Reverse Triangle Transportation Area Plan

Existing Conditions Intersection Operations Analysis

Prepared for:

Fresno Council of Governments

Draft for Review

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REVERSE TRIANGLE
TRANSPORTATION AREA PLAN

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1. Introduction

The Fresno Council of Governments (FCOG), in partnership with City of Fresno and County of Fresno has retained GHD to study the impacts from the industrial growth in the Industrial Triangle, or commonly known as the Reverse Triangle areas. The Study Area bounded by State Route 41 (SR-41) to the west, State Route 99 (SR-99) to the east, Church Avenue at the north and Adams Avenue to the south makes up the primary project area. Figure 1 presents the Study Area Map.

This south Fresno region encompasses approximately a 12,000 acres of area and is home to an Amazon e-commerce distribution center, Ulta distribution center and is experiencing new investment and economic growth in the public and private sector. The area is also the potential location for the California High Speed Rail Heavy Maintenance Facility.

GHD has prepared this Existing Conditions (2109) Intersection Operations Analysis (IOA) as part of the data collection process to analyze critical intersections and road segments approved by member agencies, namely the City and County of Fresno and Caltrans. This IOA focuses only on traffic conditions; other mode alternatives modes of travel (pedestrian/bicycle/transit/rail) will be discussed in detail in a separate upcoming report entitled Transportation Impacts Analysis Report (TIAR). The TIAR will also develop projections for a future year analyses and identify potential solutions, complete with planning level cost estimates, benefit/cost (B/C) calculations and prioritized improvements.

FIGURE 1

CITY OF FRESNO

CALWA

MALAGA

EASTON

FOWLER

99

41

Church Ave

Jensen Ave

North Ave

Central Ave

Muscat Ave

Malaga Ave

Minnewawa Ave

American Ave

Jefferson Ave

Lincoln Ave

Clayton Ave

Adams Ave

Sumner Ave

Elm Ave

Cherry Ave

East Ave

Orange Ave

Cedar Ave

Maple Ave

Chestnut Ave

Willow Ave

Peach Ave

Villa Ave

Kenneth Ave

Clovis Ave

Fresno County

Study Area

State Route (Freeway)
Roads
Rail
Fresno County
City of Fresno (city limits)
Sphere of Influence Boundary
Triangle Industrial Study Area
HSR_Maintenance Facility
Fire Station #89
Cherry Avenue Auction
Orange Elementary
Ulta Distribution Center
Amazon Distribution Center

N

0 0.25 0.5 0.75 1

Miles

REVERSE TRIANGLE
TRANSPORTATION AREA PLAN

Study Area Map

Project No. 11192258

Date 6/12/2019

Fresno Council of Governments

GHD

L:\Prj2618\G2618\Maps\Working\Study Area Map.mxd
Print date: 14 Jun 2019 - 08:06

Paper Size ANSI B (portrait)

Data source: GHD 2019, Fresno County Public GIS data, City of Fresno Public GIS data, Caltrans Public GIS data. Created by: jramirez2

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California IV FIPS 0404 Feet

2. Project Setting

The following section provides an overview of the roadway circulations setting and study roadways.

2.1 Roadway Circulation Setting

The following roadways provide primary circulation within the Study Area. The following roadway characteristics were attained using FCOG and Fresno County shape file attributes. Figure 2 identifies road classification, speed limit and truck routes within the Study Area.

North – South Alignment

State Route 99 (SR-99) is a major north-south freeway from Bakersfield, CA to Sacramento, CA. Within the study area, SR-99 is a 6-lane divided freeway with a 65 mph posted speed limit. SR-99 is a major good movement corridor.

State Route 41 (SR-41) is a major north-south freeway. Within the study area, SR-41 is a 4-lane divided freeway with a maximum 65 mph posted speed limit. SR-41 is a major good movement corridor.

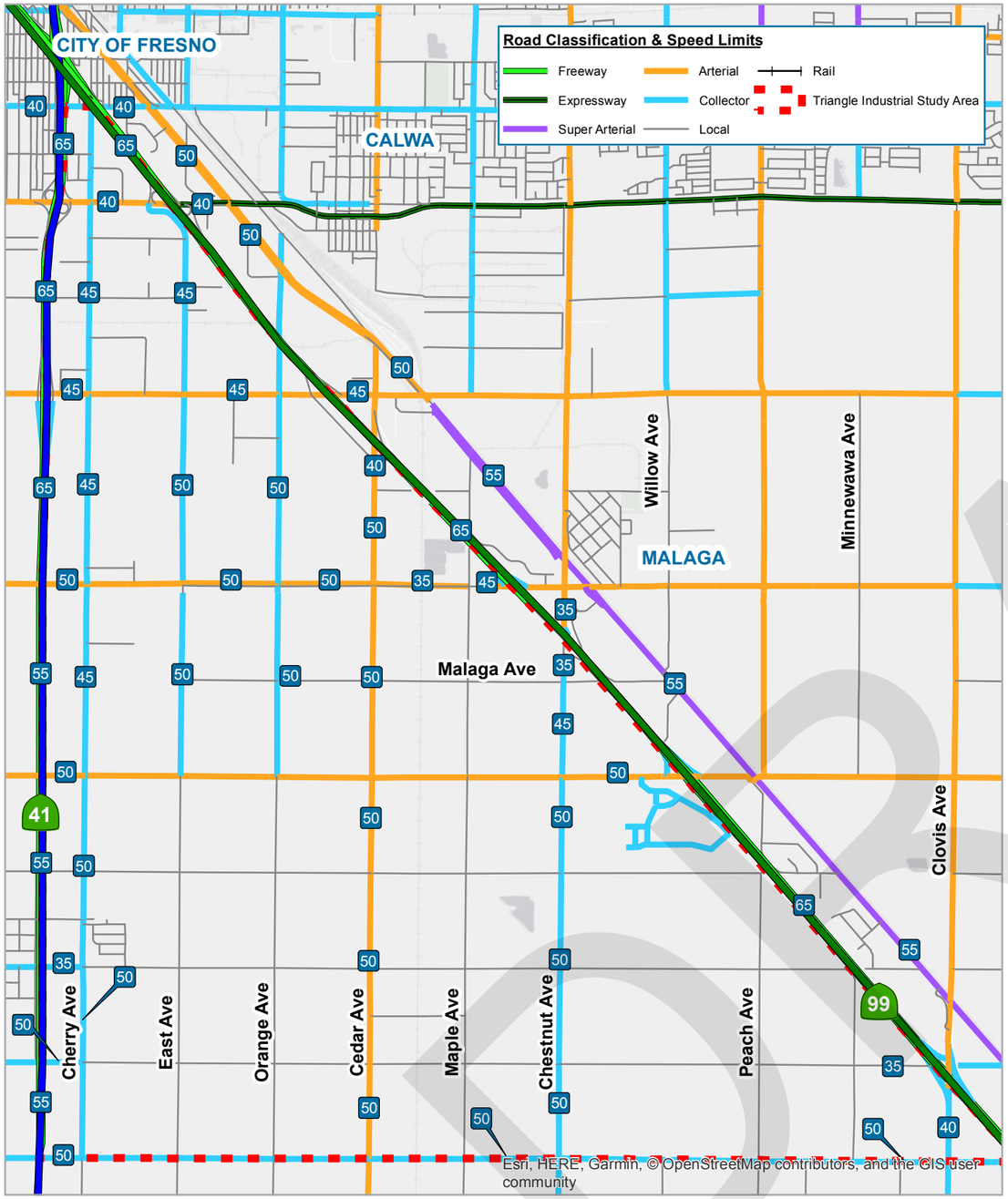
Cherry Avenue is a 2-lane collector roadway, approximately 5.5 miles in length within the study area. Speed limit ranges from 40 mph to 50 mph. North of Central Avenue to Church Avenue, Cherry Avenue is classified as a truck route. Additionally, Cherry Avenue is the frontage road to Orange Elementary, Cherry Avenue Auction and Fire Station #89.

East Avenue is a 2-lane local and collector roadway, approximately 5.0 miles in length within the study area. North of American Avenue to Jensen Avenue, East Avenue is a collector roadway. Speed limit ranges from 45 mph to 50 mph. North of Central Avenue to Jensen Avenue, Cherry Avenue is classified as a truck route. Additionally, Cherry Avenue is the frontage road to the Ulta Distribution Center.

