
Appendix H Traffic Study

**Traffic Impact Study for
the Metro East Overlay Zone
in the City of Santa Ana**

December 2006

Prepared for:

EIP Associates

12301 Wilshire Boulevard, Suite 430
Los Angeles, CA 90025

Prepared by:



Katz, Okitsu & Associates

Traffic Engineers and Transportation Planners

17852 E. Seventeenth Street, Suite 102
Tustin, California 92780-2412

714/573-0317 Phone

714/573-9584 Fax

Project No: JA6525



Katz, Okitsu & Associates
Planning and Engineering

17852 E. Seventeenth St.
Suite 102
Tustin, CA
92780-2142
714.573.0317
fax: 714.573-9534
koaoc@katzokitsu.com
www.katzokitsu.com

December 18, 2006

Mr. Chris Mundhenk
EIP Associates
12301 Wilshire Boulevard, Suite 430
Los Angeles, CA 90025

Subject: Traffic Impact Study for the Metro East Overlay Zone Project in the City of Santa Ana

Dear Mr. Mundhenk:

Katz, Okitsu & Associates is pleased to present this traffic impact study report for a proposed mixed use overlay zone project in the City of Santa Ana. The Metro East project is generally located along 1st and 4th Streets, and is bounded by 6th Street on the north, the I-5 Freeway and Santa Ana City boundary on the south, the I-5 Freeway on the west, and Tustin Avenue on the east. The Metro East project at build-out could consist of an estimated 5,551 residential units, 3.4 million square feet of office space, and 1.3 million square feet of commercial space, if all properties in the overlay zone are rebuilt at the maximum permitted densities.

The traffic study has been prepared to meet the traffic study requirements of the City of Santa Ana for the analysis of traffic impacts associated with the proposed development. The report is being submitted to you for review and forwarding to the City of Santa Ana. Please contact our office if you have any questions or comments about the report, or if you need additional information to complete your submittal. If there are any comments that require response or revisions, please notify our office as soon as possible for prompt revision.

It has been a pleasure to prepare this study for EIP and the City of Santa Ana.

Sincerely,

Rock Miller, P.E.
Principal

Los Angeles
323.260.4703
fax: 323.260.4705

San Diego
619.683.2933
fax: 619.683.7982

San Bernardino
909.890.9693
fax: 909.890.9694

Table of Contents

1. INTRODUCTION.....	1
2. PROJECT STUDY METHODOLOGY	5
2.1 STUDY TIMEFRAMES	5
2.2 PROJECT STUDY AREA.....	5
2.2.1 City of Santa Ana Intersections:.....	5
2.2.2 City of Tustin Intersections:	6
2.3 ANALYSIS METHODOLOGIES	6
2.4 INTERSECTION CAPACITY ANALYSIS	7
2.5 TRAFFIC COUNT DATA	8
2.6 FUTURE TRAFFIC VOLUMES	8
2.7 STANDARDS OF SIGNIFICANCE	9
2.7.1 City of Santa Ana	9
2.7.2 City of Tustin.....	10
3. EXISTING CONDITIONS	11
3.1 AREA ROADWAY NETWORK.....	11
3.2 EXISTING INTERSECTION CONDITIONS	16
4. FUTURE TRAFFIC CONDITIONS WITHOUT PROJECT	23
5. BUILDOUT TRAFFIC CONDITIONS WITHOUT PROJECT	30
6. PROJECT RELATED TRAFFIC	37
6.1 PROJECT TRIP GENERATION	37
6.1.1 First & Cabrillo Project.....	38
6.1.2 Metro East Overlay Zone	47
7. FUTURE TRAFFIC CONDITIONS WITH PROJECT	54
8. BUILDOUT TRAFFIC CONDITIONS WITH PROJECT	61
9. DAILY TRAFFIC ANALYSIS.....	68
10. DETERMINATION OF SIGNIFICANT IMPACT	70
10.1 FIRST & CABRILLO PROJECT	70
10.2 OVERLAY ZONE	76
11. MITIGATION AND RECOMMENDATIONS.....	81
11.1 FIRST & CABRILLO PROJECT	81
11.2 OVERLAY ZONE	83
11.2.1 Mitigation Program.....	92

List of Figures

FIGURE 1 - PROJECT LOCATION	2
FIGURE 2 - PROPOSED SITE PLAN, METRO EAST OVERLAY ZONE	3
FIGURE 3 - PROPOSED SITE PLAN, FIRST & CABRILLO TOWERS.....	4
FIGURE 4 - EXISTING INTERSECTION GEOMETRY, SANTA ANA	12
FIGURE 5 - EXISTING INTERSECTION GEOMETRY, TUSTIN.....	13
FIGURE 6 - EXISTING TRAFFIC VOLUMES, AM PEAK HOUR , SANTA ANA	17
FIGURE 7 - EXISTING TRAFFIC VOLUMES, AM PEAK HOUR , TUSTIN	18
FIGURE 8 - EXISTING TRAFFIC VOLUMES, PM PEAK HOUR, SANTA ANA	19
FIGURE 9 - EXISTING TRAFFIC VOLUMES, PM PEAK HOUR, TUSTIN.....	20
FIGURE 10 – FUTURE WITHOUT PROJECT TRAFFIC VOLUMES, AM PEAK HOUR, SANTA ANA	26
FIGURE 11 – FUTURE WITHOUT PROJECT TRAFFIC VOLUMES, AM PEAK HOUR, TUSTIN	27
FIGURE 12 – FUTURE WITHOUT PROJECT TRAFFIC VOLUMES, PM PEAK HOUR, SANTA ANA	28
FIGURE 13 – FUTURE WITHOUT PROJECT TRAFFIC VOLUMES, PM PEAK HOUR, TUSTIN.....	29
FIGURE 14 – BUILDOUT WITHOUT PROJECT TRAFFIC VOLUMES, AM PEAK HOUR, SANTA ANA	33
FIGURE 15 – BUILDOUT WITHOUT PROJECT TRAFFIC VOLUMES, AM PEAK HOUR, TUSTIN.....	34
FIGURE 16 – BUILDOUT WITHOUT PROJECT TRAFFIC VOLUMES, PM PEAK HOUR, SANTA ANA	35
FIGURE 17 – BUILDOUT WITHOUT PROJECT TRAFFIC VOLUMES, PM PEAK HOUR, TUSTIN.....	36
FIGURE 18 - PROJECT TRIP DISTRIBUTION, SANTA ANA.....	41
FIGURE 19 - PROJECT TRIP DISTRIBUTION, TUSTIN	42
FIGURE 20 – NET PROJECT TRAFFIC VOLUMES, YEAR 2010 AM PEAK HOUR, SANTA ANA	43
FIGURE 21 – NET PROJECT TRAFFIC VOLUMES, YEAR 2010 AM PEAK HOUR, TUSTIN.....	44
FIGURE 22 – NET PROJECT TRAFFIC VOLUMES, YEAR 2010 PM PEAK HOUR, SANTA ANA.....	45
FIGURE 23 – NET PROJECT TRAFFIC VOLUMES, YEAR 2010 PM PEAK HOUR, TUSTIN	46
FIGURE 24 – NET PROJECT TRAFFIC VOLUMES, YEAR 2030 AM PEAK HOUR, SANTA ANA	50
FIGURE 25 – NET PROJECT TRAFFIC VOLUMES, YEAR 2030 AM PEAK HOUR, TUSTIN.....	51
FIGURE 26 – NET PROJECT TRAFFIC VOLUMES, YEAR 2030 PM PEAK HOUR, SANTA ANA.....	52
FIGURE 27 – NET PROJECT TRAFFIC VOLUMES, YEAR 2030 PM PEAK HOUR, TUSTIN	53
FIGURE 28 – FUTURE WITH PROJECT TRAFFIC VOLUMES, AM PEAK HOUR, SANTA ANA	57
FIGURE 29 – FUTURE WITH PROJECT TRAFFIC VOLUMES, AM PEAK HOUR, TUSTIN.....	58
FIGURE 30 – FUTURE WITH PROJECT TRAFFIC VOLUMES, PM PEAK HOUR, SANTA ANA.....	59
FIGURE 31 – FUTURE WITH PROJECT TRAFFIC VOLUMES, PM PEAK HOUR, TUSTIN	60
FIGURE 32 – BUILDOUT WITH PROJECT TRAFFIC VOLUMES, AM PEAK HOUR, SANTA ANA	64
FIGURE 33 – BUILDOUT WITH PROJECT TRAFFIC VOLUMES, AM PEAK HOUR, TUSTIN.....	65
FIGURE 34 – BUILDOUT WITH PROJECT TRAFFIC VOLUMES, PM PEAK HOUR, SANTA ANA.....	66
FIGURE 35 – BUILDOUT WITH PROJECT TRAFFIC VOLUMES, PM PEAK HOUR, TUSTIN	67

List of Tables

TABLE 1 - LEVELS OF SERVICE FOR INTERSECTIONS.....8

TABLE 2 - PEAK HOUR INTERSECTION CONDITIONS SIGNALIZED INTERSECTIONS, EXIST CONDITIONS21

TABLE 3 - PEAK HOUR INTERSECTION CONDITIONS UNSIGNALIZED INTERSECTIONS, EXIST CONDITIONS 22

TABLE 4 - CUMULATIVE PROJECTS.....23

TABLE 5 – FIRST & CABRILLO PROJECT PEAK HOUR INTERSECTION CONDITIONS, SIGNALIZED
 INTERSECTIONS FUTURE WITHOUT PROJECT CONDITIONS, YEAR 2010.....24

TABLE 6 – FIRST & CABRILLO PROJECT PEAK HOUR INTERSECTION CONDITIONS, UNSIGNALIZED
 INTERSECTIONS FUTURE WITHOUT PROJECT CONDITIONS, YEAR 2010.....25

TABLE 7 – METRO EAST OVERLAY ZONE PEAK HOUR INTERSECTION CONDITIONS, SIGNALIZED
 INTERSECTIONS BUILDOUT WITHOUT PROJECT CONDITIONS, YEAR 2030.....31

TABLE 8 – METRO EAST OVERLAY ZONE PEAK HOUR INTERSECTION CONDITIONS, UNSIGNALIZED
 INTERSECTIONS BUILDOUT WITHOUT PROJECT CONDITIONS, YEAR 2030.....32

TABLE 9 - FIRST & CABRILLO PROJECT TRIP GENERATION RATES38

TABLE 10 - FIRST & CABRILLO PROJECT PROPOSED PROJECT TRIP GENERATION39

TABLE 11 - METRO EAST OVERLAY ZONE TRIP GENERATION RATES.....48

TABLE 12 - METRO EAST OVERLAY ZONE PROPOSED PROJECT TRIP GENERATION49

TABLE 13 – FIRST & CABRILLO PROJECT PEAK HOUR INTERSECTION CONDITIONS, SIGNALIZED
 INTERSECTIONS FUTURE WITH PROJECT CONDITIONS, YEAR 2010.....55

TABLE 14 – FIRST & CABRILLO PROJECT PEAK HOUR INTERSECTION CONDITIONS, UNSIGNALIZED
 INTERSECTIONS FUTURE WITH PROJECT CONDITIONS, YEAR 2010.....56

TABLE 15 – METRO EAST OVERLAY ZONE PEAK HOUR INTERSECTION CONDITIONS, SIGNALIZED
 INTERSECTIONS BUILDOUT WITH PROJECT CONDITIONS, YEAR 203062

TABLE 16 – METRO EAST OVERLAY ZONE PEAK HOUR INTERSECTION CONDITIONS, UNSIGNALIZED
 INTERSECTIONS BUILDOUT WITH PROJECT CONDITIONS, YEAR 203063

TABLE 17 - LEVELS OF SERVICE FOR ARTERIAL STREET SEGMENTS.....68

TABLE 18 – METRO EAST OVERLAY ZONE DAILY TRAFFIC ANALYSIS.....69

TABLE 19 – FIRST & CABRILLO PROJECT LEVEL OF SERVICE ANALYSIS /DETERMINATION OF IMPACTS
 FOR FUTURE CONDITIONS, AM PEAK HOUR72

TABLE 20 – FIRST & CABRILLO PROJECT LEVEL OF SERVICE ANALYSIS /DETERMINATION OF IMPACTS
 FOR FUTURE CONDITIONS, AM PEAK HOUR73

TABLE 21 – FIRST & CABRILLO PROJECT LEVEL OF SERVICE ANALYSIS /DETERMINATION OF IMPACTS
 FOR FUTURE CONDITIONS, PM PEAK HOUR.....74

TABLE 22 – FIRST & CABRILLO PROJECT LEVEL OF SERVICE ANALYSIS /DETERMINATION OF IMPACTS
 FOR FUTURE CONDITIONS, PM PEAK HOUR.....75

TABLE 23 – METRO EAST OVERLAY ZONE LEVEL OF SERVICE ANALYSIS /DETERMINATION OF IMPACTS
 FOR BUILDOUT CONDITIONS, YEAR 2030 AM PEAK HOUR.....77

TABLE 24 – METRO EAST OVERLAY ZONE LEVEL OF SERVICE ANALYSIS /DETERMINATION OF IMPACTS
 FOR BUILDOUT CONDITIONS, YEAR 2030 AM PEAK HOUR.....78

TABLE 25 – METRO EAST OVERLAY ZONE LEVEL OF SERVICE ANALYSIS /DETERMINATION OF IMPACTS
 FOR BUILDOUT CONDITIONS, YEAR 2030 PM PEAK HOUR79

TABLE 26 – METRO EAST OVERLAY ZONE LEVEL OF SERVICE ANALYSIS /DETERMINATION OF IMPACTS
 FOR BUILDOUT CONDITIONS, YEAR 2030 PM PEAK HOUR80

TABLE 27 - LEVEL OF SERVICE ANALYSIS OF MITIGATION FOR NEAR TERM FUTURE CONDITIONS83

TABLE 28 - LEVEL OF SERVICE ANALYSIS OF MITIGATION FOR BUILDOUT CONDITIONS.....91

Appendices

Appendix A – Existing Traffic Counts

Appendix B – Traffic Forecast Information

Appendix C – Land Use and Trip Generation Information

Appendix D – Intersection Level of Service Worksheets

Appendix E – Intersection Level of Service Concepts

1. Introduction

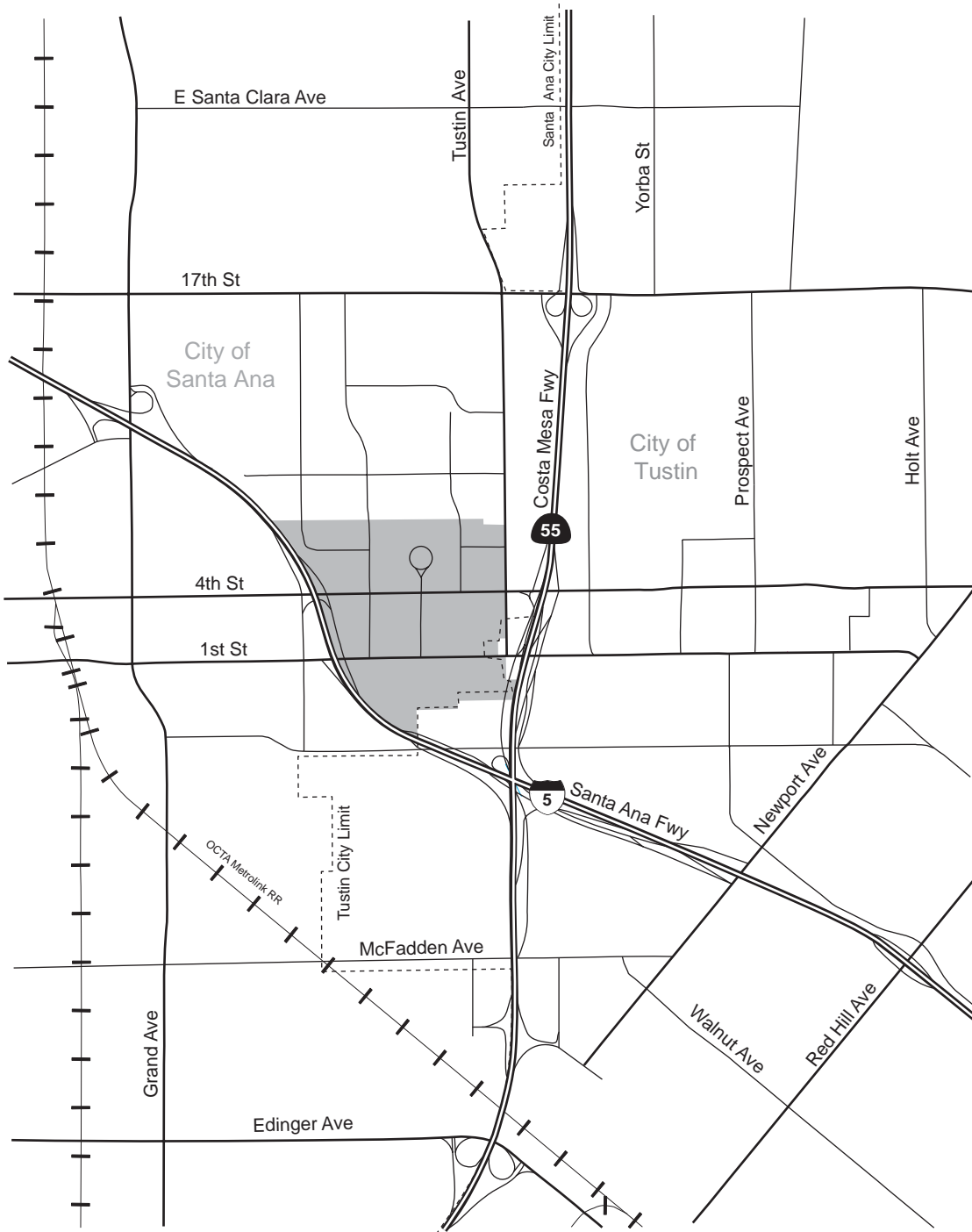
The subject of this traffic impact study is a project to apply a mixed-use overlay zone to an area of Santa Ana. This zone would permit proposed high-rise residential/mixed use projects to be located north and east of the I-5 Freeway and west of Tustin Avenue in the City of Santa Ana. The proposed projects will be located on the site of existing low-rise commercial/office buildings and vacant parcels.

The proposed Overlay Zone, known as “Metro East”, would permit an estimated 5,551 residential units, over 3.4 million square feet of office space, and 1.3 million square feet of commercial space on a 200+-acre site. This project will allow for development or redevelopment from the existing low-rise commercial and office space currently located on the site.

The sponsor of the proposed project is the City of Santa Ana. Individual parcels would be developed according to the guidelines of the proposed zone and existing City criteria. The development within the Overlay Zone would be based on current market needs and the level of developer interest within the City. The City envisions the potential buildout of a mixed-use community within the Overlay Zone by 2030. Currently, only one development project is proposed within the Overlay Zone (First and Cabrillo Towers), however the City anticipates that buildout of the Overlay Zone would generally occur at a rate of approximately 5% per year.

The Metro East project location is shown in Figure 1 and the proposed Metro East Overlay Zone site plan is shown in Figure 2. This study also analyzes the potential traffic impacts of a specific proposed project in the Overlay Zone known as First & Cabrillo Towers. This project is located at First Street and Cabrillo Street, and is shown on the site plan in Figure 3.

This report presents a review of existing traffic conditions in the study area, including existing land uses, existing roadway conditions, and existing levels of service at 38 intersections that may be impacted by the proposed project. Future intersection conditions are also analyzed for the First & Cabrillo project (Year 2010) and the complete Metro East Overlay Zone project (Year 2030). The study is intended to meet the requirements of the City of Santa Ana and the provisions of the County of Orange Congestion Management Plan (CMP) in the City of Tustin.



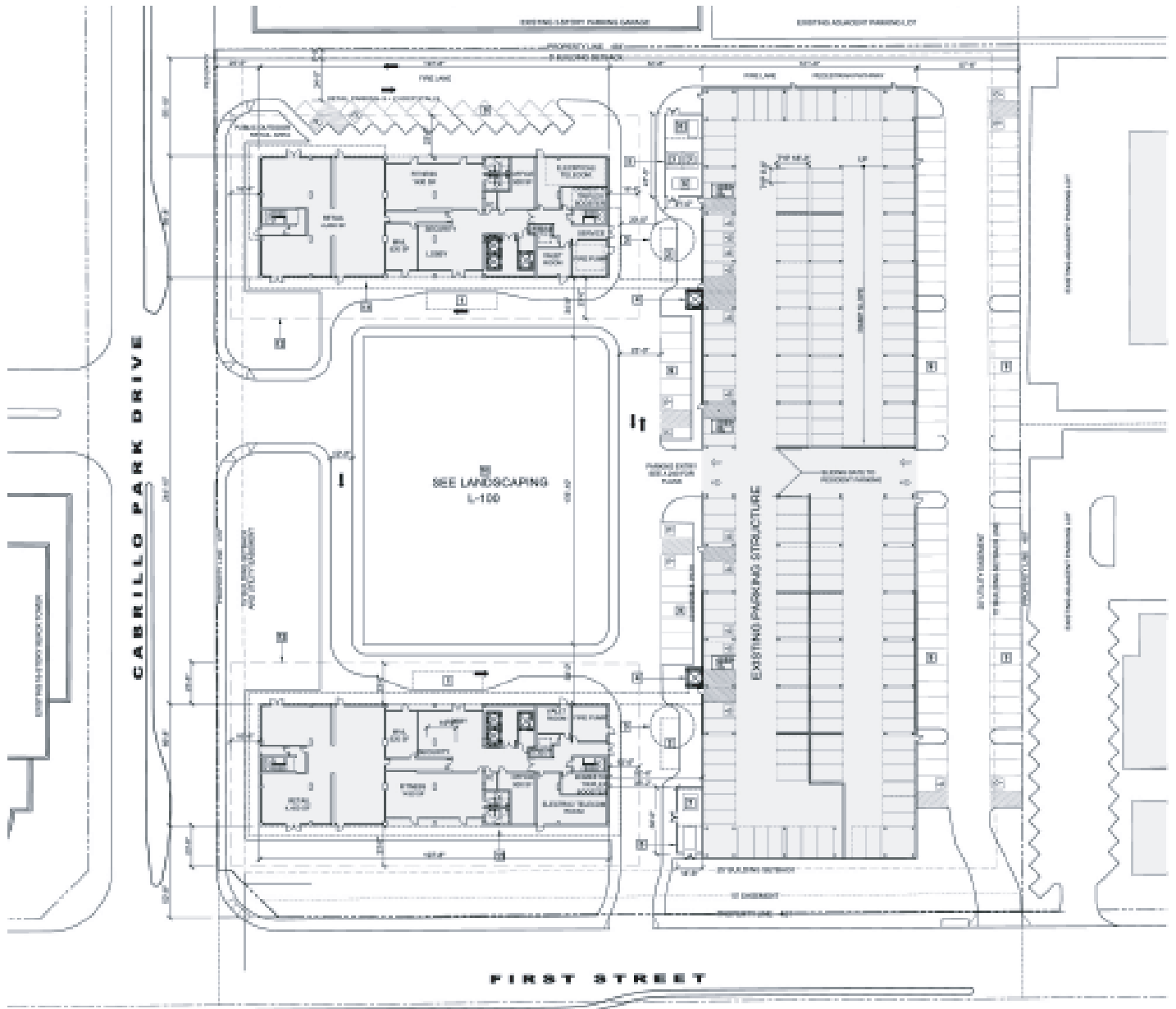
LEGEND

- Site Boundary
- Major Street
- Minor Street
- Railroad



Not to Scale





Not to Scale

2. Project Study Methodology

This chapter documents the methodologies and assumptions used to conduct the analysis for the proposed project. This section contains the following background information:

- Study timeframes
- Study area description
- Capacity analysis methodologies

2.1 Study Timeframes

This report presents an analysis of the intersection operating conditions during the morning and evening peak hours for the following anticipated timeframes:

- Existing Conditions (Year 2006)

Future conditions will analyze the following timeframes:

- Future Year 2010
- Future Year 2030

2.2 Project Study Area

The study area was determined through initial consultation with the Cities of Santa Ana and Tustin. The study area consists of the following intersections:

2.2.1 City of Santa Ana Intersections:

- 1st Street at Tustin Avenue
- 1st Street at Golden Circle Drive
- 1st Street at Cabrillo Park Drive
- 1st Street at Elk Lane
- 4th Street at SR 55 Southbound Ramps
- 4th Street at Tustin Avenue
- 4th Street at Park Center Drive
- 4th Street at Golden Circle Drive
- 4th Street at Cabrillo Park Drive
- 4th Street at I-5 Northbound Ramps
- 4th Street at I-5 Southbound Off-Ramp/Elk Lane
- Tustin Avenue at 6th Street
- Tustin Avenue at Fruit Street

- 17th Street at Tustin Avenue
- 17th Street at Cabrillo Park Drive
- 17th Street at SR 55 Northbound Ramps
- 17th Street at SR 55 Southbound Ramps
- 6th Street at Parkcenter Drive
- Parkcourt Place at Cabrillo Park Drive
- Fruit Street at Mabury Street
- Fruit Street at Cabrillo Park Drive
- Fruit Street at Parkcenter Drive
- Wellington Avenue at Cabrillo Park Drive
- Wellington Avenue at Tustin Avenue

2.2.2 City of Tustin Intersections:

- 1st Street at Yorba Street
- 1st Street at B Street
- 1st Street at El Camino Real
- 1st Street at Prospect Avenue
- 1st Street at Centennial Way
- 1st Street at Newport Avenue
- 4th Street/Irvine Boulevard at SR 55 Northbound Ramps
- 4th Street (Irvine Boulevard) at Yorba Street
- Irvine Boulevard at B Street
- Irvine Boulevard at Prospect Avenue
- Irvine Boulevard at Fashion Lane
- Irvine Boulevard at Holt Avenue
- Irvine Boulevard at Newport Boulevard

2.3 Analysis Methodologies

This section presents a brief overview of traffic analysis methodologies and concepts used in this study. Street system operating conditions are typically described in terms of “level of service.” Level of service is a report-card scale used to indicate the quality of traffic flow on roadway segments and at intersections. Level of service ranges from Level A (free flow, little congestion) to Level F (forced flow, extreme congestion). A more detailed description of the concepts described in this section is provided in Appendix E of this document.

2.4 Intersection Capacity Analysis

The analysis of peak hour intersection conditions was conducted using the TRAFFIX software program developed by Dowling Associates. The following peak periods were selected for analysis:

- Weekday AM (peak hour between 7:00 AM and 9:00 AM)
- Weekday PM (peak hour between 4:00 PM and 6:00 PM)

Traffic conditions on roadway facilities are normally analyzed using the principles or the specific analysis methods contained in the *Highway Capacity Manual, 2000 Edition (HCM)*, a publication of the Transportation Research Board, a branch of the Federal Government. Chapter 9 of the *HCM* is devoted to analysis of signalized intersections and Chapter 10 is devoted to the analysis of unsignalized intersections. The methodologies in the *HCM* for signalized and unsignalized intersections are based upon measurements or forecasts of delay for traffic utilizing all approaches to the intersection.

Traffic conditions at signalized intersections in Southern California are also often evaluated during peak hours at intersections using a methodology known as the Intersection Capacity Utilization (ICU) technique. This is the preferred analysis method for analyzing signalized intersections in Orange County and in the cities of Santa Ana and Tustin. This analysis method essentially measures the amount of traffic signal "green" time required for the intersection. It is a significant variation from the HCM method; however it produces results that are generally similar. The Cities of Santa Ana and Tustin generally use this method, so all signalized intersections were analyzed based on this method. Based upon Orange County CMP guidelines, a lane capacity of 1,700 vphpl and a 5 percent loss time were used. The City of Santa Ana has used lower capacities for left turn lanes for analysis of specific sites, however for this study the uniform methodology set forth in the County CMP is applied to all signalized intersections. This is because the overlay project requires analysis within three jurisdictions (Santa Ana, Tustin, Caltrans), and because the overlay zone is not a single development site. Unsignalized intersections were analyzed using the *HCM 2000* method for unsignalized intersections. Table 1 shows the relationship between Level of Service and Volume/Capacity criteria for signalized intersections, and delay for unsignalized intersections.

Table 1
Levels of Service for Intersections

Level of Service	Signalized Intersection Volume/Capacity Ratio	Unsignalized Intersection Control Delay (seconds)
A	0.00 – 0.60	0 – 10
B	0.61 – 0.70	10 – 15
C	0.71 – 0.80	15 – 25
D	0.81 – 0.90	25 – 35
E	0.91 – 1.00	35 – 50
F	1.00 and up	50 or more

2.5 Traffic Count Data

Existing daily and peak hour traffic data was obtained from Traffic Data Services of Santa Ana, California, in March and April, 2006. All traffic count data used in this study is compiled in Appendix A of this report.

2.6 Future Traffic Volumes

Daily and peak hour traffic volumes for Tustin Avenue, 1st Street, 4th Street, Parkcenter Drive, Cabrillo Park Drive, and other streets in the study area under future Year 2010 conditions were forecast by first increasing existing traffic volumes by a factor of 1% per year (approximately 4%). Then, future relevant project traffic increases that may be generated by other approved, expected, or proposed major developments in the area were added to the future Year 2010 traffic volumes.

To simulate forecast growth conditions for the year 2030, ambient peak hour background traffic volumes were derived from increases indicated from a comparison of the base year and future year OCTA OCTAM 3.2 traffic models. These increases were applied to existing observed peak hour traffic volumes to forecast buildout without project traffic conditions. The 2030 traffic forecasts were based on a modified version of the OCTAM 3.2 traffic model. Changes to the model's socio-economic database were made based on land-use data for the Metro East project. Trip distribution was based on the OCTAM 3.2 model using a Traffix-based micro-simulation model. The model roadway network was enhanced to replicate the roadway network in the study area. This was done to ensure a realistic distribution of traffic, particularly at the micro-analysis (intersection) level.

The modified traffic model was used to produce link volume traffic forecasts in the study area at the AM, PM, and ADT levels, both for a base year model and a future year model. The AM and

PM link volume forecasts from the base and future year models, along with the existing turning movement traffic counts, were used as the basis for producing future year traffic counts. The traffic model forecasts were used to predict future turning movement volumes at the study intersections using a methodology which adjusts existing turning movement volumes based on expected growth in approach volumes.

The future Year 2010 traffic forecast is used to determine the relative impact of the First & Cabrillo project. The Buildout Year 2030 traffic forecast is used to determine the relative impact of the Metro East Overlay Zone projects.

2.7 Standards of Significance

2.7.1 City of Santa Ana

The Circulation and Land use Elements of the City of Santa Ana General Plan for intersections located outside of Major Development Areas (MDA), set Level of Service D as the threshold for an acceptable service level. The City of Santa Ana considers Level of Service E as the maximum acceptable service level for intersections located within an MDA. These criteria are consistent with Measure M target levels, and are either more stringent than, or meet Congestion Management Plan (CMP) criteria which designates LOS E as the minimum acceptable level of service.

For the purposes of traffic studies preparation, a project is considered to have a significant traffic impact at an intersection if traffic level of service deteriorates to an unacceptable level of service (i.e., Level of Service E or F at intersections outside of MDA, Level of Service F within MDA with the addition of project traffic. For study intersections located outside of MDA, if the intersection is expected to operate at an unacceptable level of service (level of service E or F) under base conditions (conditions without the project), measures to achieve acceptable levels of service at the intersections should be recommended. For study intersections located within MDA, if the intersection is expected to operate at unacceptable levels of service (intersection level of service F at Santa Ana intersections within MDA) under base conditions (conditions without the project), improvement and recommendations are requested to achieve acceptable levels of service.

In general, a traffic study will be required to provide measures to alleviate significant traffic impact at intersections to achieve level of service D (at the minimum) for outside a “Major Development Area”. Additionally a traffic study will be required to provide measures to alleviate the significant traffic impact at intersections located within “Major Development Areas” to achieve a level of service E (at the minimum). Those mitigation measures/ improvements will be described as well as graphically illustrated as per the City of Santa Ana General Guidelines for the preparation of traffic studies.

Improvements are required for locations that operate at acceptable level of service without the project, but which operate at an unacceptable level of service with the project. For locations that are forecast to operate worse than the acceptable even without the project, the TIA must include improvements to achieve acceptable level of service per the City of Santa Ana's criteria.

2.7.2 City of Tustin

The City of Tustin has determined that Level of Service D (peak hour ICU \leq 0.90 for signalized intersections, stop delay \leq 25 seconds for unsignalized intersections) is the minimum acceptable level of service for peak hour operation in the City. For levels of service poorer than the acceptable level of service, mitigation of the project contribution is required to bring the intersection back to an acceptable level of service or to no-project conditions.

Thresholds of significance are set by the Orange County Congestion Management Plan for analysis of impacts beyond the lead agency's jurisdiction. If the project contribution is greater than .03 at CMP intersections (the impact threshold specified in the CMP), and if the location is at Level of Service E or poorer, the impact is significant. If the location is at Level of Service E or poorer and a mitigation measure is feasible to improve the level of service to Level D or better, the measure is suggested for cumulative impacts. However, if the contribution of the project is less than 0.03 the project is not deemed to impact the location.

3. Existing Conditions

This section documents existing conditions in the study area, including local land uses and driveway locations. The discussion presented here is limited to specific roadways in the Metro East project vicinity that are affected by project-related traffic. The Metro East project location is bounded by 6th Street on the north, the I-5 Freeway and Santa Ana City boundary on the south, the I-5 Freeway on the west, and Parkcenter Drive on the east. The area of potential impact is larger than the project location, as determined by project traffic impact analysis.

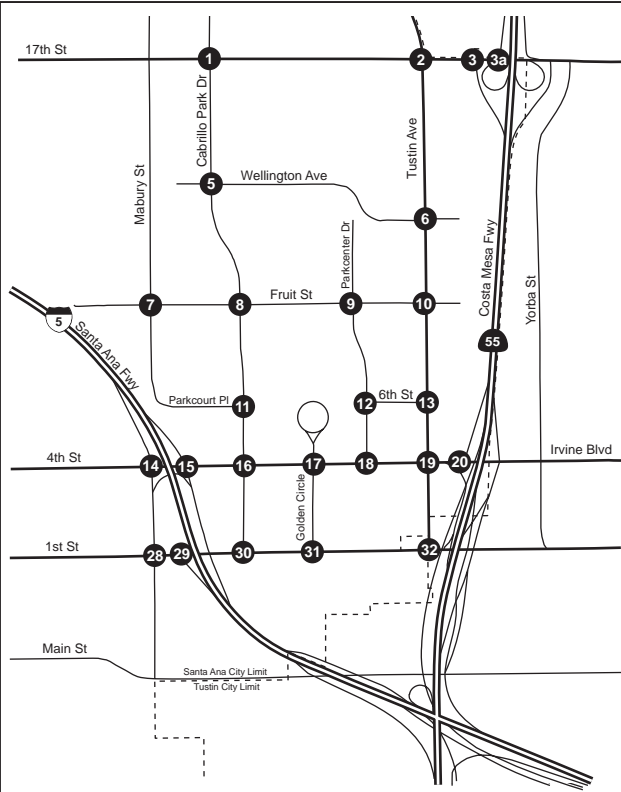
3.1 Area Roadway Network

Streets in the Metro East project vicinity which could be affected by the proposed project include 1st Street, 4th Street, 6th Street, Fruit Street, Wellington Avenue, 17th Street, Cabrillo Park Drive, Parkcenter Drive, Tustin Avenue, Yorba Street, Prospect Avenue, and Newport Avenue. Existing intersection geometries are shown in Figures 4 and 5.

1st Street

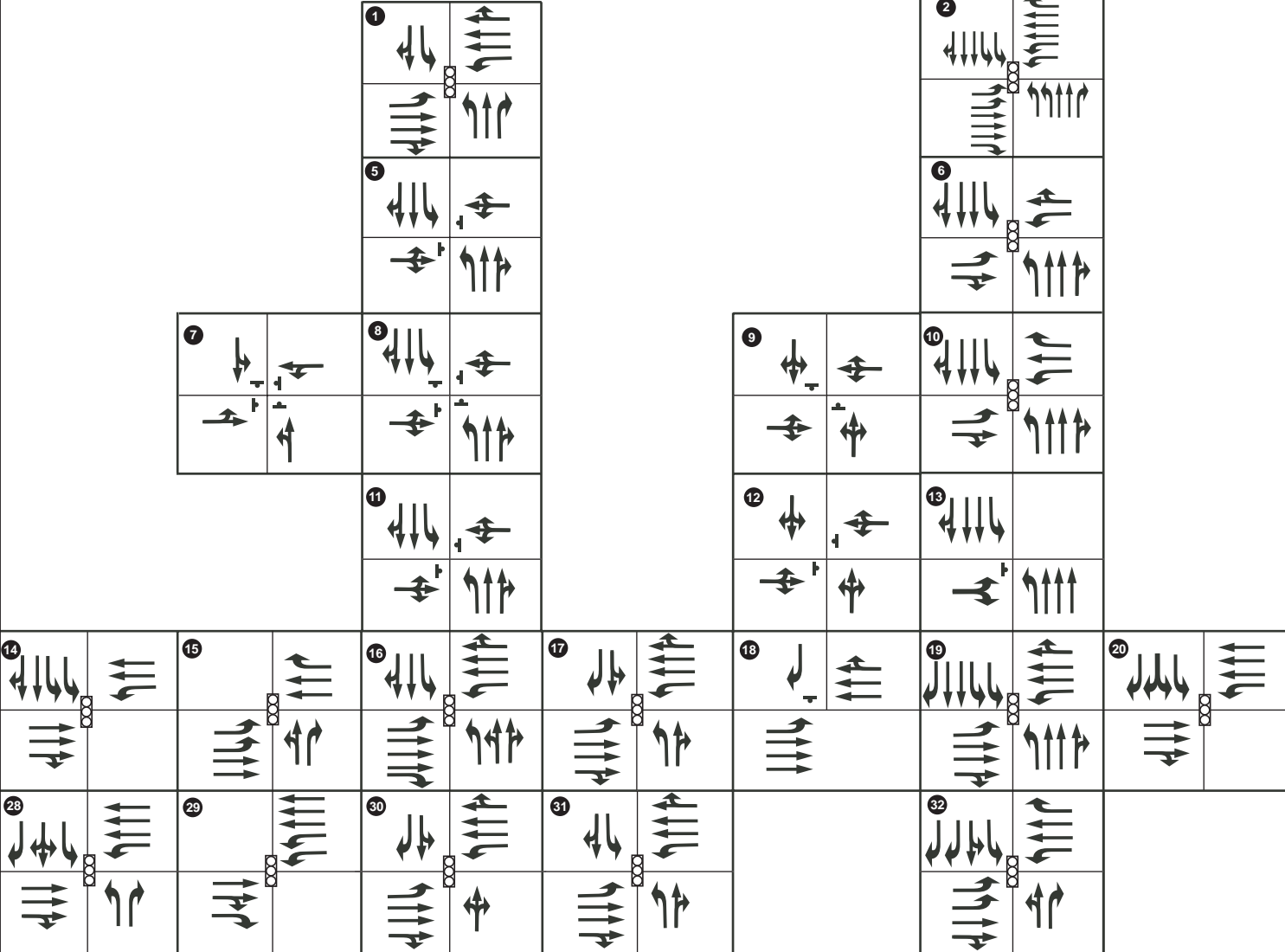
1st Street is a major east-west arterial passing through the southern part of the Metro East project area. The street provides 2 – 3 through lanes in each direction, with a posted speed limit of 35 mph. 1st Street has a striped median west of Cabrillo Park Drive. It has a raised median from Cabrillo Park Drive east for about 400 feet. The street has a striped median from this point east to Tustin Avenue. Intersections with Mabury Street, I-5 Southbound on ramp, Cabrillo Park Drive, Golden Circle, and Tustin Avenue are signalized. Most intersections along this segment of 1st Street have both eastbound and westbound left turn pockets. Right turns are made from shared through and right turn lanes. Land use adjacent to this segment of 1st Street has a variety of commercial uses including hotels, office buildings, strip commercial centers, and restaurants. Major buildings include the Xerox Center, the Pridemark Building, Colton Midtown Plaza, and the URS Building. The Santa Ana Zoo is located immediately south of 1st Street and west of the I-5 Freeway. Traffic volumes along this segment of 1st Street are about 17,000 per day.

