

Centinela Avenue Grade Separation Traffic Analysis DRAFT Report

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Submitted to:



17J18-0400 | Prepared by Iteris, Inc.

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1.0 EXECUTIVE SUMMARY

1.1 Problem Statement

The Crenshaw/LAX Light Rail Transit (LRT) Line is an under-construction light rail line that will run through southwest Los Angeles. The Crenshaw/LAX line will connect the existing Exposition Line and the Green Line, near Los Angeles International Airport. Eight new stations are part of this transit line, including three stations in the City of Inglewood: Fairview Heights, Downtown Inglewood, and Westchester/Veterans. Revenue service for the Crenshaw/LAX line is anticipated to begin late 2019. The Final EIR for the Crenshaw/LAX line was certified in September 2011 and assumed an at-grade crossing at the intersection of Centinela Avenue/Florence Avenue. This rail crossing is within one-quarter mile of the Downtown Inglewood station and about 1.5 miles northwest of the Inglewood Stadium and the Hollywood Park Development Area.

FIGURE ES-0 – Study Area



The intersection of Centinela Avenue and Florence Avenue is a T-intersection, and as a result, it does not contain northbound or southbound through movements. Without a southbound through movement, drivers proceeding south from Centinela Avenue must turn left or right onto Florence Avenue and then turn right onto Prairie Avenue or left onto Hillcrest Boulevard in order to continue south. Drivers traveling north must similarly turn right on Hillcrest Boulevard or left on Prairie Avenue and then turn right or left

from Florence Avenue onto Centinela Avenue. Traffic congestion and queuing currently occur at this location.

During construction of the Crenshaw/LAX Line, the City of Inglewood has increasingly evolved into a major sports and entertainment center in the greater Los Angeles area, as evidenced by the following:

- The Forum in Inglewood was revitalized and now actively hosts some of the largest entertainment acts in the Country.
- Approximately 238 acres in Hollywood Park are being redeveloped with a number of new uses including 2,500 units of residential, 890,000 square feet of retail, 780,000 square feet of office, a 300-room hotel, 25 acres of new recreational and park amenities, a new 72,000-seat National Football League (NFL) Stadium that will be home to both the NFL Los Angeles Rams and Los Angeles Chargers teams, and a performance arts venue with 6,000 seats. Construction of the stadium began in 2014 and is slated for completion by 2020.
- On February 20, 2018, the City of Inglewood initiated the environmental clearance process for the proposed Inglewood Basketball and Entertainment Center (IBEC), which includes an 18,000 fixed seat arena, an 85,000-square foot team practice and athletic training facility, LA Clippers team office space, sports medicine clinic and approximately 40,000 square feet of retail and other ancillary uses.
- The new LA Philharmonic's music and cultural campus for the Youth Orchestra Los Angeles (YOLA) will be relocated to the Inglewood Civic Center area. Construction on the 25,000 square feet of the YOLA Center is slated to start in the spring 2019.

Recent intensification of development in the City is expected to increase traffic volume levels on the City's roadways that provide regional and local access to the Hollywood Park area, including the Centinela Avenue/Florence Avenue intersection. Due to this anticipated increased vehicular volume resulting from recurrent and special event demand, the Metro Board directed staff to conduct a grade separation study for the Crenshaw/LAX Line at this location.

1.2 Study Approach and Methodology

The Study took a two-step approach, including:

- Step 1 – A detailed intersection queuing analysis for the Centinela/Florence crossing for typical weekday commute peak periods and,
- Step 2 – A high-level assessment of the potential special large event surge traffic to and from the Hollywood Park, in response to the City of Inglewood's request.

In Step 1, the Study analyzed traffic conditions at four intersections, including the Centinela Avenue/Florence Avenue crossing intersection and the three adjacent intersections Centinela Avenue/Warren Lane, Hillcrest Boulevard/Florence Avenue, and Prairie Avenue/Florence Avenue. Traffic assessment was conducted for various traffic scenarios for the typical weekday a.m. and p.m. peak hours under existing (year 2017), future 2019 (opening year of the Crenshaw/LAX Line) and future 2040 conditions. Traffic queueing analysis was performed to compare the conditions for LRT at-grade vs. grade

separation.

In Step 2 for the special event surge analysis, Metro conducted an evaluation of the potential event-related trips at the Centinela Avenue/Florence Avenue intersections. The analysis utilized the anticipated trip generation of each event venue as well as the trip arrival and departure patterns provided by the City of Inglewood. The analysis assumed the worst-case scenario of when there are “full house” events happening at each of these venues. The special event surge analysis is included in Chapter 9.0 of this report.

While this study is the product of an independent analysis by Metro, it was conducted in coordination with the City of Inglewood. Metro met with the City of Inglewood throughout the study to receive input on key assumptions for analysis, including intersection design, signal phasing, base traffic volumes, an annual traffic growth factor, future development in the City of Inglewood and nearby The Southern California Association of Governments (SCAG) travel demand forecasting model was used to determine the growth and routing of traffic, and the use of traffic simulation modeling. Additionally, the City of Inglewood provided cumulative growth forecasts based on new development proposals which were added to the SCAG forecast’s future year 2040 analysis in Chapter 7.0 of this report.

The analysis also assesses the performance of the Centinela Avenue/Florence Avenue intersection according to Metro’s Grade Crossing Safety Policy (October 2010), a screening tool for the evaluation of potential grade separation vs. at-grade operation along new light rail lines. As a decision threshold, Metro’s Grade Crossing Policy is intended for peak hour analysis to guide design decisions for new projects and extensions. The policy is not normally used to analyze existing light rail at-grade crossings or special event traffic analysis; however, it was utilized for the Centinela/Florence crossing to understand the level of future traffic activity and provide a baseline for evaluating the need and feasibility of potential grade separation improvements at this location. Furthermore, a policy does not exist for growth and land use changes at existing Metro grade crossings.

1.3 Analysis

1.3.1 Signal Phasing Assumptions

Figure ES-1 and **Table ES-1** show an average signal cycle under existing baseline conditions. Without the railroad gates and Light Rail Transit (LRT) preemption signal phase, the traffic signal at the Centinela/Florence intersection is currently operating at a 100-second cycle during the typical weekday peak hours.

When the LRT trains are present, the signal at this location will operate at a longer cycle length between 120 to 140 seconds to provide required track clearance and priority for the LRT trains. The exact cycle length will vary, depending on the actual train arrival schedules and the background traffic volumes. An

average signal cycle of approximately 130 seconds is anticipated based on multiple VISSIM simulation¹ runs for the peak hours. When LRT trains are present, approximately 38 percent (52 seconds on average) of the signal phase would be dedicated to the Crenshaw/LAX Line and the remaining 62% of the signal time would be dedicated to vehicles and pedestrians using the crossing. This results in effectively decreasing the green times of the current signal phases for the traffic movements crossing the LRT tracks by approximately 10 seconds on average per cycle. For illustrative purposes, an average signal cycle for Centinela Avenue/Florence Avenue is shown in **Figure ES-2** and **Table ES-2**.

¹ VISSIM is a microscopic multi-modal traffic flow simulation software package. The VISSIM traffic simulation models were used to analyze performance of roadway facilities and to generate outputs such as an average intersection delay per vehicle and intersection level of service (LOS) for the analyzed peak hours. The VISSIM models included roadway geometrics, traffic volumes, traffic signal and train pre-emption parameters, and driver behavior characteristics.

FIGURE ES-1 – Average Signal Phase Time Percent Allocation without LRT

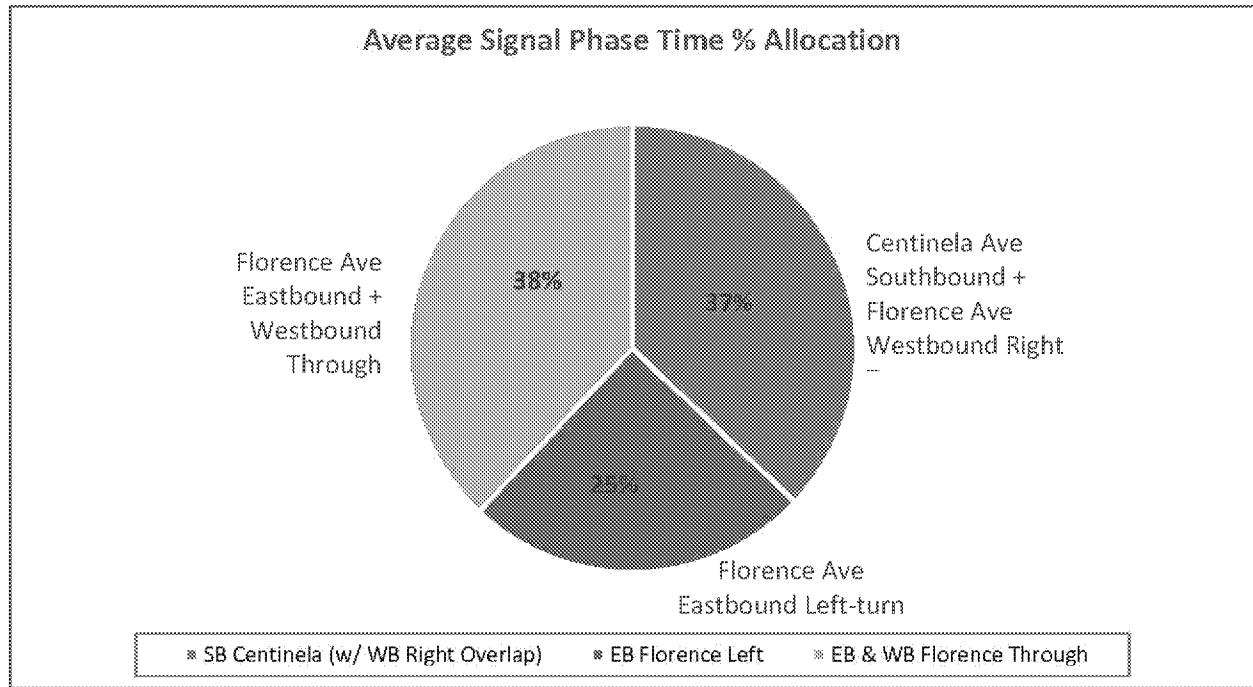
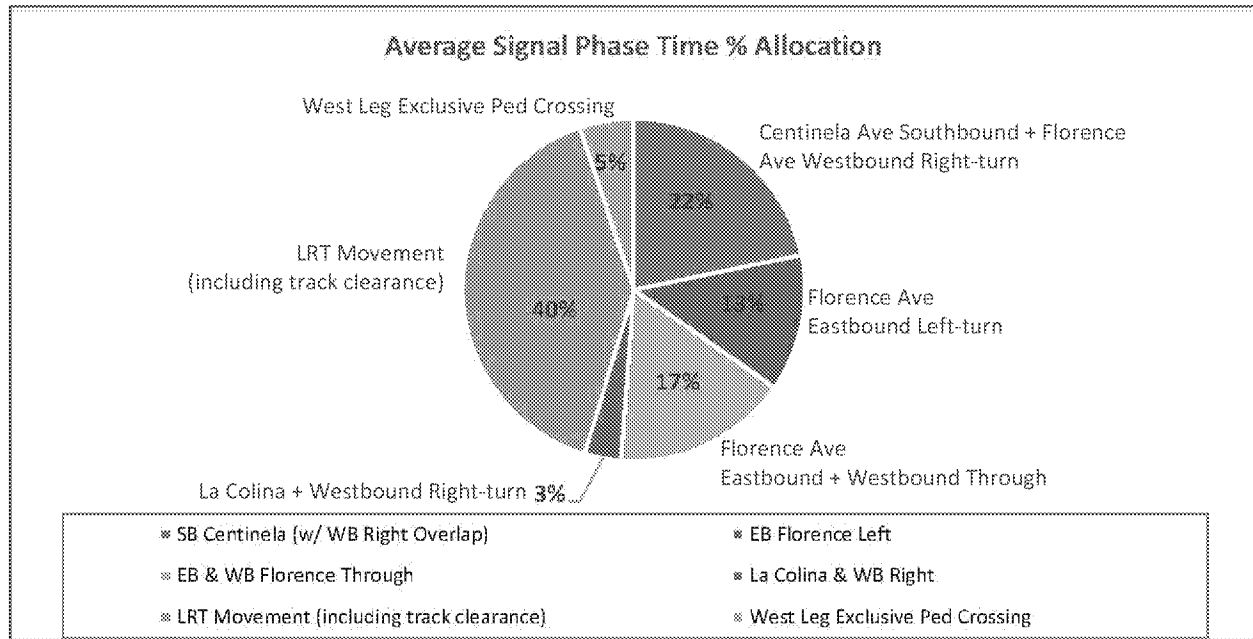


Table ES-1: Signal Phase Time Allocation without LRT

Movement	Average Signal Cycle (seconds)	Percentage share
EB Florence Ave Left-turn	25 sec	25%
EB & WB Florence Ave Through	38 sec	38%
SB Centinela Ave	37 sec	37%
Sum	100 sec	100%

Note: EB: Eastbound; WB: Westbound; SB: Southbound

FIGURE ES-2 – Average Signal Phase Time Percent Allocation with LRT



*Note: This pie chart represents the “average” cycle. However, there would not be a true typical cycle given the LRT. La Colina would not be activated every cycle, nor would the West Leg Exclusive Ped Crossing. The percent allocation for these phases would be longer than the amounts shown when activated, but since they are not activated every cycle, the total percentage averages out to the values shown in the chart.