Orange Avenue is a 2-lane local and collector roadway, approximately 4.5 miles in length within the study area. North of American Avenue to Jensen Avenue (study area limits), Orange Avenue is a collector roadway (and also beyond Jensen Avenue). Speed limit is 50 mph. North of American Avenue to project limits, Orange Avenue is classified as a truck route. Additionally, Orange Avenue is the frontage road to the Amazon Distribution Center.

Cedar Avenue is a 2-lane arterial roadway, approximately 4.0 miles in length within the study area. Speed limit ranges from 40 mph to 50 mph. North of American Avenue to project limits and beyond, Cedar Avenue is classified as a truck route. Cedar Avenue assesses southbound SR-99. Additionally, Cedar Avenue is the proposed frontage road to the High Speed Rail Maintenance Facility.

Maple Avenue is a 2-lane local roadway, approximately 3.25 miles in length within the study area. Speed limit although not identified by the local agencies, should not exceed that of a collector roadway (minimum 40 mph). This roadway is not part of the truck route system.



Church Ave

Jensen Ave

North Ave

Central Ave

American Ave

Jefferson Ave

Lincoln Ave

Clayton Ave

Adams Ave

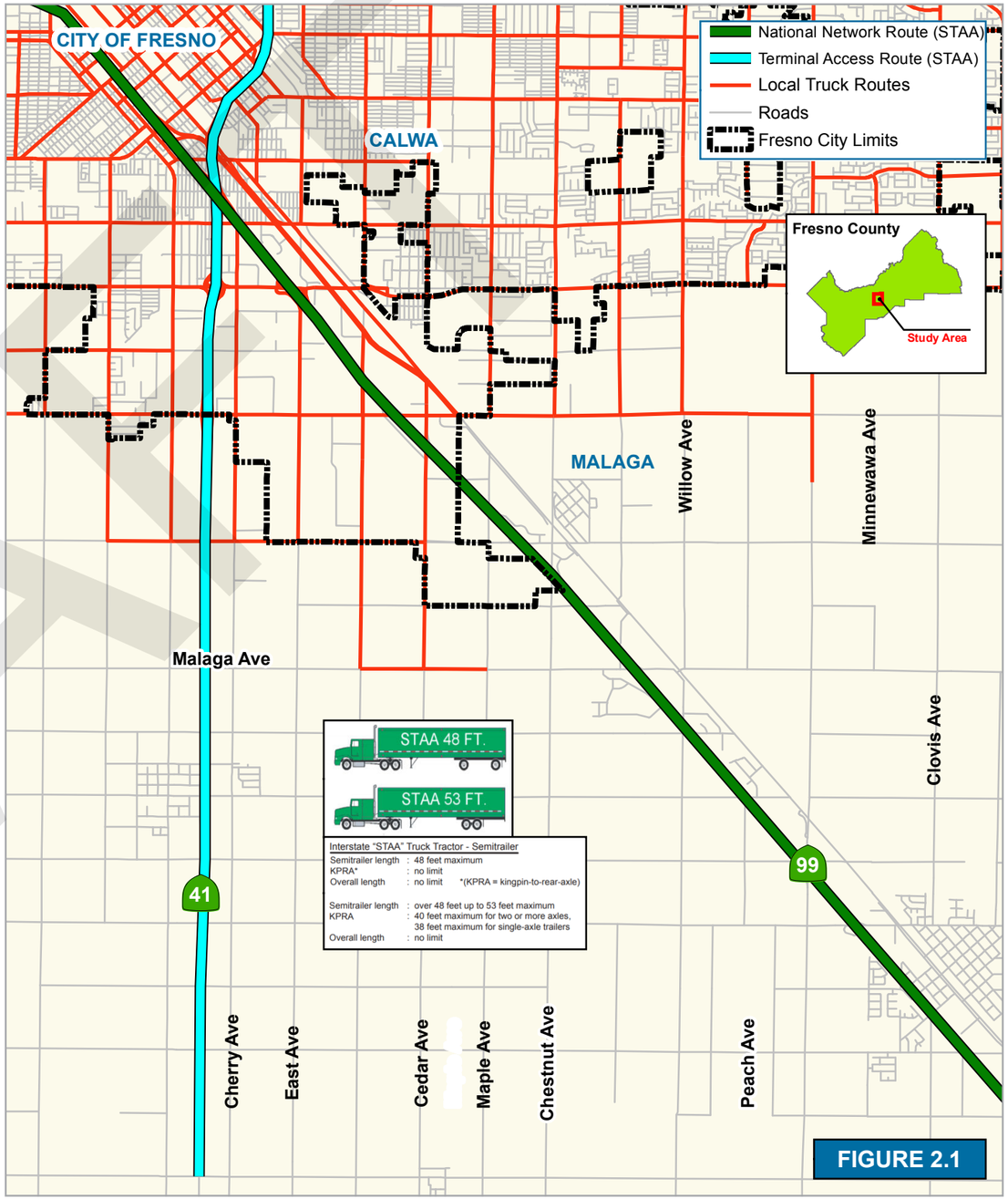


FIGURE 2.1

N

0 0.4 0.8 1.2 1.6

Miles

REVERSE TRIANGLE
TRANSPORTATION AREA PLAN

Road Classification, Speed Limits and Truck Routes

Project No. 11192258

Date 6/12/2019

Fresno Council of Governments

GHD

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Print date: 22 Jul 2019 - 11:39

Paper Size ANSI B (Landscape)

Data source: GHD 2019, Fresno County Public GIS data, City of Fresno Public GIS data, Caltrans Public GIS data. Created by: jramirez2

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California IV FIPS 0404 Feet

Chestnut Avenue is a 2-lane collector roadway, approximately 3.0 miles in length within the study area. Speed limit ranges from 35 mph to 50 mph (50 mph in the rural areas, south of American Avenue). Chestnut Avenue assesses southbound SR-99. This roadway is not part of the truck route system.

Peach Avenue is a 2-lane local roadway, approximately 2.0 miles in length within the study area. Speed limit although not identified by the local agencies, should not exceed that of a collector roadway (minimum 40 mph). This roadway is not part of the truck route system.

Minnewawa Avenue is a 2-lane local roadway, approximately 2.0 miles in length within the study area. Speed limit although not identified by the local agencies, should not exceed that of a collector roadway (minimum 40 mph). This roadway is not part of the truck route system.

Clovis Avenue is a 2-lane collector roadway, approximately 0.5 miles in length within the study area. North of State Route 99, Clovis Avenue is an arterial 4-lane arterial roadway. Speed limit within project area is 40 mph. Clovis Avenue accesses SR-99.

East – West Alignment

Church Avenue is a 2-lane collector roadway, approximately ¼ of a mile in length within the study area. Speed limit is 50 mph. This roadway is part of the truck route system.

Jensen Avenue is a 4-lane arterial roadway with two-way left-turn lane (TWLTL), approximately 1.0 mile in length within the study area. Speed limit is 40 mph. Jensen Avenue accesses both SR-99 and SR-41. This roadway is part of the truck route system.

North Avenue is a 4-lane arterial roadway with two-way left-turn lane (TWLTL), approximately 2.0 miles in length within the study area. Speed limit is 45 mph. North Avenue connects to SR-41. This roadway is part of the truck route system.

Central Avenue is a 2-lane arterial roadway, approximately 2.5 miles in length within the study area. Speed limit ranges from 35 mph to 50 mph. Central Avenue accesses SR-41. West of Cedar Avenue, this roadway is part of the truck route system.

American Avenue is a 2-lane arterial roadway, approximately 2.5 miles in length within the study area. Speed limit ranges from 35 mph to 50 mph. American Avenue accesses northbound SR-99 and is partially included in the truck route system (between Orange Avenue and Maple Avenue).

Jefferson Avenue, Lincoln Avenue and Clayton Avenue are 2-lane local roadways, ranging in approximately 2.5 to 3.5 miles in length within the study area. Speed limit although not identified by the local agencies, should not exceed that of a collector roadway (minimum 40 mph). These roadways are not part of the truck route system.

Adams Avenue is a 2-lane collector roadway, approximately 5.25 miles in length within the study area. Speed limit is 50 mph. Adams Avenue accesses northbound SR-99. Adams Avenue is not part of the truck route system.

