17th Street Grade Separation
12-Ora-Local

April 15, 2012

PROJECT STUDY REPORT EQUIVALENT

To

Request for Programming for Capital Support for:

- Project Approval and Environmental Document
- Plans, Specifications, and Estimate
- Right of Way Acquisition
- Construction Management

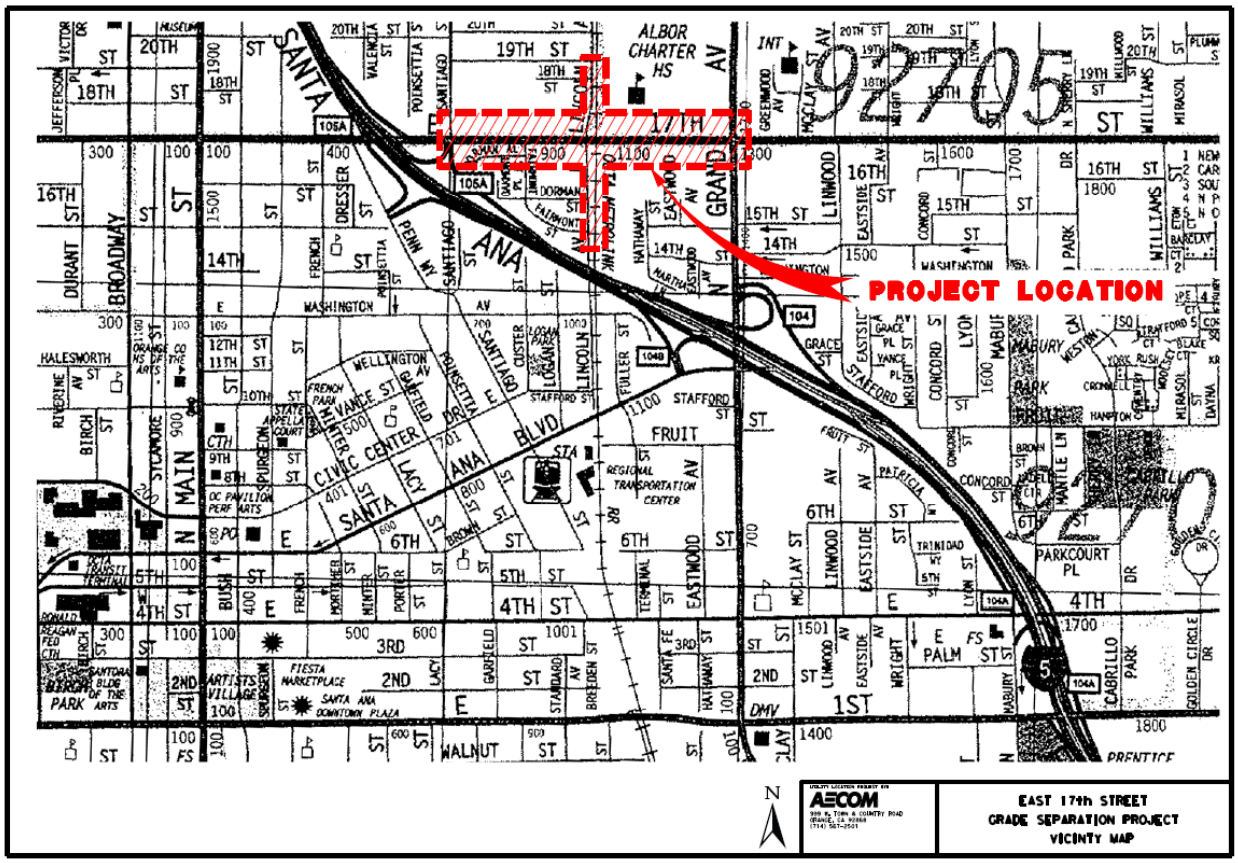
And

Request for Programming for Right of Way and Construction Capital.

REVIEWED, RECOMMENDED AND APPROVED:

Jennifer Bergener
Project Manager, OCTA

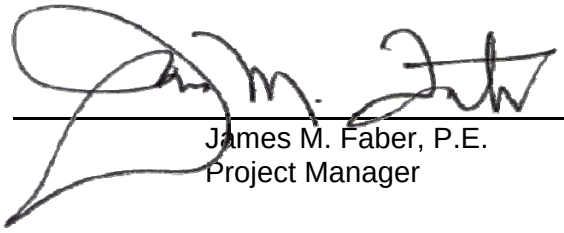
7.11.2012
Date



Vicinity Map

This Project Study Report Equivalent (PSRE) has been prepared under the direction of the following registered civil engineer. The registered civil engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.

This PSRE is based upon information that was available to AECOM as of the date of the preparation of the Report. In certain circumstances, AECOM was provided with information by client and public entities and is entitled to rely upon the accuracy of such information. There are factors that may affect the recommendations contained in this PSRE that are beyond AECOM's reasonable control or which may occur after the date of the preparation of this PSRE. This PSRE was prepared in accordance with a generally acceptable industry standard of care.



James M. Faber, P.E.
Project Manager

1/9/12
DATE

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1 EXECUTIVE SUMMARY

1.1 Introduction

The Orange County Transportation Authority (OCTA), the City of Santa Ana (City), in cooperation with, the California Department of Transportation (Caltrans), and the Federal Highway Administration (FHWA), propose to grade separate the current at-grade crossing of 17th Street with the Metrolink (SCRRA) double tracks. The proposed project would construct a railroad undercrossing structure to carry SCRRA over 17th Street, depressing the current grade of the roadway and maintaining the railroad profile.

The objective of the project is to:

- Implement improvements to eliminate the at-grade intersection of the railroad traffic and the vehicular traffic; improve safety at the crossing for pedestrians, bicycle users, and motor vehicles; provide unimpeded access for emergency, and other, vehicles resulting in the enhancement of traffic operations; and reduce existing traffic congestion and delay.

1.2 Need

17th Street serves as a principal east/west arterial in the City with connections to I-5. Increased vehicle and rail traffic has resulted in the increase of delays at the existing highway-rail crossing of 17th Street and the SCRRA double-track corridor. These delays have not only affected the traveling public, but also have impacted access by emergency vehicles, and this is compounded by the fact that there is only one other grade separation (1st Street) within the city limits. Therefore, this grade separation is critical to the City's traffic circulation since it will provide unimpeded access across the railroad.

Also, safety at the crossing is a major concern to OCTA and the City. Since 1978, there have been seven (7) separate accidents at this crossing, averaging about one every five (5) years. These seven (7) accidents are classified as follows: five (5) were caused by a train striking a vehicle stopped on the tracks, four Amtrak trains and one SCRRA train; and two were caused by a motorist driving around the gates and being struck by an Amtrak train. Unfortunately, one of the drivers was killed (see incident report for 5/26/05). See Attachment A.

1.3 Purpose

The primary project objective is to alleviate traffic congestion and delay and to improve the operation and safety along 17th Street by constructing a grade separation structure with the railroad and retiring the existing at-grade crossing. Given the economic significance of the corridor, the proposed project is deemed required and necessary, and is supported by various public agencies.

1.4 Alternatives

For this project the Project Development Team (PDT) worked very diligently to identify different feasible alternatives to solve the need and purpose of this project, taking into account the constraints presented by the project area, and the City's desired traffic operations. One overcrossing alternative and two undercrossing alternatives were studied and then discussed among the PDT members. A No-Build Alternative was not considered, but covered within the traffic study discussed later in this report, as it does not meet the purpose and need of the project which is to grade separate vehicle/pedestrian traffic from railroad traffic.

The PDT members decided to study three (3) grade separation alternatives, as follows:

- Alternative 1A: Undercrossing of Both the Railroad and Lincoln Avenue.
- Alternative 1C: Undercrossing of the Railroad and a Depressed Intersection with Lincoln Avenue.
- Alternative 2A: Overcrossing of the Railroad.

1.4.1 Alternative 1A: Undercrossing of Both the Railroad and Lincoln Avenue.

This alternative consists of: a depressed profile for 17th Street; and undercrossing bridges to pass the railroad and Lincoln Avenue over 17th Street. Improvements include: depressing the 17th Street roadway profile grade, beginning just westerly of Fairmont Street and ending approximately 500 feet west of North Grand Avenue. The 17th Street profile is designed to provide a minimum of 16.5 feet clearance to the soffit of the Lincoln Avenue Undercrossing structure, is designed for 45 mph utilizing a maximum of 6% grade for the approaches, and includes retaining walls along the depressed roadway. In order to minimize some right of way access issues, the sag curve under the railroad and Lincoln Avenue is designed such that roadway lighting would be required.

Lincoln Avenue is proposed to maintain its existing roadway profile, and is proposed to reestablish connectivity with 17th Street using an access road in the northwest quadrant, which terminates at a signalized intersection with 17th Street.

Access roads will need to be reconstructed at: Fairmont Street; the local strip mall easterly of Fairmont Street on the south side of 17th Street; the local strip mall easterly of the railroad tracks also on the south side of 17th Street; and at the Medical Center easterly of the railroad tracks on the north side of 17th Street with a new, signalized intersection with 17th Street. Retaining walls will be required along each of these access roads with the exception of Fairmont Street. In addition, access to the Senior Citizen Living Center, located westerly of the railroad tracks on the north side of 17th Street, is proposed to be connected to the road between Lincoln Avenue and 17th Street.

The project cost for this alternative, including final design, construction, construction management, and right of way acquisition is estimated to be $55,004,000.

1.4.2 Alternative 1C: Undercrossing of the Railroad and a Depressed Intersection with Lincoln Avenue.

This alternative scored the highest of the three and was subsequently selected as the recommended alternative. Like Alternative 1A, this alternative consists of a depressed profile grade for 17th Street, beginning just westerly of Fairmont Street and ending approximately 500 feet west of North Grand Avenue, and an undercrossing bridge to pass the railroad over 17th Street. Alternative 1C also proposes to depress Lincoln Avenue to meet 17th Street. The 17th Street profile is designed to provide a minimum of 16.5 feet clearance to the soffit of the railroad structure, is designed for 45 mph utilizing a 5% grade for the approaches, and includes retaining walls along the depressed roadways of both Lincoln Avenue and 17th Street. In order to minimize some right of way access issues, the sag curve under the railroad is designed such that roadway lighting would be required.

Access roads will need to be reconstructed at: Fairmont Street; the local strip mall easterly of Fairmont Street on the south side of 17th Street; the local strip mall easterly of the railroad tracks also on the south side of 17th Street; and at the Medical Center easterly of the railroad tracks on the north side of 17th Street, with a new, signalized intersection with 17th Street. Retaining walls will be required along each of these access roads with the exception of Fairmont Street. In addition, access roads along Lincoln Avenue will need to be reconstructed at: 19th Street; 18th Street; and to the Senior Citizen Living Center, located westerly of the railroad tracks on the north side of 17th Street.

The project cost for this alternative, including final design, construction, construction management, and right of way acquisition is estimated to be $54,404,000.

1.4.3 Alternative 2A: Overcrossing of the Railroad.

Alternative 2A proposes to elevate the profile of 17th Street over the railroad and Lincoln Avenue by constructing an overcrossing bridge, spanning across the SCRRA double tracks and Lincoln Avenue and includes: raising the roadway profile grade, beginning just easterly of the I-5 Northbound off-ramp, joining a newly signalized, raised intersection with Fairmont Street, spanning Lincoln Avenue and the railroad, joining a newly signalized, raised intersection with the access road to the Medical Center, and terminating the raised profile just westerly of the intersection with North Grand Avenue. The 17th Street profile is designed to provide a minimum of 24 feet clearance across the entire railroad right-of-way, and to provide a design speed of 45 mph, utilizing a 5.5% grade for the approaches.

Access roads will need to be reconstructed at: Fairmont Street, along with approximately 500 feet of Fairmont Street, south of 17th Street; the local strip mall easterly of Fairmont Street on the south side of 17th Street; the local strip mall easterly of the railroad tracks also on the south side of 17th Street; and at the Medical Center, easterly of the railroad tracks on the north side of 17th Street, with a new, signalized intersection with 17th Street. Retaining walls will be required along each of these access roads with the exception of Fairmont Street. In addition, access to the Senior Citizen Living Center, located westerly of the railroad tracks on the north side of 17th Street, is proposed to be connected to the road between Lincoln Avenue and 17th Street.

The project cost for this alternative, including final design, construction, construction management, and right of way acquisition is estimated to be $70,056,000.

1.4.4 Right of Way

The right of way impacts for these three alternatives are shown in Attachment G.

Alternative 1A creates a need to acquire right of way due to the construction of: a temporary detour road northerly of existing 17th Street; the connector road proposed in the northwest quadrant of the crossing; and property access issues post construction. Three (3) parcels will require full acquisition, three (3) parcels will require partial acquisition, 13 parcels will require temporary construction easements, and seven (7) parcels will require underground utility easements.

Alternative 1C creates a need to acquire right of way due to the construction of: a temporary detour road northerly of existing 17th Street and property access issues post construction. Three (3) parcels will require full acquisition, three (3) parcels will require

partial acquisition, (7) seven parcels will require temporary construction easements, and (7) seven parcels will require underground utility easements.

Alternative 2A creates a need to acquire right of way due to the construction of: a temporary detour road southerly of existing 17th Street; the connector road proposed in the northwest quadrant of the crossing; and property access issues post construction. 14 parcels will require full acquisition, five (5) parcels will require partial acquisition, 10 parcels will require temporary construction easements, and five (5) parcels will require underground utility easements.

1.5 Environmental Document

A Preliminary Environmental Study (PES) was prepared for this project and is included as Attachment K. The PES recommends a Categorical Exclusion (CE) for the National Environmental Policy Act (NEPA) document and a Statutory Exemption (SE) for the California Environmental Quality Act (CEQA). The PES also recommends the following technical studies to support these documents: Noise Study Report; Initial Site Assessment; Water Quality Technical Memorandum; Natural Environmental Study-Minimum Impact; Visual Impact Assessment; Relocation Impact Study; and Community Impact Assessment.

1.6 Railroad Involvement

There are two (2) SCRRA mainline tracks located within the project. OCTA owns the railroad right of way, while SCRRA maintains and operates the Metrolink service. SCRRA is an important stakeholder of the project. AECOM met with SCRRA on August 31, 2011, with Ms. Patricia Watkins. At this meeting, AECOM vowed to work closely with SCRRA for the development of this project, and to follow up with this commitment, the PDT will schedule a follow-up meeting prior to issuance of the final version of this report.

As Alternative 1C, the recommended alternative, is an undercrossing structure, the two (2) SCRRA mainline tracks will need to be realigned in a temporary shoofly configuration, easterly of the existing tracks. This work will need to be accomplished by SCRRA forces or OCTA's Contractors who meet certain SCRRA requirements. Close coordination with SCRRA in the next phases of the project will be required for approval of the shoofly track design, both railroad engineering and railroad signal, for quantifying the material requirements, for setting the schedule of this work, and to ensure the interruption to rail service is at a minimum. In addition, a new temporary highway-rail crossing will be required where the shoofly tracks will be crossing the roadway detour road. Again, close coordination with SCRRA will be required for this work.

Upon completion of the construction and as soon as the new bridge is opened to traffic, the existing highway-rail crossing will be retired by SCRRA forces. SCRRA will be responsible for all work within the right-of-way associated with retiring the at-grade crossing, including modifying the railroad signalization.

1.7 Schedule

We have included a preliminary schedule for the entire project within this PSRE as Attachment L. As always, this schedule is subject to change as the project evolves, but the following table gives a summary of the project milestones:

Begin PSRE	June 2011
Complete PSRE	May 2012
Begin Preliminary Engineering/Environmental Document	August 2012
Complete Preliminary Engineering/Environmental Document	August 2013
Begin Final Design and Right of Way Acquisition	August 2013
Complete Final Design and Right of Way Acquisition	September 2015
Begin Construction	December 2015
Complete Construction	July 2017
Complete Project Close-out	December 2017

2 INTRODUCTION

The Orange County Transportation Authority (OCTA), the City of Santa Ana (City), in cooperation with, the California Department of Transportation (Caltrans), and the Federal Highway Administration (FHWA), propose to grade separate the current at-grade crossing of 17th Street with the Metrolink (SCRRA) corridor. The proposed project would construct a railroad undercrossing structure to carry SCRRA over 17th Street, depressing the current grade of the roadway and maintaining the railroad profile.

The objective of the project is to:

- Implement improvements to eliminate the intersection of the railroad traffic and the vehicular traffic; improve safety at the crossing for pedestrians, bicycle users, and motor vehicles; provide unimpeded access for emergency, and other, vehicles resulting in the enhancement of traffic operations; and reduce existing traffic congestion and delay.

3 BACKGROUND

3.1 Project History

This highway-rail at-grade crossing is located along the Los Angeles to San Diego (LOSSAN) Corridor, which is the primary north/south rail corridor connecting the cities of Los Angeles and San Diego, as well as within Orange County. The LOSSAN Corridor in Orange County is owned by OCTA, with Metrolink commuter rail service is operated and maintained by SCRRA. The Burlington Northern Santa Fe (BNSF) Railway, the Union Pacific Railroad (UPRR), and Amtrak all have been granted user rights by OCTA.

Because it is the primary north/south rail corridor, the LOSSAN Corridor is becoming increasingly burdened due to the demand created by both commuter rail, and freight rail, operations. OCTA is in the final stages of the construction of a project with the purpose of increasing the capacity of the corridor, the Metrolink Service Expansion Project (MSEP), and this increased capacity will accommodate OCTA's planned expansion of commuter rail operations, targeting a 30 minute headway (rail service at each station within the corridor every 30 minutes) for commuter rail service within the next couple of years. In addition, due to the increase in train movements resulting from the expansion of the Ports of Los Angeles and Long Beach, freight service has also increased. Finally, due to increased development, and accompanying traffic, delay at the existing highway-rail crossing of 17th Street with SCRRA has been increasing yearly.

OCTA has embarked on an ambitious program to grade separate at-grade highway-rail crossings within Orange County, and this program was begun in 2009, with the first group of Thirteen (13) projects. Three (3) are currently under construction, and four (4) are scheduled to go to construction by 2013. This project is part of the next group of five (5) projects, some of which are scheduled to begin the Project Approval/Environmental Document (PA/ED) phase in mid-2012.

OCTA has submitted this project for the California Public Utilities Commission (PUC) Section 190 Program to be part of the 2011-2012 Grade Separation Priority List and is awaiting ranking.

3.2 Existing Facility

17th Street is one of the principal east/west arterials within the City. It connects the City with Interstate 5 (I-5), and ultimately to the Southern California Region. Within the Project limits,

17th Street is currently a six-lane arterial. Left turn pockets are located in each direction at the intersections with Lincoln Avenue and Fairmont Street. Within the project area there is one existing signal along 17th Street, at the Lincoln Avenue intersection, while traffic from Fairmont Street is stop controlled at the intersection with 17th Street.

17th Street is currently listed in the City's General Plan as a 6-Lane Major Arterial, which is defined as a roadway with 120 feet of right-of-way width and includes 3 traffic lanes for a total of 35 feet of travelway, a 7 feet median, an 8 feet shoulder, and a 10 feet sidewalk and setback (all on both sides of the roadway). Currently, the right of way along 17th Street is 104 feet in width, and it is left to a future project to widen the roadway to full width, as this project will maintain the existing cross-section of: 3 traffic lanes for a total of 35 feet of travelway, a 7.5 feet median, and a 9.5 feet sidewalk and setback (all on both sides of the roadway).

4 PURPOSE AND NEED

4.1 Need

As mentioned in the previous section, 17th Street serves as a principal east/west arterial in the City, with connections to I-5. Increased traffic, and increased train movements, have resulted in the increase of delays at the existing highway-rail crossing of 17th Street and the SCRRA corridor. These delays have not only affected the traveling public, but also have impacted the access by emergency vehicles, compounded by the fact there currently is only one other grade separation (1st Street) within the city limits, making this grade separation important to the City's traffic circulation in that it will provide unimpeded access across the railroad.

Also, safety at the crossing is a major concern to OCTA and the City. Since 1978, there have been seven (7) separate accidents at this crossing, averaging about one every five (5) years. These seven (7) accidents are classified as follows: five (5) were caused by a train striking a vehicle stopped on the tracks, four Amtrak trains and one SCRRA train; and two were caused by a motorist driving around the gates and being struck by an Amtrak train. Unfortunately, one of the drivers was killed (see incident report for 5/26/05). Please see a discussion of these in Section 4.1.1, Accident Analysis-Vehicle/Train, of this report, and Attachment A for copies of the Highway-Rail Crossing Accident/Incident Reports.

4.2 Purpose

The primary project objective is to alleviate traffic congestion and delay and to improve the operation and safety by constructing a grade separation structure with the railroad and retiring the existing at-grade crossing. Given the economic significance of the corridor, the proposed project is deemed required and necessary, and is supported by various public agencies.

5 DEFICIENCIES

As mentioned previously, safety at the crossing is a major concern to OCTA and the City. Since 1978, there have been seven (7) separate accidents involving vehicles and trains at this crossing, averaging about one every five (5) years. These accidents are further detailed in the discussion in the following subsection.

5.1 Accident Analysis-Vehicle/Train

Vehicle/Train Accident data was obtained from the CPUC website in the form of Accident/Incident Reports. These reports are included as Attachment A, range from October 1978 to December 2007, and document seven (7) accident/incidents, described in the following Table 1:

Table 1 - Summary of Accident Data from the CPUC

Location	Number of Accidents				Primary Collision Factor	
	Fatal	Injury	Non-Injury	Total		
17th Street Highway-Rail Crossing	1	0	6	7	Pedestrian	0
					Stopped on Crossing	5
					Drove Around/Through Gate	2
					Did Not Stop	0
					Stopped and Then Proceeded	0
					Other	0

This table shows there was a fatality, as one person was killed while driving around the traffic gates.

6 CORRIDOR AND SYSTEM COORDINATION

The project has not yet been programmed in the Federal Transportation Improvement Program (FTIP). The project will be programmed into FTIP in the next phase, Project Approval / Environmental Document. Since the project is a grade separation project and exempt from the CEQA, the project will not be programmed into the Regional Transportation Plan (RTP).

7 ALTERNATIVES

The Project Development Team (PDT) worked very diligently to identify different feasible alternatives to meet the need and purpose of this project, taking into account the constraints presented by the project area, and the City's desired traffic operations. One overcrossing alternative and two undercrossing alternatives were studied and then discussed among the PDT members. A No-Build Alternative was not considered, with the exception of within the traffic study discussed later in this report, as it does not meet the purpose and need of the project, to grade separate the vehicle/pedestrian traffic from the railroad traffic.

The PDT members decided to study three (3) different alternatives, as follows:

- Alternative 1A: Undercrossing of Both the Railroad and Lincoln Avenue.
- Alternative 1C: Undercrossing of the Railroad and a Depressed Intersection with Lincoln Avenue.
- Alternative 2A: Overcrossing of the Railroad.

Each alternative was evaluated using the OCTA standardized criterion and scoring for this group of five projects, which were: cost/fundability; right of way impacts; environmental impacts; local business and residential access; constructability and schedule; railroad operations; geometrics and safety, including sight distance, traffic improvements and operations; and utility impacts. This evaluation process is documented for this report using a ranking matrix. We have included two (2) versions of this ranking matrix, as Attachments B and C. Attachment B employs a scoring for each alternative ranging from 1 to 10 (best) for each criteria listed above, while Attachment C compares each alternative against the other two, and as there are three (3) alternatives being studied for this project, the scoring ranges from 1 to 3 (best) for the same criteria. In both matrices, Alternative 1C ranked the highest, and therefore was selected as the recommended alternative. The results of the rankings are summarized in Table 2 below:

Table 2 - Ranking Matrix Results for Each Alternative

Ranking System	Alternative 1A (Points)	Alternative 1C (Points)	Alternative 2A (Points)
1 to 10 (best)	810	1125	420
1 to 3 (best)	315	375	210

Each alternative is discussed in detail in the following subsections of this report. It is important to note each of the alternatives discussed below will not require the approval of any Mandatory or Advisory Fact Sheets, therefore each can be considered as meeting the requirements of a standard design.

7.1 Alternatives Description

7.1.1 Alternative 1A: Undercrossing of Both the Railroad and Lincoln Avenue.

This alternative consists of: a depressed profile for 17th Street; and undercrossing bridges to cross beneath both the railroad and Lincoln Avenue over 17th Street. Improvements include: depressing the 17th Street roadway profile, beginning just westerly of Fairmont Street and ending approximately 500 feet west of North Grand Avenue. The 17th Street profile is designed to provide a minimum of 16.5 feet clearance to the soffit of the Lincoln Avenue Undercrossing structure, is design for 45mph utilizing a 6% grade for the approaches, and includes retaining walls along the depressed

roadway. In order to minimize some right of way access issues, the sag curve under the railroad and Lincoln Avenue is designed such that roadway lighting would be required.

Lincoln Avenue is proposed to maintain its existing roadway profile, and is proposed to reestablish connectivity with 17th Street using a connector road at the northwest quadrant, which terminates at a signalized intersection with 17th Street.

Access roads will need to be reconstructed at: Fairmont Street; the local strip mall easterly of Fairmont Street on the south side of 17th Street; the local strip mall easterly of the railroad tracks also on the south side of 17th Street; and at the Medical Center easterly of the railroad tracks on the north side of 17th Street with a new, signalized intersection with 17th Street. Retaining walls will be required along each of these access roads with the exception of Fairmont Street. In addition, access to the Senior Citizen Living Center, located westerly of the railroad tracks on the north side of 17th Street, is proposed to be connected to the connector road between Lincoln Avenue and 17th Street.

Attachment D includes a layout, a profile, and a bridge general plan of this alternative, and Attachment E includes a preliminary cost estimate for the improvements associated with this alternative.

7.1.2 Alternative 1C: Undercrossing of the Railroad and a Depressed Intersection with Lincoln Avenue.

As mentioned previously, this alternative scored the highest of the three and was subsequently selected as the recommended alternative. Like Alternative 1A, this alternative consists of a depressed profile for 17th Street, beginning just westerly of Fairmont Street and ending approximately 500 feet west of North Grand Avenue, and an undercrossing bridge to pass the railroad over 17th Street. Unlike Alternative 1A, Alternative 1C proposes to also depress Lincoln Avenue to meet 17th Street. The 17th Street profile is designed to provide a minimum of 16.5 feet clearance to the soffit of the railroad structure, is design for 45mph utilizing a 5% grade for the approaches, and includes retaining walls along the depressed roadways of both Lincoln Avenue and 17th Street. In order to minimize some right of way access issues, the sag curve under the railroad is designed such that roadway lighting would be required.

Again like Alternative 1A, access roads will need to be reconstructed at: Fairmont Street; the local strip mall easterly of Fairmont Street on the south side of 17th Street; the local strip mall easterly of the railroad tracks also on the south side of 17th Street; and at the Medical Center easterly of the railroad tracks on the north side of 17th Street, with a new, signalized intersection with 17th Street. Retaining walls will be required along each of these access roads with the exception of Fairmont Street. In addition, access roads along Lincoln Avenue will need to be reconstructed at: 19th Street; 18th Street; and to the Senior Citizen Living Center, located westerly of the railroad tracks on the north side of 17th Street.

Attachment D includes a layout, a profile, and a bridge general plan sheet of this alternative, and Attachment E includes a preliminary cost estimate for the improvements associated with this alternative.

7.1.3 Alternative 2A: Overcrossing of the Railroad

Alternative 2A proposes to elevate the profile of 17th Street over both the railroad and Lincoln Avenue. This alternative proposes to construct an overcrossing bridge, spanning

across the SCRRA double tracks and Lincoln Avenue and includes: raising the roadway profile, beginning just westerly of the I-5 Northbound off-ramp, joining a newly signalized, raised intersection with Fairmont Street, spanning Lincoln Avenue and the railroad, joining a newly signalized, raised intersection with the access road to the Medical Center, and terminating the raised profile just westerly of the intersection with North Grand Avenue. The 17th Street profile is designed to provide a minimum of 24 feet clearance across the entire railroad right-of-way, and to provide a design speed of 45 mph, utilizing a 5.5% grade for the approaches.

Again, similar to Alternative 1C, access roads will need to be reconstructed at: Fairmont Street, along with approximately 500 feet of Fairmont Street, south of 17th Street; the local strip mall easterly of Fairmont Street on the south side of 17th Street; the local strip mall easterly of the railroad tracks also on the south side of 17th Street; and at the Medical Center, easterly of the railroad tracks on the north side of 17th Street, with a new, signalized intersection with 17th Street. Retaining walls will be required along each of these access roads with the exception of Fairmont Street. In addition, access to the Senior Citizen Living Center, located westerly of the railroad tracks on the north side of 17th Street, is proposed to be connected to the ramp between Lincoln Avenue and 17th Street.

Attachment D includes a layout, a profile, and a bridge general plan sheet of this alternative, and Attachment E includes a preliminary cost estimate for the improvements associated with this alternative.

7.2 Stage Construction

Stage construction is very critical to the success of this project, as it affects right of way acquisition and access to the local businesses and properties along both 17th Street and Lincoln Avenue. A detailed analysis and design for staging should be completed during the next phase of the project.

The following is a summary of one concept of construction staging for each of the alternatives:

7.2.1 Alternative 1A: Undercrossing of Both the Railroad and Lincoln Avenue.

This staging concept assumes the City will not close 17th Street or Lincoln Avenue during the construction. See Attachment F for this alternative.

Stage 1A construction would be to construct a detour road northerly of 17th Street from Fairmont Street in the west (ensuring impacts to the Senior Center are minimized) to the eastern limits of the project. At the same time, two shoofly tracks would be constructed easterly of the existing railroad tracks, to include a new, temporary at-grade crossing with the detour road. Lincoln Avenue would need to be closed to through traffic at 17th Street, but on both sides of 17th Street would remain open while traffic is detoured around the construction using local streets. Once railroad traffic was routed to the shoofly tracks and vehicle traffic was moved to the detour road, then both the railroad and Lincoln Avenue undercrossing structures could be constructed, along with a portion of the east and west approaches to the bridges. Upon completion of the Lincoln Avenue structure, Lincoln Avenue would be reopened to through traffic, and the same would be for the completion of the railroad structure, wherein the railroad traffic would be shifted to the new bridge.

Stage 1B construction would be to construct the connector road from Lincoln Avenue to just northerly of the detour road, and to complete the eastern approach once the shoofly has been removed from service. Upon completion of this work, vehicle traffic would be moved back onto 17th Street, to the southerly side of the new roadway.

Stage 2 construction would be to construct the remainder of the northerly side of 17th Street, at the west and east ends of the project, where the detour road was in Stage 1. Upon completion of this work, traffic would be placed in its final configuration on 17th Street.

Stage 3 construction would be to complete the median areas along 17th Street and construct the 17th Street/Fairmont Street Intersection and the southerly side of 17th Street, westerly of the Fairmont Street intersection using local detours of traffic around the construction.

7.2.2 Alternative 1C: Undercrossing of the Railroad and a Depressed Intersection with Lincoln Avenue.

This staging concept also assumes the City will not close 17th Street or Lincoln Avenue during the construction, and follows much the same staging as for Alternative 1A. See Attachment F for this alternative.

Stage 1A construction would be to construct a detour road northerly of 17th Street from Fairmont Street in the west (ensuring impacts to the Senior Center are minimized) to the eastern limits of the project. At the same time, two shoofly tracks would be constructed easterly of the existing railroad tracks, to include a new, temporary at-grade crossing with the detour road. Lincoln Avenue would need to be closed to through traffic at 17th Street and this closure would extend as far south as Dorman Street, while the remainder of 17th Street would remain open while traffic is detoured around the construction using local streets. Once railroad traffic was routed to the shoofly tracks and vehicle traffic was moved to the detour road, then the railroad undercrossing structure could be constructed, along with a portion of the east and west approaches to the bridge, plus the south portion of Lincoln Avenue from 17th Street to Dorman Street, and the north portion of Lincoln Avenue to 18th Street. Upon completion of the railroad structure, railroad traffic would be shifted to the new bridge.

Stage 1B construction would be to construct the remainder of the eastern approach once the shoofly has been removed from service, and to complete the Lincoln Avenue work from Stage 1A. Upon completion of this work, vehicle traffic would be moved back onto 17th Street, to the southerly side of the new roadway.

Stage 2 construction would be to construct the remainder of the northerly side of 17th Street, at the west and east ends of the project, where the detour road was in Stage 1, and the north and south ends of Lincoln Avenue. Upon completion of this work, traffic would be placed in its final configuration on 17th Street.

Stage 3 construction would be to complete the median areas along 17th Street and construct the 17th Street/Fairmont Street Intersection and the southerly side of 17th Street, westerly of the Fairmont Street intersection using local detours of traffic around the construction.

7.2.3 Alternative 2A: Overcrossing of the Railroad

This staging concept also assumes the City will not close 17th Street or Lincoln Avenue during the construction. See Attachment F for this alternative.

Stage 1 construction would be to construct a detour road southerly of 17th Street from Santiago Street in the west to North Grand Street in the east. Once the vehicle traffic is moved to the detour road, then the overcrossing structure could be constructed, along with the majority of the east and west approaches to the bridge, plus the northern portion of Lincoln Avenue connector road to 17th Street. Upon completion of this work, vehicle traffic would be moved back onto 17th Street, to the northerly side of the new roadway and bridge.

Stage 2 construction would be to construct the remainder of the southerly side of 17th Street, at the west and east ends of the project, where the detour road was in Stage 1, and Fairmont Street. Upon completion of this work, traffic would be placed in its final configuration on 17th Street.

Stage 3 construction would be to complete the median areas along 17th Street using local detours of traffic around the construction.

7.3 Right of Way

One of the most critical criteria for the selection of the recommended alternative for this group of five (5) grade separation projects is right of way impacts, as each of the projects are located in areas of almost full build-out development. The 17th Street highway-rail crossing is no different having development on all four quadrants of the crossing. On the northwest quadrant there are two restaurants; on the southwest quadrant there is a restaurant and a strip/shopping mall; on the southeast quadrant there is an auto repair shop and a strip/shopping mall; and on the northeast quadrant there is a vacant parcel and a medical facility. This development only made finding the appropriate grade separation alternative more challenging. Below is a description of the right of way needs created by each alternative and Attachment G shows a graphic representation of the acquisition and easement needs created by each.

7.3.1 Alternative 1A: Undercrossing of Both the Railroad and Lincoln Avenue.

This alternative creates a need to acquire right of way due to the construction of: the detour road northerly of existing 17th Street; the connector road proposed in the northwest quadrant of the crossing; and property access issues post construction. Three parcels will require full acquisition, three parcels will require partial acquisition, 13 parcels will require temporary construction easements, and seven parcels will require underground utility easements.

7.3.2 Alternative 1C: Undercrossing of the Railroad and a Depressed Intersection with Lincoln Avenue.

Like Alternative 1A, this alternative creates a need to acquire right of way due to the construction of: the detour road northerly of existing 17th Street and property access issues post construction. Three parcels will require full acquisition, three parcels will require partial acquisition, seven parcels will require temporary construction easements, and seven parcels will require underground utility easements.

7.3.3 Alternative 2A: Overcrossing of the Railroad

This alternative creates a need to acquire right of way due to the construction of: the detour road southerly of existing 17th Street; the connector road proposed in the northwest quadrant of the crossing; and property access issues post construction. 14

parcels will require full acquisition, five parcels will require partial acquisition, 10 parcels will require temporary construction easements, and five parcels will require underground utility easements.

7.4 Drainage

The drainage designs for the proposed alternatives of the project will follow the current Orange County Hydrology Manual (1986) and City of Santa Ana engineering design standards. Generally, 100-year and 25-year storm water discharges will be studied for sump conditions and gravity/flow-by conditions respectively.

7.4.1 Existing Drainage Conditions

The project site receives surface flows generally from northeast to southwest by means of street flow. The major drainage facility within the project site is a reinforced concrete storm drain pipe "Plan No. U-1-B", extending from Santa Clara Street, through Lincoln Avenue and 17th Street, to Grand Avenue. This storm drain intercepts the majority of street flows in the project site and the offsite flows from the north. There is another storm drain system "Plan No. 1-039-09", located at 17th Street/Santiago Street, which receives minor street flows from the project site.

7.4.2 Proposed Drainage Conditions – Alternative 1A

This alternative will require reconstruction of the existing storm drain system "U-1-B" on both Lincoln Avenue and 17th Street due to the construction of the underpass. The storm drain will need to be realigned and new catch basins will be added to maintain its current drainage functionality to the surrounding areas. In addition, this alternative will require a new local drainage system on the proposed Lincoln Avenue Overpass to handle the bridge deck flows, which will likely reconnect to the proposed pump station. It was anticipated that there will be roughly 21.1 acres of offsite drainage area being re-directed to the new storm drain by means of gravity pipe systems. For drainage solution in the depressed street area, new catch basins, a local storm drain system together with a new pump station will be needed to accommodate approximately 17.6 acres of drainage area. This alternative will not significantly affect the current drainage conditions on the other local streets around the project site.

7.4.3 Proposed Drainage Conditions – Alternative 1C

This alternative will require reconstruction of the existing storm drain system "U-1-B" on both Lincoln Avenue and 17th Street because both streets will be lowered. The storm drain will need to be realigned and new catch basins will be added to maintain its current drainage functionality to the surrounding areas. It was anticipated that there will be roughly 21.1 acres of offsite drainage area being re-directed to the new storm drain by means of gravity pipe systems. In addition, there will be approximately 17.6 acres drainage area, including both onsite and offsite areas, that will require installation of new catch basins, new local storm drain systems, and a new pump station. This alternative will not significantly affect the current drainage conditions on the other local streets, and the developed parcels around the project site. The drainage within the proposed parking site will require a new local drainage system and drain to the new system "U-1-B".

7.4.4 Proposed Drainage Conditions – Alternative 2A

This alternative will not require a pump station; however, portion of the storm drain pipe "U-1-B" will need to be realigned and reconstructed due to conflicting with the proposed overhead structure foundations. The impact to the existing drainage pattern is

considered insignificant. A new bridge deck drain system on the proposed 17th Street Overpass, some local drainage improvements at the new/local street intersections, a new storm drain extension to the system "1-039-09" on west, and potential in-parcel drainage improvements adjacent to the proposed bridge abutment walls are anticipated.

7.5 Utilities

7.5.1 Existing Utilities:

From field investigations, as-built plan research, and coordinating with various utility owners, the existing utilities within the proposed project construction area are summarized below.

City of Santa Ana:

12" waterlines: One 12" waterline runs in east-west direction along 17th Street. It ties into a 16" waterline to the west near the intersection of the 17th Street and Santiago Street and a 12" waterline laid in north-south direction along Grand Avenue to the east. Another 12" waterline runs southerly from the aforementioned waterline along an alley located approximately 280' east of the railroad crossing.

8" water lines: Three 8" waterlines are identified within the proposed project area. All three waterlines are fed from the 12" line along 17th Street. The first waterline flows northerly along the Lincoln Avenue north of 17th Street, the second one runs southerly along the Lincoln Avenue from 17th Street and the last one is located north of 17th Street and along a north-south alley roughly 700' east of the railroad crossing.

6" waterlines: 6" waterlines have been identified at the Fairmont Street and Dorman Street near the project site. These water lines are connected to the 12" water line along 17th Street and 8" water line along Lincoln Avenue south of 17th Street.

12" sewer line: A sewer line runs in east-west direction along 17th Street. It starts with 8" sewer pipe about 130' west of the intersection of 17th Street and Grand Avenue and it expands to a 12" pipe near the intersection of 17th Street and Lincoln Avenue. The sewerage flows westerly. Another 12" sewer line has been found at Lincoln Avenue north of 17th Street. It drains southerly and joins the 12" sewer line along 17th Street.

8" sewer lines: Besides the 8: sewer line along 17th Street, an 8" sewer line is located at Lincoln Avenue south of 17th Street and Dorman Street. It flows southerly along Lincoln Avenue and turns westerly along Dorman Street. The other 8" sewer line is identified at 18th Street. It flows easterly and ties in the 12" line along Lincoln Avenue.

6" sewer line: A 6" sewer line has been found at Fairmont Street.

Southern California Gas:

2", 3" and 4" gas lines: 2", 3" and 4" gas lines have been identified at 17th Street, Lincoln Avenue south of 17th Street, Dorman Street and Fairmont Street near the proposed project area.

Southern California Edison:

Underground cables: Main 12KV underground cables are identified along the south side of 17th Street and west side of Lincoln Avenue within the project area. Some minor underground SCE facilities can also be found on the north side of 17th Street.

Aerial Facilities: Power poles and aerial wires are found along the west side of Lincoln Avenue south of 17th Street and along the west side of a north south alley south of 17th Street, approximately 280' east of the railroad tracks.

AT&T

AT&T underground distribution cables: AT&T's distribution cables are present at the project site. The cables are located on the north side of 17th Street and west side of Lincoln Avenue north of 17th Street. There are also cables on the south side of 17th Street between the railroad tracks and Grand Avenue.

Verizon

Microwave tower: The Verizon tower is located east of the railroad tracks and about 450' south of the railroad crossing.

Metrolink

Metrolink's CP Lincoln telecommunication and signal control cables are located within the railroad right of way and along the railroad tracks.

7.5.2 Proposed Utility Relocation:

Alternative 1A:

The 12" waterline, 12" sewer line, 4" gas line, SCE underground cables, AT&T buried cables along 17th Street will need to be relocated outside the undercrossing excavation footprint.

The 12" sewer line along Lincoln Avenue north of 17th Street will need to be re-routed via the proposed loop connector at the northwest quadrant of the crossing before the proposed Lincoln Avenue Overcrossing Structure and re-connected to the existing sewer pipe near the west end of the project limit at 17th Street.

The 8" water line and 12KV SCE cables along Lincoln Avenue can be relocated into the Lincoln Avenue Overcrossing Structure so that the continuity of these facilities can be maintained.

The Verizon microwave tower will potentially be in conflict with the proposed shoofly tracks and require to be relocated.

The Metrolink CP Lincoln telecommunication and signal control cables will be relocated by jacking or boring the cables across and under the proposed railroad undercrossing structure.

Some other minor utilities will need to be relocated if they are in conflict with the construction. More in depth studies and engineering will be performed in the final design phase.

Alternative 1C:

The utility relocation strategy for this alternative is similar to the alternative 1A except for the following facilities.

The 8" sewer line along 17th Street east of the railroad crossing: since Lincoln Avenue is proposed to be depressed with this alternative, the sewer pipe will not only need to be relocated outside the construction area, but also re-profiled so that the sewage can be drained easterly toward another system at Grand Avenue.

All the utilities in conflict with the excavation at the proposed Lincoln Avenue will need to be relocated outside the construction area.

Alternative 2A:

All the utilities in conflict with the proposed overhead structure construction will need to be relocated prior to the construction. Due to loss of access to the adjacent properties along the south side of 17th Street, the properties will need to be acquired and a utility corridor can be designated for the majority of the proposed utility relocations.

7.6 Traffic

One of the purposes of the Project is to alleviate existing traffic congestion and delays at the existing highway-rail crossing of 17th Street and the SCRRA tracks. This is to be accomplished by, as previously mentioned, constructing a grade separation structure and retiring the existing at-grade crossing.

A traffic study for the project have been completed and are documented in 17th Street/LOSSAN Railroad Corridor Grade Separation Project Traffic/Circulation Study, Santa Ana, California Report (Traffic Report) by Iteris, dated May 09, 2012, and is included as Appendix N. The results of the studies are summarized in this section of the PSRE. In Section 1.10 Summary and Recommendations, the Traffic Report states the grade separation of the vehicle/pedestrian traffic with the train traffic "would significantly reduce delay at the crossing and queues that result from the gate down periods when trains are present". It also states "based upon these findings (from the report) Alternative 1C is projected to provide the lowest overall delay and would provide acceptable operating conditions at more intersections than Alternatives 1A and 2A".

7.6.1 Existing Year 2011 Traffic Conditions

Existing traffic conditions were surveyed and counted at four intersections on June 2, 2011 and a mid-block 24-hour count was collected on June 8, 2011. Each day was a typical weekday. The data collected, once analyzed, showed the Lincoln Avenue/17th Street Intersection experiences delays generated by a train occupying the adjacent highway-rail crossing on 17th Street. But more significantly, and for the purposes of studying the actual delays created by gate down periods, the crossing itself generates delays, which can be quantified and compared to future traffic conditions. As shown in Table 3, the current delay at the crossing averages 27.0 seconds/vehicle in the AM Peak Hour, and 28.8 seconds/vehicle in the PM Peak Hour. Overall, this crossing generates

about 40 hours of combined delay in the AM and PM Peak periods, resulting from the current 10 trains/hour. As mentioned previously in this report, the number of trains will increase in the future, therefore the delay will certainly also increase once this increase in train service is implemented.

The traffic volumes shown in Table 4 are really only critical at the Lincoln Avenue/17th Street Intersection regarding delays created at the crossing, as this intersection is almost immediately adjacent to the highway-rail crossing. The westbound traffic controls as the crossing is east of this intersection, therefore this traffic has just passed over the crossing. The through movement is the only critical movement eastbound, as mainline turning movements will not pass over the crossing, rather will end up on Lincoln Avenue. Lincoln Avenue also adds some traffic to the crossing, as the southbound left turn movement and the northbound right turn movement each add volume to the traffic passing over the crossing. As shown in this table, the westbound traffic over the crossing is 1119 vehicles for AM Peak Hour and 1345 vehicles for PM Peak Hour. The eastbound through traffic is 850 vehicles for AM Peak Hour and 1085 vehicles for PM Peak Hour. The traffic from Lincoln Avenue is a combined 169/188 vehicles for AM/PM.

The current AM and PM Peak Hour traffic volumes and the existing intersections delays/LOS are contained in the following:

- Table 3 – Existing (2011) Intersection Peak Hour LOS.
- Table 4 – Existing (2011) Peak Hour Volumes.

Table 3 - Existing (2011) Intersection Peak Hours LOS

#	Intersection	AM Peak Hour			PM Peak Hour			MD Peak Hour		
		Delay	V/C	LOS	Delay	V/C	LOS	Delay	V/C	LOS
1	Penn Way and 17th Street	24.8	0.59	C	36.6	0.62	D	18.4	0.52	B
2	I-5 NB Ramps/Santiago Street and 17th Street	40.1	0.66	D	22.3	0.61	C	49.9	0.58	D
3	Lincoln Avenue and 17th Street	27.0	0.49	C	21.4	0.59	C	27.6	0.52	C
	LOSSAN Crossing and 17th Street	27.0	-	-	28.8	-	-	27.6	-	-
	Combined Weighted Average Delay[1]	27.0	-	C	25.1	-	C	27.6	-	C
4	Grand Avenue and 17th Street	72.6	0.86	E	68.9	0.90	E	50.1	0.74	D
5	Main Street and I-5 NB Ramps/Edgewood Road	40.3	0.71	D	43.5	0.68	D	-	-	-
6	Penn Way and I-5 SB Ramps	24.6	0.44	C	22.7	0.42	C	-	-	-
7	Santiago Street and Washington Avenue[2]	10.9	n/a	B	11.7	n/a	B	-	-	-
8	Santiago Street and Civic Center Dr/Stafford Street	13.8	n/a	B	17.5	n/a	C	-	-	-
9	Santiago Street and Santa Ana Boulevard	20.2	0.57	C	20.0	0.60	B	-	-	-
10	I-5 SB Ramps and Santa Ana Boulevard	23.0	0.58	C	25.0	0.53	C	-	-	-
11	Grand Avenue and Santa Ana Blvd/NB I-5 HOV Ramps	50.3	0.70	D	46.2		D	-	-	-
12	Fairmont Street and 17th Street	10.6	n/a	B	11.2	n/a	B	-	-	-
13	Lincoln Avenue and Fairmont Street	10.6	n/a	B	10.0	n/a	B	-	-	-

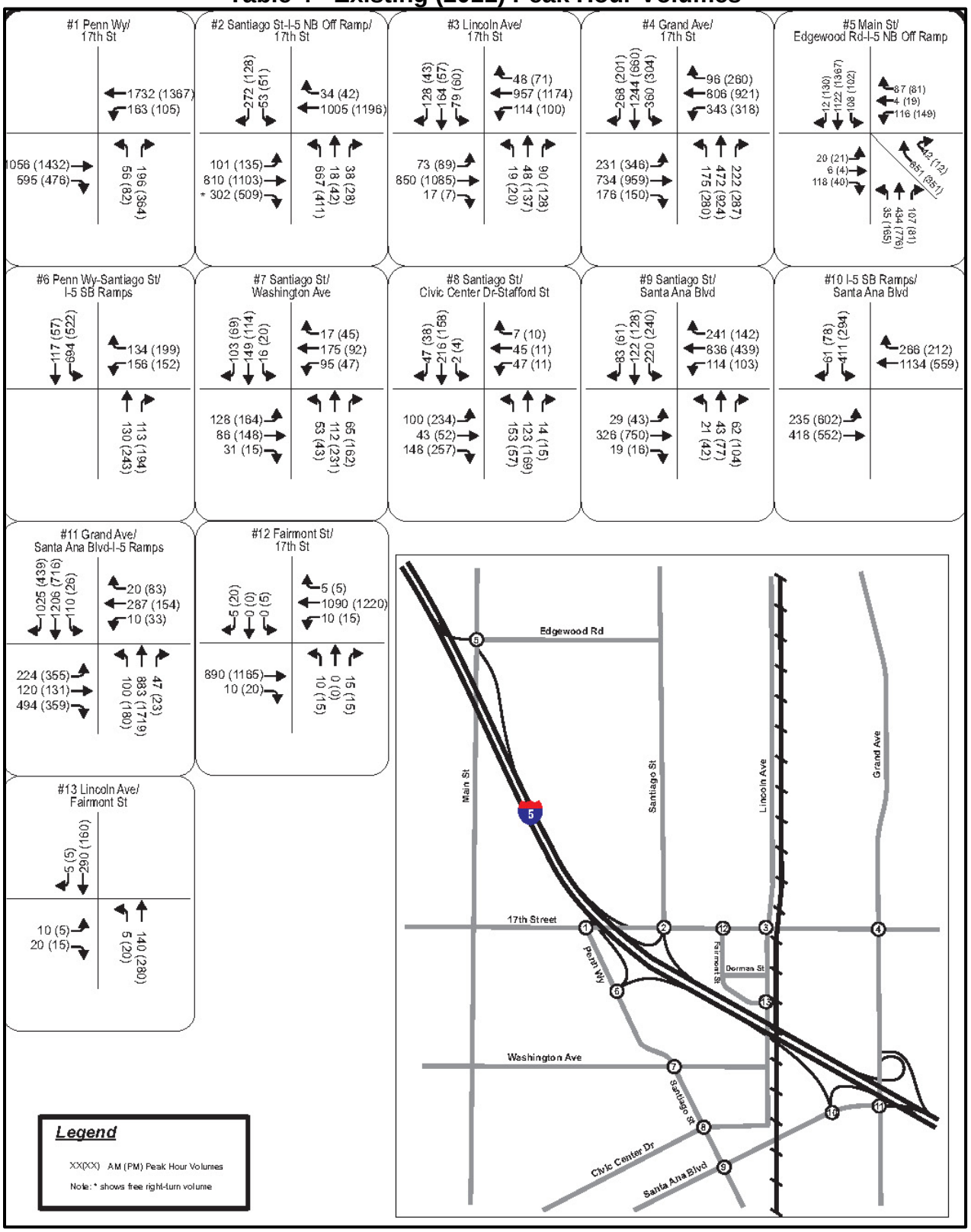
Source: Iteris, Inc., 2011

Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.

1 – The Combined Weighted Average takes into account that during gate down periods eastbound vehicles will be stopped west of Lincoln Avenue and westbound vehicles will be stopped east of the crossing. Therefore the delay is distributed between the intersection and the crossing.

2 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.

Table 4 - Existing (2011) Peak Hour Volumes



7.6.2 No Build Year 2020 Traffic Conditions

For the No Build Alternative in Year 2020, as shown in Table 5, the delays at the crossing grow from an average 27.0/28.8 seconds/vehicle for the AM/PM Peak Hour periods in 2011 to 43.9/47.7. Overall, this crossing generates about 40 hours of combined delay in the AM and PM Peak periods, resulting from the current 10 trains/hour, in 2011. This figure increases to just less than 65 hours of combined delay in the AM and PM Peak periods, for the same 10 trains/hour. As mentioned previously in this report, the number of trains will increase in the future, therefore the delay will certainly also increase once this increase in train service is implemented.

As mentioned previously for the current conditions in 2011, the westbound traffic over the crossing is 1119/1345 vehicles for AM/PM Peak Hours, while the eastbound traffic is 1019/1273 vehicles for AM/PM Peak Hours. For the 2020 No Build as shown in Table 6, these volumes grow to 1150/1530 vehicles for westbound traffic for the AM/PM Peak Hours, and 1060/1300 vehicles for eastbound traffic for the AM/PM Peak Hours.

The No Build 2020 AM and PM Peak Hour traffic volumes and the delays/intersections LOS are contained in the following:

- Table 5 – No Build 2020 Intersection Peak Hour LOS.
- Table 6 – No Build 2020 Peak Hour Volumes.

Table 5 - No Build 2020 Intersection Peak Hour LOS

#	Intersection	AM Peak Hour			PM Peak Hour		
		Delay	V/C	LOS	Delay	V/C	LOS
1	Penn Way and 17th Street	25.5	0.60	C	38.1	0.63	D
2	I-5 NB Ramps/Santiago Street and 17th Street	41.9	0.68	D	22.4	0.62	C
3	Lincoln Avenue and 17th Street	27.8	0.51	C	21.9	0.63	D
	LOSSAN Crossing and 17th Street	43.9	-	-	47.7	-	-
	Combined Delay[1]	35.1	-	D	34.0	-	C
4	Grand Avenue and 17th Street	122.3	0.99	F	111.5	1.06	F
	With NB RT lanes	89.7	0.99	F	75.7	0.97	E
	With 3rd SB TH and NB RT lanes	61.6	0.87	E	69.7	0.97	E
5	Main Street and I-5 NB Ramps/Edgewood Road	42.0	0.72	D	43.3	0.68	D
6	Penn Way and I-5 SB Ramps	25.6	0.44	C	23.0	0.43	C
7	Santiago Street and Washington Avenue[2]	12.9	n/a	B	18.5	n/a	C
8	Santiago Street and Civic Center Dr/Stafford Street	40.0	n/a	E	105.5	n/a	F
	With Traffic Signal	12.4	0.53	B	14.7	0.52	B
9	Santiago Street and Santa Ana Boulevard	27.4	0.64	C	29.8	0.74	C
10	I-5 SB Ramps and Santa Ana Boulevard	34.8	0.66	C	68.6	0.68	E
	With WB RT Lane	29.0	0.59	C	56.9	0.60	E
11	Grand Avenue and Santa Ana Blvd/NB I-5 HOV Ramps	61.1	0.85	E	45.5	0.80	D
12	Fairmont Street and 17th Street	10.6	n/a	B	11.3	n/a	B
13	Lincoln Avenue and Fairmont Street	10.8	n/a	B	10.1	n/a	B

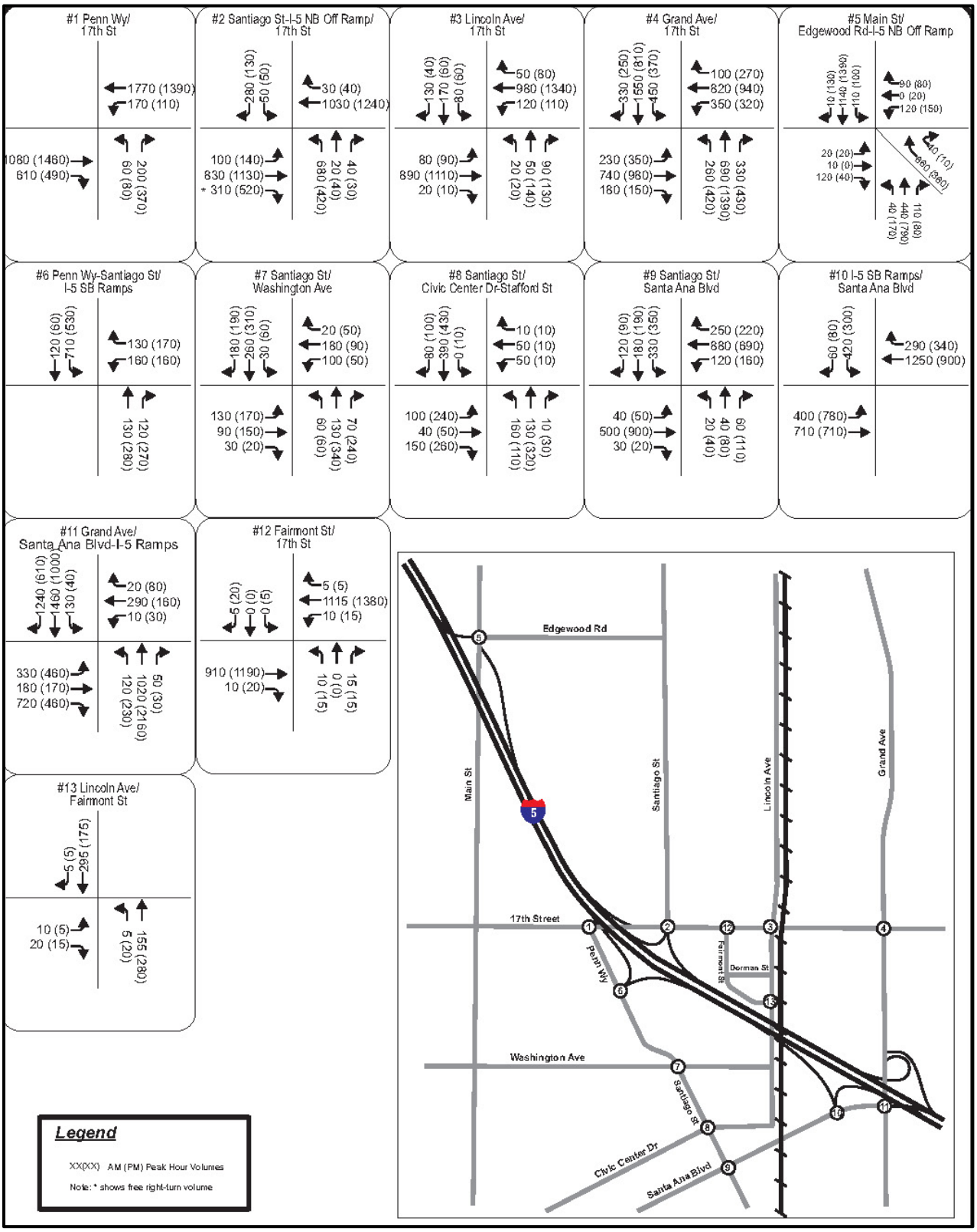
Source: Iteris, Inc., 2011

Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.

1 – The Combined Weighted Average takes into account that during gate down periods eastbound vehicles will be stopped west of Lincoln Avenue and westbound vehicles will be stopped east of the crossing. Therefore the delay is distributed between the intersection and the crossing.

2 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.

Table 6 - No Build 2020 Peak Hour Volumes



7.6.3 No Build Year 2035 Traffic Conditions

For the No Build Alternative in Year 2035, as shown in Table 7, the delays at the crossing grow from an average 27.0/28.8 seconds/vehicle for the AM/PM Peak Hour periods in 2011 to 45.5/47.7. Overall, this crossing generates about 40 hours of combined delay in the AM and PM Peak periods, resulting from the current 10 trains/hour, in 2011. This figure increases to just less than 72 hours of combined delay in the AM and PM Peak periods, for the same 10 trains/hour. As mentioned previously in this report, the number of trains will increase in the future, therefore the delay will certainly also increase once this increase in train service is implemented.

As mentioned previously for the current conditions in 2011, the westbound traffic over the crossing is 1119/1345 vehicles for AM/PM Peak Hours, while the eastbound traffic is 1019/1273 vehicles for AM/PM Peak Hours. For the 2035 No Build as shown in Table 8, these volumes grow to 1150/1530 vehicles for westbound traffic for the AM/PM Peak Hours, and 1060/1300 vehicles for eastbound traffic for the AM/PM Peak Hours.

The No Build 2035 AM and PM Peak Hour traffic volumes and the delays/intersections LOS are contained in the following:

- Table 7- No Build 2035 Intersection Peak Hour LOS.
- Table 8- No Build 2035 Peak Hour Volumes.

Table 7 - No Build 2035 Intersection Peak Hour LOS

#	Intersection	AM Peak Hour			PM Peak Hour		
		Delay	V/C	LOS	Delay	V/C	LOS
1	Penn Way and 17th Street	26.6	0.63	C	52.6	0.67	D
2	I-5 NB Ramps/Santiago Street and 17th Street	42.6	0.69	D	25.0	0.67	C
3	Lincoln Avenue and 17th Street	24.3	0.54	C	22.9	0.68	C
	LOSSAN Crossing and 17th Street	45.5	-	-	47.7	-	-
	Combined Delay[1]	33.9	-	C	34.6	-	C
4	Grand Avenue and 17th Street	186.5	1.18	F	171.3	1.14	F
	With NB RT lane	154.9	1.18	F	128.4	1.14	F
	With 3rd SB TH and NB RT lanes	95.8	1.01	F	100.8	1.10	F
5	Main Street and I-5 NB Ramps/Edgewood Road	42.6	0.72	D	45.8	0.71	D
6	Penn Way and I-5 SB Ramps	36.8	0.51	D	29.9	0.58	C
7	Santiago Street and Washington Avenue	22.5	n/a	C	39.0	n/a	E
8	Santiago Street and Civic Center Dr/Stafford Street[2]	70.9	n/a	F	176.1	n/a	F
	With Traffic Signal	12.6	0.57	B	15.9	0.57	B
9	Santiago Street and Santa Ana Boulevard	77.5	0.81	E	51.4	0.84	D
10	I-5 SB Ramps and Santa Ana Boulevard	57.5	0.73	E	76.6	0.76	E
	With WB RT Lane	30.9	0.64	C	63.6	0.69	E
11	Grand Avenue and Santa Ana Blvd/NB I-5 HOV Ramps	95.3	1.01	F	54.7	0.87	D
12	Fairmont Street and 17th Street	10.3	n/a	B	11.2	n/a	B
13	Lincoln Avenue and Fairmont Street	10.9	n/a	B	10.2	n/a	B

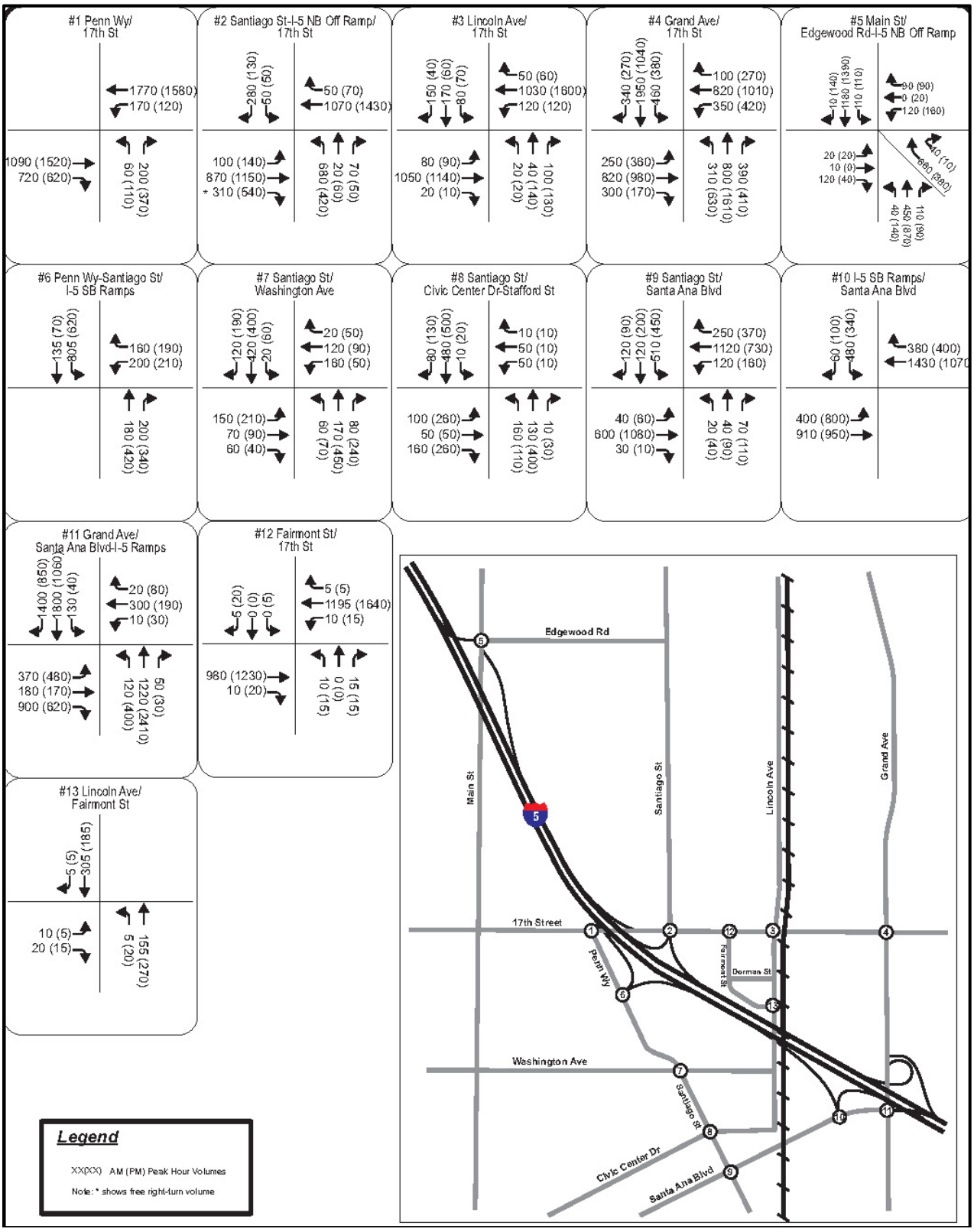
Source: Iteris, Inc., 2011

Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.

1 – The Combined Weighted Average takes into account that during gate down periods eastbound vehicles will be stopped west of Lincoln Avenue and westbound vehicles will be stopped east of the crossing. Therefore the delay is distributed between the intersection and the crossing.

2 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.

Table 8 - No Build 2035 Peak Hour Volumes



7.6.4 Accident Analysis-Vehicle/Vehicle

Traffic Accident data was received from the City for accidents that have occurred between March 2001 and March 2011 at the locations within the project limits. The data has been compiled into a spreadsheet format for analysis in Table 9 below, and the overall data is included in this report as Attachment A.

The table below categorizes these accidents in terms of injury or fatal cases, primary collision factor, and types of collisions.

Table 9 - Summary of Accident Data from the City of Santa Ana Database

Primary Collision Factors and Types of Collisions								
Location	Number of Accidents				Primary Collision Factor		Type of Collision	
	Fatal	Injury	Non-Injury	Total				
17th Street/Lincoln Avenue Intersection	1	35	55	91	Driving Under Influence	2	Rear End	0
							Broadside	0
							Sideswipe	0
							Other	2
					Unsafe Vehicle Operation	33	Rear End	29
							Broadside	0
							Sideswipe	3
							Other	1
					Traffic Signals and Signs	17	Rear End	0
							Broadside	9
							Sideswipe	1
							Other	7
					Other	39	Rear End	1
							Broadside	14
							Sideswipe	7
							Other	17

The largest percentage, 30 of the 101, of the accidents are rear end collisions, followed by broadside, sideswipe, and then other. Since rear end collisions are the reason for almost a third of the accidents, it seems to indicate that sudden interruption of the traffic flow, created by traffic signals and/or the highway-rail crossing, may have had an influence on these types of collisions.

7.7 Boundary of Study Area and Preliminary Environmental Study (PES)

The boundary of the study area and the results of the Draft PES are discussed in Section 8 of this report, Environmental Determination.

8 COMMUNITY INVOLVEMENT

OCTA and the City anticipate several public meetings during the next phase of the project, and these most likely will occur in late 2012 and early 2013.

9 ENVIRONMENTAL DETERMINATION

A Study Area Exhibit was prepared for this project, and it was used to prepare a PES for this PSRE. The Study Area is included as Attachment J, while the PES is included as Attachment K. As documented within the PES, it is anticipated a Categorical Exclusion (CE) will be needed to comply with the National Environmental Protection Act (NEPA) and Caltrans District 12 will serve as the lead agency. For compliance with the California Environmental Quality Act (CEQA) it is anticipated that a Statutory Exemption (SE) will be filed with Orange County, and OCTA will serve as the lead agency.

The following sections summarize the results of the PES:

Environmental Issues

- Noise: A Noise Study Report will be required for this project.
- Natural Environment Study: A Natural Environment Study (NES) will need to be completed for this project; however the results of this study are anticipated to be minor due to the development of the areas adjacent to, and within, the project site, therefore the anticipated document will be a NES-Minimal Impact.
- Cultural Impacts: Cultural Studies will not be required for this project.
- Air Quality Conformity: An Air Quality Report will not be required for this project.
- Hazardous Materials: A Phase 1 Initial Site Assessment will be required for this project.
- Water Quality: A Water Quality Technical Memorandum will be required for this project.
- Floodplain: A Floodplain Evaluation Report will not be required for this project.
- Visual Resources: A Visual Impact Assessment will be required for this project.
- Relocation Impacts: A Relocation Impact Study will be required for this project.
- Land Use and Community Impacts: A Community Impact Assessment Report will be required for this project.
- Permits: It is anticipated both a Regional Water Quality Control Board (RWQCB) Permit and a NPDES Permit will be required for this project.

10 RAILROAD INVOLVEMENT

There are two SCRRA mainline tracks located within the project. OCTA owns the railroad right of way, while SCRRA maintains and operates the Metrolink service. SCRRA is an important stakeholder of the project. AECOM met with SCRRA on August 31, 2011, with Ms. Patricia Watkins. At this meeting, AECOM vowed to work closely with SCRRA for the development of this

project, and to follow up with this commitment. AECOM had a follow-up meeting prior to issuance of the final version of this report. The meeting was held on March 01, 2012.

As Alternative 1C, the recommended alternative, is an undercrossing structure, the two SCRRA mainline tracks will need to be realigned in a temporary shoofly configuration, easterly of the existing tracks, including relocating the existing crossover at CP Lincoln. This work will need to be accomplished by SCRRA forces. Close coordination with SCRRA in the next phases of the project will be required for approval of the shoofly track design, both railroad engineering and railroad signal, for the quantifying of the material requirements, for setting the schedule of this work, and to ensure the interruption to rail service is at a minimum. In addition, a new temporary highway-rail crossing will be required where the shoofly tracks will be crossing the roadway detour road. Again, close coordination with SCRRA will be required for this work.

Upon completion of the construction and as soon as the new bridge is opened to traffic, the existing highway-rail crossing will be retired by SCRRA forces. SCRRA will be responsible for all work within the right-of-way associated with retiring the at-grade crossing, including modifying the railroad signalization.

11 FUNDING

This project will be a priority for OCTA for capturing funding, and this funding could be either Federal, State, or Local, or a combination of each.

12 SCHEDULE

We have included a preliminary schedule for the entire project within this PSRE as Attachment L. As always, this schedule is subject to change as the project evolves, but the following Table 10 gives a summary of the project milestones:

Table 10 - Project Milestone Preliminary Dates

Begin PSRE	June 2011
Complete PSRE	May 2012
Begin Preliminary Engineering/Environmental Document	August 2012
Complete Preliminary Engineering/Environmental Document	March 2014
Begin Final Design and Right of Way Acquisition	March 2014
Complete Final Design and Right of Way Acquisition	March 2016
Begin Construction	December 2016
Complete Construction	July 2018
Complete Project Close-out	December 2018

13 FHWA COORDINATION

FHWA coordination with this project is not required during this phase, but may be required in subsequent phases as the need to apply for federal funding is determined.

14 DISTRICT CONTACT

In the next phase of the project, the PA/ED Phase, Caltrans District 12 will serve as the lead for the NEPA clearance work, and will be an important stakeholder.

15 PROJECT REVIEWS

The three alternatives studied for this report have been reviewed and commented upon by City, SCRRA, and OCTA personnel throughout their development.

16 CONSIDERATIONS REQUIRING DISCUSSSION

16.1 Value Analysis

The estimated project cost, including Right-of-way acquisition, is well over $25 million. Therefore, a formal Value Analysis (VA) will need to be performed during the next (PA/ED) phase of the project.

16.2 Resource Conservation

This project will not affect items, which can be recycled, with the exception of some pavement. Some pavement will be removed, which may be crushed and used as fill material for another project.

17 OTHER CONSIDERATIONS AS APPROPRIATE

17.1 Permits

The potential permits for all alternatives are:

- Orange County General NPDES Permit (SWPPP)
- A Regional Water Quality Control Board (RWQCB) Permit.

Cooperative Agreements and Other Agreements:

- SCRRA Construction and Maintenance Agreement.
- CPUC Order to Construct.

17.2 Involvement with a Navigable Waterway

There is no involvement with a Navigable Waterway within the limits of this project.

17.3 Graffiti Control

The bridge and retaining wall design will include a fractured-rib finish treatment for the abutments, retaining walls, and other vertical surfaces, and this shall be constructed from the finish surface to six (6) feet above the finish surface.

In addition, the columns shall be sprayed with graffiti protection, in accordance with Caltrans specifications.

17.4 Geotechnical Investigation

A Preliminary Geotechnical Information Report is included within this report as Attachment M, which provides preliminary information and recommendations for the improvements. During the next phase of the project, geotechnical investigation, testing, and preparation of the Final Geotechnical Report will occur.

17.5 Quiet Zone

As mentioned previously, the construction of this project would necessitate a detour road northerly of 17th Street from Fairmont Street in the west (ensuring impacts to the Senior Center are minimized) to the eastern limits of the project. At the same time, two shoofly tracks would be constructed easterly of the existing railroad tracks, to include a new, temporary at-grade crossing with the detour road. This temporary at-grade crossing would be constructed per SCRRA Standards and would also need to include treatments to maintain the current Quiet Zone designation through the project area, including either median islands or quad gates.

18 PROJECT PERSONNEL

Mary Toutounchi ..... (714) 560-5883
OCTA
Project Manager/Rail

Jennifer Bergener ..... (714) 560-5462
OCTA
Project Manager/Rail .....

Jason Gabriel, P.E. ..... (714) 647-5664
City of Santa Ana
Project Manager

Juan Diaz, P.E. ..... (626) 820-1137
JMD
Program Manager Consultant

James Faber, P.E. ..... (714) 567-2477
AECOM Technical Services, Inc
Project Manager

Albert Pan. ..... (714) 567-2529
AECOM Technical Services, Inc
Project Engineer

Dr. Mohan Char, P.E. ..... (714) 567-2539
AECOM Technical Services, Inc
Structural Design Leader

John Lower, T.E. ..... (714) 974-3025
Iteris
Traffic Engineering

19 ATTACHMENTS

Attachment A – Highway-Rail Crossing Accident/Incident Reports
City of Santa Ana Traffic Collision History Reports

Attachment B – Ranking Matrix- 10 Pts. Best

Attachment C – Ranking Matrix- Alternatives Direct Comparison (3 Pts. Best)

Attachment D – Alternatives Plan and Profile
Alternatives Bridge General Plan Sheet

Attachment E – Alternatives Preliminary Cost Estimates

Attachment F – Alternatives Preliminary Construction Staging Concepts

Attachment G – Alternatives Right of Way Impacts

Attachment H – Alternatives Drainage Impacts

Attachment I – Alternatives Utility Impacts

Attachment J – Project Study Area

Attachment K – Preliminary Environmental Study (PES)

Attachment L – Project Schedule

Attachment M – Structures Preliminary Geotechnical Report

Attachment N – Traffic Study

Attachment A:

Highway-Rail Crossing Accident/Incident Reports

City of Santa Ana Traffic Collision History Reports

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

Name Of		Alphabetic Code	RR Accident/Incident No.
1. Reporting Railroad	**Southern California Regional Rail Authority**	1a. **SCAX**	1b. **120907**
2. Other Railroad Involved in Train Accident/Incident		2a.	2b.
3. Railroad Responsible for Track Maintenance	**Southern California Regional Rail Authority**	3a. **SCAX**	3b. **120907**

4. U.S. DOT-AAR Grade Crossing ID No.	5. Date of Accident/Incident	6. Time of Accident/Incident
026699P	**12/09/07**	**05:35 PM**

7. Nearest Railroad Station	8. Division	9. County	10. State Abbr.	Code
SANTA ANA	**SYSTEM**	**ORANGE**	**06**	**CA**

11. City *(if in a city)*	12. Highway Name or No.	
SANTA ANA	**17TH STREET**	☑ Public ☐ Private

Highway User Involved

13. Type — A. Auto; B. Truck; C. Truck-trailer; D. Pick-up truck; E. Van; F. Bus; G. School Bus; H. Motorcycle; J. Other Motor Vehicle; K. Pedestrian; M. Other *(specify)* — Code: **A**

14. Vehicle Speed *(est. mph at impact)*: **0**

15. Direction *(geographical)* — 1. North 2. South 3. East 4. West — Code: **2**

16. Position — 1. Stalled on crossing 2. Stopped on Crossing 3. Moving over crossing 4. Trapped — Code: **2**

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? — 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: **4**

Rail Equipment Involved

17. Equipment — 1. Train *(units pulling)*; 2. Train *(units pushing)*; 3. Train *(standing)*; 4. Car(s) *(moving)*; 5. Car(s) *(standing)*; 6. Light loco(s) *(moving)*; 7. Light loco(s) *(standing)*; 8. Other *(specify)*; A. Train pulling- RCL; B. Train pushing- RCL; C. Train standing- RCL — Code: **1**

18. Position of Car Unit in Train: **1**

19. Circumstance — 1. Rail equipment struck highway user 2. Rail equipment struck by highway user — Code: **1**

20b. Was there a hazardous materials release by — 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: **4**

20c. State the name and quantity of the hazardous materials released, if any

21. Temperature *(specify if minus)*: **60** °F

22. Visibility *(single entry)* — 1. Dawn 2. Day 3. Dusk 4. Dark — Code: **4**

23. Weather *(single entry)* — 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: **1**

24. Type of Equipment Consist *(single entry)* — 1. Freight train 2. Passenger train 3. Commuter train 4. Work train 5. Single car 6. Cut of cars 7. Yard/Switching 8. Light loco(s) 9. Main./inspect. car A. Spec. MoW Equip. — Code: **3**

25. Track Type Used by Rail Equipment Involved — 1. Main 2. Yard 3. Siding 4. Industry — Code: **1**

26. Track Number or Name: **MAIN**

27. FRA Track Class	28. Number of Locomotive Units	29. Number of Cars	30. Consist Speed *(Recorded if available)* R. Recorded E. Estimated	Code	31. Time Table Direction 1. North 2. South 3. East 4. West	Code
4	**1**	**5**	**40** mph	**R**		**4**

32. Type of Crossing Warning — 1. Gates 2. Cantilever FLS 3. Standard FLS 4. Wig wags 5. Hwy. traffic signals 6. Audible 7. Crossbucks 8. Stop signs 9. Watchman 10. Flagged by crew 11. Other *(specify)* 12. None

Code(s): **01** **03** **06** **07**

33. Signaled Crossing Warning: **20 sec warn min (1);**

34. Whistle Ban — 1. Yes 2. No 3. Unknown — Code: **2**

35. Location of Warning — 1. Both Sides 2. Side of Vehicle Approach 3. Opposite Side of Vehicle Approach	Code	36. Crossing Warning Interconnected with Highway Signals — 1. Yes 2. No 3. Unknown	Code	37. Crossing Illuminated by Street Lights or Special Lights — 1. Yes 2. No 3. Unknown	Code
	1		**3**		**3**

38. Driver's Age	39. Driver's Gender — 1. Male 2. Female	Code	40. Driver Drove Behind or in Front of Train and Struck or was Struck by Second Train — 1. Yes 2. No 3. Unknown	Code	41. Driver — 1. Drove around or thru the gate 2. Stopped and then proceeded 3. Did not stop 4. Stopped on crossing 5. Other *(specify)*	Code
48		**2**		**2**		**4**

42. Driver Passed Standing Highway Vehicle — 1. Yes 2. No 3. Unknown	Code	43. View of Track Obscured by *(primary obstruction)* — 1. Permanent Structure 2. Standing railroad equipment 3. Passing Train 4. Topography 5. Vegetation 6. Highway Vehicles 7. Other *(specify)* 8. Not Obstructed	Code
	3		**8**

Casualties to:	Killed	Injured	44. Driver was — 1. Killed 2. Injured 3. Uninjured	Code	45. Was Driver in the Vehicle? — 1. Yes 2. No	Code
				3		**1**
46. Highway-Rail Crossing Users	**0**	**0**	47. Highway Vehicle Property Damage *(est. dollar damage)*	**$200**	48. Total Number of Highway-Rail Crossing Users *(include driver)*	**2**
49. Railroad Employees	**0**	**0**	50. Total Number of People on Train *(include passengers and crew)*	**58**	51. Is a Rail Equipment Accident / Incident Report Being Filed — 1. Yes 2. No	Code **2**
52. Passengers on Train	**0**	**0**				

53a. Special Study Block

53b. Special Study Block

54. Narrative Description

TRAIN 707 STRUCK VEHICLE AT 17TH STREET CROSSING. NO REPORTED INJURIES.

55. Typed Name and Title	56. Signature	57. Date

FORM FRA F 6180.57

* NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

Name Of	Alphabetic Code	RR Accident/Incident No.
1. Reporting Railroad: **Amtrak [ATK]**	1a. **ATK**	1b. **096937**
2. Other Railroad Involved in Train Accident/Incident	2a.	2b.
3. Railroad Responsible for Track Maintenance: **Southern California Regional Rail Authority**	3a. **SCAX**	3b. **XXX**

4. U.S. DOT-AAR Grade Crossing ID No.	5. Date of Accident/Incident	6. Time of Accident/Incident
026699P	**05/26/05**	**08:00 PM**

7. Nearest Railroad Station	8. Division	9. County	10. State Abbr.	Code
SANTA ANA	**SWD**	**ORANGE**	**06**	**CA**

11. City *(if in a city)* **SANTA ANA** | 12. Highway Name or No. **17TH STREET** | ☑ Public ☐ Private

Highway User Involved

13. Type — A. Auto, B. Truck, C. Truck-trailer, D. Pick-up truck, E. Van, F. Bus, G. School Bus, H. Motorcycle, J. Other Motor Vehicle, K. Pedestrian, M. Other *(specify)* — Code: **M**

14. Vehicle Speed *(est. mph at impact)*: **5**

15. Direction *(geographical)* — 1. North 2. South 3. East 4. West — Code: **4**

16. Position — 1. Stalled on crossing, 2. Stopped on Crossing, 3. Moving over crossing, 4. Trapped — Code: **3**

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? — 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: **4**

Rail Equipment Involved

17. Equipment — 1. Train *(units pulling)*, 2. Train *(units pushing)*, 3. Train *(standing)*, 4. Car(s) *(moving)*, 5. Car(s) *(standing)*, 6. Light loco(s) *(moving)*, 7. Light loco(s) *(standing)*, 8. Other *(specify)*, A. Train pulling- RCL, B. Train pushing- RCL, C. Train standing- RCL — Code: **1**

18. Position of Car Unit in Train: **1**

19. Circumstance — 1. Rail equipment struck highway user, 2. Rail equipment struck by highway user — Code: **1**

20b. Was there a hazardous materials release by — 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: **4**

20c. State the name and quantity of the hazardous materials released, if any

21. Temperature *(specify if minus)*: **58** °F

22. Visibility *(single entry)* — 1. Dawn 2. Day 3. Dusk 4. Dark — Code: **4**

23. Weather *(single entry)* — 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: **1**

24. Type of Equipment Consist *(single entry)* — 1. Freight train, 2. Passenger train, 3. Commuter train, 4. Work train, 5. Single car, 6. Cut of cars, 7. Yard/Switching, 8. Light loco(s), 9. Main./inspect. car, A. Spec. MoW Equip. — Code: **2**

25. Track Type Used by Rail Equipment Involved — 1. Main 2. Yard 3. Siding 4. Industry — Code: **1**

26. Track Number or Name: **MAIN**

27. FRA Track Class	28. Number of Locomotive Units	29. Number of Cars	30. Consist Speed *(Recorded if available)*	Code	31. Time Table Direction	Code
4	**1**	**6**	R. Recorded / E. Estimated **42** mph	**R**	1. North 2. South 3. East 4. West	**3**

32. Type of Crossing Warning — 1. Gates, 2. Cantilever FLS, 3. Standard FLS, 4. Wig wags, 5. Hwy. traffic signals, 6. Audible, 7. Crossbucks, 8. Stop signs, 9. Watchman, 10. Flagged by crew, 11. Other *(specify)*, 12. None

Code(s): **01** **03** **05** **06**

33. Signaled Crossing Warning: **20 sec warn min (1);**

34. Whistle Ban — 1. Yes 2. No 3. Unknown — Code: **2**

35. Location of Warning — 1. Both Sides, 2. Side of Vehicle Approach, 3. Opposite Side of Vehicle Approach	Code	36. Crossing Warning Interconnected with Highway Signals — 1. Yes 2. No 3. Unknown	Code	37. Crossing Illuminated by Street Lights or Special Lights — 1. Yes 2. No 3. Unknown	Code
	1		**1**		**3**

38. Driver's Age	39. Driver's Gender — 1. Male 2. Female	Code	40. Driver Drove Behind or in Front of Train and Struck or was Struck by Second Train — 1. Yes 2. No 3. Unknown	Code	41. Driver — 1. Drove around or thru the gate, 2. Stopped and then proceeded, 3. Did not stop, 4. Stopped on crossing, 5. Other *(specify)*	Code
30		**1**		**2**		**1**

42. Driver Passed Standing Highway Vehicle — 1. Yes 2. No 3. Unknown — Code: **2**

43. View of Track Obscured by *(primary obstruction)* — 1. Permanent Structure, 2. Standing railroad equipment, 3. Passing Train, 4. Topography, 5. Vegetation, 6. Highway Vehicles, 7. Other *(specify)*, 8. Not Obstructed — Code: **8**

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	**1**	**0**
49. Railroad Employees	**0**	**0**
52. Passengers on Train	**0**	**0**

44. Driver was — 1. Killed 2. Injured 3. Uninjured — Code: **1**

45. Was Driver in the Vehicle? — 1. Yes 2. No — Code: **1**

47. Highway Vehicle Property Damage *(est. dollar damage)*: **$1,000**

48. Total Number of Highway-Rail Crossing Users *(include driver)*: **1**

50. Total Number of People on Train *(include passengers and crew)*: **129**

51. Is a Rail Equipment Accident / Incident Report Being Filed — 1. Yes 2. No — Code: **2**

53a. Special Study Block | 53b. Special Study Block

54. Narrative Description

TRAIN NO.#590 OPERATING WITH LOCOMOTIVE 454 AND 6 CARS STRUCK A PEDESTRIAN ON A BICYCLE AT MP174.7, 17TH STREET CROSSING.

55. Typed Name and Title	56. Signature	57. Date

FORM FRA F 6180.57

* NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

Name Of	Alphabetic Code	RR Accident/Incident No.
1. Reporting Railroad: **Amtrak [ATK]**	1a. **ATK**	1b. **067172**
2. Other Railroad Involved in Train Accident/Incident	2a.	2b. **XXX**
3. Railroad Responsible for Track Maintenance: **Southern California Regional Rail Authority**	3a. **SCAX**	3b. **XXX**

4. U.S. DOT-AAR Grade Crossing ID No.	5. Date of Accident/Incident	6. Time of Accident/Incident
026699P	**03/09/01**	**05:55 PM**

7. Nearest Railroad Station	8. Division	9. County	10. State Abbr.	Code
SANTA ANA	**WSD**	**ORANGE**	**06**	**CA**

11. City *(if in a city)* **SANTA ANA** | 12. Highway Name or No. **17TH STREET** | ☑ Public ☐ Private

Highway User Involved

13. Type — A. Auto, B. Truck, C. Truck-trailer, D. Pick-up truck, E. Van, F. Bus, G. School Bus, H. Motorcycle, J. Other Motor Vehicle, K. Pedestrian, M. Other *(specify)* — Code: **A**

14. Vehicle Speed *(est. mph at impact)*

15. Direction *(geographical)* — 1. North 2. South 3. East 4. West — Code: **2**

16. Position — 1. Stalled on crossing, 2. Stopped on Crossing, 3. Moving over crossing, 4. Trapped — Code: **4**

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? — 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: **4**

Rail Equipment Involved

17. Equipment — 1. Train *(units pulling)*, 2. Train *(units pushing)*, 3. Train *(standing)*, 4. Car(s) *(moving)*, 5. Car(s) *(standing)*, 6. Light loco(s) *(moving)*, 7. Light loco(s) *(standing)*, 8. Other *(specify)*, A. Train pulling- RCL, B. Train pushing- RCL, C. Train standing- RCL — Code: **2**

18. Position of Car Unit in Train: **1**

19. Circumstance — 1. Rail equipment struck highway user, 2. Rail equipment struck by highway user — Code: **1**

20b. Was there a hazardous materials release by — 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: **4**

20c. State the name and quantity of the hazardous materials released, if any

21. Temperature *(specify if minus)* **60** °F

22. Visibility *(single entry)* — 1. Dawn 2. Day 3. Dusk 4. Dark — Code: **3**

23. Weather *(single entry)* — 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: **3**

24. Type of Equipment Consist *(single entry)* — A. Spec. MoW Equip. 1. Freight train 2. Passenger train 3. Commuter train 4. Work train 5. Single car 6. Cut of cars 7. Yard/Switching 8. Light loco(s) 9. Main./inspect. car — Code: **2**

25. Track Type Used by Rail Equipment Involved — 1. Main 2. Yard 3. Siding 4. Industry — Code: **1**

26. Track Number or Name: **MAIN**

27. FRA Track Class	28. Number of Locomotive Units	29. Number of Cars	30. Consist Speed *(Recorded if available)*	Code	31. Time Table Direction	Code
4	**1**	**5**	R. Recorded / E. Estimated **4** mph	**E**	1. North 2. South 3. East 4. West	**3**

32. Type of Crossing Warning — 1. Gates, 2. Cantilever FLS, 3. Standard FLS, 4. Wig wags, 5. Hwy. traffic signals, 6. Audible, 7. Crossbucks, 8. Stop signs, 9. Watchman, 10. Flagged by crew, 11. Other *(specify)*, 12. None

Code(s): **01** **02** **03** **06**

33. Signaled Crossing Warning: **20 sec warn min (1);**

34. Whistle Ban — 1. Yes 2. No 3. Unknown — Code: **2**

35. Location of Warning — 1. Both Sides, 2. Side of Vehicle Approach, 3. Opposite Side of Vehicle Approach — Code: **1**

36. Crossing Warning Interconnected with Highway Signals — 1. Yes 2. No 3. Unknown — Code: **1**

37. Crossing Illuminated by Street Lights or Special Lights — 1. Yes 2. No 3. Unknown — Code: **1**

38. Driver's Age	39. Driver's Gender	Code	40. Driver Drove Behind or in Front of Train and Struck or was Struck by Second Train	Code	41. Driver	Code
45	1. Male 2. Female	**2**	1. Yes 2. No 3. Unknown	**2**	1. Drove around or thru the gate 2. Stopped and then proceeded 3. Did not stop 4. Stopped on crossing 5. Other *(specify)*	**4**

42. Driver Passed Standing Highway Vehicle — 1. Yes 2. No 3. Unknown — Code: **2**

43. View of Track Obscured by *(primary obstruction)* — 1. Permanent Structure 2. Standing railroad equipment 3. Passing Train 4. Topography 5. Vegetation 6. Highway Vehicles 7. Other *(specify)* 8. Not Obstructed — Code: **8**

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	**0**	**0**
49. Railroad Employees	**0**	**0**
52. Passengers on Train	**0**	**0**

44. Driver was — 1. Killed 2. Injured 3. Uninjured — Code: **3**

45. Was Driver in the Vehicle? — 1. Yes 2. No — Code: **2**

47. Highway Vehicle Property Damage *(est. dollar damage)*: **$1,000**

48. Total Number of Highway-Rail Crossing Users *(include driver)*: **0**

50. Total Number of People on Train *(include passengers and crew)*: **390**

51. Is a Rail Equipment Accident / Incident Report Being Filed — 1. Yes 2. No — Code: **2**

53a. Special Study Block

53b. Special Study Block

54. Narrative Description

TRAIN 782 STRUCK AN ABANDONED VEHICLE AT SANTA ANA, CA.

