collision	1.51	4.6	0.73	2.2	2.24	6.8
Intersection	Other Multi-vehicle Collision	0.47	1.4	0.35	1.1	0.82	2.5
Intersection	Other Single-vehicle Collision	0.20	0.6	0.97	2.9	1.16	3.5
Intersection	Collision with Pedestrian	0.42	1.3	0.00	0.0	0.42	1.3
Intersection	Rear-end Collision	1.35	4.1	2.35	7.1	3.70	11.2
Intersection	Sideswipe	0.62	1.9	2.71	8.2	3.33	10.0
Intersection	Total Intersection Total Vehicle Crashes	17.29	52.1	15.88	47.9	33.17	100.0
Intersection	Total Intersection Crashes	17.29	52.1	15.88	47.9	33.17	100.0
	Total Crashes	17.29	52.1	15.88	47.9	33.17	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Kimley»Horn

Appendix F

Caltrans Benefit-Cost Values

As described in the United States Department of Transportation's Benefit-Cost Analysis Guidance for Discretionary Grant Programs (Feb.2021 , p. 6), a blend of "localized data with national estimates or industry standards to complete a more robust analysis" can be applied. The default parameters for the 2021 INFRA Cal-B/C tool are a blend of California and national values assessed at a 2019 base year.

Users should revise default parameters if more applicable values exist for a project being assessed. Revisions can be made within the "Parameters" tab of the Excel workbook by entering a new value into the individual cell. In addition, assumptions identified in the "Project Information" tab (red or blue cells) can be adjusted based for a specific project, e.g., average vehicle occupancy, percent truck, roadway type, etc. The table below is a comparison of California and national values—assumed 2020 INFRA Cal-B/C values are highlighted in yellow.

Parameters	Cal-B/C Values	Fed. Values	Notes
Current Dollar Value applied in tool	2019	2019	All assumed Cal-B/C parameters are adjusted for 2018 dollars. Assumed Cal-B/C values in the model have been escalated to 2018 dollars, as recommended in the guidance.
Real Discount Rate	4.00%	7.00%	A sensitivity analysis of 3% is no longer required.
Average Vehicle Occupancy	Non-peak – 1.3 Peak – 1.15	Non-peak – 1.58 Peak – 1.48	Cal-B/C factors in peak and non-peak average vehicle occupancy, whereas the federal guidance uses a single AVO figure. Thus, the default values apply to California statewide average.
Period of analysis	Construction, plus 20 years after completion.	Construction, plus 20 years after completion in most situations.	Federal guidance suggests applying no more than 30 years for analytical purposes after project completion.

Travel Time Parameters			
Statewide Average Hourly Wage ($/hr.)	$29.47	$35.80	California values extracted from BLS data.
Heavy and Light Truck Drivers Average Hourly Wage ($/hr.)	$22.16		California values extracted from BLS data.
Heavy and Light Truck Drivers Benefits and Costs ($/hr.)	$11.59		California values extracted from BLS data.
Automobile/Personal ($/hr./per)	$15.10	$17.90	For calculation methodology, see Cal-B/C tech doc. (Volume 4), pp. II-37 to II-38. Link : https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/f0009451-cal-bctechsupplementvol4v4-a11y.pdf
Truck/Business ($/hr./veh.)	$34.45	$30.80	For calculation methodology, see Cal-B/C tech doc. (Volume 4), pp. II-37 to II-38. Link: https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/f0009451-cal-bctechsupplementvol4v4-a11y.pdf
Auto & Truck Composite/All Purpose ($/hr./veh)	$20.50	$23.95	Federal weighted average based on a typical distribution of local travel by surface modes (95.4% personal, 4.6% truck). California assumes a different distribution (91% personal, 9% truck). Applicants should apply their own distribution of business versus personal travel if available.
Transit/Transit Rail Operators ($/hr./per)	$15.10 (passenger)	$17.90 (local personal travel) $23.10 (intercity personal travel) $50.00 (transit rail operator)	Cal-B/C only values “transit” per passenger. Federal guidance states, for wait times, the value should be doubled. Values for personal travel based on local travel values and intercity personal travel are described in US DOT’s Value of Travel Time guidance. A valuation of the “transit operator” is also not a factor in the Cal-B/C model.

Average Fuel Price			
Automobile (regular unleaded) ($/gal)	$3.57		Fuel prices for gasoline and diesel were extracted the US Energy Information Administration's 2019 Petroleum and Other Liquids annual report. California Gasoline and Diesel Retail Prices (eia.gov) For calculation methodology, see Cal-B/C tech doc. (Volume 4), pp. II-37 to II-38. pp. II-37 to II-46. Link: https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/f0009451-cal-bctechsupplementvol4v4-a11y.pdf
Truck (diesel) ($/gal.)	$3.84		Fuel prices for gasoline and diesel were extracted the US Energy Information Administration's 2019 Petroleum and Other Liquids annual report. California Gasoline and Diesel Retail Prices (eia.gov) Link: https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/f0009451-cal-bctechsupplementvol4v4-a11y.pdf
State Sales Tax (gasoline)	2.25%		Value is applicable to California.
State Sales Tax (diesel)	13.00%		Value is applicable to California.
Average Local Sales Tax	0.50%		Value is applicable to California.
Federal Fuel Excise Tax (gasoline) ($/gal.)	$0.184		
Federal Fuel Excise Tax (diesel) ($/gal.)	$0.244		
State Fuel Excise Tax (gasoline) ($/gal.)	$0.505		Value is applicable to California (current rate increased on July 2020 to $0.505)
State Fuel Excise Tax (diesel) ($/gal.)	$0.385		Value is applicable to California (current rate increased on July 2020 to $0.385)

Non-Fuel Cost Per Mile			
Automobile	$0.351		Federal guidance does not provide an estimate. Non-fuel costs are based on 2016 Cal-B/C estimate and escalated to 2018 using OMB Table 10.1 GDP. Cal-B/C auto value assessed at 3.13 cents (2016) and base value for truck is ATRI (2014) value.
Truck/Light Duty Vehicles	$0.438	$0.43	Cal-B/C breaks out fuel and non-fuel costs. US DOT Guidance factors in fuel costs when estimating vehicle operation costs. Truck was escalated using 2018 divided by 2014 indices, as the base year in the model was 2016.
Commercial Trucks		$0.93	Cal-B/C breaks out fuel and non-fuel costs for commercial trucks. US DOT Guidance factors in fuel costs, repair, insurance, permits, license, etc.

Accident Cost Parameters			
Cost of Fatality/Killed	$9.8M	$10.9M	Accident costs are based on reported federal benefit-cost guidance rate for 2018. The assumed rate in the 2016 Cal-B/C model differs.
Level A (Severe)/Incapacitating	$467,000	$521,300	Accident costs are based on reported federal benefit-cost guidance rate for 2018. The assumed rate in the 2016 Cal-B/C model differs.

