Eaton and SR 99 Southbound Ramps

Intersection Control Evaluation

City of Chico

September 22, 2022

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1. Introduction

The City of Chico (City) has retained GHD to analyze and recommend transportation improvements for the intersection of Eaton Road & the State Route (SR) 99 Southbound (SB) Ramps (study intersection). This Intersection Control Evaluation (ICE) Report has been created to compile and present the findings of this analysis.

This project is located in the north-western portion of the City and is the western section of the SR 99/Eaton Road interchange. This intersection currently operates as a side-street stop-controlled intersection that has delay issues for the SB off ramp, which will only worsen in the future.

The adjacent northbound ramps and Eaton Road intersection is currently being converted to a roundabout (construction nearly complete as of May 2022). In addition, the City is considering converting the nearby signalized intersection of Eaton Road & Esplanade to a roundabout. With improvements occurring at adjacent intersections, there is a need to analyze intersection alternatives at the southbound SR 99 ramps and Eaton Road to see what improvements would be most beneficial, best incorporates complete street design, and conforms to Caltrans requirements for the Intersection Control Evaluation (ICE), which are contained in this report.

1.1 Intersection Improvements

The intersection has operational issues, which will only increase in the future. Intersection improvements being considered in this ICE include signalization or a modern roundabout. This report evaluates both alternatives at the study intersection to determine whether the improvements would adequately address delay and safety concerns under existing and future conditions, consistent with ICE requirements.

1.2 Purpose and Need

The purpose of the project is to improve vehicular operations, circulation, and accessibility for all modes of travel at the study area. The purpose of improving circulation in the study area includes reduction of vehicle delay, reduction of emissions, reduction in collision frequency and severity, and reduction of barriers to active transportation. Additionally, the adjacent (signalized) intersection to the east is currently being converted to a roundabout and a nearby intersection the west is being considered for further improvements. This portion of Eaton Road has tight intersection spacing and should be analyzed in conjunction with the adjacent corridor improvements.

1.3 Project Background

Under existing conditions, the intersection of Eaton Road & the SR 99 SB Ramps currently operates as a side-street stop controlled intersection with the southbound off ramp being the stop controlled movement. Currently the intersection operates at an unacceptable level of service (LOS) and is only projected to worsen in the future. The adjacent interchange intersection has been analyzed in a previous study and is currently being converted to a roundabout based on the analysis performed. The signalized intersection to the west has also been analyzed to see if a roundabout would be feasible. With the current operations and the two adjacent intersections either being converted to a roundabout or being considered for a roundabout, this intersection is another such location that should be analyzed to determine what improvements could help current and future operations.

1.3.1 Previous Studies

Two previous studies were used as references for this report as they pertained to the adjacent intersections. First is the *SR 99 NB Ramps/Eaton Road Intersection Control Evaluation (ICE)* which analyzed the eastern section of the SR 99/Eaton Road interchange. This study resulted in approval for the roundabout design that is currently being constructed.

The second study that was referenced was the *Eaton Road/Esplanade Roundabout Feasibility Study* which analyzed an adjacent intersection to the west of the study intersection. These studies were used to determine the traffic volumes at the intersection of as documented in the Traffic Analysis Methodology section. They also helped determine any potential design constraints.

2. Existing Conditions

2.1 Study Area

The Project area is located in northwest Chico near the city limits. The SR 99/Eaton Road interchange is the northern most interchange in the City. There is mostly residential or undeveloped land to the east of the interchange and commercial to the west. The interchange also allows access to Esplanade a main arterial in the City.

Figure 1 presents a vicinity map of the study area.

Roadways

Roadways that provide the primary vehicle circulation within the study area are Eaton Road and SR 99. The following are brief descriptions of the study area roadways.

Eaton Road is an east-west arterial roadway that traverses the entire City, connecting Floral Avenue to SR 99 and SR 32 (in build-out conditions). Eaton Road west of the project is a two to four-lane roadway with a connected sidewalk network (posted 40 mph). East of the project, Eaton Road is a two-lane roadway with class 2 bike lanes and intermittent sidewalks on the south side of the road. East of the SR 99 overcrossing Eaton Road has a posted speed of 40 mph.

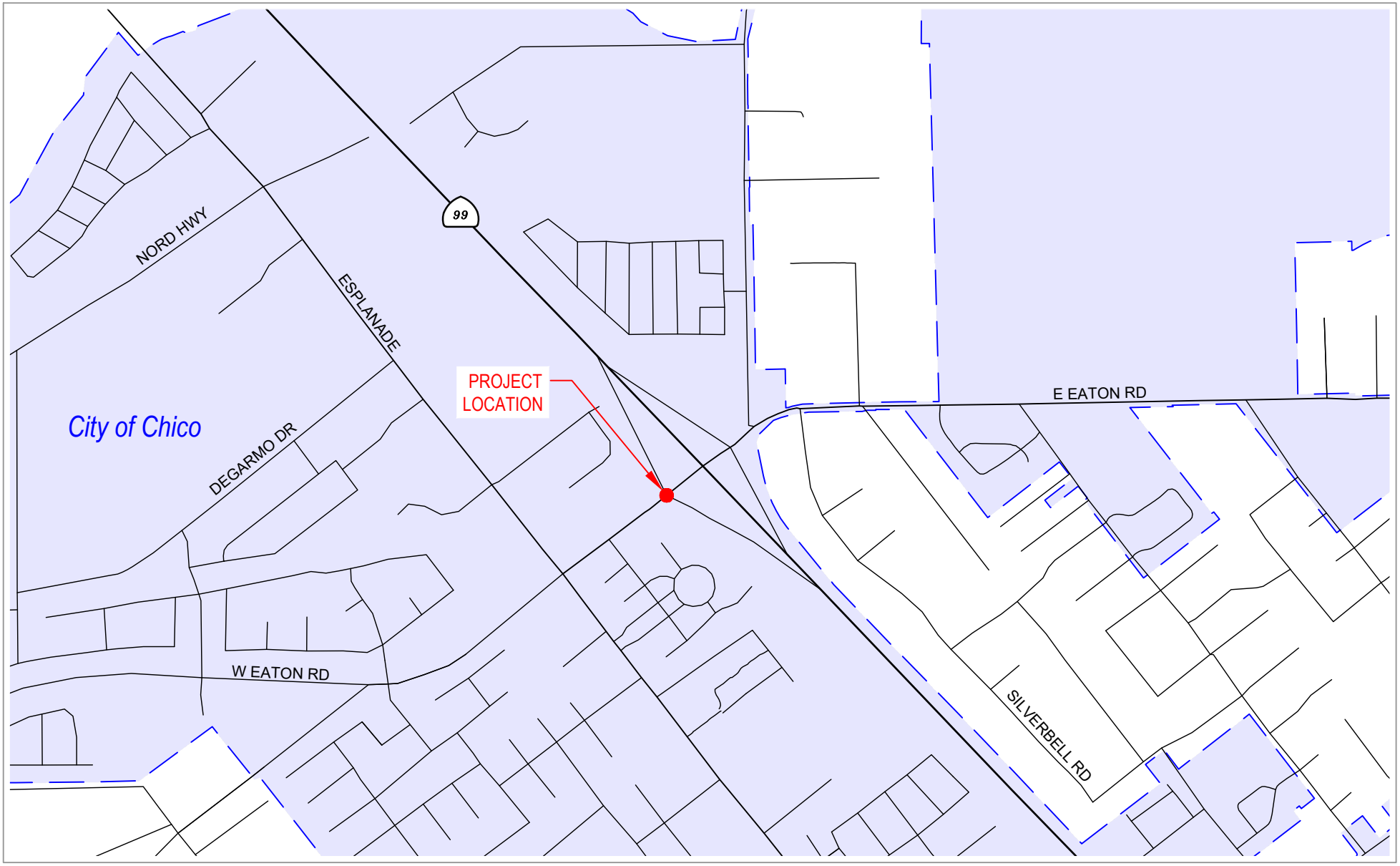
SR 99 is a four-lane divided freeway that runs north-south through the City. It provides circulation throughout the City and serves as a primary route north to Red Bluff and south to Gridley and Yuba City.

Intersection

One intersection was selected for evaluation in this study. The following is a brief description of the study intersection.

Eaton Road and SR 99 SB Ramps is a four legged intersection with side-street stop control. The north leg is the off-ramp for southbound SR 99 while the south leg is the on ramp. The west and east legs are Eaton Road. There is a pedestrian crossing on the south leg, with sidewalk available only on the southeast corner of the intersection. The eastbound approach provides a class 2 bike lane that transitions to a class 3 bike lane along the overcrossing.

Figure 2 presents the existing lane geometrics and control for the study intersection.



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1 inch = 1000 ft.

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City of Chico
Eaton Road/SR 99 Southbound Ramps ICE

Vicinity Map

Project No. **11219784**
Report No.
Date **May 2022**

FIGURE 1

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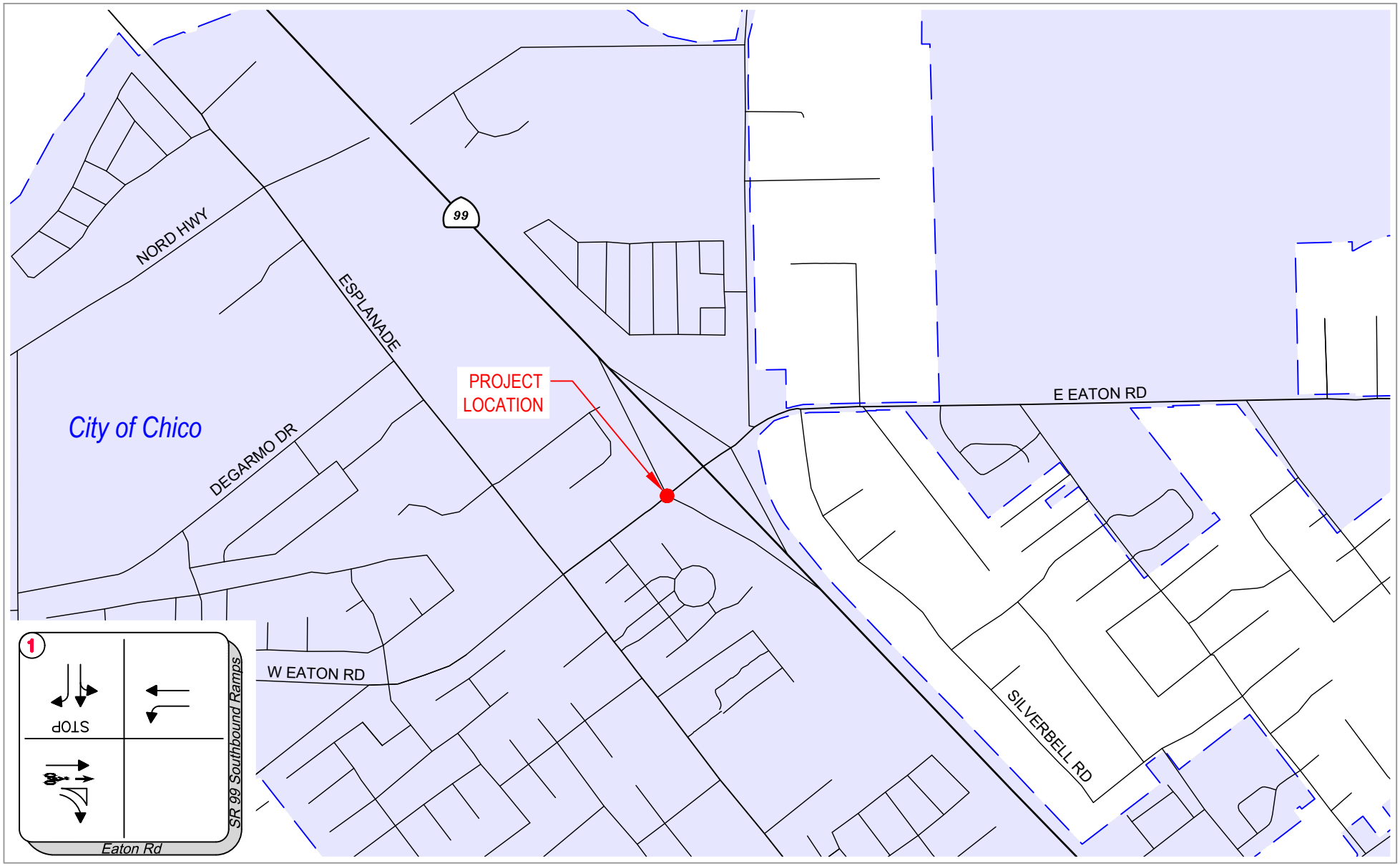

LEGEND:

BICYCLE LANE

VEHICLE LANE

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Eaton Road/SR 99 Southbound Ramps ICE

Existing Lane Geometrics & Control

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FIGURE 2

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2.2 Traffic Analysis Methodology

Data Collection and Analysis Time Periods

Due to the COVID pandemic, current year traffic volumes were derived using a variety of sources. The base volumes that were used were collected at the study intersection in 2017. These counts were compared, along with the volumes at the adjacent ramp from the SR 99 Northbound Ramps/Eaton Road ICE, to the 2020 counts collected at the intersection of Eaton Road & Esplanade for the roundabout feasibility study. The volumes were adjusted for the feasibility study to balance the volumes between the intersection of Eaton Road & Esplanade and the ramp intersections. These balanced intersection volumes were used for Existing Conditions.

The study intersections were analyzed during the weekday AM and PM peak hour periods. The AM peak hour is defined as the highest continuous hour of peak traffic flow counted between 7:00 am and 9:00 am and the PM peak hour is defined as the highest continuous hour of peak traffic flow counted between 4:00 pm and 6:00 pm under typical weekday conditions. Figure 3 presents the existing traffic volumes and the traffic volume counts are provided in Appendix A.

Level of Service Methodologies

The following section outlines the Level of Service (LOS) methodologies and analysis parameters used to quantify traffic operations at study locations.

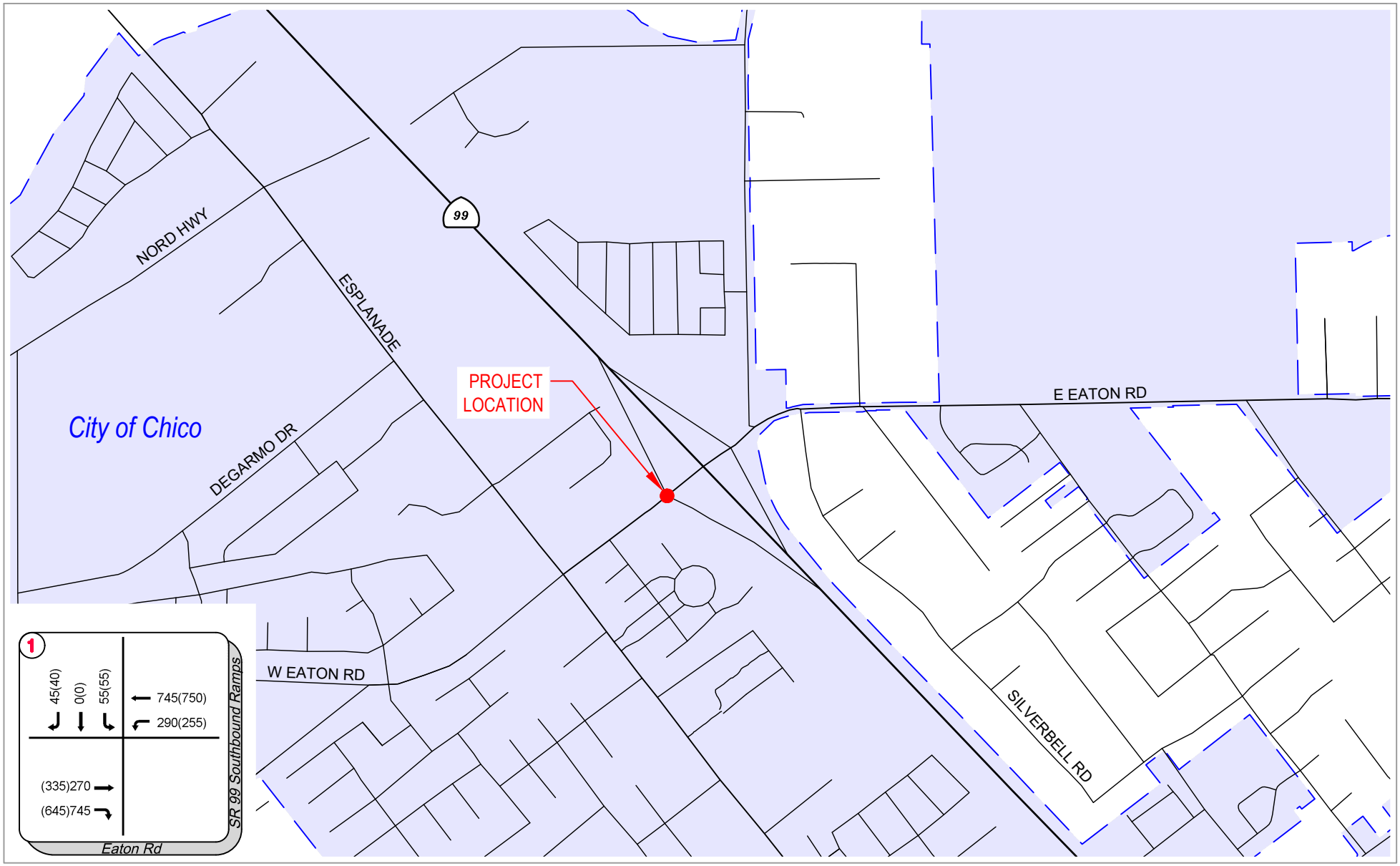
LOS has been calculated for all intersection control types using the methods documented in the Transportation Research Board's Highway Capacity Manual, Sixth Edition, HCM 6 methodology. Traffic operations have been quantified through the determination of LOS.

LOS is a qualitative measure of traffic operating conditions, whereby a letter grade A through F is assigned to an intersection or roadway segment representing progressively worsening traffic conditions. For a signalized, roundabout (RNDBT), or All-Way Stop-Controlled (AWSC) intersection, an LOS determination is based on the calculated averaged delay for all approaches and movements. For a Side-Street Stop Controlled (SSSC) intersection, an LOS determination is based upon the calculated average delay for all movements of the worst-performing side street approach. LOS definitions for different types of intersection controls are presented in Table 2.1. For unsignalized/signalized control, the LOS was determined using Synchro 10 software (Version 10.3.154.0) by Trafficware. For roundabout control, the LOS was determined using Sidra 9 software using sidra analysis methodology. All Synchro and SimTraffic LOS and Queue Reports are included in Appendix B and all Sidra LOS and Queue Reports are included in Appendix C.

The City of Chico General Plan sets a minimum target LOS of D for all streets, or LOS E for arterials served by scheduled transit or with bicycle and pedestrian facilities. Caltrans' Guide for the Preparation of Traffic Impact Studies contains the following policy pertaining to the LOS standards within Caltrans jurisdiction:

> *Caltrans endeavors to maintain a target LOS at the transition between LOS "C" and LOS "D" on State highway facilities. However, Caltrans acknowledges that this may not always be feasible and recommends that the lead agency consult with Caltrans to determine the appropriate target LOS.*

For these reasons, the LOS D target applies to all intersections in the project area.



LEGEND:

XX - AM PEAK HOUR TRAFFIC VOLUMES

(XX) - PM PEAK HOUR TRAFFIC VOLUMES

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City of Chico
Eaton Road/SR 99 Southbound Ramps ICE

2020 AM & PM Peak Hour Turning Movement Volumes

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FIGURE 3

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Table 2.1: Level of Service (LOS) Criteria for Intersections

Level of Service	Type of Flow	Delay	Maneuverability	Stopped Delay per Vehicle (seconds per vehicle)	
				Signalized	Un-signalized
A	Stable Flow	Very slight delay. Progression is very favorable, with most vehicles arriving during the green phase not stopping at all.	Turning movements are easily made, and nearly all drivers find freedom of operation.	≤10.0	≤10.0
B	Stable Flow	Good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.	Vehicle platoons are formed. Many drivers begin to feel somewhat restricted within groups of vehicles.	>10.0 and ≤20.0	>10.0 and ≤15.0
C	Stable Flow	Higher delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant, although many still pass through the intersection without stopping.	Back-ups may develop behind turning vehicles. Most drivers feel somewhat restricted	>20.0 and ≤35.0	>15.0 and ≤25.0
D	Approaching Unstable Flow	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volume-to-capacity ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	Maneuverability is severely limited during short periods due to temporary back-ups.	>35.0 and ≤55.0	>25.0 and ≤35.0
E	Unstable Flow	Generally considered to be the limit of acceptable delay. Indicative of poor progression, long cycle lengths, and high volume-to-capacity ratios. Individual cycle failures are frequent occurrences.	There are typically long queues of vehicles waiting upstream of the intersection.	>55.0 and ≤80.0	>35.0 and ≤50.0
F	Forced Flow	Generally considered to be unacceptable to most drivers. Often occurs with over saturation. May also occur at high volume-to-capacity ratios. There are many individual cycle failures. Poor progression and long cycle lengths may also be major contributing factors.	Jammed conditions. Back-ups from other locations restrict or prevent movement. Volumes may vary widely, depending principally on the downstream back-up conditions.	>80.0	>50.0

Technical Analysis Parameters

The evaluation incorporated appropriate heavy vehicle adjustment factors, peak hour factors, environmental factors, and reported the resulting intersection delays and LOS as estimated using the HCM 6 analysis methodologies for the synchro analysis and Sidra Standard methodology for the Sidra analysis. In addition to LOS the 95th percentile queues were also included in the analysis. 95th percentile queues are the queue length that is as long or longer than 95 percent of the queues that form on that lane during the peak hour.

Table 2.2 below presents the technical parameters that will be utilized for the evaluation of the study intersections for the analysis scenarios. All parameters not listed should be assumed as default values or calculated based on parameters listed.

Table 2.2: Technical Analysis Parameters for LOS

	Technical Parameter	Assumption
1	Intersection Peak Hour Factor (PHF)	Based on counts, intersection overall, 0.92 minimum was used for 2040 analysis.
2	Intersection Heavy Vehicle Percent (HV%)	Based on counts, intersection overall, minimum 2 percent

2.3 Existing Traffic Operations

Existing conditions presents the analysis scenarios in which current operations at the study location are analyzed and establishes a baseline.

Existing weekday AM and PM peak hour intersection traffic operations were quantified using existing traffic volumes and existing lane geometrics and controls. Table 2.3 presents the intersection operations and queue lengths for existing conditions during the weekday AM and PM peak hours for the study intersection.

Table 2.3: Existing Conditions Traffic Operations

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour				PM Peak Hour			
				Delay[3]	LOS	95th Percentile Queue (ft)	Available Storage	Delay[3]	LOS	95th Percentile Queue (ft)	Available Storage
	Eaton Road & SR 99 SB Ramps	SSSC	**D**	**108.0**	**F**	**-**	**-**	**93.7**	**F**	**-**	**-**
	Westbound Left Eaton Road		D	8.8	A	77	100	8.9	A	67	100
	Westbound Thru Eaton Road		D	0.0	A	0	-	0.0	A	0	-
1	**Southbound Left/Thru SR 99**		**D**	**183.2**	**F**	67	-	**150.3**	**F**	68	-
	Southbound Right SR 99 Ramps		D	16.2	C	49	130	15.8	C	49	130
	Eastbound Thru Eaton Road		D	0.0	A	20	-	0.0	A	14	-
	Eastbound Right Eaton Road		D	0.0	A	40	-	0.0	A	26	-

Notes:
1. SSSC = Side Street Stop Control
2. LOS = Delay based on worst minor street approach for SSSC intersections
3. Delay = Stopped Delay per Vehicle in seconds
4. **Bold** = Unacceptable Conditions

As presented in Table 2.3, the intersection of Eaton Road & the SR 99 SB Ramps currently operates at an unacceptable LOS in both peak hours for existing conditions. Additionally, the existing 95th percentile queue lengths are all within the available storage.

2.4 Collision Analysis and Safety Summary

The most recent five years of available collision data were reviewed to identify safety concerns in the project area. A total of 4 collisions were reported in the project area according to data from the Statewide Integrated Traffic Records System (SWITRS) from 2016 through 2020. While this is a relatively small number of overall collisions, analysis of the contributing factors and behaviors involved in the crashes informed development of improvement alternatives at the study intersection.

Of the 4 reported collisions, 1 occurred at the intersection and the other 3 occurred near the intersection, still in the influence area of the intersection. All 4 collisions were property damage only. Collisions occurred throughout the day, with 2 happening in the middle of the night, 1 at midday, and 1 in the afternoon.

Collision reports in California include a field to assign a Primary Collision Factor believed to be the main contributing behavior, as well as a California Vehicle Code violation, if applicable. Of the 4 collisions, 2 had a primary collision factor of improper turning, 1 was unsafe speed and 1 was right of way, which means a party failed to appropriately yield to a driver of an automobile. These factors suggest a need for improvements to the study intersection that better regulate driver speeds and reduce potential conflicts at the intersection.

3. Traffic Volume Forecasts

The 2040 volumes were forecasted using the deltas from the Butte County Association of Governments (BCAG) travel demand model at the study intersection to establish a base growth. These volumes were then adjusted based on the numbers used in in the SR 99/Eaton ICE and the Eaton Road/Esplanade Roundabout Feasibility Study to ensure consistency with previously reported volumes. Figure 4 presents the Year 2040 traffic volumes.

3.1 Year 2040 No Build Traffic Operations

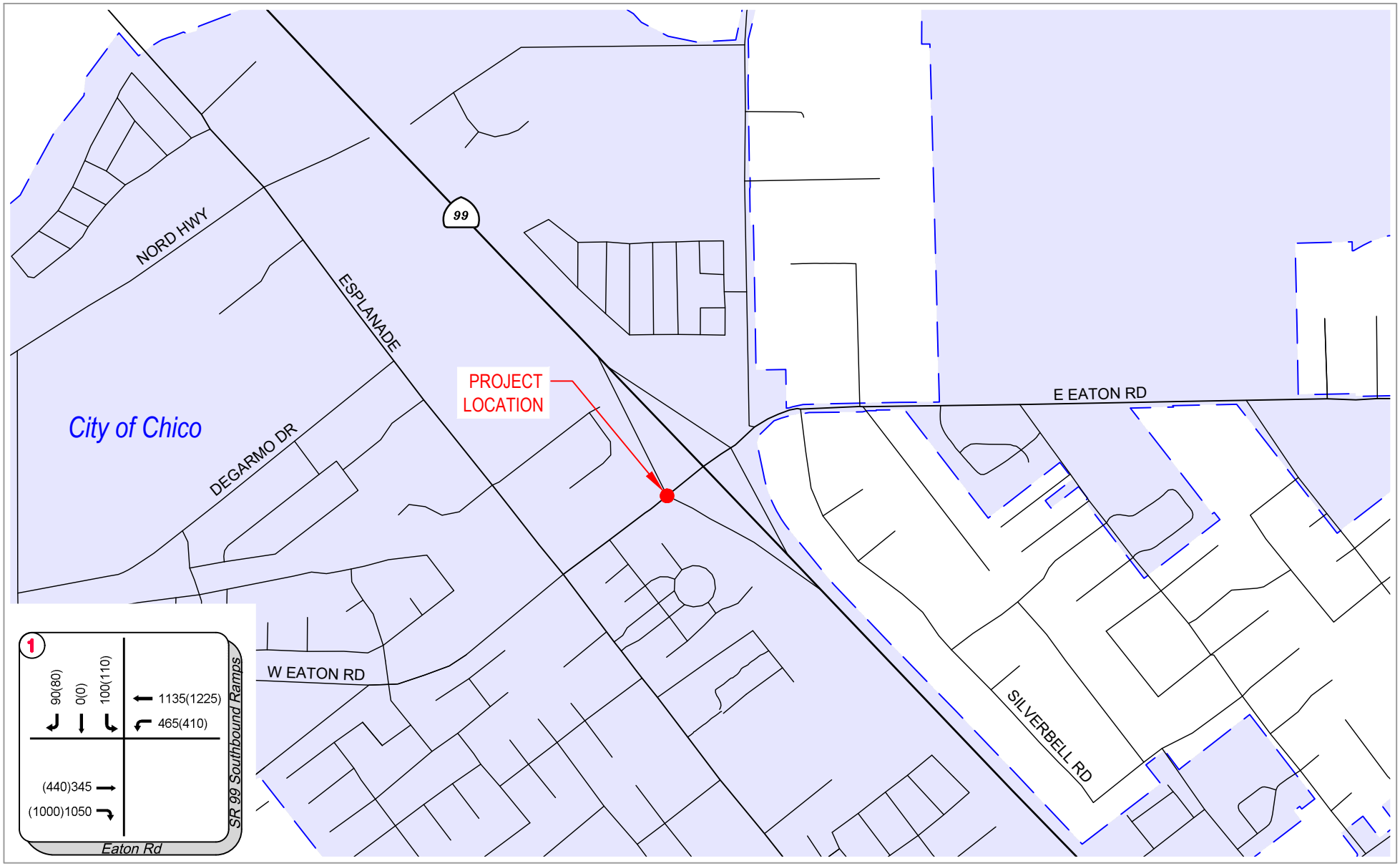
For the no build condition, Year 2040 weekday AM and PM peak hour intersection traffic operations were quantified utilizing the Year 2040 traffic volumes and existing intersection lane geometrics and control. Table 3.1 below presents the intersection operations during the weekday AM and PM peak hours.