55. Typed Name and Title	56. Signature	57. Date

FORM FRA F 6180.57

* NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

Name Of	Alphabetic Code	RR Accident/Incident No.
1. Reporting Railroad: **Amtrak [ATK]**	1a. **ATK**	1b. **50323WSD01**
2. Other Railroad Involved in Train Accident/Incident	2a.	2b.
3. Railroad Responsible for Track Maintenance: **Southern California Regional Rail Authority**	3a. **SCAX**	3b. **XXX**

4. U.S. DOT-AAR Grade Crossing ID No.	5. Date of Accident/Incident	6. Time of Accident/Incident
026699P	**03/23/95**	**11:40 AM**

7. Nearest Railroad Station	8. Division	9. County	10. State Abbr.	Code
SANTA ANA		**ORANGE**	**06**	**CA**

11. City *(if in a city)* **SANTA ANA** | 12. Highway Name or No. **17TH STREET** | ☑ Public ☐ Private

Highway User Involved

13. Type — A. Auto, B. Truck, C. Truck-trailer, D. Pick-up truck, E. Van, F. Bus, G. School Bus, H. Motorcycle, J. Other Motor Vehicle, K. Pedestrian, M. Other *(specify)* — Code: **A**

14. Vehicle Speed *(est. mph at impact)*: **35**

15. Direction *(geographical)* — 1. North 2. South 3. East 4. West — Code: **2**

16. Position — 1. Stalled on crossing, 2. Stopped on Crossing, 3. Moving over crossing, 4. Trapped — Code: **3**

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? — 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: **4**

Rail Equipment Involved

17. Equipment — 1. Train *(units pulling)*, 2. Train *(units pushing)*, 3. Train *(standing)*, 4. Car(s) *(moving)*, 5. Car(s) *(standing)*, 6. Light loco(s) *(moving)*, 7. Light loco(s) *(standing)*, 8. Other *(specify)*, A. Train pulling- RCL, B. Train pushing- RCL, C. Train standing- RCL — Code: **2**

18. Position of Car Unit in Train: **2**

19. Circumstance — 1. Rail equipment struck highway user, 2. Rail equipment struck by highway user — Code: **2**

20b. Was there a hazardous materials release by — 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code:

20c. State the name and quantity of the hazardous materials released, if any

21. Temperature *(specify if minus)*: **65** °F

22. Visibility *(single entry)* — 1. Dawn 2. Day 3. Dusk 4. Dark — Code: **2**

23. Weather *(single entry)* — 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: **1**

24. Type of Equipment Consist *(single entry)* — 1. Freight train, 2. Passenger train, 3. Commuter train, 4. Work train, 5. Single car, 6. Cut of cars, 7. Yard/Switching, 8. Light loco(s), 9. Main./inspect. car, A. Spec. MoW Equip. — Code: **2**

25. Track Type Used by Rail Equipment Involved — 1. Main 2. Yard 3. Siding 4. Industry — Code: **1**

26. Track Number or Name: **MAIN**

27. FRA Track Class	28. Number of Locomotive Units	29. Number of Cars	30. Consist Speed *(Recorded if available)* R. Recorded E. Estimated	Code	31. Time Table Direction 1. North 2. South 3. East 4. West	Code
3	**1**	**6**	**50** mph	**E**		**3**

32. Type of Crossing Warning — 1. Gates, 2. Cantilever FLS, 3. Standard FLS, 4. Wig wags, 5. Hwy. traffic signals, 6. Audible, 7. Crossbucks, 8. Stop signs, 9. Watchman, 10. Flagged by crew, 11. Other *(specify)*, 12. None

Code(s): **01** **03** **06** **07**

33. Signaled Crossing Warning: **20 sec warn min (1);**

34. Whistle Ban — 1. Yes 2. No 3. Unknown — Code:

35. Location of Warning — 1. Both Sides, 2. Side of Vehicle Approach, 3. Opposite Side of Vehicle Approach — Code: **1**

36. Crossing Warning Interconnected with Highway Signals — 1. Yes 2. No 3. Unknown — Code: **3**

37. Crossing Illuminated by Street Lights or Special Lights — 1. Yes 2. No 3. Unknown — Code: **3**

38. Driver's Age

39. Driver's Gender — 1. Male, 2. Female — Code:

40. Driver Drove Behind or in Front of Train and Struck or was Struck by Second Train — 1. Yes 2. No 3. Unknown — Code: **2**

41. Driver — 1. Drove around or thru the gate, 2. Stopped and then proceeded, 3. Did not stop, 4. Stopped on crossing, 5. Other *(specify)* — Code: **1**

42. Driver Passed Standing Highway Vehicle — 1. Yes 2. No 3. Unknown — Code: **3**

43. View of Track Obscured by *(primary obstruction)* — 1. Permanent Structure, 2. Standing railroad equipment, 3. Passing Train, 4. Topography, 5. Vegetation, 6. Highway Vehicles, 7. Other *(specify)*, 8. Not Obstructed — Code: **8**

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	**0**	**0**
49. Railroad Employees	**0**	**0**
52. Passengers on Train	**0**	**0**

44. Driver was — 1. Killed 2. Injured 3. Uninjured — Code: **3**

45. Was Driver in the Vehicle? — 1. Yes 2. No — Code: **1**

47. Highway Vehicle Property Damage *(est. dollar damage)*: **$1,500**

48. Total Number of Highway-Rail Crossing Users *(include driver)*: **0**

50. Total Number of People on Train *(include passengers and crew)*:

51. Is a Rail Equipment Accident / Incident Report Being Filed — 1. Yes 2. No — Code: **2**

53a. Special Study Block | 53b. Special Study Block

54. Narrative Description

55. Typed Name and Title	56. Signature	57. Date

FORM FRA F 6180.57

* NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

Name Of		Alphabetic Code	RR Accident/Incident No.
1. Reporting Railroad	Amtrak [ATK]	1a. ATK	1b. 11112WSDAA
2. Other Railroad Involved in Train Accident/Incident		2a.	2b.
3. Railroad Responsible for Track Maintenance	Atchison, Topeka & Santa Fe Rwy Co. [ATSF]	3a. ATSF	3b. XXX

4. U.S. DOT-AAR Grade Crossing ID No.	5. Date of Accident/Incident	6. Time of Accident/Incident
026699P	11/12/91	05:44 PM

7. Nearest Railroad Station	8. Division	9. County	10. State Abbr.	Code
SANTA ANA		ORANGE	06	CA

11. City *(if in a city)*	12. Highway Name or No.	
SANTA ANA	17TH STREET	☑ Public ☐ Private

Highway User Involved

13. Type — A. Auto, B. Truck, C. Truck-trailer, D. Pick-up truck, E. Van, F. Bus, G. School Bus, H. Motorcycle, J. Other Motor Vehicle, K. Pedestrian, M. Other *(specify)* — Code: **A**

14. Vehicle Speed *(est. mph at impact)*: **0**

15. Direction *(geographical)* — 1. North 2. South 3. East 4. West — Code: **1**

16. Position — 1. Stalled on crossing, 2. Stopped on Crossing, 3. Moving over crossing, 4. Trapped — Code: **2**

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? — 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: **4**

Rail Equipment Involved

17. Equipment — 1. Train *(units pulling)*, 2. Train *(units pushing)*, 3. Train *(standing)*, 4. Car(s) *(moving)*, 5. Car(s) *(standing)*, 6. Light loco(s) *(moving)*, 7. Light loco(s) *(standing)*, 8. Other *(specify)*, A. Train pulling- RCL, B. Train pushing- RCL, C. Train standing- RCL — Code: **2**

18. Position of Car Unit in Train: **1**

19. Circumstance — 1. Rail equipment struck highway user, 2. Rail equipment struck by highway user — Code: **1**

20b. Was there a hazardous materials release by — 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code:

20c. State the name and quantity of the hazardous materials released, if any

21. Temperature *(specify if minus)*: **75** °F

22. Visibility *(single entry)* — 1. Dawn 2. Day 3. Dusk 4. Dark — Code: **4**

23. Weather *(single entry)* — 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: **1**

24. Type of Equipment Consist *(single entry)* — 1. Freight train, 2. Passenger train, 3. Commuter train, 4. Work train, 5. Single car, 6. Cut of cars, 7. Yard/Switching, 8. Light loco(s), 9. Main./inspect. car, A. Spec. MoW Equip. — Code: **2**

25. Track Type Used by Rail Equipment Involved — 1. Main 2. Yard 3. Siding 4. Industry — Code: **1**

26. Track Number or Name: **SINGLE MAIN TRACK**

27. FRA Track Class	28. Number of Locomotive Units	29. Number of Cars	30. Consist Speed *(Recorded if available)*	Code	31. Time Table Direction	Code
5	1	7	R. Recorded / E. Estimated **55** mph	E	1. North 2. South 3. East 4. West	3

32. Type of Crossing Warning — 1. Gates, 2. Cantilever FLS, 3. Standard FLS, 4. Wig wags, 5. Hwy. traffic signals, 6. Audible, 7. Crossbucks, 8. Stop signs, 9. Watchman, 10. Flagged by crew, 11. Other *(specify)*, 12. None — Code(s): **01**

33. Signaled Crossing Warning: **20 sec warn min (1);**

34. Whistle Ban — 1. Yes 2. No 3. Unknown — Code:

35. Location of Warning — 1. Both Sides, 2. Side of Vehicle Approach, 3. Opposite Side of Vehicle Approach — Code: **1**

36. Crossing Warning Interconnected with Highway Signals — 1. Yes 2. No 3. Unknown — Code: **3**

37. Crossing Illuminated by Street Lights or Special Lights — 1. Yes 2. No 3. Unknown — Code: **1**

38. Driver's Age:

39. Driver's Gender — 1. Male, 2. Female — Code:

40. Driver Drove Behind or in Front of Train and Struck or was Struck by Second Train — 1. Yes 2. No 3. Unknown — Code: **2**

41. Driver — 1. Drove around or thru the gate, 2. Stopped and then proceeded, 3. Did not stop, 4. Stopped on crossing, 5. Other *(specify)* — Code: **4**

42. Driver Passed Standing Highway Vehicle — 1. Yes 2. No 3. Unknown — Code: **2**

43. View of Track Obscured by *(primary obstruction)* — 1. Permanent Structure, 2. Standing railroad equipment, 3. Passing Train, 4. Topography, 5. Vegetation, 6. Highway Vehicles, 7. Other *(specify)*, 8. Not Obstructed — Code: **8**

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	0	0
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was — 1. Killed 2. Injured 3. Uninjured — Code: **3**

45. Was Driver in the Vehicle? — 1. Yes 2. No — Code: **1**

47. Highway Vehicle Property Damage *(est. dollar damage)*: **$2,000**

48. Total Number of Highway-Rail Crossing Users *(include driver)*: **1**

50. Total Number of People on Train *(include passengers and crew)*:

51. Is a Rail Equipment Accident / Incident Report Being Filed — 1. Yes 2. No — Code: **2**

53a. Special Study Block

53b. Special Study Block

54. Narrative Description

55. Typed Name and Title	56. Signature	57. Date

FORM FRA F 6180.57

* NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

Name Of		Alphabetic Code	RR Accident/Incident No.
1. Reporting Railroad	Atchison, Topeka & Santa Fe Rwy Co. [ATSF]	1a. ATSF	1b. 311184201
2. Other Railroad Involved in Train Accident/Incident	Amtrak [ATK]	2a. ATK	2b. XXX
3. Railroad Responsible for Track Maintenance	Atchison, Topeka & Santa Fe Rwy Co. [ATSF]	3a. ATSF	3b. 311184201

4. U.S. DOT-AAR Grade Crossing ID No.	5. Date of Accident/Incident	6. Time of Accident/Incident
026699P	11/19/84	02:55 PM

7. Nearest Railroad Station	8. Division	9. County	10. State Abbr.	Code
SANTA ANA		ORANGE	06	CA

11. City *(if in a city)* SANTA ANA | 12. Highway Name or No. 17TH ST | ☑ Public ☐ Private

Highway User Involved

13. Type — A. Auto, B. Truck, C. Truck-trailer, D. Pick-up truck, E. Van, F. Bus, G. School Bus, H. Motorcycle, J. Other Motor Vehicle, K. Pedestrian, M. Other *(specify)* — Code: C

14. Vehicle Speed *(est. mph at impact)*: 0

15. Direction *(geographical)* — 1. North 2. South 3. East 4. West — Code:

16. Position — 1. Stalled on crossing, 2. Stopped on Crossing, 3. Moving over crossing, 4. Trapped — Code: 2

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? — 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

Rail Equipment Involved

17. Equipment — 1. Train *(units pulling)*, 2. Train *(units pushing)*, 3. Train *(standing)*, 4. Car(s) *(moving)*, 5. Car(s) *(standing)*, 6. Light loco(s) *(moving)*, 7. Light loco(s) *(standing)*, 8. Other *(specify)*, A. Train pulling- RCL, B. Train pushing- RCL, C. Train standing- RCL — Code: 1

18. Position of Car Unit in Train: 1

19. Circumstance — 1. Rail equipment struck highway user, 2. Rail equipment struck by highway user — Code: 1

20b. Was there a hazardous materials release by — 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code:

20c. State the name and quantity of the hazardous materials released, if any

21. Temperature *(specify if minus)*: 70 °F

22. Visibility *(single entry)* — 1. Dawn 2. Day 3. Dusk 4. Dark — Code: 2

23. Weather *(single entry)* — 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: 1

24. Type of Equipment Consist *(single entry)* — 1. Freight train, 2. Passenger train, 3. Commuter train, 4. Work train, 5. Single car, 6. Cut of cars, 7. Yard/Switching, 8. Light loco(s), 9. Main./inspect. car, A. Spec. MoW Equip. — Code: 2

25. Track Type Used by Rail Equipment Involved — 1. Main 2. Yard 3. Siding 4. Industry — Code: 1

26. Track Number or Name: MAIN

27. FRA Track Class	28. Number of Locomotive Units	29. Number of Cars	30. Consist Speed *(Recorded if available)* — R. Recorded, E. Estimated	Code	31. Time Table Direction — 1. North 2. South 3. East 4. West	Code
3	1	4	E. 45 mph	E	4	

32. Type of Crossing Warning — 1. Gates, 2. Cantilever FLS, 3. Standard FLS, 4. Wig wags, 5. Hwy. traffic signals, 6. Audible, 7. Crossbucks, 8. Stop signs, 9. Watchman, 10. Flagged by crew, 11. Other *(specify)*, 12. None

Code(s): 01 03

33. Signaled Crossing Warning: 20 sec warn min (1);

34. Whistle Ban — 1. Yes 2. No 3. Unknown — Code:

35. Location of Warning — 1. Both Sides, 2. Side of Vehicle Approach, 3. Opposite Side of Vehicle Approach — Code: 1

36. Crossing Warning Interconnected with Highway Signals — 1. Yes 2. No 3. Unknown — Code: 1

37. Crossing Illuminated by Street Lights or Special Lights — 1. Yes 2. No 3. Unknown — Code: 3

38. Driver's Age:

39. Driver's Gender — 1. Male, 2. Female — Code:

40. Driver Drove Behind or in Front of Train and Struck or was Struck by Second Train — 1. Yes 2. No 3. Unknown — Code: 2

41. Driver — 1. Drove around or thru the gate, 2. Stopped and then proceeded, 3. Did not stop, 4. Stopped on crossing, 5. Other *(specify)* — Code: 4

42. Driver Passed Standing Highway Vehicle — 1. Yes 2. No 3. Unknown — Code: 2

43. View of Track Obscured by *(primary obstruction)* — 1. Permanent Structure, 2. Standing railroad equipment, 3. Passing Train, 4. Topography, 5. Vegetation, 6. Highway Vehicles, 7. Other *(specify)*, 8. Not Obstructed — Code: 8

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	0	0
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was — 1. Killed 2. Injured 3. Uninjured — Code: 3

45. Was Driver in the Vehicle? — 1. Yes 2. No — Code: 2

47. Highway Vehicle Property Damage *(est. dollar damage)*: $400

48. Total Number of Highway-Rail Crossing Users *(include driver)*: 1

50. Total Number of People on Train *(include passengers and crew)*:

51. Is a Rail Equipment Accident / Incident Report Being Filed — 1. Yes 2. No — Code: 2

53a. Special Study Block | 53b. Special Study Block

54. Narrative Description

55. Typed Name and Title	56. Signature	57. Date

FORM FRA F 6180.57

* NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

Name Of		Alphabetic Code	RR Accident/Incident No.
1. Reporting Railroad	**Atchison, Topeka & Santa Fe Rwy Co. [ATSF]**	1a. **ATSF**	1b. **31108203**
2. Other Railroad Involved in Train Accident/Incident	**Amtrak [ATK]**	2a. **ATK**	2b. **101678A**
3. Railroad Responsible for Track Maintenance	**Atchison, Topeka & Santa Fe Rwy Co. [ATSF]**	3a. **ATSF**	3b. **31108203**

4. U.S. DOT-AAR Grade Crossing ID No.	5. Date of Accident/Incident	6. Time of Accident/Incident
026699P	**10/16/78**	**06:12 PM**

7. Nearest Railroad Station	8. Division	9. County	10. State Abbr.	Code
SANTA ANA		**ORANGE**	**06**	**CA**

11. City *(if in a city)* **SANTA ANA** | 12. Highway Name or No. **SANTA CLARA** | ☑ Public ☐ Private

Highway User Involved

13. Type — A. Auto, B. Truck, C. Truck-trailer, D. Pick-up truck, E. Van, F. Bus, G. School Bus, H. Motorcycle, J. Other Motor Vehicle, K. Pedestrian, M. Other *(specify)* — Code: **A**

14. Vehicle Speed *(est. mph at impact)*: **0**

15. Direction *(geographical)* — 1. North 2. South 3. East 4. West — Code: **2**

16. Position — 1. Stalled on crossing, 2. Stopped on Crossing, 3. Moving over crossing, 4. Trapped — Code: **2**

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? — 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: **4**

Rail Equipment Involved

17. Equipment — 1. Train *(units pulling)*, 2. Train *(units pushing)*, 3. Train *(standing)*, 4. Car(s) *(moving)*, 5. Car(s) *(standing)*, 6. Light loco(s) *(moving)*, 7. Light loco(s) *(standing)*, 8. Other *(specify)*, A. Train pulling- RCL, B. Train pushing- RCL, C. Train standing- RCL — Code: **1**

18. Position of Car Unit in Train: **1**

19. Circumstance — 1. Rail equipment struck highway user, 2. Rail equipment struck by highway user — Code: **1**

20b. Was there a hazardous materials release by — 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code:

20c. State the name and quantity of the hazardous materials released, if any

21. Temperature *(specify if minus)*: **65** °F

22. Visibility *(single entry)* — 1. Dawn 2. Day 3. Dusk 4. Dark — Code: **3**

23. Weather *(single entry)* — 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: **1**

24. Type of Equipment Consist *(single entry)* — 1. Freight train, 2. Passenger train, 3. Commuter train, 4. Work train, 5. Single car, 6. Cut of cars, 7. Yard/Switching, 8. Light loco(s), 9. Main./inspect. car, A. Spec. MoW Equip. — Code: **2**

25. Track Type Used by Rail Equipment Involved — 1. Main 2. Yard 3. Siding 4. Industry — Code: **1**

26. Track Number or Name: **MAIN TRACK**

27. FRA Track Class	28. Number of Locomotive Units	29. Number of Cars	30. Consist Speed *(Recorded if available)* — R. Recorded, E. Estimated	Code	31. Time Table Direction — 1. North 2. South 3. East 4. West	Code
4	**1**	**4**	**45** mph	**E**		**4**

32. Type of Crossing Warning — 1. Gates, 2. Cantilever FLS, 3. Standard FLS, 4. Wig wags, 5. Hwy. traffic signals, 6. Audible, 7. Crossbucks, 8. Stop signs, 9. Watchman, 10. Flagged by crew, 11. Other *(specify)*, 12. None

Code(s): **01** **08**

33. Signaled Crossing Warning: **20 sec warn min (1);**

34. Whistle Ban — 1. Yes 2. No 3. Unknown — Code:

35. Location of Warning — 1. Both Sides, 2. Side of Vehicle Approach, 3. Opposite Side of Vehicle Approach — Code: **1**

36. Crossing Warning Interconnected with Highway Signals — 1. Yes 2. No 3. Unknown — Code: **2**

37. Crossing Illuminated by Street Lights or Special Lights — 1. Yes 2. No 3. Unknown — Code: **1**

38. Driver's Age:

39. Driver's Gender — 1. Male, 2. Female — Code:

40. Driver Drove Behind or in Front of Train and Struck or was Struck by Second Train — 1. Yes 2. No 3. Unknown — Code: **2**

41. Driver — 1. Drove around or thru the gate, 2. Stopped and then proceeded, 3. Did not stop, 4. Stopped on crossing, 5. Other *(specify)* — Code: **4**

42. Driver Passed Standing Highway Vehicle — 1. Yes 2. No 3. Unknown — Code: **2**

43. View of Track Obscured by *(primary obstruction)* — 1. Permanent Structure, 2. Standing railroad equipment, 3. Passing Train, 4. Topography, 5. Vegetation, 6. Highway Vehicles, 7. Other *(specify)*, 8. Not Obstructed — Code: **8**

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	**0**	**0**
49. Railroad Employees	**0**	**0**
52. Passengers on Train	**0**	**0**

44. Driver was — 1. Killed 2. Injured 3. Uninjured — Code: **3**

45. Was Driver in the Vehicle? — 1. Yes 2. No — Code: **2**

47. Highway Vehicle Property Damage *(est. dollar damage)*: **$1,000**

48. Total Number of Highway-Rail Crossing Users *(include driver)*: **0**

50. Total Number of People on Train *(include passengers and crew)*:

51. Is a Rail Equipment Accident / Incident Report Being Filed — 1. Yes 2. No — Code: **2**

53a. Special Study Block | 53b. Special Study Block

54. Narrative Description

55. Typed Name and Title	56. Signature	57. Date

FORM FRA F 6180.57

* NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

Name Of		Alphabetic Code	RR Accident/Incident No.
1. Reporting Railroad	Amtrak [ATK]	1a. ATK	1b. 101678A
2. Other Railroad Involved in Train Accident/Incident	Atchison, Topeka & Santa Fe Rwy Co. [ATSF]	2a. ATSF	2b. 31108203
3. Railroad Responsible for Track Maintenance	Atchison, Topeka & Santa Fe Rwy Co. [ATSF]	3a. ATSF	3b. 31108203

4. U.S. DOT-AAR Grade Crossing ID No.	5. Date of Accident/Incident	6. Time of Accident/Incident
026699P	10/16/78	06:13 PM

7. Nearest Railroad Station	8. Division	9. County	10. State Abbr.	Code
SANTA ANNA			06	CA

11. City *(if in a city)*	12. Highway Name or No.	
SANTA ANNA	ASPEN & LINCOLN ST	☑ Public ☐ Private

Highway User Involved

13. Type — Code: A
A. Auto B. Truck C. Truck-trailer D. Pick-up truck E. Van F. Bus G. School Bus H. Motorcycle J. Other Motor Vehicle K. Pedestrian M. Other *(specify)*

14. Vehicle Speed *(est. mph at impact)*: 0

15. Direction *(geographical)* — Code: 2
1. North 2. South 3. East 4. West

16. Position — Code: 1
1. Stalled on crossing 2. Stopped on Crossing 3. Moving over crossing 4. Trapped

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? — Code: 4
1. Highway User 2. Rail Equipment 3. Both 4. Neither

Rail Equipment Involved

17. Equipment — Code: 1
1. Train *(units pulling)* 2. Train *(units pushing)* 3. Train *(standing)* 4. Car(s) *(moving)* 5. Car(s) *(standing)* 6. Light loco(s) *(moving)* 7. Light loco(s) *(standing)* 8. Other *(specify)* A. Train pulling- RCL B. Train pushing- RCL C. Train standing- RCL

18. Position of Car Unit in Train: 1

19. Circumstance — Code: 1
1. Rail equipment struck highway user 2. Rail equipment struck by highway user

20b. Was there a hazardous materials release by — Code:
1. Highway User 2. Rail Equipment 3. Both 4. Neither

20c. State the name and quantity of the hazardous materials released, if any

21. Temperature *(specify if minus)*: 65 °F

22. Visibility *(single entry)* — Code: 3
1. Dawn 2. Day 3. Dusk 4. Dark

23. Weather *(single entry)* — Code: 1
1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow

24. Type of Equipment Consist *(single entry)* — Code: 2
1. Freight train 2. Passenger train 3. Commuter train 4. Work train 5. Single car 6. Cut of cars 7. Yard/Switching 8. Light loco(s) 9. Main./inspect. car A. Spec. MoW Equip.

25. Track Type Used by Rail Equipment Involved — Code: 1
1. Main 2. Yard 3. Siding 4. Industry

26. Track Number or Name: MAIN

27. FRA Track Class: 4

28. Number of Locomotive Units: 1

29. Number of Cars: 4

30. Consist Speed *(Recorded if available)* — Code: E
R. Recorded E. Estimated: 40 mph

31. Time Table Direction — Code: 4
1. North 2. South 3. East 4. West

32. Type of Crossing Warning — Code(s): 01 03 08
1. Gates 2. Cantilever FLS 3. Standard FLS 4. Wig wags 5. Hwy. traffic signals 6. Audible 7. Crossbucks 8. Stop signs 9. Watchman 10. Flagged by crew 11. Other *(specify)* 12. None

33. Signaled Crossing Warning: 20 sec warn min (1);

34. Whistle Ban — Code:
1. Yes 2. No 3. Unknown

35. Location of Warning — Code: 1
1. Both Sides 2. Side of Vehicle Approach 3. Opposite Side of Vehicle Approach

36. Crossing Warning Interconnected with Highway Signals — Code: 2
1. Yes 2. No 3. Unknown

37. Crossing Illuminated by Street Lights or Special Lights — Code: 1
1. Yes 2. No 3. Unknown

38. Driver's Age:

39. Driver's Gender — Code:
1. Male 2. Female

40. Driver Drove Behind or in Front of Train and Struck or was Struck by Second Train — Code: 2
1. Yes 2. No 3. Unknown

41. Driver — Code: 4
1. Drove around or thru the gate 2. Stopped and then proceeded 3. Did not stop 4. Stopped on crossing 5. Other *(specify)*

42. Driver Passed Standing Highway Vehicle — Code: 2
1. Yes 2. No 3. Unknown

43. View of Track Obscured by *(primary obstruction)* — Code: 8
1. Permanent Structure 2. Standing railroad equipment 3. Passing Train 4. Topography 5. Vegetation 6. Highway Vehicles 7. Other *(specify)* 8. Not Obstructed

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	0	0
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was — Code: 3
1. Killed 2. Injured 3. Uninjured

45. Was Driver in the Vehicle? — Code: 2
1. Yes 2. No

47. Highway Vehicle Property Damage *(est. dollar damage)*: $1,000

48. Total Number of Highway-Rail Crossing Users *(include driver)*: 1

50. Total Number of People on Train *(include passengers and crew)*:

51. Is a Rail Equipment Accident / Incident Report Being Filed — Code: 2
1. Yes 2. No

53a. Special Study Block

53b. Special Study Block

54. Narrative Description

55. Typed Name and Title

56. Signature

57. Date

FORM FRA F 6180.57

* NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

City of Santa Ana
Traffic Engineering Department

Traffic Collision History Report
Midblock Collisions

Arterial: 17TH STREET
Limit 1: LINCOLN AVENUE
Limit 2: GRAND AVENUE

Total Number of Collisions: 91
Date Range Reported: 03/01/2001 - 02/28/2011

Report No.	Date Time	Dist/Dir	Location	Type of Collision	Motor Veh. Involved With	DOT1	MPC 1	DOT2	MPC 2	PCF	# Inj	# Kld
01-10535	3/9/01 17:54	57' East of	17th Street/Lincoln Avenue	Broadside	Train	West	Stopped In Road	South	Proceeding Straight	Other Hazardous Movement	0	0
01-11344	3/14/01 17:00	0' In Int.	17th Street/Lincoln Avenue	Broadside	Other Motor Vehicle	North	Proceeding Straight	West	Proceeding Straight	Traffic Signals and Signs	2	0
01-17377	4/21/01 11:35	0' In Int.	17th Street/Lincoln Avenue	Sideswipe	Other Motor Vehicle	South	Making Left Turn	East	Proceeding Straight	Auto R/W Violation	0	0
01-21048	5/14/01 09:39	37' West of	17th Street/Lincoln Avenue	Sideswipe	Bicycle	West	Making Right Turn	West	Proceeding Straight	Improper Turning	1	0
01-32096	7/20/01 10:48	5' East of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	West	Proceeding Straight	West	Making Right Turn	Unsafe Speed	0	0
02-02153	1/14/02 10:41	80' East of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	West	Proceeding Straight	West	Stopped In Road	Unsafe Speed	0	0
02-11768	3/13/02 07:55	0' In Int.	Lincoln Avenue/17th Street	Broadside	Other Motor Vehicle	South	Proceeding Straight	East	Proceeding Straight	Unknown	0	0
02-11791	3/13/02 10:01	0' In Int.	17th Street/Lincoln Avenue	Head-On	Other Motor Vehicle	East	Making Left Turn	West	Proceeding Straight	Auto R/W Violation	1	0
02-16739	4/15/02 07:51	0' In Int.	17th Street/Lincoln Avenue	Broadside	Other Motor Vehicle	South	Stopped In Road	East	Proceeding Straight	Traffic Signals and Signs	0	0
02-25698	6/10/02 13:05	300' West of	17th Street/Grand Avenue	Broadside	Other Motor Vehicle	East	Not Stated	East	Proceeding Straight	Improper Turning	0	0
02-30796	7/14/02 00:56	380' West of	17th Street/Grand Avenue	Hit Object	Fixed Object	East	Making Left Turn			Improper Turning	0	0

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02-31042	7/15/02 15:15	0' In Int.	17th Street/Lincoln Avenue	Broadside	Bicycle	West	Proceeding Straight	North	Making Right Turn	Wrong Side of Road	1	0
02-52669	12/1/02 17:46	0' In Int.	17th Street/Lincoln Avenue	Vehicle - Pedestrian	Pedestrian	West	Making Right Turn	West	Proceeding Straight	Ped R/W Violation	1	0
02-55489	12/19/02 18:00	302' West of	17th Street/Grand Avenue	Vehicle - Pedestrian	Pedestrian	South	Making Right Turn	East		Improper Turning	1	0
03-01704	1/10/03 16:25	108' East of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	West	Proceeding Straight	West	Stopped In Road	Unsafe Speed	0	0
03-08297	2/19/03 09:10	0' In Int.	17th Street/Lincoln Avenue	Broadside	Bicycle	West	Traveling Wrong Way	North	Making Right Turn	Wrong Side of Road	0	0
03-11658	3/13/03 16:59	75' East of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	West	Proceeding Straight	West	Stopped In Road	Unsafe Speed	1	0
03-25235	6/7/03 16:56	33' East of	17th Street/Lincoln Avenue	Head-On	Other Object	West	Proceeding Straight			Traffic Signals and Signs	0	0
03-26930	6/18/03 13:20	300' West of	17th Street/Grand Avenue	Broadside	Other Motor Vehicle	West	Proceeding Straight	South	Entering Traffic	Auto R/W Violation	0	0
03-28770	6/30/03 16:19	100' East of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	West	Proceeding Straight	West	Stopped In Road	Unsafe Speed	1	0
03-42255	9/26/03 08:55	0' In Int.	17th Street/Lincoln Avenue	Not Stated	Not Stated	South	Proceeding Straight	West	Proceeding Straight	Other Than Driver or Ped	0	0
03-42596	9/26/03 18:00	0' In Int.	17th Street/Lincoln Avenue	Head-On	Other Motor Vehicle	North	Making Right Turn	East	Proceeding Straight	Improper Turning	1	0

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03-43295	10/3/03 07:28	6' N/S	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	East	Proceeding Straight	East	Stopped In Road	Unsafe Speed	2	0
03-49497	11/12/03 11:10	30' West of	17th Street/Lincoln Avenue	Rear-End	Motor Vehicle on Other Roadway	East	Proceeding Straight	East	Making Right Turn	Unsafe Speed	0	0
03-49575	11/12/03 20:50	75' East of	17th Street/Lincoln Avenue	Sideswipe	Other Motor Vehicle	East	Changing Lanes	East	Proceeding Straight	Unsafe Lane Change	0	0
03-49925	11/15/03 11:20	78' East of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	West	Proceeding Straight	West	Stopped In Road	Unsafe Speed	0	0
03-50015	11/16/03 00:10	100' West of	17th Street/Grand Avenue	Hit Object	Fixed Object	West	Making Left Turn			Driving Under Influence	0	0
04-14924	4/7/04 15:41	215' West of	17th Street/Grand Avenue	Broadside	Other Motor Vehicle	North	Making Right Turn	West	Proceeding Straight	Improper Turning	0	0
04-29589	7/10/04 23:11	0' In Int.	17th Street/Lincoln Avenue	Broadside	Other Motor Vehicle	West	Proceeding Straight	North	Proceeding Straight	Traffic Signals and Signs	0	0
04-33714	8/7/04 12:08	0' In Int.	17th Street/Lincoln Avenue	Hit Object	Fixed Object	West	Proceeding Straight			Traffic Signals and Signs	0	0
04-34936	8/15/04 13:21	0' In Int.	17th Street/Lincoln Avenue	Sideswipe	Other Motor Vehicle	East	Changing Lanes	East	Changing Lanes	Unknown	0	0
04-53148	12/10/04 17:40	5' West of	17th Street/Lincoln Avenue	Broadside	Other Motor Vehicle	West	Making Left Turn	South	Proceeding Straight	Auto R/W Violation	2	0
05-07520	2/17/05 15:46	0' In Int.	17th Street/Lincoln Avenue	Broadside	Other Motor Vehicle	West	Proceeding Straight	North	Making Left Turn	Unknown	0	0

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05-11951	3/17/05 15:18	0' In Int.	17th Street/Lincoln Avenue	Broadside	Other Motor Vehicle	West	Proceeding Straight	South	Proceeding Straight	Traffic Signals and Signs	1	0
05-18530	4/27/05 17:03	0' In Int.	17th Street/Lincoln Avenue	Broadside	Other Motor Vehicle	East	Proceeding Straight	South	Making Left Turn	Traffic Signals and Signs	0	0
05-23298	5/26/05 20:33	53' E/E	17th Street/Lincoln Avenue	Broadside	Train	West	Proceeding Straight	South	Proceeding Straight	Traffic Signals and Signs	0	1
05-39088	9/9/05 14:57	25' East of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	West	Slowing/Stopping	West	Slowing/Stopping	Unsafe Speed	1	0
05-47191	10/31/05 11:05	0' In Int.	17th Street/Lincoln Avenue	Broadside	Other Motor Vehicle	North	Proceeding Straight	East	Proceeding Straight	Unknown	2	0
05-50608	11/21/05 18:13	0' In Int.	Lincoln Avenue/17th Street	Rear-End	Other Motor Vehicle	West	Proceeding Straight	West	Stopped In Road	Unsafe Speed	3	0
05-52171	12/2/05 21:24	0' In Int.	17th Street/Lincoln Avenue	Vehicle - Pedestrian	Pedestrian	West	Proceeding Straight	North	Not Applicable - Ped	Traffic Signals and Signs	2	0
05-55144	12/24/05 09:50	160' West of	17th Street/Grand Avenue	Sideswipe	Other Motor Vehicle	West	Making Right Turn	West	Proceeding Straight	Improper Turning	0	0
06-04925	2/3/06 16:20	575' West of	17th Street/Grand Avenue	Broadside	Other Motor Vehicle	North	Making Left Turn	West	Proceeding Straight	Auto R/W Violation	2	0
06-14927	4/14/06 17:45	45' East of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	West	Stopped In Road	West	Stopped In Road	Unsafe Speed	3	0
06-27141	7/5/06 15:55	0' In Int.	Lincoln Avenue/17th Street	Vehicle - Pedestrian	Pedestrian	North	Making Right Turn	West	Proceeding Straight	Traffic Signals and Signs	1	0

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06-32303	8/11/06 20:18	84' West of	17th Street/Grand Avenue	Rear-End	Other Motor Vehicle	West	Proceeding Straight	West	Making Right Turn	Unsafe Speed	0	0
06-40762	10/12/06 18:01	20' East of	17th Street/Lincoln Avenue	Hit Object	Fixed Object	West	Stopped In Road			Traffic Signals and Signs	0	0
07-05524	2/9/07 14:20	400' West of	17th Street/Grand Avenue	Rear-End	Other Motor Vehicle	East	Proceeding Straight	East	Stopped In Road	Unsafe Speed	0	0
07-12763	4/1/07 13:27	500' West of	17th Street/Grand Avenue	Rear-End	Other Motor Vehicle	East	Slowing/Stopping	East	Stopped In Road	Unsafe Speed	0	0
07-18095	5/8/07 17:30	123' West of	17th Street/Grand Avenue	Sideswipe	Other Motor Vehicle	East	Proceeding Straight	East	Stopped In Road	Improper Turning	0	0
07-30502	8/5/07 13:30	0' In Int.	17th Street/Lincoln Avenue	Not Stated	Not Stated	East		East		Unknown	0	0
07-35532	9/13/07 07:51	30' East of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	West	Slowing/Stopping	West	Slowing/Stopping	Unsafe Speed	0	0
07-43860	11/13/07 15:30	0' In Int.	17th Street/Lincoln Avenue	Hit Object	Fixed Object	West	Proceeding Straight			Traffic Signals and Signs	0	0
07-45779	11/28/07 10:40	52' East of	17th Street/Lincoln Avenue	Hit Object	Other Object	West	Proceeding Straight			Traffic Signals and Signs	0	0
07-47263	12/9/07 17:36	0' In Int.	17th Street/Lincoln Avenue	Sideswipe	Other Object	West	Stopped In Road	North		Traffic Signals and Signs	1	0
07-48429	12/18/07 13:20	200' East of	17th Street/Lincoln Avenue	Not Stated	Not Stated	West		East		Unknown	0	0

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08-05739	2/13/08 18:23	0' In Int.	Lincoln Avenue/17th Street	Not Stated	Not Stated	North				Not Stated	0	0
08-06336	2/18/08 08:30	400' West of	17th Street/Grand Avenue	Rear-End	Other Motor Vehicle	East	Proceeding Straight	East	Making Right Turn	Unsafe Speed	2	0
08-11970	3/31/08 10:53	210' West of	17th Street/Grand Avenue	Hit Object	Fixed Object	East	Making Right Turn			Unsafe Starting or Backing	1	
08-28358	8/1/08 06:04	561' East of	17th Street/Lincoln Avenue	Vehicle - Pedestrian	Pedestrian	South	Proceeding Straight	East	Proceeding Straight	Pedestrian Violation	1	0
08-28689	8/3/08 20:30	0' In Int.	Lincoln Avenue/17th Street	Broadside	Bicycle	West	Proceeding Straight	North	Proceeding Straight	Traffic Signals and Signs	1	0
08-30824	8/20/08 15:04	0' In Int.	17th Street/Lincoln Avenue	Broadside	Other Motor Vehicle	West	Making Right Turn	West	Proceeding Straight	Improper Turning	2	0
08-32395	9/1/08 18:50	0' In Int.	17th Street/Lincoln Avenue	Hit Object	Fixed Object	South	Proceeding Straight			Improper Turning	0	0
08-32726	9/4/08 07:43	165' East of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	West	Proceeding Straight	West	Stopped In Road	Other Than Driver	0	0
08-32737	9/4/08 08:29	111' East of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	West	Proceeding Straight	West	Stopped In Road	Unsafe Speed	0	0
08-33553	9/10/08 11:48	75' East of	17th Street/Lincoln Avenue	Not Stated	Not Stated	West		West		Not Stated	0	0
08-37592	10/13/08 16:38	300' West of	17th Street/Grand Avenue	Not Stated	Not Stated	North		West		Not Stated	0	0

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08-41375	11/12/08 16:21	100' East of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	West	Proceeding Straight	West	Stopped In Road	Unsafe Speed	1	0
08-47273	12/31/08 13:04	300' West of	17th Street/Grand Avenue	Rear-End	Other Motor Vehicle	West	Proceeding Straight	West	Making Right Turn	Unsafe Speed	1	0
09-04619	2/6/09 19:55	125' West of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	East	Proceeding Straight	East	Slowing/Stopping	Unsafe Speed	0	0
09-08635	3/10/09 16:01	0' In Int.	17th Street/Lincoln Avenue	Broadside	Other Motor Vehicle	West	Proceeding Straight	East	Making Left Turn	Traffic Signals and Signs	2	0
09-09483	3/16/09 21:54	0' In Int.	17th Street/Lincoln Avenue	Not Stated	Not Stated	East		East		Not Stated	0	0
09-10612	3/25/09 14:28	350' East of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	East	Proceeding Straight	East	Slowing/Stopping	Unsafe Speed	0	0
09-16613	5/12/09 08:15	80' East of	17th Street/Lincoln Avenue	Sideswipe	Other Motor Vehicle	West	Changing Lanes	West	Stopped In Road	Unsafe Lane Change	0	0
09-18235	5/24/09 18:16	0' In Int.	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	East	Proceeding Straight	East	Stopped In Road	Unsafe Speed	0	0
09-19674	6/5/09 23:59	300' West of	17th Street/Grand Avenue	Hit Object	Fixed Object	East	Proceeding Straight			Driving Under Influence	0	0
09-19946	6/7/09 09:28	0' In Int.	17th Street/Lincoln Avenue	Broadside	Other Motor Vehicle	West	Proceeding Straight	South	Proceeding Straight	Traffic Signals and Signs	5	0
09-27056	8/4/09 13:25	0' In Int.	17th Street/Lincoln Avenue	Not Stated	Not Stated	East		East		Not Stated	0	0

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09-28021	8/12/09 10:44	306' East of	17th Street/Lincoln Avenue	Broadside	Bicycle	East	Proceeding Straight	South	Proceeding Straight	Unknown	1	0
09-31817	9/12/09 13:05	50' East of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	West	Stopped In Road	West	Stopped In Road	Unsafe Speed	0	0
09-35499	10/13/09 09:41	236' East of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	West	Proceeding Straight	West	Slowing/Stopping	Unsafe Speed	3	0
09-40507	11/24/09 12:11	0' In Int.	Lincoln Avenue/17th Street	Broadside	Other Motor Vehicle	South	Making Left Turn	North	Proceeding Straight	Auto R/W Violation	1	0
09-43924	12/24/09 21:47	0' In Int.	Lincoln Avenue/17th Street	Not Stated	Not Stated	East		North		Not Stated	0	0
10-03875	2/3/10 17:34	90' West of	17th Street/Grand Avenue	Sideswipe	Other Motor Vehicle	West	Proceeding Straight	East	Stopped In Road	Improper Turning	0	0
10-12311	4/16/10 12:43	65' East of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	West	Proceeding Straight	West	Stopped In Road	Unsafe Speed	1	0
10-12335	4/16/10 16:52	150' West of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	East	Proceeding Straight	East	Proceeding Straight	Unsafe Speed	3	0
10-16752	5/25/10 12:55	100' East of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	West	Proceeding Straight	West	Stopped In Road	Unsafe Speed	1	0
10-24614	7/30/10 13:24	239' East of	17th Street/Lincoln Avenue	Sideswipe	Other Motor Vehicle	West	Slowing/Stopping	West	Making Right Turn	Not Stated	0	0
10-29643	9/9/10 17:21	280' West of	17th Street/Grand Avenue	Not Stated	Not Stated	East		East		Not Stated	0	0

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10-39788	12/8/10 18:13	20' West of	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	East	Proceeding Straight	East	Slowing/Stopping	Unsafe Speed	0	0
11-03842	2/4/11 18:24	0' In Int.	17th Street/Lincoln Avenue	Sideswipe	Other Motor Vehicle	West	Proceeding Straight	West	Proceeding Straight	Unsafe Lane Change	0	0
11-06254	2/25/11 13:10	0' In Int.	17th Street/Lincoln Avenue	Rear-End	Other Motor Vehicle	East	Stopped In Road	East	Proceeding Straight	Unsafe Speed	0	0

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Total Number of Collisions: 91 Segment Length: 0.25 miles (1,303')

Settings Used For Query

Parameter	Setting
Limit 1	Include Intersection Related
Limit 2	Do Not Include Intersection Related
Intermediate Intersections	Include Intersection Related
Sorted By	'Date and Time'

Attachment B:

Ranking Matrix- 10 Pts. Best.

17th Street Grade Separation Study
Alternatives Comparison Matrix - 10 Pts Best
Attachment B
December 14, 2011

Factors	Weight Factor	Alternative 1A: Underpass	Ranking 10 (Highest) to 1	Points	Alternative 1C: Underpass	Ranking 10 (Highest) to 1	Points	Alternative 2A: Overhead	Ranking 10 (Highest) to 1	Points
Cost Effectiveness / Fundability	30	Overall project cost is more expensive than 1C but less expensive than 2A.	5	150	Overall project cost is the least expensive.	10	300	Overall project cost is the most expensive.	1	30
Right of Way Impacts	25	About same right of way impacts as Alt 1C and less right of way impacts than Alt 2A	7	175	About same right of way impacts as Alt 1A and less right of way impacts than Alt 2A	7	175	Most right of way impacts, especially residential properties.	1	25
Environmental Impacts / Community Impacts	20	No residential acquisition is expected. No appreciative cost difference on the commercial / industrial properties comparing to the other alternatives.	7	140	No residential acquisition is expected. No appreciative cost difference on the commercial / industrial properties comparing to the other alternatives.	7	140	Several residential acquisitions are expected. / **Local community will not support this alternative.** No appreciative cost difference on the commercial / industrial properties comparing to the other alternatives.	1	20
Property Access / Traffic Circulation	15	The after project access configuration of the immediately adjacent properties is similar among all three alternatives; however, for accesses of the properties further away from the project site, traffic needs to either use a loop connector to access Lincoln Avenue at the NW quadrant of the underpass or use Fairmont Street, a residential street, to access SW quadrant of the underpass, which, in both cases, is less ideal than the configuration of Alternative 1C.	5	75	The after construction accesses of the properties directly adjacent to 17th Street are similar to both alternatives 1A and 2A; however, the accesses for the properties further away the underpass will be more ideal via a direct connect, an intersection, between 17th Street and Lincoln Avenue.	10	150	The after project access configuration of the immediately adjacent properties is similar among all three alternatives; however, for accesses of the properties further away from the project site, traffic needs to either use a loop connector to access Lincoln Avenue at the NW quadrant of the underpass or use Fairmont Street, a residential street, to access SW quadrant of the underpass, which, in both cases, is less ideal than the configuration of Alternative 1C. Pedestrian accesses would require an elevator to provide an ADA complied access route.	1	15
Constructability / Schedule Duration	10	Both railroad underpass and Lincoln undercrossing bridges are required. The bridges will need to be constructed in sequence. Overall construction schedule is shorter than 2A and longer than 1C.	5	50	Only railroad underpass structure is required. Overall construction schedule is the shortest.	10	100	Only an overhead structure is required; however the bridge is much wider and longer than the bridges for 1A & 1C. There is also much more earthwork than 1A & 1C.	1	10
Railroad Operation Impacts	15	Shoofly tracks are required.	3	45	Shoofly tracks are required.	3	45	No shoofly is required.	10	150
Geometrics and safety	20	The proposed 17th Street alignment follows the existing alignment. However, this alternative utilizes a loop connector between 17th Street and Lincoln Avenue, which is less ideal for the aspects of geometrics and safety.	5	100	Existing intersection configuration remains, which meets driver's expectation properly and is more ideal in the aspects of geometrics and safety than Alternatives 1A and 2A.	10	200	The proposed 17th Street alignment follows the existing alignment. However, this alternative utilizes a loop connector between 17th Street and Lincoln Avenue. Also grade difference at the railroad crossing is much greater than 1A & 1C, which requires steeper slope and longer distance on the descending and ascending approaches. With the indirect connection between 17th Street and Lincoln, and steeper grade, this alternative is the least ideal for the aspects of geometrics and safety.	1	20
Utility Impacts	15	The alternative requires less utility relocation work than 1C but more utility relocation work than 2A.	5	75	The most utility relocation work is required.	1	15	The least utility relocation work is required.	10	150
All Factors (Grand Total - 1500 possible)	150			**810**			**1125**			**420**

Attachment C:

Ranking Matrix- Alternatives Direct Comparison (3 Pts. Best)

17th Street Grade Separation Study
Alternatives Comparison Matrix - 3 Pts Best
Attachment C
September 27, 2011

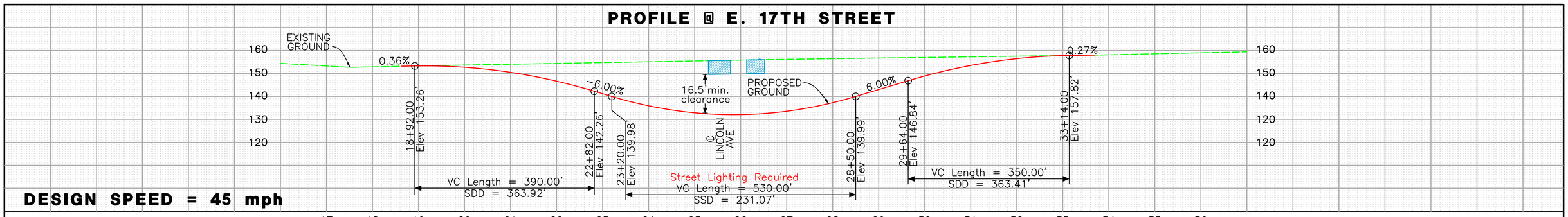
Factors	Weight Factor	Alternative 1A: Underpass	Ranking 3 (Highest) to 1	Points	Alternative 1C: Underpass	Ranking 3 (Highest) to 1	Points	Alternative 2A: Overhead	Ranking 3 (Highest) to 1	Points
Cost Effectiveness / Fundability	30	Overall project cost is more expensive than 1C but less expensive than 2A.	2	60	Overall project cost is the least expensive.	3	90	Overall project cost is the most expensive.	1	30
Right of Way Impacts	25	About same right of way impacts as Alt 1C and less right of way impacts than Alt 2A	2.5	62.5	About same right of way impacts as Alt 1A and less right of way impacts than Alt 2A	2.5	62.5	Most right of way impacts, especially residential properties.	1	25
Environmental Impacts / Community Impacts	20	No residential acquisition is expected. No appreciative cost difference on the commercial / industrial properties comparing to the other alternatives.	2.5	50	No residential acquisition is expected. No appreciative cost difference on the commercial / industrial properties comparing to the other alternatives.	2.5	50	Several residential acquisitions are expected. / **Local community will not support this alternative.** No appreciative cost difference on the commercial / industrial properties comparing to the other alternatives.	1	20
Property Access / Traffic Circulation	15	The after project access configuration of the immediately adjacent properties is similar among all three alternatives; however, for accesses of the properties further away from the project site, traffic needs to either use a loop connector to access Lincoln Avenue at the NW quadrant of the underpass or use Fairmont Street, a residential street, to access SW quadrant of the underpass, which, in both cases, is less ideal than the configuration of Alternative 1C.	2	30	The after construction accesses of the properties directly adjacent to 17th Street are similar to both alternatives 1A and 2A; however, the accesses for the properties further away the underpass will be more ideal via a direct connect, an intersection, between 17th Street and Lincoln Avenue.	3	45	The after project access configuration of the immediately adjacent properties is similar among all three alternatives; however, for accesses of the properties further away from the project site, traffic needs to either use a loop connector to access Lincoln Avenue at the NW quadrant of the underpass or use Fairmont Street, a residential street, to access SW quadrant of the underpass, which, in both cases, is less ideal than the configuration of Alternative 1C. Pedestrian accesses would require an elevator to provide an ADA complied access route.	1	15
Constructability / Schedule Duration	10	Both railroad underpass and Lincoln undercrossing bridges are required. The bridges will need to be constructed in sequence. Overall construction schedule is shorter than 2A and longer than 1C.	2	20	Only railroad underpass structure is required. Overall construction schedule is the shortest.	3	30	Only an overhead structure is required; however the bridge is much wider and longer than the bridges for 1A & 1C. There is also much more earthwork than 1A & 1C.	1	10
Railroad Operation Impacts	15	Shoofly tracks are required.	1.5	22.5	Shoofly tracks are required.	1.5	22.5	No shoofly is required.	3	45
Geometrics and safety	20	The proposed 17th Street alignment follows the existing alignment. However, this alternative utilizes a loop connector between 17th Street and Lincoln Avenue, which is less ideal for the aspects of geometrics and safety.	2	40	Existing intersection configuration remains, which meets driver's expectation properly and is more ideal in the aspects of geometrics and safety than Alternatives 1A and 2A.	3	60	The proposed 17th Street alignment follows the existing alignment. However, this alternative utilizes a loop connector between 17th Street and Lincoln Avenue. Also grade difference at the railroad crossing is much greater than 1A & 1C, which requires steeper slope and longer distance on the descending and ascending approaches. With the indirect connection between 17th Street and Lincoln, and steeper grade, this alternative is the least ideal for the aspects of geometrics and safety.	1	20
Utility Impacts	15	The alternative requires less utility relocation work than 1C but more utility relocation work than 2A.	2	30	The most utility relocation work is required.	1	15	The least utility relocation work is required.	3	45
All Factors (Grand Total - 450 possible)	150			**315**			**375**			**210**

Attachment D:

Alternatives Plan and Profile

Alternatives Bridge General Plan Sheet

PROFILE @ E. 17TH STREET



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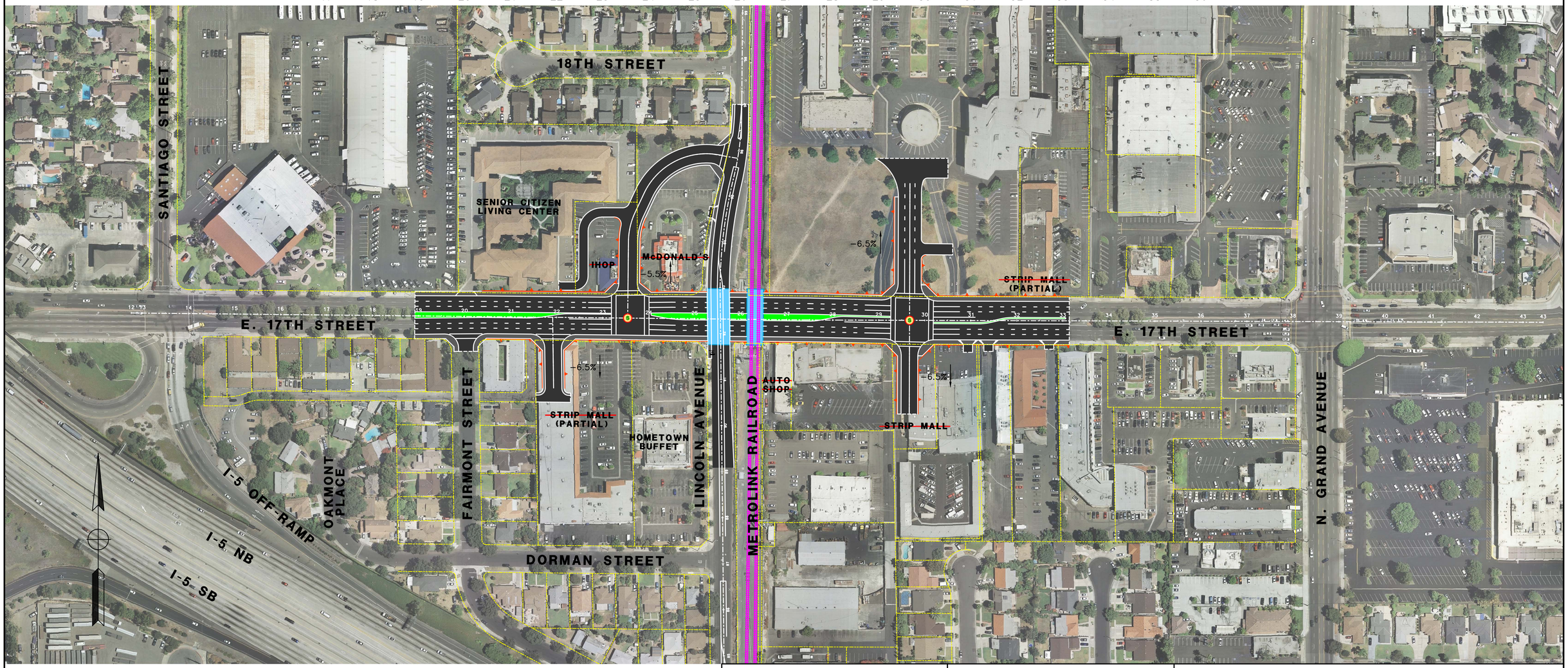


SCALE:
HOR. 1" = 100';
VERT. 1" = 20'

LEGEND:

- PROPOSED STRIPING
- PROPOSED TIE-BACK WALL
- EXISTING METROLINK TRACK
- EXISTING RIGHT-OF-WAY
- PROPOSED SIGNAL
- PROPOSED OVERCROSSING
- PROPOSED IMPROVEMENTS
- PROPOSED SIDEWALK

OCTA

PLANS PREPARED BY:

AECOM

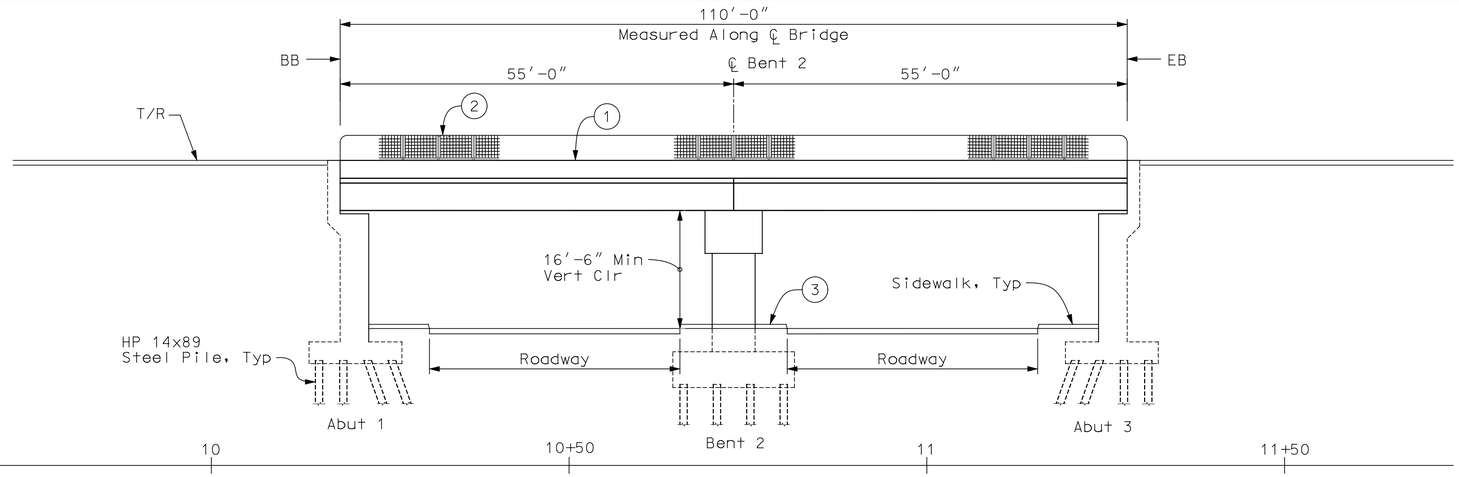
999 W. TOWN AND COUNTRY ROAD
ORANGE, CA 92868-4713
(714) 567-2501

PRELIMINARY
APRIL 30, 2012

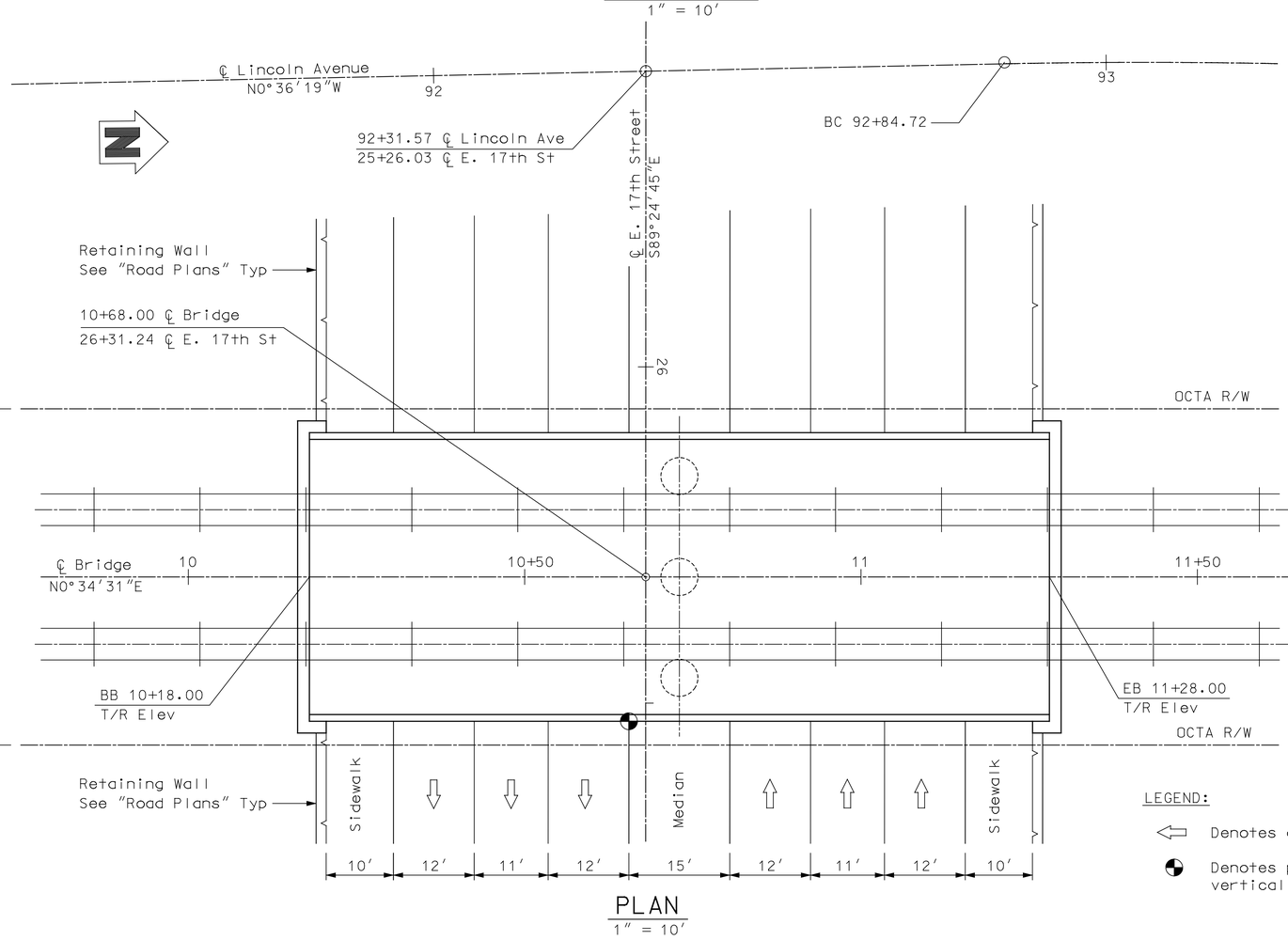
OCTA/CITY OF SANTA ANA E. SEVENTEENTH STREET GRADE SEPARATION PROJECT

ALTERNATIVE 1A - UNDERCROSSING OF BOTH RAILROAD & LINCOLN AVENUE

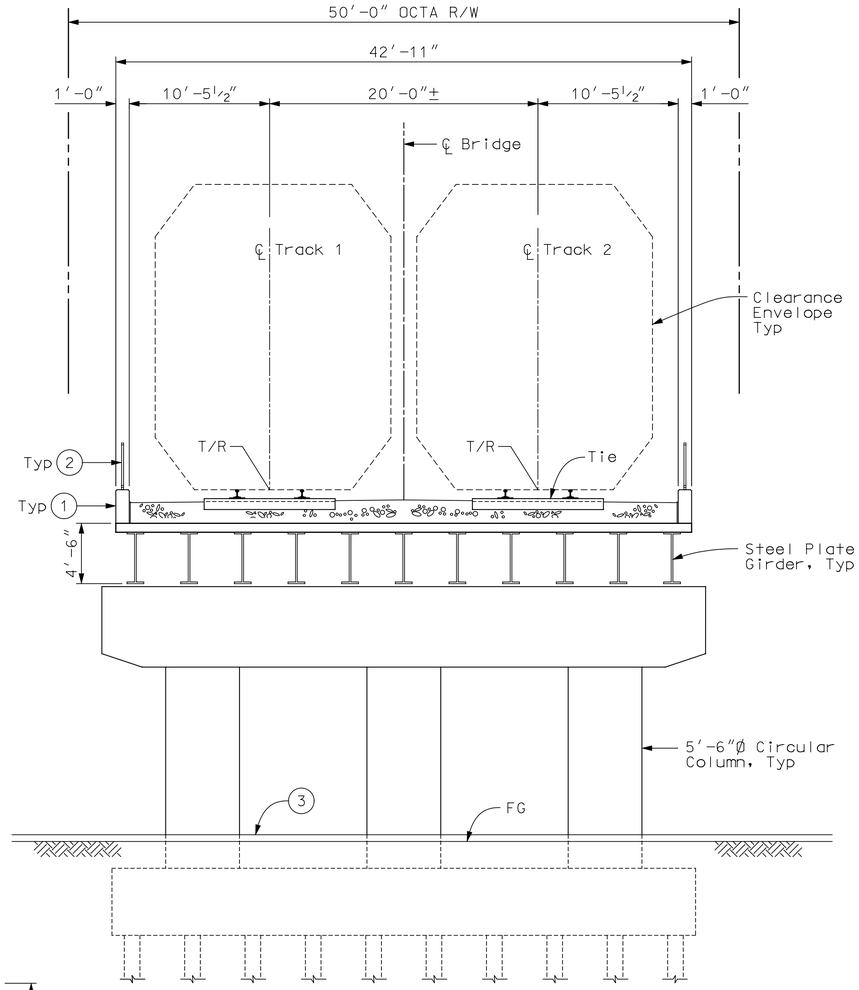
ALTERNATIVE 1A



ELEVATION
1" = 10'



PLAN
1" = 10'



TYPICAL SECTION
3/16" = 1'-0"

Notes:

1. Ballast Retainer
2. Metal Hand Railing
3. Raised Median, see "Road Plans"

LEGEND:

- ⇦ Denotes direction of traffic
- ◓ Denotes point of minimum vertical clearance

FILE NO.:	REVISIONS					REFERENCES	
	NUMBER	DATE	INITIALS	DESCRIPTION	APPROVED / INSTALLED	BENCHMARK NO.:	ELEV.:
						CONSTRUCTION COMPLETED:	

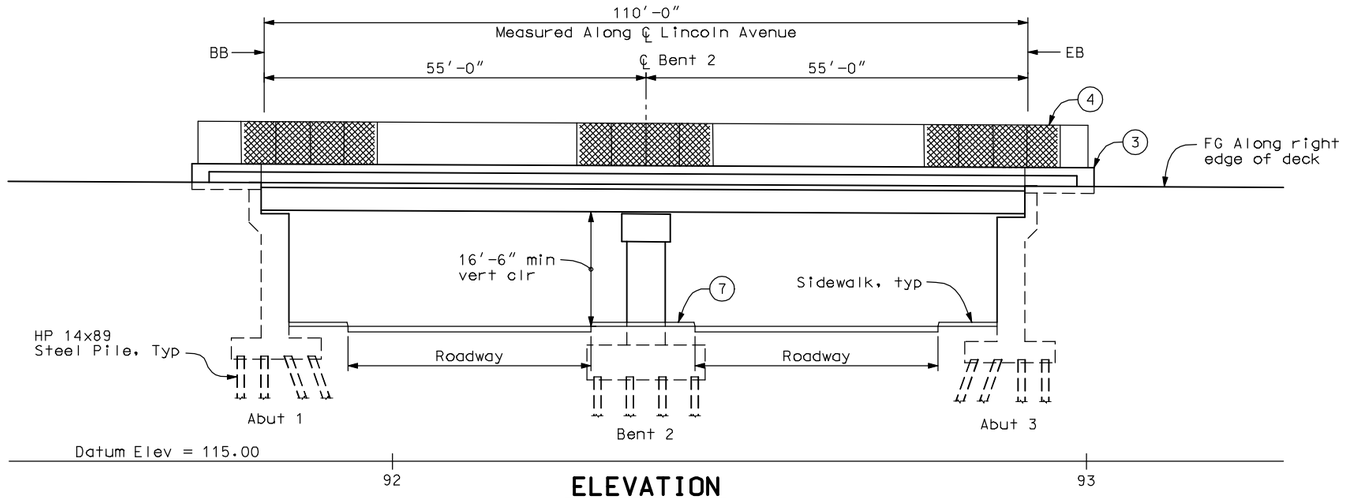
PREPARED UNDER THE SUPERVISION OF:	RCE NO.:	DATE 5/07/12
DESIGNED: J.C. DRAWN: R.A	CHECKED:	
RECOMMENDED:		
RECOMMENDED FOR CONSTRUCTION:		
DEPUTY CITY ENGINEER	RCE NO.:	

EAST 17TH STREET GRADE SEPARATION
GENERAL PLAN
ORANGE COUNTY TRANSPORTATION AUTHORITY

SHEET OF

DATE PLOTTED =9:24:18 AM 5/8/2012 USERNAME =AECOM DGN FILE =GP E 17th St UP ALT 1A.dgn

ALTERNATIVE 1A



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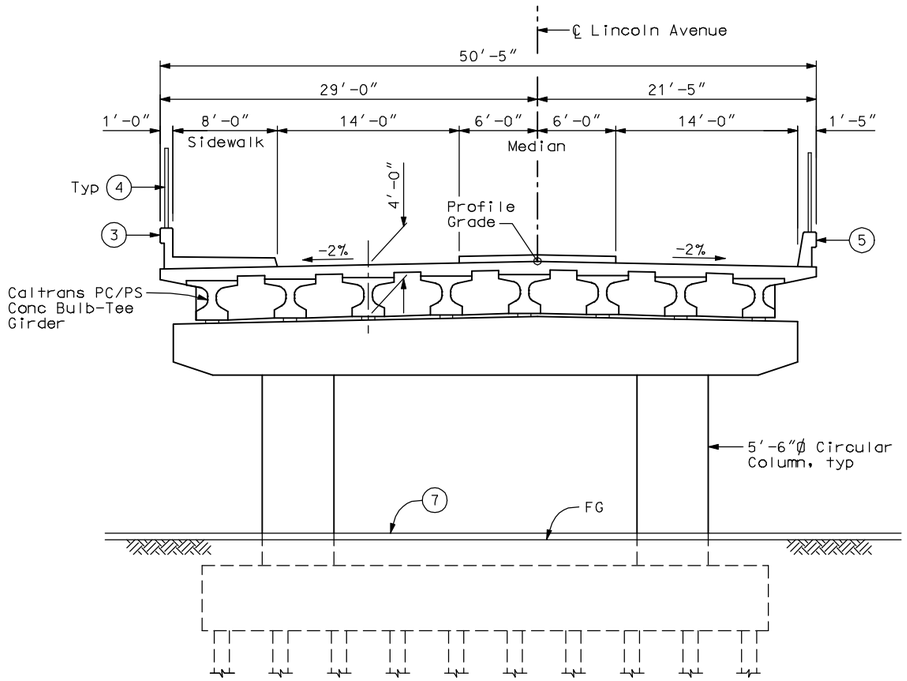
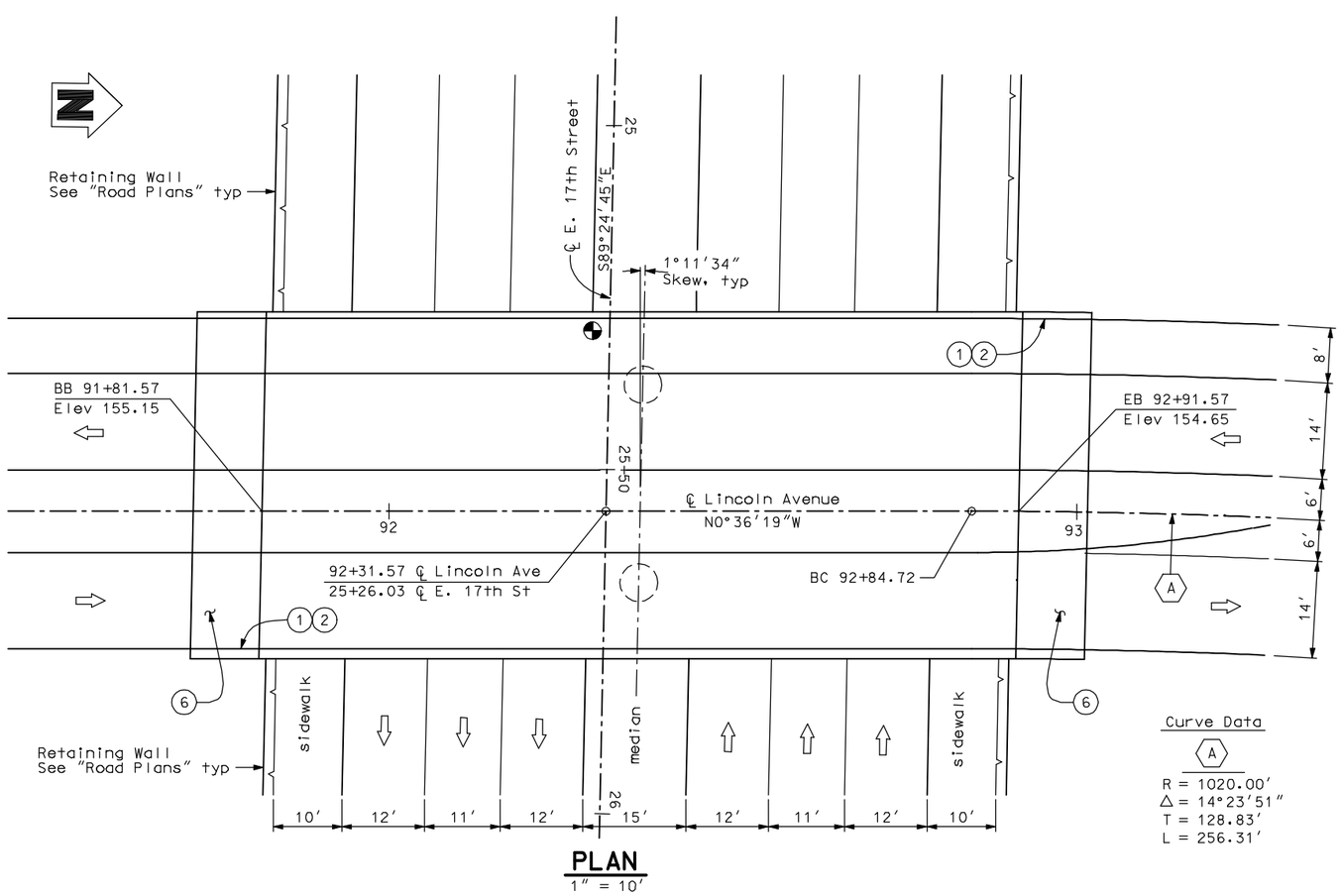


TYPICAL SECTION
3/16" = 1'-0"



PLAN
1" = 10'

Curve Data

(A)

R = 1020.00'
Δ = 14°23'51"
T = 128.83'
L = 256.31'

Notes:

1. Paint Bridge Name "Lincoln Avenue Overcrossing"
2. Paint Bridge No. "xxxxx"
3. Concrete Barrier, Type 26
4. Chain Link Railing, Type 7
5. Concrete Barrier, Type 732
6. Structure Approach Type EQ(10)
7. Raised Median, see "Road Plans"

Legend:

- ⇦ Denotes direction of traffic
- ◓ Denotes point of minimum vertical clearance

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FILE NO.:

REVISIONS

NUMBER	DATE	INITIALS	DESCRIPTION	APPROVED	INSTALLED

REFERENCES

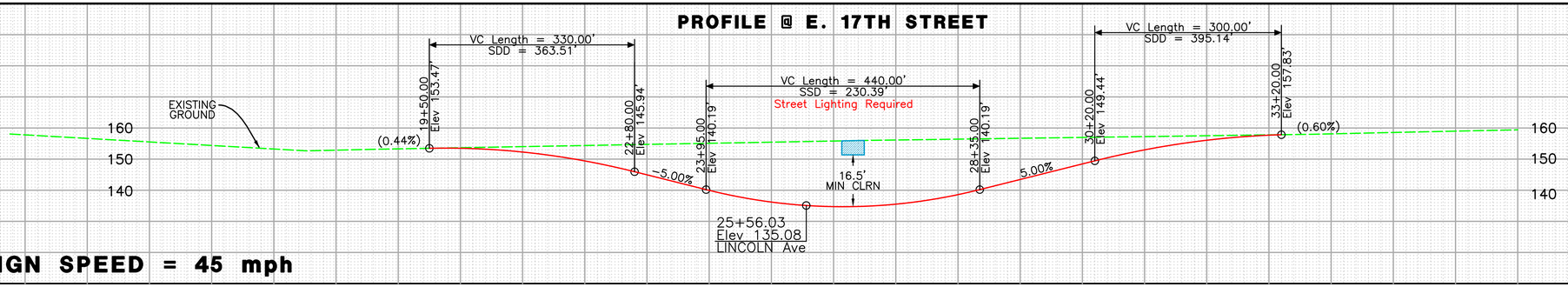
BENCHMARK NO.:	ELEV.:
CONSTRUCTION COMPLETED:	

PREPARED UNDER THE SUPERVISION OF: DATE 9/16/11
RCE NO.: XXXXX
DESIGNED: DRAWN: CHECKED: XX 9/16/11
RECOMMENDED:
RECOMMENDED FOR CONSTRUCTION:
DEPUTY CITY ENGINEER RCE NO.: XXXXX

EAST 17TH STREET GRADE SEPARATION
GENERAL PLAN
ORANGE COUNTY TRANSPORTATION AUTHORITY

SHEET OF

PROFILE @ E. 17TH STREET



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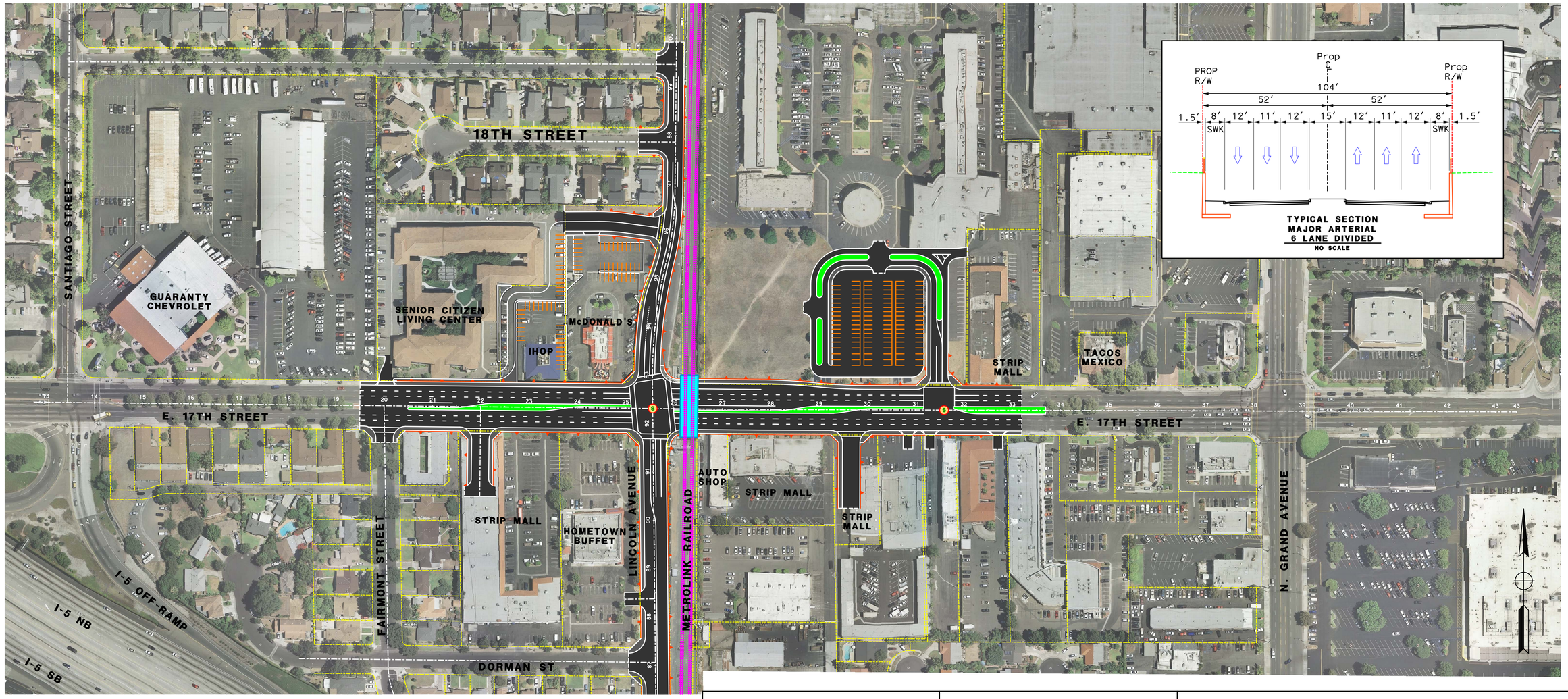


TYPICAL SECTION
MAJOR ARTERIAL
6 LANE DIVIDED
NO SCALE

SCALE:
HOR. 1" = 100';
VERT. 1" = 20'

LEGEND:

- PROPOSED STRIPING
- PROPOSED TIE-BACK WALL
- EXISTING METROLINK TRACK
- EXISTING RIGHT-OF-WAY
- PROPOSED SIGNAL
- PROPOSED OVERCROSSING
- PROPOSED IMPROVEMENTS
- PROPOSED SIDEWALK
- PROPOSED MEDIAN ISLAND

OCTA

PLANS PREPARED BY:

AECOM

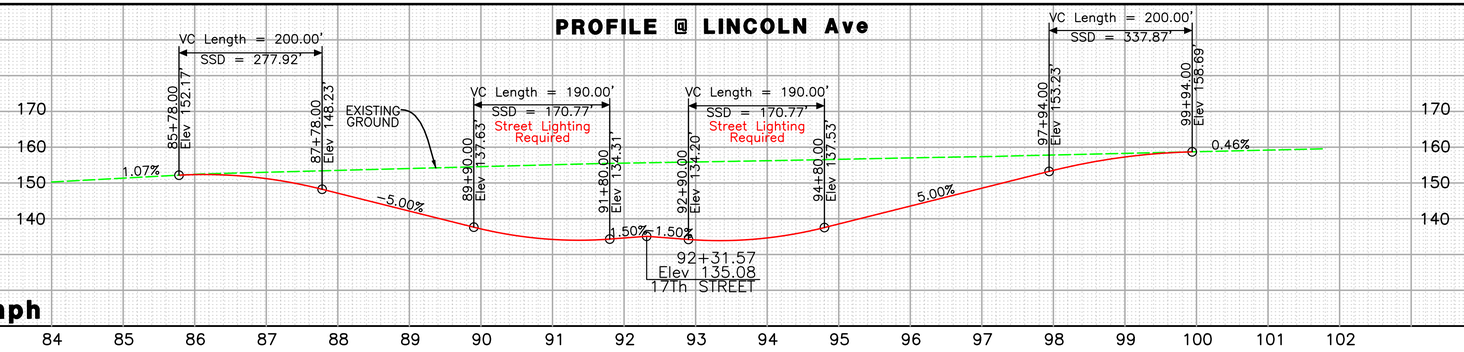
999 W. TOWN AND COUNTRY ROAD
ORANGE, CA 92868-4713
(714) 567-2501

PRELIMINARY
APRIL 30, 2012

OCTA/CITY OF SANTA ANA E. SEVENTEENTH STREET GRADE SEPARATION PROJECT

ALTERNATIVE 1C - UNDERCROSSING OF RAILROAD & DEPRESSED LINCOLN AVE INTERSECTION

PROFILE @ LINCOLN Ave



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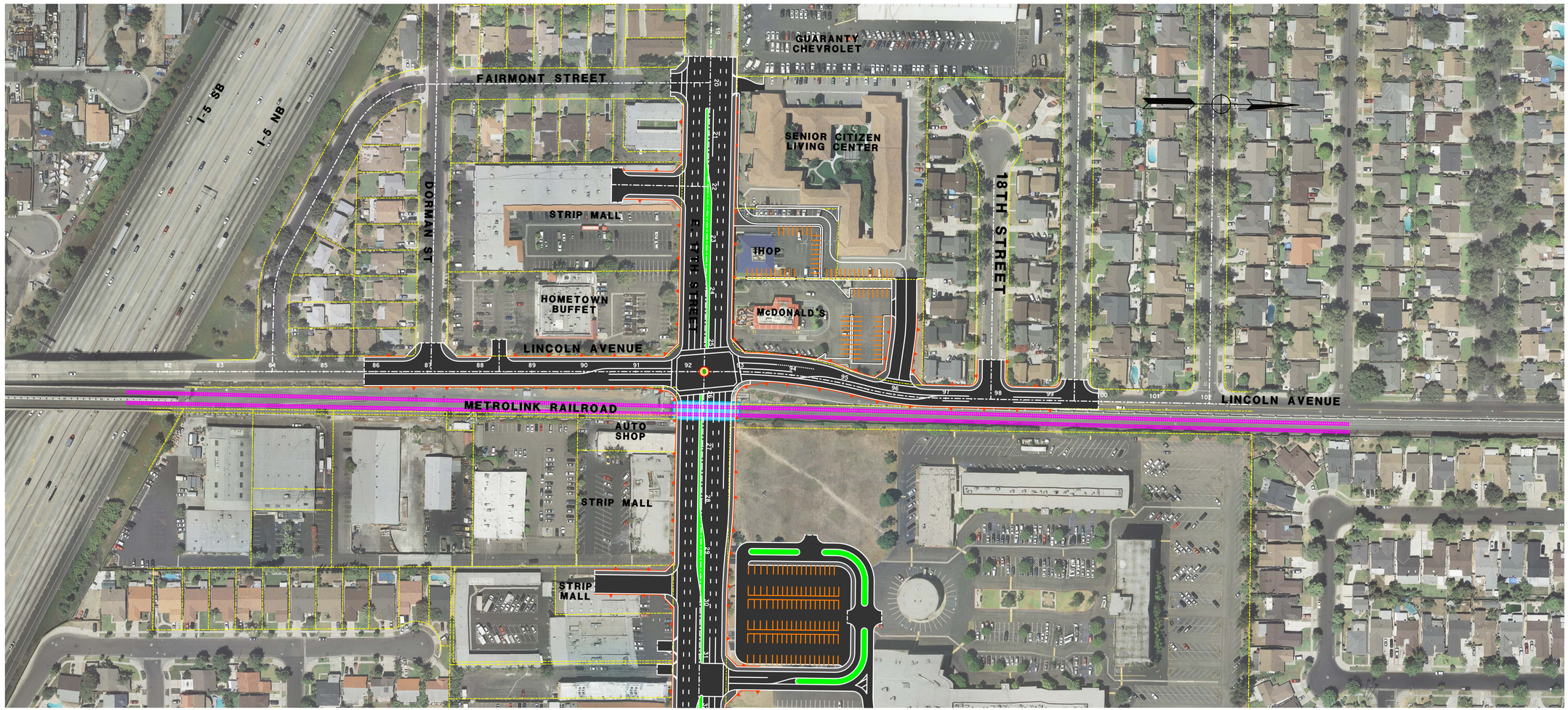

SCALE:
HOR. 1" = 100';
VERT. 1" = 20'

LEGEND:

- PROPOSED STRIPING
- PROPOSED TIE-BACK WALL
- EXISTING METROLINK TRACK
- EXISTING RIGHT-OF-WAY
- PROPOSED SIGNAL
- PROPOSED OVERCROSSING
- PROPOSED IMPROVEMENTS
- PROPOSED SIDEWALK
- PROPOSED MEDIAN ISLAND