Level B (Moderate)/Non-incapacitating	$127,100	$142,000	Accident costs are based on reported federal benefit-cost guidance rate for 2018. The assumed rate in the 2016 Cal-B/C model differs.
Level C(Minor)/Possible Injury	$65,000	$72,500	Accident costs are based on reported federal benefit-cost guidance rate for 2018. The assumed rate in the 2016 Cal-B/C model differs.
Cost of Property Damage (PDO)	$4,374	$4,500	Accident costs are based on reported federal benefit-cost guidance rate for 2018. The assumed rate in the 2016 Cal-B/C model differs.

Pollutant Emissions			
CO	$75 - $160	$0	Cal-B/C estimates are based on Corporate Average Fuel Economy for MY2017-MY2025 Passenger Cars and Light Trucks (August 2012), page 922, Table VIII-16, “Economic Values Used for Benefits Computations (2010 dollars)”. Values are inflated from 2010 dollars to 2016 dollars using the GDP deflator. Cal-B/C rates vary depending on project location. Cal-B/C calculation methodology can be viewed in its tech. doc. vol. 4, pp. II-51 to II-61. Cal-B/C value differs based on geographic three regional categories within California. Link: https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/f0009451-cal-bctechsupplementvol4v4-a11y.pdf No value identified in the federal guidance document, thus, no value assessed.
CO_2	$38	$47	USDOT recommends using new value of $52.00 per metric ton. https://www7.transportation.gov/office-policy/transportation-policy/benefit-cost-analysis-guidance-discretionary-grant-programs-0
NO_x	$14,300-16,300	$14,400	Cal-B/C value differs based on three regional categories within California. Applied the 2021 federal rate.
PM_{10}	$662,100-774,100	$673,900	Cal-B/C value differs based on three regional categories within California. Applied the 2021 federal rate.
SO_2	$36,700-$43,800	$37,500	Cal-B/C value differs based on three regional categories within California. Applied the 2021 federal rate.
VOC	$0	0	Cal-B/C value differs based on three regional categories within California. Applied the 2021 federal rate which is zero.

Appendix G

Crestmont Drive Signal Warrant Analysis

Kimley»Horn

Memorandum

To: Nate Stong, P.E.
Rick Engineering

From: Sean Houck, P.E.
Jared Calise, E.I.T.

Re: SR 227 Corridor Analysis
Crestmont Drive Signal Warrant Analysis

Date: June 22, 2021

Kimley-Horn performed signal warrant analysis at Crestmont Drive along SR 227 (the "study intersection") using all available data. Below, we go through the nine signal warrants listed in the CAMUTCD[1]. See Attachment A for traffic counts (the "counts") taken at the study intersection on January 8, 2020.

1. Eight-Hour Vehicular Volume (100%)
    a. Satisfied: Unlikely (based on available data)
    b. Sufficient Data: No
        i. Data collected: 6 total hours for the periods 7-9AM and 2-6PM (8 total required)
    c. Threshold:
        i. Condition A: 420 vehicles per hour on the mainline and 105 vehicles per hour on the minor-street higher-volume approach for 8 hours.
        ii. Condition B: 630 vehicles per hour on the mainline and 53 vehicles per hour on the minor-street higher-volume approach for 8 hours.
    d. Comments:
        i. See Attachment B for the Traffic Signal Warrants Worksheet for Warrant 1
        ii. Intersection is classified rural due to major street speeds greater than 40 mph
        iii. Must meet Condition A or Condition B
        iv. The major street approach satisfies the volume threshold for each hour of available data.
        v. The minor street approach does not satisfy the volume threshold.
            1. Minor Street Condition A: Higher-volume approach does not exceed 105 vehicles per hour for the 6 hours of available data.
            2. Minor Street Condition B: Higher-volume approach exceeds 53 vehicles per hour for 2 of the 6 hours of available data.

Eight-Hour Vehicular Volume (80%)
    a. Satisfied: Unlikely (based on available data)
    b. Sufficient Data: No (see above)
    c. Threshold:
        i. Condition A: 336 vehicles per hour on the mainline and 84 vehicles per hour on the higher-volume minor-street approach for 8 hours.
        ii. Condition B: 504 vehicles per hour on the mainline and 42 vehicles per hour on the higher-volume minor-street approach for 8 hours.

[1] California Manual on Uniform Traffic Control Devices, 2014 Edition, Revision 6 (March 30, 2021)

d. Comments:
    i. Must meet Condition A and Condition B
    ii. The major street approach satisfies the volume threshold for each hour of available data.
    iii. The minor street approach does not satisfy the volume threshold.
        1. Minor Street Condition A: Approach volume does not exceed 84 vehicles per hour for the 6 hours of available data.
        2. Minor Street Condition B: Approach volume exceeds 42 vehicles per hour for 4 of the 6 hours of available data.

2. Four-Hour Vehicular Volume
    a. Satisfied: No (Based on available data)
    b. Sufficient Data: Yes
    c. Threshold:
        i. Corresponding major-street approaches and higher-volume minor-street approach fall above the applicable curve in Figure 4C-2 in the CAMUTCD for any 4 hours of an average day.
    d. Comments:
        i. See Attachment C for the Traffic Signal Warrants Worksheet for Warrant 2.
        ii. Intersection is classified rural due to major street speeds greater than 40 mph.
        iii. Plotted points representing the corresponding major-street approaches and higher-volume minor-street approach fall above the applicable curve in Figure 4C-2 for 2 of the available 6 hours of data.

3. Peak Hour
    a. Satisfied: No
    b. Comments:
        i. "This signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time." (CAMUTCD 4C.04)

4. Pedestrian Volume
    a. Satisfied: No
    b. Sufficient Data: Yes
    c. Threshold:
        i. Four-Hour Volume: Plotted points representing the corresponding major-street approaches and total pedestrians crossing the major street fall above the curve in Figure 4C-6 for 4 hours.
        ii. Peak-Hour: Plotted points representing the corresponding major-street approach and total pedestrians crossing the major-street fall above the curve in Figure 4C-8 in the CAMUTCD for any four consecutive 15-minute periods on an average day.
    d. Comments:
        i. See Attachment E for the Traffic Signal Warrants Worksheet for Warrant 4
        ii. Intersection is classified rural due to major street speeds greater than 35 mph.
        iii. Plotted points representing the corresponding major-street approaches and total pedestrians crossing the major street do not fall above the curve in Figure 4C-6 or Figure 4C-8.

Kimley»Horn

5. School Crossing
    a. Satisfied: No
    b. Comments:
        i. There are no school crossings across the major street at the intersection.