2.1.1 Study Intersections

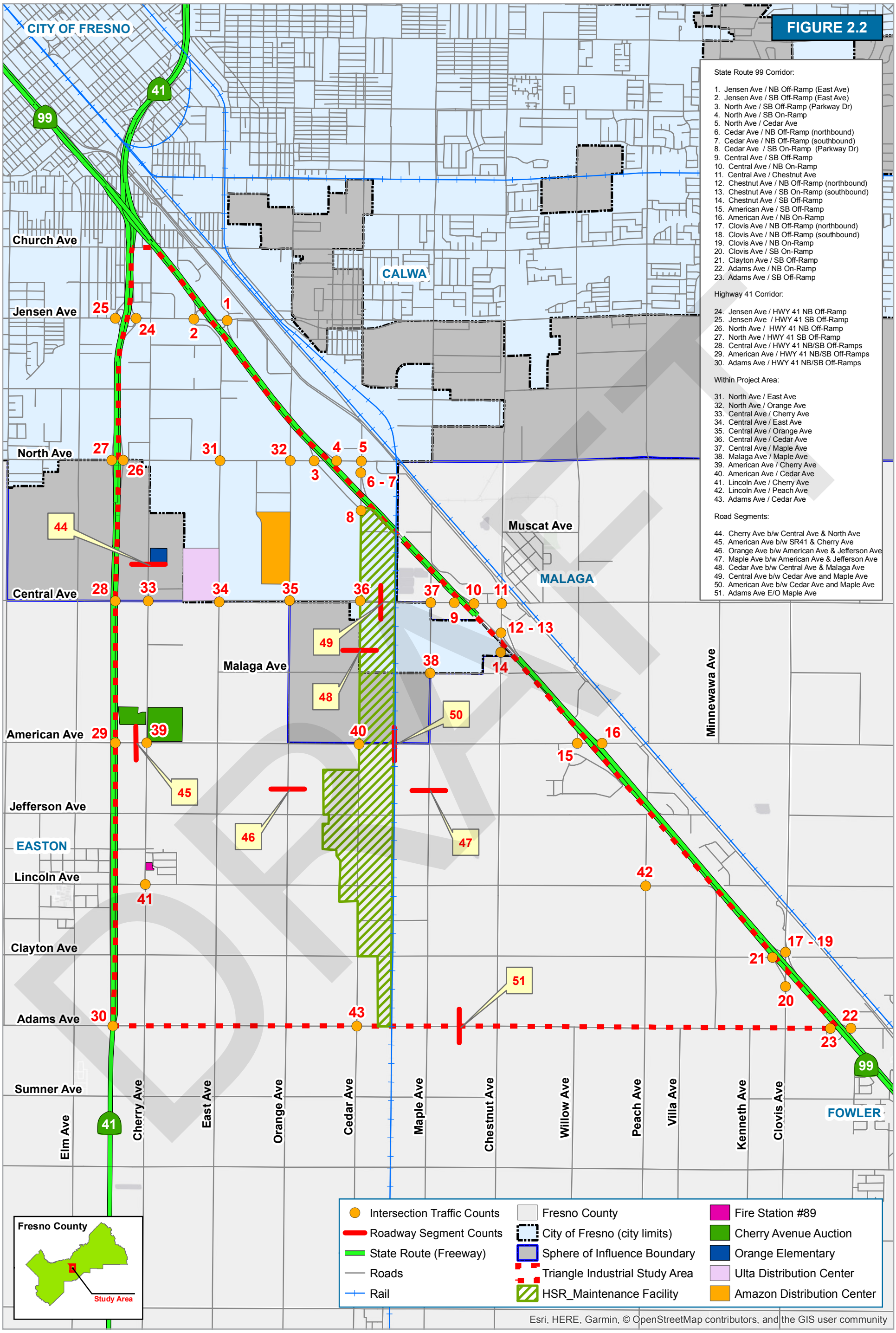
The following intersections and road segments were identified in coordination with the FCOG, City of Fresno, County of Fresno and Caltrans. The project area includes 42 intersections and 8 road segments as listed in Table 2.1. Figure 2.2 illustrates the study intersections and road segments for analysis.

Table 2.1 Study Intersections and Road Segments

Study Intersections and Road Segments	
State Route 99 Corridor	27. North Ave / HWY 41 SB Off-Ramp
1. Jensen Ave / NB Off-Ramp (East Ave)	**28. Central Ave / HWY 41 NB/SB Off-Ramps**
2. Jensen Ave / SB Off-Ramp (East Ave)	**29. American Ave / HWY 41 NB/SB Off-Ramps**
3. North Ave / SB Off-Ramp (Parkway Dr)	30. **Adams Ave / HWY 41 NB/SB Off-Ramps**
4. North Ave / SB On-Ramp	**Within Project Area**
5. North Ave / Cedar Ave	**31. North Ave / East Ave**
6. Cedar Ave / NB Off-Ramp (northbound)	**32. North Ave / Orange Ave**
7. Cedar Ave / NB Off-Ramp (southbound)	**33. Central Ave / Cherry Ave**
8. Cedar Ave / SB On-Ramp / Parkway Dr	**34. Central Ave / East Ave**
9. Central Ave / SB Off-Ramp	**35. Central Ave / Orange Ave**
10. Central Ave / NB On-Ramp	**36. Central Ave / Cedar Ave**
11. Central Ave / Chestnut Ave	37. Central Ave / Maple Ave
12. Chestnut Ave / NB Off-Ramp (northbound)	38. Malaga Ave / Maple Ave
13. Chestnut Ave / SB Off-Ramp (southbound)	39. American Ave / Cherry Ave
14. Chestnut Ave / SB On-Ramp	40. American Ave / Cedar Ave
15. American Ave / SB Off-Ramp	41. Lincoln Ave / Cherry Ave
16. American Ave / NB On-Ramp	42. Lincoln Ave / Peach Ave
17. Clovis Ave / NB Off-Ramp (northbound)	43. Adams Ave / Cedar Ave
18. Clovis Ave / NB Off-Ramp (southbound)	
19. Clovis Ave / NB On-Ramp	**Road Segments**
20. Clovis Ave / SB On-Ramp / Clayton Ave	44. Cherry Ave b/w Central Ave & North Ave
21. Clayton Ave / SB Off-Ramp	45. American Ave b/w SR41 & Cherry Ave
22. Adams Ave / NB On-Ramp	46. Orange Ave b/w American Ave & Jefferson Ave
23. Adams Ave / SB Off-Ramp	47. Maple Ave b/w American Ave & Jefferson Ave
State Route 41 Corridor	48. Cedar Ave b/w Central Ave & Malaga Ave
24. Jensen Ave / HWY 41 NB Off-Ramp	**49. Central Ave b/w Cedar Ave and Maple Ave**
25. Jensen Ave / HWY 41 SB Off-Ramp	**50. American Ave b/w Cedar Ave and Maple Ave**
26. North Ave / HWY 41 NB Off-Ramp	**51. Adams Ave E/O Maple Ave**

Notes: **Traffic volume Intersection counts provided by the City of Fresno**
Italicized Bold (road segments): Daily segment volume counts provided by the County of Fresno
Traffic volumes intersection counts provided by Caltrans
Traffic volumes intersection counts provided by Metro Traffic Data, Inc.

FIGURE 2.2



State Route 99 Corridor:

1. Jensen Ave / NB Off-Ramp (East Ave)
2. Jensen Ave / SB Off-Ramp (East Ave)
3. North Ave / SB Off-Ramp (Parkway Dr)
4. North Ave / SB On-Ramp
5. North Ave / Cedar Ave
6. Cedar Ave / NB Off-Ramp (northbound)
7. Cedar Ave / NB Off-Ramp (southbound)
8. Cedar Ave / SB On-Ramp (Parkway Dr)
9. Central Ave / SB Off-Ramp
10. Central Ave / NB On-Ramp
11. Central Ave / Chestnut Ave
12. Chestnut Ave / NB Off-Ramp (northbound)
13. Chestnut Ave / SB On-Ramp (southbound)
14. Chestnut Ave / SB Off-Ramp
15. American Ave / SB Off-Ramp
16. American Ave / NB On-Ramp
17. Clovis Ave / NB Off-Ramp (northbound)
18. Clovis Ave / NB Off-Ramp (southbound)
19. Clovis Ave / NB On-Ramp
20. Clovis Ave / SB On-Ramp
21. Clayton Ave / SB Off-Ramp
22. Adams Ave / NB On-Ramp
23. Adams Ave / SB Off-Ramp

Highway 41 Corridor:

24. Jensen Ave / HWY 41 NB Off-Ramp
25. Jensen Ave / HWY 41 SB Off-Ramp
26. North Ave / HWY 41 NB Off-Ramp
27. North Ave / HWY 41 SB Off-Ramp
28. Central Ave / HWY 41 NB/SB Off-Ramps
29. American Ave / HWY 41 NB/SB Off-Ramps
30. Adams Ave / HWY 41 NB/SB Off-Ramps

Within Project Area:

31. North Ave / East Ave
32. North Ave / Orange Ave
33. Central Ave / Cherry Ave
34. Central Ave / East Ave
35. Central Ave / Orange Ave
36. Central Ave / Cedar Ave
37. Central Ave / Maple Ave
38. Malaga Ave / Maple Ave
39. American Ave / Cherry Ave
40. American Ave / Cedar Ave
41. Lincoln Ave / Cherry Ave
42. Lincoln Ave / Peach Ave
43. Adams Ave / Cedar Ave

Road Segments:

44. Cherry Ave b/w Central Ave & North Ave
45. American Ave b/w SR41 & Cherry Ave
46. Orange Ave b/w American Ave & Jefferson Ave
47. Maple Ave b/w American Ave & Jefferson Ave
48. Cedar Ave b/w Central Ave & Malaga Ave
49. Central Ave b/w Cedar Ave and Maple Ave
50. American Ave b/w Cedar Ave and Maple Ave
51. Adams Ave E/O Maple Ave

N

0 0.25 0.5 0.75 1 Miles

REVERSE TRIANGLE
TRANSPORTATION AREA PLAN

Study Intersections and Road Segments

Project No. 11192258
Date 6/12/2019

Fresno Council of Governments
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Print date: 17 Jul 2019 - 08:20

Paper Size ANSI B (portrait)

Data source: GHD 2019, Fresno County Public GIS data, City of Fresno Public GIS data, Caltrans Public GIS data. Created by: jramirez2

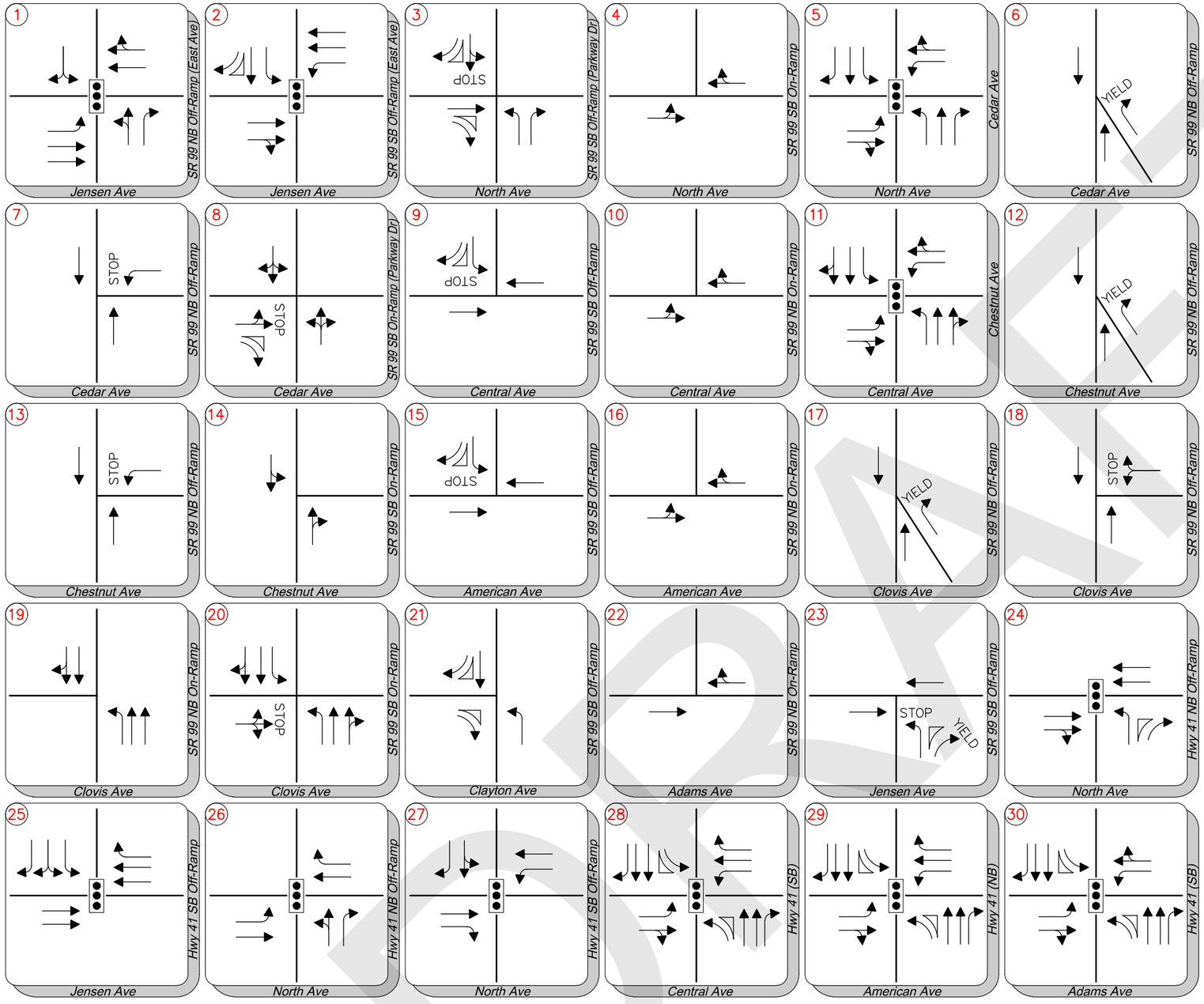
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California IV FIPS 0404 Feet

2.2 Data Collection and Analysis

As a collaborative approach GHD requested recent data collection traffic counts from City of Fresno, County of Fresno and Caltrans. Intersection and segment locations provided from the City of Fresno, County of Fresno and Caltrans are noted in the above table (Table 2.1)

The remaining of the intersections were collected by Metro Traffic Data Inc. on Thursday, May 23rd, 2019. No known special events were occurring in the area at the time of the traffic counts. Counts were obtained in the absence of inclement weather and during school session.

Figure 2.3A and 2.3B presents the existing intersection lane geometrics and traffic controls. Figure 2.4A and 2.4B presents the existing weekday AM and PM peak hour volumes.



