RTIP ID# *(required)* 201186

TCWG Consideration Date: August 26, 2014

Project Description *(clearly describe project)*

The proposed Build Alternative would reconstruct and improve the existing State Route (SR) 210 diamond interchange by widening Base Line Street and the interchange ramps within the limits of the project. Regional vicinity and project location maps are provided in Figure 1 and Figure 2, respectively. The proposed Build Alternative includes the following design features and elements:

- Base Line Street between Buckeye Street and Seine Avenue and the interchange ramps would be widened to add through lanes, turn lanes, and storage for vehicle queues.
- Base Line Street from Buckeye Street to Seine Avenue would generally be widened from four through lanes (two in each direction) to six through lanes (three in each direction).
- A two-lane exit would be created at the westbound exit ramp.
- The existing Base Line Street overcrossing would be widened to accommodate the new lanes.
- Retaining walls would be constructed, as needed, in areas of widening.
- The proposed project would require the acquisition of new permanent right of way and temporary construction easements (TCEs) would be needed during the construction period to facilitate access to the construction work areas.
- Drainage system improvements would be constructed to address storm water runoff.
- Storm water treatment best management practice (BMP) features would be included as part of the proposed project at select locations where identified benefits outweigh impacts.
- Ramp metering would be installed on the entrance ramps at the interchange.
- Utilities would be relocated, as needed, to accommodate the improved facility.
- Temporary construction easements (TCEs) along Base Line would be needed during the construction period.

A project layout illustration is provided in Figure 3.

Type of Project *(use Table 1 on instruction sheet)*

Reconfigure existing interchange

County	**Narrative Location/Route & Postmiles:** SR-210 at Base Line St. (PM R28.3/R30.3) **Caltrans Projects – EA#** 1C970
San Bernardino	

Lead Agency: SANBAG

Contact Person	**Phone#**	**Fax#**	**Email**
Keith Cooper	213-312-1752	213-312-1799	Keith.Cooper@icfi.com

Hot Spot Pollutant of Concern *(check one or both)* **PM2.5** ✓ **PM10** ✓

Federal Action for which Project-Level PM Conformity is Needed *(check appropriate box)*

Categorical Exclusion (NEPA)	✓ **EA or Draft EIS**	**FONSI or Final EIS**	**PS&E or Construction**	**Other**

Scheduled Date of Federal Action: 2015

NEPA Assignment – Project Type *(check appropriate box)*

Exempt	**Section 326 –Categorical Exemption**	✓ **Section 327 – Non-Categorical Exemption**

Current Programming Dates *(as appropriate)*

	PE/Environmental	ENG	ROW	CON
Start	2013	2013	2015	2017
End	2015	2015	2016	2018

Project Purpose and Need (Summary): *(attach additional sheets as necessary)*

The purpose of the proposed project is to improve the operations and reduce congestion at the existing interchange.

This area of southwestern San Bernardino County in the City of Highland has grown significantly over the past ten years and is experiencing continued population and employment growth. In particular, commercial and residential development is occurring along Base Line Street near SR-210. For example, new retail centers are planned on vacant land northwest of the interchange and on vacant parcels northeast of the interchange. The SR-210/Base Line Street interchange is an important component of the City of Highland's traffic circulation system. By the future year of 2040, traffic volumes on Base Line and the interchange ramps will increase substantially. The increasing demand for freeway access at Base Line Street is causing, and will continue to cause, congestion at the interchange ramp terminal intersections and along this segment of the Base Line Street arterial corridor. Both of the ramp terminal intersections at Base Line Street will experience increases in delay between existing and future year conditions. In particular, the evening peak hour level of service for the westbound ramp terminal intersection will degrade to level of service (LOS) E by 2040 if no improvements are implemented, which is below Caltrans' and the City of Highland's acceptable operating condition.

In addition to intersection levels of service, historical accident data appears to indicate that existing congestion and poor interchange operations may be factors contributing to higher than average accident rates on some elements at the SR-210/Base Line Street interchange. The expected increase in demand for freeway access will create additional safety concerns if improvements to the interchange are not implemented.

Surrounding Land Use/Traffic Generators *(especially effect on diesel traffic)*

As shown in Figure 3, surrounding land uses primarily include residential uses, with some commercial uses. New retail centers are planned on the vacant parcels located northwest of the interchange, and on the vacant parcels located northeast of the interchange.

Opening Year: Build and No Build LOS, AADT, % and # trucks, truck AADT of proposed facility

Build and No Build Alternative: Base Line Street project limits 2020 AADT highest estimate is 23,990, with 5% truck percentage, or 1,200 Truck AADT.

	No Build (AM/PM)	Build (AM/PM)
SR-210 EB Ramps/Base Line	B/B	B/B
SR-210 WB Ramps/Base Line	B/C	A/A

Source: URS Corporation, July 2014. Traffic Operations Report State Route 210 (SR-210) at Base Line (PM R28.3/R30.3) in the City of Highland. Prepared for SANBAG.

RTP Horizon Year / Design Year: Build and No Build LOS, AADT, % and # trucks, truck AADT of proposed facility

Build and No Build Alternative: Base Line Street project limits 2040 AADT highest estimate is 29,450, with 5% truck percentage, or 1,473 Truck AADT.

	No Build (AM/PM)	Build (AM/PM)
SR-210 EB Ramps/Base Line	C/C	C/B
SR-210 WB Ramps/Base Line	D/D	B/B

Source: URS Corporation, July 2014. Traffic Operations Report State Route 210 (SR-210) at Base Line (PM R28.3/R30.3) in the City of Highland. Prepared for SANBAG.

Opening Year: If facility is an interchange(s) or intersection(s), Build and No Build cross-street AADT, % and # trucks, truck AADT

Base Line Street at SR 210 On/Off Ramps Year 2020 Traffic Volumes (Build and No Build)			
Roadway Segment	AADT	Truck Percentage	Truck AADT
Base Line, west of interchange	17,210	5%	861
Base Line, between ramps	19,800	5%	990
Base Line, east of interchange	23,990	5%	1,200
Eastbound off-ramp	5,830	5%	292
Eastbound on-ramp	6,020	5%	301
Westbound off-ramp	6,200	5%	310
Westbound on-ramp	5,400	5%	270
Source: URS Corporation, July 2014. Traffic Operations Report State Route 210 (SR-210) at Base Line (PM R28.3/R30.3) in the City of Highland. Prepared for SANBAG.			

RTP Horizon Year / Design Year: If facility is an interchange (s) or intersection(s), Build and No Build cross-street AADT, % and # trucks, truck AADT

Base Line Street at SR 210 On/Off Ramps Year 2040 Traffic Volumes (Build and No Build)			
Roadway Segment	AADT	Truck Percentage	Truck AADT
Base Line, west of interchange	21,400	5%	1,070
Base Line, between ramps	24,370	5%	1,219
Base Line, east of interchange	29,450	5%	1,473
Eastbound off-ramp	6,730	5%	337
Eastbound on-ramp	6,920	5%	346
Westbound off-ramp	7,130	5%	357
Westbound on-ramp	7,410	5%	371
Source: URS Corporation, July 2014. Traffic Operations Report State Route 210 (SR-210) at Base Line (PM R28.3/R30.3) in the City of Highland. Prepared for SANBAG.			

Describe potential traffic redistribution effects of congestion relief *(impact on other facilities)*

The project proposes improvements to the local arterial as well as geometric improvements at the ramp termini. The project would not impact SR-210 operations or affect regional traffic demand and distribution.

Although the SR-210/Base Line interchange is predicted to operate at low Levels of Service in future years, it is not anticipated that traffic would divert to other routes. Even without development of the proposed project, the subject interchange would remain the shortest path for local travel. The Build Alternative would simply handle future vehicle volumes at a better Level of Service.

Therefore, no separate regional model runs for the No Build and Build conditions were necessary or performed since the projected No Build and Build volumes would be identical, and only the interchange geometric improvements changes would occur as part of the project.

Comments/Explanation/Details *(attach additional sheets as necessary)*

The proposed project is within a nonattainment area for the federal PM2.5 and PM10 standards. As such, hotspot analyses are required for conformity purposes for any project considered to be a project of air quality concern (POAQC) per 40 CFR 93.123(b)(1). EPA does not require hotspot analyses for projects that are not considered to be a POAQC.

The proposed project does not qualify as a POAQC because of the following reasons:

- The proposed project is not a new or expanded highway project. The project proposes improvements to an existing local arterial, and geometric improvements at existing interchange ramp termini. No traffic volume increases are anticipated to occur under the Build Alternative, when compared to the No Build Alternative.
- The LOS conditions in the project vicinity with and without the proposed project are shown above. The proposed project would result in overall improvements in LOS at opening year 2020 and at horizon year 2040.
- The proposed project does not include the construction of a new bus or rail terminal.
- The proposed project does not expand an existing bus or rail terminal.
- The proposed project is not in or affecting locations, areas, or categories of sites that are identified in the PM2.5 and PM10 applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation.

Therefore, the proposed project meets the CAA requirements and 40 CFR 93.116 without any explicit hot-spot analysis. The proposed project would not create a new, or worsen an existing, PM10 or PM2.5 violation.

Attachments:

Figure 1. Regional Vicinity Map

Figure 2. Project Location Map

Figure 3. Project Layout Map

Traffic Operations Report State Route 210 (SR-210) at Base Line (PM R28.3/R30.3) in the City of Highland (without appendices). July 2014. URS Corporation.