6. Coordinated Signal System
    a. Satisfied: No
    b. Sufficient Data: Yes
    c. Comments:
        i. "On a two-way street, adjacent traffic control signals do not provide the necessary degree of platooning and the proposed and adjacent traffic control signals will collectively provide a progressive operation" (CAMUTCD 4C.07.B) and when the traffic control signals are not less than 1,000 feet apart.
        ii. The signal warrant analysis for Crestmont Drive in the Public Records Center determined the adjacent signals (Los Ranchos Road and Buckley Road) provide the necessary degree of platooning and a progressive operation.
        iii. See Attachment F for the Caltrans' Public Records Center signal warrant analysis at Crestmont Drive.

7. Crash Experience
    a. Satisfied: No
    b. Sufficient Data: Yes
    c. Threshold:
        i. "Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency; and" (CAMUTCD 4C.08.A)
        ii. "Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred withing a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash; and" (CAMUTCD 4C.08.B)
        iii. "For each of any 8 hours of an average day, the vehicles per hour (vph) given in both of the 80 percent columns of Condition A in Table 4C-1, or the vph in both of the 80 percent columns of Condition B in Table 4C-1 exists on the major-street and the higher-volume minor-street approach, respectively, to the intersection, or the volume of pedestrian traffic is not less than 80 percent of the requirements specified in the Pedestrian Volume warrant. These major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours." (CAMUTCD 4C.08.C)
    d. Comments:
        i. See Attachment G for the Public Records Center crash history at Crestmont Drive between October 2017 and September 2019.
        ii. There were three reported crashes at Crestmont Drive between October 2017 and September 2019. This does not meet the required number and crash type as described in section 4C.08.B in the CAMUTCD.

8. Roadway Network
    a. Satisfied: No
    b. Comments:
        i. Crestmont Drive is not classified as a major route.

9. Intersection Near a Grade Crossing
    a. Satisfied: No
    b. Comments:
        i. The intersection is not located near a grade crossing and therefore this warrant does not apply.

Attachments:

Attachment A – Crestmont Drive Traffic Counts
Attachment B – Traffic Signal Warrants Worksheet for Warrant 1
Attachment C – Traffic Signal Warrants Worksheet for Warrant 2
Attachment D – Traffic Signal Warrants Worksheet for Warrant 3
Attachment E – Traffic Signal Warrants Worksheet for Warrant 4
Attachment F – Caltrans' Crestmont Drive Public Records Center Traffic Signal Warrants
Attachment G – Crestmont Drive Public Records Center Crash History

Attachment A – Crestmont Drive Traffic Counts

Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230

800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:
Kimley-Horn and Associates
555 Capitol Mall, Suite 300
Sacramento, CA 95814

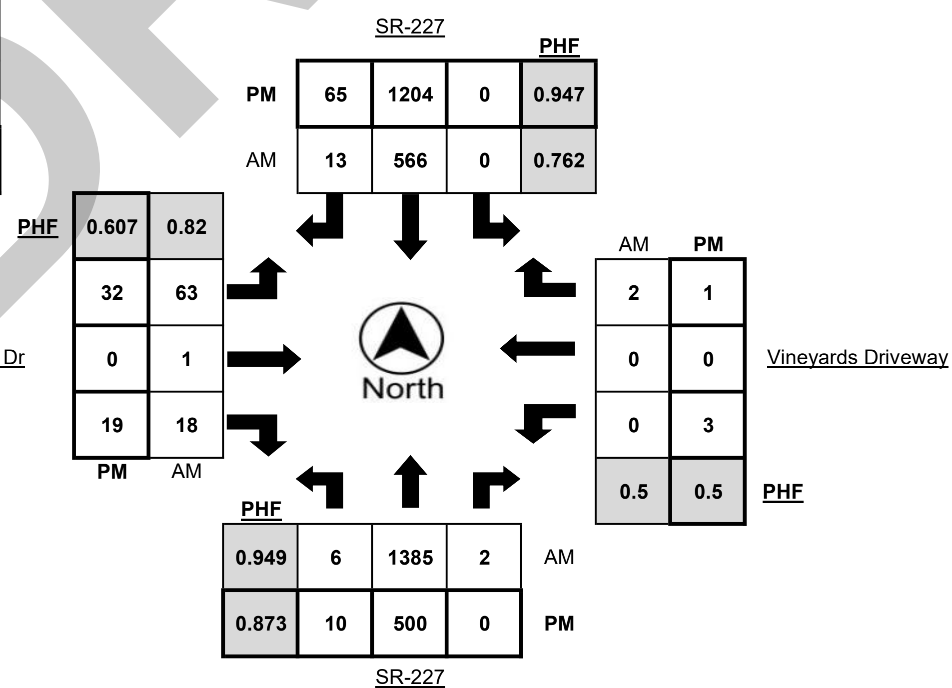
LOCATION	Crestmont Dr @ SR227	**LATITUDE**	35.2275
COUNTY	San Luis Obispo	**LONGITUDE**	-120.6278
COLLECTION DATE	Wednesday, January 8, 2020	**WEATHER**	Clear

	Northbound				Southbound				Eastbound				Westbound			
Time	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**
7:00 AM - 7:15 AM	1	192	2	4	0	66	1	6	8	0	2	0	0	0	0	0
7:15 AM - 7:30 AM	3	239	0	5	0	76	3	7	18	0	0	0	0	0	0	0
7:30 AM - 7:45 AM	2	324	0	2	0	105	3	10	16	0	3	0	0	0	0	0
7:45 AM - 8:00 AM	2	364	1	6	0	97	2	5	18	0	3	0	0	0	0	0
8:00 AM - 8:15 AM	0	339	1	10	0	185	5	5	17	0	8	1	0	0	1	1
8:15 AM - 8:30 AM	2	358	0	11	0	179	3	12	12	1	4	0	0	0	1	0
8:30 AM - 8:45 AM	3	302	1	10	0	104	4	9	10	0	3	0	0	0	0	0
8:45 AM - 9:00 AM	2	213	1	6	0	116	6	8	16	0	1	0	0	0	0	0
TOTAL	**15**	**2331**	**6**	**54**	**0**	**928**	**27**	**62**	**115**	**1**	**24**	**1**	**0**	**0**	**2**	**1**