REVERSE TRIANGLE
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REVERSE TRIANGLE TRANSPORTATION AREA PLAN

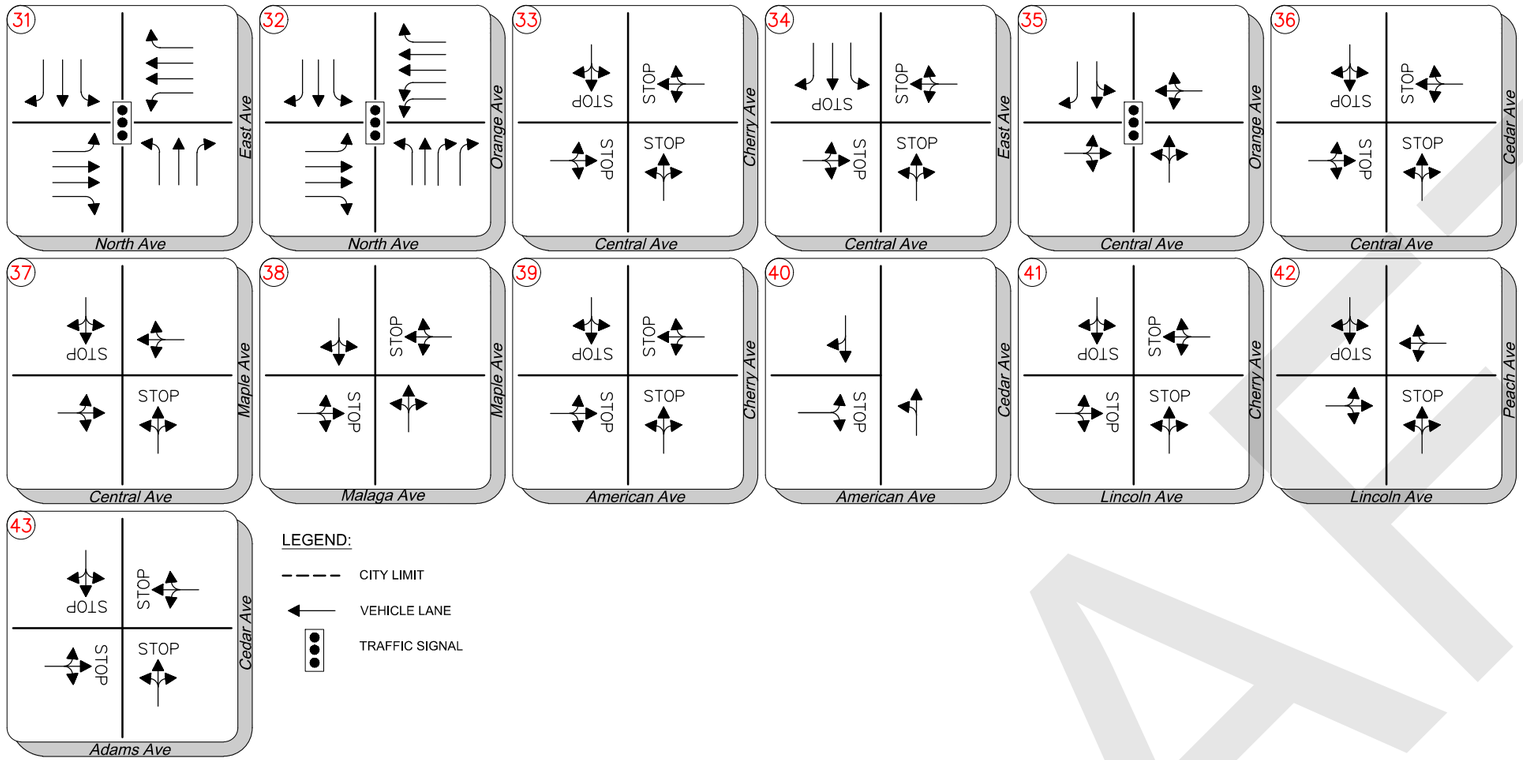
EXISTING LANE GEOMETRICS AND CONTROL

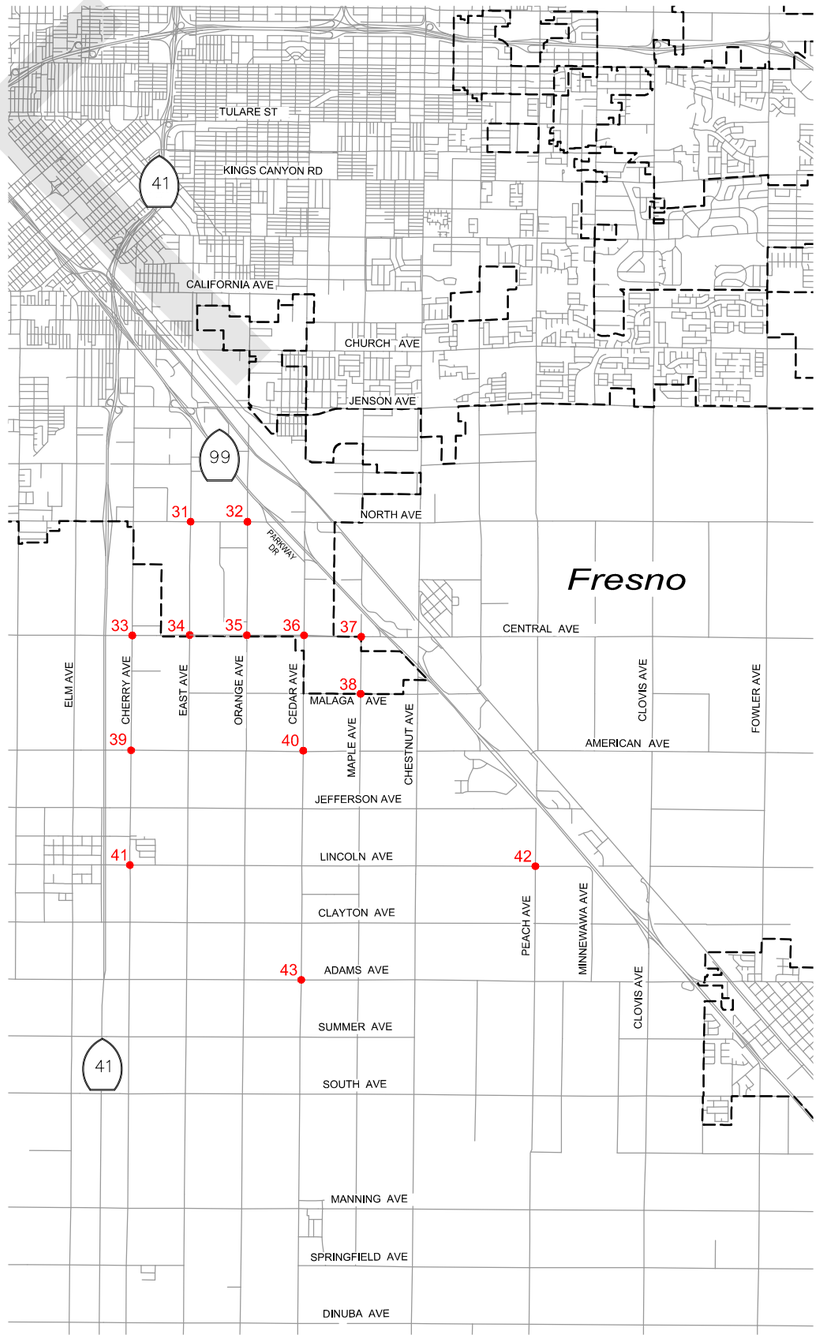
Project No. 11192258
Report No. 001
Date 07.10.2019

FIGURE 2.3A

Filename: L:\Prj\2618\T2618\T2618TG001.dwg Plot Date: 17 July 2019 - 2:13 PM

Source:





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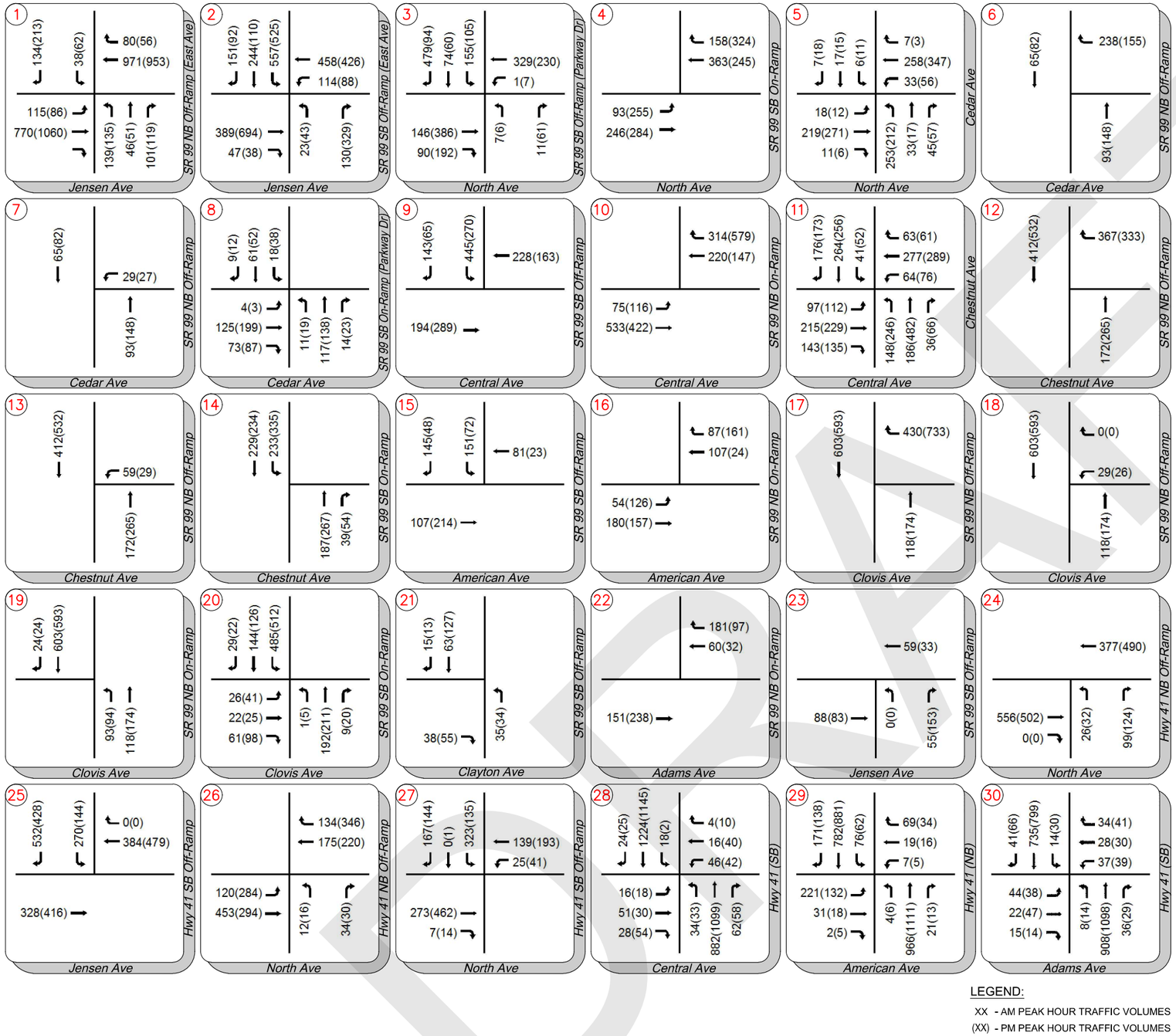
EXISTING LANE GEOMETRICS AND CONTROL

