TECHNICAL MEMORANDUM – 2030 BUILDOUT CONDITIONS
US 101 / MAIN STREET INTERCHANGE

Date: July 1, 2011

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Pages: 24 (Not including appendices)

Project No.: WBS 300150

Jurisdiction: County of San Luis Obispo

Subject: Summary of traffic conditions under 2030 Buildout traffic volumes at the US 101 / Main Street Interchange in San Luis Obispo County. Memorandum includes the following:

1.) Introduction
2.) Site description
3.) Existing geometric conditions
4.) AM and PM Level of Service analysis at 2030 Buildout Conditions
5.) Queuing Analysis at 2030 Buildout Conditions
6.) Evaluation of proposed short-term mitigation measures at 2030 Buildout Conditions
7.) Evaluation of the impacts at the study interchange of the extension of Theatre Drive through to Peterson Ranch Road, under 2030 Buildout Conditions

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1.0 INTRODUCTION

As requested by the County of San Luis Obispo, Rick Engineering Company (RICK) has prepared this technical memorandum analyzing the 2030 buildout traffic conditions at the US 101 / Main Street Interchange in the Templeton Community of unincorporated San Luis Obispo County. **Exhibit 1** shows a vicinity map with the study interchange and the surrounding roadway network system.

This is the second technical memorandum evaluating the traffic conditions at the US 101 / Main Street interchange. Deliverable 1 evaluated the existing traffic conditions at the interchange (dated July 1, 2011). The second technical memorandum evaluates traffic conditions under 2030 buildout of the Templeton area, with no changes to the existing roadway infrastructure or geometrical layout.

In addition to the reports noted in the first deliverable as providing background information, this memorandum also utilizes the following study to estimate expected future traffic volumes at the study intersections:

1. County of San Luis Obispo - Templeton Travel Demand Model (TDM) Update, February 2010, (Omni-Means, Ltd.)

This memorandum evaluates future traffic conditions, given full development in the Templeton area, and utilizes the current geometric roadway layout to quantify worse case traffic conditions. The evaluation of future conditions includes an analysis of Levels of Service (LOS) and vehicle queues at the four (4) study intersections. Several proposed mitigation measures are also analyzed to determine whether they would noticeably impact traffic flow in either a positive or negative manner. These proposed mitigation measures are defined in Deliverable 1.

2.0 EXISTING ROADWAY NETWORK

The following is a brief description of the County of San Luis Obispo roadways within the project study area. For this deliverable, 2030 buildout conditions were analyzed with the current roadway geometrics unchanged.

US 101 is a north-south freeway in the project area with two lanes in each direction, a divided median and a posted speed limit of 65 miles per hour (mph). Access between US 101 and Main Street is provided via northbound and southbound on- and off-ramps. The north and southbound off-ramps are stop sign controlled at Main Street.

Main Street is a north-south arterial through the Templeton community. Main Street parallels US 101 and serves the local downtown commercial areas. Main Street has more of an east-west alignment near the US 101 interchange. The existing bridge over US 101 has a single lane in each direction, with a roadway width of approximately 30' and a 5’ wide sidewalk on the south side. Main Street also provides access to Ramada Drive and Theatre Drive. West of Theatre Drive, Main Street narrows and serves as an access road for a local lumberyard, the Caltrans maintenance station, and a private residence. Main Street has a posted speed limit of 45 mph south of the US 101 interchange.

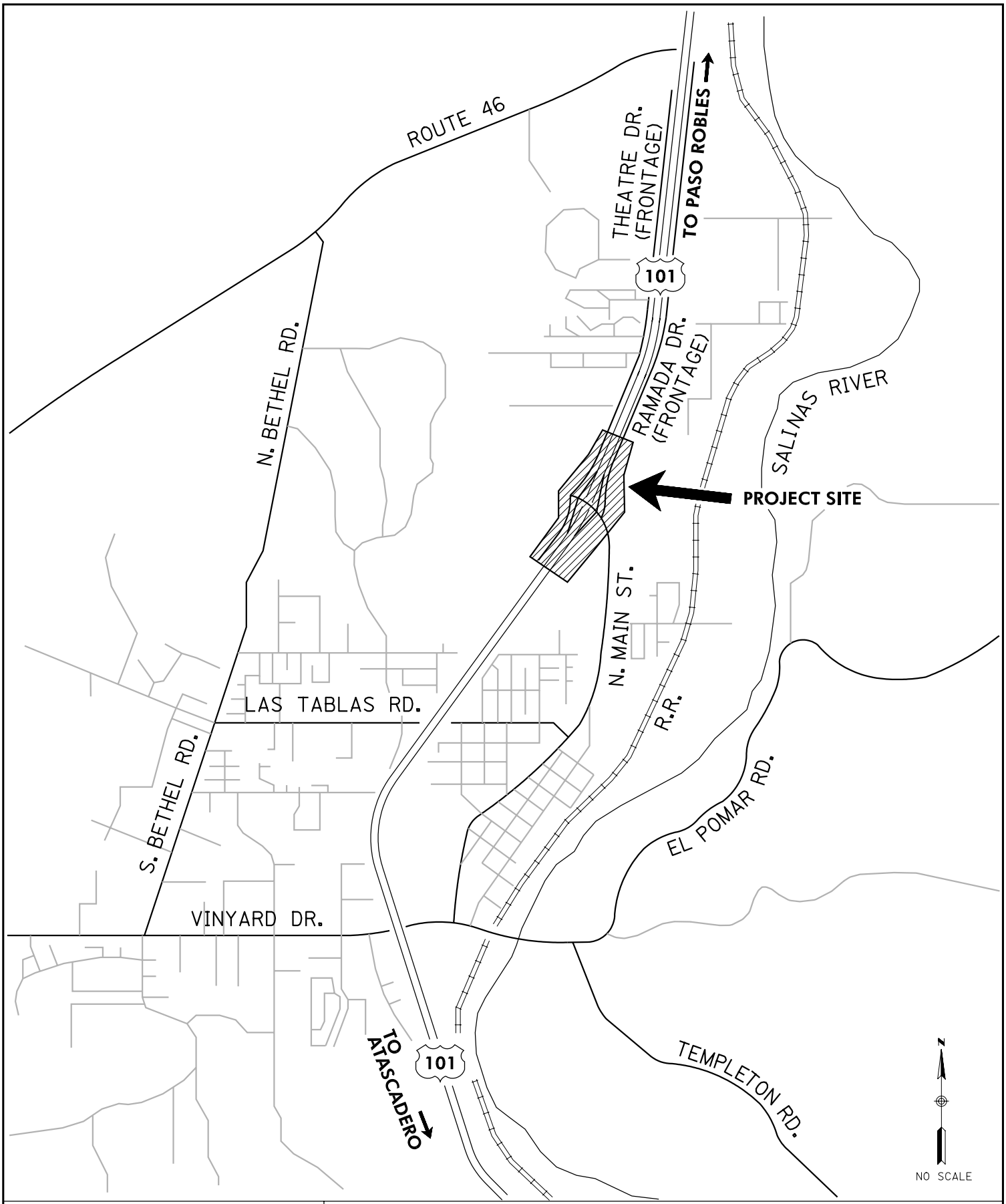

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EXHIBIT 1

PROJECT VICINITY

US 101/MAIN STREET TRAFFIC STUDY

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Theatre Drive is a north-south collector road that serves as a frontage road along the west side of US 101. As noted in previous studies, due to congestion at the US 101 / State Route (SR) 46 West interchange (next interchange to the north) many drivers use the US 101 / Main Street interchange and Theatre Drive to access the local residential and commercial uses on the west side of US 101. Theatre Drive has a posted speed limit of 45 mph north of Main Street. South of Main Street, Theatre Drive provides access for a local lumberyard and residences. Theater Drive terminates approximately 800 feet south of Main Street. Future plans include extending Theatre Drive to the south to connect with Las Tablas Road. Currently, the four-legged intersection of Theatre Drive and Main Street has three-way stop sign control, with free traffic movements allowed for westbound traffic on Main Street.

Discussions with Caltrans staff indicated that to the north, Theatre Drive south of SR 46 West is currently under construction. This project will close the portion of Theatre Drive between SR 46 West (opposite Vine Street) and Alexa Court (access road for Hampton Inn and La Bellasera Hotel). Traffic on Theatre Drive with an origin/destination to and from SR 46 West will be re-routed to Gahan Place. This construction project also includes the installation of traffic signal control at the SR 46 West and Gahan Place intersection.

Ramada Drive is a north-south collector road with a single travel lane in each direction. Ramada Drive serves as a frontage road along the east side of US 101. Main Street is the southern terminus of Ramada Drive, with a mix of commercial, industrial and agricultural developments to the north. Ramada Drive also provides access to the US 101 / SR 46 West interchange. The posted speed limit on Ramada Drive is 45 mph in the vicinity of the project site. Currently, the three-legged intersection of Ramada Drive and Main Street is stop controlled only at Ramada Drive, with free traffic movements allowed for east and westbound traffic on Main Street.

Exhibit 2 shows the existing intersection lane configurations of the study intersections. It should be noted that the northbound approach on Theatre Drive, the US 101 southbound and northbound off-ramps, and the southbound approach on Ramada Drive are flared at their intersection with Main Street. This widening of the approach effectively creates a short separate lane for vehicles making right turns from the cross street provided that the queue for the left turn and through movements (shared lane) is not backed up beyond the limits of the flare (approximately 50').

3.0 BUILDOUT (2030) TRAFFIC VOLUMES

The Existing AM and PM peak hour traffic volumes presented in Deliverable 1 were based on turning movement traffic count data collected in 2009. Data presented in the Templeton TDM Update includes both the calibrated 2008 average daily traffic (ADT) data and the projected 2030 ADT data. The ADT data for both the calibrated 2008 and projected 2030 buildout scenarios represent link volumes for the various roadway segments within the study area, including the US 101 ramps. The existing ADT data presented in Deliverable 1 (provided by the County) is slightly different than the calibrated 2008 ADT data presented in the Templeton TDM Update. Therefore, it was decided that in order to maintain consistency the difference between the calibrated 2008 ADT and projected 2030 buildout ADT data would be calculated for each roadway segment, then added to the existing ADT analyzed in Deliverable 1. See **Table 1** and **Exhibit 4** for these volumes.

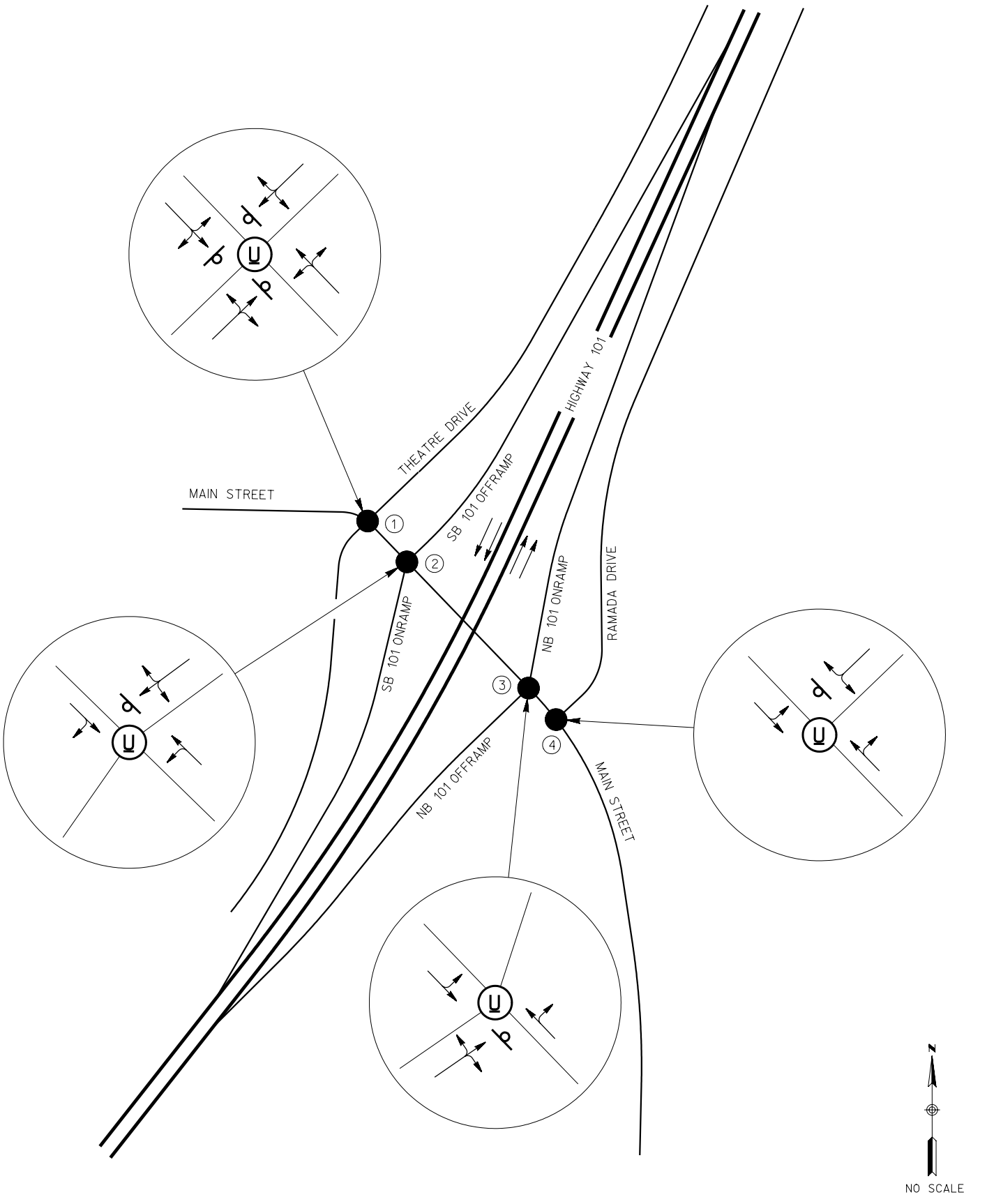

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EXHIBIT 2

2030 BASE INTERSECTION
LANE CONFIGURATION

US 101/MAIN STREET TRAFFIC STUDY

LEGEND:

● = STUDY INTERSECTION (U) = UNSIGNALIZED

o = STOP-CONTROLLED (TS) = TRAFFIC SIGNAL

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Exhibit 3 illustrates the calibrated 2008 ADT and projected 2030 buildout ADT presented in the Templeton TDM Update. The data contained in the Templeton TDM Update and shown on **Exhibit 3** indicates that daily traffic demands on Ramada Drive will more the double with the buildout of local land uses. Daily traffic demands along Theatre Drive will almost double and daily traffic on the US 101 off-ramps will increase by about 50-60%. Future development will also result in a significant increase in daily traffic demands on Main Street near Theatre Drive (+90%). Daily traffic on Main Street south of the US 101 interchange is anticipated to increase by about 30% with the buildout of future land uses. **Exhibit 4** illustrates the adjusted 2030 buildout daily and peak hour turning movements at the 4 study intersections at the US 101 / Main Street interchange.

TABLE 1

ROADWAY SEGMENT VOLUME CALCULATIONS

Roadway Segment	Modeled ADT Volumes			Adjusted ADT Volumes	
	2008	2030	Increase	2008 (Actual)	2030
Theatre Drive (North of Main St.)	6,618	12,716	6,098	7,857	13,955
Theatre Drive (South of Main St.)	817	1,506	689	100*	789
Southbound off-ramp	2,948	4,725	1,777	2,140	3,917
Southbound on-ramp	5,913	8,566	2,653	4,270	6,923
Northbound off-ramp	6,138	9,415	3,277	4,270	7,547
Northbound on-ramp	2,414	4,948	2,534	1,860	4,394
Main Street (East of Ramada Dr.)	7,234	9,301	2,067	6,836	8,903
Ramada Drive (North of Main Street)	6,601	14,109	7,508	4,835	12,343

*No existing ADT known at this location. Existing ADT was calculated from 10x the peak hour count (10 vehicles)

Turning movement volumes under 2030 Buildout conditions were calculated by multiplying the 2008 measured turning movement volume by the percentage increase in Adjusted ADT volume on the contributing roadway segment. (See **Appendix A** for turning movement volumes) Where the preceding roadway segment percentage increase was unknown, the average of the contributing roadways to the preceding roadway segment was calculated and used. It should be noted that turning movement percentage increases (Shown on **Exhibit 4**) do not match incoming roadway segment volume percentage increases at all locations. This is due to the fact that the buildout ADT percentage increases differ for each roadway segment. Since the traffic volumes progressing through the four intersections should be balanced, turning volumes were adjusted as necessary. In general, roadway volume increases on the west side of US 101 were higher than roadway volume increases on the east side of US 101. (With the exception of Ramada Drive) In particular, the projected 2030 roadway volume increase on Theatre Drive is 92% along the segment north of Main Street, and 96% for traffic south of Main Street. In contrast, the segment of Main Street east of Ramada Drive has a projected 2030 roadway volume increase of only 29%, and the northbound off-ramp segment is projected to increase by only 53%. As a consequence, overall traffic volumes on the west side of the freeway are projected to be higher than volumes on the east side of the freeway. In order to balance the intersections across the overcrossing, turning volumes on the west side of US 101 were generally adjusted downward, and turning volumes on the east side of US 101 were adjusted upward toward the average.

4.0 INTERSECTION ANALYSIS METHODOLOGY

The analysis of 2030 Buildout peak hour operations at the 4 study intersections was performed using methodologies contained in the Highway Capacity Manual (HCM2000), and modeled with the "Synchro" and "SimTraffic" software (Version 7). To model Buildout operations a peak hour factor (PHF) of 0.92 was applied at all intersections. The software estimates vehicle delays for the overall peak hour operations as an “average” and for each “critical” movement (i.e.: stop sign controlled approach, main line left-turns, etc).

It should be noted that the Main Street and Theatre Drive intersection is three-way stop sign controlled, which cannot be modeled correctly using Synchro. RICK determined that modeling the existing intersection as a two-way stop rather than an all-way stop would more closely approximate actual conditions. Since traffic westbound on Main Street currently flows freely, modeling this movement as stop-controlled would inaccurately estimate vehicle delays and queues. Eastbound traffic entering the intersection comprises a relatively small portion of the total intersection volume under existing and 2030 buildout conditions. In addition, conflicting movements between east and westbound traffic will be minimal. Therefore, it was decided that a more accurate representation of actual operations would be obtained by utilizing the two-way stop controlled methodology.

As discussed in Section 2.0 (Existing Roadway Network), the northbound approach on Theatre Drive, the US 101 southbound and northbound off-ramps, and the southbound approach on Ramada Drive are flared at their intersection with Main Street. These flares essentially create a short separate lane that vehicles use to make right turns when the left-through movement queues do not backed up beyond the limits of the flare. Therefore, the analysis of these approaches assumes a single lane approach with a short 50' turn lane for right turn movements.

5.0 LEVEL OF SERVICE METHODOLOGY

5.1 Level of Service Ratings

LOS ratings are quantitative descriptions of intersection operations and are reported using an "A" through "F" letter rating system to describe vehicle delays and congestion. LOS A indicates free-flow conditions with little or no delay and LOS F indicates forced-flow conditions with excessive delays and queues. See **Table 2** for the LOS characteristics. **Appendix B** contains the HCM2000 tables illustrating the LOS-to-delay relationship data for intersection operations (i.e.: two-way stop controlled, all-way stop controlled and signalized intersections).

The peak hour LOS values for the entire intersection operations are based on the estimated "average" vehicle delays. The LOS values are also reported for the various critical movements (i.e.: stop sign approach, main line left-turns, etc.), which are based on the estimated delays for the individual approach and/or movement. Typically, Caltrans uses the "average" control delay for reporting an intersection Measure of Effectiveness (MOE). However, the LOS analyses performed for this technical memorandum utilize the lowest performing critical movement LOS for determining when improvements are warranted, consistent with County methodology used in the Templeton Circulation Study.

TABLE 2

LEVEL OF SERVICE CHARACTERISTICS

LOS	Characteristics
A	Free flow conditions exist. Each individual driver is virtually unaffected by the presence of others in the traffic stream.
B	Stable traffic flow exists. The individual drivers have the freedom to select a desired speed, but encounter a slight decline in the freedom to maneuver.
C	Stable and acceptable flow exists, but speed and maneuverability are somewhat restricted due to higher traffic volumes. The individual driver will be significantly affected by the presence of others.
D	High density but stable flow will occur. The individual driver will experience a generally poor level of comfort and convenience. Small increases in traffic flow will cause operational problems and restrict driver maneuverability.
E	Speeds are low, but relatively uniform. The individual driver's ability to maneuver becomes extremely difficult with high frustration. The traffic volume on the road is near capacity.
F	Forced or breakdown flow has occurred. The individual driver is stopped for long periods due to congestion.

Source: Highway Capacity Manual, Transportation Research Board, 2000 Edition.

5.2 Level of Service Standards

The County of San Luis Obispo has adopted LOS C threshold as the minimum standard for rural roadway operations and LOS D or better for roadways within the boundary of the Templeton Urban Reserve Line (URL). Since the US 101 / Main Street interchange is located within the URL, LOS D is the minimum acceptable standard for peak hour operations at the intersections of Main Street with Ramada Drive and Theatre Drive. For the two intersections of Main Street with the northbound and southbound US 101 ramps, this study uses the standards found in the Caltrans traffic study guidelines (Guide for the Preparation of Traffic Impact Studies, December 2002). These traffic guidelines state that Caltrans endeavors to maintain a target LOS at the transition between LOS C and D range. Therefore, at the intersection of Main Street with the two ramp intersections, LOS C will be considered the minimum acceptable standard for peak hour operations.

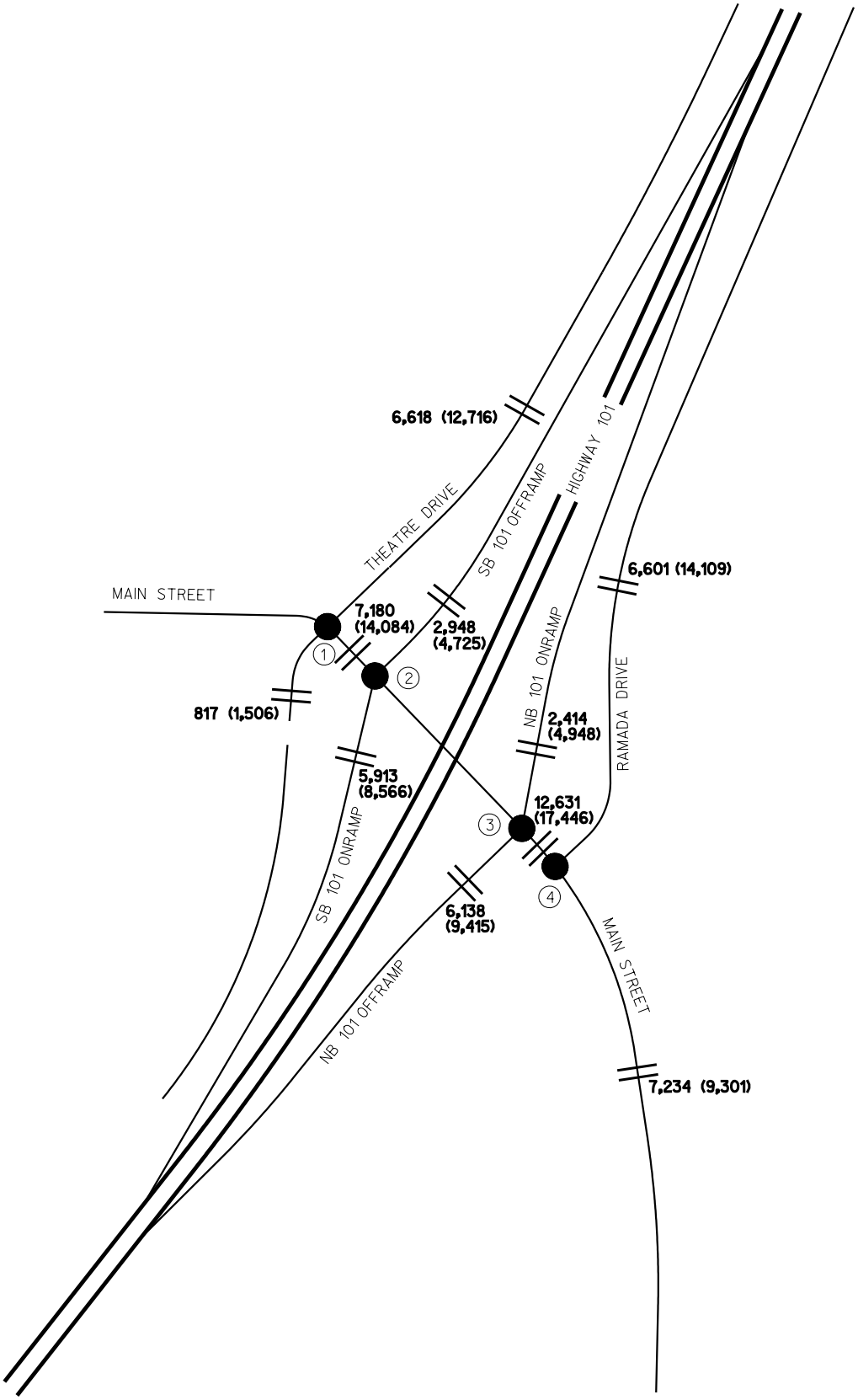
6.0 INTERSECTION OPERATIONS

6.1 Intersections Levels of Service

The following four intersections were studied as part of this traffic analysis:

1) Main Street & Theatre Drive
2) Main Street & US 101 SB Ramps
3) Main Street & US 101 NB Ramps
4) Main Street & Ramada Drive

Table 3 summarizes the intersection LOS analysis under 2030 buildout conditions. The LOS worksheets are contained in **Appendix C**.