OCTA

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ORANGE, CA 92868-4713
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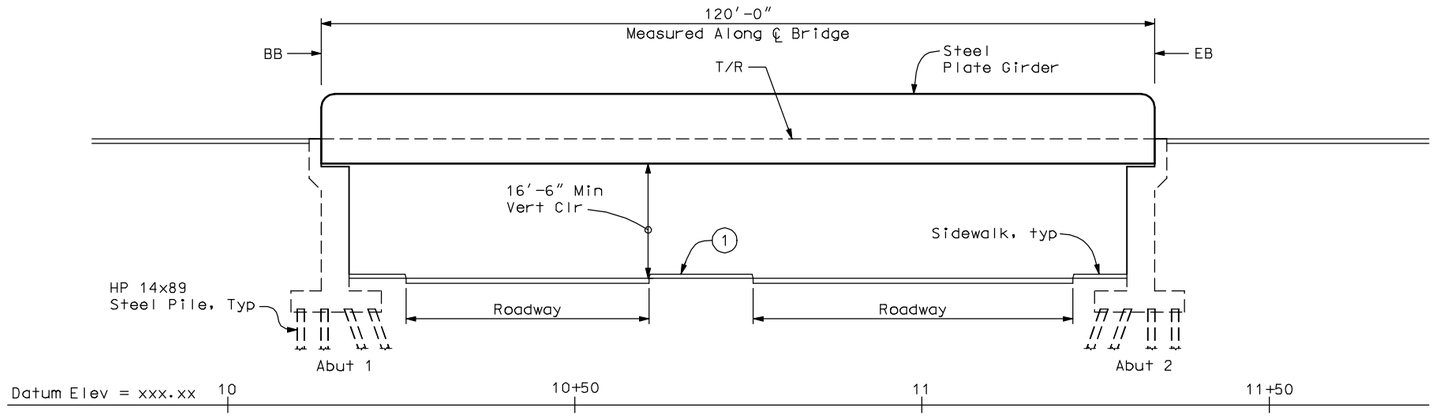
PRELIMINARY
APRIL 30, 2012

OCTA/CITY OF SANTA ANA E. SEVENTEENTH STREET GRADE SEPARATION PROJECT

ALTERNATIVE 1C- UNDERCROSSING LINCOLN AVENUE

ALTERNATIVE 1C



ELEVATION
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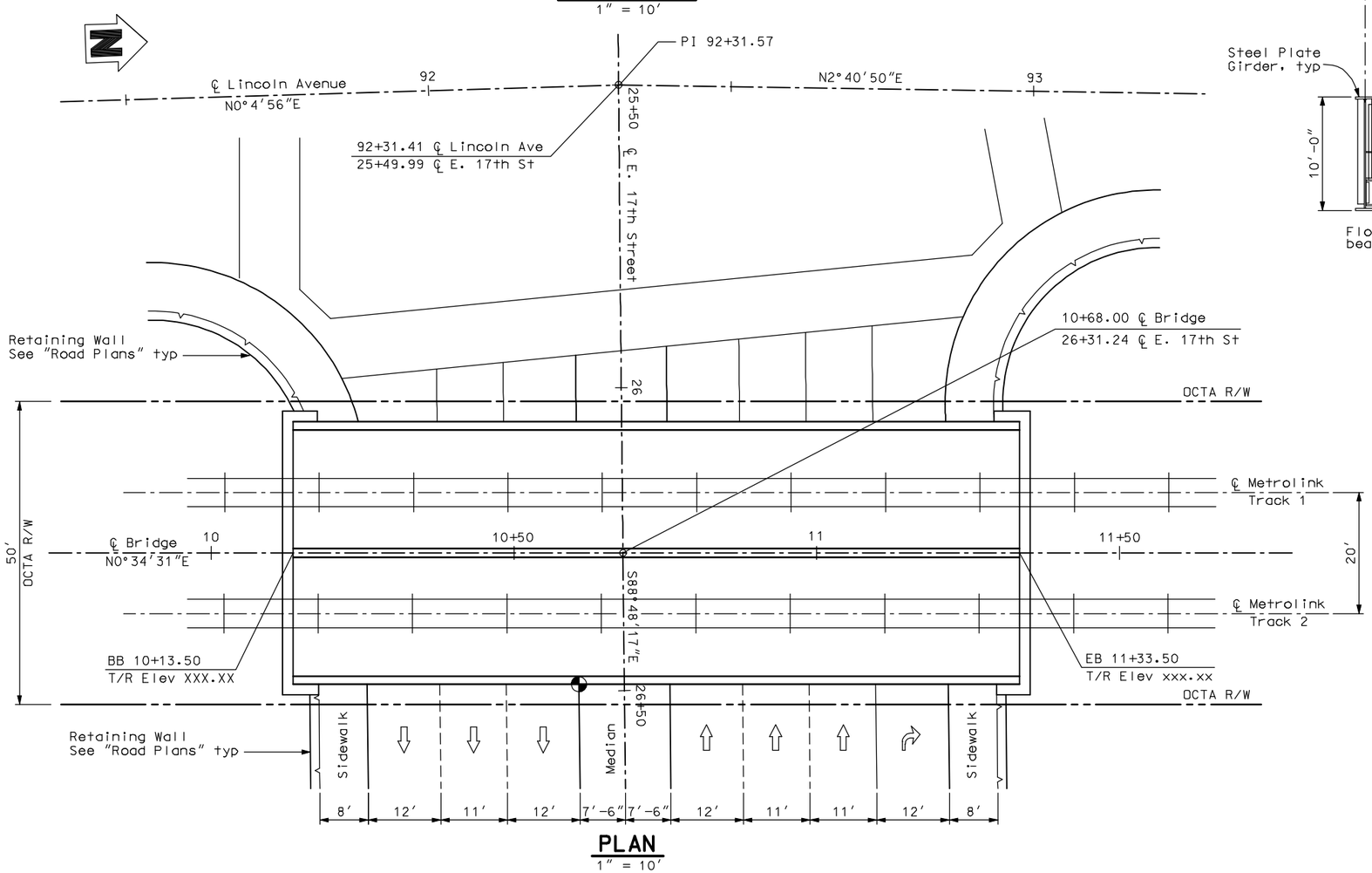
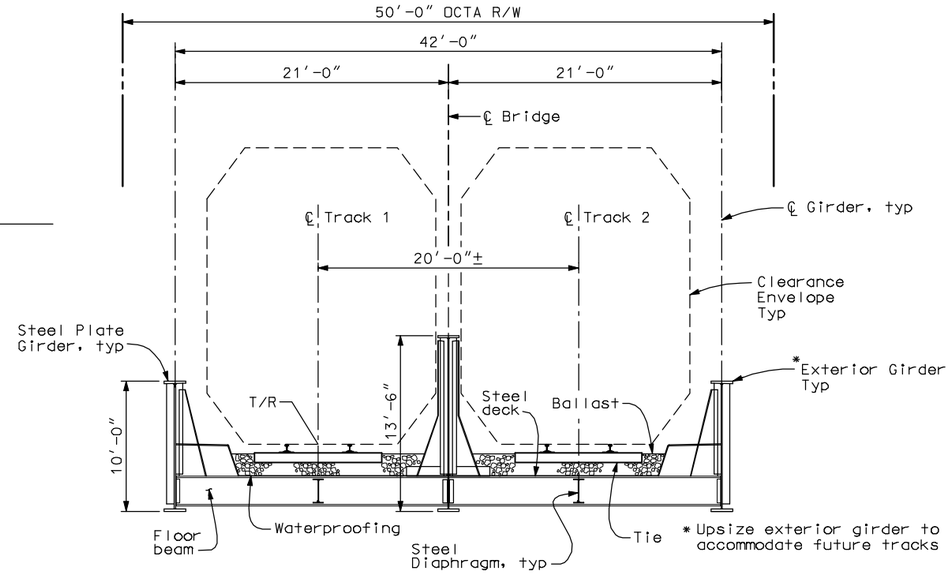


PLAN
1" = 10'



TYPICAL SECTION
3/16" = 1'-0"

Note:

(1) Raised Median, See "Road Plans"

Legend:

⇦ Denotes direction of traffic

Denotes point of minimum vertical clearance

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FILE NO.:

REVISIONS

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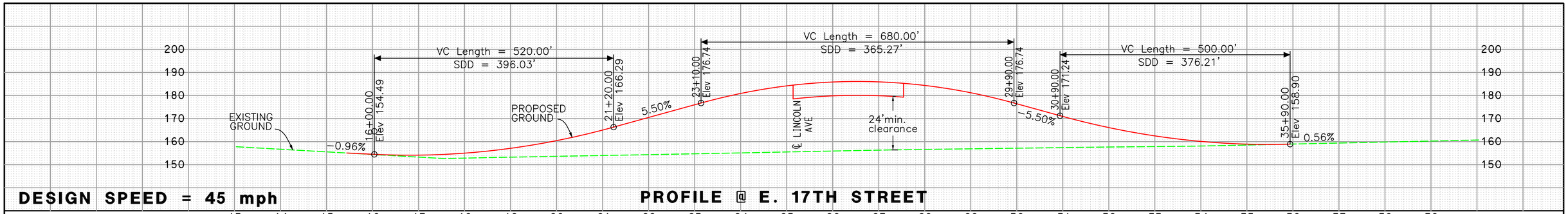
REFERENCES

BENCHMARK NO.:	ELEV.:
CONSTRUCTION COMPLETED:	

PREPARED UNDER THE SUPERVISION OF:			DATE
		RCE NO.: XXXXX	9/16/11
DESIGNED:	DRAWN:	CHECKED: XX	9/16/11
RECOMMENDED:			
RECOMMENDED FOR CONSTRUCTION:			
DEPUTY CITY ENGINEER		RCE NO.: XXXXX	

EAST 17TH STREET GRADE SEPARATION
GENERAL PLAN
ORANGE COUNTY TRANSPORTATION AUTHORITY

SHEET OF



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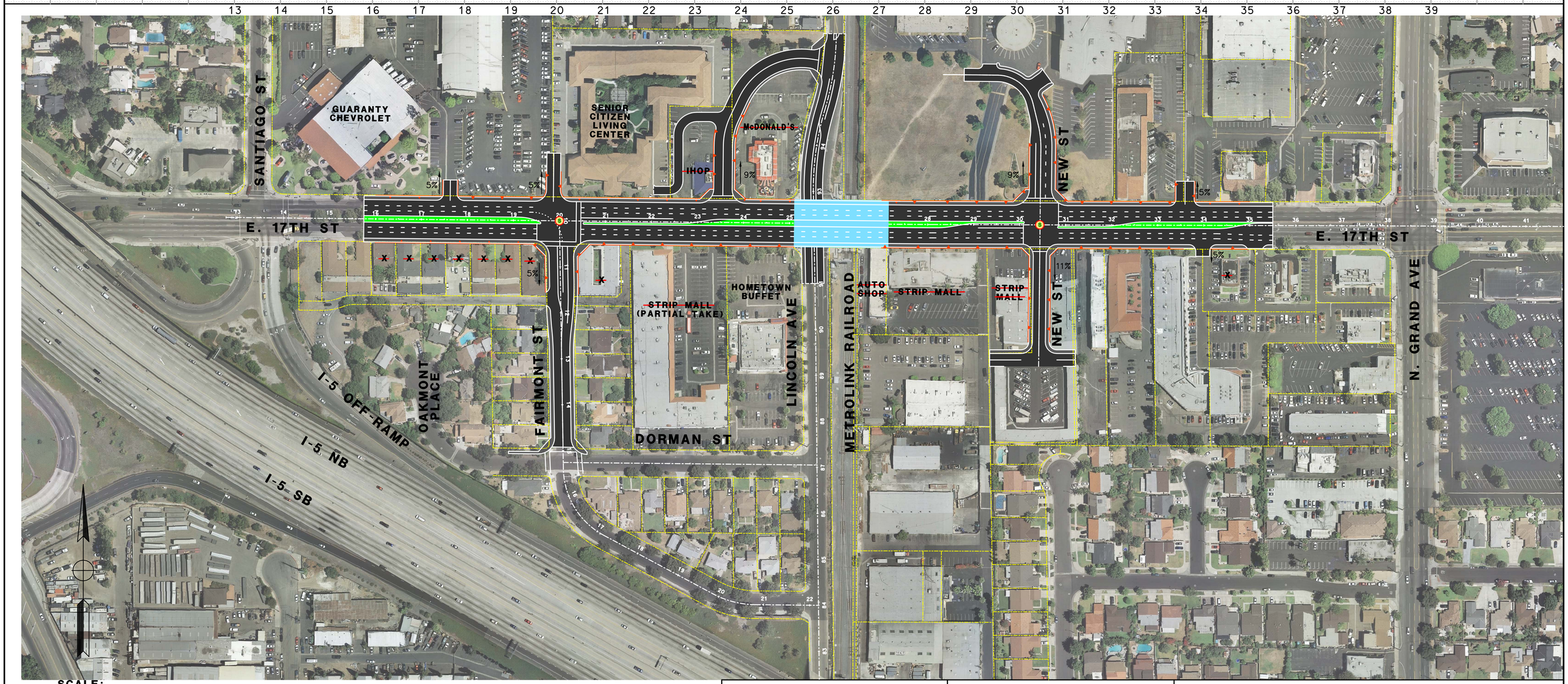
PROFILE @ E. 17TH STREET



SCALE:
HOR. 1" = 100';
VERT. 1" = 20'

LEGEND:

- PROPOSED STRIPING
- PROPOSED MSE WALL
- EXISTING METROLINK TRACK
- EXISTING RIGHT-OF-WAY
- PROPOSED SIGNAL
- PROPOSED OVERCROSSING
- PROPOSED IMPROVEMENTS
- PROPOSED SIDEWALK

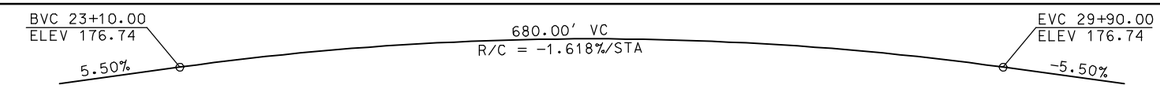
OCTA

PLANS PREPARED BY:
AECOM
999 W. TOWN AND COUNTRY ROAD
ORANGE, CA 92868-4713
(714) 567-2501

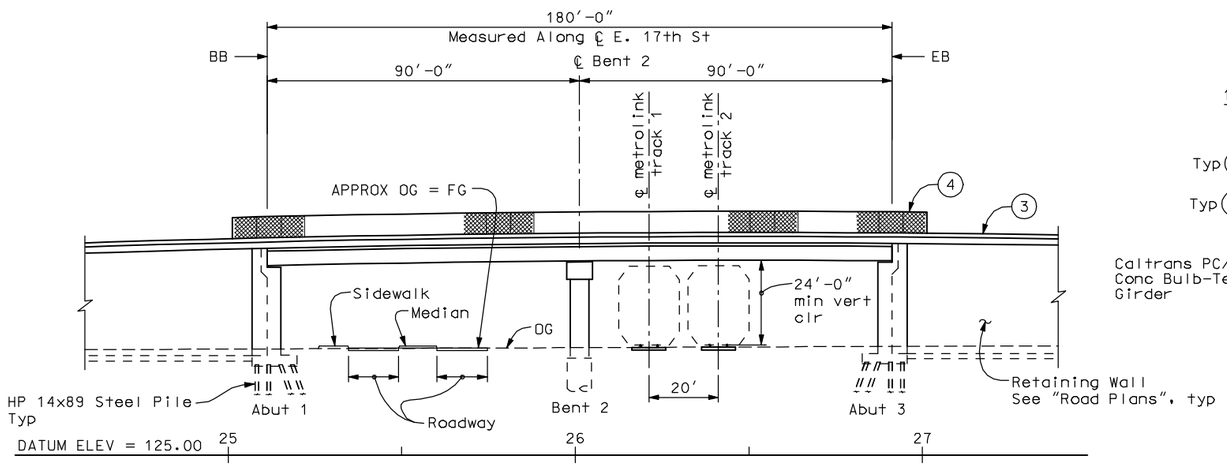
PRELIMINARY
APRIL 30, 2012

OCTA/CITY OF SANTA ANA E. SEVENTEENTH STREET GRADE SEPARATION PROJECT

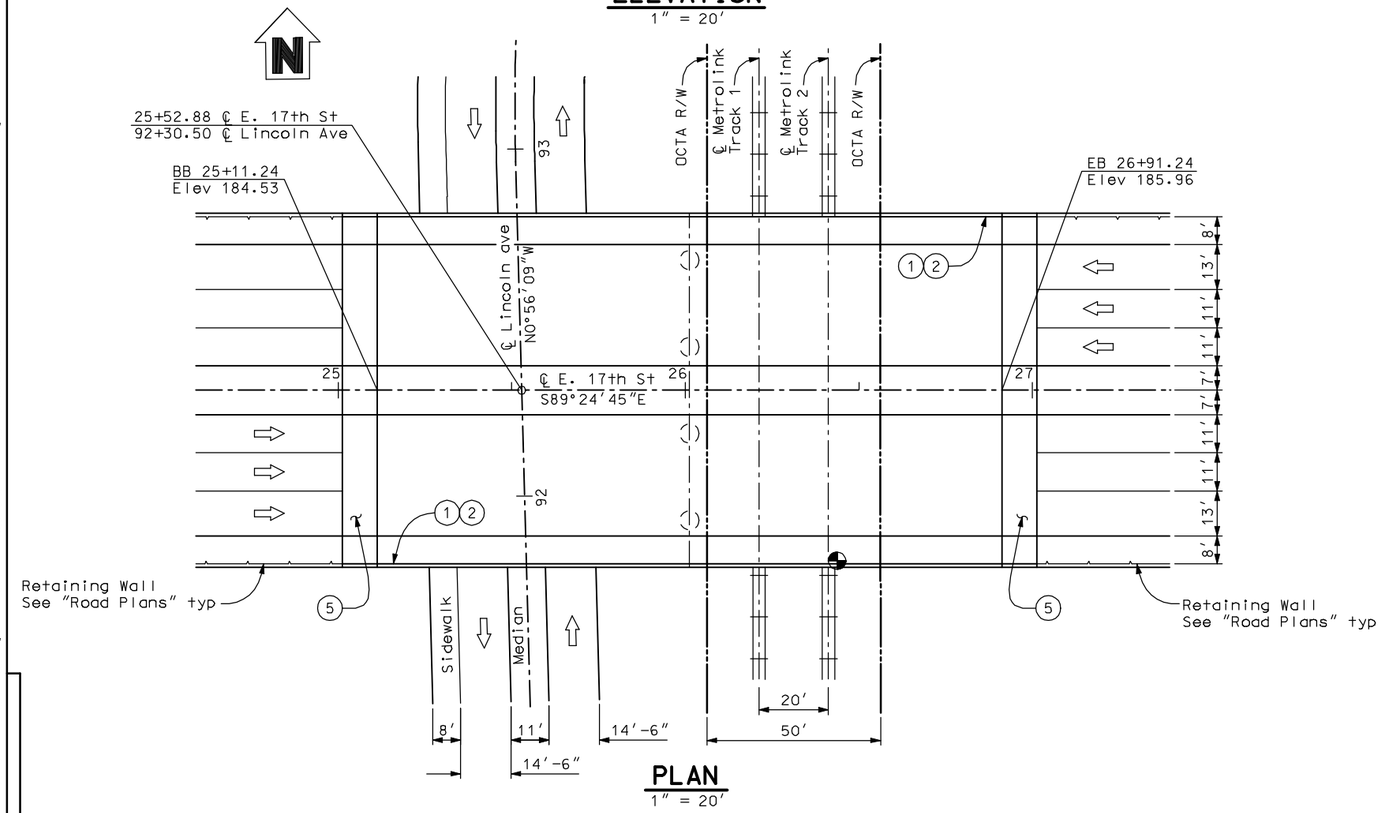
ALTERNATIVE 2A - OVERCROSSING OF RAILROAD



PROFILE GRADE
No Scale

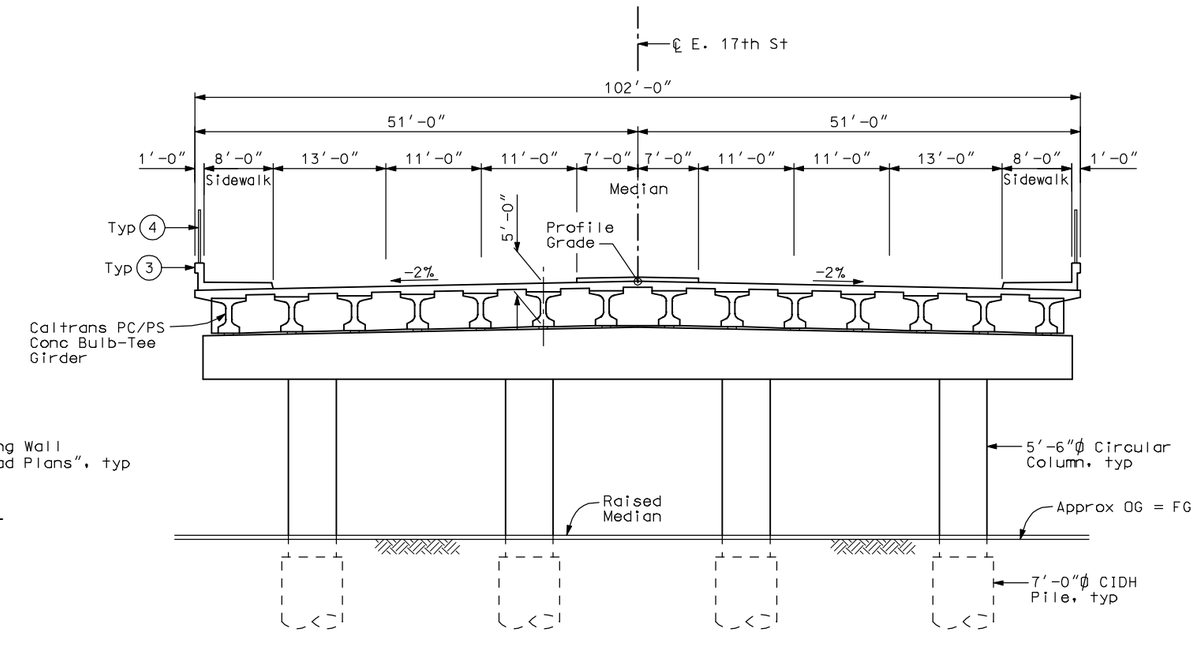


ELEVATION
1" = 20'



PLAN
1" = 20'

ALTERNATIVE 2A



TYPICAL SECTION
1/8" = 1'-0"

Notes:

1. Paint Bridge Name "East 17th Street Overhead"
2. Paint Bridge No. "xxxxx"
3. Concrete Barrier, Type 26
4. Chain Link Railing, Type 7
5. Structure Approach Type EQ(10)
6. Raised median, see "Road Plans"

Legend:

- ⇦ Denotes direction of traffic
- ◒ Denotes point of minimum Vertical Clearance

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FILE NO.:

REVISIONS

NUMBER	DATE	INITIALS	DESCRIPTION	APPROVED	INSTALLED

REFERENCES

BENCHMARK NO.:	ELEV.:
CONSTRUCTION COMPLETED:	

PREPARED UNDER THE SUPERVISION OF:			DATE
	RCE NO.: XXXXX		9/16/11
DESIGNED:	DRAWN:	CHECKED: XX	9/16/11
RECOMMENDED:			
RECOMMENDED FOR CONSTRUCTION:			
DEPUTY CITY ENGINEER	RCE NO.: XXXXX		

EAST 17TH STREET GRADE SEPARATION
GENERAL PLAN
ORANGE COUNTY TRANSPORTATION AUTHORITY

SHEET OF

Attachment E:

Alternatives Preliminary Cost Estimates

OCTA / City of Santa Ana
E 17th Street Grade Separation
Preliminary Engineering Cost Estimate
Attachment E

No.	Item	Unit of Measure	Unit Cost	Alt 1A - Underpass		Alt 1C - Underpass		Alt 2A - Overhead	
				Quantity	Item Total	Quantity	Item Total	Quantity	Item Total
Construction:									
1	Demolition	LS	$ -	1	$ 1,000,000	1	$ 1,000,000	1	$ 2,000,000
2	Clearing & Grubbing	LS	$ -	1	$ 150,000	1	$ 150,000	1	$ 250,000
3	Roadway Excavation	CY	$ 10	86,249	$ 862,494	97,898	$ 978,980	10,000	$ 100,000
4	Imported Borrow	CY	$ 10	-	$ -	-	$ -	119,302	$ 1,193,020
5	Hot Mix Asphalt	TON	$ 80	11,547	$ 923,747	16,597	$ 1,327,757	18,907	$ 1,512,578
6	Class 2 Aggregate Base	CY	$ 60	9,247	$ 554,803	13,291	$ 797,452	15,141	$ 908,455
7	8" PCC Curb & Gutter	LF	$ 10	5,664	$ 56,640	5,530	$ 55,300	11,330	$ 113,300
8	4" PCC Sidewalk	SF	$ 10	35,174	$ 351,740	45,605	$ 456,050	43,447	$ 434,473
9	Retaining Wall	SF	$ 60	51,382	$ 3,082,920	62,855	$ 3,771,300	53,461	$ 3,207,633
10	Concrete Bridge	SF	$ 300	7,800	$ 2,340,000	-	$ -	20,800	$ 6,240,000
11	Railroad Steel Bridge	SF	$ 480	4,721	$ 2,266,080	5,280	$ 2,534,400	-	$ -
12	Storm Drain System	LS	-	1	$ 150,000	1	$ 150,000	1	$ 150,000
13	Pump Station and Building	LS	-	1	$ 3,000,000	1	$ 3,000,000	-	$ -
14	Utility Relocation	LS	-	1	$ 5,000,000	1	$ 5,000,000	1	$ 3,000,000
15	Street Lighting	LS	$ 500,000	1	$ 500,000	1	$ 500,000	1	$ 700,000
16	Shoofly	TF	$ 400	3,200	$ 1,280,000	3,200	$ 1,280,000	-	$ -
17	Railroad Work	LS	$ -	1	$ 1,800,000	1	$ 1,800,000	1	$ 800,000
18	Signing & Striping	LS	$ 200,000	1	$ 200,000	1	$ 200,000	1	$ 200,000
19	Stage Construction	LS	-	1	$ 200,000	1	$ 200,000	1	$ 300,000
20	Signal	EA	$ 300,000	2	$ 600,000	2	$ 600,000	2	$ 600,000
21	SWPPP and Implementation	LS	$ 100,000	1	$ 100,000	1	$ 100,000	1	$ 100,000
22	Mobilization (10%)	LS			$ 2,442,000		$ 2,391,000		$ 2,181,000
			Subtotal:		$ 24,419,000		$ 23,902,000		$ 21,810,000
			30 % Contingency:		$ 7,326,000		$ 7,171,000		$ 6,543,000
			Construction Total:		**$ 31,745,000**		**$ 31,073,000**		**$ 28,353,000**
Engineering:									
23	Preliminary Engineering / Environmental Document (5%)	LS	-	1	$ 1,588,000	1	$ 1,554,000	1	$ 1,418,000
24	Final PS&E Design (10%)	LS	-	1	$ 3,175,000	1	$ 3,108,000	1	$ 2,836,000
25	Construction Engineering (15%)	LS	-	1	$ 4,762,000	1	$ 4,661,000	1	$ 4,253,000
			Engineering Total:		**$ 9,525,000**		**$ 9,323,000**		**$ 8,507,000**
Right of Way:									
26	Right of Way Acquisition	LS	-	1	$ 7,105,664	1	$ 7,160,489	1	$ 20,417,190
27	TCE (1 Year)	LS	-	1	$ 500,353	1	$ 652,061	1	$ 554,988
28	Underground Utility Easement	LS	-	1	$ 1,123,143	1	$ 1,100,180	1	$ 577,985
29	Severance Damages and Costs	LS	-	1	$ 1,344,000	1	$ 1,344,000	1	$ 1,723,000
30	Relocation & Incidentals	LS	-	1	$ 490,500	1	$ 518,000	1	$ 2,261,000
			Subotal:		$ 10,564,000		$ 10,775,000		$ 25,535,000
			30% Contingency:		$ 3,170,000		$ 3,233,000		$ 7,661,000
			Right of Way Total:		**$ 13,734,000**		**$ 14,008,000**		**$ 33,196,000**
			Total Project Cost:		**$ 55,004,000**		**$ 54,404,000**		**$ 70,056,000**

OCTA / City of Santa Ana - 17th Street Grade Separation

ALTERNATIVE 1A UNDERPASS

APN	Owner		Parcel Area (SF)	ROW Area (SF)	TCE Area (SF)	Underground Utility Easement Area (SF)	ROW Unit Price (Per SF)	TCE Unit Price (Per SF) 11% FMV Annually	Utility Easement Price (Per SF) 50% FMV	ROW Cost	12 month TCE Cost	Underground Utility Easement Cost	Improvements, Severance Damages, and Costs to Cure	Total ROW Costs	Relocation Costs & Incidentals	Zoning	Improvement Type Current Property Use	Comments
Properties North of 17th Street																		
396-091-01	HAMLIN FAMILY TRUST	TCE Only	381,586	0	473	0	$20.00	$2.20	$10.00	$0	$1,041	$0	$0	$1,041	$0	C4, Planned Shopping Ctr	LAND - Guaranty Chevrolet	Property sold February 2011. New ownership: Hamlin Family Trust.
396-091-25	FOUNDTAINHEAD PARTNERS LP	TCE & Utility	115,695	0	5,399	8,447	$30.00	$3.30	$15.00	$0	$17,817	$126,705	$0	$144,522	$500	SD73, Specific Development 73	LAND - Portion of parking lot and sidewalk for Senior living facility	Relo cost for 1 sign.
396-091-26	SANCARROW ASSOCIATES-CARROWS HICKORY CHIP RESTAURANTS INC	Full	27,000	27,000	0	0	$75.00	$8.25	$37.50	$2,025,000	$0	$0	$0	$2,025,000	$62,500	C1, Community Commercial	IHOP restaurant	Cost based on $500/SF x 4,062 SF of bldg area. Relo cost for 1 business displacement.
396-091-24	McDONALD'S CORPORATION	Full	63,990	63,990	0	0	$27.00	$2.97	$13.50	$1,727,730	$0	$0	$0	$1,727,730	$62,500	C1, Community Commercial	McDonald's restaurant (with excess land that could be developed with a different use)	Cost based on $600/SF x 2,848 SF of bldg area. The price per SF of land area appears low due to the excess land. Relo cost for 1 business displacement.
396-172-17	NORTH PARK PLAZA LLC	TCE & Utility	610,276	0	99,977	40,961	$35.00	$3.85	$17.50	$0	$384,911	$716,818	$0	$1,101,729	$10,000	P, Professional	LAND - Landscaping and driveways for multi-tenant office park	Appraisers will need TCE SF minus the utility SF to avoid paying twice. The southwestern most portion of the site could be developed with a separate use, and is being marketed as a build-to-suit for up to 100,000 SF. Relo cost for 1 sign. ***Property owner is reported to be uncooperative***
396-172-18	NORTH PARK PLAZA LLC	Partial & TCE	48,352	4,900	5,543	0	$30.00	$3.30	$15.00	$147,000	$18,292	$0	$408,000	$573,292	$90,000	C5, Arterial Commercial	LAND - Portion bldg, driveway and parking lot for strip retail center	Bldg will need to be cut and refaced. Cost for average quality class D bldg $85/SF x approx. 4,800 SF = $408,000. Relo cost for 3 business displacements. **Potential severance damages to this property for loss of units and income.**
396-161-09	ROHRS INVESTMENT CO	TCE Only	147,233	0	3,217	0	$20.00	$2.20	$10.00	$0	$7,077	$0	$0	$7,077	$0	C4, Planned Shopping Ctr	LAND - Portion of parking lot and driveway for neighborhood shopping center	
398-162-08	MLS PROPERTIES	Partial, TCE & Utility	92,826	12,063	1,057	3,782	$25.00	$2.75	$12.50	$301,575	$2,907	$47,275	$936,000	$1,287,757	$170,000	C1, Community Commercial	LAND - Portion of bldg and landscaping in strip retail center	Bldg will need to be cut and refaced. Cost for average quality class C bldg $90SF x approx. 10,400 SF = $936,000. Relo cost for 5 business displacements. **Potential severance damages to this property for loss of units and income.**
398-162-09	GRIFFITH, WILLIAM H TR	TCE & Utility	71,308	0	1,722	4,905	$25.00	$2.75	$12.50	$0	$4,736	$61,313	$0	$66,048	$0	C1, Community Commercial	LAND - Portion of parking lot and landscaping for Hometown Buffet restaurant	
398-071-60	EARL SCHEIB OF CALIFORNIA	Full	11,761	11,761	0	0	$79.00	$8.69	$39.50	$929,119	$0	$0	$0	$929,119	$52,500	N/Av	Former Earl Sheib auto body and paint shop	Property sold April 2010 for $726,000 or $117/SF of bldg area. Cost based on $150/SF for 6,200 SF of bldg area. Relo cost for 1 business displacement.
398-071-02	ALBERT, THOMAS TR	TCE & Utility	41,997	0	7,066	6,631	$30.00	$3.30	$15.00	$0	$23,318	$99,465	$0	$122,783	$0	C2, General Commercial	LAND - Landscaping and driveway for office/retail bldg	Shared driveway provides sole access to approx 6 properties, which most likely have ingress/egress agreements with each other. Access needs to be maintained during construction and in after condition.
398-071-03	LEVIN, MEIR	Full	20,792	20,792	0	0	$95.00	$10.45	$47.50	$1,975,240	$0	$0	$0	$1,975,240	$32,500	C5, Arterial Commercial	Retail bldg	Shared driveway provides sole access to approx 6 properties, which most likely have ingress/egress agreements with each other. Access needs to be maintained during construction and in after condition. Cost based on $190/SF x 10,388 SF of bldg area. Relo cost for 1 business displacement.
398-071-04	LEVIN, MEIR	TCE & Utility	56,672	0	2,370	3,861	$25.00	$2.75	$12.50	$0	$6,518	$48,263	$0	$54,780	$0	C5, Arterial Commercial	LAND - Portion of parking lot and driveways for retail bldg and storage bldg	Access to rear storage bldg may be impacted by full acquisition of APN 398-071-03.
398-071-05	1202 17TH ST LIMITED PARTNERS	TCE & Utility	27,717	0	1,290	1,519	$30.00	$3.30	$15.00	$0	$4,257	$22,785	$0	$27,042	$10,000	C5, Arterial Commercial	LAND - Portion of driveway for multi-tenant office bldg	Relo cost for 1 sign.
398-071-06	1206 17TH ST LIMITED PARTNERS	TCE Only	42,510	0	1,733	0	$30.00	$3.30	$15.00	$0	$5,719	$0	$0	$5,719	$0	C5, Arterial Commercial	LAND - Portion of driveway for multi-tenant medical office bldg	
398-071-75 & 74	RED MOUNTAIN ASSET FUND I, LLC	TCE Only	94,046	0	1,700	0	$25.00	$2.75	$12.50	$0	$4,675	$0	$0	$4,675	$0	C5, Arterial Commercial	LAND - Portion of driveway and landscaping for muilti-tenant retail strip center	
398-071-70	RUSSELL, WILLIAM W	TCE Only	15,507	0	228	0	$35.00	$3.85	$17.50	$0	$878	$0	$0	$878	$0	C5, Arterial Commercial	LAND - Portion of driveway and landscaping for Popeye's fast food restaurant	
398-071-49	PATON, AVALINE A	TCE & Utility	4,832	0	67	208	$5.00	$0.55	$2.50	$0	$37	$520	$0	$557	$0	N/Av, assumed C5	LAND - Planter and portion of parking lot	Undevelopable strip parcel, nominal acquisition cost.

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ALTERNATIVE 1A UNDERPASS

APN	Owner		Parcel Area (SF)	ROW Area (SF)	TCE Area (SF)	Underground Utility Easement Area (SF)	ROW Unit Price (Per SF)	TCE Unit Price (Per SF) 11% FMV Annually	Utility Easement Price (Per SF) 50% FMV	ROW Cost	12 month TCE Cost	Underground Utility Easement Cost	Improvements, Severance Damages, and Costs to Cure	Total ROW Costs	Relocation Costs & Incidentals	Zoning	Improvement Type Current Property Use	Comments
398-071-58	B K SANTA ANA PROPERTY LLC	TCE Only	57,935	0	5,322	0	$20.00	$2.20	$10.00	$0	$11,708	$0	$0	$11,708	$0	N/Av, assumed industrial per public records	LAND - Driveway to commercial/industrial bldg (cash checking service)	Access may be impacted by full take of APN 398-071-03.
398-071-62 & 64	GARDNER, RICHARD C	TCE Only	79,440	0	1,433	0	$20.00	$2.20	$10.00	$0	$3,153	$0	$0	$3,153	$0	N/Av, assumed industrial per public records	LAND - Cell tower and some type of small storage bldg or container on industrial property	Access may be impacted by full take of APN 398-071-03.
398-071-57	STATE OF CALIFORNIA	TCE Only	1,783	0	1,783	0	$5.00	$0.55	$2.50	$0	$981	$0	$0	$981	$0	N/Av	LAND - Mostly vacant strip	Undevelopable strip parcel, nominal acquisition cost.
398-071-59	STATE OF CALIFORNIA	TCE Only	1,383	0	1,383	0	$5.00	$0.55	$2.50	$0	$761	$0	$0	$761	$0	N/Av	LAND - Mostly vacant strip	Undevelopable strip parcel, nominal acquisition cost.
398-071-61	STATE OF CALIFORNIA	TCE Only	489	0	489	0	$5.00	$0.55	$2.50	$0	$269	$0	$0	$269	$0	N/Av	LAND - Mostly vacant strip	Undevelopable strip parcel, nominal acquisition cost.
398-071-63	STATE OF CALIFORNIA	TCE Only	2,364	0	2,364	0	$5.00	$0.55	$2.50	$0	$1,300	$0	$0	$1,300	$0	N/Av	LAND - Mostly vacant strip	Undevelopable strip parcel, nominal acquisition cost.
										$7,105,664	$500,353	$1,123,143	$1,344,000	**$10,073,159**	**$490,500**			
														TOTAL	**$10,563,659**			

Full Fee Acquisition

Potential Issues

ASSUMPTIONS

1. Cost differences are due to rounding.

2. A field visit to the project area was made and the properties were viewed from the public right of way. No interior inspections or detailed exterior inspections were made. Building costs and relocation costs are estimated based on typical costs for the building type and tenant/business type.

3. Measurements for building areas were taken from Google Maps and Bing Maps. These measurements are rough estimates based on our interpretation of the areas that will be impacted by the project.

4. Improvements within the TCE areas will be replaced in kind by contractor; significant improvements within TCE's will be protected in place.

5. THIS IS NOT AN APPRAISAL: These cost estimates are for preliminary budget analysis purposes only and should not be used to make any offers of compensation for the proposed right of way acquisition. Appraisals are required to determine "fair market value". These costs are based on analysis of currently available market data obtained from reliable sources; however, they have not been verified.

OCTA / City of Santa Ana - 17th Street Grade Separation

ALTERNATIVE 1C UNDERPASS

APN	Owner	ROW Acuisition	Parcel Area (SF)	ROW Area (SF)	TCE Area (SF)	Underground Utility Easement Area (SF)	ROW Unit Price (Per SF)	TCE Unit Price (Per SF) 11% FMV Annually	Utility Easement Price (Per SF) 50% FMV	ROW Cost	12 month TCE Cost	Underground Utility Easement Cost	Improvements, Severance Damages, and Costs to Cure	Total ROW Costs	Relocation Costs & Incidentals	Zoning	Improvement Type Current Property Use	Comments
Properties North of 17th Street																		
396-091-01	HAMLIN FAMILY TRUST	Utility	381,586	0	0	1,008	$20.00	$2.20	$10.00	$0	$0	$10,080	$0	$10,080	$12,500	C4, Planned Shopping Ctr	LAND - Guaranty Chevrolet	Property sold February 2011. New ownership: Hamlin Family Trust. Relo cost for 1 sign and 1 light pole.
396-091-25	FOUNDTAINHEAD PARTNERS LP	TCE & Utility	115,695	0	3,537	6,220	$30.00	$3.30	$15.00	$0	$11,672	$93,300	$0	$104,972	$500	SD73, Specific Development 73	LAND - Portion of parking lot and sidewalk for Senior living facility	Relo cost for 1 sign.
396-091-26	SANCARROW ASSOCIATES-CARROWS HICKORY CHIP RESTAURANTS INC	Full	27,000	27,000	0	0	$75.00	$8.25	$37.50	$2,025,000	$0	$0	$0	$2,025,000	$62,500	C1, Community Commercial	IHOP restaurant	Cost based on $500/SF x 4,062 SF of bldg area. Relo cost for 1 business displacement.
396-091-24	McDONALD'S CORPORATION	Full	63,990	63,990	0	0	$27.00	$2.97	$0.00	$1,727,730	$0	$0	$0	$1,727,730	$62,500	C1, Community Commercial	McDonald's restaurant (with excess land that could be developed with a different use)	Cost based on $600/SF x 2,848 SF of bldg area. The price per SF of land area appears low due to the excess land. Relo cost for 1 business displacement.
396-091-23	CALDERON, RAYNA	Utility	6,475	0	0	2,048	$40.00	$4.40	$20.00	$0	$0	$40,960	$0	$40,960	$0	R2, Two Family Residential	LAND - Multi-family residential property (2 units)	It appears underground utility easement will run under the shared driveway for APN 396-091-23 and APN 396-091-22.
396-172-17	NORTH PARK PLAZA LLC	Partial, TCE & Utility	610,276	2,840	132,832	29,064	$35.00	$3.85	$17.50	$99,400	$511,403	$508,620	$0	$1,119,423	$10,000	P, Professional	LAND - Landscaping and driveways for multi-tenant office park	Appraisers will need TCE SF minus the utility SF to avoid paying twice. The southwestern most portion of the site could be developed with a separate use, and is being marketed as a build-to-suit for up to 100,000 SF. Relo cost for 1 sign. **Potential damages for loss of parking with reconfigured access. *Property owner is reported to be uncooperative***
396-172-18	NORTH PARK PLAZA LLC	Partial & TCE	48,352	4,800	5,600	0	$30.00	$3.30	$15.00	$144,000	$18,480	$0	$408,000	$570,480	$90,000	C5, Arterial Commercial	LAND - Portion bldg and parking lot for strip retail center	Bldg will need to be cut and refaced. Cost for average quality class D bldg $85/SF x 4,800 SF = $408,000. Relo cost for 3 business displacements. **Potential severance damages to this property for loss of units and income.**
396-161-09	ROHRS INVESTMENT CO	TCE	147,233	0	8,928	0	$20.00	$2.20	$10.00	$0	$19,642	$0	$0	$19,642	$0	C4, Planned Shopping Ctr	LAND - Portion of parking lot for neighborhood shopping	
Properties South of 17th Street																		
398-162-08	MLS PROPERTIES	Partial, TCE & Utility	92,826	10,400	3,496	5,615	$25.00	$2.75	$12.50	$260,000	$9,614	$70,188	$936,000	$1,275,802	$170,000	C1, Community Commercial	LAND - Portion of bldg and landscaping in strip retail center	Bldg will need to be cut and refaced. Cost for average quality class C bldg $90SF x 10,400 SF = $936,000. Relo cost for 5 business displacements. **Potential severance damages to this property for loss of units and income.**
398-162-09	GRIFFITH, WILLIAM H TR	TCE & Utility	71,308	0	8,109	17,786	$25.00	$2.75	$12.50	$0	$22,300	$222,325	$0	$244,625	$15,000	C1, Community Commercial	LAND - Portion of parking lot and landscaping for Hometown Buffet restaurant	Relo cost for 1 sign.
398-071-60	EARL SCHEIB OF CALIFORNIA	Full	11,761	11,761	0	0	$79.00	$8.69	$39.50	$929,119	$0	$0	$0	$929,119	$52,500	N/Av	Former Earl Sheib auto body and paint shop	Property sold April 2010 for $726,000 or $117/SF of bldg area. Cost based on $150/SF for 6,200 SF of bldg area. Relo costs for 1 business diplacement.
398-071-02	ALBERT, THOMAS TR	TCE & Utility	41,997	0	7,215	6,631	$30.00	$3.30	$15.00	$0	$23,810	$99,465	$0	$123,275	$0	C2, General Commercial	LAND - Landscaping and driveway for office/retail bldg	Driveway provides sole access to approx 6 properties, which most likely have ingress/egress agreements with each other. Access needs to be maintained during contruction and in after condition.
398-071-03	LEVIN, MEIR	Full	20,792	20,792	0	0	$95.00	$10.45	$47.50	$1,975,240	$0	$0	$0	$1,975,240	$32,500	C5, Arterial Commercial	Retail bldg	Driveway provides sole access to approx 6 properties, which most likely have ingress/egress agreements with each other. Access needs to be maintained during contruction and in after condition. Cost based on $190/SF x 10,388 SF of bldg area. Relo cost for 1 business displacement.
398-071-04	LEVIN, MEIR	TCE & Utility	56,672	0	2,907	2,424	$25.00	$2.75	$12.50	$0	$7,994	$30,300	$0	$38,294	$0	C5, Arterial Commercial	LAND - Portion of parking lot and driveways for retail bldg and storage bldg	Access to rear indusrtial/storage bldg may be impacted by full take of APN 398-071-03.
398-071-05	1202 17TH ST LIMITED PARTNERS	TCE & Utility	27,717	0	1,208	1,641	$30.00	$3.30	$15.00	$0	$3,986	$24,615	$0	$28,601	$10,000	C5, Arterial Commercial	LAND - Portion of driveway for multi-tenant office bldg	Relo cost for 1 sign.
398-071-06	1206 17TH ST LIMITED PARTNERS	TCE Only	42,510	0	1,511	0	$30.00	$3.30	$15.00	$0	$4,986	$0	$0	$4,986	$0	C5, Arterial Commercial	LAND - Portion of driveway for multi-tenant medical office bldg	
398-071-49	PATON, AVALINE A	TCE & Utility	4,832	0	40	131	$5.00	$0.55	$2.50	$0	$22	$328	$0	$350	$0	N/Av, assumed C5	LAND - Planter and portion of parking lot	Undevelopable strip parcel, nominal acquisition cost.
398-071-58	B K SANTA ANA PROPERTY LLC	TCE Only	57,935	0	5,322	0	$20.00	$2.20	$10.00	$0	$11,708	$0	$0	$11,708	$0	N/Av, assumed industrial per public records	LAND - Driveway to commercial/industrial bldg (cash checking service)	Access may be impacted by full take of APN 398-071-03.

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ALTERNATIVE 1C UNDERPASS

APN	Owner	ROW Acuisition	Parcel Area (SF)	ROW Area (SF)	TCE Area (SF)	Underground Utility Easement Area (SF)	ROW Unit Price (Per SF)	TCE Unit Price (Per SF) 11% FMV Annually	Utility Easement Price (Per SF) 50% FMV	ROW Cost	12 month TCE Cost	Underground Utility Easement Cost	Improvements, Severance Damages, and Costs to Cure	Total ROW Costs	Relocation Costs & Incidentals	Zoning	Improvement Type Current Property Use	Comments
398-071-62 & 64	GARDNER, RICHARD C	TCE Only	79,440	0	1,424	0	$20.00	$2.20	$10.00	$0	$3,133	$0	$0	$3,133	$0	N/Av, assumed industrial per public records	LAND - Cell tower and some type of small storage bldg or container on industrial property	Access may be impacted by full take of APN 398-071-03.
398-071-57	STATE OF CALIFORNIA	TCE Only	1,783	0	1,783	0	$5.00	$0.55	$2.50	$0	$981	$0	$0	$981	$0	N/Av	LAND - Moslty vacant strip	Undevelopable strip parcel, nominal acquisition cost.
398-071-59	STATE OF CALIFORNIA	TCE Only	1,383	0	1,383	0	$5.00	$0.55	$2.50	$0	$761	$0	$0	$761	$0	N/Av	LAND - Moslty vacant strip	Undevelopable strip parcel, nominal acquisition cost.
398-071-61	STATE OF CALIFORNIA	TCE Only	489	0	489	0	$5.00	$0.55	$2.50	$0	$269	$0	$0	$269	$0	N/Av	LAND - Moslty vacant strip	Undevelopable strip parcel, nominal acquisition cost.
398-071-63	STATE OF CALIFORNIA	TCE Only	2,364	0	2,364	0	$5.00	$0.55	$2.50	$0	$1,300	$0	$0	$1,300	$0	N/Av	LAND - Moslty vacant strip	Undevelopable strip parcel, nominal acquisition cost.
										$7,160,489	$652,061	$1,100,180	$1,344,000	**$10,256,730**	**$518,000**			
														TOTAL	**$10,774,730**			

Full Fee Acquisition
Potential Issues

ASSUMPTIONS

1. Cost differences are due to rounding.

2. A field visit to the project area was made and the properties were viewed from the public right of way. No interior inspections or detailed exterior inspections were made. Building costs and relocation costs are estimated based on typical costs for the building type and tenant/business type.

3. Measurements for building areas were taken from Google Maps and Bing Maps. These measurements are rough estimates based on our interpretation of the areas that will be impacted by the project.

4. Improvements within the TCE areas will be replaced in kind by contractor; significant improvements within TCE's will be protected in place.

5. THIS IS NOT AN APPRAISAL: These cost estimates are for preliminary budget analysis purposes only and should not be used to make any offers of compensation for the proposed right of way acquisition. Appraisals are required to determine "fair market value". These costs are based on analysis of currently available market data obtained from reliable sources; however, they have not been verified.

OCTA / City of Santa Ana - 17th Street Grade Separation

ALTERNATIVE 2A OVERHEAD

APN	Owner	ROW Acuisition	Parcel Area (SF)	ROW Area (SF)	TCE Area (SF)	Underground Utility Easement Area (SF)	ROW Unit Price (Per SF)	TCE Unit Price (Per SF) 11% FMV Annually	Utility Easement Price (Per SF) 50% FMV	ROW Cost	12 month TCE Cost	Underground Utility Easement Cost	Improvements, Severance Damages, and Costs to Cure	Total ROW Costs	Relocation Costs & Incidentals	Zoning	Improvement Type Current Property Use	Comments
Properties North of 17th Street																		
396-091-01	HAMLIN FAMILY TRUST	TCE Only	381,586	0	4,321	0	$20.00	$2.20	$10.00	$0	$9,506	$0	$0	$9,506	$0	C4, Planned Shopping Ctr	LAND - Guaranty Chevrolet	Property sold February 2011. New ownership: Hamlin Family Trust.
396-091-25	FOUNDTAINHEAD PARTNERS LP	TCE Only	115,695	0	3,825	0	$30.00	$3.30	$15.00	$0	$12,623	$0	$0	$12,623	$500	SD73, Specific Development 73	LAND - Portion of parking lot and sidewalk for Senior living facility	Relo cost for 1 sign.
396-091-26	SANCARROW ASSOCIATES-CARROWS HICKORY CHIP RESTAURANTS INC	Full	27,000	27,000	0	0	$75.00	$8.25	$37.50	$2,025,000	$0	$0	$0	$2,025,000	$62,500	C1, Community Commercial	IHOP restaurant	Cost based on $500/SF x 4,062 SF of bldg area = $2,031,000. Relo cost for 1 business displacement.
396-091-24	McDONALD'S CORPORATION	Full	63,990	63,990	0	0	$27.00	$2.97	$0.00	$1,727,730	$0	$0	$0	$1,727,730	$62,500	C1, Community Commercial	McDonald's restaurant (with excess land that could be developed with a different use)	Cost based on $600/SF x 2,848 SF of bldg area = $1,708,000. The price per SF of land area appears low due to the excess land. Relo cost for 1 business displacement.
396-172-17	NORTH PARK PLAZA LLC	TCE & Utility	610,276	0	116,781	18,840	$35.00	$3.85	$17.50	$0	$449,607	$329,700	$0	$779,307	$10,000	P, Professional	LAND - Landscaping and driveways for multi-tenant office park	Appraisers will need TCE SF minus the utility SF to avoid paying twice. The southwestern most portion of the site could be developed with a separate use, and is being marketed as a build-to-suit for up to 100,000 SF. **Potential damages for loss of parking with reconfigured access. *Property owner is reported to be uncooperative***
396-172-18	NORTH PARK PLAZA LLC	Partial & TCE	48,352	4,900	5,544	0	$30.00	$3.30	$15.00	$147,000	$18,295	$0	$408,000	$573,295	$90,000	C5, Arterial Commercial	LAND - Portion bldg, driveway and parking lot for strip retail center	Bldg will need to be cut and refaced. Cost for average quality class D bldg $85/SF x approx. 4,800 SF = $408,000. 3 business displacements. **Potential severance damages to this property for loss of units and income.**
396-161-09	ROHRS INVESTMENT CO	TCE Only	147,233	0	1,014	0	$20.00	$2.20	$10.00	$0	$2,231	$0	$0	$2,231	$0	C4, Planned Shopping Ctr	LAND - Portion of driveway and parking lot for neighborhood shopping center	
Properties South of 17th Street																		
398-161-07	HEID PPARTNERS	Full	6,291	6,291	0	0	$83.00	$9.13	$41.50	$522,153	$0	$0	$0	$522,153	$64,000	C5, Arterial Commercial	4 unit multi-family dwelling	Cost based on $130,000 per unit, assuming 4 residential units = $520,000. Relo cost for 4 residential displacements. **Possible business use in some of the units.**
398-161-06	CAZAREZ, MARTIN P	Full	6,280	6,280	0	0	$83.00	$9.13	$41.50	$521,240	$0	$0	$0	$521,240	$64,000	C5, Arterial Commercial	4 unit multi-family dwelling	Cost based on $130,000 per unit, assuming 4 residential units = $520,000. Relo cost for 4 residential displacements.
398-161-05	VAGLIENTY, IRMA	Full	6,291	6,291	0	0	$83.00	$9.13	$41.50	$522,153	$0	$0	$0	$522,153	$64,000	C5, Arterial Commercial	4 unit multi-family dwelling	Cost based on $130,000 per unit, assuming 4 residential units = $520,000. Relo cost for 4 residential displacements.
398-161-04	RUIZ, ALEJANDRO	Full	6,248	6,248	0	0	$83.00	$9.13	$41.50	$518,584	$0	$0	$0	$518,584	$64,000	C5, Arterial Commercial	4 unit multi-family dwelling	Cost based on $130,000 per unit, assuming 4 residential units = $520,000. Relo cost for 4 residential displacements. **Possible business use in some of the units.**
398-161-03	BESHEARS, JAMES W	Full	6,237	6,237	0	0	$83.00	$9.13	$41.50	$517,671	$0	$0	$0	$517,671	$64,000	C5, Arterial Commercial	4 unit multi-family dwelling	Cost based on $130,000 per unit, assuming 4 residential units = $520,000. Relo cost for 4 residential displacements.
398-161-02	BESHEARS, JAMES W	Full	6,221	6,221	0	0	$83.00	$9.13	$41.50	$516,343	$0	$0	$0	$516,343	$64,000	C5, Arterial Commercial	4 unit multi-family dwelling	Cost based on $130,000 per unit, assuming 4 residential units = $520,000. Relo cost for 4 residential displacements.
398-161-01	MAG DEVELOPMENT LLC	Full	6,500	6,500	0	0	$120.00	$13.20	$60.00	$780,000	$0	$0	$0	$780,000	$100,000	C5, Arterial Commercial	5-6 unit residential bldg	Cost based on $130,000 per unit, assuming 6 residential units = $780,000. Relo cost for 5 business displacements. **Appears to be a former residential building now being used by 5 businesses.**
398-162-01	GARCIA, MARIO	Full	11,366	11,366	0	0	$158.50	$17.44	$79.25	$1,801,511	$0	$0	$0	$1,801,511	$304,000	C5, Arterial Commercial	18-19 unit apartment bldg	Cost based on $100,000 per unit, assuming 18-19 residential units = $1,800,000. Relo cost for 19 residential displacements.
398-162-08	MLS PROPERTIES	Partial, TCE & Utility	92,826	5,653	6,789	9,312	$25.00	$2.75	$12.50	$141,325	$18,670	$116,400	$360,000	$636,395	$90,000	C1, Community Commercial	LAND - Portion of bldg and landscaping in strip retail center	Bldg will need to be cut and refaced. Cost for average quality class C bldg $90SF x approx. 4,000 SF = $360,000. Relo cost for 2 business displacements and 1 sign. **Potential severance damages to this property for loss of units and income.**
398-162-09	GRIFFITH, WILLIAM H TR	TCE & Utility	71,308	0	9,716	7,963	$25.00	$2.75	$12.50	$0	$26,719	$99,538	$0	$126,257	$15,000	C1, Community Commercial	LAND - Portion of parking lot and landscaping for Hometown Buffet restaurant	Relo cost for 1 sign.
398-071-59	STATE OF CALIFORNIA	TCE & Utility	1,383	0	445	340	$5.00	$0.55	$2.50	$0	$245	$850	$0	$1,095	$0	N/Av	LAND - Moslty vacant strip	Undevelopable strip parcel, nominal acquisition cost.

OCTA / City of Santa Ana - 17th Street Grade Separation

ALTERNATIVE 2A OVERHEAD

APN	Owner	ROW Acuisition	Parcel Area (SF)	ROW Area (SF)	TCE Area (SF)	Underground Utility Easement Area (SF)	ROW Unit Price (Per SF)	TCE Unit Price (Per SF) 11% FMV Annually	Utility Easement Price (Per SF) 50% FMV	ROW Cost	12 month TCE Cost	Underground Utility Easement Cost	Improvements, Severance Damages, and Costs to Cure	Total ROW Costs	Relocation Costs & Incidentals	Zoning	Improvement Type Current Property Use	Comments
398-071-60	EARL SCHEIB OF CALIFORNIA	Full	11,761	11,761	0	0	$79.00	$8.69	$39.50	$929,119	$0	$0	$0	$929,119	$52,500	N/Av	Former Earl Sheib auto body and paint shop	Property sold April 2010 for $726,000 or $117/SF of bldg area. Cost based on $150/SF per comps for 6,200 SF of bldg area.
398-071-02	ALBERT, THOMAS TR	Full	41,997	41,997	0	0	$60.00	$6.60	$30.00	$2,519,820	$0	$0	$0	$2,519,820	$280,000	C2, General Commercial	Office/retail bldg	Driveway provides sole access to approx 6 properties, which most likely have ingress/egress agreements with each other. Access needs to be maintained during contruction and in after condition. Cost based on $190/SF x 13,088 SF of bldg area.
398-071-03	LEVIN, MEIR	Full	20,792	20,792	0	0	$95.00	$10.45	$47.50	$1,975,240	$0	$0	$0	$1,975,240	$32,500	C5, Arterial Commercial	Retail bldg	Driveway provides sole access to approx 6 properties, which most likely have ingress/egress agreements with each other. Access needs to be maintained during contruction and in after condition. Cost based on $190/SF x 10,388 SF of bldg area. Relo cost for 1 businesss displacement.
398-071-04	LEVIN, MEIR	Full	56,672	56,672	0	0	$61.00	$6.71	$30.50	$3,456,992	$0	$0	$0	$3,456,992	$130,000	C5, Arterial Commercial	Retail & storage bldgs	Driveway provides sole access to approx 6 properties, which most likely have ingress/egress agreements with each other. Access needs to be maintained during contruction and in after condition. Cost based on $150/SF x 22,940 SF of bldg area. Relo cost for 3 business displacements and 14 personal property displacements.
398-071-05	1202 17TH ST LIMITED PARTNERS	Partial, TCE & Utility	27,717	2,264	1,589	2,064	$30.00	$3.30	$15.00	$67,920	$5,244	$30,960	$180,000	$284,124	$197,500	C5, Arterial Commercial	LAND - Portion bldg and driveway for multi-tenant office bldg	Bldg will need to be cut and refaced. Cost for average quality class C bldg $120SF x approx. 1,500 SF = $180,000. Relo cost for 3 business displacements. **Potential severance damages to this property for loss of units and income.**
398-071-06	1206 17TH ST LIMITED PARTNERS	Partial & TCE	42,510	4,522	1,698	0	$30.00	$3.30	$15.00	$135,660	$5,603	$0	$442,000	$583,263	$360,000	C5, Arterial Commercial	LAND - Portion bldg and driveway for multi-tenant office bldg	Bldg will need to be cut and refaced. Cost for average quality with brick façade, class D bldg $130SF x approx. Relo cost for 4 business displacements and 1 sign. 3,400 SF = $442,000. **PLEASE NOTE: THERE IS A PARKING STRUCTURE UNDERNEITH THE BLDG. This cost estimate assumes the underground parking will not be impacted. Potential severance damages to this property for loss of units and income (and possible loss of underground parking if it cannot be protected).**
398-071-49	PATON, AVALINE A	TCE & Utility	4,832	0	289	215	$5.00	$0.55	$2.50	$0	$159	$538	$0	$696	$0	N/Av, assumed C5	LAND - Planter and portion of parking lot	Undevelopable strip parcel, nominal acquisition cost.
398-071-75 & 74	RED MOUNTAIN ASSET FUND I, LLC	Partial & TCE	94,046	3,502	1,785	0	$25.00	$2.75	$12.50	$87,550	$4,909	$0	$333,000	$425,459	$75,000	C5, Arterial Commercial	LAND - Portion bldg, driveway and landscaping for muilti-tenant retail strip center	Bldg will need to be cut and refaced. Cost for average quality class C bldg $90SF x approx. 3,700 SF = $333,000. Relo cost for 1 business displacement and 1 sign. **Potential severance damages to this property for loss of units and income.**
398-071-70	RUSSELL, WILLIAM W	Full	15,507	15,507	0	0	$97.00	$10.67	$48.50	$1,504,179	$0	$0	$0	$1,504,179	$15,000	C5, Arterial Commercial	Popeyes Fast Food Restaurant	Cost based on $600/SF x 2,500 SF of bldg area = $1,500,000. Relo cost for 1 sign.
398-071-71	PARK, DONG HYUK	TCE Only	18,203	0	306	0	$35.00	$3.85	$17.50	$0	$1,178	$0	$0	$1,178	$0	C5, Arterial Commercial	Starbucks Drive Thru	
										$20,417,190	$554,988	$577,985	$1,723,000	**$23,273,163**	**$2,261,000**			
														TOTAL	**$25,534,163**			

Full Fee Acquisition
Potential Issues

ASSUMPTIONS

1. Cost differences are due to rounding.

2. A field visit to the project area was made and the properties were viewed from the public right of way. No interior inspections or detailed exterior inspections were made. Building costs and relocation costs are estimated based on typical costs for the building type and tenant/business type.

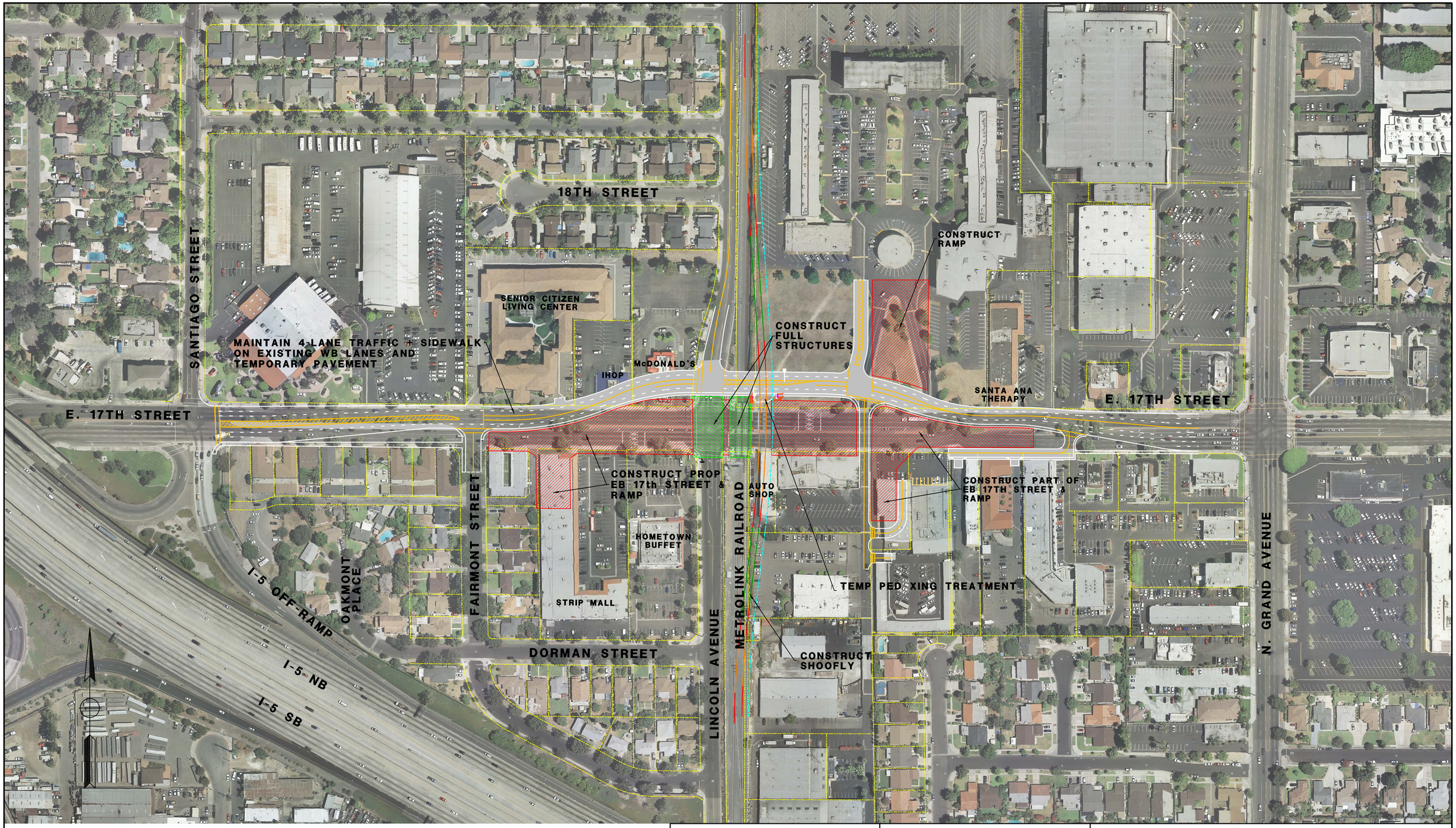
3. Measurements for building areas were taken from Google Maps and Bing Maps. These measurements are rough estimates based on our interpretation of the areas that will be impacted by the project.

4. Improvements within the TCE areas will be replaced in kind by contractor; significant improvements within TCE's will be protected in place.

5. THIS IS NOT AN APPRAISAL: These cost estimates are for preliminary budget analysis purposes only and should not be used to make any offers of compensation for the proposed right of way acquisition. Appraisals are required to determine "fair market value". These costs are based on analysis of currently available market data obtained from reliable sources; however, they have not been verified.

Attachment F:

Alternatives Preliminary Construction Staging Concepts



SCALE: 1" = 100'

OCTA

PLANS PREPARED BY:
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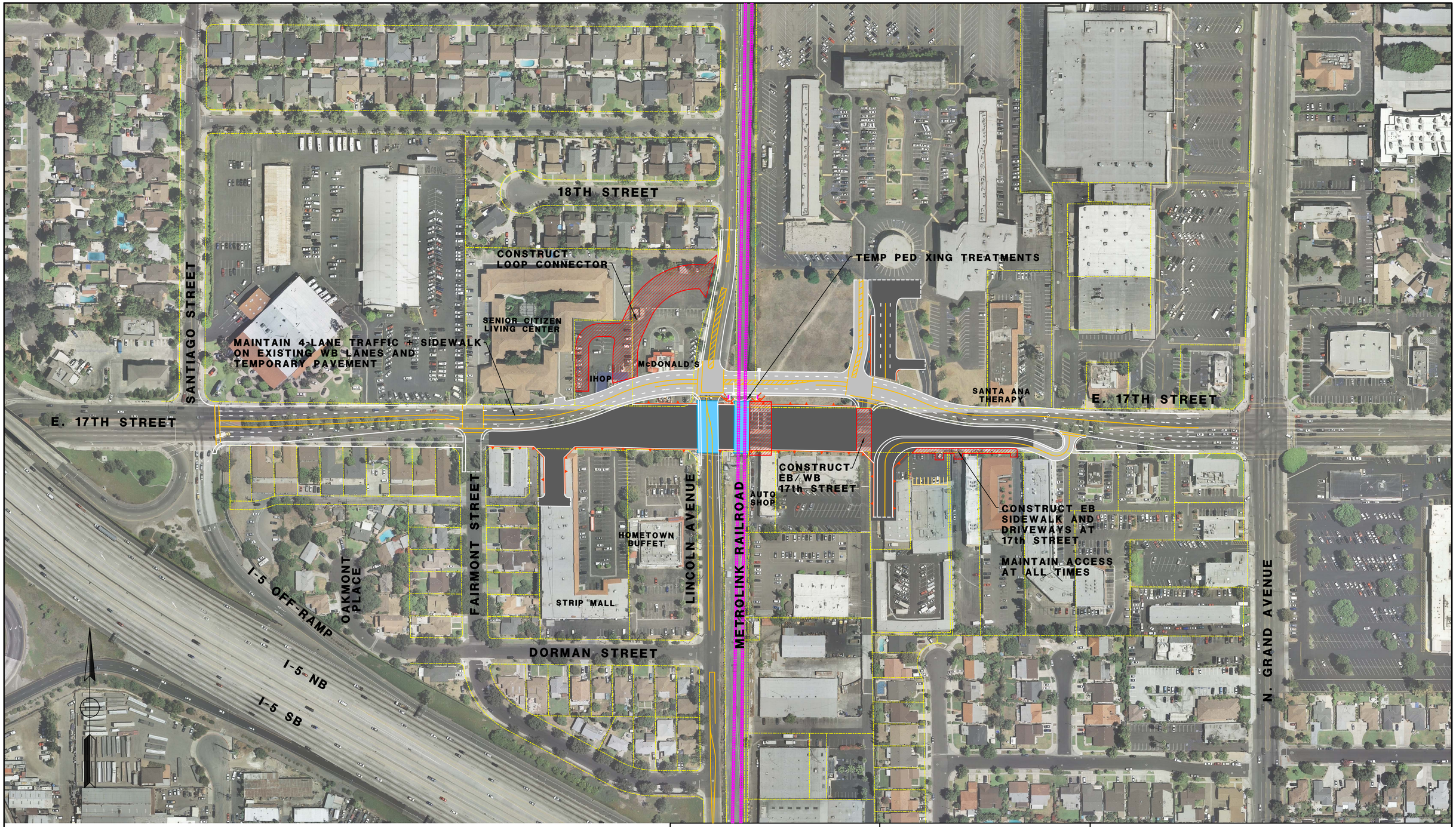
999 W. TOWN AND COUNTRY ROAD
ORANGE, CA 92868-4713
(714) 567-2501

PRELIMINARY
APRIL 30, 2012

OCTA/CITY OF SANTA ANA E. SEVENTEENTH STREET GRADE SEPARATION PROJECT

ALTERNATIVE 1A - UNDERCROSSING STAGE 1A



SCALE: 1" = 100'

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APRIL 30, 2012

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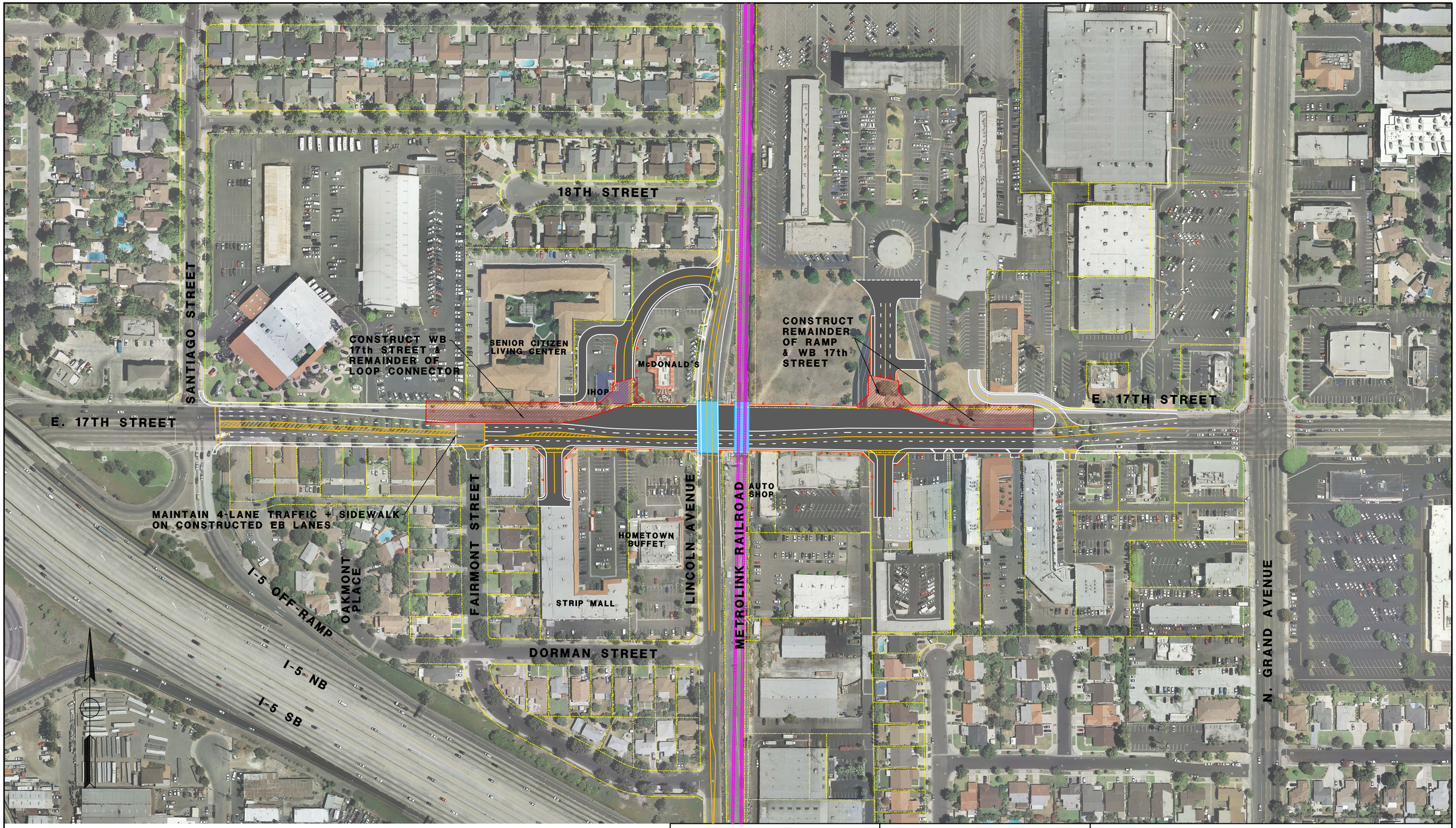
ALTERNATIVE 1A - UNDERCROSSING STAGE 1B



SCALE: 1" = 100'

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OCTA/CITY OF SANTA ANA E. SEVENTEENTH STREET GRADE SEPARATION PROJECT

ALTERNATIVE 1A - UNDERCROSSING STAGE 2B

SCALE: 1" = 100'

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ALTERNATIVE 1A - UNDERCROSSING STAGE 3

SCALE: 1" = 100'

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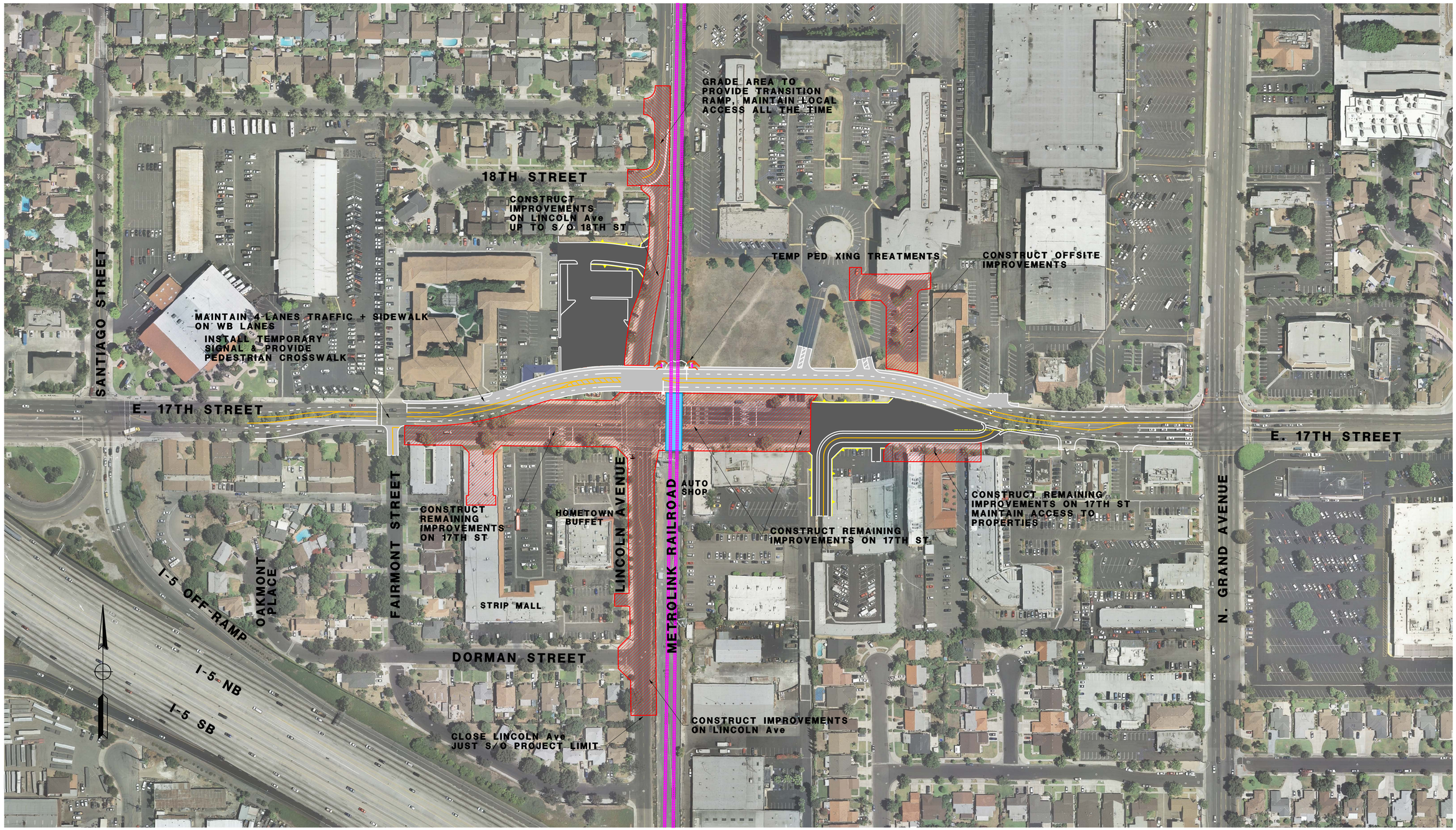
OCTA/CITY OF SANTA ANA
E. SEVENTEENTH STREET
GRADE SEPARATION PROJECT

ALTERNATIVE 1C - UNDERCROSSING
STAGE 1A



SCALE: 1" = 100'

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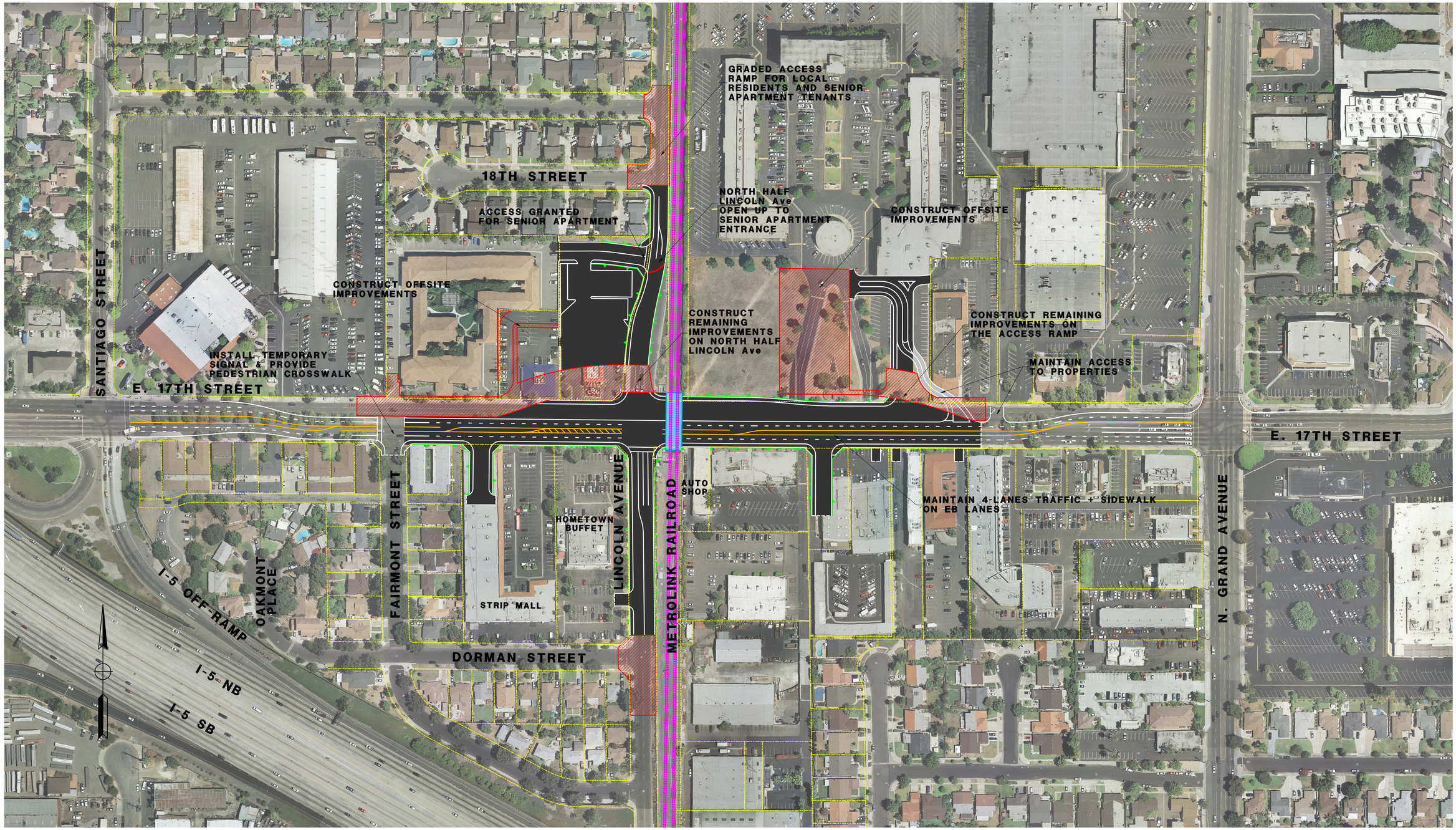
ALTERNATIVE 1C - UNDERCROSSING STAGE 1B



SCALE: 1" = 100'

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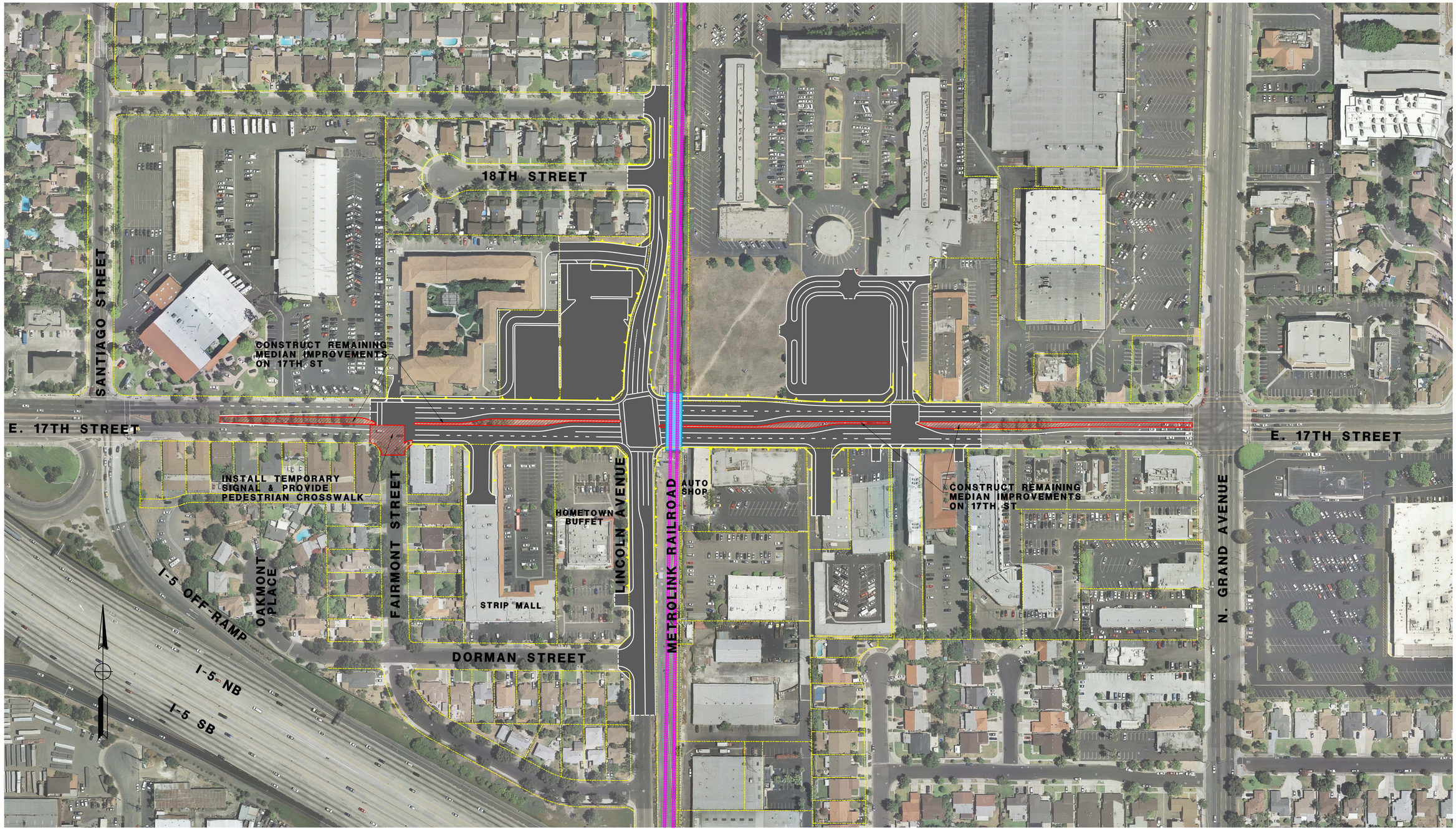
ALTERNATIVE 1C - UNDERCROSSING STAGE 2



SCALE: 1" = 100'

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ALTERNATIVE 1C - UNDERCROSSING STAGE 3

SCALE: 1" = 100'

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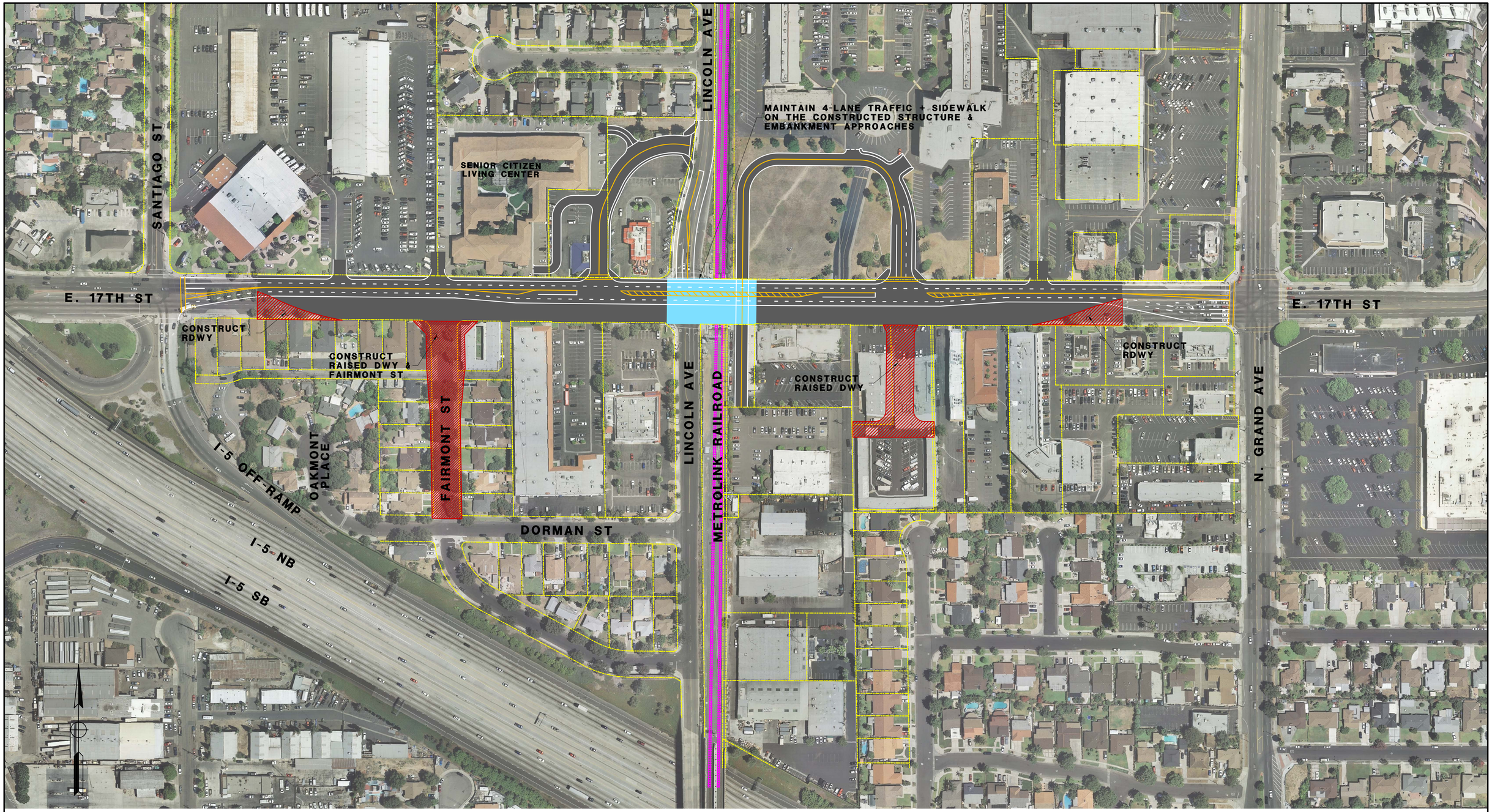
ALTERNATIVE 2A - OVERCROSSING STAGE 1



SCALE: 1" = 100'