Project No. 11192258
Report No. 001
Date 07.10.2019

FIGURE 2.3B

Filename: L:\Prj\2618\T2618\T2618TG001.dwg Plot Date: 17 July 2019 - 2:14 PM

Source:



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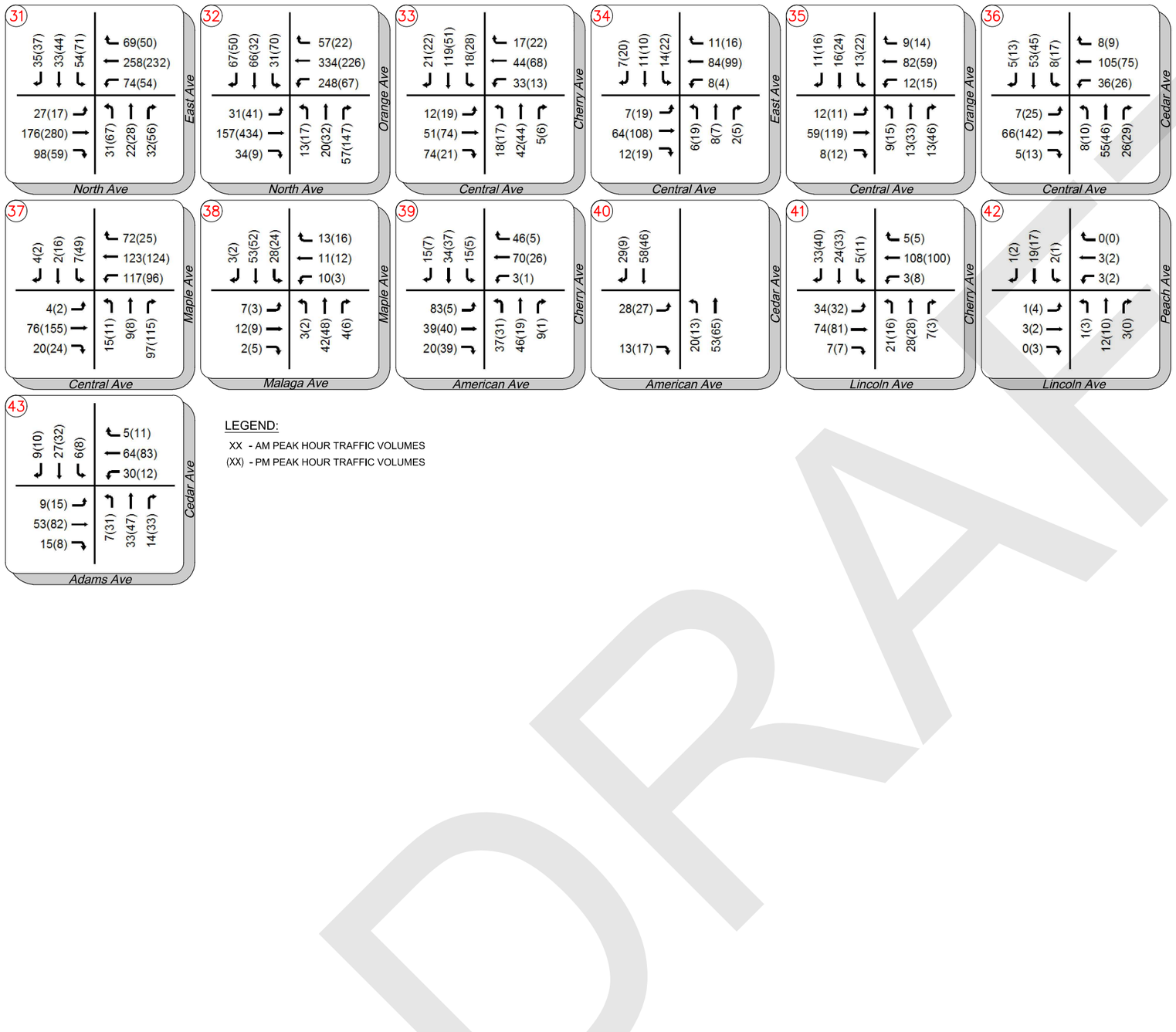
EXISTING PEAK HOUR TRAFFIC VOLUMES

Project No. **11192258**
Report No. **001**
Date **07.10.2019**

FIGURE 2.4A

Filename: L:\Prj\2618\T2618\T2618TG001.dwg Plot Date: 17 July 2019 - 2:15 PM

Source:



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EXISTING PEAK HOUR TRAFFIC VOLUMES

Project No. 11192258
Report No. 001
Date 07.10.2019

FIGURE 2.4B

Filename: L:\Prj\2618\T2618\T2618TG001.dwg Plot Date: 17 July 2019 - 2:15 PM

Source:

3. Level of Service Methodologies and Guidelines

The following section presents a summary of the general level of service (LOS) methodologies and guidelines used in the analysis of intersections.

3.1 General LOS Methodologies

Intersection level of service (LOS) was calculated for all control types (e.g. signalization, stop sign controlled) using the Synchro 10.0 (Trafficware) integrated computer software program. LOS determinations are presented on a letter grade scale from "A" to "F", whereby LOS "A" represents "free-flow" conditions and LOS "F" represents over capacity conditions.

3.1.1 Intersection LOS Methodologies

For signalized intersections, intersection delays and LOS are average values for all intersection movements. Table 3.1 presents the delay-based LOS criteria for different types of intersection control.

3.2 Agency LOS Guidelines and Policies

3.2.1 City of Fresno LOS Guidelines[1]

The following City of Fresno guidelines is direct language taken from the City of Fresno Traffic Impact Study Report Guidelines (October 18, 2006 – updated February 2, 2009).

All City intersections and roadway segments shall operate at a LOS D or better under the near-term conditions, unless a finding of overriding consideration was adopted in the Master General Plan EIR. Under long-term conditions (Year 2025 Conditions) all City intersections and roadway segments shall operate at a LOS D or better, except for the roadway segments adopted in the Master Genera l Plan EIR to operate at LOS E or F. The LOS shall be based on average delay for signalized and unsignalized intersections and Florida Tables (Tables 3.2 below) for roadway segments. The traffic analysis methodologies for the facility types indicated below will be accepted without prior consultation.