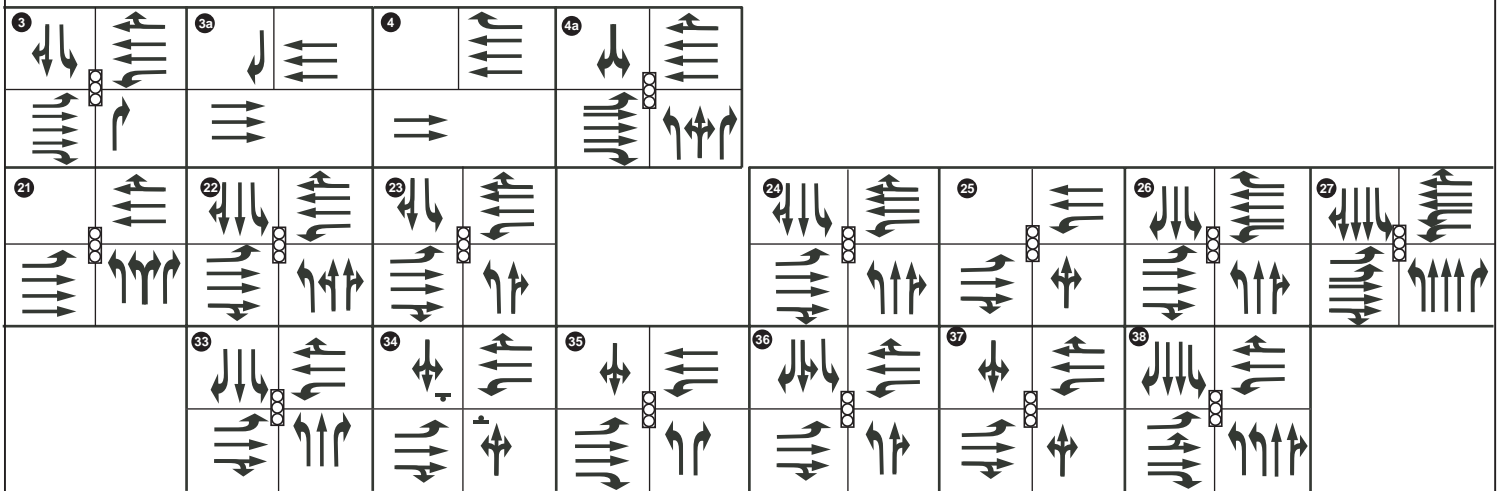
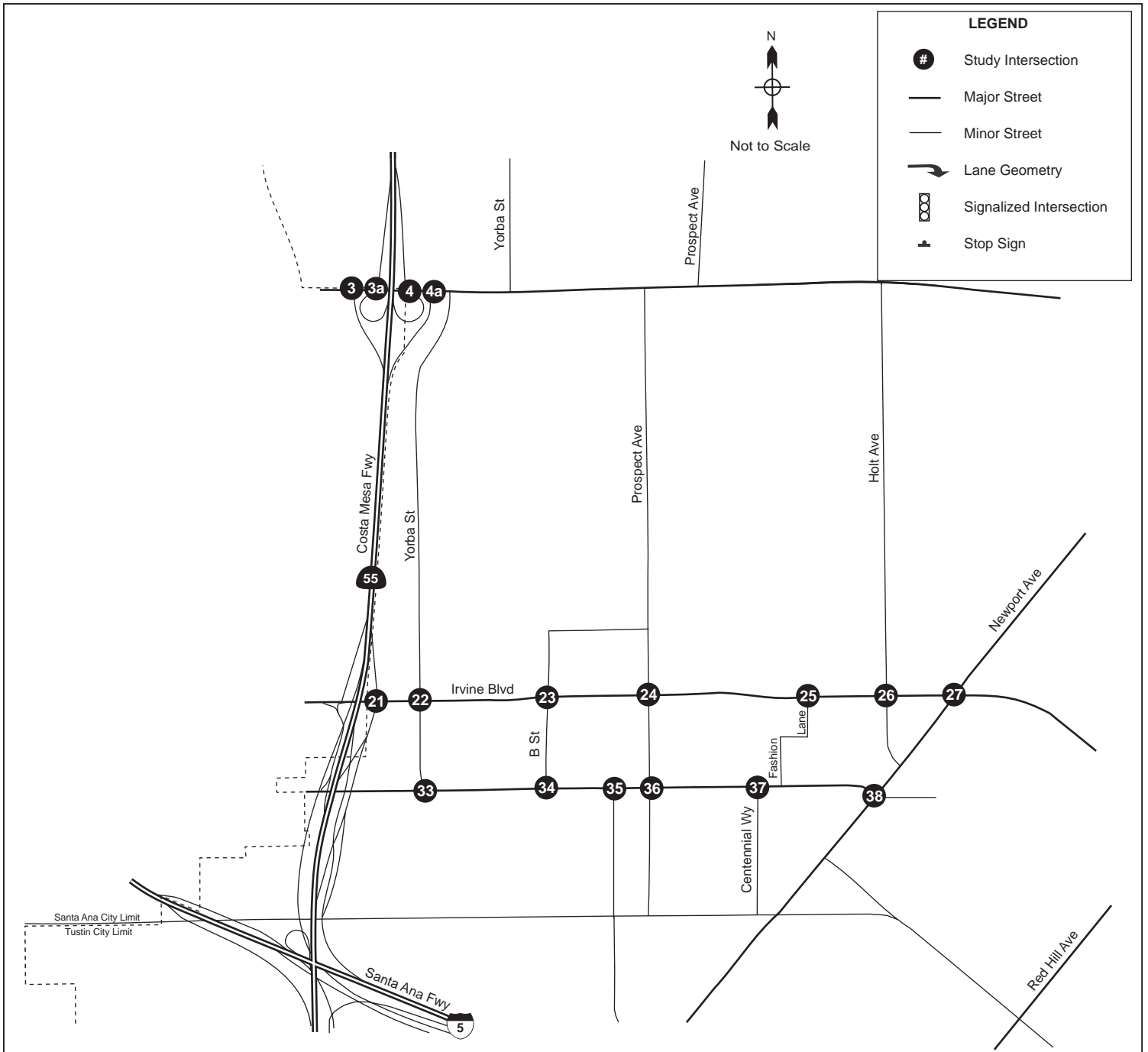
1st Street has two through lanes in each direction east of Tustin Avenue, with a raised landscaped median east of the SR-55 overcrossing. The posted speed limit is 35 mph. Intersections are signalized at Tustin Avenue, Yorba Street, El Camino Real, Prospect Avenue, Centennial Way, and Newport Avenue. All signalized intersections have both eastbound and westbound left turn pockets. Right turns are generally made from shared through and right turn lanes (except at El Camino Real and Newport Avenue, which have right turn pockets). This segment of 1st Street has a mix of office, strip commercial, and retail land uses. Major buildings/commercial centers include



LEGEND

- # Study Intersection
- Major Street
- Minor Street
- ↩ Lane Geometry
- ☐ Signalized Intersection
- ⊥ Stop Sign





Healthsouth, CR Commercial, the U.S. Post Office, Wellington Plaza, Bank of the West, and Bank America. Traffic volumes along this segment of 1st Street are about 17,000 – 18,000 per day. 1st Street provides access to I-5 immediately west of the Metro East project site, and passes over SR-55 immediately east of the Metro East project site.

4th Street

4th Street is a major east-west arterial bisecting the Metro East project area. West of Cabrillo Park Drive the roadway has a painted median with three eastbound and three westbound through lanes (with some lane drops/lane adds at freeway on- and off-ramps). East of Cabrillo Park Drive the street provides three through lanes in each direction with a raised landscaped median. The speed limit is 40 mph. Intersections with the I-5 ramps, Cabrillo Park Drive, Golden Circle, and Tustin Avenue are signalized. Most signalized intersections have left turn pockets, but shared through and right turn lanes. Land uses along this segment of 4th Street are primarily commercial/retail and office. Major buildings/centers include the State Insurance Fund Building, Kaiser Permanente, Town Center Plaza, Citizen's Business Bank, and the Parkcenter 400 building. Daily traffic volumes along this segment of 4th Street are about 23,200 west of Tustin Avenue and 29,400 west of Cabrillo Park Drive.

East of Tustin Avenue 4th Street becomes Irvine Boulevard, and has three through lanes in each direction with a raised median. The posted speed limit is 40 mph. Intersections with Tustin Avenue, SR-55 northbound and southbound ramps, Yorba Street, Prospect Avenue, Fashion Lane, Holt Avenue, and Newport Avenue are signalized. All signalized intersections have both eastbound and westbound left turn pockets. Right turns are generally made from shared through and right turn lanes (except at Newport Avenue, which has a westbound right turn pocket. This segment of 1st Street has a mix of office, strip commercial, and retail land uses. Major commercial centers include Granada Plaza, the Modjeska Building, Citibank, Tustin Corporate Center, and Lafayette Plaza. Daily traffic volumes along this segment of 4th Street are about 36,000 near the freeway ramps and 28,000 – 29,000 between Yorba Street and Newport Avenue.

4th Street provides full access with SR-55 immediately east of the Metro East project site, and partial access to and from northbound I-5 at the western limit of the study area.

6th Street

6th Street is a local east-west street serving the low-rise commercial and office buildings in the central part of the study area. The roadway is undivided, providing one lane each way. The speed limit on 6th Street is 25 mph. The intersection with Tustin Avenue is stop controlled on the minor leg only (6th Street). Land uses along 6th Street are office, commercial, and vacant. Daily traffic volumes along 6th Street are about 1,100 – 1,300.

Fruit Street

Fruit Street is an east-west collector street serving the residential and non-residential areas in the northern part of the study area. The roadway is undivided, with one lane each way. The speed limit on Fruit Street is 35 mph. Intersections are stop-controlled, except for Tustin Avenue, which is signalized with permitted left turn phasing. Land uses along Fruit Street are a mix of single-family residential, apartments, tennis courts, and a community park (“Cabrillo Park”) west of Parkcenter Drive. East of Parkcenter are apartments and offices. At Tustin Avenue Calvary Chapel, a large church, occupies the northwest corner of Fruit Street at Tustin Avenue. A strip commercial center occupies the southwest corner property. Traffic volumes along Fruit Street are about 3,000 – 4,000 per day.

Wellington Avenue

Wellington Avenue is an east-west local street north of the study area. The roadway is undivided, with one lane each way. The speed limit on Wellington Avenue is 30 mph. The intersection with Cabrillo Park Drive is stop-controlled on the minor leg only (Wellington Avenue). The intersection with Tustin Avenue is signalized. Land uses along Wellington Avenue are primarily residential (both apartments and single-family homes). Near Tustin Avenue there are office uses (Parkcenter Medical Building and Westcoast Radiology), and the Calvary Church. Daily traffic volumes along Wellington Avenue are about 3,000 near Cabrillo Park Drive and about 6,000 near Tustin Avenue.

Cabrillo Park Drive

Cabrillo Park Drive is a 4-lane north-south arterial street located in the western portion of the study area. The roadway provides two lanes in each direction with a raised landscaped median and left turn lanes. Right turns are made from shared through and right turn lanes. Land uses along Cabrillo Park Drive in the Metro East project vicinity are primarily residential and a City park, with a mix of Single-family dwelling units and apartments. Commercial and office land uses are south of Parkcourt Place. Kaiser Permanente and the State Insurance Fund Building are at the intersection of Cabrillo Park Drive and 4th Street. The intersections of Cabrillo Park Drive and 17th Street, 4th Street, and 1st Street are signalized. The posted speed limit on Cabrillo Park Drive is 35 mph. Daily traffic volumes are about 9,500 south of Fruit Street.

Parkcenter Drive

Park Center Drive is a local north-south 2-lane undivided street located near the center of the study area. The street provides access to several low-rise commercial/office complexes. There is no posted speed limit on Parkcenter Drive. A limit of 25 mph would therefore apply. The daily traffic volume near Fourth Street is approximately 3,000 vehicles per day. All intersecting streets are stop-controlled at Parkcenter. The intersection with 4th street is controlled by a stop sign for Parkcenter Drive.

Tustin Avenue

Tustin Avenue is a major north-south arterial located immediately east of the Metro East project site. In the Metro East project vicinity, the roadway provides three lanes in each direction, divided by a two-way left turn lane. The roadway has left turn pockets at most intersections. Most land use along Tustin Avenue is commercial and office, with some convenience commercial, medical office, a hospital, apartments, and a church. Major buildings/commercial centers along the street include “The Center on 17th”, Fireman’s Fund, Tustin Centre, the Parkcenter Medical Building, Westcoast Radiology, Western Medical Center, Open Advantage MRI, Calvary Church, and Creekside Plaza. The intersections of Tustin Avenue at 17th Street, Tustin Avenue at Wellington Avenue, Tustin Avenue at 4th Street, Tustin Avenue at 1st Street, and Tustin Avenue at Fruit Street are signalized. The intersection of Tustin Avenue at 6th Street is stop-controlled on the minor street (6th Street). The posted speed limit is 40 mph. The daily traffic volume near the Metro East project site is approximately 17,000 vehicles per day south of 4th Street, and 24,700 vehicles per day north of Fruit Street.

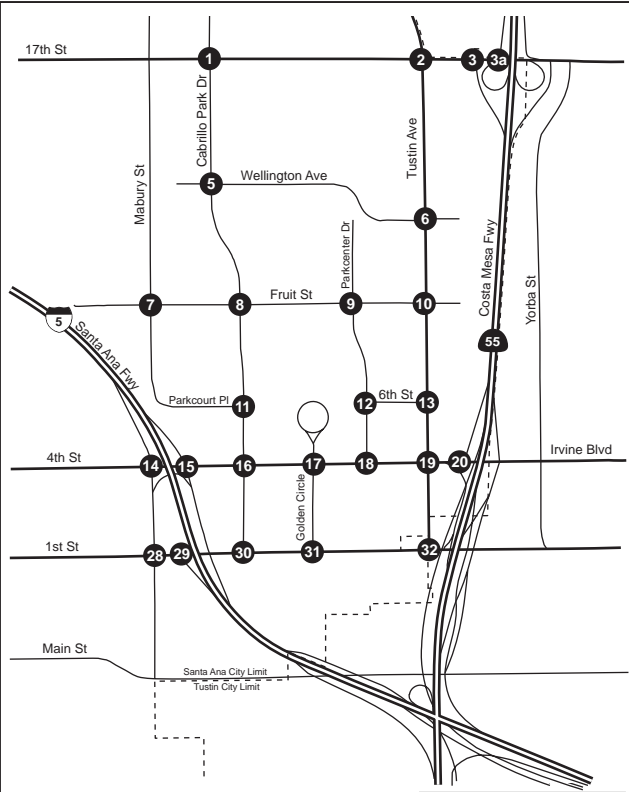
Area Freeways

Regional circulation is provided by Interstate 5 (I-5) west and south of the proposed development site, and State Route 55 (SR-55), which is east of the proposed development site. I-5 is a major route between Los Angeles, Orange, and San Diego Counties, serving many major employment centers and residential areas, including significant portions of Anaheim, Santa Ana, Tustin, and Irvine. SR-55 is a major north-south freeway in Orange County, serving the cities of Anaheim, Orange, Tustin, Santa Ana, Irvine, and Costa Mesa, and providing access to many major employment centers. It also serves commuter traffic traveling between Orange County and the Inland Empire.

3.2 Existing Intersection Conditions

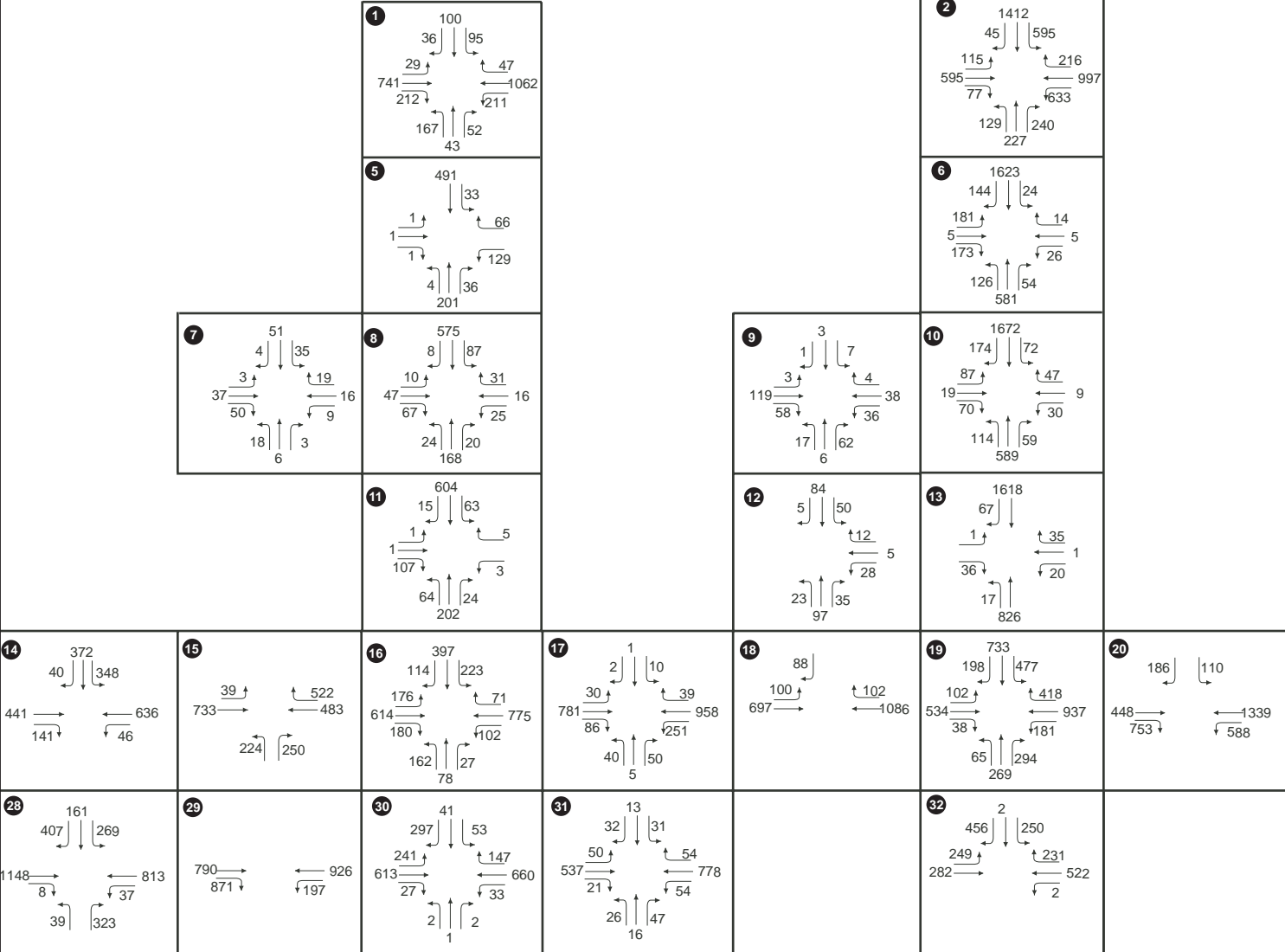
Figures 6 and 7 illustrate existing peak hour traffic volumes during the AM peak hour. Figures 8 and 9 illustrate existing peak hour traffic volumes during the PM peak hour. Based on these existing traffic volumes, level of service analyses were conducted for the 38 study intersections. The results of these analyses are summarized in Table 2 for signalized intersections and in Table 3 for unsignalized intersections.

As shown, all of the 28 signalized intersections operate at Level of Service D or better under the existing conditions scenario. Eight of the 9 unsignalized intersections operate at Level of Service D or better for the poorest movement under the existing conditions scenario. One unsignalized intersection, 1st Street at B Street, operates at Level of Service E for the poorest movement in the PM peak hour.



LEGEND

- #** Study Intersection
- Major Street
- Minor Street
- XX Turning Movement Volume

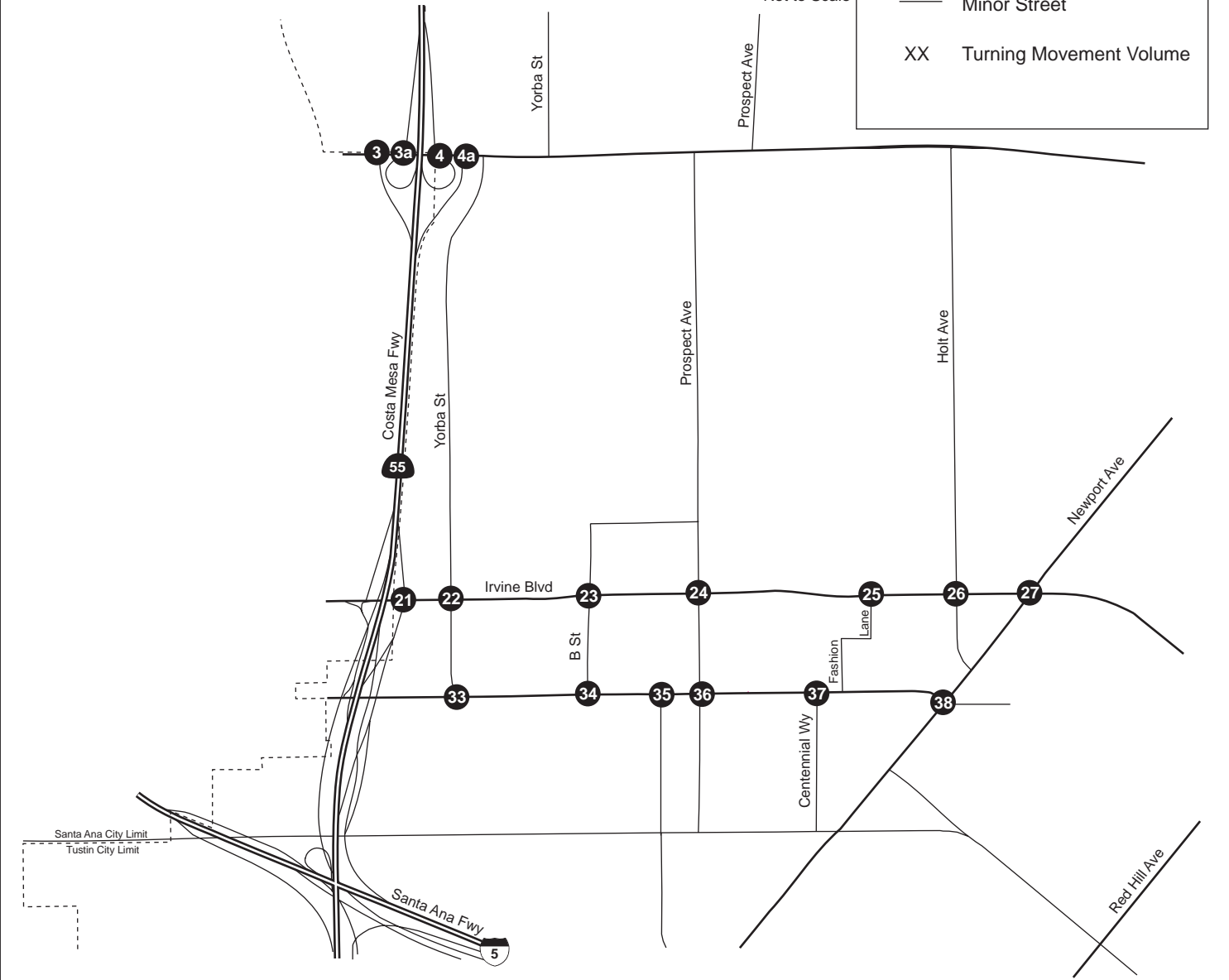




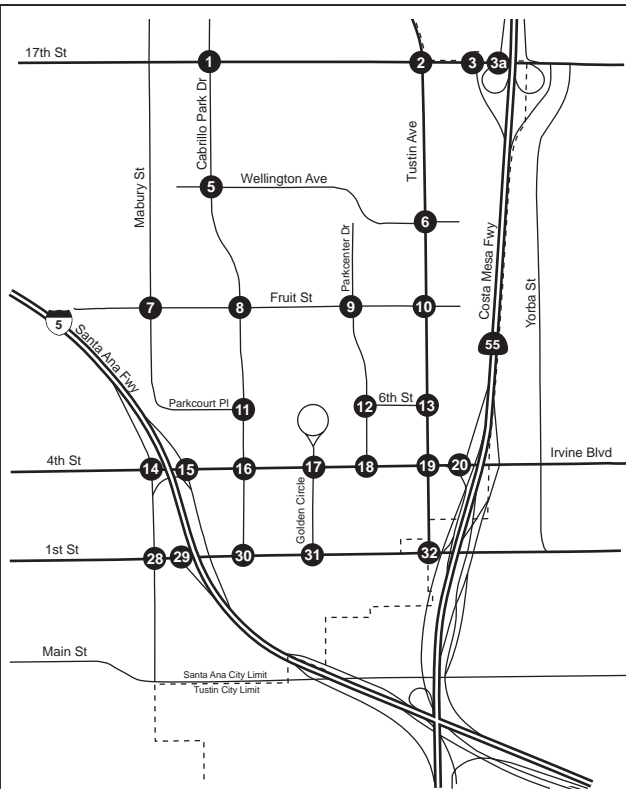
Not to Scale

LEGEND

- # Study Intersection
- Major Street
- Minor Street
- XX Turning Movement Volume

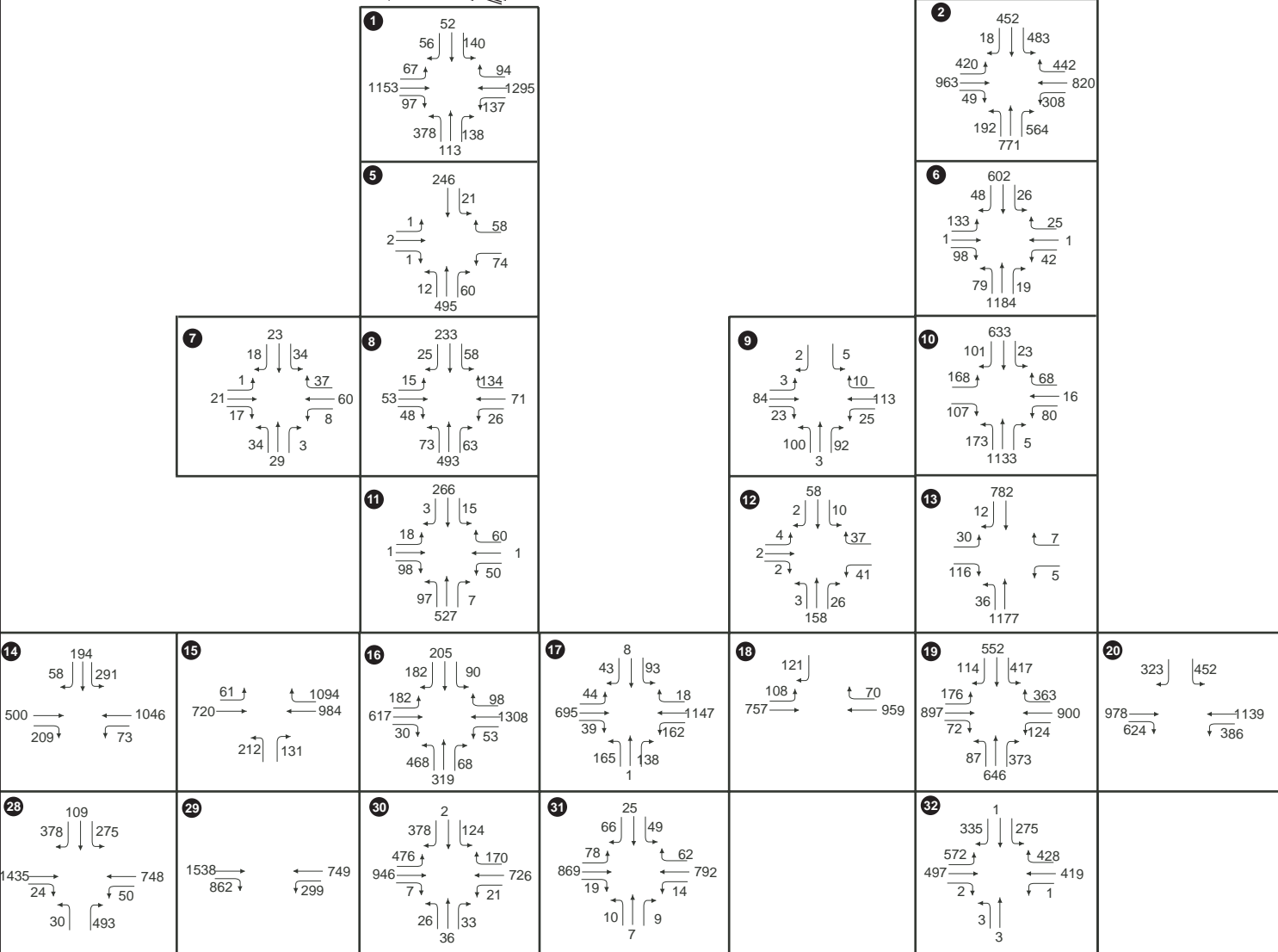


<p>3</p> <p>68 36 17 653 724 12 1211 306</p>	<p>3a</p> <p>544 668 1447 687</p>	<p>4</p> <p>456 1355 314 1447</p>	<p>4a</p> <p>79 82 1043 16 952 416 27 283</p>
<p>21</p> <p>173 400 402 350 628 1496</p>	<p>22</p> <p>565 436 55 652 131 161 73 100 28 1381 12 15</p>	<p>23</p> <p>88 109 103 607 17 15 110 40 17 9</p>	<p>24</p> <p>366 165 72 487 75 84 223 149 85 1350 87 59</p>
<p>25</p> <p>4 67 17 36 1812 164</p>	<p>26</p> <p>266 245 95 55 24 82 164 91 425 25 10</p>	<p>27</p> <p>1434 256 87 529 35 86 432 83 25 1423 227 136</p>	
<p>33</p> <p>177 161 60 457 44 75 139 123 101 608 72 61</p>	<p>34</p> <p>12 125 82 713 18 3 14 13 24 607 20 16</p>	<p>35</p> <p>4 4 633 166 112 2 2 5 681 69 37 2</p>	<p>36</p> <p>159 152 67 507 41 56 89 164 132 484 58</p>
<p>37</p> <p>2 9 86 103 1 60 1 8 563 69</p>	<p>38</p> <p>1482 143 150 90 160 235 508 33 39 160 58 26</p>		



LEGEND

- #** Study Intersection
- Major Street
- Minor Street
- XX Turning Movement Volume

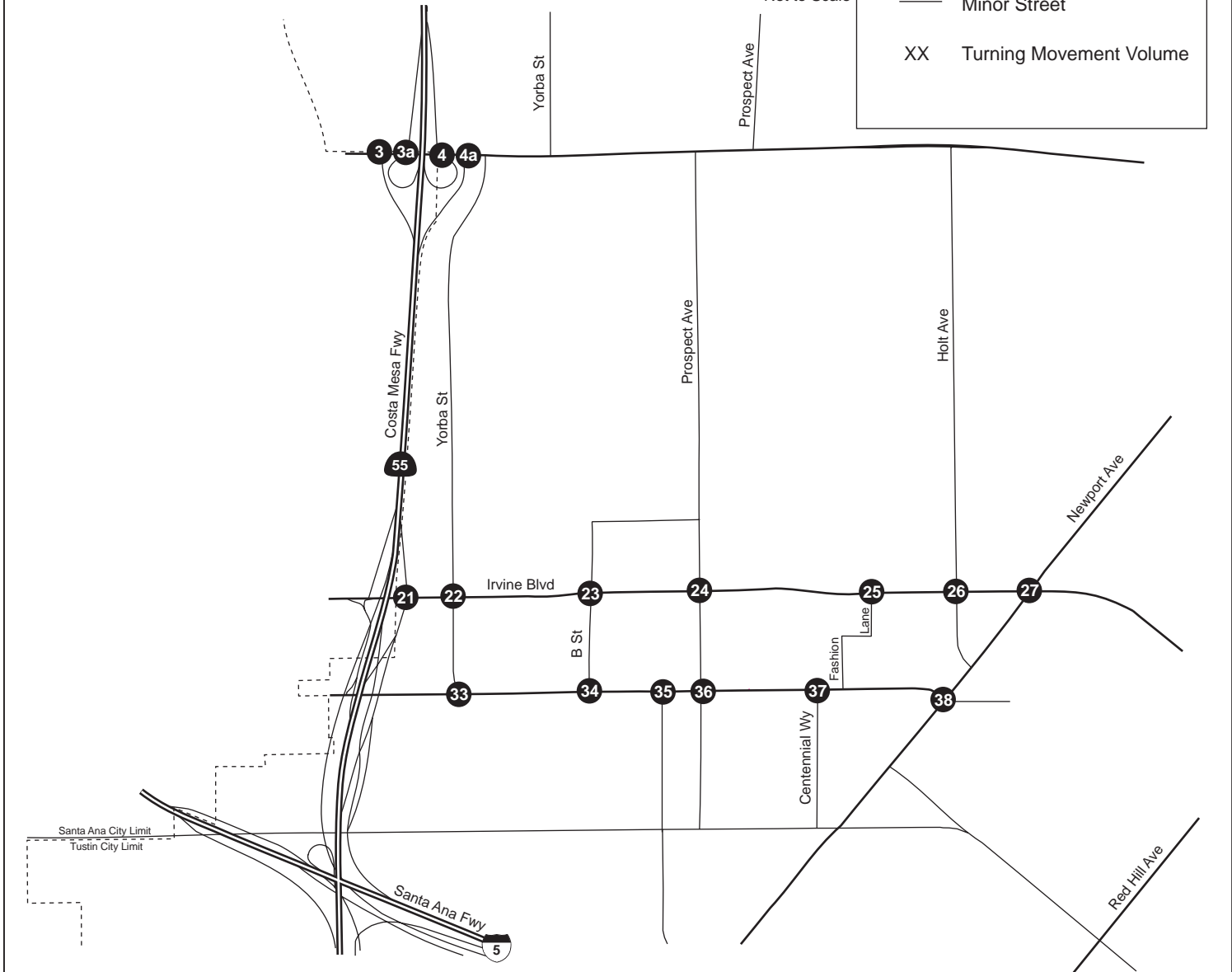




Not to Scale

LEGEND

- # Study Intersection
- Major Street
- Minor Street
- XX Turning Movement Volume



<p>3</p> <p>14 12 ↓ 16 38 ↓ 51 1248 → ← 1871 541 ↓ 257</p>	<p>3a</p> <p>436 ↘ 1735 → ← 1743 471 ↙</p>	<p>4</p> <p>1735 → ← 1743 610 ↓ 627 ↑</p>	<p>4a</p> <p>97 ↘ 4 95 ↘ 14 1231 → ← 1026 620 ↑ 333 23 ↓</p>			
<p>21</p> <p>403 ↓ 688 035 → ← 1146 326 ↑ 339 1 ↓</p>	<p>22</p> <p>95 ↘ 41 111 ↘ 30 904 → ← 1635 155 ↓ 25 334 ↑ 30 229 ↓</p>	<p>23</p> <p>23 52 ↓ 10 66 ↘ 39 1068 → ← 4707 20 ↓ 40 27 ↑ 39 24 ↓</p>	<p>24</p> <p>275 63 ↘ 135 142 ↘ 191 928 → ← 121 112 ↓ 76 130 ↑ 98 366 ↓</p>	<p>25</p> <p>21 ↓ 996 → ← 1253 56 ↓ 88 98 ↓ 95</p>	<p>26</p> <p>101 113 ↘ 131 154 ↘ 141 881 → ← 302 99 ↓ 42 103 ↑ 49 167 ↓</p>	<p>27</p> <p>529 146 ↘ 97 270 ↘ 20 826 → ← 1147 80 ↓ 193 173 ↑ 320 729 ↓</p>
<p>33</p> <p>119 65 ↘ 136 124 ↘ 215 621 → ← 719 45 ↓ 62 104 ↑ 25 280 ↓</p>	<p>34</p> <p>15 47 ↘ 16 26 ↘ 25 786 → ← 885 20 ↓ 17 10 ↑ 48 5 ↓</p>	<p>35</p> <p>14 ↓ 673 → ← 636 147 ↓ 82 234 ↓ 109</p>	<p>36</p> <p>101 113 ↘ 168 142 ↘ 186 658 → ← 630 49 ↓ 97 95 ↑ 25 178 ↓</p>	<p>37</p> <p>5 4 ↓ 7 13 ↘ 4 694 → ← 648 106 ↓ 96 141 ↑ 146 3 ↓</p>	<p>38</p> <p>767 162 ↘ 59 338 ↘ 60 174 → ← 174 238 ↓ 87 344 ↑ 62 1021 ↓</p>	

Table 2
Peak Hour Intersection Conditions
Signalized Intersections, Existing Conditions, Year 2006

Intersection	AM Peak Hour		PM Peak Hour	
	ICU	Level of Service	ICU	Level of Service
Signalized Intersections – Santa Ana				
1st Street at Tustin Avenue	.351	A	.474	A
1st Street at Golden Circle Drive	.306	A	.326	A
1st Street at Cabrillo Park Drive	.408	A	.636	B
1st Street at Elk Lane	.655	B	.805	D
1st Street at I-5 SB On Ramp	.434	A	.559	A
4th Street at SR-55 Southbound Ramps	.897	D	.796	C
4th Street at Tustin Avenue	.689	B	.743	C
4th Street at Golden Circle Drive	.406	A	.486	A
4th Street at Cabrillo Park Drive	.522	A	.714	C
4th Street at I-5 Northbound Ramps	.500	A	.836	D
4th Street at I-5 Southbound Off-Ramp	.358	A	.443	A
Tustin Avenue at Fruit Street	.558	A	.435	A
Tustin Avenue at Wellington Avenue	.591	A	.395	A
17th Street at Tustin Avenue	.676	B	.718	C
17th Street at Cabrillo Park Drive	.539	A	.662	B
17th Street at SR-55 NB Ramps	.447	A	.542	A
17th Street at SR 55 SB Ramps	.419	A	.465	A
Signalized Intersections – Tustin				
1st Street at Yorba Street	.418	A	.579	A
1st Street at El Camino Real	.343	A	.434	A
1st Street at Prospect Avenue	.415	A	.576	A
1st Street at Centennial Way	.361	A	.516	A
1st Street at Newport Avenue	.708	C	.612	B
Irvine Boulevard at SR-55 Northbound Ramps	.716	C	.822	D
Irvine Boulevard at Yorba Street	.701	C	.614	B
Irvine Boulevard at B Street	.548	A	.491	A
Irvine Boulevard at Prospect Avenue	.579	A	.607	B
Irvine Boulevard at Fashion Lane	.606	B	.546	A
Irvine Boulevard at Holt Avenue	.556	A	.522	A
Irvine Boulevard at Newport Boulevard	.686	B	.560	A

Table 3
Peak Hour Intersection Conditions
Unsignalized Intersections, Existing Conditions, Year 2006

Intersection	AM Peak Hour			PM Peak Hour		
	Average Delay	Worst Case Delay	Level of Service ¹	Average Delay	Worst Case Delay	Level of Service ¹
Unsignalized Intersections – Santa Ana						
6th Street at Parkcenter Drive	3.0	10.7	B	2.8	10.2	B
Parkcourt Pl. at Cabrillo Park Dr.	2.2	13.6	B	4.1	21.3	C
Fruit Street at Mabury Street	7.8	7.8	A	7.6	7.6	A
Fruit Street at Cabrillo Park Drive	10.7	10.7	B	12.1	12.1	B
Fruit Street at Parkcenter Drive	3.6	10.9	B	5.3	11.1	B
Wellington Av. at Cabrillo Park Dr.	3.6	16.2	C	2.7	17.6	C
Tustin Avenue at 6th Street	1.0	33.1	D	1.8	32.5	D
4th Street at Parkcenter Drive	1.1	12.3	B	1.3	11.8	B
Unsignalized Intersections – Tustin						
1st Street at B Street	2.8	31.4	D	2.5	36.0	E

Note 1: Level of Service shown in seconds per vehicle average for the worst-case approach.