Table ES-2: Signal Phase Time Allocation with LRT

Movement	Average Signal Cycle* (seconds)	Percentage share
EB Florence Ave Left-turn	17 sec	13%
EB & WB Florence Ave Through	21 sec	17%
La Colina & WB Right-turn	4 sec	3%
SB Centinela Ave & WB right turn overlap	29 sec	22%
West Leg Exclusive Pedestrian Crossing	7 sec	5%
LRT Movement (including track clearance)	52 sec	40%
Sum	130 sec	100%

*Note: When the LRT trains are present, the signal at this location would be operating at a longer cycle length between 120 to 140 seconds, depending on the train arrival schedules and the background traffic volumes. An average signal cycle of approximately 130 seconds was estimated based on multiple VISSIM model runs.

1.3.2 Nomograph

The Metro Grade Crossing Safety Policy nomographs for Centinela Avenue/Florence Avenue in 2017 and 2040 are shown in **Figures ES-3** and **ES-4** for typical weekday a.m. and p.m. peak hours. The two sets of plots on the nomograph illustrate the increased traffic volumes between existing and future years, and the effect of this increase in traffic according to the Metro Grade Crossing Safety Policy.

As shown in **Figure ES-3**, in existing plus LRT traffic forecasts for the a.m. peak hour, approximately 900 cars per hour per lane are anticipated to cross the Centinela/Florence crossing with maximum train frequency of every 5 minutes in each direction for the LRT. Due to increased development, traffic is anticipated to increase to over 1,000 cars per hour per lane in future year 2040. As shown in **Figure ES-4**, under the existing plus LRT traffic conditions for the p.m. peak hour, over 500 cars per hour per lane are anticipated to cross the Centinela/Florence crossing with maximum train frequency of every 5 minutes in each direction for the LRT. Due to increased development, traffic is anticipated to increase to over 800 cars per hour per lane in future year 2040.

Based on traffic volumes and train frequency during the a.m. peak hour (which experiences higher traffic volumes than the p.m. peak hour), the screening categorizes the intersection as having “Possible At-Grade Operation”. As described on the nomograph, “At-Grade Operation” may be possible in 2040 for this intersection but further engineering analysis is required for intersections in this category. The year 2040 traffic data points move the intersection slightly closer to the “Grade Separation Usually Required” category for both the year 2040 a.m. peak hour and p.m. peak hour nomographs.

FIGURE ES-3 Nomograph for Initial Screening (Weekday AM peak hour) – Existing with LRT vs. 2040 with LRT

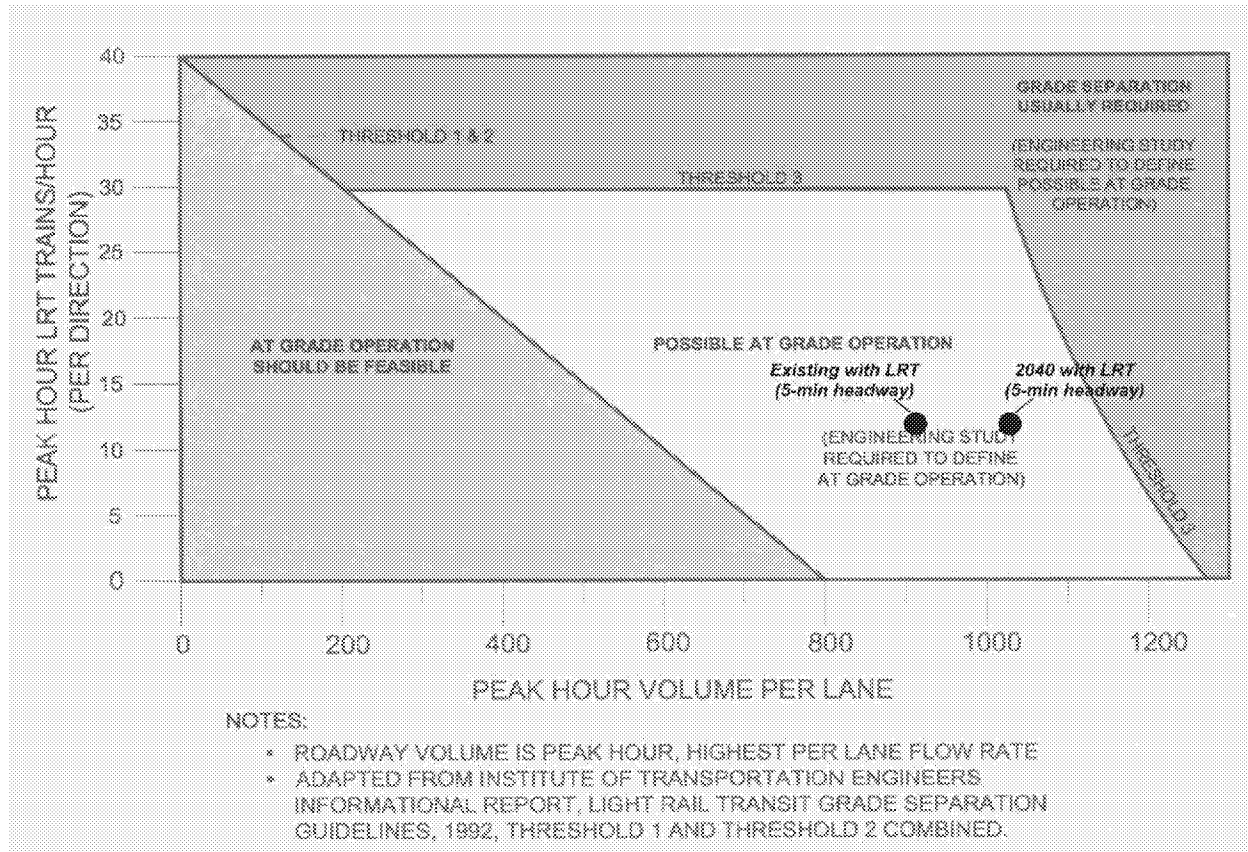
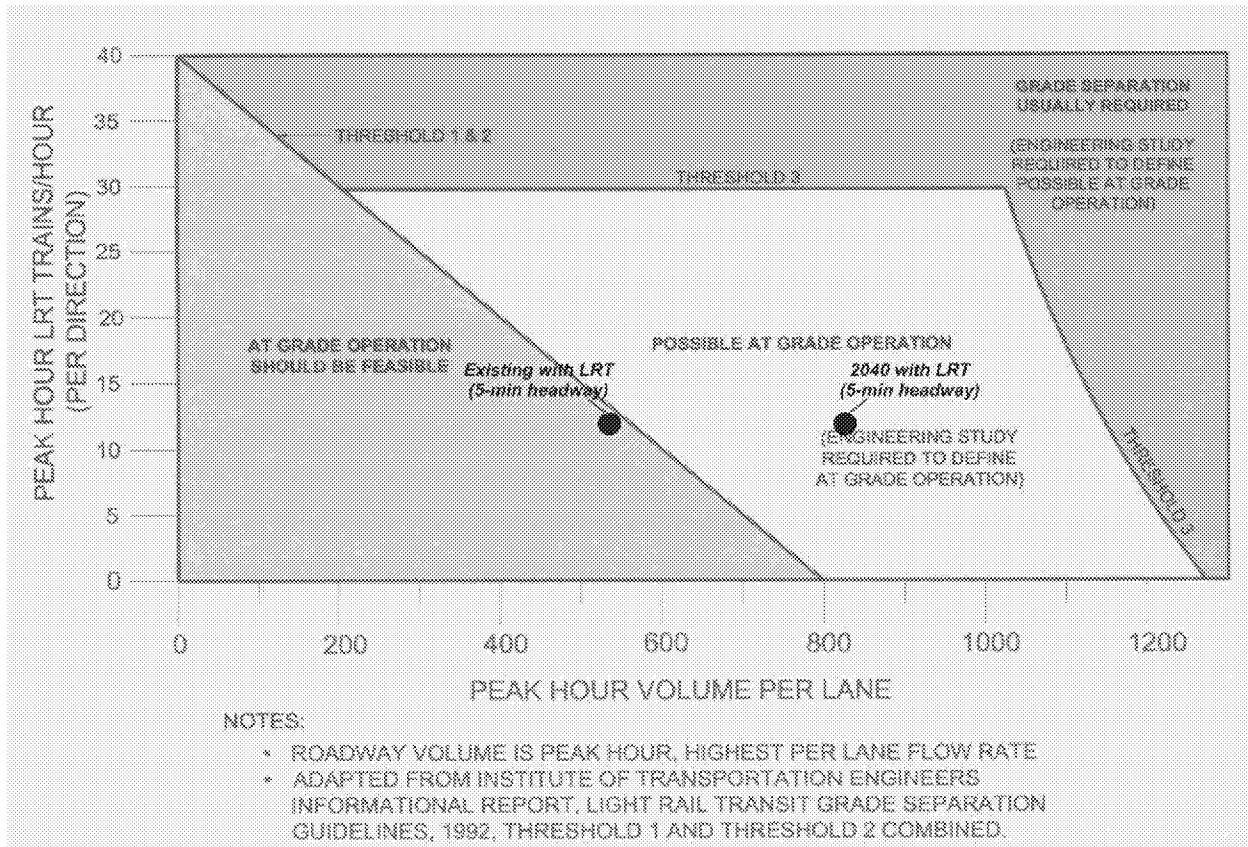


FIGURE ES-4 Nomograph for Initial Screening (Weekday PM peak hour) – Existing with LRT vs. 2040 with LRT



1.3.3 Traffic Congestion

The quality of traffic operations is characterized using the concept of level of service (LOS). Level of service is defined by a range of grades from A (best) to F (worst), where LOS A represents relatively free flow operating conditions with little or no delay and LOS "F" is characterized by unstable flow conditions, heavy congestion and vehicle delays, with traffic volumes at or near the intersection's design capacity. From 2017 to 2040, traffic congestion is expected to increase at all four study intersections. As shown in **Table ES-3**, average vehicle delay at Centinela Avenue/Florence Avenue is estimated to increase from 15 seconds (LOS C) to 118 seconds (LOS F) during the a.m. peak hour and from 14 seconds (LOS B) to 109 seconds (LOS F) during the p.m. peak hour with at-grade crossing. With a grade-separated crossing, average vehicle delay at Centinela Avenue/Florence Avenue is projected to be 32 seconds (LOS C) in the a.m. peak hour and 55 seconds (LOS E) in the p.m. peak hour in year 2040.