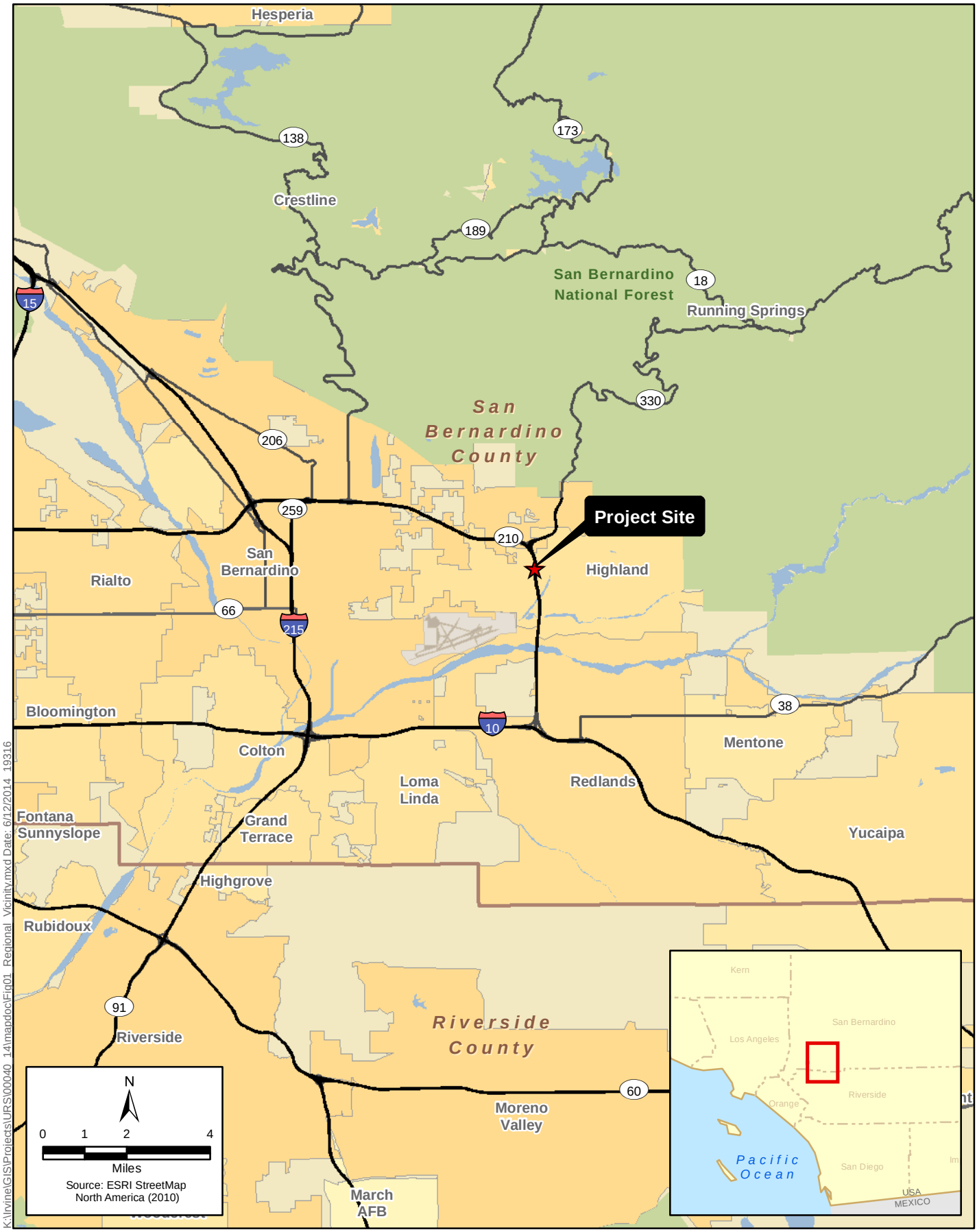

Figure 1
Regional Vicinity Map
SR-210/Base Line Interchange Project

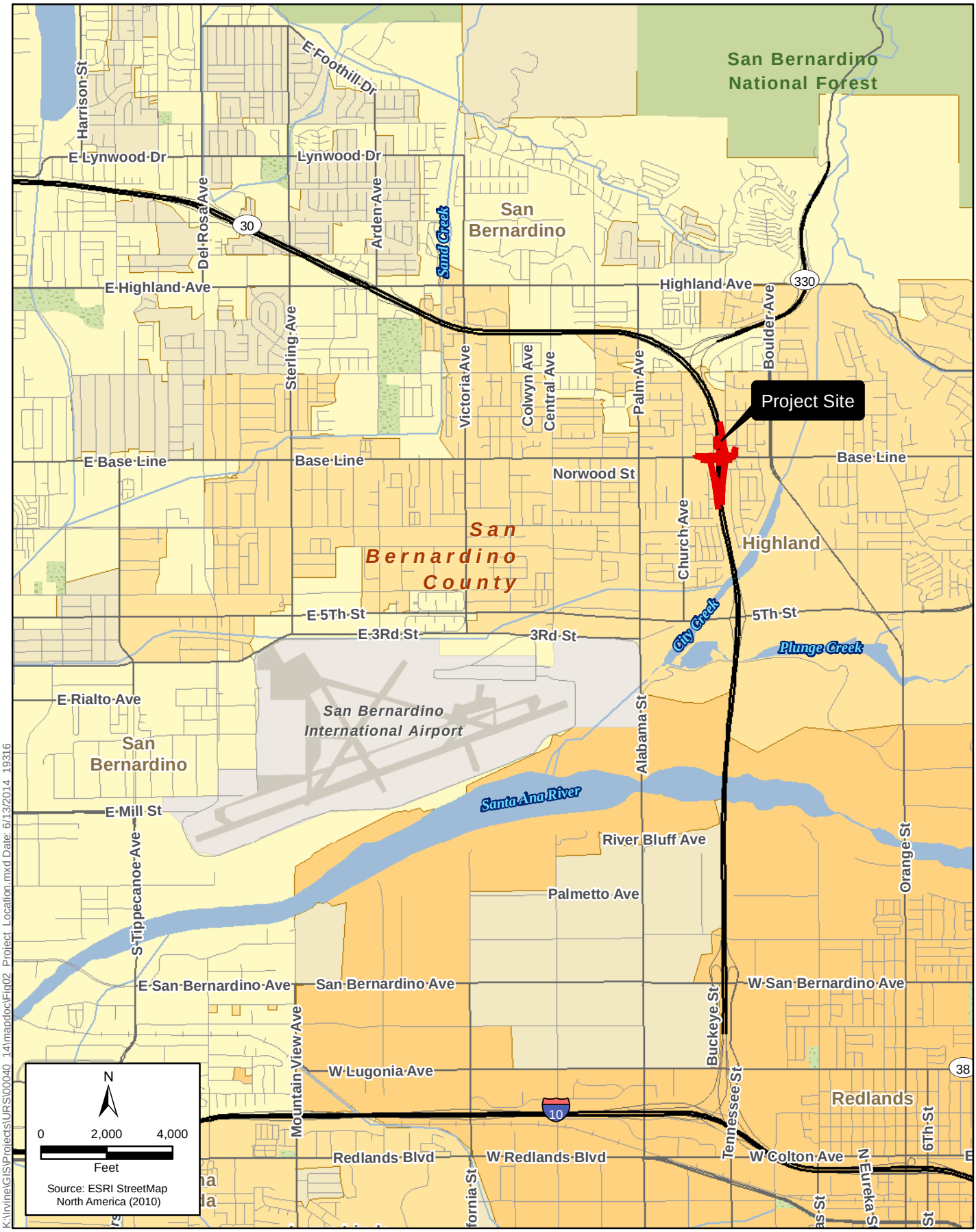

Figure 2
Project Location Map
SR-210/Base Line Interchange Project

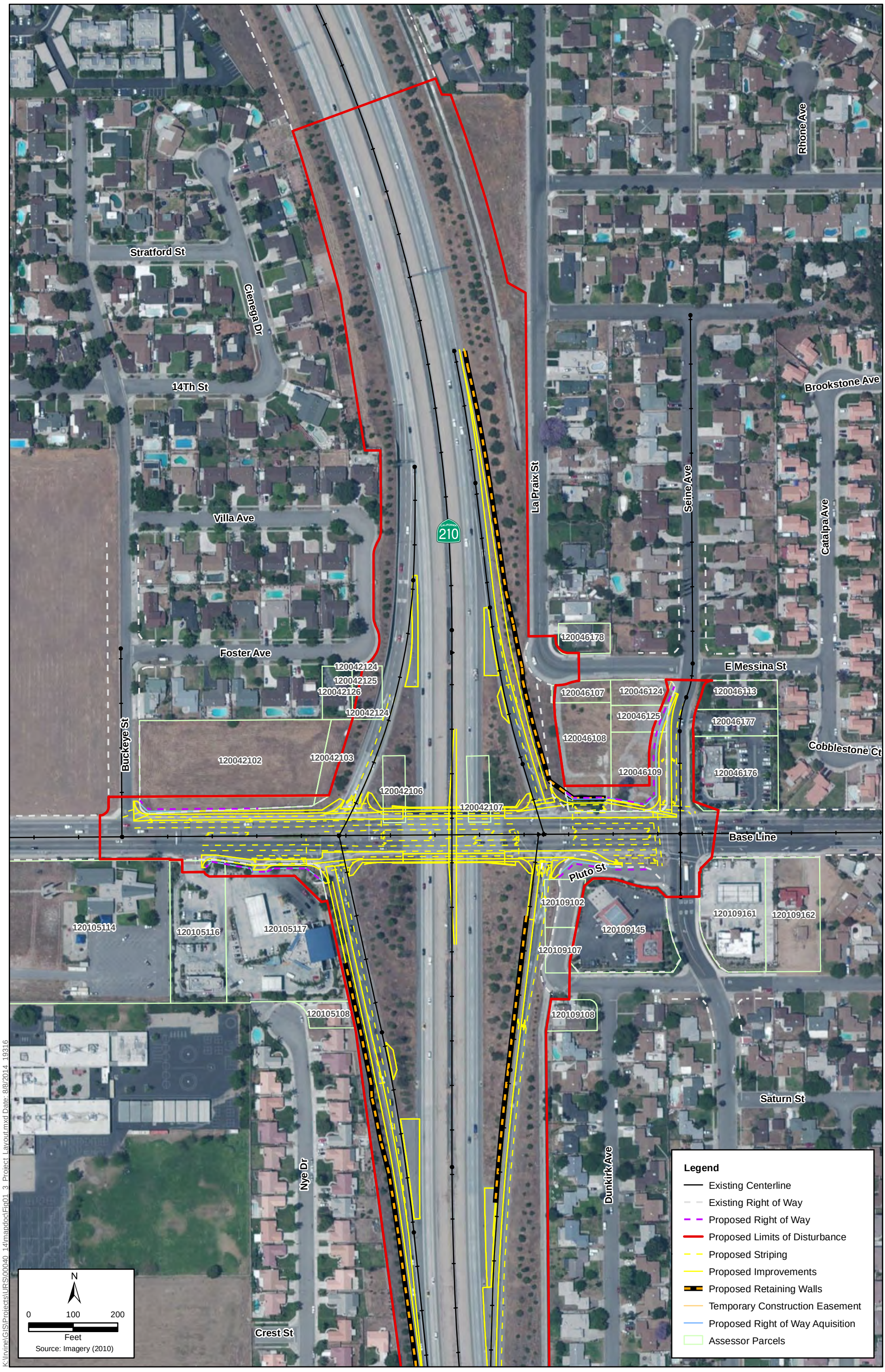

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Figure 3 - Sheet 1
Project Layout Map
SR-210/Base Line Interchange Project