Table 3.1: Year 2040 Conditions Traffic Operations – No Build Alternative

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour				PM Peak Hour			
				Delay[3]	LOS	95th Percentile Queue (ft)	Available Storage	Delay[3]	LOS	95th Percentile Queue (ft)	Available Storage
1	**Eaton Road & SR 99 SB Ramps**	SSSC	**D**	**OVR**	**F**	**-**	**-**	**OVR**	**F**	**-**	**-**
	Westbound Left Eaton Road		D	10.3	B	108	100	10.6	B	91	100
	Westbound Thru Eaton Road		D	0.0	A	-	-	0.0	A	2	-
	Southbound Left/Thru SR 99		**D**	**OVR**	**F**	**2445**	**1130**	**OVR**	**F**	**1937**	**1130**
	Southbound Right SR 99 Ramps		**D**	**35.0**	**E**	**206**	**130**	**39.3**	**E**	**193**	**130**
	Eastbound Thru Eaton Road		D	0.0	A	19	-	0.0	A	26	-
	Eastbound Right Eaton Road		D	0.0	A	93	-	0.0	A	68	-

Notes:
1. SSSC = Side Street Stop Control
2. LOS = Delay based on worst minor street approach for SSSC intersections
3. Delay = Stopped Delay per Vehicle in seconds
4. **Bold** = Unacceptable Conditions
5. OVR = Delay over 300 seconds

As presented in Table 3.1, the intersection of Eaton Road & the SR 99 SB Ramps is projected to operate at an unacceptable LOS in both peak hours for Year 2040 no build conditions. Additionally, the existing 95th percentile exceed the available storage for the southbound off-ramps, extending back onto SR 99.



LEGEND:

XX - AM PEAK HOUR TRAFFIC VOLUMES

(XX) - PM PEAK HOUR TRAFFIC VOLUMES

N

GHD

City of Chico
Eaton Road/SR 99 Southbound Ramps ICE

2040 AM & PM Peak Hour Turning Movement Volumes

Project No. **11219784**
Report No.
Date **May 2022**

FIGURE 4

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4. Improvement Alternatives Analysis

Improvement alternatives for the study intersection include modified controls at the intersection that will bring the intersection to acceptable operations in Year 2040. The alternatives that were analyzed were signal control improvements and modern roundabout. The following sections describe the improvement assumptions for each alternative at the intersection and provide traffic operations results.

4.1 Signalized Improvement Alternative

Traffic operations for the signalized alternative for Build Year 2040 are presented in the following section. LOS and queueing reports for the signalized alternative are provided in Appendix B Improvement assumptions for the study intersection are described in the section below. Signal alternative exhibits are provided in Appendix D

4.1.1 Signal Alterative Intersection Geometrics

For the signalized alternative, the lane geometrics were modified to add a westbound thru lane and extending the left turn pocket back to 400 feet. This will require widening of the overcrossing to allow for the additional lane and extended pocket. Additionally, the west leg was widened to add an additional westbound receiving lane.

Pedestrian and bike access were expanded to provide Class II bike lanes and six-foot-wide sidewalks along both sides of Eaton Road. At the southbound ramps intersection, high-visibility crosswalks were incorporated across both ramp legs and the west Eaton Road leg, as well as a crosswalk across the channelized eastbound right turn lane to connect to an expanded pedestrian refuge island.

4.1.2 Signalized Year 2040 Build Conditions

For the signalized build condition, Year 2040 weekday AM and PM peak hour intersection traffic operations were quantified utilizing the Year 2040 traffic volumes and the signalized alternative intersection lane geometrics and control. Table 4.1 below presents the intersection operations for the signalized alternative during the weekday AM and PM peak hours.

Table 4.1: Year 2040 Build Conditions Traffic Operations – Signal Improvement Alternative

#	Intersection	Control Type[1]	Target LOS	AM Peak Hour				PM Peak Hour			
				Delay[2]	LOS	95th Percentile Queue (ft)	Available Storage	Delay[2]	LOS	95th Percentile Queue (ft)	Available Storage
1	Eaton Road & SR 99 SB Ramps	Signal	D	10.6	B	-	-	11.2	B	-	-
	Westbound Left Eaton Road		D	17.9	B	240	400	20.8	C	362	400
	Westbound Thru Eaton Road		D	3.3	A	114	-	3.5	A	202	-
	Southbound Left/Thru SR 99		D	23.5	C	98	-	25.3	C	147	-
	Southbound Right SR 99 Ramps		D	23.9	C	53	130	24.1	C	86	130
	Eastbound Thru Eaton Road		D	17.6	B	196	-	17.7	B	294	-
	Eastbound Right Eaton Road		D	0.0	A	34	-	0.0	A	27	-

Notes:

1. LOS = Delay based on average of all approaches for Signal
2. Delay = Stopped Delay per Vehicle in seconds
3. **Bold** = Unacceptable Conditions

As presented in Table 4.1, the study intersection is projected to operate at an acceptable LOS in both peak hours for signalized build conditions. Additionally, the existing 95th percentile queue lengths are all within the available storage.

4.2 Roundabout Improvement Alternative

Traffic operations for the roundabout alternative for Build Year 2040 are presented in the following section. LOS and queueing reports for the roundabout alternative are provided in Appendix C. Improvement assumptions for the study intersection are described in the section below. Roundabout alternative exhibits are provided in Appendix E

4.2.1 Roundabout Alternative Intersection Geometrics

A preliminary roundabout alternative for the Southbound Eaton Road Ramps has been prepared for this ICE. This alternative proposes single lane entries on two of the three approaches, with the westbound approach flaring to two lanes just west of the overcrossing.

The proposed roundabout is a Hybrid 2x1 Design, with three legs possessing single lane entries. The westbound approach includes a two-lane, flared, entry and two circulating lanes for the westbound movement. Flared entries are designed when a single approach lane is abruptly flared shortly before the roundabout entry to accommodate two lanes. This approach, consistent with the SR 99 NB ramp, is designed to be a Case I approach for large vehicles, meaning truck should split/overtake both lanes to make thru and left turning movements. The roundabout is oval in shape, possessing an effective ICD of 132 feet (measured in the east/west directions) and 147 feet (measured in the north/south directions).

All entries possess radii of 90 feet and provide adequate tangency to balance truck accommodations, fastest path and path overlap for the two lane entry. The two lane entry was designed in accordance with the Caltrans HQ Roundabout Review Criteria with an entry tangent (“A” measurement) of 45 feet, meeting the desirable range of 40 to 50 feet. The exit tangent (“B” Measurement) is approximately 148-feet, exceeding the 40 foot minimum desired dimension.

The exit ramp approach was designed in accordance with Chapter 500 of the Highway Design Manual. Roundabout control was initiated by the elimination of the shoulder and initiation of curb and gutter along the left edge, effectively creating a splitter island. The ramp geometrics matches the NB ramp geometrics.

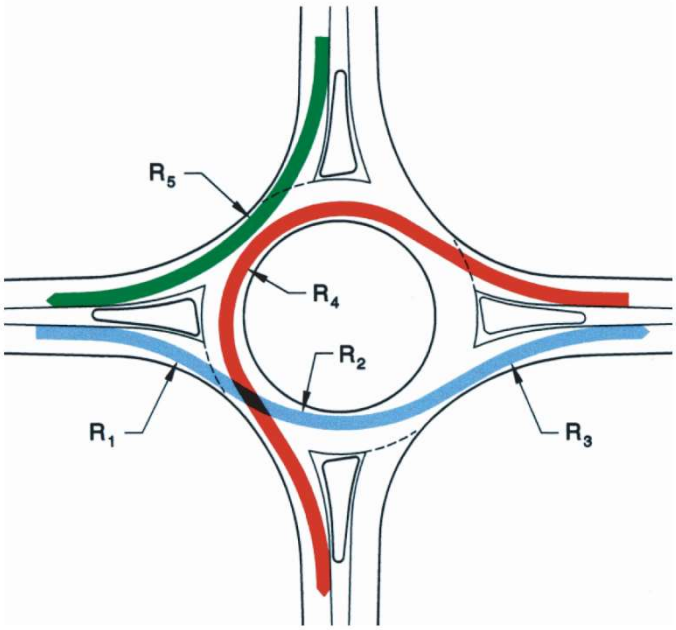
Pedestrian accommodations are provided for the roundabout alternative, through the implementation of a 10 ft wide shred use path that runs along the southern side of the intersection. this segment is a continuation of the pedestrian facilities at the northbound ramps, providing consistent pedestrian access from the Esplanade across SR 99, and terminating 60 feet west of Hackamore Lane.

4.2.1.1 Roundabout Alternative Fast Path

The “Fastest Path” represents the path that the most aggressive drivers could take through the roundabout and assumes no other traffic to be within the intersection. NCHRP Report 672 indicates that the recommended maximum vehicle entry speeds along the fastest path should be less than 30 mph at multi-lane roundabout approaches and less than 25 mph on single-lane approaches. NCHRP Report 672 also indicates that the differential speed between consecutive or conflicting projected speeds should be less than 15 mph.

As shown in Figure 5 on the next pate, fastest path speeds are determined for five critical locations, per approach. These include entry speeds (referred to as V1); through movement circulating speeds (V2); exiting speeds (V3); left turn movement circulating speeds (V4); and right turn speeds (V5).

Figure 5: Fast Path Diagram



The projected fastest-path speeds for each approach are shown below in Table 4.1.

Table 4.2: Fast Path Vehicle Speeds

Movement	Southbound Exit Ramp Road	Eastbound Eaton Road	Westbound Eaton Road
Entering (V1)	24.6	23.7	29.7
Circulating (V2)	19.9	17.7	20.9
Exiting (V3)	32.2	30.9	32.8
Left Turn (V4)	14.0	N/A	15.0
Right Turn (V5)	19.9	19.5	N/A

All vehicle entering speeds comply with NCHRP guidelines as well as the standards set with HDM index.

4.2.1.2 Vehicle Turn Movements

The AutoTurn software analysis tool was used to test the maneuverability of large design vehicles through the roundabout. From the Caltrans Highway Design Manual, 7th Edition, analysis was completed to ensure that the swept path from a 45 foot Bus navigate the roundabout without mounting the truck apron at the center island. The 45 foot bus does require the use of both approach lanes at the eastern leg to navigate left turns without mounting the central island apron. The roundabout was designed for the STAA design vehicle. STAA movements utilized the central island truck apron as well as a right turn outside apron (truck blister) for the partial bypass at the western leg of Eaton Road.

4.2.1.3 Natural Path Alignment

The "Natural Path" is the path that drivers will comfortably and naturally steer their vehicle through the roundabout, assuming that other traffic is also present in the intersection. Determining natural paths is particularly important on multi-lane approaches and circulating areas of roundabouts when considering the potential for path overlap problems. In order for most drivers to drive a fluid and natural path, the potential for path overlap, consecutive curve radii and associated speeds should not differ drastically, and sufficient space should be provided for drivers to transition between reversing curves. Multilane roundabout approaches were designed with natural path in mind, lining drivers up prior to the yield line with their lane to eliminate path overlap issues.

4.2.1.4 Sight Distance

Intersection sight distance differs at roundabouts versus other intersection. Drivers must be able to see potentially conflicting oncoming traffic from the left as they approach the roundabout entry. NCHRP Report 672 provides methodologies to establish the required sight distance triangles for conflicting traffic, as well as pedestrians in crosswalks, for both entering and circulating vehicle movements. Intersection Sight distances as well as other sight distances within or near the roundabout intersection were established using methodologies established within NCHRP report 672. Approach sight triangle lengths utilized the standard Caltrans stopping sight distances established by the Highway Design Manual Table 201.1 for each leg's applicable design speed.

4.2.1.5 Angle of Visibility

The angle between consecutive entries must not be overly acute in order to allow drivers to comfortably turn their heads to the left to view oncoming traffic from the adjacent upstream entry and circulatory roadway. Guidance from the NCHRP Section 6.7.4 recommends a minimum 75-degree intersection angle. All angles of visibility exceed the minimum acceptable value of 75 degrees.

4.2.1.6 Entry Angle

NCHRP Report 672 establishes design guidance but does not establish methodology for analyzing entry angle. The general guidance is that entry angles should vary from 20 degrees to 40 degrees. All entry angles, including the right turn bypass angle, range between 20 and 26 degrees, providing deflection from the central island, while maintain good roadway alignment and truck accommodations. For more information, see design check exhibits.

4.2.2 Roundabout Year 2040 Build Conditions

For the roundabout build condition, Year 2040 weekday AM and PM peak hour intersection traffic operations were quantified utilizing the Year 2040 traffic volumes and the roundabout alternative intersection lane geometrics and control. Table 4.3 below presents the intersection operations for the roundabout alternative during the weekday AM and PM peak hours.

Table 4.3: Year 2040 Build Conditions Traffic Operations – Roundabout Alternative

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour				PM Peak Hour			
				Delay[3]	LOS	95th Percentile Queue (ft)	Available Storage	Delay[3]	LOS	95th Percentile Queue (ft)	Available Storage
1	Eaton Road & SR 99 SB Ramps	RNDBT	D	9.6	A	-	-	7.5	A	-	-
	Westbound Left/Thru Eaton Road		D	3.4	A	0	600	3.0	A	0	600
	Westbound Thru Eaton Road		D	0.1	A	0	100	0.1	A	0	100
	Southbound SR 99 Ramps		D	17.5	B	53	-	15.3	B	43	-
	Eastbound Thru/Right Eaton Road		D	12.9	B	283	425	11.1	B	273	425
	Eastbound Right Eaton Road		D	23.4	C	330	425	15.9	B	265	425

Notes:

1. RNDBT = Roundabout
2. LOS = Delay based on average of all approaches for RNDBT
3. Delay = Stopped Delay per Vehicle in seconds
4. **Bold** = Unacceptable Conditions

As presented in Table 4.3, the study intersection is projected to operate at an acceptable LOS in both peak hours for signalized build conditions. Additionally, the existing 95th percentile queue lengths are all within the available storage.

5. Life Cycle Benefit/Cost Analysis

The following sections present a brief summary of the parameters used to assess and monetize the life cycle benefits and costs for each of the proposed build alternatives.

Safety Benefit

Safety costs associated with collisions anticipated for each proposed intersection improvement were quantified using the Caltrans Intersection Control Evaluation Collision Cost Analysis spreadsheet.

To compute the existing collision rate, existing collision data over a five year period was utilized. The intersection ADT was converted to a Million Vehicle (MV) per year. The number of collisions were then divided by the total number of vehicles to obtain a collision rate (collision/MV). This determines the base cost of collisions for existing conditions.

Costs associated with collisions anticipated for each proposed intersection improvement were quantified using the Caltrans Intersection Control Evaluation Collision Cost Analysis spreadsheet.

Due to the low number of collisions in the project area, the monetized safety benefit is relatively low and does not currently reflect a safety-driven project. In the future as traffic volumes increase, additional collisions may occur that result in a greater safety benefit than currently documented.

The benefits of converting to a roundabout would reduce the number of conflict points for vehicles. Additionally, roundabouts reducing the entry speed of vehicles reducing the severity of any collision that do occur. Signal improvements will reduce congestion, which would in turn reduce potential collisions.

Vehicular Delay Reduction Benefit

To calculate the delay reduction benefit, the value of travel time was quantified for each proposed build alternative. Costs associated with vehicular delay were computed using the delay for the AM and PM peak hour periods of all the alternatives. In assessing the delay costs, the weighted average for costing the value of time for automobiles and trucks was used.

An average delay cost of $18.65/person/hour was used—a value escalated from the original value in the published data by Caltrans for Vehicle Operation Costs Parameters for 2016 (https://dot.ca.gov/programs/transportation-planning/economics-datamanagement /transportation-economics/vehicle-operation-cost-parameters). The rate was grown by 12% from the 2016 values, based on 2% per year, and was weighted based on heavy vehicle percentages. The delay reduction benefit, therefore, includes the reduction in delay in dollar amounts compared to No Build conditions.

Fuel Benefit

To calculate the fuel cost for the alternatives, the vehicle operating costs were quantified. The fuel costs (vehicle operating costs) were computed using the delay for the AM and PM peak hour periods of all alternatives. An average fuel price for regular unleaded automobile fuel of $4.09 was used based on the last year's average price at the pump adjusted to rates.

Environmental Benefit

To calculate the environmental cost, the greenhouse gas emissions costs were quantified for the project. The health cost of Carbon Monoxide (CO) in a rural/suburban California town is $84/ton. The health cost of Nitrogen Oxide is $15,568/ton. The methodology for using the environmental costs comes from the ICE guidelines. Emissions calculations are provided in Appendix F.

Construction Cost

Based on the concept-level preliminary project costs estimates, the total estimated project construction costs (including design, environmental, right of way, construction, and construction management costs) for each alternative are presented in the Life Cycle Cost Analysis tables presented in the Life Cycle Cost Analysis section.

Other Costs

Operation and maintenance costs are other important components of the cost associated within the various alternatives. The operation and maintenance costs for a traffic signal include providing power service to the signal and street lighting ($750/year), signal retiming ($1,000/year), and signal maintenance for power outages/new detector loops/etc. ($1,500/year).

The roundabout alternatives would have lower operation and maintenance costs limited to power service for street lighting ($750/year). These values are typical industry averages.

Life Cycle Benefit/Cost Analysis

Table 5.1 presents a summary of the life cycle benefit/cost ratio between the available alternatives for the intersection of Eaton Road & the SR 99 SB Ramps.

Table 5.1: Life Cycle Benefit/Cost Ratio

Life Cycle Benefit/Cost Ratio	No Build VS Roundabout	No Build VS Signal
Safety Benefit	$ 4,039,000	$ 446,000
Delay Reduction Benefit	$ 4,970,000	$ 4,730,000
Fuel and GHG Benefit	$ 988,000	$ 999,000
Total Benefits	**$ 9,997,000**	**$ 6,175,000**
Added Operations & Maintenance Costs	$ 10,000	$ 34,000
Construction Costs	$ 8,745,000	$ 11,175,000
Total Costs	**$ 8,755,000**	**$ 11,209,000**
Life Cycle Benefit/Cost Ratio	**1.1**	**0.6**

As presented in Table 5.1, the Roundabout alternative has a higher benefit/cost ratio than the Signal alternative. The signal alternative has a higher construction cost due to the need to widen the overcrossing and does not have a significant safety benefit, unlike the roundabout alternative.

6. Vehicle Miles Traveled

Vehicle miles traveled (VMT) has replaced LOS as the criterion used to evaluate transportation impacts under the California Environmental Quality Act (CEQA). The California Code of Regulations (14 CCR §15064.3) states the following criteria for analyzing transportation impacts:

> *(2) Transportation Projects. Transportation projects that reduce, or have no impact on, vehicle miles traveled should be presumed to cause a less than significant transportation impact. For roadway capacity projects, agencies have discretion to determine the appropriate measure of transportation impact consistent with CEQA and other applicable requirements.*

The Eaton Road & the SR 99 SB Ramps ICE consists of improvements to the existing intersection, and is not anticipated to have a meaningful impact on VMT. The improvements would not create a shorter route between any destinations as the overall roadway network remains unchanged, and is therefore anticipated to have no aggregate impact on VMT.

7. Conclusion

7.1 Preferred Alternative

Based on the preliminary design, operational analysis, and benefit/cost evaluation, the roundabout design is the Preferred Alternative. The Preferred Alternative provides acceptable traffic operations and does not require major changes to the overcrossing. Comparatively, the cost for the signal alternative is prohibitive as it requires widening the overcrossing to provide adequate storage for the westbound traffic and will impact mainline SR 99 operations and alignment during construction.

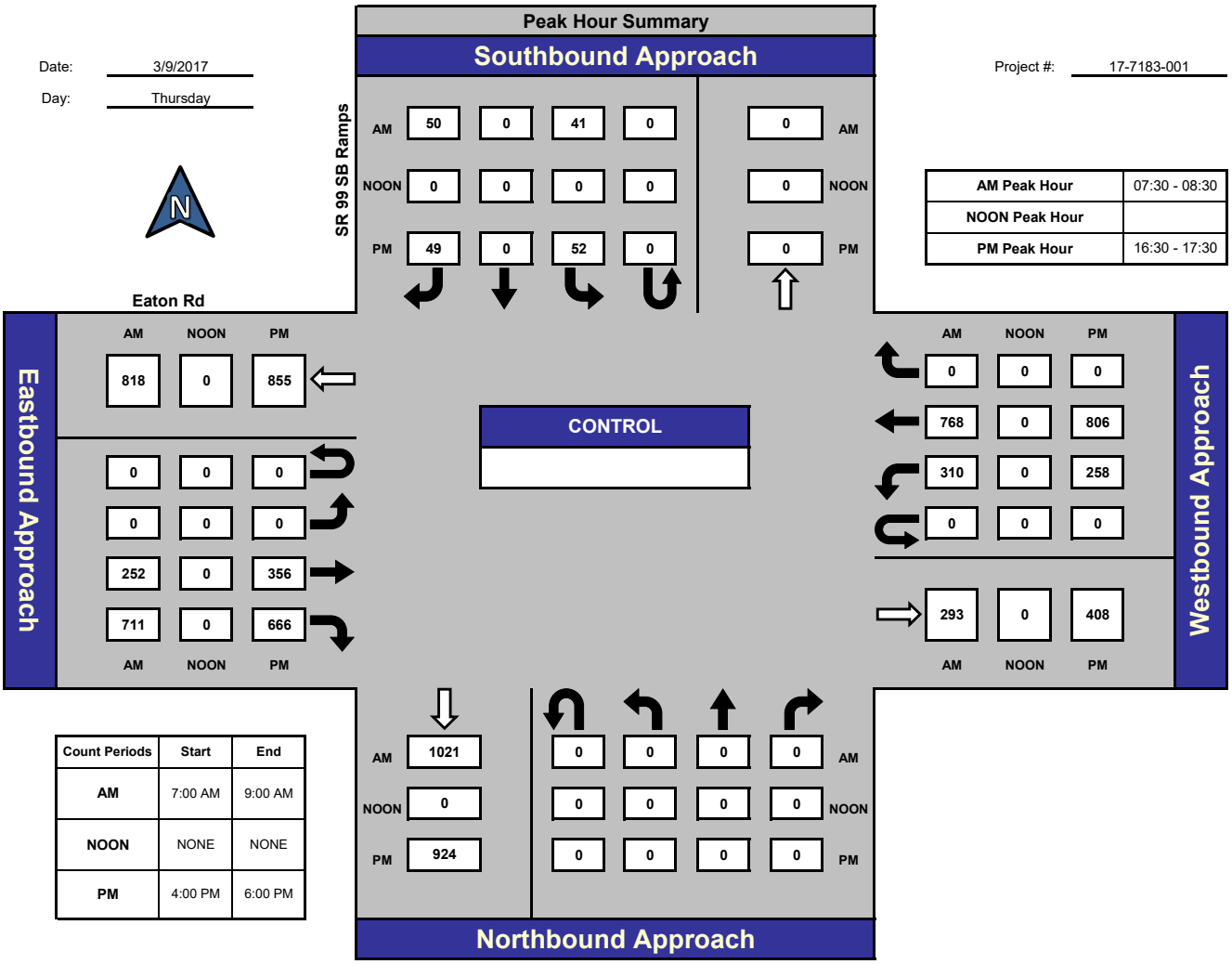
Appendix A: Traffic Volume Counts

SR 99 SB Ramps & Eaton Rd

Date: 3/9/2017

Day: Thursday

Project #: 17-7183-001



AM Peak Hour	07:30 - 08:30
NOON Peak Hour	
PM Peak Hour	16:30 - 17:30

Count Periods	Start	End
AM	7:00 AM	9:00 AM
NOON	NONE	NONE
PM	4:00 PM	6:00 PM

Total Ins & Outs

	North Leg		
	91	0	AM
	0	0	NOON
	101	0	PM

West Leg				East Leg		
AM	NOON	PM		AM	NOON	PM
818	0	855		1078	0	1064
963	0	1022		293	0	408

	South Leg	
AM	1021	0
NOON	0	0
PM	924	0

Total Volume Per Leg

North Leg	
91	AM
0	NOON
101	PM

West Leg			East Leg		
AM	NOON	PM	AM	NOON	PM
1781	0	1877	1371	0	1472

South Leg	
AM	1021
NOON	0
PM	924

Eaton Rd & Esplanade

Date 10/14/2020

AM

	Southbound				Northbound				Eastbound				Westbound				
Start Time	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Int Total
7:00 AM	50	24	1	75	8	24	31	63	11	35	18	64	15	13	33	61	263
7:15 AM	78	36	2	116	4	16	45	65	4	45	23	72	23	9	31	63	316
7:30 AM	75	37	5	117	12	31	58	101	12	55	38	105	23	16	59	98	421
7:45 AM	103	67	3	173	12	50	56	118	5	59	51	115	31	22	45	98	504
Total	306	164	11	481	36	121	190	347	32	194	130	356	92	60	168	320	1504
8:00 AM	61	34	5	100	12	47	54	113	6	48	40	94	29	21	42	92	399
8:15 AM	73	41	4	118	9	37	48	94	4	40	27	71	26	23	38	87	370
8:30 AM	48	30	6	84	21	44	49	114	8	39	26	73	11	30	33	74	345
8:45 AM	65	50	6	121	8	32	45	85	4	32	30	66	26	12	44	82	354
Total	247	155	21	423	50	160	196	406	22	159	123	304	92	86	157	335	1468
9:00 AM	53	29	4	86	7	35	30	72	6	18	30	54	22	15	33	70	282
9:15 AM	57	31	8	96	16	29	33	78	3	18	21	42	32	14	27	73	289
9:30 AM	37	38	7	82	14	31	27	72	5	16	40	61	13	9	33	55	270
9:45 AM	47	35	5	87	11	35	32	78	4	38	34	76	27	21	46	94	335
Total	194	133	24	351	48	130	122	300	18	90	125	233	94	59	139	292	1176
10:00 AM	61	40	1	102	13	34	52	99	7	21	22	50	25	14	38	77	328
Total	61	40	1	102	13	34	52	99	7	21	22	50	25	14	38	77	328
Grand Total	808	492	57	1357	147	445	560	1152	79	464	400	943	303	219	502	1024	4476
Approach %	59.5%	36.3%	4.2%		12.8%	38.6%	48.6%		8.4%	49.2%	42.4%		29.6%	21.4%	49.0%		
Total %	18.1%	11.0%	1.3%	30.3%	3.3%	9.9%	12.5%	25.7%	1.8%	10.4%	8.9%	21.1%	6.8%	4.9%	11.2%	22.9%	

	Southbound				Northbound				Eastbound				Westbound				
Start Time	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Int Total
Peak Hour Analysis from 7:30 AM to 8:15 AM																	
Peak Hour for Entire Intersection Begins at			7:30 AM														
7:30 AM	75	37	**5**	117	**12**	31	**58**	101	**12**	55	38	105	23	16	**59**	**98**	421
7:45 AM	**103**	**67**	3	**173**	12	**50**	56	**118**	5	**59**	**51**	**115**	**31**	22	45	98	**504**
8:00 AM	61	34	5	100	12	47	54	113	6	48	40	94	29	21	42	92	399
8:15 AM	73	41	4	118	9	37	48	94	4	40	27	71	26	**23**	38	87	370
Total Volume	312	179	17	508	45	165	216	426	27	202	156	385	109	82	184	375	1694
% App Total	61.4%	35.2%	3.3%		10.6%	38.7%	50.7%		7.0%	52.5%	40.5%		29.1%	21.9%	49.1%		
PHF	0.757	0.668	0.85	0.734	0.938	0.825	0.931	0.903	0.563	0.856	0.765	0.837	0.879	0.891	0.78	0.957	0.84