**Table ES-3: Centinela Ave/Florence Ave Intersection Peak Hour LOS
2017, 2019, 2040 (with and without LRT grade separation)**

Scenario	AM Peak Hour Ave. Vehicle Delay (seconds) - LOS	PM Peak Hour Ave. Vehicle Delay (seconds) - LOS
Existing Conditions	15.4 – C	14.4 – B
Existing Plus At-Grade Crossing ¹	107.9 – F	97.8 – F
Opening Year 2019 with At-Grade Crossing ²	103.7 – F	98.1 – F
Opening Year 2019 with Grade-Separated Crossing ²	20.1 – C	15.3 – B
Future Year 2040 with At-Grade Crossing ^{1,3}	117.9 – F	108.5 – F
Future Year 2040 with Grade-Separated Crossing ^{1,3}	31.7 – C	55.3 – E

Note:

1. Three-car trains and 5-minute headways per direction during peak hours
2. Two-car trains and 5-minute headways per direction during peak hours
3. Year 2040 with LRT scenarios assumed implementation of the Crenshaw Line EIR mitigation (widened southbound approach of Centinela Avenue and added a second left-turn lane from eastbound Florence Avenue to northbound Centinela Avenue).

1.3.4 Queue Lengths

Vehicle queues for all movements at study intersections are expected to increase with the background traffic growth and the opening of the Crenshaw/LAX Line. To understand if an at-grade LRT crossing is feasible from the traffic operations and safety perspectives, two types of vehicle queues were evaluated for the Centinela/Florence crossing per the Metro Grade Crossing Policy, including:

- **Influence zone:** The area between the light rail tracks or gate and an adjacent intersection where the queue from the adjacent intersection has the potential to back up onto the light rail tracks. An extensive influence zone queue may cause a safety concern. At Centinela/Florence crossing, the influence zone queues are: northbound movement at Centinela Avenue/Warren Lane, westbound movement at Hillcrest Blvd/Florence Avenue, and eastbound movement at Prairie Avenue/Florence Avenue.
- **Gate spillback:** The area between the light rail tracks or gate and an adjacent intersection where the queue resulting from the gate has the potential to back up to the adjacent intersection. An extensive spillback queue may result in traffic gridlocking in the localized area around an at-grade crossing. At Centinela/Florence crossing, the gate spillback queue are traffic movements that would have direct conflicts with the LRT tracks, including: southbound left turn and right turn movement on Centinela Avenue, westbound right-turn movement from Florence Avenue to Centinela Avenue, and eastbound left turn movement from Florence Avenue to Centinela Avenue.

At the Centinela/Florence intersection, the influence zone and gate spillback queues were estimated for all study scenarios (existing, 2019 opening year, and 2040). The key findings from the queueing analysis are:

- **Existing (no LRT) Conditions scenario:** Under the pre-Crenshaw/LAX LRT conditions, the intersection operated at acceptable levels of service (LOS C) in the weekday a.m. and p.m. peak hours and no significant traffic queuing conditions under were identified based on field observations and average queue lengths on typical weekdays.
- **Existing Plus At-Grade Crossing scenario:** If the LRT tracks were in operation with 5-minute headways and 3-car trains with the current background traffic, this intersection LOS would change from LOS C or better to LOS F in both peak hours. Traffic movements in the southbound queue (left turn and right-turn), eastbound left turn queue and westbound right turn queue could potentially spill back from the LRT tracks to the adjacent intersections (Warren, Prairie, and Hillcrest). Yet, the average and worst-case influence zone queue lengths are not anticipated to extend from the adjacent intersections to cross the LRT tracks (i.e., no salient safety issue was identified).
- **Opening year 2019 With At-Grade Crossing scenario:** In the near-term, with 5-minute headways per direction, 2-car trains, and slightly higher background traffic conditions, this intersection LOS would change from existing LOS C or better to LOS F conditions in both the a.m. and p.m. peak hours. The vehicle queues at Centinela/Florence may accumulate and begin to spill back from the LRT tracks to the three adjacent intersections periodically (Warren to the north, Prairie to the east, and Hillcrest to the west). However, no salient safety issue was identified for this at-grade crossing because the average influence zone queues from the adjacent intersections are projected to be within the storage capacity on Florence and on Centinela.
- **Opening year 2019 With Grade-Separated Crossing scenario:** The intersection is anticipated to operate at comparable LOS and queuing conditions to the existing conditions.
- **Future Year 2040 With At-Grade Crossing scenario:** Due to the cumulative traffic growth, 5-minute headway per direction, and 3-car train services, this intersection LOS would deteriorate from existing LOS C or better to LOS F in both the a.m. and p.m. peak hours. Traffic movements approaching the at-grade crossings (southbound, eastbound left turn and westbound right-turn) may experience extensive delays and queue lengths and motorists may have to wait for more than one signal cycle before they can safely cross the LRT tracks. These traffic movements could potentially spill back from the LRT tracks to the adjacent intersections (Warren, Prairie, and Hillcrest) frequently. Based on the projected average vehicle delay, it is estimated that approximately between 1 and 2 cycles may potentially be needed to clear the average southbound Centinela Avenue queue, of approximately 470 feet, at Florence Avenue during both the typical weekday a.m. and p.m. peak hours. However, no salient safety issue is anticipated for this at-grade crossing because the typical average influence zone queue from the adjacent intersections is projected to be within the storage capacity on Florence and on Centinela. Potential maximum queue may spill back to one to two blocks of the intersection; however,

application of the Metro Grade Crossing Policy indicated that the Centinela Avenue crossing continues to be categorized as a “possible at-grade operation” under the typical weekday traffic conditions (without the special event traffic surge).

- **Future Year 2040 With Grade-Separated Crossing scenario:** Due to the cumulative traffic growth, this intersection is projected to operate at LOS C in the a.m. peak hour and at border line LOS E in the p.m. peak hour. The average traffic queue for the southbound left turn and right turn queue may be extensive and begin to spill back to Warren Lane to the north. The average eastbound and westbound movement queues can be generally accommodated within one block of the at-grade crossing, but the maximum queue may begin to spill back to Prairie and to Hillcrest periodically.

Figures ES-5 and ES-6 show a comparison of existing average queue lengths and 2040 with at-grade crossing average queue lengths at the intersection approaches, during the weekday a.m. and p.m. peak hours respectively. As shown in the figures, in 2040, the average influence zone traffic queues are not expected to extend from the adjacent intersections to across the Crenshaw/LAX Line tracks at Centinela/Florence intersection. The east/westbound through movements on Florence Avenue may be congested, but are not expected to result in salient safety issues to the at-grade crossing. However, due to the LRT train pre-emption and gate operations as well as growth in background traffic, the estimated traffic queuing for the southbound movements, eastbound left-turn, and westbound right-turn movement will be extensive under 2040 conditions at this crossing.

The Step 1 analysis indicated that, without special large event traffic surge conditions, at-grade operation of the Crenshaw/LAX line is anticipated to be possible per Metro’s Grade Crossing Policy at the Centinela/Florence intersection in opening year 2019 and future 2040 conditions.

FIGURE ES-5: Existing and 2040 Average AM Queue Lengths at Centinela/Florence

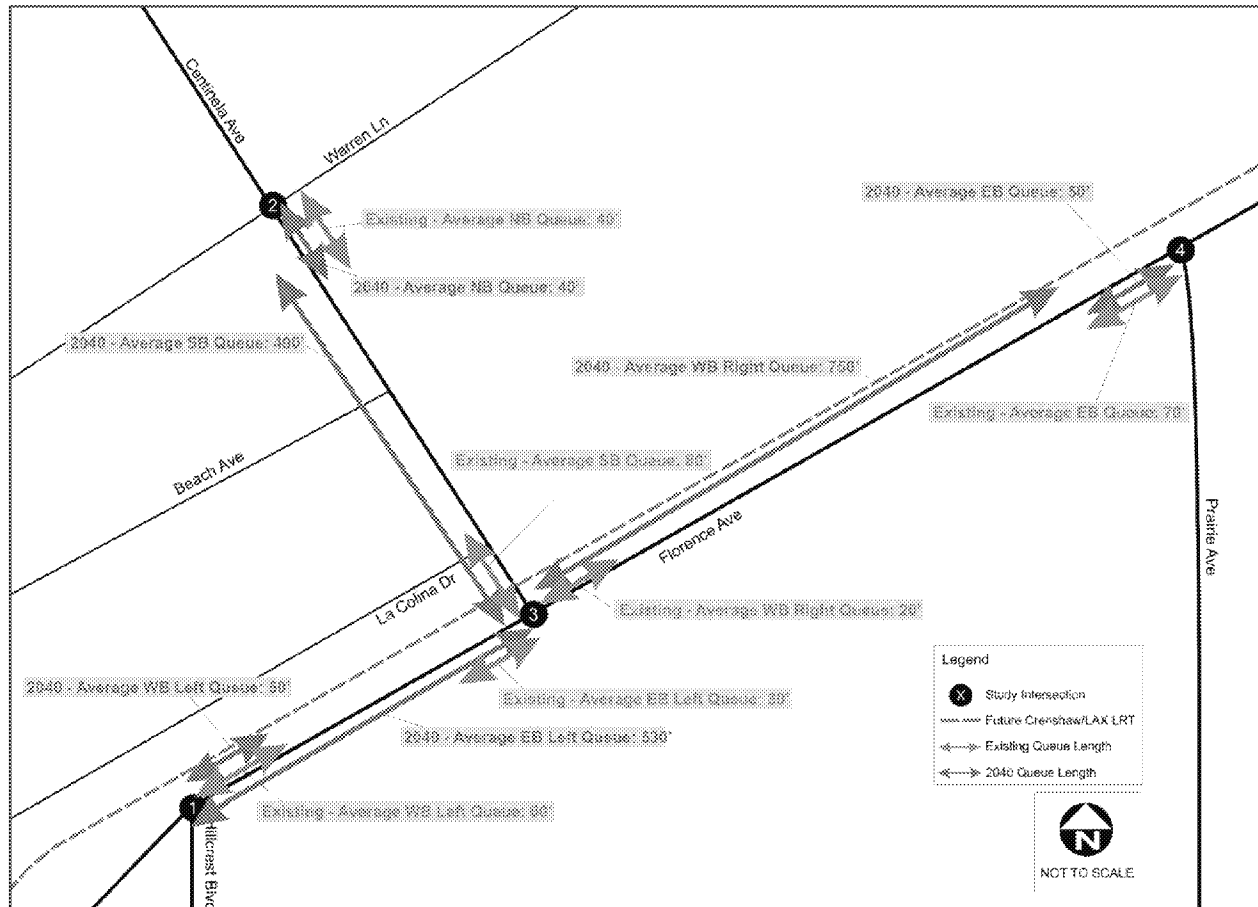
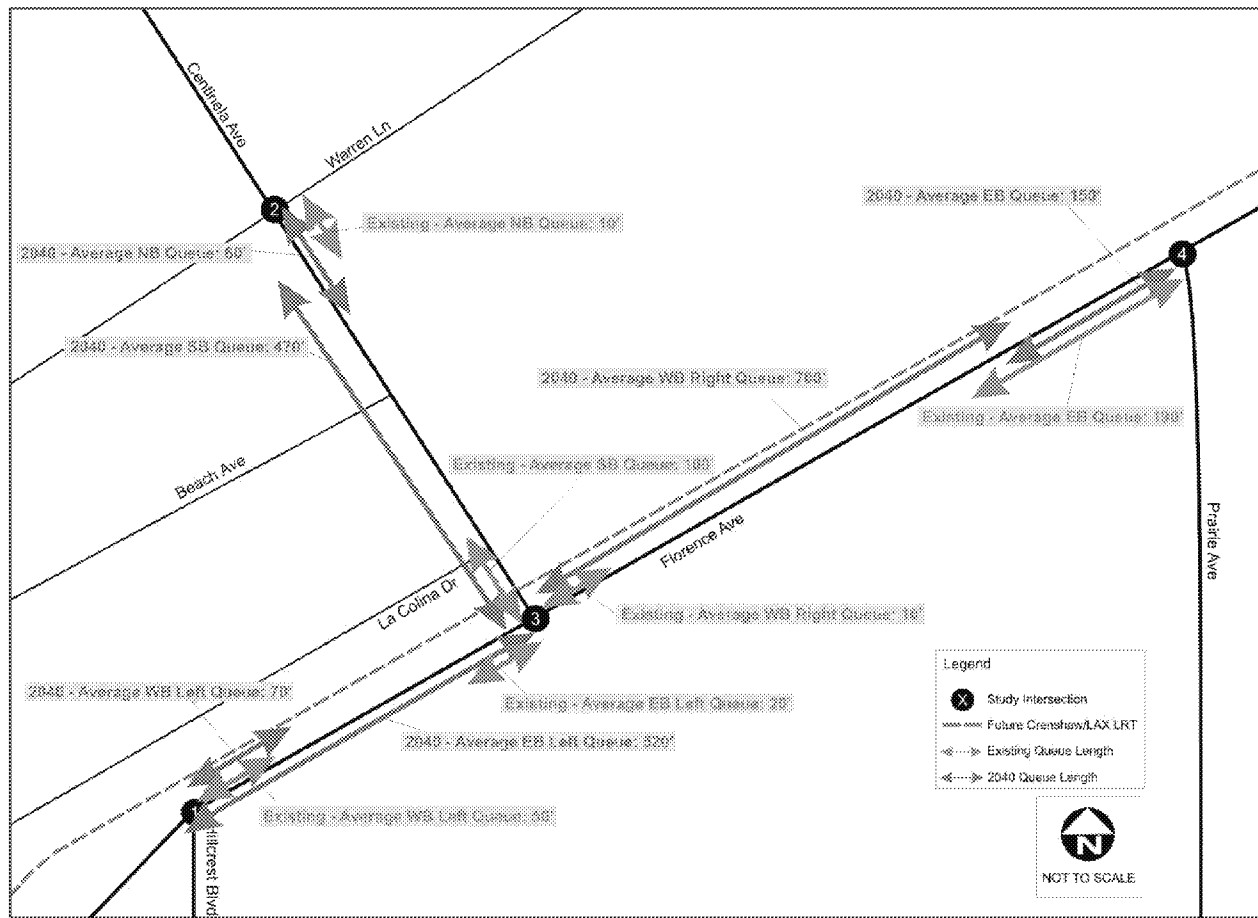


