South State Route 99 Corridor Study Update

October 2019,
Final Report

TCAG
Tulare County Association of Governments

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Executive Summary

Executive Summary

- **Purpose of the Study**

The purpose of this study was to assess current (2019), intermediate (2030), and future (2042) operating conditions along the State Route 99 (SR 99) freeway corridor between the Avenue 184 and the south county line. This section of SR 99 is 2 lanes in each direction, approximately 23.5 miles long, passing through farmland and small towns. A seven mile section at the northern end of this study's range is scheduled to be widened to three lanes in 2038. TCAG prepared studies for this corridor in 2013 and 2016. This study, along with the previous studies, are part of a long-term monitoring plan by TCAG as part of the federally-required Congestion Management Process. Study findings can also help to determine where Measure R funds, in partnership with State funds, could be applied to improve overall levels of service at area intersections along this stretch of SR 99.

Since the last update in 2016, Caltrans has installed traffic sensing devices along the State Route 99 corridor, making volume data more accurate as well as directional. This accuracy of data has not been available in past studies, and Caltrans has made this data available through their PEMS (Performance Measurement System) website. In this operational section of the study, results for the intermediate year of 2030 are discussed. Analyses show that, at the rate of growth of vehicle travel applied for this study, demand begins to exceed capacity in 2030 due to congestion at points along the corridor.

TCAG also acquired a new data interface Iteris Performance Monitoring System (iPeMS)[1] that makes practicable the summarizing and analysis of massive quantities of third-party speed data to measure the performance of transportation corridors in new ways. This study uses the iPeMS data to monitor traffic operations for mainline SR 99 for current (2019) analyses.

Crash data for the study corridor was acquired from another new data interface, the Transportation Injury Mapping System (TIMS)[2] (Safe Transportation Research and Education Center, University of California, Berkeley. 2019). While this section of the study is not a full safety analysis, the TIMS data provides another perspective by which to consider the performance of the study corridor.

[1] Iteris Transportation Systems, 1700 Carnegie Ave., Suite 100, Santa Ana, CA 92705

[2] Safe Transportation Research and Education Center, University of California, Berkeley. 2019

Summary Findings

Current (2019) operations analyses show no failing intersections, ramps, or sections of mainline, although the north bound freeway sections show signs of strain during the PM peak hours. By 2030 we see sections of the north bound freeway breaking down during peak hours under the stress of increasing auto and truck traffic (volume exceeds capacity), as well as outdated ramp junctions. The south bound, while not as bad are beginning to show signs as well. By 2042, we see failure on both directions of the entire length of the freeway as increasing truck and auto traffic takes its toll. The 2030 mitigation analyses show that widening to 3 lanes not only allows decreased travel times, but higher speeds as well, and removes the strain on the freeway to levels lower than currently observed (2019). If a commercial or housing development takes place at or near an intersection, this could expedite the need for mitigation measures.

1- Introduction

I. Introduction

- **Components**

This study is divided into six components and are described below:

Existing (2019) Operations Analyses: studies the current conditions of interchange intersections, freeway mainline and both merge and diverge ramp junctions.

2030 Operations Analyses: This intermediate year was chosen for analysis because freeway mainline as well as merge and diverge ramp junctions analyses show the LOS levels as beginning to fail. Staff applied a 2% growth factor to Caltrans historic data, for AADT on the SR 99 mainline. Understanding that the arterials immediately adjacent to SR 99 will be affected by the inter-regional traffic on the route, volumes for the 2030 ramps analyses were calculated by applying current volumes using a factor of the compounded growth rate on SR-99 of 2% weighted by Tulare County's growth rate of 1.3%[3], resulting in an annual increase in ramp volumes of 1.39%. The trended mainline heavy vehicle traffic was estimated at 25.36%. Intersections were not analyzed for this year.

2030 Mitigation Analyses: The mitigation applied was widening SR 99 mainline to a three lane freeway in both directions. Any possible redesign of ramps was not taken into consideration. Adding a lane in each direction also allows for slightly increased free-flow speeds (67 mph vs. 65.5 for two lane). Aside from adding the lane and the free-flow speed, the factors for the analyses were the same as those used for 2030 Operations Analyses.

2042 Operations Analyses: This is the horizon year for analysis. The likely intersection, mainline and ramp junction conditions resulting from taking no action to mitigate growing congestion on SR 99 are shown in these analyses. Staff applied a 2% annual growth factor to Caltrans historic data, for AADT on the SR 99 mainline. Understanding that the arterials immediately adjacent to SR 99 will be affected by the inter-regional traffic on the route, volumes for the 2042 ramps analyses were calculated by applying current volumes using a factor of the compounded growth rate on SR-99 of 2% weighted by Tulare County's growth rate of 1.3%, resulting in an annual increase in ramp and volumes of 1.39%. The trended heavy vehicle traffic on the mainline was estimated at 27.86%. Intersection volumes were grown at 1.3% annually, which is the County's adopted rate of growth. Heavy vehicle percentages at intersections and

[3] California Department of Transportation, Economic Analysis Branch, Office of State Planning, California County-Level Economic Forecast 2017-2050, by Mark Schniepp, (The California Economic Forecast, 2017), 213

ramps was assumed as the same percentages collected during data collection for 2019 Operations Analyses.

Mainline Travel Time Analyses: TCAG obtained the Iteris Performance Measurement System (iPeMS) Travel-time application and data for July 1, 2016, thru June 30, 2018 from Iteris Inc. in order to analyze travel time data and perform studies for major travel corridors within Tulare County. Because this is the first study TCAG has conducted on this corridor using the iPeMS application, this is intended to be a base study that we can build upon for future studies. Average Travel Time and Average Speed were the two main attributes monitored. Only the AM peak 3 hours and the PM peak 3 hours were studied. These were the two heaviest traveled periods for the SR 99 corridor.

Mainline Accident Analysis: In this analysis, statistics on accident data for the corridor study segment are presented. Data was grouped in one-year increments for the last 10 year period and segregated by accident severity and type. The data for the period 2008-2018 are abstracted from the Transportation Injury Mapping System (TIMS) that has been developed by SafeTREC to provide quick, easy and free access to California crash data.

▪ Study Area

The study area consists of a section of SR 99 from Avenue 184 south to the Tulare County line (approximately 24 miles) in southern part of Tulare County (***Figure 1***) [4]. The following intersections were part of the study, along with associated freeway mainline segments and ramp junctions:

Avenue 16 (PM 2.0) is classified[45] a two lane local road that terminates at SR 99 from the west. Access to and from southbound SR 99 is provided by a direct diamond on ramp and a hook off ramp. No northbound access to SR 99 from Avenue 16 is available.

Avenue 24 (PM 2.8) is classified a two lane local road. Access to northbound SR 99 is provided by a direct diamond on ramp. Access to southbound SR 99 is through a direct diamond off ramp from Drive 140, and uses the same access as Avenue 16.

Avenue 48 (PM 5.9) is classified as a two-lane major collector near SR 99, which passes through the community of Earlimart. Access from and to northbound SR 99 is provided by an offset diamond ramp facility. Access from and to southbound SR 99 is through a loop off ramp, and direct diamond on ramp via Front Street.

[4] California Department of Transportation, Division of Research, Innovation, and System Information, California Road Systems (CRS) Maps, Map Group 11Q, 2011.

Avenue 56 (Sierra Avenue) (PM 6.9) is classified as a two-lane major collector which passes through the community of Earlimart. Access from and to northbound and southbound SR 99 is by a direct diamond interchange.

Drive 135 / Front Street (PM 7.5) is a north-south two lane local road through Earlimart. Access from southbound SR 99 is provided by a direct diamond off ramp connecting to Drive 135.

Avenue 72 (PM 9.0) is classified as a two lane minor collector road in the vicinity of SR 99 (Avenue 72 does not cross SR 99). Access from northbound SR 99 is by a diamond off ramp to Road 130. Access to northbound SR 99 is by a short hook ramp from Ave 130 north of Avenue 80. Access from southbound SR 99 is via a direct diamond off ramp extending south along Bishop Street, and access to southbound 99 is by a diamond on ramp.

Avenue 80 (PM 10.5) is classified as a two lane east-west local road (which does not intersect, or cross SR 99). Access to northbound SR 99 is provided by a short hook off ramp from Road 128 north of Avenue 80. Access to west Avenue 80 from southbound SR 99 is by a direct diamond off ramp. Access to southbound SR 99 is provided via Road 128/Bishop St and uses the same access as Avenue 72.

Avenue 96/Terra Bella Street (PM 12.1) is classified as a major collector road which runs through the community of Pixley. Access from and to northbound SR 99 is by an offset diamond ramp structure. Access from southbound SR 99 is provided by hook ramp to S. Main Street, and access to SR 99 is provided by a diamond on ramp from S. Main Street.

Avenue 100/E. Court Avenue (PM 12.8) is classified as an east-west minor collector road. Access from northbound SR 99 is provided by a hook ramp to N. Park Drive, then south to Avenue 100. From southbound SR 99, access is by a direct diamond off ramp.

Main Street (PM 13.1) is classified as a north-south minor collector road west of SR 99 through the community of Pixley. Access to Main Street from southbound SR 99 is by a diamond off ramp.

Avenue 104 (alignment)***/ N. Park Drive*** (PM 13.3) is classified as a north-south minor collector east of SR 99 in Pixley. Access from northbound SR 99 (to Ave 100) is provided by hook ramp to Road 104 (alignment)/ Park Avenue.

Avenue 120 (PM 15.2) is classified as a two lane minor collector. Access to and from northbound SR 99 is via hook ramps connecting to Drive 122B. Southbound SR 99 access is provided by a direct diamond on and off ramps.

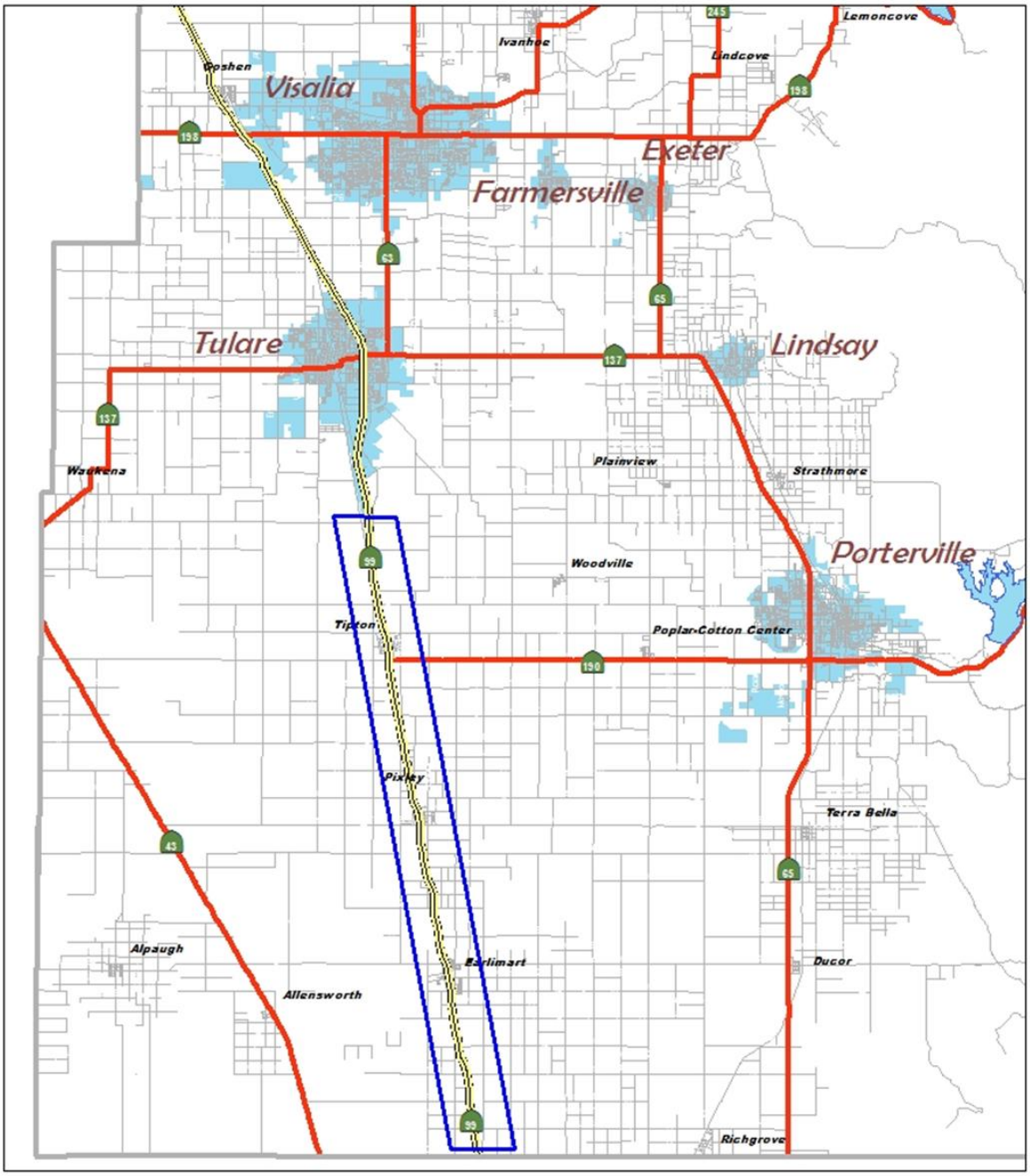
State Route 190 / ***Avenue 144*** (PM 18.2) is classified as a major arterial highway (SR 190) east of SR 99 and a major collector (Avenue 144) west of SR 99. SR 190 provides access to northbound SR 99 through a cloverleaf-type interchange. Access to and from southbound SR 99 is provided by a hook off ramp to Burnett Road, and an extended direct diamond on ramp.

Avenue 152 (PM 19.2) is classified as a major collector east of its intersection with SR 99, and a minor collector west of the intersection of SR 99. There are two local streets which run

parallel to Route 99 providing access to/from Avenue 152 through a pair of hook on/off ramps just south of Avenue 152. Burnett Road provides access to the southbound on/off ramps and Thompson Road provides access to the northbound on/off ramps.

Avenue 184 (PM 23.3) is classified as a major collector with access to and from SR 99 through a cloverleaf interchange where the loops are on the same side of the northbound and southbound cross street.

Figure 1



TCAG

South State Route 99 Corridor Study

Project Study Area

Regional Context

Tulare County is located in the southern San Joaquin Valley. Nearly half of the land in the county is devoted to national parks or national forests. The primary industry in Tulare County is agriculture, and has led the nation in agricultural production for many of the last ten years. Tulare County currently has a population of 468,200 people and is expected to grow faster than the state average. The annual growth between 2017 and 2022 is expected to accelerate, averaging 1.3 percent per year. State Route 99 (SR 99) is a major north-south route of travel and goods movement through northern and central California. From its southern end at Interstate 5 (I-5) near Wheeler Ridge to its northern end at SR 36 near Red Bluff, SR 99 goes through the densely populated eastern parts of the valley. The highway is a 6-8 lane freeway over more than half of its length, with some sections in the San Joaquin Valley being 4-lane highway. Those sections remaining four lanes are primarily in Tulare, Merced and Madera Counties. In Tulare County, SR 99 covers a distance of 54 miles from Kingsburg (Fresno County line) to Delano (Kern County line).