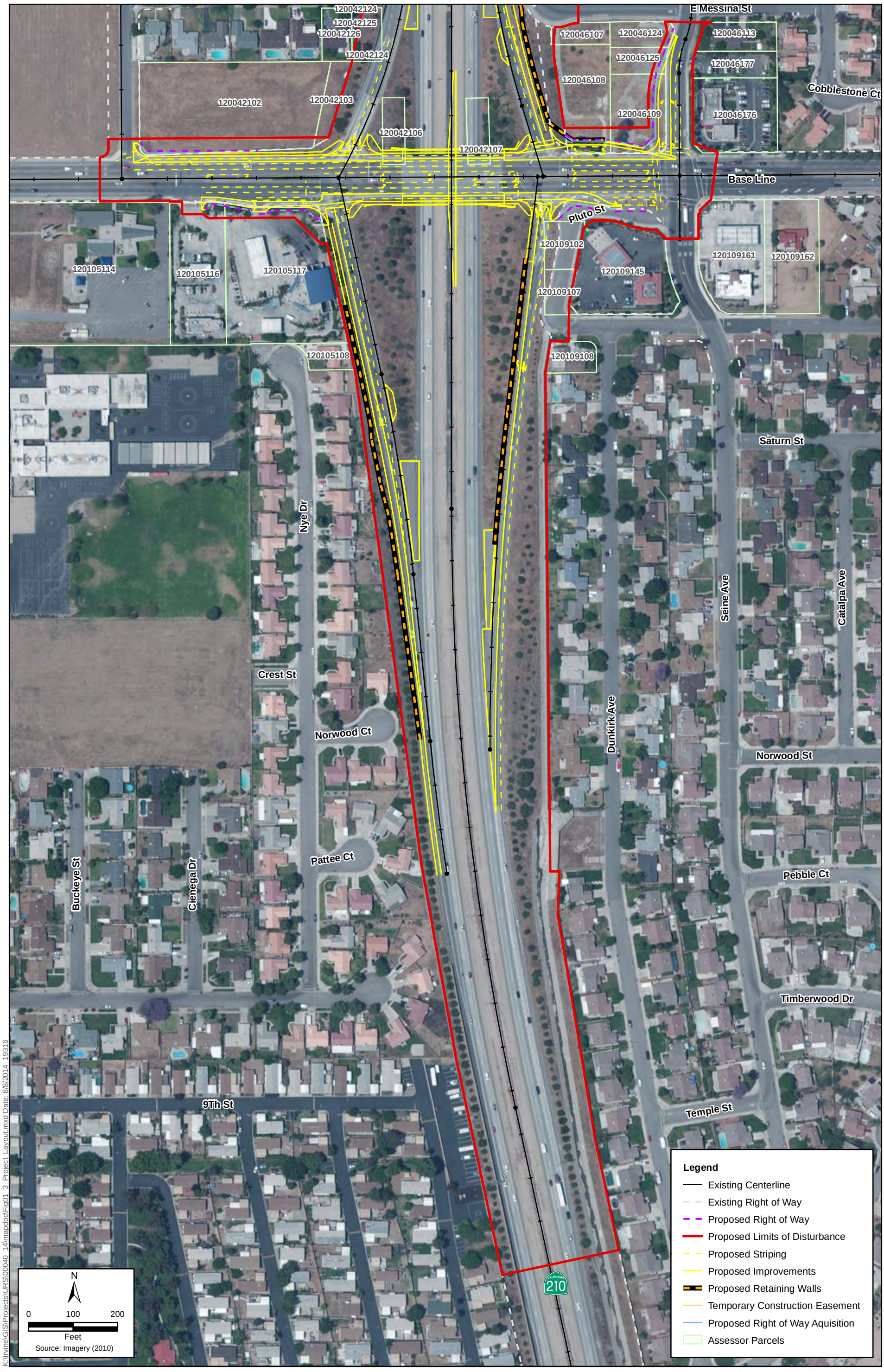

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Figure 3 - Sheet 2
Project Layout Map
SR-210/Base Line Interchange Project

TRAFFIC OPERATIONS ANALYSIS REPORT STATE ROUTE 210 (SR-210) AT BASE LINE (PM R28.3/R30.3) IN THE CITY OF HIGHLAND

EA 1C970, PROJECT NO. 0813000105

Prepared for

San Bernardino Associated Governments

In conjunction with

Caltrans – District 8

July 2014

URS

2020 East First Street, Suite 400
Santa Ana, California 92705

Project Number: 29866552

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TRAFFIC OPERATIONS ANALYSIS

1.0 INTRODUCTION

This document presents the traffic operations analysis completed for the proposed improvements to the State Route 210 (SR-210)/Base Line interchange in the City of Highland. The project sponsors and stakeholders include the San Bernardino Associated Governments (SANBAG), City of Highland and the California Department of Transportation (Caltrans). The traffic study area includes an area of influence based on potential operational and/or safety concerns. This area is defined as the existing SR-210/Base Line interchange plus the first adjacent signalized intersections in either direction of the interchange ramp terminal intersections and the first adjacent interchanges on either side of the SR-210/Base Line interchange. The area of influence along the local roadway network (Base Line) encompasses Church Avenue to the west and Seine Avenue to the east. The mainline freeway area of influence extends to State Route 330 (SR-330) to the north and 5th Street-Greenspot Road to the south; however, these adjacent interchanges are not physically affected by the proposed SR-210/Base Line interchange improvements.

Traffic volumes were developed for three scenarios:

- Existing 2013 traffic,
- Opening Year 2020 traffic and
- Horizon Year 2040 traffic.

Traffic operations on Base Line and at the interchange were analyzed for each of these three scenarios for the No Build Alternative, and for the Build Alternative in Opening Year 2020 and Horizon Year 2040. Mainline freeway operations were analyzed under Horizon Year 2040 Build and No Build conditions to demonstrate the relationship of the proposed project with adjacent freeway segments and interchanges.

Under the No Build Alternative, Base Line would not be widened through the interchange and the existing diamond interchange would remain unimproved.

The proposed project would widen Base Line from Buckeye Street to Seine Avenue and widen the existing interchange ramps in the City of Highland. Within the limits of the proposed project, Base Line is generally a four-lane arterial with turn lanes at intersections. The purpose of the proposed project is to reduce congestion and improve operational efficiency at the interchange and throughout the Base Line corridor. The proposed Build Alternative would reconstruct and improve the existing diamond interchange by widening Base Line and the interchange ramps within the limits of the project. The proposed Build Alternative includes the following design features and elements:

- Base Line between Buckeye Street and Seine Avenue and the interchange ramps would be widened to add through lanes, turn lanes and storage for vehicle queues.
- A two-lane exit would be created at the westbound exit ramp.
- The existing Base Line overcrossing would be widened to accommodate the new lanes.
- Ramp metering would be installed on the entrance ramps at the interchange.

1.1 Background

The City of Highland has been developing a master plan for Base Line to establish the ultimate build-out of this critical gateway arterial corridor within the City. The plan extends approximately one mile west and one mile east of the SR-210 interchange, from Palm Avenue on the west to Boulder Avenue on the east. The City identified the existing Base Line interchange to be a critical segment of the arterial corridor. Therefore, in September 2010, the City of Highland completed a detailed study of this segment of the Base Line corridor through the existing SR-210 interchange area and beyond titled, Base Line 2040 Master Plan Configuration Traffic Study (Master Plan Study). The Master Plan Study considered four possible alternatives through the interchange area:

- No Build
- Modified Interchange Configuration
- Proposed Minimal Improvements
- Additional Improvements

The Modified Interchange Configuration contemplated a complete reconstruction of the existing SR-210/Base Line interchange; however that alternative was dropped from further study due to the significant right of way impacts, business and residential relocations, replacement of the existing overcrossing and high costs. The Proposed Minimal Improvements alternative essentially would implement the recommended intersection improvements identified in the City's Preferred General Plan. At the interchange, this includes two eastbound through lanes, three westbound through lanes and one full length left turn pocket and one back-to-back left turn pocket in each direction on the Base Line overcrossing. The Additional Improvements alternative included the same improvements as the Proposed Minimal Improvements alternative, plus additional widening of the Base Line overcrossing to provide two full length left turn pockets in each direction (in lieu of the back-to-back configuration) and three through lanes in the eastbound direction (in lieu of only two).

The Master Plan Study concluded that the Additional Improvements alternative did not provide an appreciable improvement in level of service over the Proposed Minimal Improvements option. The Master Plan Study recommended that the Proposed Minimal Improvements alternative be advanced and that further coordination with Caltrans be initiated to identify interchange ramp and/or mainline improvements that may be necessary elements of the complete circulation system.

In August 2012, SANBAG, working with the City of Highland, performed a cursory analysis of the Master Plan Study, with an emphasis on the interchange ramps and freeway operational aspects of the Proposed Minimal Improvements alternative. In general, SANBAG confirmed the improvements proposed by the City of Highland. In addition, SANBAG's study recommended the following additional improvements:

- Provision of a two-lane exit at the westbound exit ramp connection to the mainline freeway
- Addition of ramp meters on the entrance ramps
- Widening the entrance ramps to provide HOV preferential lanes
- Provision of a third turn lane at the westbound exit ramp terminal intersection at Base Line

It was determined that the City of Highland's Master Plan Study – Proposed Minimal Improvements alternative coupled with the additional features identified by the SANBAG analysis would provide for adequate operations at the interchange through the Horizon Year 2040.

In February 2014, a Traffic Operations Analysis Report (TOAR) for the SR-210 Mixed Flow Lane Addition Project from Highland Avenue (PM R25.0) to San Bernardino Avenue (PM R33.2) in San Bernardino County was approved by Caltrans. The freeway widening project also includes the creation of auxiliary lanes between the Base Line interchange and the 5th Street-Greenspot Road interchange and an eastbound acceleration lane at the 5th Street entrance ramp and an eastbound deceleration lane at the Highland Avenue exit ramp. It is anticipated that the mainline freeway lane addition project will be constructed by 2020. The SR-210/Base Line interchange lies within this segment of the SR-210 proposed widening.

Finally, a traffic forecasting methodology memorandum titled, SR-210/Base Line Interchange Improvement Project – Traffic Forecasting Memorandum (Forecasting Memo), dated October 30, 2013 was prepared to identify the detailed procedures to be used in developing the traffic volumes for use in the traffic operations analysis of the SR-210/Base Line interchange. In addition to the step-by-step methodologies presented in the Forecasting Memo, the Existing, Opening Year and Horizon Year traffic volumes were also documented in the Forecasting Memo. The Forecasting Memo was approved by Caltrans on February 6, 2014.

Base Line

The City of Highland General Plan circulation element designates Base Line within the limits of the project as a Primary Arterial. Within the study area, Base Line is designated as a Truck Route with a Class II Bike Lane (on-street) in the City of Highland General Plan. The existing Base Line overcrossing consists of two lanes in each direction plus westbound and eastbound double left turn lanes.

Beyond the limits of the freeway interchange, the City of Highland is considering widening improvements at certain locations to implement other elements of the City's arterial corridor master plan. Some of those improvements have already been designed and are anticipated to be constructed by the end of 2014. These include a dedicated eastbound right turn pocket on Base Line approaching Seine Avenue and an additional northbound left turn pocket (total of two) on Seine Avenue approaching Base Line.

Other improvements in the City's master plan beyond the interchange are also being considered by the City, but there is no firm funding or scheduling commitment for implementation of these remaining corridor elements. These improvements include expanding the Base Line intersections at Church Avenue and at Buckeye Street, widening Base Line from four through lanes to six through lanes between Church Avenue and Buckeye Street, widening eastbound Base Line to three lanes between Seine Avenue and Stoney Creek Drive, widening Base Line to add a westbound shared through-right turn lane approaching the Seine Avenue intersection and installation of various raised medians throughout the Base Line corridor. Because of the uncertainty of any or all of these future improvements, the traffic operational analyses prepared in this study assume that none of these other improvements will be constructed. The results presented in this study are therefore, conservative and not dependent on other projects that would not be in the direct control of the interchange project sponsors and stakeholders. This assumption also provides stronger independent utility for the interchange project.