FIGURE ES-6: Existing and 2040 Average PM Queue Lengths at Centinela/Florence



1.4 Safety Analysis

Although traffic delays and traffic queues are expected to increase in the future at the Centinela Avenue/Florence Avenue intersection, average traffic queues are not forecast to back up from the adjacent intersections to the at-grade LRT tracks. Based on the planning-level safety assessment for the at-grade crossing at Centinela/Florence crossing, the at-grade crossing is not anticipated to create an unsafe condition in opening year 2019 condition and in future year 2040 conditions.

1.5 Special Event Conditions (Step 2 Analysis)

Since the Crenshaw EIS/EIR was conducted, a number of regional facilities that were not planned are moving forward, including NFL stadium, Performance Arena and the Inglewood Basketball and Entertainment center. In Step 2 for the special event surge analysis, Metro conducted an evaluation of the potential event-related trips at the Centinela Avenue/Florence Avenue intersection. The analysis utilized the anticipated trip generation of each event venue as well as the trip arrival and departure patterns provided by the City of Inglewood. The analysis assumed the worst-case scenario of when there are "full house" events happening at each of these venues. The event surge analysis looked at multiple

event scenarios at Hollywood Park, at the Stadium, the Forum, the proposed Clippers Arena, and the Performance Arena. The City of Inglewood estimated that approximately 312 events per year may occur at the event venues in the Inglewood Hollywood Park. About half of the 312 events will occur on weekdays, generally in the afternoon p.m. peak hour. The City estimated that up to 22 large NFL games may occur per year, including two on weekdays and 20 on weekends. Some NFL games may, on occasion, take place simultaneously with events at other venues.

The analysis also assesses the performance of the Centinela Avenue/Florence Avenue intersection according to Metro's Grade Crossing Safety Policy (October 2010), a screening tool for the evaluation of potential grade separation vs. at-grade operation along new light rail lines. As a decision threshold, Metro's Grade Crossing Policy is intended for peak hour analysis to guide design decisions for new projects and extensions. The policy is not normally used to analyze existing light rail at-grade crossings or special event traffic analysis; however, it was utilized for the Centinela/Florence crossing to understand the level of future traffic activity and provide a baseline for evaluating the need and feasibility of potential grade separation improvements at this location. Furthermore, a policy does not exist for growth and land use changes at existing Metro grade crossings.

Special event traffic at NFL size venues in the U.S. normally requires special traffic and access management to these venues during events that go beyond the normal traffic control devices at intersection crossings. Such plans have not yet been fully developed by the City of Inglewood and can therefore not be analyzed in relation to the Centinela/Florence crossing. A high-level assessment of the potential event surge traffic data was conducted, assuming the worst-case scenario, without the presence of the event traffic management (e.g., roadway closure or detour) in the study area. The event surge analysis also assumed a worst-case scenario that Crenshaw/LAX line² to operate at the most frequent 5-minute headway per direction during p.m. peak and night-time periods during NFL game seasons.

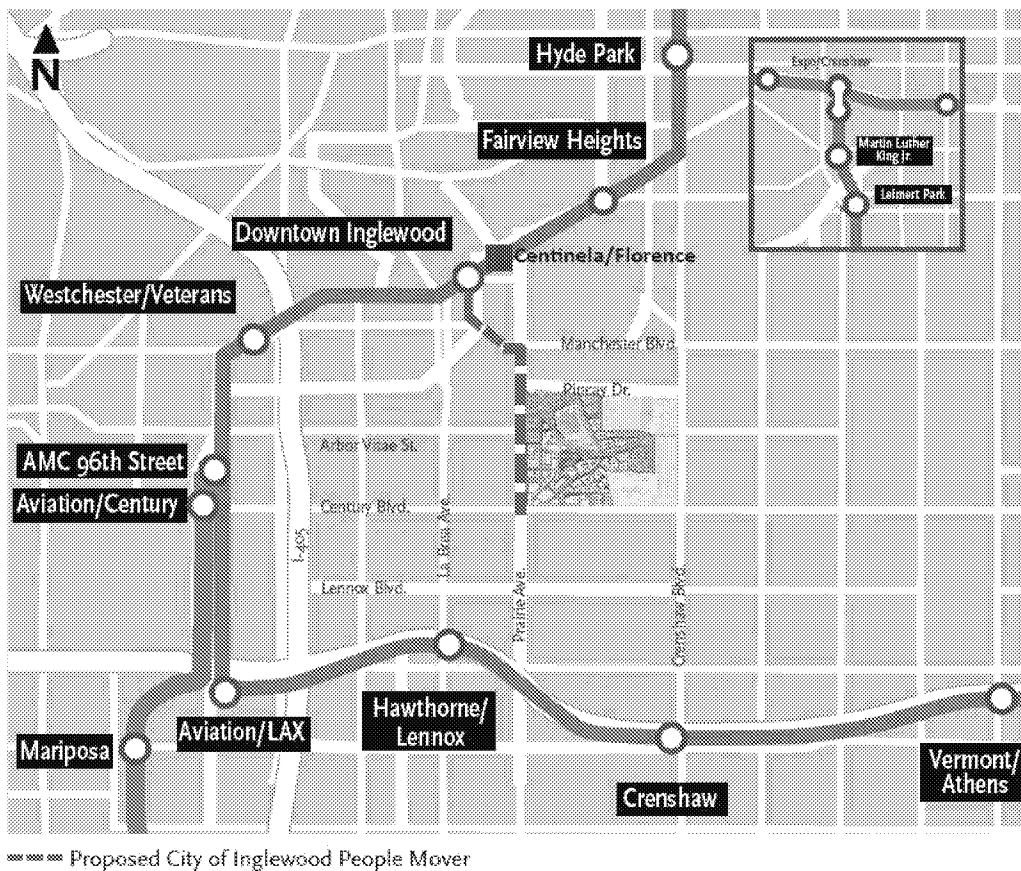
The Step 2 analysis indicated that the post-NFL game traffic (9:00 – 10:00 p.m.) would meet the volume threshold for "Grade Separation Normally Required Category", if the Metro Grade Crossing Policy were applied. More than 1,200 cars per hour per lane are anticipated to cross Centinela/Florence after the approximately 22 NFL games. The post-event traffic may be twice as high as the normal background traffic at this location. Chapter 9.0 of this report provides more discussion on the special event surge traffic analysis.

² On a typical weekday or weekend night time, the operating frequency for the Metro rail services may range between 10 to 20 minutes. For the purpose of the special event conditions analysis for this report, it is assumed that more frequent services (such as five minutes headways) along the Crenshaw/LAX Line may be provided in support of the regional transportation need in the study area.

2.0 INTRODUCTION

The Crenshaw/LAX Light Rail Transit (LRT) Line will connect the existing Exposition Line and the Green Line, near Los Angeles International Airport. Eight new stations are part of this project, including three stations in the City of Inglewood: Fairview Heights, Downtown Inglewood, and Westchester/Veterans. Iteris has been tasked with evaluating traffic operations at the Centinela Avenue grade crossing of the Crenshaw/LAX Line in the City of Inglewood, which is referred to as the “project” in this report. The Centinela Avenue crossing is currently under construction as an at-grade crossing between the Fairview Heights and Downtown Inglewood stations. This rail crossing is within one-quarter mile of the Downtown Inglewood station and about 1.5 miles northwest of the Inglewood Stadium and the Hollywood Park Development Area (**Figure 1**). This report analyzes existing and future traffic conditions in the vicinity of the at-grade crossing location.

Figure 1 – Project Study Area



2.1 Study Intersections

A scoping agreement, dated August 17, 2017, was prepared by Iteris to outline the proposed study area, traffic forecasting, and traffic operations analysis methodologies for the Centinela Grade Separation Study. As noted in the scoping agreement, the study area consists of the following four intersections:

1. Hillcrest Boulevard/Florence Avenue;
2. Centinela Avenue/Warren Lane;
3. Centinela Avenue/Florence Avenue; and
4. Prairie Avenue/Florence Avenue.

The three locations in addition to Centinela Avenue/Florence Avenue were chosen because they represent the next closest signalized intersections in each direction. **Figure 2** shows the location of the Crenshaw/LAX LRT Line in relation to the surrounding street network, as well as the study intersections.