2- Operations & Mitigation Analysis Methodology

II. Operations and Mitigation Analysis Methodology

- **Mainline and Ramp Junction Data**

Data provided by a recent Origin-Destination study by Fehr and Peers[5], indicates that truck percentages on State Route 99 within the study area are approximately 25% of the total average annual daily trips (AADT), these numbers corroborate trending heavy vehicle data provided by Caltrans which suggests current 2019 heavy vehicle percentages of 23.07%. Caltrans estimates were used for this study. Future year's truck volumes were estimated by trending historic data provided by Caltrans.

Total vehicle volumes were provided by Caltrans through 2017, and staff used a reasonable growth factor of 2% per year to estimate 2019 volumes, this growth factor is just slightly lower than the trended historic data provided by Caltrans. The estimated AADT for all vehicles ranges between 50,000 and 60,000 vehicles for 2019[6]. This same growth factor of 2% was applied to estimate future year's volumes as well.

- **Intersection and Mainline Level of Service Analysis**

Existing (2019) and future (2030) and (2042) traffic operations were quantified through the determination of Level of Service (LOS). LOS is a qualitative measure of traffic operating conditions, whereby a letter grade A through F is assigned to an intersection representing progressively worsening traffic conditions (*Table 1*). Levels of Service are calculated for different intersection control types using the methods documented in the *Highway Capacity Manual 2010* (HCM 2010).[7]

LOS standards vary throughout the County and its eight incorporated cities. The TCAG 2018 Regional Transportation Plan (RTP) provides that acceptable LOS shall be no lower than LOS "D" for urban areas and LOS "C" for rural areas. However, each local agency that owns and operates transportation facilities may select a LOS standard more stringent than the minimum LOS standards identified in the RTP. For the purposes of this report LOS "D" is taken as the threshold for acceptable traffic operations at all study intersections.

Caltrans policy defines LOS "D" as an acceptable operating condition when planning for future state facilities in urbanized areas. If the existing state highway facility is operating at less than the target LOS, the existing measures of effectiveness (MOE) should be maintained. Existing

[5] 99 / SR198 Gateways Truck Origin and Destination Study, January 9, 2015, pp. 2
[6] http://www.dot.ca.gov/trafficops/census/
[7] Transportation Research Board of the National Academies, Highway Capacity Manual 2010, Volume 1-Concepts, 2010, 4-4.

measures of effectiveness are Control Delay per Vehicle (sec/veh) for signalized intersections, and Average Control Delay per Vehicle (sec/veh) for non-signalized intersections.

Table 1

Definition of Level of Service (LOS)

Table 1 – Intersection Level of Service Criteria (LOS)

LOS	Signalized Intersection	Unsignalized Intersection
A	≤10 sec	≤10 sec
B	10-20 sec	10-15 sec
C	20-35 sec	15-25 sec
D	35-55 sec	25-35 sec
E	55-80 sec	35-50 sec
F	≥80 sec	≥50 sec

A= Free flow
B=Reasonably free flow
C=Stable flow
D=Approaching unstable flow
E=Unstable flow
F=Forced or breakdown flow

The transportation LOS system uses the letters A through F, with A being best and F being worst.

LOS A describes operations with a control delay of 10 sec/veh or less and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is exceptionally favorable or cycle length very short. Most vehicles would arive during the green indication and travel through the intersection without stopping.

LOS B describes operations with a control delay of between 10 and 20 sec/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is highly favorable or cycle length very short. More vehicles stop than with LOS A.

LOS C describes operations with a control delay of between 20 and 35 sec/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the progression is favorable or cycle length is moderate. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant, although many vehicles pass through the intersection without stopping.

LOS D describes operations with a control delay of between 35 and 55 sec/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high and either progression is inneffective or cycle length is long. Many vehicles stop, and cycle failures are noticable.

LOS E describes operations with a control delay of between 55 and 80 sec/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high and progression is very poor and the cycle length is long. Individual cycle failures are frequent.

LOS F describes operations with a control delay exceeding 80 sec/veh or a volume-to-capacity ratio greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is very high, progression is very poor, and the cycle length is long. Most cycles fail to clear the queue.

Source: 2010 Highway Capacity Manual

▪ Signal Warrant Analysis

California Manual on Uniform Traffic Control Devices (CAMUTCD), Chapter 4-C, Warrant #3, the Peak Hour warrant, was applied to all non-signalized intersections being analyzed. Rules for applying warrant analysis are listed below:

Section 4C.04 Warrant 3, Peak Hour

Support:

The Peak Hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street.

Standard:

This signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.

The need for a traffic control signal shall be considered if an engineering study finds that the criteria in either of the following two categories are met:

1. If all three of the following conditions exist for the same 1 hour (any four consecutive 15-minute periods) of an average day:

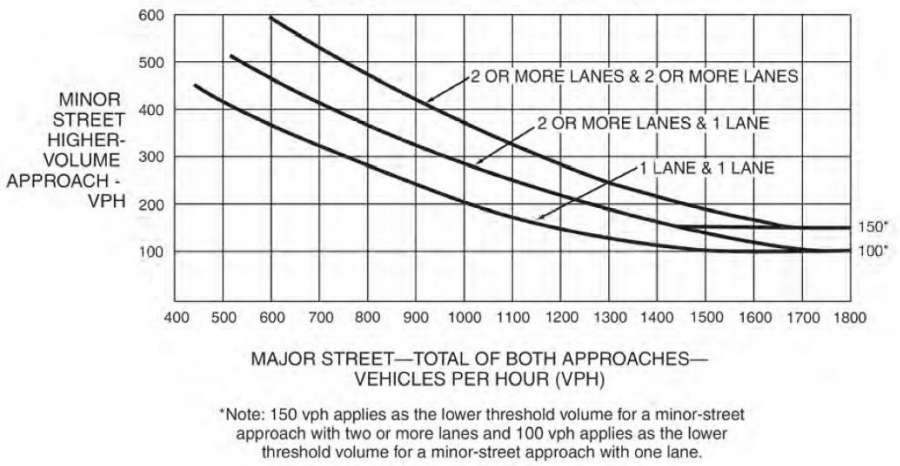
   a. The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach; and

   b. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes; and

   c. The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.

To determine whether significance should be associated with non-signalized intersection LOS, a supplemental traffic signal warrant analysis was also performed. Signal warrant criteria described in the

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.

2. The plotted point representing the vehicles per hour on the major street (total of both approaches)
   and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4C-3 for the existing combination of approach lanes.

Option:

If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-4 may be used in place of Figure 4C-3 to evaluate the criteria in the second category of the Standard.

If this warrant is the only warrant met and a traffic control signal is justified by an engineering study, the traffic control signal may be operated in the flashing mode during the hours that the volume criteria of this warrant are not met.

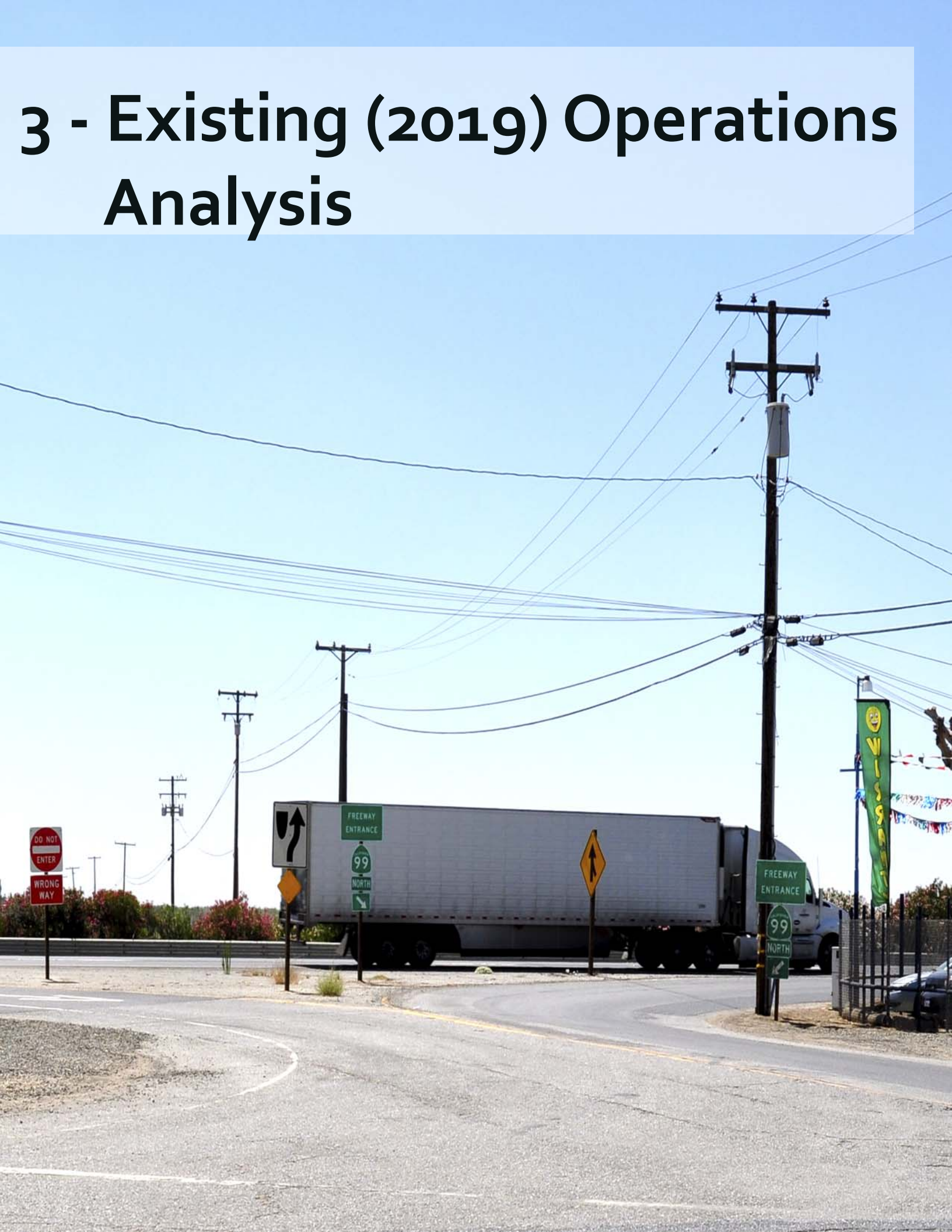
Guidance:

If this warrant is the only warrant met and a traffic control signal is justified by an engineering study, the traffic control signal should be traffic-actuated.

California MUTCD 2014 Edition Page 831
(FHWA's MUTCD 2009 Edition, including Revisions 1 & 2, as amended for use in California)
Chapter 4C – Traffic Control Signal Needs Studies November 7, 2014
Part 4 – Highway Traffic Signals

An intersection that meets a signal warrant may benefit from signalization; however, the final decision for this mitigation should be based on further monitoring and a comprehensive Traffic Engineering Study.

3 - Existing (2019) Operations Analysis



III. Existing (2019) Operations Analysis

- **2019 Intersections Analysis**

A total of 30 intersections within the study area were analyzed for approach delay and LOS, see ***Figure 2***. Data on which to establish intersection operations was derived from peak hour turning movement counts collected by Metro Traffic Data Collection Services during January 2019. Data was collected during "normal" traffic operations (i.e. Tuesday through Thursday during non-holiday weeks, and when school is in session) from the hours of 4 p.m. to 6 p.m. Peak hour conditions were identified as the one hour period of time having the highest total traffic volumes through the intersection.

Traffic count data was analyzed by TCAG staff using the *Highway Capacity Software 7* (*HCS 7)* developed by the Center for Microcomputers in Transportation (McTrans) at the University of Florida. The HCS 7 software is based on analytical methods in the HCM 2010. The following input parameters were used for the 2019 operations analysis:

Volume	*(vehicles per hour per approach)*
Analysis Period	*15 minutes*
Peak hour factor (PHF)	*Avg. Volume during Pk Hour* / *4(Avg. Volume during Peak 15 min.period)*
Percent heavy vehicles: approach)	*(heavy vehicles / total volume x100 (per*
Median type / storage	*divided or undivided*
Base saturation flow	*1750 passenger cars/hour/lane (pc/h/ln)* [1]
% Heavy vehicles	*Trended Caltrans data*
% Grade	*0%*
Channelization	*yes or no*
Number of lanes and usage	*lanes per approach / shared?*

HCS 7 calculates and reports the capacity in vehicles per hour (vph), the volume to capacity ratio (v/c), and control delay for each approach to the intersection. The analysis also calculates the vehicle approach delay in seconds (sec), and the approach level of service (LOS).

Results of 2019 Intersections Analysis

The 2019 intersections analysis shows that all intersections within the study area are operating at an acceptable LOS for the PM peak hours. The data also shows that none of the intersections meet the requirements of CAMUTCD Warrant #3, the Peak Hour warrant, for possible signalization. Table 2 summarizes the results of the analysis.