It should be noted that the existing intersection levels of service documented in this report assume that traffic signal timing is optimized. Based on field observations it is apparent that the timing of some traffic signals in the study area is not optimized. For example, at Tustin Avenue and 17th Street, the signals allow for re-service of the northbound and southbound left turn movements, causing unnecessary delay to the through movements on Tustin Avenue. Signal timing optimization is recommended for all City of Santa Ana traffic signals in the study area.

Non-optimal signal coordination between City and State-jurisdiction traffic signals is also observed near the several freeway ramp intersections in the study area. This includes I-5/4th Street, SR-55/4th Street, and SR-55/17th Street.

4. Future Traffic Conditions Without Project

This section documents the future (2010) traffic conditions without the addition of project-related traffic to the surrounding street system. To forecast the near-term growth conditions for the year 2010, the peak hour background traffic volumes in Figures 6 - 9 were increased by a factor of 1% per year (approximately 4%). Also considered are future traffic increases that may be generated by other developments that have been approved in the study area. The City of Santa Ana identified four relevant projects near the Metro East project site which will add traffic to the intersections analyzed in the study. Table 4 lists the cumulative projects that were analyzed individually as part of this study and their percentage of completion. The trip generation for these cumulative projects is shown in Appendix C. Cumulative project traffic volumes for City of Tustin intersections were derived from the Tustin Legacy study. These volumes were interpolated for Year 2010 and incorporated into the traffic forecasts for the relevant intersections in the City of Tustin.

Table 4 - Cumulative Projects

Name/Location	Description	Size/Units	Percent Complete
Santa Ana Industrial/ 1340 South Ritchey Street	Three industrial buildings over former railroad right of way	31,000 Square Feet	0%
Cobblestone Plaza/ 1234 East 17th Street	Expansion of existing commercial center	11,000 Square Feet	0%
Xerox Tower II/ 200 North Cabrillo Park Dr.	New office building adjacent to existing Xerox Tower	210,000 Square Feet	0%

SOURCE: City of Santa Ana, Development Activity Report - September 2006

Tables 5 and 6 illustrate the future without project intersection level of service conditions. As shown in the table, 35 of the 38 intersections are expected to operate at Level of Service D or better under the future without project condition for the year 2010. One signalized intersection 4th Street at SR-55 Southbound Ramps, and the poorest approaches to two unsignalized intersections, Tustin Avenue at 6th Street and 1st Street at B Street, will operate at Level of Service E in both the AM and PM peak hours. Figures 10 - 13 illustrate the AM and PM peak hour traffic volumes for the Future without Project conditions.

**Table 5 – First & Cabrillo Project
Peak Hour Intersection Conditions, Signalized Intersections
Future without Project Conditions, Year 2010**

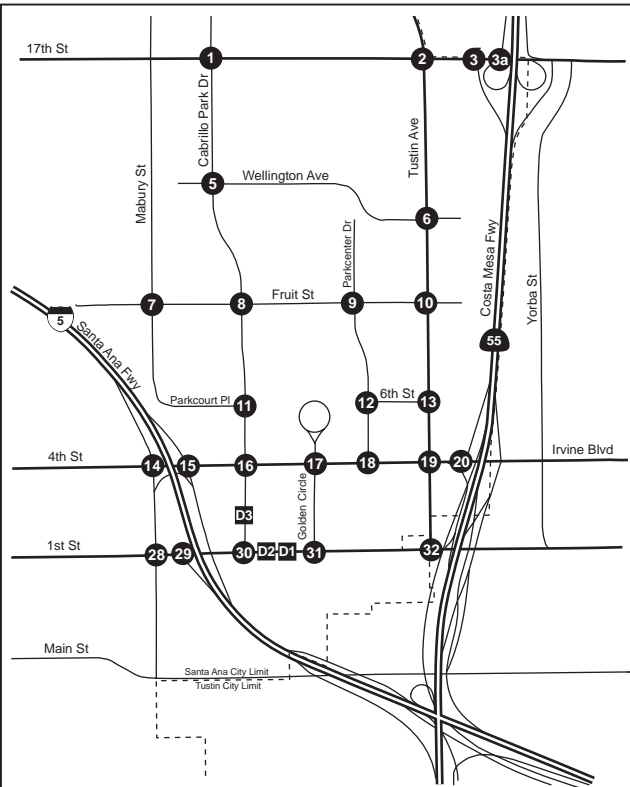
Intersection	AM Peak Hour		PM Peak Hour	
	ICU	Level of Service	ICU	Level of Service
Signalized Intersections – Santa Ana				
1st Street at Tustin Avenue	.370	A	.497	A
1st Street at Golden Circle Drive	.320	A	.338	A
1st Street at Cabrillo Park Drive	.451	A	.673	B
1st Street at Elk Lane	.680	B	.835	D
1st Street at I-5 SB On Ramp	.458	A	.633	B
4th Street at SR-55 Southbound Ramps	.941	E	.857	D
4th Street at Tustin Avenue	.737	C	.785	C
4th Street at Golden Circle Drive	.423	A	.506	A
4th Street at Cabrillo Park Drive	.566	A	.787	C
4th Street at I-5 Northbound Ramps	.518	A	.868	D
4th Street at I-5 Southbound Off-Ramp	.371	A	.464	A
Tustin Avenue at Fruit Street	.583	A	.452	A
Tustin Avenue at Wellington Avenue	.619	B	.411	A
17th Street at Tustin Avenue	.711	C	.751	C
17th Street at Cabrillo Park Drive	.579	A	.709	C
17th Street at SR-55 NB Ramps	.463	A	.564	A
17th Street at SR 55 SB Ramps	.435	A	.484	A
Signalized Intersections – Tustin				
1st Street at Yorba Street	.438	A	.601	B
1st Street at El Camino Real	.359	A	.453	A
1st Street at Prospect Avenue	.432	A	.599	A
1st Street at Centennial Way	.374	A	.538	A
1st Street at Newport Avenue	.737	C	.645	B
Irvine Boulevard at SR-55 Northbound Ramps	.761	C	.869	D
Irvine Boulevard at Yorba Street	.732	C	.640	B
Irvine Boulevard at B Street	.572	A	.510	A
Irvine Boulevard at Prospect Avenue	.604	B	.630	B
Irvine Boulevard at Fashion Lane	.635	B	.567	A
Irvine Boulevard at Holt Avenue	.770	C	.693	B
Irvine Boulevard at Newport Boulevard	.835	D	.703	C

**Table 6 – First & Cabrillo Project
Peak Hour Intersection Conditions, Unsignalized Intersections
Future without Project Conditions, Year 2010**

Intersection	AM Peak Hour			PM Peak Hour		
	Average Delay ¹	Worst Case Delay ¹	Level of Service ²	Average Delay	Worst Case Delay	Level of Service ¹
Unsignalized Intersections – Santa Ana						
6th Street at Parkcenter Drive	3.1	10.8	B	2.9	10.3	B
Parkcourt at Cabrillo Park Dr.	2.3	14.7	B	4.4	26.4	D
Fruit Street at Mabury Street	7.9	7.9	A	8.0	8.0	A
Fruit Street at Cabrillo Park Dr.	11.6	11.6	B	13.3	13.3	B
Fruit Street at Parkcenter Drive	3.5	11.2	B	5.4	11.3	B
Wellington Av. at Cabrillo Park Dr.	3.9	18.1	C	3.2	20.8	C
Tustin Avenue at 6th Street	1.2	38.8	E	1.9	37.0	E
4th Street at Parkcenter Drive	1.1	13.6	B	1.3	12.2	B
Unsignalized Intersections – Tustin						
1st Street at B Street	3.0	35.8	E	2.9	43.1	E

Note 1: Delay shown in seconds per vehicle

Note 2: Level of Service shown for worst-case approach

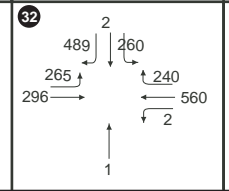
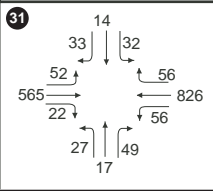
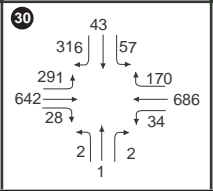
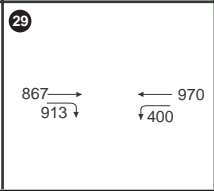
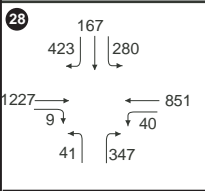
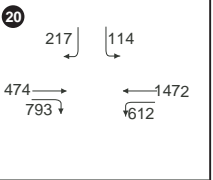
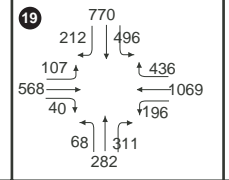
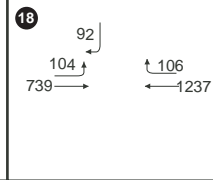
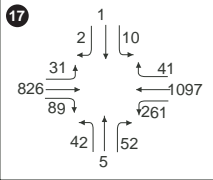
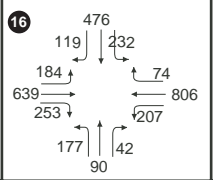
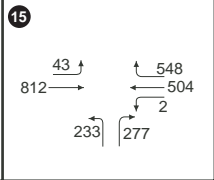
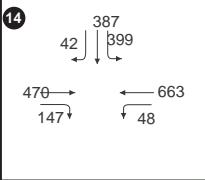
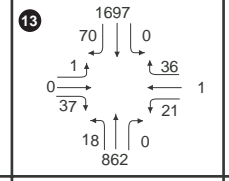
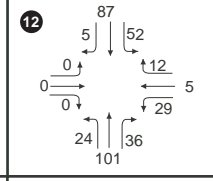
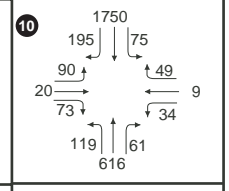
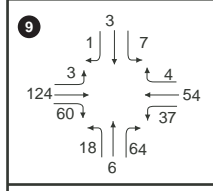
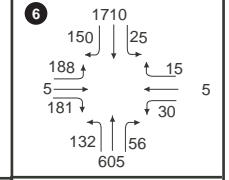
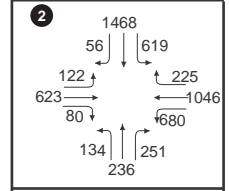
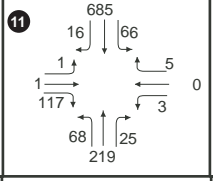
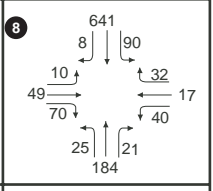
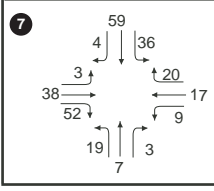
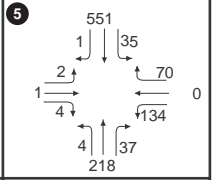
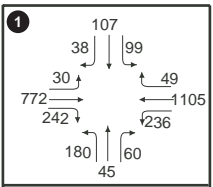
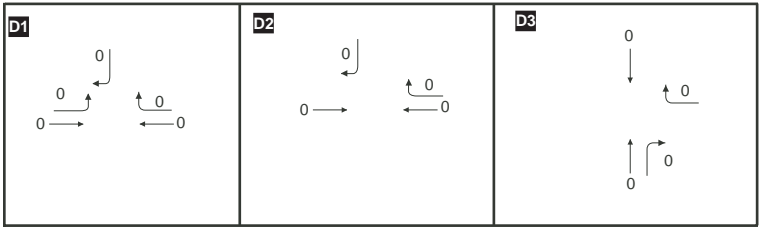


LEGEND

- # Study Intersection
- D1 Driveway
- Major Street
- Minor Street
- XX Turning Movement Volume



Project Driveways

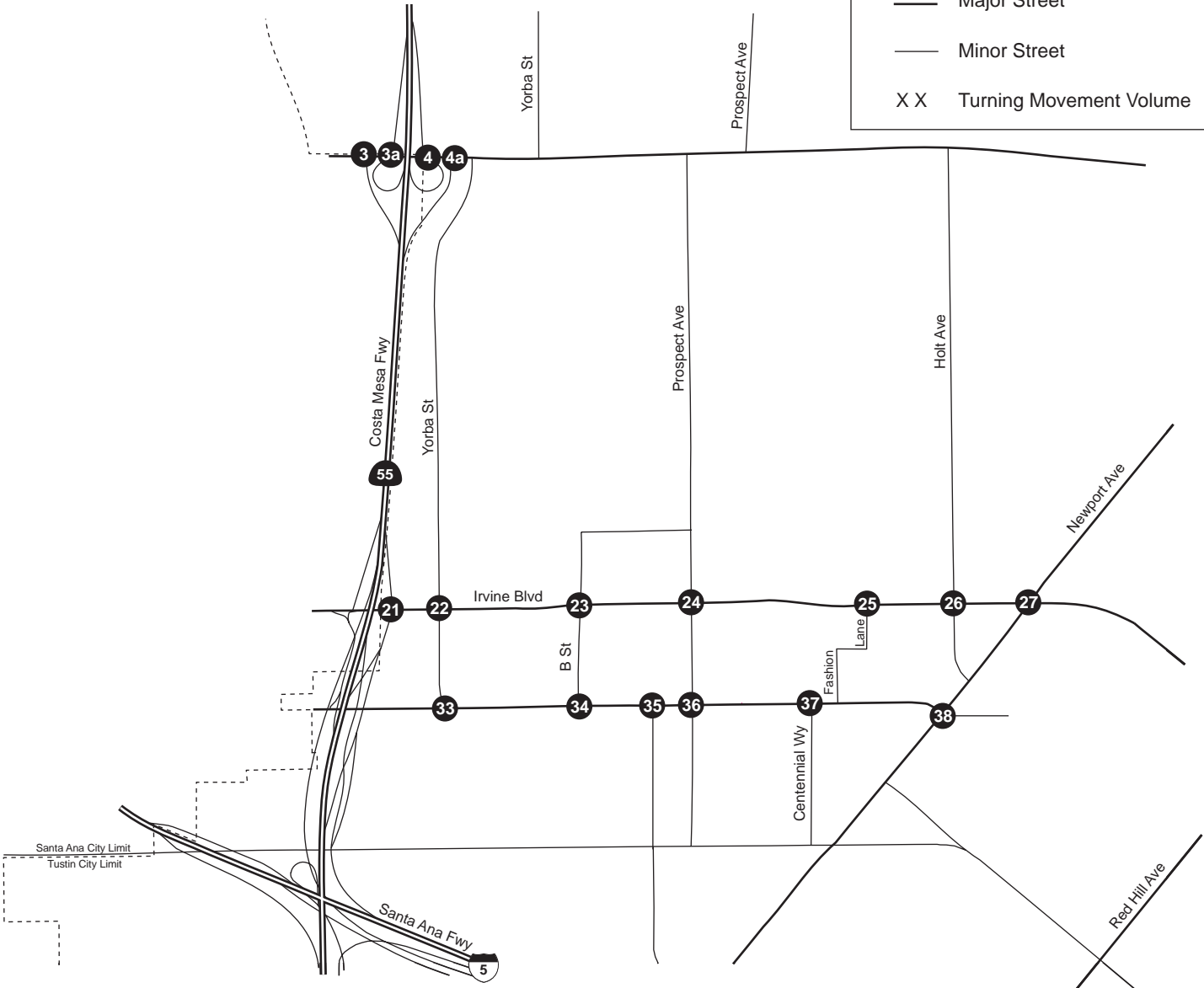




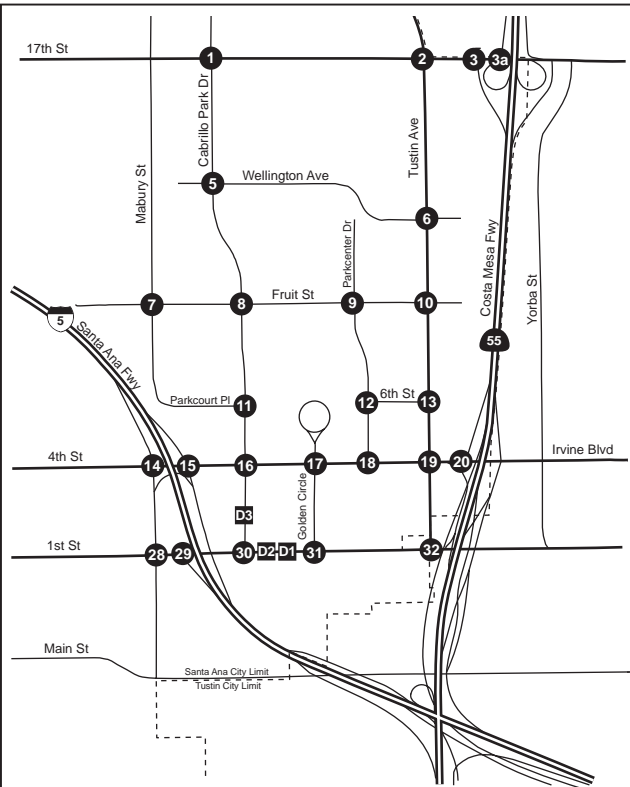
Not to Scale

LEGEND

- # Study Intersection
- D1 Driveway
- Major Street
- Minor Street
- X X Turning Movement Volume



<p>3</p> <p>685 → ← 12</p> <p>753 ↓ ↑ 1771</p> <p>↑ 318</p>	<p>3a</p> <p>124 ↓</p> <p>685 → ← 1771</p> <p>↑ 714</p>	<p>4</p> <p>1087 → ← 29</p> <p>327 ↓ ← 999</p>	<p>4a</p> <p>82 ↓ ↓ 6</p> <p>85 ↓ ↓ 17</p> <p>1087 → ← 999</p> <p>433 ↑ ↑ 294</p> <p>28</p>			
<p>21</p> <p>185 ↓ ← 653</p> <p>420 → ← 1580</p> <p>473 ↓ ↓ 364</p>	<p>22</p> <p>588 ↓</p> <p>456 ↓ ↓ 104</p> <p>57 ↓ ↓ 29</p> <p>681 → ← 1457</p> <p>136 ↓ ↓ 16</p> <p>167 ↑ ↑ 12</p> <p>76</p>	<p>23</p> <p>92 ↓</p> <p>113 ↓ ↓ 42</p> <p>107 ↓ ↓ 18</p> <p>634 → ← 1662</p> <p>18 ↓ ↓ 74</p> <p>16 ↑ ↑ 9</p> <p>114</p>	<p>24</p> <p>381 ↓</p> <p>172 ↓ ↓ 155</p> <p>75 ↓ ↓ 88</p> <p>509 → ← 1424</p> <p>78 ↓ ↓ 90</p> <p>87 ↑ ↑ 61</p> <p>232</p>	<p>25</p> <p>4 ↓</p> <p>489 → ← 1904</p> <p>67 ↓ ↓ 171</p> <p>18 ↑ ↑ 37</p> <p>0</p>	<p>26</p> <p>420 ↓</p> <p>280 ↓ ↓ 249</p> <p>99 ↓ ↓ 170</p> <p>567 → ← 2030</p> <p>57 ↓ ↓ 26</p> <p>28 ↑ ↑ 10</p> <p>85</p>	<p>27</p> <p>1491 ↓</p> <p>290 ↓ ↓ 204</p> <p>90 ↓ ↓ 26</p> <p>699 → ← 1867</p> <p>60 ↓ ↓ 250</p> <p>170 ↑ ↑ 220</p> <p>449</p>
<p>33</p> <p>184 ↓</p> <p>167 ↓ ↓ 128</p> <p>62 ↓ ↓ 105</p> <p>478 → ← 649</p> <p>46 ↓ ↓ 75</p> <p>78 ↑ ↑ 63</p> <p>145</p>	<p>34</p> <p>12 ↓</p> <p>130 ↓ ↓ 14</p> <p>85 ↓ ↓ 25</p> <p>745 → ← 648</p> <p>19 ↓ ↓ 21</p> <p>3 ↑ ↑ 17</p> <p>15</p>	<p>35</p> <p>4 ↓ ↓ 2</p> <p>4 ↓ ↓ 5</p> <p>661 → ← 720</p> <p>174 ↓ ↓ 72</p> <p>122 ↑ ↑ 38</p> <p>2</p>	<p>36</p> <p>165 ↓</p> <p>158 ↓ ↓ 171</p> <p>70 ↓ ↓ 137</p> <p>529 → ← 512</p> <p>43 ↓ ↓ 60</p> <p>61 ↑ ↑ 63</p> <p>93</p>	<p>37</p> <p>2 ↓ ↓ 1</p> <p>9 ↓ ↓ 8</p> <p>526 → ← 595</p> <p>89 ↓ ↓ 72</p> <p>107 ↑ ↑ 62</p> <p>1</p>	<p>38</p> <p>1541 ↓</p> <p>149 ↓ ↓ 34</p> <p>227 ↓ ↓ 41</p> <p>95 → ← 172</p> <p>166 ↓ ↓ 60</p> <p>247 ↑ ↑ 27</p> <p>528</p>	

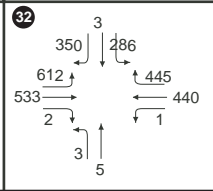
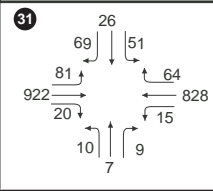
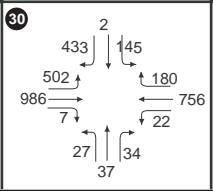
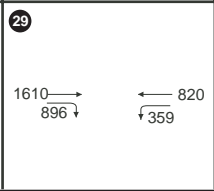
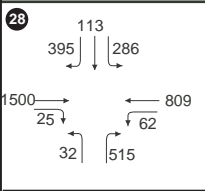
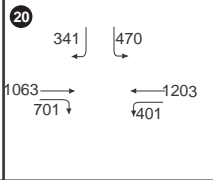
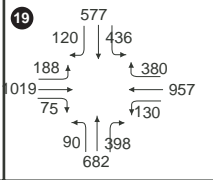
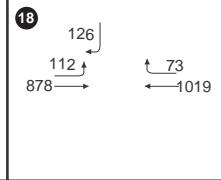
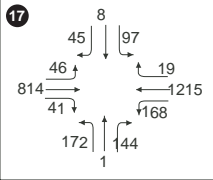
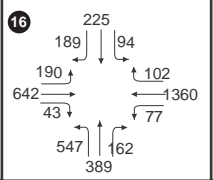
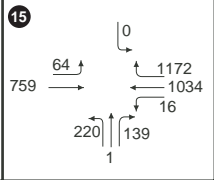
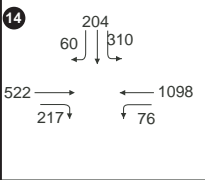
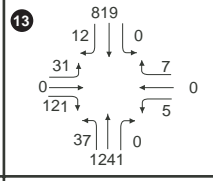
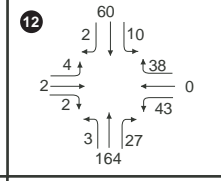
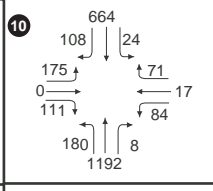
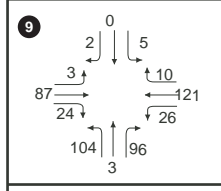
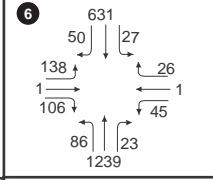
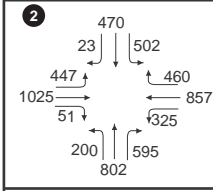
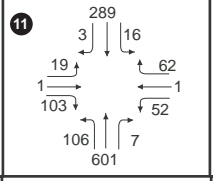
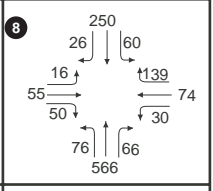
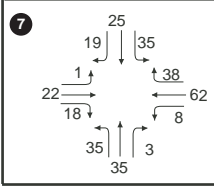
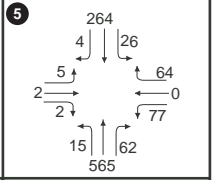
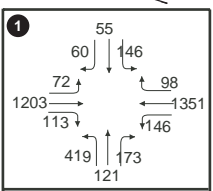
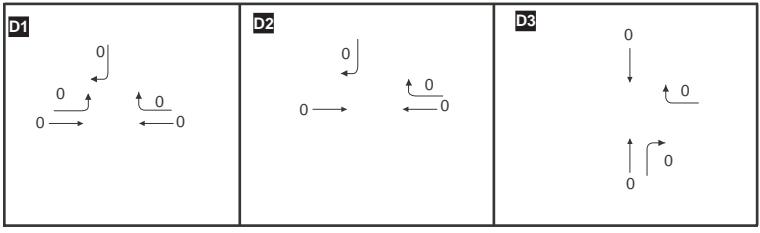


LEGEND

- # Study Intersection
- D1 Driveway
- Major Street
- Minor Street
- XX Turning Movement Volume

N
↑
○
↓
Not to Scale

Project Driveways

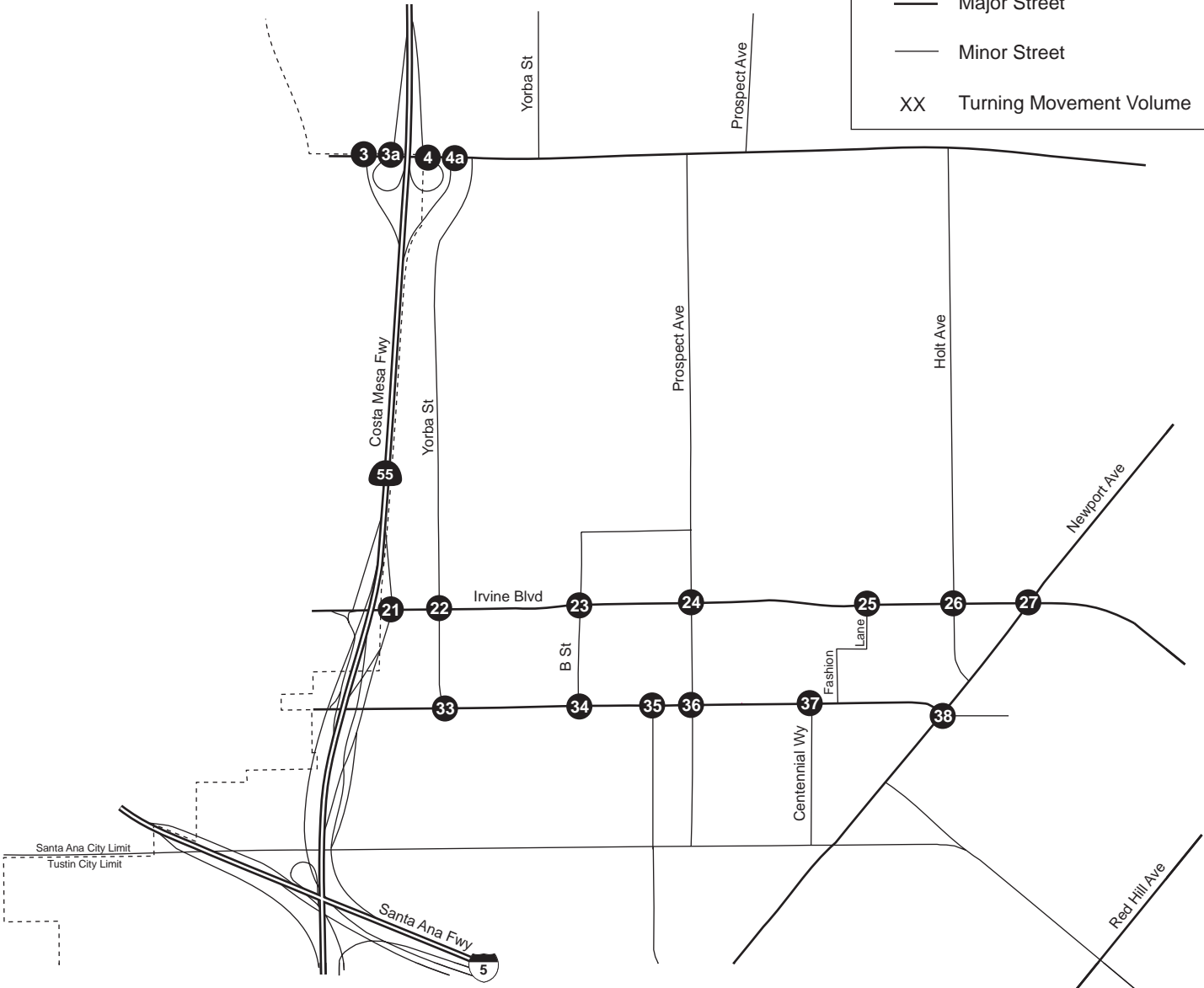




Not to Scale

LEGEND

- # Study Intersection
- D1 Driveway
- Major Street
- Minor Street
- XX Turning Movement Volume



3 1329 → ↕53 563 ↓ ←1954 ↕267	3a 44 ↘ 1329 → ←1954 ↘490	4 1290 → ↕68 634 ↓ ←1071	4a 101 ↘ ↕4 99 ↘ ↕15 1290 → ←1071 645 ↘ ↕24 ↕346			
21 442 ↘ ↕716 1099 → ←1198 351 ↘ ↕353 ↕1	22 99 ↘ ↕43 118 ↘ ↕31 960 → ←706 161 ↘ ↕26 347 ↘ ↕31 ↕238	23 24 ↘ ↕10 54 ↘ ↕41 69 ↘ ↕42 1131 → ←781 21 ↘ ↕25 28 ↘ ↕41	24 286 ↘ ↕140 66 ↘ ↕199 148 ↘ ↕79 984 → ←1171 117 ↘ ↕102 136 ↘ ↕381	25 22 ↘ ↕308 58 ↘ ↕92 1055 → ←103 102 ↘ ↕203	26 216 ↘ ↕267 144 ↘ ↕446 207 ↘ ↕358 180 ↘ ↕44 1338 → ←120 108 ↘ ↕332	27 643 ↘ ↕193 208 ↘ ↕80 284 ↘ ↕311 83 ↘ ↕311 1524 → ←328 180 ↘ ↕381 ↕758
33 124 ↘ ↕141 68 ↘ ↕224 129 ↘ ↕64 662 → ←752 47 ↘ ↕26 108 ↘ ↕291	34 16 ↘ ↕17 49 ↘ ↕26 27 ↘ ↕18 833 → ←924 21 ↘ ↕50 10 ↘ ↕5	35 0 ↘ ↕0 15 ↘ ↕0 711 → ←664 158 ↘ ↕85 244 ↘ ↕13 ↕0	36 106 ↘ ↕176 118 ↘ ↕194 148 ↘ ↕658 54 ↘ ↕101 692 → ←130 100 ↘ ↕185	37 5 ↘ ↕7 4 ↘ ↕4 731 → ←677 110 ↘ ↕100 147 ↘ ↕152 ↕3	38 916 ↘ ↕61 241 ↘ ↕62 425 ↘ ↕183 252 ↘ ↕100 251 ↘ ↕64 359 ↘ ↕1062	

5. Buildout Traffic Conditions Without Project

This section documents the buildout (2030) traffic conditions without the addition of project-related traffic to the surrounding street system. It includes development of the buildout traffic conditions in the study area based on traffic growth projections provided by the OCTAM model applied to existing traffic patterns. The year 2030 was selected for analysis per direction from the City. Year 2030 also corresponds with the OCTAM-3 traffic model buildout year. The output from the traffic model forecast is included in Appendix B.

To forecast growth conditions for the year 2030, ambient peak hour background traffic volume increases were derived from the base year and buildout year County traffic model. These roadway approach volume increases were applied to existing observed traffic volumes to forecast buildout traffic conditions without the proposed project. Figures 14 and 15 illustrate the resulting buildout AM peak hour volumes, while Figures 16 and 17 illustrate the resulting buildout PM peak hour volumes. Tables 7 and 8 summarize the results of the level of service analyses for this scenario.

As shown in the tables, 29 of the 38 intersections are expected to operate at Level of Service D or better under the Buildout without Project condition for the year 2030. Six signalized intersections and four unsignalized intersections are forecast to operate at Level of Service E or worse in the AM or PM peak hour, or both.