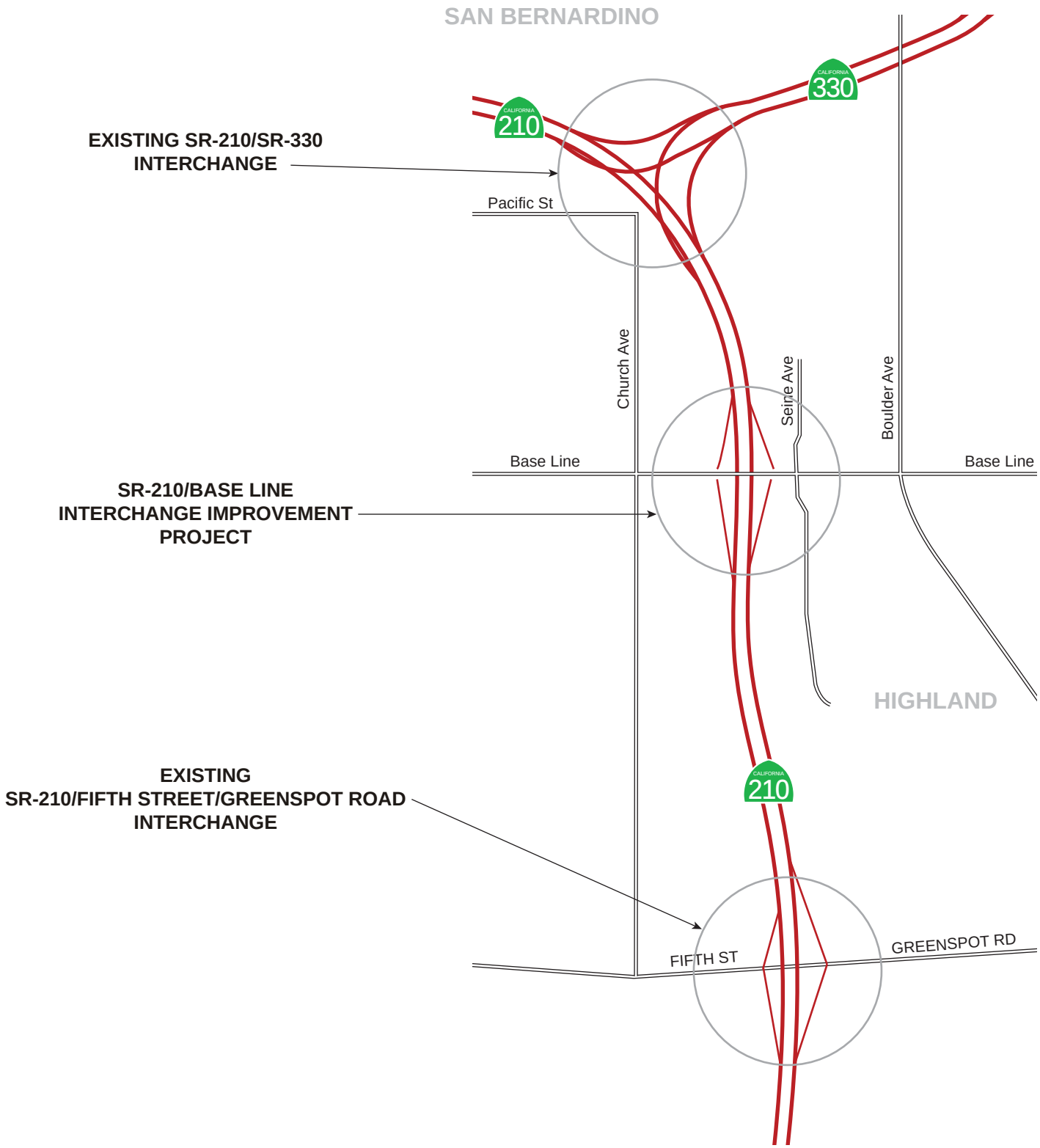
State Route 210 (SR-210)

The SR-210/Base Line interchange is located in the City of Highland and serves growing residential and commercial development in the City. SR-210 is an east/west freeway, and it traverses in a generally northwest/southeast direction, diagonally through the western portion of the City. To the north and west, SR-210 continues through San Bernardino County and is the link to the I-215 and I-15 Freeways and State Routes 18 and 57, and the greater Los Angeles area. To the south, SR-210 continues through San Bernardino County and connects to the I-10 Freeway. Adjacent interchanges exist on SR-210 at SR-330 to the north and at 5th Street–Greenspot Road to the south. The project location map is illustrated in **Figure 1**.

SR-210 in San Bernardino County is included in the National Highway System, the California Freeway and Expressway System and the "12 foot Wide Arterial System". The SR-210, within the project limits, is classified as a Principal Arterial highway.

State Route 330 (SR-330)

State Route 330 (SR-330) is a 15-mile freeway/conventional two-lane highway where the westerly segment begins at the junction of the SR-210 and extends northeasterly to SR-18. SR-330 is generally considered a conventional two-lane highway since only the initial one mile segment from the junction at SR-210 is constructed to freeway standards. SR-330 is located within San Bernardino County and is utilized as one of the main accesses into the cities of Big Bear and Lake Arrowhead. Access from east/westbound SR-210, onto northbound SR-330 is provided via connector ramps and access onto east/westbound SR-210 from southbound SR-330 is provided also via connector ramps. Where SR-330 connects to SR-210, there are existing auxiliary lanes on SR-210 in both the eastbound and westbound directions between SR-330 and the Base Line interchange.



PROJECT LOCATION MAP

SR-210 AT BASE LINE
INTERCHANGE IMPROVEMENT PROJECT

URS	CREATED BY: SV	DATE: April 2014	FIGURE 1
	PM: DS	PROJECT NO: 29866552	

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2.0 EXISTING AND FUTURE YEAR TRAFFIC VOLUMES

2.1 Existing Traffic Volumes

Existing traffic counts including AM and PM peak hour turning movement counts at all study area intersections and 24-hour daily traffic counts at locations in the project area were conducted in June 2013 by National Data and Surveying Services (NDS) and attached as Appendix A. To adjust the traffic volumes to a March 2013 count (spring 2013) when school was in session, a seasonal adjustment factor was estimated and applied to the existing traffic counts. Based on traffic data from Caltrans PEMS for March and June in year 2013, the peak hour average traffic volumes in March 2013 are approximately 7% higher than the peak hour average traffic volumes in June 2013. Therefore, a seasonal adjustment factor of 1.07 was estimated and applied to the June 2013 traffic counts to provide 2013 seasonal adjusted traffic counts for use as the existing 2013 traffic volumes in this study. **Table 1** shows the PEMS traffic data used to estimate the seasonal factor.

Table 1: Caltrans PEMS Traffic Data and Seasonal Factor

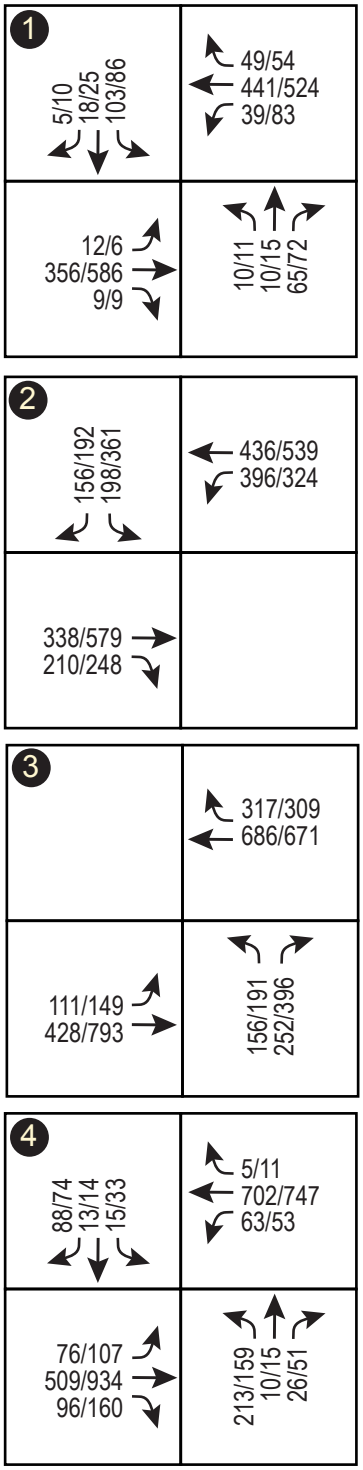
	Average Peak Hour Volumes (vph) [1]							
	EB SR-210				**WB SR-210**			
	March		**June**		**March**		**June**	
	AM	PM	AM	PM	AM	PM	AM	PM
Base Line Off-Ramp	456	843	417	780	772	539	728	541
Base Line On-Ramp	341	568	284	569	688	469	593	472
Sum March								*4,676*
Sum June								*4,383*
Ratio (March / June)								**1.07**

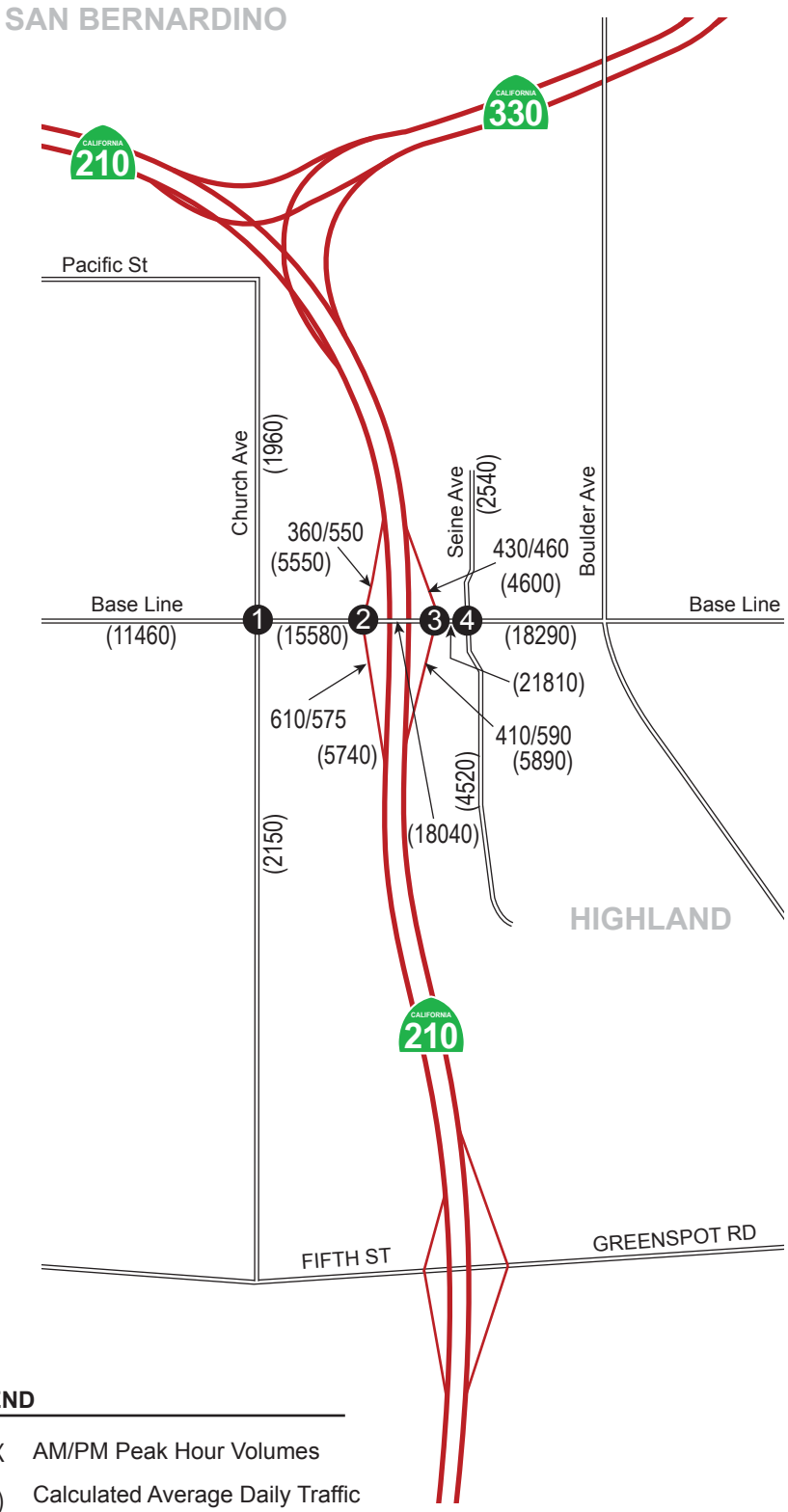
Note 1. Based on Year 2013 monthly peak hour average PEMS data. Vph = vehicles per hour.