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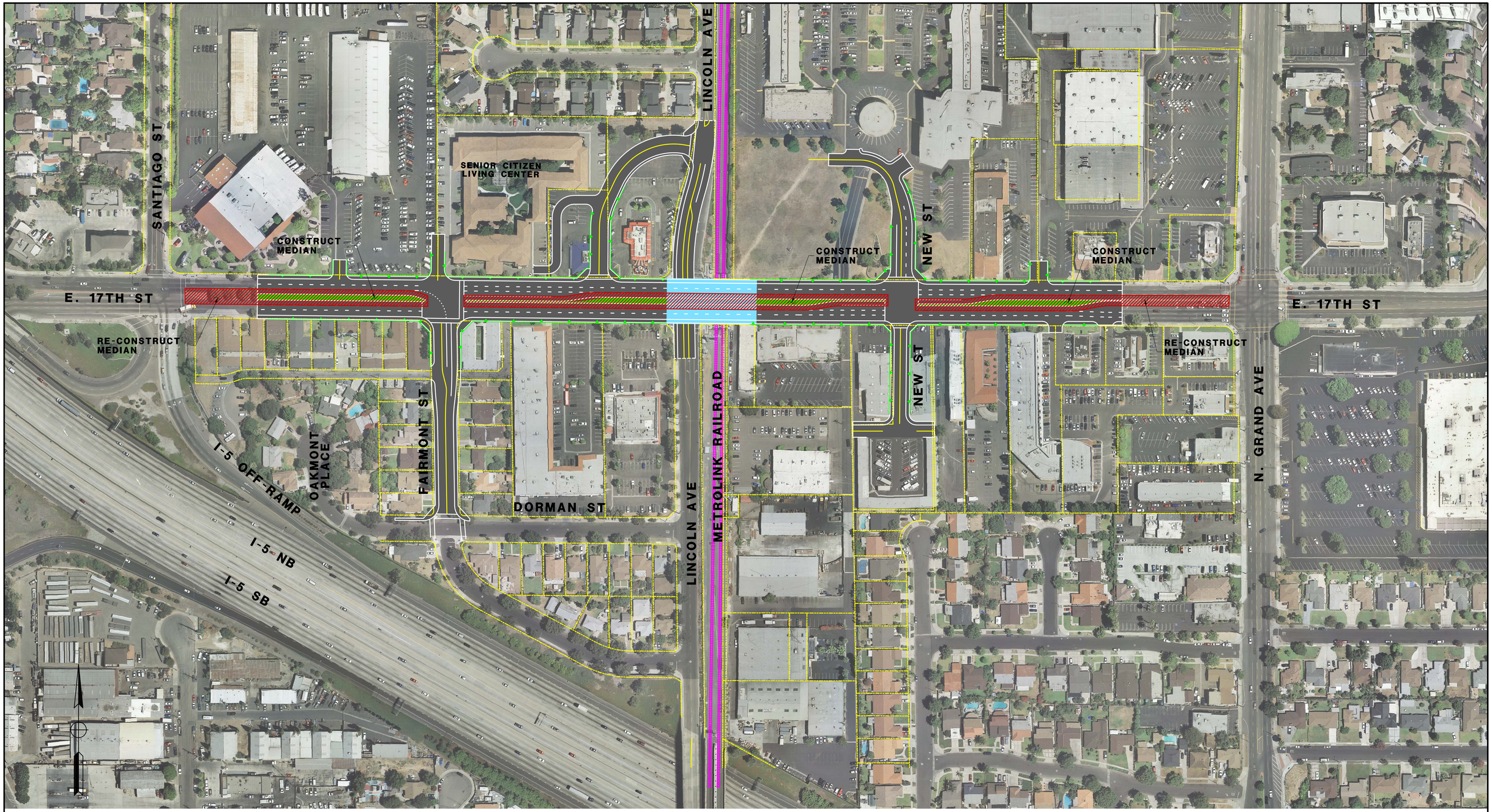
ALTERNATIVE 2A - OVERCROSSING STAGE 2



SCALE: 1" = 100'

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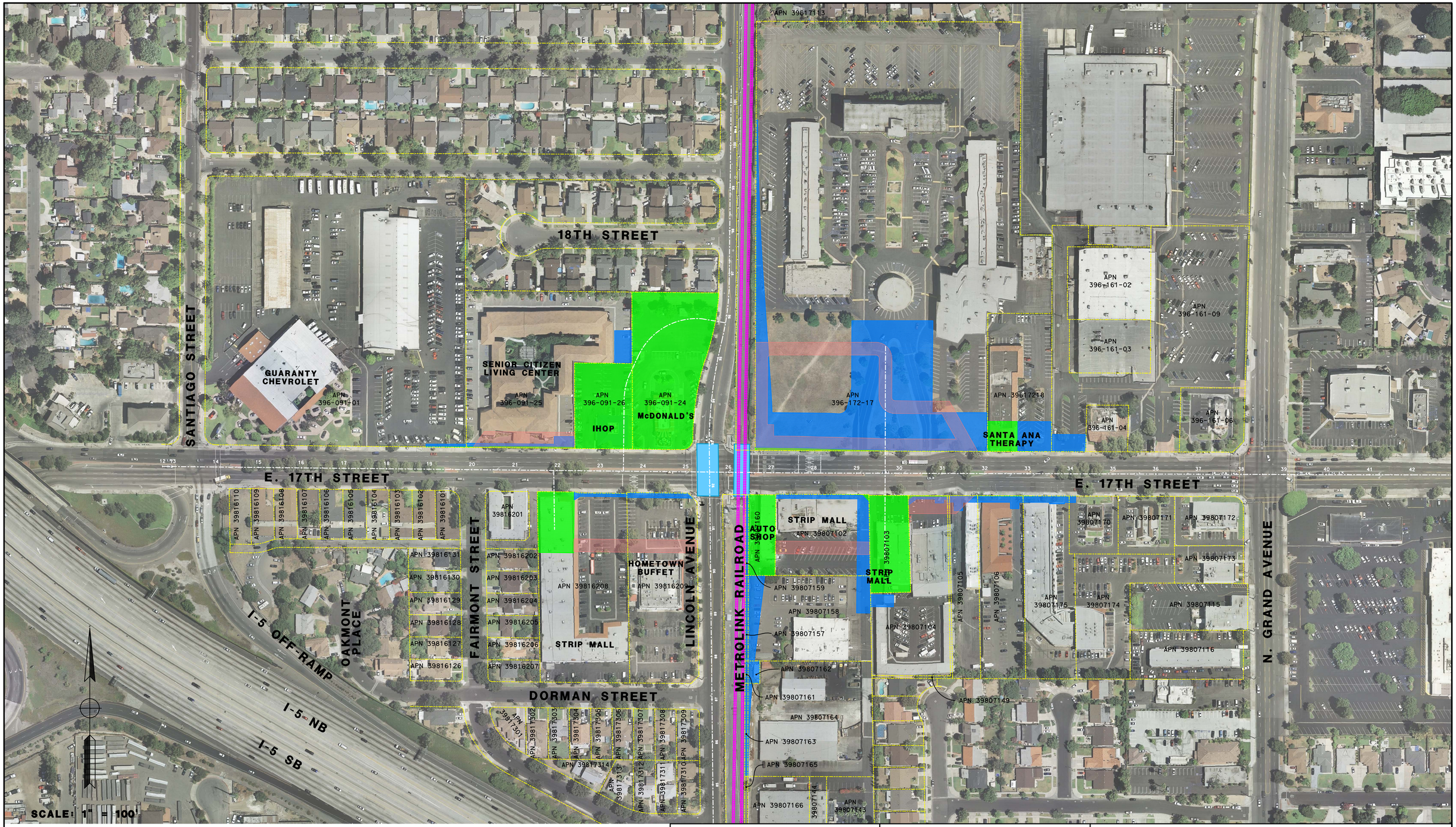
OCTA/CITY OF SANTA ANA E. SEVENTEENTH STREET GRADE SEPARATION PROJECT

ALTERNATIVE 2A - OVERCROSSING STAGE 3

Attachment G:

Alternatives Preliminary Right of Way Impacts



LEGEND

- RIGHT-OF-WAY ACQUISITION
- TEMPORARY CONSTRUCTION EASEMENT
- EXISTING RIGHT-OF-WAY
- UNDERGROUND UTILITY EASEMENT

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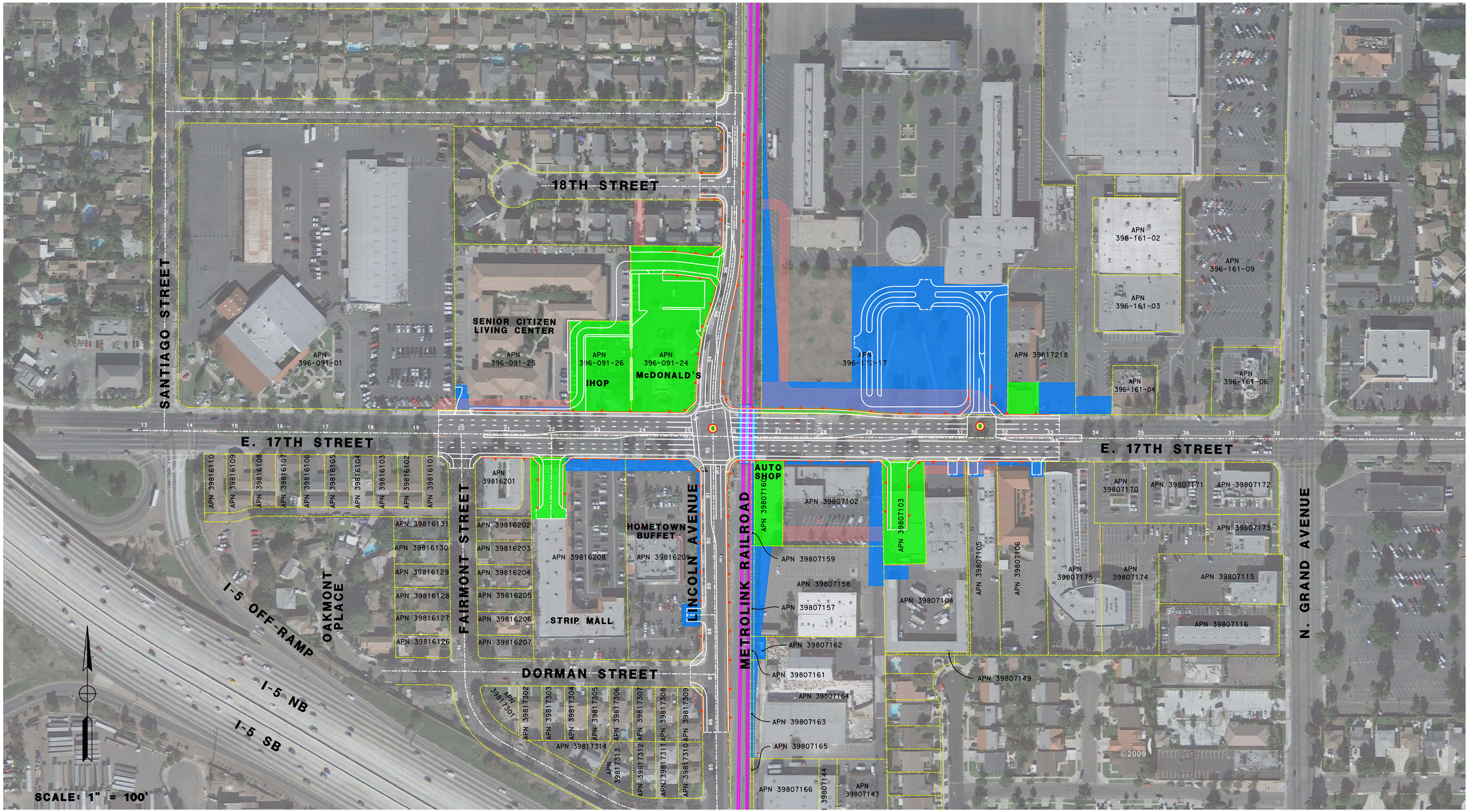
OCTA/CITY OF SANTA ANA E. SEVENTEENTH STREET GRADE SEPARATION PROJECT

ALTERNATIVE 1A - UNDERCROSSING RIGHT OF WAY ACQUISITION



LEGEND

- RIGHT-OF-WAY ACQUISITION
- TEMPORARY CONSTRUCTION EASEMENT
- EXISTING RIGHT-OF-WAY
- UNDERGROUND UTILITY EASEMENT

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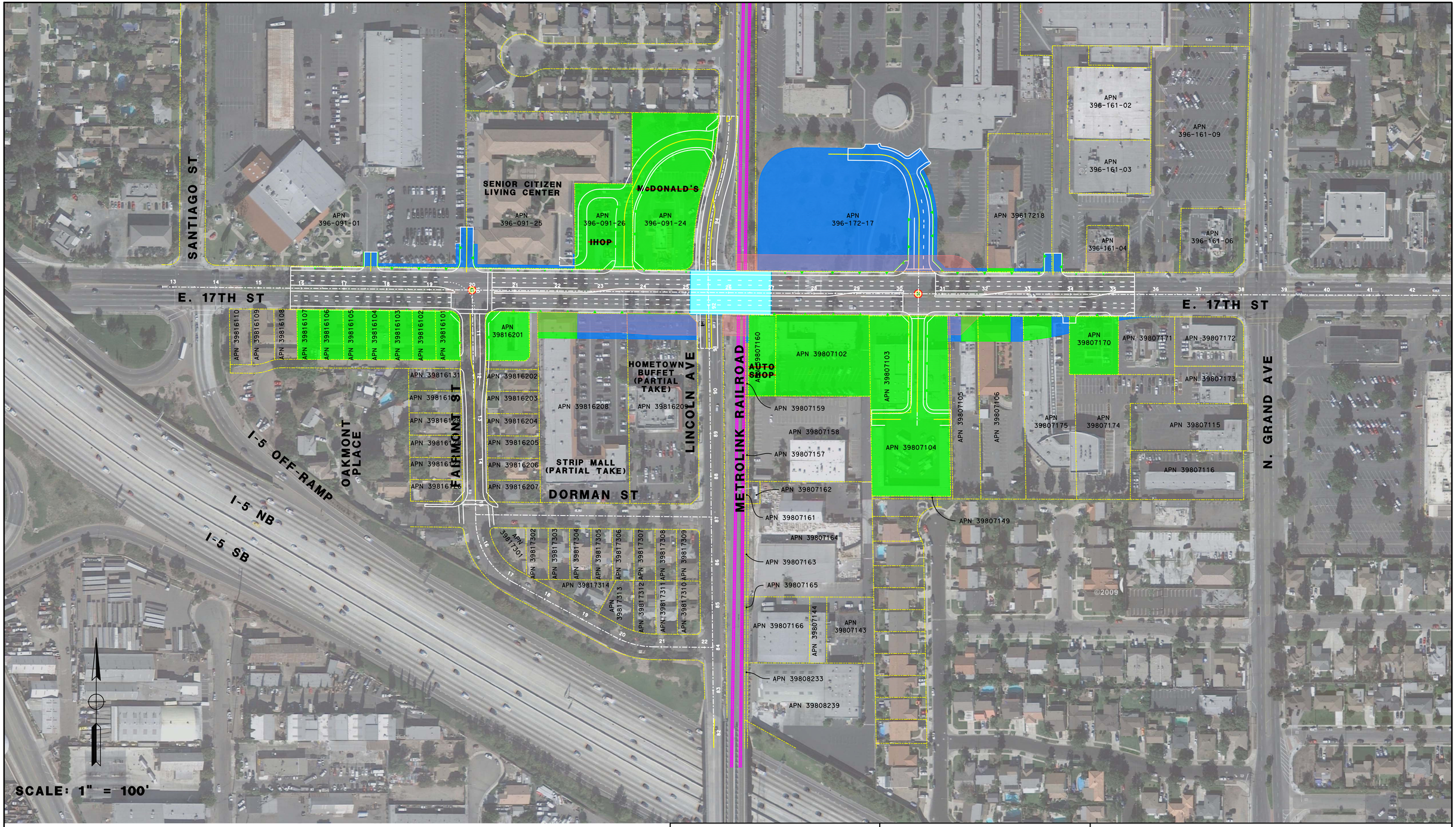
ALTERNATIVE 1C - UNDERCROSSING RIGHT OF WAY ACQUISITION



LEGEND

- RIGHT-OF-WAY ACQUISITION
- TEMPORARY CONSTRUCTION EASEMENT
- EXISTING RIGHT-OF-WAY
- UNDERGROUND UTILITY EASEMENT

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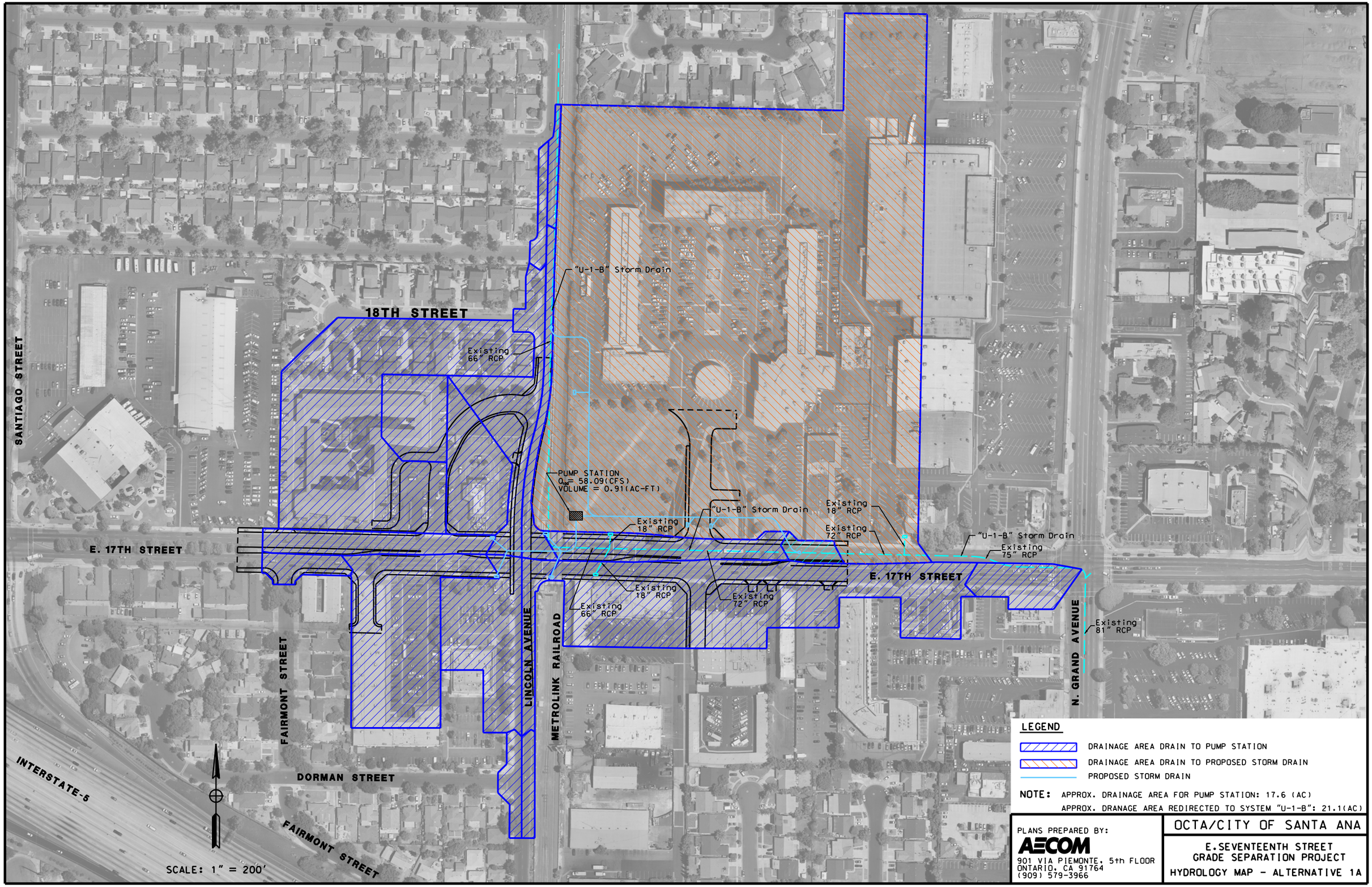
APRIL 30, 2012

OCTA/CITY OF SANTA ANA E. SEVENTEENTH STREET GRADE SEPARATION PROJECT

ALTERNATIVE 2A - OVERCROSSING RIGHT OF WAY ACQUISITION

Attachment H:

Alternatives Drainage Impacts



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ONTARIO, CA 91764
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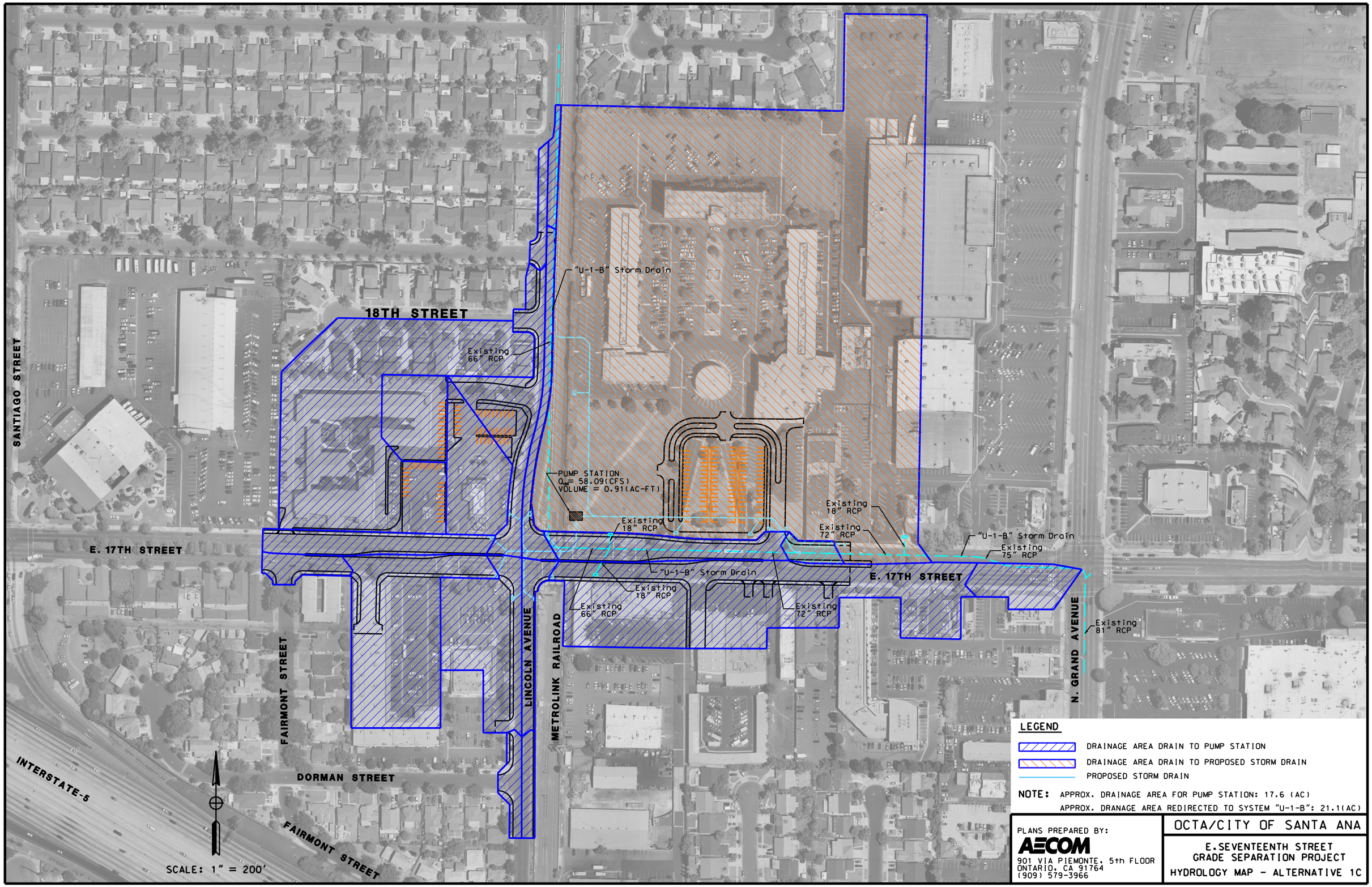
OCTA/CITY OF SANTA ANA

E.SEVENTEENTH STREET GRADE SEPARATION PROJECT

HYDROLOGY MAP - ALTERNATIVE 1A



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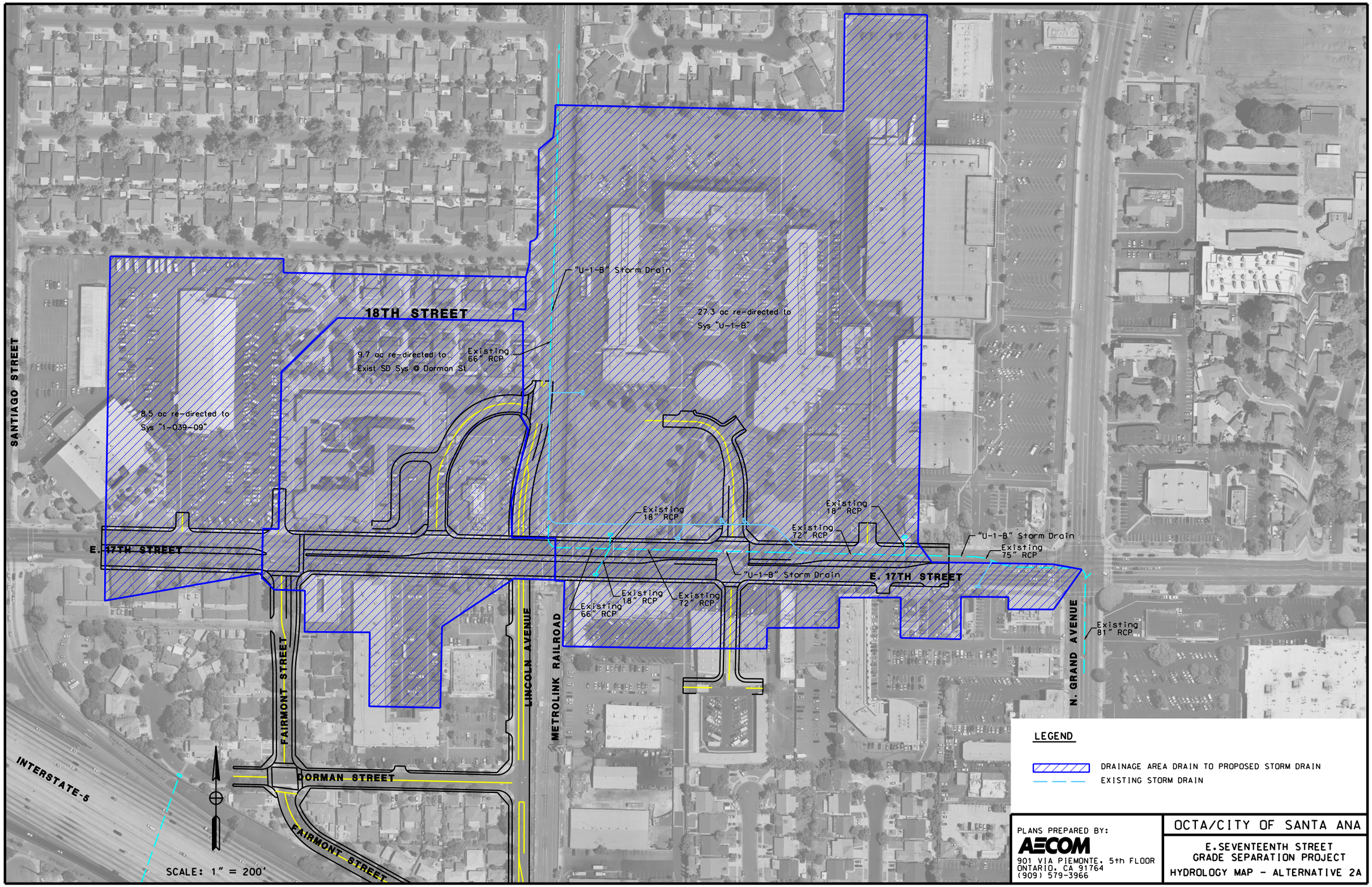
E. SEVENTEENTH STREET
GRADE SEPARATION PROJECT

HYDROLOGY MAP - ALTERNATIVE 1C



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(909) 579-3966

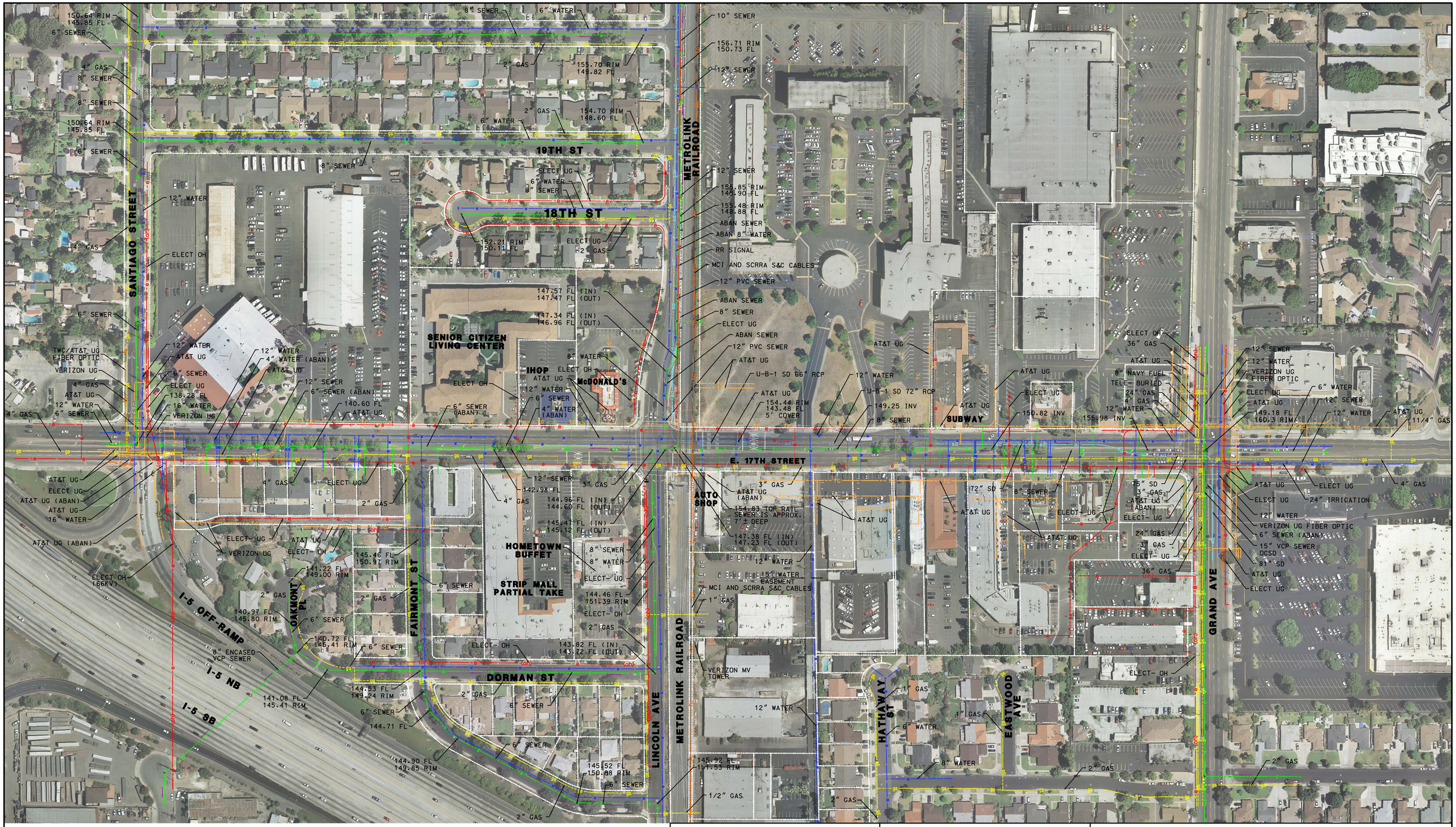
OCTA/CITY OF SANTA ANA

E. SEVENTEENTH STREET
GRADE SEPARATION PROJECT

HYDROLOGY MAP - ALTERNATIVE 2A

Attachment I:

Alternatives Utilities Impacts



SCALE: 1" = 100'

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999 W. TOWN AND COUNTRY ROAD
ORANGE, CA 92868-4713
(714) 567-2501

PRELIMINARY
APRIL 30, 2012

OCTA/CITY OF SANTA ANA E. SEVENTEENTH STREET GRADE SEPARATION PROJECT

EXISTING UTILITIES

SCALE: 1" = 80'

OCTA

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PRELIMINARY

APRIL 30, 2012

OCTA/CITY OF SANTA ANA E. SEVENTEENTH STREET GRADE SEPARATION PROJECT

ALTERNATIVE 1A - UNDERCROSSING UTILITY RELOCATION

SCALE: 1" = 80'

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OCTA/CITY OF SANTA ANA E. SEVENTEENTH STREET GRADE SEPARATION PROJECT

ALTERNATIVE 1C - UNDERCROSSING UTILITY RELOCATION

SCALE: 1" = 80'

OCTA

PLANS PREPARED BY:

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(714) 567-2501

PRELIMINARY

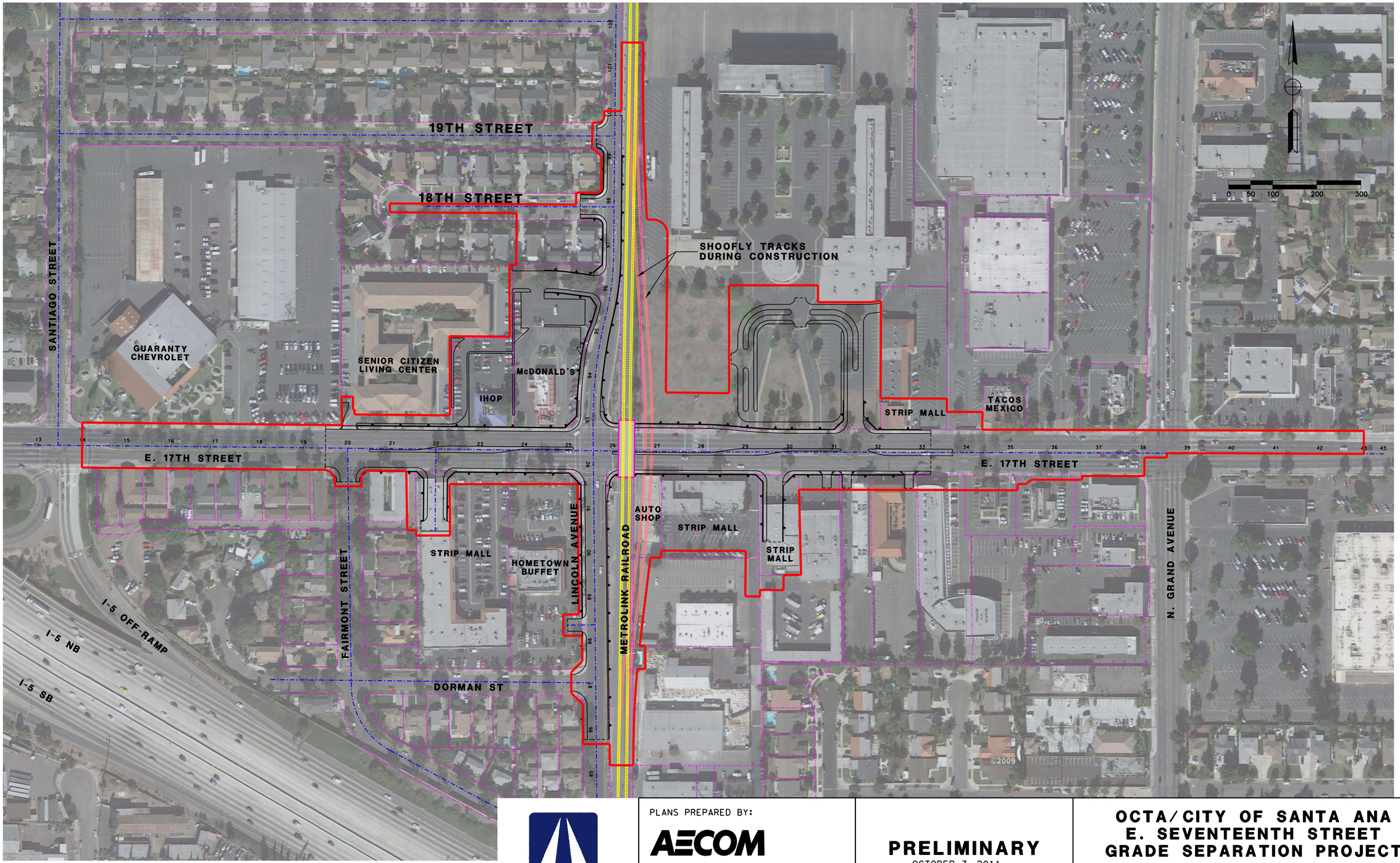
APRIL 30, 2012

OCTA/CITY OF SANTA ANA E. SEVENTEENTH STREET GRADE SEPARATION PROJECT

ALTERNATIVE 2A - OVERCROSSING UTILITY RELOCATION

Attachment J:

Project Study Area



LEGEND:

CONSTRUCTION BOUNDARY

OCTA

PLANS PREPARED BY:

AECOM

999 W. TOWN AND COUNTRY ROAD
ORANGE, CA 92868-4713
(714) 567-2501

PRELIMINARY
OCTOBER 3, 2011

OCTA/CITY OF SANTA ANA E. SEVENTEENTH STREET GRADE SEPARATION PROJECT

ALTERNATIVE 1C - UNDERPASS COONSTRUCTION BOUNDARY

Attachment K:

Preliminary Environmental Study (PES)

Exhibit 6-A Preliminary Environmental Study (PES) Form

Federal Project No.: To be added *(Federal Program Prefix-Project No., Agreement No.)* **Final Design:** December 2013 *(Expected Start Date)*

To: Jim Kaufman, Chief, Office of Local Programs *(District Local Assistance Engineer)*
District 12 *(District)*
3347 Michelson Dr., Suite 100
Irvine, California 92612-8894 *(Address)*
Jim.Kaufman@dot.ca.gov *(E-mail Address)*

From: Orange County Transportation Authority *(Local Agency)*
Mary Toutounchi – (714) 560-5833 *(Project Manager's Name and Telephone No.)*
550 South Main Street
Orange, California 92868-4506 *(Address)*
mtoutounchi@octa.net *(E-mail Address)*

Is this Project "ON" the State Highway System? ☐ Yes ☒ No **IF YES, STOP HERE** and contact the District Local Assistance Engineer regarding the completion of other environmental documentation.

Federal State Transportation Improvement Program (FSTIP) http://www.dot.ca.gov/hq/transprog/fedpgm.htm**:** *(Currently Adopted Plan Date)* *(Page No.___ attach to this form)*

Programming for FSTIP:

Preliminary Engineering		Right of Way		Construction	
(Fiscal Year)	*(Dollars)*	*(Fiscal Year)*	*(Dollars)*	*(Fiscal Year)*	*(Dollars)*
	$		$		$

Project Description as Shown in RTP and FSTIP:

Detailed Project Description: *(Describe the following, as applicable: purpose and need, project location and limits, required right of way acquisition, proposed facilities, staging areas, disposal and borrow sites, construction activities, and construction access.)*
Project Name: 17th Street Grade Separation Project. The Orange County Transportation Authority (OCTA) and the City of Santa Ana (City), in coordination with the California Department of Transportation (Department), is proposing to grade separate the current at-grade crossing of 17th Street with the Metrolink (SCRRA) double tracks. The purpose of the proposed project is to improve safety, as it would remove the existing at-grade conflict between vehicular traffic and rail traffic. In addition, the proposed project would reduce the congestion and inconvenience caused by this existing at-grade facility. See page 1 for the complete project description.

(Continue description on "Notes" sheet, last page of this Exhibit, if necessary)

Preliminary Design Information:
Does the project involve any of the following? Please check the appropriate boxes and delineate on an attached map, plan, or layout including any additional pertinent information.

Yes	No		Yes	No		Yes	No	
☒	☐	Widen existing roadway	☒	☐	Ground disturbance	☒	☐	Easements
☐	☒	Increase number of through lanes	☒	☐	Road cut/fill	☒	☐	Equipment staging
☐	☒	New alignment	☒	☐	Excavation: anticipated maximum depth 25 feet	☐	☒	Temporary access road/detour
☐	☒	Capacity increasing—other (e.g., channelization)				☒	☐	Utility relocation
						☒	☐	Right of way acquisition (if yes, attach map with APN)
			☐	☒	Drainage/culverts			
☐	☒	Realignment	☐	☒	Flooding protection			
☐	☒	Ramp or street closure	☐	☒	Stream channel work	☒	☐	Disposal/borrow sites
☒	☐	Bridge work						
			☒	☐	Pile driving	☐	☒	Part of larger adjacent project
☒	☐	Vegetation removal						
☒	☐	Tree removal	☒	☐	Demolition	☒	☐	Railroad

Required Attachments:
☒ Regional map ☒ Project location map ☐ Project footprint map (existing/proposed right of way)
☐ Engineering drawings (existing and proposed cross sections), if available ☐ Borrow/disposal site location map, if applicable
(Note: all maps (except project location map and regional maps) should be consistent with the project description (minimum scale: 1" = 200').)
☒ Notes to support the conclusions of this checklist/project description continuation page (attached)

Examine the project for potential effects on the environment, direct or indirect and answer the following questions. The "construction area," as specified below, includes all areas of ground disturbance associated with the project, including staging and stockpiling areas and temporary access roads.

Each answer must be briefly documented on the "Notes" pages at the end of the PES Form.

A. Potential Environmental Effects	Yes	To Be Determined	No
General			
1. Will the project require future construction to fully utilize the design capabilities included in the proposed project?	☐	☐	☒
2. Will the project generate public controversy?	☐	☐	☒
Noise			
3. Is the project a Type I project as defined in 23 CFR 772.5(h); "construction on new location or the physical alteration of an existing highway, which significantly changes either the horizontal or vertical alignment or increases the number of through-traffic lanes"?	☒	☐	☐
4. Does the project have the potential for adverse construction-related noise impact (such as related to pile driving)?	☐	☒	☐
Air Quality			
5. Is the project in a NAAQS non-attainment or maintenance area?	☒	☐	☐
6. Is the project exempt from the requirement that a conformity determination be made? (If "Yes," state which conformity exemption in 40 CFR 93.126, Table 2 applies): railroad/highway crossing	☒	☐	☐
7. Is the project exempt from regional conformity? (If "Yes," state which conformity exemption in 40 CFR 93.127, Table 3 applies):	☐	☐	☐
8. If project is not exempt from regional conformity, (If "No" on Question #7)			
Is project in a metropolitan non-attainment/maintenance area?	☐	☐	☐
Is project in an isolated rural non-attainment area?	☐	☐	☐
Is project in a CO, PM10 and/or PM2.5 non-attainment/maintenance area?	☐	☐	☐
Hazardous Materials/Hazardous Waste			
9. Is there potential for hazardous materials (including underground or aboveground tanks, etc.) and/or hazardous waste (including oil/water separators, waste oil, asbestos-containing material, lead-based paint, ADL, etc.) within or immediately adjacent to the construction area?	☐	☒	☐
Water Quality/Resources			
10. Does the project have the potential to impact water resources (rivers, streams, bays, inlets, lakes, drainage sloughs) within or immediately adjacent to the project area?	☐	☒	☐
11. Is the project within a designated sole-source aquifer?	☐	☐	☒
Coastal Zone			
12. Is the project within the State Coastal Zone, San Francisco Bay, or Suisun Marsh?	☐	☐	☒
Floodplain			
13. Is the construction area located within a regulatory floodway or within the base floodplain (100-year) elevation of a watercourse or lake?	☐	☐	☒
Wild and Scenic Rivers			
14. Is the project within or immediately adjacent to a Wild and Scenic River System?	☐	☐	☒
Biological Resources			
15. Is there a potential for federally listed threatened or endangered species, or their critical habitat or essential fish habitat to occur within or adjacent to the construction area?	☐	☒	☐
16. Does the project have the potential to directly or indirectly affect migratory birds, or their nests or eggs (such as vegetation removal, box culvert replacement/repair, bridge work, etc.)?	☐	☒	☐
17. Is there a potential for wetlands to occur within or adjacent to the construction area?	☐	☐	☒

18. Is there a potential for agricultural wetlands to occur within or adjacent to the construction area?	☐	☐	☒
19. Is there a potential for the introduction or spread of invasive plant species?	☒	☐	☐
Sections 4(f) and 6(f)			
20. Are there any historic sites or publicly owned public parks, recreation areas, wildlife or waterfowl refuges (Section 4[f]) within or immediately adjacent to the construction area?	☐	☐	☒
21. Does the project have the potential to affect properties acquired or improved with Land and Water Conservation Fund Act (Section 6[f]) funds?	☐	☐	☒
Visual Resources			
22. Does the project have the potential to affect any visual or scenic resources?	☐	☒	☐
Relocation Impacts			
23. Will the project require the relocation of residential or business properties?	☒	☐	☐
Land Use, Community, and Farmland Impacts			
24. Will the project require any right of way, including partial or full takes? Consider construction easements and utility relocations.	☒	☐	☐
25. Is the project inconsistent with plans and goals adopted by the community?	☐	☐	☒
26. Does the project have the potential to divide or disrupt neighborhoods/communities?	☐	☐	☒
27. Does the project have the potential to disproportionately affect low-income and minority populations?	☐	☐	☒
28. Will the project require the relocation of public utilities?	☒	☐	☐
29. Will the project affect access to properties or roadways?	☒	☐	☐
30. Will the project involve changes in access control to the State Highway System (SHS)?	☐	☐	☒
31. Will the project involve the use of a temporary road, detour, or ramp closure?	☒	☐	☐
32. Will the project reduce available parking?	☒	☐	☐
33. Will the project construction encroach on state or federal lands?	☐	☐	☒
34. Will the project convert any farmland to a different use or impact any farmlands?	☐	☐	☒
Cultural Resources			
35. Is there National Register listed, or potentially eligible historic properties, or archaeological resources within or immediately adjacent to the construction area? *(Note: Caltrans PQS answers question #35)*	☐	☐	☐
36. Is the project adjacent to, or would it encroach on Tribal land?	☐	☐	☒

For Sections B, C, and D, check appropriate box to indicate required technical studies, coordination, permits, or approvals.

B. Required Technical Studies and Analyses	C. Coordination	D. Anticipated Actions/Permits/Approvals
☒ **Traffic**		
Check one:		
☒ Traffic Study	☒ Caltrans	☒ Approval
☐ Technical Memorandum	☐ Caltrans	☐ Approval
☐ Discussion in ED Only	☐ Caltrans	☐ Approval
☒ **Noise**		
Check as applicable:		
☒ Traffic Related		
☒ Construction Related		
Check one:		
☒ Noise Study Report	☒ Caltrans	☒ Approval
☐ NADR	☐ Caltrans	☐ Approval
☐ Technical Memorandum	☐ Caltrans	☐ Approval
☐ Discussion in ED Only	☐ Caltrans	☐ Approval
☐ **Air Quality**		
Check as applicable:		
☐ Traffic Related		
☐ Construction Related		
Check one:		
☐ Air Quality Report	☐ Caltrans	☐ Approval
☐ Technical Memorandum	☐ Caltrans	☐ Approval
☐ Discussion in ED Only	☐ Caltrans	☐ Approval
	☐ FHWA	☐ Conformity Finding (6005 CEs, EAs, EISs)
	☐ Caltrans	☐ Conformity Finding (6004 CEs)
	☐ Regional Agency	☐ PM10/PM2.5 Interagency Consultation
☒ **Hazardous Materials/ Hazardous Waste**		
Check as applicable:		
☒ Initial Site Assessment (Phase 1)	☒ Caltrans	☒ Approval
☐ Preliminary Site Assessment (Phase 2)	☐ Caltrans	☐ Approval
☐ Discussion in ED Only	☐ Caltrans	☐ Approval
	☒ Cal EPA DTSC	☒ Review Database
	☒ Local Agency	☒ Review Database
☒ **Water Quality/Resources**		
Check as applicable:		
☐ Water Quality Assess. Report	☐ Caltrans	☐ Approval
☒ Technical Memorandum	☒ Caltrans	☒ Approval
☐ Discussion in ED Only	☐ Caltrans	☐ Approval
☐ **Sole-Source Aquifer (Districts 5, 6 and 11)**	☐ EPA (S.F. Regional Office)	☐ Approval of Analysis in ED
☐ **Coastal Zone**	☐ CCC	☐ Coastal Zone Consistency Determination

B. Required Technical Studies and Analyses	C. Coordination	D. Anticipated Actions/Permits/Approvals
☐ **Floodplain**		
Check as applicable:		
☐ Location Hydraulic Study	☐ Caltrans	☐ Approval
☐ Floodplain Evaluation Report	☐ Caltrans	☐ Approval
☐ Summary Floodplain Encroachment Report	☐ Caltrans	☐ Approval
	☐ Caltrans	☐ Only Practicable Alternative Finding
	☐ FHWA	☐ Approves significant encroachments and concurs in Only Practicable Alternative Findings
☐ **Wild and Scenic Rivers**	☐ River Managing Agency	☐ Wild and Scenic Rivers Determination
☒ **Biological Resources**		
Check as applicable:		
☒ NES, Minimal Impact	☒ Caltrans	☒ Approval
☐ NES		
☐ BA	☐ Caltrans	☐ Approves for Consultation
	☐ USFWS ☐ NOAA Fisheries	☐ Section 7 Informal/Formal Consultation
☐ EFH Evaluation	☐ NOAA Fisheries	☐ MSA Consultation
☐ Bio-Acoustic Evaluation	☐ NOAA Fisheries	☐ Approval
☐ Technical Memorandum	☐ Caltrans	☐ Approval
☐ **Wetlands**		
Check as applicable:		
☐ WD and Assessment	☐ Caltrans	☐ Approval
	☐ ACOE	☐ Wetland Verification
	☐ NRCS	☐ Agricultural Wetland Verification
	☐ Caltrans	☐ Wetlands Only Practicable Alternative Finding
☒ **Invasive Plants**		
☒ Discussion in ED Only (NES)	☒ Caltrans	☒ Approval
☐ **Section 4(f)**		
Check as applicable:		
	☐ Caltrans	☐ Determine Temporary Occupancy
☐ De minimis	☐ Caltrans	☐ De minimis finding
☐ Programmatic 4(f) Evaluation Type: _____	☐ Caltrans	☐ Approval
☐ Individual 4(f) Evaluation	☐ Caltrans	☐ Approval
	☐ Agency with Jurisdiction ☐ SHPO ☐ DOI ☐ HUD ☐ USDA	

B. Required Technical Studies and Analyses	C. Coordination	D. Anticipated Actions/Permits/Approvals
☐ **Section 6(f)**	☐ Agency with Jurisdiction ☐ NPS	☐ Determines Consistency with Long-Term Management Plan
	☐ NPS	☐ Approves Conversion
☒ **Visual Resources**		
Check one:		
☒ Visual Impact Assessment	☒ Caltrans	☒ Approval
☐ Technical Memorandum	☐ Caltrans	☐ Approval
☐ Discussion in ED Only	☐ Caltrans	☐ Approval
☒ **Relocation Impacts**		
Check one:		
☐ Relocation Impact Memo	☐ Caltrans	☐ Approval
☒ Relocation Impact Study	☒ Caltrans	☒ Approval
☐ Relocation Impact Report	☐ Caltrans	☐ Approval
☒ **Land Use and Community Impacts**		
Check one:		
☒ CIA	☒ Caltrans	☒ Approval
☐ Technical Memorandum	☐ Caltrans	☐ Approval
☐ Discussion in ED Only	☐ Caltrans	☐ Approval
☐ **Construction/Encroachment on State Lands**		
Check as applicable:		
☐ SLC Jurisdiction	☐ SLC	☐ SLC Lease
☐ Caltrans Jurisdiction	☐ Caltrans	☐ Encroachment Permit
☐ SP Jurisdiction	☐ SP	☐ Encroachment Permit
☐ **Construction/Encroachment on Federal Lands**	☐ Federal Agency with Jurisdiction	☐ Encroachment Permit
☐ **Construction/Encroachment On Indian Trust Lands**	☐ Bureau of Indian Affairs	☐ Right of Way Permit
☐ **Farmlands**		
Check one:		
☐ CIA	☐ Caltrans	☐ Approval
☐ Technical Memorandum	☐ Caltrans	☐ Approval
☐ Discussion in ED Only	☐ Caltrans	☐ Approval
Check as applicable:		
☐ Form AD 1006	☐ NRCS	☐ Approves Conversion
	☐ CDOC	☐ Approves Conversion
☐ Conversion to Non-Agri Use	☐ ACOE	

B. Required Technical Studies and Analyses	C. Coordination	D. Anticipated Actions/Permits/ Approvals
☐ **Cultural Resources** (PQS completes this section) ***Check as applicable:***	☐ Caltrans PQS	☐ Screened Undertaking
☐ APE Map	☐ Caltrans PQS and DLAE	☐ Approves APE Map
	☐ Local Preservation Groups and/or Native American Tribes	☐ Provides Comments Regarding Concerns with Project
☐ HPSR ☐ ASR ☐ HRER	☐ Caltrans	☐ Approves for Consultation
☐ Finding of Effect Report	☐ Caltrans	☐ Concurs on No Effect, No Adverse Effect with Standard Conditions
	☐ SHPO	☐ Letter of Concurrence on Eligibility, No Adverse Effect without Standard
☐ MOA	☐ Caltrans	☐ Approves MOA
	☐ SHPO	☐ Approves MOA
	☐ ACHP (if requested)	☐ Approves MOA
☒ **Permits** Copies of permits and a list of mitigation commitments are mandatory submittals following NEPA approval.	☐ ACOE	☐ Section 404 Nationwide Permit
	☐ ACOE	☐ Section 404 Individual Permit
	☐ Caltrans/ACOE/EPA ☐ USFWS ☐ NOAA Fisheries	☐ NEPA/404 Integration MOU
	☐ ACOE	☐ Rivers and Harbors Act Section 10 Permit
	☐ USCG	☐ USCG Bridge Permit
	☐ RWQCB	☐ Section 401 Water Quality Certification
	☐ CDFG	☐ Section 1602 Streambed Alteration Agreement
	☒ RWQCB	☒ NPDES Permit
	☐ CCC ☐ Local Agency	☐ Coastal Zone Permit
	☐ BCDC	☐ BCDC Permit

Notes: Additional studies may be required for other federal agencies.

ACHP	=	Advisory Council on Historic Preservation
ACOE	=	U.S. Army Corps of Engineers
ADL	=	Aerially Deposited Lead
APE	=	Area of Potential Effect
APN	=	Assessor Parcel Number
ASR	=	Archaeological Survey Report
BA	=	Biological Assessment
BCDC	=	Bay Conservation and Development Commission
BE	=	Biological Evaluation
BO	=	Biological Opinion
Cal EPA	=	California Environmental Protection Agency
CCC	=	California Coastal Commission
CDFG	=	California Department of Fish and Game
CDOC	=	California Department of Conservation
CE	=	Categorical Exclusion
CIA	=	Community Impact Assessment
CWA	=	Clean Water Act
DLAE	=	District Local Assistance Engineer
DOI	=	U.S. Department of Interior
DTSC	=	Department of Toxic Substances Control
EA	=	Environmental Assessment
ED	=	Environmental Document
EFH	=	Essential Fish Habitat
EIS	=	Environmental Impact Statement
EPA	=	U.S. Environmental Protection Agency
FEMA	=	Federal Emergency Management Agency
FHWA	=	Federal Highway Administration
FONSI	=	Finding of No Significant Impacted
FTIP	=	Federal Transportation Improvement Program
HPSR	=	Historic Property Survey Report
HRER	=	Historical Resources Evaluation Report
HUD	=	U.S. Housing and Urban Development
MOA	=	Memorandum of Agreement
MSA	=	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	=	National Environmental Policy Act
NADR	=	Noise Abatement Decision Report
NES	=	Natural Environment Study
NHPA	=	National Historic Preservation Act
NOAA	=	National Oceanic and Atmospheric Administration
NMFS		National Marine Fisheries Service
NPDES	=	National Pollutant Discharge Elimination System
NPS	=	National Park Service
NRCS	=	Natural Resources Conservation Service
PM10	=	Particulate Matter 10 Microns in Diameter or Less
PM2.5	=	Particulate Matter 2.5 Microns in Diameter or Less
PMP	=	Project Management Plan
PQS	=	Professionally Qualified Staff
ROD	=	Record of Decision
RTIP	=	Regional Transportation Improvement Program
RTP	=	Regional Transportation Plan
RWQCB	=	Regional Water Quality Control Board
SER	=	Standard Environmental Reference
SEP	=	Senior Environmental Planner
SHPO	=	State Historic Preservation Officer
SLC	=	State Lands Commission
SP	=	State Parks
TIP	=	Transportation Improvement Program
USCG	=	U.S. Coast Guard
USDA	=	U.S. Department of Agriculture
USFWS	=	U.S. Fish and Wildlife Service
WD	=	Wetland Delineation

E. Preliminary Environmental Document Classification (NEPA)

Based on the evaluation of the project, the environmental document to be developed should be:

Check one:

☐ Environmental Impact Statement (*Note: Engagement with participating agencies in accordance with SAFETEA-LU Section 6002 required)*

☐ Compliance with SAFETEA-LU Section 6002 regarding Participating Agencies required

☐ Complex Environmental Assessment

☐ Routine Environmental Assessment

☐ Categorical Exclusion without required technical studies.

☒ Categorical Exclusion with required technical studies

(if Categorical Exclusion is selected, check one of the following):

☐ Section 6004

☐ 23 CFR 771 activity (c)(_____)

☒ 23 CFR 771 activity (d) (3)

☐ Activity _____ listed in the Section 6004 MOU

☐ Section 6005

F. Public Availability and Public Hearing

Check as applicable:

☒ Not Required

☐ Notice of Availability of Environmental Document

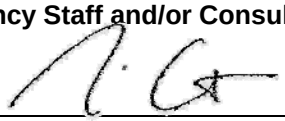
☐ Public Meeting

☐ Notice of Opportunity for a Public Hearing

☐ Public Hearing Required

G. Signatures

Local Agency Staff and/or Consultant Signature

	January 5, 2012	(949) 333-6618
(Signature of Preparer)	*(Date)*	*(Telephone No.)*

Brian Calvert
(Name)

Local Agency Project Engineer Signature

This document was prepared under my supervision, in accordance with the *Local Assistance Procedures Manual,* Exhibit 6-B, "Instructions for Completing the Preliminary Environmental Study Form."

(Signature of Local Agency)	*(Date)*	*(Telephone No.)*

Caltrans District Professionally Qualified Staff (PQS) Signature

☐ Project does not meet definition of an "undertaking"; no further review is necessary under Section 106 ("No" Section A, #35).

☐ Project is limited to the type of activity listed in Attachment 2 of the Section 106 PA and based on the information provided in the PES Form, the project does not have the potential to affect historic properties ("No" Section A, #35).

☐ Project is limited to the type of activity listed in Attachment 2 of the Section 106 PA, but the following additional procedures or information is needed to determine the potential for effect ("To Be Determined" Section A, #35):
☐ Records Search ☐ _____ ☐ _____ ☐ _____

☐ Project meets the definition of an "undertaking"; all properties in the project area are exempt from evaluation per Attachment 4 of the Section 106 PA ("No" Section A, #35).

☐ The proposed undertaking is considered to have the potential to affect historic properties; further studies for 106 compliance are indicated in Sections B, C, and D of this PES Form ("Yes" Section A, #35).

_____ _____ _____
(Signature of Professionally Qualified Staff) *(Date)* *(Telephone No.)*

The following signatures are required for all CEs, routine and complex EAs, and EISs:

Caltrans District Senior Environmental Planner (or Designee) and DLAE Signatures

I have reviewed this Preliminary Environmental Study (PES) Form and determined that the submittal is complete and sufficient. I concur with the studies to be performed and the recommended NEPA Class of Action.

_____ _____ _____
(Signature of Senior Environmental Planner or Designee) *(Date)* *(Telephone No.)*

_____
(Name)

_____ _____ _____
(Signature of District Local Assistance Engineer or Designee) *(Date)* *(Telephone No.)*

_____
(Name)

☐ HQ DEA Environmental Coordinator concurrence _____. E-mail concurrence attached.
(*date*)

PROJECT DESCRIPTION

The Orange County Transportation Authority (OCTA) and the City of Santa Ana (City), in coordination with the California Department of Transportation (Department), is proposing to grade separate the current at-grade crossing of 17th Street with the Metrolink (SCRRA) double tracks in the City of Santa Ana, Orange County (County), California (see Figures 1 and 2). The proposed project would construct a railroad underpass structure to carry SCRRA over 17th Street, depressing the current grade of the roadway and maintaining the railroad profile.

The purpose of the proposed project is to eliminate the existing at-grade crossing of 17th Street and the Metrolink (SCRRA) tracks by creating a grade separation, including depressing the profile of 17th Street under the adjacent Metrolink tracks to: enhance traffic operations; improve pedestrian and bicycle user safety; improve emergency response times; and reduce existing traffic congestion along 17th Street.

The proposed project would consist of: a depressed profile for 17th Street, beginning just westerly of Fairmont Street and ending approximately 500 feet west of North Grand Avenue; and an undercrossing bridge to pass the railroad over 17th Street. The project proposes to also depress Lincoln Avenue to meet 17th Street. The 17th Street profile is designed to provide a minimum of 16.5 feet of clearance to the soffit of the railroad structure, is design for 45 miles per hour (mph) utilizing a 5% grade for the approaches, and includes retaining walls along the depressed roadways of both Lincoln Avenue and 17th Street. In addition, roadway lighting would be required.

Access roads would be reconstructed at: Fairmont Street; the local strip mall easterly of Fairmont Street on the south side of 17th Street; the local strip mall easterly of the railroad tracks also on the south side of 17th Street; and at the Medical Center, with a new signalized intersection with 17th Street, easterly of the railroad tracks on the north side of 17th Street. Retaining walls would be required along each of these access roads with the exception of Fairmont Street. In addition, access roads along Lincoln Avenue would need to be reconstructed at: 19th Street; 18th Street; and to the Senior Citizen Living Center, located westerly of the railroad tracks on the north side of 17th Street.

PRELIMINARY ENVIRONMENTAL STUDY FORM RESPONSES

General

1. **Will the project require future construction to fully utilize the design capabilities included in the proposed project?**

   The proposed project, as designed, would provide a number of potential traffic-related, environmental, and safety-related benefits, without future construction:

   - elimination of traffic delays related to the existing OCTA Metrolink at-grade crossing at 17th Street;
   - assist in vehicle emissions reduction (along 17th Street) related to motorists waiting for trains to traverse the existing at-grade crossing;
   - decrease in delays and improved travel time along 17th Street, which in turn reduces travel cost;
   - decrease in emergency response times related to existing at-grade crossing traffic delays; and;
   - reduction or elimination of rear-end collisions, and elimination of potential broadside collisions with trains, along 17th Street at the OCTA Metrolink tracks.

   The proposed project would be able to function independently, and would not require future construction to fully utilize the design capabilities included in the proposed project.

2. **Will the project generate public controversy?** No known public controversy exists regarding the proposed project. There is no reason to expect substantial public interest in the project based on potential environmental effects. The proposed project is expected to provide a number of potential traffic-related, environmental, and safety-related benefits to the community. It is anticipated that any local interest in the environmental impacts of the project would be primarily related to typical concerns related to grade separation projects such as property acquisition and visual and noise impacts for residents located immediately adjacent to the project alignment. This will be further evaluated in the Community Impact Assessment that is prepared.

Noise

3. **Is the project a Type I project as defined in 23 CFR 772.5(h); "construction on new location or the physical alteration of an existing highway, which significantly changes either the horizontal or vertical alignment or increases the number of through-traffic lanes"?** According to 23 CFR 772.5(h), a Type I project involves "construction on new location or the physical alteration of an existing highway which significantly changes either the horizontal or vertical alignment or increases the number of through-traffic lanes." The proposed project involves the grade separation of an existing road/railroad crossing, which would involve the construction of an undercrossing (roadway passing under the railroad tracks). This would alter the vertical alignment of the roadway, thus the proposed project is a Type I project.

4. **Does the project have the potential for adverse construction-related noise impact (such as related to pile driving)?** The proposed project will likely involve pile driving during construction. This type of work would be limited in duration; however, this will be further evaluated and addressed in the Noise Study.

Air Quality

5. **Is the project in a National Ambient Air Quality Standards non-attainment or maintenance area?** The proposed project is located in the South Coast Air Basin (SCAB). As shown below, the State of California has designated the SCAB as being a nonattainment area for ozone (O_3) and

particulate matter (PM_{10}). At the federal level, EPA has also designated this area as being a nonattainment area for O_3 (8-hour standard), PM_{10}, and $PM_{2.5}$.

Selected Criteria Pollutants: Attainment Status for the South Coast Air Basin (SCAB)

	Status	
Pollutants	Federal	State
O_3 (one-hour standard)	—	Extreme Nonattainment
O_3 (eight-hour standard)	Nonattainment, Severe-17	—
PM_{10}	Serious Nonattainment	Nonattainment
$PM_{2.5}$	Nonattainment	Nonattainment
CO	Attainment	Attainment
NO_2	Unclassified/Attainment	Attainment
SO_2	Attainment	Attainment

6. **Is the project exempt from the requirement that a conformity determination be made? (If "Yes," state which conformity exemption in 40 CFR 93.126, Table 2 applies).** Yes, the proposed project is exempt from the requirement to determine conformity under the Safety heading in 40 CFR 93.126 (railroad/highway crossing).

   Some short-term air quality impacts could occur during construction. The Department's policy to reduce construction-period emissions by the greatest extent feasible is to require implementation of effective and comprehensive control measures, as identified below:

   Combustion Exhaust Emissions
   The proposed project would conform to Department construction requirements, as specified in the Department's Standard Specifications Section 7-1.01F (Air Pollution Control), which states: "The Contractor shall comply with all air pollution control ordinances and statutes which apply to any work performed pursuant to the contract, including any air pollution control rules, regulations, ordinances and statutes, specified in Section 11017 of the Government Code."

   Fugitive Dust Emissions
   SCAQMD Rule 403 (Fugitive Dust) requires that fugitive dust control measures be applied to all construction projects in the SCAB and SSAB, unless the project is specifically exempted by the rule. Construction projects that are classified as "large operations" (i.e., 20 hectares [50 acres] or larger) are required to submit a fully executed Large Operation Notification Form (Form 403 N) to the Executive Office of the SCAQMD within seven days of qualifying as a large operation and to maintain daily records to document the specific control actions taken. The control measures incorporated in the Rule are available in a Rule 403 Implementation Handbook. The proposed project, although not a large operation under the Rule's definition, would be required to implement mitigation measures for each source of PM_{10} emissions, as specified in the Rule, and attached to this PES.

   The implementation of exhaust and fugitive dust emission control measures identified above would avoid and/or minimize such emissions by the greatest extent feasible, and no additional measures are necessary.

7. **Is the project exempt from regional conformity? (If "Yes," state which conformity exemption in 40 CFR 93.127, Table 3 applies).** Not applicable based on response to Question 6.

8. **If project is not exempt from regional conformity? (If "No" on Question #7).** Not applicable based on response to Question 6.

Hazardous Materials/Hazardous Waste

9. **Is there potential for hazardous materials (including underground or aboveground tanks, etc.) and/or hazardous waste (including oil/water separators, waste oil, asbestos-containing material, lead-based paint, ADL, etc.) within or immediately adjacent to the construction area?** Based on a review of readily available database information, it is not anticipated that any hazardous materials or waste sites would be impacted by the proposed project as no known sites were identified within the limits of disturbance for the proposed project and it is not anticipated that the project would impact groundwater. A review of the California Department of Toxic Substances' EnviroStor database revealed that the nearest site that utilizes hazardous waste and substances on site is the Orange County Register (located at 625 N. Grand Avenue). This site is located approximately 0.5 mile south of the east end of the project site. However, although not identified in the database search, a field review of the project site indicated that some light industrial type uses are present and have the potential for using or storing hazardous materials. The primary site that was noted in the field is the Earl Scheib Paint and Body shop that is located at 1102 17th Street. The Initial Site Assessment (ISA) that is prepared for the proposed project will further evaluate the potential for hazardous materials/waste concerns related to the proposed project.

Water Quality

10. **Does the project have the potential to impact water resources (rivers, streams, bays, inlets, lakes, drainage sloughs) within or immediately adjacent to the project area?** There are no rivers, streams, bays, inlets, lakes, or drainage sloughs located within or immediately adjacent to the proposed project based on an initial field review of the project site. While the project is not located near any rivers, streams, bays, inlets, lakes, or drainage sloughs, the project areas drainage system will ultimately discharge into waters of the United States and the State of California, making the project subject to the requirements of a National Pollution Discharge Elimination System (NPDES) permit. Additionally, other impacts could potentially occur related to groundwater, dewatering during construction, and the potential need for a pump system to remove storm water from the lower elevations of the project area. This will be further evaluated in the Water Quality Memorandum that is prepared for the proposed project.

11. **Is the project within a designated sole-source aquifer?** The designated sole-source aquifers in California are located in the counties of Fresno, Santa Cruz, Butte, and Imperial. The proposed project is located in Orange County and not near any of California's designated sole-source aquifers.

Coastal Zone

12. **Is the project within the State Coastal Zone, San Francisco Bay, or Suisun Marsh?** The State Coastal Zone is designated as the coastal area that is generally located within one mile of the Pacific Coast. The project area is considerably further from the coast and not within an area regulated by the State Coastal Zone Management Agency (SCZMA).

Floodplain

13. **Is the construction area located within a regulatory floodway or within the base floodplain (100-year) elevation of a watercourse or lake?** As identified on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) number 06059C0163J, dated December 3, 2009, for Orange County, California and Incorporated Areas the proposed project is not located with a one-percent annual chance (100-year) floodplain or a regulatory floodway. The proposed project is located in unshaded Zone X, which is defined as areas determined to be outside the 0.2% annual chance (500-year) floodplain.

Wild and Scenic Rivers

14. **Is the project within or immediately adjacent to a Wild and Scenic River System?** There are no wild and scenic rivers located in or adjacent to the study area according to the Wild and Scenic River System list that is maintained by the National Park Service.

Biological Resources

15. **Is there a potential for federally listed threatened or endangered species, or their critical habitat or essential fish habitat to occur within or adjacent to the construction area?** A review of the California Natural Diversity Database and California Native Plant Society database was performed. In addition a preliminary review of the project site was conducted. The project site is entirely developed, and includes an expansive area containing turf grass that has been subject to some invasion of ruderal vegetation, near the medical facilities in the northeast quadrant of the project site. This area appears to be subject to regular, active mowing and irrigation activities. Based on these reviews, no federally listed or threatened or endangered species occur, or have the potential to occur, on or adjacent to the project site. In addition, no critical habitat for any federally listed threatened or endangered species is present. This will be further documented in the Natural Environment Study (Minimal Impact) (NES [MI]) that is prepared.

16. **Does the project have the potential to directly or indirectly affect migratory birds, or their nests or eggs (such as vegetation removal, box culvert replacement/repair, bridge work, etc.)?** The Migratory Bird Treaty Act (MBTA) makes it unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, or kill migratory birds. The law applies to the removal of nests as well as the abandonment of nests occupied by migratory birds during the breeding season. Due to the presence of vegetation and trees within and adjacent to the identified limits of disturbance for the proposed project there is the potential for impacts to migratory and nesting birds during construction activities. This will be further evaluated and addressed in the NES (MI) that is prepared for the proposed project. It is anticipated that tree removal associated with project would occur outside of the bird breeding season. If tree removal would occur during the bird breeding season (February 15 through September 1), a pre-construction nesting bird survey shall be conducted prior to any ground disturbance or vegetation removal.

17. **Is there a potential for wetlands to occur within or adjacent to the construction area?** Based on a preliminary review of the project site no surface waters subject to regulation by the U.S. Army Corps of Engineers, State Water Resources Control Board, or California Department of Fish and Game are present. Per the National Wetland Inventory (NWI) maps, available through the Natural Resource Conservation Service (NRCS) field office, and the Wetlands Online Mapper (U.S. Fish and Wildlife Service, Wetlands Online Mapper, http://www.fws.gov/wetlands/Data/Mapper.html), which is based on the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory database, there are no wetlands on, immediately adjacent to, or in the vicinity of the proposed project. The potential for wetlands to occur within or adjacent to the project, and the potential for the project to affect wetlands, if any, will be confirmed during the detailed field evaluation performed as part of the NES (MI). Based on a preliminary review of the project site, wetlands are not anticipated to be encountered within or adjacent to the identified limits of disturbance.

18. **Is there a potential for agricultural wetlands to occur within or adjacent to the construction area?** According to the Wetlands Online Mapper (U.S. Fish and Wildlife Service, Wetlands Online Mapper, http://www.fws.gov/wetlands/Data/Mapper.html), which is based on the U.S. Fish and Wildlife Service National Wetlands Inventory database, there are no wetlands on, immediately adjacent to, or in the vicinity of the proposed project. The potential for agricultural wetlands to occur within or adjacent to the project, and the potential for the project to affect agricultural wetlands, if any, will be confirmed during the field evaluation performed as part of the NES (MI). Based on a preliminary review of the project site, wetlands including agricultural wetlands, are not anticipated to be encountered within or adjacent to the identified limits of disturbance.

19. **Is there a potential for the introduction or spread of invasive plant species?** During construction there would be the potential for the spread of invasive species through introduction from construction equipment and other outside sources. Standard Department construction best management practices (BMPs) would be implemented during construction to limit the potential for the introduction or spread of invasive species. This will be addressed in the NES (MI) that is prepared.

Sections 4(f) and 6(f)

20. **Are there any historic sites or publicly owned public parks, recreation areas, wildlife or waterfowl refuges (Section 4[f]) within or immediately adjacent to the construction area?** It is not anticipated that any Section 4(f) resources would be impacted by the proposed project as no publicly owned parks or recreation areas, wildlife or waterfowl refuges, or known historic sites are located within or immediately adjacent to the proposed project site

21. **Does the project have the potential to affect properties acquired or improved with Land and Water Conservation Fund Act (Section 6[f]) funds?** No parks are located within or adjacent to the proposed project site. No properties acquired with Land and Water Conservation Fund (Section 6(f)) funds would be impacted by the proposed project.

Visual Resources

22. **Does the project have the potential to affect any visual or scenic resources?** The project vicinity consists of primarily light industrial and commercial uses immediately adjacent to the 17th Street/Lincoln Avenue intersection. Uses in the northwest quadrant include McDonald's and the International House of Pancakes (IHOP); in the southwest quadrant uses include Hometown Buffer and a strip mall; to the northwest they included a vacant lot with North Park Plaza (medical offices) to the north of the vacant lot immediately adjacent to the rail line; and to the southwest they include Earl Scheib Paint and Body and a strip mall and commercial uses. Along the north side of 17th Street at the west end of the project alignment is Santiago Villas (a 55 and older apartment complex) with the Guaranty Chevrolet car dealership located to the west of Santiago Villas. Along the south side of 17th Street at the west end of the project alignment there is a multi-family complex to the east of Fairmont Street and single-family homes to the west of Fairmont Street. At the north and south ends of the project alignment, along the west side of Lincoln Avenue there are single-family homes present. At the south end of the project along the east side of the rail line there are light industrial uses present. The Visual Impact Assessment Guide was completed for the proposed project. Based on a preliminary review of the project site and the information known about the project area, the proposed project received a scope of 17. Based on these results an abbreviated Visual Impact Assessment is anticipated for the proposed project. Where feasible the project would include landscaping and would provide architectural elements on the new structure. This will be further addressed in the Visual Impact Assessment that is prepared.

Relocation Impacts

23. **Will the project require the relocation of residential or business properties?** The proposed project would not require the relocation of any residences. A total of four commercial parcels would be acquired, which would require the relocation of approximately five businesses. This will be further evaluated in the Relocation Impact Study and Community Impact Assessment that are prepared.

Land Use, Community, and Farmlands Impacts

24. **Will the project require any right of way, including partial or full takes? Consider construction easements and utility relocations.** The proposed project would require the full acquisition of four properties, which all contain commercial/light industrial uses. In addition, partial property acquisition and/or temporary construction easements (TCEs) would be required on several parcels. This is documented in the table on the following page. This will be further evaluated in the Relocation Impact Study and Community Impact Assessment that are prepared.

Anticipated Acquisitions

Parcel No.	Full Acquisition	Partial Acquisition	Temporary Construction Easement
396-091-01	No	Yes	No
396-091-25	No	Yes	Yes
396-091-26	Yes	No	No
396-091-24	Yes	No	No
396-091-23	No	Yes	No
396-172-17	No	Yes	Yes
396-172-18	No	Yes	Yes
396-161-09	No	No	Yes
398-162-08	No	Yes	Yes
398-162-09	No	Yes	Yes
398-071-60	Yes	No	No
398-071-02	No	Yes	Yes
398-071-03	Yes	No	No
398-071-04	No	Yes	Yes
398-071-05	No	Yes	Yes
398-071-06	No	No	Yes
398-071-49	No	Yes	Yes
398-071-58	No	No	Yes
398-071-62 & 64	No	No	Yes
398-071-57	No	No	Yes
398-071-59	No	No	Yes
398-071-61	No	No	Yes
398-071-63	No	No	Yes

25. Is the project inconsistent with plans and goals adopted by the community? The City of Santa Ana General Plan Circulation Element (Adopted February 2, 1998 and reformatted January 2010) identifies 17th Street as a major arterial, which is defined as generally consisting of six-lanes , which is consistent with the proposed project design. The proposed project would be consistent with plans and goals adopted by the community. The proposed project is consistent with the goals that are included in the City of Santa Ana General Plan Circulation Element. Specifically it meets the following goals.

- Goal 1, “Provide and maintain a comprehensive circulation system that facilitates the efficient movement of people and goods throughout the City, and enhances its economic viability.” This is achieved by meeting Policy 1.10, which is to “Provide barrier-free accessibility throughout the circulation system.”
- Goal 2, “Provide design and construction that facilitates safe utilization of the City’s transportation system.” This is achieved by meeting Policy 2.4 which is to “Support rail crossings to minimize conflicts with on-street traffic while enhancing passenger safety and comfort, and Policy 2.7, which is to “Continue design practices which facilitate the safe use of circulation systems.

Consistency with plans adopted by the community will be further evaluated further in the Community Impact Assessment that is prepared for the proposed project.

26. Does the project have the potential to divide or disrupt neighborhoods/communities? The proposed project would be constructed along an existing roadway and would not divide a neighborhood/community. The proposed project includes a sidewalk along both sides of the overcrossing which will provide an enhanced connection across the railroad tracks; currently pedestrians currently have to cross the railroad tracks at-grade. The pedestrian crossing at the intersection of 17th Street and Lincoln Avenue, which is the primary pedestrian access across 17th Street, would remain as part of the proposed project. The proposed project would result in the full acquisition of four parcels and partial acquisition of seven parcels, see Items 23 and 24 above, and would also involve construction adjacent to single-family and multi-family residences, which could cause temporary disruptions within the affected neighborhoods. This will be evaluated further in the Community Impact Assessment that is prepared for the proposed project.

27. Does the project have the potential to disproportionately affect low-income and minority populations? All projects involving a federal action (funding, permit, or land) must comply with Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* signed by President Bill Clinton on February 11, 1994. This Executive Order directs federal agencies to take the appropriate and necessary steps to identify and address disproportionately high and adverse effects of federal projects on the health or environment of minority and low-income populations to the greatest extent practicable and permitted by law. The proposed project is located within Census Tract 754.01, Block Group 2 (located along the north side 17th Street and along the west side of the railroad line), Census Tract 754.03, Block Group 3 (located along the north side 17th Street and along the east side of the railroad line), and Census Tract 754.04, Block Group 3 (located along the south side of 17th Street). As shown in the following table, the project area (defined as Census Tract 754.01, Block Group 2; Census Tract 754.03, Block Group 2; and Census Tract 754.04, Block Group 3) has a lower percentage of individuals identified as White than County and a higher percentage than the City. The project also has a higher percentage of individuals identified as African American and as American Indian/Alaskan Native; however, this percentage within the project areas is small (0.6 percent). For all other groups (Asian, Pacific Islander/Native Hawaiian, and Other races/Ethnicities) the percentage within the project area is less than the percentages identified for the County and City.

Population and Ethnic Distribution

Area	2000 Population	White (%)	Latino/ Hispanic (of any race) (%)	African-American (%)	Asian (%)	American Indian/ Alaskan Native (%)	Pacific Islander/ Native Hawaiian (%)	Other races/ Ethnicities*
Orange County	2,846,289	51.3	30.8	1.5	13.5	0.3	0.3	0.2
City of Santa Ana	337,977	12.4	76.1	1.3	8.7	0.3	0.3	0.1
Project Area**	2,987	29.3	64.1	1.9	2.9	0.6	0.2	0.1

* For Census Tract level, data classified as "Some other race alone" applied

** Includes Census Tract 754.01, Block Group 2; Census Tract 754.03, Block Group 2; and Census Tract 754.04, Block Group 3

As shown in the following table the median household income for the Census tracts where the project is located (i.e., Census Tract 754.01, Block Group 2; Census Tract 754.03, Block Group 2; and Census Tract 754.04, Block Group 3) is below that reflected for the County but higher than that reflected for the City. Low income is defined based on the Department of Health and Human Services (DHHS) poverty guidelines. For 1999 (commensurate with available income data), this was $16,700 for a family of four, and for 2011 (current), it is $22,350. Therefore, although the project area

has a lower median household income than for the County, the project area is not considered a low income area as it is above the DHHS poverty guidelines.

Median Household Income

Census Tract/City	1999 Median Household Income
Orange County	$58,820
City of Santa Ana	$43,412
Project Area"	$51,840

** Includes Census Tract 754.01, Block Group 2; Census Tract 754.03, Block Group 2; and Census Tract 754.04, Block Group 3

Based on a comparative analysis of demographic (i.e. race and ethnicity) and income characteristics of the study area with that of the City or County populations, the study area population is not characterized as having a higher proportion of minority groups in general when compared with the City of Santa Ana overall; and as having a lower income (though not defined as low income) than the County and higher than the City. Based on the above discussion, the proposed project is not anticipated to have impacts per Executive Order 12898 regarding environmental justice. Therefore, it is not anticipated that the proposed project would cause disproportionately high and adverse effects on any minority or low-income populations as per Executive Order 12898 regarding environmental justice. In addition the proposed project would comply with Title VI of the Civil Rights Act of 1964 and related statutes.

28. Will the project require the relocation of public utilities? The proposed project would require the relocation of the following utilities.

- City of Santa Ana water line: 12 and 8-inch water lines
- City of Santa Ana sewer line: 12, 8, and 6-inch sewer lines
- City of Santa Ana stormdrain: 66 and 72-inch stormdrain pipes
- Southern California Gas: 4, 3, 2, and 1-inch gas lines
- AT&T underground telecommunication cables
- Metrolink fiber optic telecommunication lines
- Southern California Edison: power poles, power manholes, and underground power lines
- Verizon: underground cables and microwave tower

The affected utilities shall be relocated in accordance with State law and regulations and County and City policies. There shall be ongoing coordination between the project team, the affected agencies, and the utility companies in order to minimize potential disruption of utility service. No adverse effects to public services are anticipated.

29. Will the project affect access to properties or roadways? For the majority of parcels access would not be affected. However, as part of the proposed project the following access modifications would be required.

- For parcels 396-091-24 (McDonald's) and 396-091-26 (IHOP) access along 17th Street would be eliminated due to the change in elevation of the roadway and a new access would be established for these parcels from Lincoln Avenue. However, these two parcels are assumed to be full acquisitions.
- Direct access to parcel 398-071-60 (Earl Scheib Paint and Body) from 17th Street would be eliminated; however, this is a full acquisition parcel.
- The eastern most driveway for parcel 396-091-26 (Santiago Villas) would be eliminated and replaced with a connection to Lincoln Avenue.

- The existing driveways for the strip mall (Lincoln Pacific Plaza) and Hometown Buffet (parcels 398-162-08 and 398-162-09, respectively) would be eliminated with the exception of the western most driveway. This driveway would be reprofiled to match the new roadway grade and a new entrance from Lincoln Avenue would be constructed.
- For parcel 396-172-17 (North Park Plaza), the entrance along 17th Street would be relocated to the west and the roadway leading into the plaza would be reconfigured.
- For parcel 398-071-03 (J.J. Fashion and Uniforms) (full acquisition) the driveway would be modified to maintain connectivity to the service road that travels through this parcel and provides access for parcels to the south.

Other driveways along 17th Street would require minor modifications to match the new roadway grade.

30. **Will the project involve changes in access control to the State Highway System (SHS)?** The proposed project would not result in a change in access control.

31. **Will the project involve the use of a temporary road, detour, or ramp closure?** During construction the project proposes to construct a temporary shoofly (temporary) railroad alignment for the purpose of constructing the underpass structure while maintaining railroad service. This shoofly alignment would be located east of the existing railroad alignment. With respect to roadway construction it is assumed that the grade separation would be constructed in stages; allowing traffic to be maintained along 17th Street during construction. This will be addressed in detail in the Traffic Management Plan (TMP) that is prepared for the proposed project.

32. **Will the project reduce available parking?** As shown under Item 24, the project would include some full acquisitions, some partial acquisitions, and some temporary construction easements (TCE). A summary of anticipated parking impacts is provided below.
    - Parcel 396-091-26 (IHOP) – all parking spaces (approximately 53) would be removed as this is anticipated to be a full acquisition; therefore, these spaces would not be required following construction.
    - Parcel 396-091-24 (McDonald's) - all parking spaces (approximately 30 in main parking area and approximately 48 in ancillary parking area) would be removed as this is anticipated to be a full acquisition; therefore, these spaces would not be required following construction.
    - Parcel 396-091-25 (Santiago Villas) – approximately 12 parking spaces would be temporarily removed during construction; these would be replaced following construction of the proposed project. During construction temporary spaces on the parcel 396-091-24 could likely be established if needed; therefore, no net loss of parking would result.
    - Parcel 396-172-17 (North Park Plaza) - approximately 54 parking spaces would be removed by the proposed project. A new parking lot would be constructed adjacent to the new access roadway on this property to replace the parking spaces that are removed; therefore, no net loss of parking would result.
    - Parcel 396-172-18 (North Park Plaza Center strip mall) – approximately 10 parking spaces would be temporarily removed during construction. These parking spaces would be reestablished following construction; therefore, no net loss of parking would occur.
    - Parcel 396-161-09 (parking lot adjacent to Marisco's restaurant) - approximately 16 parking spaces would be temporarily removed during construction. These parking spaces would be reestablished following construction; therefore, no net loss of parking would occur.
    - Parcel 398-071-05 (office building) – approximately two parking spaces would be temporarily removed during construction. These parking spaces would be reestablished following construction; therefore, no net loss of parking would occur.

- Parcel 398-071-03 (J.J. Fashion and Uniforms) - approximately 17 parking spaces would be removed; these parking spaces are associated with the portion of the structure/business that would be acquired as part of the project; therefore, these spaces would not be required following construction.
- Parcel 398-071-04 (strip mall) - approximately six parking spaces (the eastern most spaces fronting 17th Street) would be temporarily removed during construction. These parking spaces would be reestablished following construction; therefore no net loss of parking would occur.
- Parcel 398-071-02 (strip mall) – approximately three parking spaces would be temporarily removed during construction. These parking spaces would be reestablished following construction; therefore, no net loss of parking would occur.
- Parcel 398-071-60 (Earl Scheib Paint and Body) - all parking spaces (approximately 10) would be removed as this is anticipated to be a full acquisition; therefore, these spaces would not be required following construction.
- Parcel 398-071-58 - approximately 17 parking spaces would be temporarily removed during construction. These parking spaces would be reestablished following construction; therefore, no net loss of parking would occur.
- Parcel 398-162-09 (Hometown Buffet) - approximately 10 parking spaces fronting 17th Street would be temporarily removed during construction. These parking spaces would be reestablished following construction; therefore, no net loss of parking would occur.
- Parcel 398-162-08 (Lincoln Pacific Plaza) - approximately eight parking spaces would be temporarily removed during construction. These parking spaces would be reestablished following construction; therefore, no net loss of parking would occur. A portion of the strip mall would be acquired as part of the proposed project so this parking may not be reestablished if it is determined that it is no longer needed.

Impacts on parking will be further addressed in the Community Impact Assessment that is prepared.

33. Will the project construction encroach on state or federal lands? The proposed project would not involve any encroachment on state or federal lands.

34. Will the project convert any farmland to a different use or impact any farmlands? Through mapping maintained by the Natural Resources Conservation Service/California Department of Conservation, it has been determined that the project area, which is located in an urbanized area, does not meet the definition of farmland as defined in 7 CFR 658. The entire project area is designated as "Urban and Built-up Land". Therefore, the provisions of the Farmland Protection Policy Act of 1984 do not apply to this project.