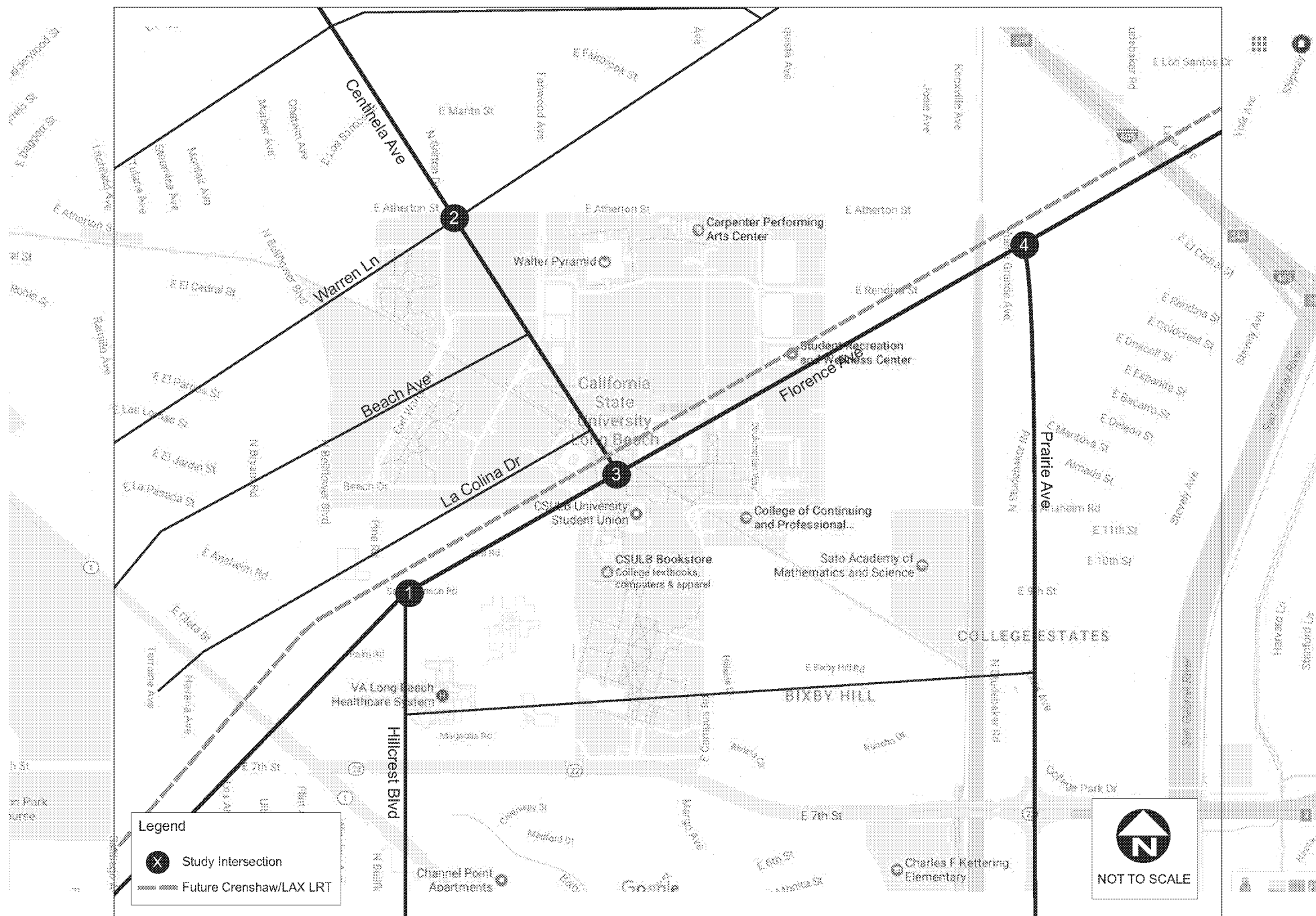
2.2 Study Periods

The following scenarios are analyzed in this report:

- Existing 2017 Conditions;
 - Assumes no Crenshaw/LAX Line
- Existing 2017 with At-grade Crossing Conditions ;
- Opening Year 2019 with At-grade Crossing Conditions;
- Opening Year 2019 with Grade-Separated Crossing Conditions;
- Future Year 2040 with At-grade Crossing Conditions; and
- Future Year 2040 with Grade-Separated Crossing Conditions.

For each scenario, the peak hour time periods were analyzed as follows:

- Typical Weekday a.m. peak hour; and
- Typical Weekday p.m. peak hour.



The weekday peak hour time periods are used in this analysis as they represent the periods of highest traffic volumes, consisting of commuter trips. These trips, which occur on a regular daily basis as opposed to trips related to weekend trips or special event traffic, are considered throughout the industry as the most useful data for informing decisions on long-range infrastructure needs. Mid-day and weekend peak hour traffic volumes were observed to be much lower than weekday peak hour volumes.

For the purpose of this analysis, 3-car trains and 5-minute headways per direction during peak hours were assumed for the existing 2017 with LRT scenarios and future 2040 with LRT scenarios. However, for the opening year 2019 with LRT scenarios, the analysis assumed 2-car trains and 5-minute headways per direction during peak hours.

3.0 ENVIRONMENTAL SETTING

This section presents an overview of the existing roadway system within the study area, and the methodology used to determine existing traffic volumes.

3.1 Roadway Configurations

The existing configurations of the significant roadways within the study area are described below:

- **Centinela Avenue** has a north-south orientation in the project area beginning at Florence Avenue, and it curves in a northwest direction through La Cienega Boulevard. It is classified as a major arterial in the City's General Plan Circulation Element and has two travel lanes in each direction. There is on-street parking on both sides of the avenue within the project area. The speed limit is established as 40 mph.
- **Florence Avenue** runs in an east-west orientation with two travel lanes in each direction and an additional center turn lane between Glasgow Avenue and Hyde Park Boulevard. Florence Avenue is classified as a major arterial in the City's General Plan Circulation Element. Florence Avenue connects to I-405 through the heart of Inglewood and becomes Aviation Boulevard at Manchester Boulevard. Within the project area, the future Crenshaw/LAX Line would run parallel to Florence Avenue on the north side of the street. On-street parking is prohibited within the project area. The speed limit is established as 40 mph.
- **Hillcrest Boulevard** runs in a north-south orientation in the project area and it is classified as a collector in the City's General Plan Circulation Element. Within the study area, Hillcrest Boulevard has one travel lane in each direction and has on-street parking on both sides. The speed limit is established as 30 mph.
- **Prairie Avenue** lies on the eastern border of the project area beginning north from Florence Avenue down south until Manchester Boulevard. Prairie Avenue consists of two travel lanes in each direction and is designated as a major arterial in the City's General Plan Circulation Element. There is no on-street parking available in the project area. The speed limit in the project area is established as 40 mph.
- **Warren Lane** runs in a southwest direction from Park Avenue to Edgewood Street. Warren Lane is designated as a collector in the City's General Plan Circulation Element. The street has one travel lane in each direction, with parking on both sides. The speed limit is established as 25 mph.

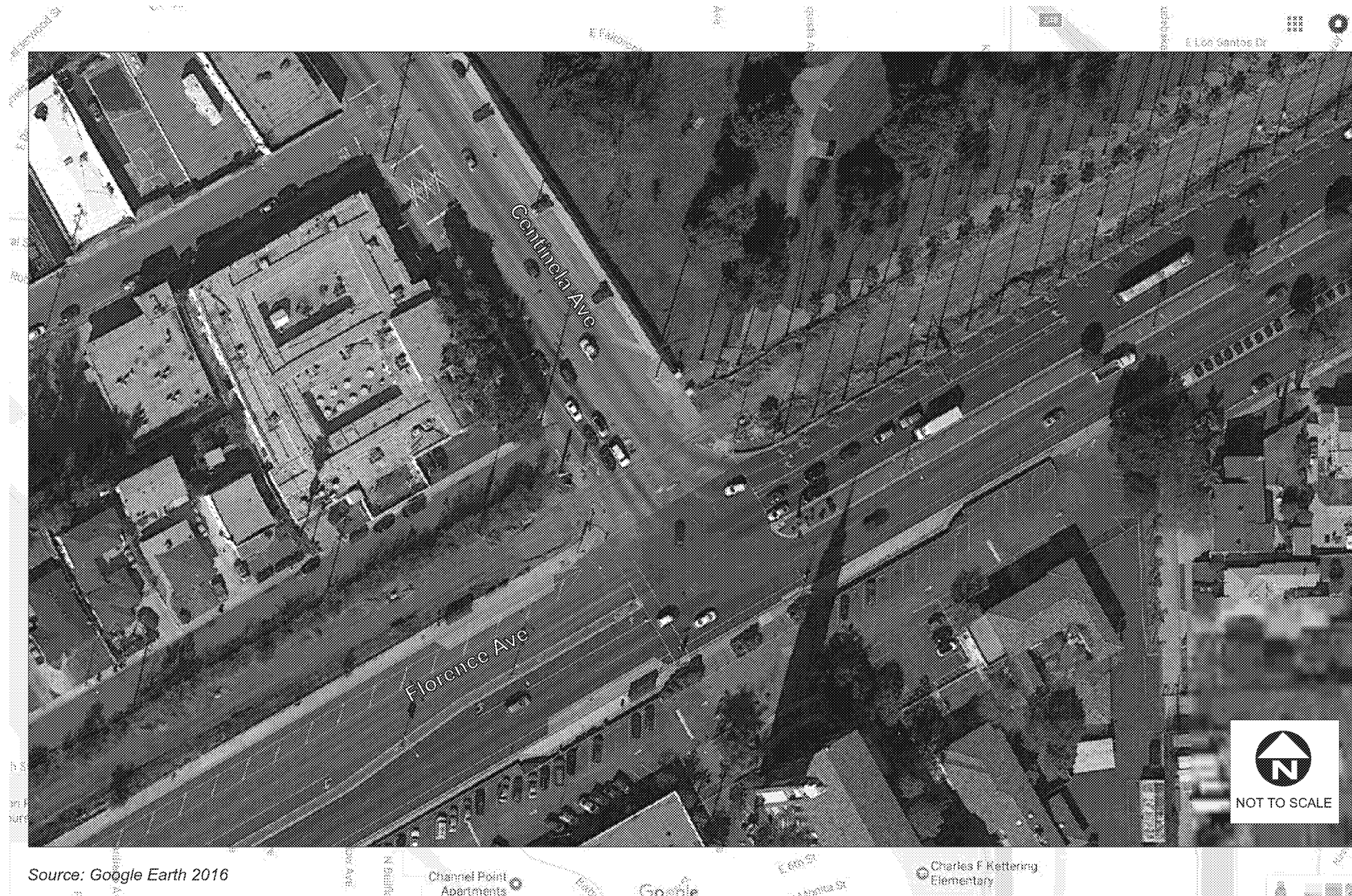
The intersection of Centinela Avenue and Florence Avenue is a T-intersection, and as a result, it does not contain northbound or southbound through movements. Without a southbound through movement, drivers proceeding south from Centinela Avenue must turn left or right onto Florence Avenue and then turn right onto Prairie Avenue or left onto Hillcrest Boulevard to continue south. Drivers traveling north must similarly turn right on Hillcrest Boulevard or left on Prairie Avenue and then turn right or left from Florence Avenue onto Centinela Avenue. Traffic congestion and queuing currently occur at this location.