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NO SCALE

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EXHIBIT 3

MODELED ADT VALUE COMPARISON

US 101/MAIN STREET TRAFFIC STUDY

LEGEND:

● = STUDY INTERSECTION

XX (XX) = 2008 MODELED ADT
(2030 MODELED ADT)

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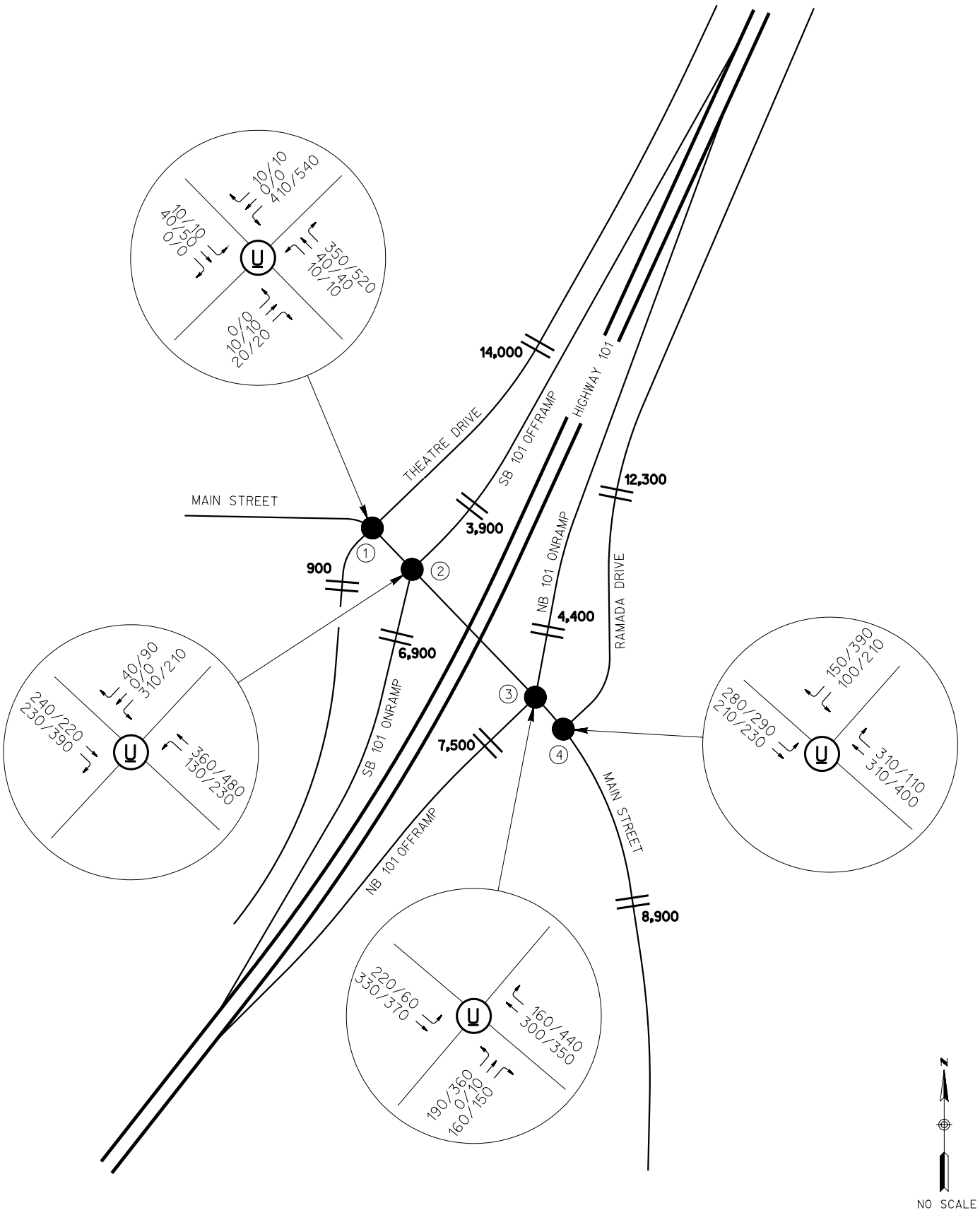

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EXHIBIT 4

2030 ADJUSTED TRAFFIC VOLUMES

US 101/MAIN STREET TRAFFIC STUDY

LEGEND:

● = STUDY INTERSECTION

XX/XX = 2030 ADJUSTED AM/PM PEAK HOUR

XX = 2030 ADJUSTED ADT

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TABLE 3
2030 BUILDOUT INTERSECTION LOS ANALYSIS

Study Intersection Main Street at:	Critical Movement	2009 Existing Traffic	
		Avg. Delay	LOS
Theatre Drive (TWSC)	**AM Peak (Avg.)**	**14.5**	**B**
	EB	1.7	A
	NB	10.1	B
	SB	29.8	D
	PM Peak (Avg.)	**> 50**	**F**
	EB	1.6	A
	NB	11.0	B
	SB	> 50	F
US 101 SB Ramps (TWSC)	**AM Peak (Avg.)**	**> 50**	**F**
	WB	3.6	A
	SB	> 50	F
	PM Peak (Avg.)	**> 50**	**F**
	WB	6.2	A
	SB	> 50	F
US 101 NB Ramps (TWSC)	**AM Peak (Avg.)**	**> 50**	**F**
	EB	5.4	A
	NB	> 50	F
	PM Peak (Avg.)	**> 50**	**F**
	EB	2.4	A
	NB	> 50	F
Ramada Drive (TWSC)	**AM Peak (Avg.)**	**31.7**	**D**
	EB	8.1	A
	SB	> 50	F
	PM Peak (Avg.)	**> 50**	**F**
	EB	7.4	A
	SB	**> 50**	F

X.X – Data Represents Total Average Peak Hour Volume
LOS = Level of Service; Average Delay in seconds
TWSC = Two-Way Stop Controlled Intersection
NB = Northbound, SB = Southbound, EB = Eastbound, WB = Westbound

The data in **Table 3** indicates that average vehicle delays at all 4 study intersections will be within the LOS F range during the PM peak hour. As stated in Section 5.2, the LOS C threshold is used in this analysis as the minimum acceptable standard for peak hour operations at the US 101 / Main Street ramp intersections and the LOS D threshold will be used at the frontage road intersections. The data also demonstrates that average delays at the US 101 ramp intersections will also be within the LOS F range during the AM peak hour. Excessive delays will be experienced on the US 101 north and southbound off-ramps, and the southbound approaches of Theatre Drive and Ramada Drive. See Section 7.0 for analysis of traffic control mitigation measures.

6.2 Queuing Analysis

To analyze queuing lengths under 2030 Buildout conditions, simulations were run using the SimTraffic software within Synchro. **Table 4** summarizes the intersection queuing analysis under 2030 buildout conditions, and **Appendix F** contains the full SimTraffic analysis data.

TABLE 4

2030 BUILDOUT INTERSECTION QUEUE ANALYSIS

Study Intersection Main Street at:	Critical Movement (Exist. PHV)	Existing Storage Length (feet)	95th Percentile Queue Length (feet)	Storage Length Sufficient / Insufficient
Theatre Drive (TWSC)	**AM PEAK**			
	NB LTR	-	13	Sufficient
	SB LTR	-	262	Sufficient
	PM PEAK			
	NB LTR	-	36	Sufficient
	SB LTR	-	594	Sufficient
US 101 SB Ramps (TWSC)	**AM PEAK**			
	WB LT	335	158	Sufficient
	SB LT	1000	**1088**	**Insufficient**
	PM PEAK			
	WB LT	335	217	Sufficient
	SB LT	1000	**1275**	**Insufficient**
US 101 NB Ramps (TWSC)	**AM PEAK**			
	EB LT	335	**395**	**Insufficient**
	NB LT	800	**1018**	**Insufficient**
	PM PEAK			
	EB LT	335	**436**	**Insufficient**
	NB LT	800	**1017**	**Insufficient**
Ramada Drive (TWSC)	**AM PEAK**			
	EB LT	40[1]	**65**	**Insufficient**
	SB L	-	1373	Sufficient
	PM PEAK			
	EB LT	40[1]	**62**	**Insufficient**
	SB L	-	1192	Sufficient

[1]Measured clear distance between adjacent intersections
TWSC = Two-Way Stop Controlled Intersection
NB = Northbound, SB = Southbound, EB = Eastbound, WB = Westbound
L = Left turn movement, T = Through movement, R = Right turn movement

The data in **Table 4** indicates that vehicle queues on both the US 101 north and southbound off-ramps will exceed the available storage and possibly backup onto the freeway main-line during the AM and PM peak hours. In addition, queues on the eastbound approach of Main Street at the US 101 northbound ramps will extend west of the US 101 southbound ramps intersection during both peak hour periods. The eastbound queue at the Ramada Drive intersection will also exceed the available storage between the US 101 northbound ramps and Ramada Drive intersections during both peak hour periods.

7.0 INTERSECTION OPERATIONS WITH ALL-WAY STOP MITIGATION

As a part of this technical memorandum, an evaluation was conducted for the feasibility of utilizing all-way stop control as a mitigation measure to alleviate traffic congestion at the US 101 / Main Street interchange and adjacent intersections. These measures are designed to be implemented under 2030 Buildout traffic volumes and existing geometric layout conditions, and include all-way stop control at either one or both of the aforementioned intersections.

Note that the Synchro software utilizes the HCM methodology to compute the control delays and LOS (Shown in Table 2). Since this method treats the intersections separately, delays generated at one intersection will not be reflected at an adjacent intersection within close proximity**.** As such, increased average delays and decreased LOS are not shown by the Synchro software at the frontage road intersections, although all-way stop control at the ramp intersections will almost certainly affect operations at the Theatre Drive and Ramada Drive intersections. These impacts are clearly seen when utilizing the SimTraffic simulation for the queuing analysis. The microlevel analysis found within SimTraffic is better able to accurately demonstrate the likely affects of the mitigation measures at the US 101 ramp intersections and at the adjacent frontage road intersections.

As discussed in Deliverable 1, there was a discussion with County staff regarding analyzing the west side of the freeway as one intersection (US 101 southbound ramps and Theatre Drive combined) and the east side of the freeway as another intersection (US 101 northbound ramps and Ramada Drive combined). In order to optimize traffic flow and minimize queues, vehicles would need to be allowed free movements between the ramp and frontage road intersections. However, allowing free movements would create driver confusion, particularly for left turn turning vehicles with multiple options (i.e.: left turn at ramp or at the frontage road). In addition, on the west side of the freeway there would be 2 southbound approaches (Theater Drive and US 101 southbound off-ramp), which would also create driver confusion. A review of existing conditions indicate that the distance between the east and westbound limit lines on Main Street would be at least 200' on either side of the freeway. Due to the operational and safety concerns, it was decided that the east and west intersections should not be grouped together for the all-way stop control mitigation analysis. The installation of all-way stop control at all 4 study intersections is not considered a viable alternative, as significant vehicle queues would be experienced along Main Street.

7.1 Intersection Operations

As conducted for the analysis of existing conditions, the mitigation measure scenarios were run in Synchro to determine the affects of adding all-way stop control at the Main Street and US 101 northbound ramps intersection only (Short-Term Measure #1), at the Main Street and US 101 southbound ramps intersection only (Short-Term Measure #2), and at both intersections simultaneously (Short-Term Measure #3). Currently, these intersections have stop control only for the off-ramp approaches. It should be noted that the evaluation of short-term mitigation measures focuses on the analysis of PM peak hour operations only, as this period represents the "worse case" scenario. The results of the LOS analysis for the mitigation scenarios are presented in **Table 5**, with the LOS worksheets included in **Appendix D.**

TABLE 5
2030 BUILDOUT INTERSECTION LOS ANALYSIS
WITH ALL-WAY STOP MITIGATION

Study Intersection Main Street at:	Critical Movement (PM Peak)	Vehicle Delay - LOS Value			
		2030 Base-Line	**STM #1** US 101 NB Ramps	**STM #2** US 101 SB Ramps	**STM #3** US 101 NB & SB Ramps
Theatre Drive	**Average**	**>50 - F**	**>50 - F**	**>50 - F**	**>50 - F**
	EB	1.6 - A	2.3 - A	2.3 - A	2.3 - A
	NB	11.0 - B	12.1 - B	12.1 - B	12.1 - B
	SB	>50 - F	>50 - F	>50 - F	>50 - F
US 101 SB Ramps	**Average**	**>50 - F**	**>50 - F**	**>50 – F**	**>50 – F**
	EB	N/A	N/A	>50 - F	>50 - F
	WB	6.2 - A	6.0 - A	>50 - F	>50 - F
	SB	>50 - F	>50 - F	13.8 - B	13.8 - C
US 101 NB Ramps	**Average**	**>50 - F**	**>50 - F**	**>50 - F**	**>50 - F**
	EB	2.4 - A	31.7 - D	1.9 - A	31.7 - D
	WB	N/A	>50 - F	N/A	>50 - F
	NB	>50 - F	43.0 - E	>50 - F	43.0 - E
Ramada Drive	**Average**	**>50 - F**	**>50 - F**	**>50 - F**	**>50 - F**
	EB	7.4 - A	5.7 - A	5.7 - A	5.7 - A
	SB	>50 - F	>50 - F	>50 - F	>50 - F

- Delays and Level of Service (LOS) calculated utilizing the methodologies described in Chapters 16 and 17 of the 2000 Highway Capacity Manual (HCM).
X.X – Data Represents Total Average Peak Hour Volume
LOS = Level of Service; Average Delay in seconds
TWSC = Two-Way Stop Controlled Intersection
NB = Northbound, SB = Southbound, EB = Eastbound, WB = Westbound

The data in **Table 5** indicates that the installation of all-way stop control at either ramp intersection would reduce delays for the off-ramp movements (STM #1, STM #2 or STM #3). The LOS for the southbound off-ramp would meet the minimum LOS threshold standards under STM #2 and STM # 3 (LOS C or better). The delays for the northbound off-ramp, while reduced, would still not meet minimum LOS threshold standards under STM #1 and STM #3. The analysis also demonstrates that delays would increase significantly for the east and westbound approaches on Main Street. Increased delays for vehicles on Main Street would also result in longer vehicle queues. It should also be noted that delays on the southbound approaches of Theatre Drive and Ramada Drive would also be in the LOS F range during the PM peak hour regardless of the short-term mitigation scenario.

7.2 Queuing Analysis

An analysis of queuing results from SimTraffic shows that adding all-way stop control at the two US 101 ramp intersections on Main Street would result in additional queuing through the adjacent intersections with the frontage roads. See **Table 6** for summarized queuing analysis results for the all-way stop controlled short-term mitigation scenarios, and **Appendix G** for the full SimTraffic queuing computations.

TABLE 6
2030 BUILDOUT INTERSECTION QUEUE LENGTHS
WITH ALL-WAY STOP MITIGATION

Study Intersection Main Street at:	Critical Movement (Exist. PHV)	Existing Storage Length	95th Percentile Queue Length			
			Existing	**STM #1** US 101 NB Ramps	**STM #2** US 101 SB Ramps	**STM #3** US 101 NB & SB Ramps
Theatre Drive	**PM Peak**					
	NB LTR	---	36	14	14	14
	SB LTR	---	594	173	475	498
US 101 SB Ramps	**PM Peak**					
	EB RT	40[1]	N/A	N/A	63	62
	WB LT	335	217	389	359	268
	SB LT	1000	1275	651	61	61
US 101 NB Ramps	**PM Peak**					
	EB LT	335	436	93	158	140
	WB RT	40[1]	N/A	43	N/A	38
	NB LT	800	1017	288	970	175
Ramada Drive	**PM Peak**					
	EB LT	40[1]	62	44	40	40
	WB TR	---	47	878	70	439
	SB L	---	1192	827	615	737

[1]Measured clear distance between adjacent intersections
AWSC = All-Way Stop Controlled Intersection
TWSC = Two-Way Stop Controlled Intersection
NB = Northbound, SB = Southbound, EB = Eastbound, WB = Westbound

STM #1: With All-Way stop control added at the northbound ramps intersection, queues would decrease for the turning movements southbound from Theatre Drive and the southbound ramps onto Main Street. However, the westbound traffic queue at the southbound ramps intersection would increase and exceed the storage capacity on the bridge. The most significant improvement on the east side of US 101 would be the decrease in the 95th percentile queue for eastbound and northbound traffic at the northbound ramps intersection. Both queues would decrease to fit within the existing roadway storage length. However, the westbound queues on Main Street at the US 101 north and southbound ramp intersections would exceed the available capacity. Westbound queues on Main Street at Ramada Drive would also increase significantly.

If all-way stop control is utilized as a mitigation measure at the northbound ramps intersection (STM #1), it would be necessary to install "KEEP CLEAR" pavement markings within the intersection of Main Street and Ramada Drive in order to keep the westbound queue generated at the northbound ramp intersection from blocking the east and southbound left turn movements through the Ramada Drive intersection. In addition, westbound through traffic stopped at the northbound ramps will block the line-of-sight for vehicles making the southbound left turns from Ramada Drive to eastbound Main Street, potentially impacting safety at this intersection.

STM #2: With All-Way stop control added at the southbound ramps intersection, queues would decrease for the eastbound traffic at the northbound ramps intersection and for the southbound traffic at the intersection of Ramada Drive and Main Street. Otherwise queues would remain mostly unaffected on the east side of US 101. The most significant improvement on the west side of US 101 associated with this mitigation would be to significantly decrease the 95th percentile queue length on the southbound off-ramp. The queue length for westbound traffic at the southbound ramps intersection would be increased, and the queue would exceed available storage capacity on the bridge.

It would be necessary to install "KEEP CLEAR" pavement markings on Main Street within the intersection with the southbound ramps to keep the westbound queue generated at Theatre Drive from blocking the southbound left turns from the off-ramp. At this location, line-of-sight could be impacted for the northbound Theatre Drive traffic. However, these traffic volumes are minimal, and do not pose the same safety concerns as at the Ramada Drive intersection.

STM #3: With All-Way stop control added at both ramp intersections on Main Street, queues would be significantly lower at both off-ramp approaches, as well as for the eastbound approach to the northbound ramps intersection. The most significant improvement associated with this mitigation would be a decrease in the 95th percentile queue on both off-ramps to within the limits of the ramp storage lengths (as compared to base-line 2030 conditions). As discussed under STM #1 and STM #2, "KEEP CLEAR" pavement markings would be required on Main Street for westbound traffic at Ramada Drive and the eastbound traffic at the southbound ramps intersection.

7.3 Conclusion: All-Way Stop Control feasibility

Based upon the analyses above, the use of all-way stop control at either of the ramp intersections independently, (STM #1 and #2), is **not recommended** as a traffic control alternative for 2030 buildout base-line conditions. This is due to the fact that although queuing on the ramps would decrease to a length fitting within existing storage capacity, queuing would increase for westbound through-traffic and would exceed storage capacity on the bridge. Additionally, overall LOS at all four intersections would continue to not meet County and Caltrans standards.

With regard to queuing, the use of All-Way stop control at both intersections concurrently (STM #3) is considered a feasible alternative to mitigate unsafe queuing conditions on the US 101 off-ramps expected as a result of 2030 buildout traffic volumes. Although significant queuing would be expected on the southbound approach of Theatre Drive and on the westbound approach of Main Street at Ramada Drive, there is adequate storage capacity at these locations to accommodate additional vehicles. LOS improvements would be expected at both the southbound and northbound offramps under STM #3. (See Table 4) However, utilizing All-Way stop control at both intersections would significantly decrease the LOS for both eastbound and westbound Main Street approaches, (See Appendix B and C), which would further exacerbate operational deficiencies. Since at all four intersections the LOS would not meet either Caltrans or County minimum standards, STM #3 is **not recommended** as a viable alternative for 2030 buildout base-line conditions.

8.0 INTERSECTION OPERATIONS WITH TRAFFIC SIGNAL MITIGATION

This section evaluates the feasibility of utilizing traffic signals as a mitigation measure to alleviate anticipated future traffic congestion at the US 101 / Main Street interchange. The measures are designed to be implemented under 2030 Buildout traffic volumes and existing geometric conditions.

As previously stated, the Synchro software treats the intersections separately, and therefore, delays generated at one intersection may not be reflected at an adjacent intersection within close proximity, although signalizing the ramp intersections will almost certainly affect operations at the Theatre Drive and Ramada Drive intersections.

Additionally, it should be noted that for the two scenarios where the intersections on the west side and the intersections on the east side are grouped, (STM #7 and STM #8), there is some difficulty in accurately modeling expected traffic conditions with Synchro software. At the eastern intersections, it was decided in discussions with County staff that the most accurate way of modeling the two intersections as a single system would be to run the two intersections as a single intersection (node) with five legs. At the western intersections, due to the more complex roadway geometry, the decision was made by County staff to model the intersections as separate intersections with two coordinated signal systems. While efforts were made to approximate actual traffic conditions with both intersections signalized, Synchro software is limited because it will not treat the two intersections as one. It is possible that at both the east and west intersection groups, actual field conditions would be better than those shown in **Table 7** and **Table 8** with optimized signal timing and striping layout.

8.1 Signal Warrant Analysis

Since the intersections where the signals are proposed are within the limits of Caltrans right-of-way, they must first meet the justification for the installation of a traffic signal at an intersection, which is based on the eight warrants provided in the Caltrans Manual on Uniform Traffic Control Devices (CAMUTCD).