The 2013 existing seasonal adjusted 2013 AM and PM peak hour volumes for this study area including turn movements at the study intersections are illustrated in **Figure 2**, and the traffic counts are provided in the Appendix A.

2.2 Future Year Traffic Volume Forecasts

A traffic forecast model was developed by the San Bernardino Associated Governments (SANBAG) specifically for use within San Bernardino County. The current SANBAG model is a sub-regional (subset) of the regional Southern California Associated Governments (SCAG) Model and incorporates more refined local details otherwise not included in larger scale regional models. The SANBAG Model incorporates elements of the most recent Regional Transportation Plan (RTP), 2012-2035.





LEGEND

XX/XX	AM/PM Peak Hour Volumes
(XX)	Calculated Average Daily Traffic (ADT) Volumes.

EXISTING YEAR 2013 TRAFFIC VOLUMES

SR-210 AT BASE LINE
INTERCHANGE IMPROVEMENT PROJECT

URS

CREATED BY: SV	DATE: April 2014	FIGURE 2
PM: DS	PROJECT NO: 29866552	

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The development of the San Bernardino County Transportation Analysis Model (SBTAM) was completed in June 2012, in partnership with Southern California Association of Governments (SCAG). SANBAG currently has the 2008 and 2035 SBTAM traffic model networks applicable for the proposed project study area.

The forecasted traffic volume model plots from the 2008 and 2035 SBTAM traffic demand models were utilized for the project study area. Review of the 2008 SBTAM traffic demand model found the 2008 SBTAM model traffic volumes at the SR-210/Base Line interchange to be significantly higher than traffic counts conducted at the interchange in both 2011 and 2013. The high model traffic volumes at the SR-210/Base Line interchange were discussed with SANBAG on October 28, 2013. SANBAG concluded that the travel demand model volumes were not calibrated for this interchange and the model forecasting would need to be adjusted. As a result, growth rates from the 2008 and 2035 SBTAM models were calculated. These growth rates were applied to the seasonal adjusted 2013 traffic counts to develop forecasted traffic volumes. A more detailed discussion of the forecasting methodology is presented in the SR-210/Base Line Interchange Improvement Project – Traffic Forecasting Memorandum, dated October 30, 2013.

The growth rate derived traffic forecasts were post-processed to develop Opening Year 2020 and Horizon Year 2040 traffic volume projections. Both AM and PM peak hour turning movement volumes were post-processed at each study intersection using the design year (2040) peak hour approach and departure volumes in conjunction with the seasonal adjusted existing (2013) turning movement volumes.

The following steps outline the traffic forecasting methodology and post-processing used to estimate the Opening Year 2020 and Horizon Year 2040 traffic volume forecasts:

- The growth between the 2008 and 2035 SBTAM travel demand model volumes was used to determine the overall growth between 2008 and 2035 accounting for 27 years of growth. This growth in traffic volumes was used to determine annualized growth rates, which ranged between 1.5 to 2.5 percent per year, for the interchange and along the Base Line corridor.
- Growth factors were estimated based on the annualized growth rates from the SBTAM models. These growth factors were applied to the Existing 2013 seasonal adjusted traffic volumes to develop Opening Year 2020 and Horizon Year 2040 projected traffic volumes.
- The growth rate derived traffic volume forecasts were post-processed in developing Opening Year 2020 and Horizon Year 2040 traffic volume projections. Both AM and PM peak hour turning movement volumes were post-processed at each study intersection using the future year (Opening Year 2020/Horizon Year 2040, as appropriate) peak hour approach and departure volumes in conjunction with the seasonal adjusted existing (2013) turning movement volumes.
- The AM and PM peak hour traffic volumes were balanced between intersections using the peak hour directional approach and departure volumes at the study area intersections.

The post-processed peak hour volumes for Opening Year 2020 and Horizon Year 2040 are presented later in this report.

The project proposes improvements to the local arterial as well as geometric improvements at the ramp termini. The project would not impact SR-210 operations or affect regional traffic demand or distribution. Therefore, no separate regional model runs for No Build and Build conditions are necessary since the No Build and Build volumes are identical and only the interchange geometric improvement changes occur as part of the project.

3.0 ANALYSIS METHODOLOGIES

This report evaluates traffic operations at the SR-210/Base Line interchange and along the Base Line corridor in the study area under Existing 2013 conditions, Opening Year 2020 and Horizon Year 2040 conditions. The Base Line arterial corridor and intersecting interchange ramps are analyzed for improvements. The freeway ramp junctions and adjacent mainline freeway segments are considered to ensure that proposed improvements at the interchange will not have negative impacts on the mainline freeway or adjacent interchanges.

3.1 Intersection Operations

Intersection levels of service were calculated using the HCM analysis methodologies, using the Synchro 8 software, which accounts for the effects of signal coordination and platoon formation on intersection operations. Traffic signal timing was optimized using Synchro 8. Network cycle lengths between 60 seconds to 120 seconds at 10 second intervals were first analyzed and evaluated. A common network cycle length was selected for optimization based upon several measures of effectiveness such as performance index, total delay, total stops and unserved vehicles. Next, network offsets along with the phase splits at the study intersections were optimized.

The average control delay per vehicle is estimated for each lane group and aggregated for each approach and for the intersection as a whole. Level of service is directly related to the control delay value. The level of service criteria are listed in **Table 2** for signalized intersections.

Table 2: Level of Service (LOS) Criteria for Signalized Intersections

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

Source:
Exhibit 18-4 from Highway Capacity Manual 2010.

3.2 Basic Freeway Segment Operations

A basic freeway segment is a freeway mainline segment that is not within a ramp influence area (i.e., within 1,500 feet of a ramp) or within a weaving segment. Adding or dropping a lane results in the termination of a basic freeway segment. Peak hour volumes on basic freeway segments are analyzed using the methodology contained in HCM Chapter 11 ("Basic Freeway Segments"), with calculations performed using the Highway Capacity Software (HCS 2010). Level of service criteria for basic freeway segments are given in **Table 3**.

Table 3: LOS Criteria for Basic Freeway Segments

LOS	Density (pc/mi/ln)
A	≤ 11
B	> 11-18
C	> 18-26
D	> 26-35
E	> 35-45
F	Demand exceeds capacity >45

Source:
Exhibit 11-5 from Highway Capacity Manual 2010.

3.3 Weaving Segments

A weaving segment is a freeway mainline segment in which two streams of traffic must cross, such as in an auxiliary lane connecting an upstream on-ramp to a downstream off-ramp. The segment is evaluated if the weaving length is less than the maximum length as calculated by the equation listed below.

$$L_{MAX} = [5{,}728(1 + VR)^{1.6}] - [1{,}566N_{WL}]$$

Peak hour volumes in freeway weaving sections are analyzed using the methodology contained in HCM Chapter 12 ("Freeway Weaving"). A weaving segment, in which both weaving movements require a single lane change, such as in an auxiliary lane between a single-lane on-ramp and single-lane off-ramp, is a "Type A" weaving segment. A weaving segment in which one weaving movement requires a single lane change and the other weaving movement can be made without any lane change, such as in an auxiliary lane between a single-lane on-ramp and a two-lane off-ramp, is a "Type B" weaving segment. Consistent with Highway Capacity Manual procedures, a segment consisting of a one-lane on-ramp closely followed by a one-lane off-ramp without connecting auxiliary lane is not analyzed as a weaving segment, but as separate merge and diverge areas (Highway Capacity Manual, p. 12-16). Level of service criteria for weaving segments are listed in **Table 4**.

Table 4: LOS Criteria for Weaving Segments

LOS	Density (pc/mi/ln)	
	Freeway Weaving Segment	Multilane and Collector-Distributor Weaving Segments
A	0-10	0-12
B	> 10-20	> 12-24
C	> 20-28	> 24-32
D	> 28-35	> 32-36
E	> 35	> 36
F	Demand Exceeds Capacity	

Source:
Exhibit 12-10 from Highway Capacity Manual 2010.

3.4 Ramp Connection Merge/Diverge Areas

The merge/diverge analysis methodology consists of three primary steps. The first step calculates the flow entering the outer two lanes of the freeway immediately upstream of the merge influence area or at the beginning of the deceleration lane of the diverge influence area. The influence area for ramps and ramp junctions is 1,500 feet, including the acceleration and deceleration lane along with the outer two lanes of the freeway. Chapter 13 ("Ramps and Ramp Junctions") of the HCM indicates that other freeway lanes may be affected by merging or diverging maneuvers, but the defined area within the 1,500 feet generally experiences most of the impacts across all levels of service.

The second step compares capacity values with the demand flows in order to determine potential for congestion. There are several capacity values that are evaluated that include: maximum total flow approaching a diverge area on the freeway, maximum total flow departing from a merge or diverge area on the freeway, maximum total flow entering the ramp influence area, and maximum flow on a ramp. The capacity of a merge or diverge area is controlled by the capacity of the freeway segments upstream and downstream of the ramps or by the capacity of the ramp itself.

The third step calculates the density of flow within the ramp influence area and the level of service based on the density is determined. The level of service is represented by LOS A through LOS E. Although a density value is determined, LOS F occurs when the total demand flows exceed any of the capacity checks. Level of service criteria for merge and diverge areas are listed in **Table 5**. The density values shown for LOS A through LOS E assume stable operation, with no breakdown within the merge influence area.