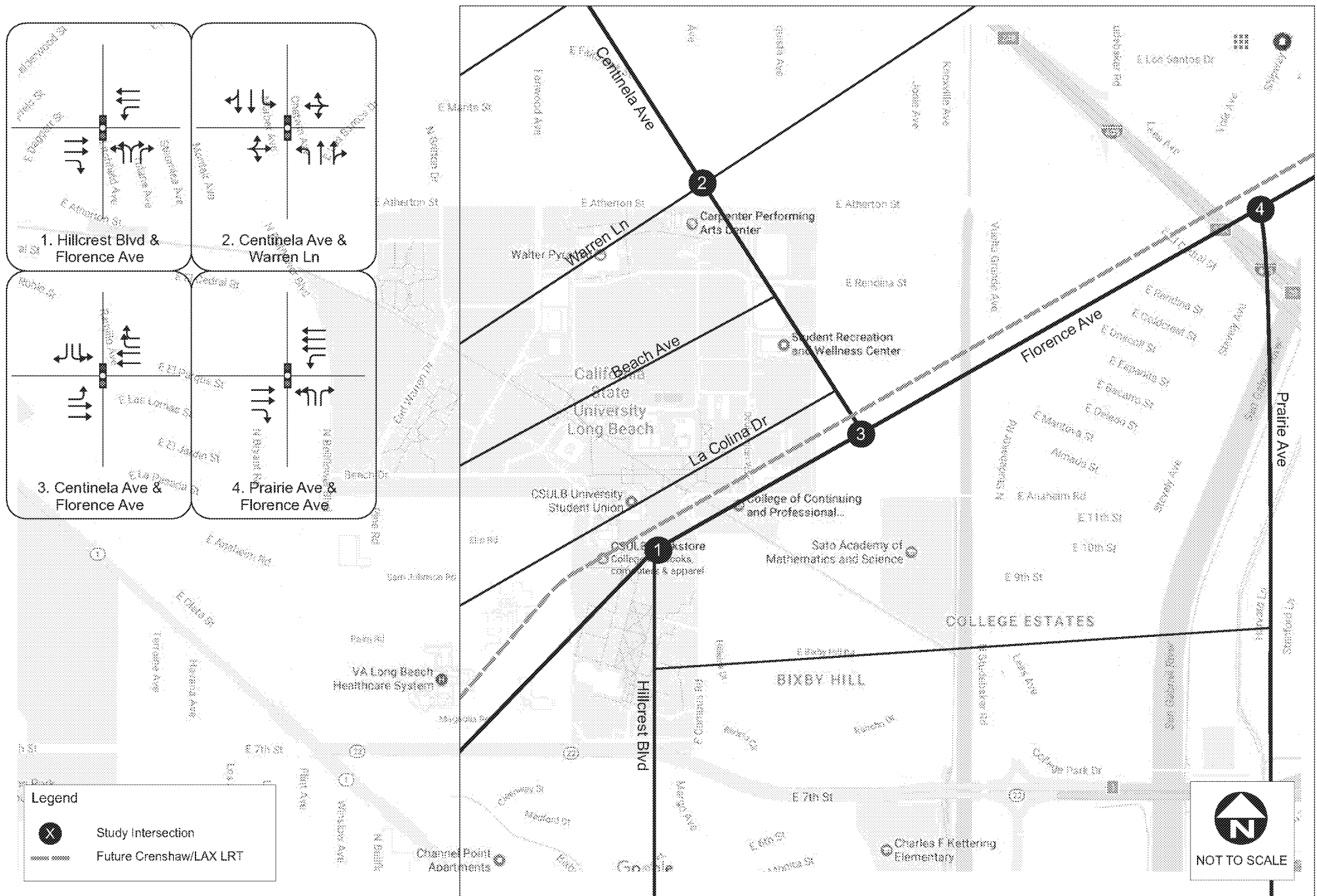
Figure 3 shows an aerial photo of the Centinela Avenue/Florence Avenue intersection before the current construction conditions. **Figure 4** shows the existing intersection lane configurations.

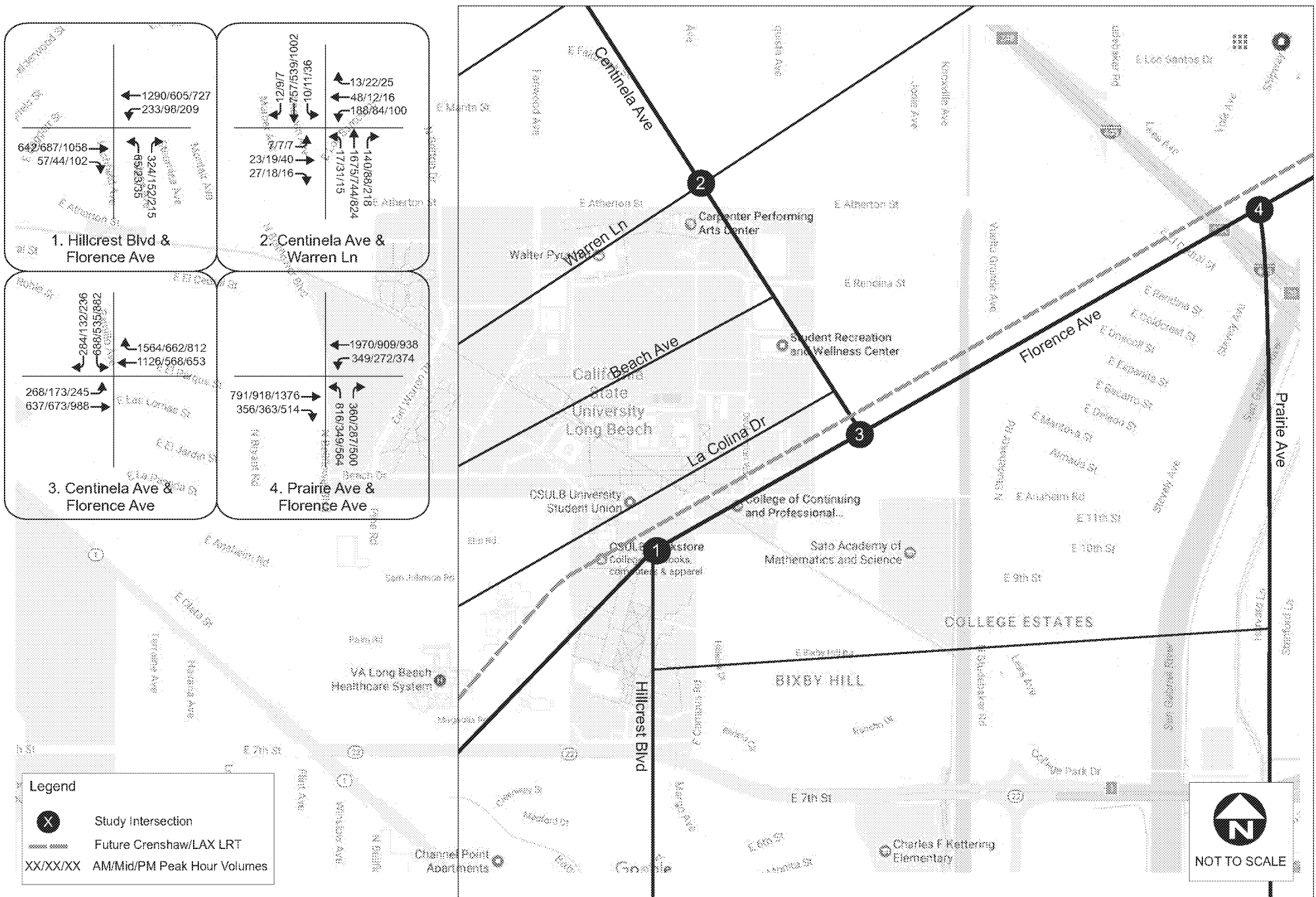
3.2 Existing Traffic Volumes

Peak period intersection count data was collected at the four study intersections on a typical weekday and two weekend days, during the five time periods described. Weekday count data was collected on Thursday, August 31, 2017 (with local schools in session) and weekend count data was collected on Saturday, September 16 and Sunday 17, 2017. The existing counts were reviewed by City of Inglewood staff.

While the traffic counts were collected after the start of the school year (with its associated increase in traffic volumes) and outside of holiday periods (that might result in lower traffic volumes), on-going construction activities for the Crenshaw/LAX Line resulted in the closure of one westbound through lane along Florence Avenue at Centinela Avenue during the count period. As a result, the City of Inglewood provided historical (2015) traffic count data for the a.m. and p.m. peak period at the study intersections. The 2015 counts were then increased by an annual growth rate of 1.34%. This rate was provided by City staff and based on the average growth in traffic volumes at study intersections between 2010 and 2017; this growth rate was approved by Iteris. These City-provided volumes were used for the weekday a.m. and p.m. peak hour analysis of existing conditions in lieu of the August 31st counts. Though the August 31st counts were ultimately not used in the analysis, the counts confirmed the rough magnitude of turning movement volumes. Existing traffic count data is provided in **Appendix A**. Thus, the existing traffic volumes used in analysis are based on pre-construction conditions. **Figure 5** shows the existing weekday peak hour intersection volumes, which include the mid-day peak hour as well.







4.0 TRAFFIC OPERATIONS ANALYSIS METHODOLOGY

Iteris prepared a computer simulation, using VISSIM, of the operation of the study intersections in the vicinity of the Crenshaw/LAX Line crossing at Centinela Avenue. This section describes the steps taken to develop the VISSIM model for use in the analysis.

4.1 Model Development

The microsimulation platform VISSIM was used to develop the model. The VISSIM model was developed using VISSIM build 6.00-21, and was calibrated for existing year 2017 conditions. The VISSIM model developed for this project includes roadway geometrics, traffic signal parameters, and driver behavior characteristics. Unlike static analyses conducted according to the Highway Capacity Manual (HCM), a simulation model includes “virtual drivers” that travel through the model network, from entry nodes to exit nodes, along network paths that are assigned by the analyst. The model uses random seeds and probability distributions for a number of traffic flow characteristics, such that each model run will produce slightly different outputs. Each seed contains random variables to account for variations in driver behavior and departure time. This model is therefore stochastic; it simulates the random fluctuations that are typically observed in real-time traffic networks. This feature makes the results more robust, given that they are based on the average of multiple observations or model runs, rather than a single calculation.

Data Inputs

To develop data to be used as inputs as well as calibration targets, multiple data resources were used:

- Traffic Volumes – Intersection counts conducted in 2015 and normalized to 2017 conditions.
- Queues – P.M. peak hour queue values at the southbound approach of the Centinela Avenue/Florence Avenue intersection in 2017. These values were used for model calibration as described in the next section. In addition, queue counts were collected in May 2018 (while schools were in session) that confirmed, within a reasonable range, the 2017 values applied in the calibration process. These 2018 queue counts are provided in **Appendix A**.
- Lane Configuration – Confirmed by field survey
- Signal Timing Plan – Provided by City of Inglewood

Error Checking

The error correction process involved software error checking, input coding, and animation review. Input coding included geometry, demand, signal timing, traffic volumes, and route choices. The animation was reviewed to confirm that realistic travel behaviors were being simulated.

4.2 Model Confidence and Calibration

The objectives of model confidence and calibration are to obtain the best match possible between model performance estimates and field measurements of performance. However, at a certain point in the calibration process there are diminishing returns where large investments in effort yield small improvements in accuracy. The Federal Highway Administration (FHWA) has set confidence and calibration procedures and standards for microsimulation models and these were used in the calibration process.

Given the varying results that inherently exist between microsimulation runs (due to the random seed number), the confidence is intended to demonstrate that the average of the model runs falls within a certain range of values which we believe is representative and not skewed towards a statistical outlier. In order to achieve a 95% confidence level that the average model output was accurate to within 50 feet of the southbound queue length measurements, the required number of runs was three and nine, for a.m. and p.m., respectively, utilizing the following formula:

$$N = \left(2 * t_{0.025, N-1} \frac{s}{R} \right)^2$$

R = Confidence Interval for the true mean

$t_{0.025, N-1}$ = Student's t-statistic for two-sided error of 2.5 percent (totals 5 percent) with N-1 degrees of freedom (this is related to a 95% Confidence Level)

s = Standard Deviation about the mean for selected MOE (southbound queues in this case)

N = Number of required simulation runs

The following FHWA calibration target was applied to the traffic volumes:

- GEH Statistic³ < 5 for Individual Link Flows > 85% of cases

As tabulated in **Appendix B**, the model calibration resulted in 100% of the cases with GEH statistic <5 which exceeds the FHWA calibration target for both a.m. and p.m. peak hour models.