In Deliverable 1, the eight warrants provided in Figures 4C-3 through 4C-101 (CA) were used to analyze the traffic signal warrants based on existing average daily traffic and peak hour traffic volumes, and lane geometry. For the 2030 buildout scenario the traffic signal warrant analysis focuses on an evaluation of Warrant 3 (Peak Hour Volume). In addition, Caltrans has developed a worksheet where traffic volumes may be unknown or approximate in nature. Figure 4C-103 of the CAMUTCD, (Traffic Signal Warrants Worksheet - Average Traffic Estimate Form), uses estimated daily traffic to determine if the traffic signal warrant is satisfied. This worksheet is “to be used only for new intersections or other locations where it is not reasonable to count actual traffic volumes.”

Under the 2030 buildout traffic conditions, both the peak hour signal warrant and the average daily traffic estimate form warrant are satisfied for the US 101 southbound and northbound ramp intersections under the “urban” designation. It should be noted that requirements to meet the “urban” classification are more strict than the “rural” requirements, and as such, the warrants have been met for both designations. See **Appendix H** the signal warrant worksheets.

8.2 Intersection Operations

The short-term mitigation measure scenarios were run in Synchro to determine the affects of adding traffic signals at the Main Street and US 101 northbound ramps intersection only (Short-Term Measure #4), at the Main Street and US 101 southbound ramps intersection only (Short-Term Measure #5), and at both intersections simultaneously (Short-Term Measure #6). Two additional signal scenarios were also analyzed. First, a scenario was run with both intersections west of US 101 signalized and grouped as one traffic signal system, and the intersections east of US 101 configured as a single-node, five-legged intersection with a traffic signal (Short Term Measure #7). Secondly, a scenario was analyzed with the northbound ramps and Ramada Drive intersections configured as a single-node, five-legged intersection with a traffic signal, and a signal at the southbound ramps intersection only on the west side of US 101 (Short Term Measure #8). Currently, all intersections have stop control only on the minor streets. It should be noted that the evaluation of short-term mitigation measures focuses on the analysis of PM peak hour operations only, as this period represents the "worse case" scenario. The results of the LOS analysis for the signalized mitigation scenarios are presented in **Table 7**, with the LOS worksheets included in **Appendix D.**

TABLE 7
2030 (BUILDOUT) INTERSECTION LOS ANALYSIS
WITH SIGNALIZED MITIGATION

Study Intersection Main Street at:	Critical Movement (PM Peak)	Vehicle Delay - LOS Value					
		Existing	**STM #4** US 101 NB Ramps	**STM #5** US 101 SB Ramps	**STM #6** US 101 NB & SB Ramps	**STM #7** Western & Eastern Intersections	**STM #8** Eastern Intersections & US 101 SB Ramps
Theatre Drive	**Average**	**>50 - F**	**>50 - F**	**>50 - F**	**28.4 – D**	**41.7 – D**	**40.4 – E**
	EB	1.6 - A	2.3 - A	2.3 - A	2.3 – A	57.7 – E	1.6 - A
	WB	N/A	N/A	N/A	N/A	14.4 – B	N/A
	NB	11.0 - B	12.1 - B	12.1 - B	12.1 – B	51.1 - D	10.9 - B
	SB	>50 - F	>50 - F	>50 - F	>50 - F	67.7 - E	>50 - F
US 101 SB Ramps	**Average**	**>50 - F**	**>50 - F**	**17.9 - B**	**21.9 – C**	**>80 - F**	**20.3 – C**
	EB	N/A	N/A	4.0 - A	4.6 – A	13.4 – B	5.1 - A
	WB	6.2 - A	6.0 - A	23.3 - C	30.3 – C	>80 - F	11.8 – B
	SB	>50 - F	>50 - F	37.7 - D	40.6 – D	>80 - F	71.4 - E
US 101 NB Ramps	**Average**	**>50 - F**	**14.2 – B**	**>50 - F**	**19.1 – B**	**>80 - F[1]**	**>80 - F[1]**
	EB	2.4 - A	8.9 - A	1.9 - A	9.8 - A	>80 – F	>80 – F
	WB	N/A	11.0 – B	N/A	12.7 – B	N/A[1]	N/A[1]
	NB	>50 - F	22.3 - C	>50 -F	34.6 - C	>80 -F	>80 -F
Ramada Drive	**Average**	**>50 - F**	**>50 - F**	**>50 - F**	**>50 - F**	**N/A[1]**	**N/A[1]**
	EB	7.4 - A	5.7 - A	5.7 - A	5.7 - A	N/A[1]	N/A[1]
	SB	>50 - F	>50 - F	>50 - F	>50 - F	>80 – F	>80 – F
	WB	N/A	N/A	N/A	N/A	54.7 – D[1]	>80 – F[1]

[1]For STM #7 and #8, the northbound ramps and Ramada Drive are modeled as one intersection. Westbound delays are shown only at Ramada Drive, and eastbound delays are shown only for the northbound ramps intersection.
- Delays and Level of Service (LOS) calculated utilizing the methodologies described in Chapters 16 and 17 of the 2000 Highway Capacity Manual (HCM).
X.X – Data Represents Total Average Peak Hour Volume
NB = Northbound, SB = Southbound, EB = Eastbound, WB = Westbound

The data in **Table 7** indicates that of the five signalized mitigation measures, overall LOS values were most improved when signals were installed on both sides of US 101 (STM #6 and STM #8). In particular, all intersections except the intersection of Ramada Drive with Main Street, met minimum LOS standards with traffic signals at both ramp intersections (STM #6). However, individual approaches still did not meet LOS standards at the Theatre Drive and southbound ramps intersection under STM #6.

Adding traffic signal control on Main Street at either ramp intersection would improve the overall LOS at that intersection. With STM #4 in place, the northbound ramps intersection would meet County and Caltrans LOS standards. With STM #5 in place, the southbound ramps intersection would meet County and Caltrans LOS standards. With STM #6 in place, both ramp intersections would meet County and LOS standards for overall standards. Additionally, the Theatre Drive intersection would meet minimum LOS requirements under this mitigation measure. However, it should be noted that even though overall intersection LOS meet the minimum standards, at least one approach would fail to meet the minimum standards at each intersection for under all three short-term mitigation measures.

With STM #7 in place, only the intersection of Theatre Drive and Main Street would meet minimum County LOS requirements, and the southbound approach would continue to not meet delay requirements. Under STM #8, the southbound ramps intersection would meet the Caltrans standard for overall LOS, but would fail to meet the minimum level for both the Theatre Drive / Main Street intersection, and for the eastern intersection. It should be noted that under both STM #7 and #8, Levels of Service at the eastern intersection worsened significantly. For this intersection, split-phase timing was used for all approaches at the request of the County. This method will provide the greatest level of safety in an intersection with multiple potential turning conflicts, but it also worsens the overall intersection LOS and queuing lengths.

8.3 Queuing Analysis

An analysis of queuing results from SimTraffic shows that adding traffic signal control at the US 101 ramp intersections on Main Street would not significantly reduce queuing on the north or southbound off-ramps. See **Table 8** for summarized queuing analysis for the traffic signal mitigation scenarios, and **Appendix G** for full Synchro queuing computations.

TABLE 8
2030 BUILDOUT INTERSECTION QUEUE ANALYSIS
WITH SIGNALIZED MITIGATION

Study Intersection Main Street at:	Critical Movement (PM Peak)	Existing Storage Length	95th Percentile Queue Length					
			Existing	**STM #4** US 101 NB Ramps	**STM #5** US 101 SB Ramps	**STM #6** US 101 NB & SB Ramps	**STM #7** Western & Eastern Intersections	**STM #8** Eastern Intersections & US 101 SB Ramps
Theatre Drive	**PM Peak**							
	NB LTR	---	36	14	14	17	79	27
	SB LTR	---	594	207	373	481	459	259
	EB LTR	---	N/A	N/A	N/A	N/A	180	N/A
	WB LTR	40[1]	N/A	N/A	N/A	N/A	64	N/A
US 101 SB Ramps	**PM Peak**							
	EB RT	40[1]	N/A	N/A	75	52	100	68
	WB LT	335	217	403	361	356	355	318
	SB LT	1000	107	677	230	753	609	251
US 101 NB Ramps	**PM Peak**							
	EB LT	335	436	248	141	400	357[3]	404[3]
	WB RT	40[1]	N/A	49	N/A	61	N/A[3]	N/A[3]
	NB LT	800	1017	534	856	861	836	908
Ramada Drive	**PM Peak**							
	EB LT	40[1]	62	31	32	32	N/A[3]	N/A[3]
	WB TR	---	N/A	413	N/A	898	840[3]	1116[3]
	SB L	---	1192	856	895	808	589	793

[1]Measured clear distance between adjacent intersections.
[2]Existing storage length not limited by geometrical constraints.
[3] For STM #7 and #8, the northbound ramps and Ramada Dr are modeled as one intersection. Westbound queues are shown only at Ramada Dr, and eastbound queues are shown only for the northbound ramps intersection.
NB = Northbound, SB = Southbound, EB = Eastbound, WB = Westbound

The data in **Table 8** indicates that none of the five traffic signal mitigation measures improved all of the queue lengths. In general, all of the mitigation measures resulted in an improvement to southbound movements on Ramada Drive, and a worsening of south and westbound approaches at the southbound ramps intersection. Additionally, all mitigation measures that signalized either or both of the intersections east of US 101, improved queue lengths at the minor streets (northbound offramp and southbound Ramada Drive), but worsened queuing on westbound Main Street.

The installation of signal control at the northbound ramp intersection (STM #4) would decrease queue lengths for the southbound approach at the Theatre Drive intersection with Main Street, and at both the eastbound and northbound approaches to the northbound ramps intersection. However, queue lengths would increase at both the southbound and westbound approaches to the southbound ramps intersection, as well as the westbound approach to the intersection of Ramada Drive with Main Street.

With a traffic signal installed at the southbound ramps intersection only (STM #5), queues were similar to those under 2030 buildout base conditions. The most significant increases to queue lengths were the doubling of queue length on the westbound and southbound approaches to the southbound ramps intersection. The most significant decrease was at the eastbound approach to the northbound ramps intersection.

With traffic signals installed at both the north and southbound ramps intersections (STM #6), improvements to queue lengths relative to 2030 buildout base conditions were minimal. Additionally, queuing conditions at the south and westbound approaches to the southbound ramps intersection were made significantly worse.

The installation of traffic signals at both intersections west of US 101 and east of US 101 (STM #7) results in the greatest queue improvements at the southbound approach to the intersection of Ramada Drive with Main Street. At this location, queue lengths are approximately half of the lengths expected under 2030 buildout base conditions. Significant increases in queue lengths are shown to occur at the south and westbound approaches to the southbound ramps intersection, and at the westbound approach on Main Street to the combined intersection east of US 101.

The installation of traffic signals at the combined intersection east of US 101 and at the southbound ramps intersection (STM #8) results in a similar queuing pattern to STM #7. The main difference between the two mitigation measures is that STM #8 would result in decreased queues at the intersections west of US 101 and increased queues at the combined intersection east of US 101, relative to STM #7.

8.4 Conclusion: Traffic Signal feasibility

As a mitigation measure to improve Levels of Service at the interchange, STM #6 would have the greatest overall impact. With regard to queue lengths, STM #4 and STM #5 show the greatest overall improvements. However, it is important to note that none of the mitigation measures resulted in all four intersections meeting County and Caltrans LOS standards under 2030 Buildout traffic conditions.

Without changes to the roadway geometry, two issues limit the effectiveness of using signals to improve traffic circulation. First, the proximity of the two intersections on the west side of US 101 and the two intersections on the east side of US 101 require sub-optimal signal phasing and timing. Secondly, the width of the existing bridge does not allow for dedicated left-turn lanes for through-traffic on Main Street. Under current conditions, through-traffic must wait for vehicles turning left to clear the intersection or the intersection must be split-phased. Both options worsen the LOS and queues on Main Street.

Due to the fact that overall conditions were not significantly improved under any single traffic signal mitigation measure and the substantial additional costs associated with installation and maintenance of traffic signals as compared with all-way stop control, it is **not recommended** that signalization be considered as a mitigation measure under 2030 Buildout traffic conditions at the southbound and northbound US 101 ramps.

9.0 SIGNALIZED INTERSECTION CAPACITY (ILV) ANALYSIS

Caltrans utilizes the Signalized Intersection Capacity method in the Highway Capacity Manual to determine the traffic volume to intersection capacity. The Intersecting Lane Volume (ILV) method is a rough approximation of the functionality of a signalized intersection given traffic volumes. In general, with an ILV/hr of less than 1200, the signalized intersection would be expected to operate with minimal delay (See **Table 9** ILV characteristics). Estimated 2030 Buildout AM and PM peak hour volumes were used for this analysis. Under these conditions, both intersections are expected to have an ILV/hr close to 1200-1300 during the PM peak hour, which is considered approaching or within the "unstable flow" conditions (See **Appendix E** for the ILV method calculation sheets).

TABLE 9

ILV TRAFFIC FLOW CHARACTERISTICS

ILV/hr	Description
< 1200	Stable flow with slight, but acceptable delay. Occasional signal loading may develop. Free midblock operations.
1200-1500	Unstable flow with considerable delays possible. Some vehicles occasionally wait two or more cycles to pass through the intersection. Continuous backup occurs on some approaches.
> 1500	Stop-and-go operation with severe delay and heavy congestion. Traffic volume is limited by maximum discharge rates of each phase. Continuous backup in varying degrees occurs on all approaches. Where downstream capacity is restrictive, mainline congestion can impede orderly discharge through the intersection.

Source: Highway Design Manual, Table 406, California Department of Transportation.

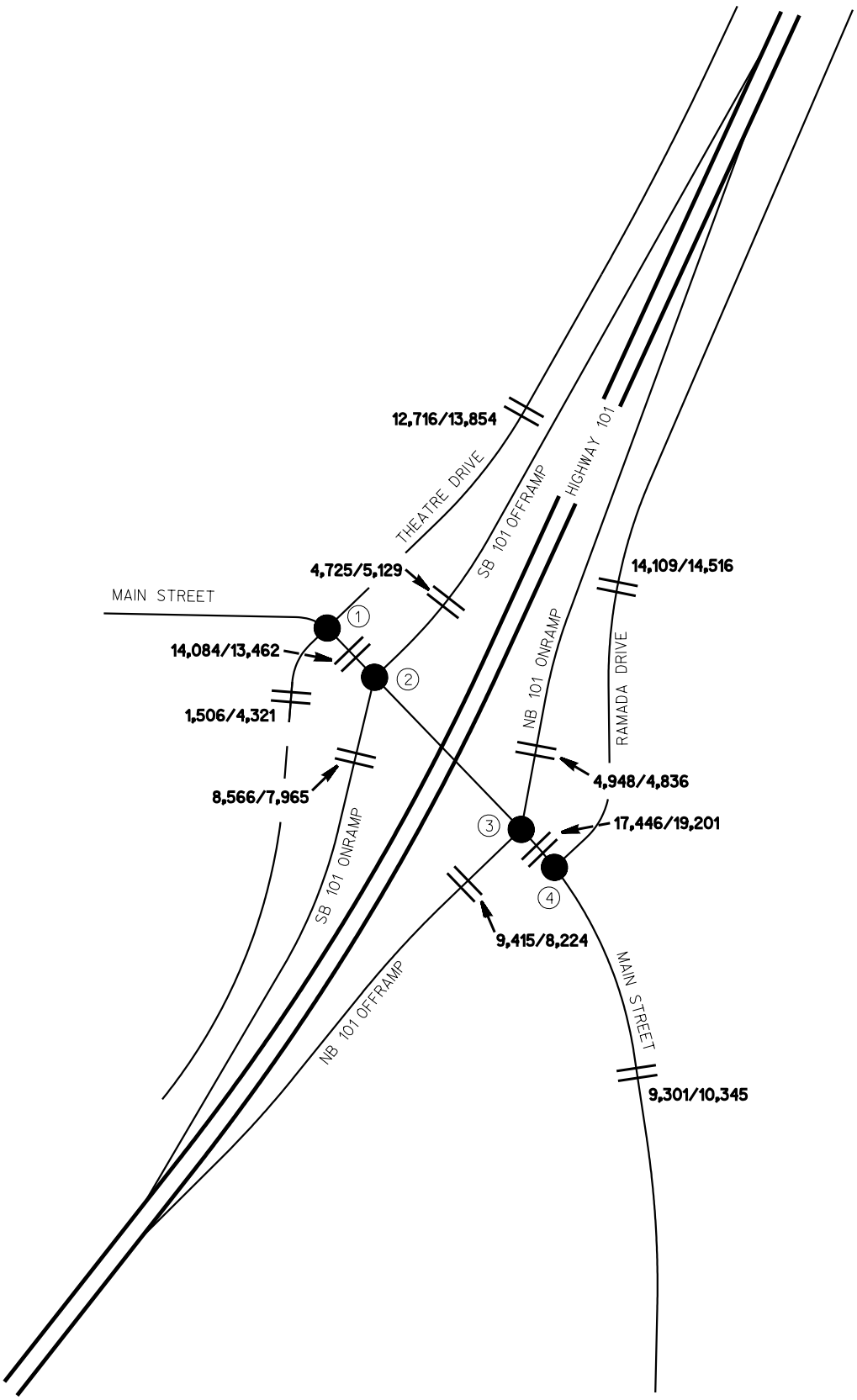
10.0 TRAFFIC ANALYSIS - 2030 BUILDOUT WITH THEATRE DRIVE EXTENSION

As part of this technical memorandum, RICK analyzed the potential impacts associated with extending Theatre Drive south to connect with Peterson Ranch Road. Currently, Theatre Drive terminates approximately 800' south of Main Street. As part of the County's Capital Improvement Program (CIP) Alternatives, the County has included the Theatre Drive extension as a proposed infrastructure improvement to the local circulation system.

The projected 2030 base-line traffic forecasts illustrated on Exhibit 4 were used to estimate the daily traffic demands associated with the 2030 CIP Alternatives scenario. Similar to the methodology used to derive the 2030 base-line traffic forecasts (Section 3.0), the differences between the 2030 modeled ADT data and the 2030 CIP Alternatives ADT data contained in the Templeton TDM Update were identified. The 2030 modeled ADT and 2030 CIP Alternatives ADT data are illustrated on **Exhibit 5**. This data indicates that the extension of Theatre Drive will almost triple daily traffic demands along the segment between Main Street and Peterson Ranch Road. Based on the future development of commercial and industrial land uses along Theater Drive daily traffic demands will also increase on Theatre Drive north of Main Street, Main Street east of Theatre Drive, the US 101 southbound off-ramp and Ramada Drive.

The incremental differences between the 2030 modeled ADT and 2030 CIP Alternatives ADT data (Templeton TDM Update) were then applied to the 2030 base-line ADT shown on **Exhibit 5**. The peak hour turning movements associated with the 2030 CIP Alternatives scenario were then derived using the adjusted 2030 base-line ADT data and the directional splits for the various

turning movements at the study intersections. **Exhibit 6** illustrates the adjusted 2030 buildout ADT and peak hour turning movement data for the County's CIP Alternatives scenario. The extension of Theatre Drive and development of future land uses will increase the 2030 base-line traffic demands by about 10% on Theatre Drive north of Main Street, Main Street east of Theatre Drive and the US 101 southbound off ramp. Future traffic demands along Ramada Drive are anticipated to increase by about 3% as associated with the County's CIP Alternative scenario. It should also be noted that the Templeton TDM Update data indicates that traffic demands on the US 101 southbound on-ramp, US 101 northbound on-ramp and US 101 northbound off-ramp are projected to decrease as a result of the CIP alternatives.



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NO SCALE

RICK ENGINEERING COMPANY

EXHIBIT 5

2030 MODELED ADT
VS. 2030 MODELED "CIP" ADT

US 101/MAIN STREET TRAFFIC STUDY

LEGEND:

● = STUDY INTERSECTION

XX/XX = 2030 MODELED ADT/2030 MODELED "CIP" ADT

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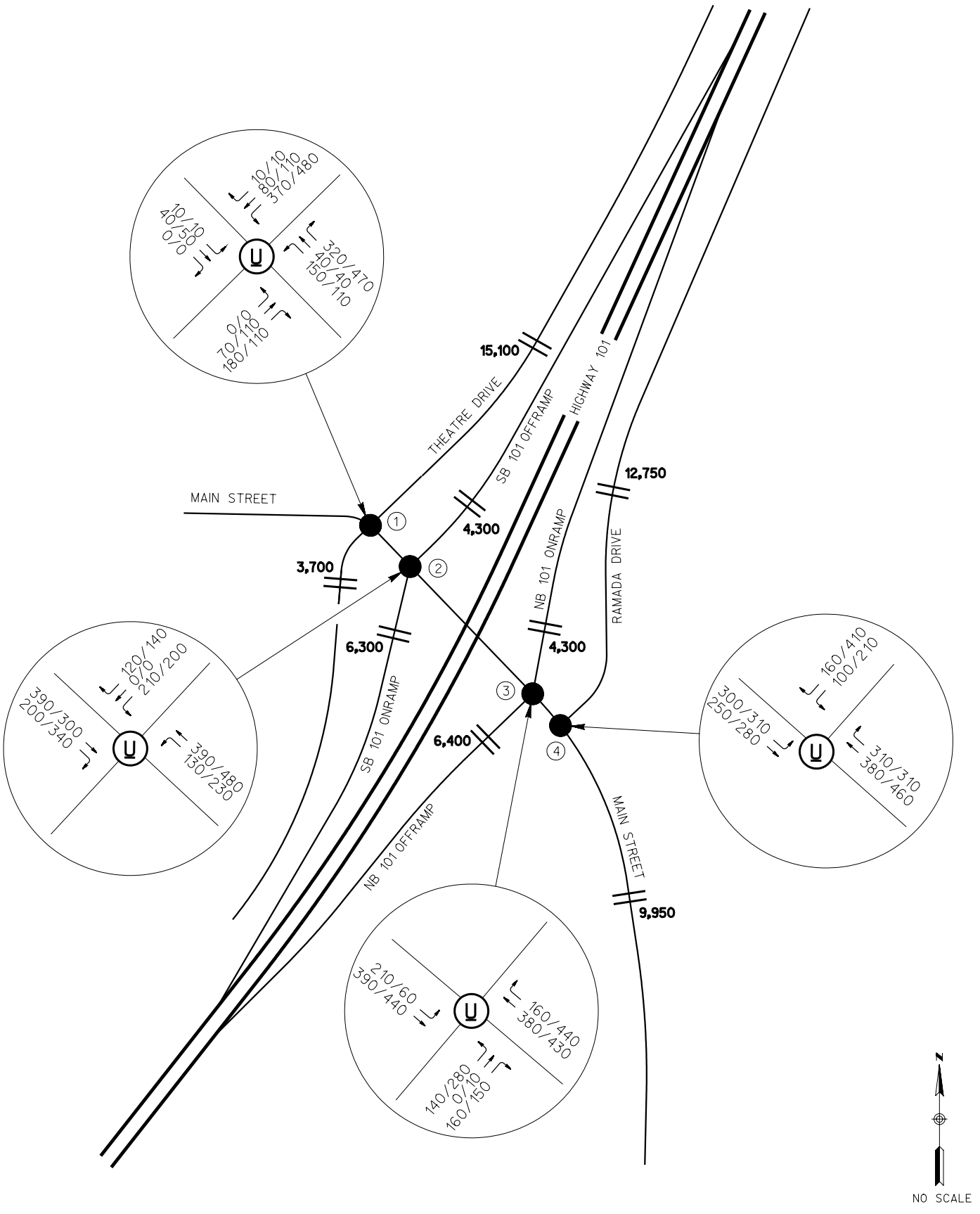

EXHIBIT 6

2030 "CIP" VOLUMES

LEGEND:

● = STUDY INTERSECTION

XX/XX = 2030 ADJUSTED AM/PM "CIP" VOLUMES

XX = 2030 ADJUSTED "CIP" ADT

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US 101/MAIN STREET TRAFFIC STUDY