The turning count volumes recorded in the field for the PM peak hour period are shown in Figure 3

Figure 2

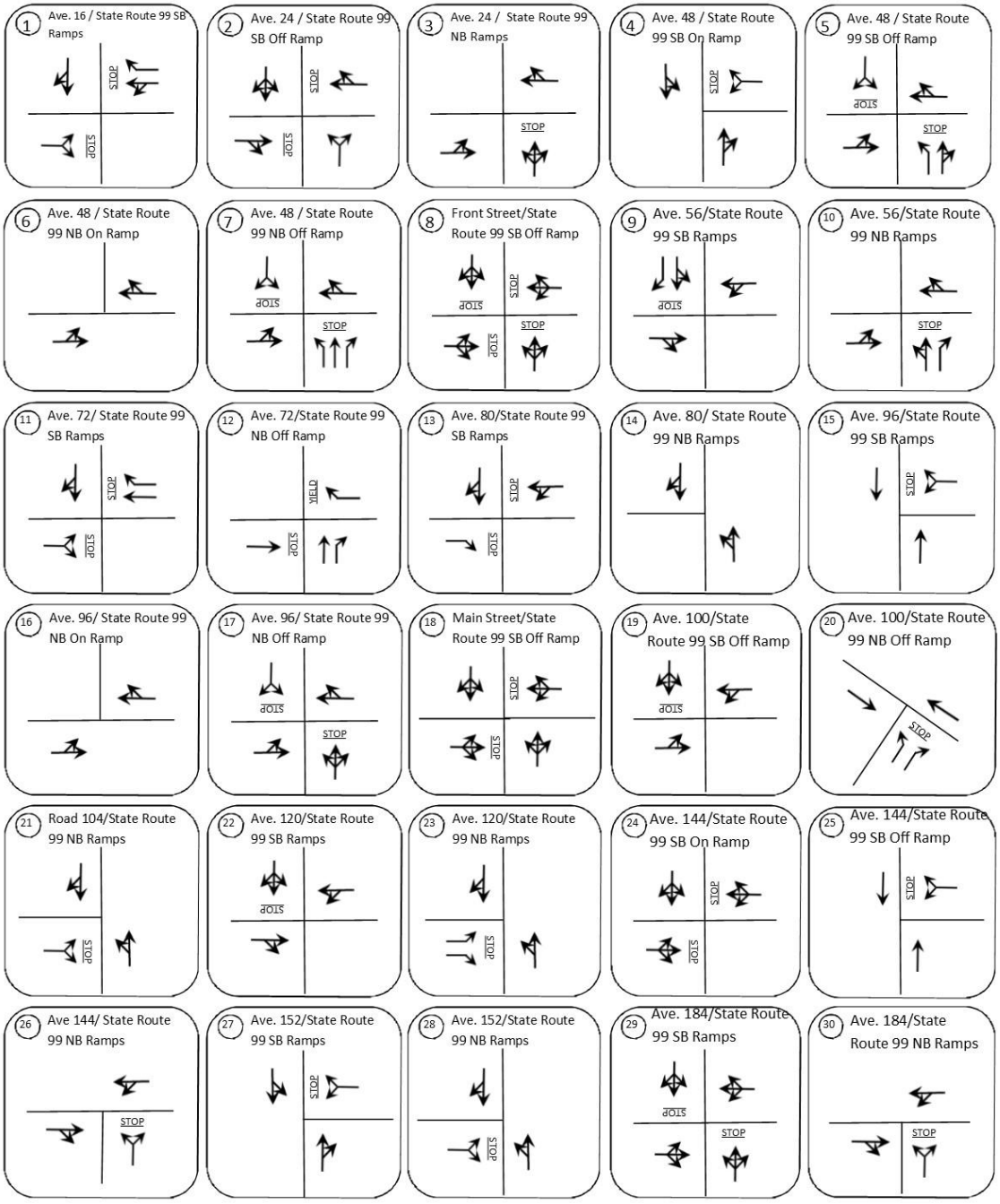


Figure 2

Existing Lane Geometrics and Control

Figure 3

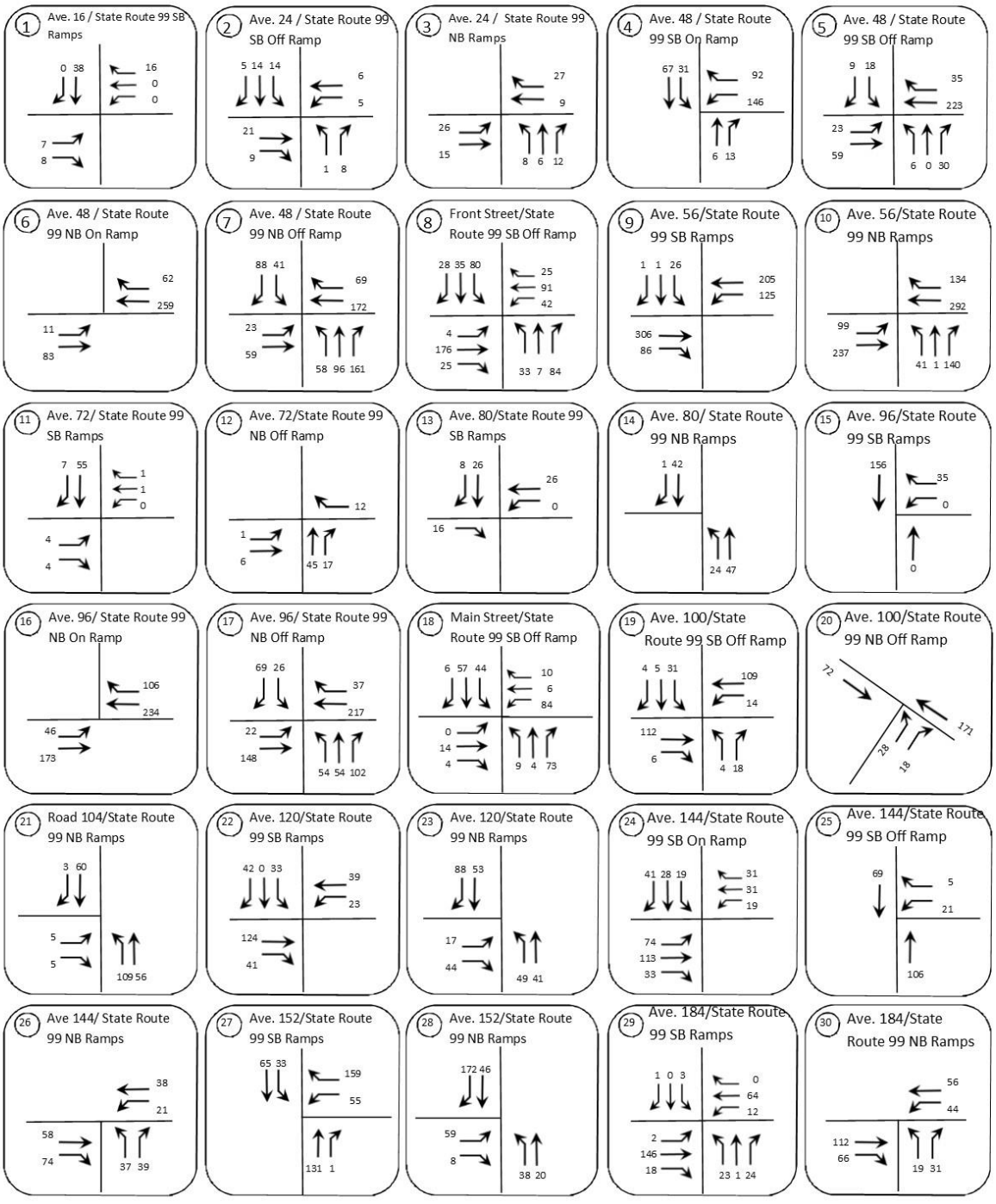


Figure 3

Existing Turning Movement Volumes

Table 2
2019 Operations
Intersection Level of Service

	Intersection	Control Type	PM Peak Hour		
			Delay (sec/veh)	LOS	Warrant Met
1	Avenue 16/State Route SB 99 Ramps	TWSC	8.9	A	No
2	Avenue 24/State Route SB 99 Off Ramp	TWSC	9.2	A	No
3	Avenue 24/State Route NB 99 Ramps	TWSC	9.3	A	No
4	Avenue 48/State Route 99 SB On Ramp	TWSC	10.6	B	No
5	Avenue 48/State Route 99 SB Off Ramp	TWSC	10.9	B	No
6	Avenue 48/State Route 99 NB On Ramp	Y	1.0	A	No
7	Avenue 48/State Route 99 NB Off Ramp	TWSC	12.4	B	No
8	Front St./State Route 99 SB Off Ramp	AWSC	21.3	C	No
9	Avenue 56/State Route 99 NB Ramps	TWSC	14.1	B	No
10	Avenue 56/State Route 99 SB Ramps	TWSC	21.2	C	No
11	Avenue 72/State Route 99 SB Ramps	TWSC	9.2	A	No
12	Avenue 72/State Route 99 NB Off Ramp	TWSC	9.4	A	No
13	Avenue 80/State Route 99 SB Off Ramp	TWSC	9.4	A	No
14	Avenue 80/State Route 99 NB On Ramp	Y	2.6	A	No
15	Avenue 96/State Route 99 SB Ramps	TWSC	8.5	A	No
16	Avenue 96/State Route 99 NB On Ramp	Y	2.0	A	No
17	Avenue 96/State Route 99 NB Off Ramp	TWSC	15.2	C	No
18	Main St./State Route 99 SB Off	TWSC	11.1	B	No
19	Avenue 100/State Route 99 SB Off Ramp	TWSC	11.6	B	No
20	Avenue 100/State Route 99 NB Off Ramp	TWSC	9.8	A	No
21	Road 104/State Route 99 NB Ramps	TWSC	10.3	B	No
22	Avenue 120/State Route 99 SB Ramps	TWSC	9.7	A	No
23	Avenue 120/State Route 99 NB Ramps	TWSC	9.5	A	No
24	Avenue 144/State Route 99 SB On Ramp	TWSC	12.3	B	No
25	Avenue 144/State Route 99 SB Off Ramp	TWSC	9.6	A	No
26	Avenue 144/State Route 99 NB Ramps	TWSC	9.5	A	No
27	Avenue 152/State Route 99 SB Ramps	TWSC	10.3	B	No
28	Avenue 152/State Route 99 NB Ramps	TWSC	10.4	B	No
29	Avenue 184/State Route 99 SB Ramps	TWSC	10.3	B	No
30	Avenue 184/State Route 99 NB Ramps	TWSC	9.9	A	No

Legend: TWSC= Two Way Stop Control
AWSC= All Way Stop Control
Y= Yield

▪ 2019 Freeway Mainline Analysis

The peak hour volumes on which to analyze 2019 freeway mainline operations were provided by Caltrans PeMS (Performance Monitoring System)[8]. The following input parameters were used in the analysis:

Volume	*Caltrans data*
Peak Hour Factor:	*.90*
Terrain:	*Level*
Heavy Vehicle Adjustment:	*23.07% (Trended Caltrans data)*
Base free Flow Speed:	*65.5 mph*
Lane Width:	*12 ft.*
Right Lateral Clearance:	*10 ft.*
Total Ramp Density:	*0.50 ramps /mi*
Total Ramp Adjustment:	*1.8 mph*
Driver Population Adjustment:	*1.0*

The HCS 7 software calculates and reports the flow rate (VP) in passenger cars per hour per lane (pc/h/ln), the free flow speed (FFS) in mile per hour (mph), the average passenger car speed (S) in mph, density (D) in passenger cars per mile per lane (pc/mi/ln), and level of service (LOS). The results of the 2019 mainline analysis are summarized in Table 3.

▪ 2019 Ramp Junction Analysis

PM peak hour volume data for the freeway ramp junction analysis was obtained from the count data observed by the traffic data collection consultant. Input parameters for the ramp junction analysis included:

Ramps	*merge or diverge*
Freeway lanes (analysis direction):2	
Freeway Free-flow speed:	*65.5 mph*
Freeway Volume (V)	*from Caltrans data*
Side of freeway	*left or right*
Ramp free flow speed:	*35 mph*
Ramp Volume(R)	*from turn movement data*

[8] http://pems.dot.ca.gov/

Length of deceleration lane	*as measured*
Peak hour factor (PHF):	*.90*
Terrain:	*level*
Percent trucks and busses:	*from data*
Percent RVs	*from data*
Driver Population Adjustment:	*1.0*

HCS 7 calculates and reports the ramp densities (D_R) in passenger cars per mile per hour (pc/mi/ln), the speed (S_R) for merge/diverge segments in miles per hour (mph), and the ramp level of service (LOS). The results of the existing mainline operations analysis are summarized in Table 4.

- **Results of 2019 Mainline and Ramp Junctions Analysis**

The results of freeway mainline and ramp analysis for the 2019 operations indicate that all facilities are currently operating at acceptable levels of service for the AM and PM peak hour periods. The results of the existing ramp junction analysis are summarized in Table 5.

Table 3
2019 Operations
State Route 99 Mainline AM Peak Hour Level of Service

2019 Mainline Segment (From/To)	AM Peak Hour			
	North Bound Volume	North Bound LOS	South Bound Volume	South Bound LOS
County Line to Avenue 24	2178	C	2240	C
Avenue 24 to Avenue 48	2279	C	2297	C
Avenue 48 to Avenue 56	1643	B	2292	C
Avenue 56 to Avenue 72	1574	B	2120	C
Avenue 72 to Avenue 80	1490	B	1935	C
Avenue 80 to Avenue 96	1416	B	1916	C
Avenue 96 to Avenue 100	1465	B	1833	C
Avenue 100 to Avenue 104 (Park)	1563	B	1959	C
Avenue 104 to Avenue 120	1648	B	2070	C
Avenue 120 to Avenue 144	1691	C	2077	C
Avenue 144 to Avenue 152	1785	C	2144	C
Avenue 152 to Avenue 184	1897	C	2229	C

Table 4
2019 Operations
State Route 99 Mainline PM Peak Hour Level of Service

2019 Mainline Segment (From/To)	PM Peak Hour			
	North Bound Volume	North Bound LOS	South Bound Volume	South Bound LOS
County Line to Avenue 24	2906	D	2134	C
Avenue 24 to Avenue 48	2836	D	2384	C
Avenue 48 to Avenue 56	2825	D	2176	C
Avenue 56 to Avenue 72	2714	D	2147	C
Avenue 72 to Avenue 80	2570	D	2100	C
Avenue 80 to Avenue 96	2544	D	2159	C
Avenue 96 to Avenue 100	2533	D	2122	C
Avenue 100 to Avenue 104 (Park)	2535	D	2060	C
Avenue 104 to Avenue 120	2508	D	1972	C
Avenue 120 to Avenue 144	2527	D	1997	C
Avenue 144 to Avenue 152	2624	D	2074	C
Avenue 152 to Avenue 184	2740	D	2175	C

Table 5
2019 Operations
State Route 99 Ramp Junction Level of Service

Ramp Junctions	Ramp	Peak Hour Speed (mph)	Peak Hour Density[1] (pc/mi/ln)	Peak Hour LOS
State Route 99 Avenue 184 Interchange				
Northbound Off-Ramp	Diverge	35	33.9	D
Northbound On-Ramp	Merge	35	35.2	D
Southbound Off-Ramp	Diverge	35	27.1	D
Southbound On-Ramp	Merge	35	27.4	D
State Route 99 Avenue 152 Interchange				
Northbound Off-Ramp	Diverge	35	32.4	D
Northbound On-Ramp	Merge	35	37.2	D
Southbound Off-Ramp	Diverge	35	27.7	D
Southbound On-Ramp	Merge	35	26.2	C
State Route 99 State Route 190 Interchange				
Northbound Off-Ramp	Diverge	35	31.2	D
Northbound On-Ramp	Merge	35	33.8	D
Southbound Off-Ramp	Diverge	35	26.6	C
Southbound On-Ramp	Merge	35	26.0	C
State Route 99 Avenue 120 Interchange				
Northbound Off-Ramp	Diverge	35	31.0	D
Northbound On-Ramp	Merge	35	33.0	D
Southbound Off-Ramp	Diverge	35	25.7	C
Southbound On-Ramp	Merge	35	25.6	C
State Route 99 Road 104 Interchange				
Northbound Off-Ramp	Diverge	35	31.3	D
Northbound On-Ramp	Merge	35	32.1	D
State Route 99 Main Street Interchange				
Southbound Off-Ramp	Diverge	35	25.5	C
State Route 99 Avenue 100 Interchange				
Southbound Off-Ramp	Diverge	35	25.4	C
Northbound Off-Ramp	Diverge	35	31.3	D
State Route 99 Avenue 96 Interchange				
Northbound Off-Ramp	Diverge	35	31.7	D
Northbound On-Ramp	Merge	35	33.2	D
Southbound Off-Ramp	Diverge	35	26.2	C
Southbound On-Ramp	Merge	35	27.9	D