³ The use of the GEH statistic (named after its developer, Geoffrey E. Havers) "stems from the inability of either the absolute difference or relative difference statistics to cope with flows over a wide range" of values (Scottish Transport Appraisal Guidance, 2002). The GEH statistic is a modified Chi-squared statistic that incorporates both relative and absolute differences to compare modeled and observed characteristics. The form of the GEH statistic allows for greater absolute differences for low volumes while requiring lower relative differences for large volumes. The expression for the GEH statistic is $GEH = \sqrt{2[(E - V).sup.2] / (E + V)}$ (2) Where E = model estimated characteristic; V = observed characteristic.

5.0 EXISTING CONDITIONS ANALYSIS

This section presents the results of the existing conditions traffic analysis utilizing the VISSIM model, as well as Metro's Grade Crossing Safety Policy Analysis (Initial Screening).

5.1 Existing (No LRT) Traffic Operations

A Level of Service (LOS) and queue analysis were conducted using 2017 traffic volumes. As mentioned, the existing traffic volumes used in analysis are based on pre-construction conditions. LOS is a term that describes the operating performance of an intersection or roadway based on the Highway Capacity Manual (HCM) 2010. Intersection LOS is developed based on a number of factors, including the vehicle volumes per travel lane and the amount of traffic in each direction of a crossing. LOS is measured quantitatively and reported on a scale from A to F, with A representing the least congested conditions and F representing the most congested conditions.

Under existing without the LRT conditions (**Table 1**), the intersections in the study are currently operating at LOS D or better during the weekday a.m. and p.m. peak hours. Detailed LOS output data is provided in **Appendix C**.

Table 1: Existing (no LRT) Intersection Peak Hour LOS

Intersection	AM Peak Hour Ave. Vehicle Delay (seconds) - LOS	PM Peak Hour Ave. Vehicle Delay (seconds)- LOS
1. Hillcrest Blvd / Florence Ave	13.3 – B	16.0 – C
2. Centinela Ave / Warren Ln	10.9 – B	7.5 – A
3. Centinela Ave / Florence Ave	15.4 – C	14.4 – B
4. Prairie Ave / Florence Ave	22.1 – C	27.9 – D

Table 2 summarizes the average and maximum queues for the critical intersection movements. The queue tables in this report reference the "influence zone" and the "gate spillback" as described in the Metro Grade Crossing Policy. The influence zone is the area between the light rail tracks or gate and an adjacent intersection where the queue from the adjacent intersection has the potential to back up onto the light rail tracks. The gate spillback is the area between the light rail tracks or gate and an adjacent intersection where the queue resulting from the gate has the potential to back up to the adjacent intersection. As shown in **Table 1** and **Table 2**, the intersection of Florence/Centinela is operating at LOS C or better in the peak hours and no significant traffic queuing conditions was identified based on field observations.

Table 2: Existing Intersection Peak Hour Queues

Intersection - Movement		Storage Capacity (ft)	AM Peak Hour		PM Peak Hour	
			Ave Queue (ft)	Max Queue (ft)	Ave Queue (ft)	Max Queue (ft)
1. Hillcrest Blvd / Florence Ave	WB Left-turn	230	60	270	50	230
	WB Through	475	20	320	10	100
2. Centinela Ave / Warren Ln	NB Through (Influence Zone)	600	40	360	10	180
3. Centinela Ave / Florence Ave	SB Left-turn (Gate Spillback)	600	80	310	100	400
	SB Right-turn (Gate Spillback)	230	50	270	20	200
	EB Left-turn	150	30	240	20	110
	WB Right-turn	250	20	180	10	120
4. Prairie Ave / Florence Ave	EB Through	940	70	400	190	740
	EB Right-turn	175	30	250	70	570

Note: Bold font: projected queue length exceeds the storage capacity.

5.2 Existing Plus At-Grade Crossing Traffic Operations

The purpose of this analysis scenario is to evaluate the traffic operations with the at-grade crossing during existing conditions, for potential compliance in an environmental document. The following assumptions from Metro for the operation of the Crenshaw/LAX Line in this scenario are as follows:

- 5-minute headways per direction during peak hours;
- 3-car trains;
- Trains speeds of 35 – 45 mph in the westbound direction and 40 – 50 mph in eastbound direction. (At the Centinela Avenue crossing, eastbound trains are estimated to operate at higher speeds than westbound trains because eastbound trains would be accelerating away from the Downtown Inglewood station and westbound trains would be decelerating at the approach of the Downtown Inglewood station.)

Figure 6 shows the intersection lane configurations with completion of the at-grade crossing. This configuration includes additional turn lanes at the Centinela Avenue/Florence Avenue intersection. Table 3 summarizes the existing plus at-grade crossing LOS at the study intersections for the weekday peak hours. Detailed LOS output data is provided in Appendix C. Table 4 summarizes the existing plus at-grade crossing average and maximum queues at the critical intersection movements.

Table 3: Existing Plus At-Grade Crossing Intersection Peak Hour LOS

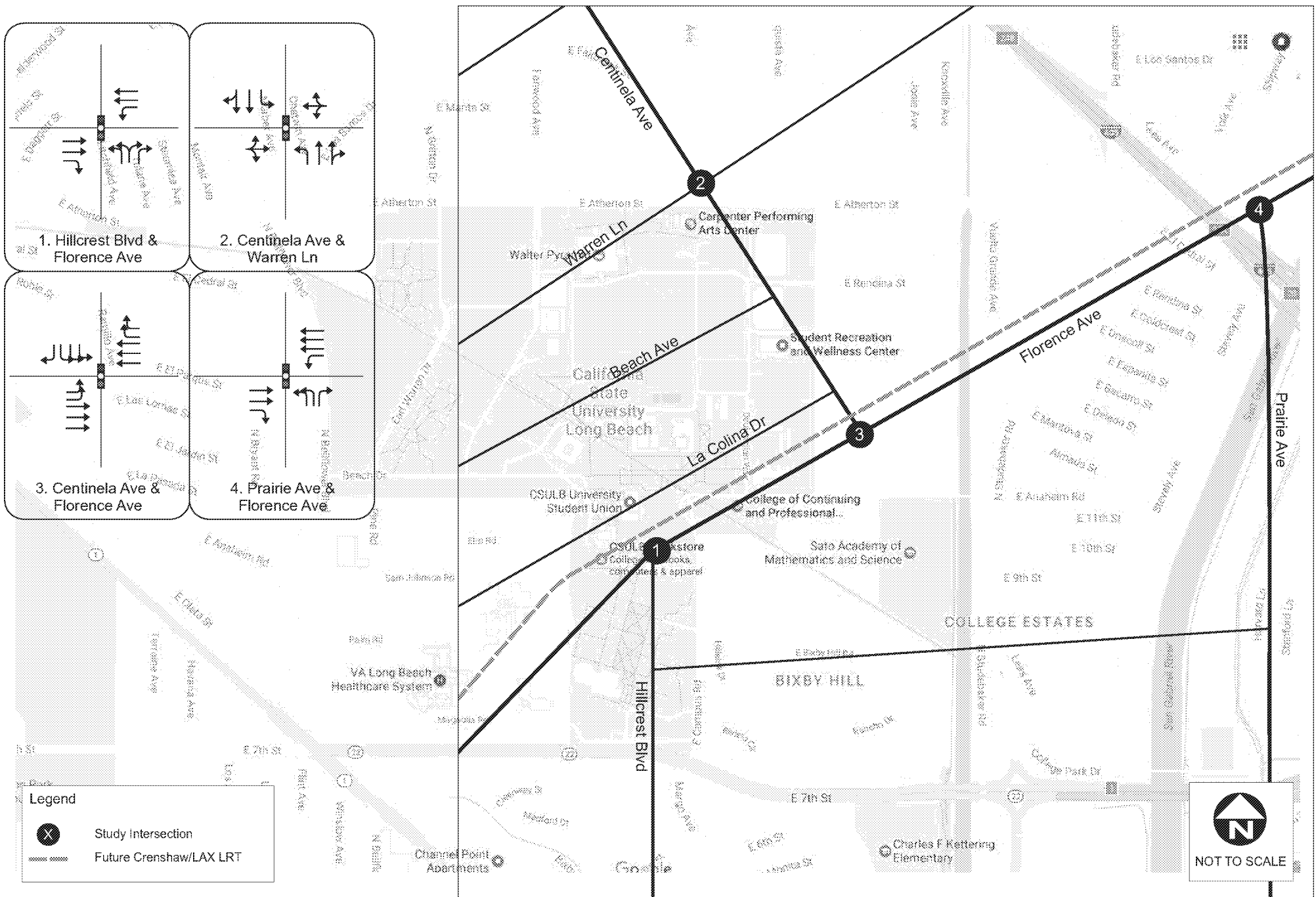
Intersection	AM Peak Hour Ave. Vehicle Delay (seconds) - LOS	PM Peak Hour Ave. Vehicle Delay (seconds) - LOS
1. Hillcrest Blvd / Florence Ave	76.8 – E	88.4 – F
2. Centinela Ave / Warren Ln	24.1 – C	27.4 – C
3. Centinela Ave / Florence Ave	107.9 – F	97.8 – F
4. Prairie Ave / Florence Ave	78.8 – E	27.6 – C

Table 4: Existing Plus At-Grade Crossing Intersection Peak Hour Queues

Intersection - Movement		Storage Capacity (ft)	AM Peak Hour		PM Peak Hour	
			Ave. Queue (ft)	Max. Queue (ft)	Ave. Queue (ft)	Max. Queue (ft)
1. Hillcrest Blvd / Florence Ave	WB Left-turn	230	50	300	80	400
	WB Through	475	30	450	20	420
2. Centinela Ave / Warren Ln	NB Through (Influence Zone)	560*	30	380	30	360
3. Centinela Ave / Florence Ave	SB Left-turn (Gate Spillback)	520*	310	> 520	300	> 520
	SB Right-turn (Gate Spillback)	230	330	> 520	320	> 520
	EB Left-turn	150	490	590	520	600
	WB Right-turn	250	790	1,080	70	410
4. Prairie Ave / Florence Ave	EB Through	940	80	540	130	660
	EB Right-turn	175	50	530	100	660

Note:

*SB Centinela queue storage capacity is shorter than that of the NB direction due to the placement of the SB approach stop bar (north of La Colina). In addition, SB Centinela queue storage capacity in this scenario is shorter than existing and grade-separated conditions for the same reason. Bold font: projected queue length exceeds the storage capacity.



As shown in **Table 3**, if the LRT tracks were in operation with 5-minute headways and 3-car trains with the current background traffic, the Centinela Avenue/Florence Avenue intersection LOS would worsen from LOS C or better to LOS F in both peak hours. As shown in **Table 4**, traffic movements in the southbound queue (left turn and right-turn), eastbound left turn queue and westbound right turn queue could potentially spill back from the LRT tracks to the adjacent intersections (Warren, Prairie, and Hillcrest). For the southbound movement at the Centinela Avenue/Florence Avenue intersection, the average gate spillback queue is forecast to be under 500 feet, where the gate spillback area to accommodate this queue is approximately 520 feet, but the maximum southbound queue on Centinela Avenue may periodically spill back to Warren Lane to the north.

The distance from the Centinela Avenue/Warren Lane intersection back to the future at-grade crossing (influence zone area) is approximately 560 feet. The estimated influence zone queue length is not anticipated to extend from the adjacent intersections to cross the LRT tracks. Thus, an unsafe influence zone queue condition is not forecast to occur.

5.3 Initial Grade Crossing Policy Analysis – Existing with LRT Conditions

The “Metro Grade Crossing Safety Policy for Light Rail” was originally approved by the Metro Board on December 4, 2003; it was revised on October 28, 2010. The Grade Crossing Safety Policy is intended to provide an official structured process by which street crossings by light rail projects are evaluated to determine whether they should be grade-separated or whether they can safely and efficiently operate as at-grade crossings.