**Table 7 – Metro East Overlay Zone
Peak Hour Intersection Conditions, Signalized Intersections
Buildout without Project Conditions, Year 2030**

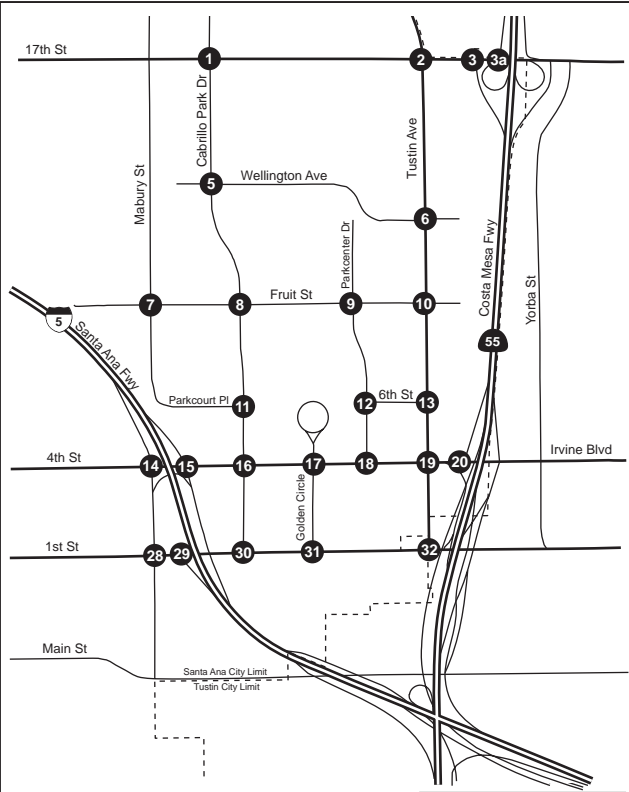
Intersection	AM Peak Hour		PM Peak Hour	
	ICU	Level of Service	ICU	Level of Service
Signalized Intersections – Santa Ana				
1st Street at Tustin Avenue	.493	A	.603	B
1st Street at Golden Circle Drive	.362	A	.364	A
1st Street at Cabrillo Park Drive	.466	A	.759	C
1st Street at Elk Lane	.707	C	.883	D
1st Street at I-5 SB On Ramp	.505	A	.674	B
4th Street at SR-55 Southbound Ramps	1.367	F	1.144	F
4th Street at Tustin Avenue	.881	D	.888	D
4th Street at Golden Circle Drive	.488	A	.633	B
4th Street at Cabrillo Park Drive	.726	C	.832	D
4th Street at I-5 Northbound Ramps	.544	A	.939	E
4th Street at I-5 Southbound Off-Ramp	.504	A	.492	A
Tustin Avenue at Fruit Street	.719	C	.541	A
Tustin Avenue at Wellington Avenue	.832	D	.502	A
17th Street at Tustin Avenue	.844	D	.821	D
17th Street at Cabrillo Park Drive	.724	C	.826	D
17th Street at SR-55 NB Ramps	1.211	F	.688	B
17th Street at SR 55 SB Ramps	.619	B	.526	A
Signalized Intersections – Tustin				
1st Street at Yorba Street	.607	B	.702	C
1st Street at El Camino Real	.616	B	.606	B
1st Street at Prospect Avenue	.773	C	.877	D
1st Street at Centennial Way	.435	A	.641	B
1st Street at Newport Avenue	.967	E	.768	C
Irvine Boulevard at SR-55 Northbound Ramps	1.089	F	1.223	F
Irvine Boulevard at Yorba Street	.818	D	.763	C
Irvine Boulevard at B Street	.670	B	.537	A
Irvine Boulevard at Prospect Avenue	.771	C	.772	C
Irvine Boulevard at Fashion Lane	.677	B	.661	B
Irvine Boulevard at Holt Avenue	.853	D	.794	C
Irvine Boulevard at Newport Boulevard	.901	E	.741	C

**Table 8 – Metro East Overlay Zone
Peak Hour Intersection Conditions, Unsignalized Intersections
Buildout without Project Conditions, Year 2030**

Intersection	AM Peak Hour			PM Peak Hour		
	Average Delay ¹	Worst Case Delay ¹	Level of Service ²	Average Delay	Worst Case Delay	Level of Service ¹
Unsignalized Intersections – Santa Ana						
6th Street at Parkcenter Drive	3.2	11.4	B	2.9	10.8	B
Parkcourt Pl. at Cabrillo Park Dr.	2.2	18.4	C	6.5	49.9	E
Fruit Street at Mabury Street	8.0	8.0	A	8.1	8.1	A
Fruit Street at Cabrillo Park Dr.	14.7	14.7	B	18.1	18.1	C
Fruit Street at Parkcenter Drive	3.7	11.9	B	5.8	12.2	B
Wellington Av. at Cabrillo Park Dr.	7.8	45.5	E	5.0	39.6	E
Tustin Avenue at 6th Street	2.3	101.4	F	4.0	85.0	F
4th Street at Parkcenter Drive	1.2	16.0	C	1.5	12.8	B
Unsignalized Intersections – Tustin						
1st Street at B Street	19.8	274.8	F	9.6	169.5	F

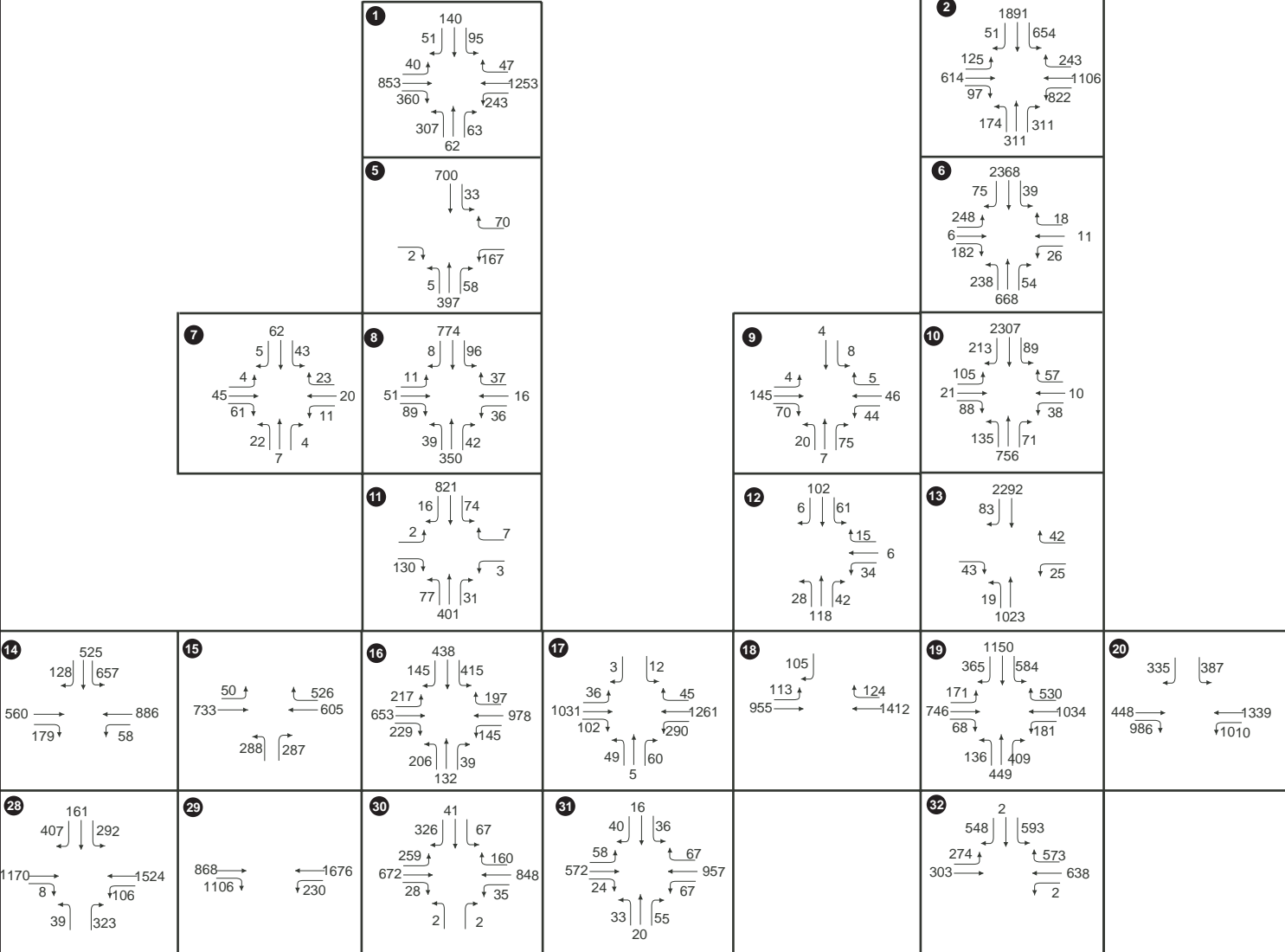
Note 1: Delay shown in seconds per vehicle

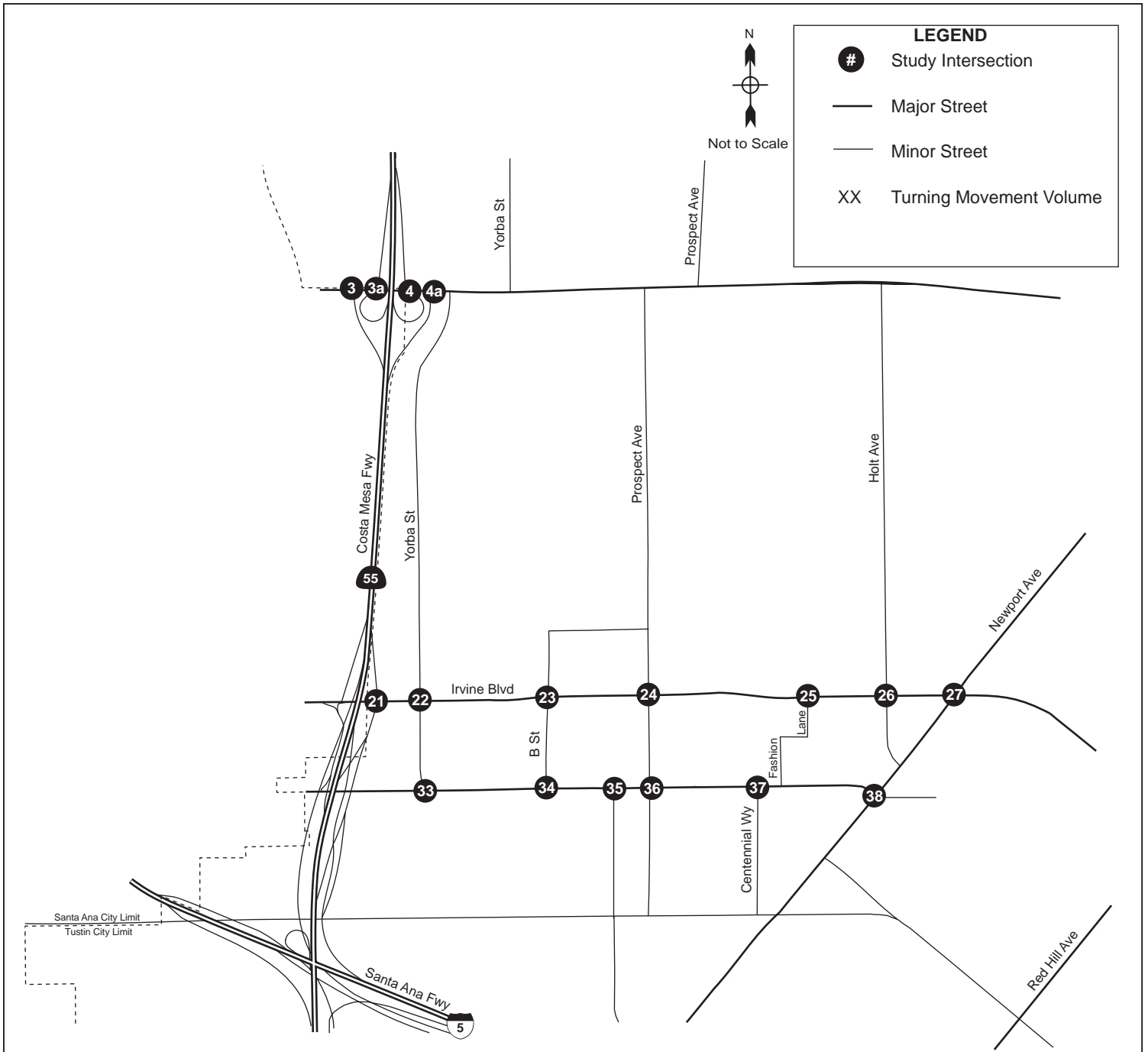
Note 2: Level of Service shown for worst-case approach



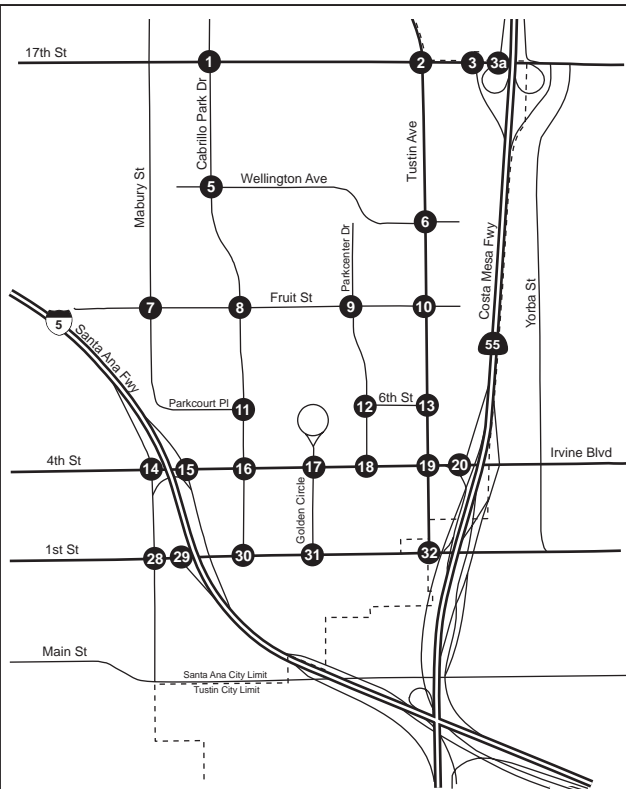
LEGEND

- # Study Intersection
- Major Street
- Minor Street
- XX Turning Movement Volume



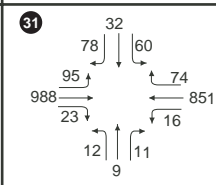
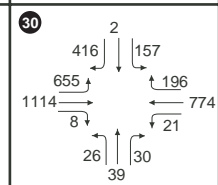
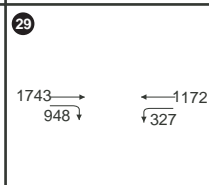
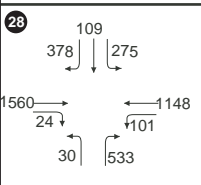
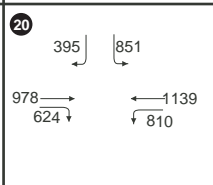
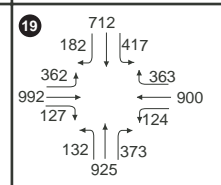
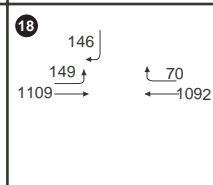
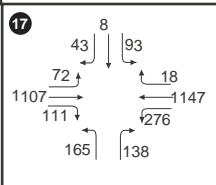
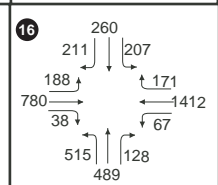
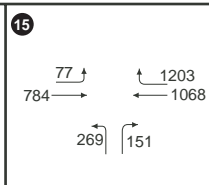
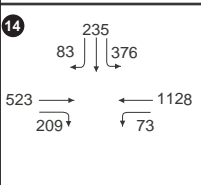
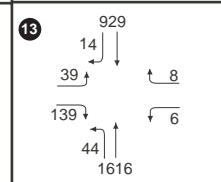
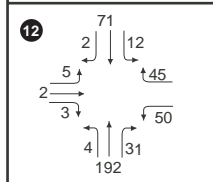
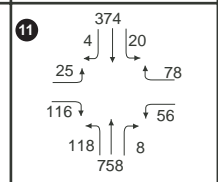
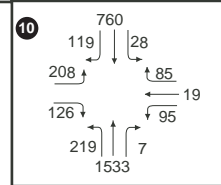
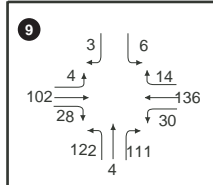
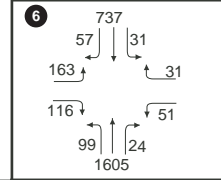
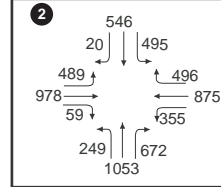
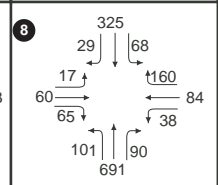
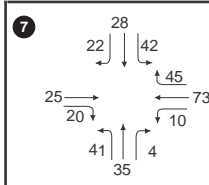
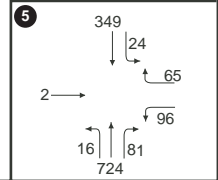
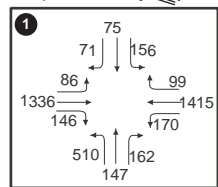


<p>3</p> <p>76 36 ↓ 19 ↓ 17 ↓ 15 ↓ 758 → ← 1414 757 ↓ 602 ↓</p>	<p>3a</p> <p>544 ↓ 784 → ← 1711</p>	<p>4</p> <p>1370 → ← 456 1441 ←</p>	<p>4a</p> <p>15 ↓ 6 ↓ 352 ↓ 16 ↓ 1083 → ← 952 646 ↑ 283 ↑ 63 ↓</p>			
<p>21</p> <p>313 ↓ 1000 ↓ 456 → ← 1496 699 ↓ 663 ↓</p>	<p>22</p> <p>672 436 ↓ 317 ↓ 55 ↓ 50 ↓ 969 → ← 1732 131 ↓ 28 ↓ 161 ↓ 45 ↓ 99 ↓</p>	<p>23</p> <p>100 131 ↓ 57 ↓ 142 ↓ 17 ↓ 1435 → ← 4954 32 ↓ 83 ↓ 24 ↓ 17 ↓ 122 ↓</p>	<p>24</p> <p>553 193 ↓ 149 ↓ 133 ↓ 85 ↓ 886 → ← 1515 214 ↓ 126 ↓ 187 ↓ 109 ↓ 418 ↓</p>	<p>25</p> <p>4 ↓ 873 → ← 2029 91 ↓ 47 ↓ 17 ↓</p>	<p>26</p> <p>520 360 ↓ 450 ↓ 113 ↓ 110 ↓ 805 → ← 2090 115 ↓ 38 ↓ 36 ↓ 18 ↓ 91 ↓</p>	<p>27</p> <p>1887 310 ↓ 170 ↓ 97 ↓ 34 ↓ 880 → ← 1800 60 ↓ 357 ↓ 170 ↓ 220 ↓ 532 ↓</p>
<p>33</p> <p>177 231 ↓ 232 ↓ 68 ↓ 139 ↓ 819 → ← 1015 44 ↓ 81 ↓ 76 ↓ 82 ↓ 139 ↓</p>	<p>34</p> <p>13 144 ↓ 25 ↓ 82 ↓ 41 ↓ 1230 → ← 1068 18 ↓ 33 ↓ 3 ↓ 25 ↓ 14 ↓</p>	<p>35</p> <p>4 ↓ 2 ↓ 4 ↓ 5 ↓ 836 → ← 907 481 ↓ 136 ↓ 345 ↓ 77 ↓ 3 ↓</p>	<p>36</p> <p>414 245 ↓ 185 ↓ 145 ↓ 218 ↓ 576 → ← 599 107 ↓ 116 ↓ 129 ↓ 98 ↓ 273 ↓</p>	<p>37</p> <p>2 ↓ 2 ↓ 9 ↓ 12 ↓ 623 → ← 820 87 ↓ 100 ↓ 116 ↓ 82 ↓</p>	<p>38</p> <p>2060 262 ↓ 33 ↓ 222 ↓ 39 ↓ 92 → ← 177 243 ↓ 58 ↓ 356 ↓ 26 ↓ 569 ↓</p>	



LEGEND

- #** Study Intersection
- Major Street
- Minor Street
- XX Turning Movement Volume

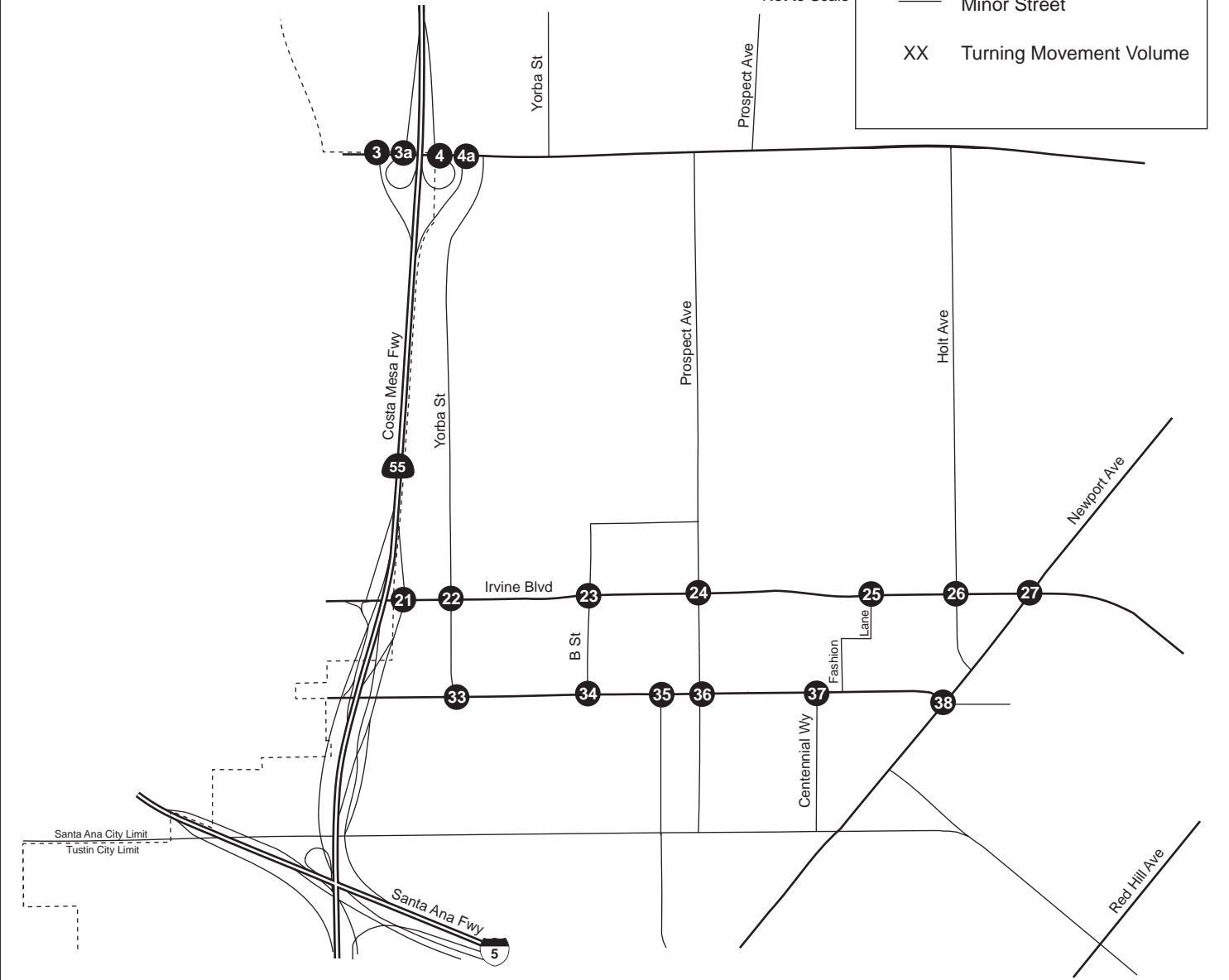




Not to Scale

LEGEND

- # Study Intersection
- Major Street
- Minor Street
- XX Turning Movement Volume



<p>3</p> <p>17 12 ↓ 16 ↓</p> <p>38 ↓ 51 ↓</p> <p>1248 → ← 1446</p> <p>687 ↓ 365 ↓</p>	<p>3a</p> <p>959 ↓</p> <p>1354 → ← 1549</p>	<p>4</p> <p>1500 →</p> <p>877 ↑ 1026 ↓</p>	<p>4a</p> <p>97 ↓ 4 ↓</p> <p>108 ↓ 15 ↓</p> <p>1492 → ← 1163</p> <p>934 ↑ 494 ↓</p> <p>32 ↓</p>			
<p>21</p> <p>555 ↓ 1069 ↓</p> <p>1035 → ← 1146</p> <p>488 ↓ 622 ↓</p>	<p>22</p> <p>105 ↓ 41 ↓</p> <p>95 ↓ 61 ↓</p> <p>217 ↓ 1884 ↓</p> <p>1000 → ← 200 ↓</p> <p>334 ↑ 30 ↓</p> <p>375 ↓</p>	<p>23</p> <p>29 ↓ 10 ↓</p> <p>66 ↓ 39 ↓</p> <p>98 ↓ 4745 ↓</p> <p>1119 → ← 33 ↓</p> <p>40 ↑ 39 ↓</p> <p>32 ↓</p>	<p>24</p> <p>453 ↓ 135 ↓</p> <p>85 ↓ 191 ↓</p> <p>176 ↓ 1383 ↓</p> <p>1064 → ← 213 ↓</p> <p>258 ↑ 143 ↓</p> <p>577 ↓</p>	<p>25</p> <p>23 ↓</p> <p>148 → ← 1547</p> <p>113 ↓ 242 ↓</p>	<p>26</p> <p>310 ↓ 149 ↓</p> <p>130 ↓ 620 ↓</p> <p>200 ↓ 1591 ↓</p> <p>1130 → ← 210 ↓</p> <p>134 ↑ 120 ↓</p> <p>560 ↓</p>	<p>27</p> <p>690 ↓ 160 ↓</p> <p>230 ↓ 80 ↓</p> <p>301 ↓ 1560 ↓</p> <p>1290 → ← 115 ↓</p> <p>275 ↑ 482 ↓</p> <p>1031 ↓</p>
<p>33</p> <p>120 ↓ 177 ↓</p> <p>89 ↓ 283 ↓</p> <p>174 ↓ 954 ↓</p> <p>839 → ← 47 ↓</p> <p>105 ↑ 25 ↓</p> <p>280 ↓</p>	<p>34</p> <p>18 ↓ 21 ↓</p> <p>56 ↓ 33 ↓</p> <p>30 ↓ 1198 ↓</p> <p>1038 → ← 23 ↓</p> <p>11 ↑ 60 ↓</p> <p>5 ↓</p>	<p>35</p> <p>14 ↓</p> <p>848 → ← 805</p> <p>255 ↓ 133 ↓</p> <p>388 ↓ 168 ↓</p>	<p>36</p> <p>248 ↓ 248 ↓</p> <p>204 ↓ 253 ↓</p> <p>246 ↓ 682 ↓</p> <p>742 → ← 91 ↓</p> <p>166 ↑ 178 ↓</p> <p>391 ↓</p>	<p>37</p> <p>6 ↓ 9 ↓</p> <p>4 ↓ 6 ↓</p> <p>15 ↓ 847 ↓</p> <p>892 → ← 117 ↓</p> <p>151 ↑ 199 ↓</p> <p>4 ↓</p>	<p>38</p> <p>1070 ↓ 59 ↓</p> <p>248 ↓ 62 ↓</p> <p>519 ↓ 187 ↓</p> <p>183 → ← 294 ↓</p> <p>502 ↑ 62 ↓</p> <p>1425 ↓</p>	

6. Project Related Traffic

6.1 Project Trip Generation

Trip generation is a measure or forecast of the number of trips that begin or end at the project site. All or part of these trips will result in traffic increases on the streets where they occur. Traffic generated is a function of the extent and type of development proposed for the site.

Trip generation is generally based upon studies and analyses contained in the report, *Trip Generation*, produced by the Institute of Transportation Engineers (ITE). The document reports daily and peak period traffic generation rates for a wide variety of uses that commonly occur based upon national experience. Special generation rates can be appropriate for some uses based upon local preferences or localized analysis of comparable uses. For the overlay zone, the trip generation rates in the ITE *Trip Generation* report are used and applied to the highest potential densities permitted by the overlay zone. It is probable that individual projects will be proposed at lower densities, and other properties may not redevelop according to the overlay zone allowances. For this reason, the maximum permitted densities of the overlay zone represent a “worst-case” assumption for traffic generation. In consideration of this, the traffic generation rates applied to the maximum permitted land use may be viewed as slightly conservative, resulting in a compensating effect. For analysis of individual future projects, the traffic generation rates should be based upon careful analysis of the specific project. Traffic generation rate assumptions applied to the build out of the overlay zone should not be applied to individual projects, especially if they are not proposed to the maximum densities allowed within the overlay zone. It may be very appropriate to consider different trip generation for individual sites that are built at lower densities or that contain uses not contemplated by the plan. This is especially important for evaluation of residential developments, since residential traffic generation per unit increases as density decreases. It is also important for retail commercial developments, since shopping centers can generate traffic very differently than the ground-floor in-line retail developments that are expected to be integrated within other development types.

Trip generation is generally equal to the traffic volume expected at project driveways. The trip generation rates are equivalent to the number of trips that start or end (in and out) at the project site, and are specific by land use for a given time period (i.e. AM peak hour). Trip generation rates are expressed as a function of a given characteristic of the land use area (i.e. floor area, site area, number of employees, or seating capacity). The rates are based on regression analysis, and are derived from field observations from as many sources as possible. At each site, trips in and out of the site are counted, trip rate modifiers are identified and regression analysis is used to derive a “best fit” for a particular land use. An equation is developed which calculate an average trip generation rate for the specific land use.

6.1.1 First & Cabrillo Project

The proposed First & Cabrillo Towers project consists of 374 townhome/condominium units in two high rise towers. There will also be 8,957 square feet of retail space in the towers. This mixed-use residential/retail development is expected to generate additional traffic volumes as documented below.

6.1.1.1 Project Traffic

The trip generation rates for the proposed project consisting of 374 townhomes/condominiums and 8,957 square feet of retail space are shown in Table 9. The trip generation rates summarized in this table are provided by ITE Trip Generation, 7th Edition with consideration of comparable trip generation rates for similar uses in this region. This report is widely used in Southern California and indicates the probable traffic generation rates for various land uses based on studies of existing developments in comparable settings. The trip generation for the First/Cabrillo project based on these rates is shown in Table 10. Trip generation rates for other projects in the Metro East Overlay Zone are subject to review and must be specific to the individual projects proposed

6.1.1.2 Existing Land Use Traffic

An office building currently occupies the First/Cabrillo project site. The building is currently vacant with the exception of a swim club. The office building will be demolished upon approval of the proposed project. The trip generation currently associated with the existing First/Cabrillo project site usage is also shown in Table 10.

Table 9
First & Cabrillo Project
Trip Generation Rates

Land Use	Measure	Daily	AM Peak Hour			PM Peak Hour		
			Total	In	Out	Total	In	Out
Trip Generation Rates, Proposed Uses								
High-Rise Residential Condominium <i>ITE Code 232</i>	DU	4.18	0.34	0.065	0.275	0.38	0.236	0.144
Specialty Retail Center <i>ITE Code 814</i>	1,000 sf	44.32	1.76 ¹	0.99 ¹	0.77 ¹	2.71	1.19	1.52
Trip Generation Rates, Existing Uses								
Health/Fitness Club <i>ITE Code 492</i>	1,000 sf	32.93	1.21	0.51	0.70	4.05	2.07	1.98

Note 1: ITE Code 814 rate not available. Average rate for similar uses used.

Table 10
First & Cabrillo Project
Proposed Project Trip Generation

Land Use	Measure	Daily	AM Peak Hour			PM Peak Hour		
			Total	In	Out	Total	In	Out
Vehicle Trips								
Existing Use (Trip Credits)								
Health/Fitness Club <i>ITE Code 492</i>	5,500 sf	181	7	3	4	22	11	11
Proposed Use								
High-Rise Residential Condominium, North Tower <i>ITE Code 232</i>	183 DU	765	62	12	50	70	43	27
Specialty Retail Center, North Tower <i>ITE Code 814</i>	4,480 sf	199	8	5	3	12	5	7
Subtotal, North Tower	N/A	964	70	17	53	82	48	34
High-Rise Residential Condominium, South Tower <i>ITE Code 232</i>	191 DU	798	65	12	53	73	45	28
Specialty Retail Center, South Tower <i>ITE Code 814</i>	4,477 sf	199	8	5	3	12	5	7
Subtotal, South Tower	N/A	997	73	17	56	85	50	35
Total, Proposed Use	N/A	1,961	143	34	109	167	98	69
Trip Reductions								
Internal Trip Capture (5%)¹	N/A	40	2	1	1	2	1	1
Net Project Vehicle Trips		1,740	134	30	104	143	86	57

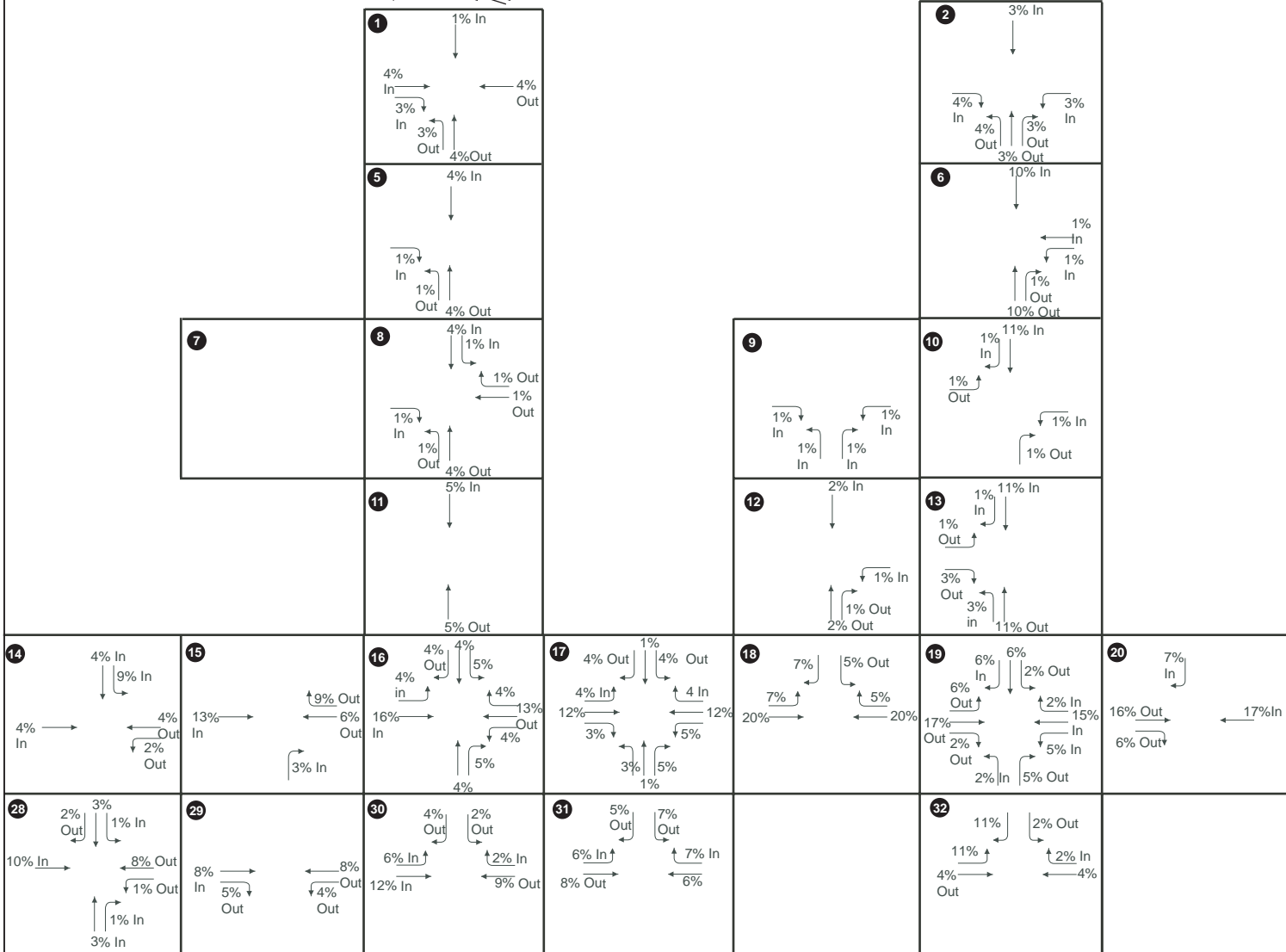
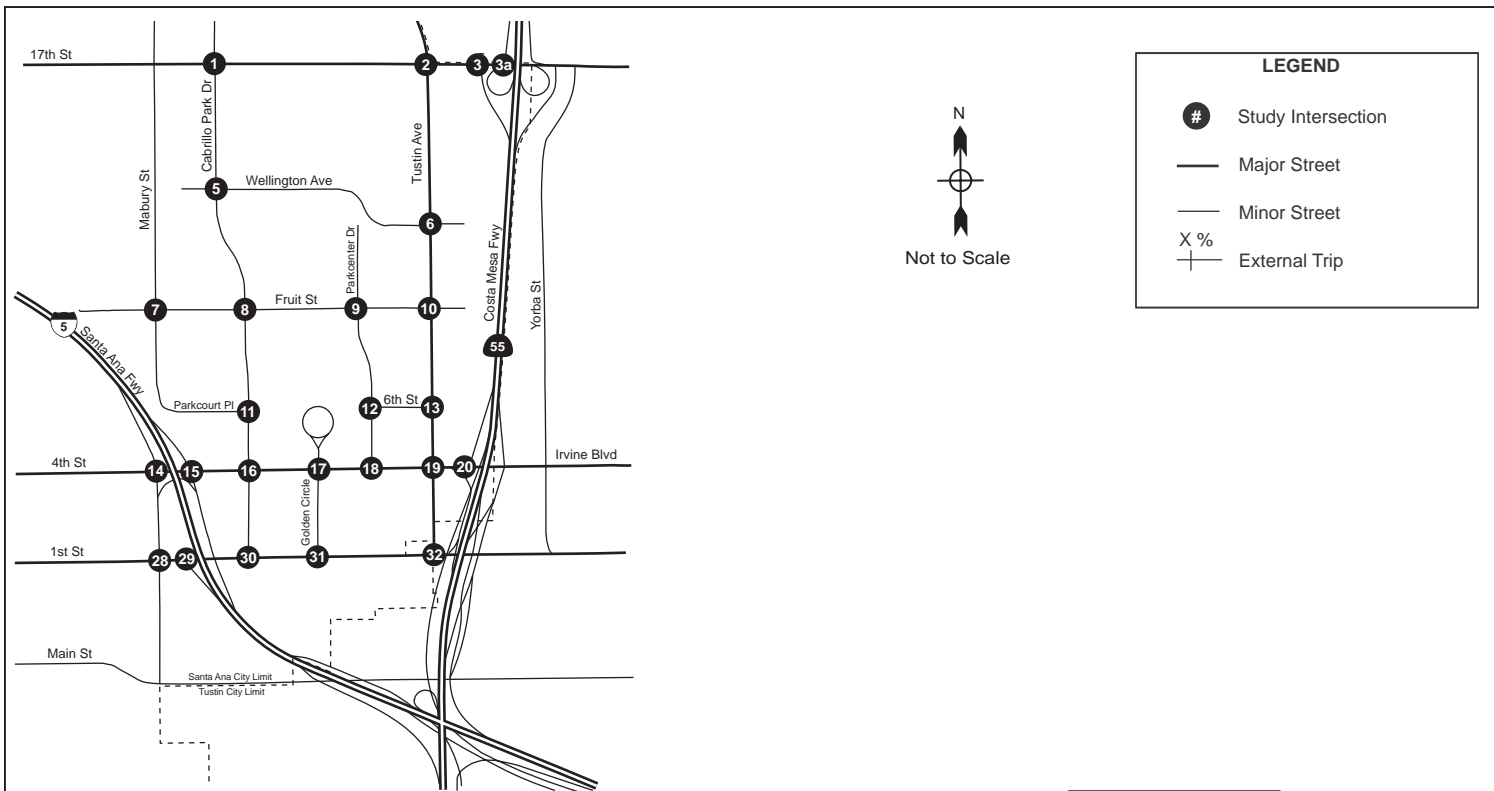
Note 1: 5% of retail trips + corresponding residential trip end

As shown in Table 10, the proposed project is expected to generate approximately 1,961 daily trips. Of this amount, 143 are expected to be in the AM peak hour, including 34 trips entering and 109 trips exiting the site. There are expected to be 167 trips during the PM peak hour, including 98 trips entering and 69 trips exiting the site.

The trip reductions from the removal of the existing land use are 181 daily trips, including 7 trips in the AM peak hour and 22 trips in the PM peak hour. The internal trip capture trip reductions are 40 daily trips, including 2 trips in the AM peak hour and 2 trips in the PM peak hour. These reductions apply to the retail component of the 1st/Cabrillo project and the corresponding residential trip ends. There are no pass-by trips, per City direction.

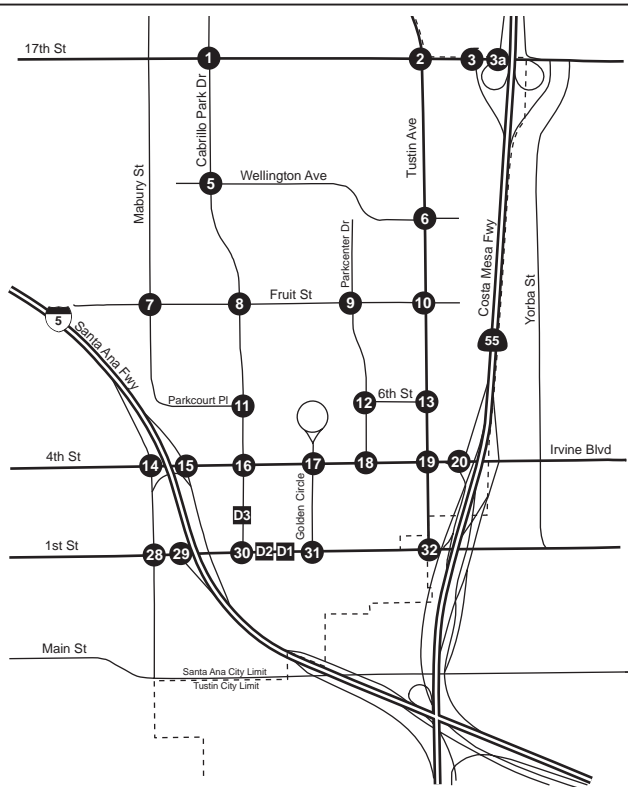
The net project vehicle trips from the proposed project consist of the 1st/Cabrillo project trip generation less the trip reductions for removal of existing uses and internal trip capture. These net project vehicle trips are approximately 1,740 daily trips. Of this amount, 134 are expected to be in the AM peak hour, including 30 trips entering and 104 trips exiting the site. There are expected to be 143 net project trips during the PM peak hour, including 86 trips entering and 57 trips exiting the site. The “NET Project Vehicle Trips” are shown in Table 10.