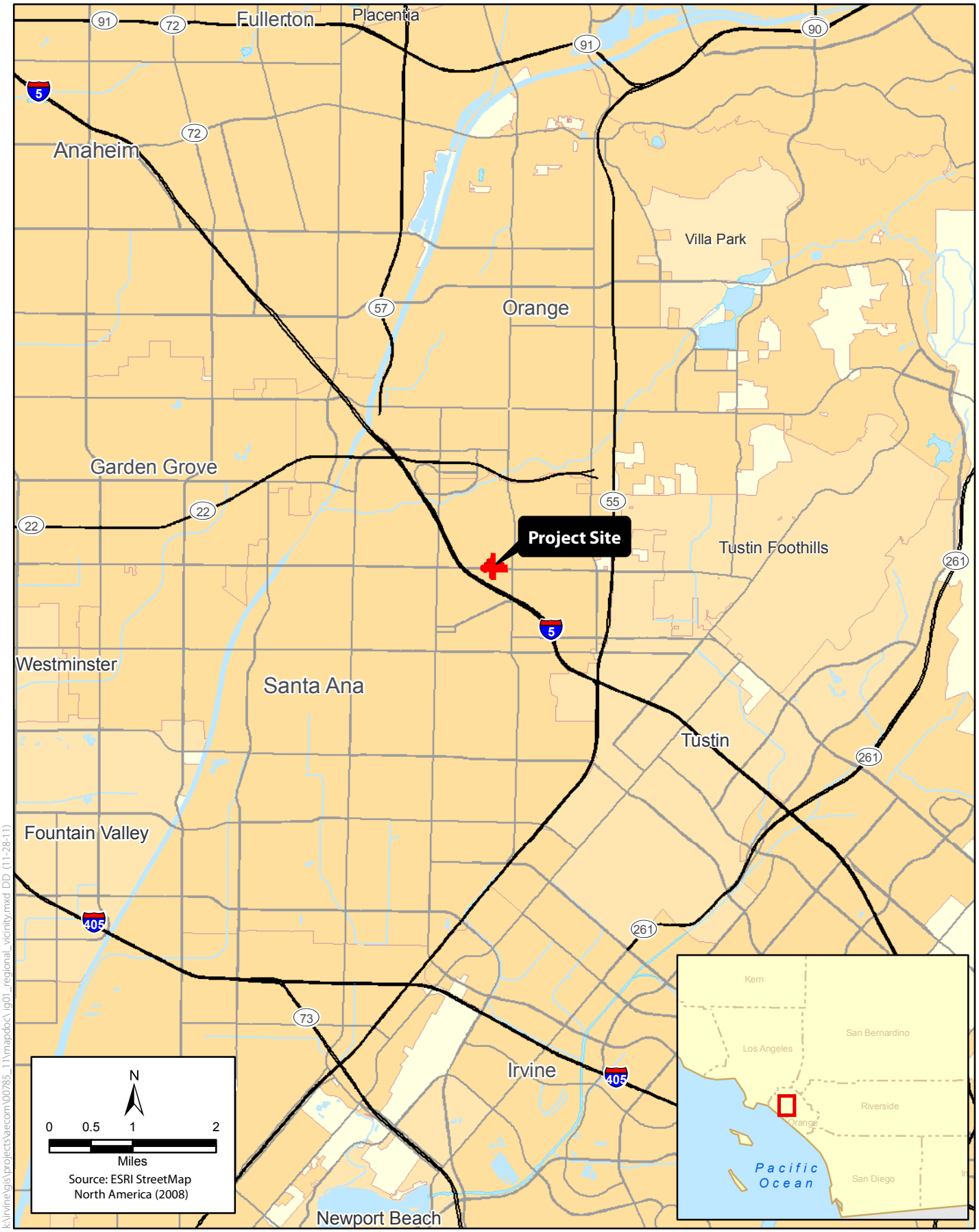
Cultural Resources

35. Is there National Register listed, or potentially eligible historic properties, or archaeological resources within or immediately adjacent to the construction area? *(Note: Caltrans PQS answers question #35)* To be addressed by Caltrans PQS, however, the following has been documented in preparation of this PES. An archaeological record search was conducted on December 1, 2011. Results of this record search indicate that one cultural resource has been recorded within the anticipated project area of potential effect (APE), the existing Metrolink Railroad/Burlington Northern Santa Fe Railway, formerly the Atchison, Topeka and Santa Fe Railway. This resource is not considered substantial and construction of the project would not have an Adverse Effect on the resource. Sixty additional cultural resources, all historic period structures or historic districts, have been recorded within a one-mile radius of the anticipated APE; however, none are adjacent to the APE. A total of 42 previous studies have been conducted within one-mile of the anticipated APE. None of these studies covers any portion of the proposed project site. A preliminary examination of the anticipated project APE indicated that it was completely developed, and that no ground surface was exposed.

In terms of potential historic built environment resources, a qualified investigator (QI) conducted a preliminary site visit of the project area for potential cultural resources. Based on the site visit, it is not anticipated that any National Register of Historic Places (NRHP) eligible resources are present in the anticipated project APE. However, within the anticipated APE there appear to be less than five properties over 50 years old that will require formal evaluation. The project area appears to have developed during the post-war era and is primarily commercial in use. If it is determined that the Santa Ana Medical Arts Complex is unaltered then this property would potentially warrant further investigation for NRHP eligibility under design Criterion C. The tower at the rear of the complex is a highly intact Mid-Century Modern design; however, it does not appear that this resource would be affected by the proposed project.

Additional investigation related to potential cultural resources will be conducted during the PA/ED phase of the project.

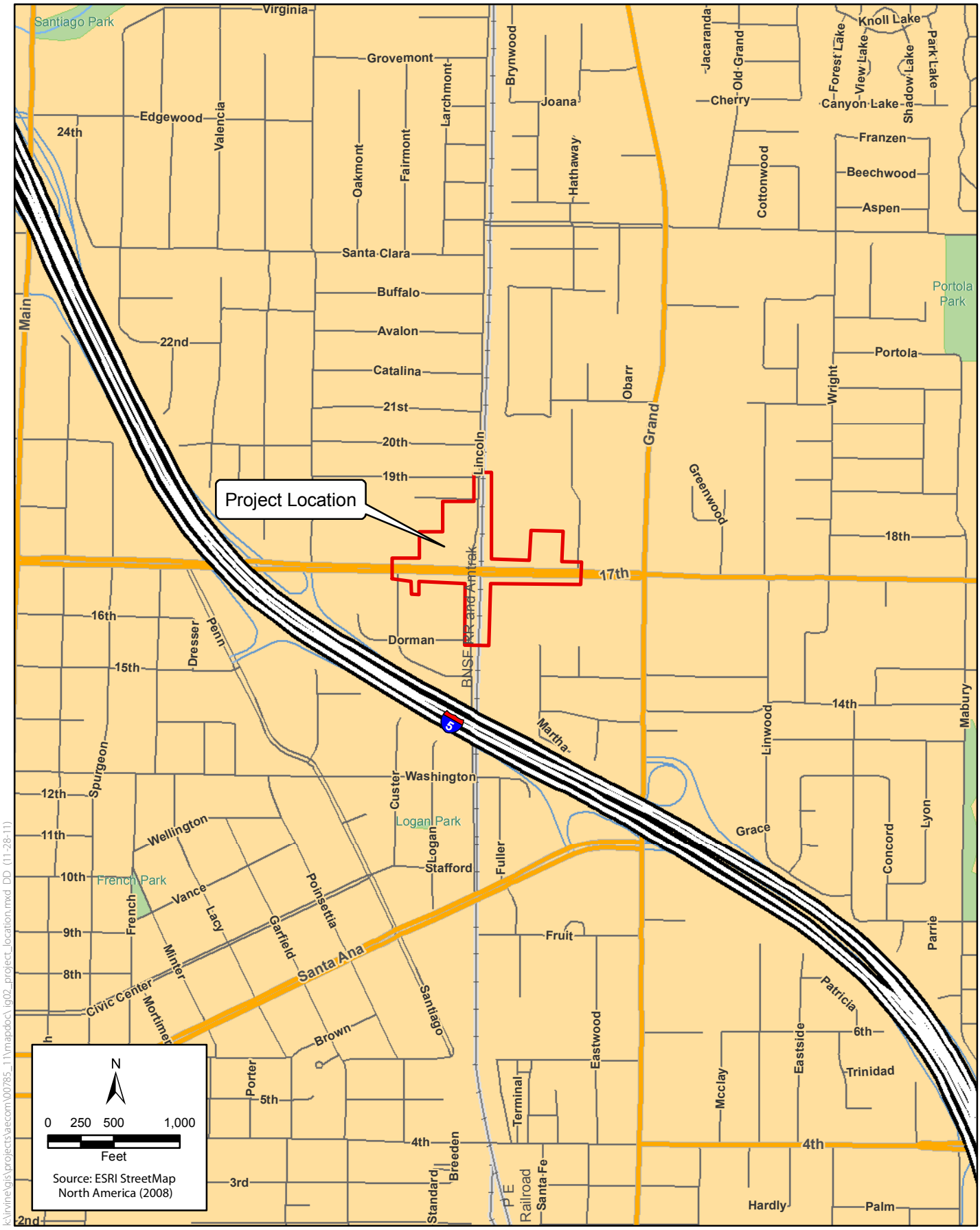
36. Is the project adjacent to, or would it encroach on Tribal land? No Tribal Land has been identified on or adjacent to the proposed project site and no impacts to Tribal Lands are anticipated.



k:\irvine\gis\projects\aecom\00785_11\mapdoc\ig01_regional_vicinity.mxd DD (11-28-11)

District: 12
County: Orange
Route: 17th Street

Figure 1
Regional Vicinity Map
17th Street Grade Separation Project



District: 12
County: Orange
Route: 17th Street

Figure 2
Project Location Map
17th Street Grade Separation Project

tional Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

50 0 500 1000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0163J

FIRM

FLOOD INSURANCE RATE MAP

ORANGE COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 163 OF 539

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ORANGE, CITY OF	060228	0163	J
SANTA ANA, CITY OF	060232	0163	J

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06059C0163J

MAP REVISED
DECEMBER 3, 2009

Federal Emergency Management Agency

Initial Site Assessment (ISA) Checklist

Project Information

District 12 County ORA Route _____ Post Mile _____ EA Fed Proj No. To be added

Description The Orange County Transportation Authority (OCTA), in coordination with the California Department of Transportation (Department), is proposing to grade separate the existing 17th Street/ OCTA Metrolink at-grade railroad crossing in the City of Santa Ana, Orange County, California. The purpose of the proposed project is to improve safety, as it would remove the existing at-grade conflict between vehicular traffic and rail traffic. In addition, the proposed project would reduce the congestion and inconvenience caused by this existing at-grade facility.

Is the project on the HW Study Minimal-Risk Projects List (HW1)? No

Project Manager Mary Toutounchi phone # (714) 560-5833

Project Screening

Attach the project location map to this checklist to show location of all known and/or potential HW sites identified.

1. Project Features: New R/W? Yes Excavation? Yes Railroad Involvement? Yes

   Structure demolition/modification? Yes Subsurface utility relocation? Yes

2. Project Setting Heavily developed. Adjoining properties primarily include commercial and light industrial sites, Metrolink, tracks, and some single- and multi-family dwellings at the extreme limits of the project.

   Rural or Urban Urban

   Current land uses Roadway, railroad, commercial and light industrial

   Adjacent land uses Commercial and light industrial, vacant land, Metrolink tracks
   (industrial, light industry, commercial, agricultural, residential, etc.)

3. Check federal, State, and local environmental and health regulatory agency records as necessary, to see if any known hazardous waste site is in or near the project area. If a known site is identified, show its location on the attached map and attach additional sheets, as needed, to provide pertinent information for the proposed project.

4. Conduct Field Inspection. Date 11/28/2011 Use the attached map to locate potential or known HW sites.

   STORAGE STRUCTURES / PIPELINES:

Underground tanks	None observed	Surface tanks	None observed
Sumps	None observed	Ponds	None observed
Drums	None observed	Basins	None observed
Transformers	Yes	Landfill	None observed

   Other Several light industrial sites noted, with the closest location that appears to potentially use or store hazardous waste being the Earl Scheib Paint and Body located at 1102 17th Street in the southeast quadrant of the project site.

Initial Site Assessment (ISA) Checklist

(continued)

CONTAMINATION: (spills, leaks, illegal dumping, etc.)

Surface staining Typical pavement stains Oil sheen None observed

Odors None observed Vegetation damage None observed

Other None

HAZARDOUS MATERIALS: (asbestos, lead, etc.)

Buildings Potential Spray-on fireproofing n/a

Pipe wrap n/a Friable tile n/a

Acoustical plaster n/a Serpentine n/a

Paint Potential Other

5. Additional record search, as necessary, of subsequent land uses that could have resulted in a hazardous waste site. Use the attached map to show the location of potential hazardous waste sites.

6. Other comments and/or observations: A review of the California Department of Toxic Substances' EnviroStor database revealed that the nearest site that utilizes hazardous waste and substances on site is the Orange County Register (located at 625 N. Grand Avenue). This site is located approximately 0.5 mile south of the east end of the project site.

ISA Determination

Does the project have potential hazardous waste involvement? Yes If there is known or potential hazardous waste involvement, is additional ISA work needed before task orders can be prepared for the Investigation? Yes If "YES," explain; then give an estimate of additional time required:

An Initial Site Assessment will be prepared for the proposed project. It is anticipated to be completed in four months.

A brief memo should be prepared to transmit the ISA conclusions to the Project Manager and Project Engineer.

ISA Conducted by Brian Calvert **Date** November 30, 2011

Visual Impact Assessment Guide – 17th Street Grade Separation Project

Change to the Visual Environment

1. Will the project result in a noticeable change in the physical characteristics of the existing environment?
(Consider all project components and construction impacts - both permanent and temporary, including landform changes, structures, noise barriers, vegetation removal, railing, signage, and contractor activities)

High level of change (3) Moderate level of change (2) Low level of change (1)

2. Will the project complement or contrast with the visual character desired by the community?
(Evaluate the scale and extent of the project features compared to the surrounding scale of the community. Is the project likely to give an urban appearance to an existing rural or suburban community? Is the change viewed as positive or negative? Research planning documents, or talk with local planners and community representatives to get a rough idea of what type of visual environment local residents envision for their community.)

Highly incompatible (3) Somewhat incompatible (2) **Somewhat compatible (1)**

3. What types of project features and construction impacts are proposed? Are bridge structures, large excavations, sound barriers, or median planting removal proposed?
(Certain project improvements can be of special local interest, causing a heightened level of public concern, and requiring a more focused visual analysis.)

High concern (3) Moderate concern (2) Low concern (1)

4. Will the project changes likely be mitigated by normal means such as landscaping and architectural enhancement or will avoidance measures be necessary to minimize adverse change?
(Consider the type of changes caused by the project, i.e., can undesirable views be screened or will desirable views be permanently obscured?)

Project alternative may be needed (3) Extensive mitigation likely (2) **Normal mitigation (1)**

5. Will this project, when seen collectively with other projects, result in an aggregate adverse change in overall visual quality or character?
(Identification of contributing projects should include any projects (both departmental and local) in the area that have been constructed within the last couple of years and those currently envisioned or planned for future construction. The window of time and the extent of area applicable to possible cumulative impacts should be based on a reasonable anticipation of the viewing public's perception.)

Impacts likely in 0-5 years (3) Impacts likely in 6-10 years (2) **Cumulative Impacts unlikely (1)**

Viewer Sensitivity

1. What is the potential that the project proposal may be controversial within the community, or opposed by any organized group?
(This can be researched initially by talking with Departmental and local agency management and staff familiar with the affected community's sentiments as evidenced by past projects and/or current information. Factor in your own judgment as well.)

High Potential (3) **Moderate Potential (2)** Low Potential (1)

2. How sensitive are potential viewer-groups likely to be regarding visible changes proposed by the project?
(Consider among other factors the number of viewers within the group, probable viewer expectations, activities, viewing duration, and orientation. The expected viewer sensitivity level may be scoped by applying

professional judgment, and by soliciting information from other Caltrans staff, local agencies and community representatives familiar with the affected community's sentiments and demonstrated concerns.)

High Sensitivity (3) **Moderate Sensitivity (2)** Low Sensitivity (1)

3. To what degree does the project appear to be consistent with applicable laws, ordinances, regulations, policies or standards?
(Although the State is often not obligated to adhere to local planning ordinances, these documents are critical in understanding the importance the local communities place on aesthetic issues. The Caltrans Environmental Planning branch may have copies of the planning documents that pertain to the project. If not, this information can be obtained by contacting the local planning department. Many local and state planning documents can be found online at the California Land Use Planning Network).

Incompatible (3) Moderately compatible (2) **Largely compatible (1)**

4. Are any permits going to be required by outside regulatory agencies (i.e., Federal, State, or local) that will necessitate a particular level of Visual Impact Assessment?
(Anticipated permits, as well as specific permit requirements - which are defined by the permitter, may be determined by talking with the project Environmental Planner and Project Engineer. Note: coordinate with the Caltrans representative responsible for obtaining the permit prior to communicating directly with any permitting agency.)

Yes (3) Maybe (2) **No (1)**

5. Will the Project Development Team or public benefit from a more detailed visual analysis in order to help reach consensus on a course of action?
(Consider the proposed project features, possible environmental impacts, and probable mitigation recommendations.)

Yes (3) **Maybe (2)** No (1)

Determining the Type of Visual Impact Assessment Required

The total score will indicate the general level of Visual Impact Assessment that should be performed for the project. Once the level of recommended assessment is identified, the user should double-check the results by comparing each of the ten question-areas to the total score in order to confirm that the level of document appears sufficient and reasonable in each case.

Score 25-30 – Prior to preparing a VIA, a formal visual scoping study that meets or exceeds FHWA requirements is recommended to alert the Project Development Team to potential highly adverse impacts and to develop new project alternatives to avoid those impacts.

Score 20-24 – A fully developed VIA, that meets or exceeds FHWA requirements, is recommended. This technical study will likely receive extensive public review.

Score 15-19 – An abbreviated VIA would be appropriate in this case. The assessment would describe project features, impacts and mitigation requirements. Visual simulations would be optional.

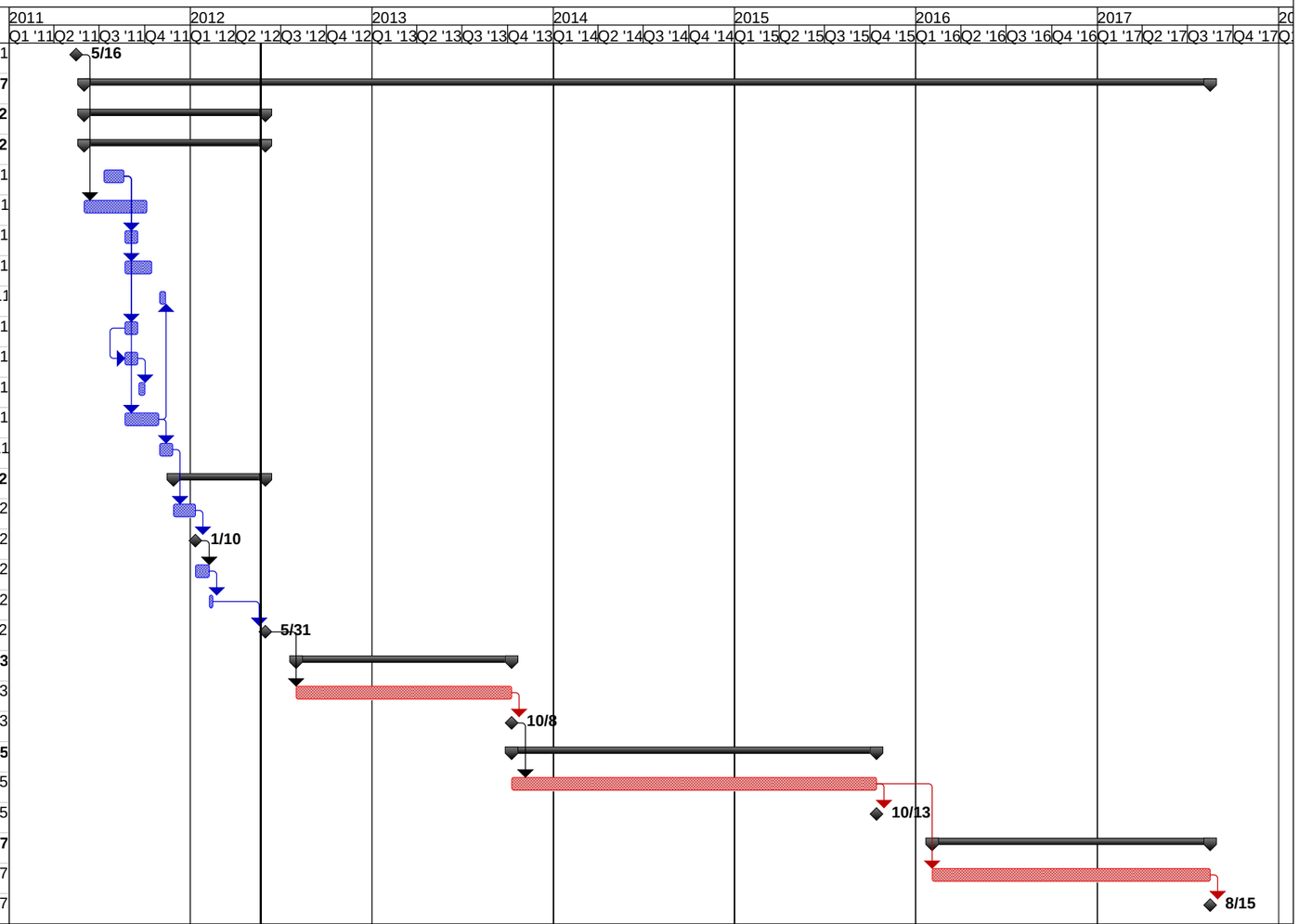
Score 10-14 – A brief Visual assessment in memo form would likely be sufficient.

Attachment L:

Project Schedule

OCTA
17th St. Railroad Grade Separation
Project Development Schedule

ID	Task Name	Duration	Start	Finish
1	NTP	0 days	Mon 5/16/11	Mon 5/16/11
2	**Task 1: Project Management**	**1620 days**	**Wed 6/1/11**	**Tue 8/15/17**
3	**Phase I- PSRE and PES**	**261 days**	**Wed 6/1/11**	**Thu 5/31/12**
4	**Project Study Report**	**261 days**	**Wed 6/1/11**	**Thu 5/31/12**
5	Task 2: Field Survey and Data Collection	30 days	Mon 7/11/11	Fri 8/19/11
6	Task 3 Traffic Survey and Forecast	90 days	Wed 6/1/11	Tue 10/4/11
7	Task 4: Right of Way Survey	20 days	Mon 8/22/11	Fri 9/16/11
8	Task 5: Utility Survey	40 days	Mon 8/22/11	Fri 10/14/11
9	Task 6: Conceptual Geotechnical Investigation	10 days	Mon 10/31/11	Fri 11/11/11
10	Task 7: Conceptual Hydraulics and Hydrology Study	20 days	Mon 8/22/11	Fri 9/16/11
11	Task 8: Constraints Analysis	20 days	Mon 8/22/11	Fri 9/16/11
12	Task 9: Environmental Assessment/PES	10 days	Mon 9/19/11	Fri 9/30/11
13	Task 10: Alternatives Analysis and Structural Type Selection	50 days	Mon 8/22/11	Fri 10/28/11
14	Task 11: Complete Conceptual Drawings and Cost Estimates	20 days	Mon 10/31/11	Fri 11/25/11
15	**Task 12: Produce and Distribute Final Report**	**133 days**	**Mon 11/28/11**	**Thu 5/31/12**
16	Draft PSRE	32 days	Mon 11/28/11	Tue 1/10/12
17	Submit Draft PSRE to OCTA	0 days	Tue 1/10/12	Tue 1/10/12
18	OCTA Review Draft PSRE	20 days	Wed 1/11/12	Tue 2/7/12
19	Final PSRE	5 days	Wed 2/8/12	Tue 2/14/12
20	OCTA Review/Approve Final PSRE	0 days	Thu 5/31/12	Thu 5/31/12
21	**Phase 2- Project Approval/Environmental Document**	**310 days**	**Wed 8/1/12**	**Tue 10/8/13**
22	Project Approval/Environmental Document	310 days	Wed 8/1/12	Tue 10/8/13
23	Complete Project Approval/Environmental Document	0 days	Tue 10/8/13	Tue 10/8/13
24	**Phase 3- Design and Right of Way Acquisition**	**525 days**	**Wed 10/9/13**	**Tue 10/13/15**
25	Phase 3- Design and Right of Way Acquisition	525 days	Wed 10/9/13	Tue 10/13/15
26	Complete Design and Right of Way Acquisition	0 days	Tue 10/13/15	Tue 10/13/15
27	**Phase 4-Construction**	**400 days**	**Wed 2/3/16**	**Tue 8/15/17**
28	Phase 4- Construction	400 days	Wed 2/3/16	Tue 8/15/17
29	Complete Construction	0 days	Tue 8/15/17	Tue 8/15/17



Project: 17th Street Grade Separation
Date: Tue 5/22/12

Task	Rolled Up Critical Task	Project Summary	Manual Task	Finish-only
Critical Task	Rolled Up Milestone	Group By Summary	Duration-only	Progress
Milestone	Rolled Up Progress	Inactive Task	Manual Summary Rollup	Deadline
Summary	Split	Inactive Milestone	Manual Summary	
Rolled Up Task	External Tasks	Inactive Summary	Start-only	

Attachment M:

Structures Preliminary Geotechnical Report

TECHNICAL MEMORANDUM

GROUP DELTA CONSULTANTS

Certified MBE

Geotechnical Engineering
Geology
Hydrogeology
Earthquake Engineering
Materials Testing & Inspection
Forensic Services

Proj. No. / Name: I-534 /17th Street Grade Separation

Prepared for: Mohan Char, PE / AECOM

Prepared by: Curt Scheyhing, PE, GE and Kul Bhushan, PhD, GE

Date: January 9, 2012

Subject: 17th Street Grade Separation
LOSSAN Corridor Orange County, CA
Structures Preliminary Geotechnical Report (SPGR)
For Support of PSR Equivalent

1.0 INTRODUCTION

1.1 Purpose and Scope of Work

The purpose of this report is to provide preliminary geotechnical, seismic, and foundation information to assist structural engineers in preparing Advance Planning Studies for the new bridge structures and retaining walls required for the project. Our scope of work included review of available information including preliminary layouts and profiles, bridge and retaining wall plans, subsurface conditions from published geologic data as well as nearby borings and Cone Penetration Tests (CPTs), published groundwater data, and published seismic information, and presenting preliminary information and recommendations in this report. The information and preliminary recommendations contained herein are based on limited available data; therefore, they are subject to change after site-specific explorations are performed in the PS&E stage.

1.2 Project Description

OCTA in partnership with various cities is planning railroad / local street grade separations for five individual project sites in Orange County along the Los Angeles–San Diego-San Luis Obispo Rail Corridor. This report was prepared for the Project Study Report (PSR) equivalent for the 17th Street grade separation project in City of Santa Ana. The project includes the grade separation and portions of the affected approach streets (17th Street and Lincoln Avenue).

Preliminary engineering studies are being performed for the 17th Street Grade Separation to evaluate and develop alternatives and study impacts of the proposed improvements on existing facilities including drainage channels, industrial railroad tracks, power poles, utilities, access roads, ingress/egress locations and any adjoining parcel constraints. A project vicinity map, aerial photograph, and topographic map of the site are shown in Figures 1A through 1C, respectively.

Three alternatives are being evaluated: Alternative 1A (Underpass), Alternative 1C (Underpass), and Alternative 2A (Overhead), see Figures 2A, 2B, and 2C, respectively:

- **Alternative 1A** (Figure 2A) consists of a lowered E 17th Street and two separate bridges constructed at Lincoln Avenue and Metrolink RR to carry the vehicular and rail traffic, respectively, over the depressed 17th Street. Vertical cut retaining walls will be built on both sides of depressed E 17th Street and the bridges will maintain Lincoln Avenue and the railroad tracks at the approximate existing profiles.
- **Alternative 1C** (Figure 2B) consists of a lowered E 17th Street and a lowered Lincoln Avenue with one bridge constructed at Metrolink RR to carry the rail traffic over the depressed 17th Street. Vertical cut retaining walls will be built on both sides of depressed E 17th Street and Lincoln Avenue, a depressed at-grade intersection will be constructed at 17th and Lincoln, and the bridge will maintain the railroad tracks at the approximate existing profiles.
- **Alternative 2A** (Figure 2C) consists of a raised E 17th Street and one bridge constructed to carry the vehicular traffic over both Metrolink RR and Lincoln Avenue. Vertical fill retaining walls would be built on both sides of the raised E 17th Street, and both Lincoln Avenue and the railroad tracks will be maintained at the existing profiles.

Bridge General Plans are shown in Figures 3A and 3B (for Alternative 1A), Figure 3C (for Alternative 1C), and Figure 3D (for Alternative 2A).

We understand that the locally preferred alternative is Alternative 1C, as shown in the Layout in Figure 2B and General Plan in Figure 3C. Based on the preliminary General Plan the proposed bridge will be a single span structure (Abutments 1 and 2) with exterior Steel Plate Girders and Floor Beam and Stringers, with a span length of 120 feet and width of 40 feet. Abutments will be full height concrete cantilever abutments. The bridge loads will be supported on four rows of driven steel H-Piles (2 vertical and 2 battered).

Alternative 1A is shown in the Layout in Figure 2A and General Plans in Figures 3A and 3B. Based on the preliminary General Plan the proposed bridges would both be two-span structures (Abutments 1 and 3, Bent 2) with span lengths of 55 feet, pre-cast pre-stressed concrete box girders or Bulb-Tee Girders, and full height concrete cantilever abutments. All three supports of both bridges would be founded on driven steel H-Piles.

Alternative 2A is shown in the Layout in Figure 2C and General Plan in Figure 3D. Based on the preliminary General Plan the proposed bridge would be a two-span structure (Abutments 1 and 3, Bent 2) with span lengths of 90 feet, width of 102 feet, pre-cast pre-stressed Bulb-Tee girders, full height concrete cantilever abutments, and Mechanically Stabilized Embankment (MSE) wall approaches. Abutments would be founded on driven steel H-Piles, and the center bent would be supported on four (4) 7-ft diameter Cast-in-Drilled-Hole (CIDH) piles.

The bridge design may follow AREMA and/or Caltrans standards, and may include LRFD and/or WSD design methods.

2.0 SITE AND SUBSURFACE CONDITIONS

2.1 Site Conditions

The grade separation area is in a highly developed urban area with many existing constraints and challenges related to maintaining train and vehicular traffic and avoiding disturbance to existing facilities during construction. An aerial photograph is shown in Figure 1B, and the USGS Orange 7.5-Minute Quadrangle topographic map is shown in Figure 1C.

The existing at-grade intersection of east-west trending 6-lane 17th Street and north-south trending double-track LOSSAN Corridor is a relatively level area near El. 151 feet, with natural drainage at a gradient of about 0.7% toward the southwest. Lincoln Ave parallels the west side of the tracks. The surrounding area is residential, commercial, and industrial development. Most of the area is asphalt paved roadway and parking lots or buildings. The rail corridor is unpaved. A large unpaved field is present northeast of the intersection. Overhead lines and numerous buried utilities are present.

2.2 Subsurface Conditions

2.2.1 Geology

The project area is in an alluvial plain of the Santa Ana River and Santiago Creek Drainages. Soils in the area are generally deep alluvial sediments consisting of interbedded mixes of sands, gravels, silts, and clays. Density/stiffness and percentage of sand/gravel/silt/clay varies by location and by depth. Based on the California Geological Survey Seismic Hazard Zone Reports for the Orange 7.5-minute quadrangle, Young (Holocene) alluvial fan deposits (Q_{yfsa}) underlie the 17th Street Grade Separation site. Older denser/stiffer Pleistocene alluvial fan deposits (Qof, Qvof) generally underlie the Holocene deposits at variable depth. Depth to bedrock with shear wave velocity of 1000 m/s may be on the order of 1000 feet.

2.2.2 Soil Conditions

We reviewed the boring and CPT data in our files on a project (OC Register) located about 3,000 ft south of the site, and we reviewed Caltrans as-built LOTB sheets for the Grand Avenue and 17th Street Undercrossings at I-5 located southeast and west of the project site, respectively. These data which extend to depths of more than 80 feet indicate that the soils generally consist of interbedded sands, silty sands, clayey sands, silts, sandy silts, clays, and sandy clays with variable amounts of gravel. In general, the soils increase in density and consistency with depth. In the upper 30 to 50 feet granular soils (sands, silty sands, and sandy silts) are generally medium dense to locally dense/very dense and cohesive soils (clays, sandy

clays, and clayey silts) are generally very stiff to locally stiff. Below the upper layer, granular soils are generally very dense to locally dense, and cohesive soils are generally very stiff. Logs of test borings are presented in Appendix A.

2.2.3 Groundwater

Based on the California Geological Survey Seismic Hazard Zone Reports for the Orange 7.5-minute quadrangle, the high historical groundwater is greater than 40 feet (see Figure 4). In the boring logs reviewed the permanent groundwater table was not encountered to depths of 80 feet. At the OC Register site the groundwater table was measured in an existing monitoring well at a depth of 78 feet below ground surface in August 2006.

2.3 Seismic Hazards

Potential seismic hazards at any site include ground rupture, strong shaking, liquefaction and seismic settlement, and seismic slope instability.

2.3.1 Ground Rupture

The site is not located in an Alquist-Priolo Zone and no active faults are known to cross the sites, so ground rupture hazard from faulting is remote.

2.3.2 Ground Shaking and ARS Curves

The site is located in an active seismic area and seismic shaking should be anticipated tin the design. The active faults potentially contributing to the design site accelerations include Puente Hills Blind Thrust, Elsinore Fault Zone (Whittier and Chino Sections), Compton-Los Alamitos Blind Thrust, Peralta Hills, and Newport-Inglewood-Rose Canyon faults. A regional fault map is shown in Figure 5.

ARS curves were developed in accordance with current Caltrans and AREMA standards. Soil Profile in the area is generally NEHRP Type D (stiff soil), with typical shear wave velocity in upper 100 feet on the order of 270 meters per second. Caltrans criteria currently use the upper bound envelope of deterministic and probabilistic (975 year return period) spectra for design using Next Generation Attenuation (NGA) relationships. Caltrans also applies near fault and basin factors to the spectra. A summary of the Caltrans seismic parameters is presented in Table 1. AREMA (2006) uses a 3-level probabilistic earthquake approach: Level 1 (Serviceability) – 50 to 100 year return period, Level 2 (Ultimate) – 200 to 500 year return period, Level 3 (Survivability) – 1000 to 2400 year return period, developed from probabilistic peak bedrock base accelerations and soil amplification factors depending on the site soil profile. Actual return period within each range for design is based on AREMA risk and structure importance factors. We assumed the upper end of the return period range for preliminary spectra development.

Preliminary probabilistic analyses using USGS 2008 Deaggregation (Beta) website with Next Generation Attenuation (NGA) relationships and current fault models indicate that Peak Ground Accelerations (PGA) for shear wave velocity (V_{S30}) of 270 m/s and Peak Bedrock Accelerations (PBA) for shear wave velocity (V_{S30}) of 760 m/s vary by return period / exceedence probability at the site (latitude 33.7599 North, longitude 117.8562 West) approximately as follows:

- 72 year (50% in 50 yrs): PGA = 0.18g PBA = 0.13g
- 475 year (10% in 50 yrs): PGA = 0.37g PBA = 0.30g
- 975 year (5% in 50 yrs): PGA = 0.45g PBA = 0.38g
- 2475 year (2% in 50 yrs): PGA = 0.58g PBA = 0.51g

For the AREMA spectra, we used base acceleration PBA corresponding to 100 year, 500 year, and 2400 year average return periods of 0.15, 0.30, and 0.50g, respectively, 5% of critical damping, and site coefficient of 1.2 (for soil type 2). The response spectra for Caltrans method and AREMA method are shown in Figures 6A and 6B, respectively. A comparison plot of the Caltrans and AREMA spectra is included for reference as Figure 6C.

Pseudo-static accelerations of 1/3 of PGA may be used for slope stability evaluations. Based on the USGS Probabilistic Deaggregation results, a magnitude of 7.0 would be appropriate for pseudo-static stability or liquefaction analyses.

2.3.3 Liquefaction Potential

For liquefaction to occur three simultaneous conditions are required: loose to medium dense saturated granular soils, groundwater shallower than about 60 feet, and strong earthquake shaking.

We reviewed the State Seismic Hazard Zone Map of the Orange 7.5-minute Quadrangle. The grade separation location is shown on Figure 6. The 17th Street grade separation site is not in mapped Liquefaction Hazard Zone (Figure 7), and highest historical groundwater is deeper than 40 feet (Figure 4). Current groundwater from nearby borings is deeper than 70 feet. As a result it is GDC's opinion based on existing data that the site has a very low to negligible potential for liquefaction to impact the design. Potential impacts include some liquefaction settlement below the water table if groundwater at the site is found to be shallower than about 60 feet, and if loose to medium dense soils are present below that depth. Actual liquefaction potential must be assessed by site-specific soils and groundwater data developed in the PS&E investigation.

2.3.3 Seismic-Induced Landslides

The site is relatively level. The site is not located in a mapped State Landslide Hazard Zone. Liquefaction, where and if it occurs, is relatively deep. Excavations, fill slopes, and/or retaining walls will be of relatively low height and engineered for stability. Therefore, potential for seismically induced slope instability is negligible to low. The seismic stability of any cut slopes / fill slopes / retaining walls will be evaluated with site-specific soil investigation and geometry in the PS&E studies.

2.3.4 Seismic Settlement

In addition to liquefaction settlement, settlement of loose to medium dense sandy soils above the water table can occur during seismic shaking. Due to predominantly overconsolidated clayey soils and moderately dense sandy soils and lack of groundwater, seismic settlement is expected to be low to negligible. This preliminary conclusion should be checked by site-specific investigations during PS&E.

3.0 SCOUR ASSESSMENT

There is no stream or river channel at the site, and therefore scour is not an issue.

4.0 CORROSION ASSESSMENT

No corrosion test results are available for the site. Lab tests should be performed during the PS&E studies and appropriate mitigation measures will be recommended based on the test results.

5.0 PRELIMINARY FOUNDATION RECOMMENDATIONS

5.1 Driven Steel H-Piles

The abutments may be supported on driven vertical and batter pile foundations. Due to presence of variable dense sand layers above the pile tip indicating potential for hard driving at shallow depth, driven H-Piles may be preferable to large displacement pre-stressed concrete driven piles. As shown in the general plan, steel H-Piles are proposed for Abutments and Bent for Alternate 1A, for both Abutments for Alternate 1C, and for the Abutments for Alternate 2A. GDC has developed preliminary recommendations for Caltrans standard 100-ton (Class 200) HP14x89 piles. Due to the presence of variable layers of stiff clays and dense sands, the piles may be primarily friction piles (in the event of a mostly clay profile near the pile tip elevation) or may derive substantial portion of their capacity from end bearing (where a suitable dense sand bearing layer is present at the pile tip). For preliminary cost estimates, we recommend a pile penetration of 70 feet for 400 kip nominal compressive resistance. It is recommended that piles have a minimum of 3 diameters (3.5 feet) center-to-center spacing; no axial capacity reduction for group effects is necessary for this spacing.

Preliminary lateral capacity of piles for free-head (pinned) condition, including group effects assuming 3-diameter spacing, is summarized in the following table:

Support Location	Pile Direction	Pile Top Deflection (inch)	Pile Top Shear (kips)	Max Moment (ft-kips)	Depth to Max Moment (feet)
Abut 1 or Abut 2	Strong	0.25	16	73	6
		1.0	45	238	7
	Weak	0.25	11	39	5
		1.0	28	129	5.5

At larger deflections these capacities may be limited by the structural moment capacity of the piles. Horizontal component of the batter piles may be added to the lateral capacity of individual piles.

5.2 CIDH Piles

Large diameter drilled shafts (a.k.a. Cast-in-Drilled-Hole piles) are considered feasible at the site. Groundwater is likely at a depth of more than 70 feet. Use of a temporary casing for constructibility (such as an oscillator casing) may be required to mitigate caving potential in sandy layers. Slurry (wet method) construction, including inspection tubes and gamma-gamma logging, will be required for piles installed to depths extending below the groundwater table. Large diameter CIDH piles (7-ft diameter) are currently proposed for Bent 2 of Alternative 2A (Figure 3D). Preliminary estimated nominal compressive resistance vs. pile penetration for purposes of cost estimation is shown in Figure 8. A resistance factor of 0.7 should be applied to the Strength Limit factored loads, and a resistance factor of 1.0 should be applied to Extreme Event factored loads, to determine the nominal resistance for preliminary estimation of pile length from Figure 8. Preliminary lateral capacities for the 7 ft piles can be developed at AECOM's request.

5.3 Approach Fills

Approach fills up to about 30 ft high will be placed at the abutment approaches for **Alternative 2A** where 17th street is elevated and a bridge is built across Metrolink RR and Lincoln Avenue. We anticipate maximum settlements under the approach embankments to be on the order of 2 to 3 inches. Due to stiff clays and granular nature of the soils, settlement should occur relatively quickly. Settlement due to placement of the approach embankment has the potential for causing settlements of the abutment piles. Several approaches are available to mitigate approach fill settlement impacts on the abutments:

- Construct the MSE approaches prior to driving abutment piles (using a temporary wrapped face construction at the back of abutment) and allow a settlement waiting period prior to abutment construction (preliminary waiting period of 30 days is recommended);
- Construct the abutment piles and abutment walls first, then construct the MSE wall approaches; evaluate the settlement and potential downdrag loads and design the abutment piles to accommodate these loads;
- Use lightweight fill materials (such as cellular concrete) to allow for construction of the abutment prior to the approach fills, and eliminate or reduce the downdrag loads.

A settlement monitoring program should be implemented for the approach fills.

5.4 MSE Walls

MSE Walls should be designed and constructed following Caltrans practice and AASHTO LRFD Bridge Design Specifications. For planning purposes it is recommended that the foundation footprint should be excavated a minimum of 2 feet below the foundation level and replaced with compacted fill placed at 95% relative compaction (removal and recompaction). The preliminary net ultimate or nominal bearing capacity for design of the wall foundations may be taken as:

$$q'ult = 0.8*B \leq 16$$

where

q'ult = net nominal bearing resistance (ksf)

B=reinforced foundation width (feet)

Reinforced base width of wall should generally not be less than 70% of wall height. Appropriate resistance factors should be applied following the latest AASHTO LRFD Bridge Design Specifications with California Amendments. Ultimate sliding friction coefficient may be taken as 0.577. Structural backfill for MSE walls should generally conform to Caltrans Standard Special Provisions (SSP) *19-600_E_B06-05-09.doc*. MSEW backfill meeting Caltrans requirements may be assumed as a cohesionless material with a friction angle of 34 degrees.

5.5 Tie-back Walls

Tieback walls with a maximum height of about 24 ft will be required along about 1,300 ft of depressed E 17th Street. Tie-back walls also will be required along portions of Lincoln Avenue on both north and south side of E 17th Street where Lincoln Avenue is depressed to meet E 17th Street at the existing intersection. Tieback walls are also proposed from depressed E 17th Street and Lincoln Ave to provide access to existing facilities and businesses.

Tieback walls are constructed from the top down, by excavating in limited lifts (typically 5 feet), drilling, installing, and grouting the steel anchors, load testing and locking off anchors, and proceeding to excavate and construct the next lift. Temporary wall facing may be soldier piles with wood or shotcrete lagging or reinforced shotcrete without soldier piles, and finish facing may be cast-in-place concrete or shotcrete. Anchor spacing is typically 5 to 8 feet vertical and 6 to 12 feet horizontal. Anchors are typically inclined downward at 15 degrees from the horizontal, but may be installed at other angles if needed to avoid obstructions. Minimum unbonded length is 15 feet, but may be longer to place the bonded length behind any critical slip surface. Presence of external surcharge loads may change the required length of the unbonded zone. As a minimum, the unbonded length should extend at least 5 feet behind a plane inclined at 60 degrees to the horizontal from the base of wall. Bonded length is normally designed by the specialty contractor, but is typically in the 25 to 30 foot range.

The design of the tieback wall for static condition should include at-rest earth pressure plus the lateral pressures exerted by any existing buildings or other surcharge loads in the area behind the wall. Lateral earth pressure diagrams may be prepared in accordance with Section 3.11.5.7 of AASHTO LRFD Bridge Design Specifications, 4th Edition (2007). For seismic condition, the tieback wall pressures should include dynamic earth pressure. In addition to earth pressure analyses, stability of the tieback wall should be analyzed for both static and seismic conditions using a slip surface approach. For seismic analysis a pseudo-static coefficient of 1/3 of PGA should be used. The earth pressure values and stability analyses should be provided in the Structure Foundation Report.

Proof load and long-term residual load tests should be conducted on all anchors during construction in accordance with Caltrans Tie-back Anchor Specifications in order to verify the design values. Caving granular soils may be present and caving of anchor holes is possible. Soil borings shall be performed along the wall alignments to develop the soil design parameters and potential for caving soils.

Tieback walls are post-tensioned, so they provide the best control of wall deflection. Walls should be designed to limit movement of the top of wall to less than ½ inch.

5.6 Tangent or Secant Pile Walls

A "Tangent" or "Secant" pile wall consists of a line of drilled shafts (also referred to as bored piles). If the bored piles are contiguous, or tangent, to each other, the wall is called a "Tangent Pile Wall." In an alternate case, referred to as a "Secant Pile Wall," the pile elements overlap so as to form an interlocking wall. Tangent or secant pile walls may be used as a cantilever wall in areas where permission to drill tiebacks into the adjacent property cannot be obtained or tiebacks are not feasible due to presence of basements or other structures. The secant piles consist of 2- to 3-ft diameter CIDH piles drilled at close spacing (touching or overlapping each other) to form a continuous cantilever wall. The diameter and spacing of the piles is designed to provide adequate stiffness so that the deformation at the top of the wall can be controlled to

adequate levels depending on the structures that are supported on top of the wall. Earth pressures for design may be between active and at-rest values depending on the soil type and the amount of tolerable movement at the top of wall. Lateral earth pressure diagrams may be prepared in accordance with Section 3.11.5.6 of AASHTO LRFD Bridge Design Specifications, 4th Edition (2007).

The following are attached and complete this memorandum:

LIST OF TABLES

Table 1 Seismic Summary

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Figure 1B Aerial Photograph
Figure 1C Map of the USGS Orange 7.5'-Minute Quadrangle
Figure 2A Alternative 1A Layout
Figure 2B Alternative 1C Layout
Figure 2C Alternative 2A Layout
Figure 3A General Plan, Alternative 1A Railroad Bridge
Figure 3B General Plan, Alternative 1A Lincoln Ave Bridge
Figure 3C General Plan, Alternative 1C
Figure 3D General Plan, Alternative 2A
Figure 4 Historically High Groundwater Map
Figure 5 Regional Fault Map
Figure 6A Preliminary Caltrans Response Spectrum
Figure 6B AREMA 2006 Response Spectra
Figure 6C Comparison of Preliminary Caltrans and AREMA Response Spectra
Figure 7 Seismic Hazard Zones Map
Figure 8 Nominal Compressive Capacity, 7-ft Diam. CIDH Pile

LIST OF APPENDICES

Appendix A Existing LOTB

TABLES

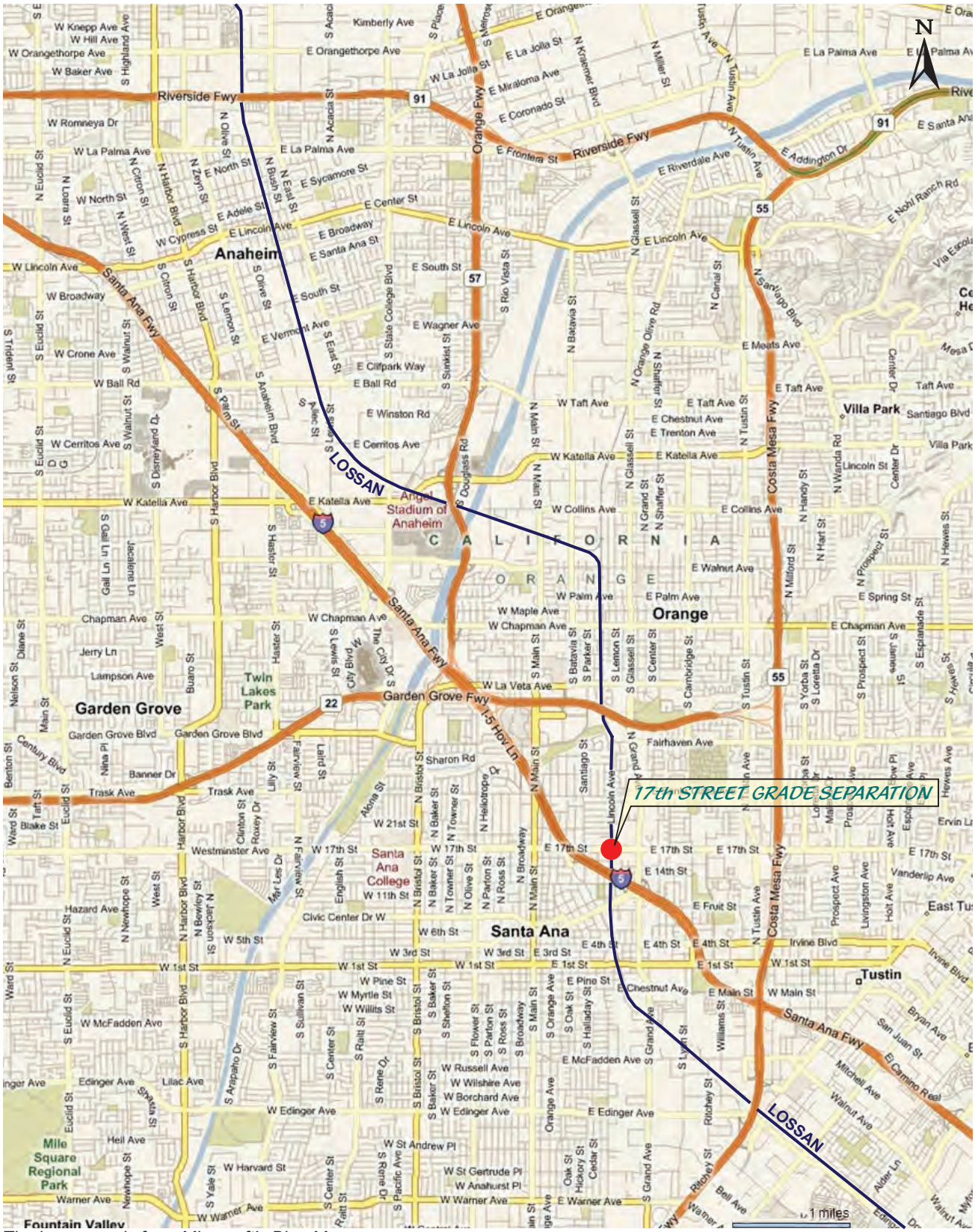
TABLE 1
SEISMIC SUMMARY

17th Street Grade Separation

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)		(10)			(11)				(12)	(13)	(14)	(15)
Site Coordinates		**Deterministic Controlling Fault(s)**	**Max. Mag-nitude**	**Fault Type**	**Dip**	**Rtop (km)**	**Rbot (km)**	**Prelim. Soil Type**	**Assumed Shear Wave Velocity V_{S30}**		**Fault-Site Distance**			**Other ARS Parameters**				**PGA (g's)**			
Lat	**Lon**		**Mw**						**(m/s)**	**(ft/s)**	**R_X (km)**	**R_{JB} (km)**	**R_{RUP} (km)**	**Basin Effect $Z_{1.0}$ (m)**	**$Z_{2.5}$ (km)**	**Hanging Wall Effect**	**Near Source Increase**	**Determ-inistic**	**ARS Online Prob.**	**USGS 2008 Prob.**	**Contr-olling**
33.7599	-117.8562	Compton-Los Alamitos Blind Thrust	6.8	R	20 deg NE	5	10	D	270	886	17	3.26	10.52	327	2.00	Y	0% (T<.5s) to 20% (T>1s)	0.43	0.40	0.46	0.46
		Newport Inglewood Rose Canyon fz (S. LA Basin sec.-S)	7.5	RLSS	90 deg Vert	0	13				11.8	11.8	11.8			N		0.29			

COLUMN NOTES:
(1) Latitude and Longitude based on Google Earth
(2) Controlling faults for deterministic analysis based on ARS Online
(3) Maximum Fault Moment Magnitude based on Caltrans 2007 Fault Database
(4) Fault Type based on Caltrans 2007 Fault Database: R=Reverse, RLSS=Right Lateral Strike Slip
(5) Dip angle and direction based on Caltrans 2007 Fault Database
(6) Depth to top of rupture surface based on Caltrans 2007 Fault Database
(7) Depth to bottom of rupture surface based on Caltrans 2007 Fault Database
(8) Estimated NEHRP Soil Type: A (V_{S30}>1500m/s), B (V_{S30}=760 to 1500 m/s), C (V_{S30}=360-760m/s), D (V_{S30}=180-360m/s), E (V_{S30}<180m/s)
(9) Approximate Estimated Site Shear Vave Velocity in upper 100 feet (30 meters)
(10) Site to Fault Distance Parameters based on ARS Online
(11) Other factors affecting ARS curves including deep sedimentary basin effect, hanging wall effect, and near source increase
(12) Deterministic Peak Ground Acceleration for each controlling fault from ARS Online
(13) Probabilistic Peak Ground Acceleration from ARS Online
(14) Probabilistic Peak Ground Acceleration from USGS 2008 Deaggregation (Beta)
(15) Highest PGA from (12) through (14)

FIGURES



The base map is from Microsoft's Bing Maps

GROUP DELTA CONSULTANTS	**GROUP DELTA CONSULTANTS, INC.** ENGINEERS AND GEOLOGISTS 32 MAUCHLY, SUITE B IRVINE , CA 92618 (949) 450-2100	FIGURE NUMBER 1A
	PROJECT NAME 17th STREET GRADE SEPARATION SANTA ANA, CALIFORNIA	PROJECT NO. I-534
	VICINITY MAP	

Reference: Bird's Eye Aerial is from Bing Maps.

N
W E
S

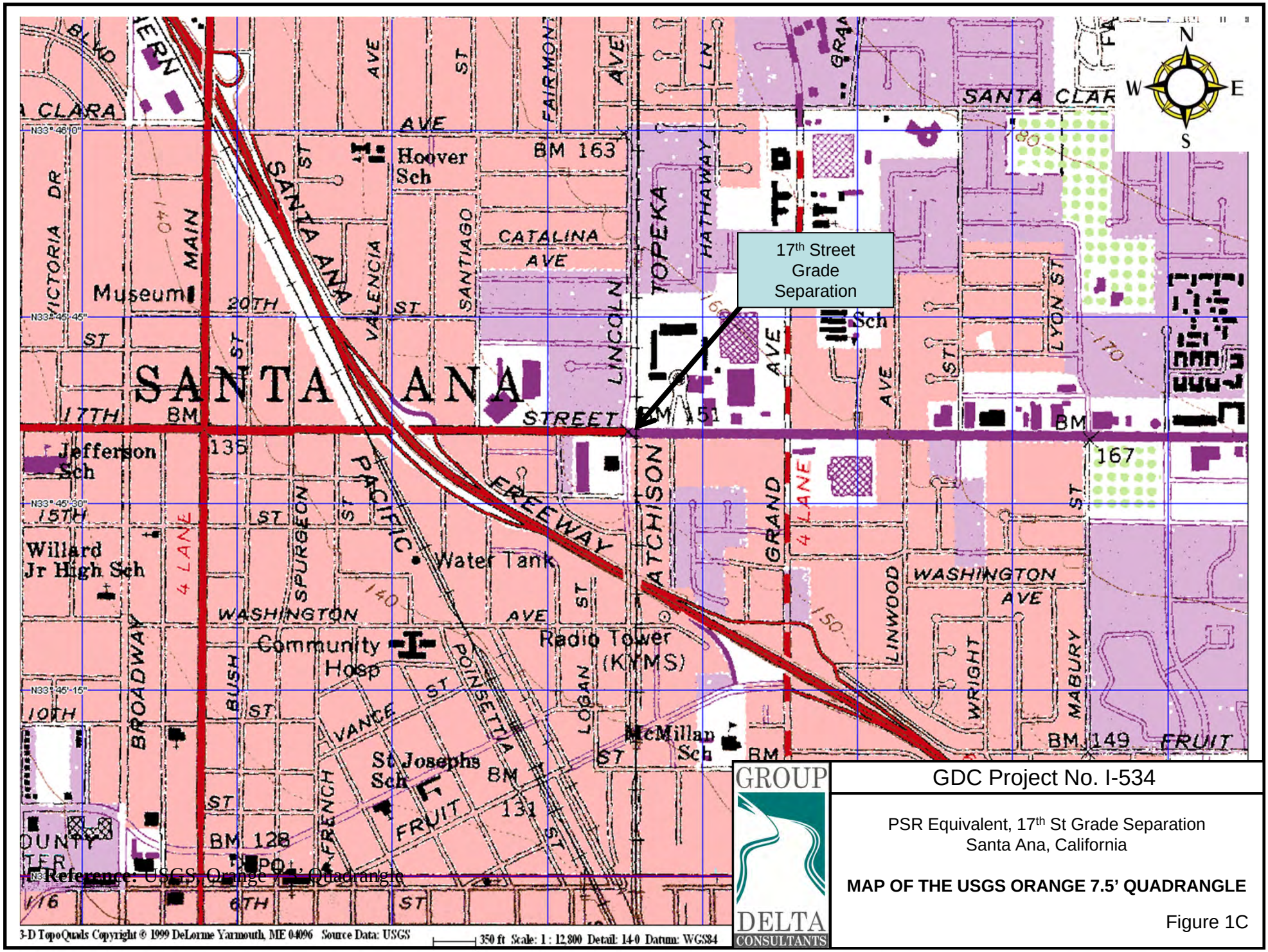
GROUP DELTA CONSULTANTS

GDC Project No. I-534

PSR Equivalent, 17th St Grade Separation
Santa Ana, California

AERIAL PHOTOGRAPH

Figure 1B



Reference: USGS, Orange 7.5' Quadrangle

GROUP DELTA CONSULTANTS

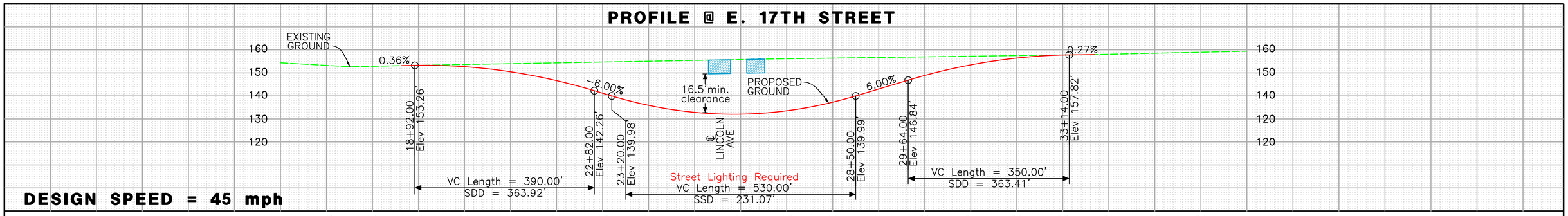
GDC Project No. I-534

PSR Equivalent, 17th St Grade Separation
Santa Ana, California

MAP OF THE USGS ORANGE 7.5' QUADRANGLE

Figure 1C

PROFILE @ E. 17TH STREET



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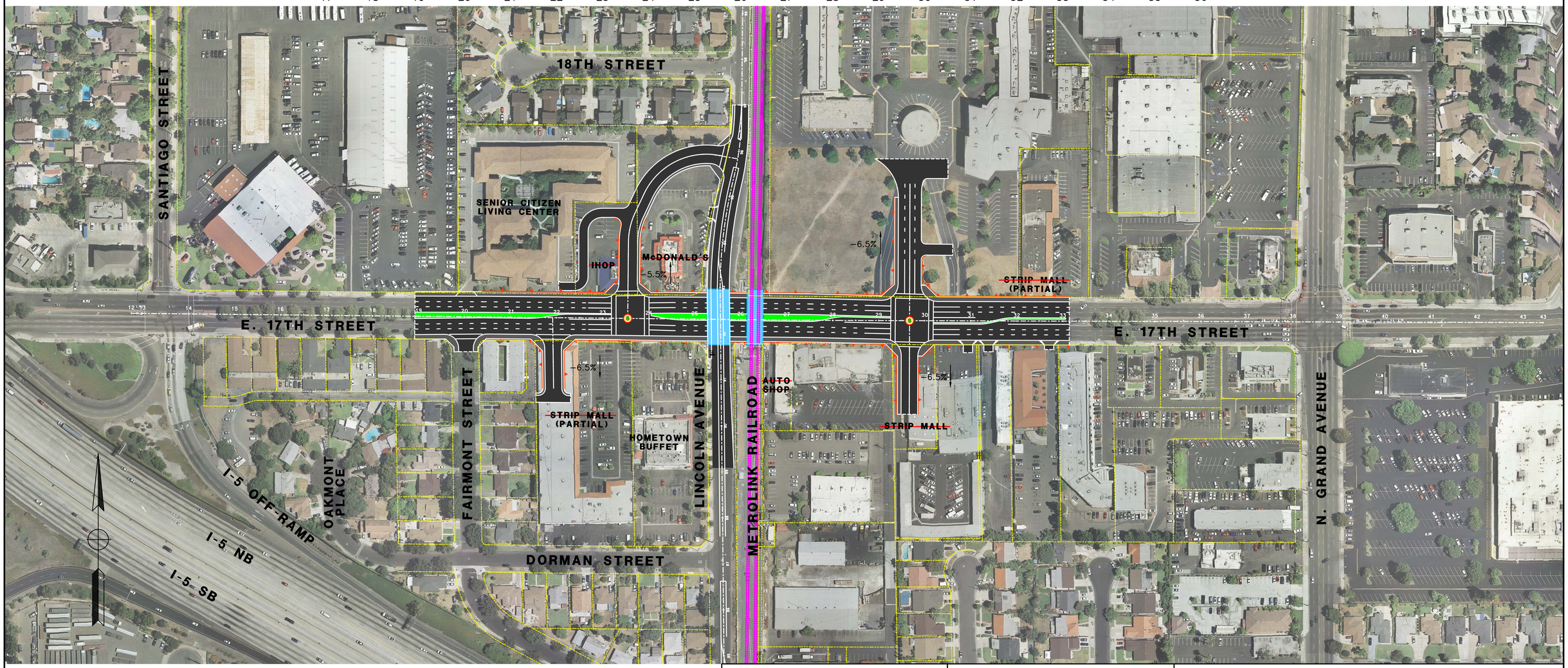


SCALE:
HOR. 1" = 100';
VERT. 1" = 20'

LEGEND:

- PROPOSED STRIPING
- PROPOSED TIE-BACK WALL
- EXISTING METROLINK TRACK
- EXISTING RIGHT-OF-WAY
- PROPOSED SIGNAL
- PROPOSED OVERCROSSING
- PROPOSED IMPROVEMENTS
- PROPOSED SIDEWALK

OCTA

PLANS PREPARED BY:

AECOM

999 W. TOWN AND COUNTRY ROAD
ORANGE, CA 92868-4713
(714) 567-2501

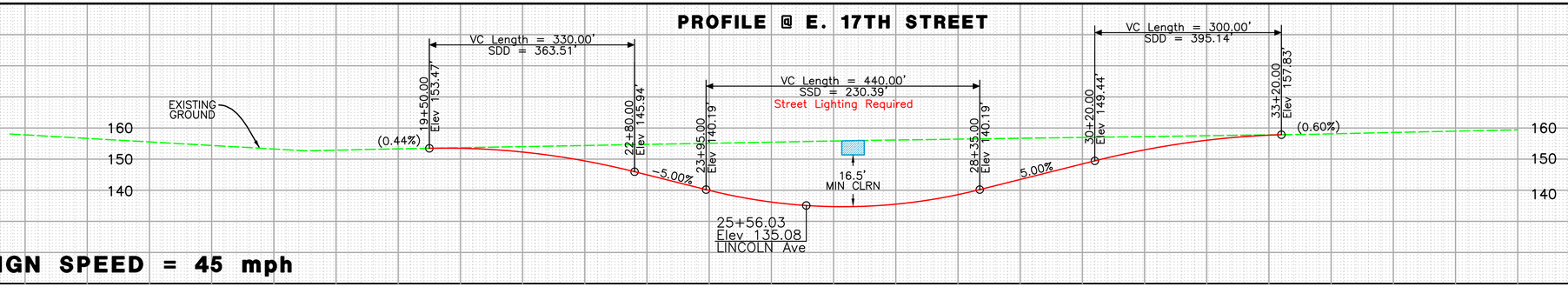
PRELIMINARY
APRIL 30, 2012

OCTA/CITY OF SANTA ANA E. SEVENTEENTH STREET GRADE SEPARATION PROJECT

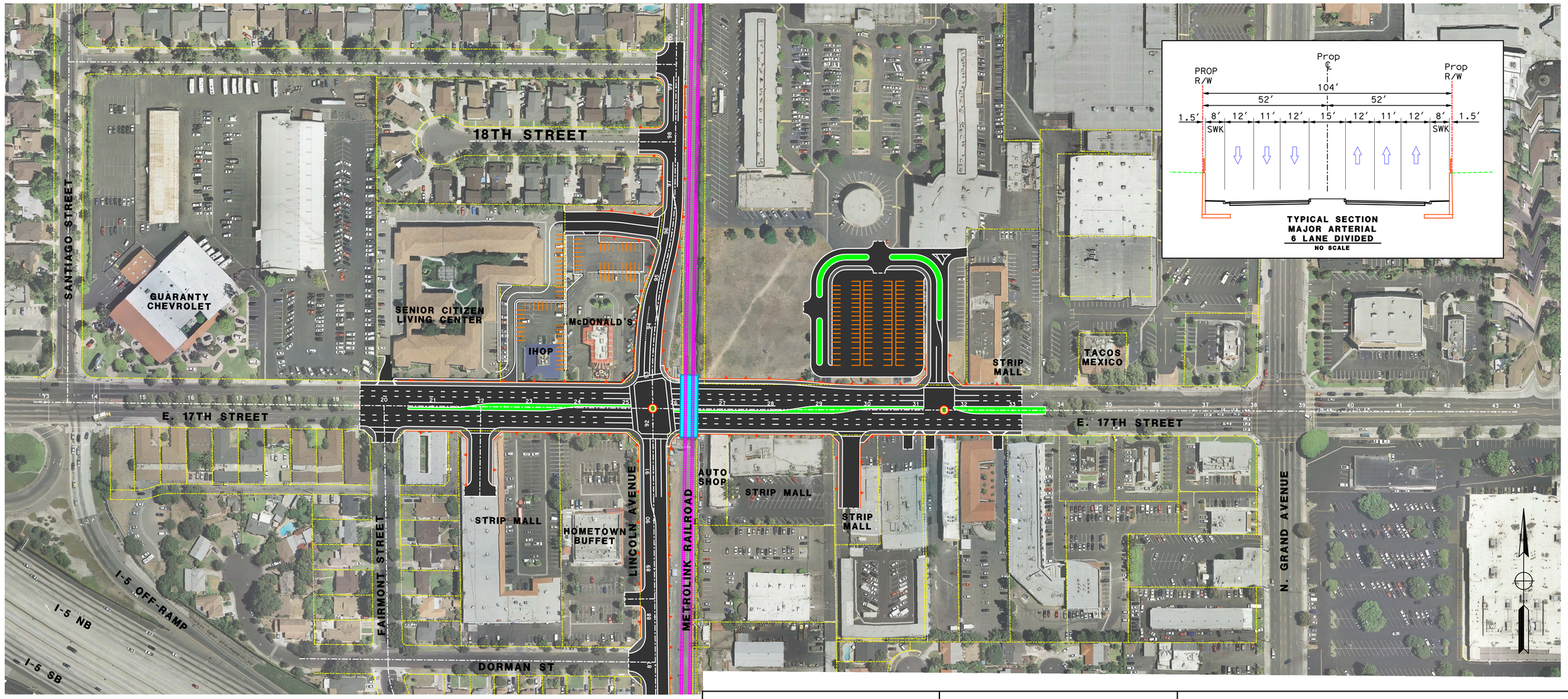
ALTERNATIVE 1A - UNDERCROSSING OF BOTH RAILROAD & LINCOLN AVENUE

FIGURE 2A

PROFILE @ E. 17TH STREET



DESIGN SPEED = 45 mph



TYPICAL SECTION
MAJOR ARTERIAL
6 LANE DIVIDED
NO SCALE

SCALE:
HOR. 1" = 100';
VERT. 1" = 20'

LEGEND:

- PROPOSED STRIPING
- PROPOSED TIE-BACK WALL
- EXISTING METROLINK TRACK
- EXISTING RIGHT-OF-WAY
- PROPOSED SIGNAL
- PROPOSED OVERCROSSING
- PROPOSED IMPROVEMENTS
- PROPOSED SIDEWALK
- PROPOSED MEDIAN ISLAND

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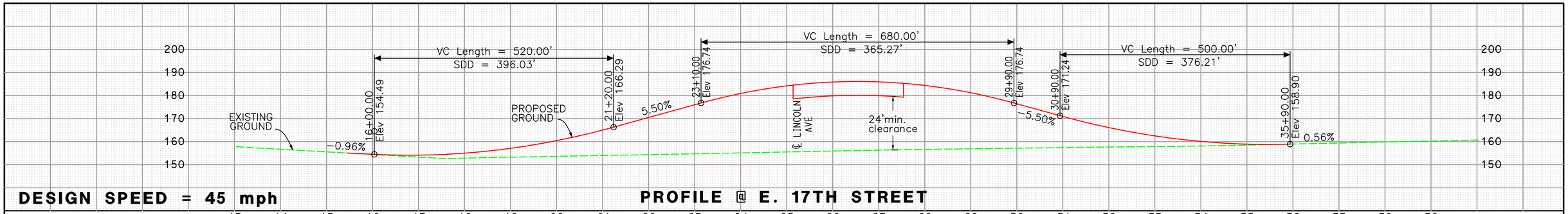
APRIL 30, 2012

OCTA/CITY OF SANTA ANA E. SEVENTEENTH STREET GRADE SEPARATION PROJECT

ALTERNATIVE 1C - UNDERCROSSING OF RAILROAD & DEPRESSED LINCOLN AVE INTERSECTION

FIGURE 2B



DESIGN SPEED = 45 mph

PROFILE @ E. 17TH STREET

SCALE:
HOR. 1" = 100';
VERT. 1" = 20'

LEGEND:

- PROPOSED STRIPING
- PROPOSED MSE WALL
- EXISTING METROLINK TRACK
- EXISTING RIGHT-OF-WAY
- PROPOSED SIGNAL
- PROPOSED OVERCROSSING
- PROPOSED IMPROVEMENTS
- PROPOSED SIDEWALK

OCTA

PLANS PREPARED BY:
AECOM
999 W. TOWN AND COUNTRY ROAD
ORANGE, CA 92868-4713
(714) 567-2501

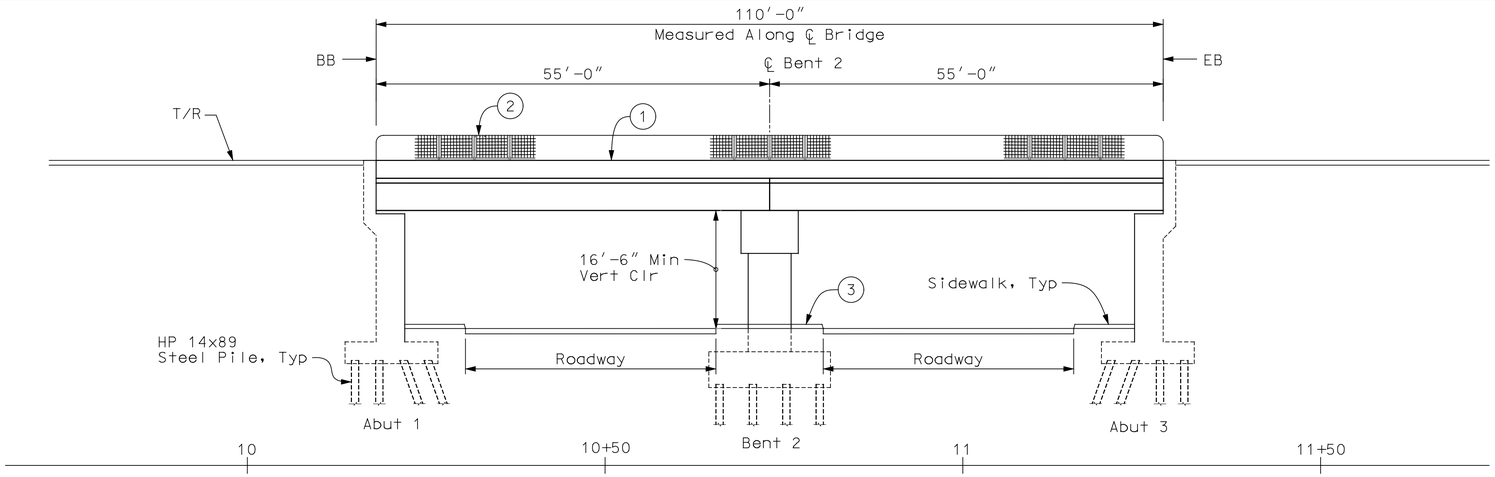
PRELIMINARY
APRIL 30, 2012

OCTA/CITY OF SANTA ANA E. SEVENTEENTH STREET GRADE SEPARATION PROJECT

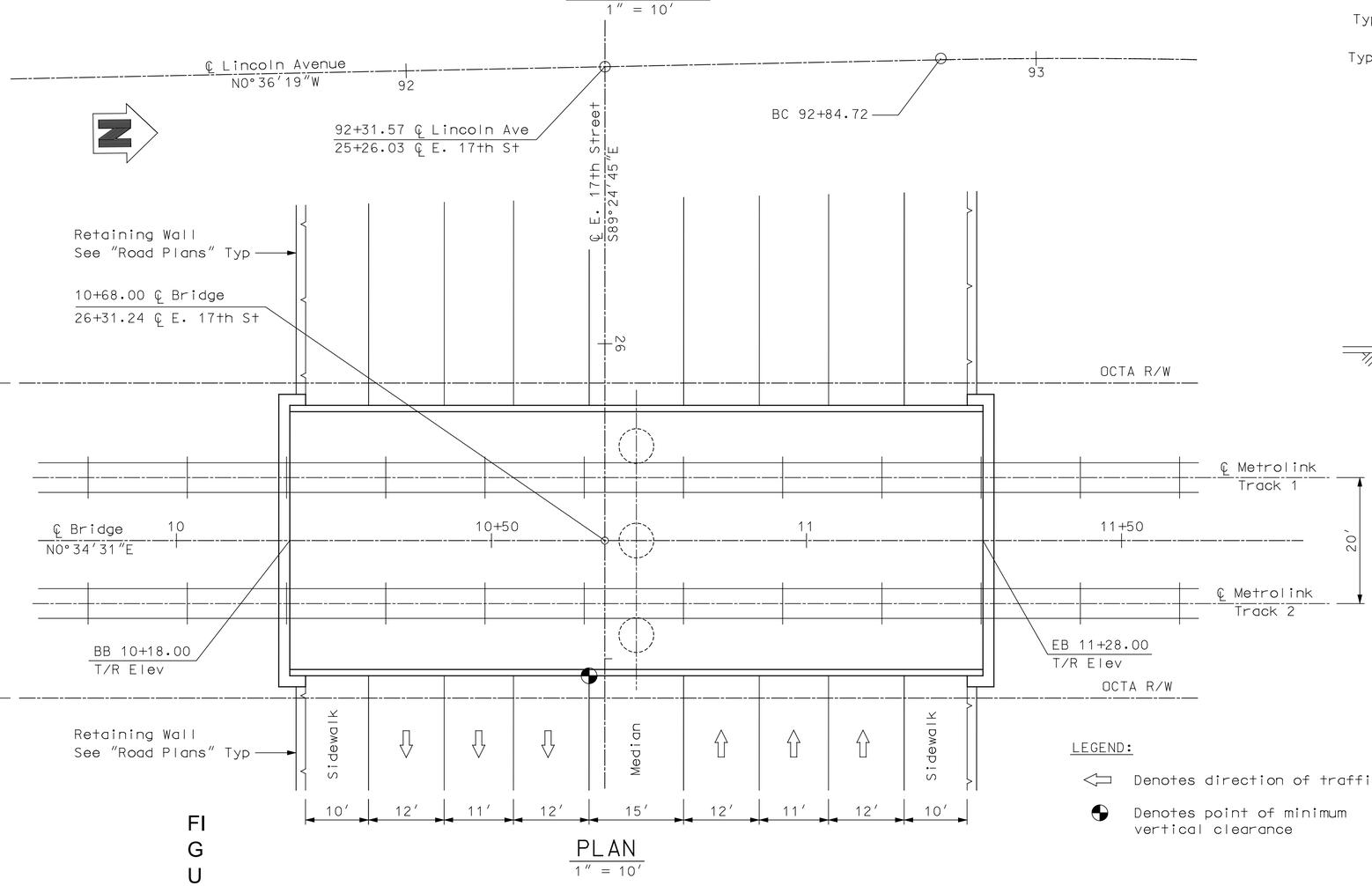
ALTERNATIVE 2A - OVERCROSSING OF RAILROAD

FIGURE 2C

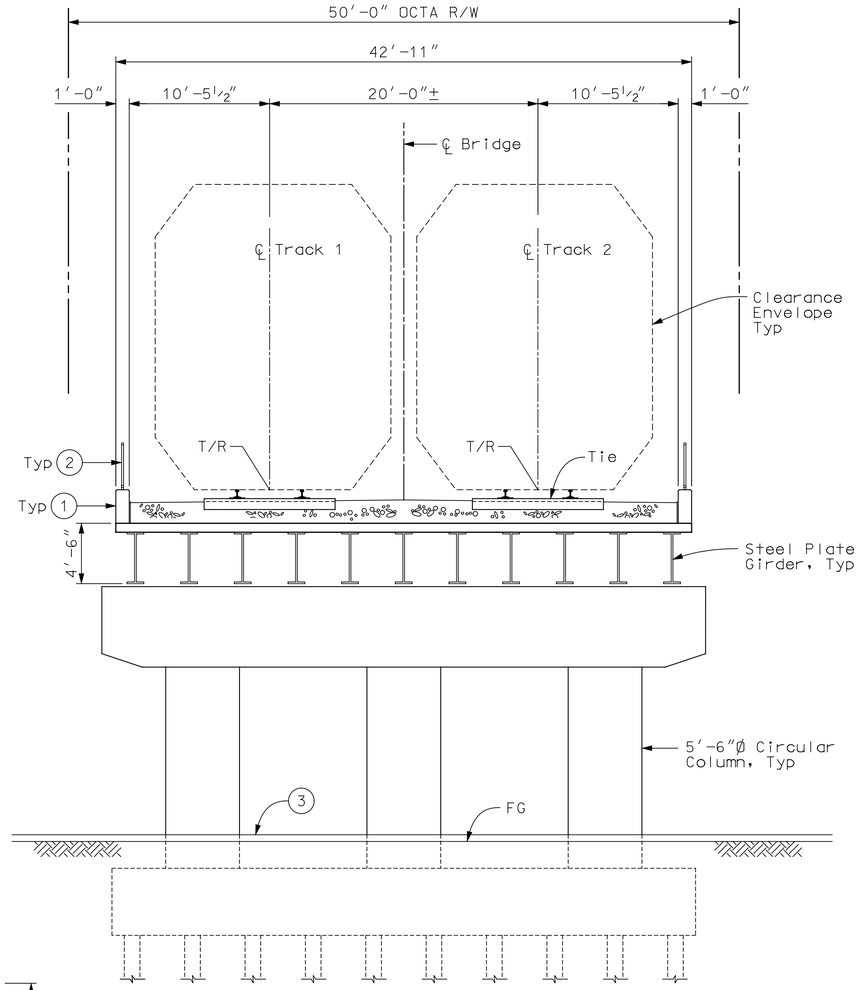
ALTERNATIVE 1A



ELEVATION
1″ = 10′



PLAN
1″ = 10′



TYPICAL SECTION
3/16″ = 1′-0″

Notes:

1. Ballast Retainer
2. Metal Hand Railing
3. Raised Median, see "Road Plans"

LEGEND:

- Denotes direction of traffic
- Denotes point of minimum vertical clearance

FIGURE 3A

DGN FILE =GP E 17th St UP ALT 1A.dgn
USERNAME =AECOM
5/8/2012
DATE PLOTTED =9:24:18 AM

FILE NO.:

REVISIONS

NUMBER	DATE	INITIALS	DESCRIPTION	APPROVED	INSTALLED

REFERENCES

BENCHMARK NO.:	ELEV.:
CONSTRUCTION COMPLETED:	

PREPARED UNDER THE SUPERVISION OF: RCE NO.:
DESIGNED: J.C. DRAWN: R.A CHECKED:
RECOMMENDED:
RECOMMENDED FOR CONSTRUCTION:
DEPUTY CITY ENGINEER RCE NO.:

DATE 5/07/12

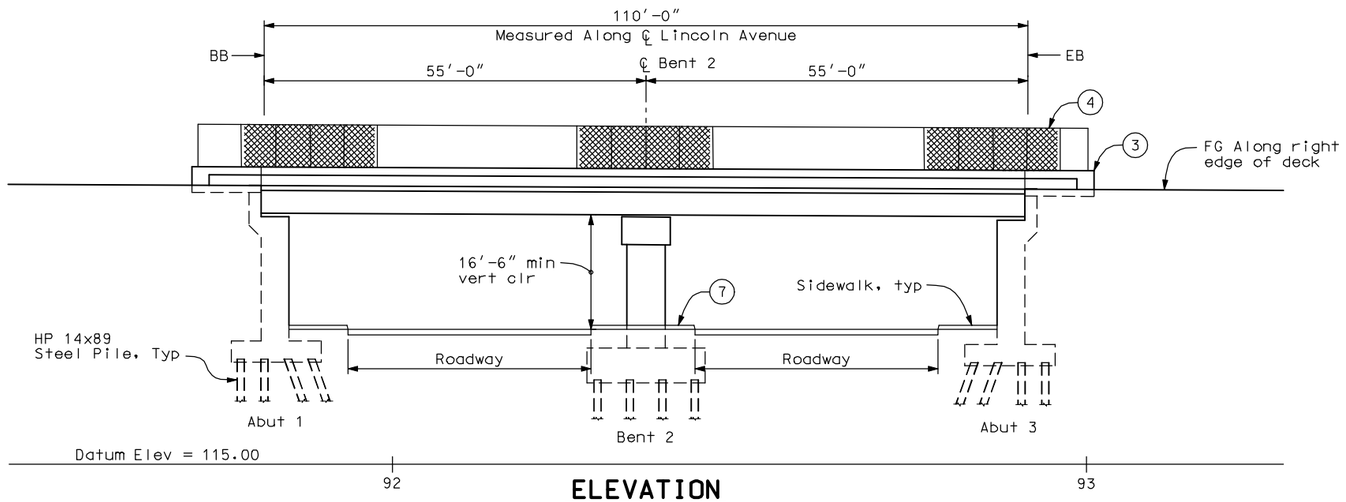
EAST 17TH STREET GRADE SEPARATION

GENERAL PLAN

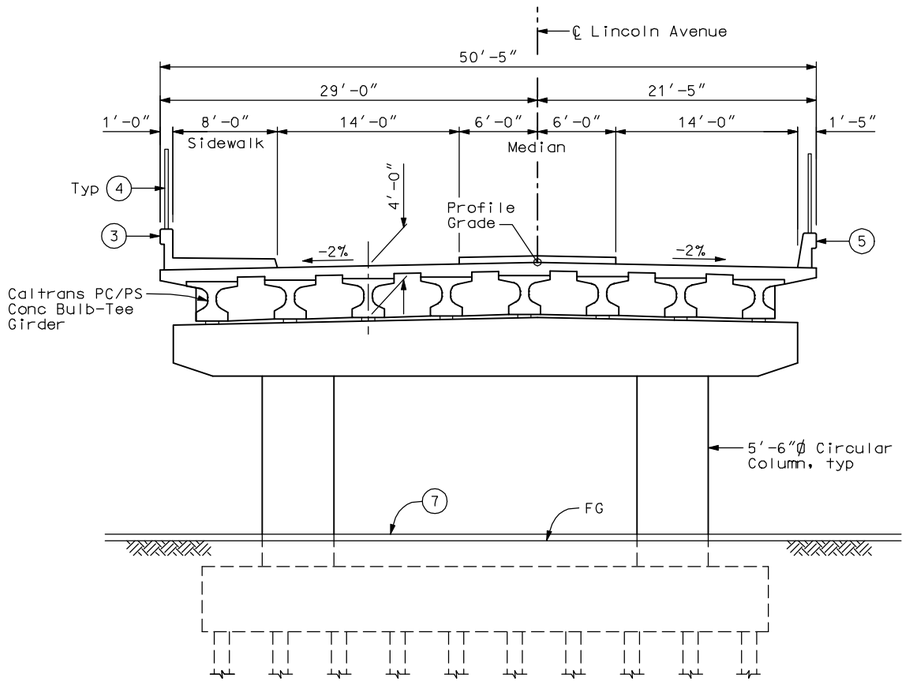
ORANGE COUNTY TRANSPORTATION AUTHORITY

SHEET OF

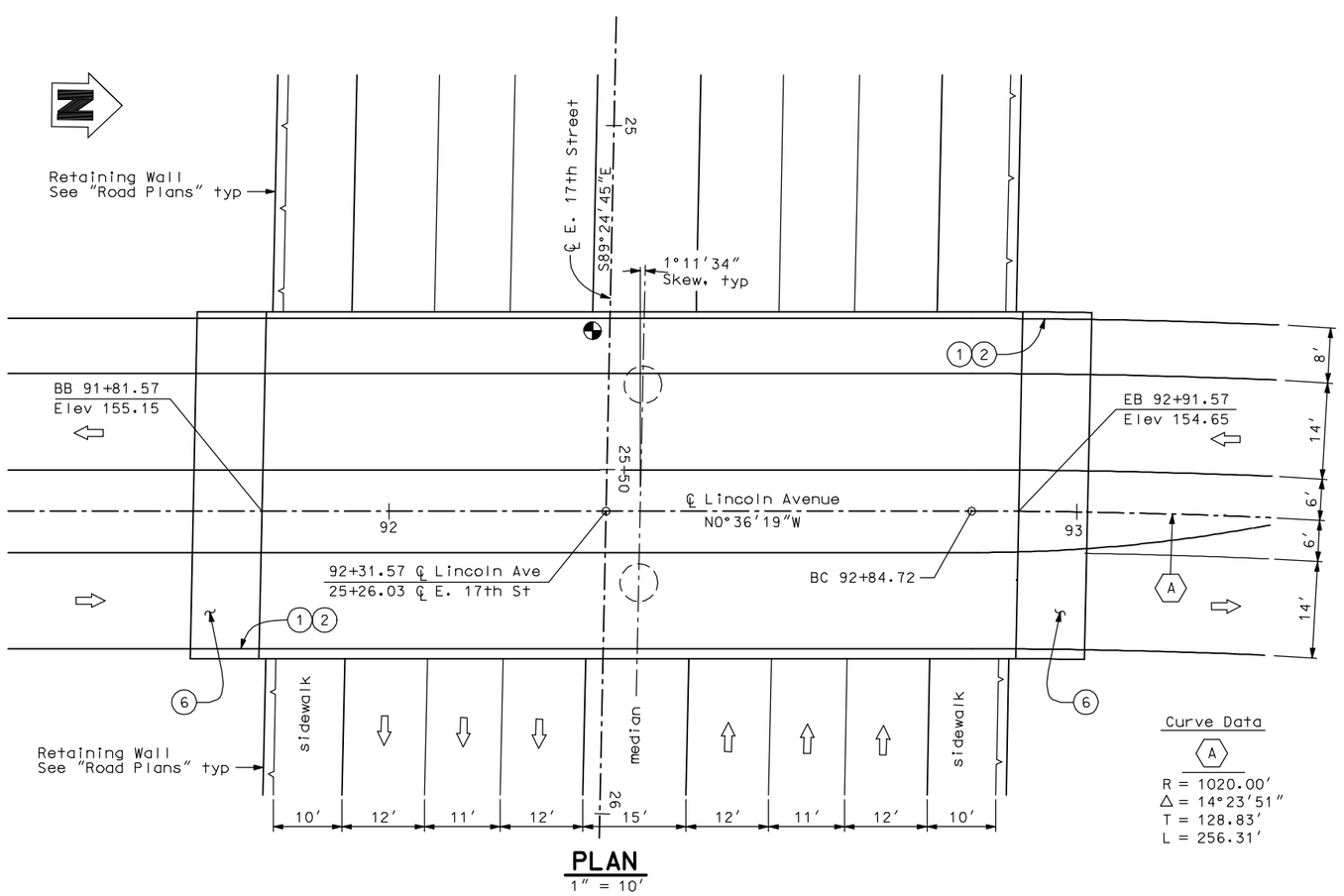
ALTERNATIVE 1A



ELEVATION
1" = 10'



TYPICAL SECTION
3/16" = 1'-0"



PLAN
1" = 10'

Curve Data

(A)

R = 1020.00'
Δ = 14°23'51"
T = 128.83'
L = 256.31'

Notes:

1. Paint Bridge Name "Lincoln Avenue Overcrossing"
2. Paint Bridge No. "xxxxx"
3. Concrete Barrier, Type 26
4. Chain Link Railing, Type 7
5. Concrete Barrier, Type 732
6. Structure Approach Type EQ(10)
7. Raised Median, see "Road Plans"

Legend:

- ⇦ Denotes direction of traffic
- ◓ Denotes point of minimum vertical clearance

FIGURE 3B

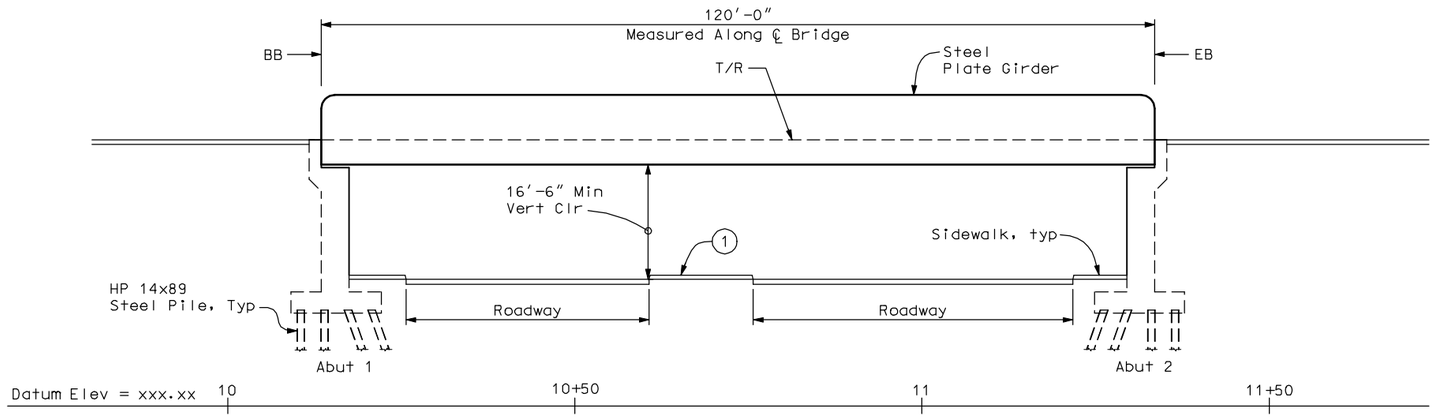
DATE PLOTTED =10:50:02 AM 1/4/2012 USERNAME =dasdigns DGN FILE =P:\402013493 17th Street PSR\4000_CAD\4008_Structural\445\4SP Lincoln Ave DC ALT 1A.dgn

FILE NO.:	REVISIONS					REFERENCES	
	NUMBER	DATE	INITIALS	DESCRIPTION	APPROVED / INSTALLED	BENCHMARK NO.:	ELEV.:
						CONSTRUCTION COMPLETED:	