Midday

	Southbound				Northbound				Eastbound				Westbound				
Start Time	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Int Total
10:30 AM	52	42	10	104	21	52	43	116	3	17	28	48	21	18	35	74	342
10:45 AM	47	37	10	94	19	39	47	105	10	34	40	84	16	24	51	91	374
11:00 AM	47	47	9	103	18	52	41	111	4	25	23	52	25	36	45	106	372
11:15 AM	52	58	20	130	16	44	55	115	6	29	42	77	24	28	70	122	444
Total	198	184	49	431	74	187	186	447	23	105	133	261	86	106	201	393	1532
11:30 AM	77	51	7	135	20	41	46	107	5	28	29	62	23	33	70	126	430
11:45 AM	49	42	13	104	19	65	47	131	4	38	36	78	20	30	60	110	423
12:00 PM	57	58	22	137	37	62	54	153	7	41	41	89	23	38	74	135	514
12:15 PM	69	54	15	138	24	44	51	119	2	34	30	66	27	45	63	135	458
Total	252	205	57	514	100	212	198	510	18	141	136	295	93	146	267	506	1825
12:30 PM	73	60	18	151	24	66	59	149	2	38	37	77	27	38	62	127	504
12:45 PM	85	48	15	148	27	54	54	135	4	41	39	84	33	41	58	132	499
1:00 PM	70	41	16	127	32	55	46	133	6	33	23	62	37	39	70	146	468
1:15 PM	62	54	27	143	27	42	49	118	5	38	48	91	23	26	52	101	453
Total	290	203	76	569	110	217	208	535	17	150	147	314	120	144	242	506	1924
1:30 PM	63	55	33	151	29	56	55	140	4	26	28	58	28	35	68	131	480
1:45 PM	58	45	15	118	27	37	52	116	3	34	29	66	18	29	69	116	416
2:00 PM	60	42	31	133	26	67	50	143	8	38	31	77	32	30	61	123	476
Total	181	142	79	402	82	160	157	399	15	98	88	201	78	94	198	370	1372
Grand Total	921	734	261	1916	366	776	749	1891	73	494	504	1071	377	490	908	1775	6653
Approach %	48.1%	38.3%	13.6%		19.4%	41.0%	39.6%		6.8%	46.1%	47.1%		21.2%	27.6%	51.2%		
Total %	13.8%	11.0%	3.9%	28.8%	5.5%	11.7%	11.3%	28.4%	1.1%	7.4%	7.6%	16.1%	5.7%	7.4%	13.6%	26.7%	

	Southbound				Northbound				Eastbound				Westbound				
Start Time	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Int Total
Peak Hour Analysis from 12:00 PM to 12:45 PM																	
Peak Hour for Entire Intersection Begins at			12:00 PM														
12:00 PM	57	58	**22**	137	**37**	62	54	**153**	**7**	**41**	**41**	**89**	23	38	**74**	**135**	**514**
12:15 PM	69	54	15	138	24	44	51	119	2	34	30	66	27	**45**	63	135	458

12:30 PM	73	**60**	18	**151**	24	**66**	**59**	149	2	38	37	77	27	38	62	127	504
12:45 PM	**85**	48	15	148	27	54	54	135	4	41	39	84	**33**	41	58	132	499
Total Volume	284	220	70	574	112	226	218	556	15	154	147	316	110	162	257	529	1975
% App Total	49.5%	38.3%	12.2%		20.1%	40.6%	39.2%		4.7%	48.7%	46.5%		20.8%	30.6%	48.6%		
PHF	0.835	0.917	0.795	0.95	0.757	0.856	0.924	0.908	0.536	0.939	0.896	0.888	0.833	0.9	0.868	0.98	0.961

PM

	Southbound				Northbound				Eastbound				Westbound				
Start Time	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Int Total
2:30 PM	60	45	28	133	24	50	58	132	6	39	25	70	28	46	72	146	481
2:45 PM	75	45	25	145	35	56	47	138	2	39	35	76	21	34	77	132	491
3:00 PM	55	40	26	121	45	50	57	152	4	26	26	56	15	38	69	122	451
3:15 PM	64	36	23	123	41	58	50	149	7	32	25	64	30	38	68	136	472
Total	254	166	102	522	145	214	212	571	19	136	111	266	94	156	286	536	1895
3:30 PM	72	36	5	113	38	41	44	123	6	27	25	58	24	39	73	136	430
3:45 PM	71	39	1	111	49	70	44	163	4	36	21	61	31	34	90	155	490
4:00 PM	83	50	18	151	51	52	51	154	4	35	27	66	31	46	76	153	524
4:15 PM	63	41	18	122	47	60	62	169	6	40	27	73	29	47	72	148	512
Total	289	166	42	497	185	223	201	609	20	138	100	258	115	166	311	592	1956
4:30 PM	54	42	5	101	44	67	54	165	3	22	28	53	30	46	85	161	480
4:45 PM	84	51	13	148	57	67	46	170	7	34	33	74	29	50	97	176	568
5:00 PM	83	48	3	134	51	85	57	193	6	27	31	64	39	55	122	216	607
5:15 PM	67	59	14	140	43	68	59	170	8	27	34	69	25	66	101	192	571
Total	288	200	35	523	195	287	216	698	24	110	126	260	123	217	405	745	2226
5:30 PM	70	44	10	124	39	70	57	166	9	28	32	69	24	63	94	181	540
5:45 PM	55	59	6	120	30	72	50	152	8	29	37	74	32	51	87	170	516
6:00 PM	65	47	4	116	28	52	47	127	6	21	19	46	32	61	70	163	452
6:15 PM	56	34	9	99	23	62	30	115	4	36	30	70	26	56	89	171	455
Total	246	184	29	459	120	256	184	560	27	114	118	259	114	231	340	685	1963
6:30 PM	48	48	9	105	25	50	35	110	6	21	27	54	24	48	71	143	412
6:45 PM	62	47	12	121	48	55	33	136	5	18	26	49	27	50	69	146	452
7:00 PM	52	43	4	99	18	43	35	96	2	15	26	43	17	31	46	94	332
Total	162	138	25	325	91	148	103	342	13	54	79	146	68	129	186	383	1196
Grand Total	1239	854	233	2326	736	1128	916	2780	103	552	534	1189	514	899	1528	2941	9236
Approach %	53.3%	36.7%	10.0%		26.5%	40.6%	32.9%		8.7%	46.4%	44.9%		17.5%	30.6%	52.0%		
Total %	13.4%	9.2%	2.5%	25.2%	8.0%	12.2%	9.9%	30.1%	1.1%	6.0%	5.8%	12.9%	5.6%	9.7%	16.5%	31.8%	

	Southbound				Northbound				Eastbound				Westbound				
Start Time	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Int Total
Peak Hour Analysis from 4:45 PM to 5:30 PM																	
Peak Hour for Entire Intersection Begins at			4:45 PM														
4:45 PM	**84**	51	13	**148**	**57**	67	46	170	7	**34**	33	**74**	29	50	97	176	568
5:00 PM	83	48	3	134	51	**85**	57	**193**	6	27	31	64	**39**	55	**122**	**216**	**607**
5:15 PM	67	**59**	**14**	140	43	68	**59**	170	8	27	**34**	69	25	**66**	101	192	571
5:30 PM	70	44	10	124	39	70	57	166	**9**	28	32	69	24	63	94	181	540
Total Volume	304	202	40	546	190	290	219	699	30	116	130	276	117	234	414	765	2286
% App Total	55.7%	37.0%	7.3%		27.2%	41.5%	31.3%		10.9%	42.0%	47.1%		15.3%	30.6%	54.1%		
PHF	0.905	0.856	0.714	0.922	0.833	0.853	0.928	0.905	0.833	0.853	0.956	0.932	0.75	0.886	0.848	0.885	0.942

Appendix B: Synchro and SimTraffic LOS and Queueing Reports

Intersection	
Int Delay, s/veh	6.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↱	↰	↑					↰		↱
Traffic Vol, veh/h	0	270	745	290	745	0	0	0	0	55	0	45
Future Vol, veh/h	0	270	745	290	745	0	0	0	0	55	0	45
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	400	-	-	-	-	-	0	-	130
Veh in Median Storage, #	-	0	-	-	0	-	-	16974	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	300	828	322	828	0	0	0	0	61	0	50

Major/Minor	Major1			Major2					Minor2		
Conflicting Flow All	-	0	0	300	0	0			1772	-	828
Stage 1	-	-	-	-	-	-			1472	-	-
Stage 2	-	-	-	-	-	-			300	-	-
Critical Hdwy	-	-	-	4.12	-	-			6.42	-	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-			5.42	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-			5.42	-	-
Follow-up Hdwy	-	-	-	2.218	-	-			3.518	-	3.318
Pot Cap-1 Maneuver	0	-	-	1261	-	0			91	0	371
Stage 1	0	-	-	-	-	0			210	0	-
Stage 2	0	-	-	-	-	0			752	0	-
Platoon blocked, %		-	-		-						
Mov Cap-1 Maneuver	-	-	-	1261	-	-			68	0	371
Mov Cap-2 Maneuver	-	-	-	-	-	-			68	0	-
Stage 1	-	-	-	-	-	-			210	0	-
Stage 2	-	-	-	-	-	-			560	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	2.5	108
HCM LOS			F

Minor Lane/Major Mvmt	EBT	EBR	WBL	WBT	SBLn1	SBLn2
Capacity (veh/h)	-	-	1261	-	68	371
HCM Lane V/C Ratio	-	-	0.256	-	0.899	0.135
HCM Control Delay (s)	-	-	8.8	-	183.2	16.2
HCM Lane LOS	-	-	A	-	F	C
HCM 95th %tile Q(veh)	-	-	1	-	4.4	0.5

Intersection	
Int Delay, s/veh	5.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↱	↰	↑						↲	↱
Traffic Vol, veh/h	0	335	645	255	750	0	0	0	0	55	0	40
Future Vol, veh/h	0	335	645	255	750	0	0	0	0	55	0	40
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	400	-	-	-	-	-	-	-	130
Veh in Median Storage, #	-	0	-	-	0	-	-	16974	-	-	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	364	701	277	815	0	0	0	0	60	0	43

Major/Minor	Major1			Major2					Minor2		
Conflicting Flow All	-	0	0	364	0	0			1733	1733	815
Stage 1	-	-	-	-	-	-			1369	1369	-
Stage 2	-	-	-	-	-	-			364	364	-
Critical Hdwy	-	-	-	4.12	-	-			6.42	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-			5.42	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-			5.42	5.52	-
Follow-up Hdwy	-	-	-	2.218	-	-			3.518	4.018	3.318
Pot Cap-1 Maneuver	0	-	-	1195	-	0			97	88	377
Stage 1	0	-	-	-	-	0			236	214	-
Stage 2	0	-	-	-	-	0			703	624	-
Platoon blocked, %		-	-		-						
Mov Cap-1 Maneuver	-	-	-	1195	-	-			74	0	377
Mov Cap-2 Maneuver	-	-	-	-	-	-			74	0	-
Stage 1	-	-	-	-	-	-			236	0	-
Stage 2	-	-	-	-	-	-			540	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	2.3	93.7
HCM LOS			F

Minor Lane/Major Mvmt	EBT	EBR	WBL	WBT	SBLn1	SBLn2
Capacity (veh/h)	-	-	1195	-	74	377
HCM Lane V/C Ratio	-	-	0.232	-	0.808	0.115
HCM Control Delay (s)	-	-	8.9	-	150.3	15.8
HCM Lane LOS	-	-	A	-	F	C
HCM 95th %tile Q(veh)	-	-	0.9	-	3.9	0.4

Intersection	
Int Delay, s/veh	106.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↱	↰	↑					↰		↱
Traffic Vol, veh/h	0	345	1050	465	1135	0	0	0	0	100	0	90
Future Vol, veh/h	0	345	1050	465	1135	0	0	0	0	100	0	90
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	400	-	-	-	-	-	0	-	130
Veh in Median Storage, #	-	0	-	-	0	-	-	16974	-	-	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	375	1141	505	1234	0	0	0	0	109	0	98

Major/Minor	Major1			Major2				Minor2		
Conflicting Flow All	-	0	0	375	0	0		2619	-	1234
Stage 1	-	-	-	-	-	-		2244	-	-
Stage 2	-	-	-	-	-	-		375	-	-
Critical Hdwy	-	-	-	4.12	-	-		6.42	-	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-		5.42	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-		5.42	-	-
Follow-up Hdwy	-	-	-	2.218	-	-		3.518	-	3.318
Pot Cap-1 Maneuver	0	-	-	1183	-	0		~ 27	0	215
Stage 1	0	-	-	-	-	0		~ 86	0	-
Stage 2	0	-	-	-	-	0		695	0	-
Platoon blocked, %		-	-		-					
Mov Cap-1 Maneuver	-	-	-	1183	-	-		~ 15	0	215
Mov Cap-2 Maneuver	-	-	-	-	-	-		~ 15	0	-
Stage 1	-	-	-	-	-	-		~ 86	0	-
Stage 2	-	-	-	-	-	-		398	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	3	$ 1759.3
HCM LOS			F

Minor Lane/Major Mvmt	EBT	EBR	WBL	WBT	SBLn1	SBLn2
Capacity (veh/h)	-	-	1183	-	15	215
HCM Lane V/C Ratio	-	-	0.427	-	7.246	0.455
HCM Control Delay (s)	-	-	10.3	$ 3311.1	35	
HCM Lane LOS	-	-	B	-	F	E
HCM 95th %tile Q(veh)	-	-	2.2	-	14.5	2.2

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

Intersection	
Int Delay, s/veh	134.6

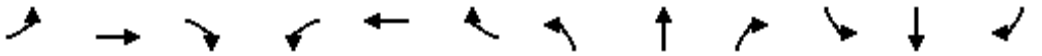
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↱	↰	↑						↲	↱
Traffic Vol, veh/h	0	440	1000	410	1225	0	0	0	0	110	0	80
Future Vol, veh/h	0	440	1000	410	1225	0	0	0	0	110	0	80
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	400	-	-	-	-	-	-	-	130
Veh in Median Storage, #	-	0	-	-	0	-	-	16974	-	-	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	478	1087	446	1332	0	0	0	0	120	0	87

Major/Minor	Major1			Major2			Minor2		
Conflicting Flow All	-	0	0	478	0	0	2702	2702	1332
Stage 1	-	-	-	-	-	-	2224	2224	-
Stage 2	-	-	-	-	-	-	478	478	-
Critical Hdwy	-	-	-	4.12	-	-	6.42	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	5.42	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.42	5.52	-
Follow-up Hdwy	-	-	-	2.218	-	-	3.518	4.018	3.318
Pot Cap-1 Maneuver	0	-	-	1084	-	0	~ 24	21	189
Stage 1	0	-	-	-	-	0	~ 88	80	-
Stage 2	0	-	-	-	-	0	624	556	-
Platoon blocked, %		-	-		-				
Mov Cap-1 Maneuver	-	-	-	1084	-	-	~ 14	0	189
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 14	0	-
Stage 1	-	-	-	-	-	-	~ 88	0	-
Stage 2	-	-	-	-	-	-	368	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	2.7	$ 2289
HCM LOS			F

Minor Lane/Major Mvmt	EBT	EBR	WBL	WBT	SBLn1	SBLn2
Capacity (veh/h)	-	-	1084	-	14	189
HCM Lane V/C Ratio	-	-	0.411	-	8.54	0.46
HCM Control Delay (s)	-	-	10.6	$ 3925.1		39.3
HCM Lane LOS	-	-	B	-	F	E
HCM 95th %tile Q(veh)	-	-	2	-	16	2.2

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



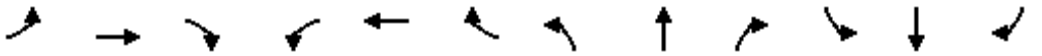
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	345	1050	465	1135	0	0	0	0	100	0	90
Future Volume (veh/h)	0	345	1050	465	1135	0	0	0	0	100	0	90
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	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	
Adj Sat Flow, veh/h/ln	0	1870	1870	1870	1870	0				1870	0	1870
Adj Flow Rate, veh/h	0	375	0	505	1234	0				109	0	98
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	2	2	0				2	0	2
Cap, veh/h	0	518		602	2518	0				185	0	165
Arrive On Green	0.00	0.28	0.00	0.34	0.71	0.00				0.10	0.00	0.10
Sat Flow, veh/h	0	1870	1585	1781	3647	0				1781	0	1585
Grp Volume(v), veh/h	0	375	0	505	1234	0				109	0	98
Grp Sat Flow(s),veh/h/ln	0	1870	1585	1781	1777	0				1781	0	1585
Q Serve(g_s), s	0.0	8.7	0.0	12.6	7.4	0.0				2.8	0.0	2.8
Cycle Q Clear(g_c), s	0.0	8.7	0.0	12.6	7.4	0.0				2.8	0.0	2.8
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	518		602	2518	0				185	0	165
V/C Ratio(X)	0.00	0.72		0.84	0.49	0.00				0.59	0.00	0.59
Avail Cap(c_a), veh/h	0	2994		1502	9018	0				708	0	630
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.00	1.00	1.00	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	15.7	0.0	14.7	3.1	0.0				20.5	0.0	20.6
Incr Delay (d2), s/veh	0.0	1.9	0.0	3.2	0.1	0.0				3.0	0.0	3.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	3.5	0.0	4.7	1.0	0.0				1.2	0.0	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	17.6	0.0	17.9	3.3	0.0				23.5	0.0	23.9
LnGrp LOS	A	B		B	A	A				C	A	C
Approach Vol, veh/h		375	A		1739						207	
Approach Delay, s/veh		17.6			7.5						23.7	
Approach LOS		B			A						C	

Timer - Assigned Phs		3	4		6		8					
Phs Duration (G+Y+Rc), s		20.7	17.8		9.5		38.5					
Change Period (Y+Rc), s		4.5	4.5		4.5		4.5					
Max Green Setting (Gmax), s		40.5	76.9		19.1		121.9					
Max Q Clear Time (g_c+I1), s		14.6	10.7		4.8		9.4					
Green Ext Time (p_c), s		1.7	2.6		0.5		13.8					

Intersection Summary	
HCM 6th Ctrl Delay	10.6
HCM 6th LOS	B

Notes

Unsignalized Delay for [EBR] is excluded from calculations of the approach delay and intersection delay.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	440	1000	410	1225	0	0	0	0	110	0	80
Future Volume (veh/h)	0	440	1000	410	1225	0	0	0	0	110	0	80
Initial Q (Qb), veh	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
Parking Bus, Adj	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	
Adj Sat Flow, veh/h/ln	0	1870	1870	1870	1870	0				1870	1870	1870
Adj Flow Rate, veh/h	0	478	0	446	1332	0				120	0	87
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	2	2	0				2	2	2
Cap, veh/h	0	624		532	2551	0				197	0	176
Arrive On Green	0.00	0.33	0.00	0.30	0.72	0.00				0.11	0.00	0.11
Sat Flow, veh/h	0	1870	1585	1781	3647	0				1781	0	1585
Grp Volume(v), veh/h	0	478	0	446	1332	0				120	0	87
Grp Sat Flow(s),veh/h/ln	0	1870	1585	1781	1777	0				1781	0	1585
Q Serve(g_s), s	0.0	12.0	0.0	12.3	8.9	0.0				3.4	0.0	2.7
Cycle Q Clear(g_c), s	0.0	12.0	0.0	12.3	8.9	0.0				3.4	0.0	2.7
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	624		532	2551	0				197	0	176
V/C Ratio(X)	0.00	0.77		0.84	0.52	0.00				0.61	0.00	0.50
Avail Cap(c_a), veh/h	0	2794		1305	8215	0				661	0	588
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.00	1.00	1.00	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	15.7	0.0	17.2	3.3	0.0				22.3	0.0	22.0
Incr Delay (d2), s/veh	0.0	2.0	0.0	3.6	0.2	0.0				3.0	0.0	2.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	4.7	0.0	4.9	1.4	0.0				1.5	0.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	17.7	0.0	20.8	3.5	0.0				25.3	0.0	24.1
LnGrp LOS	A	B		C	A	A				C	A	C
Approach Vol, veh/h		478	A		1778						207	
Approach Delay, s/veh		17.7			7.9						24.8	
Approach LOS		B			A						C	

Timer - Assigned Phs		3	4		6		8					
Phs Duration (G+Y+Rc), s		20.2	22.0		10.3		42.2					
Change Period (Y+Rc), s		4.5	4.5		4.5		4.5					
Max Green Setting (Gmax), s		38.5	78.5		19.5		121.5					
Max Q Clear Time (g_c+I1), s		14.3	14.0		5.4		10.9					
Green Ext Time (p_c), s		1.4	3.5		0.7		16.0					

Intersection Summary	
HCM 6th Ctrl Delay	11.2
HCM 6th LOS	B

Notes

Unsignalized Delay for [EBR] is excluded from calculations of the approach delay and intersection delay.

Intersection: 8: SR 99 SB Ramps & Eaton Road

Movement	EB	EB	WB	SB	SB
Directions Served	T	R	L	L	R
Maximum Queue (ft)	46	92	99	85	62
Average Queue (ft)	2	5	40	35	23
95th Queue (ft)	20	40	77	67	49
Link Distance (ft)	1852	1852		1020	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)			400		130
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 0

Intersection: 3: SR 99 SB Ramps & Eaton Road

Movement	EB	EB	WB	SB	SB
Directions Served	T	R	L	LT	R
Maximum Queue (ft)	23	33	88	75	61
Average Queue (ft)	1	3	35	35	20
95th Queue (ft)	14	26	67	68	49
Link Distance (ft)	1992	1992		637	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)			400		130
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 0

Intersection: 8: SR 99 SB Ramps & Eaton Road

Movement	EB	EB	WB	SB	SB
Directions Served	T	R	L	L	R
Maximum Queue (ft)	47	193	148	2004	155
Average Queue (ft)	2	16	58	1236	85
95th Queue (ft)	19	93	108	2445	206
Link Distance (ft)	1852	1852		1987	
Upstream Blk Time (%)				22	
Queuing Penalty (veh)				0	
Storage Bay Dist (ft)			400		130
Storage Blk Time (%)				87	1
Queuing Penalty (veh)				78	1

Network Summary

Network wide Queuing Penalty: 79

Intersection: 3: SR 99 SB Ramps & Eaton Road

Movement	EB	EB	WB	WB	SB	SB
Directions Served	T	R	L	T	LT	R
Maximum Queue (ft)	57	158	105	3	1570	155
Average Queue (ft)	3	12	52	0	1375	69
95th Queue (ft)	26	68	91	2	1937	193
Link Distance (ft)	1992	1992		1792	1551	
Upstream Blk Time (%)					65	
Queuing Penalty (veh)					0	
Storage Bay Dist (ft)			400			130
Storage Blk Time (%)					99	0
Queuing Penalty (veh)					80	1

Network Summary

Network wide Queuing Penalty: 80

Intersection: 8: Eaton Road

Movement	EB	EB	WB	WB	WB	SB	SB
Directions Served	T	R	L	T	T	L	R
Maximum Queue (ft)	215	78	285	137	130	114	69
Average Queue (ft)	123	3	149	63	65	56	30
95th Queue (ft)	196	34	240	114	111	98	53
Link Distance (ft)	1855	1855		1477	1477	1007	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)			400				130
Storage Blk Time (%)						0	
Queuing Penalty (veh)						0	

Network Summary

Network wide Queuing Penalty: 0

Intersection: 3: SR 99 SB Ramps & Eaton Road

Movement	EB	EB	WB	WB	WB	SB	SB
Directions Served	T	R	L	T	T	LT	R
Maximum Queue (ft)	341	53	407	236	238	207	141
Average Queue (ft)	167	2	229	83	80	79	37
95th Queue (ft)	294	27	362	202	170	147	86
Link Distance (ft)	1998	1998		1792	1792	624	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)			400				130
Storage Blk Time (%)			1			3	0
Queuing Penalty (veh)			6			2	0

Network Summary

Network wide Queuing Penalty: 8

Appendix C: Sidra LOS and Queueing Reports

LANE SUMMARY

Site: 3 [SB Ramps 2040 AM (Site Folder: Final Concept 2040)]

New Site
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. %
East: Eaton Road													
Lane 1	793	2.0	1555	0.510	100	3.4	LOS A	0.0	0.0	Full	600	0.0	0.0
Lane 2[d]	946	2.0	1854	0.510	100	0.1	LOS A	0.0	0.0	Short	100	0.0	NA
Approach	1739	2.0		0.510		1.6	LOS A	0.0	0.0				
North: SR 99 SB Ramps													
Lane 1[d]	208	2.0	477	0.436	100	17.5	LOS B	2.1	53.4	Full	1600	0.0	0.0
Approach	208	2.0		0.436		17.5	LOS B	2.1	53.4				
West: Eaton Road													
Lane 1[d]	846	2.0	1127	0.750	100	12.9	LOS B	11.1	282.6	Full	425	0.0	0.0
Lane 2	670	2.0	893	0.750	100	23.4	LOS C	13.0	329.8	Full	425	0.0	0.0
Approach	1516	2.0		0.750		17.6	LOS B	13.0	329.8				
Intersection	3463	2.0		0.750		9.6	LOS A	13.0	329.8				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
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 6).
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

East: Eaton Road

Mov. From E To Exit:	L2 S	T1 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	505	288	793	2.0	1555	0.510	100	NA	NA
Lane 2	-	946	946	2.0	1854	0.510	100	0.0	1
Approach	505	1234	1739	2.0		0.510			

North: SR 99 SB Ramps

Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	109	1	98	208	2.0	477	0.436	100	NA	NA
Approach	109	1	98	208	2.0		0.436			

West: Eaton Road

Mov. From W To Exit:	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	375	471	846	2.0	1127	0.750	100	NA	NA

Lane 2	-	670	670	2.0		893	0.750	100	NA	NA
Approach	375	1141	1516	2.0			0.750			
	Total	%HV	Deg.Satn (v/c)							
Intersection	3463	2.0		0.750						

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: SR 99 SB Ramps Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
East Exit: Eaton Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
West Exit: Eaton Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										

LANE SUMMARY

Site: 3 [SB Ramps 2040 PM (Site Folder: Final Concept 2040)]

New Site
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. %
East: Eaton Road													
Lane 1	811	2.0	1555	0.521	100	3.0	LOS A	0.0	0.0	Full	600	0.0	0.0
Lane 2[d]	967	2.0	1854	0.521	100	0.1	LOS A	0.0	0.0	Short	100	0.0	NA
Approach	1777	2.0		0.521		1.4	LOS A	0.0	0.0				
North: SR 99 SB Ramps													
Lane 1[d]	208	2.0	577	0.360	100	15.3	LOS B	1.7	43.2	Full	1600	0.0	0.0
Approach	208	2.0		0.360		15.3	LOS B	1.7	43.2				
West: Eaton Road													
Lane 1[d]	832	2.0	1161	0.716	100	11.1	LOS B	9.5	242.6	Full	425	0.0	0.0
Lane 2	734	2.0	1025	0.716	100	15.9	LOS B	10.4	264.9	Full	425	0.0	0.0
Approach	1565	2.0		0.716		13.3	LOS B	10.4	264.9				
Intersection	3550	2.0		0.716		7.5	LOS A	10.4	264.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
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 6).
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

East: Eaton Road

Mov. From E To Exit:	L2 S	T1 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	446	365	811	2.0	1555	0.521	100	NA	NA
Lane 2	-	967	967	2.0	1854	0.521	100	0.0	1
Approach	446	1332	1777	2.0		0.521			

North: SR 99 SB Ramps

Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	120	1	87	208	2.0	577	0.360	100	NA	NA
Approach	120	1	87	208	2.0		0.360			

West: Eaton Road

Mov. From W To Exit:	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	478	353	832	2.0	1161	0.716	100	NA	NA

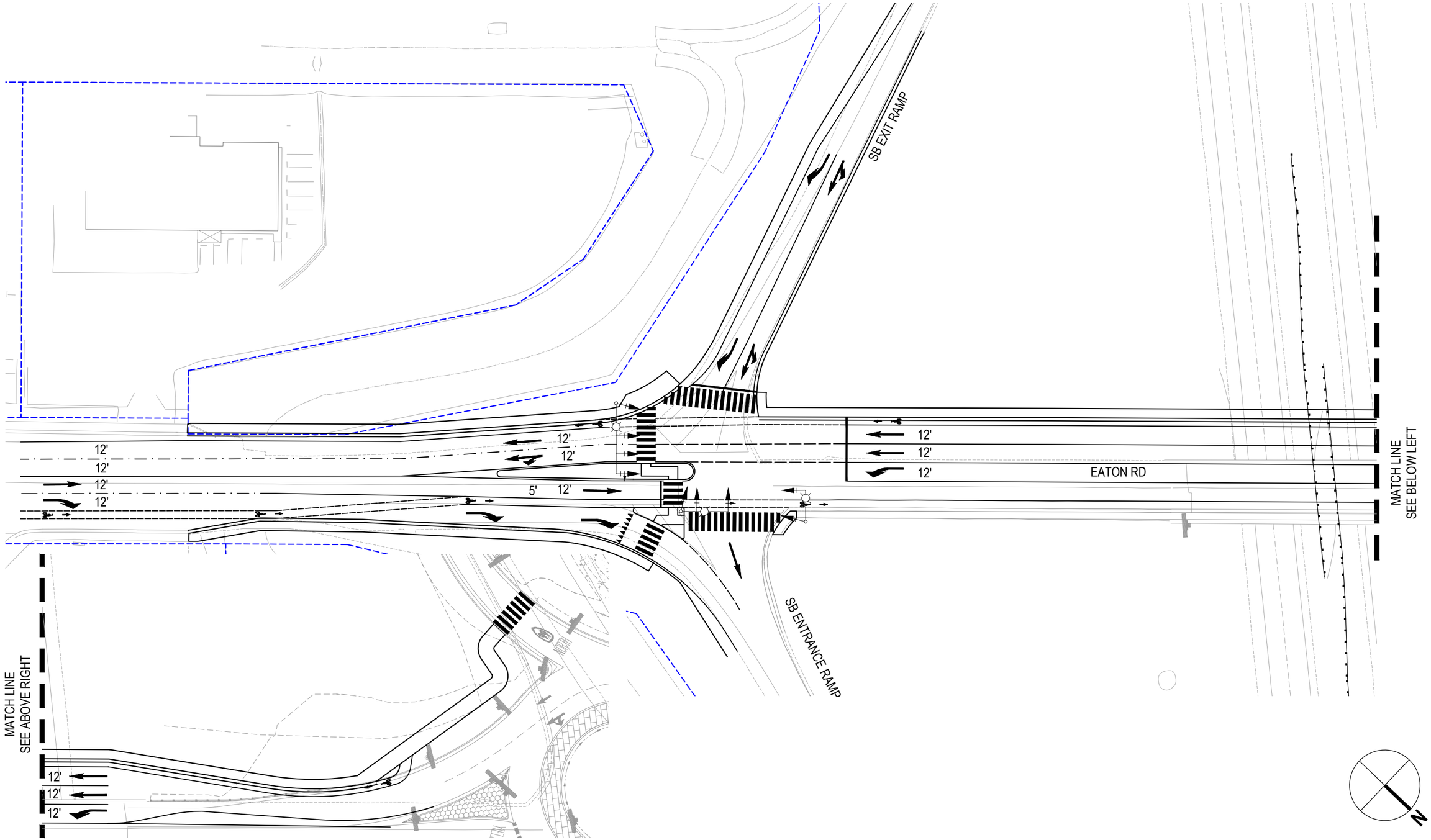
Lane 2	-	734	734	2.0		1025	0.716	100	NA	NA
Approach	478	1087	1565	2.0			0.716			
	Total	%HV	Deg.Satn (v/c)							
Intersection	3550	2.0		0.716						

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: SR 99 SB Ramps Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
East Exit: Eaton Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
West Exit: Eaton Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
Full Length Lane	2	Merge Analysis not applied.										