	Northbound				Southbound				Eastbound				Westbound			
Time	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**
2:00 PM - 2:15 PM	5	135	0	15	0	167	4	12	11	0	4	0	0	0	0	0
2:15 PM - 2:30 PM	1	124	0	11	0	156	4	11	5	0	3	0	0	0	0	0
2:30 PM - 2:45 PM	3	119	1	9	0	223	12	6	6	0	2	0	0	0	0	0
2:45 PM - 3:00 PM	1	144	0	10	0	214	17	4	11	0	2	0	0	0	0	0
3:00 PM - 3:15 PM	7	182	2	11	1	233	7	5	10	0	1	0	0	0	1	0
3:15 PM - 3:30 PM	4	112	0	16	0	241	19	7	7	0	3	1	0	0	0	0
3:30 PM - 3:45 PM	5	127	0	5	0	309	12	4	3	0	2	0	0	0	0	0
3:45 PM - 4:00 PM	3	143	0	8	0	318	16	5	8	0	6	0	2	0	0	0
4:00 PM - 4:15 PM	2	125	0	9	0	273	11	3	12	0	9	1	1	0	0	0
4:15 PM - 4:30 PM	3	114	0	3	0	295	21	1	7	0	1	1	0	0	1	0
4:30 PM - 4:45 PM	2	118	0	4	0	318	17	3	5	0	3	0	0	0	0	0
4:45 PM - 5:00 PM	2	116	0	3	0	301	10	5	13	0	0	1	0	0	0	0
5:00 PM - 5:15 PM	2	107	0	4	0	307	7	3	6	0	1	0	0	0	0	0
5:15 PM - 5:30 PM	2	127	0	4	0	314	13	3	6	0	1	0	0	0	0	0
5:30 PM - 5:45 PM	2	106	0	3	0	294	9	2	7	0	0	1	1	0	0	0
5:45 PM - 6:00 PM	7	91	0	1	0	228	13	1	6	0	8	0	0	0	0	0
TOTAL	**51**	**1990**	**3**	**116**	**1**	**4191**	**192**	**75**	**123**	**0**	**46**	**5**	**4**	**0**	**2**	**0**

	Northbound				Southbound				Eastbound				Westbound			
PEAK HOUR	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**
7:30 AM - 8:30 AM	6	1385	2	29	0	566	13	32	63	1	18	1	0	0	2	1
3:45 PM - 4:45 PM	10	500	0	24	0	1204	65	12	32	0	19	2	3	0	1	0

	PHF	**Trucks**
AM	0.918	3.1%
PM	0.924	2.1%



Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230

800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:
Kimley-Horn and Associates
555 Capitol Mall, Suite 300
Sacramento, CA 95814

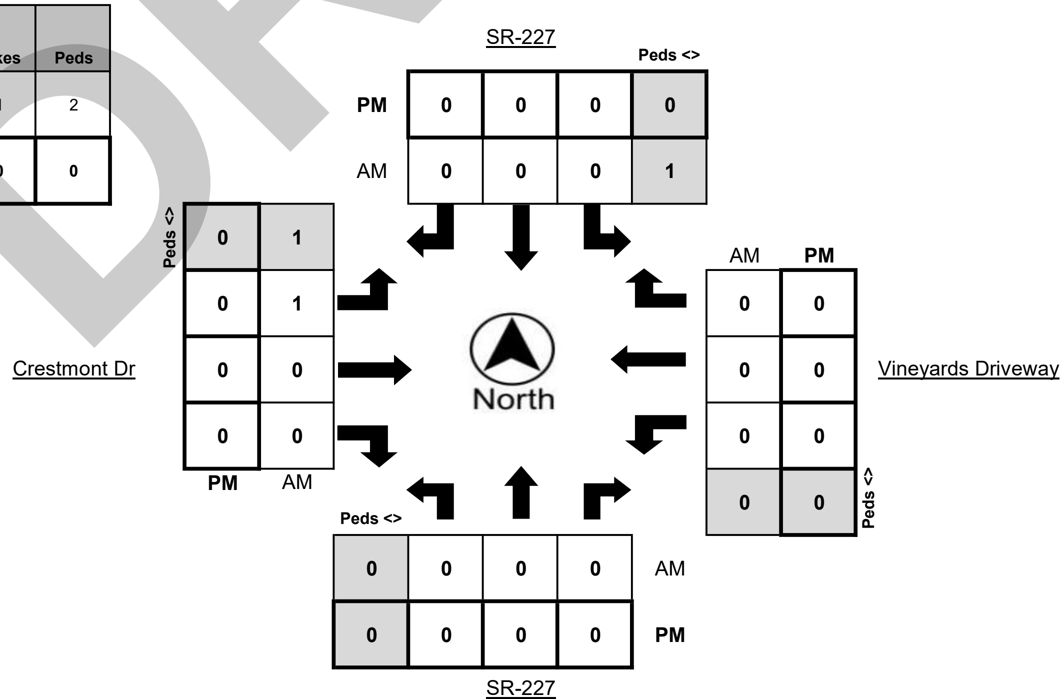
LOCATION	Crestmont Dr @ SR227	**LATITUDE**	35.2275
COUNTY	San Luis Obispo	**LONGITUDE**	-120.6278
COLLECTION DATE	Wednesday, January 8, 2020	**WEATHER**	Clear

	Northbound Bikes			N.Leg	Southbound Bikes			S.Leg	Eastbound Bikes			E.Leg	Westbound Bikes			W.Leg
Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
7:00 AM - 7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM - 7:30 AM	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
7:30 AM - 7:45 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM - 8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM - 8:15 AM	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
8:15 AM - 8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
8:30 AM - 8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM - 9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**1**

	Northbound Bikes			N.Leg	Southbound Bikes			S.Leg	Eastbound Bikes			E.Leg	Westbound Bikes			W.Leg
Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
2:00 PM - 2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:15 PM - 2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:30 PM - 2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:45 PM - 3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00 PM - 3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:15 PM - 3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:30 PM - 3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:45 PM - 4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00 PM - 4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM - 4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM - 4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM - 5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM - 5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM - 5:30 PM	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
5:30 PM - 5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM - 6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

	Northbound Bikes			N.Leg	Southbound Bikes			S.Leg	Eastbound Bikes			E.Leg	Westbound Bikes			W.Leg
PEAK HOUR	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
7:30 AM - 8:30 AM	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1
3:45 PM - 4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Bikes	Peds
AM Peak Total	1	2
PM Peak Total	0	0



Attachment B – Traffic Signal Warrants Worksheet for Warrant 1

Traffic Signal Warrants Worksheet
Warrant 1: Eight Hour Vehicular Volume
Source: CAMUTCD 2014, Revision 6

Major Street: **State Route 227** Number of Approach Lanes: **2**
Minor Street: **Crestmont Drive** Number of Approach Lanes: **1**
City, State: **San Luis Obispo, CA**

Speed Limit or critical speed on major traffic > 40 mph? **TRUE**
In built up area of isolated community of < 10,000 population? **FALSE**
This location is considered RURAL