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APPENDIX A

2030 TURNING MOVEMENT VOLUMES

RICK ENGINEERING COMPANY™
711 Tank Farm Road, Suite 110
San Luis Obispo, CA 93401
Tel: (805) 544-0707
Fax: (805) 544-2052

2030 BASE ADJUSTED AM PEAK HOUR

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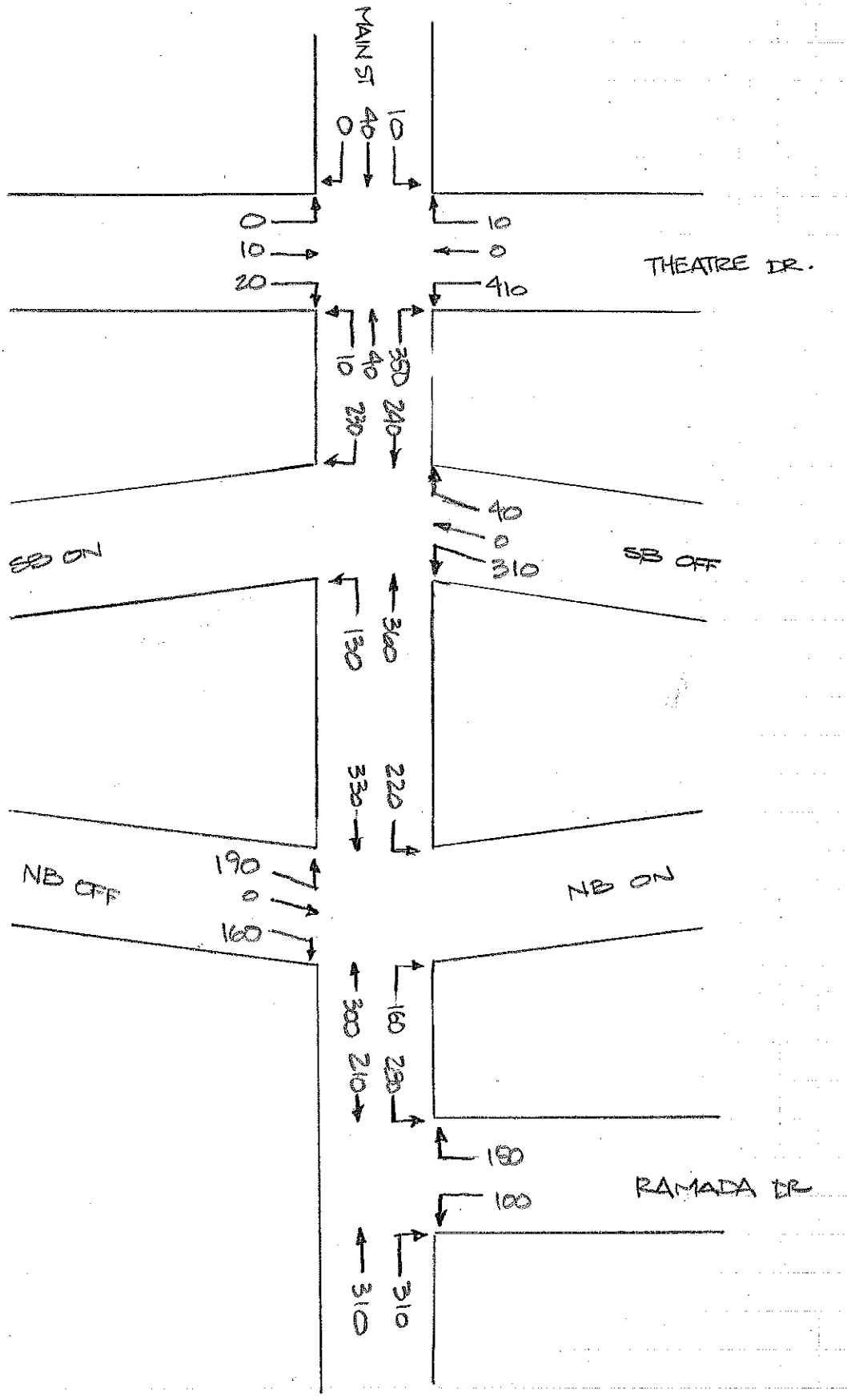

RICK ENGINEERING COMPANY™
711 Tank Farm Road, Suite 110
San Luis Obispo, CA 93401
Tel: (805) 544-0707
Fax: (805) 544-2052

2030 BASE ADJUSTED PM PEAK HOUR

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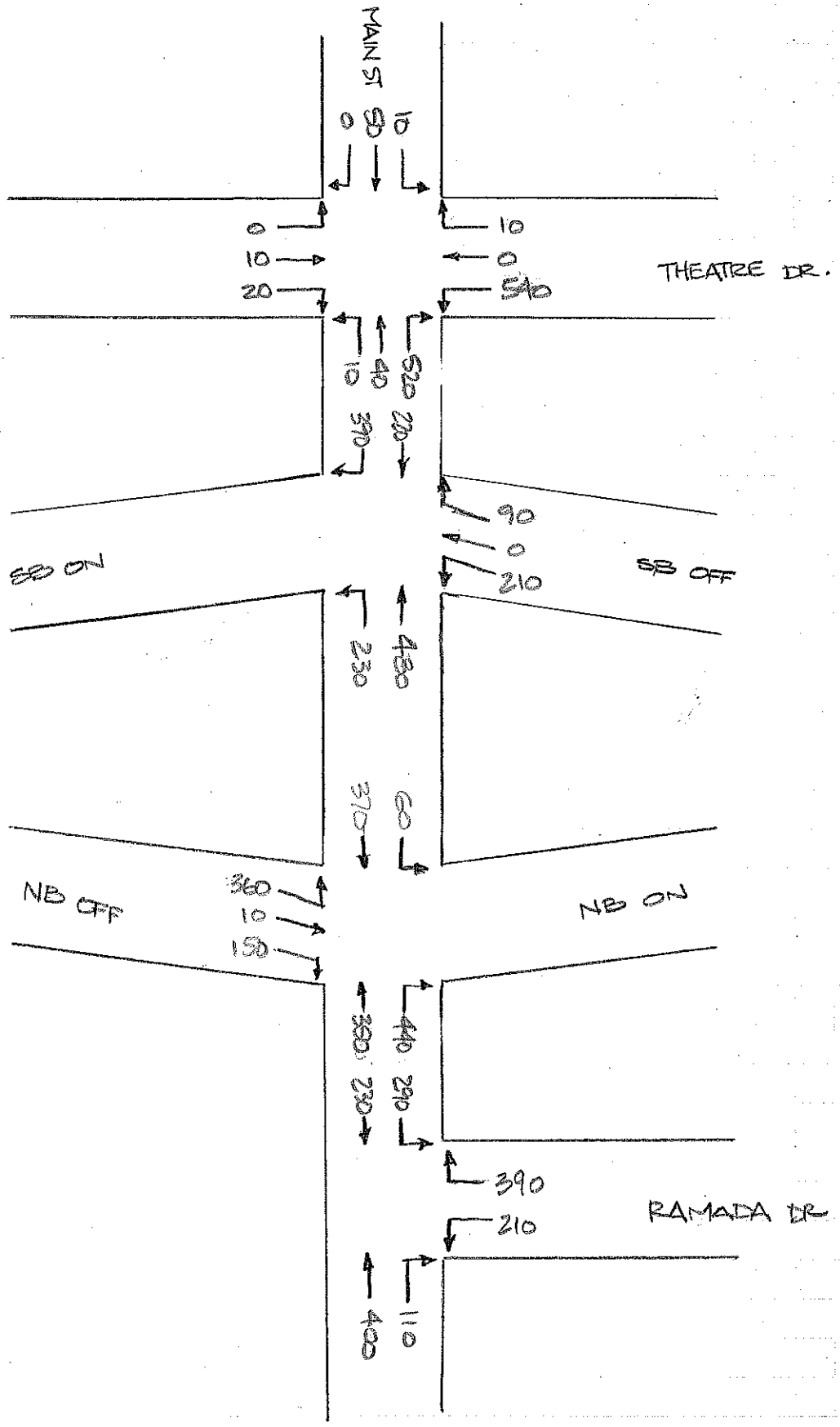

RICK ENGINEERING COMPANY™
711 Tank Farm Road, Suite 110
San Luis Obispo, CA 93401

Tel: (805) 544-0707
Fax: (805) 544-2052

2030 ADJUSTED PM PEAK - COMBINED

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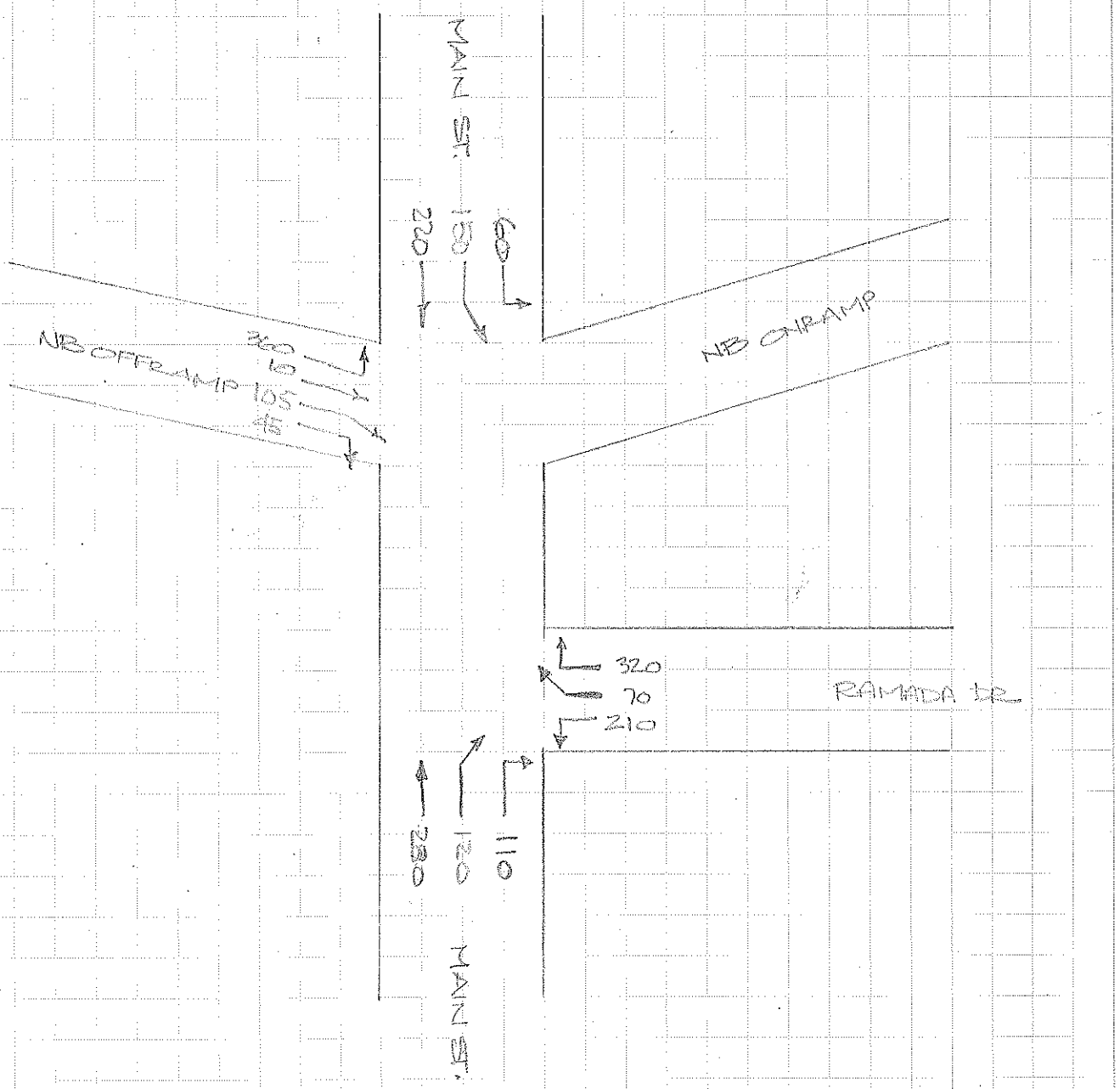
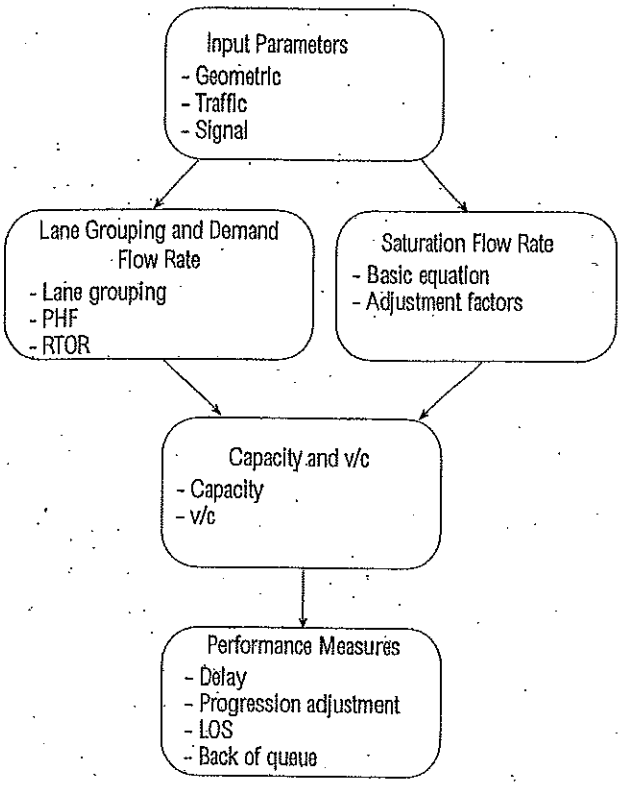


APPENDIX B

2000 HCM LOS METHODOLOGY

EXHIBIT 16-1. SIGNALIZED INTERSECTION METHODOLOGY



LOS

The average control delay per vehicle is estimated for each lane group and aggregated for each approach and for the intersection as a whole. LOS is directly related to the control delay value. The criteria are listed in Exhibit 16-2.

LOS criteria

EXHIBIT 16-2. LOS CRITERIA FOR SIGNALIZED INTERSECTIONS

LOS	Control Delay per Vehicle (s/veh)
A	≤ 10
B	> 10–20
C	> 20–35
D	> 35–55
E	> 55–80
F	> 80

EXHIBIT 17-1. TWSC UNSIGNALIZED INTERSECTION METHODOLOGY

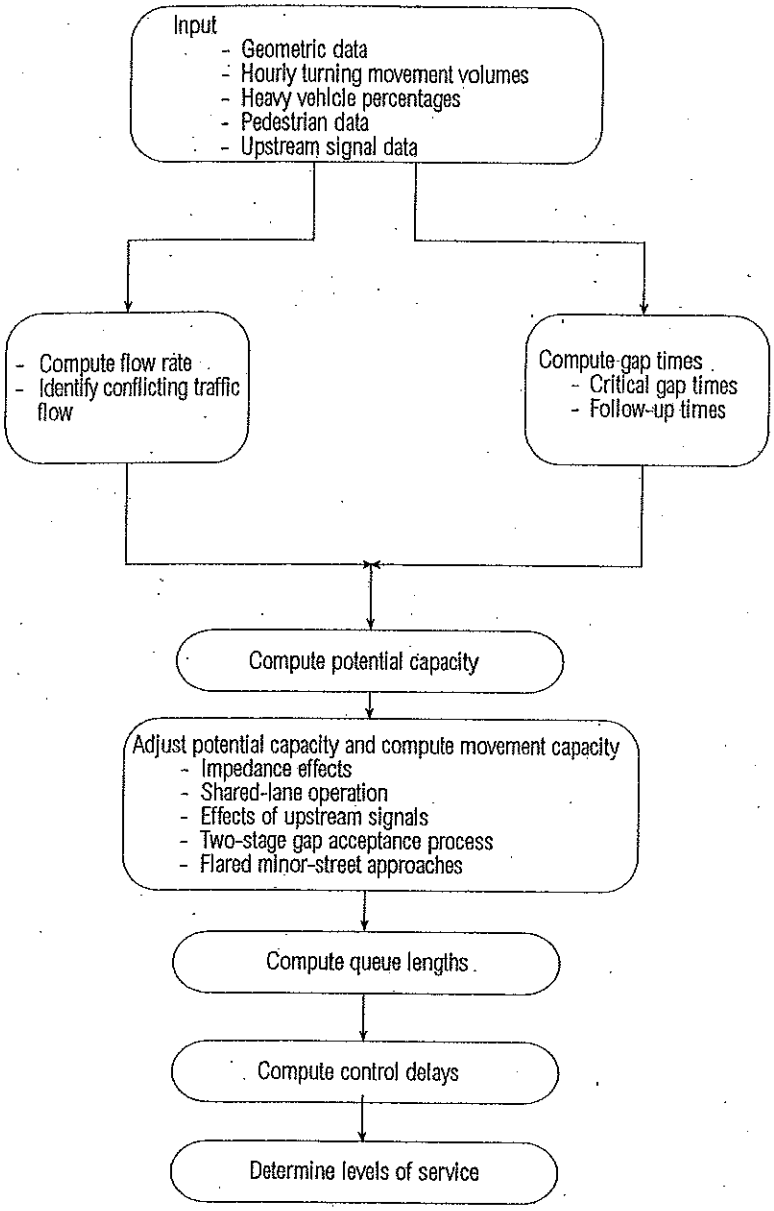
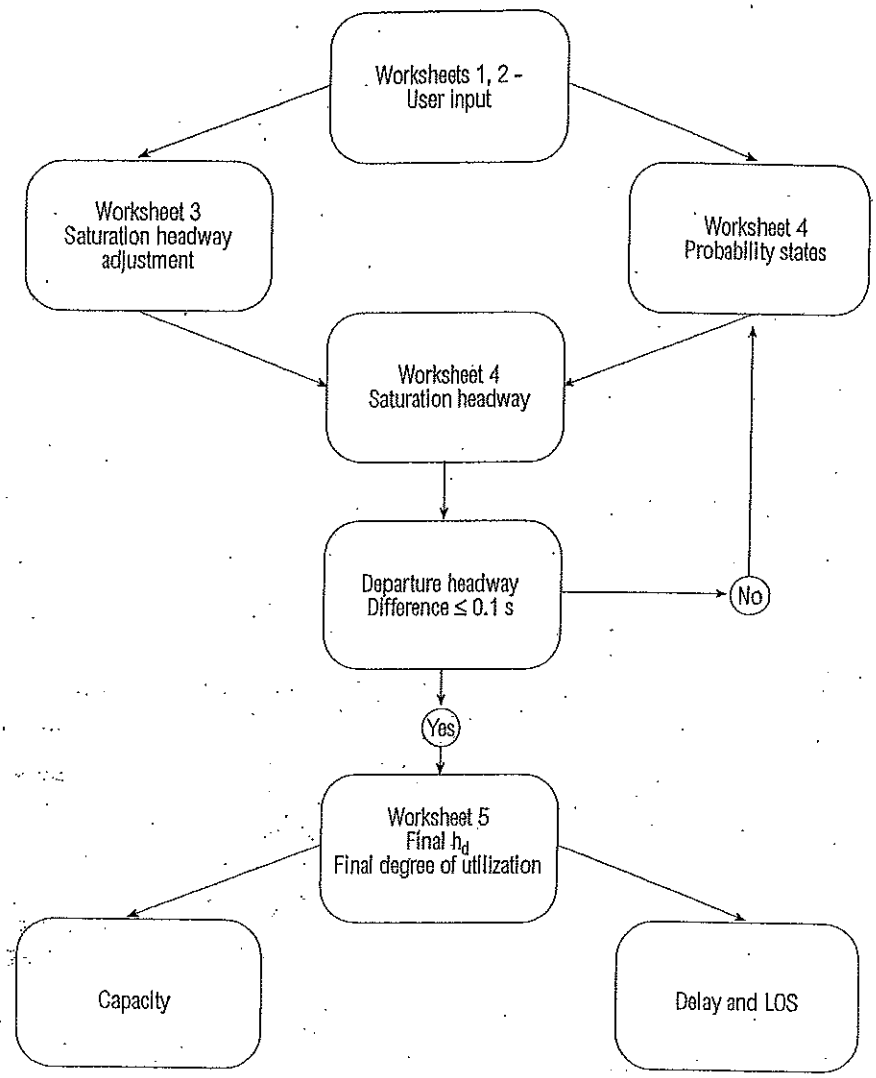


EXHIBIT 17-2. LEVEL-OF-SERVICE CRITERIA FOR TWSC INTERSECTIONS

Level of Service	Average Control Delay (s/veh)
A	0–10
B	> 10–15
C	> 15–25
D	> 25–35
E	> 35–50
F	> 50

EXHIBIT 17-31. AWSC INTERSECTION METHODOLOGY



LEVEL-OF-SERVICE CRITERIA

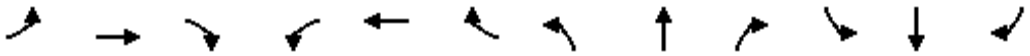
The level-of-service criteria are given in Exhibit 17-22. The criteria for AWSC intersections have different threshold values than do those for signalized intersections primarily because drivers expect different levels of performance from distinct types of transportation facilities. The expectation is that a signalized intersection is designed to carry higher traffic volumes than an AWSC intersection. Thus a higher level of control delay is acceptable at a signalized intersection for the same LOS.