- *Signalized Intersections 1 - Highway Capacity Manual* using Highway Capacity Software (HCS), TRAFFIX, Synchro, or other software approved by the City Traffic Engineer*
- *Un-signalized Intersections - Highway Capacity Manual" 'using HCS, TRAFFIX. Sim-Traffic, or other software approved by the City Traffic Engineer*
- *Signal Warrants - MUTCD Signal Warrants**
- *Roadway Segments - HCM*, Florida Tables*

[1] City of Fresno Traffic Impact Study Report Guidelines, October 18, 2006 (Updated on February 2, 2009)

Table 3.1 – Level of Service (LOS) Criteria for Intersections

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

References: Highway Capacity Manual 6th Edition

While the City of Fresno does not officially advocate the use of any software, Synchro is the software used by City staff. The LOS analysis at study intersections shall be conducted using the following default values as applicable:

- *Use of signal timing plans, if available. If not available, then:*
    - *Minimum split time for protected left-turn phase shall not be less than 12 seconds if volumes warrant the need.*
    - *Minimum pedestrian times should be satisfied on all phases with pedestrian phase for signals modeled as coordinated signals.*
    - *For study intersections modeled as actuated uncoordinated signals, the intersections shall be evaluated with at-least 10 pedestrian calls per hour in the Existing + Project and 2025 Conditions, if pedestrian projections are not available.*
    - *If existing cycle lengths are available they should be utilized. In instances were existing cycle lengths are not available, LOS calculations should be conducted using the natural cycle lengths. The cycle lengths should remain constant for comparison purposes unless the project is changing the character of the intersection and it is noted in the report.*
    - *In instances where signalized intersections are coordinated, coordinated cycle lengths should be determined based on the natural cycle lengths of the coordinated signals and shall be used for evaluation purposes.*
    - *Minimum All-Red time(s) shall equal 1.0 seconds.*
    - *Minimum Yellow time shall equal 3.5 seconds, or greater based upon the approach speeds.*

3.2.1.1 Significant Impact Threshold (City)

For study intersections, the impact is considered significant if the addition of the traffic generated from the proposed project results in any one of the following:

- *Triggers an intersection operating at acceptable LOS to operate at unacceptable levels of service*
- *Triggers an intersection operating at unacceptable LOS (LOS E) to operate at LOS F.*
- *Increases the average delay for a study intersection that is already operating at unacceptable LOS.*

Table 3.3 – Volume Thresholds for Roadway Levels of Service - Urban

Uninterruped Flow Highways						
Lanes	**Median**	**A**	**B**	**C**	**D**	**E**
2	Undivided	*	8,600	17,000	24,200	33,300
2	Divided	*	36,700	51,800	65,600	72,600
6	Divided	*	55,500	77,700	98,300	108,800

Uninterupted Flow Highway Adjustments			
Lanes	**Median**	**Exclusive left lanes**	**Adjustment factors**
2	Divided	Yes	+5%
Multi	Undivided	Yes	-5%
Multi	Undivided	No	-25%

Reference: Florida Department of Transportation Table 1, Generalized Annual Average Daily Volumes for Florida's Urbanized Areas.
*Note: * = Cannot be achieved using table input value defaults*

3.2.2 County of Fresno LOS Guidelines[2]

The following County of Fresno guidelines is direct language taken from the County of Fresno Guidelines Traffic Impact Study (Draft May 2018).

The Fresno County Circulation System is a street and highway plan designed to provide for the safe and efficient movement of people and goods to and within the county and to ensure safe and continuous access to land.

Policy TR-A.2 - The County shall plan and design its roadway system in a manner that strives to meet Level of Service (LOS) D on urban roadways within the spheres of influence of the cities of Fresno and Clovis and LOS C on all other roadways in the county.

In no case should the County plan for worse than LOS D on rural County roadways, worse than LOS E on urban roadways within the spheres of influence of the cities of Fresno and Clovis, or in cooperation with Caltrans and the Council of Fresno County Governments, plan for worse than LOS E on State highways in the county.

3.2.2.1 Significant Impact Threshold (County)

A project is considered to have a significant impact if its traffic, when added to the traffic of the without-project condition, would cause any of the changes in traffic conditions described below.

1. ***On roadway segments:***

[2] Fresno County Guidelines for the Preparation of Traffic Impact Studies (Draft May 2018)

a) *Cause a roadway that is operating at an acceptable LOS to deteriorate to an unacceptable LOS; OR*

b) *Cause the V/C ratio (on a directional peak hour basis) to increase by more than 0.05 on a roadway that is already operating at an unacceptable LOS. It should be noted that a decrease from an unacceptable LOS to a lesser LOS (e.g. from LOS D to LOS E in County areas) is not considered an impact unless the corresponding V/C ratio increase is greater than 0.05.*

2. At signalized intersections:

a) *Cause an intersection that is operating at an acceptable LOS to deteriorate to an unacceptable LOS; OR*

b) *Cause the average delay to increase by more than 5.0 seconds at a signalized intersection that is operating at an unacceptable LOS. It should be noted that a decrease from an unacceptable LOS to a lesser LOS (e.g. from LOS D to LOS E in County areas) is not considered an impact unless the corresponding delay increase is greater than 5.0 seconds.*

3. At unsignalized intersections, including all-way stop, minor approach stop, and roundabouts

a) *Cause a movement or approach that is operating at an acceptable LOS to deteriorate to an unacceptable LOS; OR*

b) *Cause the average delay to increase by more than 5.0 seconds on a movement or approach that is operating at an unacceptable LOS. It should be noted that a decrease from an unacceptable LOS to a lesser LOS (e.g. from LOS D to LOS E in County areas) is not considered an impact unless the corresponding delay increase is greater than 5.0 seconds.*

4. On roadways with a paved width of less than 18 feet (essentially one-lane roadways)

a) *Cause a roadway that already carries 100 vehicles per day (vpd) or less to carry more than 100 vpd; OR*

b) *Cause a roadway that already carries more than 100 vpd to carry any additional traffic.*

5. On roadways that require analysis based on the traffic volume criteria described above, cause an increase in the traffic index of 0.5 or more, EXCEPT on roadways that have been resurfaced within the last five years and for which the design traffic index at the time of the resurfacing exceeded the calculated traffic index with the project. If the design traffic index is not available then the exception shall not apply.

3.2.3 California Department of Transportation (Caltrans) Guidelines[3]

The following County of Fresno guidelines is direct language taken from the California Department of Transportation Guide for the Preparation of Traffic Impact Study (December 2002).

Caltrans level of service (LOS) for operating State highway facilities is based upon measures of effectiveness (MOEs) which are described in Appendix "C-2" in the TIS. Additionally, as noted in Appendix "C-3" of the TIS, Caltrans endeavors to maintain a target LOS at the transition between LOS "C" and LOS "D" on State highway facilities, however, Caltrans acknowledges that this may not always be feasible and recommends that the lead agency consult with Caltrans to determine the appropriate target LOS. If an existing State highway facility is operating at less than the appropriate target LOS, the existing MOE should be maintained.

3.2.3.1 Measures of Effectiveness by Facility Type

Measures of effectiveness for level of service definitions located in the most recent version of the Highway Capacity Manual, Transportation Research Board, National Research Council. Table 3.4 illustrated the type of facility and its measure of effectiveness as described in the TIS. Additionally, Table 3.5 shows the transition between LOS "C" and LOS "D" criteria for signalized intersections and terminals.

Table 3.4 – Measures of Effectiveness by Facility Type

Type of Facility	Measure of Effectiveness (MOE)
Basic Freeway Segments	Density (pc/mi/ln)
Ramps	Density (pc/mi/ln)
Ramp Terminals	Delay (sec/veh)
Multi-Lane Highways	Density (pc/mi/ln)
Two-Lane Highways	Percent-Time-Following Average Travel Speed (mi/hr)
Signalized Intersections	Control Delay per Vehicle (sec/veh)
Unsignalized Intersections	Average Control Delay per Vehicle (sec/veh)
Urban Streets	Average Travel Speed (mi/hr)

Table 3.5 – Signalized Intersections and Ramp Terminals

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

[3] California Department of Transportation Guide for the Preparation of Traffic Impact Studies (TIS), December 2002

3.3 Intersection Operation Analysis Software

The Synchro 10 (Trafficware) software suite was used to implement the LOS analysis for signalized/unsignalized intersections analyzed within this study.

3.4 Significance Thresholds

The following thresholds of significance are used to determine if the proposed Project causes a significant impact and requires mitigation:

3.4.1 Signalized Intersections

- The Project causes the intersection's acceptable LOS to decline to an unacceptable LOS

3.5 Technical Analysis Parameters

This TIA provides evaluation of traffic operating conditions by incorporating appropriate heavy vehicle adjustment factors, peak hour factors, and signal timings and reports the resulting intersection delays and LOS as estimated using Synchro 10.0. The following section describes all technical parameters incorporated into intersection analysis.

Table 3.6 presents technical parameters which were applied to study intersections during the analysis.

Table 3.6 – Intersection LOS: Technical Analysis Parameters

Technical Parameters	Assumption
% Trucks	Intersection Overall Approach, based on Existing Counts, min 2%
PHF for Existing & Short Term	Intersection Overall Approach, based on Existing Counts
PHF for Future Conditions	Intersection Overall, 0.92 or higher
Signal Timings	Based on Agency timing plans (City of Fresno and Caltrans)
Grade	2% or less at all intersections

4. Existing Conditions

The *Existing* conditions is the analysis scenario in which current operations at study locations are analyzed and establishes the baseline traffic conditions.