Figures 18 and 19 illustrate the expected trip distribution for the First & Cabrillo and Metro East Overlay Zone net project trips. The trip distribution was derived using the OCTAM-3 model. Figures 20 - 23 shows the added trips expected as a result of the First & Cabrillo project less the existing use trips.





3 2% In 1% Out	3a 2% In 2% Out 1% In 1% In	4 1% Out 1% In	4a 1% Out 1% In 2% Out 1% Out				
21 7% Out 9% Out 11% In	22 1% In 1% In 8% Out 8% In	23 8% Out 8% In	24 1% In 1% In 7% Out 7% In	25 7% Out 7% In	26 1% In 1% In 6% Out 6% In	27 1% In 1% In 5% Out 5% In	
	33 6% Out 6% In	34 6% Out 6% In	35 4% Out 2% Out 2% In	36 3% Out 1% Out 1% In	37 3% Out 3% In	38 2% Out 1% Out 1% In	

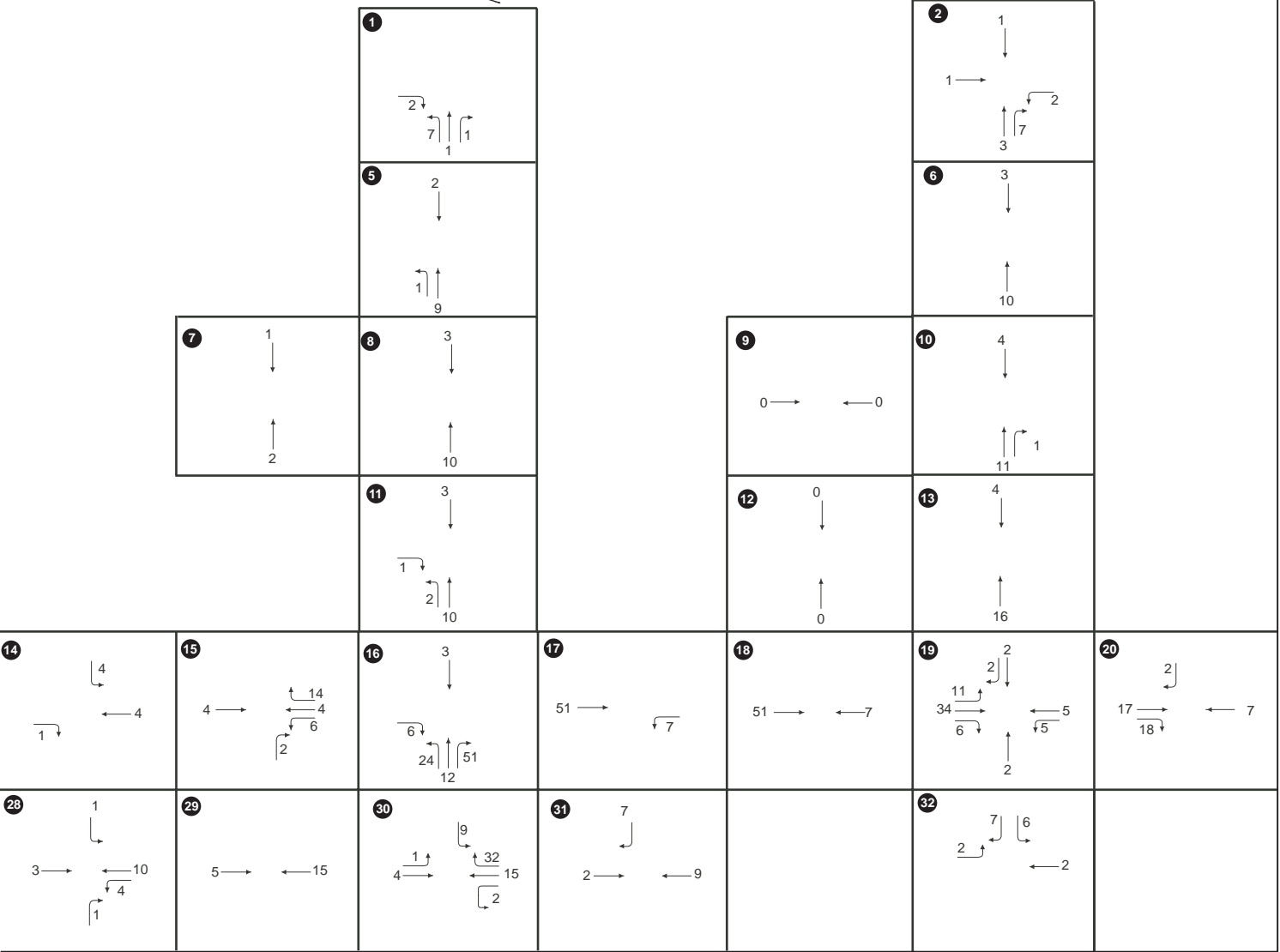
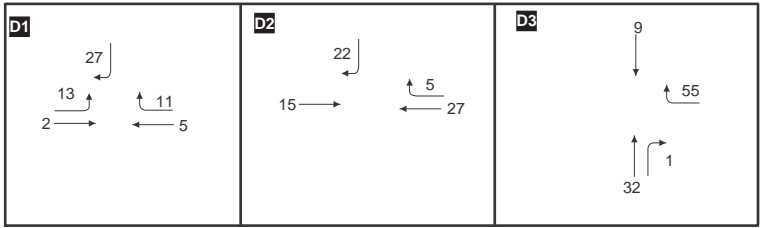


LEGEND

- # Study Intersection
- D1 Driveway
- Major Street
- Minor Street
- XX Project Trips



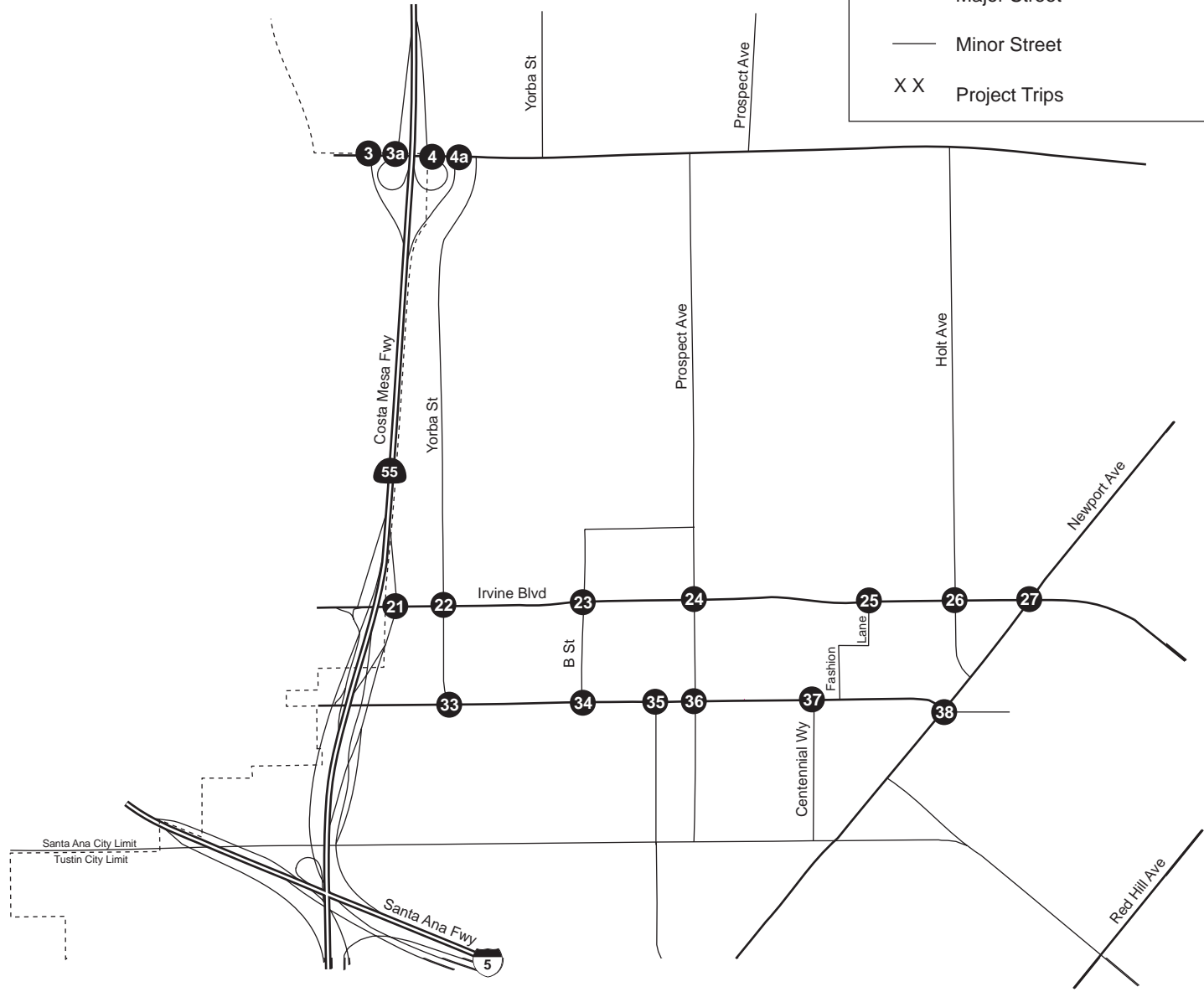
Project Driveways



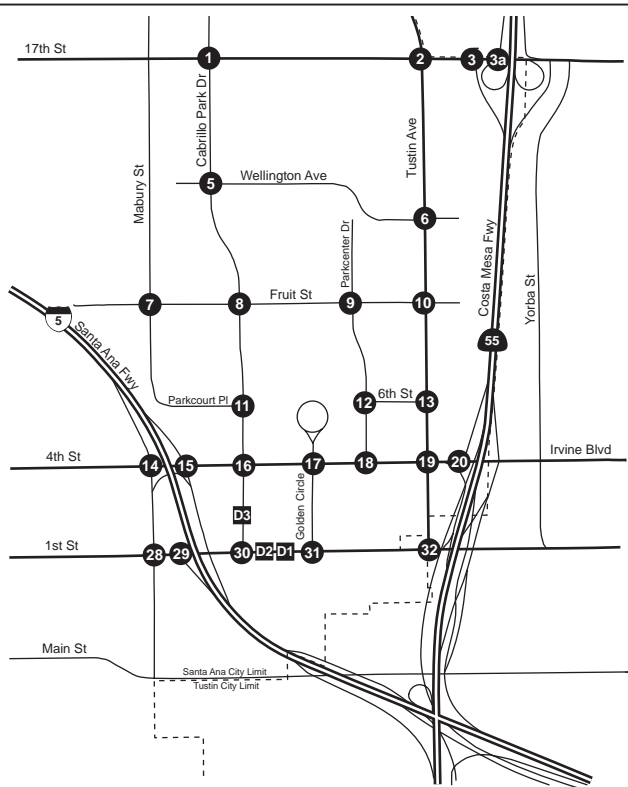


LEGEND

- # Study Intersection
- D1 Driveway
- Major Street
- Minor Street
- XX Project Trips



<p>3</p> <p>8 → ← 2</p>	<p>3a</p> <p>8 → ← 2</p>	<p>4</p> <p>3 → ← 1</p>	<p>4a</p> <p>3 → ← 1</p>				
<p>21</p> <p>8 → ← 2</p> <p>5 ↘ ↙</p>	<p>22</p> <p>7 → ← 2</p> <p>1 ↘ ↙</p>	<p>23</p> <p>7 → ← 2</p>	<p>24</p> <p>7 → ← 2</p>	<p>25</p> <p>7 → ← 2</p>	<p>26</p> <p>6 → ← 2</p> <p>1 ↘ ↙</p>	<p>27</p> <p>5 → ← 2</p> <p>1 ↘ ↙</p>	
	<p>33</p> <p>6 → ← 2</p>	<p>34</p> <p>6 → ← 2</p>	<p>35</p> <p>4 → ← 1</p> <p>2 ↘ ↙</p> <p>1 ↘ ↙</p>	<p>36</p> <p>3 → ← 1</p> <p>1 ↘ ↙</p>	<p>37</p> <p>3 → ← 1</p>	<p>38</p> <p>2 → ← 1</p> <p>1 ↘ ↙</p>	

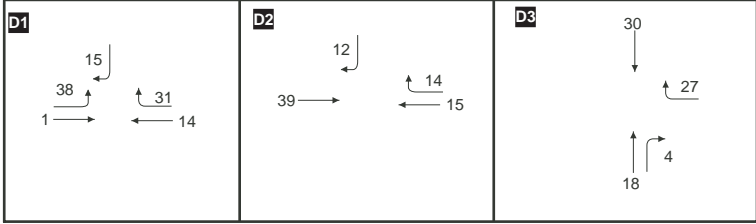


LEGEND

- # Study Intersection
- D1 Driveway
- Major Street
- Minor Street
- XX Project Trips



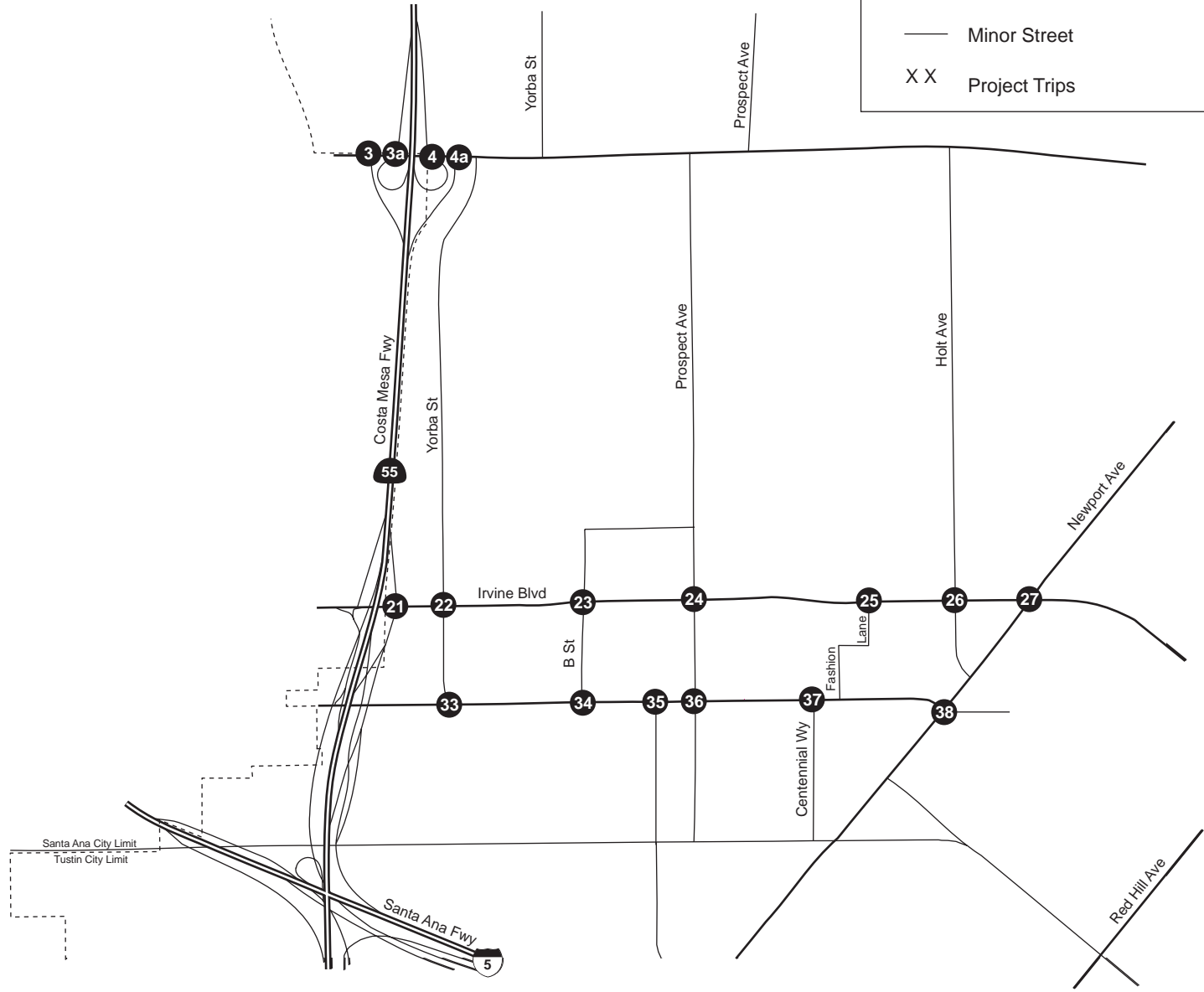
Project Driveways





LEGEND

- # Study Intersection
- D1 Driveway
- Major Street
- Minor Street
- X X Project Trips



3	3a	4	4a					
5 → ← 7	5 → ← 7	2 → ← 3	2 → ← 3					
21	22	23	24	25	26	27		
5 → ← 7 15 ↘	4 → ← 6 1 ↘ 1 ↘	4 → ← 6	4 → ← 6	4 → ← 6	3 → ← 5 1 ↘ 1 ↘	3 → ← 4 1 ↘ 1 ↘		
	33	34	35	36	37	38		
	3 → ← 5	3 → ← 5	2 → ← 3 1 ↘ 2 ↘	2 → ← 3 1 ↘ 1 ↘	2 → ← 3	1 → ← 2 1 ↘ 1 ↘		

6.1.2 Metro East Overlay Zone

The proposed Metro East Overlay Zone project consists of a high-rise residential/office/commercial mixed-use overlay zone that will be applied to 74 parcels of land. The proposed zone will be applied on the site of existing low-rise commercial/office buildings and vacant parcels. The proposed overlay zone, known as “Metro East”, would allow for construction of approximately 5,551 residential units, 3.4 million square feet of office space, and 1.3 million square feet of commercial space. This mixed-use residential/office/commercial development is expected to generate additional traffic volumes as documented below.

6.1.2.1 Project Traffic

For the purposes of this study, the Overlay Zone was divided into 15 subzones (“traffic analysis zones”), each containing from one to eleven parcels of land. Each of the traffic analysis zones is bounded by a street, a barrier to travel, or other logical boundary. The trip generation for the Overlay zone was computed individually for each parcel and land use within the parcels. The Metro East project trips generated were then aggregated into the traffic analysis zones for the purpose of traffic assignment. The Metro East traffic analysis zones are shown in Appendix C of this report.

The trip generation rates for the Overlay Zone are shown in Table 11. The trip generation rates summarized in this table are from *Trip Generation*, with consideration of comparable trip generation rates for similar uses in this region. The trip generation for the Metro East project is summarized in Table 12. Table 12 shows the proposed trips, existing trips, internal trip capture, and net vehicle trips for the Overlay Zone. Trip generation by parcel and land use is documented in detail in Appendix C of this report. Trip generation rates for individual projects in the Metro East Overlay Zone are subject to review. They should be specific to the actual projects proposed as determined by project-specific traffic studies. Higher generation rates may be quite appropriate for properties built to different densities or land use compositions.

6.1.2.2 Existing Land Use Traffic

Office and commercial buildings and vacant land currently occupy the Metro East project site. The existing office and commercial buildings will be eligible for redevelopment upon approval of the proposed project. The trip generation currently associated with the Metro East properties within the project zone is shown in Table 12.

6.1.2.3 Net Project Traffic

As shown in Table 12, the application of the overlay zone to all existing properties is expected to generate approximately 115,521 daily trips. Of this amount, 8,487 are expected to be in the AM peak hour, including 5,799 trips entering and 2,688 trips exiting the site. There are expected to be

11,974 trips during the PM peak hour, including 4,467 trips entering and 7,507 trips exiting the site.

Table 11
Metro East Overlay Zone
Trip Generation Rates

Land Use	Measure	Daily	AM Peak Hour			PM Peak Hour		
			Total	In	Out	Total	In	Out
Trip Generation Rates, Proposed and Existing Uses								
High-Rise Residential Condominium <i>ITE Code 232</i>	DU	4.18	0.34	0.065	0.275	0.38	0.236	0.144
Shopping Center <i>ITE Code 820</i>	1,000 sf	42.94	1.03	0.63	0.40	3.75	1.8	1.95
Office <i>ITE Code 740</i>	1,000 sf	11.01	1.55	1.36	0.19	1.49	0.25	1.24
Motel <i>ITE Code 320</i>	Rooms	5.63	0.45	0.17	0.28	0.47	0.25	0.22
Auto-Related Service / Retail <i>ITE Code</i>	1,000 sf	61.91	2.21	1.13	1.08	5.98	2.93	3.05
Medical Office <i>ITE Code 720</i>	1,000 sf	36.13	2.48	1.96	0.52	3.72	1.00	2.72
Nursing Homes <i>ITE Code 620</i>	Beds	2.37	0.17	0.09	0.08	0.22	0.07	.15

The trip generation for the existing land uses are 38,597 daily trips, including 4,593 trips in the AM peak hour and 4,858 trips in the PM peak hour. The internal trip capture trip reductions applied to the forecasted trips are 9,232 daily trips, including 661 trips in the AM peak hour and 988 trips in the PM peak hour. These reductions apply to the retail/commercial and office components of the Metro East project and the corresponding residential trip ends. There are no credits for pass-by trips, per City direction. The forecast is thus likely conservative in estimating a very low rate of interaction between commercial use trips, non-commercial use trips, and existing traffic passing through the overlay zone.

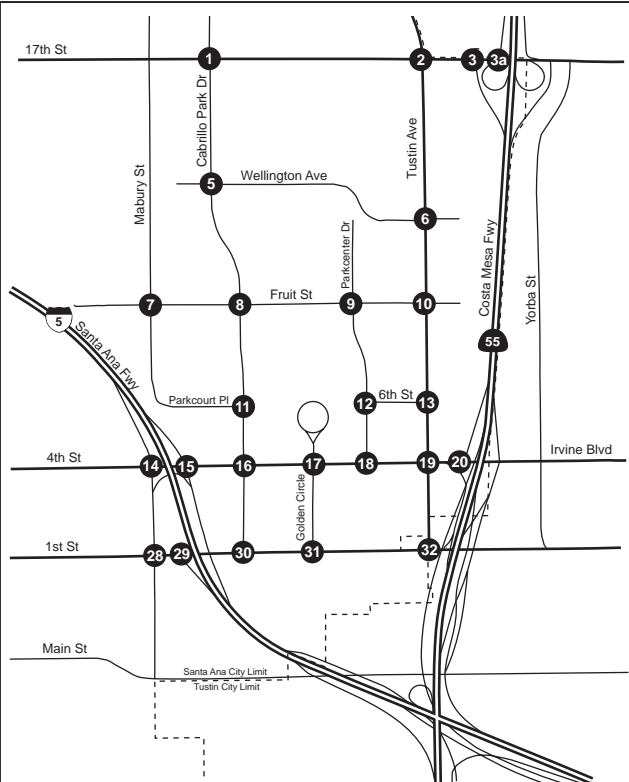
The net project vehicle trips from the proposed project consist of the Metro East project trip generation less the trip credits and internal trip capture. These net project vehicle trips are approximately 67,692 daily trips. Of this amount, 3,233 are expected to be in the AM peak hour, including 1,337 trips entering and 1,896 trips exiting the site. There are expected to be 6,128 net project trips during the PM peak hour, including 3,113 trips entering and 3,015 trips exiting the site. The "NET Project Vehicle Trips" are shown in Table 12. Figures 24 - 27 show the trips expected to be added as a result of the Metro East project.

Table 12
Metro East Overlay Zone
Proposed Project Trip Generation ¹

Land Use	Measure	Daily	AM Peak Hour			PM Peak Hour		
			Total	In	Out	Total	In	Out
Vehicle Trips								
Existing Use (Trip Credits)								
Office <i>ITE Code 710</i>	2,720,168 sf	29,949	4,216	3,699	517	4,053	680	3373
Shopping/Commercial <i>ITE Code 820</i>	65,961 sf	2,832	68	42	26	247	119	128
Motel <i>ITE Code</i>	180 Rooms	1,013	81	31	50	85	45	40
Auto-Related Service / Retail <i>ITE Code</i>	49,959 sf	3,093	110	56	54	299	146	153
Medical Office <i>ITE Code 720</i>	40,846 sf	1,476	101	80	21	152	41	111
Nursing Homes <i>ITE Code 620</i>	99 Beds	234	17	9	8	22	7	15
Subtotal, Existing Use	N/A	38,597	4,593	3,917	676	4,858	1,038	3,820
Proposed Use								
High-Rise Residential Condominium <i>ITE Code 232</i>	5,551 Units	23,204	1,887	359	1528	2,109	1,307	802
Shopping/Commercial Center <i>ITE Code 814</i>	1,275,440 sf	54,767	1,314	802	512	4,783	2,296	2,487
Office <i>ITE Code</i>	3,410,507 sf	37,550	5,286	4,638	648	5,082	864	4,218
Subtotal, Proposed Use	N/A	115,521	8,487	5,799	2,688	11,974	4,467	7,507
Trip Reductions								
Internal Trip Capture (5%) ¹	N/A	9,232	661	545	116	988	316	672
Net Project Vehicle Trips		67,692	3,233	1,337	1,896	6,128	3,113	3,015

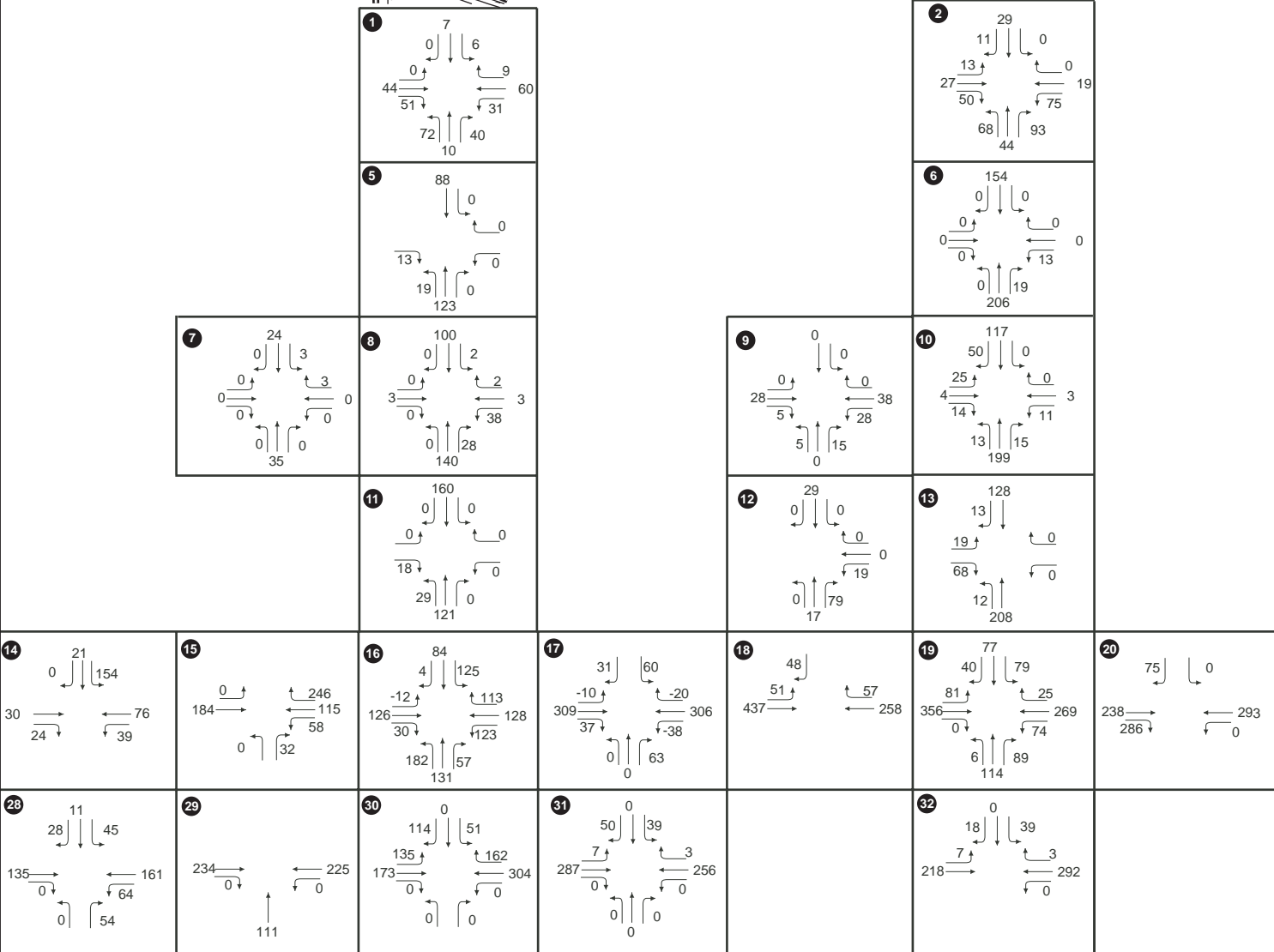
Note 1: Please see Appendix C for calculation of trip generation by parcel and net vehicle trips by study zone.

Note 2: 5% of retail trips + corresponding residential trip end.



LEGEND

- #** Study Intersection
- Major Street
- Minor Street
- XX Turning Movement Volume

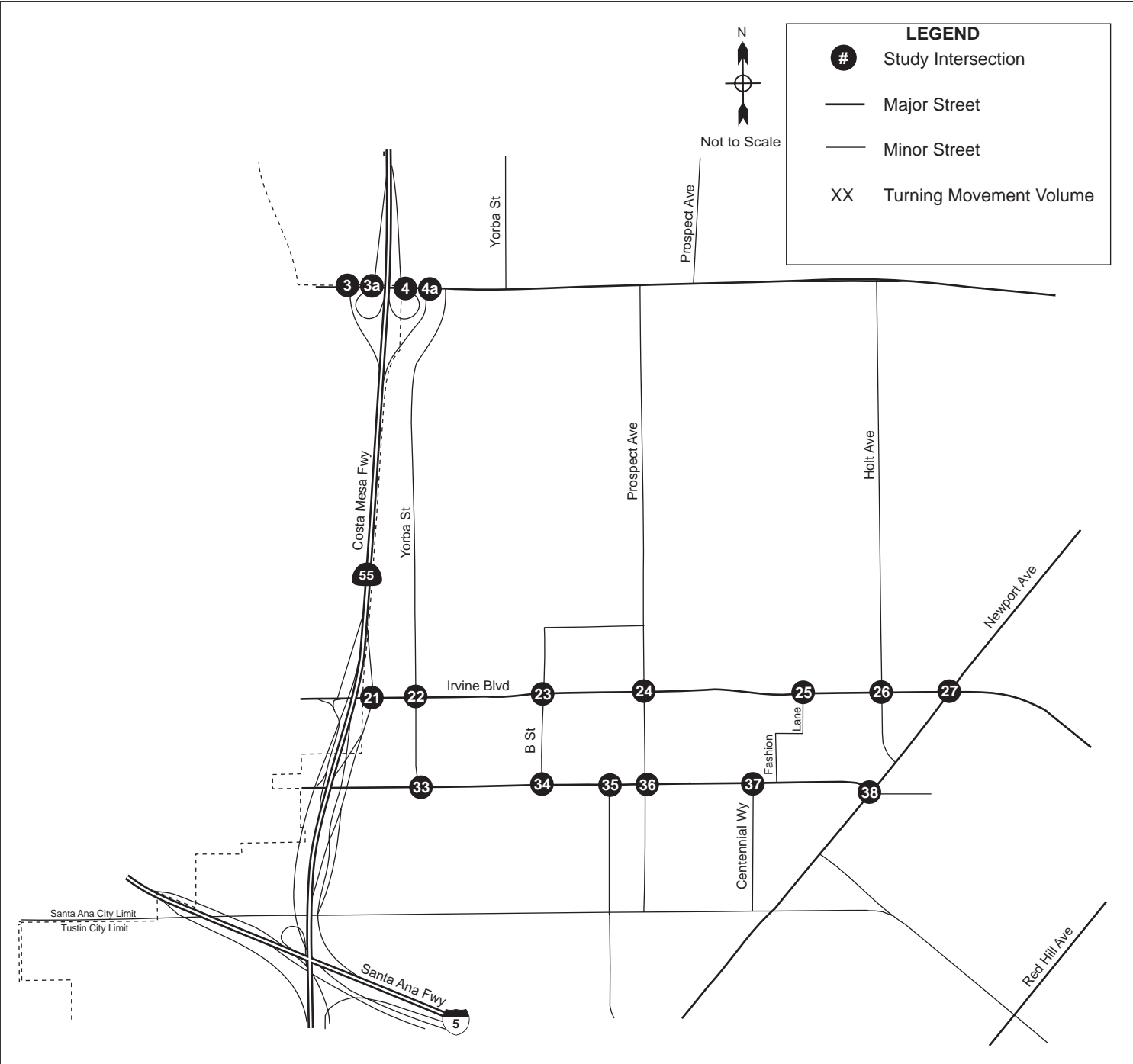




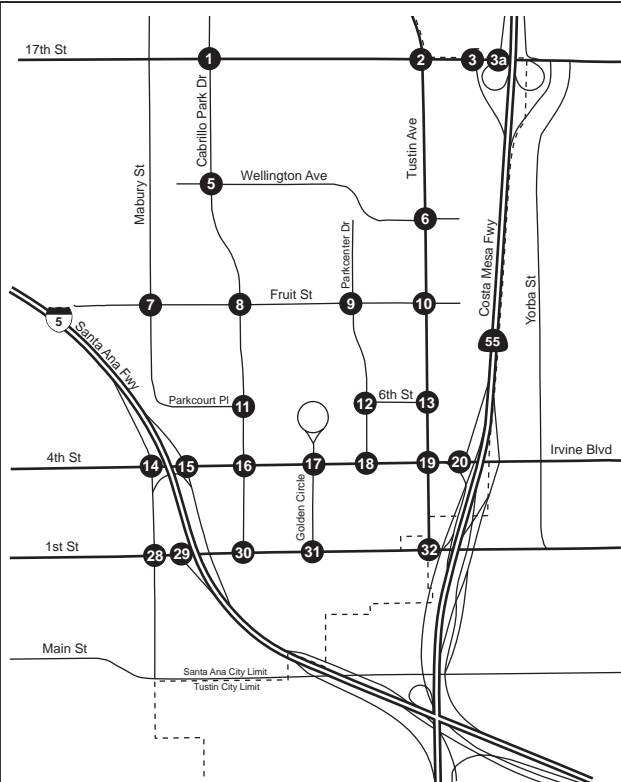
Not to Scale

LEGEND

- # Study Intersection
- Major Street
- Minor Street
- XX Turning Movement Volume

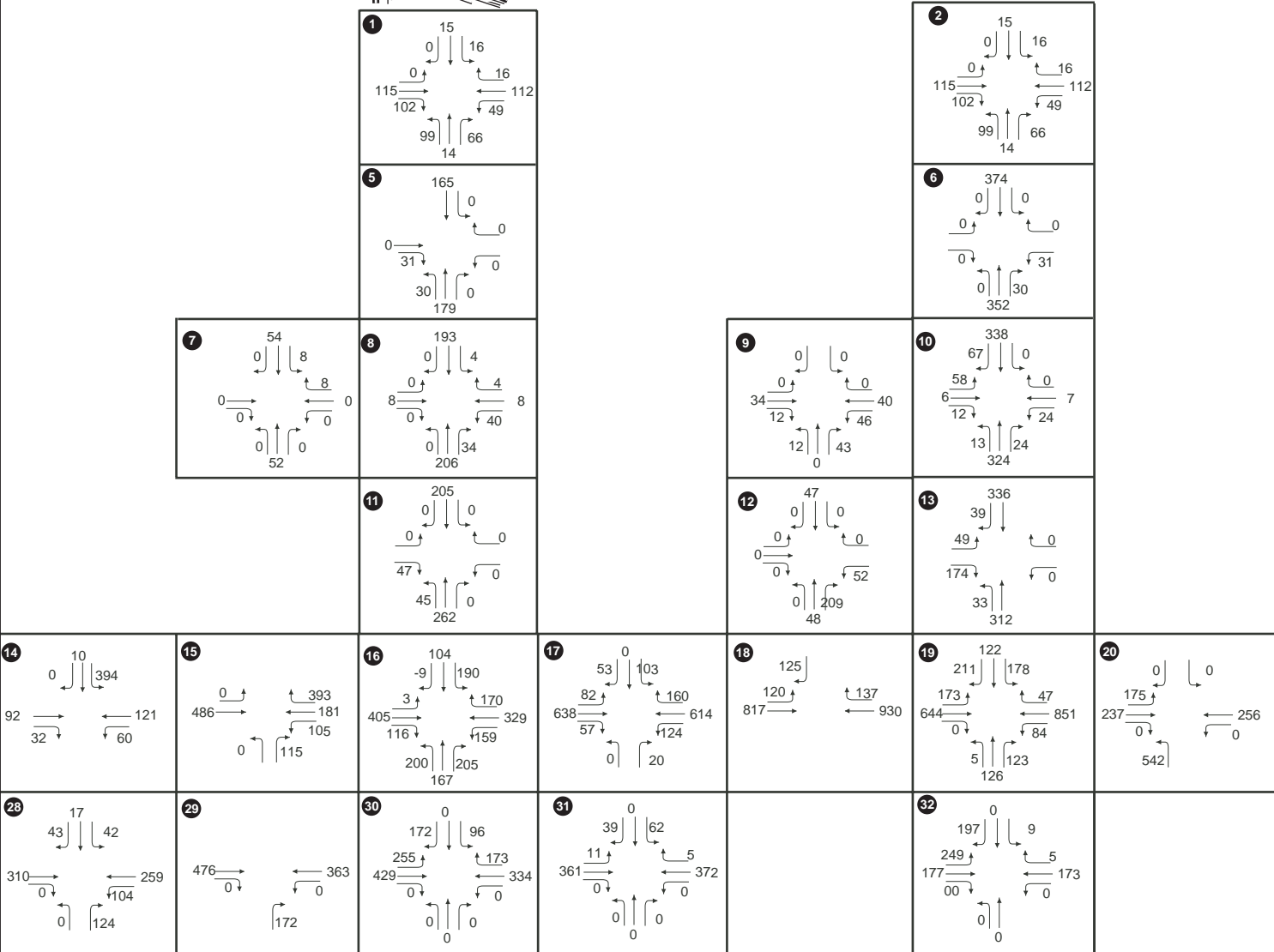


<p>3</p>	<p>3a</p>	<p>4</p>	<p>4a</p>			
<p>21</p>	<p>22</p>	<p>23</p>	<p>24</p>	<p>25</p>	<p>26</p>	<p>27</p>
<p>33</p>	<p>34</p>	<p>35</p>	<p>36</p>	<p>37</p>	<p>38</p>	



LEGEND

- # Study Intersection
- Major Street
- Minor Street
- XX Turning Movement Volume

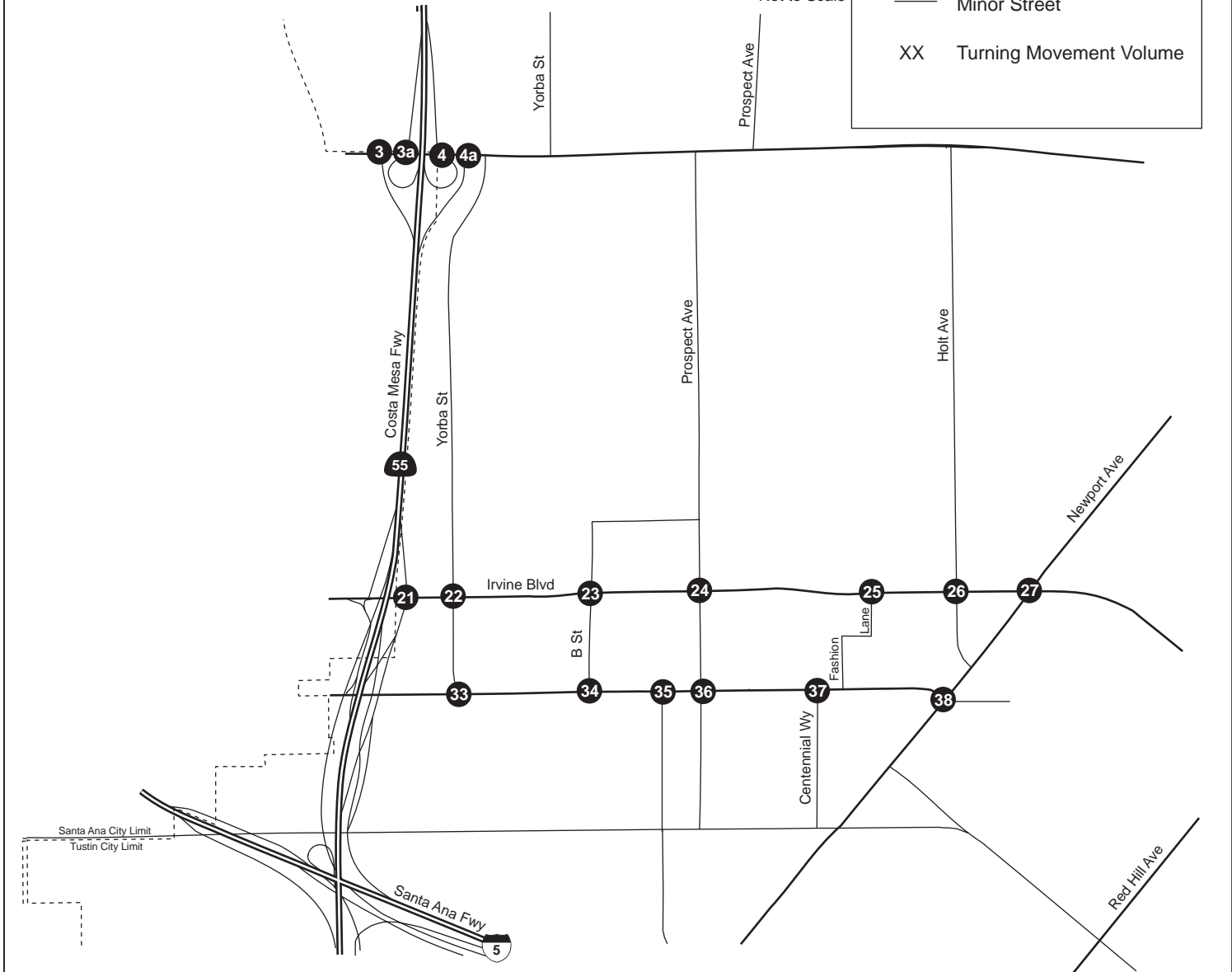




Not to Scale

LEGEND

- # Study Intersection
- Major Street
- Minor Street
- XX Turning Movement Volume



<p>3</p>	<p>3a</p>	<p>4</p>	<p>4a</p>
<p>21</p>	<p>22</p>	<p>23</p>	<p>24</p>
<p>25</p>	<p>26</p>	<p>27</p>	
<p>33</p>	<p>34</p>	<p>35</p>	<p>36</p>
<p>37</p>	<p>38</p>		

7. Future Traffic Conditions With Project

This section documents the future (2010) traffic conditions with the addition of First & Cabrillo project-related traffic to the surrounding street system. To forecast the near-term traffic conditions for the year 2010, the Without Project peak hour background traffic volumes shown in Figures 10 - 13 were increased by the Metro East project-related traffic volumes shown in Figures 20 – 23.