Condition A or Condition B or a Combination of A and B must be satisfied

Warrant 1 Satisfied: **NO** 100% Satisfied: **NO**
Condition A - Minimum Vehicle Volume 80% Satisfied: **NO**

	Minimum Requirements (80% shown in brackets)				7 AM-8 AM	8 AM-9 AM	2 PM-3 PM	3 PM-4 PM	4 PM-5 PM	5 PM-6 PM
	U	R	U	R						
Approach Lanes	1		2 or more							
Both Approaches Major Street	500 (400)	350 (280)	600 (480)	420 (336)	1483	1824	1330	1741	1728	1629
Highest Approach Minor Street	150 (120)	105 (84)	200 (160)	140 (112)	68	72	44	40	50	35

Requirements | 100% Satisfied | 80% Satisfied | U = Urban | R = Rural

100% Satisfied: **NO**
Condition B - Interruption of Continuous Traffic 80% Satisfied: **NO**

	Minimum Requirements (80% shown in brackets)				7 AM-8 AM	8 AM-9 AM	2 PM-3 PM	3 PM-4 PM	4 PM-5 PM	5 PM-6 PM
	U	R	U	R						
Approach Lanes	1		2 or more							
Both Approaches Major Street	750 (600)	525 (420)	900 (720)	630 (504)	1483	1824	1330	1741	1728	1629
Highest Approach Minor Street	75 (60)	53 (42)	100 (80)	70 (56)	68	72	44	40	50	35

Requirements | 100% Satisfied | 80% Satisfied | U = Urban | R = Rural

Combination of Conditions A & B

Requirement	**Condition**	✓	**Fulfilled**
Two Conditions Satisfied 80%	A. Minimum Vehicular Volume		No
	B. Interruption of Continuous Traffic		
And, an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems			No

Attachment C – Traffic Signal Warrants Worksheet for Warrant 2

DRAFT

Traffic Signal Warrants Worksheet
Warrant 2: Four Hour Vehicular Volume
Source: CAMUTCD 2014, Revision 6

Major Street: **State Route 227** Number of Approach Lanes: **2**
Minor Street: **Crestmont Drive** Number of Approach Lanes: **1**
City, State: **San Luis Obispo, CA**

Speed Limit or critical speed on major traffic > 40 mph? **TRUE**
In built up area of isolated community of < 10,000 population? **FALSE**
This location CAN use the 70% Factor

Warrant 2 is Satisfied if any 4 hours of an average day are plotted above the applicable curve.

Warrant 2 Satisfied: **NO**

Approach Lanes	7 AM-8 AM	8 AM-9 AM	2 PM-3 PM	3 PM-4 PM	4 PM-5 PM	5 PM-6 PM
Both Approaches Major Street	1483	1824	1330	1741	1728	1629
Highest Approach Minor Street	68	72	44	40	50	35

Point falls above the the applicable curve

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)

*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

- Plotted points representing the VPH above the applicable curve (2 total)
- Plotted points representing the VPH below the applicable curve (4 total)

Kimley»Horn

Attachment D – Traffic Signal Warrants Worksheet for Warrant 3

Traffic Signal Warrants Worksheet
Warrant 3: Peak Hour
Source: CAMUTCD 2014, Revision 6

Major Street: **State Route 227** Number of Approach Lanes: **2**
Minor Street: **Crestmont Drive** Number of Approach Lanes: **1**
City, State: **San Luis Obispo, CA**

Speed Limit or critical speed on major traffic > 40 mph? **TRUE**
In built up area of isolated community of < 10,000 population? **FALSE**
This location CAN use the 70% Factor

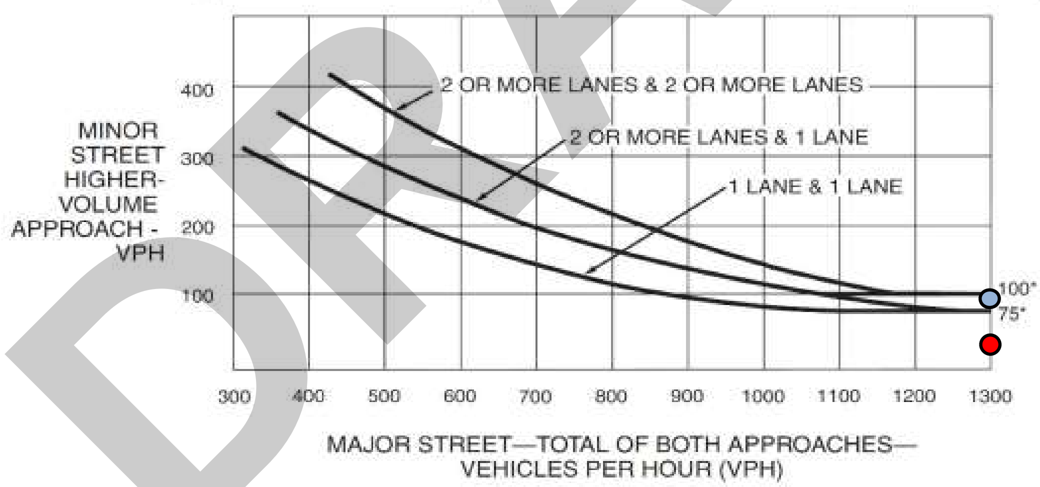
Warrant 3 is Satisfied if a peak hour of an average day is plotted above the applicable curve.

Warrant 3 Satisfied: **YES**

Approach Lanes	AM PEAK HOUR 7:30 AM-8:30 AM	PM PEAK HOUR 3:45 AM-4:45 AM
Both Approaches Major Street	1972	1779
Highest Approach Minor Street	82	51

Point falls above the the applicable curve

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

- Plotted points representing the VPH above the applicable curve (1 total)
- Plotted points representing the VPH below the applicable curve (1 total)

Kimley»Horn

Attachment E – Traffic Signal Warrants Worksheet for Warrant 4

Traffic Signal Warrants Worksheet
Warrant 4: Pedestrian Volume
Source: CAMUTCD 2014, Revision 6

Major Street: **State Route 227** — Number of Approach Lanes: **2**
Minor Street: **Crestmont Drive** — Number of Approach Lanes: **1**
City, State: **San Luis Obispo, CA**

Speed Limit or critical speed on major traffic > 35 mph? **TRUE**
In built up area of isolated community of < 10,000 population? **FALSE**
This location CAN use the 70% Factor