Table 5 (Cont.)
2019 Operations
State Route 99 Ramp Junction Level of Service

Ramp Junctions	Ramp	Peak Hour Speed (mph)	Peak Hour Density[1] (pc/mi/ln)	Peak Hour LOS
State Route 99 Avenue 80 Interchange				
Northbound On-Ramp	Merge	35	31.5	D
Southbound Off-Ramp	Diverge	35	26.7	C
State Route 99 Avenue 72 Interchange				
Northbound Off-Ramp	Diverge	35	33.5	D
Southbound Off-Ramp	Diverge	35	25.9	C
Southbound On-Ramp	Merge	35	26.7	D
State Route 99 Front Street Interchange				
Southbound Off-Ramp	Diverge	35	25.5	C
State Route 99 State Avenue 56 Interchange				
Northbound Off-Ramp	Diverge	35	35.1	E
Northbound On-Ramp	Merge	35	37.2	D
Southbound Off-Ramp	Diverge	35	26.5	C
Southbound On-Ramp	Merge	35	30.3	D
State Route 99 Avenue 48 Interchange				
Northbound Off-Ramp	Diverge	35	35.5	E
Northbound On-Ramp	Merge	35	36.7	D
Southbound Off-Ramp	Diverge	35	28.3	D
Southbound On-Ramp	Merge	35	31.7	D
State Route 99 Avenue 24 Interchange				
Northbound Off-Ramp	Diverge	35	35.8	E
Northbound On-Ramp	Merge	35	37.0	E
Southbound Off-Ramp	Diverge	35	29.5	D
State Route 99 Avenue 16 Interchange				
Southbound Off-Ramp	Diverge	35	27.6	D
Southbound On-Ramp	Merge	35	27.8	D

[1] *Represents passenger cars per mile per lane*

v/c>1 indicates saturated conditions on the facility and demand volume exceeding capacity

4- 2030 Operations Analysis

IV. 2030 Operations Analysis

- **2030 Mainline and Ramp Junctions Analysis**

The methodology used for determining the LOS and other key performance indicators for the 2030 mainline and ramps analysis was the same as that used for the 2019 analysis. 2030 freeway mainline volumes were calculated by applying the 2% annual compounding factor to current and historical volumes provided by Caltrans. It was determined a growth rate of 2% was more reasonable than the slightly higher trended historic growth of the corridor. Truck growth data provided by Caltrans from 2010 thru 2017 was trended out, using 25.36% trucks by 2030. Understanding that the arterials immediately adjacent to State Route 99 will be affected by the inter-regional traffic on the route, volumes for the 2030 ramps analysis were calculated by applying current volumes using a factor of the compounded growth rate on SR-99 of 2% weighted by Tulare County's growth rate of 1.3%, resulting in an annual increase in ramp and volumes of 1.39%. The weighted growth calculation is based on the assumption, that in a rural area with minimal land use changes, traffic would not increase beyond this level for the foreseeable future. Volumes were entered into the HCS 7 software as previously described to calculate the future LOS and delay times. The results of the 2030 analysis are presented in **Tables 6** through **8.**

- **Results of 2030 Mainline and Ramp Junction Analysis**

The analysis also shows that mainline facilities, with the exceptions listed below, are projected to operate within acceptable LOS for the PM peak hour in 2030. This means that demand on the freeway facilities will exceed capacity by 2030.

SR-99 northbound, County Line to Avenue 24 projected LOS "F" (PM Peak Hour)
SR-99 northbound, Avenue 24 to Avenue 48 projected LOS "F" (PM Peak Hour)
SR-99 northbound, Avenue 48 to Avenue 56 projected LOS "F" (PM Peak Hour)
SR-99 northbound, Avenue 56 to Avenue 72 projected LOS "F" (PM Peak Hour)
SR-99 northbound, Avenue 72 to Avenue 80 projected LOS "E" (PM Peak Hour)
SR-99 northbound, Avenue 80 to Avenue 96 projected LOS "E" (PM Peak Hour)
SR-99 northbound, Avenue 96 to Avenue 100 projected LOS "E" (PM Peak Hour)

SR-99 northbound, Avenue 100 to Avenue 104 projected LOS “E” (PM Peak Hour)

SR-99 northbound, Avenue 104 to Avenue 120 projected LOS “E” (PM Peak Hour)

SR-99 northbound, Avenue 120 to Avenue 144 projected LOS “E” (PM Peak Hour)

SR-99 northbound, Avenue 144 to Avenue 152 projected LOS “E” (PM Peak Hour)

SR-99 northbound, Avenue 152 to Avenue 184 projected LOS “F” (PM Peak Hour)

SR-99 southbound, Avenue 48 to Avenue 24 projected LOS “E” (PM Peak Hour)

The analysis also shows that ramp facilities listed below in the study area are projected to operate at LOS E or worse by 2030. This means that demand on the freeway facilities will exceed capacity by 2030.

Avenue 16 @SR 99 southbound off ramp projected LOS “E” (AM Peak Hour)

Avenue 24 @SR 99 southbound off ramp projected LOS “E” (PM Peak Hour)

Avenue 24 @SR 99 northbound on ramp projected LOS “E” (PM Peak Hour)

Avenue 24 @SR 99 northbound off ramp projected LOS “F” (PM Peak Hour)

Avenue 48 @SR 99 southbound on ramp projected LOS “E” (AM Peak Hour)

Avenue 48 @SR 99 northbound on ramp projected LOS “F” (PM Peak Hour)

Avenue 48 @SR 99 northbound off ramp projected LOS “F” (PM Peak Hour)

Avenue 56 @SR 99 northbound on ramp projected LOS “F” (PM Peak Hour)

Avenue 56 @SR 99 northbound off ramp projected LOS “F” (PM Peak Hour)

Avenue 56 @SR 99 southbound on ramp projected LOS “E” (AM Peak Hour)

Avenue 72 @SR 99 northbound off ramp projected LOS “E” (PM Peak Hour)

Avenue 80 @SR 99 northbound on ramp projected LOS “E” (PM Peak Hour)

Avenue 96 @SR 99 northbound on ramp projected LOS “E” (PM Peak Hour)

Avenue 96 @SR 99 northbound off ramp projected LOS “E” (PM Peak Hour)

Avenue 100 @SR 99 northbound off ramp projected LOS “E” (PM Peak Hour)

Avenue 104 @SR 99 northbound on ramp projected LOS “E” (PM Peak Hour)

Avenue 104 @SR 99 northbound off ramp projected LOS “E” (PM Peak Hour)

Avenue 120 @SR 99 northbound on ramp projected LOS “E” (PM Peak Hour)

Avenue 120 @SR 99 northbound off ramp projected LOS “E” (PM Peak Hour)

Avenue 144 @SR 99 northbound on ramp projected LOS “E” (PM Peak Hour)

Avenue 144 @SR 99 northbound off ramp projected LOS “E” (PM Peak Hour)

Avenue 152 @SR 99 northbound on ramp projected LOS “F” (PM Peak Hour)

Avenue 152 @SR 99 northbound off ramp projected LOS “E” (PM Peak Hour)

Avenue 184 @SR 99 northbound on ramp projected LOS “F” (PM Peak Hour)

Avenue 184 @SR 99 northbound off ramp projected LOS “E” (PM Peak Hour)

Table 6
2030 Operations
State Route 99 Mainline Level of Service
AM Peak Hour

2030 Mainline Segment (From/To)	AM Peak Hour			
	North Bound Volume	North Bound LOS	South Bound Volume	South Bound LOS
County Line to Avenue 24	2713	D	2790	D
Avenue 24 to Avenue 48	2841	D	2863	D
Avenue 48 to Avenue 56	2046	C	2855	D
Avenue 56 to Avenue 72	1959	C	2638	D
Avenue 72 to Avenue 80	1852	C	2405	D
Avenue 80 to Avenue 96	1759	C	2380	D
Avenue 96 to Avenue 100	1820	C	2277	C
Avenue 100 to Avenue 104 (Park)	1943	C	2436	D
Avenue 104 to Avenue 120	2049	C	2575	D
Avenue 120 to Avenue 144	2104	C	2584	D
Avenue 144 to Avenue 152	2232	C	2681	D
Avenue 152 to Avenue 184	2363	D	2777	D

Table 7
2030 Operations
State Route 99 Mainline Level of Service
PM Peak Hour

2030 Mainline Segment (From/To)	PM Peak Hour			
	North Bound Volume	North Bound LOS	South Bound Volume	South Bound LOS
County Line to Avenue 24	3620	F	2658	D
Avenue 24 to Avenue 48	3535	F	2971	E
Avenue 48 to Avenue 56	3518	F	2709	D
Avenue 56 to Avenue 72	3377	F	2671	D
Avenue 72 to Avenue 80	3194	E	2610	D
Avenue 80 to Avenue 96	3162	E	2682	D
Avenue 96 to Avenue 100	3147	E	2636	D
Avenue 100 to Avenue 104 (Park)	3151	E	2561	D
Avenue 104 to Avenue 120	3119	E	2453	D
Avenue 120 to Avenue 144	3143	E	2484	D
Avenue 144 to Avenue 152	3282	E	2593	D
Avenue 152 to Avenue 184	3414	F	2710	D

Table 8
2030 Operations
State Route 99 Ramp Junction Level of Service

Ramp Junctions	Ramp	Peak Hour Speed (mph)	Peak Hour Density[1] (pc/mi/ln)	Peak Hour LOS
State Route 99 Avenue 184 Interchange				
Northbound Off-Ramp	Diverge	35	41.9	F
Northbound On-Ramp	Merge	35	39.7	F
Southbound Off-Ramp	Diverge	35	35.4	E
Southbound On-Ramp	Merge	35	34.8	D
State Route 99 Avenue 152 Interchange				
Northbound Off-Ramp	Diverge	35	42.5	E
Northbound On-Ramp	Merge	35	42.5	F
Southbound Off-Ramp	Diverge	35	35.3	E
Southbound On-Ramp	Merge	35	33.2	D
State Route 99 State Route 190 Interchange				
Northbound Off-Ramp	Diverge	35	40.5	E
Northbound On-Ramp	Merge	35	39.9	E
Southbound Off-Ramp	Diverge	35	34.6	D
Southbound On-Ramp	Merge	35	33.0	D
State Route 99 Avenue 120 Interchange				
Northbound Off-Ramp	Diverge	35	39.8	E
Northbound On-Ramp	Merge	35	39.8	E
Southbound Off-Ramp	Diverge	35	33.6	D
Southbound On-Ramp	Merge	35	32.3	D
State Route 99 Road 104 Interchange				
Northbound Off-Ramp	Diverge	35	40.2	E
Northbound On-Ramp	Merge	35	38.0	E
State Route 99 Main Street Interchange				
Southbound Off-Ramp	Diverge	35	34.0	D
State Route 99 Avenue 100 Interchange				
Southbound Off-Ramp	Diverge	35	34.0	D
Northbound Off-Ramp	Diverge	35	40.3	E
State Route 99 Avenue 96 Interchange				
Northbound Off-Ramp	Diverge	35	41.0	E
Northbound On-Ramp	Merge	35	40.0	E
Southbound Off-Ramp	Diverge	35	34.5	D
Southbound On-Ramp	Merge	35	34.7	D

Table 8 (Cont.)
2030 Operations
State Route 99 Ramp Junction Level of Service

Ramp Junctions	Ramp	Peak Hour Speed (mph)	Peak Hour Density[1] (pc/mi/ln)	Peak Hour LOS
State Route 99 Avenue 80 Interchange				
Northbound On-Ramp	Merge	35	37.6	E
Southbound Off-Ramp	Diverge	35	34.7	D
State Route 99 Avenue 72 Interchange				
Northbound Off-Ramp	Diverge	35	43.3	F
Southbound Off-Ramp	Diverge	35	32.8	D
Southbound On-Ramp	Merge	35	34.5	D
State Route 99 Front Street Interchange				
Southbound Off-Ramp	Diverge	35	34.9	D
State Route 99 State Avenue 56 Interchange				
Northbound Off-Ramp	Diverge	35	45.0	F
Northbound On-Ramp	Merge	35	42.6	F
Southbound Off-Ramp	Diverge	35	34.6	D
Southbound On-Ramp	Merge	35	36.8	E
State Route 99 Avenue 48 Interchange				
Northbound Off-Ramp	Diverge	35	45.5	F
Northbound On-Ramp	Merge	35	42.6	F
Southbound Off-Ramp	Diverge	35	35.7	E
Southbound On-Ramp	Merge	35	38.4	E
State Route 99 Avenue 24 Interchange				
Northbound Off-Ramp	Diverge	35	45.8	F
Northbound On-Ramp	Merge	35	43.4	F
Southbound Off-Ramp	Diverge	35	38.2	E
State Route 99 Avenue 16 Interchange				
Southbound Off-Ramp	Diverge	35	35.9	E
Southbound On-Ramp	Merge	35	35.1	E

[1] *Represents passenger cars per mile per lane*

v/c>1 indicates saturated conditions on the facility and demand volume exceeding capacity

5- 2030 Mitigation Analysis

V. 2030 Mitigation Analysis

- **2030 Mitigation Mainline and Ramp Junctions Analysis**

This section shows the State Route 99 mainline segments and ramps analyzed for 2030 in both AM and PM peak hour with the results of mitigating the route to a 3 lane highway in both directions from the Tulare County line in the south to Avenue 184 at the north. The methodology used for determining the LOS and other key performance indicators for the 2030 mitigation mainline and ramps analysis was the same as that used for the 2019 analysis, with the exceptions that base free-flow speeds on a 3 lane highway are estimated at 67 MPH as opposed to 65.5 MPH on a two lane highway. The same 2% growth in volume was assumed as for the 2 lane 2030 analysis, and truck total percentages were assumed to be the same 25.36% as for the two lane analysis.

The results of the 2030 analysis are presented in **Tables 9** through **11**.

- **Results of 2030 Mitigation Mainline and Ramp Analysis**

The results of freeway mainline and ramp analysis for the 2030 mitigation to 6 lanes indicate that all facilities would be operating at acceptable levels of service for the AM and PM peak hour periods.