Tables 13 and 14 illustrate the future with project intersection level of service conditions. As shown in the table, 35 of the 38 intersections are expected to operate at Level of Service D or better under the future with project condition for the year 2010. Two intersections, 4th St. at SR-55 Southbound Ramps and Tustin Avenue at 6th Street (poorest approach), will operate at Level of Service E in the AM peak hour. Tustin Avenue at 6th Street (poorest approach) will also operate at Level of Service E in the PM peak hour. There are expected to be significant traffic impacts from the proposed project at these intersections in the AM peak hour. The unsignalized intersection of 1st Street at B Street (poorest approach) is also forecast to operate at Level of Service E in both the AM and PM peak hours. Figures 28 - 31 illustrate the AM and PM peak hour traffic volumes for the Future With Project conditions.

**Table 13 – First & Cabrillo Project
Peak Hour Intersection Conditions, Signalized Intersections
Future With Project Conditions, Year 2010**

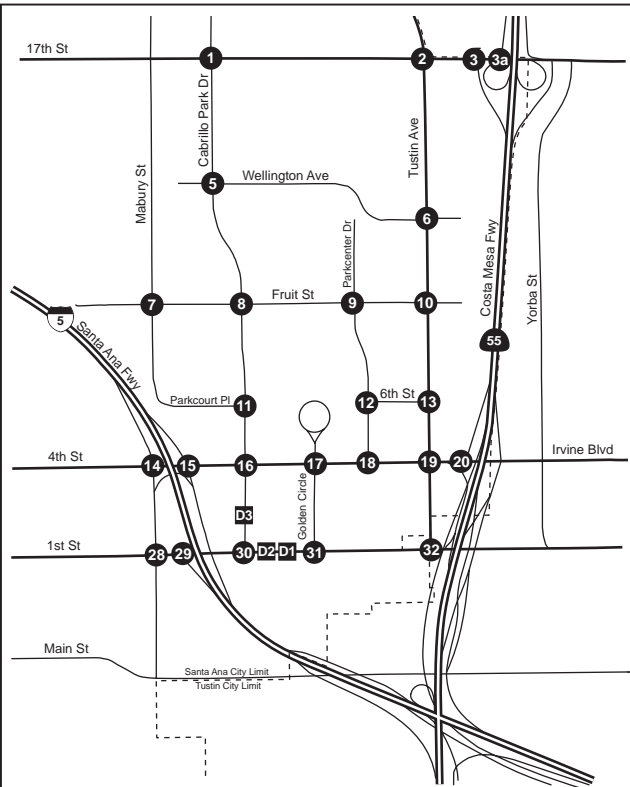
Intersection	AM Peak Hour		PM Peak Hour	
	ICU	Level of Service	ICU	Level of Service
Signalized Intersections – Santa Ana				
1st Street at Tustin Avenue	.373	A	.497	A
1st Street at Golden Circle Drive	.326	A	.355	A
1st Street at Cabrillo Park Drive	.466	A	.696	B
1st Street at Elk Lane	.699	B	.850	D
1st Street at I-5 SB On Ramp	.459	A	.636	B
4th Street at SR-55 Southbound Ramps	.953	E	.865	D
4th Street at Tustin Avenue	.744	C	.791	C
4th Street at Golden Circle Drive	.437	A	.523	A
4th Street at Cabrillo Park Drive	.584	A	.799	C
4th Street at I-5 Northbound Ramps	.536	A	.872	D
4th Street at I-5 Southbound Off-Ramp	.372	A	.468	A
Tustin Avenue at Fruit Street	.584	A	.454	A
Tustin Avenue at Wellington Avenue	.620	B	.412	A
17th Street at Tustin Avenue	.712	C	.752	C
17th Street at Cabrillo Park Drive	.584	A	.712	C
17th Street at SR-55 NB Ramps	.464	A	.564	A
17th Street at SR 55 SB Ramps	.437	A	.485	A
Signalized Intersections – Tustin				
1st Street at Yorba Street	.439	A	.603	B
1st Street at El Camino Real	.360	A	.455	A
1st Street at Prospect Avenue	.433	A	.599	A
1st Street at Centennial Way	.375	A	.538	A
1st Street at Newport Avenue	.737	C	.645	B
Irvine Boulevard at SR-55 Northbound Ramps	.767	C	.874	D
Irvine Boulevard at Yorba Street	.733	C	.641	B
Irvine Boulevard at B Street	.572	A	.511	A
Irvine Boulevard at Prospect Avenue	.605	B	.631	B
Irvine Boulevard at Fashion Lane	.635	B	.569	A
Irvine Boulevard at Holt Avenue	.770	C	.694	B
Irvine Boulevard at Newport Boulevard	.835	D	.703	C

**Table 14 – First & Cabrillo Project
Peak Hour Intersection Conditions, Unsignalized Intersections
Future With Project Conditions, Year 2010**

Intersection	AM Peak Hour			PM Peak Hour		
	Average Delay ¹	Worst Case Delay ¹	Level of Service ²	Average Delay	Worst Case Delay	Level of Service ¹
Unsignalized Intersections – Santa Ana						
6th Street at Parkcenter Drive	3.1	10.8	B	2.9	10.3	B
Parkcourt Pl. at Cabrillo Park Dr.	2.3	14.9	B	4.5	27.1	D
Fruit Street at Mabury Street	7.9	7.9	A	8.0	8.0	A
Fruit Street at Cabrillo Park Dr.	11.7	11.7	B	13.4	13.4	B
Fruit Street at Parkcenter Drive	3.5	11.2	B	5.4	11.3	B
Wellington Av. at Cabrillo Park Dr.	3.9	18.5	C	3.2	21.1	C
Tustin Avenue at 6th Street	1.2	39.9	E	2.0	37.7	E
4th Street at Parkcenter Drive	1.1	13.7	B	1.3	12.3	B
Unsignalized Intersections – Tustin						
1st Street at B Street	3.0	36.3	E	3.0	43.8	E

Note 1: Delay shown in seconds per vehicle

Note 2: Level of Service shown for worst-case approach

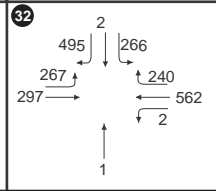
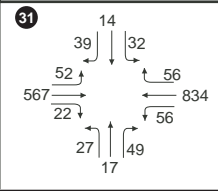
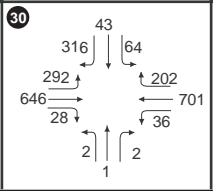
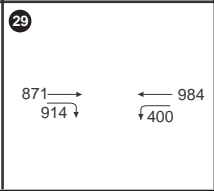
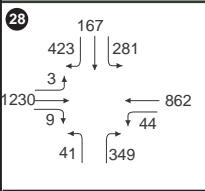
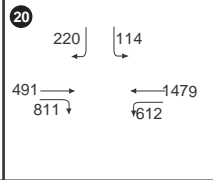
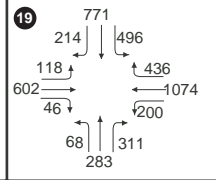
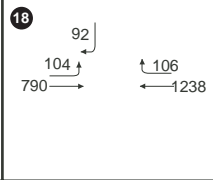
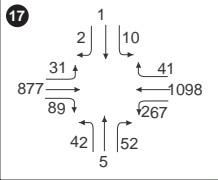
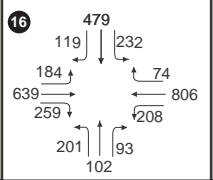
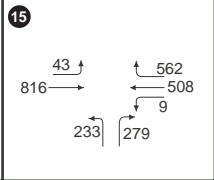
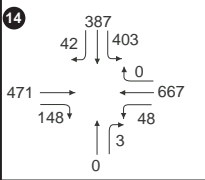
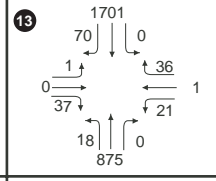
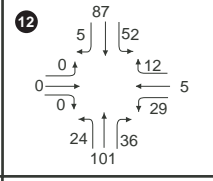
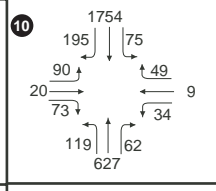
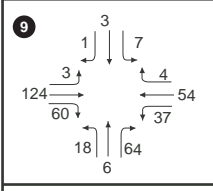
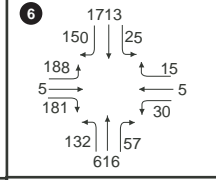
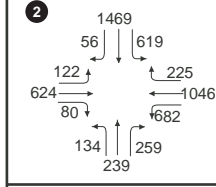
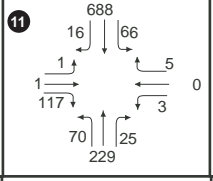
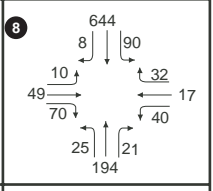
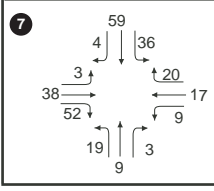
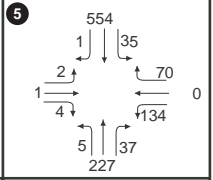
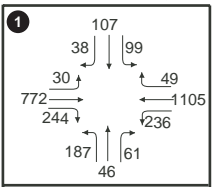
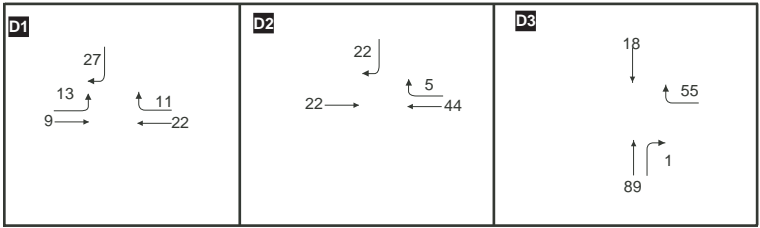


LEGEND

- # Study Intersection
- D1 Driveway
- Major Street
- Minor Street
- XX Turning Movement Volume



Project Driveways

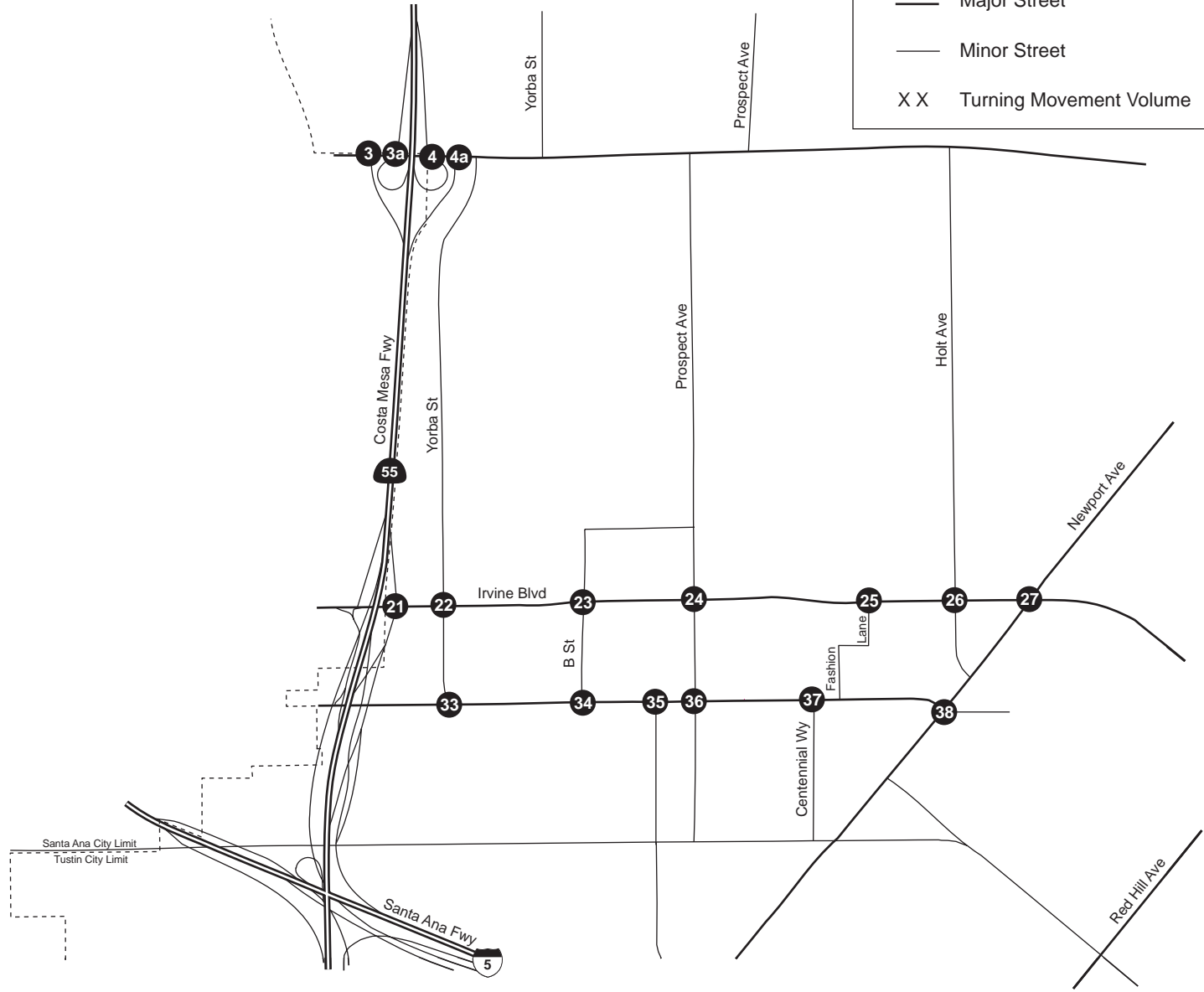




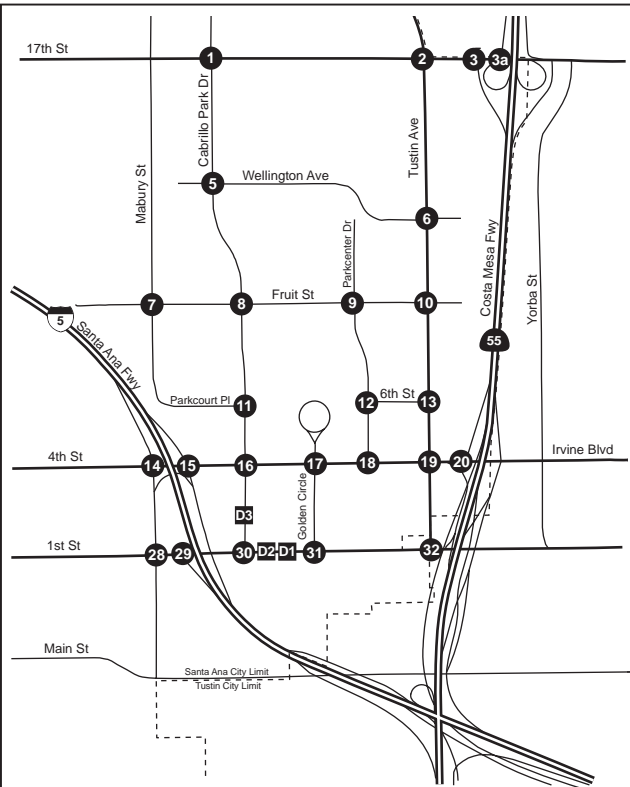
Not to Scale

LEGEND

- #** Study Intersection
- D1** Driveway
- Major Street
- Minor Street
- X X Turning Movement Volume



<p>3</p> <p>693 → ← 12</p> <p>753 ↓ ↑ 1774</p> <p> ↑ 318</p>	<p>3a</p> <p>124 ↓</p> <p>685 → ← 1774</p> <p> ↑ 714</p>	<p>4</p> <p>1099 → ← 29</p> <p>327 ↓ ← 999</p>	<p>4a</p> <p>82 ↓ ↓ 6</p> <p>85 ↓ ↓ 17</p> <p>1099 → ← 4000</p> <p>433 ↑ ↑ 294</p> <p> 28</p>			
<p>21</p> <p>193 ↓ ← 653</p> <p>428 → ← 1582</p> <p>478 ↓ ↑ 364</p>	<p>22</p> <p>588 ↓</p> <p>456 ↓ ↓ 104</p> <p>58 ↓ ← 29</p> <p>688 → ← 1459</p> <p>136 ↓ ↓ 16</p> <p>167 ↑ ↑ 12</p> <p> 76</p>	<p>23</p> <p>92 ↓</p> <p>113 ↓ ↓ 42</p> <p>107 ↓ ← 18</p> <p>641 → ← 1664</p> <p>18 ↓ ↓ 74</p> <p>16 ↑ ↑ 9</p> <p> 114</p>	<p>24</p> <p>381 ↓</p> <p>172 ↓ ↓ 155</p> <p>75 ↓ ← 88</p> <p>516 → ← 1426</p> <p>78 ↓ ↓ 90</p> <p>87 ↑ ↑ 61</p> <p> 232</p>	<p>25</p> <p>4 ↓</p> <p>496 → ← 1906</p> <p>67 ↓ ↓ 171</p> <p>18 ↑ ↑ 37</p> <p> 0</p>	<p>26</p> <p>420 ↓</p> <p>280 ↓ ↓ 249</p> <p>99 ↓ ← 170</p> <p>573 → ← 2031</p> <p>58 ↓ ↓ 26</p> <p>28 ↑ ↑ 10</p> <p> 85</p>	<p>27</p> <p>1491 ↓</p> <p>290 ↓ ↓ 204</p> <p>91 ↓ ← 26</p> <p>704 → ← 1868</p> <p>60 ↓ ↓ 250</p> <p>170 ↑ ↑ 220</p> <p> 449</p>
<p>33</p> <p>184 ↓</p> <p>167 ↓ ↓ 128</p> <p>62 ↓ ← 105</p> <p>485 → ← 651</p> <p>46 ↓ ↓ 75</p> <p>78 ↑ ↑ 63</p> <p> 145</p>	<p>34</p> <p>12 ↓</p> <p>130 ↓ ↓ 14</p> <p>85 ↓ ← 25</p> <p>752 → ← 650</p> <p>19 ↓ ↓ 21</p> <p>31 ↑ ↑ 17</p> <p> 15</p>	<p>35</p> <p>4 ↓ ↓ 2</p> <p>4 ↓ ← 5</p> <p>665 → ← 721</p> <p>176 ↓ ↓ 72</p> <p>122 ↑ ↑ 38</p> <p> 2</p>	<p>36</p> <p>165 ↓</p> <p>158 ↓ ↓ 171</p> <p>70 ↓ ← 137</p> <p>532 → ← 513</p> <p>44 ↓ ↓ 60</p> <p>61 ↑ ↑ 63</p> <p> 93</p>	<p>37</p> <p>2 ↓ ↓ 1</p> <p>9 ↓ ← 8</p> <p>530 → ← 596</p> <p>89 ↓ ↓ 72</p> <p>107 ↑ ↑ 62</p> <p> 1</p>	<p>38</p> <p>1541 ↓</p> <p>149 ↓ ↓ 34</p> <p>227 ↓ ← 41</p> <p>97 → ← 173</p> <p>167 ↓ ↓ 60</p> <p>247 ↑ ↑ 27</p> <p> 528</p>	

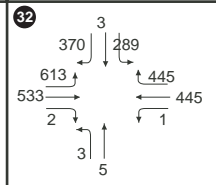
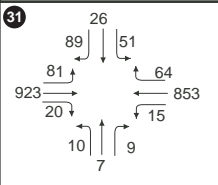
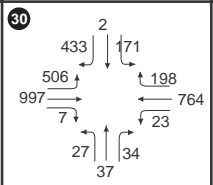
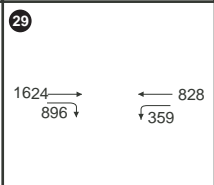
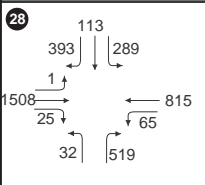
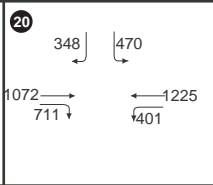
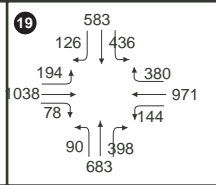
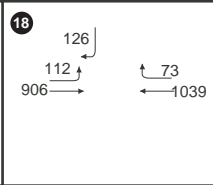
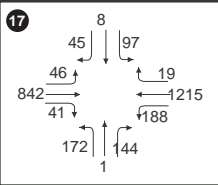
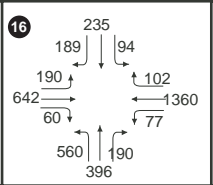
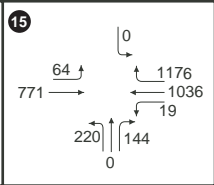
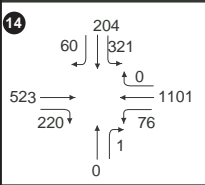
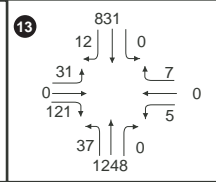
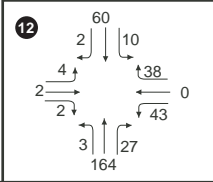
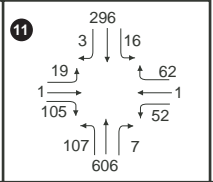
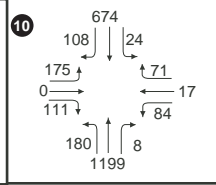
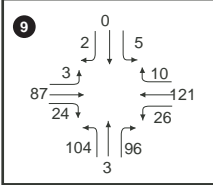
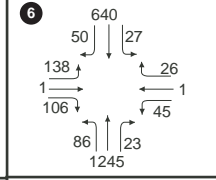
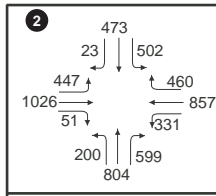
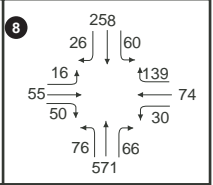
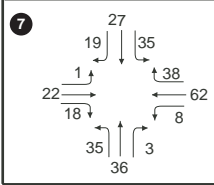
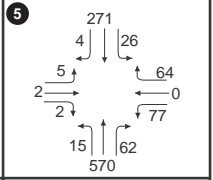
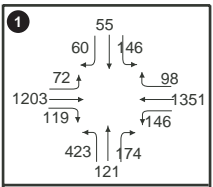
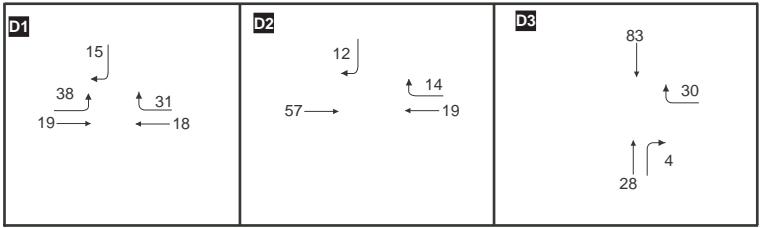


LEGEND

- # Study Intersection
- D1 Driveway
- Major Street
- Minor Street
- XX Turning Movement Volume



Project Driveways





<p>3</p> <p>1334 → 563 ↓</p> <p>↑53 ←1961 ↓267</p>	<p>3a</p> <p>1334 → 44 ↓</p> <p>←1961 ↓490</p>	<p>4</p> <p>1292 → 634 ↓</p> <p>↑68 ←1073</p>	<p>4a</p> <p>1292 → 645 ↓</p> <p>↑101 ←4 ↓15 ←1073 ↑346</p>
<p>21</p> <p>1103 → 366 ↓</p> <p>↑446 ←716 ↓1205</p> <p>↑353 ↓1</p>	<p>22</p> <p>964 → 161 ↓</p> <p>↑99 ←31 ↓712 ↑31 ↓238</p> <p>↑347 ↓26</p>	<p>23</p> <p>1135 → 21 ↓</p> <p>↑24 ←10 ↓41 ←42 ↓41 ↑25</p>	
<p>24</p> <p>988 → 117 ↓</p> <p>↑286 ←66 ↓140 ↑199 ←1177 ↓79</p> <p>↑136 ↓381</p>	<p>25</p> <p>1059 → 58 ↓</p> <p>↑22 ←314 ↓92</p> <p>↑102 ↓203</p>	<p>26</p> <p>1341 → 180 ↓</p> <p>↑216 ←144 ↓267 ↑446 ←363 ↓44</p> <p>↑108 ↓20 ↑332</p>	<p>27</p> <p>1527 → 83 ↓</p> <p>↑643 ←208 ↓193 ↑80 ←332 ↓311</p> <p>↑180 ↓381 ↑758</p>
<p>33</p> <p>666 → 47 ↓</p> <p>↑124 ←224 ↓757 ↑64</p> <p>↑108 ↓26 ↑291</p>	<p>34</p> <p>837 → 21 ↓</p> <p>↑16 ←17 ↓26 ←929 ↓18</p> <p>↑10 ↓50 ↑5</p>	<p>35</p> <p>713 → 159 ↓</p> <p>↑0 ←0 ↓85 ↑667</p> <p>↑246 ↓0 ↑13</p>	<p>36</p> <p>694 → 54 ↓</p> <p>↑106 ←118 ↓176 ↑194 ←660 ↓101</p> <p>↑100 ↓130 ↑185</p>
<p>37</p> <p>733 → 110 ↓</p> <p>↑5 ←4 ↓7 ↑4 ←680 ↓100</p> <p>↑147 ↓152 ↑3</p>	<p>38</p> <p>189 → 251 ↓</p> <p>↑798 ←169 ↓61 ↑62 ←185 ↓90</p> <p>↑359 ↓64 ↑1062</p>		

8. Buildout Traffic Conditions With Project

This section documents the buildout (2030) traffic conditions with the addition of Metro East Overlay Zone project-related traffic to the surrounding street system. To simulate the buildout traffic conditions for the year 2030, the Without Project peak hour background traffic volumes shown in Figures 14 - 17 were increased by the Metro East project-related traffic increases shown in Figures 24 – 27.

Tables 15 and 16 summarize the results of the level of service analyses for this scenario. As shown in the tables, eighteen intersections will operate at Level of Service E or worse in either the AM or PM peak hour, or both. Figures 32 - 35 illustrate the AM and PM peak hour traffic volumes for the Buildout with Project conditions.

**Table 15 – Metro East Overlay Zone
Peak Hour Intersection Conditions, Signalized Intersections
Buildout with Project Conditions, Year 2030**

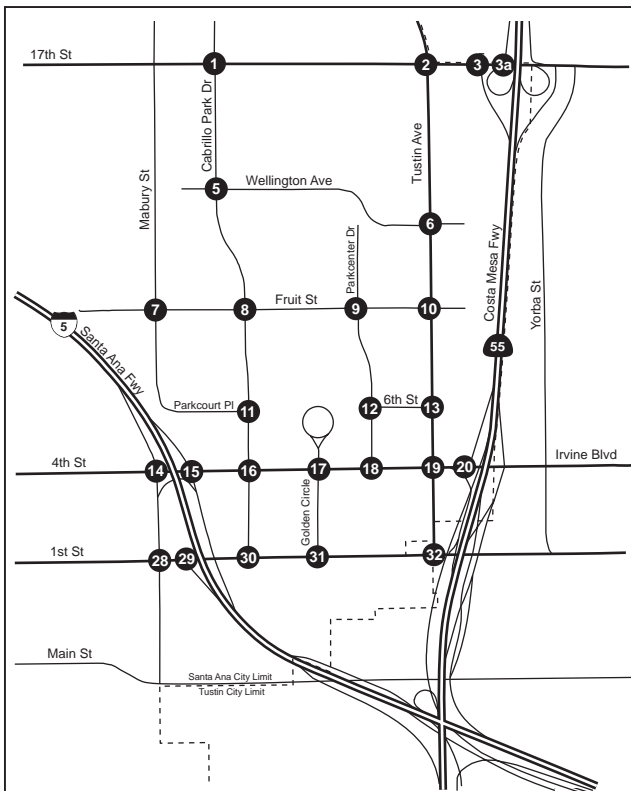
Intersection	AM Peak Hour		PM Peak Hour	
	ICU	Level of Service	ICU	Level of Service
Signalized Intersections – Santa Ana				
1st Street at Tustin Avenue	.584	A	.679	B
1st Street at Golden Circle Drive	.437	A	.467	A
1st Street at Cabrillo Park Drive	.667	B	1.065	F
1st Street at Elk Lane	.814	D	1.098	F
1st Street at I-5 SB On Ramp	.551	A	.799	C
4th Street at SR-55 Southbound Ramps	1.550	F	1.487	F
4th Street at Tustin Avenue	1.047	F	1.267	F
4th Street at Golden Circle Drive	.606	B	.934	E
4th Street at Cabrillo Park Drive	.912	E	1.139	F
4th Street at I-5 Northbound Ramps	.688	B	1.170	F
4th Street at I-5 Southbound Off-Ramp	.571	A	.644	B
Tustin Avenue at Fruit Street	.774	C	.645	B
Tustin Avenue at Wellington Avenue	.865	D	.577	A
17th Street at Tustin Avenue	.902	E	.881	D
17th Street at Cabrillo Park Drive	.807	D	.965	E
17th Street at SR-55 NB Ramps	1.217	F	.706	C
17th Street at SR 55 SB Ramps	.642	B	.565	A
Signalized Intersections – Tustin				
1st Street at Yorba Street	.641	B	.757	C
1st Street at El Camino Real	.654	B	.683	B
1st Street at Prospect Avenue	.804	D	.934	E
1st Street at Centennial Way	.465	A	.683	B
1st Street at Newport Avenue	.990	E	.804	D
Irvine Boulevard at SR-55 Northbound Ramps	1.196	F	1.432	F
Irvine Boulevard at Yorba Street	.843	D	.834	D
Irvine Boulevard at B Street	.686	B	.592	A
Irvine Boulevard at Prospect Avenue	.790	C	.833	D
Irvine Boulevard at Fashion Lane	.694	B	.711	C
Irvine Boulevard at Holt Avenue	.870	D	.812	D
Irvine Boulevard at Newport Boulevard	.913	E	.784	C

**Table 16 – Metro East Overlay Zone
Peak Hour Intersection Conditions, Unsignalized Intersections
Buildout with Project Conditions, Year 2030**

Intersection	AM Peak Hour			PM Peak Hour		
	Average Delay ¹	Worst Case Delay ¹	Level of Service ²	Average Delay	Worst Case Delay	Level of Service ¹
Unsignalized Intersections – Santa Ana						
6th Street at Parkcenter Drive	2.9	12.7	B	3.1	14.7	B
Parkcourt Pl. at Cabrillo Park Dr.	2.4	27.1	D	26.3	>120	F
Fruit Street at Mabury Street	8.3	8.3	A	8.7	8.7	A
Fruit Street at Cabrillo Park Dr.	20.7	20.7	C	44.8	44.8	E
Fruit Street at Parkcenter Drive	3.9	13.7	B	7.2	15.9	C
Wellington Av. at Cabrillo Park Dr.	19.1	132.1	F	15.0	158.1	F
Tustin Avenue at 6th Street	57.6	>> 120	F	147.3	>> 120	F
4th Street at Parkcenter Drive	2.0	26.0	D	10.9	144.4	F
Unsignalized Intersections – Tustin						
1st Street at B Street	120.8	>> 120	F	77.0	>> 120	F

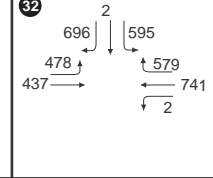
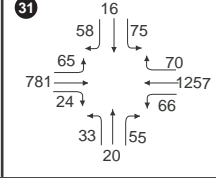
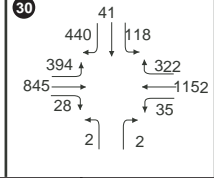
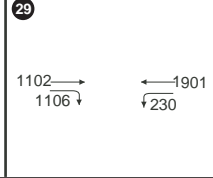
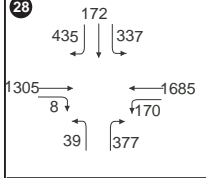
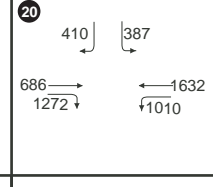
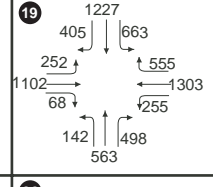
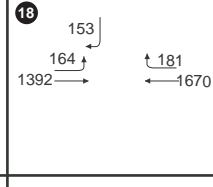
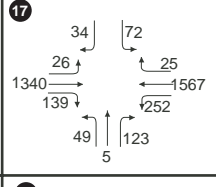
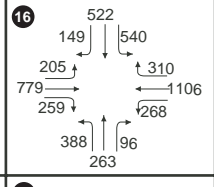
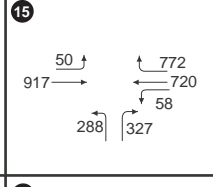
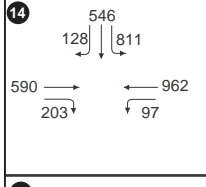
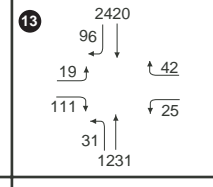
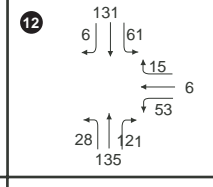
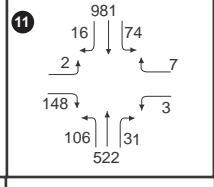
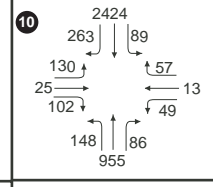
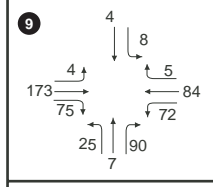
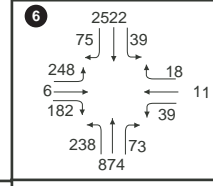
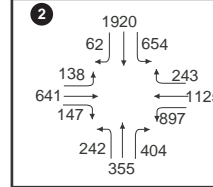
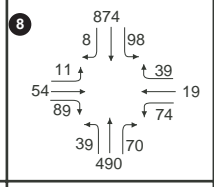
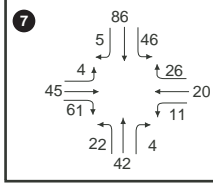
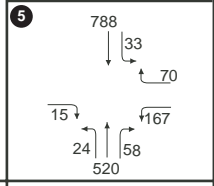
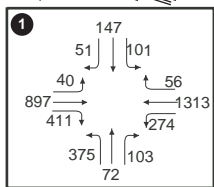
Note 1: Delay shown in seconds per vehicle

Note 2: Level of Service shown for worst-case approach



LEGEND

- # Study Intersection
- Major Street
- Minor Street
- XX Turning Movement Volume