Condition A (Four-Hour) or Condition B (Peak-Hour) must be satisfied

Warrant 4 Satisfied: **NO**

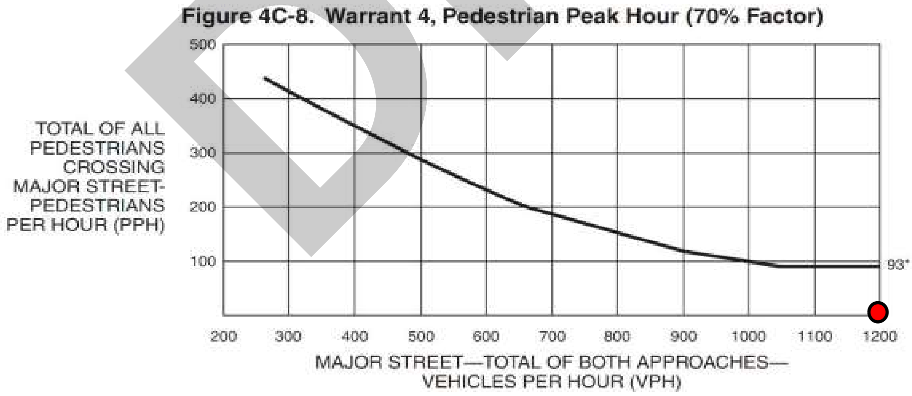
Approach Lanes	7 AM-8 AM	8 AM-9 AM	2 PM-3 PM	3 PM-4 PM	4 PM-5 PM	5 PM-6 PM
Both Approaches Major Street	1483	1824	1330	1741	1728	1629
Pedestrians Crossing Major-	1	0	0	0	0	0

Point falls above the the applicable four-hour curve
Point falls above the the applicable peak-hour curve

Figure 4C-6. Warrant 4, Pedestrian Four-Hour Volume (70% Factor)

Plotted points representing the VPH above the applicable curve (0 total)
Plotted points representing the VPH below the applicable curve (6 total)

Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)



Plotted points representing the VPH above the applicable curve (0 total)
Plotted points representing the VPH below the applicable curve (6 total)

Attachment F – Caltrans' Crestmont Drive Public Records Center Traffic Signal Warrants

DRAFT

Figure 4C-101 (CA). Traffic Signal Warrants Worksheet (Sheet 1 of 5)

05	SLO	227	R9.37
DIST	CO	RTE	PM

COUNT DATE 02/05/2014
CALC ____ DATE ____
CHK JMG DATE 02/13/2014

Major St: Edna Road (Rte. 227) Critical Approach Speed 55 mph
Minor St: Crestmont Drive Critical Approach Speed ____ mph

Speed limit or critical speed on major street traffic > 40 mph........................ ☑
or } RURAL (R)
In built up area of isolated community of < 10,000 population........................ ☐

☐ URBAN (U)

WARRANT 1 - Eight Hour Vehicular Volume SATISFIED YES ☐ NO ☑
(Condition A or Condition B or combination of A and B must be satisfied)

Condition A - Minimum Vehicle Volume
100% SATISFIED YES ☐ NO ☑
80% SATISFIED YES ☐ NO ☑

	MINIMUM REQUIREMENTS (80% SHOWN IN BRACKETS)												
	U	R	U	R									
APPROACH LANES	1		2 or More		07/08	08/09	11/12	12/13	14/15	15/16	16/17	17/18	Hour
Both Approaches Major Street	500 (400)	350 (280)	600 (480)	420 (336)	1314	1773	876	1039	1397	1461	1657	1666	
Highest Approach Minor Street	150 (120)	105 (84)	200 (160)	140 (112)	73	69	42	53	50	49	38	37	

Condition B - Interruption of Continuous Traffic
100% SATISFIED YES ☐ NO ☑
80% SATISFIED YES ☐ NO ☑

	MINIMUM REQUIREMENTS (80% SHOWN IN BRACKETS)												
	U	R	U	R									
APPROACH LANES	1		2 or More		07/08	08/09	11/12	12/13	14/15	15/16	16/17	17/18	Hour
Both Approaches Major Street	750 (600)	525 (420)	900 (720)	630 (504)	1314	1773	876	1039	1397	1461	1467	1666	
Highest Approach Minor Street	75 (60)	53 (42)	100 (80)	70 (56)	73	69	42	53	50	49	38	37	

Combination of Conditions A & B SATISFIED YES ☐ NO ☑

REQUIREMENT	CONDITION	✓	FULFILLED
TWO CONDITIONS SATISFIED 80%	A. MINIMUM VEHICULAR VOLUME	☐	Yes ☐ No ☑
	AND, B. INTERRUPTION OF CONTINUOUS TRAFFIC	☐	
AND, AN ADEQUATE TRIAL OF OTHER ALTERNATIVES THAT COULD CAUSE LESS DELAY AND INCONVENIENCE TO TRAFFIC HAS FAILED TO SOLVE THE TRAFFIC PROBLEMS			Yes ☐ No ☑

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

Figure 4C-101 (CA). Traffic Signal Warrants Worksheet (Sheet 2 of 5)

WARRANT 2 - Four Hour Vehicular Volume SATISFIED* YES ☐ NO ☑

Record hourly vehicular volumes for any four hours of an average day.

APPROACH LANES	One	2 or More	07/08	08/09	12/13	14/15	Hour
Both Approaches - Major Street	✔		1714	1773	1039	1397	
Higher Approach - Minor Street	✔		73	69	53	50	

*All plotted points fall above the applicable curve in Figure 4C-1. (URBAN AREAS)	Yes ☐	No ☐
<u>OR</u>, All plotted points fall above the applicable curve in Figure 4C-2. (RURAL AREAS)	Yes ☐	No ☑

WARRANT 3 - Peak Hour
(Part A or Part B must be satisfied) SATISFIED YES ☐ NO ☑

<u>PART A</u> SATISFIED YES ☐ NO ☑

(All parts 1, 2, and 3 below must be satisfied for the same one hour, for any four consecutive 15-minute periods)

1. The total delay experienced by traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one-lane approach, or five vehicle-hours for a two-lane approach; <u>AND</u>	Yes ☐	No ☐
2. The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes; <u>AND</u>	Yes ☐	No ☑
3. The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more approaches or 650 vph for intersections with three approaches.	Yes ☑	No ☐

<u>PART B</u> SATISFIED YES ☐ NO ☑

APPROACH LANES	One	2 or More	07/08	Hour
Both Approaches - Major Street	✔		1314	
Higher Approach - Minor Street	✔		73	

The plotted point falls above the applicable curve in Figure 4C-3. (URBAN AREAS)	Yes ☐	No ☐
<u>OR</u>, The plotted point falls above the applicable curve in Figure 4C-4. (RURAL AREAS)	Yes ☐	No ☑

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

Figure 4C-101 (CA). Traffic Signal Warrants Worksheet (Sheet 3 of 5)

WARRANT 4 - Pedestrian Volume
(Parts 1 and 2 Must Be Satisfied)

SATISFIED YES ☐ NO ☑

Part 1 (Parts A or B must be satisfied)

A.