Table 9
2030 Mitigation Analysis
State Route 99 Mainline Level of Service
AM Peak Hour

2030 Mainline Segment (From/To) 3 Lanes	AM Peak Hour			
	North Bound Volume	North Bound LOS	South Bound Volume	South Bound LOS
County Line to Avenue 24	2713	C	2790	C
Avenue 24 to Avenue 48	2841	C	2863	C
Avenue 48 to Avenue 56	2046	B	2855	C
Avenue 56 to Avenue 72	1959	B	2638	C
Avenue 72 to Avenue 80	1852	B	2405	B
Avenue 80 to Avenue 96	1759	B	2380	B
Avenue 96 to Avenue 100	1820	B	2277	B
Avenue 100 to Avenue 104 (Park)	1943	B	2436	C
Avenue 104 to Avenue 120	2049	B	2575	C
Avenue 120 to Avenue 144	2104	B	2584	C
Avenue 144 to Avenue 152	2232	B	2681	C
Avenue 152 to Avenue 184	2363	B	2777	C

Table 10
2030 Mitigation Analysis
State Route 99 Mainline Level of Service
PM Peak Hour

2030 Mainline Segment (From/To) 3 Lanes	PM Peak Hour			
	North Bound Volume	North Bound LOS	South Bound Volume	South Bound LOS
County Line to Avenue 24	3620	D	2658	C
Avenue 24 to Avenue 48	3535	C	2971	C
Avenue 48 to Avenue 56	3518	C	2709	C
Avenue 56 to Avenue 72	3377	C	2671	C
Avenue 72 to Avenue 80	3194	C	2610	C
Avenue 80 to Avenue 96	3162	C	2682	C
Avenue 96 to Avenue 100	3147	C	2636	C
Avenue 100 to Avenue 104 (Park)	3151	C	2561	C
Avenue 104 to Avenue 120	3119	C	2453	B
Avenue 120 to Avenue 144	3143	C	2484	B
Avenue 144 to Avenue 152	3282	C	2593	C
Avenue 152 to Avenue 184	3414	C	2710	C

Table 11
2030 Mitigation Analysis
State Route 99 Ramp Junction Level of Service

Ramp Junctions	Ramp	Peak Hour Speed (mph)	Peak Hour Density[1] (pc/mi/ln)	Peak Hour LOS
State Route 99 Avenue 184 Interchange				
Northbound Off-Ramp	Diverge	35	26.8	C
Northbound On-Ramp	Merge	35	24.3	C
Southbound Off-Ramp	Diverge	35	24.1	C
Southbound On-Ramp	Merge	35	21.8	C
State Route 99 Avenue 152 Interchange				
Northbound Off-Ramp	Diverge	35	28.2	D
Northbound On-Ramp	Merge	35	26.7	C
Southbound Off-Ramp	Diverge	35	24.1	C
Southbound On-Ramp	Merge	35	20.7	C
State Route 99 State Route 190 Interchange				
Northbound Off-Ramp	Diverge	35	27.1	C
Northbound On-Ramp	Merge	35	24.7	C
Southbound Off-Ramp	Diverge	35	23.7	C
Southbound On-Ramp	Merge	35	20.9	C
State Route 99 Avenue 120 Interchange				
Northbound Off-Ramp	Diverge	35	26.4	C
Northbound On-Ramp	Merge	35	25.1	C
Southbound Off-Ramp	Diverge	35	23.1	C
Southbound On-Ramp	Merge	35	20.4	C
State Route 99 Road 104 Interchange				
Northbound Off-Ramp	Diverge	35	26.5	C
Northbound On-Ramp	Merge	35	23.7	C
State Route 99 Main Street Interchange				
Southbound Off-Ramp	Diverge	35	23.7	C
State Route 99 Avenue 100 Interchange				
Southbound Off-Ramp	Diverge	35	23.5	C
Northbound Off-Ramp	Diverge	35	26.7	C
State Route 99 Avenue 96 Interchange				
Northbound Off-Ramp	Diverge	35	27.7	C
Northbound On-Ramp	Merge	35	25.3	C
Southbound Off-Ramp	Diverge	35	23.6	C
Southbound On-Ramp	Merge	35	22.3	C

Table 11 (Cont.)
2030 Mitigation Analysis
State Route 99 Ramp Junction Level of Service

Ramp Junctions	Ramp	Peak Hour Speed (mph)	Peak Hour Density[1] (pc/mi/ln)	Peak Hour LOS
State Route 99 Avenue 80 Interchange				
Northbound On-Ramp	Merge	35	23.1	C
Southbound Off-Ramp	Diverge	35	23.7	C
State Route 99 Avenue 72 Interchange				
Northbound Off-Ramp	Diverge	35	28.5	D
Southbound Off-Ramp	Diverge	35	22.0	C
Southbound On-Ramp	Merge	35	21.9	C
State Route 99 Front Street Interchange				
Southbound Off-Ramp	Diverge	35	24.1	C
State Route 99 State Avenue 56 Interchange				
Northbound Off-Ramp	Diverge	35	29.6	D
Northbound On-Ramp	Merge	35	27.0	C
Southbound Off-Ramp	Diverge	35	23.6	C
Southbound On-Ramp	Merge	35	23.5	C
State Route 99 Avenue 48 Interchange				
Northbound Off-Ramp	Diverge	35	30.2	D
Northbound On-Ramp	Merge	35	26.2	C
Southbound Off-Ramp	Diverge	35	23.8	C
Southbound On-Ramp	Merge	35	24.5	C
State Route 99 Avenue 24 Interchange				
Northbound Off-Ramp	Diverge	35	29.5	D
Northbound On-Ramp	Merge	35	26.8	C
Southbound Off-Ramp	Diverge	35	25.6	C
State Route 99 Avenue 16 Interchange				
Southbound Off-Ramp	Diverge	35	24.2	C
Southbound On-Ramp	Merge	35	22.1	C

[1] *Represents passenger cars per mile per lane*

v/c>1 indicates saturated conditions on the facility and demand volume exceeding capacity

6- 2042 Operations Analysis

VI. 2042 Operations Analysis

- **2042 Intersections, Mainline and Ramp Junction Analysis**

The methodology used for determining the LOS and other key performance indicators for the 2042 intersections, mainline and ramps analyses was the same as that used for the 2019 analyses. Truck volumes, used for the Heavy Vehicle Adjustment parameter, were calculated by applying a trending factor to current and historic truck volumes provided by Caltrans. The trended Heavy Vehicle parameter for 2042 is 27.86%. All other parameters remained the same as for 2019.

2042 freeway mainline volumes were calculated by applying the 2% annual compounding factor to current and historical volumes provided by Caltrans. Understanding that the arterials immediately adjacent to State Route 99 will be affected by the inter-regional traffic on the route, turning movement volumes for the 2042 intersections analyses were calculated by applying current volumes using a factor of the compounded growth rate on SR-99 of 2% weighted by Tulare County's growth rate of 1.3%, resulting in an annual increase in ramp and associated intersection volumes of 1.39%. The weighted growth calculation is based on the assumption, that in a rural area with minimal land use changes, traffic would not increase beyond this level for the foreseeable future.

Turning movement volumes were entered into HCS 7 as previously described to calculate the future LOS and intersection delay times. ***Figure 4*** shows the projected 2042 turning movement volumes based on the weighted calculation. The results of the 2042 analyses are presented in **Tables 12** through **15**.

- **Results of 2042 Intersections, Mainline and Ramp Junction Analysis**

The analyses shows that all intersections within the study area are projected to operate within acceptable LOS for the PM peak hour in 2042, with exception of the following:

Front Street @ SR 99 southbound off ramp projected LOS "F" (PM Peak Hour)
Avenue 56 @ SR 99 southbound ramps projected LOS "E" (PM Peak Hour)

The analyses also shows that all mainline facilities are projected to operate at unacceptable LOS for peak hour in 2042. This means that demand on the freeway facilities will exceed capacity by 2042.

SR-99 northbound, County Line to Avenue 24 projected LOS "F" (AM&PM Peak Hour)

SR-99 northbound, Avenue 24 to Avenue 48 projected LOS "F" (AM&PM Peak Hour)

SR-99 northbound, Avenue 48 to Avenue 56 projected LOS "F" (PM Peak Hour)

SR-99 northbound, Avenue 56 to Avenue 72 projected LOS "F" (PM Peak Hour)

SR-99 northbound, Avenue 72 to Avenue 80 projected LOS "F" (PM Peak Hour)

SR-99 northbound, Avenue 80 to Avenue 96 projected LOS "F" (PM Peak Hour)

SR-99 northbound, Avenue 96 to Avenue 100 projected LOS "F" (PM Peak Hour)

SR-99 northbound, Avenue 100 to Avenue 104 projected LOS "F" (PM Peak Hour)

SR-99 northbound, Avenue 104 to Avenue 120 projected LOS "F" (PM Peak Hour)

SR-99 northbound, Avenue 120 to Avenue 144 projected LOS "F" (PM Peak Hour)

SR-99 northbound, Avenue 144 to Avenue 152 projected LOS "F" (PM Peak Hour)

SR-99 northbound, Avenue 152 to Avenue 184 projected LOS "F" (AM&PM Peak Hour)

SR-99 southbound, Avenue 24 to County Line projected LOS "F" (AM&PM Peak Hour)

SR-99 southbound, Avenue 48 to Avenue 24 projected LOS "F" (AM&PM Peak Hour)

SR-99 southbound, Avenue 56 to Avenue 48 projected LOS "F" (AM&PM Peak Hour)

SR-99 southbound, Avenue 72 to Avenue 56 projected LOS "F" (AM&PM Peak Hour)

SR-99 southbound, Avenue 80 to Avenue 72 projected LOS "F" (AM&PM Peak Hour)

SR-99 southbound, Avenue 96 to Avenue 80 projected LOS "F" (AM&PM Peak Hour)

SR-99 southbound, Avenue 100 to Avenue 96 projected LOS "F" (AM&PM Peak Hour)

SR-99 southbound, Avenue 104 to Avenue100 projected LOS "E" (AM&PM Peak Hour)

SR-99 southbound, Avenue 120 to Avenue104 projected LOS "E" (AM&PM PeakHour)

SR-99 southbound, Avenue 144 to Avenue120 projected LOS "E" (AM&PM Peak Hour)

SR-99 southbound, Avenue 152 to Avenue144 projected LOS "F" (AM&PM Peak Hour)

SR-99 southbound, Avenue 184 to Avenue 152 projected LOS "F" (AM&PM Peak Hour)

The analyses also shows that all ramp facilities in the study area are projected to operate at LOS E or worse by 2042. This means that demand on the freeway facilities will exceed capacity by 2042.

Avenue 16 @SR 99 southbound off ramp projected LOS "F" (AM Peak Hour)

Avenue 16 @SR 99 southbound on ramp projected LOS “F” (AM Peak Hour)
Avenue 24 @SR 99 southbound off ramp projected LOS “F” (PM Peak Hour)
Avenue 24 @SR 99 northbound on ramp projected LOS “F” (PM Peak Hour)
Avenue 24 @SR 99 northbound off ramp projected LOS “F” (PM Peak Hour)
Avenue 48 @SR 99 southbound on ramp projected LOS “F” (AM Peak Hour)
Avenue 48 @SR 99 southbound off ramp projected LOS “F” (AM Peak Hour)
Avenue 48 @SR 99 northbound on ramp projected LOS “F” (PM Peak Hour)
Avenue 48 @SR 99 northbound off ramp projected LOS “F” (PM Peak Hour)
Avenue 56 @SR 99 northbound on ramp projected LOS “F” (PM Peak Hour)
Avenue 56 @SR 99 northbound off ramp projected LOS “F” (PM Peak Hour)
Avenue 56 @SR 99 southbound on ramp projected LOS “F” (AM Peak Hour)
Avenue 56 @SR 99 southbound off ramp projected LOS “E” (AM Peak Hour)
Front Street @SR 99 southbound off ramp projected LOS “E” (PM Peak Hour)
Avenue 72 @SR 99 northbound off ramp projected LOS “F” (PM Peak Hour)
Avenue 72 @SR 99 southbound on ramp projected LOS “E” (PM Peak Hour)
Avenue 72 @SR 99 southbound off ramp projected LOS “E” (PM Peak Hour)
Avenue 80 @SR 99 northbound on ramp projected LOS “F” (PM Peak Hour)
Avenue 80 @SR 99 southbound off ramp projected LOS “E” (PM Peak Hour)
Avenue 96 @SR 99 northbound on ramp projected LOS “F” (PM Peak Hour)
Avenue 96 @SR 99 northbound off ramp projected LOS “F” (PM Peak Hour)
Avenue 96 @SR 99 southbound on ramp projected LOS “F” (PM Peak Hour)
Avenue 96 @SR 99 southbound off ramp projected LOS “E” (PM Peak Hour)
Avenue 100 @SR 99 northbound off ramp projected LOS “F” (PM Peak Hour)
Avenue 100 @SR 99 southbound off ramp projected LOS “E” (PM Peak Hour)
Main Street @SR 99 southbound off ramp projected LOS “E” (AM peak Hour)
Avenue 104 @SR 99 northbound on ramp projected LOS “E” (PM Peak Hour)
Avenue 104 @SR 99 northbound off ramp projected LOS “E” (PM Peak Hour)
Avenue 120 @SR 99 northbound on ramp projected LOS “F” (PM Peak Hour)
Avenue 120 @SR 99 northbound off ramp projected LOS “F” (PM Peak Hour)
Avenue 120 @SR 99 southbound on ramp projected LOS “E” (AM Peak Hour)
Avenue 120 @SR 99 southbound off ramp projected LOS “E” (AM Peak Hour)

Avenue 144 @SR 99 northbound on ramp projected LOS “F” (PM Peak Hour)

Avenue 144 @SR 99 northbound off ramp projected LOS “F” (PM Peak Hour)

Avenue 144 @SR 99 southbound on ramp projected LOS “E” (AM Peak Hour)

Avenue 144 @SR 99 southbound off ramp projected LOS “E” (AM Peak Hour)

Avenue 152 @SR 99 northbound on ramp projected LOS “F” (PM Peak Hour)

Avenue 152 @SR 99 northbound off ramp projected LOS “F” (PM Peak Hour)

Avenue 152 @SR 99 southbound on ramp projected LOS “E” (AM Peak Hour)

Avenue 152 @SR 99 southbound off ramp projected LOS “F” (AM Peak Hour)

Avenue 184 @SR 99 northbound on ramp projected LOS “F” (PM Peak Hour)

Avenue 184 @SR 99 northbound off ramp projected LOS “F” (PM Peak Hour)

Avenue 184 @SR 99 southbound on ramp projected LOS “F” (PM Peak Hour)

Avenue 184 @SR 99 southbound off ramp projected LOS “E” (PM Peak Hour)