PREPARED UNDER THE SUPERVISION OF:			DATE
	RCE NO.: XXXXX		9/16/11
DESIGNED:	DRAWN:	CHECKED: XX	9/16/11
RECOMMENDED:			
RECOMMENDED FOR CONSTRUCTION:			
DEPUTY CITY ENGINEER	RCE NO.: XXXXX		

EAST 17TH STREET GRADE SEPARATION
GENERAL PLAN
ORANGE COUNTY TRANSPORTATION AUTHORITY
SHEET OF

ALTERNATIVE 1C



ELEVATION
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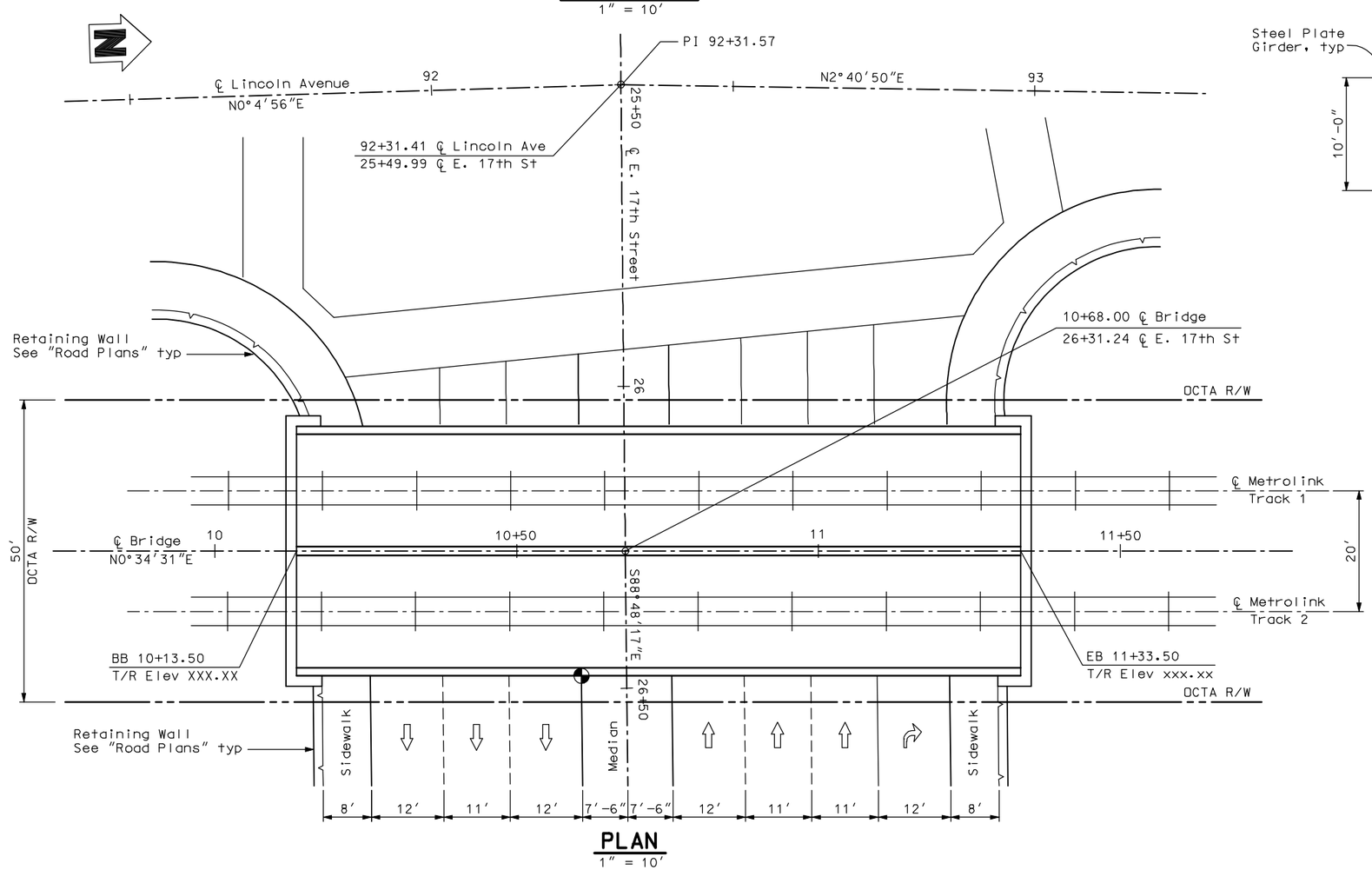
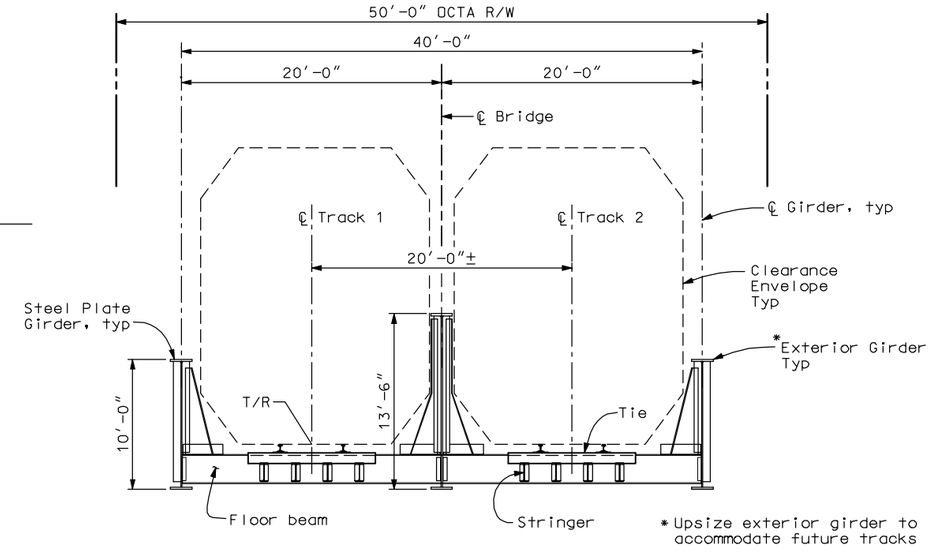


PLAN
1″ = 10′



TYPICAL SECTION
3/16″ = 1′-0″

Note:

(1) Raised Median, See "Road Plans"

Legend:

⇦ Denotes direction of traffic

◒ Denotes point of minimum vertical clearance

FIGURE 3C

FILE NO.:	REVISIONS					REFERENCES	
	NUMBER	DATE	INITIALS	DESCRIPTION	APPROVED / INSTALLED	BENCHMARK NO.:	ELEV.:
						CONSTRUCTION COMPLETED:	

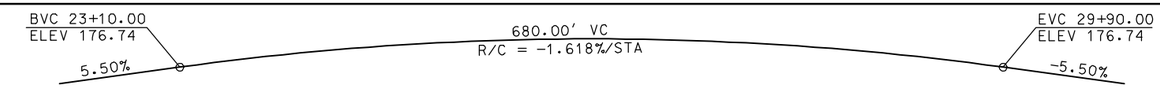
PREPARED UNDER THE SUPERVISION OF:			DATE
	RCE NO.: XXXXX		9/16/11
DESIGNED:	DRAWN:	CHECKED: XX	9/16/11
RECOMMENDED:			
RECOMMENDED FOR CONSTRUCTION:			
DEPUTY CITY ENGINEER	RCE NO.: XXXXX		

EAST 17TH STREET GRADE SEPARATION
GENERAL PLAN

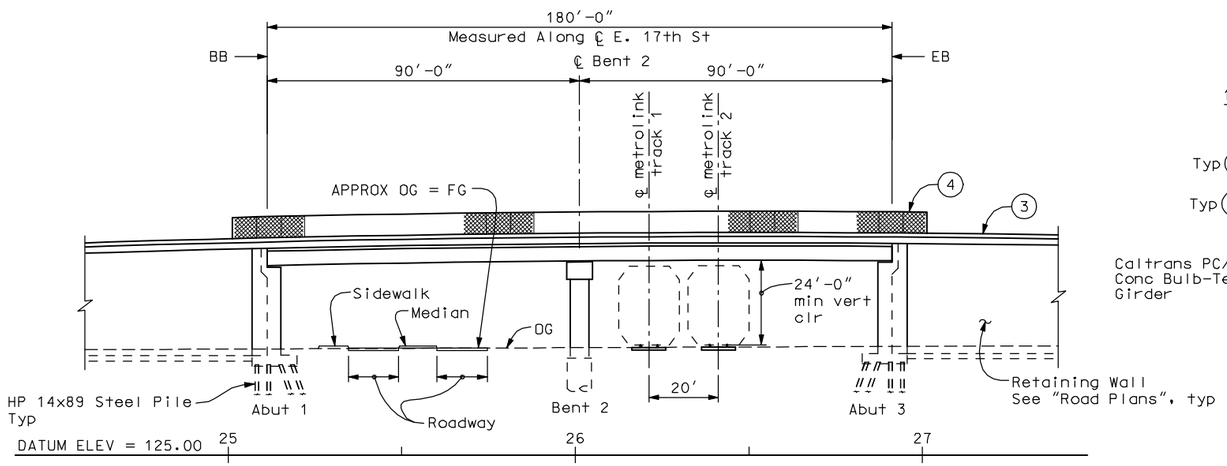
ORANGE COUNTY TRANSPORTATION AUTHORITY

SHEET OF

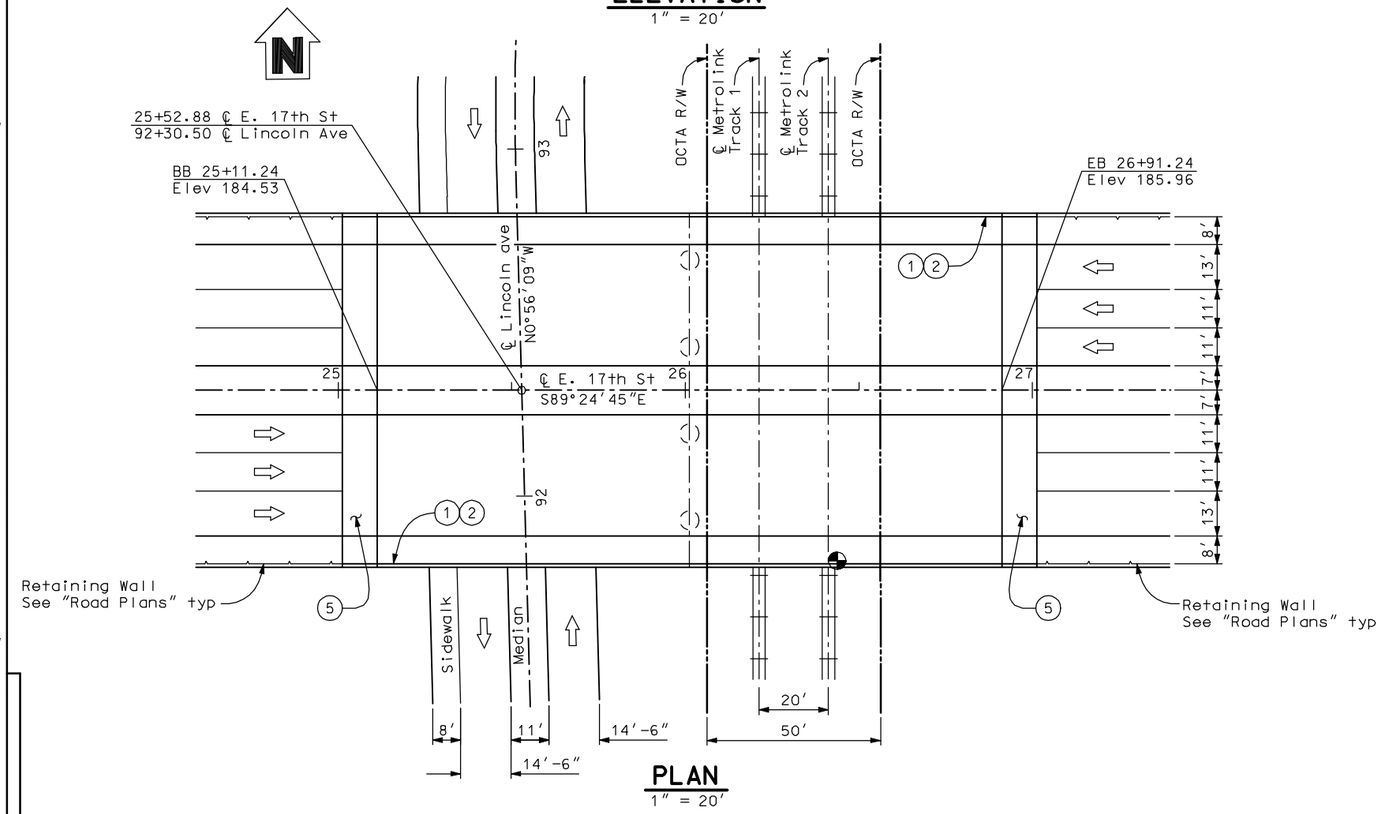
DATE PLOTTED =10:49:07 AM 1/4/2012 USERNAME =dbbaldwin DGN FILE =P:\460213493 17th Street PSR\4000_CAD\4008_Structural\MPS\MOP E 17th St UP_ALT 1C.dgn



PROFILE GRADE
No Scale

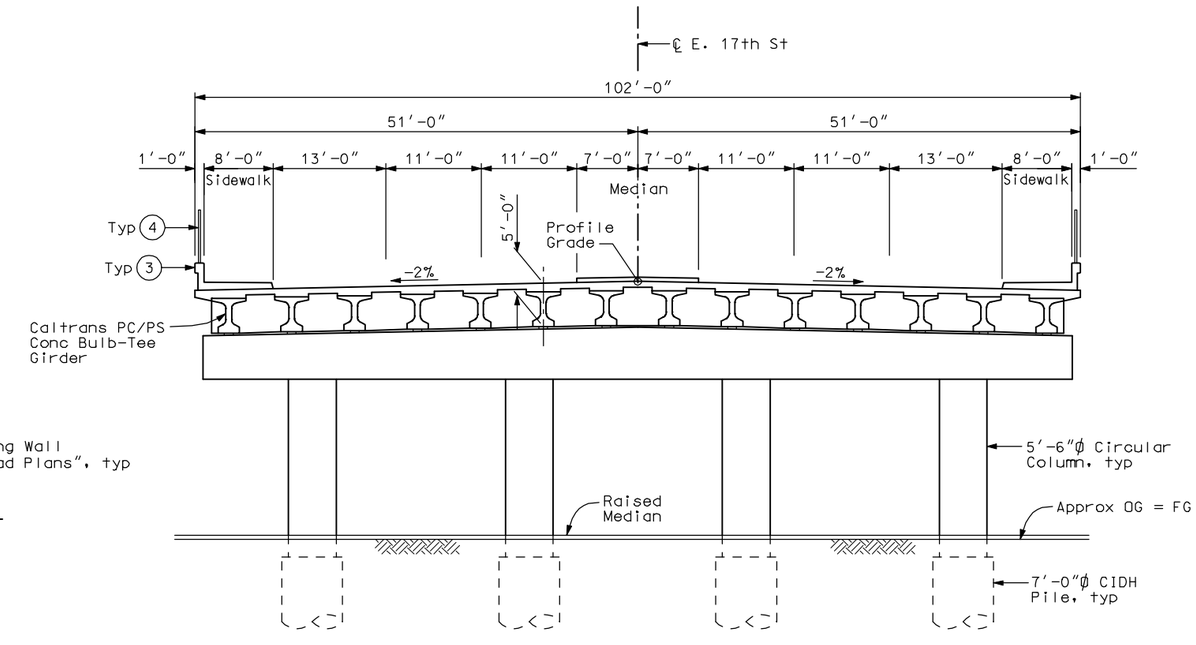


ELEVATION
1" = 20'



PLAN
1" = 20'

ALTERNATIVE 2A



TYPICAL SECTION
1/8" = 1'-0"

Notes:

1. Paint Bridge Name "East 17th Street Overhead"
2. Paint Bridge No. "xxxxx"
3. Concrete Barrier, Type 26
4. Chain Link Railing, Type 7
5. Structure Approach Type EQ(10)
6. Raised median, see "Road Plans"

Legend:

- ⇦ Denotes direction of traffic
- ◒ Denotes point of minimum Vertical Clearance

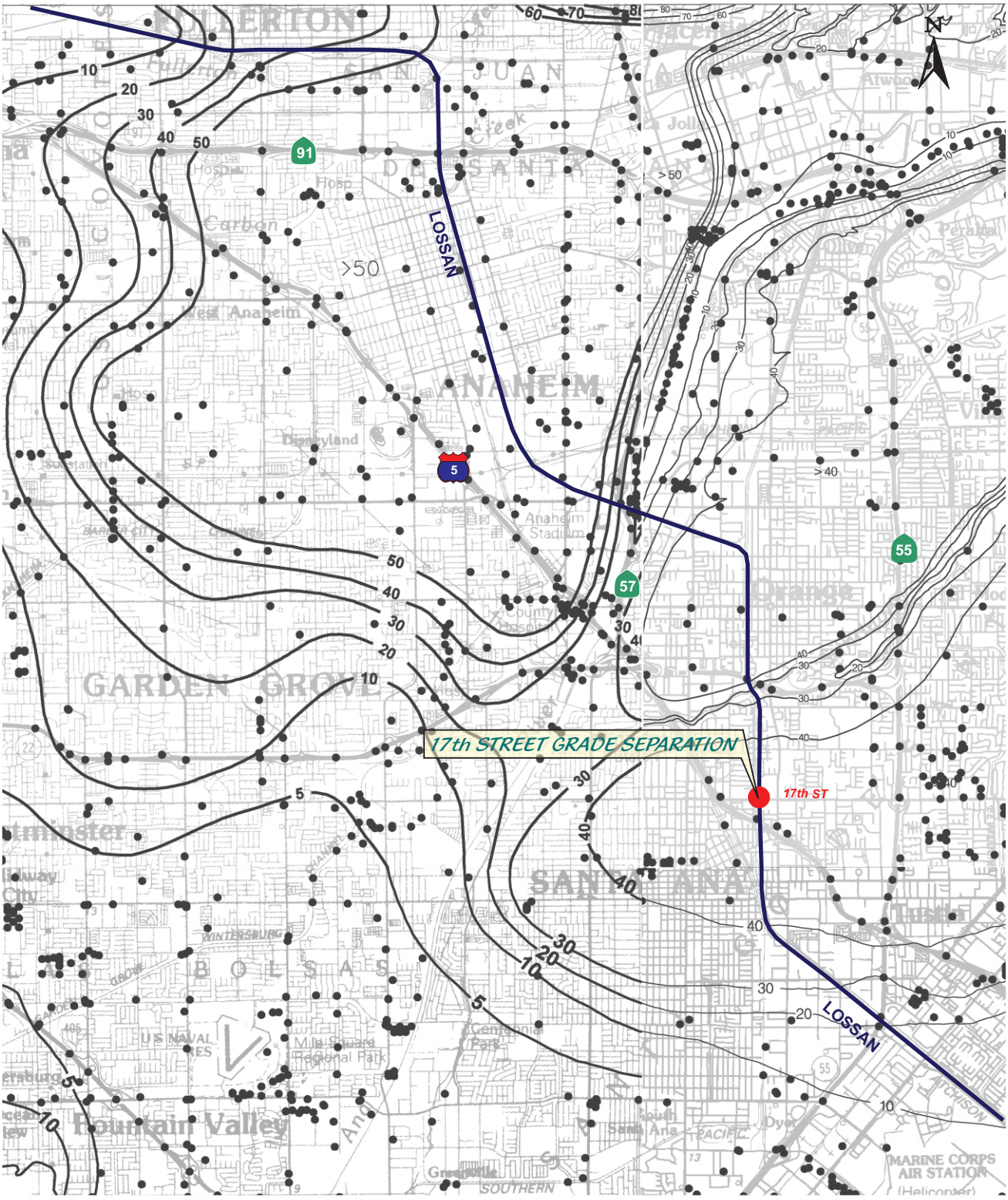
FIGURE 3D

FILE NO.:	REVISIONS					REFERENCES	
	NUMBER	DATE	INITIALS	DESCRIPTION	APPROVED / INSTALLED	BENCHMARK NO.:	ELEV.:
						CONSTRUCTION COMPLETED:	

PREPARED UNDER THE SUPERVISION OF:			DATE
	RCE NO.: XXXXX		9/16/11
DESIGNED:	DRAWN:	CHECKED: XX	9/16/11
RECOMMENDED:			
RECOMMENDED FOR CONSTRUCTION:			
DEPUTY CITY ENGINEER	RCE NO.: XXXXX		

EAST 17TH STREET GRADE SEPARATION
GENERAL PLAN
ORANGE COUNTY TRANSPORTATION AUTHORITY
SHEET OF

DATE PLOTTED = 10:44:36 AM 1/4/2012 USERNAME = desalagna DGN FILE = P:\460213493 17th Street PSR\E4000.CAD\E008_Structural\MPS\MOP E 17th St GH ALT 2A.dgn



GROUP DELTA CONSULTANTS

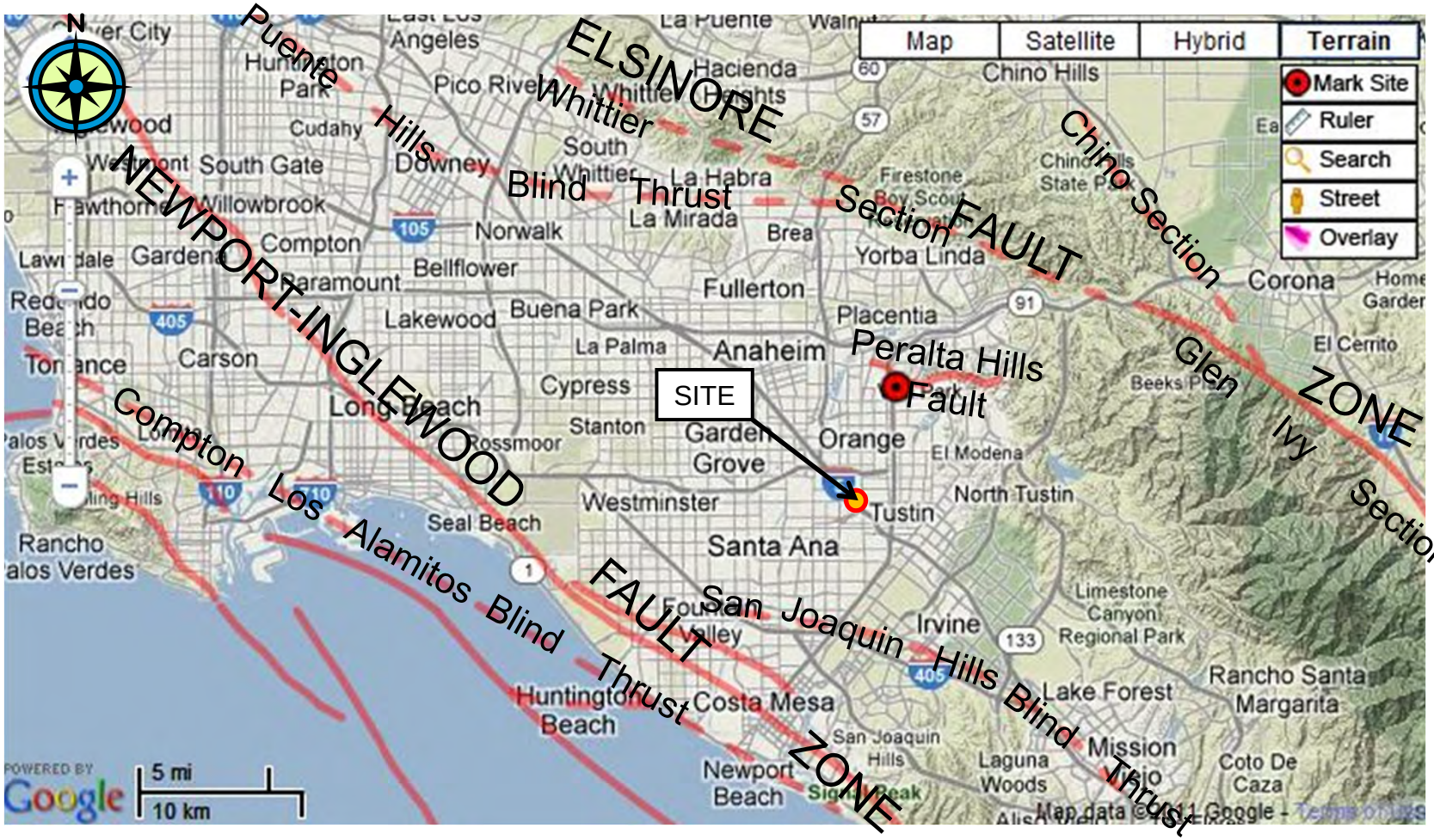
GROUP DELTA CONSULTANTS, INC.
ENGINEERS AND GEOLOGISTS
32 MAUCHLY, SUITE B
IRVINE , CA 92618 (949) 450-2100

FIGURE NUMBER
4

PROJECT NAME
17th STREET GRADE SEPARATION
SANTA ANA, CALIFORNIA

PROJECT NO.
I-534

HISTORICALLY HIGH GROUNDWATER MAP



Reference: CALTRANS ARS ONLINE.

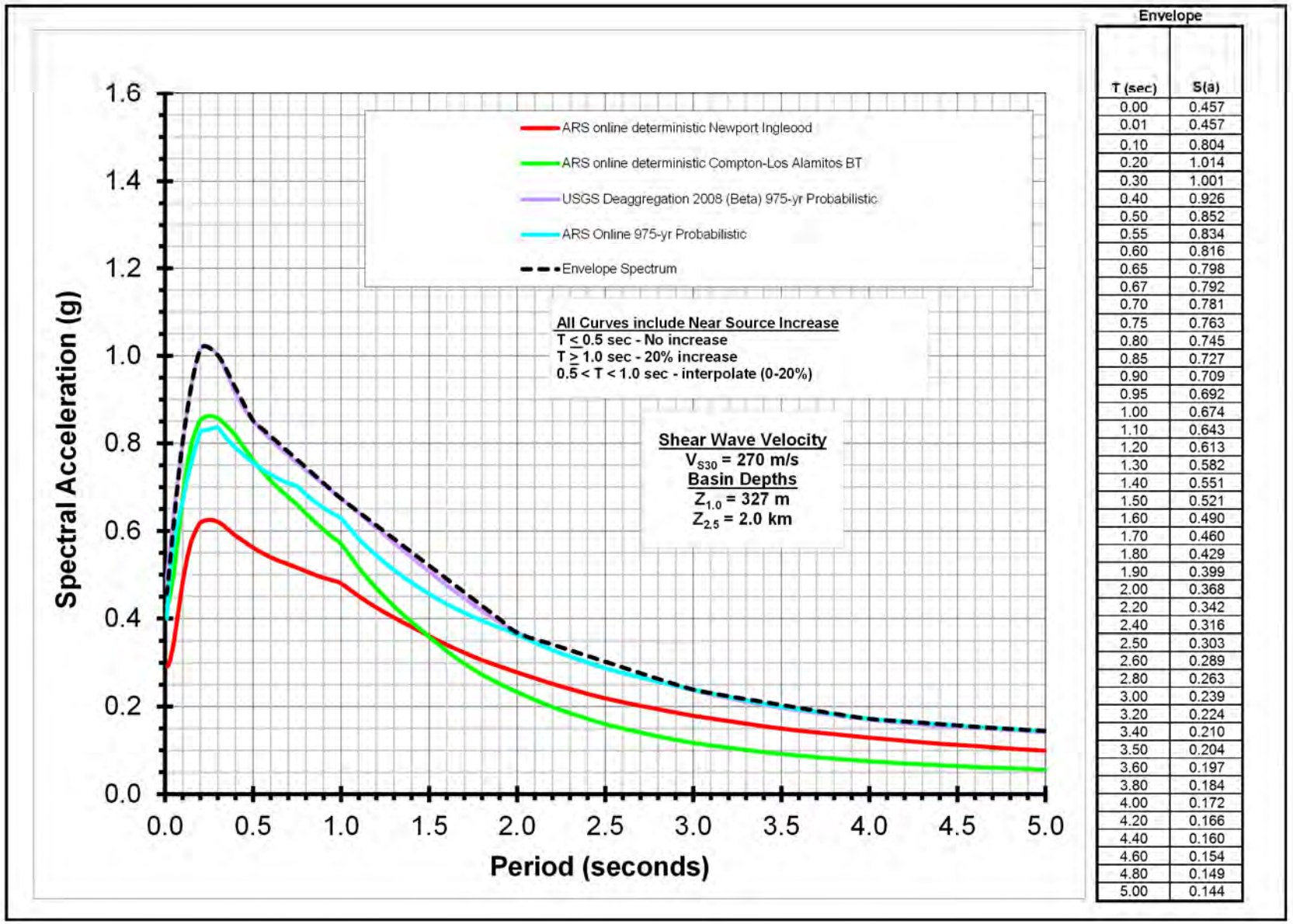
GROUP DELTA CONSULTANTS

GDC Proposal No. I11-108

PSR Equivalent, 17th St Grade Separation
Santa Ana, California

Regional Fault Map

Figure 5



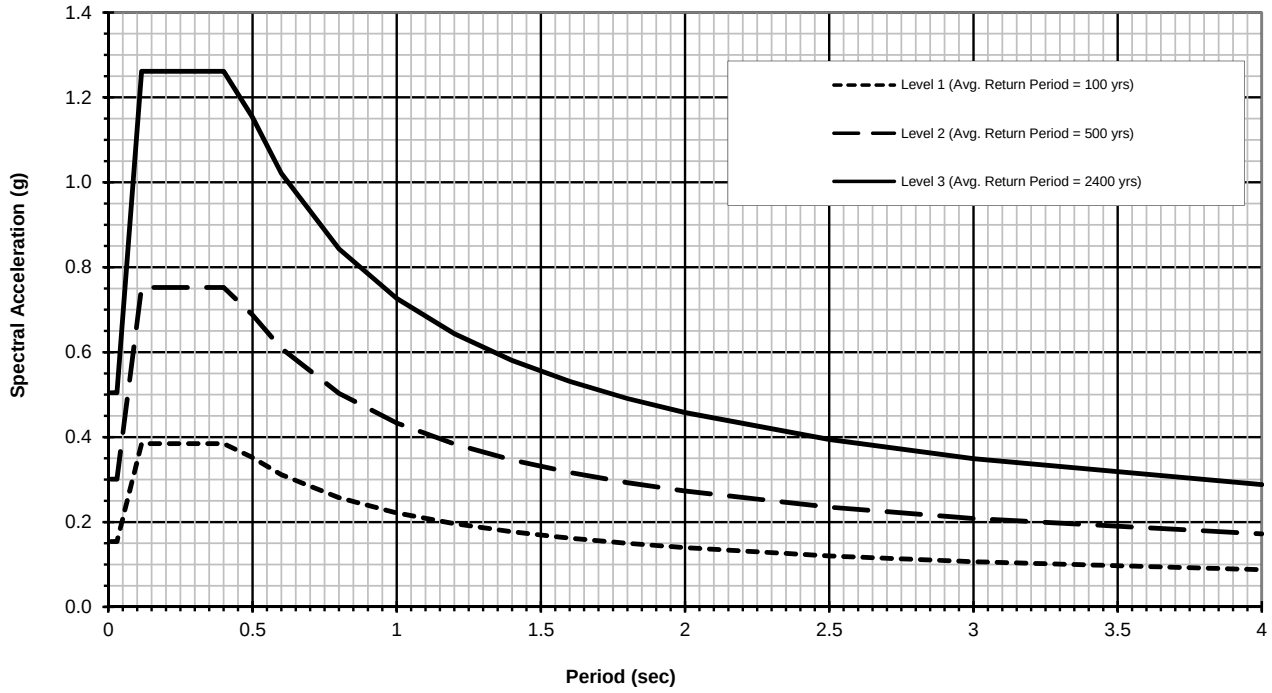
Envelope

T (sec)	S(a)
0.00	0.457
0.01	0.457
0.10	0.804
0.20	1.014
0.30	1.001
0.40	0.926
0.50	0.852
0.55	0.834
0.60	0.816
0.65	0.798
0.67	0.792
0.70	0.781
0.75	0.763
0.80	0.745
0.85	0.727
0.90	0.709
0.95	0.692
1.00	0.674
1.10	0.643
1.20	0.613
1.30	0.582
1.40	0.551
1.50	0.521
1.60	0.490
1.70	0.460
1.80	0.429
1.90	0.399
2.00	0.368
2.20	0.342
2.40	0.316
2.50	0.303
2.60	0.289
2.80	0.263
3.00	0.239
3.20	0.224
3.40	0.210
3.50	0.204
3.60	0.197
3.80	0.184
4.00	0.172
4.20	0.166
4.40	0.160
4.60	0.154
4.80	0.149
5.00	0.144

GROUP DELTA CONSULTANTS

N:\Projects_AV\I500\I-534 Grade Separation at 17th Street\Analysis\ARS\Spectrum Plot 17th St.xls

FIGURE 6A
PRELIMINARY CALTRANS
RESPONSE SPECTRUM
17TH ST GRADE SEPARATION PROJECT



Ref: AREMA (2006) Volume 2 Structures - Seismic Design
for Railway Structures Section 1.4

$$C_m = \frac{1.2\,ASD}{T_m^{\,2/3}} \le 2.5\,AD$$

$$D = \left(\frac{1.5}{0.4\xi + 1} + 0.5\right)$$

Input:	**Level 1**	**Level 2**	**Level 3**
Base Accel, A (g's)	0.154	0.301	0.505
Site Coefficient, S	1.2		
% Critical Damping, ζ	5		
Damping Adj. Factor, D	1		
Calc:			
2.5AD	0.385	0.752	1.261
To (sec)	0.1152		

C_m = A for T ≤ 0.03 seconds

$C_m = A\left[1 + \frac{(T - 0.03)(2.5D - 1)}{(T_o - 0.03)}\right]$ for $0.03 < T < T_o$ seconds

T_o = initial transition period = 0.096S
A = Base acceleration coefficient from Paragraph 1.3.2.3
T = Period of vibration
D = Damping adjustment factor from Paragraph 1.4.4.2
S = Site coefficient from Paragraph 1.4.4.1

Period	Spectral Acceleration (g)		
(sec)	Level 1	Level 2	Level 3
0.01	0.15	0.30	0.50
0.03	0.15	0.30	0.50
0.1152	0.38	0.75	1.26
0.2	0.38	0.75	1.26
0.3	0.38	0.75	1.26
0.4	0.38	0.75	1.26
0.5	0.35	0.69	1.15
0.6	0.31	0.61	1.02
0.8	0.26	0.50	0.84
1	0.22	0.43	0.73
1.2	0.20	0.38	0.64
1.4	0.18	0.35	0.58
1.6	0.16	0.32	0.53
1.8	0.15	0.29	0.49
2	0.14	0.27	0.46
2.5	0.12	0.24	0.39
3	0.11	0.21	0.35
4	0.09	0.17	0.29

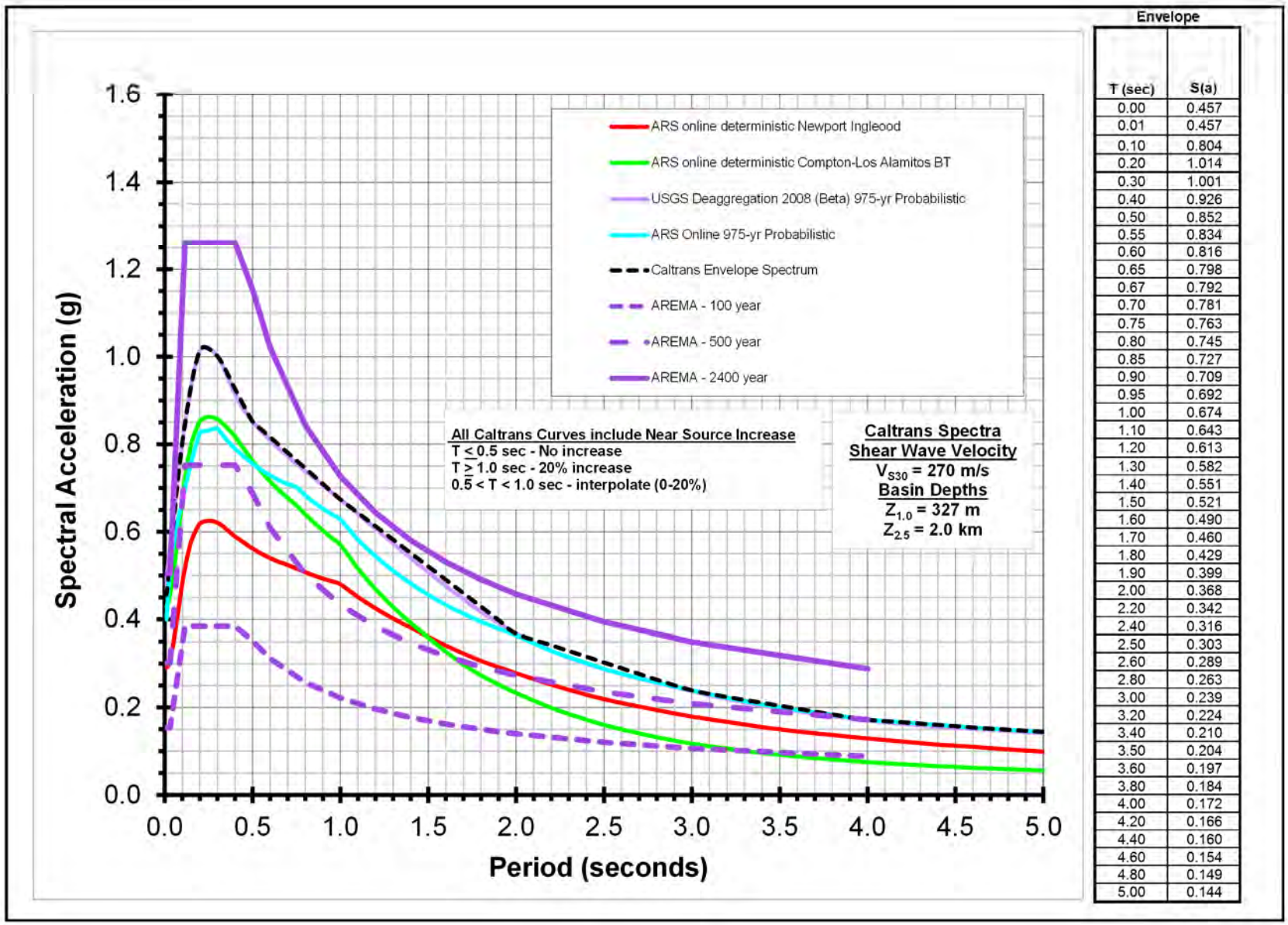
GROUP DELTA CONSULTANTS

AREMA 2006 RESPONSE SPECTRA

17TH STREET GRADE SEPARATION PROJECT

FIGURE

6B

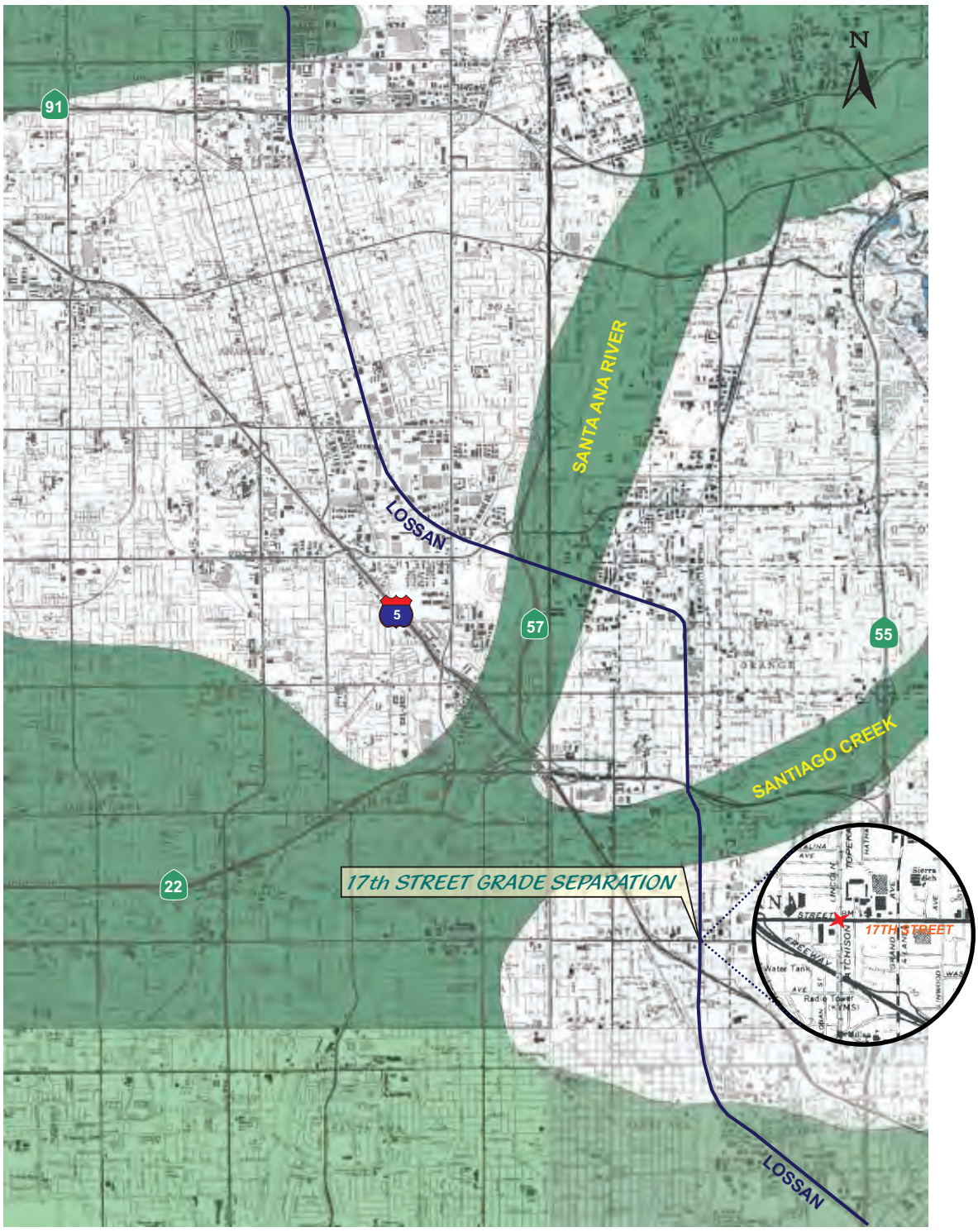


Envelope	
T (sec)	S(a)
0.00	0.457
0.01	0.457
0.10	0.804
0.20	1.014
0.30	1.001
0.40	0.926
0.50	0.852
0.55	0.834
0.60	0.816
0.65	0.798
0.67	0.792
0.70	0.781
0.75	0.763
0.80	0.745
0.85	0.727
0.90	0.709
0.95	0.692
1.00	0.674
1.10	0.643
1.20	0.613
1.30	0.582
1.40	0.551
1.50	0.521
1.60	0.490
1.70	0.460
1.80	0.429
1.90	0.399
2.00	0.368
2.20	0.342
2.40	0.316
2.50	0.303
2.60	0.289
2.80	0.263
3.00	0.239
3.20	0.224
3.40	0.210
3.50	0.204
3.60	0.197
3.80	0.184
4.00	0.172
4.20	0.166
4.40	0.160
4.60	0.154
4.80	0.149
5.00	0.144

GROUP DELTA CONSULTANTS

N:\Projects_AV\I500\I-534 Grade Separation at 17th Street\Analysis\ARS\Spectrum Plot 17th St.xls

FIGURE 6C
COMPARISON OF PRELIMINARY CALTRANS AND AREMA RESPONSE SPECTRA
17TH ST GRADE SEPARATION PROJECT



Liquefaction

Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

GROUP DELTA CONSULTANTS

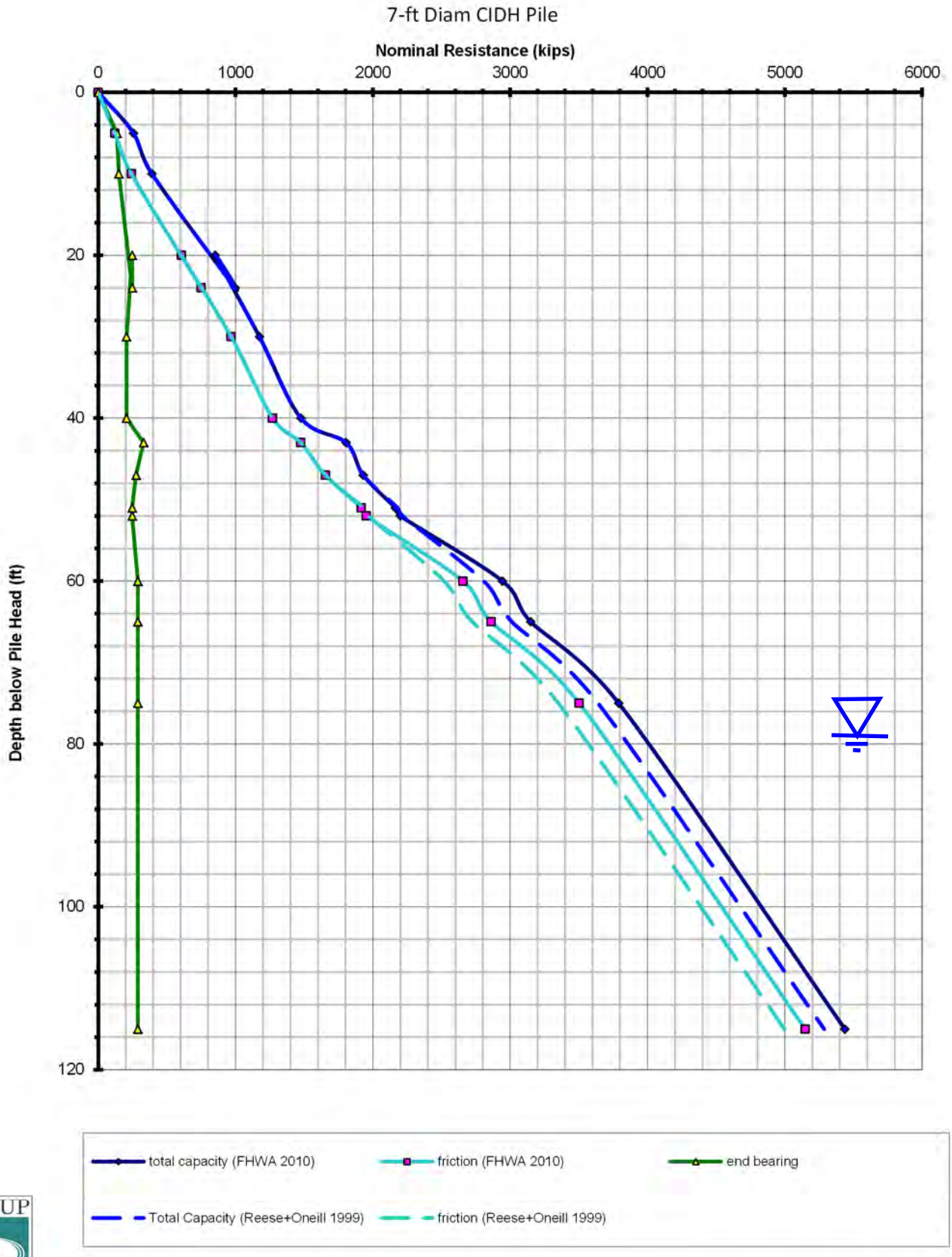
GROUP DELTA CONSULTANTS, INC.
ENGINEERS AND GEOLOGISTS
32 MAUCHLY, SUITE B
IRVINE , CA 92618 (949) 450-2100

FIGURE NUMBER
7

PROJECT NAME
17th STREET GRADE SEPARATION
SANTA ANA, CALIFORNIA

PROJECT NO.
I-534

SEISMIC HAZARD ZONES MAP



GROUP DELTA CONSULTANTS

N:\Projects_AV\500\I-534 Grade Separation at 17th Street\CIDH Axial 2010 Bent 2 7-ft diam pile.xls Plot

FIGURE 8
NOMINAL COMPRESSIVE CAPACTY
7 FT DIAMETER CIDH PILE

Appendix A
Existing LOTB

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	5	31.8/32.8	386	468

GEOTECHNICAL PROFESSIONAL

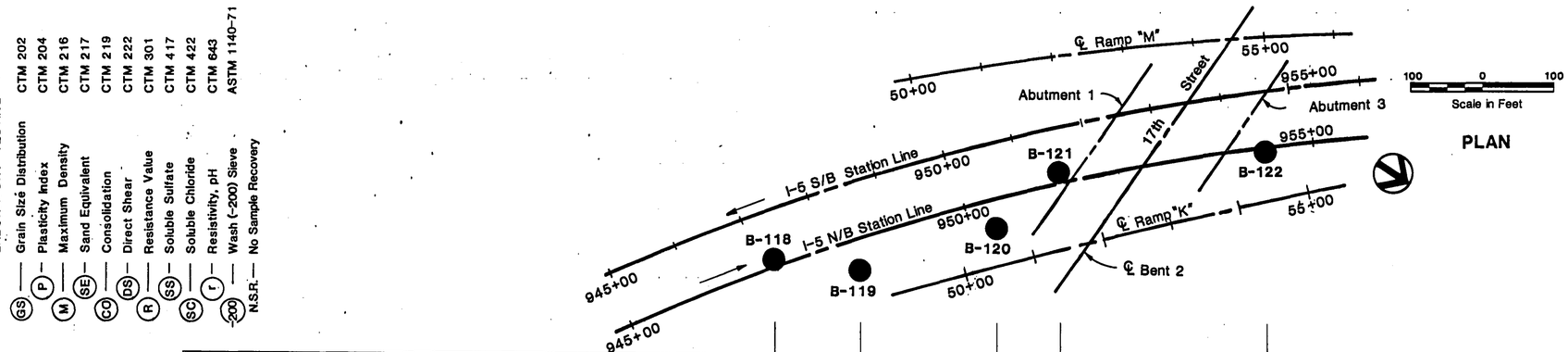
7-13-92
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER JAMES J. WEAVER No. 884 Exp. 12-31-92 GEOTECHNICAL STATE OF CALIFORNIA

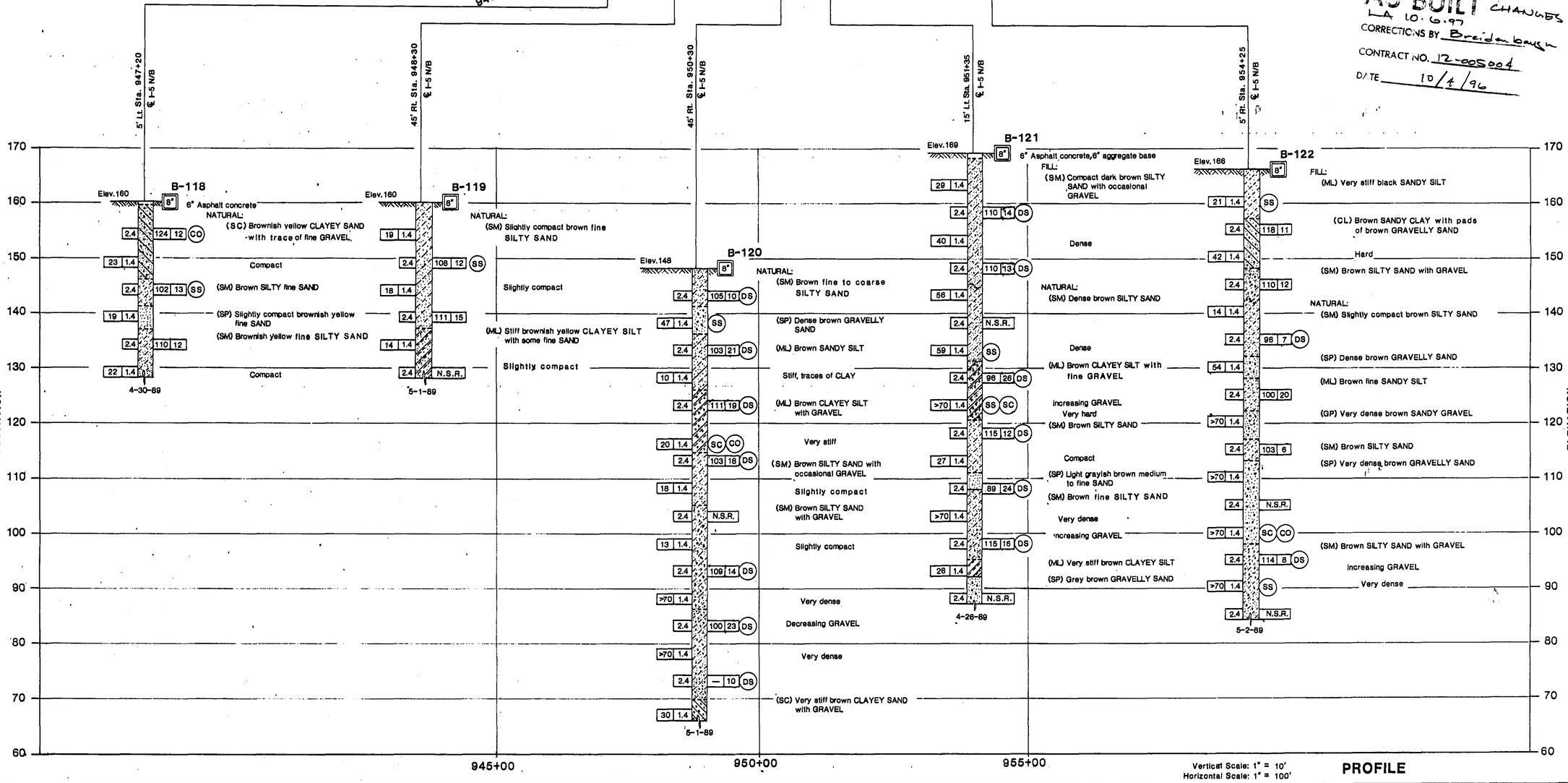
No AS BUILT CHANGES
LA 10.6.97
CORRECTIONS BY Breidenbach
CONTRACT NO. 12-005004
DATE 10/4/96

LABORATORY TESTING

(GS)	Grain Size Distribution	CTM 202
(P)	Plasticity Index	CTM 204
(M)	Maximum Density	CTM 216
(SE)	Sand Equivalent	CTM 217
(CO)	Consolidation	CTM 219
(DS)	Direct Shear	CTM 222
(R)	Resistance Value	CTM 301
(SS)	Soluble Sulfate	CTM 417
(SC)	Soluble Chloride	CTM 422
(r)	Resistivity, pH	CTM 643
(200)	Wash (-200) Sieve	ASTM 1140-71
N.S.R.	No Sample Recovery	



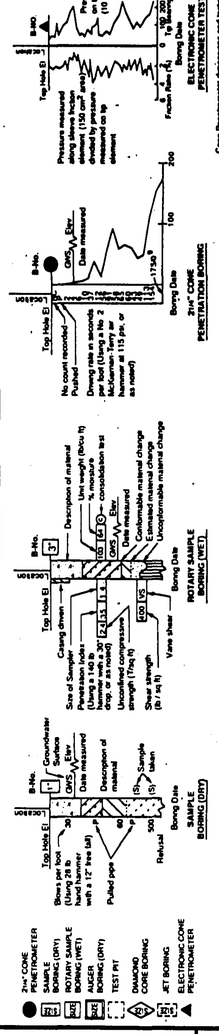
PLAN



Vertical Scale: 1" = 10'
Horizontal Scale: 1" = 100'

PROFILE

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

GRAVEL · SAND · SILT · CLAY · SANDY CLAY or CLAYEY SAND · SANDY SILT or SILTY SAND · SILTY CLAY · CLAYEY SILT · PEAT and/or ORGANIC MATTER · FILL MATERIAL · IGNEOUS ROCK · SEDIMENTARY ROCK · METAMORPHIC ROCK

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

Penetration Index (Blows / Ft)	Granular	Cohesive
0-4	Very loose	Very soft
5-9	Loose	Soft
10-19	Slightly compact	Stiff
20-34	Compact	Very stiff
35-69	Dense	Hard
>70	Very dense	Very hard

NOTE Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

DESIGN OVERSIGHT
SIGN OFF DATE

DRAWN BY R.C.O.
CHECKED BY MR

FIELD INVESTIGATOR Michael David Rooks
DATE 11-30-89

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER William K. Hayden

CU 12102
EA 005001

BRIDGE NO. 55-673 R/L
POST MILE 32.5

17th STREET UNDERCROSSING
LOG OF TEST BORINGS 1 OF 2

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 21 OF 23

389

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	5	31.8/32.8	387	468

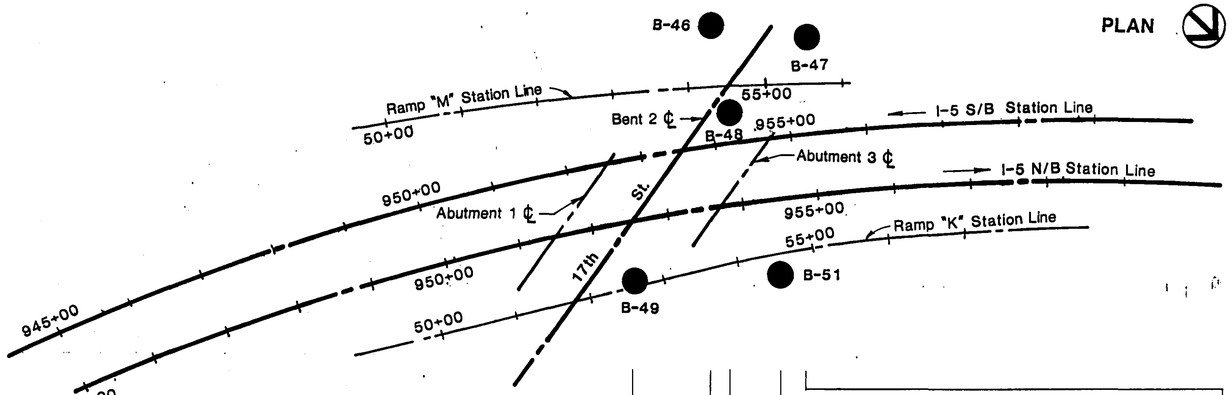
GEOTECHNICAL PROFESSIONAL

7-13-92
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER JAMES J. WEAVER No. 684 Exp. 12-31-92 GEOTECHNICAL STATE OF CALIFORNIA

Scale in Feet: 100 0 100

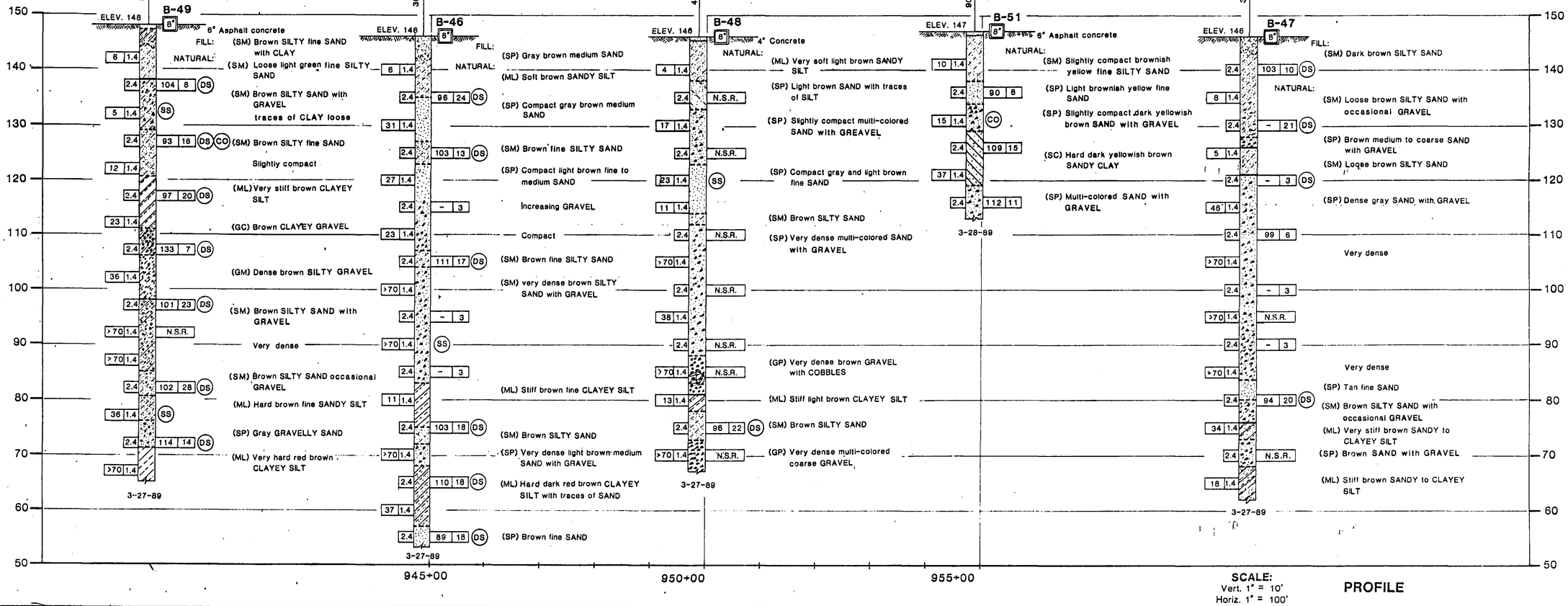
PLAN



No AS BUILT CHANGES
LA 10.6.97
CORRECTIONS BY Breidenbach

CONTRACT NO. 12-005004

DATE 10/4/96



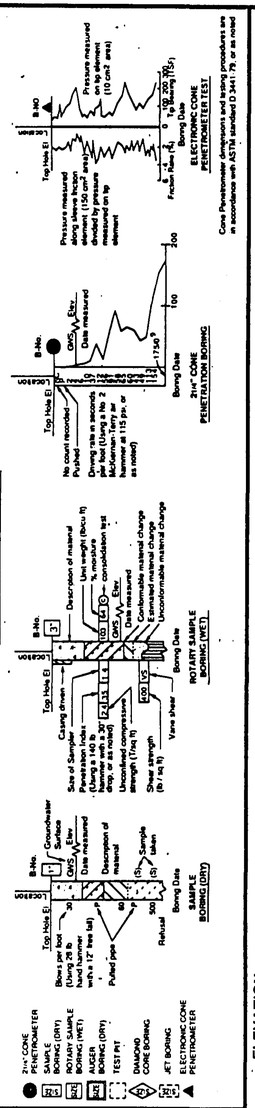
SCALE:
Vert. 1" = 10'
Horiz. 1" = 100'

PROFILE

LABORATORY TESTING

GS	Grain Size Distribution — CTM 202
P	Plasticity Index — CTM 204
M	Maximum Density — CTM 216
SE	Sand Equivalent — CTM 217
CO	Consolidation — CTM 219
DS	Direct Shear — CTM 222
R	Resistance Value — CTM 301
SS	Soluble Sulfate — CTM 417
SC	Soluble Chloride — CTM 422
r	Resistivity, pH — CTM 643
200	Wash (-200) Sieve — ASTM 1140-71
N.S.R.	No Sample Recovery

Core Penetrometer dimensions and testing procedures are in accordance with ASTM standard D 3441-79, or as noted



LEGEND OF EARTH MATERIALS

GRAVEL · SAND · SILT · CLAY · SANDY CLAY or CLAYEY SAND · SANDY SILT or SILTY SAND · SILTY CLAY · CLAYEY SILT · PEAT and/or ORGANIC MATTER · FILL MATERIAL · IGNEOUS ROCK · SEDIMENTARY ROCK · METAMORPHIC ROCK

CONSISTENCY CLASSIFICATION FOR SOILS

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5-9	Loose	Soft
10-19	Slightly compact	Stiff
20-34	Compact	Very stiff
35-69	Dense	Hard
>70	Very dense	Very hard

NOTE Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis

DESIGN OVERSIGHT — SIGN OFF DATE 3-28-92

DRAWN BY R.C.O.

CHECKED BY M.R.

Michael David Kraeder
FIELD INVESTIGATOR

DATE 11-30-89

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

William R. Heyhurst
PROJECT ENGINEER

BRIDGE NO. 55-673 R/L

POST MILE 32.5

17TH STREET UNDERCROSSING

LOG OF TEST BORINGS 2 OF 2

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12102
EA 005001

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 22 OF 23

390

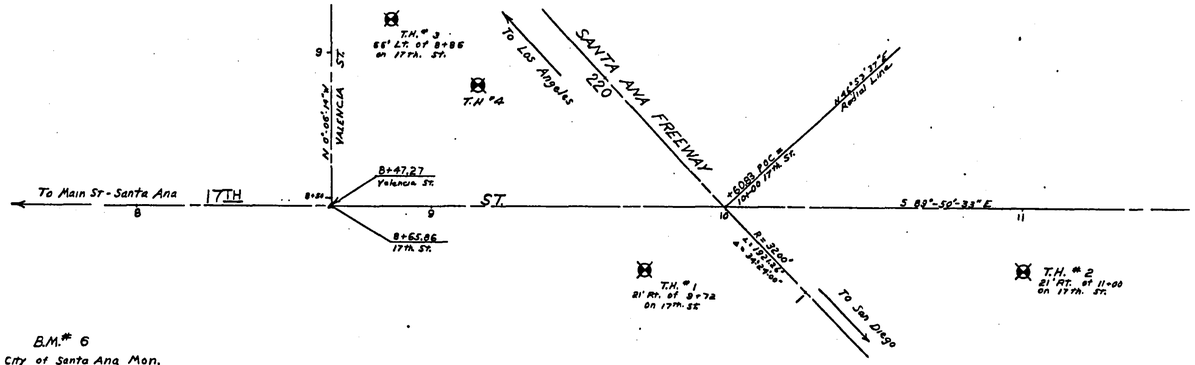
123681

7-13-92 TO ACCOMPANY PLANS DATED	DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
	12	Ora	5	31.8/32.8	388	468

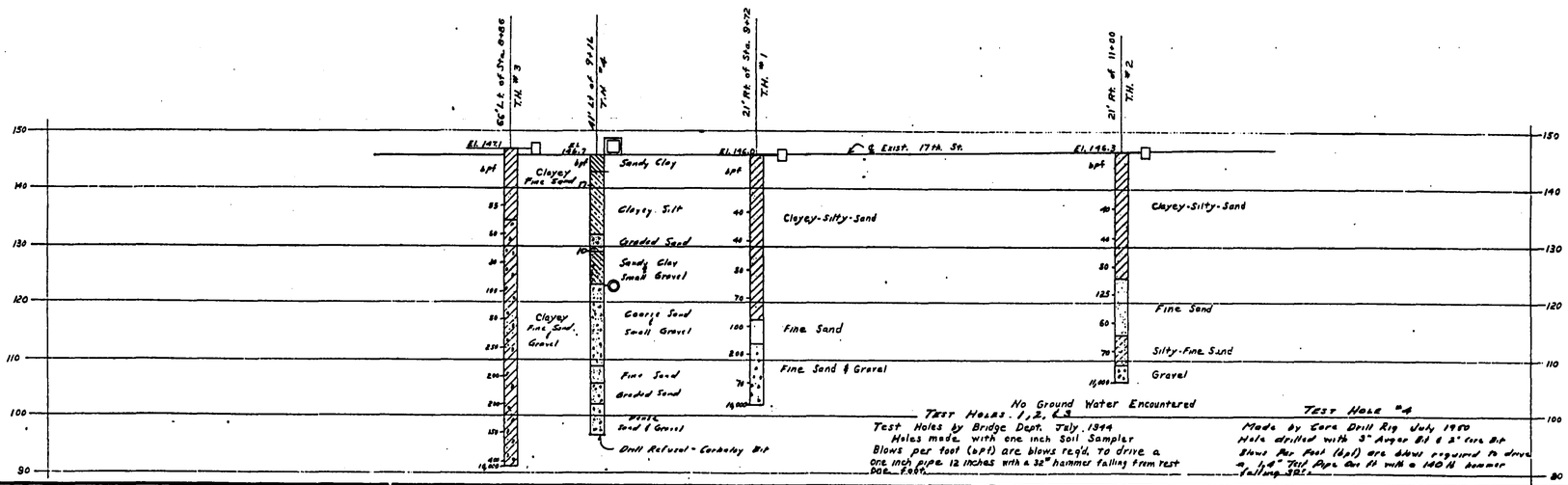
AS BUILT PLANS
Contract No. 51-144622
Date Completed
Document No. 7000244

DIST	COUNTY	ROUTE	SECTION	SHEET NO.	TOTAL SHEETS
7	ORA	5	31	15	15

APRIL 16 1951



B.M.# 6
Std. City of Santa Ana Mon.
2' below pavement, 5' South of intersection of ℄'s of 17th & Valencia Sts., access to which is through a 0.25' Tile with metal cover. El. = 143.876



No Ground Water Encountered

TEST HOLES 1, 2, & 3
Test Holes by Bridge Dept. July 1944
Holes made with one inch Soil Sampler
Blows per foot (bpf) are blows req'd. to drive a one inch pipe 12 inches with a 32" hammer falling from rest 20o. Feet.

TEST HOLE #4
Made by Core Drill Rig July 1950
Hole drilled with 3" Auger Bit & 2" Core Bit
Blows per foot (bpf) are blows required to drive a 1.4" Tail Pipe 6in ft with a 140 lb hammer falling 30".

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

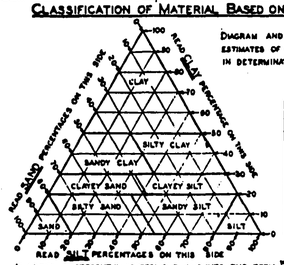


DIAGRAM AND TABLE SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES.

GROUPING USED IN TRIANGULAR CLASSIFICATION			
CLASS NAME	PERCENTAGE OF SIZES PRESENT		
	SAND	SILT	CLAY
SAND	80-100	0-20	0-20
SILTY SAND	48-80	0-28	0-20
SANDY SILT	0-48	28-80	0-20
SILT	0-20	80-100	0-20
CLAYEY SAND	30-80	0-48	20-30
CLAYEY SILT	0-28	52-80	20-30
SANDY CLAY	30-70	0-48	30-50
SILTY CLAY	0-30	30-70	30-50
CLAY	0-30	0-50	50-100

IF GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, VIZ. "GRAVELLY SAND". THE TERMS "COARSE," "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE GRAVEL, SAND AND SILT REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF BORING OPERATIONS

- Plan of any boring
- 1" Sampler boring
- Rotary wash boring
- 1" Closed sampler driven
- Core boring
- 2½" Penetrometer driven
- 2" Sampler boring
- 2" I.D. 5" Auger boring
- 6" to 20" Auger boring
- Casing driven
- Jet boring
- (S) Sample taken

THE APPROPRIATE BORING SYMBOLS DESIGNATING THE METHOD OF OPERATION ARE SHOWN AT THE UPPER RIGHT-HAND CORNER OF THE RESPECTIVE BORING. WHERE TOOL CHANGES WERE MADE DURING THE BORING OPERATION SYMBOLS ARE SHOWN AT THE POINT OF CHANGE.

LEGEND OF EARTH MATERIALS

- Gravel – G
- Sand – S
- Silt – Si
- Clay – C
- Silty Sand – Si S
- Clayey Sand – C S
- Sandy Silt – S Si
- Clayey Silt – C Si
- Sandy Clay – SC
- Silty Clay – Si C
- Peat and/or Organic Clay – O
- Sandstone – SS
- Shale – Sh
- Broken Rock (Fragments) – Br
- Rock – R

ABBREVIATIONS

El. 69.4	Elevation of ground at test hole
bpf	Blows per foot – (see note above)
P	Pulled pipe
M	Moisture as % dry weight
El. 94.3 – 6-13-44	Elevation of ground water and date

NOTES

THE CONTRACTOR'S ATTENTION IS DIRECTED TO SECTION 2, ARTICLE (c) OF THE STANDARD SPECIFICATIONS AND TO THE SPECIAL PROVISIONS ACCOMPANYING THIS SET OF PLANS.

CLASSIFICATION OF EARTH MATERIAL AS SHOWN ON THIS SHEET IS BASED UPON FIELD INSPECTION AND IS NOT TO BE CONSTRUED TO IMPLY MECHANICAL ANALYSIS.

No "As Built" changes

17 TH. STREET U.C. - SANTA ANA FRWY.

LOG OF TEST BORINGS

SCALE Horiz. - 1" = 20' Vert. - 1" = 10' | FILE NO.

BRIDGE NO 55-0178 | DRAWING NO. C-178-13

No AS BUILT CHANGES
LA 10.6.97
CORRECTIONS BY Breidenbaugh
CONTRACT NO. 12-005004
DATE 10/1/96

DESIGN OVERSIGHT
SIGN OFF DATE 3-28-92

NOTE:
ADDITIONAL AS-BUILT FOUNDATION DATA MAY BE AVAILABLE AT THE DIVISION OF NEW TECHNOLOGY, MATERIALS AND RESEARCH 5900 FOLSOM BOULEVARD, SACRAMENTO, CALIFORNIA 95819

	BY	CHECKED
DESIGN		
DETAILS		
QUANTITIES		

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

William R. Stephens
PROJECT ENGINEER

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12102
EA 005001

BRIDGE NO.	17TH STREET UNDERCROSSING
55-673 R/L	
POST MILE 32.5	AS-BUILT LOG OF TEST BORINGS

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 23 OF 23

391

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	5	31.4 / 32.7	360	378

GEOTECHNICAL PROFESSIONAL

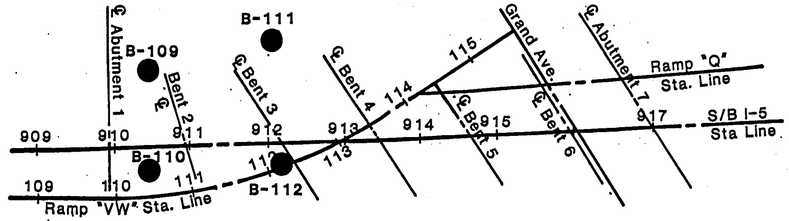
3-2-92
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER JAMES J. WEAVER No. 884 Exp. 12-31-92 GEOTECHNICAL STATE OF CALIFORNIA

PARSONS BRINCKERHOFF
Parsons Brinckerhoff Quade & Douglas
Engineers Architects Planners
505 South Main Street, Suite 900
Orange, CA. 92668

LABORATORY TESTING

GS	Grain Size Distribution — CTM 202
P	Plasticity Index — CTM 204
M	Maximum Density — CTM 216
SE	Sand Equivalent — CTM 217
CO	Consolidation — CTM 219
DS	Direct Shear — CTM 222
R	Resistance Value — CTM 301
SS	Soluble Sulfate — CTM 417
SC	Soluble Chloride — CTM 422
r	Resistivity, pH — CTM 643
200	Wash (-200) Sieve — ASTM 1140-71
	N.S.R. — No Sample Recovery



1"=100' 100 0 100
Scale in Feet

PLAN

NOTES:

Reference benchmark KV-4
Chiseled square in concrete
@ West End, of I-5 Bridge
over Grand Ave., North bound lanes.
Elev. 166.50

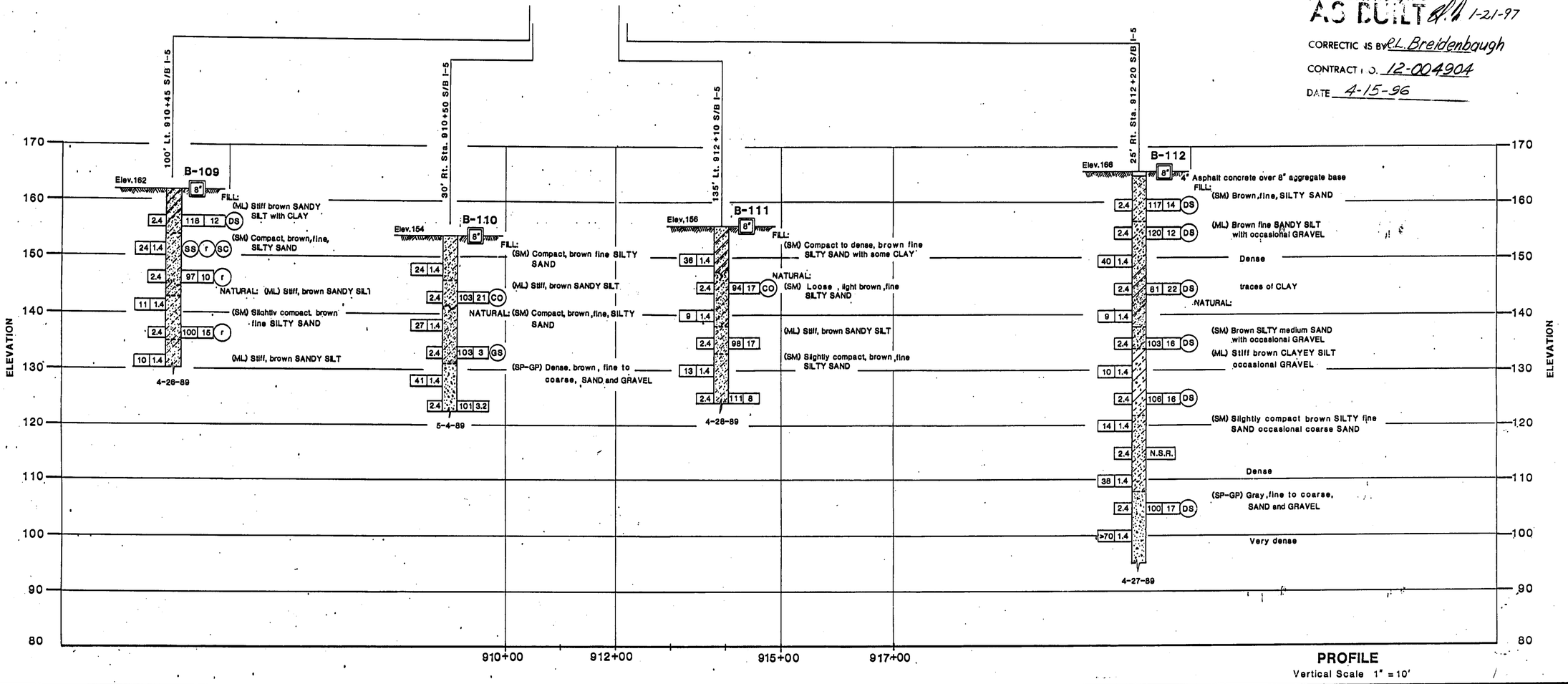
No Ground Water Encountered

NO CHANGES AS BUILT 1-21-97

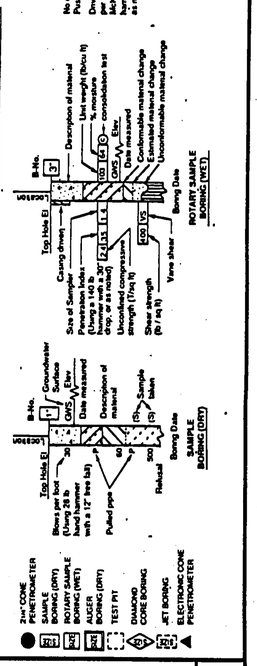
CORRECTIONS BY R.L. Breidenbaugh

CONTRACT NO. 12-004904

DATE 4-15-96



PROFILE
Vertical Scale 1" = 10'



LEGEND OF EARTH MATERIALS

GRAVEL · SAND · SILT · CLAY · SANDY CLAY or CLAYEY SAND · SANDY SILT or SILTY SAND · SILTY CLAY · CLAYEY SILT · PEAT and/or ORGANIC MATTER · FILL MATERIAL · IGNEOUS ROCK · SEDIMENTARY ROCK · METAMORPHIC ROCK

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

Penetration Index (Blows / Ft)	Granular	Cohesive
0-4	Very loose	Very soft
5-9	Loose	Soft
10-19	Slightly compact	Stiff
20-34	Compact	Very stiff
35-69	Dense	Hard
>70	Very dense	Very hard

NOTE Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

DESIGN OVERSIGHT
SIGN OFF DATE 10-30-91

DRAWN BY R.C.O.
CHECKED BY M.R.

FIELD INVESTIGATOR Michael David Clute
DATE 11-30-89

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12101
EA 004901

BRIDGE NO. 55-671L
POST MILE 31.8

GRAND AVE. UNDERCROSSING (LT. BRIDGE)

LOG OF TEST BORINGS 1 OF 2

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 22 OF 24

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	5	31.4 / 32.7	361	378

James J. Weaver
GEOTECHNICAL PROFESSIONAL

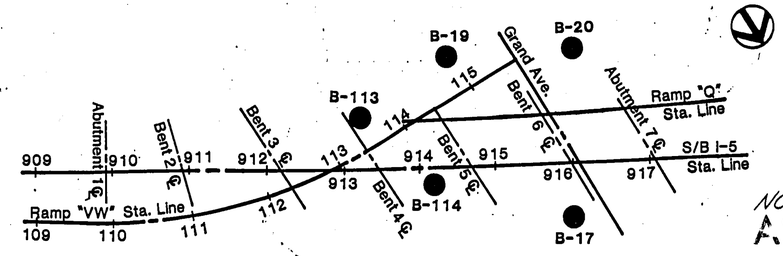
3-2-92
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER JAMES J. WEAVER No. 884 Exp. 12-31-92 GEOTECHNICAL STATE OF CALIFORNIA

PARSONS BRINCKERHOFF
Parsons Brinckerhoff Quade & Douglas
Engineers Architects Planners
505 South Main Street, Suite 900
Orange, CA. 92668

LABORATORY TESTING

(GS)	Grain Size Distribution	CTM 202
(P)	Plasticity Index	CTM 204
(M)	Maximum Density	CTM 216
(SE)	Sand Equivalent	CTM 217
(CO)	Consolidation	CTM 219
(DS)	Direct Shear	CTM 222
(R)	Resistance Value	CTM 301
(SS)	Soluble Sulfate	CTM 417
(SC)	Soluble Chloride	CTM 422
(r)	Resistivity, pH	CTM 643
(200)	Wash (-200) Sieve	ASTM 1140-71
N.S.R.	No Sample Recovery	



1"=100' 100 0 100
Scale in Feet

PLAN

NO CHANGES AS BUILT R.L.B. 1-21-97

CORRECTIONS BY R.L. Breidenbaugh

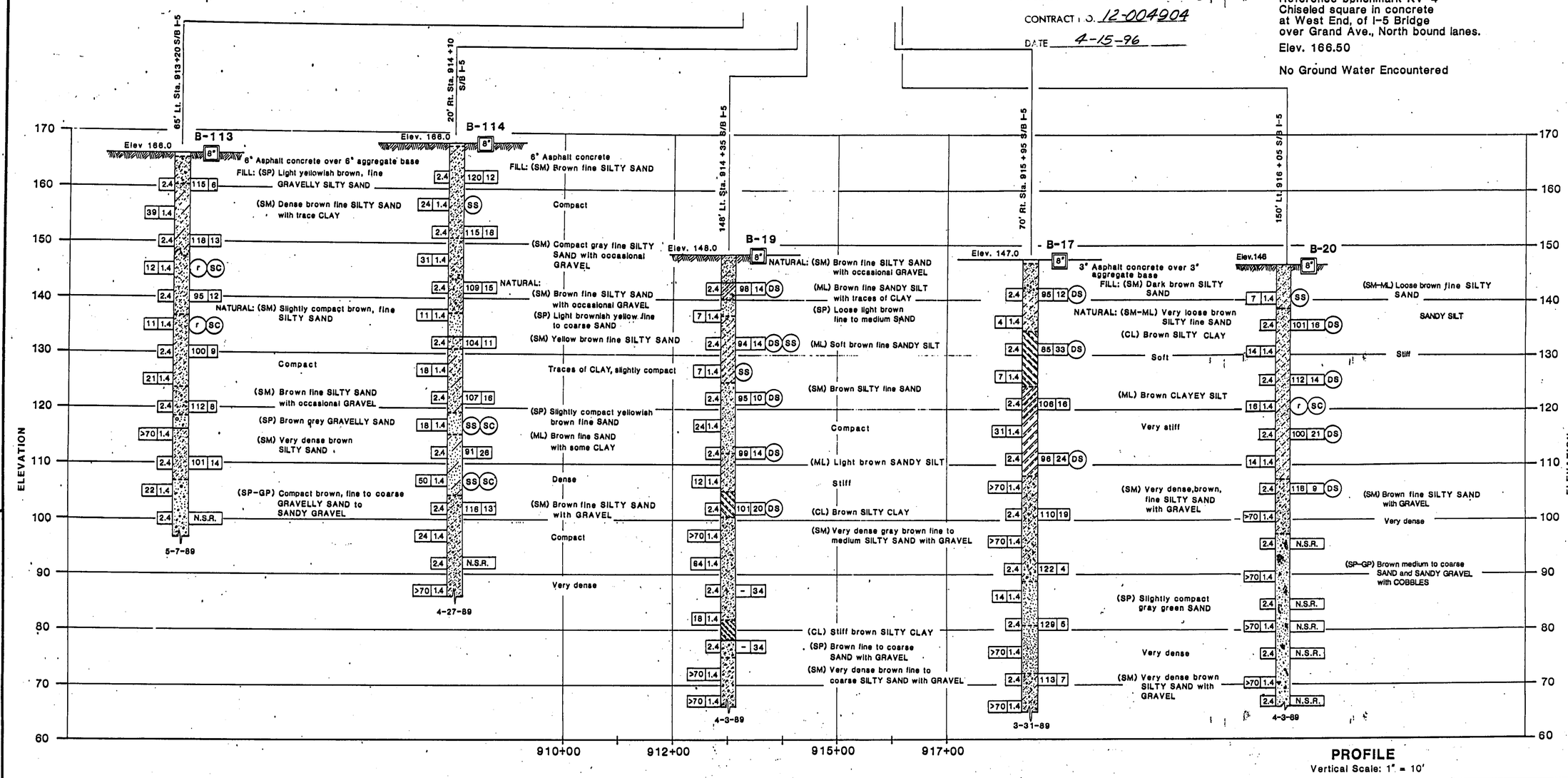
CONTRACT NO. 12-004904

DATE 4-15-96

NOTES:

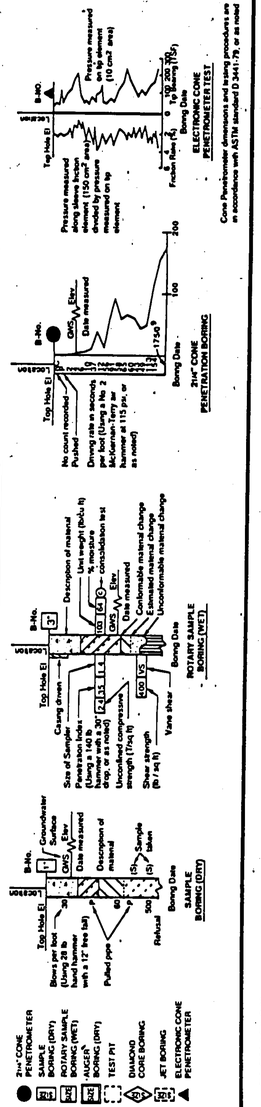
Reference benchmark KV-4
Chiseled square in concrete
at West End, of I-5 Bridge
over Grand Ave., North bound lanes.
Elev. 166.50

No Ground Water Encountered

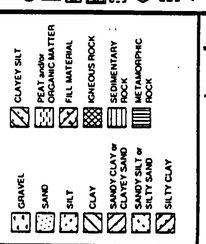


PROFILE
Vertical Scale: 1" = 10'

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS



CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

Penetration Index (Blows / Ft)	Granular	Cohesive
0-4	Very loose	Very soft
5-9	Loose	Soft
10-19	Slightly compact	Slight
20-34	Compact	Very stiff
35-69	Dense	Hard
>70	Very dense	Very hard

NOTE Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

DESIGN OVERSIGHT — SIGN OFF DATE 10-30-91

DRAWN BY R.C.O.

CHECKED BY M.R.

Michael Paul Reader
FIELD INVESTIGATOR

DATE 11-30-89

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12101
EA 004901

BRIDGE NO. 55-671L
POST MILE 31.8

GRAND AVE. UNDERCROSSING (LT. BRIDGE)
LOG OF TEST BORINGS 2 OF 2

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 23 OF 24

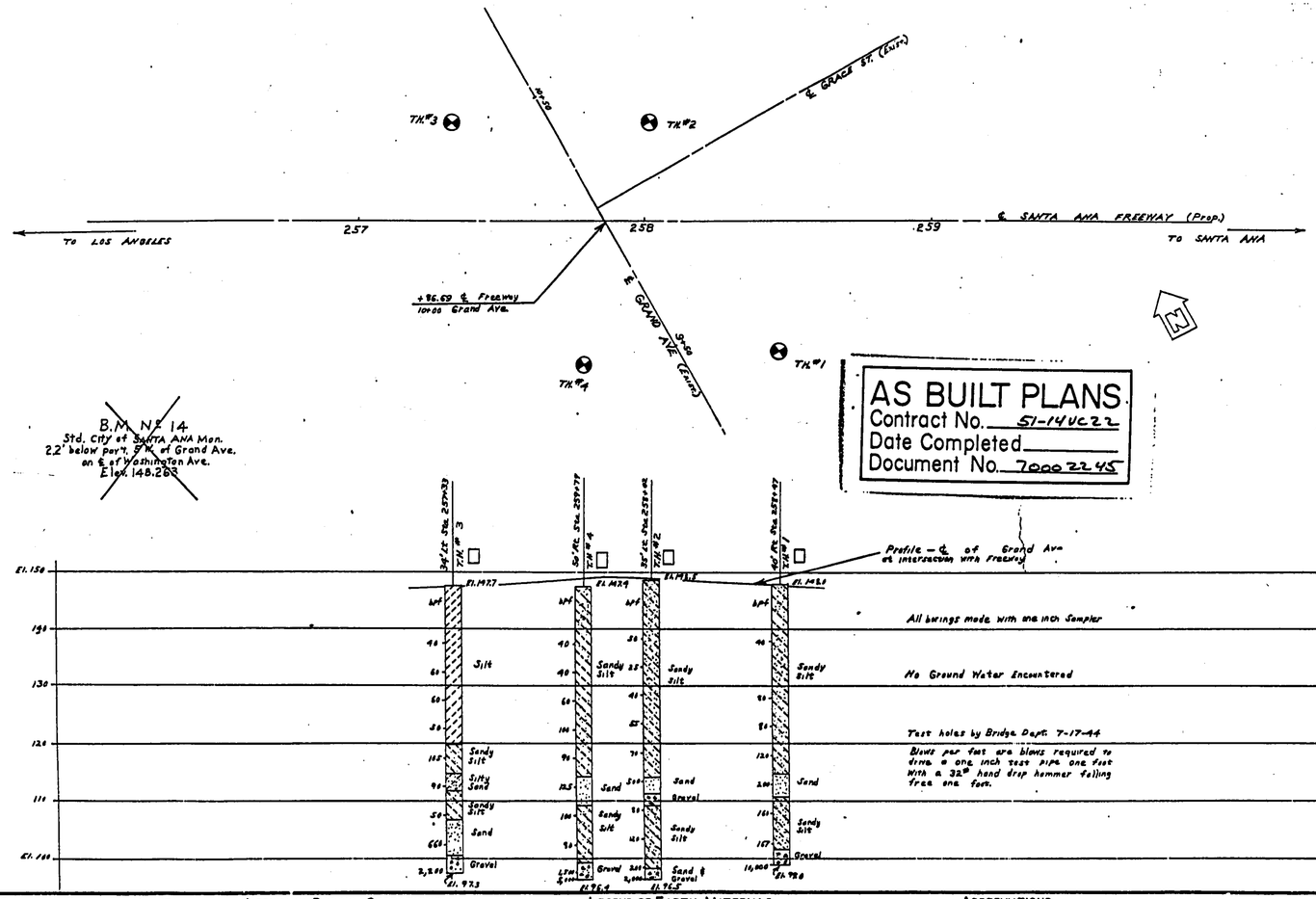
133861

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	5	31.4/32.7	362	378

3-2-92
TO ACCOMPANY PLANS DATED

DIST	COUNTY	ROUTE	SECTION	SHEET	TOTAL SHEETS
7	ORA	2	SA	2	14

APR 14 1951



B.M. No 14
Std. City of SANTA ANA Mon.
2.2' below por't. S'ly. of Grand Ave.
on ℄ of Washington Ave.
Elev. 148.280

AS BUILT PLANS
Contract No. 51-14UC22
Date Completed
Document No. 7000 2245

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

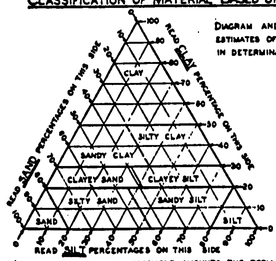


DIAGRAM AND TABLE SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES.