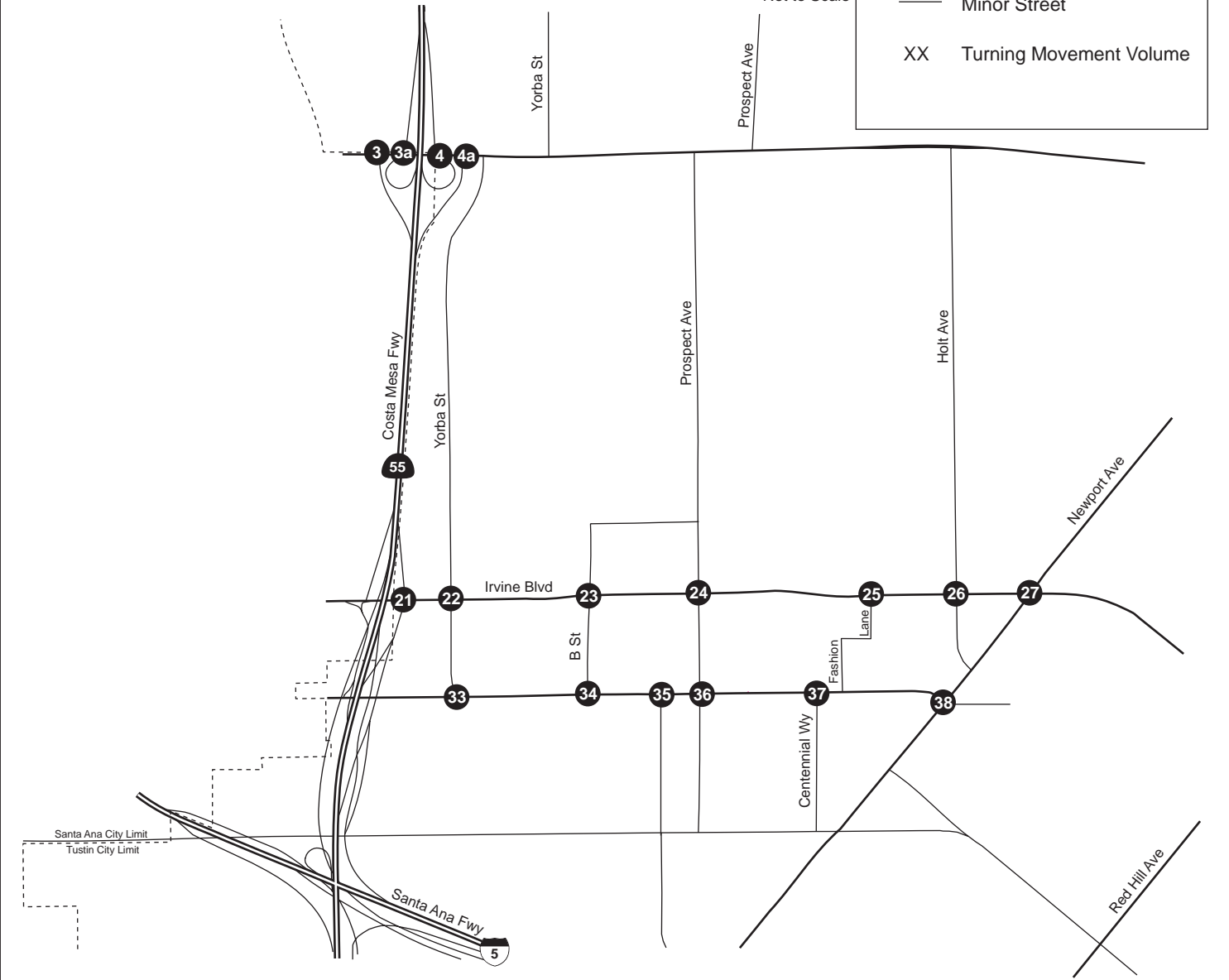




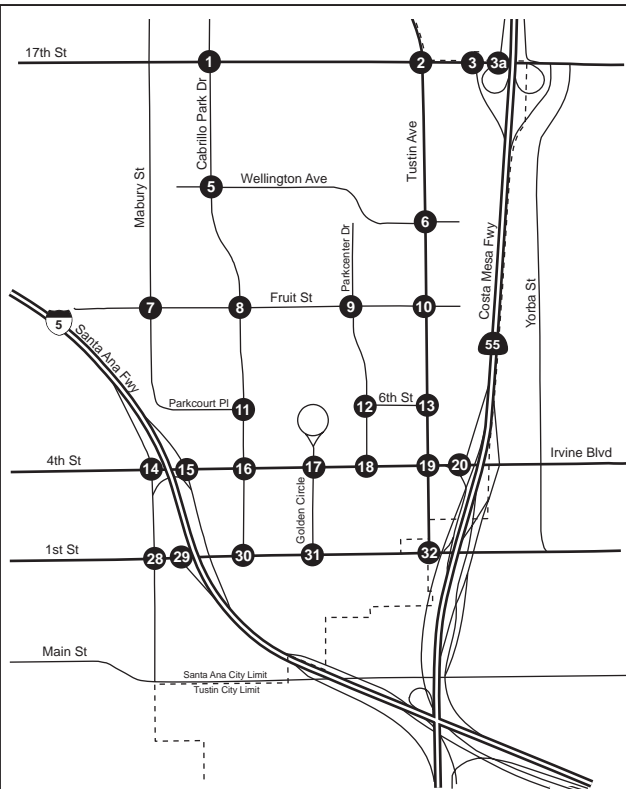
Not to Scale

LEGEND

- # Study Intersection
- Major Street
- Minor Street
- XX Turning Movement Volume

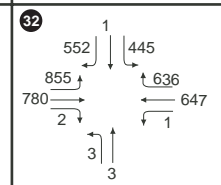
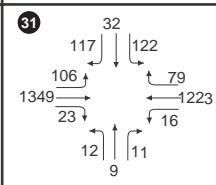
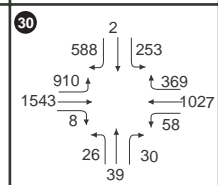
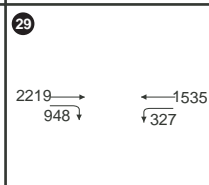
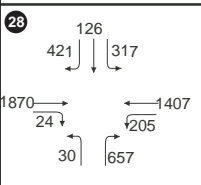
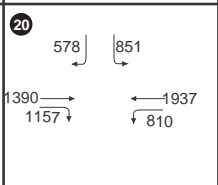
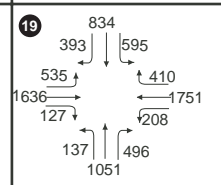
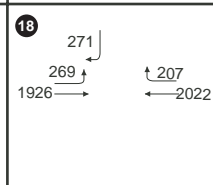
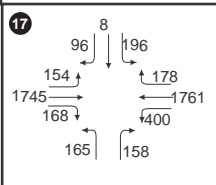
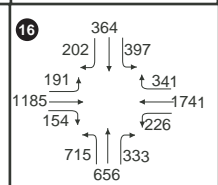
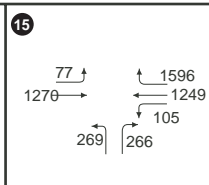
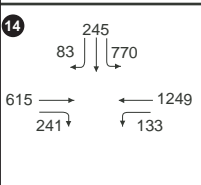
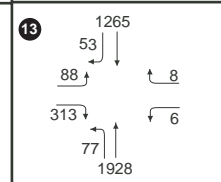
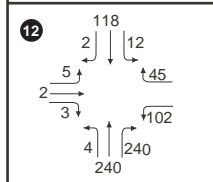
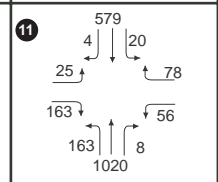
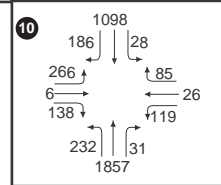
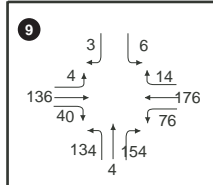
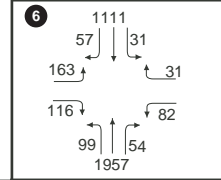
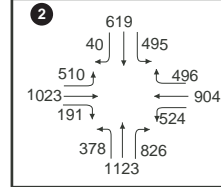
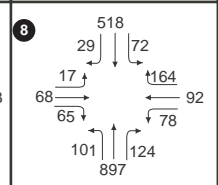
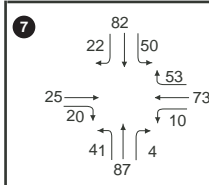
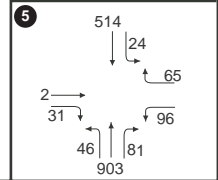
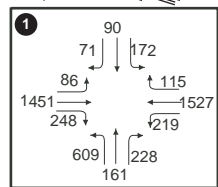


<p>3</p> <p>76 36 17 878 757</p> <p>19 15 1508 602</p>	<p>3a</p> <p>593</p> <p>904</p> <p>1759</p>	<p>4</p> <p>1427</p> <p>456 1481</p>	<p>4a</p> <p>15 352 1149 67 646 283 6</p> <p>16 992</p>
<p>21</p> <p>423 585 912</p> <p>1000 1575 663</p>	<p>22</p> <p>678 443 66 1086 131 161 106</p> <p>317 50 1804 28 45 139</p>	<p>23</p> <p>100 131 142 1540 44 30 122</p> <p>57 17 2020 83 17 17</p>	<p>24</p> <p>553 193 133 966 239 201 418</p> <p>149 85 1567 132 116 116</p>
<p>25</p> <p>960 4 91 17</p> <p>2087 182 47</p>	<p>26</p> <p>520 360 113 873 134 49</p> <p>450 110 2135 38 18 18</p>	<p>27</p> <p>1893 317 108 937 60 170 539</p> <p>170 34 1837 257 387</p>	
	<p>33</p> <p>177 237 75 948 44 76 139</p> <p>232 139 1118 81 82 139</p>	<p>34</p> <p>13 144 82 1359 18 3 14</p> <p>37 47 1171 33 25 14</p>	<p>35</p> <p>4 4 939 519 372 3</p> <p>2 5 989 136 77 3</p>
	<p>36</p> <p>421 251 152 650 119 138 277</p> <p>204 228 666 116 98 98</p>	<p>37</p> <p>2 2 9 725 87 116</p> <p>12 896 100 82</p>	<p>38</p> <p>2060 298 267 130 262 369 569</p> <p>33 39 204 58 26 26</p>



LEGEND

- #** Study Intersection
- Major Street
- Minor Street
- XX Turning Movement Volume

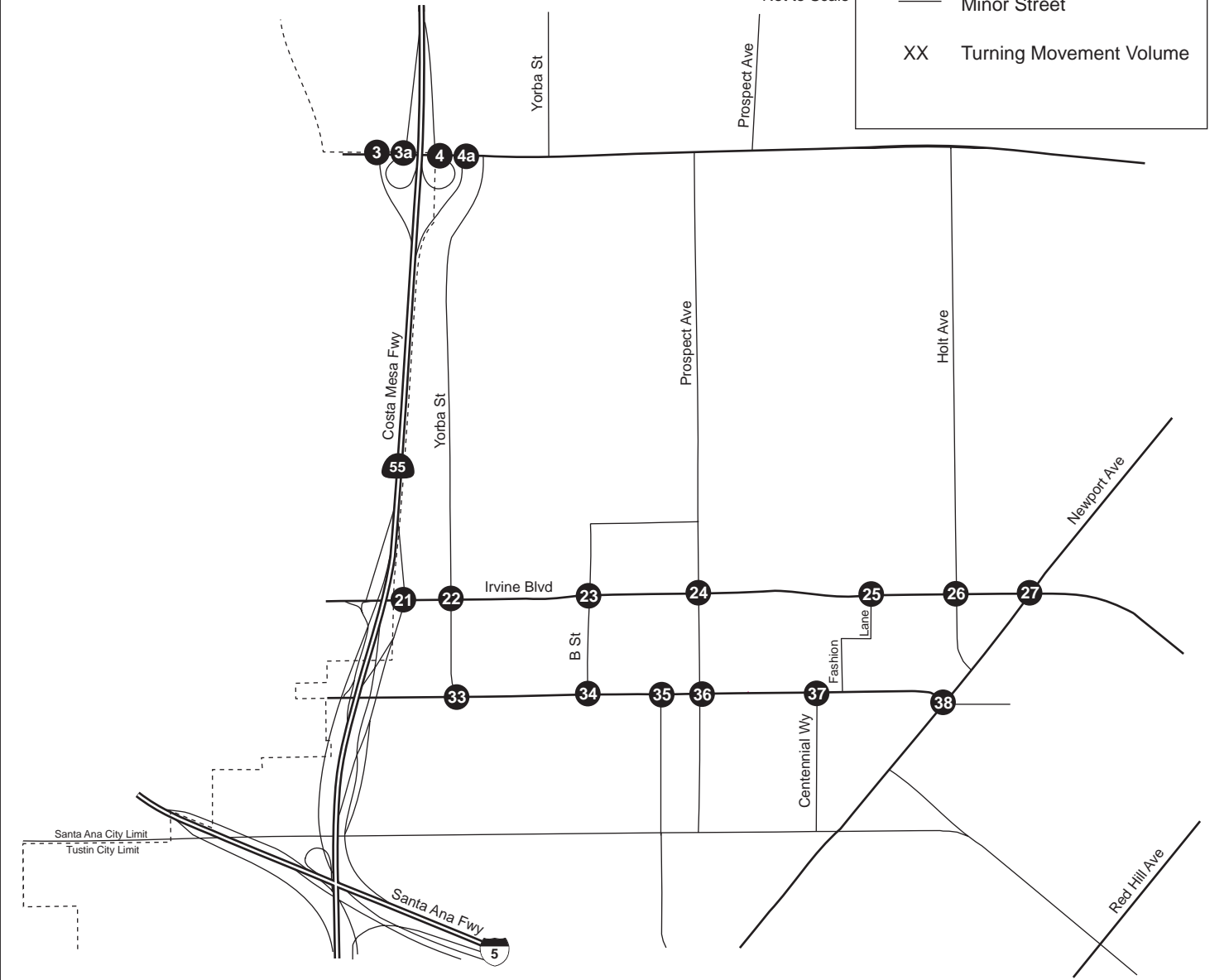




Not to Scale

LEGEND

- # Study Intersection
- Major Street
- Minor Street
- XX Turning Movement Volume



<p>3</p> <p>17 12 ↓ 16 ↓</p> <p>38 ↓ 51 ↓</p> <p>1447 → ← 1627</p> <p>687 ↓ 365 ↓</p>	<p>3a</p> <p>1055 ↓</p> <p>1553 → ← 1651</p>	<p>4</p> <p>1591 →</p> <p>877 ↑ 1119 ←</p>	<p>4a</p> <p>97 ↓ 4 ↓</p> <p>108 ↓ 15 ↓</p> <p>1583 → ← 1256</p> <p>103 ↓ 934 ↓ 494 ↓</p> <p>32 ↓</p>			
<p>21</p> <p>730 ↓ 1069 ↓</p> <p>1272 → ← 1402</p> <p>1030 ↓ 622 ↓</p>	<p>22</p> <p>113 ↓ 41 ↓</p> <p>239 ↓ 61 ↓</p> <p>1216 → ← 2117</p> <p>200 ↓ 34 ↓</p> <p>334 ↓ 30 ↓</p> <p>384 ↓</p>	<p>23</p> <p>29 ↓ 10 ↓</p> <p>66 ↓ 39 ↓</p> <p>98 ↓ 39 ↓</p> <p>1315 → ← 4955</p> <p>53 ↓ 40 ↓</p> <p>63 ↓ 39 ↓</p> <p>32 ↓</p>	<p>24</p> <p>453 ↓ 135 ↓</p> <p>85 ↓ 191 ↓</p> <p>1216 → ← 1544</p> <p>257 ↓ 122 ↓</p> <p>307 ↓ 152 ↓</p> <p>577 ↓</p>	<p>25</p> <p>23 ↓</p> <p>1308 → ← 1716</p> <p>62 ↓ 113 ↓</p> <p>113 ↓ 242 ↓</p>	<p>26</p> <p>310 ↓ 149 ↓</p> <p>130 ↓ 620 ↓</p> <p>200 ↓ 729 ↓</p> <p>240 ↓ 49 ↓</p> <p>165 ↓ 120 ↓</p> <p>560 ↓</p>	<p>27</p> <p>698 ↓ 160 ↓</p> <p>253 ↓ 80 ↓</p> <p>323 ↓ 1675 ↓</p> <p>1399 → ← 1675</p> <p>115 ↓ 310 ↓</p> <p>275 ↓ 525 ↓</p> <p>1040 ↓</p>
<p>33</p> <p>120 ↓ 177 ↓</p> <p>97 ↓ 283 ↓</p> <p>1016 → ← 1124</p> <p>47 ↓ 62 ↓</p> <p>105 ↓ 25 ↓</p> <p>280 ↓</p>	<p>34</p> <p>18 ↓ 41 ↓</p> <p>56 ↓ 56 ↓</p> <p>30 ↓ 23 ↓</p> <p>1215 → ← 1368</p> <p>23 ↓ 22 ↓</p> <p>11 ↓ 60 ↓</p> <p>5 ↓</p>	<p>35</p> <p>14 ↓</p> <p>985 → ← 936</p> <p>315 ↓ 133 ↓</p> <p>450 ↓ 168 ↓</p>	<p>36</p> <p>260 ↓ 280 ↓</p> <p>212 ↓ 289 ↓</p> <p>255 ↓ 791 ↓</p> <p>852 → ← 791</p> <p>109 ↓ 142 ↓</p> <p>184 ↓ 178 ↓</p> <p>404 ↓</p>	<p>37</p> <p>6 ↓ 9 ↓</p> <p>4 ↓ 6 ↓</p> <p>15 ↓ 988 ↓</p> <p>117 ↓ 137 ↓</p> <p>151 ↓ 199 ↓</p> <p>4 ↓</p>	<p>38</p> <p>1070 ↓ 59 ↓</p> <p>296 ↓ 62 ↓</p> <p>570 ↓ 249 ↓</p> <p>243 → ← 249</p> <p>324 ↓ 100 ↓</p> <p>535 ↓ 62 ↓</p> <p>1425 ↓</p>	

9. Daily Traffic Analysis

For planning purposes the City of Santa Ana has established maximum road capacities for various roadway street classifications corresponding to various Levels of Service. The maximum roadway capacities are based on daily traffic volume, number of lanes and roadway classification, as shown in Table 17 below. This analysis is intended to determine the appropriate roadway classification and number of through travel lanes for roadways based upon expected daily usage.

Table 17
Levels of Service for Arterial Street Segments
Based upon Daily Traffic Volumes ¹

Roadway Classification	Lanes/ Configuration	Level of Service A	Level of Service B	Level of Service C	Level of Service D	Level of Service E	Level of Service F
Principal Arterial	8 Lanes Divided	45,000	52,500	60,000	67,500	75,000	> 75,000
Major Arterial	6 Lanes Divided	33,900	39,400	45,000	50,600	56,300	> 56,300
Primary Arterial	4 Lanes Divided	22,500	26,300	30,000	33,800	37,500	> 37,500
Secondary Arterial	4 lanes Undivided	15,000	17,500	20,000	22,500	25,000	> 25,000
Commuter Street	2 Lanes Undivided	7,500	8,800	10,000	11,300	12,500	> 12,500

Note 1: Source: City of Santa Ana General Plan Circulation Element

For the Metro East Overlay Zone, the Level of Service for roadway segments is determined by forecasting the expected daily traffic usage for each roadway and comparing the daily traffic volumes for each roadway segment to the appropriate Level of Service D capacity for that roadway classification. The daily usage is forecast based upon the peak hour usage forecasted and a daily traffic conversion factor (10%). When the daily volume is within the Level of Service D volume criteria, the roadway segment is forecast to operate at an acceptable level of service.

Table 18 presents the daily traffic volume segment analysis for the Metro East Overlay Zone, both for existing conditions and for Buildout with Project conditions. One roadway segment, Cabrillo Park between 1st Street and 4th Street is expected to operate at an unacceptable level of service under Buildout with Project conditions, with the expected traffic levels and secondary arterial roadway configuration. However this roadway is currently constructed with a raised median and can be considered to be 4 lanes divided, justifying a higher allowable daily capacity. It is not considered to be impacted for daily traffic based upon the current configuration.

Table 18 – Metro East Overlay Zone Daily Traffic Analysis

Street	Between	And	Existing Volume	Buildout Volume	LOS “D” Capacity	Buildout Level of Service
1st Street	Elk Lane	I-5	36,588	47,800	50,600	D
1st Street	I-5	Cabrillo Park	19,904	41,000	50,600	C
1st Street	Cabrillo Park	Tustin Av.	19,401	29,500	50,600	A
1st Street	Tustin Av.	SR-55	16,200	25,000	33,800	C
4 th Street	Elk Lane	I-5	19,984	27,700	33,800	C
4 th Street	I-5	Cabrillo Park	29,830	41,000	50,600	C
4 th Street	Cabrillo Park	Parkcenter.	21,692	45,300	50,600	D
4 th Street	Parkcenter	Tustin Av.	23,171	45,300	50,600	D
4 th Street	Tustin Av.	SR-55	29,890	49,200	50,600	D
Parkcourt	Mabury St.	Cabrillo Park	2,180	3,500	11,300	A
6 th Street	Parkcenter	Tustin Av.	2,240	5,500	11,300	A
Fruit Street	Cabrillo Park	Tustin Av.	3,015	5,600	11,300	A
Wellington	Cabrillo Park	Tustin Av.	2,348	4,400	11,300	A
17th Street	Grand Av.	Cabrillo Park	33,294	39,900	50,600	C
17th Street	Cabrillo Park	Tustin Av.	33,252	35,900	50,600	B
17th Street	Tustin Av.	SR-55	33,970	41,000	50,600	C
Elk Lane	Chestnut	1 st St.	6,610	10,400	11,300	D
Elk Lane	1st St.	4 th St.	7,620	8,600	11,300	B
Mabury	Parkcourt	17 th St.	1,420	2,900	11,300	A
Cabrillo Park	1 st St.	4 th St.	11,836	25,500	22,500	F
Cabrillo Park	4 th St.	Fruit St.	9,130	17,300	22,500	B
Cabrillo Park	Fruit St.	Wellington	9,671	16,600	22,500	B
Cabrillo Park	Wellington St.	17 th St.	10,647	15,400	22,500	B
Golden Circle	1 st St.	4 th St.	4,440	5,900	11,300	A
Golden Circle	4 th St.	Circle	2,070	6,300	11,300	A
Parkcenter	4 th St.	6 th St.	3,080	7,600	11,300	A
Parkcenter	6 th St.	Fruit St.	2,650	4,200	11,300	A
Tustin Av.	1 st St.	4 th St.	16,145	26,800	50,600	B
Tustin Av.	4 th St.	Fruit St.	22,859	34,400	50,600	B
Tustin Av.	Fruit St.	Wellington.	24,688	34,200	50,600	B
Tustin Av.	Wellington St.	17 th St.	26,867	35,300	50,600	B

10. Determination Of Significant Impact

Traffic impacts are identified if the proposed project will result in a significant change in traffic conditions on a roadway or at an intersection. A significant impact is normally defined when project related traffic would cause level of service to deteriorate to below the minimum acceptable level by a measurable amount. A cumulative impact may also be significant if the location is already below the minimum acceptable level or forecast without the project to be below the minimum acceptable level and project related traffic causes a further decline.

The City of Santa Ana considers LOS D as the threshold for an acceptable service level for intersections located outside of Major Development Areas (MDA). The City considers LOS E as the maximum threshold for acceptable service levels for intersections located within an MDA. If the project contribution to the volume/capacity ratio at the intersection is greater than .01 and if the location is at Level of Service D or poorer outside of an MDA or Level of Service E or poorer within an MDA, the impact is considered significant.

The City of Tustin has determined that Level of Service D is the minimum acceptable level of service for peak hour operation in the City. For levels of service poorer than the acceptable level of service, mitigation of the project contribution is required to bring the intersection back to an acceptable level of service or to no-project conditions.

If the project contribution to ICU is greater than .03 at CMP intersections (the impact threshold specified in the CMP), and if the location is at Level of Service E or poorer, the impact is significant.

10.1 *First & Cabrillo Project*

The level of service analyses for the First & Cabrillo Project Future (Year 2010) study scenarios determined that Level of service will remain at Level D or better under both the “Future without Project” and “Future with Project” scenarios for 35 of the 38 study intersections. Three of the study intersections were determined to be operating deficiently. Tables 19 and 20 provide a comparison of the levels of service and volume/capacity ratios or delay of all study scenarios for the Future condition in the AM peak hour. Tables 21 and 22 provide a comparison of the levels of service and volume/capacity ratios or delay of all study scenarios in the PM peak hour. Traffic impacts attributed to the First/Cabrillo project can be evaluated by comparing the “Future without Project” condition to the “Future with Project” condition.

As shown in Tables 19 and 20, the First/Cabrillo project will contribute to unacceptable levels of service at two of the intersections evaluated in the AM peak hour. The signalized intersection of

4th Street/SR-55 Southbound Ramps, and the unsignalized intersection of Tustin Avenue/6th Street are forecast to operate at unacceptable levels of service. The First/Cabrillo project will contribute to future impacts at these intersections. The unsignalized intersection of 1st Street/B Street (poorest movement) will also operate at a poor level of service. The poor level of service at this intersection in the AM peak hour is due to increases in background traffic. The First/Cabrillo project impact at this intersection is not considered significant. Recommended mitigation measures to improve these intersections are discussed in the section on Mitigation and Recommendations.

Tables 21 and 22 show that the First/Cabrillo project will not contribute significantly to unacceptable levels of service at any of the study intersections evaluated in the PM peak hour. The unsignalized intersections of Tustin Avenue/6th Street, and 1st Street/B Street (poorest movement) will operate at unacceptable levels of service. The poor level of service at these intersections in the PM peak hour is due to increases in background traffic. Project impacts at these intersections are not considered significant based on City criteria. Recommended mitigation measures to improve these conditions are discussed in the section on Mitigation and Recommendations.

**Table 19 – First & Cabrillo Project
Level of Service Analysis /Determination of Impacts
for Future Conditions, AM Peak Hour**

Intersection	Existing	Future without Project	Future with Project	Increase/Decrease	Significant Impact ³
Signalized Intersections – Santa Ana (LOS ¹ / ICU ²)					
1st St. at Tustin Av.	A/.351	A/.370	A/.373	.003	No
1st St. at Golden Circle Dr.	A/.306	A/.320	A/.326	.006	No
1st St. at Cabrillo Park Dr.	A/.408	A/.451	A/.466	.015	No
1st St. at Elk Lane	B/.655	B/.680	B/.699	.019	No
1st St. at I-5 SB on Ramp	A/.384	A/.458	A/.459	.001	No
4th St. at SR-55 S/B Ramps	D/.897	E/.941	E/.953	.012	Yes
4th St. at Tustin Av.	B/.689	C/.737	C/.744	.007	No
4th St. at Golden Circle Dr.	A/.406	A/.423	A/.437	.014	No
4th St. at Cabrillo Park Dr.	A/.522	A/.566	A/.584	.018	No
4th St. at I-5 N/B Ramps	A/.500	A/.518	A/.536	.018	No
4th St. at I-5 S/B Off-Ramp	A/.358	A/.371	A/.372	.001	No
Tustin Av. at Fruit St.	A/.558	A/.583	A/.584	.001	No
Tustin Av. at Wellington Av.	A/.591	B/.619	B/.620	.001	No
17th St. at Tustin Av.	B/.676	C/.711	C/.712	.001	No
17th St. at Cabrillo Park Dr.	A/.539	A/.579	A/.584	.005	No
17th St. at SR-55 NB Ramps	A/.447	A/.463	A/.464	.001	No
17th St. at SR 55 SB Ramps	A/.419	A/.435	A/.437	.002	No
Signalized Intersections – Tustin (LOS / ICU)					
1st St. at Yorba St.	A/.418	A/.438	A/.439	.001	No
1st St. at El Camino Real	A/.343	A/.359	A/.360	.001	No
1st St. at Prospect Av.	A/.415	A/.432	A/.433	.001	No
1st St. at Centennial Way	A/.361	A/.374	A/.375	.001	No
1st St. at Newport Av.	C/.708	C/.737	C/.737	.000	No
Irvine Bl. at SR-55 N/B Ramps	C/.716	C/.761	C/.767	.006	No
Irvine Bl. at Yorba St.	C/.701	C/.732	C/.733	.001	No
Irvine Bl. at B St.	A/.548	A/.572	A/.572	.000	No
Irvine Bl. at Prospect Av.	A/.579	B/.604	B/.605	.001	No
Irvine Bl. at Fashion Lane	B/.606	B/.635	B/.635	.000	No
Irvine Bl. at Holt Av.	A/.556	C/.770	C/.770	.000	No
Irvine Bl. at Newport Bl.	B/.686	D/.835	D/.835	.000	No

Note 1: LOS=Level of Service; Note 2: ICU=Intersection Capacity Utilization; Note 3: Impact from First/Cabrillo Project Only

**Table 20 – First & Cabrillo Project
Level of Service Analysis /Determination of Impacts
for Future Conditions, AM Peak Hour**

Intersection	Existing	Future without Project	Future with Project	Increase/Decrease	Significant Impact ³
Unsignalized Intersections – Santa Ana (LOS ¹ / Delay ²)					
6th St. at Parkcenter Dr.	B/10.7	B/10.8	B/10.8	0.0	No
Parkcourt Pl. at Cabrillo Park Dr.	B/13.6	B/14.7	B/14.9	0.2	No
Fruit St. at Mabury St.	A/7.5	A/7.9	A/7.9	0.0	No
Fruit St. at Cabrillo Park Dr.	B/10.7	B/11.6	B/11.7	0.1	No
Fruit St. at Parkcenter Dr.	B/10.9	B/11.2	B/11.2	0.0	No
Wellington Av. at Cabrillo Park Dr.	C/16.2	C/18.1	C/18.5	0.4	No
Tustin Av. at 6th St.	D/33.1	E/38.8	E/39.9	1.1	Yes
4th St. at Parkcenter Dr.	B/12.3	B/13.6	B/13.7	0.1	No
Unsignalized Intersections – Tustin (LOS / Delay)					
1st St. at B St.	D/31.4	E/35.8	E/36.3	0.5	No

Note 1: LOS=Level of Service; Note 2: Delay = Seconds per vehicle average, poorest movement;

Note 3: Impact from First/Cabrillo Project Only

**Table 21 – First & Cabrillo Project
Level of Service Analysis /Determination of Impacts
for Future Conditions, PM Peak Hour**

Intersection	Existing	Future without Project	Future with Project	Increase/Decrease	Significant Impact ³
Signalized Intersections – Santa Ana (LOS ¹ / ICU ²)					
1st St. at Tustin Av.	A/.474	A/.497	A/.497	.000	No
1st St. at Golden Circle Dr.	A/.326	A/.338	A/.355	.017	No
1st St. at Cabrillo Park Dr.	B/.636	B/.673	B/.696	.023	No
1st St. at Elk Lane	D/.805	D/.835	D/.850	.015	No
1st St. at I-5 SB on Ramp	A/.559	B/.633	B/.636	.003	No
4th St. at SR-55 S/B Ramps	C/.796	D/.857	D/.865	.008	No
4th St. at Tustin Av.	C/.743	C/.785	C/.791	.006	No
4th St. at Golden Circle Dr.	A/.486	A/.506	A/.523	.017	No
4th St. at Cabrillo Park Dr.	C/.714	C/.787	C/.799	.012	No
4th St. at I-5 N/B Ramps	A/.836	D/.868	D/.872	.004	No
4th St. at I-5 S/B Off-Ramp	A/.443	A/.464	A/.468	.004	No
Tustin Av. at Fruit St.	A/.435	A/.452	A/.454	.002	No
Tustin Av. at Wellington Av.	A/.395	A/.411	A/.412	.001	No
17th St. at Tustin Av.	C/.718	C/.751	C/.752	.001	No
17th St. at Cabrillo Park Dr.	B/.662	C/.709	C/.712	.003	No
17th St. at SR-55 NB Ramps	A/.542	A/.564	A/.564	.000	No
17th St. at SR 55 SB Ramps	A/.465	A/.484	A/.485	.001	No
Signalized Intersections – Tustin (LOS / ICU)					
1st St. at Yorba St.	A/.579	B/.601	B/.603	.002	No
1st St. at El Camino Real	A/.434	A/.453	A/.455	.002	No
1st St. at Prospect Av.	A/.576	A/.599	A/.599	.000	No
1st St. at Centennial Way	A/.516	A/.538	A/.538	.000	No
1st St. at Newport Av.	B/.612	B/.645	B/.645	.000	No
Irvine Bl. at SR-55 N/B Ramps	D/.822	D/.869	D/.874	.005	No
Irvine Bl. at Yorba St.	B/.614	B/.640	B/.641	.001	No
Irvine Bl. at B St.	A/.491	A/.510	A/.511	.001	No
Irvine Bl. at Prospect Av.	B/.607	B/.630	B/.631	.001	No
Irvine Bl. at Fashion Lane	A/.546	A/.567	A/.569	.002	No
Irvine Bl. at Holt Av.	A/.522	B/.693	B/.694	.001	No
Irvine Bl. at Newport Bl.	A/.560	C/.703	C/.703	.000	No

Note 1: LOS=Level of Service; Note 2: ICU=Intersection Capacity Utilization; Note 3: Impact from First/Cabrillo Project Only

**Table 22 – First & Cabrillo Project
Level of Service Analysis /Determination of Impacts
for Future Conditions, PM Peak Hour**

Intersection	Existing	Future without Project	Future with Project	Increase/Decrease	Significant Impact ³
Unsignalized Intersections – Santa Ana (LOS ¹ / Delay ²)					
6 th St. at Parkcenter Dr.	B/10.2	B/10.3	B/10.3	0.0	No
Parkcourt Pl. at Cabrillo Park Dr.	C/21.3	D/26.4	D/27.1	0.7	No
Fruit St. at Mabury St.	A/7.6	A/8.0	A/8.0	0.0	No
Fruit St. at Cabrillo Park Dr.	B/12.1	B/13.3	B/13.4	0.1	No
Fruit St. at Parkcenter Dr.	B/11.1	B/11.3	B/11.3	0.0	No
Wellington Av. at Cabrillo Park Dr.	C/17.6	C/20.8	C/21.1	0.3	No
Tustin Av. at 6 th St.	D/32.5	E/37.0	E/37.7	0.7	No
4th St. at Parkcenter Dr.	B/11.8	B/12.2	B/12.3	0.1	No
Unsignalized Intersections – Tustin (LOS / Delay)					
1st St. at B St.	E/36.0	E/43.1	E/43.8	0.7	No

Note 1: LOS=Level of Service; Note 2: Delay = Seconds per vehicle average, poorest movement;

Note 3: Impact from First/Cabrillo Project Only

10.2 Overlay Zone

The level of service analyses for the Overlay Zone Project Buildout (Year 2030) study scenarios determined that level of service will remain at Level D or better under both the “Buildout without Project” and “Buildout with Project” scenarios for 20 of the 38 study intersections. 18 of the study intersections were determined to be operating deficiently. Tables 23 and 24 provide a comparison of the levels of service and volume/capacity ratios or delay of all study scenarios for the Buildout condition in the AM peak hour. Tables 25 and 26 provide a comparison of the levels of service and volume/capacity ratios or delay of all study scenarios in the PM peak hour. Traffic impacts created by the Metro East project can be evaluated by comparing the “Buildout without Project” condition to the “Buildout with Project” condition.

As shown in Tables 23 and 24, the Metro East project will contribute to unacceptable levels of service at eight of the intersections evaluated in the AM peak hour. Recommended mitigation measures to improve these conditions are discussed in the section on Mitigation and Recommendations.

Tables 25 and 26 show that the Metro East project will contribute to unacceptable levels of service at sixteen of the intersections evaluated in the PM peak hour. As shown in the tables, most of the signalized intersections along 4th Street between the I-5 Freeway and the SR-55 Freeway will operate at unacceptable levels of service. The Metro East project impact at these intersections is considered significant based on City criteria. Recommended mitigation measures to improve these conditions are discussed in the section on Mitigation and Recommendations.