Appendix D: Signal Alternative Exhibits



PRELIMINARY,
SUBJECT TO CHANGE

CITY of CHICO

:ATON RD

ROUTE 99 AT EATON ROAD SB RAMPS SIGNAL GEOMETRY

GHD
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Roseville, CA 95678 USA
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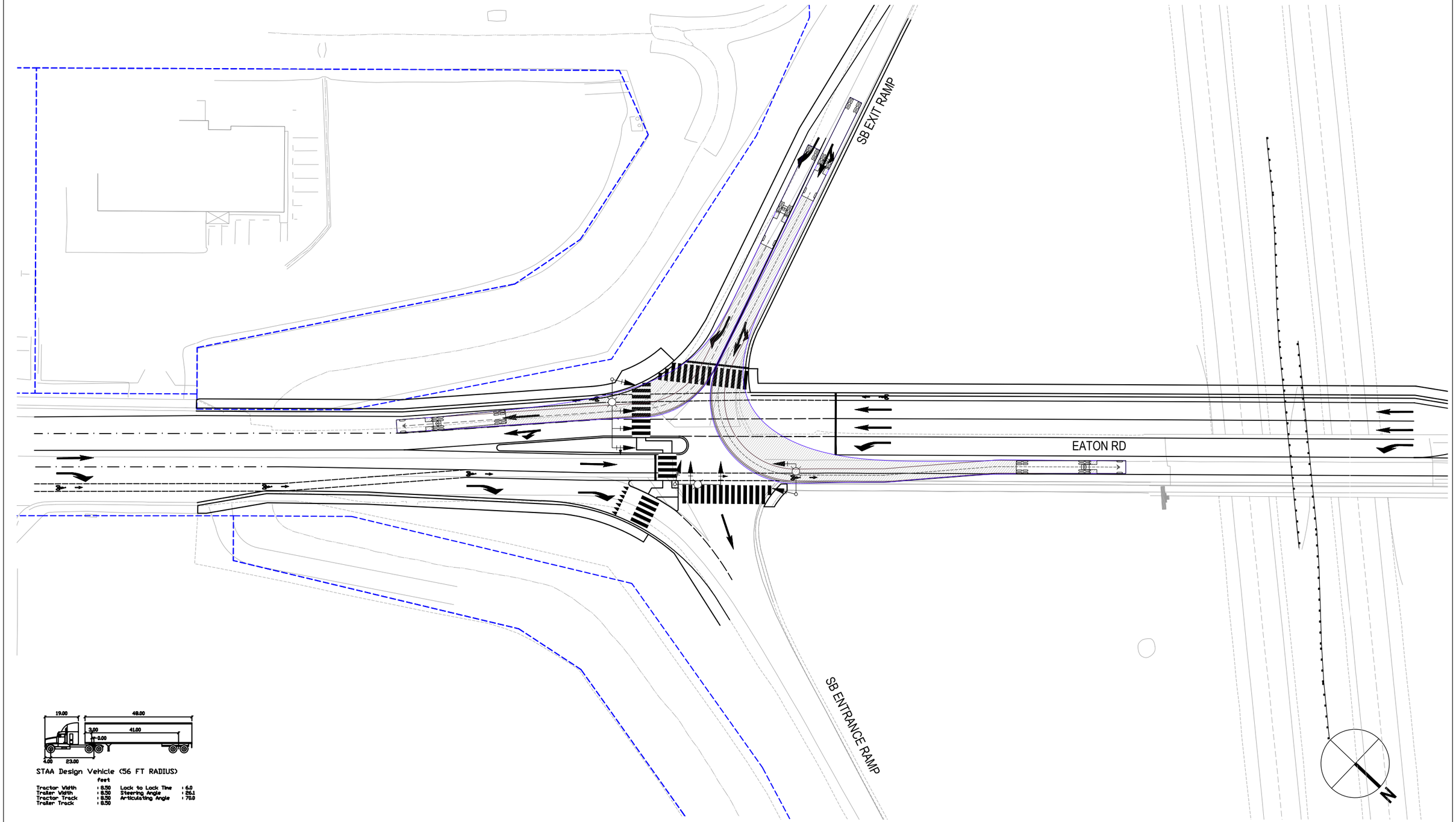
Project No.: 2468
Date: May 2022
Scale:

Filename: N:\US\Roseville\Projects\561\11219784\Digital_Design\ACAD 2018\XREFS\2684RA007_v2.dwg
Plot Date: 31 May 2022 - 5:34 PM



STAA Design Vehicle (56 FT RADIUS)

	feet		
Tractor Width	8.50	Lock to Lock Time	6.0
Trailer Width	8.50	Steering Angle	25.1
Tractor Track	8.50	Articulating Angle	70.0
Trailer Track	8.50		

PRELIMINARY,
SUBJECT TO CHANGE

CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS SIGNAL
TRUCK TURNS - EXIT RAMP

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Project No.: 2468
Date: May 2022
Scale:

Filename: N:\US\Roseville\Projects\561\11219784\Digital_Design\ACAD 2018\XREFS\2684RA007_v2.dwg
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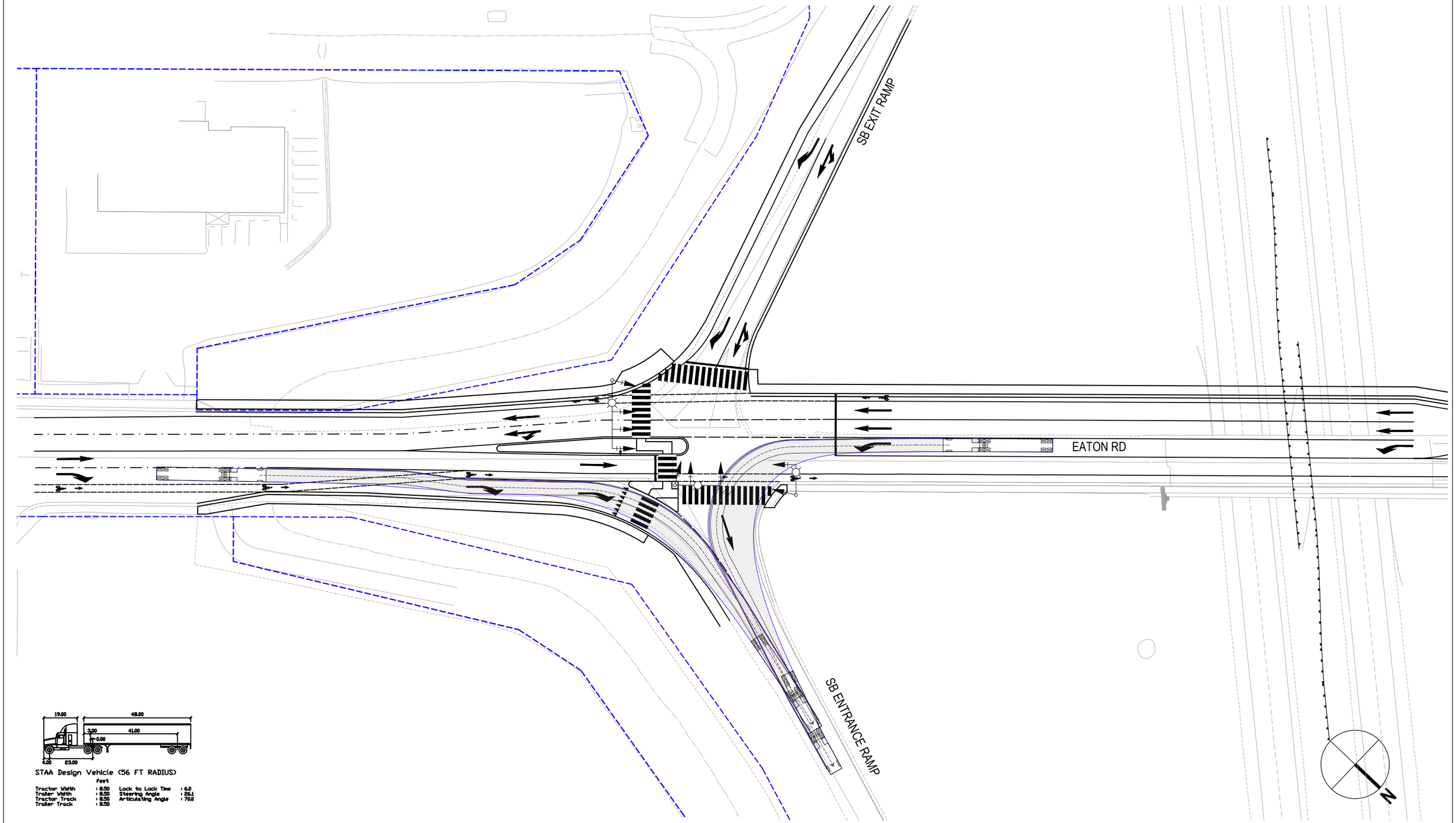

STAA Design Vehicle (56 FT RADIUS)

	feet		
Tractor Width	: 8.50	Lock to Lock Time	: 6.0
Trailer Width	: 8.50	Steering Angle	: 26.1
Tractor Track	: 8.50	Articulating Angle	: 70.0
Trailer Track	: 8.50		

PRELIMINARY, SUBJECT TO CHANGE

CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS SIGNAL
TRUCK TURNS - ENTRANCE RAMP

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Date: May 2022
Scale:

Filename: N:\US\Roseville\Projects\561\11219784\Digital_Design\ACAD 2018\XREFS\2684RA007_v2.dwg
Plot Date: 31 May 2022 - 5:35 PM

Appendix E: Roundabout Alternative Exhibits

EATON Rd NB RAMPS
COMPLETED UNDER
03-1H590
0316000187

PROPOSED SB RAMP IMPROVEMENTS

SB EXIT RAMP

ROUTE 99

NB ENTRANCE RAMP

HICKS Ln

EATON Rd

SB ENTRANCE RAMP

NB EXIT RAMP

N

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SUBJECT TO CHANGE

CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS ROUNDABOUT
PROJECT LOCATION

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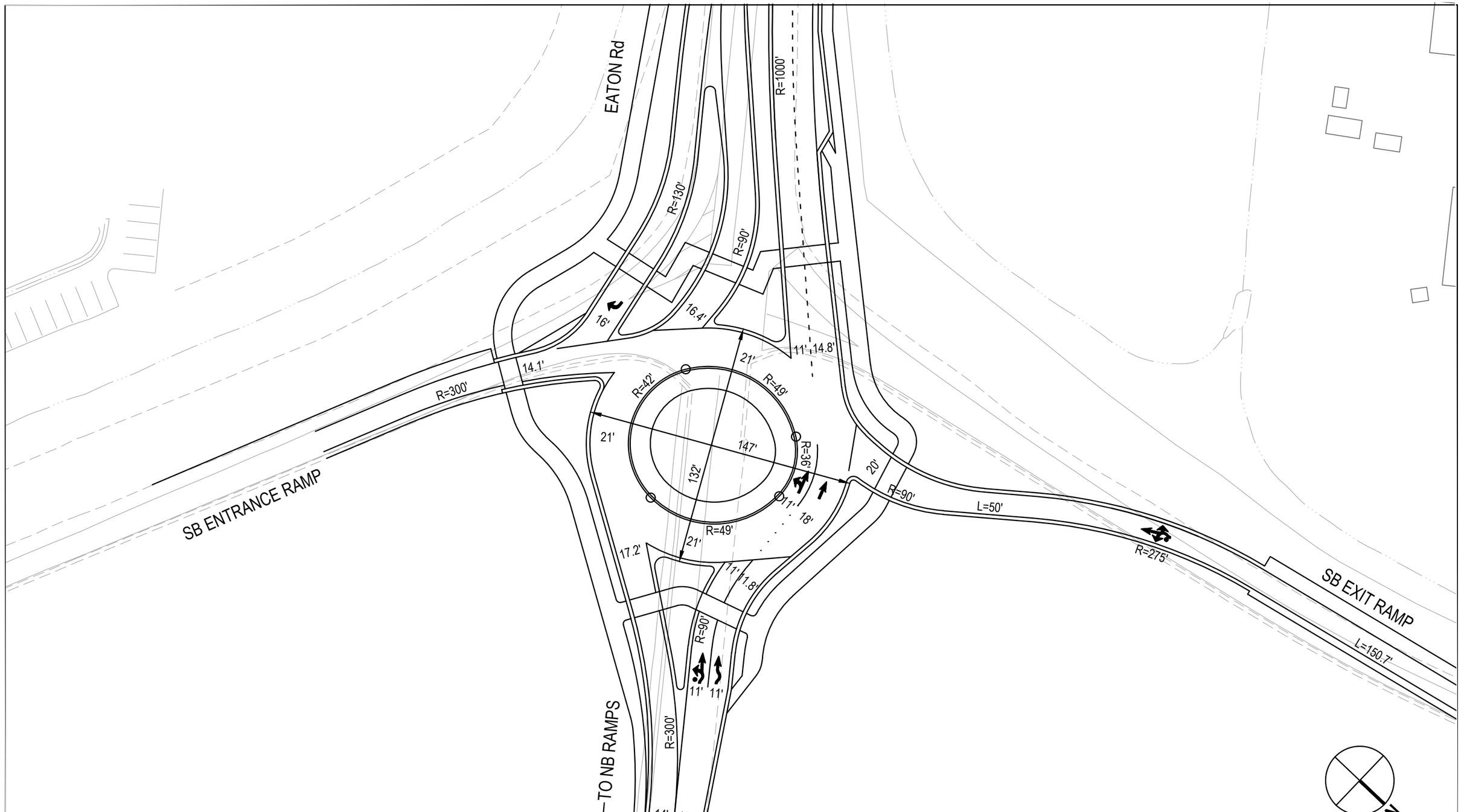
Project No.: 2468
Date: February 2021
Scale:

Filename: N:\US\Roseville\Projects\561\11219784\Digital_Design\ACAD 2018\Figures\Design Checks\2684EX002.
Plot Date: 23 May 2022 - 5:16 PM



PRELIMINARY,
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CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS ROUNDABOUT GEOMETRY

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Project No.: 2468
Date: February 2021
Scale:

Filename: N:\US\Roseville\Projects\561\11219784\Digital_Design\ACAD 2018\Figures\Design Checks\2684EX002.
Plot Date: 23 May 2022 - 5:16 PM

NOTES:

1. EXITING SPEEDS ARE DIRECTLY CORRELATED TO CIRCULATING SPEEDS AND DERIVED AS FOLLOWS:

   R3 SPEED = (R2 SPEED) + (ACCELERATION RATE X DISTANCE TO EXIT LEG CROSSWALK)

2. N/A=FASTEST PATH SPEED DOES NOT EXIST FOR THIS APPROACH

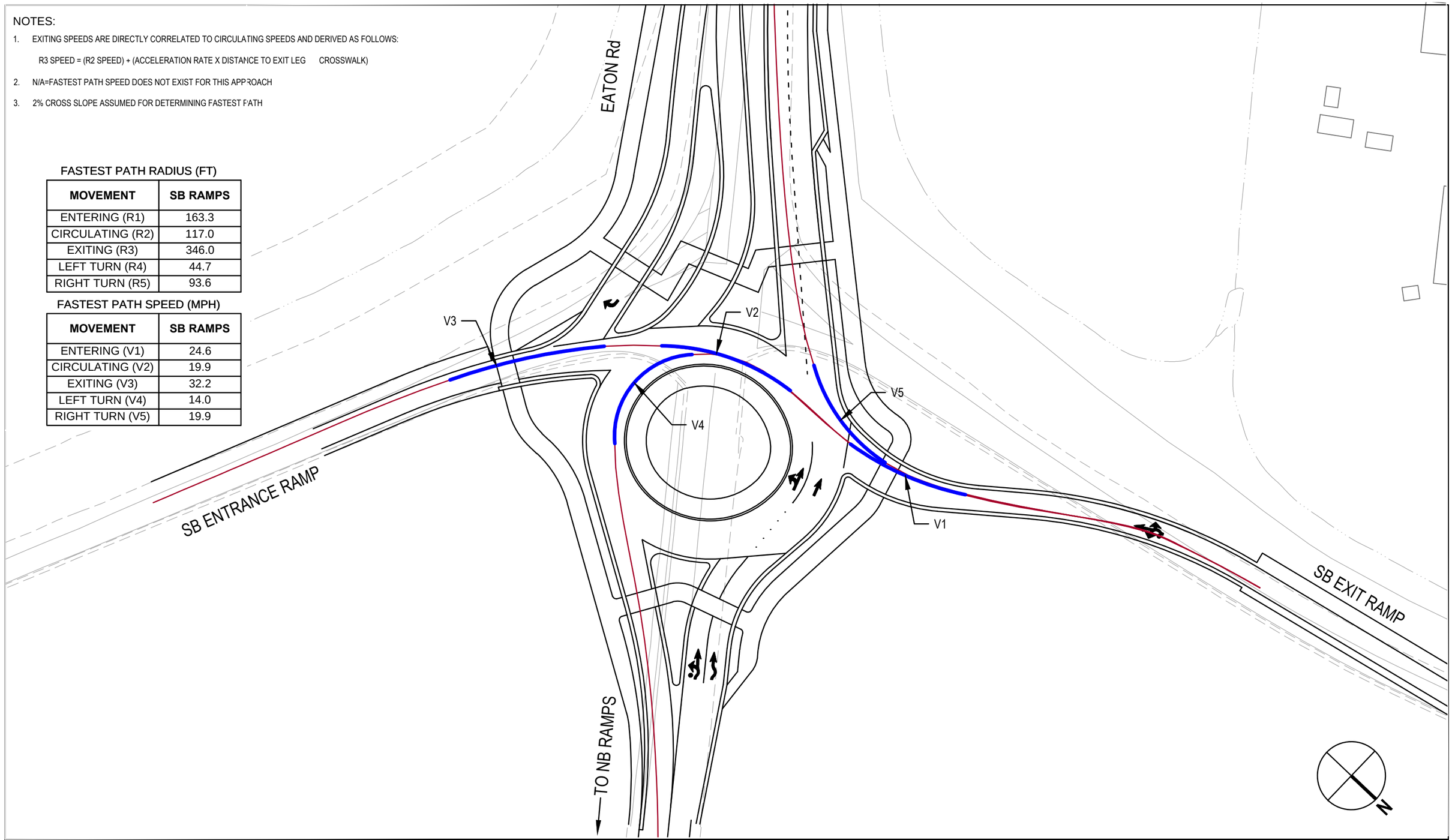
3. 2% CROSS SLOPE ASSUMED FOR DETERMINING FASTEST PATH

FASTEST PATH RADIUS (FT)

MOVEMENT	SB RAMPS
ENTERING (R1)	163.3
CIRCULATING (R2)	117.0
EXITING (R3)	346.0
LEFT TURN (R4)	44.7
RIGHT TURN (R5)	93.6

FASTEST PATH SPEED (MPH)

MOVEMENT	SB RAMPS
ENTERING (V1)	24.6
CIRCULATING (V2)	19.9
EXITING (V3)	32.2
LEFT TURN (V4)	14.0
RIGHT TURN (V5)	19.9



PRELIMINARY,
SUBJECT TO CHANGE

CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS ROUNDABOUT
SB FASTEST PATH

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Date: February 2021
Scale:

Filename: N:\US\Roseville\Projects\561\11219784\Digital_Design\ACAD 2018\Figures\Design Checks\2684EX002.
Plot Date: 23 May 2022 - 5:16 PM

NOTES:

1. EXITING SPEEDS ARE DIRECTLY CORRELATED TO CIRCULATING SPEEDS AND DERIVED AS FOLLOWS:

   R3 SPEED = (R2 SPEED) + (ACCELERATION RATE X DISTANCE TO EXIT LEG CROSSWALK)

2. N/A=FASTEST PATH SPEED DOES NOT EXIST FOR THIS APPROACH

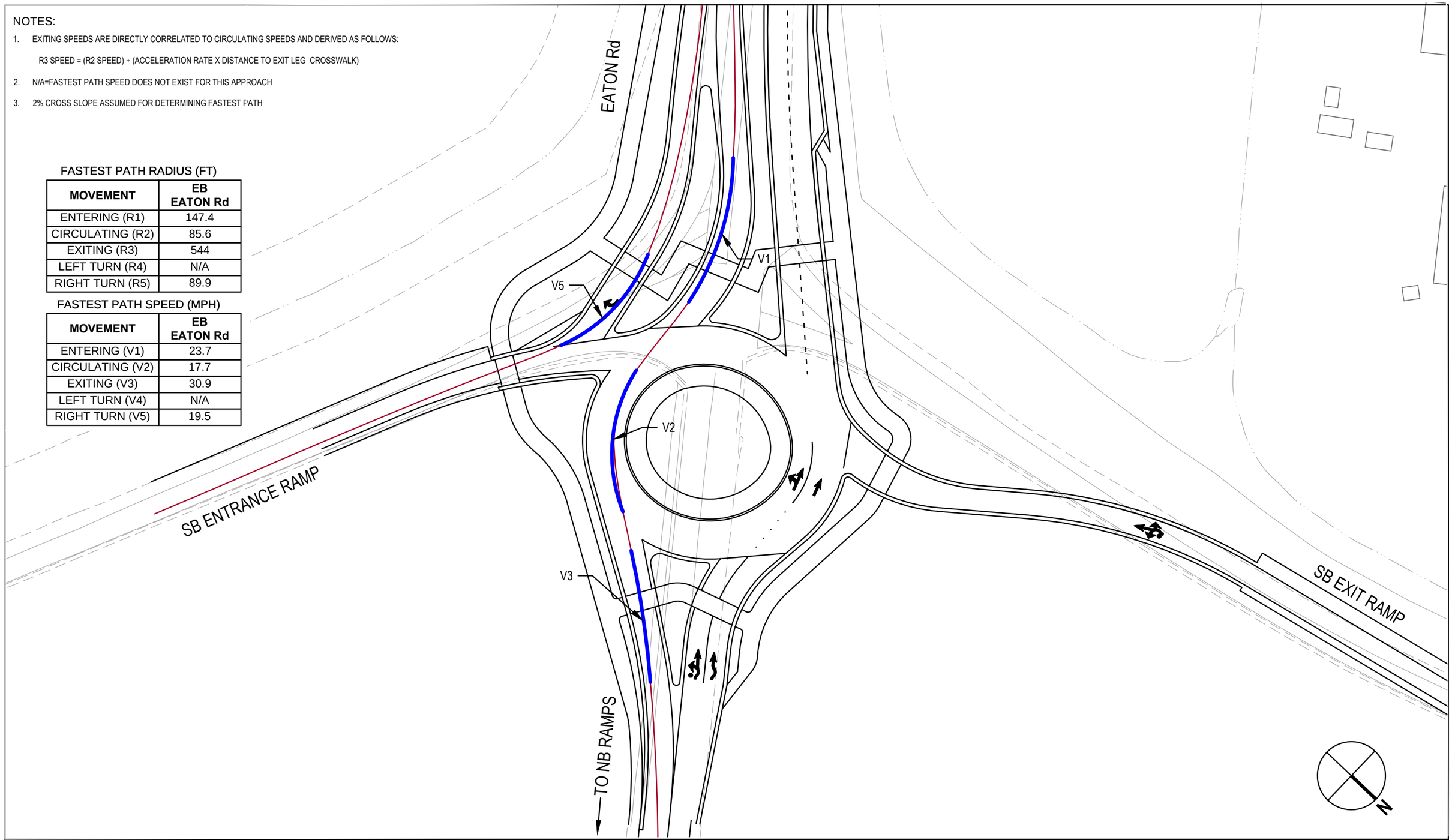
3. 2% CROSS SLOPE ASSUMED FOR DETERMINING FASTEST PATH

FASTEST PATH RADIUS (FT)

MOVEMENT	EB EATON Rd
ENTERING (R1)	147.4
CIRCULATING (R2)	85.6
EXITING (R3)	544
LEFT TURN (R4)	N/A
RIGHT TURN (R5)	89.9

FASTEST PATH SPEED (MPH)

MOVEMENT	EB EATON Rd
ENTERING (V1)	23.7
CIRCULATING (V2)	17.7
EXITING (V3)	30.9
LEFT TURN (V4)	N/A
RIGHT TURN (V5)	19.5



PRELIMINARY, SUBJECT TO CHANGE

CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS ROUNDABOUT
EB FASTEST PATH