Table 5: LOS Criteria for Merge and Diverge Areas

LOS	Density (pc/mi/ln)
A	≤ 10
B	> 10-20
C	> 20-28
D	> 28-35
E	> 35
F	Demand exceeds capacity

Source:
Exhibit 13-2 from Highway Capacity Manual 2010.

3.5 Queuing Analysis

Queuing analyses were conducted for the two ramp terminal intersections on Base Line at SR-210 and for the intersection of Base Line and Seine Avenue using Synchro Analysis software consistent with HCM 2010 analysis methodology. The queuing analyses compare the minimum required storage lengths to the storage lengths provided for the analyzed intersections.

The minimum required storage lengths are based on the 95th percentile queue lengths as calculated in the Synchro queuing worksheets. Synchro reports the 95th percentile queue length for a single lane of a lane group (highest queue length considering all lanes of the lane group) and not the total queue length of all lanes in that lane group.

The provided storage lengths for an intersection are measured from the limit line to the end of the bay taper for turn movements. For off-ramps, the provided storage lengths are measured from the off-ramp exit gore point to the crosswalk if it is a continuous lane. If turn lane (left or right) pockets are provided at the end of the off-ramp, then the provided storage lengths are measured from the limit line to the end of the bay taper for that turn lane.

3.6 Ramp Meter Queuing Analysis

Ramp metering analyses were conducted for ramp metering conditions for the Horizon Year 2040 Build Alternative scenario. The ramp metering analysis spreadsheets are set up for both AM and PM peak period conditions. Additionally, the ramp lanes, an average vehicle length, and the ramp storage length are input for each ramp. A ramp metering discharge rate (vehicles per hour per lane) between 240 and 900 vph/lane is used by Caltrans. For on-ramps, the provided storage lengths are measured from the crosswalk to the ramp meter limit line.

4.0 EXISTING 2013 TRAFFIC CONDITIONS

4.1 Intersection Levels of Service

The existing seasonal adjusted traffic counts for the AM and PM peak hours were input into Synchro along with the existing intersection geometric configurations and parameters such as peak hour factors (PHF), percent heavy vehicles, signal timing, etc. The levels of service at the study intersections under existing conditions are summarized in **Table 6** and the level of service calculation worksheets are contained in Appendix B.

Table 6: Existing 2013 Peak Hour Intersection Level of Service

ID	Signalized Intersection Name	AM Peak		PM Peak	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
1	Base Line/Church Avenue	18.8	B	20.2	C
2	SR-210 EB ramps/Base Line	18.5	B	17.1	B
3	SR-210 WB ramps/Base Line	25.6	C	18.4	B
4	Base Line/Seine Avenue	20.1	C	24.3	C

Notes:
1. Used Highway Capacity Manual 2010 methodology.
2. Analysis was performed using existing lane geometry and traffic controls.
3. Existing volumes based on counts conducted in June 2013 with a seasonal factor.

As shown in **Table 6**, all study area intersections are currently operating at LOS C or better during the existing conditions in both the AM and PM peak hours.

5.0 OPENING YEAR 2020 TRAFFIC CONDITIONS

5.1 Opening Year 2020 Projected Traffic Volumes

Opening year traffic volumes were developed for the Year 2020 using the methodology described in the Future Year Traffic Volume Forecasts section of this report. The Opening Year 2020 ramp peak hour volumes at Base Line and turn movements at study intersections along Base Line are illustrated on **Figure 3**. Traffic volumes for both No Build and Build conditions are the same, because the project does not appreciably affect mainline or local traffic demand.

5.2 Opening Year 2020 No Build Alternative Traffic Conditions

The 2020 No Build analysis includes the improvements described previously at the Base Line/Seine Avenue intersection, which are being constructed by the City of Highland and should be complete by the end of 2014.

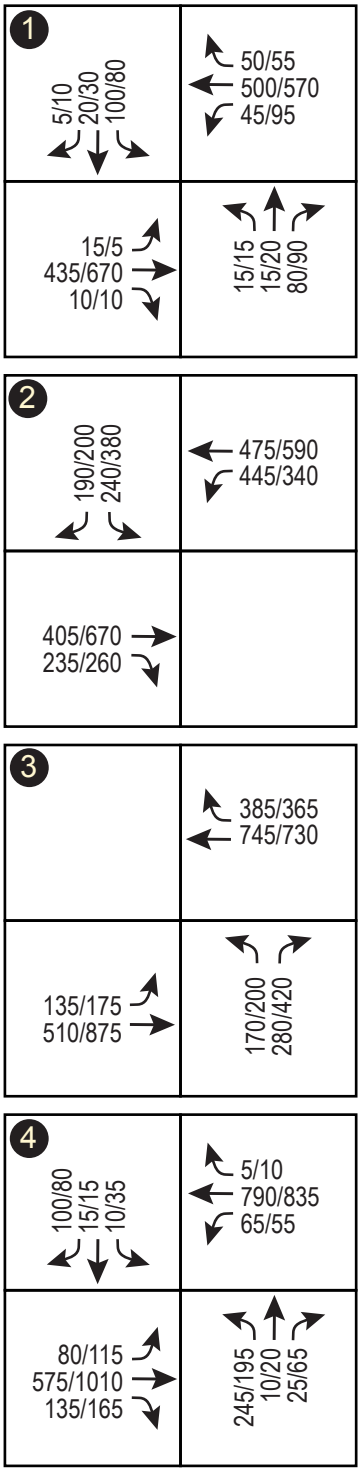
The level of service results at the study intersections under Opening Year 2020 No Build conditions are summarized in **Table 7**. Level of service calculation worksheets are contained in Appendix B.

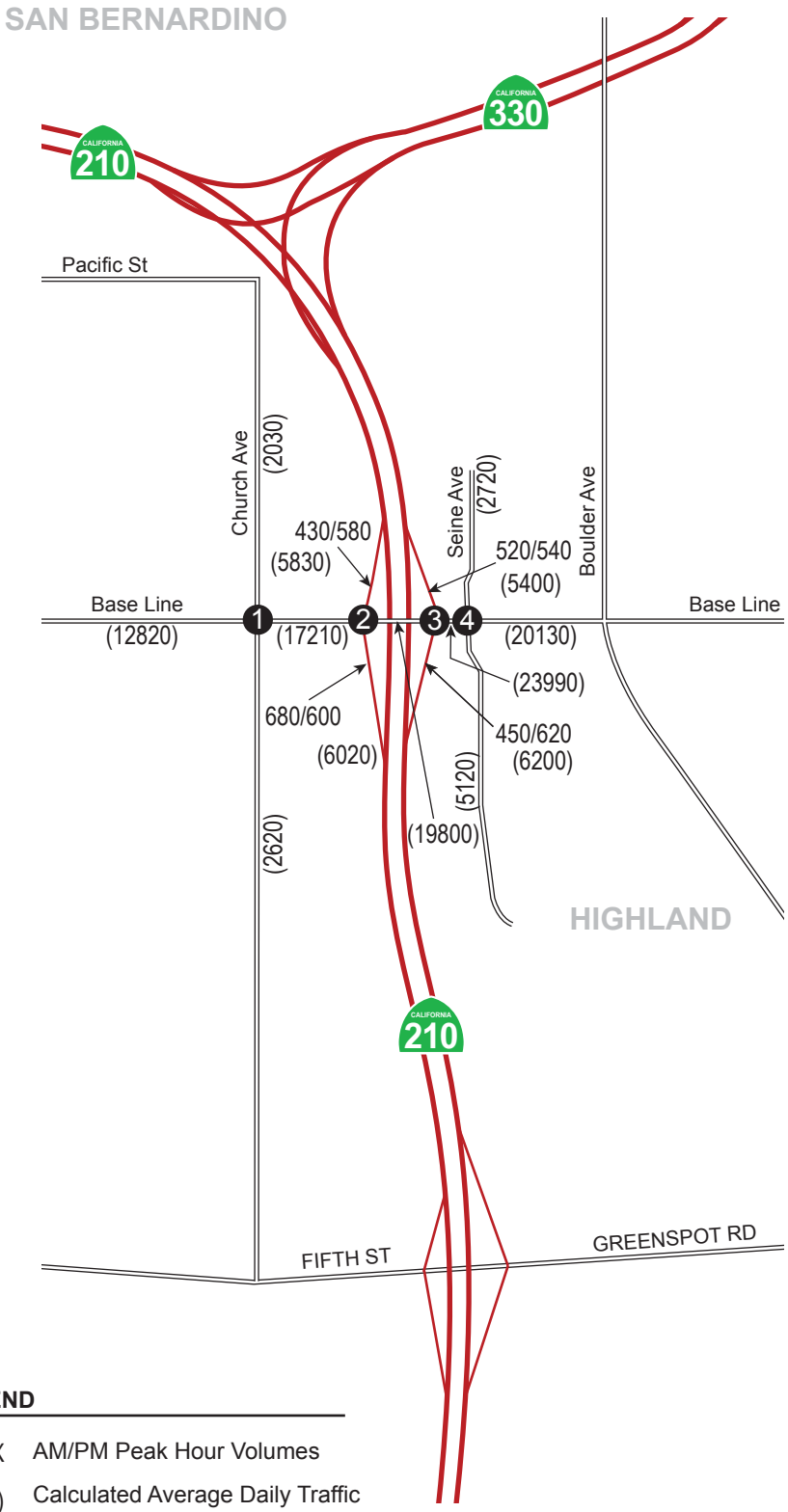
Table 7: Opening Year 2020 No Build – Peak Hour Intersection Level of Service

ID	Signalized Intersection Name	AM Peak		PM Peak	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
1	Base Line/Church Avenue	19.0	B	16.9	B
2	SR-210 EB ramps/Base Line	18.5	B	19.0	B
3	SR-210 WB ramps/Base Line	19.6	B	26.9	C
4	Base Line/Seine Avenue	25.2	C	17.9	B

Notes:
1. Using Highway Capacity Manual 2010 methodology.
2. 2020 No Build volumes were calculated based on the revised forecast volumes prepared using the 2013 counts and SBTAM demand model.

As shown in **Table 7**, all study area intersections are projected to operate at LOS C or better under Opening Year 2020 No Build conditions in both the AM and PM peak hours.





LEGEND

XX/XX	AM/PM Peak Hour Volumes
(XX)	Calculated Average Daily Traffic (ADT) Volumes.

OPENING YEAR 2020 TRAFFIC VOLUMES

SR-210 AT BASE LINE
INTERCHANGE IMPROVEMENT PROJECT

URS	CREATED BY: SV	DATE: April 2014	FIGURE 3
	PM: DS	PROJECT NO: 29866552	

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5.3 Opening Year 2020 Build Alternative Traffic Conditions

The 2020 Build Alternative widens Base Line from Buckeye Street to Seine Avenue and widens the existing interchange ramps. The proposed Build Alternative would reconstruct and improve the existing diamond interchange by widening Base Line and the interchange ramps within the limits of the project. The proposed Build Alternative includes the following design features and elements:

- Base Line between Buckeye Street and Seine Avenue and the interchange ramps would be widened to add through lanes, turn lanes and storage for vehicle queues.
- A two-lane exit would be created at the westbound exit ramp.
- For the westbound off-ramp, the right turn movement is analyzed as a restricted right turn with a “no-right-turn-on-red” sign.
- Ramp metering would be installed on the on-ramps at the interchange.
- A new crosswalk is proposed across Base Lane, located on the west leg of the Base Line and SR-210 eastbound ramps intersection.