Figure 4

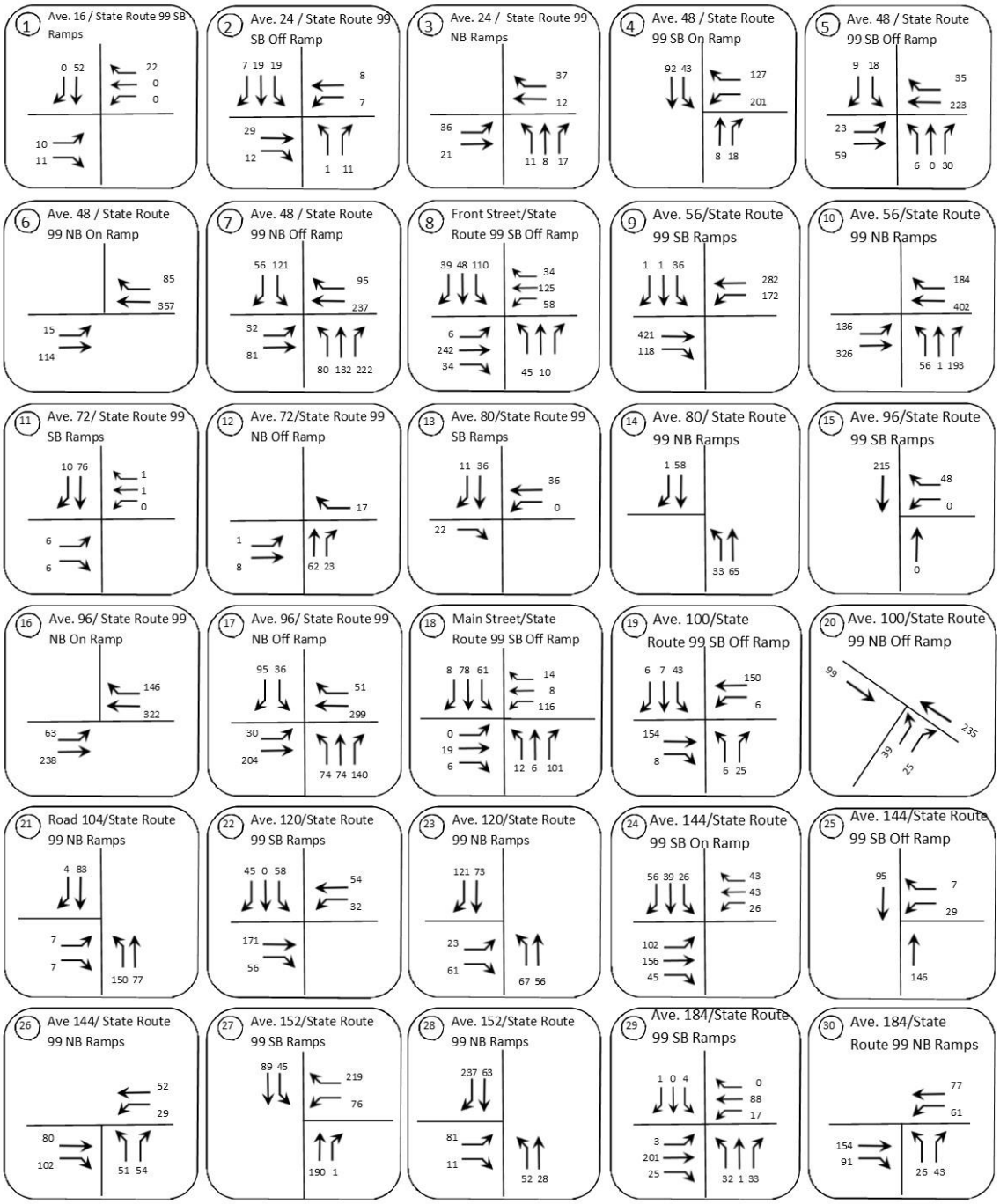


Figure 4

2042 Turning Movement Volumes

Table 12
2042 Operations
Intersection Level of Service

	Intersection	Control Type	PM Peak Hour		
			Delay (sec/veh)	LOS	Warrant Met
1	Avenue 16/State Route SB 99 Ramps	TWSC	9.0	A	N
2	Avenue 24/State Route SB 99 Off Ramp	TWSC	9.4	A	N
3	Avenue 24/State Route NB 99 Ramps	TWSC	9.6	A	N
4	Avenue 48/State Route 99 SB On Ramp	TWSC	12.3	B	N
5	Avenue 48/State Route 99 SB Off Ramp	TWSC	12.4	B	N
6	Avenue 48/State Route 99 NB On Ramp	Y	1.1	A	N
7	Avenue 48/State Route 99 NB Off Ramp	TWSC	17.6	C	N
8	Front St./State Route 99 SB Off Ramp	AWSC	54.1	F	N
9	Avenue 56/State Route 99 NB Ramps	TWSC	23.9	C	N
10	Avenue 56/State Route 99 SB Ramps	TWSC	40.8	E	N
11	Avenue 72/State Route 99 SB Ramps	TWSC	9.4	A	N
12	Avenue 72/State Route 99 NB Off Ramp	TWSC	9.6	A	N
13	Avenue 80/State Route 99 SB Off Ramp	TWSC	9.6	A	N
14	Avenue 80/State Route 99 NB On Ramp	Y	2.6	A	N
15	Avenue 96/State Route 99 SB Ramps	TWSC	8.6	A	N
16	Avenue 96/State Route 99 NB On Ramp	Y	2.4	A	N
17	Avenue 96/State Route 99 NB Off Ramp	TWSC	29.0	D	N
18	Main St./State Route 99 SB Off	TWSC	13.6	B	N
19	Avenue 100/State Route 99 SB Off Ramp	TWSC	13.5	B	N
20	Avenue 100/State Route 99 NB Off Ramp	TWSC	10.5	B	N
21	Road 104/State Route 99 NB Ramps	TWSC	11.4	B	N
22	Avenue 120/State Route 99 SB Ramps	TWSC	10.3	B	N
23	Avenue 120/State Route 99 NB Ramps	TWSC	10.0	A	N
24	Avenue 144/State Route 99 SB On Ramp	TWSC	15.9	C	N
25	Avenue 144/State Route 99 SB Off Ramp	TWSC	10.1	B	N
26	Avenue 144/State Route 99 NB Ramps	TWSC	10.1	B	N
27	Avenue 152/State Route 99 SB Ramps	TWSC	11.4	B	N
28	Avenue 152/State Route 99 NB Ramps	TWSC	11.4	B	N
29	Avenue 184/State Route 99 SB Ramps	TWSC	11.5	B	N
30	Avenue 184/State Route 99 NB Ramps	TWSC	10.7	B	N

Legend: TWSC= Two Way Stop Control
AWSC= All Way Stop Control
Y= Yield

Table 13
2042 Operations
State Route 99 Mainline Level of Service
AM Peak Hour

2042 Mainline Segment (From/To)	AM Peak Hour			
	North Bound Volume	North Bound LOS	South Bound Volume	South Bound LOS
County Line to Avenue 24	3441	F	3539	F
Avenue 24 to Avenue 48	3603	F	3631	F
Avenue 48 to Avenue 56	2595	D	3620	F
Avenue 56 to Avenue 72	2484	D	3346	F
Avenue 72 to Avenue 80	2349	D	3050	E
Avenue 80 to Avenue 96	2231	C	3019	E
Avenue 96 to Avenue 100	2308	C	2887	E
Avenue 100 to Avenue 104 (Park)	2464	D	3089	E
Avenue 104 to Avenue 120	2599	D	3265	E
Avenue 120 to Avenue 144	2668	D	3277	E
Avenue 144 to Avenue 152	2831	D	3400	F
Avenue 152 to Avenue 184	2997	E	3522	F

Table 14
2042 Operations
State Route 99 Mainline Level of Service
PM Peak Hour

2042 Mainline Segment (From/To)	PM Peak Hour			
	North Bound Volume	North Bound LOS	South Bound Volume	South Bound LOS
County Line to Avenue 24	4591	F	3370	F
Avenue 24 to Avenue 48	4483	F	3768	F
Avenue 48 to Avenue 56	4462	F	3436	F
Avenue 56 to Avenue 72	4282	F	3387	F
Avenue 72 to Avenue 80	4051	F	3310	F
Avenue 80 to Avenue 96	4010	F	3401	F
Avenue 96 to Avenue 100	3991	F	3343	F
Avenue 100 to Avenue 104 (Park)	3997	F	3248	E
Avenue 104 to Avenue 120	3956	F	3111	E
Avenue 120 to Avenue 144	3987	F	3150	E
Avenue 144 to Avenue 152	4163	F	3289	F
Avenue 152 to Avenue 184	4330	F	3437	F

Table 15
2042 Operations
State Route 99 Ramp Junction Level of Service

Ramp Junctions	Ramp	Peak Hour		
		Speed (mph)	Density[1] (pc/mi/ln)	LOS
State Route 99 Avenue 184 Interchange				
Northbound Off-Ramp	Diverge	35	53.9	F
Northbound On-Ramp	Merge	35	50.7	F
Southbound Off-Ramp	Diverge	35	45.0	F
Southbound On-Ramp	Merge	35	43.7	F
State Route 99 Avenue 152 Interchange				
Northbound Off-Ramp	Diverge	35	54.0	F
Northbound On-Ramp	Merge	35	51.9	F
Southbound Off-Ramp	Diverge	35	45.0	F
Southbound On-Ramp	Merge	35	41.8	F
State Route 99 State Route 190 Interchange				
Northbound Off-Ramp	Diverge	35	51.6	F
Northbound On-Ramp	Merge	35	50.6	F
Southbound Off-Ramp	Diverge	35	44.0	F
Southbound On-Ramp	Merge	35	41.4	F
State Route 99 Avenue 120 Interchange				
Northbound Off-Ramp	Diverge	35	50.8	F
Northbound On-Ramp	Merge	35	50.1	F
Southbound Off-Ramp	Diverge	35	42.7	E
Southbound On-Ramp	Merge	35	40.7	F
State Route 99 Road 104 Interchange				
Northbound Off-Ramp	Diverge	35	51.3	F
Northbound On-Ramp	Merge	35	48.2	F
State Route 99 Main Street Interchange				
Southbound Off-Ramp	Diverge	35	43.0	E
State Route 99 Avenue 100 Interchange				
Southbound Off-Ramp	Diverge	35	43.0	E
Northbound Off-Ramp	Diverge	35	51.4	F
State Route 99 Avenue 96 Interchange				
Northbound Off-Ramp	Diverge	35	52.2	F
Northbound On-Ramp	Merge	35	50.3	F
Southbound Off-Ramp	Diverge	35	43.8	F
Southbound On-Ramp	Merge	35	43.6	F

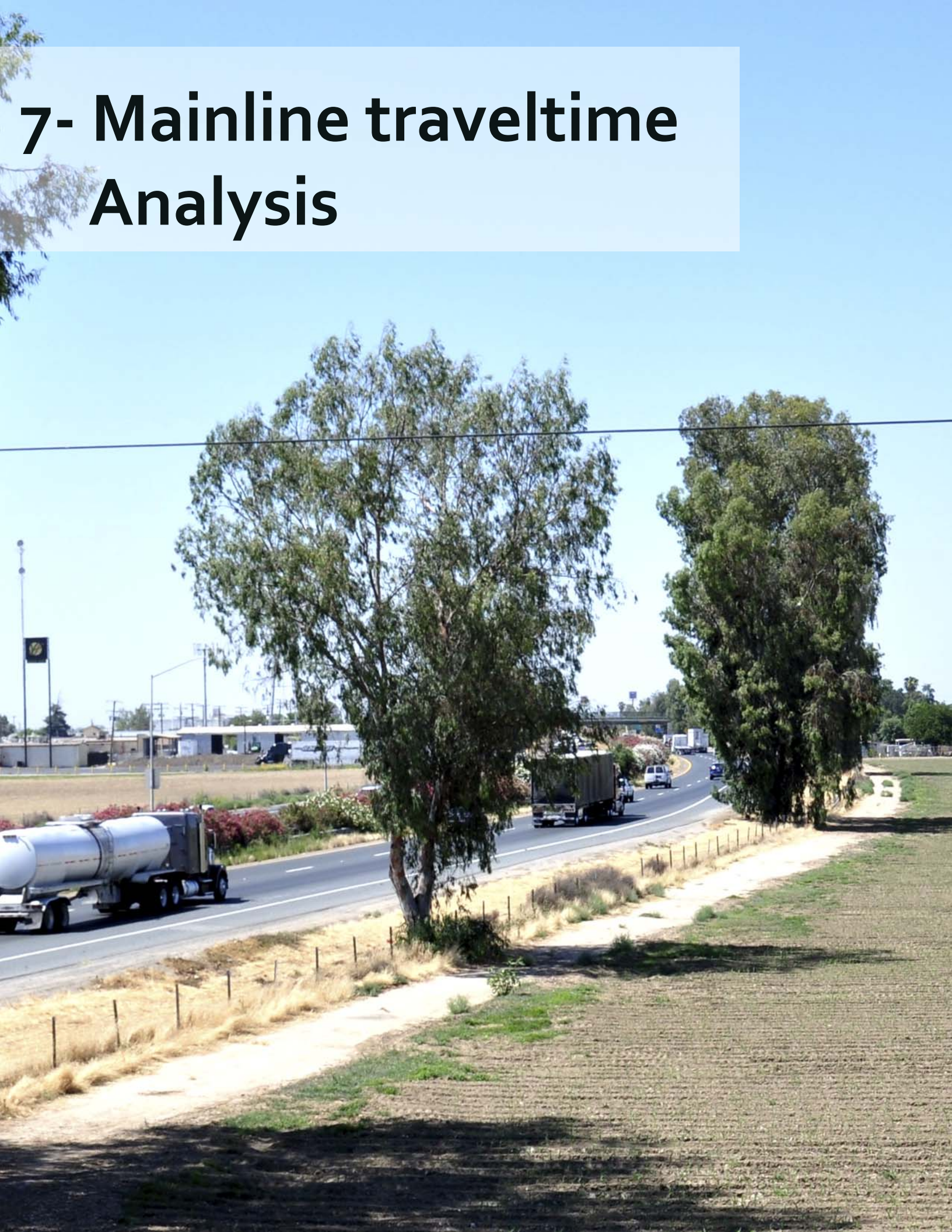
Table 15 (Cont.
2042 Operations
State Route 99 Ramp Junction Level of Service

Ramp Junctions	Ramp	Peak Hour Speed (mph)	Peak Hour Density[1] (pc/mi/ln)	Peak Hour LOS
State Route 99 Avenue 80 Interchange				
Northbound On-Ramp	Merge	35	47.8	F
Southbound Off-Ramp	Diverge	35	44.2	F
State Route 99 Avenue 72 Interchange				
Northbound Off-Ramp	Diverge	35	55.2	F
Southbound Off-Ramp	Merge	35	42.0	F
Southbound On-Ramp	Merge	35	43.2	F
State Route 99 Front Street Interchange				
Southbound Off-Ramp	Diverge	35	44.3	F
State Route 99 State Avenue 56 Interchange				
Northbound Off-Ramp	Diverge	35	57.4	F
Northbound On-Ramp	Merge	35	53.8	F
Southbound Off-Ramp	Diverge	35	44.0	F
Southbound On-Ramp	Merge	35	46.3	F
State Route 99 Avenue 48 Interchange				
Northbound Off-Ramp	Diverge	35	54.4	F
Northbound On-Ramp	Merge	35	54.0	F
Southbound Off-Ramp	Diverge	35	45.8	F
Southbound On-Ramp	Merge	35	48.3	F
State Route 99 Avenue 24 Interchange				
Northbound Off-Ramp	Diverge	35	58.5	F
Northbound On-Ramp	Merge	35	54.8	F
Southbound Off-Ramp	Diverge	35	48.7	F
State Route 99 Avenue 16 Interchange				
Southbound Off-Ramp	Diverge	35	45.7	F
Southbound On-Ramp	Merge	35	44.1	F

[1] *Represents passenger cars per mile per lane*

v/c>1 indicates saturated conditions on the facility and demand volume exceeding capacity

7- Mainline traveltime Analysis



VII. Mainline Travel Time Analysis

- **Travel Time Methodology**

TCAG obtained the Iteris Performance Measurement System (iPeMS) Travel-time application and data for July 1, 2016, thru June 30, 2018 from Iteris Inc. in order to analyze travel time data and perform studies for major travel corridors within Tulare County. Because this is the first study TCAG has conducted on this corridor using the iPeMS application, this is intended to be a base study that we can build upon for future studies to see how and where congestion and related problems are occurring, as well as how particular projects may affect congestion. The objective of the Travel Time Study is to collect travel time data that will aid TCAG and its member agencies in prioritizing and developing projects to improve congestion within Tulare County.