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Date: February 2021
Scale:

Filename: N:\US\Roseville\Projects\561\11219784\Digital_Design\ACAD 2018\Figures\Design Checks\2684EX002.
Plot Date: 23 May 2022 - 5:16 PM

NOTES:

1. EXITING SPEEDS ARE DIRECTLY CORRELATED TO CIRCULATING SPEEDS AND DERIVED AS FOLLOWS:

   R3 SPEED = (R2 SPEED) + (ACCELERATION RATE X DISTANCE TO EXIT LEG CROSSWALK)

2. N/A=FASTEST PATH SPEED DOES NOT EXIST FOR THIS APPROACH

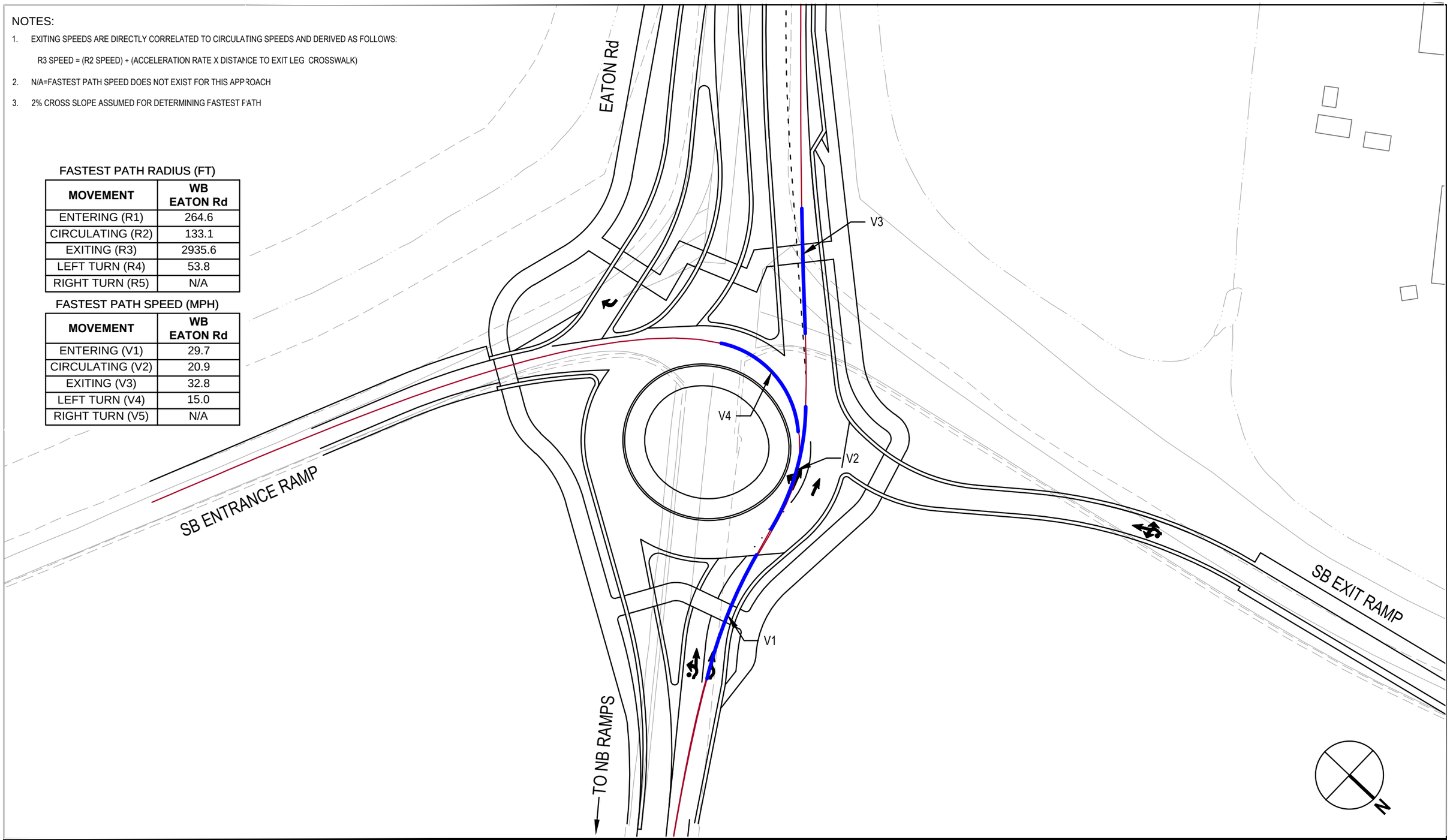
3. 2% CROSS SLOPE ASSUMED FOR DETERMINING FASTEST PATH

FASTEST PATH RADIUS (FT)

MOVEMENT	WB EATON Rd
ENTERING (R1)	264.6
CIRCULATING (R2)	133.1
EXITING (R3)	2935.6
LEFT TURN (R4)	53.8
RIGHT TURN (R5)	N/A

FASTEST PATH SPEED (MPH)

MOVEMENT	WB EATON Rd
ENTERING (V1)	29.7
CIRCULATING (V2)	20.9
EXITING (V3)	32.8
LEFT TURN (V4)	15.0
RIGHT TURN (V5)	N/A



PRELIMINARY, SUBJECT TO CHANGE

CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS ROUNDABOUT
WB FASTEST PATH

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Project No.: 2468
Date: February 2021
Scale:

Filename: N:\US\Roseville\Projects\561\11219784\Digital_Design\ACAD 2018\Figures\Design Checks\2684EX002.
Plot Date: 23 May 2022 - 5:16 PM

EATON Rd

SB ENTRANCE RAMP

TO NB RAMPS

SB EXIT RAMP

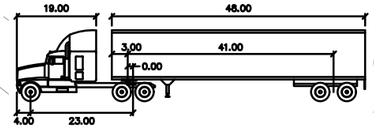
LEGEND

STAA DESIGN VEHICLE (67 FT TURNS)
CALTRANS 2018 (US)

VEHICLE BODY CLEARANCE

FRONT TIRES SWEPT PATH

VEHICLE PROFILE



STAA DESIGN VEHICLE feet

Tractor Width	: 8.50	Lock to Lock Time	: 6.0
Trailer Width	: 8.50	Steering Angle	: 21.4
Tractor Track	: 8.50	Articulating Angle	: 70.0
Trailer Track	: 8.50		

PRELIMINARY, SUBJECT TO CHANGE

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ROUTE 99 AT EATON ROAD SB RAMPS ROUNDABOUT
SB TRUCK TURNS

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Scale:

Filename: N:\US\Roseville\Projects\561\11219784\Digital_Design\ACAD 2018\Figures\Design Checks\2684EX002.
Plot Date: 23 May 2022 - 5:16 PM

EATON Rd

SB ENTRANCE RAMP

TO NB RAMPS

SB EXIT RAMP

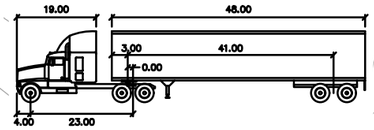
LEGEND

STAA DESIGN VEHICLE (67 FT TURNING RADIUS)
CALTRANS 2018 (US)

VEHICLE BODY CLEARANCE

FRONT TIRES SWEPT PATH

VEHICLE PROFILE



STAA DESIGN VEHICLE feet

Tractor Width	: 8.50	Lock to Lock Time	: 6.0
Trailer Width	: 8.50	Steering Angle	: 21.4
Tractor Track	: 8.50	Articulating Angle	: 70.0
Trailer Track	: 8.50		

N

PRELIMINARY,
SUBJECT TO CHANGE

CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS ROUNDABOUT
EB TRUCK TURNS

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Plot Date: 23 May 2022 - 5:16 PM

EATON Rd

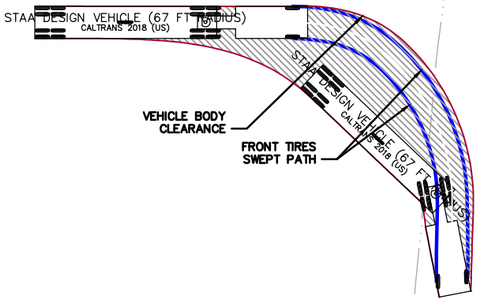
SB ENTRANCE RAMP

SB EXIT RAMP

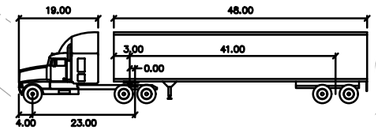
TO NB RAMPS

LEGEND

STAA DESIGN VEHICLE (67 FT TURNING RADIUS)
CALTRANS 2018 (US)



VEHICLE PROFILE



STAA DESIGN VEHICLE feet

Tractor Width	: 8.50	Lock to Lock Time	: 6.0
Trailer Width	: 8.50	Steering Angle	: 21.4
Tractor Track	: 8.50	Articulating Angle	: 70.0
Trailer Track	: 8.50		

N

PRELIMINARY,
SUBJECT TO CHANGE

CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS ROUNDABOUT
WB TRUCK TURNS

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Project No.: 2468
Date: February 2021
Scale:

Filename: N:\US\Roseville\Projects\561\11219784\Digital_Design\ACAD 2018\Figures\Design Checks\2684EX002.
Plot Date: 23 May 2022 - 5:16 PM

EATON Rd

SB ENTRANCE RAMP

SB EXIT RAMP

TO NB RAMPS

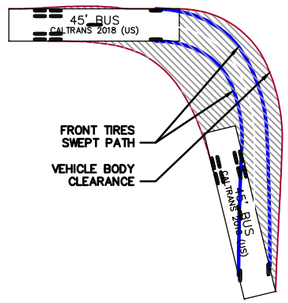
45' BUS
CALTRANS 2018 (US)

45' BUS
CALTRANS 2018 (US)

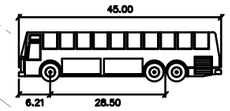
45' BUS
CALTRANS 2018 (US)

45' BUS
CALTRANS 2018 (US)

LEGEND



VEHICLE PROFILE



45' BUS	feet
Width	: 8.50
Track	: 8.50
Lock to Lock Time	: 6.0
Steering Angle	: 42.9

N

PRELIMINARY,
SUBJECT TO CHANGE

CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS ROUNDABOUT
SB BUS TURNS

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Project No.: 2468
Date: February 2021
Scale:

Filename: N:\US\Roseville\Projects\561\11219784\Digital_Design\ACAD 2018\Figures\Design Checks\2684EX002.
Plot Date: 23 May 2022 - 5:16 PM

EATON Rd

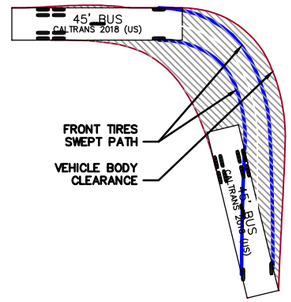
SB ENTRANCE RAMP

TO NB RAMPS

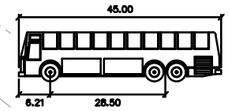
SB EXIT RAMP

45' BUS CAL TRANS 2018 (US)

LEGEND



VEHICLE PROFILE



45' BUS	feet
Width	: 8.50
Track	: 8.50
Lock to Lock Time	: 6.0
Steering Angle	: 42.9

N

PRELIMINARY,
SUBJECT TO CHANGE

CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS ROUNDABOUT
EB BUS TURNS

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Project No.: 2468
Date: February 2021
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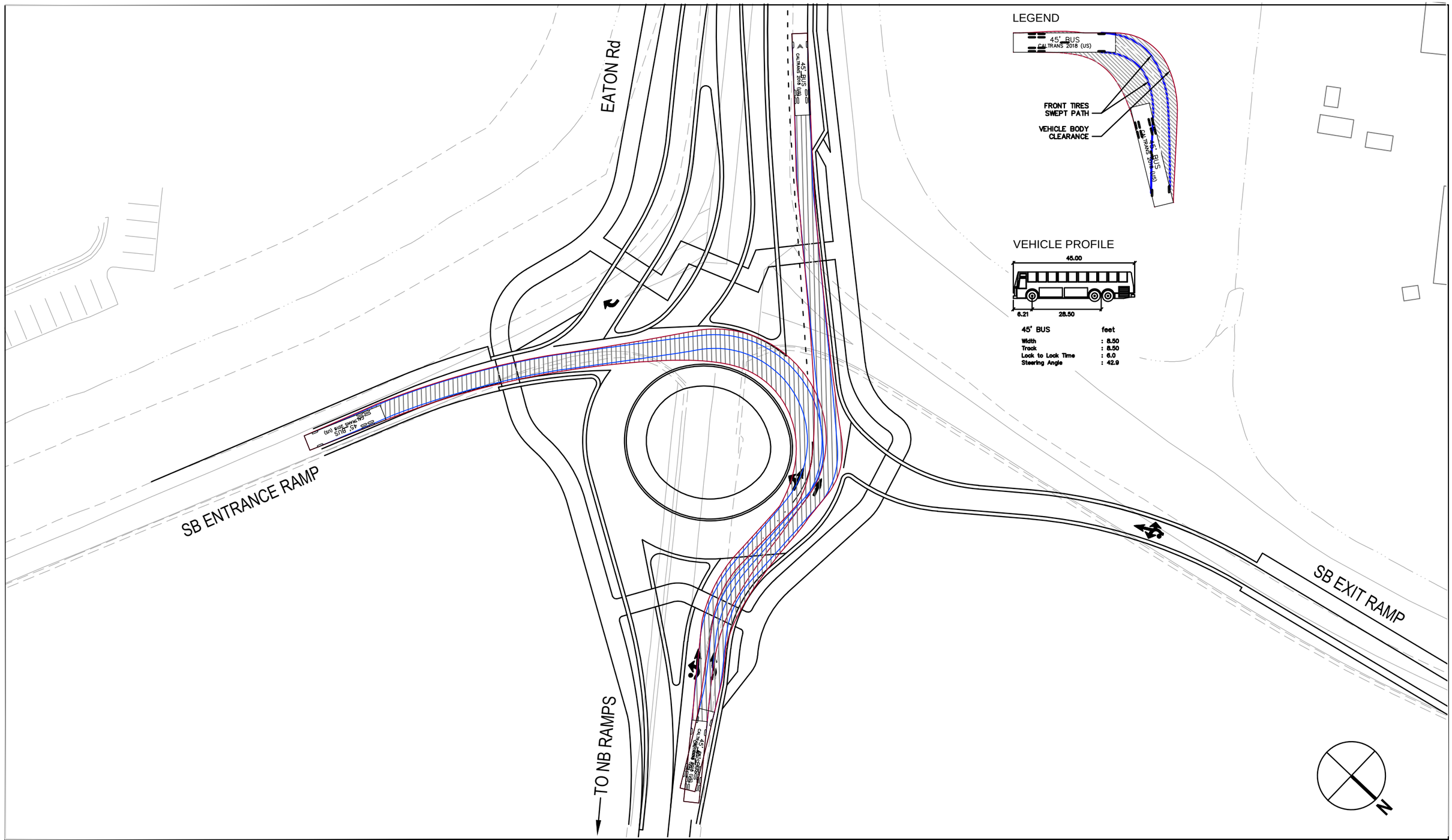

PRELIMINARY, SUBJECT TO CHANGE

CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS ROUNDABOUT
WB BUS TURNS

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Plot Date: 23 May 2022 - 5:16 PM

LEGEND:

SIGHT DISTANCE TRIANGLE

EATON Rd

SB ENTRANCE RAMP

TO NB RAMPS

SB EXIT RAMP

50

V=25.3 MPH
L=241.0'

V=25.3 MPH
L=241.0'

N

PRELIMINARY,
SUBJECT TO CHANGE

CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS ROUNDABOUT
SB INTERSECTION SIGHT DISTANCE

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LEGEND:

SIGHT DISTANCE TRIANGLE

EATON Rd

50'

50'

V=22.3 MPH
L=212.4'

V=15.0 MPH
L=142.8'

SB ENTRANCE RAMP

SB EXIT RAMP

TO NB RAMPS

N

PRELIMINARY,
SUBJECT TO CHANGE

CITY of CHICO

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SB INTERSECTION SIGHT DISTANCE

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LEGEND:

SIGHT DISTANCE TRIANGLE

EATON Rd

SB ENTRANCE RAMP

V=13.9 MPH
L=132.6'

50'

SB EXIT RAMP

TO NB RAMPS

N

PRELIMINARY,
SUBJECT TO CHANGE

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SB INTERSECTION SIGHT DISTANCE

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LEGEND:

SIGHT DISTANCE TRIANGLE

EATON Rd

SB ENTRANCE RAMP

V=19.9 MPH
L=11.5'

V=17.7 MPH
L=95.7'

V=20.9 MPH
L=118.8'

SB EXIT RAMP

TO NB RAMPS

N

PRELIMINARY,
SUBJECT TO CHANGE

CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS ROUNDABOUT
CIRCULATING SIGHT DISTANCE

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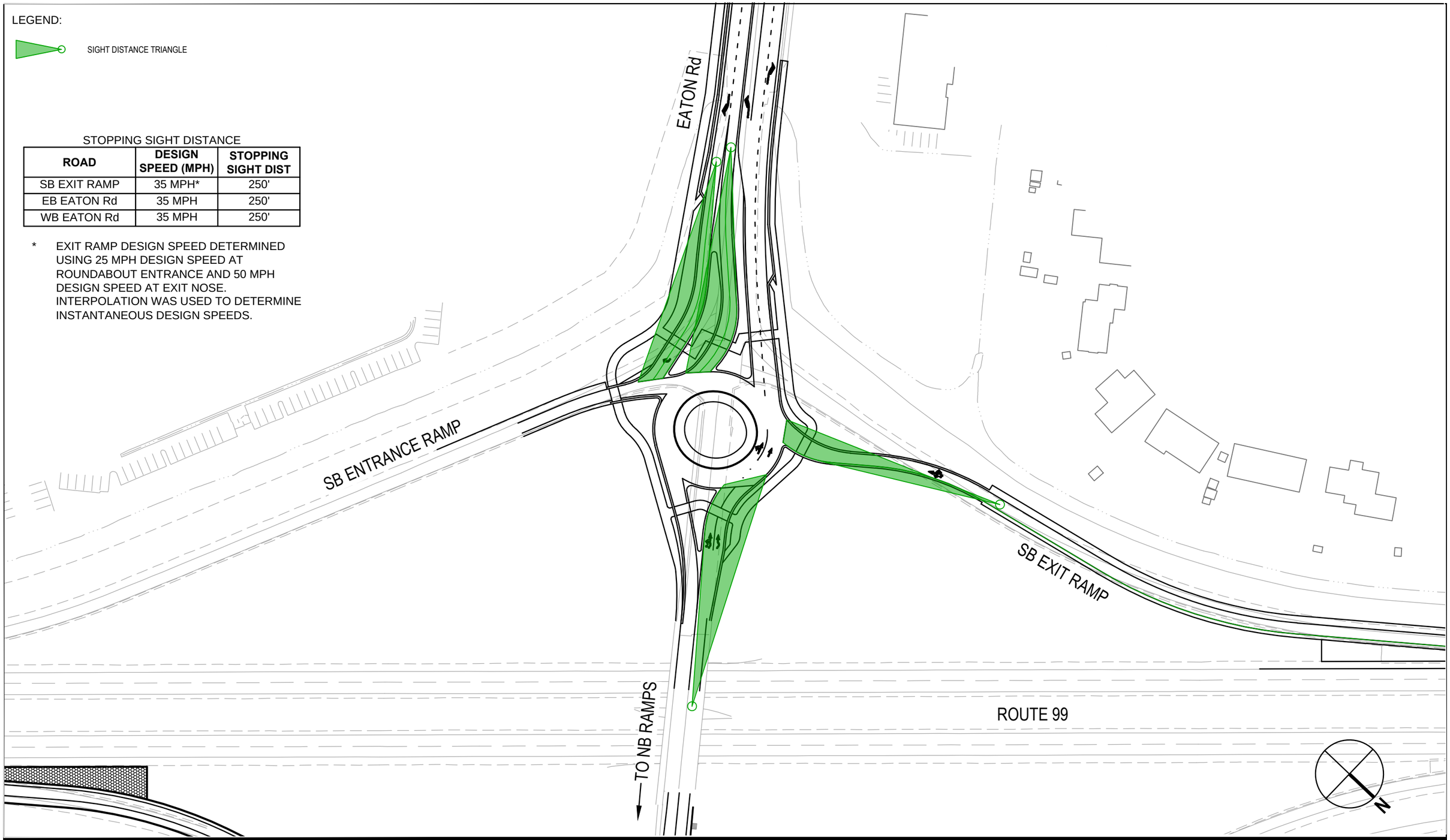
LEGEND:

SIGHT DISTANCE TRIANGLE

STOPPING SIGHT DISTANCE

ROAD	DESIGN SPEED (MPH)	STOPPING SIGHT DIST
SB EXIT RAMP	35 MPH*	250'
EB EATON Rd	35 MPH	250'
WB EATON Rd	35 MPH	250'

* EXIT RAMP DESIGN SPEED DETERMINED USING 25 MPH DESIGN SPEED AT ROUNDABOUT ENTRANCE AND 50 MPH DESIGN SPEED AT EXIT NOSE. INTERPOLATION WAS USED TO DETERMINE INSTANTANEOUS DESIGN SPEEDS.



PRELIMINARY, SUBJECT TO CHANGE

CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS ROUNDABOUT
STOPPING SIGHT DISTANCE - YIELD LINE

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Scale:

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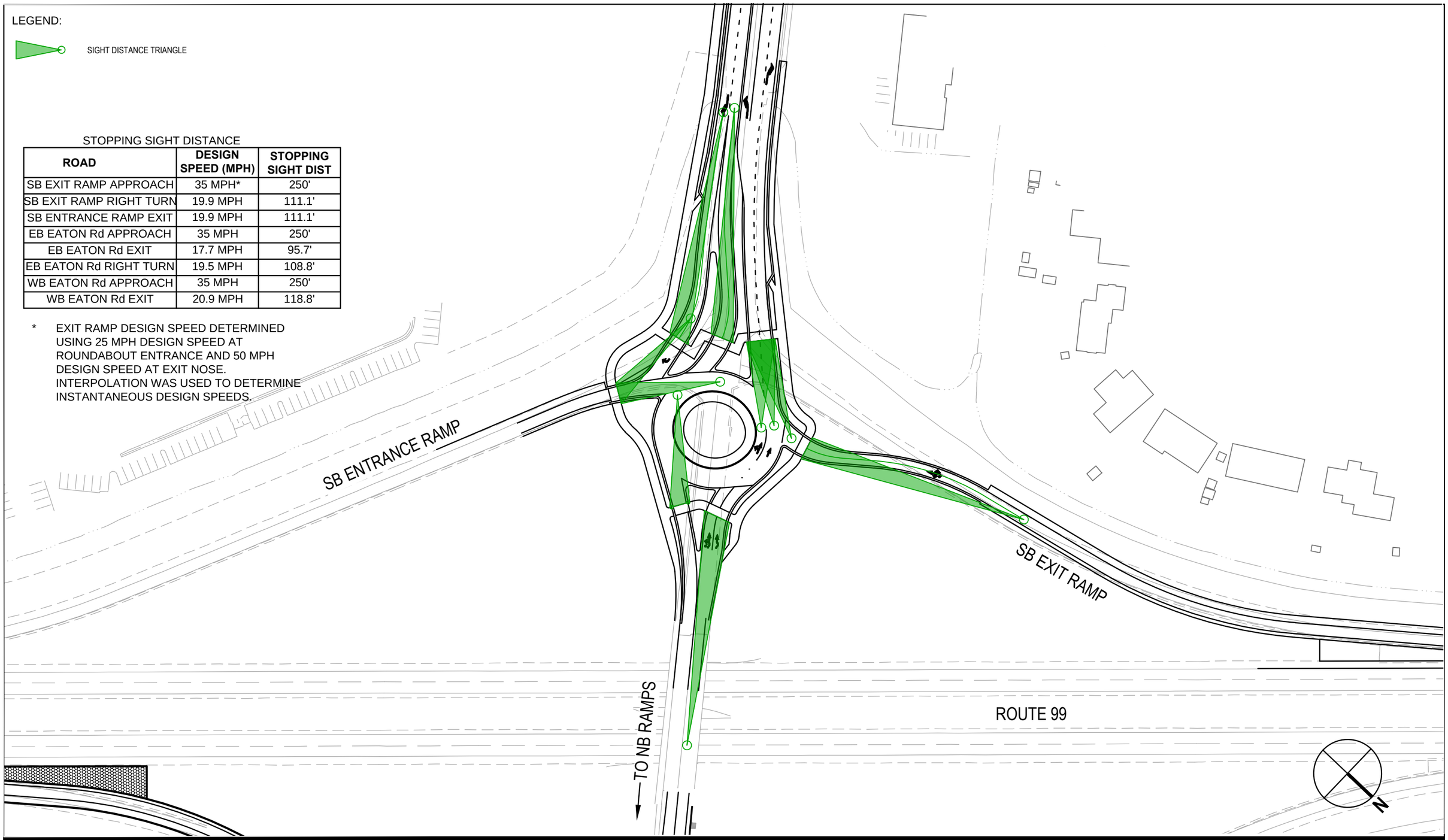
LEGEND:

SIGHT DISTANCE TRIANGLE

STOPPING SIGHT DISTANCE

ROAD	DESIGN SPEED (MPH)	STOPPING SIGHT DIST
SB EXIT RAMP APPROACH	35 MPH*	250'
SB EXIT RAMP RIGHT TURN	19.9 MPH	111.1'
SB ENTRANCE RAMP EXIT	19.9 MPH	111.1'
EB EATON Rd APPROACH	35 MPH	250'
EB EATON Rd EXIT	17.7 MPH	95.7'
EB EATON Rd RIGHT TURN	19.5 MPH	108.8'
WB EATON Rd APPROACH	35 MPH	250'
WB EATON Rd EXIT	20.9 MPH	118.8'

* EXIT RAMP DESIGN SPEED DETERMINED USING 25 MPH DESIGN SPEED AT ROUNDABOUT ENTRANCE AND 50 MPH DESIGN SPEED AT EXIT NOSE. INTERPOLATION WAS USED TO DETERMINE INSTANTANEOUS DESIGN SPEEDS.