GROUPING USED IN TRIANGULAR CLASSIFICATION			
CLASS NAME	PERCENTAGE OF SIZES PRESENT		
	SAND	SILT	CLAY
SAND	80- 100	0-20	0-20
SILTY SAND	45- 80	0-35	0-20
SANDY SILT	0- 45	35-80	0-20
SILT	0- 20	80-100	0-20
CLAYEY SAND	50- 80	0- 45	20-30
CLAYEY SILT	0- 30	50- 80	20-30
SANDY CLAY	50- 70	0-40	30-50
SILTY CLAY	0- 30	20-70	30-50
CLAY	0- 50	0- 50	50-100

If GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, viz. "GRAVELLY SAND." THE TERMS "COARSE," "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE GRAVEL, SAND AND SILT REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF BORING OPERATIONS

- Plan of any boring
- 1" Sampler boring
- Rotary wash boring
- 1" Closed sampler driven
- Core boring
- 2½" Penetrometer driven
- 2" Sampler boring
- 2" to 5" Auger boring
- 8" to 20" Auger boring
- Casing driven
- Jet boring
- (S) Sample taken

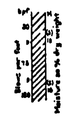
THE APPROPRIATE BORING SYMBOLS DESIGNATING THE METHOD OF OPERATION ARE SHOWN AT THE UPPER RIGHT-HAND CORNER OF THE RESPECTIVE BORING. WHERE TOOL CHANGES WERE MADE DURING THE BORING OPERATION SYMBOLS ARE SHOWN AT THE POINT OF CHANGE.

LEGEND OF EARTH MATERIALS

- Gravel — G
- Sand — S
- Silt — Si
- Clay — C
- Silty Sand — Si S
- Clayey Sand — C S
- Sandy Silt — S Si
- Clayey Silt — C Si
- Sandy Clay — SC
- Silty Clay — Si C
- Peat and/or Organic Clay — O
- Sandstone — SS
- Shale — Sh
- Broken Rock (Fragments) — Br
- Rock — R

ABBREVIATIONS

El. 69.4	Elevation of ground at test hole
bpf	Blows per foot — (see note above)
P	Pulled pipe
M	Moisture as % dry weight
El. 91.3 6-12-96	Elevation of ground water and date



NOTES

THE CONTRACTOR'S ATTENTION IS DIRECTED TO SECTION 2, ARTICLE (c) OF THE STANDARD SPECIFICATIONS AND TO THE SPECIAL PROVISIONS ACCOMPANYING THIS SET OF PLANS.

CLASSIFICATION OF EARTH MATERIAL AS SHOWN ON THIS SHEET IS BASED UPON FIELD INSPECTION AND IS NOT TO BE CONSTRUED TO IMPLY MECHANICAL ANALYSIS.

GRAND AVE. UNDERCROSSIN·

LOG OF TEST BORINGS

SCALE Horiz. 1" = 20'
Vert. 1" = 10'

BRIDGE NO. 55-176

FILE NO.

DRAWING NO. C-1716-2

NO CHANGES
AS BUILT 1-22-97
CORRECTIONS BY R.L. Breidenbaugh
CONTRACT NO. 2-004904
DATE 4-15-96

DESIGN OVERSIGHT
SIGN OFF DATE 10-30-91

NOTE:
ADDITIONAL AS-BUILT FOUNDATION DATA MAY BE AVAILABLE AT THE DIVISION OF NEW TECHNOLOGY, MATERIALS AND RESEARCH 5900 FOLSOM BOULEVARD, SACRAMENTO, CALIFORNIA 95819

	BY	CHECKED
DESIGN		
DETAILS		
QUANTITIES		

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12101
EA 004901

BRIDGE NO. 55-671L
POST MILE 31.8

GRAND AVE. UNDERCROSSING (LT. BRIDGE)
AS-BUILT LOG OF TEST BORINGS

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 24 OF 24

353

17TH STREET/LOSSAN RAILROAD CORRIDOR GRADE SEPARATION PROJECT TRAFFIC/CIRCULATION STUDY, SANTA ANA, CALIFORNIA

Submitted by:

ITERIS®

Submitted to:

AECOM

May 9, 2012

16J11-1631

DOCUMENT VERSION CONTROL

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Revised per Comments	December 20, 2011	2.00
Revised per City comments	March 12, 2012	3.00
Revised per City request for Safety Calculations	May 9, 2012	4.00

File name: final traffic report v4 05-09-12.docx

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1.0 EXECUTIVE SUMMARY

1.1 INTRODUCTION

The Orange County Transportation Authority (OCTA), and the City of Santa Ana propose to grade separate the existing at-grade crossing of the LOSSAN Rail Corridor with 17th Street. This study analyzed existing and future traffic operations in the project vicinity with and without the proposed grade separation. The analyses are intended to demonstrate the reduced vehicular delay resulting from project implementation. It will also examine other circulation issues such as access impacts to adjacent driveways, pedestrian and transit circulation. The study examines multimodal traffic conditions in the study area and identifies specific measures to address impacts related to project construction detours and other long-term roadway improvements needed to address future traffic demand in the study area and provide additional operational support for the project.

1.2 PROJECT LOCATION

The proposed grade separation project is located in the City of Santa Ana just east of the existing intersection of 17th Street with Lincoln Avenue.

1.3 PROJECT DESCRIPTION

Three project alternatives have been advanced for analysis. They include the locally recommended alternative (Alternative 1C), which will depress both 17th Street and Lincoln Avenue and two additional alternatives (Alternatives 1A and 2A) that would elevate or depress 17th Street and maintain Lincoln Avenue at approximately its current elevation. Illustrations of the three alternatives are provided in the Appendix and are briefly described in Section 1.5 below.

1.4 PURPOSE AND NEED

The existing at-grade crossing of the LOSSAN corridor at 17th Street creates delay at the crossing and the adjacent intersections resulting from the time that the crossing gates are down, which in turn reduces the peak-hour capacity of 17th Street, and creates substantial queues on 17th Street that often take several traffic signal cycles to clear. Thus, the purpose of this project is to reduce congestion, improve corridor capacity during the peak traffic periods, and reduce vehicles queues on 17th Street. In addition, while not studied in this report the grade separation would also provide safer operations by segregating train movements from other travel modes in the corridor. Such improvements are consistent with state, regional, and local transportation plans.

1.5 PROJECT DESCRIPTION

The alternatives under consideration are three build alternatives and the No-Build Alternative.

1.5.1 *ALTERNATIVE 1C (RECOMMENDED ALTERNATIVE)*

Alternative 1C maintains both 17th Street and Lincoln Avenue in approximately their existing alignment, but would create a grade-separated crossing by depressing both roadways so that 17th Street would pass under the LOSAAN corridor. Driveways adjacent to the existing crossing would be closed and some consolidated site access would be included south and west of the existing intersection. At the 17th Street and Lincoln Avenue intersection, 17th Street would have three eastbound and westbound through lanes, single left-turn lanes, and a westbound right-turn lane. Lincoln Avenue would have one left-turn lane, one through lane, and one right-turn lane on the northbound approach and one left-turn lane and one shared through/right-turn lane on the southbound approach.

1.5.2 *ALTERNATIVE 1A*

Alternative 1A depresses 17th Street under both the LOSSAN tracks and Lincoln Avenue with a new connecting roadway between 17th Street and Lincoln Avenue provided in the northwest quadrant of the crossing. Lincoln Avenue would be reconstructed in approximately the same location and elevation as existing. The new connecting roadway would have a new signalized intersection at 17th Street west of the new overcrossing and a stop sign-controlled intersection with Lincoln Avenue north of the overcrossing. A new signalized intersection for local access is also proposed east of the overcrossing. Some access driveways adjacent to the existing intersection would be relocated to nearby consolidated access driveways. Pedestrian facilities connecting 17th Street and Lincoln Avenue would be provided along the new connector roadway. The existing bus stops on 17th Street would need to be relocated to the new signalized intersection just west of the Lincoln Avenue overcrossing.

1.5.3 *ALTERNATIVE 2A*

In Alternative 2A, 17th Street is elevated and crosses the LOSSAN tracks and Lincoln Avenue with a new overcrossing. Street connections between 17th Street and Lincoln Street are via enhanced Fairmont and Dorman Streets. The intersection of Fairmont Street with 17th Street west of the overcrossing would be signalized. A new local-access roadway would be developed east of the overcrossing to provide access to the parcels north and south of 17th Street and its intersection with 17th Street would also be signalized. Because of the elevation change in 17th Street approximately 20 properties that currently have direct access to 17th Street would either be acquired because they would have no access with this alternative or would have their access moved to a side street or consolidated with other adjacent properties. Pedestrian facilities connecting 17th Street and Lincoln Avenue would be provided along the connecting roadway; however, access between Lincoln Avenue and 17th Street would be less direct than existing. The

existing bus stops along 17th Street would need to be relocated to the Fairmont Street and 17th Street intersection and/or have an additional stop added east of the overcrossing.

1.6 Existing Year 2011 Traffic Conditions

The weekday AM and PM peak hour level of service analyses were conducted at eleven study intersection locations, and weekday midday peak hour level of service analyses were conducted at four study intersections. Intersection counts were collected on Thursday, June 2, 2011, and midblock 24-hour counts were collected on Wednesday, June 8, 2011.

The results indicate that per the Highway Capacity Manual (HCM) methodology, the intersection of Grand Avenue and 17th Street is operating at LOS E during both the AM, and PM peak hours and that the intersection of Lincoln Avenue and 17th Street is affected by the delay generated by the adjacent LOSSAN crossing. The crossing currently generates almost a combined 40 hours of vehicular delay in the AM and PM peak hours with the current 10 trains per hour. That level of delay will increase in the future with additional roadway traffic and more trains per hour. In addition to poor levels of service at some locations along 17th Street, the at-grade LOSSAN crossing contributes to the formation of long queues at the adjacent signalized intersections. Both the eastbound and westbound approaches of the 17th Street and Lincoln Avenue intersection currently have substantial queues resulting from the crossing taking two signal cycles to clear during the peak hours.

The roadway segment analysis results indicate that all the study roadway segments are operating well within capacity on a daily basis.

1.7 Future Year Traffic Volume Projections

Traffic volumes projections for the project's opening year 2020 and the horizon year 2035 were developed using the latest version of the Orange County Transportation Analysis Model (OCTAM). The future activity at the LOSAAN corridor was estimated by adding trains for programmed service enhancements to the existing schedules to account for those known service changes. OCTAM projects a substantial increase in traffic volumes between existing conditions and Year 2035 at many of the analyzed intersections. The Year 2020 volumes were developed through a linear interpolation of the Year 2035 data.

To provide a conservative estimate of traffic conditions during the project's construction the Year 2020 Baseline traffic volumes were used as the projected traffic volumes for the construction analyses.

1.8 Proposed Detour Route

Project construction would be done in two major phases. Phase 1 would include the creation of a by-pass roadway located north of the existing 17th Street alignment. During Phase 1 the cross-section of the temporary 17th Street bypass road would be 4 through lanes with a median left-

turn lane to provide access to Lincoln Avenue to the north, while the south approach would be closed. Detour access for the closed south approach of Lincoln Avenue during Phase 1 would be provided along two routes. The limited volume of local traffic would be able to use Fairmont Street to access Washington Avenue or Stafford Street to access Santiago Street. Traffic approaching from outside of the immediate area would be directed to use Grand Avenue, Santa Ana Boulevard, and Santiago Street/Penn Way as an alternative route.

During Phase 2 of the project, through traffic on 17th Street would be shifted to the new 17th Street facility and direct access to and from Lincoln Avenue would be eliminated. During this phase of construction Lincoln Avenue traffic would be diverted to the southern by-pass route described above. Local traffic would still use Fairmont Street to access properties south of 17th Street.

1.8.1 *Measures to Address Construction Detour Traffic and Area Congestion*

To accommodate the projected changes in traffic patterns and volumes during the project's construction and to support long-term traffic movement in the area, a series of changes to the existing study area intersections are proposed. The following list references restriping and other geometric changes that can occur within the existing and/or project-provided pavement widths. Additional references are made to "support" widening to MPAH designations; these would require additional rights-of-way acquisition.

Locations	***Modification***
I-5 NB Ramps/Santiago Street and 17th Street	• Restripe eastbound approach to one left-turn lane, two through lanes, and two right-turn lanes
Lincoln Avenue and 17th Street	Construction Phase 1 • Construct intersection to the north with one left-turn lane and two through lanes on the eastbound approach, one through lane and one shared through/right-turn lane on the westbound approach, and one left-turn and one right-turn lane on the southbound approach. Construction Phase 2 • Close intersection. • Construct a temporary one-way southbound roadway in the northwest quadrant of the crossing connecting southbound Lincoln Avenue with westbound 17th Street.
Grand Avenue and 17th Street	• Construct a northbound right-turn lane with overlap phasing. This improvement would require additional right-of-way to complete. • Design turn lane and signal modifications in a manner that will support the buildout of the intersection to Master Plan of Arterial Highways cross-section.

Locations	*Modification*
Santiago Street and Civic Center Drive/Stafford Street	• Install new permanent traffic signal. • Restriped intersection to one left-turn lane, one through lane, and one shared through/right-turn lane on the southbound approach. • Restrict on-street parking along the west side of Santiago Street north of Civic Center Drive for a distance of approximately 150 feet (removes 1 parking space) to provide two lanes approaching the intersection.
I-5 Southbound Ramps and Santa Ana Boulevard	• Construct a westbound right-turn only lane onto the southbound on-ramp.
I-5 HOV Ramp/Grand Avenue/Santa Ana Boulevard	• Consider the addition of eastbound-to-southbound right turn overlap phasing to the traffic signal.

To accommodate the projected changes in lane configurations, traffic patterns, and volumes during the project's construction the following changes to existing study area intersections are recommended:

1.8.1.1 Santiago Street and Santa Ana Boulevard Intersection Coordination

This intersection is located along one route of the proposed Santa Ana Fixed Guideway project. Any physical improvements or reconfiguration of the intersection will require coordination with that proposed project. Since the timeline for the Fixed Guideway project is not known at this time, the operation at this intersection may need to be reviewed prior to commencement of the 17th Street grade separation if the Fixed Guideway project is operational at the start of, or during construction of, the 17th Street project.

1.8.2 *Other Programs to Improve LOS Conditions*

In addition to discreet mitigation measures to address impacts at the specific intersections, other non-geometric measures should be considered to help reduce overall congestion within the study area, especially during the construction period.

1.8.2.1 Public Awareness Campaign

For this project the campaign would include an informational program developed in conjunction with OCTA to inform local businesses and residents of the construction detour routes, days and times of construction, especially closures, and the preferred detour routes to avoid congestion. The program would also inform residents and businesses of options to driving through the construction areas by encouraging them to use alternative modes, shift travel to non-construction periods, and other options to allow motorists to make more informed choices regarding travel in the area and as a result reduce vehicle travel in the area. The City will work with the Logan, Lacy, French Park, French Court, and Park Santiago neighborhoods as needed to monitor traffic in the neighborhoods during construction to both reduce commuter through traffic and watch of project impacts.

1.8.2.2 Adaptive Traffic Signal Control

The City has recently upgraded area traffic signals to current standards, including the ability to monitor major intersection operations via cameras at the City's Traffic Management Center (TMC). This provides the ability to respond to observed traffic congestion via adjusting traffic signal timing from the TMC. This may be a viable option for times when the TMC is staffed and communications between the TMC and field are operating. For the substantial number of hours that the TMC is not budgeted to be staffed during the extended construction phase of this project, construction and/or traffic incidents may substantially affect traffic conditions during unmonitored periods. While large-scale construction projects and regular events can be anticipated, other disruptions such as crashes are impossible for time-of-day signal timing to accommodate. With adaptive signal control technology, information is collected and signal timing is updated continually to benefit the traveling public.

The Federal Highway Administration website on adaptive traffic signal control states that: *"Outdated traffic signal timing incurs substantial costs to businesses and consumers. They account for more than 10 percent of all traffic delay and congestion on major routes alone."* [1] It is recommended that in addition to the new traffic signal at the Santiago Street and Civic Center intersection all of the study intersections along Santa Ana Boulevard and Santiago Street corridors be considered and designed for improved operations by adding adaptive traffic signal control to the Santa Ana Boulevard corridor.

1.8.2.3 Travel Demand Management Program

Areawide travel demand reduction measures should be encouraged and explored by the City, in cooperation with local businesses and other agencies to identify potential measures that could assist in reducing single occupant travel demand and shifts to other modes of travel, including walking, bicycling, and riding transit. This would reduce the volume of traffic using the Santa Ana Boulevard, and other, corridors.

1.8.3 *Pedestrian Accommodations*

To provide access during project construction for pedestrians crossing 17th Street and Lincoln Avenue there will be temporary accommodation set up during both phases of the project construction. During construction Phase 1 the temporary traffic signal at the relocated intersection of Lincoln Avenue and 17th Street will have pedestrian push buttons and walk lights. During the second phase of project construction, a temporary traffic signal will be installed at the Fairmont Street and 17th Street intersection. To cross Lincoln Avenue during the Phase 2 construction, pedestrians will need to go either north or south of the construction zone to the next intersection. During all phases of project construction a continuous east-west pedestrian corridor will be maintained along 17th Street.

[1] http://www.fhwa.dot.gov/everydaycounts/technology/adsc/

1.8.4 *Bicycles*

Bicycles will continue to be able to share the road with other traffic along 17th Street during project construction. The temporary by-pass road parallel to 17th Street will be designed with outside lanes wide enough to accommodate shared bicycle and automobile use. To cross 17th Street bicyclists will be encouraged to use other parallel corridors to avoid construction traffic and increased intersection delay.

1.8.5 *Transit Stops*

The existing OCTA bus stops along 17th Street near Lincoln Avenue will need to be temporarily relocated during the project construction. During Phase 1 the existing stops near Lincoln Avenue can be relocated to the new bypass road just to the north. During Phase 2 of construction the stops should be relocated to the west to the new temporary traffic signal at Fairmont Street, which is located about 600 feet to the west.

1.8.6 *Local Access*

A challenge for the project will be maintaining local site access for those properties adjacent to the Lincoln/17th intersection, especially during construction. Some cross-access agreements and temporary easements will be required to provide continual access for those properties that are not acquired as part of the project. As a result of one or both of the streets being depressed at the current intersection some site driveways will be lost both during construction and post-construction.

1.9 Analysis Results and Roadway Improvements

Intersection analyses were conducted for both phases of the project's construction, as well as post-construction years 2020 (project opening) and Year 2035 (horizon year).

1.9.1 *Construction Period Traffic Operations*

Phase 1 is estimated to require 12 months to complete. During this period most of the intersections are projected to operate at acceptable levels of service with the exception of the intersection of 1) Grand Avenue at 17th Street, and 2) Santiago Street at Civic Center Drive. At the Lincoln Avenue and 17th Street intersection, the majority of the intersection delay during construction Phase 1 is related to the queues created by the temporary LOSSAN at-grade crossing. The intersection of the I-5 Southbound Ramp at Santa Ana Boulevard is projected to operate at a poor, but acceptable LOS.

The recommended northbound right-turn lane at the Grand/17th intersection will improve the LOS at the intersection, but will not raise the intersection's LOS to an acceptable level. The addition of the traffic signal at the Santiago/Civic Center intersection will provide a very good LOS at the intersection. The recommended right-turn lane at the I-5 Ramps/Santa Ana intersection will reduce delay, but will not lower the intersection's LOS letter grade.

Phase 2 is estimated to require six months to complete. During this phase most of the intersections are projected to operate at acceptable levels of service with the exception of the same intersections as Phase 1. The improvements recommended for Phase 1 are also recommended for Construction Phase 2.

1.9.2 *Post-Construction Traffic Operations – Year 2020 and Year 2035*

1.9.2.1 No Build Alternative

The Baseline or No-Build condition assumes that all of the geometric conditions and intersection operating parameters would remain the same as existing with the exception that traffic signal timings were assumed to be optimized to better address future traffic volumes and patterns. In addition, the existing at-grade crossing of the LOSSAN corridor and 17th Street would also remain.

With this alternative, the intersection of Grand Avenue with 17th Street is projected to operate at LOS F in both years and peak hours. The widening of Grand Avenue to the full MPAH cross-section would improve operating conditions and provide an acceptable LOS in Year 2020. But, in Year 2035 the intersection is projected to be operating at an unacceptable LOS. By year 2035 the intersection of Grand Avenue/I-5 HOV Exit Ramp with Santa Ana Boulevard is also projected to be operating at a poor LOS during the AM peak hour. Since this scenario would not include a project, no mitigation was analyzed.

1.9.2.2 Future Year With Project Operating Conditions

With all of the alternatives (1C, 1A, and 2A) the intersections of Grand Avenue at 17th Street and Santiago Street at Civic Center Drive are projected to operate at LOS F during one or more peak hours. By year 2035 the intersection of Grand Avenue/I-5 HOV Exit Ramp with Santa Ana Boulevard is also projected to be operating at a poor LOS during the AM peak hour.

The most significant benefits with the Project regardless of the alternative is the reduced delay at the Lincoln Avenue/17th Street intersection and the substantial reduction in intersection queuing as a result of eliminating the at-grade rail crossing.

Alternative 1C provides the least overall delay at the area intersections versus the two other build alternatives by retaining the most direct access between the two streets and not requiring some level of circuitous traffic routing. Both Alternatives 1A and 2A would generate some additional delay for turning vehicles as a result.

While the difference in delay at the intersections is relatively small, Alternative 1C provides the least overall delay of the alternatives. A comparison between the three alternatives of the intersection delay is shown in **Tables ES1-2**.

Development of any of the three alternatives will have short-term impacts during construction. Alternative 1C would provide the most non-motorized convenient roadway system as it would not require the separate connectors that would be required with Alternative 1A and 2A to move between Lincoln Avenue and 17th Street. All of the alternatives can adequately accommodate existing and future transit services; however Alternatives 1A and 2A would require the existing stops near the Lincoln/17th intersection to be relocated to the west.

Alternative 1C would be the most limiting to adjacent site access as all driveways would need to be located away from the required retaining walls.

TABLE ES-1: YEAR 2020 PEAK HOUR LOS COMPARISON

#	Intersection	Alternative 1C				Alternative 1A				Alternative 2A			
		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Penn Way and 17th Street	25.5	C	38.6	D	24.3	C	38.0	D	24.2	C	38.0	D
2	I-5 NB Ramps/Santiago Street and 17th Street	40.0	D	21.6	C	34.5	C	27.6	C	43.8	D	27.6	C
3	Lincoln Avenue and 17th Street	24.2	C	18.2	D	-	-	-	-	-	-	-	-
3a	Lincoln Avenue and 17th Street (north)	-	-	-	-	19.5	C	21.2	C	-	-	-	-
3b	Lincoln Avenue and 17th Street (south)	-	-	-	-	41.1	D	31.1	C	-	-	-	-
4	**Grand Avenue and 17th Street**	**119.7**	**F**	**108.9**	**F**	**122.3**	**F**	**111.5**	**F**	**122.3**	**F**	**111.5**	**F**
	With NB RT lanes	**89.7**	**F**	**75.7**	**E**	**89.7**	**F**	**75.7**	**E**	**89.7**	**F**	**75.7**	**E**
	With 3rd SB TH and NB RT lanes	61.6	E	69.7	E	61.6	E	69.7	E	61.6	E	69.7	E
5	Main Street and I-5 NB Ramps/Edgewood Road	42.0	D	43.3	D	42.0	D	43.3	D	42.0	D	43.3	D
6	Penn Way and I-5 SB Ramps	25.6	C	23.0	C	25.6	C	23.0	C	25.6	C	23.0	C
7	Santiago Street and Washington Avenue[1]	12.9	B	18.5	C	12.9	B	18.5	C	12.9	B	18.5	C
8	**Santiago Street and Civic Center Drive/Stafford Street**	**40.0**	**E**	**105.5**	**F**	**40.0**	**E**	**105.5**	**F**	**40.0**	**E**	**105.5**	**F**
	With Traffic Signal	12.4	B	14.7	B	12.4	B	14.7	B	12.4	B	14.7	B
9	Santiago Street and Santa Ana Boulevard	27.4	C	29.8	C	27.4	C	29.8	C	27.4	E	29.8	C
10	**I-5 SB Ramps and Santa Ana Boulevard**	34.8	C	**68.6**	**E**	34.8	C	**68.6**	**E**	34.8	C	**68.6**	**E**
	With WB RT Lane	29.0	C	**56.9**	**E**	29.0	C	**56.9**	**E**	29.0	C	**56.9**	**E**
11	**Grand Avenue and Santa Ana Blvd/NB I-5 HOV Ramps**	**61.1**	**E**	45.5	D	**61.1**	**E**	44.8	D	**61.1**	**E**	44.8	D
12	Fairmont Street and 17th Street	10.6	B	11.3	B	9.2	A	12.8	B	35.9	D	37.8	D
13	Lincoln Avenue and Fairmont Street	10.8	B	10.1	B	10.9	B	10.1	B	11.9	C	10.4	B

Source: Iteris, Inc., 2011
Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.
1 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.
Bold text indicates unacceptable level of service.

TABLE ES-2: YEAR 2035 INTERSECTION PEAK HOUR LOS COMPARISON

#	Intersection	Alternative 1C				Alternative 1A				Alternative 2A			
		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Penn Way and 17th Street	26.7	C	52.6	D	30.6	C	52.7	D	26.5	C	50.6	D
2	I-5 NB Ramps/Santiago Street and 17th Street	40.0	D	25.2	C	54.3	D	30.9	C	44.2	D	26.0	C
3	Lincoln Avenue and 17th Street	21.0	C	17.7	B	-	-	-	-	-	-	-	-
3a	Lincoln Avenue and 17th Street (north)	-	-	-	-	20.6	C	21.8	C	-	-	-	-
3b	Lincoln Avenue and 17th Street (south)	-	-	-	-	28.2	C	44.4	D	-	-	-	-
4	**Grand Avenue and 17th Street**	**186.3**	**F**	**168.9**	**F**	**174.9**	**F**	**150.7**	**F**	**186.5**	**F**	**170.7**	**F**
	With NB RT lanes	**154.9**	**F**	**128.4**	**F**	**154.9**	**F**	**128.4**	**F**	**154.9**	**F**	**128.4**	**F**
	With 3rd SB TH and NB RT lanes	**95.8**	**F**	**100.8**	**F**	**95.8**	**F**	**100.8**	**F**	**95.8**	**F**	**100.8**	**F**
5	Main Street and I-5 NB Ramps/Edgewood Road	42.6	D	45.8	D	42.6	D	45.8	D	42.6	D	45.0	D
6	Penn Way and I-5 SB Ramps	36.8	D	29.9	C	36.8	D	29.9	C	36.8	D	29.9	D
7	**Santiago Street and Washington Avenue**[1]	22.5	C	**39.0**	**E**	22.5	C	**39.0**	**E**	22.5	C	**39.0**	**E**
8	**Santiago Street and Civic Center Drive/Stafford Street**	**70.9**	**F**	**176.1**	**F**	**70.9**	**F**	**176.1**	**F**	**70.9**	**F**	**176.1**	**F**
	With Traffic Signal	12.6	B	15.9	B	12.6	B	15.9	B	12.6	B	15.9	B
9	Santiago Street and Santa Ana Boulevard	77.5	E	51.4	D	77.5	E	51.4	D	77.5	F	51.4	D
10	**I-5 SB Ramps and Santa Ana Boulevard**	**57.5**	**E**	**76.6**	**E**	**57.5**	**E**	**76.6**	**E**	**57.5**	**E**	**76.6**	**E**
	With WB RT Lane	30.9	C	**63.6**	**E**	30.9	C	**63.6**	**E**	30.9	C	**63.6**	**E**
11	**Grand Avenue and Santa Ana Blvd/NB I-5 HOV Ramps**	**95.3**	**F**	54.7	D	**95.3**	**F**	54.7	D	**95.3**	**F**	54.7	D
12	Fairmont Street and 17th Street	10.3	B	11.2	B	11.4	B	13.6	B	18.2	B	14.6	B
13	Lincoln Avenue and Fairmont Street	10.9	B	10.2	B	10.1	B	10.1	B	12.0	B	18.1	C

Source: Iteris, Inc., 2011
Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.
1 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.
Bold text indicates unacceptable level of service.

1.10 SUMMARY AND RECOMMENDATIONS

In summary, the proposed grade separation of the 17th Street at-grade crossing with the LOSSAN corridor would significantly reduce delay at the crossing and queues that result from the gate down periods when trains are present. Existing queues at the intersections along the 17th Street corridor have large fluctuations in length during the peak hours as result of the trains crossing and in many cases taking multiple signal cycles to clear the resulting queues. This results in additional delay at the adjacent Lincoln /17th intersection.

The construction period traffic analyses show that with some temporary and some permanent intersection modifications traffic can be adequately accommodated during both Phases 1 and 2 of project construction. Construction period intersection and roadway modifications would include:

- I-5 Northbound Ramps/Santiago Street and 17th Street – temporary lane restriping
- Lincoln Avenue and 17th Street – temporary relocation in Phase 1 and temporary by-pass road in Phase 2
- Grand Avenue and 17th Street – promote permanent lane addition
- Santiago Street and Civic Center Drive/Stafford Street – permanent lane restriping and new traffic signal
- I-5 Southbound Ramps and Santa Ana Boulevard – City and Caltrans jointly pursue implementation of a permanent westbound lane addition between Grand Avenue and the I-5 southbound ramps.

Some of the above improvements would be required to maintain acceptable traffic operations during the project's construction. Others would assist in providing better levels of service while capacity is restricted along the 17th Street corridor.

For acceptable, long-term traffic operations additional intersection modifications would be required at the Grand Avenue and 17th Street intersection. All of the build alternatives would provide similar conditions at the study area intersections. However, based on these findings Alternative 1C is projected to provide the lowest overall delay and would provide acceptable operating conditions at more intersections than Alternatives 1A and 2A.

2.0 INTRODUCTION

This report summarizes the analyses, findings, and recommendations of a traffic operations study for the 17th Street and LOSSAN rail corridor grade separation project alternatives. It provides analyses examining existing and future traffic operations in the project vicinity with and without the proposed grade separation. The analyses are intended to support the Need and Purpose of the project by demonstrating the reduced vehicular delay resulting from project implementation. It will also examine other circulation issues such as access impacts to adjacent driveways, pedestrian and transit circulation. The study examines multimodal traffic conditions in the study area and identifies specific measures to address impacts related to project construction detours and other long-term roadway improvements needed to address future traffic demand in the study area and provide additional operational support for the project.

2.1 PROJECT LOCATION

The proposed grade separation project is located in the City of Santa Ana just east of the existing intersection of 17th Street with Lincoln Avenue as illustrated in **Figure 1**.

2.2 PROJECT DESCRIPTION

Three project build alternatives have been advanced for analysis. They include the locally recommended alternative (Alternative 1C), which would depress both 17th Street and Lincoln Avenue and two additional alternatives (Alternatives 1A and 2A) that would either elevate or depress 17th Street and maintain the Lincoln Avenue at approximately its current elevation. Illustrations of the three alternatives are provided in the Appendix and are briefly described below.

2.2.1 *ALTERNATIVE 1C (LOCALLY RECOMMENDED ALTERNATIVE)*

Alternative 1C would maintain both 17th Street and Lincoln Avenue in approximately their existing alignment, but would create a grade-separated crossing by depressing both roadways so that 17th Street would pass under the LOSAAN corridor. Driveways adjacent to the existing crossing would be closed and some consolidated site access would be included south and west of the existing intersection. At the 17th Street and Lincoln Avenue intersection 17th Street would have three eastbound and westbound through lanes, single left-turn lanes, and a westbound right-turn lane. Lincoln Avenue would have one left-turn lane, one through lane, and one right-turn lane on the northbound approach and one left-turn lane and one shared through/right-turn lane on the southbound approach.

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17th Street LOSSAN Grade Separation
Figure 1
Project Vicinity Map

2.2.2 *ALTERNATIVE 1A*

Alternative 1A depresses 17th Street under both the LOSSAN tracks and Lincoln Avenue with a new connecting roadway between 17th Street and Lincoln Avenue provided in the northwest quadrant of the crossing. Lincoln Avenue would be reconstructed in approximately the same location and elevation as existing. The new connecting roadway would have a new signalized intersection at 17th Street west of the new overcrossing and a stop sign-controlled intersection with Lincoln Avenue north of the overcrossing. A new signalized intersection for local access is also proposed east of the overcrossing. Some access driveways adjacent to the existing intersection would be relocated to nearby consolidated access driveways. Pedestrian facilities connecting 17th Street and Lincoln Avenue would be provided along the new connector roadway. The existing bus stops on 17th Street would need to be relocated to the new signalized intersection just west of the Lincoln Avenue overcrossing.

2.2.3 *ALTERNATIVE 2A*

In Alternative 2A, 17th Street is elevated and crosses over the LOSSAN tracks and Lincoln Avenue with a new overcrossing. Roadway connections between 17th Street and Lincoln Street are via an enhance Fairmont Street and Dorman Street. The intersection of Fairmont Street with 17th Street west of the overcrossing would be signalized. A new local-access roadway would be developed east of the overcrossing to provide access to the parcels north and south of 17th Street and its intersection with 17th Street would also be signalized. Because of the elevation change in 17th Street approximately 20 properties that currently have direct access to 17th Street would either be acquired because they would have no access with this alternative or would have their access moved to a side street or consolidated with other adjacent properties. Pedestrian facilities connecting 17th Street and Lincoln Avenue would be provided along the connecting roadway; however, access between Lincoln Avenue and 17th Street would be less direct than existing. The existing bus stops along 17th Street would need to be relocated to the Fairmont Street and 17th Street intersection and/or have an additional stop added east of the overcrossing. All changes to the bus stops would be coordinated with OCTA.

2.3 SCOPE OF ANALYSIS

The analyses conducted for this study includes the operations at the signalized intersections along 17th Street from Penn Way to Grand Avenue and the intersections along the proposed construction detour route, which will be discussed later. The intersection operations analyses included both delay-based analyses and intersection capacity utilization-based (ICU) analyses. The analyses focused on the weekday AM and PM peak hours. However, midday conditions were also evaluated along 17th Street for potential pedestrian issues and needs.

Roadway segment analyses were also conducted to a limited extent; primarily to determine if projected traffic volumes during the project's construction would exceed the capacity of the reduced number of lanes along 17th Street construction or along the proposed detour route. The evaluation of traffic operations during the project's construction also included a qualitative

pedestrian analysis and identification of permanent and temporary construction period mitigation needs.

Intersection operating conditions analyses for a projected project opening at Year 2020 with and without the improvements identified to address construction period needs, and without any other additional transportation improvements, was conducted to determine if any other additional improvements may be needed at the study intersections to address future projected traffic demand and compare future operations to existing conditions. The same analyses were conducted for horizon Year 2035 conditions.

2.4 STUDY AREA

Based on the location of the project and the proposed detour route, the following thirteen (13) intersections and seven (7) roadway links within the city were selected for analysis in this study. Target levels of service (LOS) are as defined in the City General Plan.

Intersections:

	Location	LOS Target
1	Penn Way & 17th Street (signalized)	D
2	Santiago Street/I-5 NB Off-Ramp & 17th Street (signalized)	D
3	Lincoln Avenue & 17th Street (signalized)	D
4	Grand Avenue & 17th Street (signalized)	E
5	Main Street & Edgewood Road/I-5 NB Off-Ramp (signalized)	D
6	Penn Way/Santiago Street & I-5 SB Ramps (signalized)	D
7	Santiago Street & Washington Avenue (unsignalized)	D
8	Santiago Street & Civic Center Drive/Stafford Street (unsignalized)	D
9	Santiago Street & Santa Ana Boulevard (signalized)	E
10	I-5 SB Ramps & Santa Ana Boulevard (signalized)	D
11	Grand Avenue & Santa Ana Boulevard/I-5 Ramps (signalized)	D
12	Fairmont Street & 17th Street	D
13	Lincoln Avenue & Fairmont Street	D

Roadway Links:

	Location	LOS Target
1	17th Street (west of Penn Way)	D
2	Edgewood Road (east of Main Street)	D
3	Santiago Street (south of Santa Clara Avenue)	D
4	Santiago Street (south of I-5 SB Ramps)	D
5	Santa Ana Boulevard (west of I-5 SB Ramps)	D
6	Grand Avenue (south of 17th Street)	D
7	17th Street (east of Grand Avenue)	D

The locations of the study intersections and roadway links are shown in **Figure 2**.

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17th Street LOSSAN Grade Separation
Figure 2
Project Study Intersections

3.0 ANALYSIS METHODOLOGY

The efficiency of traffic operations at a location is measured in terms of Level of Service (LOS). LOS is a description of traffic performance at intersections. The LOS concept is a measure of average operating conditions at intersections and roadway segments. Levels range from 'A' to 'F', with 'A' representing excellent (free-flow) conditions and 'F' representing extreme congestion. Specific criteria are used to define LOS for different types of facilities as discussed below.

3.1 INTERSECTIONS

3.1.1 *CITY OF SANTA ANA GUIDELINE*

Level of Service (LOS) analysis for City of Santa Ana signalized intersections were conducted using both the Intersection Capacity Utilization (ICU) methodology, which generates a volume-to-capacity ratio that translates into a corresponding LOS, and the 2000 Highway Capacity Manual (HCM) delay-based methodology. The HCM methodology estimates the average delay per vehicle for each of the movements through the intersection. The ICU LOS criteria for signalized intersections are show in **Table 1**. The HCM-based delay and LOS values are shown in **Table 2**.

TABLE 1: INTERSECTION LEVEL OF SERVICE DEFINITIONS (ICU)

LOS	Interpretation	Volume to Capacity Ratio (V/C)
A	Very low delay. Most vehicles do not stop at the intersection.	0.00 – 0.60
B	More vehicles stop than with LOS A, causing higher delays.	0.61 – 0.70
C	The number of vehicles stopping becomes significant, though many still pass through the intersection without stopping.	0.71 – 0.80
D	The influence of congestion becomes more noticeable. Many vehicles stop and the proportion of vehicles not stopping declines.	0.81 – 0.90
E	Results in delay considered to be unacceptable.	0.91 – 1.00
F	Considered unacceptable to most drivers, often occurs with oversaturation, when arriving traffic exceeds the capacity at the intersection.	Over 1.00
Source: City of Santa An a General Plan - Circulation Element, 1998 (Reformatted January 2010)		

3.1.2 *CALTRANS GUIDELINE*

The intersection LOS analysis was conducted using the HCM methodology for both the signalized and unsignalized intersections. **Table 2** below describes the level of service concept

and operating conditions expected under each level of service for signalized and unsignalized intersections, respectively.

3.2 ROADWAY SEGMENTS

The City of Santa Ana has established maximum road capacities for various roadway street classifications as shown in **Table 3**. The maximum roadway capacities are based on daily traffic volume, number of lanes and roadway classifications.

TABLE 2: INTERSECTION LEVEL OF SERVICE DEFINITIONS (HCM)

LOS	Interpretation	Signalized Intersection Delay (seconds)	Stop-Controlled Intersection Average Stop Delay (seconds)
A	Excellent operation. All approaches to the intersection appear quite open, turning movements are easily and nearly all drivers find freedom of operation.	≤10	≤10
B	Very good operation. Many drivers begin to feel somewhat restricted within platoons of vehicles. This represents stable flow. An approach to an intersection may occasionally be fully utilized and traffic queues start to form.	>10 and ≤20	>10 and ≤15
C	Goof operation. Occasionally backups may develop behind turning vehicles. Most drivers feel somewhat restricted.	>20 and ≤35	>15 and ≤25
D	Fair operation. There are no long-standing traffic queues. This level is typically associated with design practice for peak periods.	>35 and ≤55	>25 and ≤35
E	Poor operation. Some long-standing vehicular queues develop on critical approaches.	>55 and ≤80	>35 and ≤50
F	Forced flow. Represents jammed conditions. Backups from locations downstream or on the cross street may restrict or prevent movements of vehicles out of the intersection approach lanes; therefore, volumes carried are not predictable. Potential for stop-and-go type traffic flow.	>80	>50
Source: Highway Capacity Manual 2000			

TABLE 3: ROADWAY LEVEL OF SERVICE DEFINITIONS

Road Classification	Lane Configuration	LOS A (V/C=0.6)	LOS B (V/C=0.7)	LOS C (V/C=0.8)	LOS D (V/C=0.9)	LOS E (V/C=1.0)	LOS F (V/C>1.0)
Principal	8-lane divided	45,000	52,500	60,000	67,500	75,000	-
Major	6-lane divided	33,900	39,400	45,000	50,600	56,300	-
Primary	4-lane divided	22,500	26,300	30,000	33,800	37,500	-
Secondary	4-lane undivided	15,000	17,500	20,000	22,500	25,000	-
Collector	2-lane undivided	7,500	8,800	10,000	11,300	12,500	-

Source: City of Santa Ana General Plan - Circulation Element, 1998 (Reformatted January 2010)

3.3 CITY OF SANTA ANA THRESHOLDS OF SIGNIFICANCE

The Circulation Element of the City of Santa Ana General Plan sets LOS D as the threshold for an acceptable service level for intersections located outside of major development areas (MDA). The City of Santa Ana considers LOS E as the maximum acceptable service level of intersections located within an MDA. The intersection of Santiago Street and Santa Ana Boulevard is the only non-Caltrans intersection within the study area that is located within an MDA. The City of Santa Ana considers LOS D as the maximum acceptable service level of roadway segments.

The LOS targets for each of the study area intersections and roadway links were previously listed in the table in Section 2.4.

4.0 SETTING

4.1 EXISTING CIRCULATION NETWORK

The characteristics of the existing roadway system in the vicinity of the project area are described below:

4.1.1 *FREEWAYS*

Santa Ana Freeway (I-5) extends in a general northwest and southeast direction through the City of Santa Ana and it is a major route between Los Angeles, Orange, and San Diego Counties. The closest interchanges that provide access to the project site are located at Main Street/Edgewood Road to the northwest of the project site, 17th Street along the project corridor, and Grand Avenue and Santa Ana Boulevard to the southeast of the project site.

4.1.2 *LOCAL STREETS*

17th Street is an east-west street classified as a Major Arterial in the City's Circulation Element. It has three travel lanes in each direction.

Santa Ana Boulevard is an east-west street classified as a Primary Arterial east of Ross Street up to I-5, and a Major Arterial west of Ross Street. It has four lanes between Raitt Street and Flower Street, six lanes between Flower Street and Ross Street, three lanes between Ross Street and French Street (one-way street), two lanes between French Street and Garfield Street, four lanes between Garfield Street and Santiago Street, and six lanes between Santiago Street and Grand Avenue.

Washington Avenue is an east-west local street and it has one travel lane in each direction.

Civic Center Drive is an east-west street classified as a Secondary Arterial from Fairview Street to French Street. It is classified as a Local street east of French Street. It has two travel lanes in each direction west of French Street, and one travel lane in each direction east of French Street.

Main Street is a north-south street classified as a Secondary Arterial in the City's Circulation Element. It has two to three travel lanes in each direction.

Grand Avenue is a north-south street classified as a Major Arterial in the City's Circulation Element. It has two to three travel lanes in each direction.

Santiago Street is a north-south local street. It is named Santiago Street north of 17th Street, and continues south of 17th Street as Penn Way/Santiago Street. It has one to two travel lanes in each direction.

Lincoln Avenue is a north-south local street extending between East Park Lane on the north and Stafford Way on the south. It has one travel lane in each direction.

Fairmont Street is a local street that runs both north-south and east-west extending between Lincoln Avenue to the south/east and 17th Street to the north. It has one travel lane in each direction and stop sign-controlled intersection at each end.

Dorman Street is an east-west local street and it has one travel lane in each direction.

5.0 EXISTING CONDITIONS

This section describes the existing intersection level of service based on existing weekday traffic volume counts and the previously described methodologies. Traffic flow is measured and analyzed on a weekday daily basis for roadway segments, and during weekday peak hours for intersections. For roadway segment traffic flow is measured on roadways at mid-block locations to determine the overall level of travel demand and LOS. Average Daily Traffic (ADT) values are developed that represent the typical daily traffic flow on each analyzed segments. During the peak hours, intersection traffic volumes are counted to determine the operating conditions during the peak hours of travel demand. Typically, intersection traffic demand is measured for the peak morning (AM), midday (MD), and afternoon (PM) commute peak periods (7 to 9 AM, 11:30 AM to 1:30 PM, and 4 to 6 PM). Then the single busiest hour in each period is determined and used to develop intersection LOS estimates. Each study intersection was field reviewed to determine the geometric characteristics including the number of lanes on each intersection approach by type (through lanes, left turn lanes, right turn lanes and shared lanes), type of traffic control and other relevant information. The existing intersection geometries are illustrated in **Figure 3**.

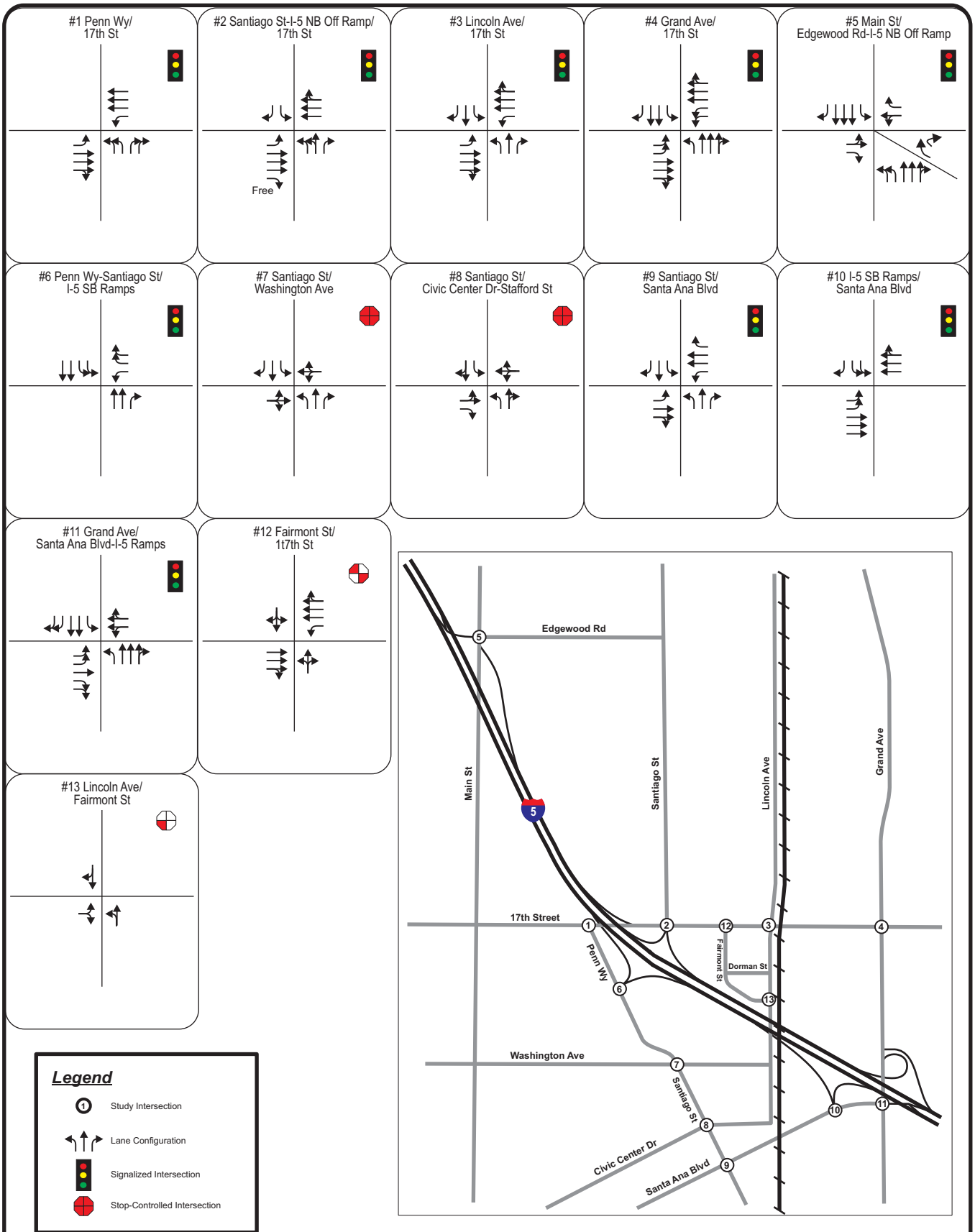
Existing intersection counts were conducted on Thursday, June 2, 2011 and Wednesday, June 8, 2011, typical weekdays, at 11 of the 13 study intersections. Intersection turning movement data for the intersections of Fairmont Street with 17th Street and Lincoln Avenue were developed based on upstream and downstream volumes from adjacent intersection and the scale and type of land uses in the area. Both locations have a low volume of turning traffic. Existing roadway segment counts were conducted on June 8, 2011, at the 7 study roadway segments. **Figure 4** shows the existing peak-hour turning movement volumes. Traffic count sheets are provided in the **Appendix**.

5.1 EXISTING LEVEL OF SERVICE

5.1.1 *INTERSECTION*

The AM and PM peak-hour level of service analyses were conducted at all 13 analyzed intersections, and the MD peak-hour level of service analyses were conducted at 4 study intersections. Using the HCM delay-based methodology, the level of service analysis was performed using the Synchro software, version 7, and TRAFFIX software, version 8.0, for multi-lane unsignalized intersections and intersections with more than four approaches. **Table 4** illustrates the current intersection LOS at each study intersection.

The existing LOSSAN crossing has also been included in the table. As shown, the crossing generates and average of 27.0 seconds per vehicle or about 16 total vehicle-hours of delay in the AM peak hour and 28.8 seconds per vehicle or about 21.9 vehicle-hours of delay during the PM peak hour.



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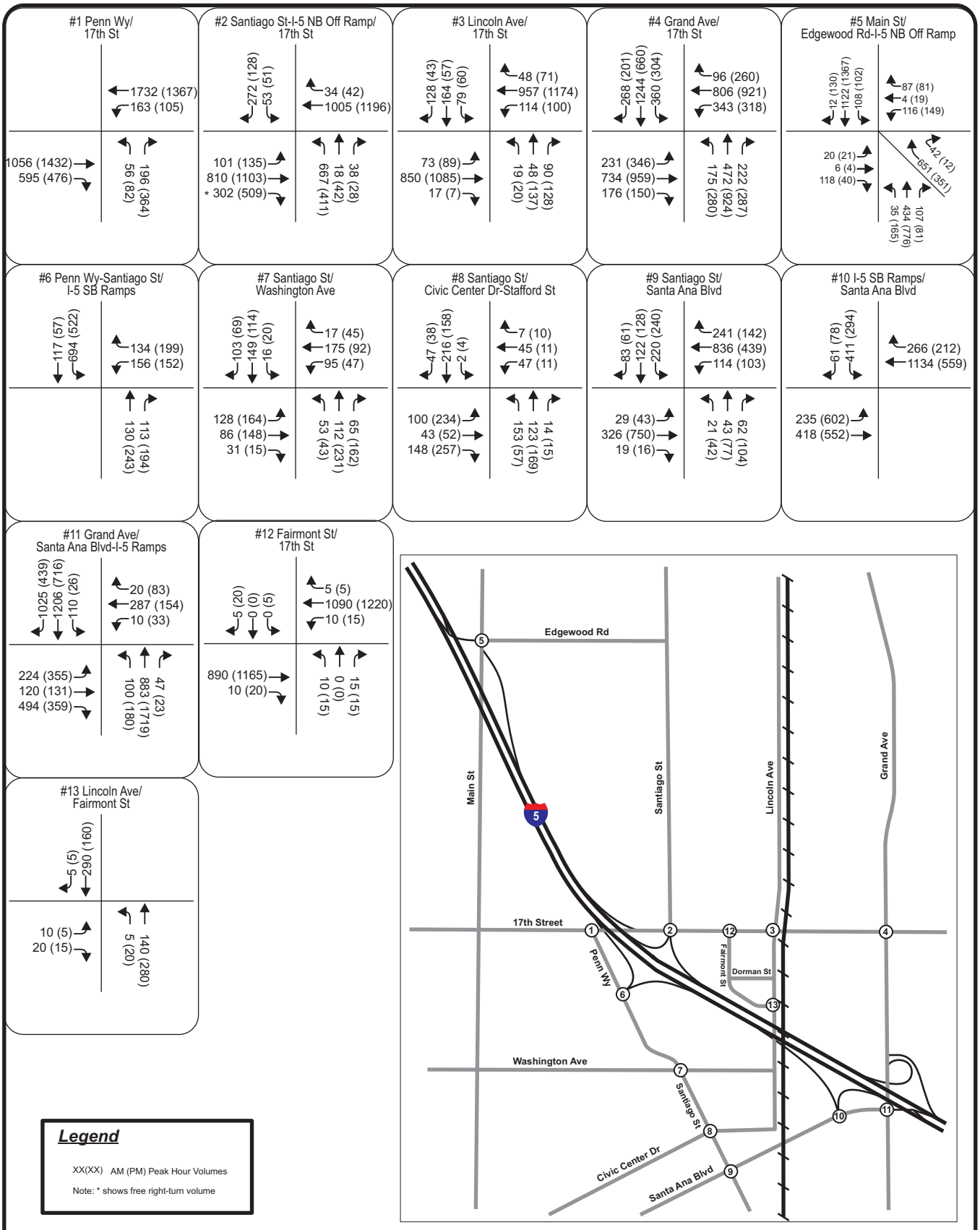
17th Street LOSSAN Grade Separation

Figure 3

Existing Intersection Lane Configurations & Traffic Control



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17th Street LOSSAN Grade Separation
Figure 4
Existing Peak Hour Volumes

TABLE 4: EXISTING INTERSECTION PEAK HOUR LOS

#	Intersection	AM Peak Hour			PM Peak Hour			MD Peak Hour		
		Delay	V/C	LOS	Delay	V/C	LOS	Delay	V/C	LOS
1	Penn Way and 17th Street	24.8	0.59	C	36.6	0.62	D	18.4	0.52	B
2	I-5 NB Ramps/Santiago Street and 17th Street	40.1	0.66	D	22.3	0.61	C	49.9	0.58	D
3	Lincoln Avenue and 17th Street	27.0	0.49	C	21.4	0.59	C	27.6	0.52	C
	LOSSAN Crossing and 17th Street	27.0	-	-	28.8	-	-	27.6	-	-
	Combined Weighted Average Delay[1]	27.0	-	C	25.1	-	C	27.6	-	C
4	Grand Avenue and 17th Street	72.6	0.86	E	68.9	0.90	E	50.1	0.74	D
5	Main Street and I-5 NB Ramps/Edgewood Road	40.3	0.71	D	43.5	0.68	D	-	-	-
6	Penn Way and I-5 SB Ramps	24.6	0.44	C	22.7	0.42	C	-	-	-
7	Santiago Street and Washington Avenue[2]	10.9	n/a	B	11.7	n/a	B	-	-	-
8	Santiago Street and Civic Center Dr/Stafford Street	13.8	n/a	B	17.5	n/a	C	-	-	-
9	Santiago Street and Santa Ana Boulevard	20.2	0.57	C	20.0	0.60	B	-	-	-
10	I-5 SB Ramps and Santa Ana Boulevard	23.0	0.58	C	25.0	0.53	C	-	-	-
11	Grand Avenue and Santa Ana Blvd/NB I-5 HOV Ramps	50.3	0.70	D	46.2		D	-	-	-
12	Fairmont Street and 17th Street	10.6	n/a	B	11.2	n/a	B	-	-	-
13	Lincoln Avenue and Fairmont Street	10.6	n/a	B	10.0	n/a	B	-	-	-

Source: Iteris, Inc., 2011
Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.
1 – The Combined Weighted Average takes into account that during gate down periods eastbound vehicles will be stopped west of Lincoln Avenue and westbound vehicles will be stopped east of the crossing. Therefore the delay is distributed between the intersection and the crossing.
2 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.

The analysis results indicate that with both the ICU and HCM methodologies, the intersection of Grand Avenue and 17th Street is operating at LOS E during both the AM, and PM peak hours. All of the other analyzed intersections have acceptable LOS results.

It is important to note that because of the proximity of the LOSSAN crossing to the Lincoln Avenue intersection on 17th Street and the need to clear the area between the two during gate down periods, the delay experienced as a result of the at-grade crossing is distributed in the program between the intersection and the grade crossing. In addition, because of the traffic signal preemption used to provide this clearing phase the delay value with the at-grade crossing in place will need to evaluate the intersection and crossing as a single operating entity.

The delay and LOS values generated by both the HCM and ICU methodologies assume that the intersection and rail crossing exist independently of one another. However, the traffic signal pre-emption and crossing gates clearly make the two operate in a coordinated manner. While the Synchro simulation analysis assumes the Lincoln/17th intersection and LOSSAN crossing exist

separately, the program does account for the additional delay generated by the rail crossing at the adjacent intersections.

To determine what the delay attributable to the crossing is versus typical intersection operations, the study uses a weighted average delay of the intersection and the crossing to develop individual delay components of the two locations and a weighted average delay value based on the two locations acting as a single location. That process evaluates each approach based on the volume of approaching traffic and the approach delay calculated by the simulation program. The calculation of the combined delay is summarized in the various tables listing the analysis results and a summary table is provided in the **Appendix**.

5.1.2 *Intersection Queues*

In addition to poor levels of service at some locations along 17th Street, the current LOSSAN crossing contributes to the formation of long queues at the adjacent signalized intersections, which can take several traffic signal cycles to dissipate during the peak hours. The existing crossing is blocked by the northbound and southbound trains up to 10 times during a typical weekday peak hour. To identify the magnitude of the existing queuing at the 17th Street intersections, counts were conducted to record the length of queue for each movement at the start of the traffic signal's green phase at the intersections of 17th Street with Penn Way, Santiago Street/I-5 Ramps, Lincoln Avenue, and Grand Avenue. The data showed that the at-grade crossing has a significant effect on intersection queues on 17th Street.

For the westbound through lanes at the Penn Way and Santiago/I-5 Ramps intersections, the queues vary during the hour with some cycles having very few vehicles queued (normal intersection operations) and others having up to 30 vehicles queued (queues developed during gate down periods). In some instances these queues take more than one signal cycle to dissipate. The westbound approach at the Grand Avenue intersection however, has very constant queue lengths during the peak hours indicating that the intersection is operating near its capacity during the peak hour and the queues are generated by the steady flow of approaching westbound traffic. The opposite pattern is present for the eastbound approach where the queues form and dissipate indicating an uneven flow approaching the intersection from the west. The reverse pattern is seen at the Penn Way and Santiago/I-5 intersections. This cyclical pattern of queues forming and dispersing is also present, and to a greater extent, at both approaches of the Lincoln Avenue and 17th Street intersection. This is a result of the railroad crossing gates stopping traffic flow while trains pass creating queue formation upstream of the crossing and queue starvation downstream of the crossing. The platoons of vehicles are then released and arrive at the downstream intersection resulting in queues that take one or two signal cycles to clear. Summary tables of the intersection queue counts are provided in the **Appendix**. The patterns and size of the queues surveyed indicate than none of the intersections have queuing issues during normal signal operations.

5.1.3 *ROADWAY SEGMENTS*

Table 5 summarizes the existing LOS for the seven analyzed roadway segments based on the V/C ratio standards from the City of Santa Ana General Plan Circulation Element. LOS "E" capacity values were used to determine the volume-to-capacity value for each segment. The LOS threshold for roadway segment per the City of Santa is LOS "D" while the OCTA Comprehensive Transportation Funding Program has the adopted practice of using LOS "E". The results indicate that all the study roadway segments are operating at LOS C or better.

TABLE 5: EXISTING ROADWAY LOS

Street	Location	Street Classification	Lanes	Daily Volume	LOS "E" Capacity	V/C	LOS
17th Street	w/o Penn Way	Major Arterial	6	43,890	56,300	0.78	C
Edgewood Road	e/o Main Street	Collector	2	4,920	12,500	0.39	A
Santiago Street	s/o Santa Clara Avenue	Collector	2	2,680	12,500	0.21	A
Santiago Street	s/o I-5 SB Ramps	Collector	2	7,030	12,500	0.56	A
Santa Ana Boulevard	w/o I-5 SB Ramps	Primary Arterial	6	22,850	37,500	0.61	B
Grand Avenue	s/o 17th Street	Major Arterial	6	27,680	56,300	0.49	A
17th Street	e/o Grand Avenue	Major Arterial	6	33,010	56,300	0.59	A

5.2 EXISTING TRANSIT FACILITIES

The Orange County Transportation Authority (OCTA) is the main transit service provider in Orange County, and it offers a wide range of services including an extensive network of fixed-route transit service throughout Orange County.

The Santa Ana Regional Transportation Center (SARTC) is located south of the proposed project site at Santa Ana Boulevard and Santiago Avenue. It serves as a transfer point for OCTA buses, Metrolink, and Amtrak.

The following OCTA bus routes would directly serve the proposed project area:

- Route 59: Anaheim – (Irvine via Kraemer Boulevard/Glassell Street/Grand Avenue/Von Karman Avenue) operates along Grand Avenue and Santa Ana Boulevard in the study area with service provided at varying intervals and 3 to 4 buses travelling through the study area during the peak hour.
- Route 60: Long Beach – (Tustin via Westminster Avenue/17th Street) operates along 17th Street in the study area with service provided approximately every 10 minutes.

Other routes in the area do not travel on or cross 17th Street, but would be affected by the projected future increase in traffic on adjacent streets as result of traffic detours during construction. The following routes either travel on or cross Santa Ana Boulevard:

- Route 83: (Anaheim–Laguna Hills via I-5/Main Street) operates at varying intervals with approximately 3 buses traveling through the study area during the peak hour.
- Route 206: (Santa An–Lake Forest Express via I-5) operates at varying intervals however no buses travel through the study area during the peak hour.
- Route 462: (The Depot at Santa Ana–Civic Center via Santa Ana Boulevard/Civic Center Drive) operates at varying intervals with approximately 2 to 3 buses traveling through the study area during the peak hour.
- Route 463: (The Depot at Santa Ana–Hutton Center via Grand Avenue) operates at varying intervals with approximately 2 to 3 buses traveling through the study area during the peak hour.

Existing Bus Stops

In the study area there are several bus stop locations that would either be relocated during and/or after the completion of the project's constructions or may be affected by an increase in traffic along the street as a result of construction detours and/or regional traffic growth. The existing bus stops within the study area are listed below and are illustrated in **Figure 5**:

<u>Route 60</u>

Eastbound on 17th Street

Far side of Spurgeon Street, Santiago Street, and Grand Avenue
Near side at Lincoln Avenue

Westbound on 17th Street

Far side at Grand and at Penn Way
Near side stops on 17th at Lincoln

<u>Route 59</u>

Southbound on Grand Avenue

Far side at 17th, between 14th Street and 15th Street

Northbound on Grand Avenue

Nearside at 14th Street

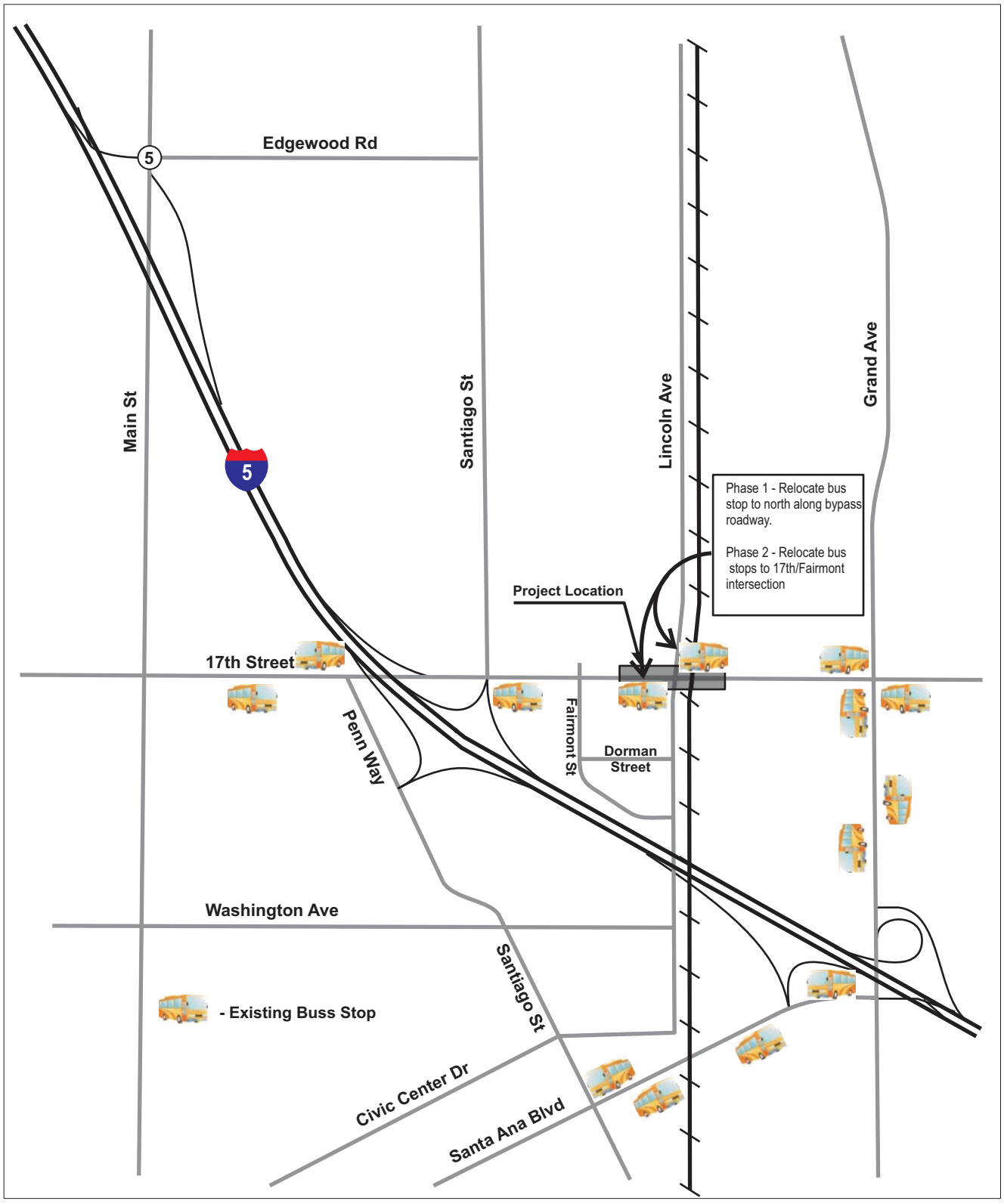
<u>Various Routes on Santa Ana Boulevard</u>

Westbound

Far side of Grand and near side of Santiago Street

Eastbound

Far side of the SARTC driveway and Fuller Street



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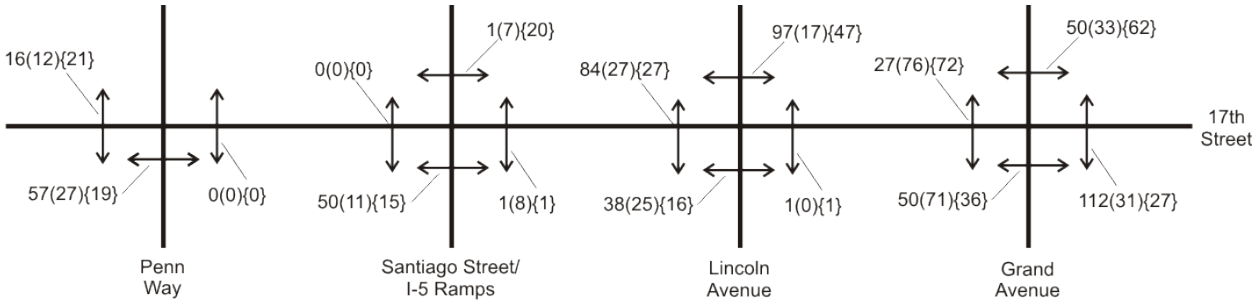
17th Street LOSSAN Grade Separation
Figure 5
Existing and Project-Period Transit Stops

5.3 EXISTING PEDESTRIAN FACILITIES AND USAGE

Pedestrian activity counts were also conducted at the four intersections along 17th Street to determine the level of pedestrian activity and the need for pedestrian accommodations during the project construction period. The pedestrian counts were conducted during the AM, midday, and PM peak periods. Summary tables of the pedestrian count results are provided in the Appendix and are illustrated in **Figure 6**.

The counts showed that all four of the intersections have regular pedestrian activity during the peak periods with the Penn Way intersection averaging between 40 and 70 pedestrians crossing per hour during the peak hours, the Santiago/I-5 intersection between 30 and 50 pedestrians per hour, the Lincoln Avenue intersection between 70 and 170 pedestrians per hour, and the Grand Avenue intersection between 170 and 210 pedestrians per hour. The crosswalks at the 17th Street and Grand intersection are also designated as school routes.

FIGURE 6: EXISTING PEDESTRIAN CROSSWALK VOLUMES



5.4 EXISTING BICYCLE FACILITIES

Bicycle usage in encouraged within the City of Santa Ana, however there are currently no striped or marked bicycle facilities within the study area. Class II facilities are planned and included in the *OCTA Commuter Bikeways Strategic Plan* along Penn Way/Santiago Street between 17th Street and 6th Street, and along Santa Ana Boulevard between Raitt Street and Grand Avenue.

5.5 EXISTING 17TH STREET LOSSAN AT-GRADE CROSSING

The LOSSAN crossing is used by several rail lines including Metrolink Orange County (OC) and Inland Empire/Orange County (IEOC) lines and the Amtrak Pacific Surfliner line.

For the Metrolink lines, the existing service schedules include the following:

Orange County Line (OC)

- 2 trains per hour in both the AM and PM peak hours and 20 trains per day in each direction

Inland Empire Orange County Line (IEOC)

- 2 trains per hour in both the AM and PM peak hours and 20 trains per day in each direction

Amtrak Service Pacific Surfliner operates with 1 train per day in the peak hour each way and 13 to 14 trains per day each direction.

The BNSF freight rail traffic also uses the crossing with approximately 8 freight trains per day crossing 17th Street during off-peak hours.

Based on the above service schedules, the existing LOSSAN crossing has approximately 10 trains per hour crossing 17th Street during the peak hours. Because the size and timing of each train can vary from day to day an average gate down time was assumed for the analyses. A sample of the gate down times was collected and an average time of 2 minutes per train was assumed for use in this study. For simplicity in the calculations the trains were also assumed to arrive at evenly-spaced intervals throughout the peak hours.

6.0 FUTURE YEAR BASELINE (NO-BUILD) TRAFFIC VOLUME FORECASTS

Traffic volumes projections for the project's opening year 2020 and the horizon year 2035 were developed using the latest version of the Orange County Transportation Analysis Model (OCTAM). To develop better results in the study area some minor adjustments to the model were made such as the relocation of land use connection to more accurately replicate conditions on the ground. In addition, for Alternatives 1A and 2A, the intersection of Lincoln Avenue and 17th Street was removed and the connecting roadways included. The current OCTAM model also has a base year of 2005; therefore, the model is adjusted to reflect a base year of 2011 for this study.

In addition to the 17th Street grade separation project other crossings in the area are also programmed to be grade separated. The existing LOSSAN crossing on Santa Ana Boulevard is assumed to be grade-separated by the time construction commences on the 17th Street project.

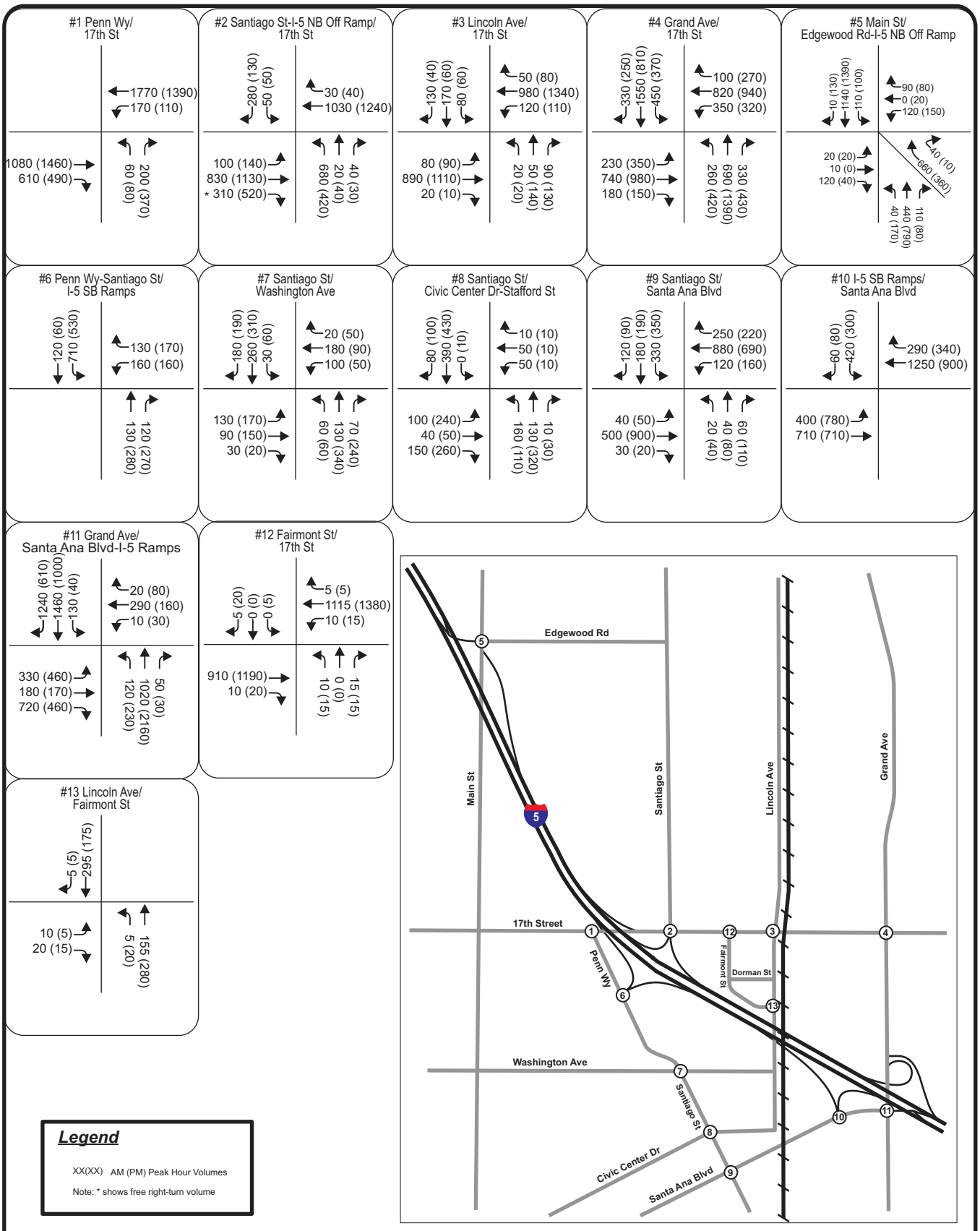
The Santa Ana Fixed Guideway project is not assumed to be operational by the opening year of the 17th Street project. However, the intersection of Santiago Street and Santa Ana Boulevard is an intersection that is proposed to be on the route of the Fixed Guideway project. The two current alternative designs for the Fixed Guideway project were reviewed and both alternatives can be accommodated with the recommendations included in this report.

The future activity at the LOSSAN corridor was estimated by adding trains for programmed service increases to the existing schedules. With the currently proposed schedule enhancements to the Metrolink service along the corridor the Metrolink train activity will increase from the existing 8 trains per hour during the peak hours to about 14 trains per hour by Year 2020. The existing Amtrak and freight schedules were not assumed to change. This will result in an increase from the current total of 10 trains per peak hour to 16 trains by Year 2020.

OCTAM projects a substantial increase in traffic volumes between existing conditions and Year 2020 and 2035 at many of the analyzed intersections.

6.1 YEAR 2020 TRAFFIC VOLUME FORECASTS

The Year 2020 volumes were developed through a linear interpolation of the Year 2035 data that is generated by OCTAM. Based on current economic conditions and the observed rate of growth in traffic over the past 3 to 5 years these volumes may include growth beyond what may actually be experienced. If that is the case, they provide a conservative estimate of future conditions. The weekday AM and PM peak-hour intersection volumes are shown in **Figure 7**.



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17th Street LOSSAN Grade Separation

Figure 7

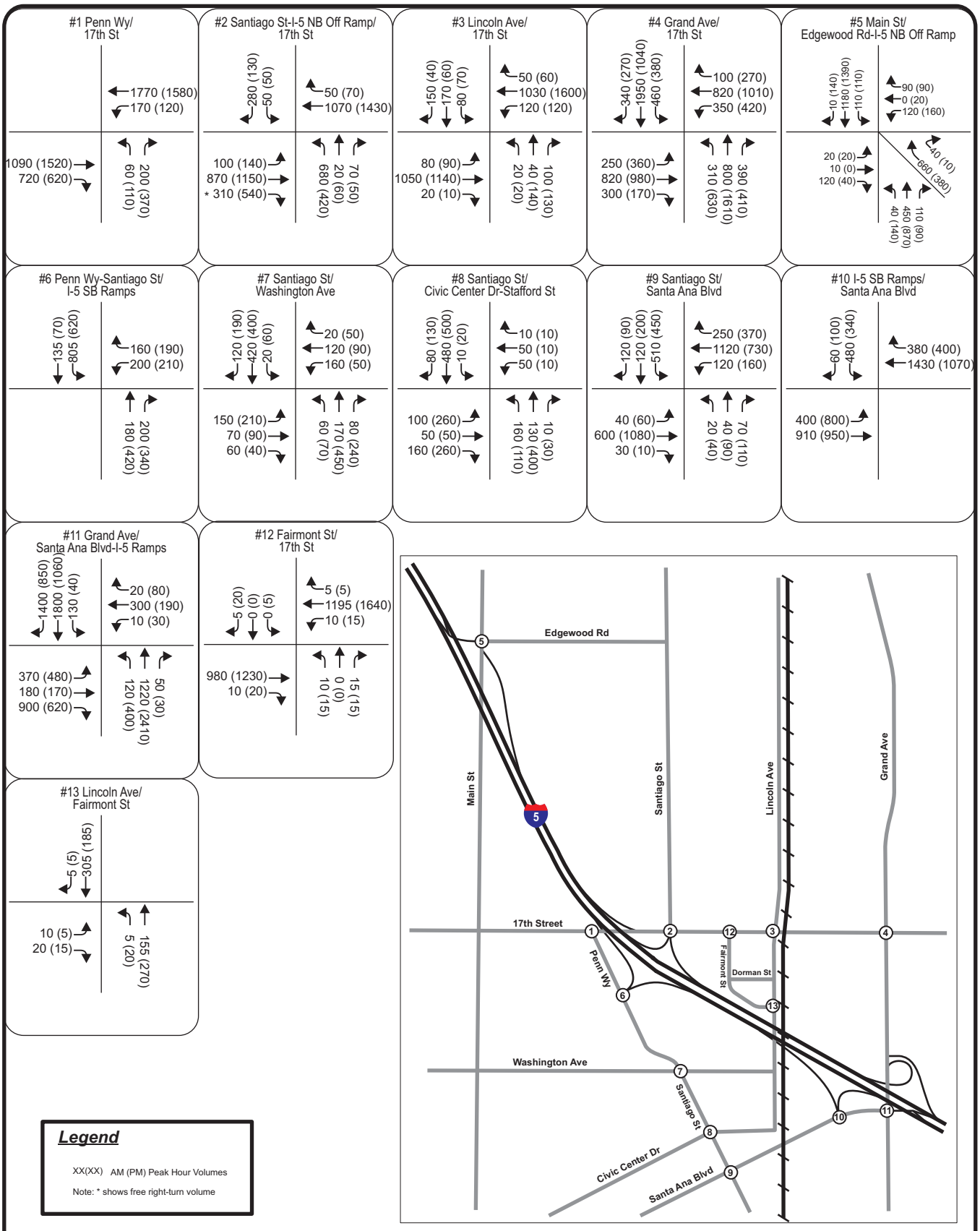
Year 2020 No Build (Baseline) Peak Hour Volumes

6.2 YEAR 2035 TRAFFIC VOLUME FORECASTS

The Year 2035 traffic volume estimates developed using OCTAM show substantial growth along the Grand Avenue and Santa Ana Boulevard corridor. These projected increases will factor into the long-term need for future physical traffic improvements, operational improvements, or travel demand management strategies to improve capacity and reduce corridor demand. The weekday AM and PM peak-hour intersection volumes are shown in **Figure 8**.

6.3 CONSTRUCTION PERIOD TRAFFIC VOLUME FORECASTS

To provide a conservative estimate of traffic conditions during the construction period the Year 2020 Baseline traffic volumes were used as the projected traffic volumes during the construction period. The assignment of those traffic volumes during the two main construction phases are explained and analyzed in the next section.



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17th Street LOSSAN Grade Separation

Figure 8

Year 2035 No Build (Baseline) Peak Hour Volumes

7.0 CONSTRUCTION PERIOD OPERATING CONDITIONS, MITIGATION, AND ENHANCEMENTS

The construction period analysis was only conducted for Alternative 1C, the Locally Selected Alternative, but would be similar, if not the same for all three of the build alternatives.

7.1 PROPOSED DETOUR ROUTE

Project construction will be done in two major phases. Phase 1 will include the creation of a by-pass roadway located north of the existing 17th Street alignment. The intersection with Lincoln Avenue will be temporarily relocated to the north and access to the south leg of the intersection will be closed. During Phase 1, 17th Street will be either depressed (or elevated in the case of Alternative 2A) and the underpass at the track crossing will be constructed. The cross-section of the temporary 17th Street bypass road will be 4 through lanes with a median left-turn lane to provide access to Lincoln Avenue to the north. A temporary traffic signal will be provided at the intersection of Fairmont Street and 17th Street to provide pedestrian access across 17th Street.

Detour access for the closed south approach of Lincoln Avenue during Phase 1 will be provided along two routes. The limited volume of local traffic will be able to continue to use Fairmont Street to access Washington Avenue or Stafford Street to access Santiago Street as is currently available. Traffic approaching from outside of the immediate area will be directed to use Grand Avenue, Santa Ana Boulevard, and Santiago Street/Penn Way as an alternative route.

During Phase 2 of the project, through traffic on 17th Street will be shifted to the new 17th Street facility and direct access to and from Lincoln Avenue will be eliminated. During this phase of construction Lincoln Avenue traffic will be diverted to the southern by-pass route described above. Local traffic can still use Fairmont Street to access properties south of 17th Street as currently exists.

It is also expected that some additional local traffic will use Fairmont Street and Dorman Street as alternative routes to access land uses to the south of 17th Street. A review of the trip origin and destination data from the OCTAM model indicates that this diversion would likely be at the most about 50 vehicles per hour during the peak hour. With the limited access to and from the north on Lincoln Avenue additional pressure will likely occur to find additional by-pass routes, especially along Santiago Street and the east-west streets to the north of 17th Street. Traffic conditions in the Park Santiago neighborhood will need to be monitored to determine if a substantial volume of cut-through traffic is occurring during the construction period. Measures to address neighborhood protection for the Park Santiago area are discussed later in the report.

Using the detour routes described above, the construction period traffic assignments were developed using the Year 2020 Baseline volumes. The rerouted traffic volumes for construction

Phase 1 and Phase 2 are illustrated in **Figures 9 and 10**, respectively. The total traffic volumes at the analyzed intersection for Phase 1 and Phase 2 are shown in **Figures 11 and 12**, respectively.

7.2 TARGET LOS AND OPERATING CONDITIONS

The target LOS for the analyzed intersections is LOS D and E, depending on the location, as was previously discussed. Mitigation measures, both permanent and temporary, were identified in an attempt to meet that LOS standard or at a minimum maintain conditions at pre-project levels. At locations where the target or pre-project LOS thresholds could not be met alternative strategies and/or longer-term concepts have been suggested to address future needs.

For roadway segments, in addition to the daily traffic volumes the capacity of each location can be determined based on the peak-hour volume of traffic using the methodology presented on the 2010 Highway Capacity Manual. That methodology uses the percentage of the daily traffic that occurs in the peak hour and the highest percentage of the directional flow of that traffic to determine the maximum directional volume of traffic that is acceptable at each LOS value.

Based on the existing conditions traffic counts the percentage of daily traffic that occurs during the peak hours averages about 9% resulting in a K factor of 0.09. During those peak hours the volume is split approximately 55% in one direction and 45% in the reverse direction. Therefore the directional factor (D factor) is 0.55.

Based on those values and the types of roadways in the study area the peak-hour 4-lane directional link capacity for LOS D is about 1,550 vehicles per hour and about 1,900 vehicles per hour for LOS E. For a 6-lane street the LOS D threshold volume is about 2,300 vehicles per hour per direction and 2,700 vehicles for LOS E. These values were considered during the development of the detour route to determine if any roadway segments would be over capacity during the peak hour. All of the segments within the study area were determined to be within acceptable capacity limits. A table summarizing the 2010 HCM roadway segment values is provided in the Appendix.

7.3 CONSTRUCTION PERIOD TRAFFIC OPERATIONS – EXISTING ROADWAY NETWORK

To determine the location and scale of any required construction mitigation measures, the constructions period traffic volumes were assigned to the area streets and capacity analyses conducted based on the intersection configuration at the time of construction. The intersection operating conditions for construction Phase 1 and Phase 2 are presented in the following paragraphs.