The level of service results at the study intersections under Opening Year 2020 Build conditions are summarized in **Table 8**. Level of service calculation worksheets are contained in Appendix B.

Table 8: Opening Year 2020 Build – Peak Hour Intersection Level of Service

ID	Signalized Intersection Name	AM Peak		PM Peak	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
1	Base Line/Church Avenue	19.0	B	16.9	B
2	SR-210 EB ramps/Base Line	14.0	B	14.3	B
3	SR-210 WB ramps/Base Line	7.9	A	8.7	A
4	Base Line/Seine Avenue	23.2	C	21.0	C

Notes:
1. Using Highway Capacity Manual 2010 methodology.
2. 2020 No Build volumes were calculated based on the revised forecast volumes prepared using the 2013 counts and SBTAM demand model.

As shown in **Table 8**, all study area intersections are projected to operate at LOS C or better under Opening Year 2020 Build conditions in both the AM and PM peak hours.

6.0 HORIZON YEAR 2040 TRAFFIC CONDITIONS

6.1 Horizon Year 2040 Projected Traffic Volumes

Horizon year traffic volumes were developed for the Year 2040 using the methodology described above in the Future Year Traffic Volume Forecasts section of this report. The Horizon Year 2040 ramp peak hour volumes at Base Line and turn movements at study intersections along Base line are illustrated in **Figure 4.** Traffic volumes for both the No Build and Build conditions are the same, because the project does not appreciably affect mainline or local traffic demand.

6.2 Horizon Year 2040 No Build Traffic Conditions

Similar to the Opening Year 2020 No Build Alternative, the Horizon Year 2040 No Build Alternative analysis includes the improvements described previously at the Base Line/Seine Avenue intersection, which are being constructed by the City of Highland and should be complete by the end of 2014. The Horizon Year 2040 No Build Alternative was considered as a baseline to measure and compare the proposed improvement alternative.

6.2.1 Intersection Levels of Service

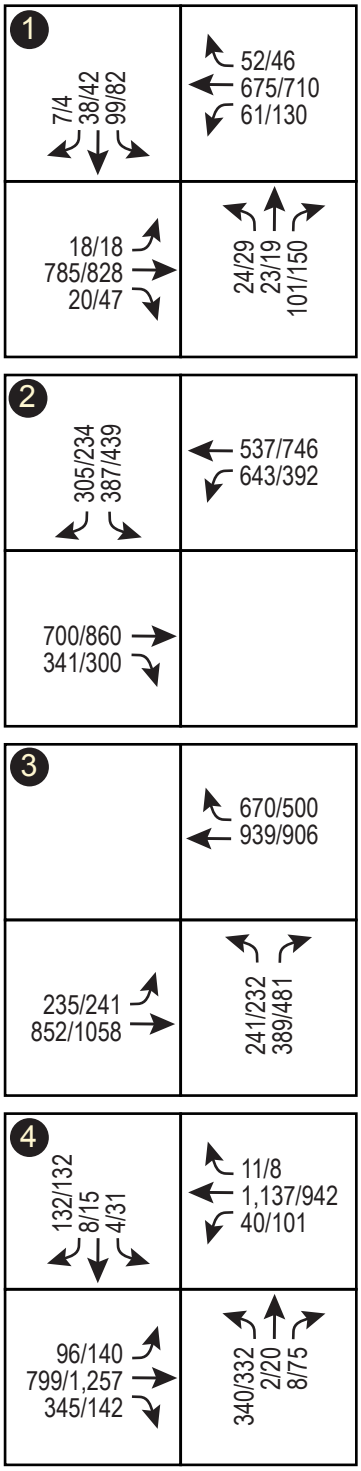
The level of service results at the study intersections under Horizon Year 2040 No Build conditions are summarized in **Table 9**. Level of service calculation worksheets are contained in the Appendix B.

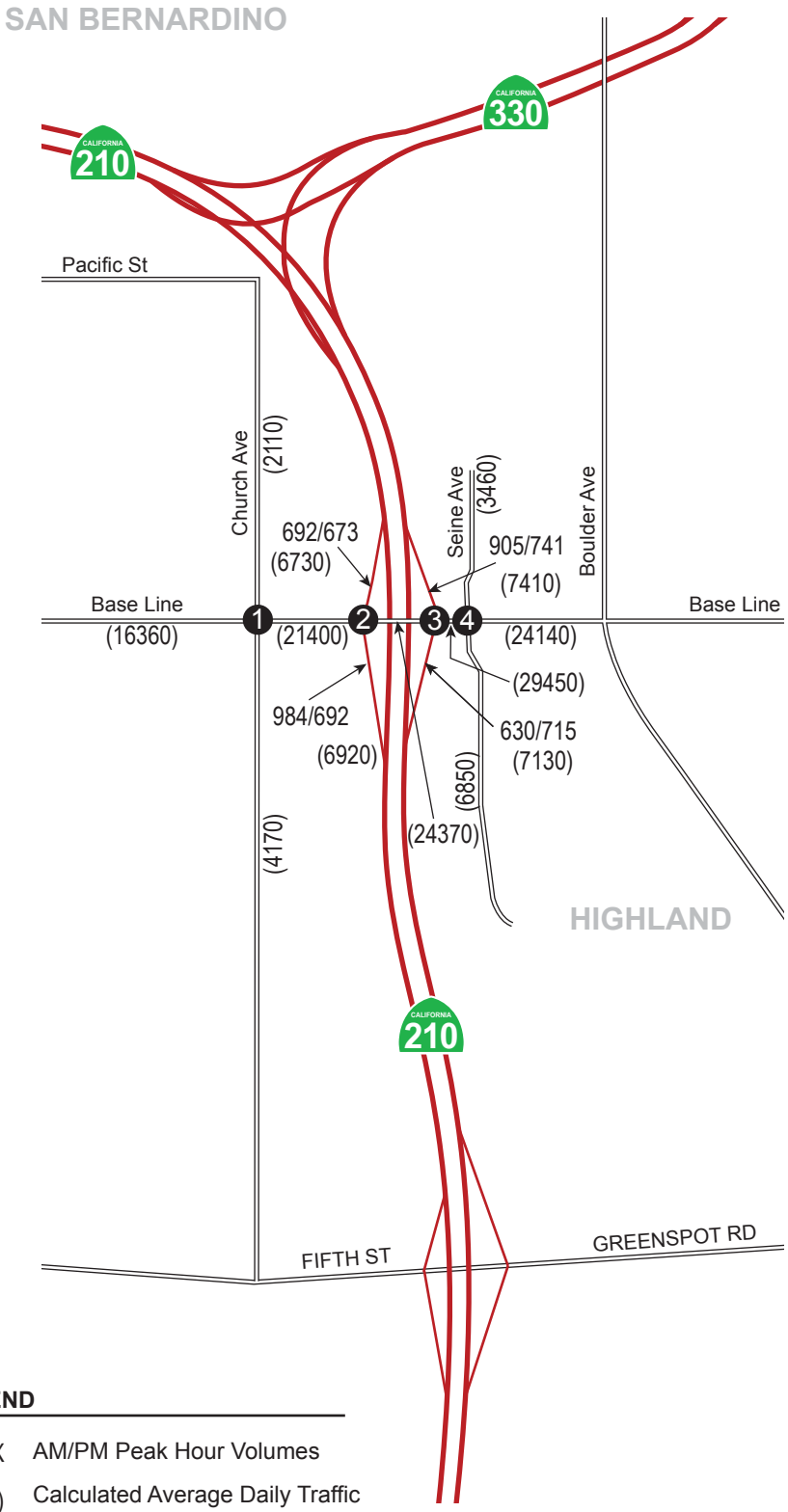
Table 9: Horizon Year (2040) No Build – Peak Hour Intersection Level of Service

ID	Signalized Intersection Name	AM Peak		PM Peak	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
1	Base Line/Church Avenue	17.7	B	17.8	B
2	SR-210 EB ramps/Base Line	24.8	C	20.8	C
3	SR-210 WB ramps/Base Line	50.2	D	48.8	D
4	Base Line/Seine Avenue	28.7	C	32.2	C

Notes:
1. Using Highway Capacity Manual 2010 methodology.
2. 2040 No Build volumes were calculated based on the revised forecast volumes prepared using the 2013 counts and SBTAM demand model.

As shown in **Table 9**, the study area intersections are predicted to degrade from existing conditions (which were generally LOS B and LOS C) to LOS C and LOS D if no improvements are implemented at the interchange.





LEGEND

XX/XX	AM/PM Peak Hour Volumes
(XX)	Calculated Average Daily Traffic (ADT) Volumes.

HORIZON YEAR 2040 TRAFFIC VOLUMES

SR-210 AT BASE LINE
INTERCHANGE IMPROVEMENT PROJECT

URS

CREATED BY: SV	DATE: April 2014	FIGURE 4
PM: DS	PROJECT NO: 29866552	

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6.2.1 Queuing Analysis

This section evaluates projected queuing for the Horizon Year 2040 No Build Alternative condition at closely spaced intersections along Base Line. The queuing analysis was conducted for the two SR-210 freeway ramp terminal intersections and for the intersection of Base Line and Seine Avenue. The intersection of Base Line at Church Avenue was not included since the distance of this intersection from the interchange is too far to have a queuing impact. **Table 10** shows Horizon Year 2040 predicted 95th percentile queue lengths in feet by approach movement compared to the storage provided in the No Build Alternative configuration. Queuing calculation worksheets are contained in the Appendix B.

Table 10: Horizon Year (2040) No Build – 95th Percentile Queue Summary

Intersection/Movement	Storage (feet)	Queue Length per lane (feet)		Adequate Storage
		AM Peak	PM Peak	
SR-210 EB Ramps/Base Line				
Base Line Rd EB Through	850	251	294	Yes
Base Line Rd EB Right-Turn	100	**111**	**102**	**No**
Base Line Rd WB Left-Turn	150	**242**	**162**	**No**
Base Line Rd WB Through	330	77	128	Yes
SR-210 EB Off-Ramp SB Left-Turn	750	189	205	Yes
SR-210 EB Off-Ramp SB Right-Turn	750	190	206	Yes
SR-210 WB Ramps/Base Line				
Base Line Rd EB Left-Turn	100	**148**	**153**	**No**
Base Line Rd EB Through	350	158	258	Yes
Base Line Rd WB Through	225	**628**	**590**	**No**
SR-210 WB Off-Ramp NB Left-Turn	900	205	176	Yes
SR-210 WB Off-Ramp NB Right-Turn	900	430	502	Yes
Seine Avenue/Base Line				
Base Line Rd EB Left-Turn	90	**135**	**176**	**No**
Base Line Rd EB Through	225	**251**	**463**	**No**
Base Line Rd EB Right-Turn	100	90	48	Yes
Base Line Rd WB Left-Turn	150	58	**156**	**No**
Base Line Rd WB Through	1000	470	328	Yes
Seine Ave NB Left-Turn	110	**167**	**195**	**No**
Seine Ave NB Through	800	5	25	Yes
Seine Ave NB Right-Turn	80	0	30	Yes
Seine Ave SB Left-Turn	100	11	43	Yes
Seine Ave SB Through	600	55	60	Yes

Notes:

Shaded cells indicate insufficient storage.