EXHIBIT 17-22. LEVEL-OF-SERVICE CRITERIA FOR AWSC INTERSECTIONS

Level of Service	Control Delay (s/veh)
A	0–10
B	> 10–15
C	> 15–25
D	> 25–35
E	> 35–50
F	> 50

APPENDIX C

SYNCHRO LOS DATA:
2030 BUILDOUT CONDITIONS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	40	0	10	40	350	0	10	20	410	0	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	43	0	11	43	380	0	11	22	446	0	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	424			43			332	511	43	337	321	234
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	424			43			332	511	43	337	321	234
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			100	98	98	23	100	99
cM capacity (veh/h)	1119			1546			600	454	1018	580	582	798

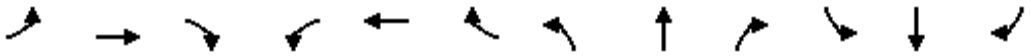
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	54	435	33	457
Volume Left	11	11	0	446
Volume Right	0	380	22	11
cSH	1119	1546	1362	583
Volume to Capacity	0.01	0.01	0.02	0.78
Queue Length 95th (ft)	1	1	2	184
Control Delay (s)	1.7	0.3	10.1	29.8
Lane LOS	A	A	B	D
Approach Delay (s)	1.7	0.3	10.1	29.8
Approach LOS			B	D

Intersection Summary			
Average Delay	14.5		
Intersection Capacity Utilization	61.7%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	240	230	130	360	0	0	0	0	310	0	40
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	261	250	141	391	0	0	0	0	337	0	43
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												2
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	391			511			1082	1060	386	1060	1185	391
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	391			511			1082	1060	386	1060	1185	391
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			86			100	100	100	0	100	93
cM capacity (veh/h)	1151			1039			161	191	655	179	161	651

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	511	533	380
Volume Left	0	141	337
Volume Right	250	0	43
cSH	1700	1039	195
Volume to Capacity	0.30	0.14	1.95
Queue Length 95th (ft)	0	12	706
Control Delay (s)	0.0	3.6	486.2
Lane LOS		A	F
Approach Delay (s)	0.0	3.6	486.2
Approach LOS			F

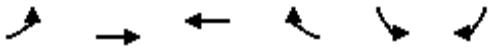
Intersection Summary				
Average Delay	131.2			
Intersection Capacity Utilization	80.0%	ICU Level of Service	D	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	220	330	0	0	300	160	190	0	160	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	239	359	0	0	326	174	207	0	174	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	500			359			1250	1337	359	1337	1250	413
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	500			359			1250	1337	359	1337	1250	413
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	77			100			0	100	74	100	100	100
cM capacity (veh/h)	1049			1184			122	117	679	79	132	633

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	598	500	380
Volume Left	239	0	207
Volume Right	0	174	174
cSH	1049	1700	197
Volume to Capacity	0.23	0.29	1.93
Queue Length 95th (ft)	22	0	700
Control Delay (s)	5.4	0.0	477.1
Lane LOS	A		F
Approach Delay (s)	5.4	0.0	477.1
Approach LOS			F

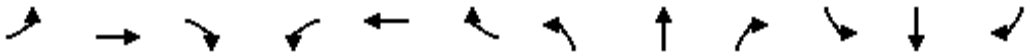
Intersection Summary			
Average Delay	125.0		
Intersection Capacity Utilization	75.6%	ICU Level of Service	D
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	280	210	310	310	100	150
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	304	228	337	337	109	163
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						2
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	674				1342	505
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	674				1342	505
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	66				1	71
cM capacity (veh/h)	903				110	561

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	533	674	272
Volume Left	304	0	109
Volume Right	0	337	163
cSH	903	1700	232
Volume to Capacity	0.34	0.40	1.17
Queue Length 95th (ft)	37	0	321
Control Delay (s)	8.1	0.0	156.4
Lane LOS	A		F
Approach Delay (s)	8.1	0.0	156.4
Approach LOS			F

Intersection Summary			
Average Delay	31.7		
Intersection Capacity Utilization	77.4%	ICU Level of Service	D
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	50	0	10	40	520	0	10	20	540	0	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	54	0	11	43	565	0	11	22	587	0	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	609			54			435	707	54	440	424	326
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	609			54			435	707	54	440	424	326
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			100	97	98	0	100	98
cM capacity (veh/h)	955			1532			511	350	1004	492	508	708

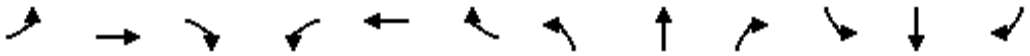
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	65	620	33	598
Volume Left	11	11	0	587
Volume Right	0	565	22	11
cSH	955	1532	1050	494
Volume to Capacity	0.01	0.01	0.03	1.21
Queue Length 95th (ft)	1	1	2	569
Control Delay (s)	1.6	0.2	11.0	137.9
Lane LOS	A	A	B	F
Approach Delay (s)	1.6	0.2	11.0	137.9
Approach LOS			B	F

Intersection Summary			
Average Delay	63.1		
Intersection Capacity Utilization	79.6%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	220	390	230	480	0	0	0	0	210	0	90
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	239	424	250	522	0	0	0	0	228	0	98
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												2
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	522			663			1522	1473	451	1473	1685	522
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	522			663			1522	1473	451	1473	1685	522
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			73			100	100	100	0	100	82
cM capacity (veh/h)	1029			912			62	91	602	81	67	549

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	663	772	326
Volume Left	0	250	228
Volume Right	424	0	98
cSH	1700	912	110
Volume to Capacity	0.39	0.27	2.98
Queue Length 95th (ft)	0	28	775
Control Delay (s)	0.0	6.2	974.8
Lane LOS		A	F
Approach Delay (s)	0.0	6.2	974.8
Approach LOS			F

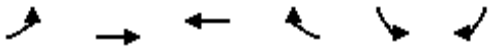
Intersection Summary				
Average Delay	183.2			
Intersection Capacity Utilization	95.1%	ICU Level of Service	F	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	60	370	0	0	350	440	360	10	150	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	65	402	0	0	380	478	391	11	163	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	859			402			1152	1391	402	1239	1152	620
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	859			402			1152	1391	402	1239	1152	620
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	92			100			0	92	75	100	100	100
cM capacity (veh/h)	770			1140			161	128	642	98	179	483

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	467	859	565
Volume Left	65	0	391
Volume Right	0	478	163
cSH	770	1700	205
Volume to Capacity	0.08	0.51	2.76
Queue Length 95th (ft)	7	0	1234
Control Delay (s)	2.4	0.0	841.8
Lane LOS	A		F
Approach Delay (s)	2.4	0.0	841.8
Approach LOS			F

Intersection Summary			
Average Delay	252.2		
Intersection Capacity Utilization	97.5%	ICU Level of Service	F
Analysis Period (min)	15		



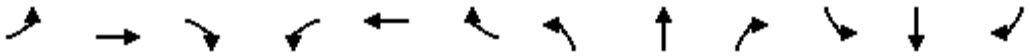
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	290	230	400	110	210	390
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	315	250	435	120	228	424
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						2
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	554				1375	495
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	554				1375	495
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	69				0	25
cM capacity (veh/h)	1001				108	569

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	565	554	652
Volume Left	315	0	228
Volume Right	0	120	424
cSH	1001	1700	232
Volume to Capacity	0.31	0.33	2.81
Queue Length 95th (ft)	34	0	1419
Control Delay (s)	7.4	0.0	856.5
Lane LOS	A		F
Approach Delay (s)	7.4	0.0	856.5
Approach LOS			F

Intersection Summary			
Average Delay	317.6		
Intersection Capacity Utilization	77.5%	ICU Level of Service	D
Analysis Period (min)	15		

APPENDIX D

LOS ANALYSIS WITH MITIGATION MEASURES: 2030 BUILDOUT CONDITIONS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	30	0	10	40	530	0	0	10	550	0	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	33	0	11	43	576	0	0	11	598	0	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	620			33			418	696	33	413	408	332
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	620			33			418	696	33	413	408	332
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			100	100	99	0	100	98
cM capacity (veh/h)	946			1560			524	355	1032	531	519	703

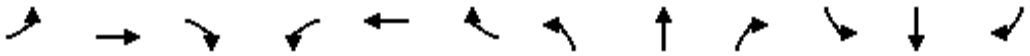
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	43	630	11	609
Volume Left	11	11	0	598
Volume Right	0	576	11	11
cSH	946	1560	516	533
Volume to Capacity	0.01	0.01	0.02	1.14
Queue Length 95th (ft)	1	1	2	514
Control Delay (s)	2.3	0.2	12.1	110.5
Lane LOS	A	A	B	F
Approach Delay (s)	2.3	0.2	12.1	110.5
Approach LOS			B	F

Intersection Summary			
Average Delay	52.3		
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	220	370	230	530	0	0	0	0	160	0	50
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	239	402	250	576	0	0	0	0	174	0	54
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												2
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	576			641			1543	1516	440	1516	1717	576
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	576			641			1543	1516	440	1516	1717	576
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			73			100	100	100	0	100	89
cM capacity (veh/h)	983			929			65	86	611	76	65	511

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	641	826	228
Volume Left	0	250	174
Volume Right	402	0	54
cSH	1700	929	96
Volume to Capacity	0.38	0.27	2.38
Queue Length 95th (ft)	0	27	517
Control Delay (s)	0.0	6.0	723.2
Lane LOS		A	F
Approach Delay (s)	0.0	6.0	723.2
Approach LOS			F

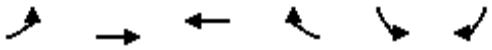
Intersection Summary				
Average Delay	100.3			
Intersection Capacity Utilization	93.8%	ICU Level of Service	F	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	50	330	0	0	380	300	380	10	120	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	54	359	0	0	413	326	413	11	130	0	0	0

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total (vph)	413	739	424	130
Volume Left (vph)	54	0	413	0
Volume Right (vph)	0	326	0	130
Hadj (s)	0.08	-0.21	0.54	-0.65
Departure Headway (s)	6.9	6.5	7.9	6.7
Degree Utilization, x	0.80	1.33	0.93	0.24
Capacity (veh/h)	509	560	449	530
Control Delay (s)	31.7	182.8	52.9	10.6
Approach Delay (s)	31.7	182.8	43.0	
Approach LOS	D	F	E	

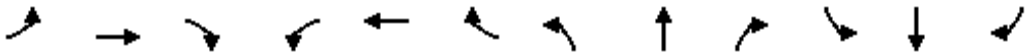
Intersection Summary				
Delay		100.8		
HCM Level of Service		F		
Intersection Capacity Utilization		87.9%	ICU Level of Service	E
Analysis Period (min)		15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	210	240	390	80	140	290
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	228	261	424	87	152	315
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						2
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	511				1185	467
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	511				1185	467
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	78				6	47
cM capacity (veh/h)	1049				163	593

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	489	511	467
Volume Left	228	0	152
Volume Right	0	87	315
cSH	1049	1700	379
Volume to Capacity	0.22	0.30	1.23
Queue Length 95th (ft)	21	0	497
Control Delay (s)	5.7	0.0	156.6
Lane LOS	A		F
Approach Delay (s)	5.7	0.0	156.6
Approach LOS			F

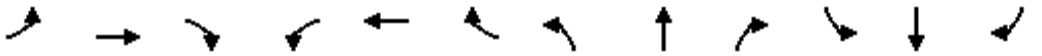
Intersection Summary			
Average Delay	51.8		
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	30	0	10	40	530	0	0	10	550	0	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	33	0	11	43	576	0	0	11	598	0	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	620			33			418	696	33	413	408	332
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	620			33			418	696	33	413	408	332
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			100	100	99	0	100	98
cM capacity (veh/h)	946			1560			524	355	1032	531	519	703

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	43	630	11	609
Volume Left	11	11	0	598
Volume Right	0	576	11	11
cSH	946	1560	516	533
Volume to Capacity	0.01	0.01	0.02	1.14
Queue Length 95th (ft)	1	1	2	514
Control Delay (s)	2.3	0.2	12.1	110.5
Lane LOS	A	A	B	F
Approach Delay (s)	2.3	0.2	12.1	110.5
Approach LOS			B	F

Intersection Summary			
Average Delay	52.3		
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	220	370	230	530	0	0	0	0	160	0	50
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	239	402	250	576	0	0	0	0	174	0	54

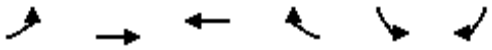
Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total (vph)	641	826	174	54
Volume Left (vph)	0	250	174	0
Volume Right (vph)	402	0	0	54
Hadj (s)	-0.29	0.15	0.58	-0.61
Departure Headway (s)	5.4	5.9	8.1	6.9
Degree Utilization, x	0.97	1.36	0.39	0.10
Capacity (veh/h)	656	609	437	509
Control Delay (s)	50.8	191.5	15.1	9.5
Approach Delay (s)	50.8	191.5	13.8	
Approach LOS	F	F	B	

Intersection Summary				
Delay	114.4			
HCM Level of Service	F			
Intersection Capacity Utilization	93.8%	ICU Level of Service	F	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	50	330	0	0	380	300	380	10	120	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	54	359	0	0	413	326	413	11	130	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	739			359			1043	1207	359	1114	1043	576
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	739			359			1043	1207	359	1114	1043	576
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	94			100			0	94	81	100	100	100
cM capacity (veh/h)	863			1194			196	171	683	135	214	515

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	413	739	554
Volume Left	54	0	413
Volume Right	0	326	130
cSH	863	1700	236
Volume to Capacity	0.06	0.43	2.35
Queue Length 95th (ft)	5	0	1112
Control Delay (s)	1.9	0.0	653.9
Lane LOS	A		F
Approach Delay (s)	1.9	0.0	653.9
Approach LOS			F

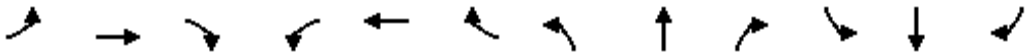
Intersection Summary			
Average Delay	212.9		
Intersection Capacity Utilization	87.9%	ICU Level of Service	E
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	210	240	390	80	140	290
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	228	261	424	87	152	315
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						2
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	511				1185	467
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	511				1185	467
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	78				6	47
cM capacity (veh/h)	1049				163	593

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	489	511	467
Volume Left	228	0	152
Volume Right	0	87	315
cSH	1049	1700	379
Volume to Capacity	0.22	0.30	1.23
Queue Length 95th (ft)	21	0	497
Control Delay (s)	5.7	0.0	156.6
Lane LOS	A		F
Approach Delay (s)	5.7	0.0	156.6
Approach LOS			F

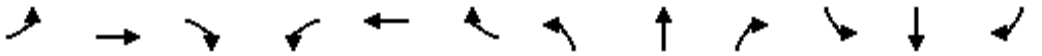
Intersection Summary			
Average Delay	51.8		
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	30	0	10	40	530	0	0	10	550	0	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	33	0	11	43	576	0	0	11	598	0	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	620			33			418	696	33	413	408	332
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	620			33			418	696	33	413	408	332
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			100	100	99	0	100	98
cM capacity (veh/h)	946			1560			524	355	1032	531	519	703

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	43	630	11	609
Volume Left	11	11	0	598
Volume Right	0	576	11	11
cSH	946	1560	516	533
Volume to Capacity	0.01	0.01	0.02	1.14
Queue Length 95th (ft)	1	1	2	514
Control Delay (s)	2.3	0.2	12.1	110.5
Lane LOS	A	A	B	F
Approach Delay (s)	2.3	0.2	12.1	110.5
Approach LOS			B	F

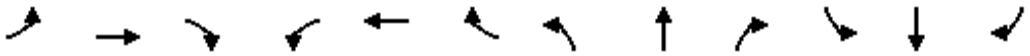
Intersection Summary			
Average Delay	52.3		
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	220	370	230	530	0	0	0	0	160	0	50
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	239	402	250	576	0	0	0	0	174	0	54

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total (vph)	641	826	174	54
Volume Left (vph)	0	250	174	0
Volume Right (vph)	402	0	0	54
Hadj (s)	-0.29	0.15	0.58	-0.61
Departure Headway (s)	5.4	5.9	8.1	6.9
Degree Utilization, x	0.97	1.36	0.39	0.10
Capacity (veh/h)	656	609	437	509
Control Delay (s)	50.8	191.5	15.1	9.5
Approach Delay (s)	50.8	191.5	13.8	
Approach LOS	F	F	B	

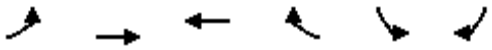
Intersection Summary				
Delay	114.4			
HCM Level of Service	F			
Intersection Capacity Utilization	93.8%	ICU Level of Service	F	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	50	330	0	0	380	300	380	10	120	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	54	359	0	0	413	326	413	11	130	0	0	0

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total (vph)	413	739	424	130
Volume Left (vph)	54	0	413	0
Volume Right (vph)	0	326	0	130
Hadj (s)	0.08	-0.21	0.54	-0.65
Departure Headway (s)	6.9	6.5	7.9	6.7
Degree Utilization, x	0.80	1.33	0.93	0.24
Capacity (veh/h)	509	560	449	530
Control Delay (s)	31.7	182.8	52.9	10.6
Approach Delay (s)	31.7	182.8	43.0	
Approach LOS	D	F	E	

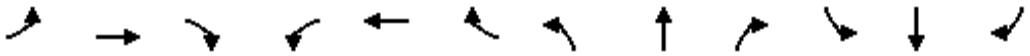
Intersection Summary				
Delay		100.8		
HCM Level of Service		F		
Intersection Capacity Utilization		87.9%	ICU Level of Service	E
Analysis Period (min)		15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	210	240	390	80	140	290
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	228	261	424	87	152	315
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						2
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	511				1185	467
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	511				1185	467
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	78				6	47
cM capacity (veh/h)	1049				163	593

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	489	511	467
Volume Left	228	0	152
Volume Right	0	87	315
cSH	1049	1700	379
Volume to Capacity	0.22	0.30	1.23
Queue Length 95th (ft)	21	0	497
Control Delay (s)	5.7	0.0	156.6
Lane LOS	A		F
Approach Delay (s)	5.7	0.0	156.6
Approach LOS			F

Intersection Summary			
Average Delay	51.8		
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	30	0	10	40	530	0	0	10	550	0	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	33	0	11	43	576	0	0	11	598	0	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (ft)					542							
pX, platoon unblocked												
vC, conflicting volume	620			33			418	696	33	413	408	332
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	620			33			418	696	33	413	408	332
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			100	100	99	0	100	98
cM capacity (veh/h)	946			1560			524	355	1032	531	519	703

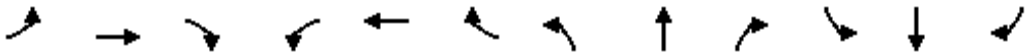
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	43	630	11	609
Volume Left	11	11	0	598
Volume Right	0	576	11	11
cSH	946	1560	516	533
Volume to Capacity	0.01	0.01	0.02	1.14
Queue Length 95th (ft)	1	1	2	514
Control Delay (s)	2.3	0.2	12.1	110.5
Lane LOS	A	A	B	F
Approach Delay (s)	2.3	0.2	12.1	110.5
Approach LOS			B	F

Intersection Summary			
Average Delay	52.3		
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	220	370	230	530	0	0	0	0	160	0	50
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	239	402	250	576	0	0	0	0	174	0	54
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												2
Median type		None			None							
Median storage veh)												
Upstream signal (ft)					409							
pX, platoon unblocked	0.90						0.90	0.90		0.90	0.90	0.90
vC, conflicting volume	576			641			1543	1516	440	1516	1717	576
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	471			641			1548	1518	440	1518	1742	471
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			73			100	100	100	0	100	90
cM capacity (veh/h)	965			929			58	77	611	68	56	527

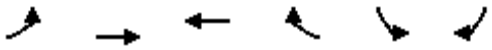
Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	641	826	228
Volume Left	0	250	174
Volume Right	402	0	54
cSH	1700	929	86
Volume to Capacity	0.38	0.27	2.65
Queue Length 95th (ft)	0	27	542
Control Delay (s)	0.0	6.0	849.4
Lane LOS		A	F
Approach Delay (s)	0.0	6.0	849.4
Approach LOS			F

Intersection Summary			
Average Delay	117.3		
Intersection Capacity Utilization	93.8%	ICU Level of Service	F
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	330	0	0	380	300	380	10	120	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	15	15	15	16	16	16	12	12	12	12	12	12
Total Lost time (s)		4.0			4.0			4.0	4.0			
Lane Util. Factor		1.00			1.00			1.00	1.00			
Frt		1.00			0.94			1.00	0.85			
Flt Protected		0.99			1.00			0.95	1.00			
Satd. Flow (prot)		2016			1966			1759	1568			
Flt Permitted		0.79			1.00			0.95	1.00			
Satd. Flow (perm)		1599			1966			1759	1568			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	359	0	0	413	326	413	11	130	0	0	0
RTOR Reduction (vph)	0	0	0	0	54	0	0	0	68	0	0	0
Lane Group Flow (vph)	0	413	0	0	685	0	0	424	62	0	0	0
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Turn Type	Perm						Split		Perm			
Protected Phases		2			2		6	6				
Permitted Phases	2								6			
Actuated Green, G (s)		27.1			27.1			14.9	14.9			
Effective Green, g (s)		27.1			27.1			14.9	14.9			
Actuated g/C Ratio		0.54			0.54			0.30	0.30			
Clearance Time (s)		4.0			4.0			4.0	4.0			
Vehicle Extension (s)		3.0			3.0			3.0	3.0			
Lane Grp Cap (vph)		867			1066			524	467			
v/s Ratio Prot					c0.35			c0.24				
v/s Ratio Perm		0.26							0.04			
v/c Ratio		0.48			0.64			0.81	0.13			
Uniform Delay, d1		7.1			8.0			16.2	12.8			
Progression Factor		1.00			1.00			1.00	1.00			
Incremental Delay, d2		1.9			3.0			9.0	0.1			
Delay (s)		8.9			11.0			25.2	13.0			
Level of Service		A			B			C	B			
Approach Delay (s)		8.9			11.0			22.3			0.0	
Approach LOS		A			B			C			A	

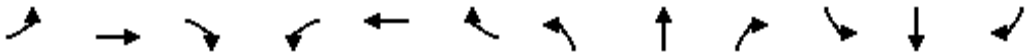
Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	210	240	390	80	140	290
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	228	261	424	87	152	315
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						2
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		110				
pX, platoon unblocked					0.88	
vC, conflicting volume	511				1185	467
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	511				1144	467
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	78				0	47
cM capacity (veh/h)	1049				152	593

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	489	511	467
Volume Left	228	0	152
Volume Right	0	87	315
cSH	1049	1700	352
Volume to Capacity	0.22	0.30	1.33
Queue Length 95th (ft)	21	0	558
Control Delay (s)	5.7	0.0	196.8
Lane LOS	A		F
Approach Delay (s)	5.7	0.0	196.8
Approach LOS			F

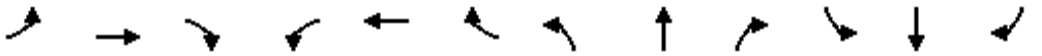
Intersection Summary			
Average Delay	64.6		
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	30	0	10	40	530	0	0	10	550	0	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	33	0	11	43	576	0	0	11	598	0	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (ft)					133							
pX, platoon unblocked	0.83						0.83	0.83		0.83	0.83	0.83
vC, conflicting volume	620			33			418	696	33	413	408	332
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	442			33			200	533	33	194	187	96
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			100	100	99	3	100	99
cM capacity (veh/h)	917			1560			608	366	1032	616	573	793

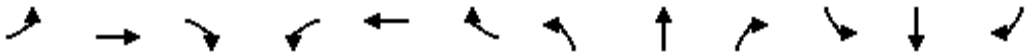
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	43	630	11	609
Volume Left	11	11	0	598
Volume Right	0	576	11	11
cSH	917	1560	516	619
Volume to Capacity	0.01	0.01	0.02	0.98
Queue Length 95th (ft)	1	1	2	362
Control Delay (s)	2.3	0.2	12.1	58.1
Lane LOS	A	A	B	F
Approach Delay (s)	2.3	0.2	12.1	58.1
Approach LOS			B	F

Intersection Summary				
Average Delay	27.6			
Intersection Capacity Utilization	73.6%	ICU Level of Service	D	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	220	370	230	530	0	0	0	0	160	0	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	16	16	15	15	15	12	12	12	12	12	12
Total Lost time (s)		4.0			4.0						4.0	4.0
Lane Util. Factor		1.00			1.00						1.00	1.00
Frt		0.92			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.95	1.00
Satd. Flow (prot)		1877			1961						1719	1538
Flt Permitted		1.00			0.60						0.95	1.00
Satd. Flow (perm)		1877			1190						1719	1538
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	239	402	250	576	0	0	0	0	174	0	54
RTOR Reduction (vph)	0	62	0	0	0	0	0	0	0	0	0	38
Lane Group Flow (vph)	0	579	0	0	826	0	0	0	0	0	174	16
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type				Perm						Split		Perm
Protected Phases		2			2					6	6	
Permitted Phases				2								6
Actuated Green, G (s)		64.1			64.1						13.1	13.1
Effective Green, g (s)		64.1			64.1						13.1	13.1
Actuated g/C Ratio		0.75			0.75						0.15	0.15
Clearance Time (s)		4.0			4.0						4.0	4.0
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		1412			895						264	236
v/s Ratio Prot		0.31									c0.10	
v/s Ratio Perm					c0.69							0.01
v/c Ratio		0.41			0.92						0.66	0.07
Uniform Delay, d1		3.8			8.5						33.9	30.8
Progression Factor		1.00			1.00						1.00	1.00
Incremental Delay, d2		0.2			14.7						5.8	0.1
Delay (s)		4.0			23.3						39.8	30.9
Level of Service		A			C						D	C
Approach Delay (s)		4.0			23.3			0.0			37.7	
Approach LOS		A			C			A			D	