PRELIMINARY, SUBJECT TO CHANGE

CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS ROUNDABOUT
STOPPING SIGHT DISTANCE - CROSSWALKS

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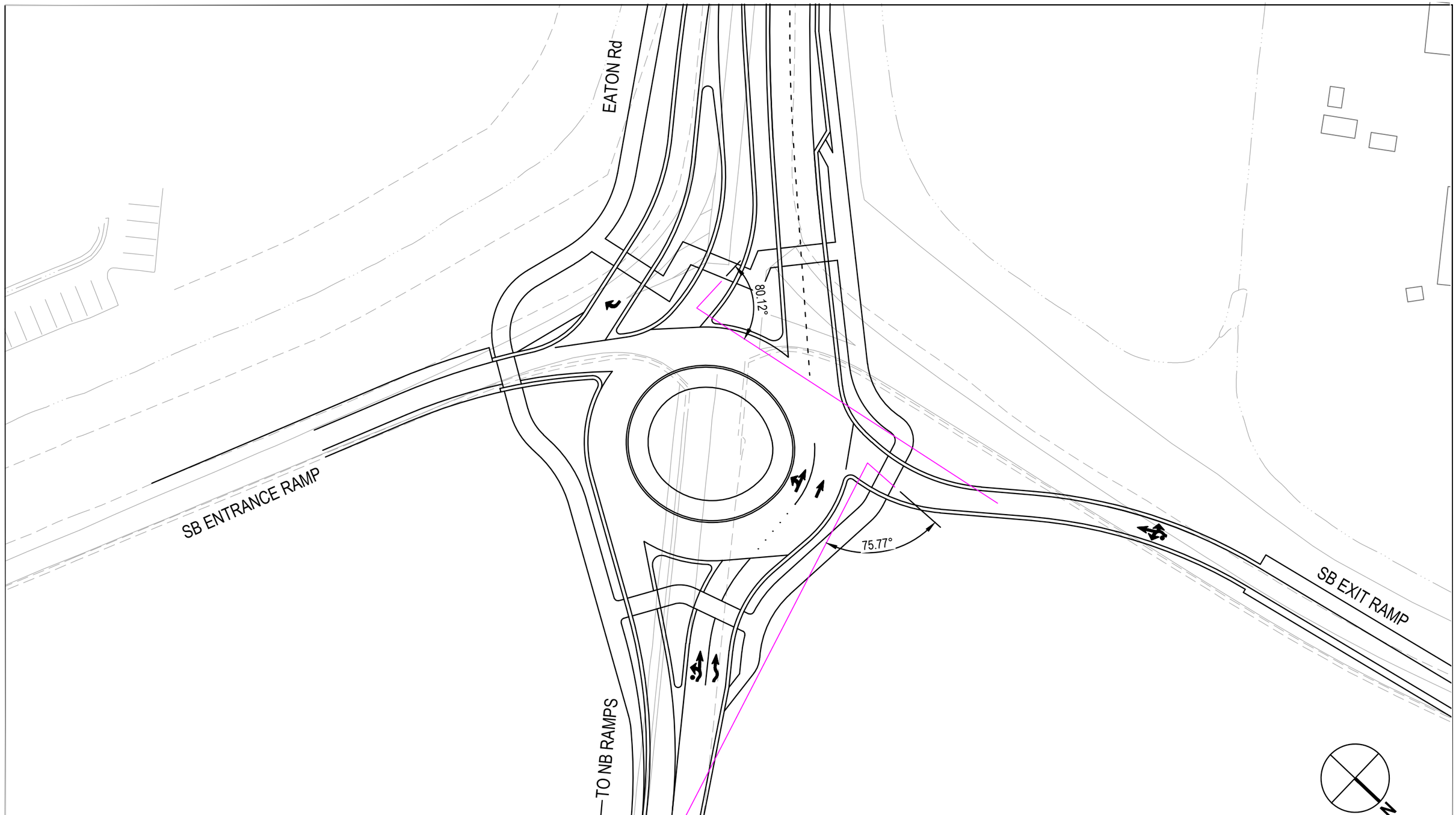

PRELIMINARY,
SUBJECT TO CHANGE

CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS ROUNDABOUT
INTERSECTION VIEW ANGLES

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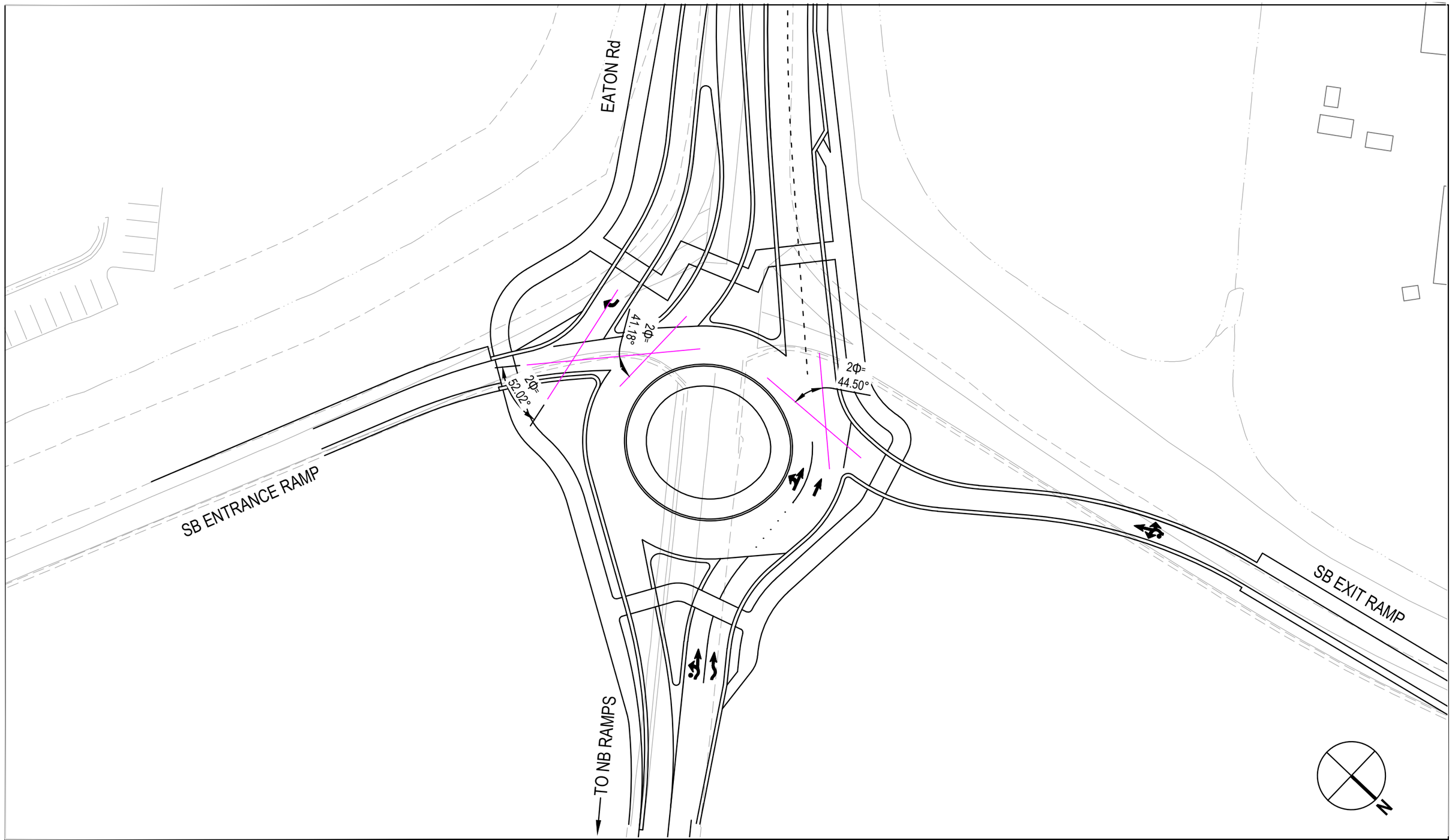

PRELIMINARY,
SUBJECT TO CHANGE

CITY of CHICO

ROUTE 99 AT EATON ROAD SB RAMPS ROUNDABOUT
ENTRY ANGLES

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Date: February 2021
Scale:

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Appendix F: Emissions Reports

INTERSECTION SUMMARY

Site: 3v [Ramps Existing AM (Site Folder: No Build Conditions)]

New Site
Site Category: (None)
Stop (Two-Way)

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	20.2	mph	20.2	mph
Travel Distance (Total)	743.3	veh-mi/h	891.9	pers-mi/h
Travel Time (Total)	36.8	veh-h/h	44.2	pers-h/h
Desired Speed (Program)	34.9	mph		
Speed Efficiency	0.58			
Travel Time Index	5.31			
Congestion Coefficient	1.73			
Demand Flows (Total)	2390	veh/h	2868	pers/h
Percent Heavy Vehicles (Demand)	2.0	%		
Degree of Saturation	2.061			
Practical Spare Capacity	-61.2	%		
Effective Intersection Capacity	1160	veh/h		
Control Delay (Total)	13.79	veh-h/h	16.55	pers-h/h
Control Delay (Average)	20.8	sec	20.8	sec
Control Delay (Worst Lane)	631.7	sec		
Control Delay (Worst Movement)	914.8	sec	914.8	sec
Geometric Delay (Average)	3.3	sec		
Stop-Line Delay (Average)	17.5	sec		
Idling Time (Average)	18.0	sec		
Intersection Level of Service (LOS)	NA			
95% Back of Queue - Vehicles (Worst Lane)	16.5	veh		
95% Back of Queue - Distance (Worst Lane)	418.9	ft		
Ave. Queue Storage Ratio (Worst Lane)	0.11			
Total Effective Stops	913	veh/h	1096	pers/h
Effective Stop Rate	0.38		0.38	
Proportion Queued	0.10		0.10	
Performance Index	70.3		70.3	
Cost (Total)	697.65	$/h	697.65	$/h
Fuel Consumption (Total)	35.3	gal/h		
Carbon Dioxide (Total)	315.8	kg/h		
Hydrocarbons (Total)	0.029	kg/h		
Carbon Monoxide (Total)	0.322	kg/h		
NOx (Total)	0.354	kg/h		

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA: Intersection LOS for Vehicles is Not Applicable for two-way sign control since the average intersection delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 2.5 %
Number of Iterations: 6 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 2.6% 1.3% 0.6%

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	1,147,200	veh/y	1,376,640	pers/y
Delay	6,621	veh-h/y	7,945	pers-h/y
Effective Stops	438,252	veh/y	525,902	pers/y
Travel Distance	356,768	veh-mi/y	428,121	pers-mi/y
Travel Time	17,665	veh-h/y	21,198	pers-h/y
Cost	334,872	$/y	334,872	$/y
Fuel Consumption	16,948	gal/y		
Carbon Dioxide	151,590	kg/y		
Hydrocarbons	14	kg/y		
Carbon Monoxide	154	kg/y		

NOx	170	kg/y

INTERSECTION SUMMARY

Site: 3v [Ramps 2040 AM (Site Folder: No Build Conditions)]

New Site
Site Category: (None)
Stop (Two-Way)

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	3.4	mph	3.4	mph
Travel Distance (Total)	1082.9	veh-mi/h	1299.5	pers-mi/h
Travel Time (Total)	319.5	veh-h/h	383.5	pers-h/h
Desired Speed (Program)	34.9	mph		
Speed Efficiency	0.10			
Travel Time Index	0.00			
Congestion Coefficient	10.00			
Demand Flows (Total)	3463	veh/h	4156	pers/h
Percent Heavy Vehicles (Demand)	2.0	%		
Degree of Saturation	18.297			
Practical Spare Capacity	-95.6	%		
Effective Intersection Capacity	189	veh/h		
Control Delay (Total)	272.01	veh-h/h	326.41	pers-h/h
Control Delay (Average)	282.8	sec	282.8	sec
Control Delay (Worst Lane)	7964.8	sec		
Control Delay (Worst Movement)	8063.8	sec	8063.8	sec
Geometric Delay (Average)	3.3	sec		
Stop-Line Delay (Average)	279.5	sec		
Idling Time (Average)	293.8	sec		
Intersection Level of Service (LOS)	NA			
95% Back of Queue - Vehicles (Worst Lane)	76.9	veh		
95% Back of Queue - Distance (Worst Lane)	1952.7	ft		
Ave. Queue Storage Ratio (Worst Lane)	0.49			
Total Effective Stops	1463	veh/h	1756	pers/h
Effective Stop Rate	0.42		0.42	
Proportion Queued	0.14		0.14	
Performance Index	462.3		462.3	
Cost (Total)	5167.13	$/h	5167.13	$/h
Fuel Consumption (Total)	137.0	gal/h		
Carbon Dioxide (Total)	1222.7	kg/h		
Hydrocarbons (Total)	0.146	kg/h		
Carbon Monoxide (Total)	1.015	kg/h		
NOx (Total)	0.822	kg/h		

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA: Intersection LOS for Vehicles is Not Applicable for two-way sign control since the average intersection delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 99.7% 40.5% 0.0%

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	1,662,261	veh/y	1,994,713	pers/y
Delay	130,565	veh-h/y	156,677	pers-h/y
Effective Stops	702,457	veh/y	842,949	pers/y
Travel Distance	519,815	veh-mi/y	623,779	pers-mi/y
Travel Time	153,383	veh-h/y	184,059	pers-h/y
Cost	2,480,221	$/y	2,480,221	$/y
Fuel Consumption	65,740	gal/y		
Carbon Dioxide	586,875	kg/y		
Hydrocarbons	70	kg/y		
Carbon Monoxide	487	kg/y		
NOx	394	kg/y		

INTERSECTION SUMMARY

Site: 3vv [Ramps 2020 AM (Site Folder: Signal Conditions)]

New Site
Site Category: (None)
Signals - EQUISAT (Pretimed) Isolated Cycle Time = 80 seconds (Site Optimum Cycle Time - Minimum Delay)

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	25.5	mph	25.5	mph
Travel Distance (Total)	743.4	veh-mi/h	892.1	pers-mi/h
Travel Time (Total)	29.1	veh-h/h	34.9	pers-h/h
Desired Speed (Program)	34.9	mph		
Speed Efficiency	0.73			
Travel Time Index	7.01			
Congestion Coefficient	1.37			
Demand Flows (Total)	2390	veh/h	2868	pers/h
Percent Heavy Vehicles (Demand)	2.0	%		
Degree of Saturation	0.504			
Practical Spare Capacity	94.4	%		
Effective Intersection Capacity	4740	veh/h		
Control Delay (Total)	7.62	veh-h/h	9.15	pers-h/h
Control Delay (Average)	11.5	sec	11.5	sec
Control Delay (Worst Lane)	45.7	sec		
Control Delay (Worst Movement)	45.7	sec	45.7	sec
Geometric Delay (Average)	3.2	sec		
Stop-Line Delay (Average)	8.3	sec		
Idling Time (Average)	6.3	sec		
Intersection Level of Service (LOS)	LOS B			
95% Back of Queue - Vehicles (Worst Lane)	9.6	veh		
95% Back of Queue - Distance (Worst Lane)	242.8	ft		
Ave. Queue Storage Ratio (Worst Lane)	0.34			
Total Effective Stops	1201	veh/h	1442	pers/h
Effective Stop Rate	0.50		0.50	
Proportion Queued	0.34		0.34	
Performance Index	74.1		74.1	
Cost (Total)	600.72	$/h	600.72	$/h
Fuel Consumption (Total)	37.3	gal/h		
Carbon Dioxide (Total)	333.3	kg/h		
Hydrocarbons (Total)	0.030	kg/h		
Carbon Monoxide (Total)	0.358	kg/h		
NOx (Total)	0.401	kg/h		

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.0 %
Number of Iterations: 2 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 33.4% 0.0% 0.0%

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	1,147,200	veh/y	1,376,640	pers/y
Delay	3,658	veh-h/y	4,390	pers-h/y
Effective Stops	576,613	veh/y	691,936	pers/y
Travel Distance	356,848	veh-mi/y	428,218	pers-mi/y
Travel Time	13,968	veh-h/y	16,761	pers-h/y
Cost	288,347	$/y	288,347	$/y
Fuel Consumption	17,889	gal/y		
Carbon Dioxide	159,973	kg/y		
Hydrocarbons	14	kg/y		
Carbon Monoxide	172	kg/y		
NOx	192	kg/y		

INTERSECTION SUMMARY

Site: 3vv [Ramps 2040 AM (Site Folder: Signal Conditions)]

New Site
Site Category: (None)
Signals - EQUISAT (Pretimed) Isolated Cycle Time = 80 seconds (Site Optimum Cycle Time - Minimum Delay)

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	24.9	mph	24.9	mph
Travel Distance (Total)	1083.2	veh-mi/h	1299.9	pers-mi/h
Travel Time (Total)	43.5	veh-h/h	52.3	pers-h/h
Desired Speed (Program)	34.9	mph		
Speed Efficiency	0.71			
Travel Time Index	6.81			
Congestion Coefficient	1.40			
Demand Flows (Total)	3463	veh/h	4156	pers/h
Percent Heavy Vehicles (Demand)	2.0	%		
Degree of Saturation	0.695			
Practical Spare Capacity	41.0	%		
Effective Intersection Capacity	4982	veh/h		
Control Delay (Total)	13.86	veh-h/h	16.64	pers-h/h
Control Delay (Average)	14.4	sec	14.4	sec
Control Delay (Worst Lane)	46.2	sec		
Control Delay (Worst Movement)	46.2	sec	46.2	sec
Geometric Delay (Average)	3.1	sec		
Stop-Line Delay (Average)	11.3	sec		
Idling Time (Average)	7.3	sec		
Intersection Level of Service (LOS)	LOS B			
95% Back of Queue - Vehicles (Worst Lane)	16.6	veh		
95% Back of Queue - Distance (Worst Lane)	421.2	ft		
Ave. Queue Storage Ratio (Worst Lane)	0.49			
Total Effective Stops	1859	veh/h	2231	pers/h
Effective Stop Rate	0.54		0.54	
Proportion Queued	0.39		0.39	
Performance Index	121.1		121.1	
Cost (Total)	894.93	$/h	894.93	$/h
Fuel Consumption (Total)	55.0	gal/h		
Carbon Dioxide (Total)	491.9	kg/h		
Hydrocarbons (Total)	0.045	kg/h		
Carbon Monoxide (Total)	0.526	kg/h		
NOx (Total)	0.588	kg/h		

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.0 %
Number of Iterations: 2 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 46.0% 1.8% 0.0%

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	1,662,261	veh/y	1,994,713	pers/y
Delay	6,654	veh-h/y	7,985	pers-h/y
Effective Stops	892,413	veh/y	1,070,896	pers/y
Travel Distance	519,957	veh-mi/y	623,949	pers-mi/y
Travel Time	20,902	veh-h/y	25,082	pers-h/y
Cost	429,568	$/y	429,568	$/y
Fuel Consumption	26,403	gal/y		
Carbon Dioxide	236,091	kg/y		
Hydrocarbons	21	kg/y		
Carbon Monoxide	252	kg/y		
NOx	282	kg/y		

INTERSECTION SUMMARY

Site: 3 [Ramps Existing AM (Site Folder: Final Concept)]

New Site
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	30.8	mph	30.8	mph
Travel Distance (Total)	770.2	veh-mi/h	924.3	pers-mi/h
Travel Time (Total)	25.0	veh-h/h	30.0	pers-h/h
Desired Speed (Program)	34.5	mph		
Speed Efficiency	0.89			
Travel Time Index	8.80			
Congestion Coefficient	1.12			
Demand Flows (Total)	2390	veh/h	2868	pers/h
Percent Heavy Vehicles (Demand)	2.0	%		
Degree of Saturation	0.488			
Practical Spare Capacity	74.3	%		
Effective Intersection Capacity	4900	veh/h		
Control Delay (Total)	3.08	veh-h/h	3.70	pers-h/h
Control Delay (Average)	4.6	sec	4.6	sec
Control Delay (Worst Lane)	11.2	sec		
Control Delay (Worst Movement)	13.9	sec	13.9	sec
Geometric Delay (Average)	2.9	sec		
Stop-Line Delay (Average)	1.8	sec		
Idling Time (Average)	0.2	sec		
Intersection Level of Service (LOS)	LOS A			
95% Back of Queue - Vehicles (Worst Lane)	3.8	veh		
95% Back of Queue - Distance (Worst Lane)	97.6	ft		
Ave. Queue Storage Ratio (Worst Lane)	0.09			
Total Effective Stops	1109	veh/h	1330	pers/h
Effective Stop Rate	0.46		0.46	
Proportion Queued	0.36		0.36	
Performance Index	40.8		40.8	
Cost (Total)	538.35	$/h	538.35	$/h
Fuel Consumption (Total)	36.2	gal/h		
Carbon Dioxide (Total)	323.9	kg/h		
Hydrocarbons (Total)	0.029	kg/h		
Carbon Monoxide (Total)	0.350	kg/h		
NOx (Total)	0.397	kg/h		

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.8 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 100.0% 93.3% 0.8%

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	1,147,200	veh/y	1,376,640	pers/y
Delay	1,480	veh-h/y	1,776	pers-h/y
Effective Stops	532,101	veh/y	638,521	pers/y
Travel Distance	369,709	veh-mi/y	443,651	pers-mi/y
Travel Time	12,007	veh-h/y	14,408	pers-h/y
Cost	258,407	$/y	258,407	$/y
Fuel Consumption	17,385	gal/y		
Carbon Dioxide	155,481	kg/y		
Hydrocarbons	14	kg/y		
Carbon Monoxide	168	kg/y		

NOx	190 kg/y

INTERSECTION SUMMARY

Site: 3 [SB Ramps 2040 AM (Site Folder: Final Concept 2040)]

New Site
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	27.4	mph	27.4	mph
Travel Distance (Total)	1124.2	veh-mi/h	1349.1	pers-mi/h
Travel Time (Total)	41.0	veh-h/h	49.2	pers-h/h
Desired Speed (Program)	34.5	mph		
Speed Efficiency	0.80			
Travel Time Index	7.73			
Congestion Coefficient	1.26			
Demand Flows (Total)	3463	veh/h	4156	pers/h
Percent Heavy Vehicles (Demand)	2.0	%		
Degree of Saturation	0.750			
Practical Spare Capacity	13.3	%		
Effective Intersection Capacity	4614	veh/h		
Control Delay (Total)	9.20	veh-h/h	11.03	pers-h/h
Control Delay (Average)	9.6	sec	9.6	sec
Control Delay (Worst Lane)	23.4	sec		
Control Delay (Worst Movement)	20.3	sec	20.3	sec
Geometric Delay (Average)	2.9	sec		
Stop-Line Delay (Average)	6.7	sec		
Idling Time (Average)	2.3	sec		
Intersection Level of Service (LOS)	LOS A			
95% Back of Queue - Vehicles (Worst Lane)	13.0	veh		
95% Back of Queue - Distance (Worst Lane)	329.8	ft		
Ave. Queue Storage Ratio (Worst Lane)	0.31			
Total Effective Stops	2316	veh/h	2780	pers/h
Effective Stop Rate	0.67		0.67	
Proportion Queued	0.47		0.47	
Performance Index	81.6		81.6	
Cost (Total)	865.77	$/h	865.77	$/h
Fuel Consumption (Total)	56.2	gal/h		
Carbon Dioxide (Total)	502.3	kg/h		
Hydrocarbons (Total)	0.045	kg/h		
Carbon Monoxide (Total)	0.533	kg/h		
NOx (Total)	0.615	kg/h		

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 1.4 %
Number of Iterations: 5 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 2.1% 1.2% 0.7%

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	1,662,261	veh/y	1,994,713	pers/y
Delay	4,414	veh-h/y	5,297	pers-h/y
Effective Stops	1,111,861	veh/y	1,334,234	pers/y
Travel Distance	539,625	veh-mi/y	647,549	pers-mi/y
Travel Time	19,685	veh-h/y	23,622	pers-h/y
Cost	415,570	$/y	415,570	$/y
Fuel Consumption	26,963	gal/y		
Carbon Dioxide	241,090	kg/y		
Hydrocarbons	22	kg/y		
Carbon Monoxide	256	kg/y		

NOx	295 kg/y

Appendix G: Cost Estimates

PROJECT

PLANNING COST ESTIMATE ©

EA: 03-00TBD PID: 030000TBD

EA: 03-00TBD

PID: 030000TBD

District-County-Route: 03-BUT-99

PM: R36.31

Type of Estimate : Preliminary Project Cost Estimate

Program Code : STIP

Project Limits : SB Route 99 at Eaton Road Interchange

Project Description: Intersection Safety and operations improvements

Scope : Construct Signal at the Intersection of Eaton Road and SB Route 99 Ramps

Alternative : Build Alternative

SUMMARY OF PROJECT COST ESTIMATE

	Current Year Cost	Escalated Cost
TOTAL ROADWAY COST	$ 5,142,800	$ 6,720,966
TOTAL STRUCTURES COST	$ 3,408,144	$ 4,453,998
SUBTOTAL CONSTRUCTION COST	$ 8,550,944	$ 11,174,964
TOTAL RIGHT OF WAY COST	$ -	$ -
TOTAL CAPITAL OUTLAY COSTS	$ 8,551,000	$ 11,175,000
PA/ED SUPPORT	$ 600,000	$ 600,000
PS&E SUPPORT	$ 1,710,200	$ 1,783,000
RIGHT OF WAY SUPPORT	$ 100,000	$ 105,000
CONSTRUCTION SUPPORT	$ 750,000	$ 815,000
TOTAL SUPPORT COST	$ 3,161,000	$ 3,303,000
TOTAL PROJECT COST	$ 11,750,000	$ 14,500,000

Programmed Amount

	Month	/	Year
Date of Estimate (Month/Year)	1	/	2022
Estimated Construction Start (Month/Year)	4	/	2024
Number of Working Days =	225		
Estimated Mid-Point of Construction (Month/Year)	7	/	2024
Estimated Construction End (Month/Year)	10	/	2024

Number of Plant Establishment Days

Estimated Project Schedule

PID Approval

PA/ED Approval

PS&E

RTL

Begin Construction

Reviewed by District O.E. or Cost Estimate Certifier

Office Engineer / Cost Estimate Certifier	xx/xx/xxxx	(xxx) xxx-xxxx
	Date	**Phone**

Approved by Project Manager

Project Manager	xx/xx/xxxx	(xxx) xxx-xxxx
	Date	**Phone**

I. ROADWAY ITEMS SUMMARY

	Section		Cost
1	**Earthwork**	$	297,000
2	**Pavement Structural Section**	$	1,128,200
3	**Drainage**	$	300,000
4	**Specialty Items**	$	147,500
5	**Environmental**	$	202,500
6	**Traffic Items**	$	1,060,000
7	**Detours**	$	-
8	**Minor Items**	$	31,400
9	**Roadway Mobilization**	$	316,700
10	**Supplemental Work**	$	126,700
11	**State Furnished**	$	63,400
12	**Time-Related Overhead**	$	-
13	**Roadway Contingency**	$	1,469,400
	TOTAL ROADWAY ITEMS	**$**	**5,142,800**

Estimate Prepared By :

Michael Pitcock, PE	12/14/2021	(916) 782-8688
	Date	Phone

Estimate Reviewed By :

Daniel Kehrer, PE	12/15/2021	(916) 782-8688
	Date	Phone

By signing this estimate you are attesting that you have discussed your project with all functional units and have incorporated all their comments or have discussed with them why they will not be incorporated.