4.1 Intersection Operations

Existing weekday AM and PM peak hour intersection traffic operations were quantified utilizing the existing traffic volumes, signal timings, and intersection lane geometrics and control. Table 4.1 presents intersection operations for the *Existing* conditions.

Table 4.1 – Existing Peak Hour Conditions Intersection Operations

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour			PM Peak Hour		
				Delay	LOS	Warrant Met?[3]	Delay	LOS	Warrant Met?[3]
1	Jensen Avenue / SR-99 NB Off-Ramp (East Avenue)	Signal	D	18.7	B	–	16.0	B	–
2	Jensen Avenue / SR-99 SB Off-Ramp (East Avenue)	Signal	D	48.7	D	–	36.7	D	–
3	**North Avenue / SR-99 SB Off-Ramp (Parkway Dr)**	**TWSC**	**D**	**90.2**	**F**	**Yes**	**86.4**	**F**	**No**
4	North Avenue / SR-99 SB On-Ramp	None	D	N/A					
5	North Avenue / Cedar Avenue	Signal	D	21.1	C	–	19.5	B	–
6	Cedar Avenue / SR-99 NB Off-Ramp (northbound)	None	D	N/A		–			–
7	Cedar Avenue / SR-99 NB Off-Ramp (southbound)	TWSC	D	9.7	A	No	10.9	B	No
8	Cedar Avenue / SR-99 SB On-Ramp (Parkway Dr)	TWSC	D	10.9	B	No	10.8	B	No
9	**Central Avenue / SR-99 SB Off-Ramp**	**TWSC**	**D**	**73.8**	**F**	**No**	18.8	C	No
10	Central Avenue / SR-99 NB On-Ramp	None	D	N/A					
11	Central Avenue / Chestnut Avenue	Signal	D	29.6	C	–	32.6	C	–
12	Chestnut Avenue / SR-99 NB Off-Ramp (northbound)	None	D	N/A					
13	Chestnut Avenue / SR-99 NB Off-Ramp (southbound)	TWSC	D	15.6	C	No	17.9	C	No
14	Chestnut Avenue / SR-99 SB On-Ramp	None	D	N/A					
15	American Avenue / SR-99 SB Off-Ramp	TWSC	D	12.0	B	No	11.9	B	No
16	American Avenue / SR-99 NB On-Ramp	None	D	N/A					

Table 4.1 – Existing Peak Hour Conditions Intersection Operations

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour			PM Peak Hour		
				Delay	LOS	Warrant Met?[3]	Delay	LOS	Warrant Met?[3]
17	Clovis Avenue / SR-99 NB Off-Ramp (northbound)	None	D	N/A					
18	Clovis Avenue / SR-99 NB Off-Ramp (southbound)	TWSC	D	12.4	B	No	12.5	B	No
19	Clovis Avenue / SR-99 NB On-Ramp	None	D	N/A					
20	**Clovis Avenue / SR-99 SB On-Ramps**	**TWSC**	**D**	32.0	D	No	**75.6**	**F**	**No**
21	Clayton Avenue / SR-99 SB Off-Ramp	TWSC	D	9.1	A	No	9.5	A	No
22	Adams Avenue / SR-99 NB On-Ramp	None	D	N/A					
23	Adams Avenue / SR-99 SB Off-Ramp	TWSC	D	9.0	A	No	9.8	A	No
24	Jensen Avenue / HWY-41 NB Off-Ramp	Signal	D	5.9	A	–	8.8	A	–
25	Jensen Avenue / HWY-41 SB Off-Ramp	Signal	D	20.2	A	–	9.9	A	–
26	North Avenue / HWY-41 NB Off-Ramp	Signal	D	7.2	A	–	10.6	B	–
27	North Avenue / HWY-41 SB Off-Ramp	Signal	D	50.5	D	–	10.8	B	–
28	Central Avenue / HWY-41 NB/SB Off-Ramps	Signal	D	29.3	C	–	24.7	C	–
29	American Avenue / HWY-41 NB/SB Off-Ramps	Signal	D	35.6	D	–	25.0	C	–
30	Adams Avenue / HWY-41 NB/SB Off-Ramps	Signal	D	20.2	C	–	22.3	C	–
31	North Avenue / East Avenue	Signal	D	19.0	B	–	19.1	B	–
32	North Avenue / Orange Avenue	Signal	D	16.8	B	–	19.0	B	–
33	Central Avenue / Cherry Avenue	AWSC	D	8.8	A	No	8.2	A	No
34	Central Avenue / East Avenue	AWSC	D	8.6	A	No	9.9	A	No
35	Central Avenue / Orange Avenue	Signal	D	9.4	A	–	10.1	B	–
36	Central Avenue / Cedar Avenue	AWSC	D	9.0	A	No	10.6	B	No
37	Central Avenue / Maple Avenue	TWSC	D	14.7	B	No	23.7	C	No
38	Malaga Avenue / Maple Avenue	TWSC	D	10.5	B	No	10.1	B	No
39	American Avenue / Cherry Avenue	AWSC	D	8.4	A	No	7.5	A	No

Table 4.1 – Existing Peak Hour Conditions Intersection Operations

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour			PM Peak Hour		
				Delay	LOS	Warrant Met?[3]	Delay	LOS	Warrant Met?[3]
40	American Avenue / Cedar Avenue	TWSC	D	10.0	A	No	9.5	A	No
41	Lincoln Avenue / Cherry Avenue	AWSC	D	8.5	A	No	8.4	A	No
42	Lincoln Avenue / Peach Avenue	TWSC	D	9.2	A	No	9.3	A	No
43	Adams Avenue / Cedar Avenue	AWSC	D	8.1	A	No	8.4	A	No

Notes:
NB=Northbound, SB=Southbound, SR=State Route, HWY=Highway (State Route), N/A=Not Applicable
1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control
2. LOS = Delay based on worst minor approach for TWSC intersections; average of all approaches for AWSC, signal
3. Warrant = Based on California MUTCD Warrant 3
4. None = No stop control type, movement is free-flow, therefore no delay was registered. Intersections movement consists of on/off ramp thru movements.

As presented in Table 4.1, all study intersections for Existing conditions are currently found to operate at or above the threshold LOS D, except for the following intersections during the AM and/or PM peak hours:

- #3 - North Avenue / SR-99 SB Off-Ramp (Parkway Dr)
- #9 - Central Avenue / SR-99 SB Off-Ramp
- #20 - Clovis Avenue / SR-99 SB On-Ramps

4.2 Daily Segment Operations

Existing roadway segments were quantified using existing AADT values collected on Wednesday, May 8, 2019. Table 4.2 contains a summary of the roadway segments LOS results under Existing Conditions.

Table 4.2 Roadway Segments Level of Service

#	Roadway Segment	Limits	No. of Lanes	Facility Type	AADT	LOS
44	Cherry Avenue	Central Avenue & North Avenue	2	Collector	1,720	B
45	American Avenue	Highway 41 & Cherry Avenue	2	Arterial	2,580[1]	B
46	Orange Avenue	American Avenue & Jefferson Avenue	2	Local	510	B
47	Maple Avenue	American Avenue & Jefferson Avenue	2	Local	830	B
48	Cedar Avenue	Central Avenue & Malaga Avenue	2	Arterial	1,620	B
49	Central Avenue	Cedar Avenue & Maple Avenue	2	Arterial	3,490	B
50	American Avenue	Cedar Avenue & Maple Avenue	2	Arterial	2,330	B
51	Adams Avenue	East of Maple Avenue	2	Collector	2,250	B

1. Seven-day average total

As shown in Table 4, all of the study roadway segments are currently operating at acceptable conditions under Existing conditions.

5. Conclusions

In general, existing traffic operating conditions indicate the study intersections generally meet or exceed current LOS thresholds. At a few ramp locations along the southbound State Route 99 corridor between Clovis and North Avenues experience unacceptable operations under Existing conditions. Mitigation measures for these locations will be identified in the upcoming TIAR. Currently, Caltrans is working on several studies within the study area that will identify recommended improvements.

Appendices

Appendix A: Traffic Peak Hour Volume Counts

- Metro Traffic Data, Inc.
- City of Fresno
- Caltrans

Appendix B Roadway Segment Daily Counts

- Metro Traffic Data, Inc.
- County of Fresno

Appendix C: Signal Timing Plans

- Caltrans
- City of Fresno