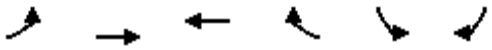
Intersection Summary			
HCM Average Control Delay	17.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	85.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	93.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	50	330	0	0	380	300	380	10	120	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	54	359	0	0	413	326	413	11	130	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		409										
pX, platoon unblocked												
vC, conflicting volume	739			359			1043	1207	359	1114	1043	576
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	739			359			1043	1207	359	1114	1043	576
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	94			100			0	94	81	100	100	100
cM capacity (veh/h)	863			1194			196	171	683	135	214	515

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	413	739	554
Volume Left	54	0	413
Volume Right	0	326	130
cSH	863	1700	236
Volume to Capacity	0.06	0.43	2.35
Queue Length 95th (ft)	5	0	1112
Control Delay (s)	1.9	0.0	653.9
Lane LOS	A		F
Approach Delay (s)	1.9	0.0	653.9
Approach LOS			F

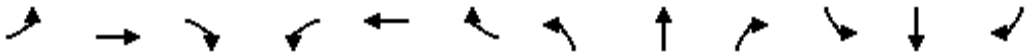
Intersection Summary			
Average Delay	212.9		
Intersection Capacity Utilization	87.9%	ICU Level of Service	E
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	210	240	390	80	140	290
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	228	261	424	87	152	315
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						2
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		519				
pX, platoon unblocked						
vC, conflicting volume	511				1185	467
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	511				1185	467
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	78				6	47
cM capacity (veh/h)	1049				163	593

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	489	511	467
Volume Left	228	0	152
Volume Right	0	87	315
cSH	1049	1700	379
Volume to Capacity	0.22	0.30	1.23
Queue Length 95th (ft)	21	0	497
Control Delay (s)	5.7	0.0	156.6
Lane LOS	A		F
Approach Delay (s)	5.7	0.0	156.6
Approach LOS			F

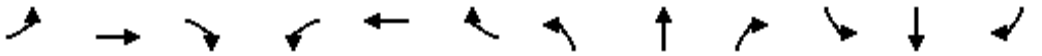
Intersection Summary			
Average Delay	51.8		
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	30	0	10	40	530	0	0	10	550	0	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	33	0	11	43	576	0	0	11	598	0	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (ft)					133							
pX, platoon unblocked	0.84						0.84	0.84		0.84	0.84	0.84
vC, conflicting volume	620			33			418	696	33	413	408	332
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	449			33			209	540	33	202	196	105
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			100	100	99	2	100	99
cM capacity (veh/h)	918			1560			604	365	1032	612	571	788

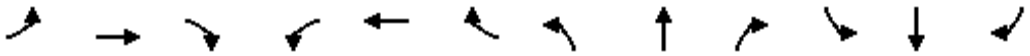
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	43	630	11	609
Volume Left	11	11	0	598
Volume Right	0	576	11	11
cSH	918	1560	516	615
Volume to Capacity	0.01	0.01	0.02	0.99
Queue Length 95th (ft)	1	1	2	369
Control Delay (s)	2.3	0.2	12.1	59.8
Lane LOS	A	A	B	F
Approach Delay (s)	2.3	0.2	12.1	59.8
Approach LOS			B	F

Intersection Summary				
Average Delay	28.4			
Intersection Capacity Utilization	73.6%	ICU Level of Service	D	
Analysis Period (min)	15			



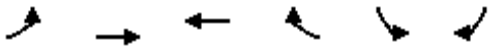
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	220	370	230	530	0	0	0	0	160	0	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	16	16	15	15	15	12	12	12	12	12	12
Total Lost time (s)		4.0			4.0						4.0	4.0
Lane Util. Factor		1.00			1.00						1.00	1.00
Frt		0.92			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.95	1.00
Satd. Flow (prot)		1877			1961						1719	1538
Flt Permitted		1.00			0.60						0.95	1.00
Satd. Flow (perm)		1877			1191						1719	1538
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	239	402	250	576	0	0	0	0	174	0	54
RTOR Reduction (vph)	0	60	0	0	0	0	0	0	0	0	0	38
Lane Group Flow (vph)	0	581	0	0	826	0	0	0	0	0	174	16
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type				Perm						Split		Perm
Protected Phases		2			2					6	6	
Permitted Phases				2								6
Actuated Green, G (s)		68.5			68.5						13.5	13.5
Effective Green, g (s)		68.5			68.5						13.5	13.5
Actuated g/C Ratio		0.76			0.76						0.15	0.15
Clearance Time (s)		4.0			4.0						4.0	4.0
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		1429			906						258	231
v/s Ratio Prot		0.31									c0.10	
v/s Ratio Perm					c0.69							0.01
v/c Ratio		0.41			0.91						0.67	0.07
Uniform Delay, d1		3.7			8.4						36.2	32.8
Progression Factor		1.00			2.16						1.00	1.00
Incremental Delay, d2		0.9			12.2						6.8	0.1
Delay (s)		4.6			30.3						43.0	33.0
Level of Service		A			C						D	C
Approach Delay (s)		4.6			30.3			0.0			40.6	
Approach LOS		A			C			A			D	

Intersection Summary			
HCM Average Control Delay	21.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	93.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	330	0	0	380	300	380	10	120	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	15	15	15	16	16	16	12	12	12	12	12	12
Total Lost time (s)		4.0			4.0			4.0	4.0			
Lane Util. Factor		1.00			1.00			1.00	1.00			
Frt		1.00			0.94			1.00	0.85			
Flt Protected		0.99			1.00			0.95	1.00			
Satd. Flow (prot)		2016			1966			1759	1568			
Flt Permitted		0.79			1.00			0.95	1.00			
Satd. Flow (perm)		1597			1966			1759	1568			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	359	0	0	413	326	413	11	130	0	0	0
RTOR Reduction (vph)	0	0	0	0	27	0	0	0	41	0	0	0
Lane Group Flow (vph)	0	413	0	0	712	0	0	424	89	0	0	0
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Turn Type	Perm						Split		Perm			
Protected Phases		2			2		6	6				
Permitted Phases	2								6			
Actuated Green, G (s)		55.1			55.1			26.9	26.9			
Effective Green, g (s)		55.1			55.1			26.9	26.9			
Actuated g/C Ratio		0.61			0.61			0.30	0.30			
Clearance Time (s)		4.0			4.0			4.0	4.0			
Vehicle Extension (s)		3.0			3.0			3.0	3.0			
Lane Grp Cap (vph)		978			1204			526	469			
v/s Ratio Prot					c0.36			c0.24				
v/s Ratio Perm		0.26							0.06			
v/c Ratio		0.42			0.59			0.81	0.19			
Uniform Delay, d1		9.1			10.6			29.1	23.5			
Progression Factor		0.95			1.00			1.00	1.00			
Incremental Delay, d2		1.2			2.1			8.8	0.2			
Delay (s)		9.8			12.7			37.9	23.7			
Level of Service		A			B			D	C			
Approach Delay (s)		9.8			12.7			34.6			0.0	
Approach LOS		A			B			C			A	

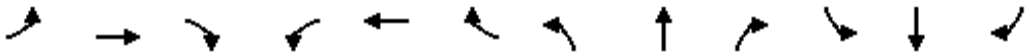
Intersection Summary			
HCM Average Control Delay	19.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	210	240	390	80	140	290
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	228	261	424	87	152	315
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						2
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		110				
pX, platoon unblocked					0.90	
vC, conflicting volume	511				1185	467
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	511				1150	467
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	78				1	47
cM capacity (veh/h)	1049				154	593

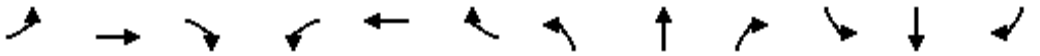
Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	489	511	467
Volume Left	228	0	152
Volume Right	0	87	315
cSH	1049	1700	362
Volume to Capacity	0.22	0.30	1.29
Queue Length 95th (ft)	21	0	534
Control Delay (s)	5.7	0.0	180.3
Lane LOS	A		F
Approach Delay (s)	5.7	0.0	180.3
Approach LOS			F

Intersection Summary			
Average Delay	59.3		
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	50	0	10	40	520	0	10	20	540	0	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	16	16	16	13	13	13	13	13	13
Total Lost time (s)		6.5			6.5			6.5	6.5		6.5	
Lane Util. Factor		1.00			1.00			1.00	1.00		1.00	
Frt		1.00			0.88			1.00	0.85		1.00	
Flt Protected		0.99			1.00			1.00	1.00		0.95	
Satd. Flow (prot)		1675			1796			1870	1589		1778	
Flt Permitted		0.99			1.00			1.00	1.00		0.95	
Satd. Flow (perm)		1675			1796			1870	1589		1778	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	54	0	11	43	565	0	11	22	587	0	11
RTOR Reduction (vph)	0	0	0	0	319	0	0	0	20	0	1	0
Lane Group Flow (vph)	0	65	0	0	300	0	0	11	2	0	597	0
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Split			Split			Split		Perm	Split		
Protected Phases	2	2		8	8		6	6		4	4	
Permitted Phases									6			
Actuated Green, G (s)		8.8			34.2			9.5	9.5		41.5	
Effective Green, g (s)		8.8			34.2			9.5	9.5		41.5	
Actuated g/C Ratio		0.07			0.29			0.08	0.08		0.35	
Clearance Time (s)		6.5			6.5			6.5	6.5		6.5	
Vehicle Extension (s)		3.0			3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)		123			512			148	126		615	
v/s Ratio Prot		c0.04			c0.17			c0.01			c0.34	
v/s Ratio Perm									0.00			
v/c Ratio		0.53			0.59			0.07	0.01		0.97	
Uniform Delay, d1		53.6			36.8			51.2	50.9		38.7	
Progression Factor		1.00			0.38			1.00	1.00		1.00	
Incremental Delay, d2		4.1			0.4			0.2	0.0		29.0	
Delay (s)		57.7			14.4			51.4	51.0		67.7	
Level of Service		E			B			D	D		E	
Approach Delay (s)		57.7			14.4			51.1			67.7	
Approach LOS		E			B			D			E	

Intersection Summary			
HCM Average Control Delay	41.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	83.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	220	390	230	480	0	0	0	0	210	0	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	16	16	15	15	15	12	12	12	12	12	12
Total Lost time (s)		6.5			6.5						6.5	6.5
Lane Util. Factor		1.00			1.00						1.00	1.00
Frt		0.91			1.00						1.00	0.85
Flt Protected		1.00			0.98						0.95	1.00
Satd. Flow (prot)		1874			1959						1719	1538
Flt Permitted		1.00			0.65						0.95	1.00
Satd. Flow (perm)		1874			1284						1719	1538
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	239	424	250	522	0	0	0	0	228	0	98
RTOR Reduction (vph)	0	47	0	0	0	0	0	0	0	0	0	39
Lane Group Flow (vph)	0	616	0	0	772	0	0	0	0	0	228	59
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type				Perm						Split		Perm
Protected Phases		4			8					6	6	
Permitted Phases		8		8	8							6
Actuated Green, G (s)		75.7			34.2						9.5	9.5
Effective Green, g (s)		75.7			34.2						9.5	9.5
Actuated g/C Ratio		0.63			0.29						0.08	0.08
Clearance Time (s)		6.5			6.5						6.5	6.5
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		1182			366						136	122
v/s Ratio Prot		c0.18									c0.13	
v/s Ratio Perm		0.15			c0.60							0.04
v/c Ratio		0.52			2.11						1.68	0.49
Uniform Delay, d1		12.2			42.9						55.2	52.9
Progression Factor		1.09			0.92						1.00	1.00
Incremental Delay, d2		0.2			500.0						334.3	3.0
Delay (s)		13.4			539.5						389.5	55.9
Level of Service		B			F						F	E
Approach Delay (s)		13.4			539.5			0.0			289.3	
Approach LOS		B			F			A			F	

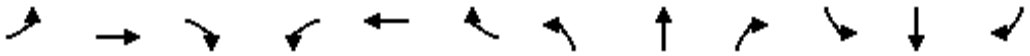
Intersection Summary			
HCM Average Control Delay	295.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.29		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	34.8
Intersection Capacity Utilization	101.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL2	EBL	EBT	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2	SWL2	SWL
Lane Configurations												
Volume (vph)	60	150	220	280	120	110	360	10	105	45	210	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	15	12	15	16	16	12	12	12	12	12	12	12
Total Lost time (s)			6.5	6.5				6.5	6.5			6.5
Lane Util. Factor			1.00	1.00				1.00	1.00			1.00
Frt			1.00	0.94				1.00	0.85			1.00
Flt Protected			0.98	1.00				0.95	1.00			0.95
Satd. Flow (prot)			1943	1943				1727	1568			1752
Flt Permitted			0.98	1.00				0.95	1.00			0.95
Satd. Flow (perm)			1943	1943				1727	1568			1752
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	65	163	239	304	130	120	391	11	114	49	228	0
RTOR Reduction (vph)	0	0	0	9	0	0	0	0	12	0	0	0
Lane Group Flow (vph)	0	0	467	545	0	0	0	402	151	0	0	228
Heavy Vehicles (%)	5%	5%	5%	5%	3%	3%	5%	3%	3%	3%	3%	3%
Turn Type	Split	Split					Split		Perm		Split	
Protected Phases	2	2	2	4			6	6			8	8
Permitted Phases									6			
Actuated Green, G (s)			23.5	37.7				21.3	21.3			11.5
Effective Green, g (s)			23.5	37.7				21.3	21.3			11.5
Actuated g/C Ratio			0.20	0.31				0.18	0.18			0.10
Clearance Time (s)			6.5	6.5				6.5	6.5			6.5
Vehicle Extension (s)			3.0	3.0				3.0	3.0			3.0
Lane Grp Cap (vph)			381	610				307	278			168
v/s Ratio Prot			c0.24	c0.28				c0.23				0.13
v/s Ratio Perm									0.10			
v/c Ratio			1.23	0.89				1.31	0.54			1.36
Uniform Delay, d1			48.2	39.2				49.4	44.9			54.2
Progression Factor			0.99	1.00				1.00	1.00			1.00
Incremental Delay, d2			103.8	15.4				160.7	2.2			194.4
Delay (s)			151.7	54.7				210.1	47.1			248.6
Level of Service			F	D				F	D			F
Approach Delay (s)			151.7	54.7				163.1				404.1
Approach LOS			F	D				F				F

Intersection Summary			
HCM Average Control Delay	204.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	118.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SWR	SWR2
Lane Configurations		
Volume (vph)	70	320
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	6.5	
Lane Util. Factor	1.00	
Frt	0.85	
Flt Protected	1.00	
Satd. Flow (prot)	1563	
Flt Permitted	1.00	
Satd. Flow (perm)	1563	
Peak-hour factor, PHF	0.92	0.92
Adj. Flow (vph)	76	348
RTOR Reduction (vph)	137	0
Lane Group Flow (vph)	287	0
Heavy Vehicles (%)	5%	3%
Turn Type	Perm	
Protected Phases		
Permitted Phases	8	
Actuated Green, G (s)	11.5	
Effective Green, g (s)	11.5	
Actuated g/C Ratio	0.10	
Clearance Time (s)	6.5	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	150	
v/s Ratio Prot		
v/s Ratio Perm	c0.18	
v/c Ratio	1.91	
Uniform Delay, d1	54.2	
Progression Factor	1.00	
Incremental Delay, d2	433.5	
Delay (s)	487.7	
Level of Service	F	
Approach Delay (s)		
Approach LOS		

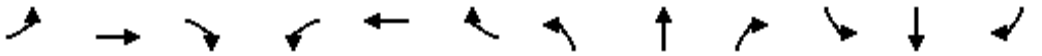
Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	50	0	10	40	520	0	10	20	540	0	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	54	0	11	43	565	0	11	22	587	0	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (ft)					133							
pX, platoon unblocked	0.86						0.86	0.86		0.86	0.86	0.86
vC, conflicting volume	609			54			435	707	54	440	424	326
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	461			54			258	575	54	264	245	131
tC, single (s)	4.1			4.1			7.2	6.6	6.2	7.2	6.6	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			100	97	98	0	100	99
cM capacity (veh/h)	930			1532			574	357	1004	551	549	781

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	65	620	33	598
Volume Left	11	11	0	587
Volume Right	0	565	22	11
cSH	930	1532	1072	554
Volume to Capacity	0.01	0.01	0.03	1.08
Queue Length 95th (ft)	1	1	2	448
Control Delay (s)	1.6	0.2	10.9	88.0
Lane LOS	A	A	B	F
Approach Delay (s)	1.6	0.2	10.9	88.0
Approach LOS			B	F

Intersection Summary			
Average Delay	40.4		
Intersection Capacity Utilization	79.6%	ICU Level of Service	D
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	220	390	230	480	0	0	0	0	210	0	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	16	16	15	15	15	12	12	12	12	12	12
Total Lost time (s)		5.0			5.0						5.0	5.0
Lane Util. Factor		1.00			1.00						1.00	1.00
Frt		0.91			1.00						1.00	0.85
Flt Protected		1.00			0.98						0.95	1.00
Satd. Flow (prot)		1874			1959						1719	1538
Flt Permitted		1.00			0.57						0.95	1.00
Satd. Flow (perm)		1874			1132						1719	1538
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	239	424	250	522	0	0	0	0	228	0	98
RTOR Reduction (vph)	0	64	0	0	0	0	0	0	0	0	0	46
Lane Group Flow (vph)	0	599	0	0	772	0	0	0	0	0	228	52
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type				Perm						Split		Perm
Protected Phases		4			8					2	2	
Permitted Phases				8								2
Actuated Green, G (s)		76.0			76.0						14.0	14.0
Effective Green, g (s)		76.0			76.0						14.0	14.0
Actuated g/C Ratio		0.76			0.76						0.14	0.14
Clearance Time (s)		5.0			5.0						5.0	5.0
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		1424			860						241	215
v/s Ratio Prot		0.32									c0.13	
v/s Ratio Perm					c0.68							0.03
v/c Ratio		0.42			0.90						0.95	0.24
Uniform Delay, d1		4.2			9.1						42.6	38.3
Progression Factor		1.00			1.12						1.00	1.00
Incremental Delay, d2		0.9			1.6						42.8	0.6
Delay (s)		5.1			11.8						85.5	38.8
Level of Service		A			B						F	D
Approach Delay (s)		5.1			11.8			0.0			71.4	
Approach LOS		A			B			A			E	

Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	97.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL2	EBL	EBT	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2	SWL2	SWL
Lane Configurations												
Volume (vph)	60	150	220	280	120	110	360	10	105	45	210	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	15	12	15	16	16	12	12	12	12	12	12	12
Total Lost time (s)			6.5	6.5				6.5	6.5			6.5
Lane Util. Factor			1.00	1.00				1.00	1.00			1.00
Frt			1.00	0.94				1.00	0.85			1.00
Flt Protected			0.98	1.00				0.95	1.00			0.95
Satd. Flow (prot)			1943	1943				1727	1568			1752
Flt Permitted			0.98	1.00				0.95	1.00			0.95
Satd. Flow (perm)			1943	1943				1727	1568			1752
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	65	163	239	304	130	120	391	11	114	49	228	0
RTOR Reduction (vph)	0	0	0	10	0	0	0	0	15	0	0	0
Lane Group Flow (vph)	0	0	467	544	0	0	0	402	148	0	0	228
Heavy Vehicles (%)	5%	5%	5%	5%	3%	3%	5%	3%	3%	3%	3%	3%
Turn Type	Split	Split					Split		Prot		Split	
Protected Phases	2	2	2	8			6	6	6		4	4
Permitted Phases												
Actuated Green, G (s)			20.5	23.5				18.5	18.5			11.5
Effective Green, g (s)			20.5	23.5				18.5	18.5			11.5
Actuated g/C Ratio			0.20	0.24				0.18	0.18			0.12
Clearance Time (s)			6.5	6.5				6.5	6.5			6.5
Vehicle Extension (s)			3.0	3.0				3.0	3.0			3.0
Lane Grp Cap (vph)			398	457				319	290			201
v/s Ratio Prot			c0.24	c0.28				c0.23	0.09			0.13
v/s Ratio Perm												
v/c Ratio			1.17	1.19				1.26	0.51			1.13
Uniform Delay, d1			39.8	38.2				40.8	36.7			44.2
Progression Factor			0.63	1.00				1.00	1.00			1.00
Incremental Delay, d2			95.8	105.7				139.9	1.4			104.3
Delay (s)			121.0	143.9				180.7	38.1			148.5
Level of Service			F	F				F	D			F
Approach Delay (s)			121.0	143.9				139.6				228.4
Approach LOS			F	F				F				F

Intersection Summary			
HCM Average Control Delay	162.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	118.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SWR	SWR2
Lane Configurations		
Volume (vph)	70	320
Ideal Flow (vphpl)	1900	1900
Lane Width	12	12
Total Lost time (s)	6.5	
Lane Util. Factor	1.00	
Frt	0.85	
Flt Protected	1.00	
Satd. Flow (prot)	1563	
Flt Permitted	1.00	
Satd. Flow (perm)	1563	
Peak-hour factor, PHF	0.92	0.92
Adj. Flow (vph)	76	348
RTOR Reduction (vph)	165	0
Lane Group Flow (vph)	259	0
Heavy Vehicles (%)	5%	3%
Turn Type	Prot	
Protected Phases	4	
Permitted Phases		
Actuated Green, G (s)	11.5	
Effective Green, g (s)	11.5	
Actuated g/C Ratio	0.12	
Clearance Time (s)	6.5	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	180	
v/s Ratio Prot	c0.17	
v/s Ratio Perm		
v/c Ratio	1.44	
Uniform Delay, d1	44.2	
Progression Factor	1.00	
Incremental Delay, d2	227.0	
Delay (s)	271.3	
Level of Service	F	
Approach Delay (s)		
Approach LOS		

Intersection Summary

APPENDIX E

SIGNALIZED INTERSECTION CAPACITY ANALYSIS (ILV) SHEETS

INTERSECTION

Signalized Intersection
CAPACITY ANALYSIS

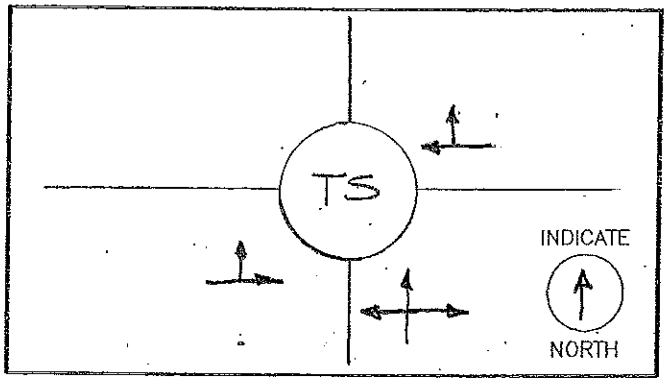
INTERSECTION MAIN ST / US 101 NB RAMPS (AM PEAK HOUR)

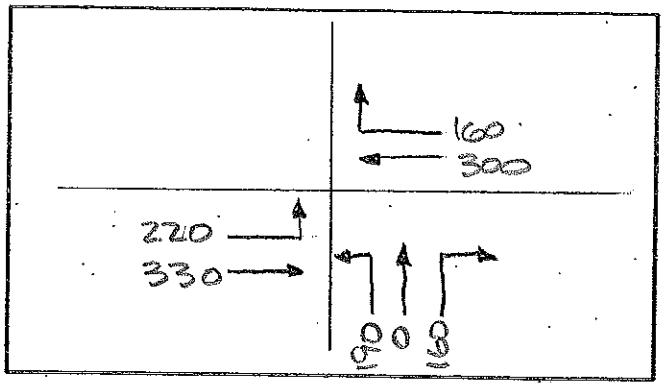
DIST. CO. RTE. P.M. 05-SLO-101-52.5

BY R. HAYES DATE 2/24/11

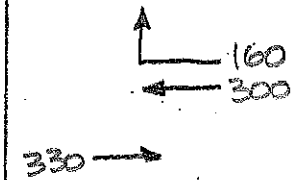
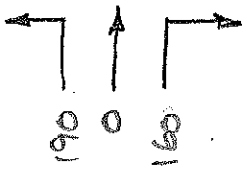
TIME _____ AM PM

DIAGRAM AND TRAFFIC FLOWS:





LANE VOLUMES (ILV/HR)

PHASE 1	PHASE 2	PHASE 3	PHASE 4
			

CRITICAL LANE VOLUMES (ILV/HR)

PHASE 1	PHASE 2	PHASE 3	PHASE 4
220	330	190	

TOTAL OPERATING LEVEL (ILV/HR) IS . . .