SECTION 1: EARTHWORK

Item code		Unit	Quantity		Unit Price ($)			Cost
190101	Roadway Excavation	CY	5,700	x	50.00	=	$	285,000
190105A	Roadway Excavation (Aerially Deposited Lead)	LS		x		=	$	-
194001	Ditch Excavation	CY		x		=	$	-
19801X	Imported Borrow	CY/TON		x		=	$	-
192003	Structure Excavation (Bridge)	CY	200	x	60.00	=	$	12,000
193013	Structure Backfill (Retaining Wall)	CY		x		=	$	-
193031	Pervious Backfill Material (Retaining Wall)	CY		x		=	$	-
16010X	Clearing & Grubbing	LS/ACRE		x		=	$	-
170101	Develop Water Supply	LS		x		=	$	-
19801X	Imported Borrow	CY/TON		x		=	$	-
210130	Duff	ACRE		x		=	$	-
XXXXXX	Some Item	Unit		x		=	$	-

TOTAL EARTHWORK SECTION ITEMS $ 297,000

SECTION 2: PAVEMENT STRUCTURAL SECTION

Item code		Unit	Quantity		Unit Price ($)			Cost
401050	Jointed Plain Concrete Pavement	CY		x		=	$	-
400050	Continuously Reinforced Concrete Pavement	CY		x		=	$	-
404092	Seal Pavement Joint	LF		x		=	$	-
404093	Seal Isolation Joint	LF		x		=	$	-
413117	Seal Concrete Pavement Joint (Silicone)	LF		x		=	$	-
413118	Seal Pavement Joint (Asphalt Rubber)	LF		x		=	$	-
280010	Rapid Strength Concrete Base	CY		x		=	$	-
410095	Dowel Bar (Drill and Bond)	EA		x		=	$	-
390132	Hot Mix Asphalt (Type A)	TON	2,400	x	150.00	=	$	360,000
390137	Rubberized Hot Mix Asphalt (Gap Graded)	TON		x		=	$	-
395041	RHMA-O (Open Graded Fiction Course)	TON		x		=	$	-
393006	Geosynthetic Pavement Interlayer (Paving Grid)	SQYD		x		=	$	-
260203	Class 2 Aggregate Base	TON/CY	5,700	x	75.00	=	$	427,500
198215	Subgrade Enhancement Geogrid	SQYD		x			$	-
290201	Asphalt Treated Permeable Base	CY		x		=	$	-
250401	Class 4 Aggregate Subbase	CY		x		=	$	-
374002	Asphaltic Emulsion (Fog Seal Coat)	TON		x		=	$	-
397005	Tack Coat	TON	4	x	1,800.00	=	$	7,200
390100	Prime Coat	TON	7	x	4,000.00	=	$	28,000
377501	Slurry Seal	TON		x		=	$	-
3750XX	Screenings (Type XX)	TON		x		=	$	-
374492	Asphaltic Emulsion (Polymer Modified)	TON		x		=	$	-
370001	Sand Cover (Seal)	TON		x		=	$	-
731530A	Hot Mix Asphalt (Textured Paving)	TONS		x		=	$	-
730020	Minor Concrete (Curb)	CY	14	x	1,200.00	=	$	16,800
731504	Minor Concrete (Curb and Gutter)	CY	62	x	1,100.00	=	$	68,200
731521	Minor Concrete (Sidewalk)	CY	245	x	900.00	=	$	220,500
39407X	Place Hot Mix Asphalt Dike (Type E)	LF		x		=	$	-
150771	Remove Asphalt Concrete Dike	LF		x		=	$	-
420201	Grind Existing Concrete Pavement	SQYD		x		=	$	-
150860	Remove Base and Surfacing	CY		x		=	$	-
390095	Replace Asphalt Concrete Surfacing	CY		x		=	$	-
15312X	Remove Concrete	LF/CY/LS		x		=	$	-
394090	Place Hot Mix Asphalt (Miscellaneous Area)	SQYD		x		=	$	-
153103	Cold Plane Asphalt Concrete Pavement	SQYD		x		=	$	-
39405X	Shoulder Rumble Strip (HMA, X-In Indentations)	STA		x		=	$	-
413113	Repair Spalled Joints, Polyester Grout	SQYD		x		=	$	-
420102	Groove Existing Concrete Pavement	SQYD		x		=	$	-
390136	Minor Hot Mix Asphalt	TON		x		=	$	-
394095	Roadside Paving (Miscellaneous Areas)	SQYD		x		=	$	-
XXXXXX	Some Item	Unit		x		=	$	-

TOTAL PAVEMENT STRUCTURAL SECTION ITEMS $ 1,128,200

SECTION 3: DRAINAGE

Item code		Unit	Quantity		Unit Price ($)			Cost
15080X	Remove Culvert	EA/LF		x		=	$	-
150820	Modify Inlet	EA		x		=	$	-
155232	Sand Backfill	CY		x		=	$	-
15020X	Abandon Culvert	EA/LF		x		=	$	-
152430	Adjust Inlet	LF		x		=	$	-
155003	Cap Inlet	EA		x		=	$	-
510501	Minor Concrete	CY		x		=	$	-
510502	Minor Concrete (Minor Structure)	CY		x		=	$	-
5105XX	Minor Concrete (Type XX)	CY		x		=	$	-
620XXX	XX" Alternative Pipe Culvert (Type X)	LF		x		=	$	-
6411XX	XX" Plastic Pipe	LF		x		=	$	-
65XXXX	XX" Reinforced Concrete Pipe (Type X)	LF		x		=	$	-
6650XX	XX" Corrugated Steel Pipe (0.XXX" Thick)	LF		x		=	$	-
68XXXX	XX" Plastic Pipe (Edge Drain)	LF		x		=	$	-
69011X	XX" Corrugated Steel Pipe Downdrain (0.XXX" Th	LF		x		=	$	-
70321X	XX" Corrugated Steel Pipe Inlet (0.XXX" Thick)	LF		x		=	$	-
70XXXX	XX" Corrugated Steel Pipe Riser (0.XXX" Thick)	LF		x		=	$	-
7050XX	XX" Steel Flared End Section	EA		x		=	$	-
703233	Grated Line Drain	LF		x		=	$	-
72XXXX	Rock Slope Protection (Type and Method)	CY/TON		x		=	$	-
72901X	Rock Slope Protection Fabric (Class X)	SQYD		x		=	$	-
721420	Concrete (Ditch Lining)	CY		x		=	$	-
721430	Concrete (Channel Lining)	CY		x		=	$	-
750001	Miscellaneous Iron and Steel	LB		x		=	$	-
XXXXXX	Additional Drainage	LS	1	x	300,000	=	$	300,000

TOTAL DRAINAGE ITEMS $ 300,000

SECTION 4: SPECIALTY ITEMS

Item code		Unit	Quantity		Unit Price ($)			Cost
080050	Progress Schedule (Critical Path Method)	LS		x		=	$	-
582001	Sound Wall (Masonry Block)	SQFT		x		=	$	-
510530	Minor Concrete (Wall)	CY		x		=	$	-
15325X	Remove Sound Wall	LF/LS		x		=	$	-
070030	Lead Compliance Plan	LS	1	x	5,000.00	=	$	5,000
141120	Treated Wood Waste	LB	4,000	x	1.00	=	$	4,000
153221	Remove Concrete Barrier	LF		x		=	$	-
150662	Remove Metal Beam Guard Railing	LF	220	x		=	$	-
150668	Remove Flared End Section	EA		x		=	$	-
8000XX	Chain Link Fence (Type XX)	LF		x		=	$	-
80XXXX	XX" Chain Link Gate (Type CL-6)	EA		x		=	$	-
832005	Midwest Guardrail System	LF	300	x	60.00	=	$	18,000
839218	Double Midwest Guardrail System	LF	150	x	70.00	=	$	10,500
839310	Double Thrie Beam Barrier	LF		x		=	$	-
839521	Cable Railing	LF		x		=	$	-
8395XX	Terminal System (Type WB-31)	EA		x		=	$	-
839585	Alternative Flared Terminal System	EA		x		=	$	-
839584	Alternative In-line Terminal System	EA		x		=	$	-
498052	60" CIDH Concrete Pile (Sign Foundation)	LF		x		=	$	-
839XXX	Crash Cushion (REACT)	EA	2	x	50,000.00	=	$	100,000
520103	Bar Reinforced Steel (Retaining Wall)	LB		x		=	$	-
510060	Structural Concrete, Retaining Wall	CY		x		=	$	-
513553	Retaining Wall (Masonry Wall)	SQFT		x		=	$	-
511035	Architectural Treatment	SQFT		x		=	$	-
598001	Anti-Graffiti Coating	SQFT		x		=	$	-
203070	Rock Stain	SQFT		x		=	$	-
5136XX	Reinforced Concrete Crib Wall (Type X)	SQFT		x		=	$	-
839543	Transition Railing (Type WB-31)	EA		x		=	$	-
597601	Prepare and Stain Concrete	SQFT		x		=	$	-
839561	Rail Tensioning Assembly	EA	2	x	5,000.00	=	$	10,000
83958X	End Anchor Assembly (Type X)	EA		x		=	$	-
XXXXXX	Some Item	Unit		x		=	$	-

TOTAL SPECIALTY ITEMS $ 147,500

SECTION 5: ENVIRONMENTAL

5A - ENVIRONMENTAL MITIGATION

Item code		Unit	Quantity		Unit Price ($)			Cost	
	Biological Mitigation	LS		x		=	$	-	
130670	Temporary Reinforced Silt Fence	LF		x		=	$	-	
141000	Temporary Fence (Type ESA)	LF		x		=	$	-	
							Subtotal Environmental Mitigation	*$*	*-*

5B - LANDSCAPE AND IRRIGATION

Item code		Unit	Quantity		Unit Price ($)			Cost	
20XXXX	Highway Planting	LS		x		=	$	-	
20XXXX	Irrigation System	LS		x		=	$	-	
204099	Plant Establishment Work	LS		x		=	$	-	
204101	Extend Plant Establishment Work	LS		x		=	$	-	
20XXXX	Follow-up Landscape Project	LS		x		=	$	-	
150685	Remove Irrigation Facility	LS		x		=	$	-	
20XXXX	Maintain Existing (Irrigation or Planted Areas)	LS		x		=	$	-	
206400	Check and Test Existing Irrigation Facilities	LS		x		=	$	-	
21011X	Imported Topsoil (X)	CY/TON		x		=	$	-	
20XXXX	Rock Blanket, Rock Mulch, DG, Gravel Mulch	SQFT/SQYD		x		=	$	-	
200122	Weed Germination	SQYD		x		=	$	-	
208304	Water Meter	EA		x		=	$	-	
2087XX	XX" Conduit (Use for Irrigation x-overs)	LF		x		=	$	-	
20890X	Extend X" Conduit (Use for Extension of Irrigation x-overs)	LF		x		=	$	-	
							Subtotal Landscape and Irrigation	*$*	*-*

5C - EROSION CONTROL

Item code		Unit	Quantity		Unit Price ($)			Cost	
210010	Move In/Move Out (Erosion Control)	EA		x		=	$	-	
210350	Fiber Rolls	LF	2,000	x	5.00	=	$	10,000	
210360	Compost Sock	LF		x		=	$	-	
2102XX	Rolled Erosion Control Product (X)	SQFT	50,000	x	1.00	=	$	50,000	
21025X	Bonded Fiber Matrix	SQFT				=	$	-	
210300	Hydromulch	SQFT	50,000	x	0.10	=	$	5,000	
210420	Straw	SQFT		x		=	$	-	
210430	Hydroseed	SQFT	50,000	x	0.10	=	$	5,000	
210600	Compost	CY	300	x	100.00	=	$	30,000	
210630	Incorporate Materials	SQFT	50,000	x	0.10	=	$	5,000	
							Subtotal Erosion Control	*$*	*105,000*

5D - NPDES

Item code		Unit	Quantity		Unit Price ($)			Cost	
130300	Prepare SWPPP	LS	1	x	2,500.00	=	$	2,500	
130200	Prepare WPCP	LS		x		=	$	-	
130100	Job Site Management	LS	1	x	25,000.00	=	$	25,000	
130330	Storm Water Annual Report	EA		x		=	$	-	
130310	Rain Event Action Plan (REAP)	EA	20	x	350.00	=	$	7,000	
130320	Storm Water Sampling and Analysis Day	EA		x		=	$	-	
130520	Temporary Hydraulic Mulch	SQYD	6,000	x	5.00	=	$	30,000	
130550	Temporary Hydroseed	SQYD	6,000	x	1.00	=	$	6,000	
130505	Move-In/Move-Out (Temporary Erosion Control)	EA		x		=	$	-	
130640	Temporary Fiber Roll	LF		x		=	$	-	
130900	Temporary Concrete Washout	LS	1	x	3,000.00	=	$	3,000	
130710	Temporary Construction Entrance	EA	1	x	5,000.00	=	$	5,000	
130610	Temporary Check Dam	LF		x		=	$	-	
130620	Temporary Drainage Inlet Protection	EA	30	x	300.00	=	$	9,000	
130730	Street Sweeping	LS	1	x	10,000.00	=	$	10,000	
							Subtotal NPDES	*$*	*97,500*

			TOTAL ENVIRONMENTAL	**$**	**202,500**

Supplemental Work for NPDES

066595	Water Pollution Control Maintenance Sharing*	LS		x		=	$	-	
066596	Additional Water Pollution Control**	LS		x		=	$	-	
066597	Storm Water Sampling and Analysis***	LS		x		=	$	-	
XXXXXX	Some Item	LS		x		=	$	-	
							Subtotal Supplemental Work for NDPS	*$*	*-*

*Applies to all SWPPPs and those WPCPs with sediment control or soil stabilization BMPs.

**Applies to both SWPPPs and WPCP projects.

*** Applies only to project with SWPPPs.

SECTION 6: TRAFFIC ITEMS

6A - Traffic Electrical

Item code		Unit	Quantity		Unit Price ($)			Cost
860460	Lighting and Sign Illumination	LS		x		=	$	-
870200	Lighting System	LS	1	x	300,000.00	=	$	300,000
860990	Closed Circuit Television System	LS		x		=	$	-
86110X	Ramp Metering System (Location X)	LS		x		=	$	-
871812	Interconnection Conduit and Cable	LS		x		=	$	-
5602XX	Furnish Sign Structure (Type X)	LB		x		=	$	-
5602XX	Install Sign Structure (Type X)	LB		x		=	$	-
498040	XX" CIDHC Pile (Sign Foundation)	LF		x		=	$	-
86080X	Inductive Loop Detectors	EA/LS		x		=	$	-
8609XX	Traffic Monitoring Station (Type X)	LS		x		=	$	-
15075X	Remove Sign Structure	EA/LS		x		=	$	-
151581	Reconstruct Sign Structure	EA		x		=	$	-
152641	Modify Sign Structure	EA		x		=	$	-
860090	Maintain Existing Traffic Management System Ele	LS		x		=	$	-
86XXXX	Fiber Optic Conduit System	LS		x		=	$	-
XXXXX	Some Item	Unit		x		=	$	-

Subtotal Traffic Electrical $ *300,000*

6B - Traffic Signing and Striping

Item code		Unit	Quantity		Unit Price ($)			Cost
566011	Roadside Sign - One Post	EA		x		=	$	-
566012	Roadside Sign - Two Post	EA		x		=	$	-
5602XX	Furnish Sign	SQFT		x		=	$	-
568016	Install Sign Panel on Existing Frame	SQFT		x		=	$	-
150711	Remove Painted Traffic Stripe	LF		x		=	$	-
141101	Remove Yellow Painted Traffic Stripe (Hazardous Waste)	LF		x		=	$	-
150712	Remove Painted Pavement Marking	SQFT		x		=	$	-
150742	Remove Roadside Sign	EA		x		=	$	-
152320	Reset Roadside Sign	EA		x		=	$	-
152390	Relocate Roadside Sign	EA		x		=	$	-
82010X	Delineator (Class X)	EA		x		=	$	-
840502	Thermoplastic Traffic Stripe (Enhanced Wet Night	LF		x		=	$	-
846012	Thermoplastic Crosswalk and Pavement Marking (	SQFT		x		=	$	-
120090	Construction Area Signs	LS	1	x	10,000.00	=	$	10,000
84XXXX	Permanent Pavement Delineation & Signage	LS	1	x	70,000.00	=	$	70,000

Subtotal Traffic Signing and Striping $ *80,000*

6C - Traffic Management Plan

Item code		Unit	Quantity		Unit Price ($)			Cost
12865X	Portable Changeable Message Signs	LS	1	x	$ 30,000	=	$	30,000

Subtotal Traffic Management Plan $ *30,000*

6C - Stage Construction and Traffic Handling

Item code		Unit	Quantity		Unit Price ($)			Cost
	Stage Construction	LS	1	x	500,000.00	=	$	500,000
120199	Traffic Plastic Drum	EA		x		=	$	-
12016X	Channelizer (Type X)	EA		x		=	$	-
120120	Type III Barricade	EA		x		=	$	-
129100	Temporary Crash Cushion Module	EA		x		=	$	-
120100	Traffic Control System	LS	1	x	150,000.00	=	$	150,000
129110	Temporary Crash Cushion	EA		x		=	$	-
129000	Temporary Railing (Type K)	LF		x		=	$	-
120149	Temporary Pavement Marking (Paint)	SQFT		x		=	$	-
82010X	Delineator (Class X)	EA		x		=	$	-
XXXXXX	Some Item	Unit		x		=	$	-

Subtotal Stage Construction and Traffic Handling $ *650,000*

TOTAL TRAFFIC ITEMS **$ 1,060,000**

SECTION 7: DETOURS

Includes constructing, maintaining, and removal

Item code		Unit	Quantity		Unit Price ($)		Cost
190101	Roadway Excavation	CY		x		= $	-
19801X	Imported Borrow	CY/TON		x		= $	-
390132	Hot Mix Asphalt (Type A)	TON		x		= $	-
26020X	Class 2 Aggregate Base	TON/CY		x		= $	-
250401	Class 4 Aggregate Subbase	CY		x		= $	-
130620	Temporary Drainage Inlet Protection	EA		x		= $	-
129000	Temporary Railing (Type K)	LF		x		= $	-
128601	Temporary Signal System	LS		x		= $	-
120149	Temporary Pavement Marking (Paint)	SQFT		x		= $	-
80010X	Temporary Fence (Type X)	LF		x		= $	-
XXXXXX	Some Item	LS		x		= $	-

* Includes constructing, maintaining, and removal

TOTAL DETOURS **$ -**

SUBTOTAL SECTIONS 1 through 7 $ 3,135,200

SECTION 8: MINOR ITEMS

8A - Americans with Disabilities Act Items							
	ADA Items				1.0%	$	31,352
8B - Bike Path Items							
	Bike Path Items				0.0%	$	-
8C - Other Minor Items							
	Other Minor Items				0.0%	$	-
	Total of Section 1-7	$	3,135,200	x	1.0%	= $	31,352

TOTAL MINOR ITEMS **$ 31,400**

SECTIONS 9: ROADWAY MOBILIZATION

Item code							
999990	Total Section 1-8	$	3,166,600	x	10%	= $	316,660

TOTAL ROADWAY MOBILIZATION **$ 316,700**

SECTION 10: SUPPLEMENTAL WORK

Item code		Unit	Quantity		Unit Price ($)		Cost
066670	Payment Adjustments For Price Index Fluctuations	LS		x		= $	-
066094	Value Analysis	LS		x		= $	-
066070	Maintain Traffic	LS		x		= $	-
066919	Dispute Resolution Board	LS		x		= $	-
066921	Dispute Resolution Advisor	LS		x		= $	-
066015	Federal Trainee Program	LS		x		= $	-
066610	Partnering	LS		x		= $	-
066204	Remove Rock and Debris	LS		x		= $	-
066222	Locate Existing Crossover	LS		x		= $	-
XXXXXX	Some Item	Unit		x		= $	-
	*Cost of **NPDES** Supplemental Work specified in Section 5D*					= $	-
	Total Section 1-8	$	3,166,600		4%	= $	126,664

TOTAL SUPPLEMENTAL WORK **$ 126,700**

SECTION 11: STATE FURNISHED MATERIALS AND EXPENSES

Item code		Unit	Quantity		Unit Price ($)		Cost
066105	Resident Engineers Office	LS		x		=	$0
066063	Traffic Management Plan - Public Information	LS		x		=	$0
066901	Water Expenses	LS		x		=	$0
8609XX	Traffic Monitoring Station (X)	LS		x		=	$0
066841	Traffic Controller Assembly	LS		x		=	$0
066840	Traffic Signal Controller Assembly	LS		x		=	$0
066062	COZEEP Contract	LS		x		=	$0
066838	Reflective Numbers and Edge Sealer	LS		x		=	$0
066065	Tow Truck Service Patrol	LS		x		=	$0
066916	Annual Construction General Permit Fee	LS		x		=	$0
XXXXXX	Some Item	Unit		x		=	$0
	Total Section 1-8		$ 3,166,600		2%	= $	63,332

TOTAL STATE FURNISHED **$63,400**

SECTION 12: TIME-RELATED OVERHEAD

Total of Roadway and Structures Contract Items excluding Mobilization $6,290,732 (used to calculate TRO)

Total Construction Cost (excluding TRO and Contingency) $7,081,544 (used to check if project is greater than $5 million excluding contingency)

Estimated Time-Related Overhead (TRO) Percentage (0% to 10%) = **0%**

Item code		Unit	Quantity		Unit Price ($)		Cost
090100	Time-Related Overhead	WD	180	X	$0	=	$0

TOTAL TIME-RELATED OVERHEAD **$0**

SECTION 13: ROADWAY CONTINGENCY

Total Section 1-12	$	3,673,400	x	**40%**	=	$1,469,360

TOTAL CONTINGENCY **$1,469,400**

II. STRUCTURE ITEMS

	Bridge 1		Bridge 2		
DATE OF ESTIMATE	05/27/22		00/00/00		00/00/00
Bridge Name	Eaton Rd Overcrossing		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Bridge Number	12-160		57-XXX		57-XXX
Structure Type	Overcrossing Widening		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Width (Feet) [out to out]	35 LF		0 LF		0 LF
Total Bridge Length (Feet)	202 LF		0 LF		0 LF
Total Area (Square Feet)	7100 SQFT		0 SQFT		0 SQFT
Structure Depth (Feet)	6 LF		0 LF		0 LF
Footing Type (pile or spread)	TBD		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Cost Per Square Foot	$400		$0		$0
COST OF EACH	**$2,840,120**		**$0**		**$0**

	Building 1		Building 2		
DATE OF ESTIMATE	00/00/00		00/00/00		00/00/00
Building Name	xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Bridge Number	57-XXX		57-XXX		57-XXX
Structure Type	xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Width (Feet) [out to out]	0 LF		0 LF		0 LF
Total Building Length (Feet)	0 LF		0 LF		0 LF
Total Area (Square Feet)	0 SQFT		0 SQFT		0 SQFT
Structure Depth (Feet)	0 LF		0 LF		0 LF
Footing Type (pile or spread)	xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Cost Per Square Foot	$0		$0		$0
COST OF EACH	**$0**		**$0**		**$0**

TOTAL COST OF BRIDGES		**$2,840,120**
TOTAL COST OF BUILDINGS		**$0**
STRUCTURES MOBILIZATION	10%	**$284,012**

Recommended Contingency: (Pre-PSR 30%-50%, PSR 25%, Draft PR 20%, PR 15%, after PR approval 10%, Final PS&E 5%)

Total recommended percentages includes any quantified risk based contingency from the risk register.

STRUCTURES CONTINGENCY	10%	**$284,012**
TOTAL COST OF STRUCTURES		**$3,408,144**

Estimate Prepared By: _____ _____

XXXXXXXXXXXXXXXX ------ Division of Structures — Date

EA: 03-00TBD PID: 030000TBD

III. RIGHT OF WAY

Fill in all of the available information from the Right of Way Data Sheet.

A)	A1)	Acquisition, including Excess Land Purchases, Damages & Goodwill, Fees		$	
	A2)	SB-1210		$	
B)		Acquisition of Offsite Mitigation		$	
C)	C1)	Utility Relocation (Local Agency Share)		$	
	C2)	Potholing (Design Phase)		$	
D)		Railroad Acquisition		$	0
E)		Clearance / Demolition		$	0
F)		Relocation Assistance (RAP and/or Last Resort Housing Costs)		$	0
G)		Title and Escrow		$	0
H)		Environmental Review		$	0
I)		Condemnation Settlements	0%	$	0
J)		Design Appreciation Factor	0%	$	0
K)		Utility Relocation (Construction Cost)		$	0

L)	**TOTAL RIGHT OF WAY ESTIMATE**	**$0**
M)	**TOTAL R/W ESTIMATE: Escalated**	**$0**
N)	**RIGHT OF WAY SUPPORT**	**$105,000**

Support Cost Estimate Prepared By _____ Project Coordinator[1] Phone

Utility Estimate Prepared By _____ Utility Coordinator[2] Phone

R/W Acquisition Estimate Prepared By _____ Right of Way Estimator[3] Phone

Note: Items G & H applied to items A + B

[1] When estimate has Support Costs only [2] When estimate has Utility Relocation [3] When R/W Acquisition is required

PROJECT

PLANNING COST ESTIMATE ©

EA: 03-00TBD PID: 030000TBD

EA: 03-00TBD

PID: 030000TBD

District-County-Route: 03-BUT-99

PM: R36.31

Type of Estimate : Preliminary Project Cost Estimate

Program Code : STIP

Project Limits : SB Route 99 at Eaton Road Interchange

Project Description: Intersection Safety and operations improvements

Scope : Construct Multilane Roundabout at the Intersection of Eaton Road and SB Route 99 Ramps

Alternative : Build Alternative

SUMMARY OF PROJECT COST ESTIMATE

	Current Year Cost	Escalated Cost
TOTAL ROADWAY COST	$ 4,767,600	$ 6,230,629
TOTAL STRUCTURES COST	$ -	$ -
SUBTOTAL CONSTRUCTION COST	$ 4,767,600	$ 6,230,629
TOTAL RIGHT OF WAY COST	$ -	$ -
TOTAL CAPITAL OUTLAY COSTS	$ 4,768,000	$ 6,231,000
PA/ED SUPPORT	$ 600,000	$ 600,000
PS&E SUPPORT	$ 953,600	$ 994,000
RIGHT OF WAY SUPPORT	$ 100,000	$ 105,000
CONSTRUCTION SUPPORT	$ 750,000	$ 815,000
TOTAL SUPPORT COST	$ 2,404,000	$ 2,514,000
TOTAL PROJECT COST	$ 7,200,000	$ 8,750,000

Programmed Amount

	Month	/	Year
Date of Estimate (Month/Year)	1	/	2022
Estimated Construction Start (Month/Year)	4	/	2024
Number of Working Days =	225		
Estimated Mid-Point of Construction (Month/Year)	7	/	2024
Estimated Construction End (Month/Year)	10	/	2024

Number of Plant Establishment Days

Estimated Project Schedule

PID Approval

PA/ED Approval

PS&E

RTL

Begin Construction

Reviewed by District O.E. or Cost Estimate Certifier

Office Engineer / Cost Estimate Certifier	xx/xx/xxxx	(xxx) xxx-xxxx
	Date	**Phone**

Approved by Project Manager

Project Manager	xx/xx/xxxx	(xxx) xxx-xxxx
	Date	**Phone**

I. ROADWAY ITEMS SUMMARY

	Section		Cost
1	**Earthwork**	$	285,000
2	**Pavement Structural Section**	$	1,389,900
3	**Drainage**	$	400,000
4	**Specialty Items**	$	9,000
5	**Environmental**	$	202,500
6	**Traffic Items**	$	620,000
7	**Detours**	$	-
8	**Minor Items**	$	29,100
9	**Roadway Mobilization**	$	293,600
10	**Supplemental Work**	$	117,500
11	**State Furnished**	$	58,800
12	**Time-Related Overhead**	$	-
13	**Roadway Contingency**	$	1,362,200
	TOTAL ROADWAY ITEMS	**$**	**4,767,600**

Estimate Prepared By :

Michael Pitcock, PE	12/14/2021	(916) 782-8688
	Date	Phone

Estimate Reviewed By :

Daniel Kehrer, PE	12/15/2021	(916) 782-8688
	Date	Phone

By signing this estimate you are attesting that you have discussed your project with all functional units and have incorporated all their comments or have discussed with them why they will not be incorporated.