Hours - - ->				
Vehicles per hour for any 4 hours				
Pedestrians per hour for any 4 hours				

Figure 4C-5 or Figure 4C-6
SATISFIED YES ☐ NO ☑

B.

Hours - - ->				
Vehicles per hour for any 1 hour				
Pedestrians per hour for any 1 hour				

Figure 4C-7 or Figure 4C-8
SATISFIED YES ☐ NO ☑

Part 2 **SATISFIED** YES ☐ NO ☐

AND, The distance to the nearest traffic signal along the major street is greater than 300 ft	Yes ☐	No ☐
OR, The proposed traffic signal will not restrict progressive traffic flow along the major street.	Yes ☐	No ☐

WARRANT 5 - School Crossing
(Parts A and B Must Be Satisfied)

SATISFIED YES ☐ NO ☑

Part A
Gap/Minutes and # of Children

SATISFIED YES ☐ NO ☐

		Hour
Gaps vs Minutes	Minutes Children Using Crossing	
	Number of Adequate Gaps	
School Age Pedestrians Crossing Street / hr		

Gaps < Minutes YES ☐ NO ☐
AND Children > 20/hr YES ☐ NO ☐

AND, Consideration has been given to less restrictive remedial measures.	Yes ☐	No ☐

Part B **SATISFIED** YES ☐ NO ☐

The distance to the nearest traffic signal along the major street is greater than 300 ft	Yes ☐	No ☐
OR, The proposed signal will not restrict the progressive movement of traffic.	Yes ☐	No ☐

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

Figure 4C-101 (CA). Traffic Signal Warrants Worksheet (Sheet 4 of 5)

WARRANT 6 - Coordinated Signal System
(All Parts Must Be Satisfied)

SATISFIED YES ☐ NO ✔

MINIMUM REQUIREMENTS	DISTANCE TO NEAREST SIGNAL	
≥ 1000 ft	N 2376 ft, S 1478 ft, E ______ ft, W ______ ft	Yes ✔ No ☐
On a one-way street or a street that has traffic predominantly in one direction, the adjacent traffic control signals are so far apart that they do not provide the necessary degree of vehicular platooning. OR, On a two-way street, adjacent traffic control signals do not provide the necessary degree of platooning and the proposed and adjacent traffic control signals will collectively provide a progressive operation.		Yes ☐ No ✔

WARRANT 7 - Crash Experience Warrant
(All Parts Must Be Satisfied)

SATISFIED YES ☐ NO ✔

Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency.			Yes ☐ No ✔
REQUIREMENTS	Number of crashes reported within a 12 month period susceptible to correction by a traffic signal, and involving injury or damage exceeding the requirements for a reportable crash.		Yes ☐ No ✔
5 OR MORE	0		
REQUIREMENTS	CONDITIONS	√	
ONE CONDITION SATISFIED 80%	Warrant 1, Condition A - Minimum Vehicular Volume	☐	Yes ☐ No ✔
	OR, Warrant 1, Condition B - Interruption of Continuous Traffic	☐	
	OR, Warrant 4, Pedestrian Volume Condition Ped Vol ≥ 152 for any hour OR, Ped Vol ≥ 80 for any 4 hours	☐	

WARRANT 8 - Roadway Network
(All Parts Must Be Satisfied)

SATISFIED YES ☐ NO ✔

MINIMUM VOLUME REQUIREMENTS	ENTERING VOLUMES - ALL APPROACHES	√	FULFILLED
1000 Veh/Hr	During Typical Weekday Peak Hour 1703 Veh/Hr and has 5-year projected traffic volumes that meet one or more of Warrants 1, 2, and 3 during an average weekday.	✔	Yes ✔ No ☐
	OR During Each of Any 5 Hrs. of a Sat. or Sun ______ Veh/Hr	☐	

CHARACTERISTICS OF MAJOR ROUTES	MAJOR ROUTE A	MAJOR ROUTE B	
Hwy. System Serving as Principal Network for Through Traffic	✔	☐	
Rural or Suburban Highway Outside Of, Entering, or Traversing a City	✔	☐	
Appears as Major Route on an Official Plan	✔	☐	
Any Major Route Characteristics Met, Both Streets			Yes ☐ No ✔

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

Figure 4C-101 (CA). Traffic Signal Warrants Worksheet (Sheet 5 of 5)

WARRANT 9 - Intersection Near a Grade Crossing (Both Parts A and B Must Be Satisfied) **SATISFIED YES ☐ NO ☑**

PART A A grade crossing exists on an approach controlled by a STOP or YIELD sign and the center of the track nearest to the intersection is within 140 feet of the stop line or yield line on the approach. Track Center Line to Limit Line ______ ft	Yes ☐ No ☐
PART B **There is one minor street approach lane at the track crossing -** During the highest traffic volume hour during which rail traffic uses the crossing, the plotted point falls above the applicable curve in Figure 4C-9. Major Street - Total of both approaches: ______ VPH Minor Street - Crosses the track (one direction only, approaching the intersection): ______ VPH X AF (Use Tables 4C-2, 3, & 4 below to calculate AF) = ______ VPH **OR, There are two or more minor street approach lanes at the track crossing -** During the highest traffic volume hour during which rail traffic uses the crossing, the plotted point falls above the applicable curve in Figure 4C-10. Major Street - Total of both approaches : ______ VPH Minor Street - Crosses the track (one direction only, approaching the intersection): ______ VPH X AF (Use Tables 4C-2, 3, & 4 below to calcualte AF) = ______ VPH	Yes ☐ No ☐

The minor street approach volume may be multiplied by up to three following adjustment factors (AF) as described in Section 4C.10.