Σ
740

- ☒ < 1200 ILV/HR.
- ☐ > 1200 BUT < 1500 ILV/HR.
- ☐ > 1500 ILV/HR (CAPACITY)

REMARKS: INTERSECTION WOULD BE CLASSIFIED AS HAVING "STABLE FLOW".

INTERSECTION

Signalized Intersection
CAPACITY ANALYSIS

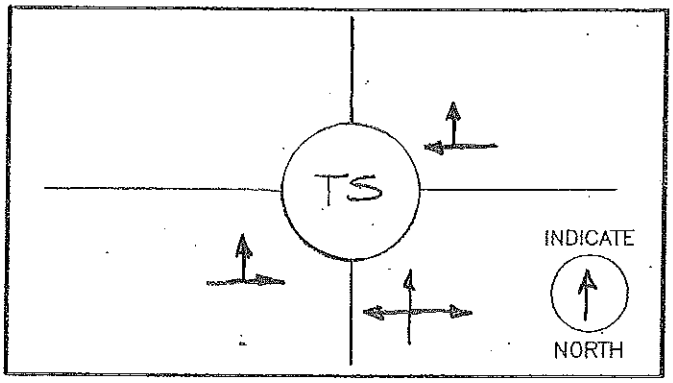
INTERSECTION MAIN ST / US 101 NB RAMPS (PM PEAK HOUR)

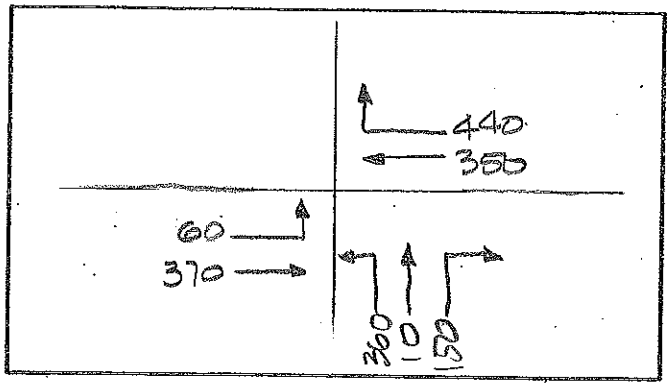
DIST. CO. RTE. P.M. 05-SLO-101-52.5

BY R. HAYES DATE 2/24/11

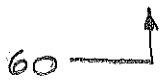
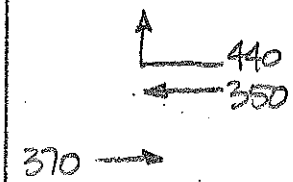
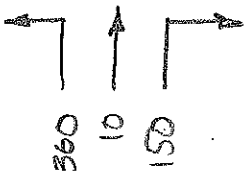
TIME _____ AM PM

DIAGRAM AND TRAFFIC FLOWS:





LANE VOLUMES (ILV/HR)

PHASE 1	PHASE 2	PHASE 3	PHASE 4
			

CRITICAL LANE VOLUMES (ILV/HR)

PHASE 1	PHASE 2	PHASE 3	PHASE 4
60	440	360	

TOTAL OPERATING LEVEL (ILV/HR) IS . . .

Σ
860

☒ < 1200 ILV/HR.

☐ > 1200 BUT < 1500 ILV/HR.

☐ > 1500 ILV/HR (CAPACITY)

REMARKS: INTERSECTION WOULD BE CLASSIFIED AS HAVING "STABLE FLOW"

INTERSECTION

Signalized Intersection
CAPACITY ANALYSIS

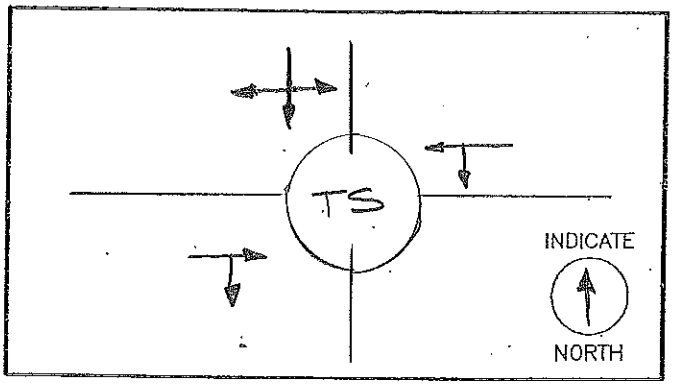
INTERSECTION MAIN ST/US 101 SB RAMPS (AM PEAK HOUR)

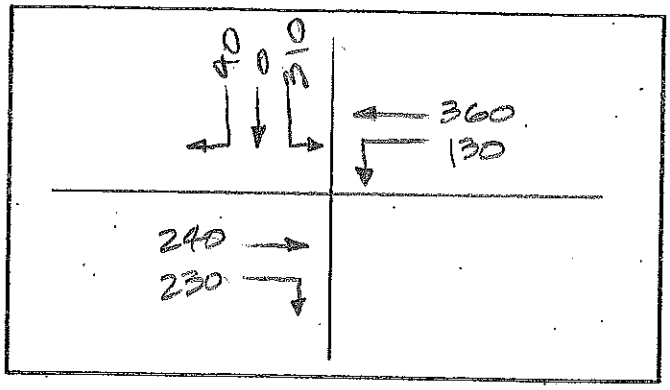
DIST. CO. RTE. P.M. 05-SLO-101-52.5

BY R. HAYES DATE 2/24/11

TIME _____ AM PM

DIAGRAM AND TRAFFIC FLOWS:





LANE VOLUMES (ILV/HR)

PHASE 1	PHASE 2	PHASE 3	PHASE 4
130	360 240 230	40 0 310	

CRITICAL LANE VOLUMES (ILV/HR)

PHASE 1	PHASE 2	PHASE 3	PHASE 4
130	360	310	

TOTAL OPERATING LEVEL (ILV/HR) IS . . .

Σ
800

- ☒ < 1200 ILV/HR.
- ☐ > 1200 BUT < 1500 ILV/HR.
- ☐ > 1500 ILV/HR (CAPACITY)

REMARKS: INTERSECTION WOULD BE CLASSIFIED AS "STABLE FLOW"

INTERSECTION

Signalized Intersection
CAPACITY ANALYSIS

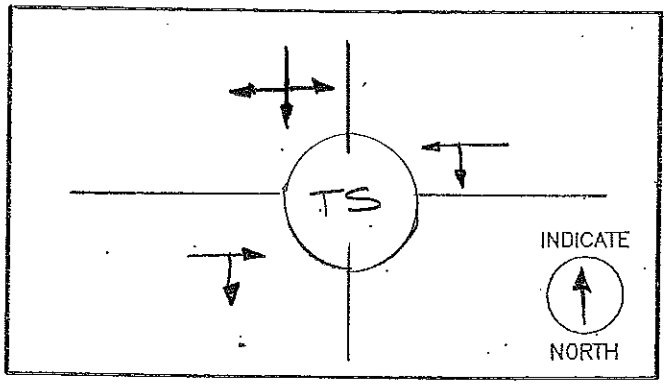
INTERSECTION MAIN ST/US 101 SB RAMPS (PM PEAK HOUR)

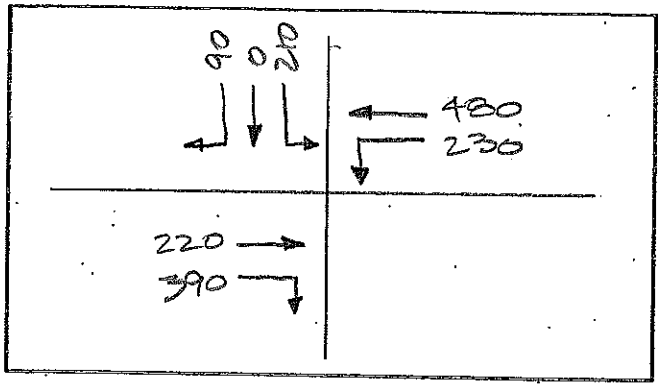
DIST. CO. RTE. P.M. 05-SLO-101-52.5

BY R. HAYES DATE 2/24/11

TIME _____ AM PM

DIAGRAM AND TRAFFIC FLOWS:





LANE VOLUMES (ILV/HR)

PHASE 1	PHASE 2	PHASE 3	PHASE 4
230	480, 220, 390	90, 0, 210	

CRITICAL LANE VOLUMES (ILV/HR)

PHASE 1	PHASE 2	PHASE 3	PHASE 4
230	480	210	

TOTAL OPERATING LEVEL (ILV/HR) IS . . .

Σ
920

- ☒ < 1200 ILV/HR.
- ☐ > 1200 BUT < 1500 ILV/HR.
- ☐ > 1500 ILV/HR (CAPACITY)

REMARKS: INTERSECTION WOULD BE CLASSIFIED "STABLE FLOW"

APPENDIX F

QUEUING ANALYSIS:
2030 BUILDOUT CONDITIONS

Intersection: 1: Main St. & Theatre Dr.

Movement	EB	NB	NB	SB
Directions Served	LTR	LT	R	LR
Maximum Queue (ft)	47	26	69	374
Average Queue (ft)	5	2	22	117
95th Queue (ft)	27	13	56	262
Link Distance (ft)	805	690		894
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			50	
Storage Blk Time (%)			1	
Queuing Penalty (veh)			0	

Intersection: 2: Main St. & SB 101 Offramp

Movement	EB	WB	SB	SB
Directions Served	TR	LT	LT	R
Maximum Queue (ft)	49	209	1098	75
Average Queue (ft)	29	55	1069	49
95th Queue (ft)	61	158	1088	106
Link Distance (ft)	42	334	1046	
Upstream Blk Time (%)	7		82	
Queuing Penalty (veh)	33		0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			95	1
Queuing Penalty (veh)			38	4

Intersection: 3: Main St. & NB 101 Onramp

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LT	R
Maximum Queue (ft)	356	35	1022	75
Average Queue (ft)	303	10	1000	72
95th Queue (ft)	395	32	1018	82
Link Distance (ft)	334	24	983	
Upstream Blk Time (%)	12	1	92	
Queuing Penalty (veh)	66	4	0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			13	99
Queuing Penalty (veh)			21	188

Intersection: 4: Main St. & Ramada Dr.

Movement	EB	WB	SB	SB
Directions Served	LT	TR	L	R
Maximum Queue (ft)	80	91	1206	75
Average Queue (ft)	43	24	1080	58
95th Queue (ft)	65	73	1373	107
Link Distance (ft)	24	1005	1154	
Upstream Blk Time (%)	51		44	
Queuing Penalty (veh)	251		0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			92	13
Queuing Penalty (veh)			138	13

Zone Summary

Zone wide Queuing Penalty: 756

Intersection: 1: Main St. & Theatre Dr.

Movement	EB	NB	NB	SB
Directions Served	LTR	LT	R	LR
Maximum Queue (ft)	48	47	29	799
Average Queue (ft)	8	11	15	262
95th Queue (ft)	37	36	38	594
Link Distance (ft)	805	690		894
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			50	
Storage Blk Time (%)		1		
Queuing Penalty (veh)		0		

Intersection: 2: Main St. & SB 101 Offramp

Movement	EB	WB	SB	SB
Directions Served	TR	LT	LT	R
Maximum Queue (ft)	64	339	1068	75
Average Queue (ft)	28	78	905	65
95th Queue (ft)	69	217	1275	107
Link Distance (ft)	42	334	1046	
Upstream Blk Time (%)	9	1	37	
Queuing Penalty (veh)	53	7	0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			91	4
Queuing Penalty (veh)			82	8

Intersection: 3: Main St. & NB 101 Onramp

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LT	R
Maximum Queue (ft)	344	36	1017	75
Average Queue (ft)	309	6	999	64
95th Queue (ft)	436	27	1017	78
Link Distance (ft)	334	24	983	
Upstream Blk Time (%)	13	1	96	
Queuing Penalty (veh)	55	5	0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			12	91
Queuing Penalty (veh)			19	338

Intersection: 4: Main St. & Ramada Dr.

Movement	EB	WB	SB	SB
Directions Served	LT	TR	L	R
Maximum Queue (ft)	68	53	1201	75
Average Queue (ft)	40	17	1171	45
95th Queue (ft)	62	47	1192	105
Link Distance (ft)	24	1005	1154	
Upstream Blk Time (%)	44		94	
Queuing Penalty (veh)	229		0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			93	11
Queuing Penalty (veh)			361	24

Zone Summary

Zone wide Queuing Penalty: 1180

APPENDIX G

QUEUING WITH MITIGATION MEASURES: 2030 BUILDOUT CONDITIONS

Intersection: 1: Main St. & Theatre Dr.

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	R	LR
Maximum Queue (ft)	38	19	29	193
Average Queue (ft)	4	1	2	105
95th Queue (ft)	22	9	14	173
Link Distance (ft)	628	44		444
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			50	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Main St. & SB 101 Offramp

Movement	EB	WB	SB	SB
Directions Served	TR	LT	LT	R
Maximum Queue (ft)	44	341	646	75
Average Queue (ft)	7	218	638	15
95th Queue (ft)	29	389	651	64
Link Distance (ft)	44	333	631	
Upstream Blk Time (%)	0	7	98	
Queuing Penalty (veh)	0	53	0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			99	0
Queuing Penalty (veh)			50	0

Intersection: 3: Main St. & NB 101 Onramp

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LT	R
Maximum Queue (ft)	103	51	344	75
Average Queue (ft)	52	34	134	63
95th Queue (ft)	93	43	288	92
Link Distance (ft)	333	25	973	
Upstream Blk Time (%)		22		
Queuing Penalty (veh)		148		
Storage Bay Dist (ft)				50
Storage Blk Time (%)			37	4
Queuing Penalty (veh)			44	16

Intersection: 4: Main St. & Ramada Dr.

Movement	EB	WB	SB	SB
Directions Served	LT	TR	L	R
Maximum Queue (ft)	31	803	833	75
Average Queue (ft)	27	701	801	74
95th Queue (ft)	44	878	827	79
Link Distance (ft)	25	788	794	
Upstream Blk Time (%)	5	29	95	
Queuing Penalty (veh)	21	0	0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			7	99
Queuing Penalty (veh)			19	138

Zone Summary

Zone wide Queuing Penalty: 491

Intersection: 1: Main St. & Theatre Dr.

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	R	LR
Maximum Queue (ft)	206	8	30	479
Average Queue (ft)	45	1	2	462
95th Queue (ft)	165	4	14	475
Link Distance (ft)	538	41		443
Upstream Blk Time (%)				74
Queuing Penalty (veh)				0
Storage Bay Dist (ft)			50	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Main St. & SB 101 Offramp

Movement	EB	WB	SB	SB
Directions Served	TR	LT	LT	R
Maximum Queue (ft)	58	346	53	60
Average Queue (ft)	54	311	43	36
95th Queue (ft)	63	359	61	66
Link Distance (ft)	41	333	622	
Upstream Blk Time (%)	27	4		
Queuing Penalty (veh)	160	27		
Storage Bay Dist (ft)				50
Storage Blk Time (%)			4	1
Queuing Penalty (veh)			2	2

Intersection: 3: Main St. & NB 101 Onramp

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LT	R
Maximum Queue (ft)	190	38	846	75
Average Queue (ft)	81	22	753	75
95th Queue (ft)	158	38	970	75
Link Distance (ft)	333	26	802	
Upstream Blk Time (%)		2	53	
Queuing Penalty (veh)		10	0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			90	35
Queuing Penalty (veh)			108	135

Intersection: 4: Main St. & Ramada Dr.

Movement	EB	WB	SB	SB
Directions Served	LT	TR	L	R
Maximum Queue (ft)	50	93	614	75
Average Queue (ft)	32	29	614	75
95th Queue (ft)	40	70	615	75
Link Distance (ft)	26	656	599	
Upstream Blk Time (%)	26		76	
Queuing Penalty (veh)	115		0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			60	63
Queuing Penalty (veh)			175	89

Zone Summary

Zone wide Queuing Penalty: 822

Intersection: 1: Main St. & Theatre Dr.

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	R	LR
Maximum Queue (ft)	205	10	29	496
Average Queue (ft)	42	1	2	458
95th Queue (ft)	163	5	14	498
Link Distance (ft)	530	40		444
Upstream Blk Time (%)				68
Queuing Penalty (veh)				0
Storage Bay Dist (ft)			50	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Main St. & SB 101 Offramp

Movement	EB	WB	SB	SB
Directions Served	TR	LT	LT	R
Maximum Queue (ft)	58	319	54	60
Average Queue (ft)	54	156	44	35
95th Queue (ft)	62	268	61	65
Link Distance (ft)	40	333	724	
Upstream Blk Time (%)	28	0		
Queuing Penalty (veh)	166	0		
Storage Bay Dist (ft)				50
Storage Blk Time (%)			3	1
Queuing Penalty (veh)			1	2

Intersection: 3: Main St. & NB 101 Onramp

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LT	R
Maximum Queue (ft)	170	38	239	75
Average Queue (ft)	71	36	95	61
95th Queue (ft)	140	38	175	89
Link Distance (ft)	333	26	915	
Upstream Blk Time (%)		16		
Queuing Penalty (veh)		111		
Storage Bay Dist (ft)				50
Storage Blk Time (%)			27	8
Queuing Penalty (veh)			32	30

Intersection: 4: Main St. & Ramada Dr.

Movement	EB	WB	SB	SB
Directions Served	LT	TR	L	R
Maximum Queue (ft)	50	501	744	75
Average Queue (ft)	32	221	725	72
95th Queue (ft)	40	439	737	83
Link Distance (ft)	26	835	710	
Upstream Blk Time (%)	6		94	
Queuing Penalty (veh)	27		0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			7	99
Queuing Penalty (veh)			20	139

Zone Summary

Zone wide Queuing Penalty: 529

Intersection: 1: Main St. & Theatre Dr.

Movement	EB	NB	SB
Directions Served	LTR	R	LR
Maximum Queue (ft)	30	30	223
Average Queue (ft)	2	2	120
95th Queue (ft)	14	14	207
Link Distance (ft)	655		443
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		50	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: Main St. & SB 101 Offramp

Movement	EB	WB	SB	SB
Directions Served	TR	LT	LT	R
Maximum Queue (ft)	24	346	667	75
Average Queue (ft)	5	245	655	20
95th Queue (ft)	15	403	677	74
Link Distance (ft)	41	333	652	
Upstream Blk Time (%)	0	12	97	
Queuing Penalty (veh)	0	93	0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			99	1
Queuing Penalty (veh)			50	1

Intersection: 3: Main St. & NB 101 Onramp

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LT	R
Maximum Queue (ft)	284	62	586	75
Average Queue (ft)	129	38	269	53
95th Queue (ft)	248	49	534	105
Link Distance (ft)	333	26	878	
Upstream Blk Time (%)		34		
Queuing Penalty (veh)		232		
Storage Bay Dist (ft)				50
Storage Blk Time (%)			58	10
Queuing Penalty (veh)			70	38

Intersection: 4: Main St. & Ramada Dr.

Movement	EB	WB	SB	SB
Directions Served	LT	TR	L	R
Maximum Queue (ft)	32	551	858	75
Average Queue (ft)	31	175	839	73
95th Queue (ft)	31	413	856	81
Link Distance (ft)	26	742	827	
Upstream Blk Time (%)	18		90	
Queuing Penalty (veh)	81		0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			4	99
Queuing Penalty (veh)			12	139

Zone Summary

Zone wide Queuing Penalty: 715

Intersection: 1: Main St. & Theatre Dr.

Movement	EB	NB	SB
Directions Served	LTR	R	LR
Maximum Queue (ft)	68	29	458
Average Queue (ft)	10	2	187
95th Queue (ft)	42	14	373
Link Distance (ft)	696		443
Upstream Blk Time (%)			2
Queuing Penalty (veh)			0
Storage Bay Dist (ft)		50	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: Main St. & SB 101 Offramp

Movement	EB	WB	SB	SB
Directions Served	TR	LT	LT	R
Maximum Queue (ft)	58	353	225	74
Average Queue (ft)	47	341	134	37
95th Queue (ft)	75	361	230	82
Link Distance (ft)	40	333	685	
Upstream Blk Time (%)	10	25		
Queuing Penalty (veh)	58	193		
Storage Bay Dist (ft)				50
Storage Blk Time (%)			53	1
Queuing Penalty (veh)			27	2

Intersection: 3: Main St. & NB 101 Onramp

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LT	R
Maximum Queue (ft)	170	38	871	75
Average Queue (ft)	62	30	845	50
95th Queue (ft)	141	47	856	108
Link Distance (ft)	333	26	828	
Upstream Blk Time (%)		14	89	
Queuing Penalty (veh)		95	0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			98	4
Queuing Penalty (veh)			117	17

Intersection: 4: Main St. & Ramada Dr.

Movement	EB	WB	SB	SB
Directions Served	LT	TR	L	R
Maximum Queue (ft)	32	246	909	75
Average Queue (ft)	31	78	877	75
95th Queue (ft)	32	195	895	76
Link Distance (ft)	26	727	857	
Upstream Blk Time (%)	13		80	
Queuing Penalty (veh)	59		0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			23	93
Queuing Penalty (veh)			66	130

Zone Summary

Zone wide Queuing Penalty: 764

Intersection: 1: Main St. & Theatre Dr.

Movement	EB	NB	SB
Directions Served	LTR	R	LR
Maximum Queue (ft)	55	29	495
Average Queue (ft)	8	2	463
95th Queue (ft)	34	14	481
Link Distance (ft)	574		443
Upstream Blk Time (%)			78
Queuing Penalty (veh)			0
Storage Bay Dist (ft)		50	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: Main St. & SB 101 Offramp

Movement	EB	WB	SB	SB
Directions Served	TR	LT	LT	R
Maximum Queue (ft)	51	348	696	75
Average Queue (ft)	49	343	466	49
95th Queue (ft)	52	356	753	106
Link Distance (ft)	43	333	681	
Upstream Blk Time (%)	29	37	3	
Queuing Penalty (veh)	169	283	0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			86	2
Queuing Penalty (veh)			43	4

Intersection: 3: Main St. & NB 101 Onramp

Movement	EB	WB	NB	NB
Directions Served	LT	TR	LT	R
Maximum Queue (ft)	346	64	869	75
Average Queue (ft)	323	44	852	48
95th Queue (ft)	400	61	861	100
Link Distance (ft)	333	27	835	
Upstream Blk Time (%)	23	53	72	
Queuing Penalty (veh)	89	360	0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			79	9
Queuing Penalty (veh)			95	36

Intersection: 4: Main St. & Ramada Dr.

Movement	EB	WB	SB	SB
Directions Served	LT	TR	L	R
Maximum Queue (ft)	32	836	818	75
Average Queue (ft)	31	445	791	73
95th Queue (ft)	32	898	808	81
Link Distance (ft)	27	820	779	
Upstream Blk Time (%)	20	5	97	
Queuing Penalty (veh)	91	0	0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			6	96
Queuing Penalty (veh)			18	135

Zone Summary

Zone wide Queuing Penalty: 1322

Intersection: 1: Main St. & Theatre Dr.