SECTION 1: EARTHWORK

Item code		Unit	Quantity		Unit Price ($)			Cost
190101	Roadway Excavation	CY	5,700	x	50.00	=	$	285,000
190105A	Roadway Excavation (Aerially Deposited Lead)	LS		x		=	$	-
194001	Ditch Excavation	CY		x		=	$	-
19801X	Imported Borrow	CY/TON		x		=	$	-
192037	Structure Excavation (Retaining Wall)	CY		x		=	$	-
193013	Structure Backfill (Retaining Wall)	CY		x		=	$	-
193031	Pervious Backfill Material (Retaining Wall)	CY		x		=	$	-
16010X	Clearing & Grubbing	LS/ACRE		x		=	$	-
170101	Develop Water Supply	LS		x		=	$	-
19801X	Imported Borrow	CY/TON		x		=	$	-
210130	Duff	ACRE		x		=	$	-
XXXXXX	Some Item	Unit		x		=	$	-

TOTAL EARTHWORK SECTION ITEMS	**$ 285,000**

SECTION 2: PAVEMENT STRUCTURAL SECTION

Item code		Unit	Quantity		Unit Price ($)			Cost
401050	Jointed Plain Concrete Pavement	CY		x		=	$	-
400050	Continuously Reinforced Concrete Pavement	CY	80	x	600.00	=	$	48,000
404092	Seal Pavement Joint	LF		x		=	$	-
404093	Seal Isolation Joint	LF		x		=	$	-
413117	Seal Concrete Pavement Joint (Silicone)	LF		x		=	$	-
413118	Seal Pavement Joint (Asphalt Rubber)	LF		x		=	$	-
280010	Rapid Strength Concrete Base	CY		x		=	$	-
410095	Dowel Bar (Drill and Bond)	EA		x		=	$	-
390132	Hot Mix Asphalt (Type A)	TON	2,650	x	150.00	=	$	397,500
390137	Rubberized Hot Mix Asphalt (Gap Graded)	TON		x		=	$	-
395041	RHMA-O (Open Graded Fiction Course)	TON		x		=	$	-
393006	Geosynthetic Pavement Interlayer (Paving Grid)	SQYD		x		=	$	-
260203	Class 2 Aggregate Base	TON/CY	5,050	x	75.00	=	$	378,750
198215	Subgrade Enhancement Geogrid	SQYD		x			$	-
290201	Asphalt Treated Permeable Base	CY		x		=	$	-
250401	Class 4 Aggregate Subbase	CY		x		=	$	-
374002	Asphaltic Emulsion (Fog Seal Coat)	TON		x		=	$	-
397005	Tack Coat	TON	3	x	1,800.00	=	$	5,400
390100	Prime Coat	TON	8	x	4,000.00	=	$	32,000
377501	Slurry Seal	TON		x		=	$	-
3750XX	Screenings (Type XX)	TON		x		=	$	-
374492	Asphaltic Emulsion (Polymer Modified)	TON		x		=	$	-
370001	Sand Cover (Seal)	TON		x		=	$	-
731530A	Hot Mix Asphalt (Textured Paving)	TONS		x		=	$	-
730020	Minor Concrete (Curb)	CY	72	x	1,200.00	=	$	86,400
731504	Minor Concrete (Curb and Gutter)	CY	121	x	1,100.00	=	$	133,100
731521	Minor Concrete (Sidewalk)	CY	343	x	900.00	=	$	308,700
39407X	Place Hot Mix Asphalt Dike (Type E)	LF		x		=	$	-
150771	Remove Asphalt Concrete Dike	LF		x		=	$	-
420201	Grind Existing Concrete Pavement	SQYD		x		=	$	-
150860	Remove Base and Surfacing	CY		x		=	$	-
390095	Replace Asphalt Concrete Surfacing	CY		x		=	$	-
15312X	Remove Concrete	LF/CY/LS		x		=	$	-
394090	Place Hot Mix Asphalt (Miscellaneous Area)	SQYD		x		=	$	-
153103	Cold Plane Asphalt Concrete Pavement	SQYD		x		=	$	-
39405X	Shoulder Rumble Strip (HMA, X-In Indentations)	STA		x		=	$	-
413113	Repair Spalled Joints, Polyester Grout	SQYD		x		=	$	-
420102	Groove Existing Concrete Pavement	SQYD		x		=	$	-
390136	Minor Hot Mix Asphalt	TON		x		=	$	-
394095	Roadside Paving (Miscellaneous Areas)	SQYD		x		=	$	-
XXXXXX	Some Item	Unit		x		=	$	-

TOTAL PAVEMENT STRUCTURAL SECTION ITEMS	**$ 1,389,900**

SECTION 3: DRAINAGE

Item code		Unit	Quantity		Unit Price ($)			Cost
15080X	Remove Culvert	EA/LF		x		=	$	-
150820	Modify Inlet	EA		x		=	$	-
155232	Sand Backfill	CY		x		=	$	-
15020X	Abandon Culvert	EA/LF		x		=	$	-
152430	Adjust Inlet	LF		x		=	$	-
155003	Cap Inlet	EA		x		=	$	-
510501	Minor Concrete	CY		x		=	$	-
510502	Minor Concrete (Minor Structure)	CY		x		=	$	-
5105XX	Minor Concrete (Type XX)	CY		x		=	$	-
620XXX	XX" Alternative Pipe Culvert (Type X)	LF		x		=	$	-
6411XX	XX" Plastic Pipe	LF		x		=	$	-
65XXXX	XX" Reinforced Concrete Pipe (Type X)	LF		x		=	$	-
6650XX	XX" Corrugated Steel Pipe (0.XXX" Thick)	LF		x		=	$	-
68XXXX	XX" Plastic Pipe (Edge Drain)	LF		x		=	$	-
69011X	XX" Corrugated Steel Pipe Downdrain (0.XXX" Th	LF		x		=	$	-
70321X	XX" Corrugated Steel Pipe Inlet (0.XXX" Thick)	LF		x		=	$	-
70XXXX	XX" Corrugated Steel Pipe Riser (0.XXX" Thick)	LF		x		=	$	-
7050XX	XX" Steel Flared End Section	EA		x		=	$	-
703233	Grated Line Drain	LF		x		=	$	-
72XXXX	Rock Slope Protection (Type and Method)	CY/TON		x		=	$	-
72901X	Rock Slope Protection Fabric (Class X)	SQYD		x		=	$	-
721420	Concrete (Ditch Lining)	CY		x		=	$	-
721430	Concrete (Channel Lining)	CY		x		=	$	-
750001	Miscellaneous Iron and Steel	LB		x		=	$	-
XXXXXX	Additional Drainage	LS	1	x	400,000	=	$	400,000

TOTAL DRAINAGE ITEMS	**$**	**400,000**

SECTION 4: SPECIALTY ITEMS

Item code		Unit	Quantity		Unit Price ($)			Cost
080050	Progress Schedule (Critical Path Method)	LS		x		=	$	-
582001	Sound Wall (Masonry Block)	SQFT		x		=	$	-
510530	Minor Concrete (Wall)	CY		x		=	$	-
15325X	Remove Sound Wall	LF/LS		x		=	$	-
070030	Lead Compliance Plan	LS	1	x	5,000.00	=	$	5,000
141120	Treated Wood Waste	LB	4,000	x	1.00	=	$	4,000
153221	Remove Concrete Barrier	LF		x		=	$	-
150662	Remove Metal Beam Guard Railing	LF		x		=	$	-
150668	Remove Flared End Section	EA		x		=	$	-
8000XX	Chain Link Fence (Type XX)	LF		x		=	$	-
80XXXX	XX" Chain Link Gate (Type CL-6)	EA		x		=	$	-
832005	Midwest Guardrail System	LF		x		=	$	-
839301	Single Thrie Beam Barrier	LF		x		=	$	-
839310	Double Thrie Beam Barrier	LF		x		=	$	-
839521	Cable Railing	LF		x		=	$	-
8395XX	Terminal System (Type WB-31)	EA		x		=	$	-
839585	Alternative Flared Terminal System	EA		x		=	$	-
839584	Alternative In-line Terminal System	EA		x		=	$	-
498052	60" CIDH Concrete Pile (Sign Foundation)	LF		x		=	$	-
839XXX	Crash Cushion (Insert Type)	EA		x		=	$	-
520103	Bar Reinforced Steel (Retaining Wall)	LB		x		=	$	-
510060	Structural Concrete, Retaining Wall	CY		x		=	$	-
513553	Retaining Wall (Masonry Wall)	SQFT		x		=	$	-
511035	Architectural Treatment	SQFT		x		=	$	-
598001	Anti-Graffiti Coating	SQFT		x		=	$	-
203070	Rock Stain	SQFT		x		=	$	-
5136XX	Reinforced Concrete Crib Wall (Type X)	SQFT		x		=	$	-
839543	Transition Railing (Type WB-31)	EA		x		=	$	-
597601	Prepare and Stain Concrete	SQFT		x		=	$	-
839561	Rail Tensioning Assembly	EA		x		=	$	-
83958X	End Anchor Assembly (Type X)	EA		x		=	$	-
XXXXXX	Some Item	Unit		x		=	$	-

TOTAL SPECIALTY ITEMS	**$**	**9,000**

SECTION 5: ENVIRONMENTAL

5A - ENVIRONMENTAL MITIGATION

Item code		Unit	Quantity		Unit Price ($)			Cost	
	Biological Mitigation	LS		x		=	$	-	
130670	Temporary Reinforced Silt Fence	LF		x		=	$	-	
141000	Temporary Fence (Type ESA)	LF		x		=	$	-	
							Subtotal Environmental Mitigation	*$*	*-*

5B - LANDSCAPE AND IRRIGATION

Item code		Unit	Quantity		Unit Price ($)			Cost	
20XXXX	Highway Planting	LS		x		=	$	-	
20XXXX	Irrigation System	LS		x		=	$	-	
204099	Plant Establishment Work	LS		x		=	$	-	
204101	Extend Plant Establishment Work	LS		x		=	$	-	
20XXXX	Follow-up Landscape Project	LS		x		=	$	-	
150685	Remove Irrigation Facility	LS		x		=	$	-	
20XXXX	Maintain Existing (Irrigation or Planted Areas)	LS		x		=	$	-	
206400	Check and Test Existing Irrigation Facilities	LS		x		=	$	-	
21011X	Imported Topsoil (X)	CY/TON		x		=	$	-	
20XXXX	Rock Blanket, Rock Mulch, DG, Gravel Mulch	SQFT/SQYD		x		=	$	-	
200122	Weed Germination	SQYD		x		=	$	-	
208304	Water Meter	EA		x		=	$	-	
2087XX	XX" Conduit (Use for Irrigation x-overs)	LF		x		=	$	-	
20890X	Extend X" Conduit (Use for Extension of Irrigation x-overs)	LF		x		=	$	-	
							Subtotal Landscape and Irrigation	*$*	*-*

5C - EROSION CONTROL

Item code		Unit	Quantity		Unit Price ($)			Cost	
210010	Move In/Move Out (Erosion Control)	EA		x		=	$	-	
210350	Fiber Rolls	LF	2,000	x	5.00	=	$	10,000	
210360	Compost Sock	LF		x		=	$	-	
2102XX	Rolled Erosion Control Product (X)	SQFT	50,000	x	1.00	=	$	50,000	
21025X	Bonded Fiber Matrix	SQFT				=	$	-	
210300	Hydromulch	SQFT	50,000	x	0.10	=	$	5,000	
210420	Straw	SQFT		x		=	$	-	
210430	Hydroseed	SQFT	50,000	x	0.10	=	$	5,000	
210600	Compost	CY	300	x	100.00	=	$	30,000	
210630	Incorporate Materials	SQFT	50,000	x	0.10	=	$	5,000	
							Subtotal Erosion Control	*$*	*105,000*

5D - NPDES

Item code		Unit	Quantity		Unit Price ($)			Cost	
130300	Prepare SWPPP	LS	1	x	2,500.00	=	$	2,500	
130200	Prepare WPCP	LS		x		=	$	-	
130100	Job Site Management	LS	1	x	25,000.00	=	$	25,000	
130330	Storm Water Annual Report	EA		x		=	$	-	
130310	Rain Event Action Plan (REAP)	EA	20	x	350.00	=	$	7,000	
130320	Storm Water Sampling and Analysis Day	EA		x		=	$	-	
130520	Temporary Hydraulic Mulch	SQYD	6,000	x	5.00	=	$	30,000	
130550	Temporary Hydroseed	SQYD	6,000	x	1.00	=	$	6,000	
130505	Move-In/Move-Out (Temporary Erosion Control)	EA		x		=	$	-	
130640	Temporary Fiber Roll	LF		x		=	$	-	
130900	Temporary Concrete Washout	LS	1	x	3,000.00	=	$	3,000	
130710	Temporary Construction Entrance	EA	1	x	5,000.00	=	$	5,000	
130610	Temporary Check Dam	LF		x		=	$	-	
130620	Temporary Drainage Inlet Protection	EA	30	x	300.00	=	$	9,000	
130730	Street Sweeping	LS	1	x	10,000.00	=	$	10,000	
							Subtotal NPDES	*$*	*97,500*

			TOTAL ENVIRONMENTAL	**$**	**202,500**

Supplemental Work for NPDES

066595	Water Pollution Control Maintenance Sharing*	LS		x		=	$	-	
066596	Additional Water Pollution Control**	LS		x		=	$	-	
066597	Storm Water Sampling and Analysis***	LS		x		=	$	-	
XXXXXX	Some Item	LS		x		=	$	-	
							Subtotal Supplemental Work for NDPS	*$*	*-*

*Applies to all SWPPPs and those WPCPs with sediment control or soil stabilization BMPs.

**Applies to both SWPPPs and WPCP projects.

*** Applies only to project with SWPPPs.

SECTION 6: TRAFFIC ITEMS

6A - Traffic Electrical

Item code		Unit	Quantity		Unit Price ($)			Cost
860460	Lighting and Sign Illumination	LS		x		=	$	-
870200	Lighting System	LS	1	x	300,000.00	=	$	300,000
860990	Closed Circuit Television System	LS		x		=	$	-
86110X	Ramp Metering System (Location X)	LS		x		=	$	-
871812	Interconnection Conduit and Cable	LS		x		=	$	-
5602XX	Furnish Sign Structure (Type X)	LB		x		=	$	-
5602XX	Install Sign Structure (Type X)	LB		x		=	$	-
498040	XX" CIDHC Pile (Sign Foundation)	LF		x		=	$	-
86080X	Inductive Loop Detectors	EA/LS		x		=	$	-
8609XX	Traffic Monitoring Station (Type X)	LS		x		=	$	-
15075X	Remove Sign Structure	EA/LS		x		=	$	-
151581	Reconstruct Sign Structure	EA		x		=	$	-
152641	Modify Sign Structure	EA		x		=	$	-
860090	Maintain Existing Traffic Management System Ele	LS		x		=	$	-
86XXXX	Fiber Optic Conduit System	LS		x		=	$	-
XXXXX	Some Item	Unit		x		=	$	-

Subtotal Traffic Electrical $ *300,000*

6B - Traffic Signing and Striping

Item code		Unit	Quantity		Unit Price ($)			Cost
566011	Roadside Sign - One Post	EA		x		=	$	-
566012	Roadside Sign - Two Post	EA		x		=	$	-
5602XX	Furnish Sign	SQFT		x		=	$	-
568016	Install Sign Panel on Existing Frame	SQFT		x		=	$	-
150711	Remove Painted Traffic Stripe	LF		x		=	$	-
141101	Remove Yellow Painted Traffic Stripe (Hazardous Waste)	LF		x		=	$	-
150712	Remove Painted Pavement Marking	SQFT		x		=	$	-
150742	Remove Roadside Sign	EA		x		=	$	-
152320	Reset Roadside Sign	EA		x		=	$	-
152390	Relocate Roadside Sign	EA		x		=	$	-
82010X	Delineator (Class X)	EA		x		=	$	-
840502	Thermoplastic Traffic Stripe (Enhanced Wet Night	LF		x		=	$	-
846012	Thermoplastic Crosswalk and Pavement Marking (	SQFT		x		=	$	-
120090	Construction Area Signs	LS	1	x	10,000.00	=	$	10,000
84XXXX	Permanent Pavement Delineation & Signage	LS	1	x	80,000.00	=	$	80,000

Subtotal Traffic Signing and Striping $ *90,000*

6C - Traffic Management Plan

Item code		Unit	Quantity		Unit Price ($)			Cost
12865X	Portable Changeable Message Signs	LS	1	x	$ 30,000	=	$	30,000

Subtotal Traffic Management Plan $ *30,000*

6C - Stage Construction and Traffic Handling

Item code		Unit	Quantity		Unit Price ($)			Cost
	Stage Construction	LS	1	x	100,000.00	=	$	100,000
120199	Traffic Plastic Drum	EA		x		=	$	-
12016X	Channelizer (Type X)	EA		x		=	$	-
120120	Type III Barricade	EA		x		=	$	-
129100	Temporary Crash Cushion Module	EA		x		=	$	-
120100	Traffic Control System	LS	1	x	100,000.00	=	$	100,000
129110	Temporary Crash Cushion	EA		x		=	$	-
129000	Temporary Railing (Type K)	LF		x		=	$	-
120149	Temporary Pavement Marking (Paint)	SQFT		x		=	$	-
82010X	Delineator (Class X)	EA		x		=	$	-
XXXXXX	Some Item	Unit		x		=	$	-

Subtotal Stage Construction and Traffic Handling $ *200,000*

TOTAL TRAFFIC ITEMS **$ 620,000**

SECTION 7: DETOURS

Includes constructing, maintaining, and removal

Item code		Unit	Quantity		Unit Price ($)		Cost
190101	Roadway Excavation	CY		x		= $	-
19801X	Imported Borrow	CY/TON		x		= $	-
390132	Hot Mix Asphalt (Type A)	TON		x		= $	-
26020X	Class 2 Aggregate Base	TON/CY		x		= $	-
250401	Class 4 Aggregate Subbase	CY		x		= $	-
130620	Temporary Drainage Inlet Protection	EA		x		= $	-
129000	Temporary Railing (Type K)	LF		x		= $	-
128601	Temporary Signal System	LS		x		= $	-
120149	Temporary Pavement Marking (Paint)	SQFT		x		= $	-
80010X	Temporary Fence (Type X)	LF		x		= $	-
XXXXXX	Some Item	LS		x		= $	-

* Includes constructing, maintaining, and removal

TOTAL DETOURS **$ -**

SUBTOTAL SECTIONS 1 through 7 $ 2,906,400

SECTION 8: MINOR ITEMS

8A - Americans with Disabilities Act Items						
ADA Items				1.0%	$	29,064
8B - Bike Path Items						
Bike Path Items				0.0%	$	-
8C - Other Minor Items						
Other Minor Items				0.0%	$	-
Total of Section 1-7	$	2,906,400	x	1.0%	= $	29,064

TOTAL MINOR ITEMS **$ 29,100**

SECTIONS 9: ROADWAY MOBILIZATION

Item code							
999990	Total Section 1-8	$	2,935,500	x	10%	= $	293,550

TOTAL ROADWAY MOBILIZATION **$ 293,600**

SECTION 10: SUPPLEMENTAL WORK

Item code		Unit	Quantity		Unit Price ($)		Cost
066670	Payment Adjustments For Price Index Fluctuations	LS		x		= $	-
066094	Value Analysis	LS		x		= $	-
066070	Maintain Traffic	LS		x		= $	-
066919	Dispute Resolution Board	LS		x		= $	-
066921	Dispute Resolution Advisor	LS		x		= $	-
066015	Federal Trainee Program	LS		x		= $	-
066610	Partnering	LS		x		= $	-
066204	Remove Rock and Debris	LS		x		= $	-
066222	Locate Existing Crossover	LS		x		= $	-
XXXXXX	Some Item	Unit		x		= $	-

*Cost of **NPDES** Supplemental Work specified in Section 5D* = $ -

Total Section 1-8	$	2,935,500		4%	= $	117,420

TOTAL SUPPLEMENTAL WORK **$ 117,500**

SECTION 11: STATE FURNISHED MATERIALS AND EXPENSES

Item code		Unit	Quantity		Unit Price ($)		Cost
066105	Resident Engineers Office	LS		x		=	$0
066063	Traffic Management Plan - Public Information	LS		x		=	$0
066901	Water Expenses	LS		x		=	$0
8609XX	Traffic Monitoring Station (X)	LS		x		=	$0
066841	Traffic Controller Assembly	LS		x		=	$0
066840	Traffic Signal Controller Assembly	LS		x		=	$0
066062	COZEEP Contract	LS		x		=	$0
066838	Reflective Numbers and Edge Sealer	LS		x		=	$0
066065	Tow Truck Service Patrol	LS		x		=	$0
066916	Annual Construction General Permit Fee	LS		x		=	$0
XXXXXX	Some Item	Unit		x		=	$0
	Total Section 1-8		$ 2,935,500		2%	= $	58,710

TOTAL STATE FURNISHED **$58,800**

SECTION 12: TIME-RELATED OVERHEAD

Total of Roadway and Structures Contract Items excluding Mobilization $2,935,500 (used to calculate TRO)

Total Construction Cost (excluding TRO and Contingency) $3,405,400 (used to check if project is greater than $5 million excluding contingency)

Estimated Time-Related Overhead (TRO) Percentage (0% to 10%) = **0%**

Item code		Unit	Quantity		Unit Price ($)		Cost
090100	Time-Related Overhead	WD	180	X	$0	=	$0

TOTAL TIME-RELATED OVERHEAD **$0**

SECTION 13: ROADWAY CONTINGENCY

Total Section 1-12	$	3,405,400	x	**40%**	=	$1,362,160

TOTAL CONTINGENCY **$1,362,200**

EA: 03-00TBD PID: 030000TBD

II. STRUCTURE ITEMS

	Bridge 1		Bridge 2		
DATE OF ESTIMATE	00/00/00		00/00/00		00/00/00
Bridge Name	xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Bridge Number	57-XXX		57-XXX		57-XXX
Structure Type	xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Width (Feet) [out to out]	0 LF		0 LF		0 LF
Total Bridge Length (Feet)	0 LF		0 LF		0 LF
Total Area (Square Feet)	0 SQFT		0 SQFT		0 SQFT
Structure Depth (Feet)	0 LF		0 LF		0 LF
Footing Type (pile or spread)	xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Cost Per Square Foot	$0		$0		$0
COST OF EACH	**$0**		**$0**		**$0**

	Building 1		Building 2		
DATE OF ESTIMATE	00/00/00		00/00/00		00/00/00
Building Name	xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Bridge Number	57-XXX		57-XXX		57-XXX
Structure Type	xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Width (Feet) [out to out]	0 LF		0 LF		0 LF
Total Building Length (Feet)	0 LF		0 LF		0 LF
Total Area (Square Feet)	0 SQFT		0 SQFT		0 SQFT
Structure Depth (Feet)	0 LF		0 LF		0 LF
Footing Type (pile or spread)	xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxx
Cost Per Square Foot	$0		$0		$0
COST OF EACH	**$0**		**$0**		**$0**

TOTAL COST OF BRIDGES		**$0**
TOTAL COST OF BUILDINGS		**$0**
STRUCTURES MOBILIZATION	10%	**$0**

Recommended Contingency: (Pre-PSR 30%-50%, PSR 25%, Draft PR 20%, PR 15%, after PR approval 10%, Final PS&E 5%)

Total recommended percentages includes any quantified risk based contingency from the risk register.

STRUCTURES CONTINGENCY	10%	**$0**
TOTAL COST OF STRUCTURES		**$0**

Estimate Prepared By: _____ _____

XXXXXXXXXXXXXXXX ------ Division of Structures — Date

EA: 03-00TBD PID: 030000TBD

III. RIGHT OF WAY

Fill in all of the available information from the Right of Way Data Sheet.

A)	A1)	Acquisition, including Excess Land Purchases, Damages & Goodwill, Fees		$	
	A2)	SB-1210		$	
B)		Acquisition of Offsite Mitigation		$	
C)	C1)	Utility Relocation (Local Agency Share)		$	
	C2)	Potholing (Design Phase)		$	
D)		Railroad Acquisition		$	0
E)		Clearance / Demolition		$	0
F)		Relocation Assistance (RAP and/or Last Resort Housing Costs)		$	0
G)		Title and Escrow		$	0
H)		Environmental Review		$	0
I)		Condemnation Settlements	0%	$	0
J)		Design Appreciation Factor	0%	$	0
K)		Utility Relocation (Construction Cost)		$	0

L)	**TOTAL RIGHT OF WAY ESTIMATE**	**$0**
M)	**TOTAL R/W ESTIMATE: Escalated**	**$0**
N)	**RIGHT OF WAY SUPPORT**	**$105,000**

Support Cost Estimate Prepared By _____ Project Coordinator[1] Phone

Utility Estimate Prepared By _____ Utility Coordinator[2] Phone

R/W Acquisition Estimate Prepared By _____ Right of Way Estimator[3] Phone

Note: Items G & H applied to items A + B

[1] When estimate has Support Costs only [2] When estimate has Utility Relocation [3] When R/W Acquisition is required

Appendix H: B/C Calculations

Summary of Life Cycle Cost Analyses: Roundabout and Signal Alternatives

Annual Costs	Roundabout Alternative		Traffic Signal Alternative		No Build Alternative	
Safety	**Predicted Annual Crashes**	**Safety Cost**	**Predicted Annual Crashes**	**Safety Cost**	**Predicted Annual Crashes**	**Safety Cost**
	Annual Costs of Predicted Crashes	**$ 116,119**	Annual Costs of Predicted Crashes	**$ 380,494**	Annual Costs of Predicted Crashes	**$ 406,171**
Delay	**Annual Intersection Delay (person-hrs)**	**Delay Cost**	**Annual Intersection Delay (person-hrs)**	**Delay Cost**	**Annual Intersection Delay (person-hrs)**	**Delay Cost**
Average Annual Person (in Vehicle) Delay	2142	**$ 27,000**	3036	**$ 38,000**	23414	**$ 263,000**
Operation and Maintenance	**Operation and Maintenance**	**O&M Cost**	**Operation and Maintenance**	**O&M Cost**	**Operation and Maintenance**	**O&M Cost**
Annualized Cost of Signal Retiming		$ -	Signal Retiming Every 3 Years	$ 1,000		
Annual Cost of Power for Signal		$ -	Power for Signal	$ 750		
Annual Cost of Illumination	Intersection Illumination	$ 750	Intersection Illumination	$ 750		
Annual Cost of Maintenance	Landscaping Costs	$ 1,500	Signal Maintenance Costs (power outage, detection, etc.)	$ 1,500	Intersection Illumination	$ 1,500
	Total Annual Operation and Maintenance Costs	**$ 2,250**	Total Annual Operation and Maintenance Costs	**$ 4,000**	Total Annual Operation and Maintenance Costs	**$ 1,500**
Initial Capital Costs	**Total Capital Costs**	**Cost**	**Total Capital Costs**	**Cost**	**Total Capital Costs**	**Cost**
Preliminary Engineering		$ 2,409,000		$ 3,198,000		$ -
Right-of-way and Utilities		$ 105,000		$ 105,000		$ -
Construction		**$ 6,230,629**		**$ 11,174,964**		**$ -**

***Delay cost is based upon an average of the AM and PM peak hours.**

Total Discounted Life Cycle Costs (2020 - 2040)	Roundabout Alternative		Traffic Signal Alternative		No Build Alternative	
Safety	**Total Predicted Crashes**	**Safety Cost**	**Total Predicted Crashes**	**Safety Cost**	**Total Predicted Crashes**	**Safety Cost**
	Total Costs of Predicted Crashes	**$1,578,100**	Total Costs of Predicted Crashes	**$5,171,040**	Total Costs of Predicted Crashes	**$5,617,500**
Delay	**Total Intersection Delay (person-hrs)**	**Delay Cost**	**Total Intersection Delay (person-hrs)**	**Delay Cost**	**Total Intersection Delay (person-hrs)**	**Delay Cost**
Total Person (in Vehicle) Delay		**$ 550,000**		**$ 790,000**		**$ 5,520,000**
Fuel and GHG Cost	**Fuel and Green House Gas Cost**		**Fuel and Green House Gas Cost**		**Fuel and Green House Gas Cost**	
Total Fuel and GHG Costs		**$ 1,349,278**		**$ 1,338,279**		**$ 2,337,401**
Operation and Maintenance	**Operation and Maintenance**	**O&M Cost**	**Operation and Maintenance**	**O&M Cost**	**Operation and Maintenance**	**O&M Cost**
		$ -	Signal Retiming Every 3 Years	$ 13,590	Signal Retiming Every 3 Years	$ -
		$ -	Power for Signal	$ 10,193	Power for Signal	$ -
	Intersection Illumination	$ 10,193	Intersection Illumination	$ 10,193	Intersection Illumination	$ -
	Landscaping Costs	$ 20,385	Signal Maintenance Costs (power outage, detection, etc.)	$ 20,385	Signal Maintenance Costs (power outage, detection, etc.)	$ 20,385
	Total Annual Operation and Maintenance Costs	**$ 30,578**	Total Annual Operation and Maintenance Costs	**$ 54,361**	Total Annual Operation and Maintenance Costs	**$ 20,385**
Initial Capital Costs	**Total Capital Costs**	**Cost**	**Total Capital Costs**	**Cost**	**Total Capital Costs**	**Cost**
Preliminary Engineering		$ 2,409,000		$ 3,198,000		$ -
Right-of-way and Utilities		$ 105,000		$ 105,000		$ -
Construction		$ 6,231,000		$ 11,175,000		$ -
	Total Initial Capital Costs	**$ 8,745,000**	Total Initial Capital Costs	**$ 14,478,000**	Total Initial Capital Costs	**$ -**
Total Life Cycle Costs (Opening Year $)	**Net Present Value**	**$ 12,253,000**	**Net Present Value**	**$ 21,832,000**	**Net Present Value**	**$ 13,496,000**

***Delay cost is based upon an average of the AM and PM peak hours.**

Comparative Summary: Roundabout to Signal To Existing TWSC

Life Cycle Costs (20 year design)	Roundabout Alternative	Traffic Signal Alternative	No Build Alternative
Collision and Mobility Costs			
Collision Costs of predicted crashes [2]	$1,579,000	$5,172,000	$5,618,000
Delay Costs	$550,000	$790,000	$5,520,000
Fuel and GHG Costs	$1,350,000	$1,339,000	$2,338,000
Project Costs Including Design, Construction and Maintenance			
Operations and Maintenance Costs	$31,000	$55,000	$21,000
Project Costs (including soft costs) [3]	$8,745,000	$14,478,000	$0
Total Life Cycle Costs	**$12,255,000**	**$21,834,000**	**$13,497,000**

Notes:

1. Existing geometry is analyzed for the PM peak hour traffic volumes of the Ultimate Design Year.

2. The collision costs presented within this table were derived using the Caltrans tool for Intersection Control Evaluation Collision Cost Analysis

3. To improve safety at the existing intersection, an exlusive northbound left turn pocket needs to be included. The cost of such an improvement is not included within this report as it is beyond the scope of the ICE analysis. However, it should be noted, that the inclusion of this cost would only result in the increase in the Total Life Cycle Cost.


GHD