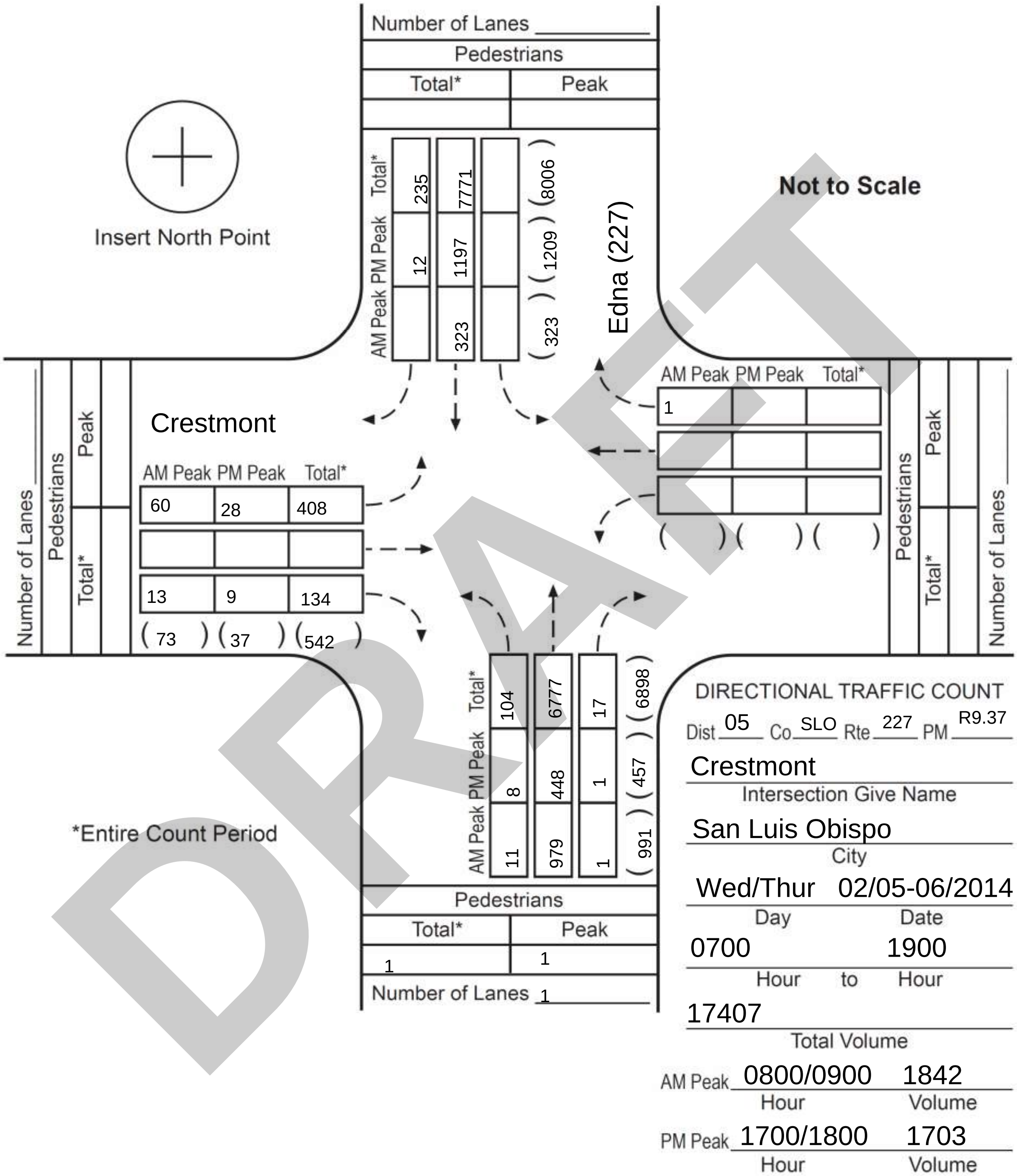
1- Number of Rail Traffic per Day______________________________ Adjustment factor from table 4C-2____

2- Percentage of High-Occupancy Buses on Minor Street Approach_____ Adjustment factor from table 4C-3____

3- Percentage of Tractor-Trailer Trucks on Minor Street Approach_______ Adjustment factor from table 4C-4____

NOTE: If no data is availale or known, then use AF = 1 (no adjustment)

Figure 4C-102 (CA). Traffic Count Worksheet



Attachment G – Crestmont Drive Public Records Center Crash History

OTM22130

Table B - Selective Accident Rate Calculation

Policy controlling the use of Traffic Accident Surveillance and Analysis System (TASAS) - Transportation Systems Network (TSN) Reports

1. TASAS - TSN has officially replaced the TASAS - "Legacy" database.

2. Reports from TSN are to be used and interpreted by the California Department of Transportation (Caltrans) officials or authorized representative.

3. Electronic versions of these reports may be emailed between Caltrans' employees only using the State computer system.

4. The contents of these reports shall be considered confidential and may be privileged pursuant to 23 U.S.C. Section 409, and are for the sole use of the intended recipient(s). Any unauthorized review, use, disclosure or distribution is prohibited. If you are not the intended recipient, please contact the sender by reply e-mail and destroy all copies of the original message. Do not print, copy or forward.

OTM22130

Table B - Selective Accident Rate Calculation

Report Parameters-

Event ID: 4327638

Request Name: CPRA R010858-060321

Ref Date: 06/15/2021

Request- & Line	LOC	DIR	LSC	Route/Location	Begin Date	End Date	Rate Type	Out Seq	Override Rates			Override ADT		Req. Type	Com-bine?	Excl Ramp?
									Rate	Inj%	Fat%	Main	Cross			
1 1	I	T	I	05 SLO 227 R009.055 - 05 SLO 227 R009.819	01-OCT-17	30-SEP-20	N	L						N	N	N

<u>Event Log:</u>

Job id is : 223815 Accidents Table B Request CPRA R010858-060321 Submitted by T5SCADEN
05 SLO 227 R 9.055 - 05 SLO 227 R 9.819 10/01/2017 TO 09/30/2020

California Department of Transportation

Table B - Selective Accident Rate Calculation

Location Description	**Rate Group (RUS)**	Tot	Fat	Inj	F+I	Multi Veh	Wet	Dark	**Pers** Kld / Inj	**ADT** Main / X-St	Total **MV+** or **MVM**	Actual Fat	Actual F+I	Actual Tot	Average Fat	Average F+I	Average Tot
		No. of Accidents / Significance										**Accident Rates**					
05 SLO 227 R009.089 LOS RANCHOS RD 0001-0001 2017-10-01 2020-09-30 *36 mo.*	I 04 R	4	0	1	1	4	0	0	0 1	15.4 3.1	20.25 +	0.000	.05	.20	0.005	.21	.54
05 SLO 227 R009.367 CRESTMONT RD 0001-0001 2017-10-01 2020-09-30 *36 mo.*	I 17 R	3	0	1	1	3	0	0	0 2	15.5 1.4	18.49 +	0.000	.05	.16	0.003	.08	.19
05 SLO 227 R009.818 BUCKLEY RD 0001-0001 2017-10-01 2020-09-30 *36 mo.*	I 09 S	10	0	5	5	9	0	1	0 8	16.1 2.2	20.05 +	0.000	.25	.50	0.002	.16	.42

Accident Rates expressed as: **# of accidents / Million vehicle miles**

+ denotes that **Million Vehicles** (MV) used in accident rates instead (for intersections and ramps).

For Ramps RUS only considers R(Rural) U(Urban)

Sean Houck, P.E.
Sean.Houck@kimley-horn.
com
916-571.1016

Kimley-Horn
555 Capitol Mall
Suite 300
Sacramento, CA 95814

www.kimley-horn.com