**Table 23 – Metro East Overlay Zone
Level of Service Analysis /Determination of Impacts
for Buildout Conditions, Year 2030 AM Peak Hour**

Intersection	Existing	Buildout without Project	Buildout with Project	Increase/Decrease	Significant Impact?
Signalized Intersections – Santa Ana (LOS¹ / ICU²)					
1st St. at Tustin Av.	A/.351	A/.493	A/.584	.091	No
1st St. at Golden Circle Dr.	A/.306	A/.362	A/.437	.075	No
1st St. at Cabrillo Park Dr.	A/.408	A/.466	B/.667	.201	No
1st St. at Elk Lane	B/.655	C/.707	D/.814	.107	No
1st St. at I-5 SB on Ramp	A/.384	A/.505	B/.616	.111	No
4th St. at SR-55 S/B Ramps	D/.897	F/1.367	F/1.550	.183	Yes
4th St. at Tustin Av.	B/.689	D/.881	F/1.047	.166	Yes
4th St. at Golden Circle Dr.	A/.406	A/.488	B/.606	.118	No
4th St. at Cabrillo Park Dr.	A/.522	C/.726	E/.912	.186	Yes
4th St. at I-5 N/B Ramps	A/.500	A/.544	B/.688	.144	No
4th St. at I-5 S/B Off-Ramp	A/.358	A/.504	A/.571	.067	No
Tustin Av. at Fruit St.	A/.558	C/.719	C/.774	.055	No
Tustin Av. at Wellington Av.	A/.591	D/.832	D/.865	.033	No
17th St. at Tustin Av.	B/.676	D/.844	E/.902	.058	Yes
17th St. at Cabrillo Park Dr.	A/.539	C/.724	D/.807	.083	No
17th St. at SR-55 NB Ramps	A/.447	F/1.211	F/1.217	.006	No
17th St. at SR 55 SB Ramps	A/.419	B/.619	B/.642	.023	No
Signalized Intersections – Tustin (LOS / ICU)					
1st St. at Yorba St.	A/.418	B/.607	B/.641	.034	No
1st St. at El Camino Real	A/.343	B/.616	B/.654	.038	No
1st St. at Prospect Av.	A/.415	C/.773	D/.804	.031	No
1st St. at Centennial Way	A/.361	A/.435	A/.465	.03	No
1st St. at Newport Av.	C/.708	E/.967	E/.990	.023	No
Irvine Bl. at SR-55 N/B Ramps	C/.716	F/1.089	F/1.196	.107	Yes
Irvine Bl. at Yorba St.	C/.701	D/.818	D/.843	.025	No
Irvine Bl. at B St.	A/.548	B/.670	B/.686	.016	No
Irvine Bl. at Prospect Av.	A/.579	C/.771	C/.790	.019	No
Irvine Bl. at Fashion Lane	B/.606	B/.677	B/.694	.017	No
Irvine Bl. at Holt Av.	A/.556	D/.853	D/.870	.017	No
Irvine Bl. at Newport Bl.	B/.686	E/.901	E/.913	.012	No

Note 1: LOS=Level of Service; Note 2: ICU=Intersection Capacity Utilization

**Table 24 – Metro East Overlay Zone
Level of Service Analysis /Determination of Impacts
for Buildout Conditions, Year 2030 AM Peak Hour**

Intersection	Existing	Buildout without Project	Buildout with Project	Increase/Decrease	Significant Impact?
Unsignalized Intersections – Santa Ana (LOS¹ / Delay²)					
6th St. at Parkcenter Dr.	B/10.7	B/11.4	B/12.7	1.3	No
Parkcourt Pl. at Cabrillo Park Dr.	B/13.6	C/18.4	D/27.1	8.7	No
Fruit St. at Mabury St.	A/7.5	A/8.0	A/8.3	0.3	No
Fruit St. at Cabrillo Park Dr.	B/10.7	B/14.7	C/20.7	6.0	No
Fruit St. at Parkcenter Dr.	B/10.9	B/11.9	B/13.7	1.8	No
Wellington Av. at Cabrillo Park Dr.	C/16.2	E/45.5	F/132.1	86.6	Yes
Tustin Av. at 6th St.	D/33.1	F/101.4	F/>> 120	>> 120	Yes
4th St. at Parkcenter Dr.	B/12.3	C/16.0	D/26.0	10.0	No
Unsignalized Intersections – Tustin (LOS / Delay)					
1st St. at B St.	D/31.4	F/274.8	F/>> 120	>> 120	YES

Note 1: LOS=Level of Service; Note 2: Delay = Seconds per vehicle average, poorest movement

**Table 25 – Metro East Overlay Zone
Level of Service Analysis /Determination of Impacts
for Buildout Conditions, Year 2030 PM Peak Hour**

Intersection	Existing	Buildout without Project	Buildout with Project	Increase/Decrease	Significant Impact?
Signalized Intersections – Santa Ana (LOS¹ / ICU²)					
1st St. at Tustin Av.	A/.474	B/.603	B/.679	.076	No
1st St. at Golden Circle Dr.	A/.326	A/.364	A/.467	.103	No
1st St. at Cabrillo Park Dr.	B/.636	C/.759	F/1.065	.306	Yes
1st St. at Elk Lane	D/.805	D/.883	F/1.098	.215	Yes
1st St. at I-5 SB on Ramp	A/.559	B/.674	C/.900	.226	No
4th St. at SR-55 S/B Ramps	C/.796	F/1.144	F/1.487	.343	Yes
4th St. at Tustin Av.	C/.743	D/.888	F/1.267	.379	Yes
4th St. at Golden Circle Dr.	A/.486	B/.633	E/.934	.301	Yes
4th St. at Cabrillo Park Dr.	C/.714	D/.832	F/1.139	.307	Yes
4th St. at I-5 N/B Ramps	D/.836	E/.939	F/1.170	.231	Yes
4th St. at I-5 S/B Off-Ramp	A/.443	A/.492	B/.644	.152	No
Tustin Av. at Fruit St.	A/.435	A/.541	B/.645	.104	No
Tustin Av. at Wellington Av.	A/.395	A/.502	A/.577	.075	No
17th St. at Tustin Av.	C/.718	D/.821	D/.881	.06	No
17th St. at Cabrillo Park Dr.	B/.662	D/.826	E/.965	.139	Yes
17th St. at SR-55 NB Ramps	A/.542	B/.688	C/.706	.018	No
17th St. at SR 55 SB Ramps	A/.465	A/.526	A/.565	.039	No
Signalized Intersections – Tustin (LOS / ICU)					
1st St. at Yorba St.	A/.579	C/.702	C/.757	.055	No
1st St. at El Camino Real	A/.434	B/.606	B/.683	.077	No
1st St. at Prospect Av.	A/.576	D/.877	E/.934	.057	Yes
1st St. at Centennial Way	A/.516	B/.641	B/.683	.042	No
1st St. at Newport Av.	B/.612	C/.768	D/.804	.036	No
Irvine Bl. at SR-55 N/B Ramps	D/.822	F/1.223	F/1.432	.209	Yes
Irvine Bl. at Yorba St.	B/.614	C/.763	D/.834	.071	No
Irvine Bl. at B St.	A/.491	A/.537	A/.592	.055	No
Irvine Bl. at Prospect Av.	B/.607	C/.772	D/.833	.061	No
Irvine Bl. at Fashion Lane	A/.546	B/.661	C/.711	.05	No
Irvine Bl. at Holt Av.	A/.522	C/.794	D/.812	.018	No
Irvine Bl. at Newport Bl.	A/.560	C/.741	C/.784	.043	No

Note 1: LOS=Level of Service; Note 2: ICU=Intersection Capacity Utilization

**Table 26 – Metro East Overlay Zone
Level of Service Analysis /Determination of Impacts
for Buildout Conditions, Year 2030 PM Peak Hour**

Intersection	Existing	Buildout without Project	Buildout with Project	Increase/Decrease	Significant Impact?
Unsignalized Intersections – Santa Ana (LOS¹ / Delay²)					
6 th St. at Parkcenter Dr.	B/10.2	B/10.8	B/14.7	3.9	No
Parkcourt Pl. at Cabrillo Park Dr.	C/21.3	E/49.9	F/356.5	306.6	Yes
Fruit St. at Mabury St.	A/7.6	A/8.1	A/8.7	0.6	No
Fruit St. at Cabrillo Park Dr.	B/12.1	C/18.1	E/44.8	26.7	Yes
Fruit St. at Parkcenter Dr.	B/11.1	B/12.2	C/15.9	3.7	No
Wellington Av. at Cabrillo Park Dr.	C/17.6	E/39.6	F/158.1	118.5	Yes
Tustin Av. at 6 th St.	D/32.5	F/85.0	F/>> 120	>> 120	Yes
4 th St. at Parkcenter Dr.	B/11.8	B/12.8	F/144.4	131.6	Yes
Unsignalized Intersections – Tustin (LOS / Delay)					
1st St. at B St.	E/36.0	F/169.5	F/>> 120	>> 120	Yes

Note 1: LOS=Level of Service; Note 2: Delay = Seconds per vehicle average, poorest movement;

11. Mitigation and Recommendations

Construction costs for roadway widenings are estimated at approximately \$50 per square foot of improved roadway where private structures are not affected by right of way acquisition. This amount is adequate for planning purposes, construction, and acquisition of right of way that does not affect buildings or functional usage of the private property.

If the required property affects the usage of or structures on private property, a complete or partial taking of the property and its structures and a relocation of the business may be required. Acquisition of structures and entire properties is estimated at \$300 per square foot of building plus \$40 per square foot of property. This may result in surplus property that can likely be resold and redeveloped at a credit of \$40 per square foot of property. This condition is noted in the description of the improvement.

11.1 *First & Cabrillo Project*

The mitigation for the First and Cabrillo project is generally based upon the application of appropriate mitigation measures for the complete overlay zone to the First and Cabrillo project. This approach is compared to the mitigation measures required for the near term scenario to insure that required mitigations can be provided in a timely manner.

Only two intersections, Fourth Street/SR-55 Southbound ramps, and Sixth Street/Tustin Avenue experience significant traffic impacts as a result of the First & Cabrillo project in the near term forecast. The mitigation measure program for the overlay zone should thus be feasible to assure mitigation at these intersections by 2010.

One other intersection, First Street/B Street has a poor level of service due to the combination of background traffic and cumulative (other) project traffic, but it is not significantly impacted from the 1st/Cabrillo project in Year 2010.

Fourth Street/SR-55 Southbound Ramps

The intersection of Fourth Street at the SR-55 Southbound Ramps currently experiences acceptable level of service (LOS D) in the AM and PM peak hours. With the addition of background traffic growth, increases in cumulative project traffic, and traffic from the proposed project the level of service is expected to decline to Level of Service E in the AM peak hour. The recommended mitigation for this intersection is the construction of an eastbound right turn lane.

This improvement will require acquisition of right-of-way on the southwest corner of the intersection. A Del Taco restaurant currently occupies this property. The construction of a 300-foot right turn lane would cost about \$250,000 in right of way and construction costs within the

improvement area. The required lane can be constructed without impacting the restaurant building by elimination of the outdoor dining area and elimination the internal drive that connects the drive through lane to the entry driveway in front of the restaurant building, however this would require a new driveway on 4th Street for the drive through exit. The amount of impact to the property may result in the need for full acquisition of the property and relocation or redevelopment of the restaurant. A net cost of \$1 million is assumed for planning purposes, including full site acquisition, business relocation, and site disposal for redevelopment, as reflected in the mitigation program for the overlay zone.

Participation in the overlay zone mitigation program should be required of the First/Cabrillo project prior to issuance of building permits. In addition, the overlay zone mitigation program should assure construction of the eastbound right turn lane at this intersection as an early improvement. Since the project will involve Caltrans and private property, it should be initiated immediately to assure timely completion. This improvement is expected to mitigate all project traffic impacts to an acceptable level of service (Level of Service C), as shown in Table 27.

Sixth Street/Tustin Avenue

The intersection of Sixth Street at Tustin Avenue currently experiences acceptable level of service (LOS D) in the AM and PM peak hours. With the addition of background traffic growth, increases in cumulative project traffic, and traffic from the proposed project the level of service for the poorest movements at this unsignalized intersection are expected to decline to Level of Service E in both the AM and PM peak hours. The recommended mitigation for this intersection is to prohibit east/west left turns and east/west through movements using either a raised median or other means such as diverter islands. An option would be to find that the deficiency is not a significant impact, since it applies only to a relatively few vehicles turning left from Sixth Street onto Tustin Avenue. Turn volumes are not high enough to warrant signalization. The recommended mitigation measure is feasible without right-of-way acquisition, and can be done in the existing curb-curb width of the street. The cost of constructing a median to prohibit the affected turns would be about \$25,000.

Fair share participation in mitigation is accomplished by participation in the overall overlay zone mitigation program prior to issuance of building permits. The program should assure mitigation at this location as an early improvement. The recommended mitigation would improve level of service at this location to within City guidelines (to Level of Service B), fully mitigating impact of the 1st/Cabrillo project.

**Table 27 - Level of Service Analysis of Mitigation
For Near Term Future Conditions**

Intersection	Existing	Future without Project	Future with Project	Mitigation with Project	Increase/Decrease	Significant Impact?	Mitigation Cost ¹
Weekday AM Peak Hour (LOS/ ICU or delay)							
4 th St/SR-55 SB Ramp	D/.897	E/.941	E/.953	C/.755	- .186	No	\$1,000,000
6 th Street/Tustin Av	D/33.1"	E/38.8"	E/39.9"	B/13.9"	- 24.9	No	\$25,000

Note 1: Includes property acquisition.

11.2 Overlay Zone

Eighteen study area intersections experience significant traffic impacts from the Overlay Zone project in Year 2030. These intersections are expected to have poor levels of service due to the combination of background traffic growth and net project traffic generated by the Overlay Zone project. The following intersections are expected to be impacted by the Metro East project. Recommended mitigation measures are described for each intersection.

First Street/Elk Lane/Mabury Street

The intersection of First Street at Elk Lane/Mabury Street is currently operating at Level of Service D in the PM peak hour. The addition of background traffic growth and traffic from the proposed project is expected to result in a decline in level of service to Level of Service F in the PM peak hour. The recommended mitigation for this intersection is the provision of second northbound right turn lane, and right turn overlap signal phasing for the two northbound right turn lanes. The additional northbound right turn lane cannot be constructed while maintaining the current configuration of the intersection without impacting the Zoo immediately east of the intersection. It would be necessary to shift the alignment of the approach to the west. This would require acquisition of right-of-way from the parking area of the vacant hotel building on the southwest corner of the intersection. The cost of a 300-foot right turn lane would be about \$250,000. If implemented these improvements would fully mitigate project traffic impacts to Level of Service C.

First Street/Cabrillo Park Drive

The intersection of First Street at Cabrillo Park currently experiences acceptable level of service in the AM and PM peak hours. With the addition of background traffic growth and traffic from the proposed project the level of service is expected to decline to Level of Service F in the PM peak hour. The recommended mitigation for this intersection is restriping for a second eastbound left turn lane, by reducing the eastbound through approach to two lanes. The roadway provides only two eastbound travel lanes further to the west. The affected third through lane nearest the

median actually begins only 600 feet to the west, just east of the I-5 southbound on ramp intersection. The required area for the additional turn lane can be provided by not striping to begin the third through lane until east of Cabrillo Park Drive. This can be done within the existing curb-curb width of the street. The restriping would cost about \$25,000. This improvement will fully mitigate project traffic impacts to Level of Service D.

First Street/B Street

The intersection of First Street and B Street currently operates at Level of Service E in the PM peak hour. Growth in background traffic and traffic from the proposed project is expected to result in a decline in level of service to Level of Service F in both the AM and PM peak hours. The recommended mitigation for this intersection is the installation of a traffic signal. The intersection meets warrants at future (2030) traffic levels. The cost of a new traffic signal installation is about \$250,000. Project impacts will be fully mitigated to Level of Service B at this intersection with this improvement. The City of Tustin is currently proceeding to design a traffic signal for this intersection, however construction is not fully committed.

First Street/Prospect Avenue

The intersection of First Street at Prospect Avenue is currently operating at Level of Service A in the AM and PM peak hours. Background traffic growth and traffic from the proposed project is expected to cause a decline in level of service to Level of Service E in the PM peak hour. The increase in ICU at this intersection is above the CMP impact threshold of .03. The recommended mitigation for this intersection is the construction of a northbound right turn lane and northbound right turn overlap signal phasing. The northbound right turn lane will impact the building on the southeast corner of the intersection. An 80-foot turn lane would cost about \$100,000, and the overlap signal phasing would cost about \$5,000. Right-of-way acquisition could raise the total cost of this improvement to \$1.5 million. These improvements will fully mitigate project traffic impacts to Level of Service D.

This intersection would not be impacted significantly or experience poor level of service until the overlay zone is substantially redeveloped. If the development density is lower than the presumed levels, the impact may not occur. It could also be mitigated if a lower level of development is ultimately approved for the overlay zone.

First Street/Newport Boulevard

The intersection of First Street at Newport Boulevard currently experiences Level of Service C or better in the AM and PM peak hours. The addition of background traffic growth and traffic from the proposed project is expected to result in a decline in level of service at this intersection to Level of Service E in the AM peak hour. The Metro East project impact is below the threshold of a CMP intersection, however improvements are feasible. The improvements at this intersection are

eastbound right turn overlap signal phasing and provision of a third southbound through lane, by constructing a southbound right turn lane. These improvements would require widening of the intersection. This is feasible by shifting the sidewalk and bicycle path to the east, reducing the landscape setback to adjacent businesses. The construction of a 160-foot right turn lane would cost about \$200,000. These improvements will improve intersection performance to Level of Service C. Since the impact of the overlay zone is not significant at this location according to the CMP (less than 0.03), fair share participation is appropriate. The fair share should take into consideration traffic for developments outside of the overlay zone that may also contribute to the forecast condition.

Fourth Street/I-5 Northbound Ramps

The intersection of the I-5 northbound ramps and 4th Street is expected to operate at a poor level of service (LOS F) in the PM peak hour with the addition of background traffic growth and traffic from the proposed project. The recommended mitigation for this intersection is the construction of a second westbound right turn lane. This will require widening on the northeast corner of the intersection. The affected parcel is currently vacant. The cost of a 300-foot right turn lane would be about \$300,000 and presumes dedication of right of way from vacant property. The project will involve Caltrans. This improvement will fully mitigate project traffic impacts to Level of Service C.

Fourth Street/Cabrillo Park Drive

The intersection of Fourth Street at Cabrillo Park currently experiences acceptable level of service (LOS C or better) in both the AM and PM peak hours. The addition of background traffic growth and traffic from the proposed project is expected to reduce level of service to Level of Service F in the PM peak hour. The recommended mitigation for this intersection is the construction of a westbound right turn lane, a northbound right turn lane, and a southbound right turn lane, and restriping to change the lane configuration of the north/south approaches. The northbound and southbound approaches should be controlled by a split phase intersection control and restriped to provide to one left, one shared through-left, one through, and one right turn lane.

The construction of the right turn lanes will require widening of the street approaches. The widening of the westbound approach can be done within the landscape setback area of the parcel on the northeast corner of the intersection. The widening of the southbound approach will require right of way from a vacant property. The widening of the northbound approach will require construction within the existing landscape setback of the adjacent property on the southeast corner. The construction of all three right turn lanes and restriping of the approaches would cost about \$500,000, including acquisition of developed properties and dedication of right of way for undeveloped properties. These improvements are expected to fully mitigate project impacts to Level of Service D.

Fourth Street/Golden Circle

The intersection of Fourth Street at Golden Circle currently operates at Level of Service A in both the AM and PM peak hours. Background traffic growth and traffic from the proposed project is expected to result in a decline in level of service to Level of Service E in the PM peak hour. The recommended mitigation for this intersection is the construction of an eastbound right turn lane, and a restriping of the southbound lane configuration to provide one left turn lane and one shared through-right turn lane. The restriping can be done within the existing curb-to-median width of the intersection. The eastbound right turn lane would require acquisition of right-of-way within the landscape setback area in front of the Citizen's Bank building on the southwest corner of the intersection. This would reduce the landscape setback area in front of the building and require construction of a new sidewalk. The construction of a 100-foot right turn lane would cost about \$150,000, including right-of-way acquisition of the landscape setback area. These improvements will fully mitigate project traffic impacts to Level of Service D. Based upon the existing level of service, the right turn lane improvement will not be required until substantial redevelopment within the overlay zone occurs. Also if level of Service E is tolerated or if the final development density in the overlay zone is below the forecast level, the need for this improvement may not occur.

Fourth Street/Parkcenter Drive

The intersection of Fourth Street and Parkcenter currently operates at Level of Service B in both the AM and PM peak hours. Growth in background traffic and traffic from the proposed project is expected to result in a decline to Level of Service F in the PM peak hour. The recommended mitigation for this intersection is the installation of a traffic signal. The intersection will meet warrants for signalization based upon Year 2030 traffic levels. The cost of a new traffic signal installation is about \$250,000. Project impacts will be fully mitigated to Level of Service B. This improvement will not be necessary until a traffic forecast indicates that the traffic signal will be warranted by a planned development phase.

Fourth Street/Tustin Avenue

The intersection of Fourth Street at Tustin Avenue currently experiences acceptable levels of service (LOS C or better) in the AM and PM peak hours. The addition of background traffic growth and traffic from the proposed project is expected to reduce service to Level of Service F in both the AM and PM peak hours. The recommended mitigation for this intersection is the construction of a westbound right turn lane, a second eastbound left turn lane, and a northbound right turn lane (to allow conversion of the northbound shared thru-right lane to a through lane). Also, northbound right turn overlap signal phasing should be installed.

The necessary improvements are the most complex improvements needed for the overlay zone. The required improvements will require widening of Fourth Street by approximately 12 feet

continuously from about 500 feet east of Tustin Avenue to the SR-55 ramp intersection to provide for the second eastbound left turn lane and relocation of through lanes to allow for the additional left turn lane. Further widening will be required in the areas intended for right turn lanes. This improvement will require a detailed alignment study of the intersection, the impact of improvements upon adjacent properties, and precise geometrics of intersection improvements. The improvement may require full acquisition of the service station properties on the northeast and southwest corners. Contamination of soil on service station properties may also be encountered.

This improvement is not a near term need based upon existing levels of service and the 2010 forecast. Interim improvements may be feasible and consistent with the ultimate improvement. It is suggested that the mitigation program include the recommended alignment study. Further, the alignment study should also be used to identify interim improvements that can be phased with actual traffic growth. It is proposed that a mitigation budget of \$5 million be established for this intersection. This amount would include resources to initially fund the alignment/interim improvement study (\$50,000) and to identify the precise ultimate improvement plus affected private properties. This budget is based upon probable acquisition of two service station properties.

Fourth Street/SR-55 Southbound Ramps

The intersection of Fourth Street at SR-55 Southbound Ramps currently operates at Level of Service D or better in the AM and PM peak hours. Background traffic growth and traffic from the proposed project is expected to result in a decline in level of service to Level of Service F in the AM and PM peak hours. The recommended mitigation for this intersection is the construction of an eastbound free-right turn lane, and changing the southbound ramp configuration to widen by one lane and restripe to provide two left and two right turn lanes. The eastbound free-right will require acquisition of right-of-way on the southwest corner of the intersection. A Del Taco restaurant currently occupies this property. The change in the southbound ramp configuration is feasible without right-of-way acquisition. The ramp widening would cost about \$250,000. The construction of the 300-foot right turn lane would cost about \$250,000, however it may affect the Del Taco restaurant on the southwest corner and require a full take of the property. For this reason, a total budget of \$1.5 million is suggested. These improvements fully mitigate project impacts to Level of Service D.

The right turn lane was identified as a near-term 2010 improvement for the First & Cabrillo project. The freeway off ramp widening need is not as urgent, and it may be appropriate to construct the improvement in phases. As indicated previously, planning for construction of the eastbound right turn lane should commence in conjunction with approval of the overlay zone and the First & Cabrillo project to assure completion by 2010.

Irvine Boulevard/SR-55 Northbound Ramps

The intersection of Irvine Boulevard at SR-55 Northbound Ramps is currently operating at Level of Service D or better in the AM and PM peak hours. The addition of background traffic growth and traffic from the proposed project is expected to result in a decline in level of service to Level of Service F in the AM and PM peak hours. The recommended mitigation for this intersection is the construction of a westbound free-right turn lane and the conversion of the third eastbound through lane to a second eastbound left turn lane by restriping. Right-of-way acquisition will be required for the westbound right turn lane. The affected parcel is currently occupied by a Chevron station. The turn lane could be constructed without impacting the pumps or the station building. The construction of a 300-foot right turn lane would cost about \$250,000, not including right-of-way acquisition. The lane restriping would cost about \$100,000, due to Caltrans involvement. These improvements fully mitigate project traffic impacts at this intersection to Level of Service D.

While this improvement is not needed by 2010, it will likely be required soon afterward based upon the 2010 forecast. It may be appropriate to begin planning for this improvement upon approval of the overlay zone and the first project that participates in the mitigation program.

17th Street/Tustin Avenue

The intersection of 17th Street and Tustin Avenue currently operates at Level of Service C or better in the AM and PM peak hours. Level of service is expected to decline to Level of Service E in the AM peak hour due to growth in background traffic and traffic from the proposed project. The recommended mitigation for this intersection is the construction of a third northbound through/right turn lane and designating the lanes to allow vehicles to turn right from the right turn lane and from the adjacent (new) through lane. Adding the northbound lane does not require any additional right-of-way on the south leg. Additional right-of-way would be required on the north leg however. It is feasible to widen the east curb on the north leg where the parcel is currently vacant. The widening of the east curb to provide for construction of the northbound right turn lane would cost about \$500,000. The improvement would result in an improvement in intersection performance to Level of Service D, mitigating project impacts.

An alignment study is recommended for this improvement. Alternative configurations for the intersection may be identified that could achieve adequate level of service at lower cost or lesser impacts to private properties. The mitigation program should include an alignment study at an additional cost of \$50,000.

17th Street/Cabrillo Park Drive

The intersection of 17th Street at Cabrillo Park currently has a good level of service in both the AM and PM peak hours (LOS B or better). With the addition of background traffic growth and traffic from the proposed project level of service is expected to decline to Level of Service E in the PM peak hour. The recommended mitigation to address project impacts at this intersection is the restriping of the northbound lane configuration to one left, one shared left-through, and one right turn lane, together with provision for split signal phasing north/south. The improvement can be done within the existing curb-to-curb width of the street and would cost about \$50,000. These improvements are expected to fully mitigate project traffic impacts at this intersection to Level of Service D. Based upon existing level of service, this improvement will not be needed until near full development of the overlay zone.

Cabrillo Park Drive/Wellington Avenue

The unsignalized intersection of Cabrillo Park Drive and Wellington Avenue currently operates at Level of Service C for the poorest movements in both the AM and PM peak hours. Level of service is expected to decline to Level of Service F in both the AM and PM peak hours due to growth in background traffic and traffic from the proposed project. The recommended mitigation for this intersection is the installation of a traffic signal or a modern roundabout. The traffic signal is warranted at future (2030) traffic levels. A roundabout is also feasible, and can be constructed within the existing right-of-way at potentially lower cost than a traffic signal. The diagonal curb-to-curb dimension of the street is about 100 feet, which is adequate for the construction of a single-lane roundabout. The new traffic signal installation would cost about \$250,000. The roundabout would cost about \$100,000. Either improvement is expected to result in an improvement to Level of Service B or better, fully mitigating project impacts.

Modern roundabouts are a relatively new intersection control design in the U.S. that allows motorists to circulate around a raised central island, while yielding to vehicles that are already within the circle. This form of intersection control has been used for many years in foreign countries, including Britain, Australia, and many other European or U.K. influenced countries. Roundabout intersections are generally safer and more efficient than all other forms of intersection traffic controls. Their annual operating costs are insignificant when compared with the annual operating costs of a traffic signal. Also they are appropriate for construction at locations where a traffic signal is not yet warranted by existing or near term traffic levels. The Federal Highway Administration and the Insurance Institute for Highway Safety are strong advocates for this form of intersection control due to the superior performance when compared to signalized intersections.

A modern roundabout is especially appropriate for locations similar to Cabrillo Park Drive at intersections with lesser roadways because the moderate volumes on Cabrillo Park Drive and lower volumes on cross streets are well within the traffic capacity of a single lane roundabout. Also, the existing landscaped median is consistent with the landscape opportunities that can be provided within the central island and splitter island approaches to a roundabout. Multi-lane roundabouts are also feasible for busier intersections, however the outer circle diameter is much larger than the available right of way for Cabrillo Park intersections.

Cabrillo Park Drive/Fruit Street

The all-way stop intersection of Cabrillo Park and Fruit Street currently operates at Level of Service B in both the AM and PM peak hours. Future background traffic growth and traffic from the proposed project is expected to result in a decline in level of service to Level of Service LOS E in the PM peak hour. The recommended mitigation for this intersection is the installation of a traffic signal or a modern roundabout. The modern roundabout is feasible, and can be constructed within the existing diagonal curb-curb dimension of the street (about 100 feet). The traffic signal installation would cost about \$250,000. The roundabout would cost about \$100,000 and have lower annual operating costs. Either improvement is expected to result in an improvement to Level of Service D or better, fully mitigating project impacts.

Cabrillo Park Drive/Parkcourt

The intersection of Cabrillo Park and Parkcourt currently operates at Level of Service C or better in the AM and PM peak hours. Level of service is expected to decline to Level of Service F in the PM peak hour with the addition of background traffic growth and traffic from the proposed project. The recommended mitigation for this intersection is the prohibition of cross-traffic through the use of median islands, diverters, or other means. Median islands or diverters can be constructed within the existing curb-curb width of the street. The cost of constructing median islands or diverters would be \$25,000. These improvements would fully mitigate the traffic impacts of the Metro East project at this intersection.

Tustin Avenue/Sixth Street

The unsignalized intersection of Tustin Avenue and Sixth Street currently operates at Level of Service D in both the AM and PM peak hours. Level of service is expected to decline to Level of Service F in the AM and PM peak hours with the addition of background traffic growth and traffic from the proposed project. The recommended mitigation for this intersection is the prohibition of eastbound and westbound cross-traffic and left turns through the construction of median islands or diverters. The recommended mitigation measure is feasible without right-of-way acquisition, and can be done in the existing curb-curb width of the street. The cost of constructing a median island would be about \$40,000. This improvement will fully mitigate the traffic impacts of the Metro East project at this intersection. Intersection performance will improve to Level of Service C

The intersection improvements described in this section are expected to fully mitigate all project traffic impacts to an acceptable level of service (Level of Service D or better), except as noted above as shown in Table 28 below.

**Table 28 - Level of Service Analysis of Mitigation
For Buildout Conditions**

Intersection	Existing	Buildout without Project	Buildout with Project	Mitigation with Project	Increase/Decrease	Significant Impact?	Mitigation Cost ⁴
Weekday Peak Hour ¹ (LOS ² / ICU or delay ³)							
First Street/Elk Lane	D/.805	D/.883	F/1.098	C/.784	-.099	No	\$250,000
First St/Cabrillo Park Dr	B/.636	C/.759	F/1.065	C/.797	.038	No	\$25,000
First Street/B Street	D/31.4"	F/>>120"	F/>>120"	B/.514	-274.3	No	\$250,000
First Street/Prospect Ave	A/.576	D/.877	E/.934	D/.829	-.048	No	\$1,500,000
First Street/Newport Blvd	C/.708	E/.967	E/.990	C/.712	-.255	No	\$200,000
Fourth St/I-5 N/B Ramps	D/.836	E/.939	F/1.170	C/.700	-.239	No	\$300,000
Fourth St/Cabrillo Park Dr	C/.714	D/.832	F/1.139	D/.863	.031	No	\$500,000
Fourth St/Golden Circle	A/.486	B/.633	E/.934	D/.836	.203	No	\$150,000
Fourth St/Parkcenter Dr	B/11.8"	B/12.8"	F/144.4"	B/14.8"	2.0"	No	\$250,000
Fourth Street/Tustin Ave	C/.743	D/.888	F/1.267	E/.932	.044	Yes	\$5,000,000
Fourth St/SR-55 S/B Ramps	C/.796	F/1.144	F/1.487	D/.894	-.250	No	\$1,500,000
Irvine Bl/SR-55 N/B Ramps	D/.822	F/1.223	F/1.432	D/.864	-.359	No	\$350,000
17 th Street/Tustin Avenue	B/.676	D/.844	E/.902	D/.856	.012	No	\$500,000
17 th Street/Cabrillo Park Dr	B/.662	D/.826	E/.965	D/.840	.014	No	\$50,000
Cabrillo Pk Dr/Wellington Av	C/16.2"	E/39.6"	F/158.1"	B/12.0"	-27.6"	No	\$250,000
Cabrillo Park Drive/Fruit St	B/12.1"	C/18.1"	E/44.8"	C/25.5"	7.4"	No	\$250,000
Cabrillo Park Dr/Parkcourt	C/21.3"	E/49.9"	F/356.5"	B/14.5"	-35.4"	No	\$25,000
Tustin Avenue/Sixth Street	D/33.1"	F/101.4"	F/>>120"	D/28.7"	-72.7"	No	\$40,000
Total Mitigation Cost							\$11,390,000

Note 1: LOS, V/C, Delay shown for worst case peak hour; Note 2: LOS: Level of Service

Note 3: Delay shown in seconds (") for unsignalized intersections; Note 4: Including right-of-way

The proposed mitigation for 4th Street at Tustin Avenue results in Level of Service E. This would be acceptable under the CMP and with the designation of the overlay zone as a major development area (MDA) of the City. It would be necessary for the City to designate the overlay zone as a major development area (MDA) in order to fully reduce the impact to a level of insignificance.

11.2.1 Mitigation Program

This traffic study has identified mitigation measures that can be implemented to fully mitigate project impacts. However a program for systematic mitigation of impacts as development proceeds within the overlay zone is required to assure mitigation of the individual improvements. The program would prescribe the method of participation in the mitigation program by individual projects and guide the timely implementation of the mitigation measures.

The program would require the following elements:

- The overlay zone should be declared to be a major development area (MDA) so that more appropriate level of service thresholds would apply.
- A funding and improvement program (the Program) should be established to identify financial resources adequate to construct all identified mitigation measures in a timely basis.
- The Program should allow for acquisition of entire properties including business relocation where necessary to construct mitigation measures. Funds derived from sale of surplus acquired properties should be returned to the Program.
- All properties that redevelop within the overlay zone should participate in the Program on a fair share per new development trip basis. The fair share should be based upon the total cost of all identified mitigation measures, divided by the PM peak hour trip generation increase forecast. This rate per peak hour trip should be imposed upon the incremental traffic growth for any new development within the overlay zone.
- The Program should include resources to conduct preliminary engineering studies to complete alignment studies and project specific environmental clearances for Tustin Avenue at 17th Street and at 4th Street.
- The Program should raise funds from full development of the overlay zone to fund all identified mitigation measures.
- The Program should regularly monitor phasing development of the overlay zone and defer or eliminate improvements if the densities permitted in the overlay zone are not occurring.
- Program phasing should be monitored through preparation of specific project traffic impact studies for any project that is expected to include more than 100 dwelling units or 100,000 square feet of non-residential development. Traffic impact studies should use traffic generation rates that are deemed to be most appropriate for the actual development proposed.
- The Program should initiate project development to assure timely completion of the improvements identified to be needed for the First and Cabrillo project by 2010 or as soon after as practically feasible.
- Properties within Santa Ana within one-half mile of the overlay zone that redevelop to result in higher traffic generation should also participate in the Program to insure equity.

- The Program should provide for full construction of projects outside of Santa Ana, if the overlay zone will create a traffic impact based upon the CMP.
- The Program should provide fair share contribution to construction costs of other improvements outside of the overlay zone if they are identified in this traffic study but they are not impacted as defined by the CMP.
- The fair share contribution would presume participation by other developments outside of the City of Santa Ana (generally within the City of Tustin) in proportion to traffic growth at the affected sites.
- Traffic impact studies for future projects shall be prepared by a qualified traffic engineer approved or retained by the City.
- The City may elect to implement appropriate mitigation measures as a condition of approval of the proposed developments, where appropriate. All or part of the costs of these improvements may be considered to be a negotiated credit toward the Program, however the Program must be administered in a manner that assures that it can fund necessary improvements to maintain adequate level of service at all intersections within this study. If funding of priority improvements cannot be assured, credit for construction of lower priority improvements may not be assured or may be postponed until more Program funds are available.
- Traffic studies for future developments within the Overlay Zone must also use trip generation rates which are specific for these projects and are approved by the City. The preparer of traffic studies for specific projects in the Overlay Zone must use City-approved or site-proper trip generation rates specific to these projects. These studies are subject to City review.

Appendix A

Existing Traffic Counts

**This data is available for review at the City of Santa Ana
at the following address:**

**Mr. Sergio Klotz, Senior Planner
City of Santa Ana
Planning and Building Agency
20 Civic Center Plaza
Santa Ana, CA 92702**

Appendix B

Traffic Model Forecast

**This data is available for review at the City of Santa Ana
at the following address:**

**Mr. Sergio Klotz, Senior Planner
City of Santa Ana
Planning and Building Agency
20 Civic Center Plaza
Santa Ana, CA 92702**

Appendix C
Land Use and Trip Generation
Information

**This data is available for review at the City of Santa Ana
at the following address:**

**Mr. Sergio Klotz, Senior Planner
City of Santa Ana
Planning and Building Agency
20 Civic Center Plaza
Santa Ana, CA 92702**

Appendix D

Intersection Level of Service Worksheets

**This data is available for review at the City of Santa Ana
at the following address:**

**Mr. Sergio Klotz, Senior Planner
City of Santa Ana
Planning and Building Agency
20 Civic Center Plaza
Santa Ana, CA 92702**

Appendix E

Intersection Level of Service Concepts

DEFINITIONS OF LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS

LEVEL OF SERVICE DEFINITIONS FOR SIGNALIZED INTERSECTIONS
(Source: *City of Los Angeles Traffic Studies Policies and Procedures, November 1993*)

<u>Level of Service</u>	<u>Volume/Capacity Ratio</u>	<u>Definition</u>
A	0.000 - 0.600	EXCELLENT. No vehicle waits longer than one Red light and no approach phase is fully used.
B	0.601 - 0.700	VERY GOOD. An occasional approach phase is fully utilized; many drivers begin to feel somewhat restricted within groups of vehicles.
C	0.701 – 0.800	GOOD. Occasionally, drivers may have to wait through more than one red light; backups may develop behind turning vehicles.
D	0.801 – 0.900	FAIR. Delays may be substantial during portions of the rush hours, but enough lower volume periods occur to permit clearing of developing lines, preventing excessive backups.
E	0.901 – 1.00	POOR. Represents the most vehicles that intersection approaches can accommodate; may be long lines of waiting vehicles through several signal cycles.
F	Greater than 1.000	FAILURE. Backups from nearby intersections or on cross streets may restrict or prevent movement of vehicles out of the intersection approaches. Tremendous delays with continuously increasing queue lengths can be expected.

THRESHOLDS OF SIGNIFICANCE

A project will normally have a significant adverse impact on traffic and circulation if it results in any of the following conditions:

- An increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system (i.e., results in a substantial increase in either the number of the vehicle trips, the volume to capacity ratio on roads, or congestion at intersections); or,
- An increase in the level of service standard established by the Orange County Transportation Authority for designated roads or highways.
- An increase in the number of the peak hour trips over and above a residential project in conformance with the General Plan land use designation.

To understand how well a roadway or intersection is handling traffic, several concepts have been devised. The first is a qualitative measure, referred to as Level of Service, which evaluates a roadway’s operation based on observations. A LOS “A” is an optimal traffic condition, while a LOS “F” represents service congestion. A second, more quantitative measure, referred to as Volume to Capacity Ratio (V/C), is the ratio of an intersection’s or roadway’s traffic volumes to its design capacity. The relationship between the LOS and V/C Ratio are summarized below in Table C-1.

**TABLE C-1
DEFINITIONS OF LEVEL OF SERVICE**

<i>Level of service Definitions</i>		
LOS	ICU Range (V/C Ratio)	Description
A	Less than 0.60	Free flowing traffic conditions, no congestion.
B	0.60 to less than 0.70	Generally free from congestion. All vehicles may clear signal in a single cycle.
C	0.70 to less than 0.80	Light congestion with occasional back-ups at critical approaches.
D	0.80 to less than 0.90	Congestion at critical approaches.
E	0.90 to less than 1.0	Moderate to severe congestion during peak period.
F	1.00 or greater	Severe congestion.
Source: Blodgett/Baylosis Associates, 2000		

DEFINITIONS OF LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS

LEVEL OF SERVICE DEFINITIONS FOR SIGNALIZED INTERSECTIONS
(Source: *City of Los Angeles Traffic Studies Policies and Procedures, November 1993*)

<u>Level of Service</u>	<u>Volume/Capacity Ratio</u>	<u>Definition</u>
A	0.000 - 0.600	EXCELLENT. No vehicle waits longer than one Red light and no approach phase is fully used.
B	0.601 - 0.700	VERY GOOD. An occasional approach phase is fully utilized; many drivers begin to feel somewhat restricted within groups of vehicles.
C	0.701 – 0.800	GOOD. Occasionally, drivers may have to wait through more than one red light; backups may develop behind turning vehicles.
D	0.801 – 0.900	FAIR. Delays may be substantial during portions of the rush hours, but enough lower volume periods occur to permit clearing of developing lines, preventing excessive backups.
E	0.901 – 1.00	POOR. Represents the most vehicles that intersection approaches can accommodate; may be long lines of waiting vehicles through several signal cycles.
F	Greater than 1.000	FAILURE. Backups from nearby intersections or on cross streets may restrict or prevent movement of vehicles out of the intersection approaches. Tremendous delays with continuously increasing queue lengths.