#1 Penn Wy/
17th St

#2 Santiago St-I-5 NB Off Ramp/
17th St

20 (10)

10 (20)

#3 Lincoln Ave/
17th St

-170 (-60)

20 (10)
-120 (-110)

10 (20)
-20 (-10)

-20 (-20)
-50 (-140)
-90 (-130)

#4 Grand Ave/
17th St

150 (50)

-100 (-100)
100 (100)

-80 (-110)

40 (130)
80 (110)

#5 Main St/
Edgewood Rd-I-5 NB Off Ramp

#6 Penn Wy-Santiago St/
I-5 SB Ramps

#7 Santiago St/
Washington Ave

-125 (-75)
-75 (-45)

-80 (-140)
80 (140)

125 (75)

#8 Santiago St/
Civic Center Dr-Stafford St

-5 (105)

-25 (-5)
-25 (-5)

-30 (-40)
30 (40)

25 (5)
125 (95)

#9 Santiago St/
Santa Ana Blvd

-25 (-5)
-75 (-45)
120 (200)

150 (100)
25 (5)
75 (45)

#10 I-5 SB Ramps/
Santa Ana Blvd

260 (180)

130 (230)

#11 Grand Ave/
Santa Ana Blvd-I-5 Ramps

250 (150)

10 (30)
-10 (-30)

110 (170)
10 (30)

#12 Fairmont St/
17th St

20 (10)

40 (20)

20 (20)
10 (20)

#13 Lincoln Ave/
Fairmont St

-270 (-150)

40 (20)

30 (40)
-140 (-250)

Legend

XX(XX) AM (PM) Peak Hour Volumes

Note: * shows free right-turn volume

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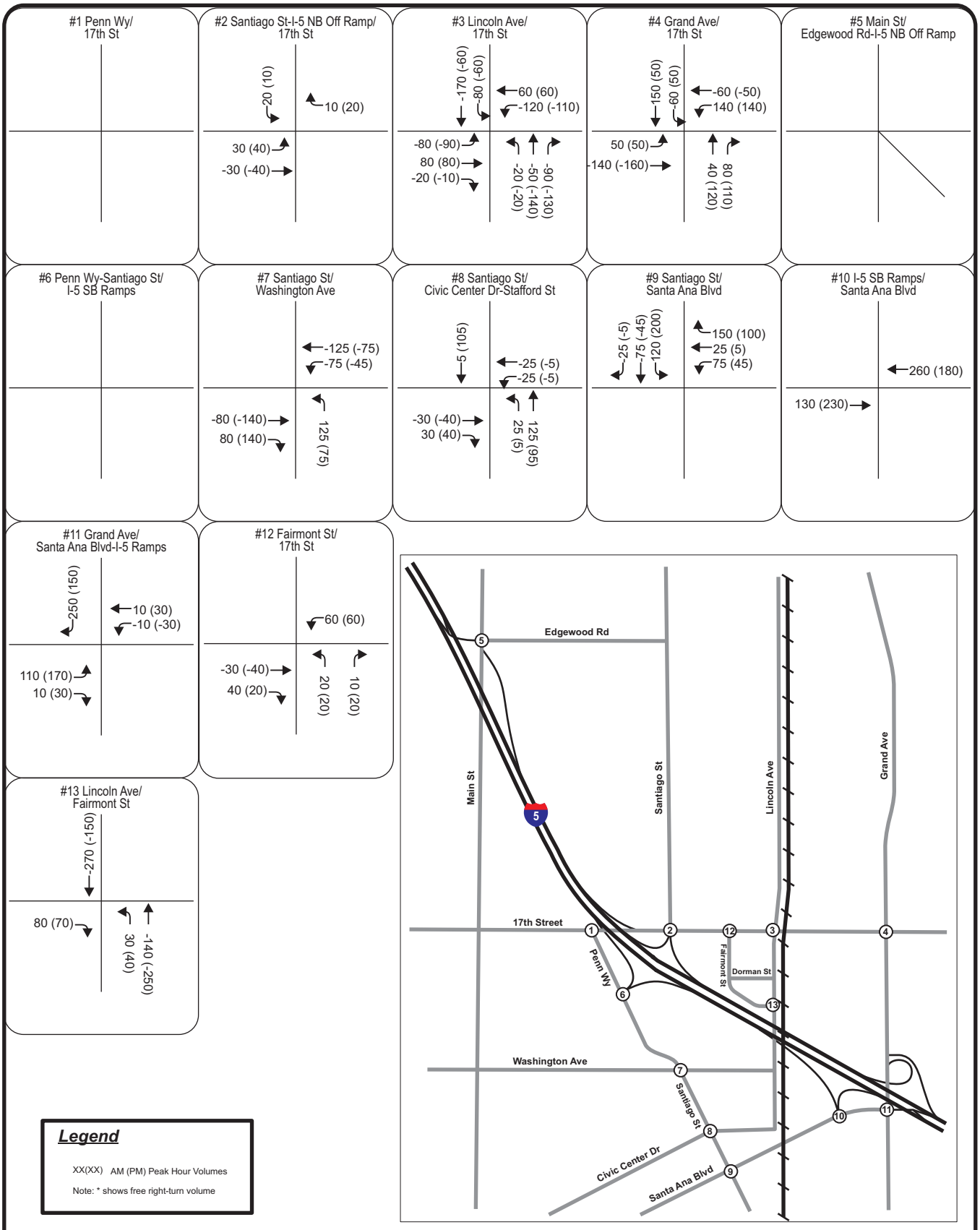
17th Street LOSSAN Grade Separation
Figure 9
Phase I Construction Detour Volumes



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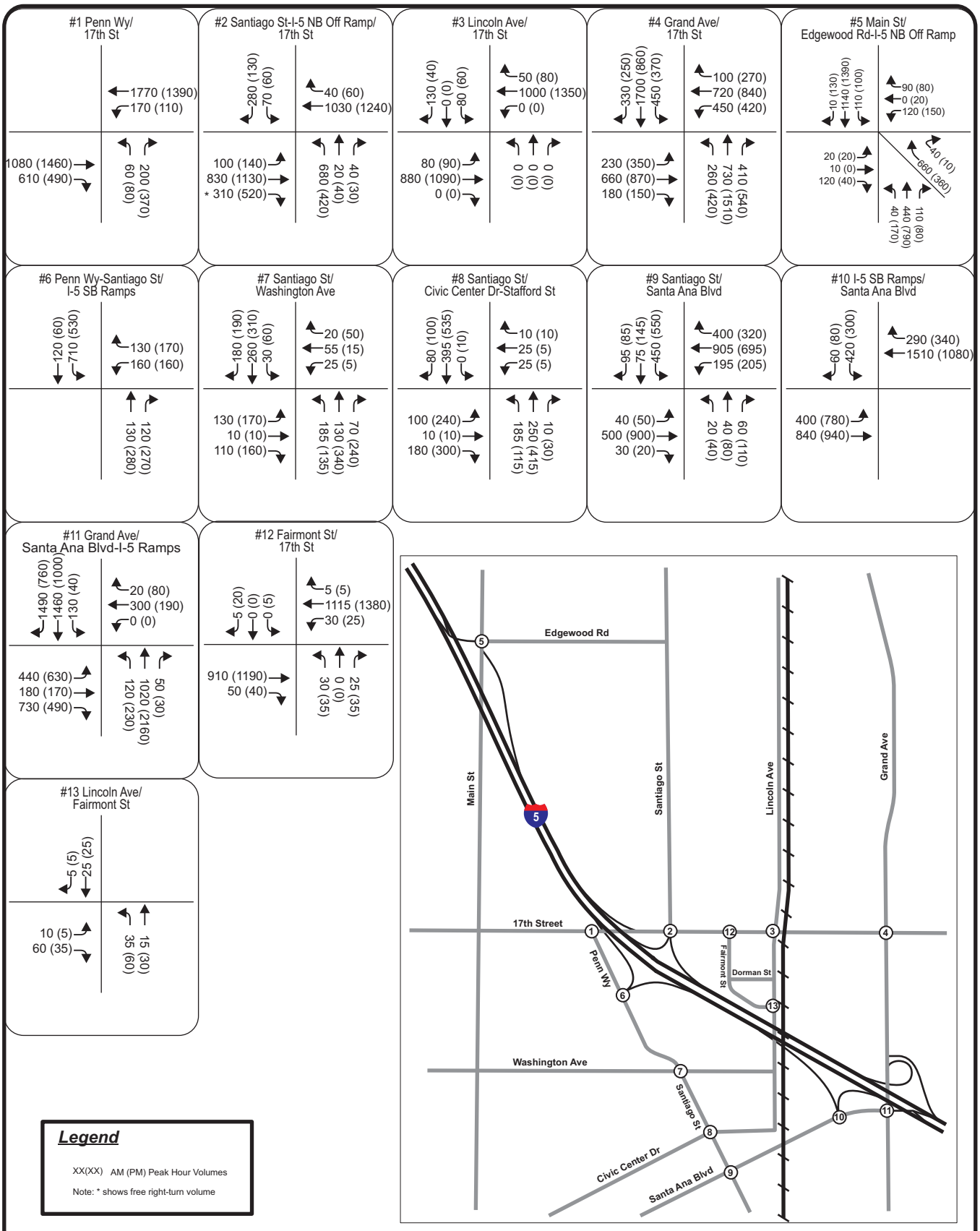
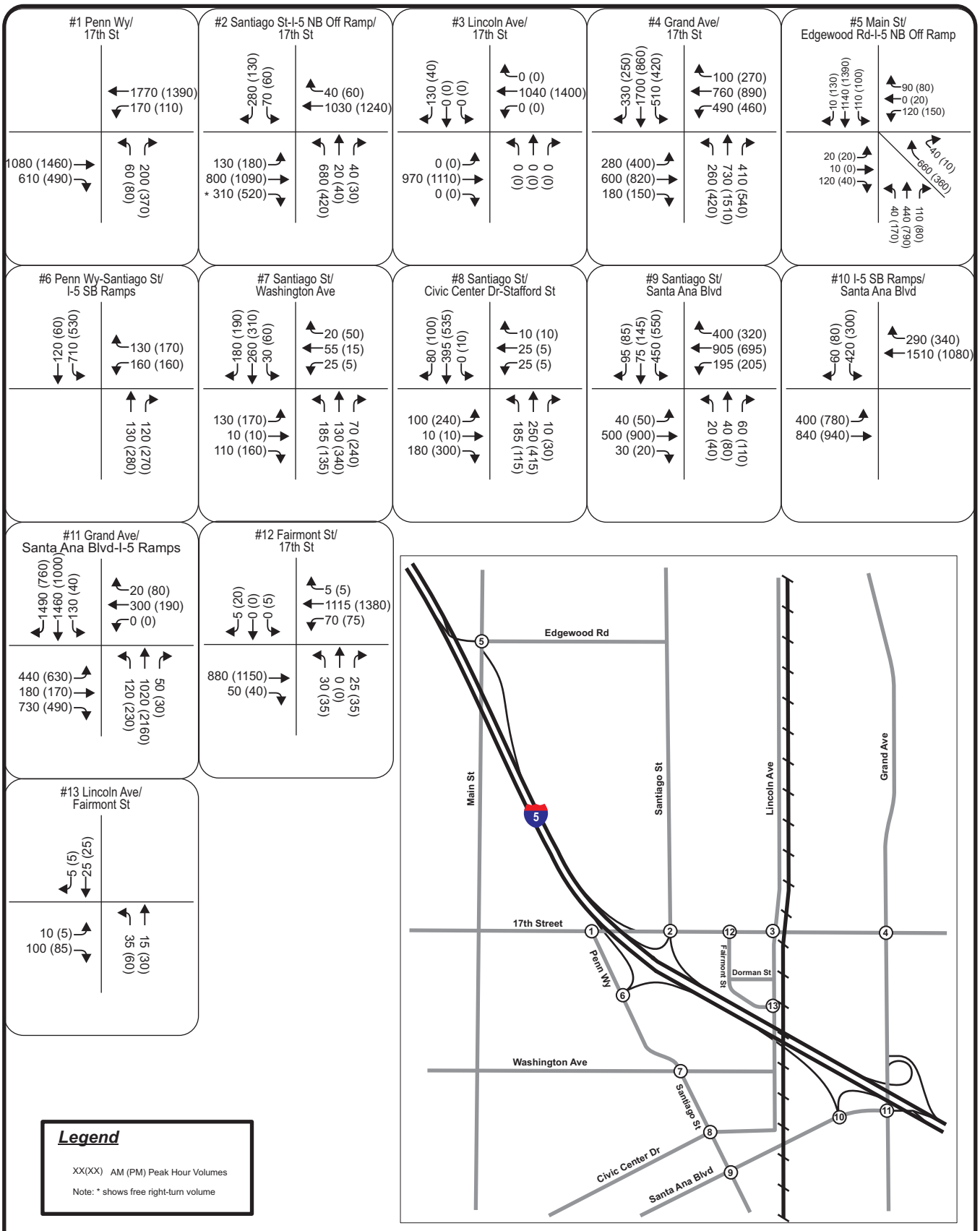
17th Street LOSSAN Grade Separation
Figure 10
Phase II Construction Detour Volumes



17th Street LOSSAN Grade Separation

Figure 11

Year 2020 Total Phase I Construction Period Peak Hour Volumes



17th Street LOSSAN Grade Separation

Figure 12

Year 2020 Total Phase II Construction Period Peak Hour Volumes

7.3.1 *Phase 1 Construction Roadway Modifications*

To accommodate Phase 1 construction activity at the LOSSAN and 17th Street grade crossing, several intersection modifications must be made including the development of a temporary by-pass road around the crossing in Phase 1 and temporary lane reductions approaching and through construction areas. The following paragraphs outline the required construction modifications.

7.3.1.1 Lincoln Avenue and 17th Street (Phase 1)

During Phase 1 of construction the signalized intersection will be shifted to the north to a temporary location and would include one left-turn lane and two through lanes on the eastbound approach, one through lane and one shared through/right-turn lane on the westbound approach, and one left-turn and one right-turn lane on the southbound approach. Pedestrian accommodations at the relocated intersection will be provided.

At the Lincoln Avenue and 17th Street intersection, the majority of the intersection delay will be related to the queues created by the gate down time at LOSSAN crossing. For example, the delay during the AM peak hour in Phase 1 for this intersection itself is projected to be 24.2 seconds per vehicle. However, after adding the weighted average delay from the LOSSAN crossing the delay at the intersection increases to 37.5 seconds per vehicle. During the PM peak hour the intersection delay will be about 21.1 seconds per vehicle, but with the weighted average delay of the crossing delay added the total combined delay will be about 44.7 seconds per vehicle. Because several of the intersections along the detour route are also projected to experience LOS E conditions the additional total delay along in the study area generated by detouring 17th Street east-west through traffic to an alternative route would add more total delay than the traffic staying on 17th Street. This suggests that measures that can expedite the Phase 1 construction timeline and divert westbound traffic to the next underpass should be considered.

7.3.1.2 I-5 NB Ramps/Santiago St and 17th St

To accommodate the lane reduction through the construction zone, the existing eastbound intersection approach would be restriped from the its current one left-turn lane, three through lanes, and one right-turn lane configuration so that during the project construction it would provide one left-turn lane, two through lanes, and two right-turn lanes. East of this intersection along 17th Street the eastbound curb lane would be converted to provide only right-turn access into the adjacent properties and would be closed east of Fairmont Street.

7.3.2 *Phase 1 Intersection Operating Conditions*

Phase 1 is estimated to require 12 months to complete. The projected intersection peak-hour operating conditions during construction Phase 1 are listed in **Table 6**. Most of the intersections are projected to operate at acceptable levels of service with the exception of the four intersections shown in bold print in the table.

Table 6: Construction Period Phase 1 Intersection Peak Hour LOS

#	Intersection	AM Peak Hour			PM Peak Hour		
		Delay	V/C	LOS	Delay	V/C	LOS
1	Penn Way and 17th Street	25.7	0.60	C	37.9	0.63	D
2	I-5 NB Ramps/Santiago Street and 17th Street[1]	41.1	0.68	D	26.1	0.69	C
3	Lincoln Avenue and 17th Street[1]	24.2	0.57	C	21.1	0.68	C
	LOSSAN Crossing and 17th Street	52.1	-	-	69.3	-	-
	Combined Delay[2]	37.5	-	D	44.7	-	D
4	**Grand Avenue and 17th Street**	**147.5**	**1.05**	**F**	**136.8**	**1.13**	**F**
5	Main Street and I-5 NB Ramps/Edgewood Road	42.0	0.72	D	43.3	0.68	D
6	Penn Way and I-5 SB Ramps	25.6	0.44	C	23.0	0.43	C
7	Santiago Street and Washington Avenue[3]	11.7	n/a	B	14.8	n/a	B
8	**Santiago Street and Civic Center Dr/Stafford Street**	**40.9**	**n/a**	**E**	**164.8**	**n/a**	**F**
9	Santiago Street and Santa Ana Boulevard	56.9	0.72	E	74.5	0.86	E
10	**I-5 SB Ramps and Santa Ana Boulevard**	**56.0**	**0.71**	**E**	**69.9**	**0.71**	**E**
11	**Grand Avenue and Santa Ana Blvd/NB I-5 HOV Ramps**	**64.3**	**0.86**	**E**	**57.3**	**0.85**	**E**
12	Fairmont Street and 17th Street	13.4	n/a	B	12.9	n/a	B
13	Lincoln Avenue and Fairmont Street	10.8	n/a	B	8.8	n/a	A

Source: Iteris, Inc., 2011
Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.
1 – Analysis includes previously discussed construction-period modifications.
2 – The Combined Weighted Average takes into account that during gate down periods eastbound vehicles will be stopped west of Lincoln Avenue and westbound vehicles will be stopped east of the crossing. Therefore the delay is distributed between the intersection and the crossing.
3 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.
Bold text indicates unacceptable level of service.

7.3.3 *Phase 2 Construction Roadway Modifications*

To accommodate Phase 2 construction activity at the LOSSAN and 17th Street grade crossing, several intersection modifications must be made including the development of a temporary by-pass road around the crossing in Phase 1 and temporary lane reductions approaching and through construction areas. The following paragraphs outline the required construction modifications.

7.3.3.1 Lincoln Avenue and 17th Street (Phase 2)

During Phase 2 of the project construction the intersection would be completely removed until near the project completion. To reduce the potential for neighborhood cut-through traffic, a temporary one-way southbound roadway will be provided in the northwest quadrant of this intersection to serve southbound Lincoln to westbound 17th Street traffic during Phase 2 construction. The lane would connect to existing Lincoln Avenue near the northern limits of construction and will connect to the number three lane (curb lane) on 17th Street just east of Fairmont Street. The temporary connecting roadway will allow for the continued movement of south-to-westbound travel from Lincoln Avenue to 17th Street. The roadway will be removed as soon as the north approach of the Lincoln/17th intersection or connecting roadway is opened.

7.3.3.2 FAIRMONT STREET AND 17TH STREET

During Phase 2 the intersection of Fairmont Street and 17th Street will have a temporary traffic signal installed to improve local access from Fairmont Street and provide a signalized pedestrian crossing on 17th Street. The lane configuration of the intersection will not be changed from its Phase 1 condition.

7.3.4 *PHASE 2 INTERSECTION OPERATING CONDITIONS*

Phase 2 is estimated to require six months to complete. The projected intersection peak-hour operating conditions during construction Phase 2 are listed in **Table 7**. Most of the intersections are projected to operate at acceptable levels of service with the exception of the four intersections shown in bold print in the table.

TABLE 7: CONSTRUCTION PERIOD PHASE 2 INTERSECTION PEAK HOUR LOS

#	Intersection	AM Peak Hour			PM Peak Hour		
		Delay	V/C	LOS	Delay	V/C	LOS
1	Penn Way and 17th Street	23.7	0.61	C	37.9	0.63	D
2	I-5 NB Ramps/Santiago Street and 17th Street[1]	44.8	0.68	D	23.8	0.68	C
3	Lincoln Avenue and 17th Street[2]	-	-	-	-	-	-
4	**Grand Avenue and 17th Street**	**162.6**	**1.05**	**F**	**151.3**	**1.17**	**F**
5	Main Street and I-5 NB Ramps/Edgewood Road	42.0	0.72	D	43.3	0.68	D
6	Penn Way and I-5 SB Ramps	25.6	0.44	C	23.0	0.43	C
7	Santiago Street and Washington Avenue[3]	11.7	n/a	B	14.8	n/a	B
8	**Santiago Street and Civic Center Dr/Stafford Street**	**40.9**	**n/a**	**E**	**164.8**	**n/a**	**F**
9	Santiago Street and Santa Ana Boulevard	56.9	0.72	E	74.6	0.86	E
10	**I-5 SB Ramps and Santa Ana Boulevard**	**56.0**	**0.71**	**E**	**69.9**	**0.71**	**E**
11	**Grand Avenue and Santa Ana Blvd/NB I-5 HOV Ramps**	**64.3**	**0.86**	**E**	**57.3**	**0.85**	**E**
12	Fairmont Street and 17th Street[4]	18.9	0.50	B	12.7	0.56	B
13	Lincoln Avenue and Fairmont Street	10.8	n/a	B	8.9	n/a	A

Source: Iteris, Inc., 2011
Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.
1 – Analysis includes previously discussed construction-period modifications.
2 – Full intersection does not exist during this construction phase.
3 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.
4 – Temporary traffic signal installed during second phase of Project construction.
Bold text indicates unacceptable level of service.

7.4 CONSTRUCTION PERIOD TRAFFIC OPERATIONS WITH MITIGATION AND ENHANCEMENTS

Using the previously shown construction period traffic volumes and the LOS results in Tables 6 and 7, various options for improvements were evaluated to identify mitigation and system improvement measures to address poor operating conditions and continuity of access to area developments. Capacity analyses were conducted using the recommended mitigation measures discussed in the following section to determine what the projected peak hour levels of service will be and if any additional improvement measures would be required.

7.4.1 *Phase 1 Intersection Operating Conditions*

Phase 1 is estimated to require 12 months to complete. The three intersections indentified in the previous section (Grand Avenue/17th Street, Santiago Street/Civic Center Drive/Stafford Street, and Santa Ana Boulevard with the I-5 Ramps) are projected to experience failing levels or poor levels of service during Phase 1 construction that could be addressed through geometric improvements. The following discusses the recommended improvement measures at these three intersections.

7.4.1.1 Grand Avenue at 17th Street

As previously discussed this intersection is not built out to its ultimate configuration per the MPAH. Various configurations with additional traffic lanes were evaluated including options with a northbound right-turn and a second with both the northbound turn lane and a third southbound through lane. As will be shown later, adding only the right turn lanes will improve the LOS, but not to acceptable levels during both peak hours.

To address long-term operating conditions at this intersection a strategy for the buildout of the MPAH cross-section along with adaptive traffic signal controls. The analysis has assumed optimized traffic signal timings with the full widening of the intersection, but only optimization with the existing traffic signal equipment for the right-turn only addition.

7.4.1.2 Santiago Street and Civic Center Drive/Stafford Street

This intersection is currently controlled by stop signs on all four approaches. The projected volume of traffic will exceed the capacity of the all-way stop control during the peak hours both in the near and long-term timelines. This intersection should be improved to include a traffic signal with adaptive traffic control and restriping of two of the approaches. The eastbound approach should be restriped to have a dedicate left-turn lane and shared through/right-turn lane. The southbound approach should be restriped to have one dedicated left-turn lane, one through lane, and one shared through/right-turn lane. The north-south approaches would have protective/permissive left-turn phasing, while the east-west approaches will operate acceptably with just permissive left turns. The northbound approach should continue to provide one left-turn lane and one shared through/right-turn lane. The existing two-way left-turn lane will be narrowed to accommodate the additional striped lanes. In addition, the west side of Santiago Street should be restriped up to approximately 150 feet north of the intersection and have the one on-street parking space removed in this area to create an adequate transition from one to two southbound lanes in advance of the traffic signal.

7.4.1.3 I-5 Southbound Ramps and Santa Ana Boulevard

The operating conditions at this intersection during project construction are projected to be LOS E during the PM peak hour. However, to improve the operating condition, especially during the construction period, a recommended improvement is to add a westbound right-turn lane to the intersection. The addition of the right-turn lane was analyzed and was found to improve the level of service conditions during project construction and in future years after construction is completed, but would not improve conditions to LOS D.

7.4.1.4 Grand Avenue and Santa Ana Blvd/NB I-5 HOV Ramps

This intersection is projected to operate at LOS E during both phases of the project construction. However, options were evaluated to determine if any geometric or operational improvements could be implemented to improve the LOS, especially during the project's construction. The existing intersection is currently built out to the full MPAH cross-section so no additional approach lanes could be developed without additional right-of-way being acquired. One option that would improve the LOS slightly would be to install eastbound-to-southbound right turn overlap phasing to the traffic signal, so that right turns are served with the northbound to westbound left turn phase. The change would not improve operations to better than LOS E conditions, but would slightly reduce the per vehicle delay at the intersection.

Table 8 lists projected operating conditions with recommended improvement measures discussed in the subsequent sections. With the recommended changes most of the intersections will operate at acceptable levels of service both during the construction period and well after construction is completed.

7.4.2 *Phase 2 Intersection Operating Conditions*

Phase 2 is estimated to require six months to complete. The projected intersection peak-hour operating conditions during construction Phase 2 are listed in **Table 9**. Most of the intersections are projected to have about the same traffic volumes during the second construction phase as was projected for the first phase. Therefore, the same mitigation program is recommended with the exception of the other construction area changes that were previously discussed.

TABLE 8: CONSTRUCTION PERIOD PHASE 1 INTERSECTION PEAK HOUR LOS WITH MITIGATION AND ENHANCEMENTS

#	Intersection	AM Peak Hour			PM Peak Hour		
		Delay	V/C	LOS	Delay	V/C	LOS
4	**Grand Avenue and 17th Street**	**158.1**	**1.05**	**F**	**136.5**	**1.04**	**F**
	With NB right-turn lane	**136.2**	**1.05**	**F**	**94.9**	**1.00**	**F**
	With 3rd SB Through lane and NB RT Lane	68.3	0.91	E	77.0	1.00	E
8	**Santiago Street and Civic Center Dr/Stafford Street**	**40.9**	**n/a**	**E**	**164.8**	**n/a**	**F**
	With Traffic Signal	11.9	0.52	B	15.3	0.57	B
10	**I-5 SB Ramps and Santa Ana Boulevard**	**56.0**	**0.71**	**E**	**69.9**	**0.71**	**E**
	With WB right-turn lane	32.1	0.64	C	**57.5**	**0.63**	**E**

Source: Iteris, Inc.
Note: LOS based on HCM delay methodology.
Bold text indicates unacceptable level of service.

TABLE 9: CONSTRUCTION PERIOD PHASE 2 INTERSECTION PEAK HOUR LOS WITH MITIGATION AND ENHANCEMENTS

#	Intersection	AM Peak Hour			PM Peak Hour		
		Delay	V/C	LOS	Delay	V/C	LOS
4	**Grand Avenue and 17th Street**	**158.1**	**1.05**	**F**	**136.5**	**1.04**	**F**
	With NB right-turn lane	**136.2**	**1.05**	**F**	**94.9**	**1.00**	**F**
	With 3rd SB Through lane and NB RT Lane	68.3	0.91	E	77.0	1.00	E
8	**Santiago Street and Civic Center Dr/Stafford Street****	**40.9**	**n/a**	**E**	**164.8**	**n/a**	**F**
	With Traffic Signal	11.9	0.52	B	15.3	0.57	B
10	**I-5 SB Ramps and Santa Ana Boulevard**	**56.0**	**0.71**	**E**	**69.9**	**0.71**	**E**
	With WB right-turn lane	32.1	0.64	C	**57.5**	**0.63**	**E**

Source: Iteris, Inc.
Note: LOS based on HCM delay methodology.
Bold text indicates unacceptable level of service.

7.5 ADDITIONAL ENHANCEMENTS TO IMPROVE AREA TRAFFIC CONDITIONS

To accommodate the projected changes in lane configurations, traffic patterns, and volumes during the project's construction the following changes to existing study area intersections are recommended:

7.5.1 *SANTIAGO STREET AND SANTA ANA BOULEVARD INTERSECTION*

This intersection is located along one route of the proposed Santa Ana Fixed Guideway project. Any physical improvements or reconfiguration of the intersection will require coordination with that proposed project. In the current studies of alternatives, the intersection may be

reconfigured to accommodate the proposed at-grade streetcar operations. Since the timeline for the Fixed Guideway project is not known at this time, the operation at this intersection may need to be reviewed prior to commencement of the 17th Street grade separation if the Fixed Guideway project is operational at the start of, or during construction of, the 17th Street project. Copies of the optional configurations for this intersection with the Fixed Guideway Project in place are provided in the **Appendix**.

7.5.2 *Other Programs to Improve LOS Conditions*

In addition to discreet mitigation measures to address impacts at the specific intersections, other non-geometric measures should be considered to help reduce overall congestion within the study area, especially during the construction period. In the *Regional Traffic Study for Railroad Grade Separation Projects* conducted by CH2MHill in November 2010 for OCTA, the study identified strategies for addressing related to the BNSF grade separation crossing projects. These can be of value for this project as well.

7.5.2.1 Public Awareness Campaign

One of the regional measures identified in that study that would be applicable for the 17th Street crossing project is the development of a public awareness campaign.

For this project the campaign would include an informational program developed in conjunction with OCTA to inform local businesses and residents of the construction detour routes, days and times of construction, especially closures, and the preferred detour routes to avoid congestion. The informational program would also encourage businesses to have deliveries made during off-peak times and to inform suppliers about alternative access routes to avoid driving through construction areas.

The program would also inform residents and businesses of options to driving through the construction areas by encouraging them to use alternative modes, shift travel to non-construction periods, and other options to allow motorists to make more informed choices regarding travel in the area and as a result reduce vehicle travel in the area.

Tasks can include developing a public outreach strategy and process for disseminating information to area businesses and residents and posting current project activity information on the City's web site and other local media outlets.

The City will work with the Logan, Lacy, French Park, French Court, and Park Santiago neighborhoods as needed to monitor traffic in the neighborhoods during construction to both reduce commuter through traffic and watch of project impacts.

7.5.2.2 Adaptive Traffic Signal Control

The City has recently upgraded area traffic signals to current standards, including the ability to monitor major intersection operations via cameras at the City's Traffic Management Center (TMC). This provides the ability to respond to observed traffic congestion via adjusting traffic

signal timing from the TMC. This may be a viable option for times when the TMC is staffed and communications between the TMC and field are operating. For the substantial number of hours that the TMC is not budgeted to be staffed during the extended construction phase of this project, construction and/or traffic incidents may substantially affect traffic conditions during unmonitored periods. While large-scale construction projects and regular events can be anticipated, other disruptions such as crashes are impossible for time-of-day signal timing to accommodate. With adaptive signal control technology, information is collected and signal timing is updated continually to benefit the traveling public.

The Federal Highway Administration website on adaptive traffic signal control states that: *"Outdated traffic signal timing incurs substantial costs to businesses and consumers. They account for more than 10 percent of all traffic delay and congestion on major routes alone."* [2]

It is recommended that in addition to the new traffic signal at the Santiago Street and Civic Center intersection all of the study intersections along Santa Ana Boulevard and Santiago Street corridors be considered and designed for improved operations by adding adaptive traffic signal control to the Santa Ana Boulevard corridor. The analysis presented in this report includes traffic signal timings that have been partially optimized to improve service along the corridor. However, adaptive control systems and operations would improve conditions to a greater degree than presented here.

7.5.2.3 Travel Demand Management Program

Areawide travel demand reduction measures should be encouraged and explored by the City, in cooperation with local businesses and other agencies to identify potential measures that could assist in reducing single occupant travel demand and shifts to other modes of travel, including walking, bicycling, and riding transit. This would reduce the volume of traffic using the Santa Ana Boulevard, and other, corridors.

7.5.3 *Pedestrian Accommodations*

To provide access during project construction for pedestrians crossing 17th Street and Lincoln Avenue there will be temporary accommodation set up during both phases of the project construction. During construction Phase 1 the temporary traffic signal at the relocated intersection of Lincoln Avenue and 17th Street will have pedestrian push buttons and walk lights. During the second phase of project construction, a temporary traffic signal will be installed at the Fairmont Street and 17th Street intersection to provide a signalized pedestrian crossing on 17th Street near Lincoln Avenue. To cross Lincoln Avenue during the Phase 2 construction, pedestrians will need to go either north or south of the construction zone to the next intersection. After completion of the project, or as soon as practical, the new permanent pedestrian facilities will be open along the new 17th Street and Lincoln Street corridors. During all phases of project construction a continuous east-west pedestrian corridor will be maintained along 17th Street.

[2] http://www.fhwa.dot.gov/everydaycounts/technology/adsc/

7.5.4 *BICYCLES*

Bicycles will continue to be able to share the road with other traffic along 17th Street during project construction. The temporary by-pass road parallel to 17th Street will be designed with outside lanes wide enough to accommodate shared bicycle and automobile use. To cross 17th Street bicyclists will be encouraged to use other parallel corridors to avoid construction traffic and increased intersection delay. Such encouragement should be provided by coordinating with City staff on striping of the Santa Ana proposed bikeways. Class II facilities are planned and documented in the *OCTA Commuter Bikeways Strategic Plan* along Penn Way/Santiago Street between 17th Street and 6th Street, and along Santa Ana Boulevard between Raitt Street and Grand Avenue. Detailed striping plans should be developed along the project detour segments of these streets to determine if Class II facilities can be accommodated within existing pavement widths, or if Class III and "Share the Road" pavement markings can be accommodated to encourage bicycling.

7.5.5 *TRANSIT STOPS*

The existing OCTA bus stops along 17th Street near Lincoln Avenue will need to be temporarily relocated during the project construction. During Phase 1 the existing stops near Lincoln Avenue can be relocated to the new bypass road just to the north. During Phase 2 of construction the stops should be relocated to the west to the new temporary traffic signal at Fairmont Street, which is located about 600 feet to the west. The existing transit stops in the area where relocations will be required were shown in **Figure 5**. Any relocation of transit stops will need to be coordinated with OCTA to confirm the stops are compliant with current standards and can accommodate required needs and services.

8.0 FUTURE YEAR POST-CONSTRUCTION OPERATING CONDITIONS

Analyses were conducted to identify operating conditions for the four project options:

- Baseline (No-Build)
- Alternative 1C
- Alternative 1A
- Alternative 2A

The intersection operating conditions for each were evaluated for the weekday AM and PM peak hours. Projected future daily traffic volumes were not available so no daily roadway segment evaluations were completed.

8.1 BASELINE (NO-BUILD) ALTERNATIVE

The Baseline (No-Build) condition assumes that all of the geometric conditions and intersection operating parameters will remain the same as existing with the exception that traffic signal timings would be optimized to better address future traffic volumes and patterns. In addition, the existing at-grade crossing of the LOSSAN corridor and 17th Street would also remain.

Table 10 summarizes the peak-hour intersection operating conditions at the 13 analyzed intersections for Year 2020. The analyses for horizon year 2035 are shown in **Table 11**. The projected Baseline alternative intersection turning movement volumes for Years 2020 and 2035 were previously shown in **Figures 7 and 8**.

As shown in the tables, the intersection of Grand Avenue with 17th Street is projected to operate at LOS F in both years and peak hours. The widening of Grand Avenue to the full MPAH cross-section will improve operating conditions and provide an acceptable LOS in Year 2020. But, by Year 2035 the intersection is projected to be operating at an unacceptable LOS.

By year 2035 the intersection of Santiago Street/ Washington Avenue is also projected to be operating at a poor LOS during the PM peak hour.

By year 2035 the intersection of Grand Avenue/ I-5 HOV Exit Ramp with Santa Ana Boulevard is also projected to be operating at a poor LOS during the AM peak hour.

TABLE 10: YEAR 2020 BASELINE (NO-BUILD) INTERSECTION PEAK HOUR LOS

#	Intersection	AM Peak Hour			PM Peak Hour		
		Delay	V/C	LOS	Delay	V/C	LOS
1	Penn Way and 17th Street	25.5	0.60	C	38.1	0.63	D
2	I-5 NB Ramps/Santiago Street and 17th Street	41.9	0.68	D	22.4	0.62	C
3	Lincoln Avenue and 17th Street	27.8	0.51	C	21.9	0.63	D
	LOSSAN Crossing and 17th Street	43.9	-	-	47.7	-	-
	Combined Delay[1]	35.1	-	D	34.0	-	C
4	**Grand Avenue and 17th Street**	**122.3**	**0.99**	**F**	**111.5**	**1.06**	**F**
	With NB RT lanes	**89.7**	**0.99**	**F**	75.7	0.97	E
	With 3rd SB TH and NB RT lanes	61.6	0.87	E	69.7	0.97	E
5	Main Street and I-5 NB Ramps/Edgewood Road	42.0	0.72	D	43.3	0.68	D
6	Penn Way and I-5 SB Ramps	25.6	0.44	C	23.0	0.43	C
7	Santiago Street and Washington Avenue[2]	12.9	n/a	B	18.5	n/a	C
8	**Santiago Street and Civic Center Dr/Stafford Street**	**40.0**	**n/a**	**E**	**105.5**	**n/a**	**F**
	With Traffic Signal	12.4	0.53	B	14.7	0.52	B
9	Santiago Street and Santa Ana Boulevard	27.4	0.64	C	29.8	0.74	C
10	**I-5 SB Ramps and Santa Ana Boulevard**	34.8	0.66	C	**68.6**	**0.68**	**E**
	With WB RT Lane	29.0	0.59	C	**56.9**	**0.60**	**E**
11	**Grand Avenue and Santa Ana Blvd/NB I-5 HOV Ramps**	**61.1**	**0.85**	**E**	45.5	0.80	D
12	Fairmont Street and 17th Street	10.6	n/a	B	11.3	n/a	B
13	Lincoln Avenue and Fairmont Street	10.8	n/a	B	10.1	n/a	B

Source: Iteris, Inc., 2011

Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.

1 – The Combined Weighted Average takes into account that during gate down periods eastbound vehicles will be stopped west of Lincoln Avenue and westbound vehicles will be stopped east of the crossing. Therefore the delay is distributed between the intersection and the crossing.

2 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.

Bold text indicates unacceptable level of service.

TABLE 11: YEAR 2035 BASELINE (NO-BUILD) INTERSECTION PEAK HOUR LOS

#	Intersection	AM Peak Hour			PM Peak Hour		
		Delay	V/C	LOS	Delay	V/C	LOS
1	Penn Way and 17th Street	26.6	0.63	C	52.6	0.67	D
2	I-5 NB Ramps/Santiago Street and 17th Street	42.6	0.69	D	25.0	0.67	C
3	Lincoln Avenue and 17th Street	24.3	0.54	C	22.9	0.68	C
	LOSSAN Crossing and 17th Street	45.5	-	-	47.7	-	-
	Combined Delay[1]	33.9	-	C	34.6	-	C
4	**Grand Avenue and 17th Street**	**186.5**	**1.18**	**F**	**171.3**	**1.14**	**F**
	With NB RT lane	**154.9**	**1.18**	**F**	**128.4**	**1.14**	**F**
	With 3rd SB TH and NB RT lanes	**95.8**	**1.01**	**F**	**100.8**	**1.10**	**F**
5	Main Street and I-5 NB Ramps/Edgewood Road	42.6	0.72	D	45.8	0.71	D
6	Penn Way and I-5 SB Ramps	36.8	0.51	D	29.9	0.58	C
7	**Santiago Street and Washington Avenue**	22.5	n/a	C	**39.0**	**n/a**	**E**
8	**Santiago Street and Civic Center Dr/Stafford Street[2]**	**70.9**	**n/a**	**F**	**176.1**	**n/a**	**F**
	With Traffic Signal	12.6	0.57	B	15.9	0.57	B
9	Santiago Street and Santa Ana Boulevard	77.5	0.81	E	51.4	0.84	D
10	**I-5 SB Ramps and Santa Ana Boulevard**	**57.5**	**0.73**	**E**	**76.6**	**0.76**	**E**
	With WB RT Lane	30.9	0.64	C	**63.6**	**0.69**	**E**
11	**Grand Avenue and Santa Ana Blvd/NB I-5 HOV Ramps**	**95.3**	**1.01**	**F**	54.7	0.87	D
12	Fairmont Street and 17th Street	10.3	n/a	B	11.2	n/a	B
13	Lincoln Avenue and Fairmont Street	10.9	n/a	B	10.2	n/a	B

Source: Iteris, Inc., 2011
Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.
1 – The Combined Weighted Average takes into account that during gate down periods eastbound vehicles will be stopped west of Lincoln Avenue and westbound vehicles will be stopped east of the crossing. Therefore the delay is distributed between the intersection and the crossing.
2 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.
Bold text indicates unacceptable level of service.

8.2 ALTERNATIVE 1C

Alternative 1C was chosen as the recommended alternative. It will retain the Lincoln Avenue and 17th Street intersection by depressing both roadways and creating an underpass with 17th Street going under the LOSSAN corridor. **Table 12** summarizes the peak-hour intersection operating conditions at the 13 analyzed intersections for Year 2020. The analyses for horizon year 2035 are shown in **Table 13**. The projected Baseline alternative intersection turning movement volumes for Years 2020 and 2035 are shown in **Figures 13 and 14**.

As shown in the tables, the intersection of Grand Avenue with 17th Street is projected to operate at LOS F in both years and peak hours. The widening of Grand Avenue to the full MPAH

cross-section will improve operating conditions and provide an acceptable LOS in Year 2020. But, by Year 2035 the intersection is projected to be operating at an unacceptable LOS.

By year 2035 the intersection of Santiago Street/Washington Avenue is also projected to be operating at a poor LOS during the PM peak hour.

The addition of a traffic signal at the Santiago Street/Civic Center Drive intersection will substantially reduce traffic delay. The westbound right-turn lane at the I-5 Southbound Ramps/Santa Ana Boulevard intersection will reduce delay, but will not improve the intersection's LOS letter grade.

TABLE 12: YEAR 2020 ALTERNATIVE 1C INTERSECTION PEAK HOUR LOS

#	Intersection	AM Peak Hour			PM Peak Hour		
		Delay	V/C	LOS	Delay	V/C	LOS
1	Penn Way and 17th Street	25.5	0.60	C	38.6	0.63	D
2	I-5 NB Ramps/Santiago Street and 17th Street	40.0	0.67	D	21.6	0.62	C
3	Lincoln Avenue and 17th Street	24.2	0.51	C	18.2	0.63	D
4	**Grand Avenue and 17th Street**	**119.7**	**0.99**	**F**	**108.9**	**1.06**	**F**
	With NB RT lane	**89.7**	**0.99**	**F**	75.7	0.97	E
	With 3rd SB TH and NB RT lanes	61.6	0.87	E	69.7	0.97	E
5	Main Street and I-5 NB Ramps/Edgewood Road	42.0	0.72	D	43.3	0.68	D
6	Penn Way and I-5 SB Ramps	25.6	0.44	C	23.0	0.43	C
7	Santiago Street and Washington Avenue[1]	12.9	n/a	B	18.5	n/a	C
8	**Santiago Street and Civic Center Dr/Stafford Street**	**40.0**	**n/a**	**E**	**105.5**	**n/a**	**F**
	With Traffic Signal	12.4	0.53	B	14.7	0.52	B
9	Santiago Street and Santa Ana Boulevard	27.4	0.64	C	29.8	0.74	C
10	**I-5 SB Ramps and Santa Ana Boulevard**	34.8	0.66	C	**68.6**	**0.68**	**E**
	With WB RT Lane	29.0	0.59	C	**56.9**	**0.60**	**E**
11	**Grand Avenue and Santa Ana Blvd/NB I-5 HOV Ramps**	**61.1**	**0.85**	**E**	45.5	0.80	D
12	Fairmont Street and 17th Street	10.6	n/a	B	11.3	n/a`	B
13	Lincoln Avenue and Fairmont Street	10.8	n/a	B	10.1	n/a	B

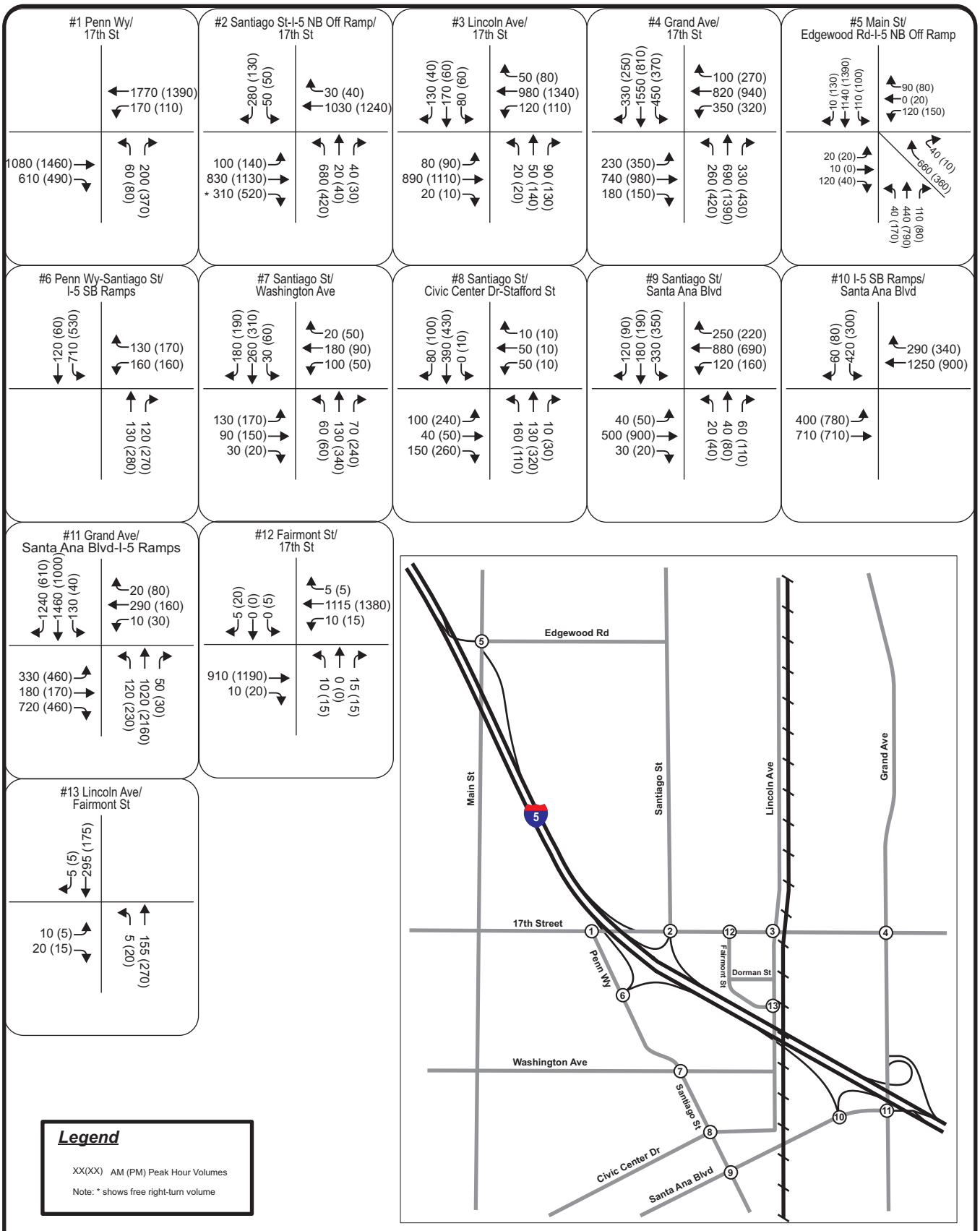
Source: Iteris, Inc., 2011
Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.
1 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.
Bold text indicates unacceptable level of service.

The intersection of Grand Avenue/ I-5 HOV Exit Ramp with Santa Ana Boulevard is also projected to be operating at a poor LOS during the AM peak hour. As was previously discussed, no physical mitigation was identified that would improve the LOS to an acceptable level. However, the adding right-turn overlap phasing for the eastbound-to-southbound right-turn movement would improve conditions marginally.

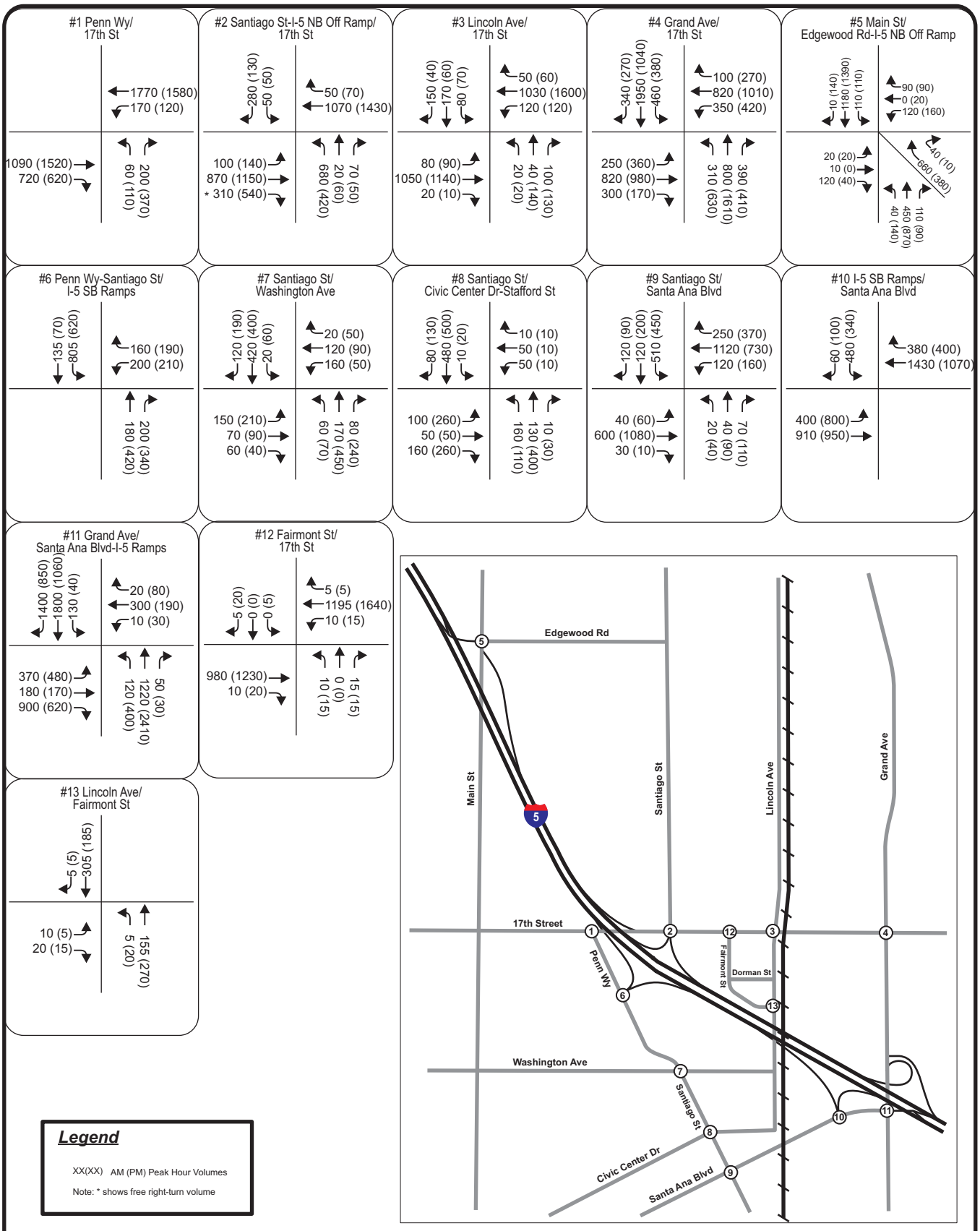
TABLE 13: YEAR 2035 ALTERNATIVE 1C INTERSECTION PEAK HOUR LOS

#	Intersection	AM Peak Hour			PM Peak Hour		
		Delay	V/C	LOS	Delay	V/C	LOS
1	Penn Way and 17th Street	26.7	0.63	C	52.6	0.67	D
2	I-5 NB Ramps/Santiago Street and 17th Street	40.0	0.69	D	25.2	0.67	C
3	Lincoln Avenue and 17th Street	21.0	0.54	C	17.7	0.68	B
4	**Grand Avenue and 17th Street**	**186.3**	**1.18**	**F**	**168.9**	**1.14**	**F**
	With NB RT lane	**154.9**	**1.18**	**F**	**128.4**	**1.14**	**F**
	With 3rd SB TH and NB RT lanes	**95.8**	**1.01**	**F**	**100.8**	**1.10**	**F**
5	Main Street and I-5 NB Ramps/Edgewood Road	42.6	0.72	D	45.8	0.71	D
6	Penn Way and I-5 SB Ramps	36.8	0.51	D	29.9	0.58	C
7	**Santiago Street and Washington Avenue**[1]	22.5	n/a	C	**39.0**	**n/a**	**E**
8	**Santiago Street and Civic Center Dr/Stafford Street**	**70.9**	**n/a**	**F**	**176.1**	**n/a**	**F**
	With Traffic Signal	12.6	0.57	B	15.9	0.57	B
9	Santiago Street and Santa Ana Boulevard	77.5	0.81	E	51.4	0.84	D
10	**I-5 SB Ramps and Santa Ana Boulevard**	**57.5**	**0.73**	**E**	**76.6**	**0.76**	**E**
	With WB RT Lane	30.9	0.64	C	**63.6**	**0.69**	**E**
11	**Grand Avenue and Santa Ana Blvd/NB I-5 HOV Ramps**	**95.3**	**1.01**	**F**	54.7	0.87	D
12	Fairmont Street and 17th Street	10.3	n/a	B	11.2	n/a	B
13	Lincoln Avenue and Fairmont Street	10.9	n/a	B	10.2	n/a	B

Source: Iteris, Inc., 2011
Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.
1 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.
Bold text indicates unacceptable level of service.



17th Street LOSSAN Grade Separation
Figure 13
Year 2020 Alternative 1C Peak Hour Volumes



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17th Street LOSSAN Grade Separation
Figure 14
Year 2035 Alternative 1C Peak Hour Volumes

8.3 ALTERNATIVE 1A

Alternative 1A will grade separate 17th Street from both the LOSSAN corridor tracks and Lincoln Avenue. The connection between 17th Street and Lincoln Avenue will be provided by a new connecting roadway in the northwest quadrant of the overcrossing. This will result in the Lincoln Avenue/17th Street intersection being split into two intersections and vehicles turning from one street to the other needing to travel through both intersections. The result is some additional delay for turning vehicles and a projected shift in some traffic from using the Lincoln Avenue/17th Street intersection for some movements to other routes in the area. **Table 14** summarizes the peak-hour intersection operating conditions at the 14 analyzed intersections for Year 2020. The analyses for horizon year 2035 are shown in **Table 15**. The projected Baseline alternative intersection turning movement volumes for Years 2020 and 2035 are shown in **Figures 15 and 16**.

As shown in the tables, the intersection of Grand Avenue with 17th Street is projected to operate at LOS F in both years and peak hours. The widening of Grand Avenue to the full MPAH cross-section will improve operating conditions and provide an acceptable LOS in Year 2020. But, by Year 2035 the intersection is projected to be operating at an unacceptable LOS.

By year 2035 the intersection of Santiago Street/Washington Avenue is also projected to be operating at a poor LOS during the PM peak hour.

The addition of a traffic signal at the Santiago Street/Civic Center Drive intersection will substantially reduce traffic delay. The westbound right-turn lane at the I-5 Southbound Ramps/Santa Ana Boulevard intersection will reduce delay, but will not improve the intersection's LOS letter grade.

The intersection of Grand Avenue/I-5 HOV Exit Ramp with Santa Ana Boulevard is also projected to be operating at a poor LOS during the AM peak hour. As was previously discussed, no physical mitigation was identified that would improve the LOS to an acceptable level. However, the adding right-turn overlap phasing for the eastbound-to-southbound right-turn movement would improve conditions marginally.

TABLE 14: YEAR 2020 ALTERNATIVE 1A INTERSECTION PEAK HOUR LOS

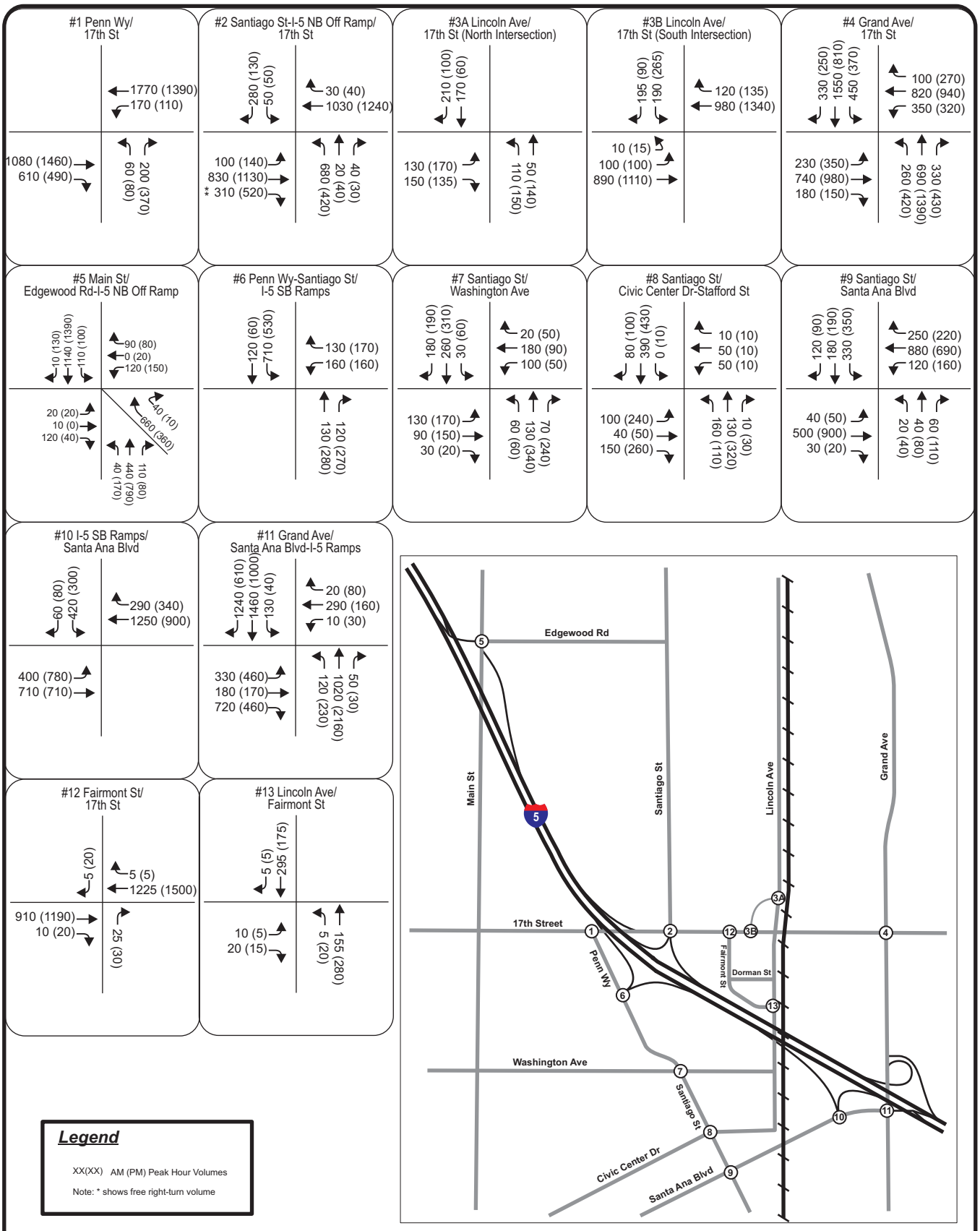
#	Intersection	AM Peak Hour			PM Peak Hour		
		Delay	V/C	LOS	Delay	V/C	LOS
1	Penn Way and 17th Street	24.3	0.61	C	38.0	0.63	D
2	I-5 NB Ramps/Santiago Street and 17th Street	34.5	0.67	C	27.6	0.62	C
3a	Lincoln Avenue and 17th Street (north)	19.5	n/a	C	21.2	n/a	C
3b	Lincoln Avenue and 17th Street (south)	41.1	0.60	D	31.1	0.66	C
4	**Grand Avenue and 17th Street**	**122.3**	**1.18**	**F**	**111.5**	**1.14**	**F**
	With NB RT lane	**89.7**	**0.99**	**F**	75.7	0.97	E
	With 3rd SB TH and NB RT lanes	61.6	0.87	E	69.7	0.97	E
5	Main Street and I-5 NB Ramps/Edgewood Road	42.0	0.72	D	43.3	0.68	D
6	Penn Way and I-5 SB Ramps	25.6	0.44	C	23.0	0.43	C
7	Santiago Street and Washington Avenue[1]	12.9	n/a	B	18.5	n/a	C
8	**Santiago Street and Civic Center Dr/Stafford Street**	**40.0**	**n/a**	**E**	**105.5**	**n/a**	**F**
	With Traffic Signal	12.4	0.53	B	14.7	0.52	B
9	Santiago Street and Santa Ana Boulevard	27.4	0.64	C	29.8	0.74	C
10	**I-5 SB Ramps and Santa Ana Boulevard**	34.8	0.66	C	**68.6**	**0.68**	**E**
	With WB RT Lane	29.0	0.59	C	**56.9**	**0.60**	**E**
11	**Grand Avenue and Santa Ana Boulevard/NB I-5 HOV Ramps**	**61.1**	**0.85**	**E**	44.8	0.80	D
12	Fairmont Street and 17th Street	9.2	n/a	A	12.8	n/a	B
13	Lincoln Avenue and Fairmont Street	10.9	n/a	B	10.1	n/a	B

Source: Iteris, Inc., 2011
Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.
1 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.
Bold text indicates unacceptable level of service.

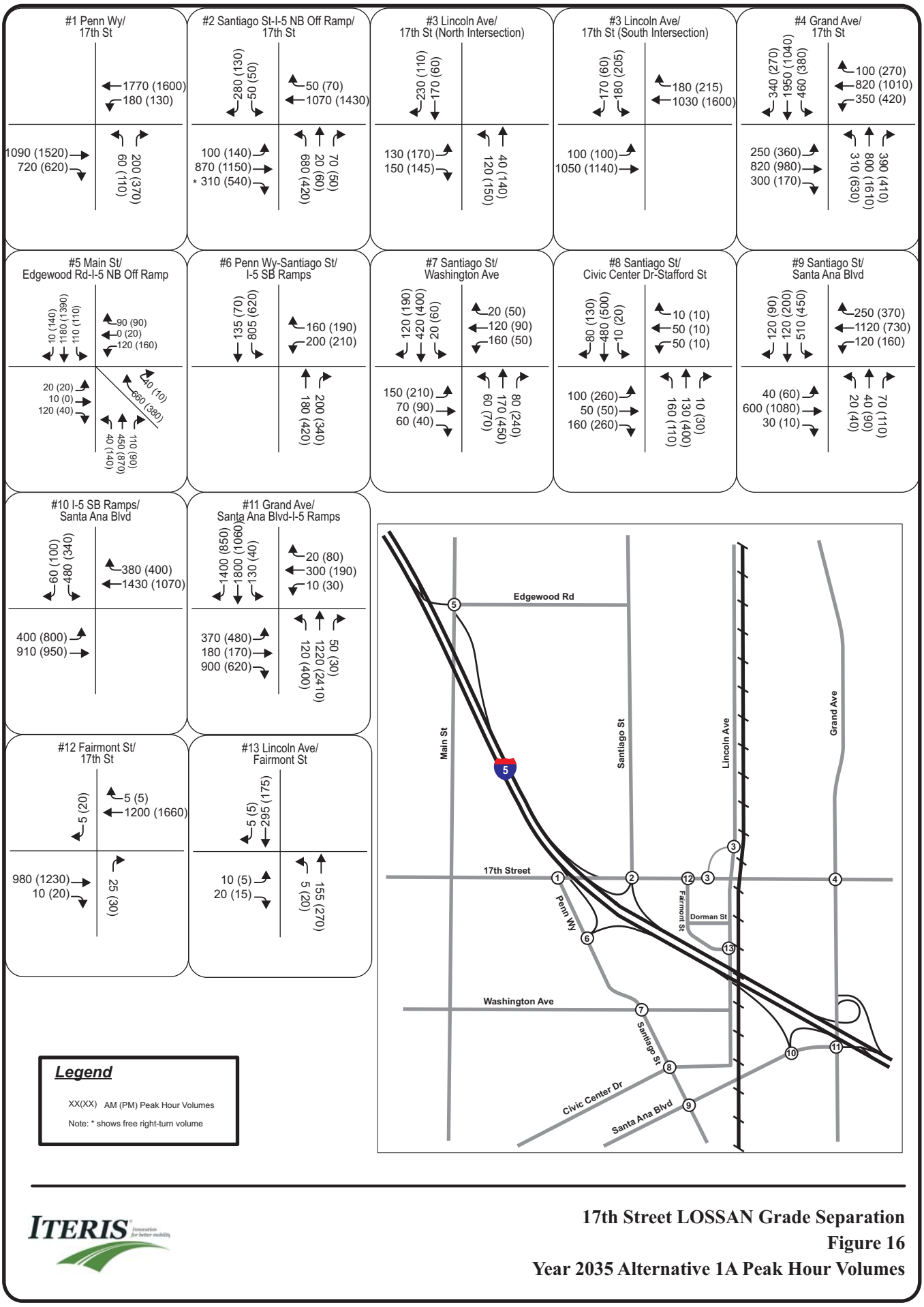
TABLE 15: YEAR 2035 ALTERNATIVE 1A INTERSECTION PEAK HOUR LOS

#	Intersection	AM Peak Hour			PM Peak Hour		
		Delay	V/C	LOS	Delay	V/C	LOS
1	Penn Way and 17th Street	30.6	0.63	C	52.7	66.9	D
2	I-5 NB Ramps/Santiago Street and 17th Street	54.3	0.67	D	30.9	0.67	C
3a	Lincoln Avenue and 17th Street (north)	20.6	n/a	C	21.8	n/a	C
3b	Lincoln Avenue and 17th Street (south)	28.2	0.63	C	44.4	0.66	D
4	**Grand Avenue and 17th Street**	**174.9**	**1.18**	**F**	**150.7**	**1.14**	**F**
	With NB RT lane	**154.9**	**1.18**	**F**	**128.4**	**1.14**	**F**
	With 3rd SB TH and NB RT lanes	**95.8**	**1.01**	**F**	**100.8**	**1.10**	**F**
5	Main Street and I-5 NB Ramps/Edgewood Road	42.6	0.72	D	45.8	0.71	D
6	Penn Way and I-5 SB Ramps	36.8	0.51	D	29.9	0.58	C
7	Santiago Street and Washington Avenue[1]	22.5	n/a	C	**39.0**	**n/a**	**E**
8	Santiago Street and Civic Center Drive/Stafford Street	**70.9**	**n/a**	**F**	**176.1**	**n/a**	**F**
	With Traffic Signal	12.6	0.57	B	15.9	0.57	B
9	Santiago Street and Santa Ana Boulevard	77.5	0.81	E	51.4	0.84	D
10	**I-5 SB Ramps and Santa Ana Boulevard**	**57.5**	**0.73**	**E**	**76.6**	**0.76**	**E**
	With WB RT Lane	30.9	0.64	C	**63.6**	**0.69**	**E**
11	**Grand Avenue and Santa Ana Boulevard /NB I-5 HOV Ramps**	**95.3**	**1.01**	**F**	54.7	0.87	D
12	Fairmont Street and 17th Street	11.4	n/a	B	13.6	n/a	B
13	Lincoln Avenue and Fairmont Street	10.1	n/a	B	10.1	n/a	B

Source: Iteris, Inc., 2011
Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.
1 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.
Bold text indicates unacceptable level of service.



17th Street LOSSAN Grade Separation
Figure 15
Year 2020 Alternative 1A Peak Hour Volumes



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17th Street LOSSAN Grade Separation

Figure 16

Year 2035 Alternative 1A Peak Hour Volumes

8.4 ALTERNATIVE 2A

Alternative 2A will grade separate 17th Street from both the LOSSAN corridor tracks and Lincoln Avenue by having 17th Street going over both. The connection between Lincoln Avenue and 17th Street will be provided by improvements to local roadways including Fairmont Street and Dorman Street in the southwest quadrant of the overcrossing. The result is the Lincoln Avenue/17th Street intersection is eliminated and vehicles turning from one street to the other will need to use Fairmont Street and possibly Dorman Street. The result is some additional delay for turning vehicles and a projected shift in some traffic from using the Lincoln Avenue/17th Street intersection for some movements to other routes in the area. **Table 16** summarizes the peak-hour intersection operating conditions at the 13 analyzed intersections for Year 2020. The analyses for horizon year 2035 are shown in **Table 17**. The projected Baseline alternative intersection turning movement volumes for Years 2020 and 2035 are shown in **Figures 17 and 18**.

As shown in the tables, the intersection of Grand Avenue with 17th Street is projected to operate at LOS F in both years and peak hours. The widening of Grand Avenue to the full MPAH cross-section will improve operating conditions and provide an acceptable LOS in Year 2020. But, in Year 2035 the intersection is projected to be operating at an unacceptable LOS.

By year 2035 the intersection of Santiago Street/ Washington Avenue is also projected to be operating at a poor LOS during the PM peak hour.

The addition of a traffic signal at the Santiago Street/Civic Center Drive intersection will substantially reduce traffic delay. The westbound right-turn lane at the I-5 Southbound Ramps/Santa Ana Boulevard intersection will reduce delay, but will not improve the intersection's LOS letter grade.

The intersection of Grand Avenue/I-5 HOV Exit Ramp with Santa Ana Boulevard is also projected to be operating at a poor LOS during the AM peak hour. As was previously discussed, no physical mitigation was identified that would improve the LOS to an acceptable level. However, the adding right-turn overlap phasing for the eastbound-to-southbound right-turn movement would improve conditions marginally.

TABLE 16: YEAR 2020 ALTERNATIVE 2A INTERSECTION PEAK HOUR LOS

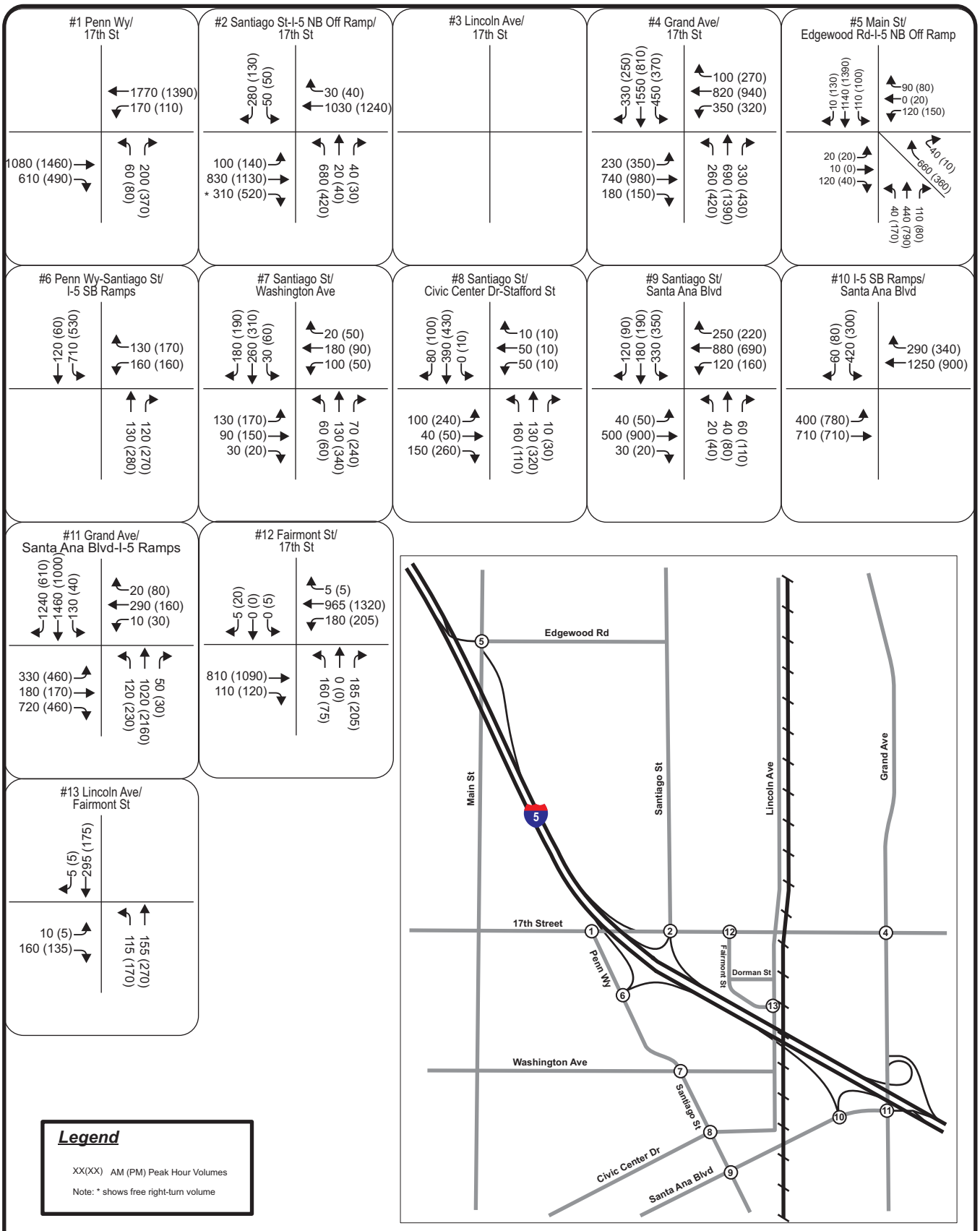
#	Intersection	AM Peak Hour			PM Peak Hour		
		Delay	V/C	LOS	Delay	V/C	LOS
1	Penn Way and 17th Street	24.2	0.60	C	38.0	0.63	D
2	I-5 NB Ramps/Santiago Street and 17th Street	43.8	0.67	D	27.6	0.62	C
3	Lincoln Avenue and 17th Street	-	-	-	-	-	-
4	**Grand Avenue and 17th Street**	**122.3**	**0.99**	**F**	**111.5**	**1.06**	**F**
	With NB RT lanes	**89.7**	**0.99**	**F**	75.7	0.97	E
	With 3rd SB TH and NB RT lanes	61.6	0.87	E	69.7	0.97	E
5	Main Street and I-5 NB Ramps/Edgewood Road	42.0	0.72	D	43.3	0.68	D
6	Penn Way and I-5 SB Ramps	25.6	0.44	C	23.0	0.43	C
7	Santiago Street and Washington Avenue[1]	12.9	n/a	B	18.5	n/a	C
8	**Santiago Street and Civic Center Drive/Stafford Street**	**40.0**	**n/a**	**E**	**105.5**	**n/a**	**F**
	With Traffic Signal	12.4	0.53	B	14.7	0.52	B
9	Santiago Street and Santa Ana Boulevard	27.4	0.64	E	29.8	0.74	C
10	**I-5 SB Ramps and Santa Ana Boulevard**	34.8	0.66	C	**68.6**	**0.68**	**E**
	With WB RT Lane	29.0	0.59	C	**56.9**	**0.60**	**E**
11	**Grand Avenue and Santa Ana Blvd/NB I-5 HOV Ramps**	**61.1**	**0.85**	**E**	44.8	0.80	D
12	Fairmont Street and 17th Street	35.9	0.54	D	37.8	0.56	D
13	Lincoln Avenue and Fairmont Street	11.9	n/a	C	10.4	n/a	B

Source: Iteris, Inc., 2011
Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.
1 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.
Bold text indicates unacceptable level of service.

TABLE 17: YEAR 2035 ALTERNATIVE 2A INTERSECTION PEAK HOUR LOS

#	Intersection	AM Peak Hour			PM Peak Hour		
		Delay	V/C	LOS	Delay	V/C	LOS
1	Penn Way and 17th Street	26.5	0.63	C	50.6	0.67	D
2	I-5 NB Ramps/Santiago Street and 17th Street	44.2	0.69	D	26.0	0.67	C
3	Lincoln Avenue and 17th Street	-	-	-	-	-	-
4	**Grand Avenue and 17th Street**	**186.5**	**1.18**	**F**	**170.7**	**1.14**	**F**
	With NB RT lane	**154.9**	**1.18**	**F**	**128.4**	**1.14**	**F**
	With 3rd SB TH and NB RT lanes	**95.8**	**1.01**	**F**	**100.8**	**1.10**	**F**
5	Main Street and I-5 NB Ramps/Edgewood Road	42.6	0.72	D	45.0	0.71	D
6	Penn Way and I-5 SB Ramps	36.8	0.51	D	29.9	58.1	D
7	Santiago Street and Washington Avenue[1]	22.5	n/a	C	**39.0**	**n/a**	**E**
8	**Santiago Street and Civic Center Drive/Stafford Street**	**70.9**	**n/a**	**F**	**176.1**	**n/a**	**F**
	With Traffic Signal	12.6	0.57	B	15.9	0.57	B
9	Santiago Street and Santa Ana Boulevard	77.5	0.81	E	51.4	0.84	D
10	**I-5 SB Ramps and Santa Ana Boulevard**	**57.5**	**0.73**	**E**	**76.6**	**0.76**	**E**
	With WB RT Lane	30.9	0.64	C	**63.6**	**0.69**	**E**
11	**Grand Avenue and Santa Ana Blvd/NB I-5 HOV Ramps**	**95.3**	**1.01**	**F**	54.7	0.87	D
12	Fairmont Street and 17th Street	18.2	0.56	B	14.6	0.57	B
13	Lincoln Avenue and Fairmont Street	12.0	n/a	B	18.1	n/a	C

Source: Iteris, Inc., 2011
Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.
1 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.
Bold text indicates unacceptable level of service.



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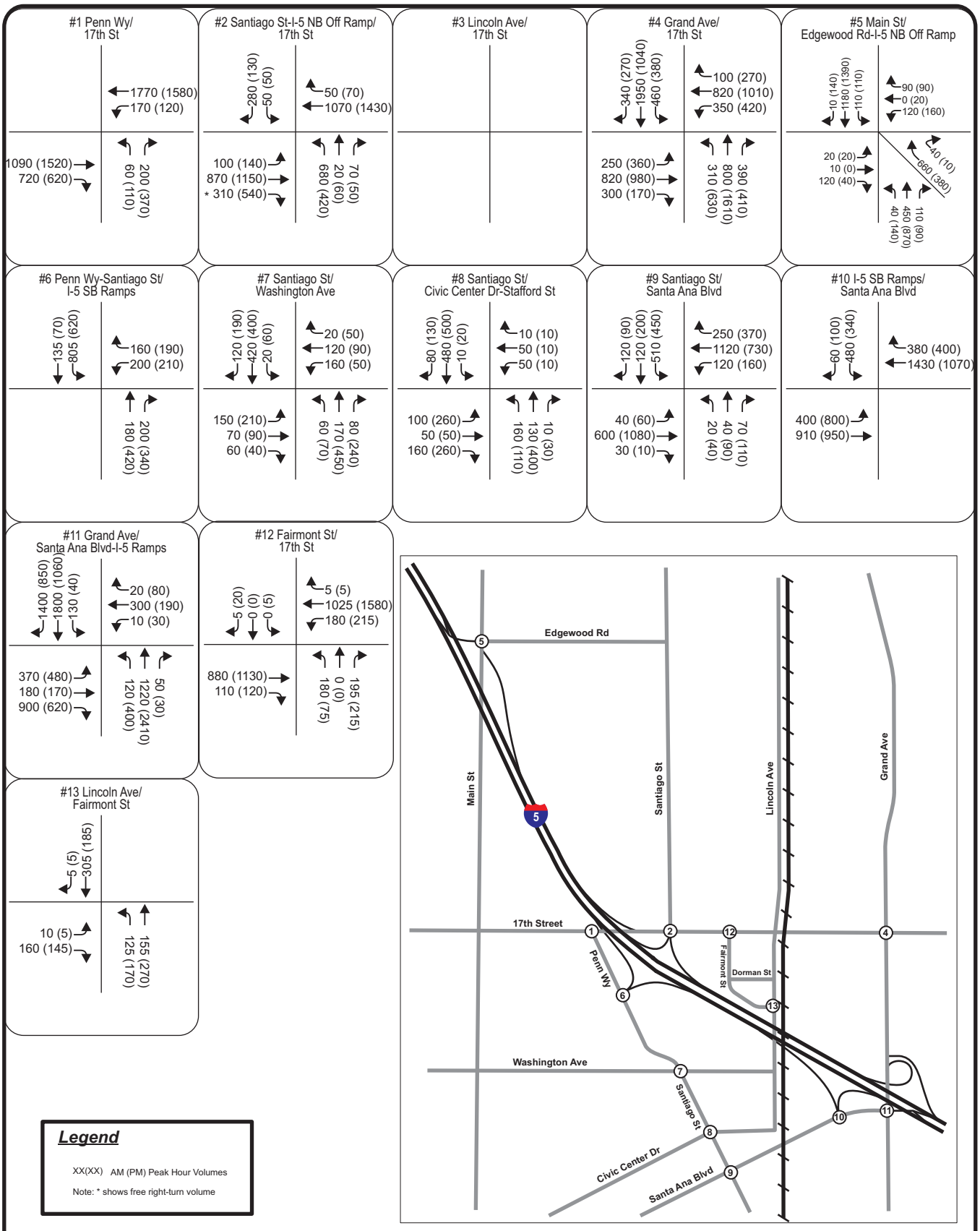
17th Street LOSSAN Grade Separation

Figure 17

Year 2020 Alternative 2A Peak Hour Volumes



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17th Street LOSSAN Grade Separation
Figure 18
Year 2035 Alternative 2A Peak Hour Volumes

9.0 SAFETY ASSESSMENT

This section presents two separate safety assessment calculations. The Hazard Index and the CPUC Priority Index Number calculations are documented in the following subsections.

9.1 HAZARD INDEX

The most widely used measure of rail safety at at-grade crossings is the Hazard Index. It is intended to identify the relative estimated hazard among railroad crossings. It is neither intended to specifically identify high or low probability of accidents, nor is it meant to predict rail/vehicle traffic accidents due to an increase in train activity in the future. The equation accepted for use as part of the CPUC's Field Inspection Checklist is:

$$H = (V \times T \times Pf) / 1{,}000$$

Where:

H = The calculated hazard index
V = The average 24-hour traffic volume
T = The average 24-hour train volume
Pf = The protection factor (0.11 for automatic gates)

The rail at-grade crossing safety calculations for Existing conditions, 2020 No Build, and 2035 No Build conditions are presented in Table 18.

Table 18
Hazard Index Calculations

Scenario	ADT	Trains per day	Hazard Index
Existing	32,412	66	235.3
2020 No Build	34,137	75	281.6
2035 No Build	37,012	110	447.8

9.2 CPUC PRIORITY INDEX NUMBER

The California Public Utilities Commission (CPUC) has established the following highway-rail grade separation priority list formula to rank at-grade crossings and prioritize their need for improvement. The 17th Street at-grade crossing priority index number was calculated as:

$$P = \frac{V \times (T + 0.1^{*} LRT) \times (AH + 1)}{C} + SCF$$

Where: P = Priority Index Number

V = The average 24-hour traffic volume
T = The average 24-hour train volume
C = Project Cost Share from Grade Separation Fund (Assume 5,000 points)
LRT = Average 24-hour Light Rail Train Volume
AH = Accident History
SCF = Special Conditions Factor = BD + VS + RS + CG + PT + OF
BD = Blocking Delay
VS = Vehicular Speed Limit
RS = Railroad Prevailing Maximum Speed
CG = Crossing Geometrics
PT = Passenger Trains
OF = Other Factors: passenger buses, school buses, trains and trucks carrying hazardous materials, and community impact

The CPUC Priority Index Number is calculated at 1,319, as presented in Table 19.

Table 19
CPUC Priority Index Calculation

Crossing Nominated for Separation or Elimination						Special conditions Factor (SCF)						Priority Index
Street	**Area**	**V**	**T**	**C**	**AH**	**BD**	**VS**	**RS**	**CG**	**PT**	**OF**	
17th Street	Santa Ana/ Orange County	32,412	66	5,000	2	2	2	6	3	9	13.5	1,319

10.0 SUMMARY AND CONCLUSIONS

The proposed grade separation of the 17th Street at-grade crossing with the LOSSAN corridor will significantly reduce delay at the crossing and queues that result from the gate down periods when trains are present. The existing at-grade rail crossing generates a substantial amount of delay, almost 40 vehicle-hours, during the AM and PM peak hours. Surveys of existing queues at the intersections along the 17th Street corridor show large fluctuations in the queue lengths during the peak hours as result of the trains crossing and in many cases requiring multiple signal cycles to clear the resulting queues. The proposed grade separation will

eliminate this delay and allow for better vehicular progression to be developed along 17th Street.

The construction period traffic analyses show that with some temporary and some permanent intersection modifications traffic can be provided to adequately accommodate traffic during both Phases 1 and 2 of the project's construction. Recommended construction period intersection and roadway modifications will include:

- I-5 Northbound Ramps/Santiago Street and 17th Street – temporary lane restriping
- Lincoln Avenue and 17th Street – temporary relocation in Phase 1 and temporary by-pass road in Phase 2
- Grand Avenue and 17th Street – encourage permanent lane additions
- Santiago Street and Civic Center Drive/Stafford Street – permanent lane restriping and new traffic signal
- I-5 Southbound Ramps and Santa Ana Boulevard –permanent lane addition

Some of the above improvements will be required to maintain acceptable traffic operations during the construction period and will provided improved operating conditions after completion of the project. Others will assist in providing better levels of service while capacity is restricted along the 17th Street corridor.

For long-term traffic operations additional intersection modifications will be required at the Grand Avenue and 17th Street intersection to provide acceptable operating conditions. All of the build alternatives will provide similar conditions at the study area intersections. However as shown in **Tables 20 and 21**, Alternative 1C is projected to provide the lowest overall delay and will provide better operating conditions at more intersections than Alternatives 1A and 2A.

TABLE 20: YEAR 2020 PEAK HOUR LOS COMPARISON

#	Intersection	Alternative 1C				Alternative 1A				Alternative 2A			
		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Penn Way and 17th Street	25.5	C	38.6	D	24.3	C	38.0	D	24.2	C	38.0	D
2	I-5 NB Ramps/Santiago Street and 17th Street	40.0	D	21.6	C	34.5	C	27.6	C	43.8	D	27.6	C
3	Lincoln Avenue and 17th Street	24.2	C	18.2	D	-	-	-	-	-	-	-	-
3a	Lincoln Avenue and 17th Street (north)	-	-	-	-	19.5	C	21.2	C	-	-	-	-
3b	Lincoln Avenue and 17th Street (south)	-	-	-	-	41.1	D	31.1	C	-	-	-	-
4	**Grand Avenue and 17th Street**	**119.7**	**F**	**108.9**	**F**	**122.3**	**F**	**111.5**	**F**	**122.3**	**F**	**111.5**	**F**
	With NB RT lanes	**89.7**	**F**	75.7	E	**89.7**	**F**	75.7	E	**89.7**	**F**	75.7	E
	With 3rd SB TH and NB RT lanes	61.6	E	69.7	E	61.6	E	69.7	E	61.6	E	69.7	E
5	Main Street and I-5 NB Ramps/Edgewood Road	42.0	D	43.3	D	42.0	D	43.3	D	42.0	D	43.3	D
6	Penn Way and I-5 SB Ramps	25.6	C	23.0	C	25.6	C	23.0	C	25.6	C	23.0	C
7	Santiago Street and Washington Avenue[1]	12.9	B	18.5	C	12.9	B	18.5	C	12.9	B	18.5	C
8	**Santiago Street and Civic Center Drive/Stafford Street**	**40.0**	**E**	**105.5**	**F**	**40.0**	**E**	**105.5**	**F**	**40.0**	**E**	**105.5**	**F**
	With Traffic Signal	12.4	B	14.7	B	12.4	B	14.7	B	12.4	B	14.7	B
9	Santiago Street and Santa Ana Boulevard	27.4	C	29.8	C	27.4	C	29.8	C	27.4	E	29.8	C
10	**I-5 SB Ramps and Santa Ana Boulevard**	34.8	C	**68.6**	**E**	34.8	C	**68.6**	**E**	34.8	C	**68.6**	**E**
	With WB RT Lane	29.0	C	**56.9**	**E**	29.0	C	**56.9**	**E**	29.0	C	**56.9**	**E**
11	**Grand Avenue and Santa Ana Blvd/NB I-5 HOV Ramps**	**61.1**	**E**	45.5	D	**61.1**	**E**	44.8	D	**61.1**	**E**	44.8	D
12	Fairmont Street and 17th Street	10.6	B	11.3	B	9.2	A	12.8	B	35.9	D	37.8	D
13	Lincoln Avenue and Fairmont Street	10.8	B	10.1	B	10.9	B	10.1	B	11.9	C	10.4	B

Source: Iteris, Inc., 2011
Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.
1 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.
Bold text indicates unacceptable level of service.

TABLE 21: YEAR 2035 INTERSECTION PEAK HOUR LOS COMPARISON

#	Intersection	Alternative 1C				Alternative 1A				Alternative 2A			
		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Penn Way and 17th Street	26.7	C	52.6	D	30.6	C	52.7	D	26.5	C	50.6	D
2	I-5 NB Ramps/Santiago Street and 17th Street	40.0	D	25.2	C	54.3	D	30.9	C	44.2	D	26.0	C
3	Lincoln Avenue and 17th Street	21.0	C	17.7	B	-	-	-	-	-	-	-	-
3a	Lincoln Avenue and 17th Street (north)	-	-	-	-	20.6	C	21.8	C	-	-	-	-
3b	Lincoln Avenue and 17th Street (south)	-	-	-	-	28.2	C	44.4	D	-	-	-	-
4	**Grand Avenue and 17th Street**	**186.3**	**F**	**168.9**	**F**	**174.9**	**F**	**150.7**	**F**	**186.5**	**F**	**170.7**	**F**
	With NB RT lanes	**154.9**	**F**	**128.4**	**F**	**154.9**	**F**	**128.4**	**F**	**154.9**	**F**	**128.4**	**F**
	With 3rd SB TH and NB RT lanes	**95.8**	**F**	**100.8**	**F**	**95.8**	**F**	**100.8**	**F**	**95.8**	**F**	**100.8**	**F**
5	Main Street and I-5 NB Ramps/Edgewood Road	42.6	D	45.8	D	42.6	D	45.8	D	42.6	D	45.0	D
6	Penn Way and I-5 SB Ramps	36.8	D	29.9	C	36.8	D	29.9	C	36.8	D	29.9	D
7	**Santiago Street and Washington Avenue**[1]	22.5	C	**39.0**	**E**	22.5	C	**39.0**	**E**	22.5	C	**39.0**	**E**
8	**Santiago Street and Civic Center Drive/Stafford Street**	**70.9**	**F**	**176.1**	**F**	**70.9**	**F**	**176.1**	**F**	**70.9**	**F**	**176.1**	**F**
	With Traffic Signal	12.6	B	15.9	B	12.6	B	15.9	B	12.6	B	15.9	B
9	Santiago Street and Santa Ana Boulevard	77.5	E	51.4	D	77.5	E	51.4	D	77.5	E	51.4	D
10	**I-5 SB Ramps and Santa Ana Boulevard**	**57.5**	**E**	**76.6**	**E**	**57.5**	**E**	**76.6**	**E**	**57.5**	**E**	**76.6**	**E**
	With WB RT Lane	30.9	C	**63.6**	**E**	30.9	C	**63.6**	**E**	30.9	C	**63.6**	**E**
11	**Grand Avenue and Santa Ana Blvd/NB I-5 HOV Ramps**	**95.3**	**F**	54.7	D	**95.3**	**F**	54.7	D	**95.3**	**F**	54.7	D
12	Fairmont Street and 17th Street	10.3	B	11.2	B	11.4	B	13.6	B	18.2	B	14.6	B
13	Lincoln Avenue and Fairmont Street	10.9	B	10.2	B	10.1	B	10.1	B	12.0	B	18.1	C

Source: Iteris, Inc., 2011
Note: All LOS letter values are based on HCM delay methodology and not ICU methodology.
1 – NB and SB right-turn volumes excluded in calculation in order to conform to HCM analysis format.
Bold text indicates unacceptable level of service.

11.0 APPENDIX

(Provided under separate cover)

A. Design Alternative Drawings

B. Traffic Counts

C. Existing Conditions Capacity Analyses

D. Construction Period Capacity Analyses

E. Year 2020 Capacity Analyses

F. Year 2035 Capacity Analyses

G. Signal Warrant Analyses

H. HCM 2010 Arterial Capacity Table

I. Lincoln Avenue / 17th Street Intersection and LOSSAN Crossing Combined Delay Calculations

J. Santa Ana Boulevard and Santiago Street Intersection Alternative for the Santa Ana Fixed Guideway Project

Appendix A
Design Alternative Drawings

Appendix B
Traffic Counts

Appendix C
Existing Conditions Capacity Analyses

Appendix D
Construction Period Capacity Analyses

Phase 1

Phase 1 Mitigated

Phase 2

Phase 2 Mitigated

Appendix E
Year 2020 Capacity Analyses

No Build

Alternative 1C

Alternative 1A

Alternative 2A

Future Year 2020 Mitigated

Appendix F
Year 2035 Capacity Analyses

No Build

Alternative 1C

Alternative 1A

Alternative 2A

Future Year 2035 Mitigated

Appendix G
Signal Warrant Analyses

Appendix H
HCM 2010 Arterial Capacity Table

Appendix I
Lincoln Avenue / 17th Street Intersection and LOSSAN Crossing Combined Delay Calculations

Appendix J
Santa Ana Boulevard and Santiago Street Intersection Alternative for the Santa Ana Fixed Guideway Project