Movement	EB	B5	WB	NB	NB	SB
Directions Served	LTR	T	LTR	LT	R	LR
Maximum Queue (ft)	74	144	74	139	75	458
Average Queue (ft)	48	43	40	42	34	458
95th Queue (ft)	69	111	64	131	79	459
Link Distance (ft)	4	605	43	679		443
Upstream Blk Time (%)	69		11			73
Queuing Penalty (veh)	0		61			0
Storage Bay Dist (ft)					50	
Storage Blk Time (%)				6	26	
Queuing Penalty (veh)				1	3	

Intersection: 2: Main St. & SB 101 Offramp

Movement	EB	WB	SB	SB
Directions Served	TR	LT	LT	R
Maximum Queue (ft)	108	348	619	75
Average Queue (ft)	72	337	600	49
95th Queue (ft)	100	355	609	104
Link Distance (ft)	43	335	585	
Upstream Blk Time (%)	30	18	88	
Queuing Penalty (veh)	184	129	0	
Storage Bay Dist (ft)				50
Storage Blk Time (%)			89	10
Queuing Penalty (veh)			80	22

Intersection: 3: Main St. & Ramada Dr.

Movement	EB	WB	NB	NB	SW	SW
Directions Served	<LT	TR>	LT	R>	<L	R>
Maximum Queue (ft)	354	808	840	75	588	75
Average Queue (ft)	331	611	833	54	580	64
95th Queue (ft)	357	840	836	103	589	79
Link Distance (ft)	335	794	818		572	
Upstream Blk Time (%)	14	1	87		94	
Queuing Penalty (veh)	60	0	0		0	
Storage Bay Dist (ft)				50		50
Storage Blk Time (%)			89	16	23	92
Queuing Penalty (veh)			134	60	89	192

Zone Summary

Zone wide Queuing Penalty: 1015

Intersection: 1: Main St. & Theatre Dr.

Movement	EB	B5	WB	NB	NB	SB
Directions Served	LTR	T	LTR	LT	R	LR
Maximum Queue (ft)	53	55	38	26	67	268
Average Queue (ft)	10	4	3	8	17	153
95th Queue (ft)	38	26	19	27	53	259
Link Distance (ft)	4	605	40	676		443
Upstream Blk Time (%)	2		0			
Queuing Penalty (veh)	0		0			
Storage Bay Dist (ft)					50	
Storage Blk Time (%)					1	
Queuing Penalty (veh)					0	

Intersection: 2: Main St. & SB 101 Offramp

Movement	EB	WB	SB	SB	B10
Directions Served	TR	LT	LT	R	T
Maximum Queue (ft)	58	343	260	75	831
Average Queue (ft)	40	181	243	45	831
95th Queue (ft)	68	318	251	101	832
Link Distance (ft)	40	335	172		816
Upstream Blk Time (%)	6	1	88		89
Queuing Penalty (veh)	39	9	0		0
Storage Bay Dist (ft)				50	
Storage Blk Time (%)			88	2	
Queuing Penalty (veh)			79	4	

Intersection: 3: Main St. & Ramada Dr.

Movement	EB	WB	NB	NB	SW	SW
Directions Served	<LT	TR>	LT	R>	<L	R>
Maximum Queue (ft)	357	1126	913	75	800	75
Average Queue (ft)	292	1108	897	62	780	73
95th Queue (ft)	404	1116	908	91	793	82
Link Distance (ft)	335	1092	879		761	
Upstream Blk Time (%)	5	80	75		74	
Queuing Penalty (veh)	22	0	0		0	
Storage Bay Dist (ft)				50		50
Storage Blk Time (%)			75	29	64	52
Queuing Penalty (veh)			112	106	250	108

Zone Summary

Zone wide Queuing Penalty: 729

APPENDIX H

SIGNAL WARRANT WORKSHEETS

Figure 4C-103 (CA). Traffic Signal Warrants Worksheet (Average Traffic Estimate Form)

05 (DIST) SLO (CO) 101 (RTE) 52.5 (PM)

COUNT DATE ESTIMATED 2030
CALC R. HAYES DATE 3/22/11
CHK _____ DATE _____

Major St: MAIN ST.
Minor St: US 101 NB RAMPS

Critical Approach Speed 45 MPH mph
Critical Approach Speed _____ mph

Speed limit or critical speed on major street traffic > 64 km/h (40 mph)..... ☐
or
In built up area of isolated community of < 10,000 population..... ☐ } RURAL (R)

☒ URBAN (U)

(Based on Estimated Average Daily Traffic - See Note)

(URBAN)..... RURAL.....

CONDITION A - Minimum Vehicular Volume

Satisfied ✓ Not Satisfied _____

Number of lanes for moving traffic on each approach

Major Street	Minor Street	Minimum Requirements EADT: Vehicles Per Day on Major Street (Total of Both Approaches) Urban	Rural	Vehicles Per Day on Higher-Volume Minor Street Approach (One Direction Only) Urban	Rural
1	1	(8,000) 17,400	5,600	(2,400) 9,400	1,680
2 or More	1	9,600	6,720	2,400	1,680
2 or More	2 or More	9,600	6,720	3,200	2,240
1	2 or More	8,000	5,600	3,200	2,240

CONDITION B - Interruption of Continuous Traffic

Satisfied ✓ Not Satisfied _____

Number of lanes for moving traffic on each approach

Major Street	Minor Street	Vehicles Per Day on Major Street (Total of Both Approaches) Urban	Rural	Vehicles Per Day on Higher-Volume Minor Street Approach (One Direction Only) Urban	Rural
1	1	(12,000)	8,400	(1,200)	850
2 or More	1	14,400	10,080	1,200	850
2 or More	2 or More	14,400	10,080	1,600	1,120
1	2 or More	12,000	8,400	1,600	1,120

Combination of CONDITIONS A + B

Satisfied ✓ Not Satisfied _____

2 CONDITIONS 80%

2 CONDITIONS 80%

No one condition satisfied, but following conditions fulfilled 80% or more..... A _____ B _____

Note: To be used only for NEW INTERSECTIONS or other locations where it is not reasonable to count actual traffic volumes.

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

Figure 4C-103 (CA). Traffic Signal Warrants Worksheet (Average Traffic Estimate Form)

05	SLO	101	52.5
DIST	CO	RTE	PM

COUNT DATE ESTIMATED 2030
CALC R. HAYES DATE 3/22/11
CHK _____ DATE _____

Major St: MAIN ST. Critical Approach Speed 45 MPH mph
Minor St: US 101 SB RAMPS Critical Approach Speed _____ mph

Speed limit or critical speed on major street traffic > 64 km/h (40 mph)..... ☐
or
In built up area of isolated community of < 10,000 population..... ☐ } **RURAL (R)**

☒ **URBAN (U)**

(Based on Estimated Average Daily Traffic - See Note)

URBAN ... RURAL ...

CONDITION A - Minimum Vehicular Volume

Satisfied ✓ Not Satisfied _____

Number of lanes for moving traffic on each approach

Major Street	Minor Street	Minimum Requirements EADT: Vehicles Per Day on Major Street (Total of Both Approaches) Urban	Rural	Vehicles Per Day on Higher-Volume Minor Street Approach (One Direction Only) Urban	Rural
1	1	8,000 ~~14,000~~	5,600	2,400 ~~4,725~~	1,680
2 or More	1	9,600	6,720	2,400	1,680
2 or More	2 or More	9,600	6,720	3,200	2,240
1	2 or More	8,000	5,600	3,200	2,240

CONDITION B - Interruption of Continuous Traffic

Satisfied ✓ Not Satisfied _____

Number of lanes for moving traffic on each approach

Major Street	Minor Street	Vehicles Per Day on Major Street (Total of Both Approaches) Urban	Rural	Vehicles Per Day on Higher-Volume Minor Street Approach (One Direction Only) Urban	Rural
1	1	12,000	8,400	1,200	850
2 or More	1	14,400	10,080	1,200	850
2 or More	2 or More	14,400	10,080	1,600	1,120
1	2 or More	12,000	8,400	1,600	1,120

Combination of CONDITIONS A + B

Satisfied ✓ Not Satisfied _____

2 CONDITIONS 80% | 2 CONDITIONS 80%

No one condition satisfied, but following conditions fulfilled 80% or more..... A _____ B _____

Note: To be used only for NEW INTERSECTIONS or other locations where it is not reasonable to count actual traffic volumes.

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

Figure 4C-101 (CA). Traffic Signal Warrants Worksheet (Sheet 1 of 4)

05	SLO	101	52.5
DIST	CO	RTE	PM

COUNT DATE ESTIMATED 2030
CALC R. HAYES DATE 3/25/2011
CHK _____ DATE _____

Major St: MAIN ST. Critical Approach Speed 45 mph
Minor St: US 101 NB RAMPS Critical Approach Speed _____ mph

Speed limit or critical speed on major street traffic > 64 km/h (40 mph)..... ☐ or
In built up area of isolated community of < 10,000 population..... ☐ } RURAL (R)
☒ URBAN (U)

WARRANT 1 - Eight Hour Vehicular Volume SATISFIED YES ☐ NO ☐
(Condition A or Condition B or combination of A and B must be satisfied)

N/A

Condition A - Minimum Vehicle Volume 100% SATISFIED YES ☐ NO ☐
80% SATISFIED YES ☐ NO ☐

	MINIMUM REQUIREMENTS (80% SHOWN IN BRACKETS)												Hour
	U	R	U	R									
APPROACH LANES	1		2 or More										
Both Approaches Major Street	500 (400)	350 (280)	600 (480)	420 (336)									
Highest Approach Minor Street	150 (120)	105 (84)	200 (160)	140 (112)									

Condition B - Interruption of Continuous Traffic 100% SATISFIED YES ☐ NO ☐
80% SATISFIED YES ☐ NO ☐

	MINIMUM REQUIREMENTS (80% SHOWN IN BRACKETS)												Hour
	U	R	U	R									
APPROACH LANES	1		2 or More										
Both Approaches Major Street	750 (600)	525 (420)	900 (720)	630 (504)									
Highest Approach Minor Street	75 (60)	53 (42)	100 (80)	70 (56)									

Combination of Conditions A & B SATISFIED YES ☐ NO ☐

REQUIREMENT	CONDITION	✓	FULFILLED
TWO CONDITIONS SATISFIED 80%	A. MINIMUM VEHICULAR VOLUME		Yes ☐ No ☐
	AND, B. INTERRUPTION OF CONTINUOUS TRAFFIC		
AND, AN ADEQUATE TRIAL OF OTHER ALTERNATIVES THAT COULD CAUSE LESS DELAY AND INCONVENIENCE TO TRAFFIC HAS FAILED TO SOLVE THE TRAFFIC PROBLEMS			Yes ☐ No ☐

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

Figure 4C-101 (CA). Traffic Signal Warrants Worksheet (Sheet 2 of 4)

N/A

WARRANT 2 - Four Hour Vehicular Volume **SATISFIED* YES ☐ NO ☐**

Record hourly vehicular volumes for any four hours of an average day.

APPROACH LANES	One	2 or More					Hour
Both Approaches - Major Street							
Higher Approach - Minor Street							

*All plotted points fall above the applicable curve in Figure 4C-1. (URBAN AREAS)	Yes ☐ No ☐
OR, All plotted points fall above the applicable curve in Figure 4C-2. (RURAL AREAS)	Yes ☐ No ☐

WARRANT 3 - Peak Hour **SATISFIED YES ☒ NO ☐**
(Part A or Part B must be satisfied)

PART A **SATISFIED YES ☒ NO ☐**

(All parts 1, 2, and 3 below must be satisfied for the same one hour, for any four consecutive 15-minute periods)

1. The total delay experienced by traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one-lane approach, or five vehicle-hours for a two-lane approach; AND	Yes ☒ No ☐
2. The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes; AND	Yes ☒ No ☐
3. The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more approaches or 650 vph for intersections with three approaches.	Yes ☒ No ☐

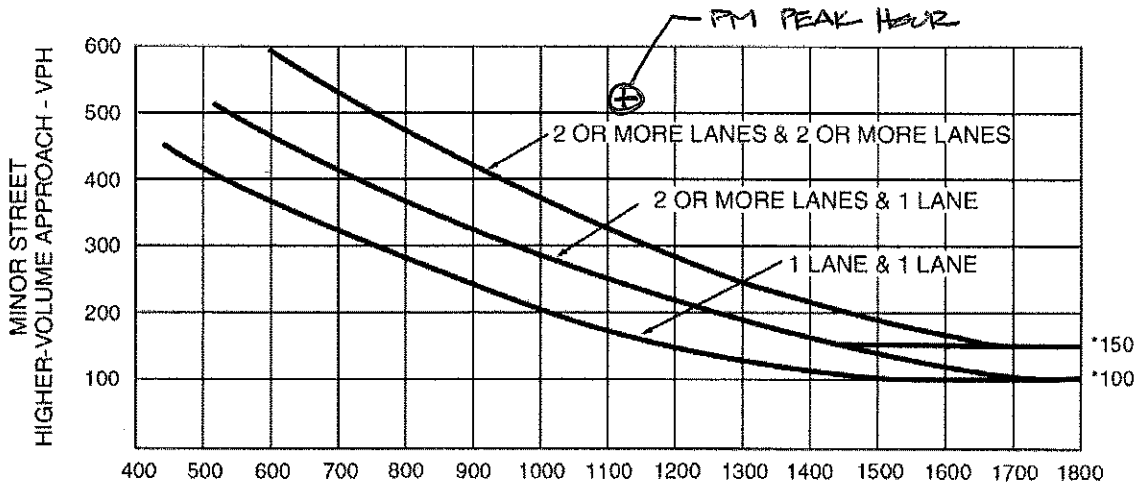
PART B **SATISFIED YES ☒ NO ☐**

APPROACH LANES	One	2 or More		Hour
Both Approaches - Major Street	1120			
Higher Approach - Minor Street	520			

The plotted point falls above the applicable curve in Figure 4C-3. (URBAN AREAS)	Yes ☒ No ☐
OR, The plotted point falls above the applicable curve in Figure 4C-4. (RURAL AREAS)	Yes ☐ No ☐

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

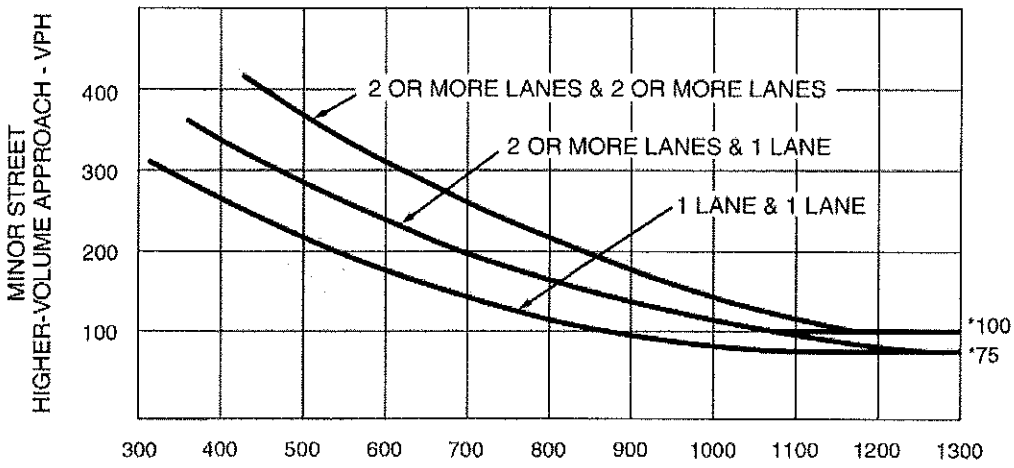
Figure 4C-3. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE ~~70~~ 64 km/h OR ABOVE 40 mph ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-101 (CA). Traffic Signal Warrants Worksheet (Sheet 1 of 4)

05	SLO	101	52.5
DIST	CO	RTE	PM

COUNT DATE ESTIMATED 2030
CALC R. HAYES DATE 3/25/2011
CHK _____ DATE _____

Major St: MAIN ST. Critical Approach Speed 45 mph
Minor St: US 101 SB RAMPS Critical Approach Speed _____ mph

Speed limit or critical speed on major street traffic > 64 km/h (40 mph)..... ☐
or
In built up area of isolated community of < 10,000 population..... ☐ } RURAL (R)

☒ URBAN (U)

WARRANT 1 - Eight Hour Vehicular Volume SATISFIED YES ☐ NO ☐
(Condition A or Condition B or combination of A and B must be satisfied)

N/A

Condition A - Minimum Vehicle Volume 100% SATISFIED YES ☐ NO ☐
80% SATISFIED YES ☐ NO ☐

	MINIMUM REQUIREMENTS (80% SHOWN IN BRACKETS)									
	U	R	U	R						Hour
APPROACH LANES	1		2 or More							
Both Approaches Major Street	500 (400)	350 (280)	600 (480)	420 (336)						
Highest Approach Minor Street	150 (120)	105 (84)	200 (160)	140 (112)						

Condition B - Interruption of Continuous Traffic 100% SATISFIED YES ☐ NO ☐
80% SATISFIED YES ☐ NO ☐

	MINIMUM REQUIREMENTS (80% SHOWN IN BRACKETS)									
	U	R	U	R						Hour
APPROACH LANES	1		2 or More							
Both Approaches Major Street	750 (600)	525 (420)	900 (720)	630 (504)						
Highest Approach Minor Street	75 (60)	53 (42)	100 (80)	70 (56)						

Combination of Conditions A & B SATISFIED YES ☐ NO ☐

REQUIREMENT	CONDITION	✓	FULFILLED
TWO CONDITIONS SATISFIED 80%	A. MINIMUM VEHICULAR VOLUME		Yes ☐ No ☐
	AND, B. INTERRUPTION OF CONTINUOUS TRAFFIC		
AND, AN ADEQUATE TRIAL OF OTHER ALTERNATIVES THAT COULD CAUSE LESS DELAY AND INCONVENIENCE TO TRAFFIC HAS FAILED TO SOLVE THE TRAFFIC PROBLEMS			Yes ☐ No ☐

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

Figure 4C-101 (CA). Traffic Signal Warrants Worksheet (Sheet 2 of 4)

N/A

WARRANT 2 - Four Hour Vehicular Volume **SATISFIED* YES ☐ NO ☐**

Record hourly vehicular volumes for any four hours of an average day.

APPROACH LANES	One	2 or More				Hour
Both Approaches - Major Street						
Higher Approach - Minor Street						

*All plotted points fall above the applicable curve in Figure 4C-1. (URBAN AREAS)	Yes ☐ No ☐
OR, All plotted points fall above the applicable curve in Figure 4C-2. (RURAL AREAS)	Yes ☐ No ☐

WARRANT 3 - Peak Hour **SATISFIED YES ☒ NO ☐**
(Part A or Part B must be satisfied)

PART A **SATISFIED YES ☒ NO ☐**
(All parts 1, 2, and 3 below must be satisfied for the same one hour, for any four consecutive 15-minute periods)

1. The total delay experienced by traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one-lane approach, or five vehicle-hours for a two-lane approach; AND	Yes ☒ No ☐
2. The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes; AND	Yes ☒ No ☐
3. The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more approaches or 650 vph for intersections with three approaches.	Yes ☒ No ☐

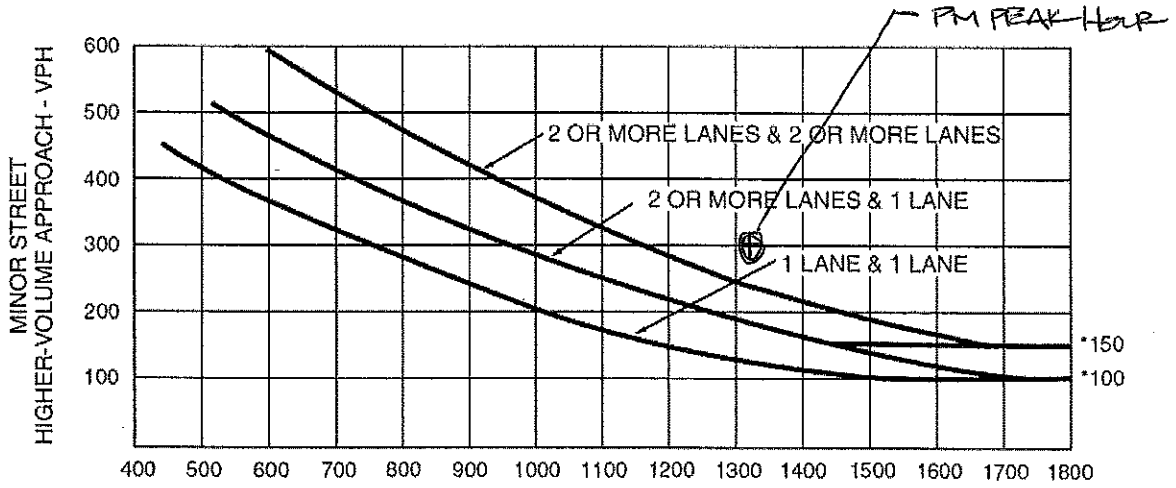
PART B **SATISFIED YES ☒ NO ☐**

APPROACH LANES	One	2 or More		Hour
Both Approaches - Major Street	1320			
Higher Approach - Minor Street	300			

The plotted point falls above the applicable curve in Figure 4C-3. (URBAN AREAS)	Yes ☒ No ☐
OR, The plotted point falls above the applicable curve in Figure 4C-4. (RURAL AREAS)	Yes ☐ No ☐

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

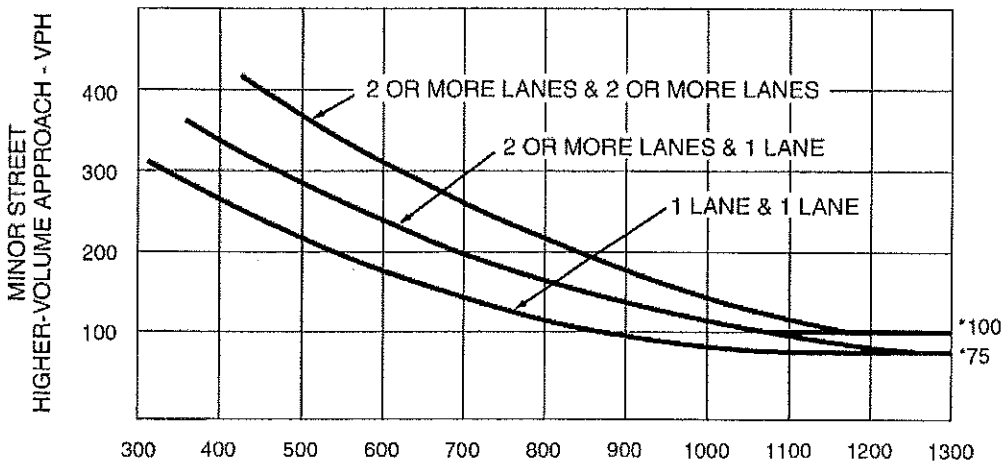
Figure 4C-3. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE ~~70~~ 64 km/h OR ABOVE 40 mph ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

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SIGNAL WARRANT CALCS

Date 3/25/2011
Job No. 16128
Page
Done By R. HAYES
Checked By

NB RAMPS:

PART A-1: SB DELAY (AVG.) = 841.8 SEC
PEAK HOUR VOLUME = 520
} DELAY = 841.8 × 520 = 121.6 VEH·HRS ✓

A-2: 520 VEH. ✓

SB RAMPS:

PART A-1: NB DELAY (AVG.) = 974.8 SEC
PEAK HOUR VOLUME = 300
} DELAY = 81.2 VEH·HRS ✓