This study focuses on key performance measures consisting of speed and travel time. For this study the corridor from the Tulare County line to Avenue 184 was analyzed as a whole. The following time periods were studied for weekdays for the study corridor in both directions.

South bound: Avenue 184 to the South Tulare County line, morning (AM) peak period during the week, defined as 6:00 AM to 9:00 AM. This was the period of heaviest traffic in the south bound direction.

North bound: South Tulare County line to Avenue 184, evening (PM) peak period during the week, defined as 4:00 PM to 7:00 PM. This was the period of heaviest traffic in the north bound direction.

Construction activity, special events, and other factors were monitored to avoid collecting unreliable data. The travel time surveys were not conducted at any particular location under any of the following circumstances: public holidays or major local events; weeks with any public holidays; major incidents on a nearby freeway or major arterial; and school closures or minimum days.

- **Travel Time Definitions**

Class I Highway Two-lane highways that are major intercity routes, primary arterials connecting major traffic generators, daily commuter routes, or primary links in state or national

highway networks generally are assigned to Class I. Class I facilities most often serve long-distance trips or provide connecting links between facilities that serve long-distance trips.

Arterial Highway is a class of street that primarily serves through-traffic and major traffic movements.

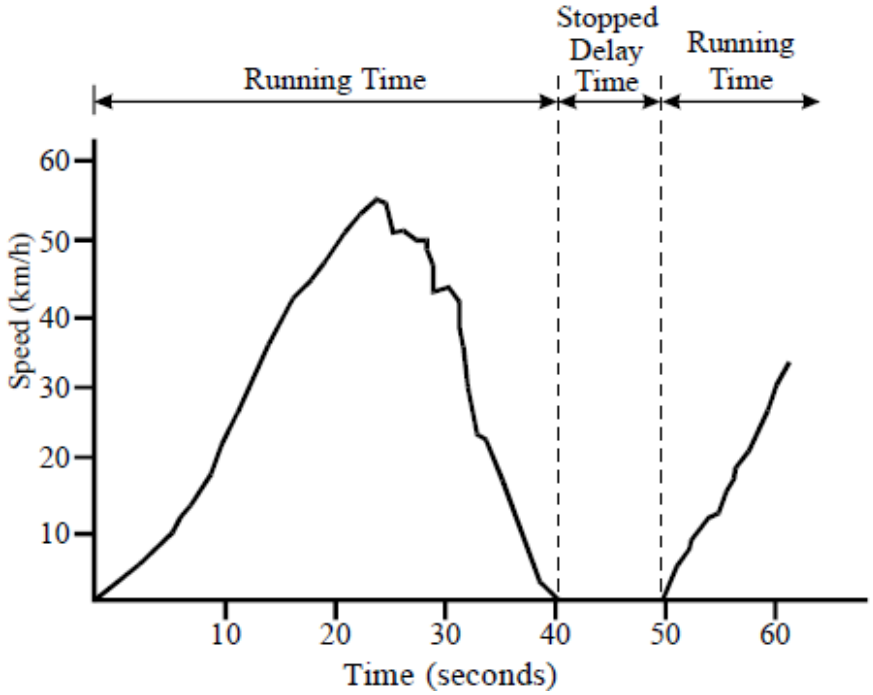
Average Distance is the average run distance of the route in miles.

Posted Speed Limit is the posted legal speed limit along the route in miles per hour.

Travel Time is broadly defined as "the time necessary to traverse a route between any two points of interest." The formula to calculate the Travel Time using distance and speed is:

$$\text{Estimated Travel Time (seconds)} = \frac{\text{Segment Length (miles)}}{\text{Time-Mean Speed (mph)}} \times (3{,}600 \text{ sec/hour})$$

Travel time is measured by traversing the route that connects any two or more points of interest.



Travel time is composed of running time, or time in which the vehicle is in motion, and stopped delay time, or time in which the vehicle is stopped (or moving sufficiently slow as to be stopped, i.e., typically less than 5 mph). The relationship between travel time and speed is illustrated in the chart below:

Average Speed is the average of speed recorded for all the travel time runs combined in mph.

Number of Stops is the number of times the vehicle speed dropped below 5 mph. Everytime the vehicle drops below 5 mph will be recorded as a stop.

Average Number of Stops is the average of the number of stops recorded for all the travel time runs combined. Source: Travel Time Data Collection Handbook

Stopped Time is the total amount of time the vehicle speed dropped below 5 mph or the vehicle came to a complete stop.

Delay Time is the amount of additional time that vehicles spend on the roadway due to congestion. Congestion is defined as speeds below a certain threshold.

Travel Time Index (TTI)[9]* Travel Time Index is defined as the ratio between travel time during peak period and the free-flow travel time. For example, a TTI value of 1.2 means travel time during peak period is 20% longer than the free-flow travel time between the same origin and destination. This report uses this definition for calculating the TTI as specified in the Travel Time Data Collection Handbook.

Annual Average Daily Traffic (AADT) are traffic volumes estimates representing the average value of daily traffic over the course of a year.

- ## Mainline Travel Time Analysis Results

Only the periods with the heaviest traffic volumes were studied for each direction. Average Speeds were lowest for the a.m. peak three hour period during the week in the south bound direction **(see Figure 5 below)**, with Average Travel Times **(Figure 6)** and Average Delay Times being the highest. High percentages of truck traffic headed to Bakersfield and Los Angeles ports in the a.m. hours are mostly responsible for the low speeds and high travel and delay times. Likewise, truck traffic returning from these areas would be mostly responsible for lower Average Speeds **(Figure 7)**, and higher Average Travel **(Figure 8)** and Delay Times, and in the north bound direction during the p.m. peak 3 hours during the week.

[9] *Source: http://www.fhwa.dot.gov/ohim/start.pdf

Figure 5
South-bound State Route 99 –
Average Speed: AM Peak Three Hours

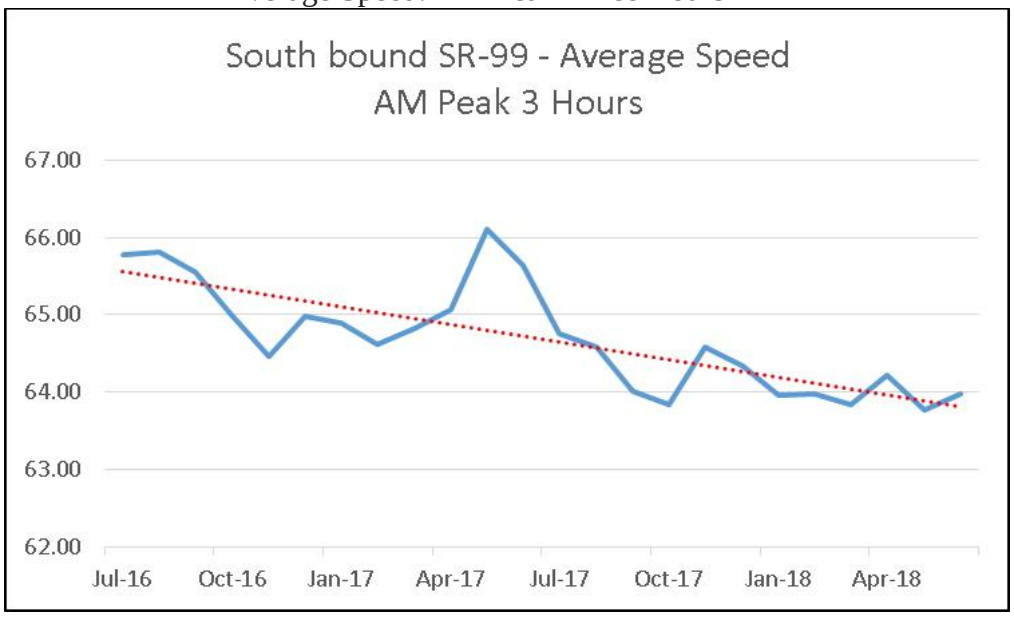


Figure 6
South-bound State Route 99 –
Average Travel Time: AM Peak Three Hours

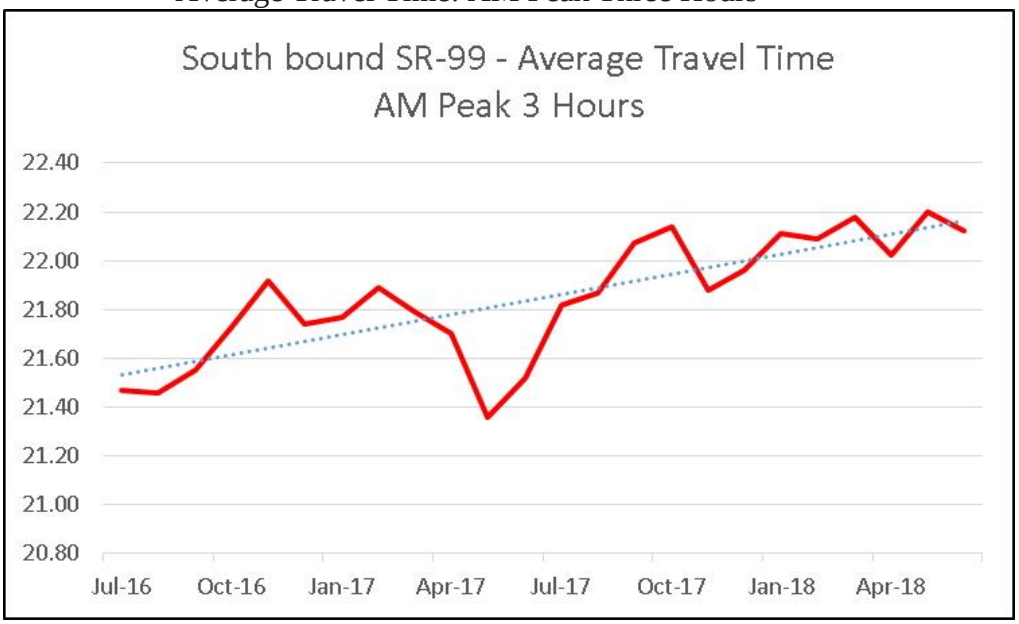


Figure 7
North-bound State Route 99 –
Average Speeds: PM Peak Three Hours

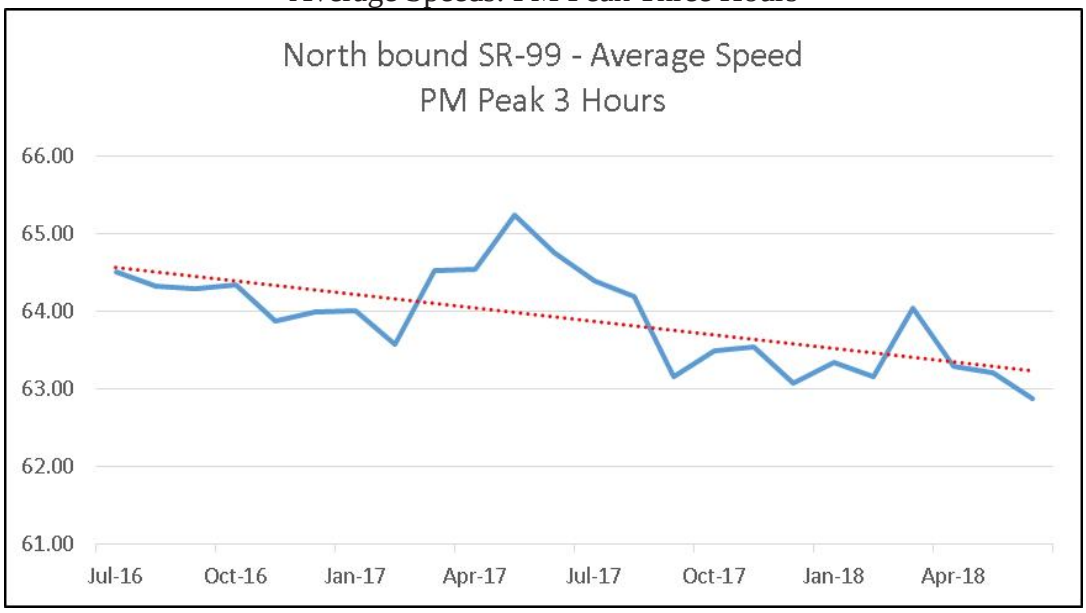
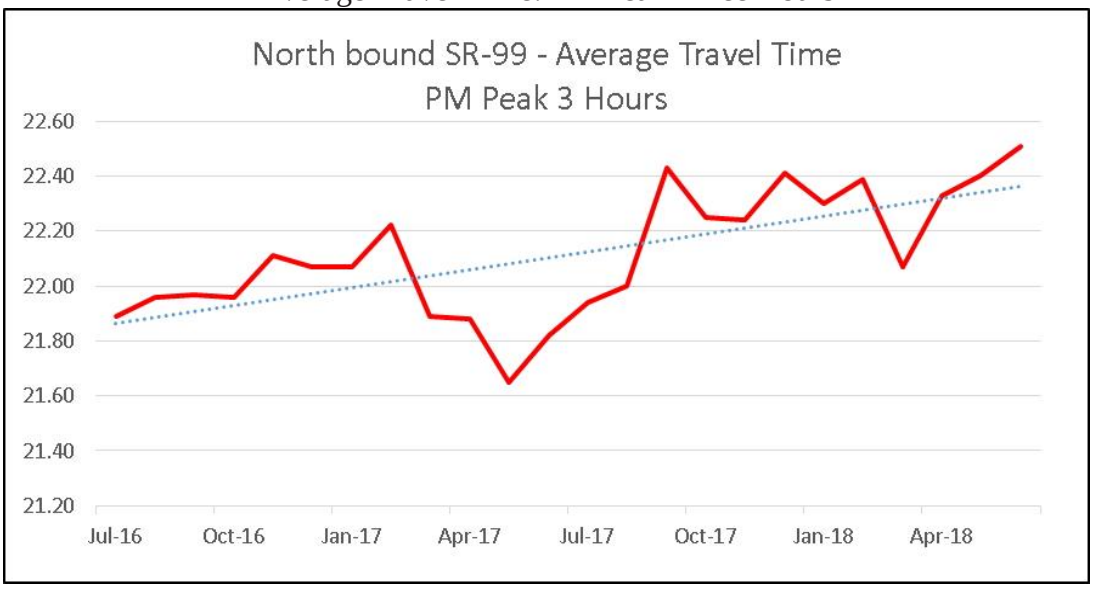


Figure 8
North-bound State Route 99 –
Average Travel Time: PM Peak Three Hours



- This section of SR-99 corridor shows increased travel times and lower speeds during the south bound a.m. peak three hour and north bound p.m. peak three hour periods.