All intersection analyses conducted using Synchro 8.

As shown in **Table 10**, many of the movements at the study area intersections do not have adequate storage capacity for predicted queue lengths in the Horizon Year 2040 No Build conditions in both AM and PM peak hours. Both left turn movements that access the interchange on-ramps show longer queues than can be stored in the existing turn pockets.

Also, the short distance between the westbound freeway ramps and Seine Avenue does not provide sufficient through traffic storage in either of the AM or PM peak periods. Multiple turn movements at the Base Line/Seine Avenue intersection show inadequate storage for the predicted queue lengths in the Horizon Year 2040 No Build conditions.

6.2.3 Mainline Freeway and Adjacent Interchange Analysis

To ensure that the interchange improvements do not have a negative impact on adjacent freeway mainline segments or adjacent interchanges, freeway operations were analyzed beyond the SR-210/Base Line interchange. Mainline freeway weaving segments, as defined by the Highway Capacity Manual, exist between the SR-330 and Base Line interchanges. Additional weaving segments will exist between the Base Line and 5th Street–Greenspot Road interchanges by 2020. Therefore, the analysis of adjacent freeway facilities is a weaving analysis. Ramp junction and mainline freeway segment analyses do not apply. **Table 11** summarizes the density and level of service results for the weave locations along SR-210 in the study area under the Horizon Year 2040 No Build condition.

Table 11: Horizon Year 2040 No Build SR-210/Base Line Mainline Freeway Operations

Direction	Freeway Mainline Segment/Ramp Connection	Merge/Diverge/Weave Analysis					
		Facility	Lanes	AM Peak		PM Peak	
				Density	LOS	Density	LOS
Westbound	SR-210/Greenspot Road On-ramp*	Merge	3MF/ 1L Ramp	N/A (1)	N/A (1)	N/A (1)	N/A (1)
	SR-210 between 5th Street-Greenspot Road and Base Line*	Weave	3 MF/ 1 Aux	22.7	C	26.8	C
	SR-210/Base Line Off	Diverge	3 MF/ 1L Ramp	N/A (1)	N/A (1)	N/A (1)	N/A (1)
	SR-210/Base Line On	Merge	3 MF/ 1L Ramp	N/A (1)	N/A (1)	N/A (1)	N/A (1)
	SR-210 between Base Line and SR-330*	Weave	3 MF/ 1 Aux	24.3	C	25.9	C
	SR-210/SR-330 Connector*	Diverge	3MF/ 1L Ramp	N/A (1)	N/A (1)	N/A (1)	N/A (1)
Eastbound	SR-210/SR-330 Connector*	Merge	3MF/ 1L Ramp	N/A (1)	N/A (1)	N/A (1)	N/A (1)
	SR-210 between SR-330 and Base Line*	Weave	3 MF/ 1 Aux	22.3	C	22.0	C
	SR-210/Base Line Off	Diverge	3MF/ 1L Ramp	N/A (1)	N/A (1)	N/A (1)	N/A (1)
	SR-210/Base Line On	Merge	3 MF/ 1 Ramp	N/A (1)	N/A (1)	N/A (1)	N/A (1)
	SR-210 between Base Line and 5th Street-Greenspot Road*	Weave	3 MF/ 1 Aux	26.8	C	25.5	C
	SR-210/5th Street Off-ramp*	Diverge	3MF/1L Ramp	N/A (1)	N/A (1)	N/A (1)	N/A (1)

Notes:
Density in passenger car equivalents per mile per lane. MF = Mixed Flow. 1L = 1 lane ramp.
*Results from SR-210 Mixed Flow Lane Addition Project from Highland Avenue (PM R25.0) to San Bernardino Avenue (PM R33.2)
(1) Ramp junction analysis is not applicable for ramp connections in weave segments.

All of the weave locations are projected to operate at an acceptable LOS D or better during the AM and PM peak periods. The reported level of service results for the mainline freeway weave locations were obtained from the SR-210 Mixed Flow Lane Addition project TOAR approved on February 18, 2014.

6.3 Horizon Year 2040 Build Alternative Traffic Conditions

The 2040 Build Alternative widens Base Line from Buckeye Street to Seine Avenue and widens the existing interchange ramps. The proposed Build Alternative would reconstruct and improve the existing diamond interchange by widening Base Line and the interchange ramps within the limits of the project. The proposed Build Alternative includes the following design features and elements:

- Base Line between Buckeye Street and Seine Avenue and the interchange ramps would be widened to add through lanes, turn lanes and storage for vehicle queues.
- A two-lane exit would be created at the westbound exit ramp.
- For the westbound off-ramp, the right turn movement is analyzed as a restricted right turn with a “no-right-turn-on-red” sign.
- Ramp metering would be installed on the on-ramps at the interchange.
- A new crosswalk is proposed across Base Lane, located on the west leg of the Base Line and SR-210 eastbound ramps intersection.

6.3.1 Intersection Levels of Service

The level of service results at the study intersections under the Horizon Year 2040 Build Alternative conditions are summarized in **Table 12**. Level of service calculation worksheets are contained in Appendix B.

Table 12: Horizon Year (2040) Build – Peak Hour Intersection Level of Service

ID	Signalized Intersection Name	AM Peak		PM Peak	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
1	Base Line/Church Avenue	17.7	B	17.8	B
2	SR-210 EB ramps/Base Line	24.5	C	16.7	B
3	SR-210 WB ramps/Base Line	15.2	B	11.1	B
4	Base Line/Seine Avenue	24.7	C	22.5	C

Notes:
1. Using Highway Capacity Manual 2010 methodology.
2. 2040 Build volumes were calculated based on the revised forecast volumes prepared using the 2013 counts and SBTAM demand model.

As shown in **Table 12**, all study area intersections are projected to operate at an acceptable LOS D or better under Horizon Year 2040 Build conditions in both the AM and PM peak hours.

6.3.2 Queuing Analysis

This section evaluates projected queuing for the Horizon Year 2040 Build Alternative condition at intersections along Base Line at the SR-210 interchange. A queuing analysis was conducted for the two ramp terminal intersections on Base Line at SR-210 and for the intersection of Base Line and Seine Avenue. The intersection of Base Line at Church Avenue was not included since the distance of this intersection from the interchange is too far to have a queuing impact. **Table 13** shows Horizon Year 2040 predicted 95th percentile queue lengths in feet by approach movement compared to the storage provided in the Horizon Year 2040 Build Alternative configuration. Queuing calculation worksheets are contained in Appendix B.

Table 13: Horizon Year (2040) Build – 95th Percentile Queue Summary

Intersection/Movement	Storage (feet)	Queue Length per lane (feet)		Adequate Storage
		AM Peak	PM Peak	
SR-210 EB Ramps/Base Line				
Base Line Rd EB Through	850	139	155	Yes
Base Line Rd EB Right-Turn	100	59	49	Yes
Base Line Rd WB Left-Turn	250	228	151	Yes
Base Line Rd WB Through	300	27	36	Yes
SR-210 EB Off-Ramp SB Left-Turn	750	122	136	Yes
SR-210 EB Off-Ramp SB Right-Turn	750	58	73	Yes
SR-210 WB Ramps/Base Line				
Base Line Rd EB Left-Turn	350	100	102	Yes
Base Line Rd EB Through	350	75	115	Yes
Base Line Rd WB Through	225	23	59	Yes
Base Line Rd WB Right-Turn	80	4	29	Yes
SR-210 WB Off-Ramp NB Left-Turn	900	171	153	Yes
SR-210 WB Off-Ramp NB Right-Turn	900	139	164	Yes
Seine Avenue/Base Line				
Base Line Rd EB Left-Turn	180	47	63	Yes
Base Line Rd EB Through	225	87	190	Yes
Base Line Rd EB Right-Turn	100	32	15	Yes
Base Line Rd WB Left-Turn	150	46	126	Yes
Base Line Rd WB Through	1000	418	330	Yes
Seine Ave NB Left-Turn	110	**163**	**147**	**No**
Seine Ave NB Through	800	4	17	Yes
Seine Ave NB Right-Turn	80	0	7	Yes
Seine Ave SB Left-Turn	100	9	33	Yes
Seine Ave SB Through	600	14	20	Yes
Seine Ave SB Right-Turn	100	42	18	Yes

Notes:

Shaded cells indicate insufficient storage.

All intersection analyses conducted using Synchro 8.

As shown in **Table 13**, the many locations of inadequate storage identified in the Horizon Year 2040 No Build scenario (refer to **Table 10**) have been improved to the extent that only one movement is under-provided in the Horizon Year 2040 Build scenario. All of the turn movements and through traffic queues at the interchange ramp terminal intersections can be contained within the storage provided by the Build Alternative.

The two on-ramps were also analyzed for future ramp metering in the Horizon Year 2040 Build Alternative scenario. The ramp lanes, an average vehicle length, and the ramp storage length were input for each ramp. A ramp metering discharge rate [vehicles per hour (vph) per lane] between 240 and 900 vph/lane is used by Caltrans. To be conservative, a ramp metering discharge rate of 240 vph/lane was used in this analysis. **Table 14** presents the ramp metering queuing analysis for each of the on-ramps.

Table 14: Horizon Year 2040 Build Alternative – Ramp Meter Queuing Analysis

On-Ramp	Peak Hour	Lanes	Available Storage per Lane (ft)	Total Arrival (1)	Meter Rate	Max. Queue Ft/Lane	Adequate Storage
WB	AM	2	250	1,244	240	122	Yes
	PM			1,163	240	141	Yes
EB	AM	2	500	1,284	240	236	Yes
	PM			952	240	0	Yes

Notes:
(1) For 3 hour peak period

Table 14 indicates that the storage provided on all on-ramps with proposed ramp metering for the Horizon Year 2040 Build Alternative are adequate using an assumed meter rate of 240 vph/lane. The projected maximum queue identified in **Table 14** can be decreased by increasing the meter rate, as needed.

6.3.3 Mainline Freeway and Adjacent Interchange Analysis

The mainline freeway and adjacent interchange analyses are governed by the traffic volumes entering and exiting the freeway at the SR-210/Base Line interchange and the geometrics of the ramp junctions at connection points between the interchange and the mainline freeway lanes. The Horizon Year 2040 traffic volumes are the same for both the No Build and Build conditions. Also, auxiliary lanes will exist between the SR-210/Base Line interchange and the adjacent SR-330 and adjacent 5th Street-Greenspot Road interchanges. Therefore, the mainline freeway and adjacent interchange analysis for the Horizon Year 2040 Build conditions is the same as the analysis for the Horizon Year 2040 No Build conditions presented in the previous section. Thus, as shown in **Table 11**, all of the weave locations are projected to operate at an acceptable LOS C or better during the AM and PM peak periods.