- Analysis of the study segments shows that these higher south bound a.m. peak 3 hour Average Travel Times and lower Average Speeds are consistent with higher Average Congested Times and greater Delay Times during this period **(Tables 16 and 17)**. The analysis also shows that these higher north bound p.m. peak 3 hour Average Travel Times and lower Average Speeds are consistent with higher Average Congested Times and greater Delay Times during this period.

Table 16
South bound
AM Peak Three Hours
Avg Speed & Ave TT

	Avg Spd	Avg TT
Jul-16	65.77	21.47
Aug-16	65.81	21.46
Sep-16	65.55	21.55
Oct-16	64.99	21.73
Nov-16	64.46	21.92
Dec-16	64.98	21.74
Jan-17	64.90	21.77
Feb-17	64.62	21.89
Mar-17	64.83	21.79
Apr-17	65.07	21.70
May-17	66.11	21.36
Jun-17	65.63	21.52
Jul-17	64.75	21.82
Aug-17	64.58	21.87
Sep-17	64.01	22.07
Oct-17	63.83	22.14
Nov-17	64.58	21.88
Dec-17	64.33	21.96
Jan-18	63.95	22.11
Feb-18	63.98	22.09
Mar-18	63.84	22.18
Apr-18	64.22	22.02
May-18	63.76	22.20
Jun-18	63.97	22.12

Table 17
North bound
PM Peak Three Hours
Avg Speed & Ave TT

	Avg Spd	Avg TT
Jul-16	64.51	21.89
Aug-16	64.32	21.96
Sep-16	64.28	21.97
Oct-16	64.34	21.96
Nov-16	63.88	22.11
Dec-16	63.99	22.07
Jan-17	64.01	22.07
Feb-17	63.58	22.22
Mar-17	64.52	21.89
Apr-17	64.54	21.88
May-17	65.23	21.65
Jun-17	64.75	21.82
Jul-17	64.38	21.94
Aug-17	64.18	22.00
Sep-17	63.15	22.43
Oct-17	63.49	22.25
Nov-17	63.54	22.24
Dec-17	63.07	22.41
Jan-18	63.34	22.30
Feb-18	63.16	22.39
Mar-18	64.03	22.07
Apr-18	63.29	22.33
May-18	63.20	22.40
Jun-18	62.87	22.51

Due to consistent characteristics of the entire length of the study area in both directions, peak 3 hour travel times are similar in each direction. Although, Average Speeds are consistently about 1 mile per hour slower in the north bound peak than the south bound peak, indicating slightly higher congestion in the north bound peak hour.

Considering the purposes of the segments in this study, congestion does not seem to be a serious issue at this time, however the trend line shows that it may become an issue in the future.

Trending the data out to the year 2030 shows Average Speeds for the north bound p.m. peak three hours down to 55.34 mph, and Average Travel Time up to 25.48 minutes, and Average Speeds for the south bound a.m. peak three hours down to 54.06 mph and Average Travel Time up to 26.08 minutes. This would indicate that while traffic congestion in the south bound peak hour lanes are currently better than the north bound peak hour, the south bound congestion is increasing faster than that of the north bound peak.

We need to consider though, that we are only trending out 24 months of data. This is not enough data to come to any solid conclusions regarding travel time and average speed, although the operational analysis does support the trend.

8- Mainline crash Analysis

VIII. Mainline Crash Analysis

This chapter analyzes crash data for the study corridor from the TIMS database.

- **Descriptive statistics of crash data**

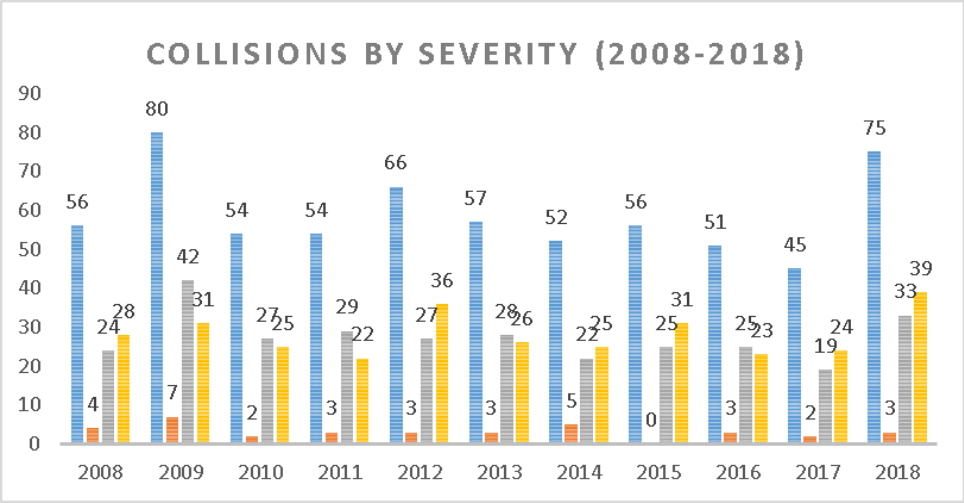
The first analysis sought to identify collisions by severity during the last 10 year period (2008 to 2018). As illustrated below in the Table18 and Figure 9, during this period, there were 646 reported crashes. Fatal injury was 5.4 percent of all injuries.

About 40 percent were "hit object" collisions, also called "run-off-the-road" crashes. Rear - end collisions (20%), typically associated with congestion, were the next common type of accidents. Nearly 8 percent of all crashes involved heavy vehicles.

Table 18
Collisions by Severity (2008-2018)

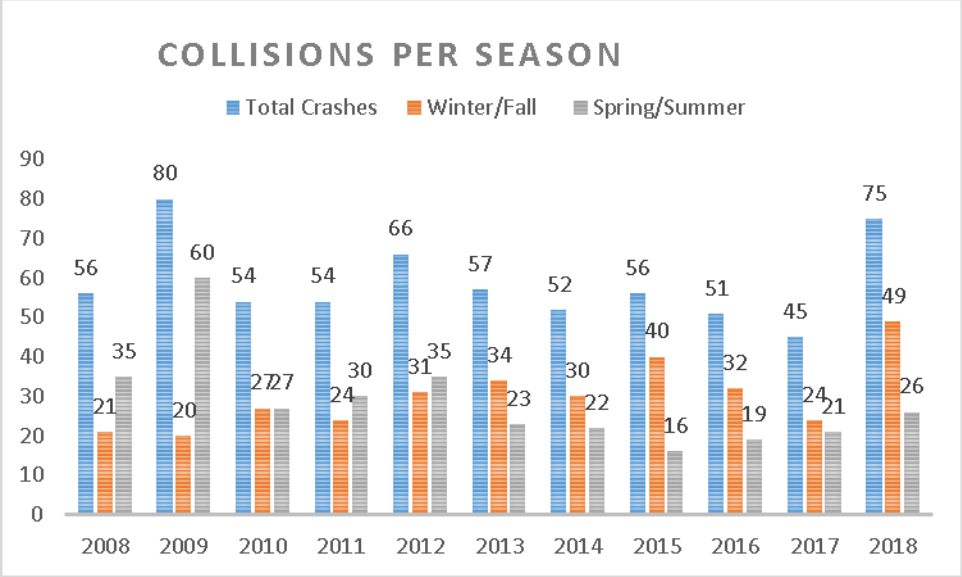
Collisions by Severity (2008-2018)				
Year	Total Crashes	Fatal Crash	Injury Crash	Property Damage Only
2008	56	4	24	28
2009	80	7	2	31
2010	54	2	27	25
2011	54	3	29	22
2012	66	3	27	36
2013	57	3	28	26
2014	52	5	22	25
2015	56	0	25	31
2016	51	3	25	23
2017	45	2	19	24
2018	75	3	33	39
TOTAL	646	35	261	310

Figure 9
Collisions by severity



Yearly distribution of the number of cases indicates that accidents are more likely to occur during fall and winter seasons (Figure 10).

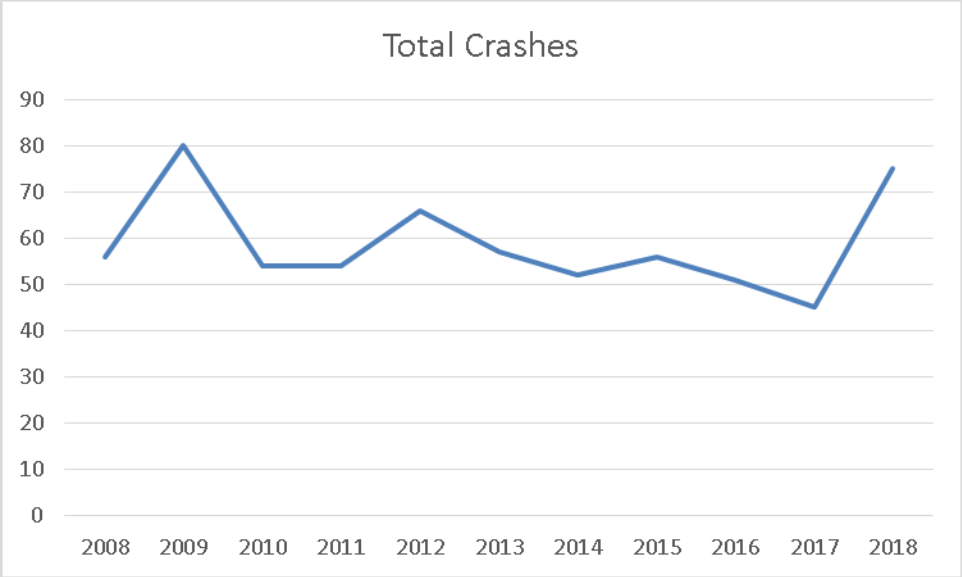
Figure 10
Collisions per season



There appears to be a slight increase in the frequency of accidents from 2008 to 2018 (See Figure 11 below) The number of total collisions in 2018 nearly doubled in comparison to the prior years when the accident had remained relatively flat. The increase could be related to a growing congestion, as traffic volumes in 2018 were noted as the highest since 2009. However,

considering that year 2019 includes only a few months of data, there is not enough information to come to any solid conclusions regarding a trend of accident rates going up.

Figure 11
Total Crashes over 10 Year period



Crash characteristics could also be related to the configuration of the highway. The SR 99 was designed in the late 1950's and constructed in the early1960's. The existing structures trough "S-Curves" were designed for much lower speeds (45 miles per hour), which is below current design standards requiring a 60 miles per hour design speed, 12' travel lanes, a 6 foot left shoulder and 10 foot right shoulder. On ramps and off ramps were designed with acceleration lane lengths between 540 and 680 feet and lane tapers of 1:18 occurring at the last 225 feet. This is well below current standards requiring lane lengths of at least 1300 feet and tapers 1:50 utilizing the lanes entire length.

- ## Comparison to Average

As presented in the Table 19 below, the calculated collision rates for the study segment are higher than collision rates on the SR 99 in Caltrans District 6 jurisdiction (Counties of Fresno, Madera, Kern and Tulare, or for the entire length of SR 99 within Tulare County.

Table 19
Collision rates

Collision rates Compared to District 6 and Tulare County Average on SR 99 (per million VMT)						
Year	All District 6	Rate	All Tulare County	Rate	**South Tulare County (Study Segment)**	**Rate**
2010	765	0.189	142	0.152	**54**	**0.089**
2012	802	0.196	172	0.182	**66**	**0.126**
2014	669	0.159	145	0.138	**52**	**0.185**
2015	752	0.168	157	0.140	**56**	**0.227**
Total	2988	0.044	616	0.040	**228**	**0.038**

Average rates were calculated by using formula below:

$$R = \frac{Accidents * 106}{(365)(T)(VMT)}$$

R = Accident Rate

T = Period of Study (Years)

VMT = Vehicle Miles Traveled (Daily)

9- Findings & Recommendations

IX. Findings and Recommendations

Existing (2019) Operations Analysis: 2019 intersections analysis shows that all intersections are working at an acceptable LOS during the PM peak 3 hour period. 2019 Mainline analysis shows that all sections of SR 99 mainline are operating at acceptable LOS during both AM and PM peak hour periods, in both north and south directions. However, it is important to note that all sections of the north bound direction during the PM peak 3 hour period consistently scored LOS D. Likewise, several ramp junctions in the north bound direction failed with an LOS of E. These were mostly in the southern-most part of the study area, and likely due to high heavy vehicle volumes, and/or shorter acceleration and deceleration lanes. Poor LOS scores of ramp junctions can contribute to early failure of the mainline section adjacent to them. TCAG recommends further engineering studies of those ramp junctions that failed.

2030 Operations Analysis: 2030 mainline analysis shows that while both directions of travel have acceptable LOS during the AM peak 3 hour period, the increasing passenger car and heavy vehicle volumes, as well as outdated ramp junctions are causing the north bound lanes to begin failing during the PM peak 3 hours. While only one segment is failing on the south bound side, the poor LOS scores for most of the ramp junctions in both directions would likely make the mainline worse. TCAG recommends further engineering study of the mainline and ramps for the entire study area.

2030 Mitigation Analysis: 2030 mainline mitigation analysis (widening to 3 lanes in each direction) reduces the lane densities of each lane, easing congestion and allowing for increased free-flow speeds of 67 mph. Both AM and PM peak 3 hour periods score favorable LOS scores (B's and C's), with the only exception being the north bound section just north of the county line, which scores a D. The redesign of ramps that would likely accompany such a widening project would only help the LOS.

2042 Operations Analysis: The 2042 intersection analysis shows that all intersections with the exception of the two listed below, would operate at acceptable levels.

Front Street @ SR 99 south bound off ramp
Avenue 56 @ SR 99 south bound ramps

The 2042 mainline and ramp analysis shows that the demand created by steadily increasing car and heavy vehicle volumes, as well as outdated ramp junctions, would exceed capacity on all facilities by 2042. TCAG recommends further engineering study, and upon corroboration of conditions, seeking funding to improve future congestion problems.

Mainline Travel Time Analysis: With only 24 months of data available, there is not enough data to come to any solid conclusions regarding Travel Time, or Average Speeds on the SR 99 corridor. However, when this data is trended it points in the same direction as the operations analyses above. Both the AM and PM peak 3 hours, in both north and south bound directions show increasing Travel Times over the length of the corridor as well as decreasing Average Speeds.

Safety Analysis:

California Route 99, despite being a relatively shorter highway, had the most fatal accidents per 100 miles of any highway in the nation *https://www.valuepenguin.com/most-dangerous-roads-america*. The state route which cuts up the center of California had a total of 264 fatal accidents between the years 2011 and 2015 and it was named the most Dangerous Road in U.S, scored the highest in the category for the "Darkest Highways" [10] and received a second place "highways with the drunk drivers" [11] category. In this report, statistics on accident data for the corridor study segment were presented. Data was grouped in one year increments for the last 10 year period and segregated by accident severity and type. Safety analysis findings of data supplied by Caltrans, for the SR 99 corridor by TCAG staff were inconclusive.

[10] https://www.valuepenguin.com/most-dangerous-roads-america
[11] https://www.valuepenguin.com/most-dangerous-roads-america