As a decision threshold, Metro’s Grade Crossing Policy is intended for peak hour analysis to guide design decisions for new projects and extensions. The policy is not normally used to analyze existing light rail at-grade crossings or special event traffic analysis; however, it was utilized for the Centinela/Florence crossing to understand the level of future traffic activity and provide a baseline for evaluating the need and feasibility of potential grade separation improvements at this location. Furthermore, a policy does not exist for growth and land use changes at existing Metro grade crossings.

The Metro Grade Crossing Policy includes three steps of review and analysis that may be conducted in order to arrive at a decision. Step 1 uses traffic volumes and train frequencies to categorize the feasibility of an at-grade crossing. Step 2 involves a detailed analysis of crossing design, roadway traffic and train operations. Step 3 is described as additional study (such as traffic simulation modeling) in coordination with the local jurisdiction to arrive at a final recommendation.

The Initial Screening is based upon the highest bi-directional roadway volume per-lane, for the highest peak hour. Roadway volume is compared against number of trains per direction during the peak hour. These values are plotted on a nomograph to determine which category would be appropriate for the crossing. The possible categories are: at-grade operation should be feasible, possible at-grade operation, and grade separation usually required.

Table 5 shows the highest bi-directional cross-street traffic volume per-lane for the a.m. peak hour and p.m. peak hour. The volumes shown are normalized 2017 volumes approved by the City of Inglewood and Metro staff.

Table 5: Cross-Street Traffic Volume per Lane – AM and PM Peak Hour

At-Grade Crossing	Cross-Street # of Lanes		Highest Cross-Street Volume/Lane
	NB	SB	Normalized 2017
Centinela Ave (north of Florence Ave)	2	4*	916 vehicles/lane (a.m.) 529 vehicles/lane (p.m.)

* Proposed configuration with at-grade crossing

Peak hour headways of five (5) minutes per direction are anticipated for the Metro Crenshaw Line/LAX Line (ultimate buildout), as provided by Metro. This frequency equates to 12 trains per hour for the peak hour.

Figure 7A show the Nomograph for Initial Screening for the a.m. peak hour, which consists of the governing peak hour volume per lane. As shown in **Figure 7A**, in existing with LRT traffic conditions for the a.m. peak hour, approximately 900 cars per hour per lane are anticipated to cross the Centinela/Florence crossing with maximum train frequency of every 5 minutes in each direction for the LRT. **Figure 7B** shows the Nomograph for Initial Screening for the p.m. peak hour. Under existing plus LRT traffic conditions for the p.m. peak hour, over 500 cars per hour per lane are anticipated to cross the Centinela/Florence crossing with maximum train frequency of every 5 minutes in each direction for the LRT.

Based on the two sets of nomographs for existing with LRT conditions, the Centinela Avenue crossing is categorized as “possible at-grade operation”, but further engineering study is required to define the operation. More detailed traffic operations/queuing analysis focusing on the Centinela/Florence LRT crossing is described within this report.

Figure 7A – Nomograph for Initial Screening – Existing with LRT conditions - AM Peak Hour

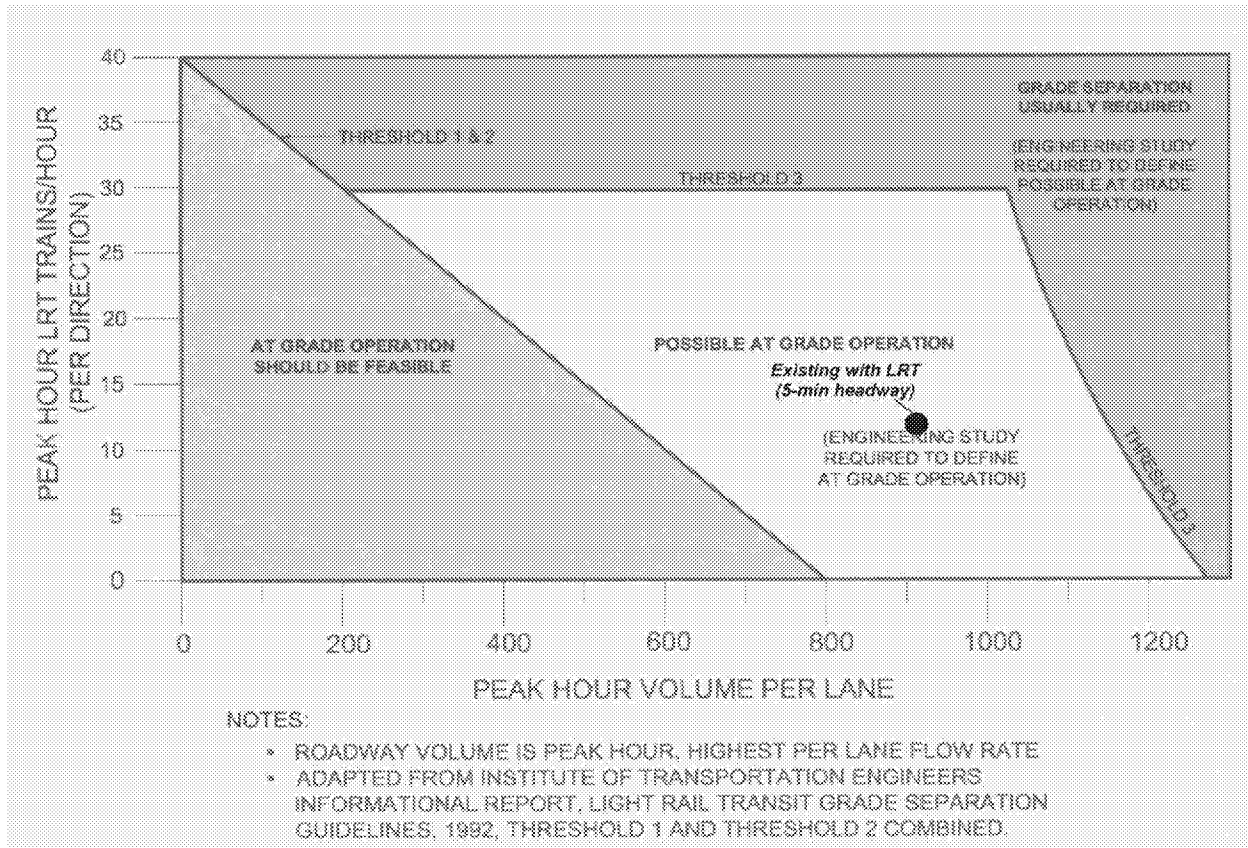
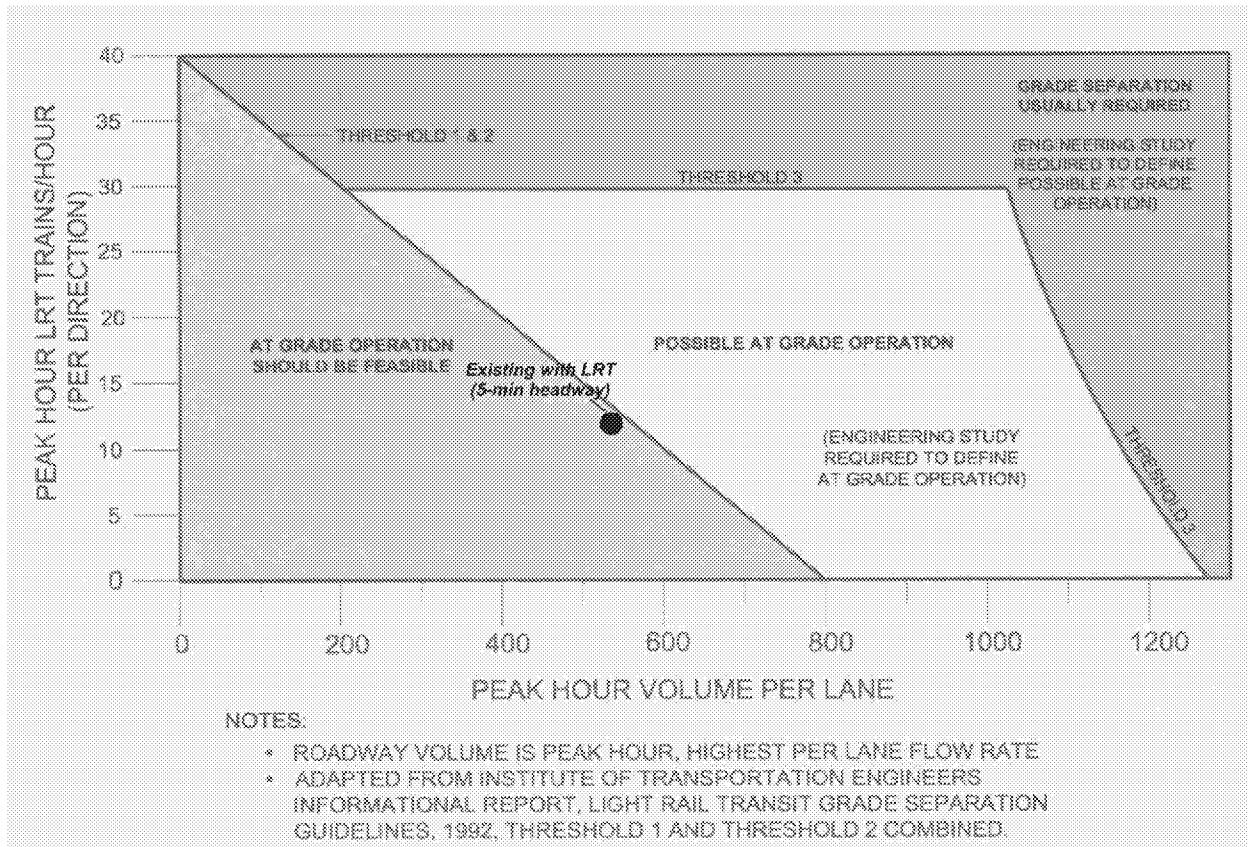


Figure 7B – Nomograph for Initial Screening – Existing with LRT conditions - PM Peak Hour



6.0 OPENING YEAR 2019 ANALYSIS

This section presents the analysis results for opening year 2019. Opening year 2019 represents the opening year for the Crenshaw/LAX Line. Opening year traffic volumes at the study intersections are based on growth rate factors from the City of Inglewood (historical volume trend of 1.34% annual growth rate), and applied to the 2017 traffic counts for each time period. It is not anticipated that the future NFL stadium (or retail, office, or residential) at the Hollywood Park Commercial and Entertainment Complex will be complete by 2019. Thus, opening year volumes at the study intersections do not include traffic generated by that future development. **Figure 8** shows the opening year 2019 weekday peak hour intersection volumes.

6.1 Opening Year 2019 Traffic Operations with At-Grade Crossing

An LOS and queue analysis was conducted to evaluate opening year 2019 intersection operations with the at-grade crossing using the 2019 traffic volumes. The assumptions from Metro for the opening year operation of the Crenshaw/LAX Line in this scenario are as follows:

- 5-minute headways per direction during peak hours;
- 2-car trains;
- Trains speeds of 35 – 45 mph in the westbound direction and 40 – 50 mph in eastbound direction.

Table 6 summarizes the opening year 2019 with at-grade crossing LOS at the study intersections for the weekday peak hours. Detailed LOS output data is provided in **Appendix C. Table 7** summarizes the opening year 2019 with at-grade crossing average and maximum queues at the critical intersection movements.

Table 6: Opening Year 2019 with At-Grade Crossing Intersection Peak Hour LOS

Intersection	AM Peak Hour Ave Vehicle Delay (seconds) - LOS	PM Peak Hour Ave Vehicle Delay (seconds) - LOS
1. Hillcrest Blvd / Florence Ave	76.5 – E	91.5 – F
2. Centinela Ave / Warren Ln	19.9 – B	28.6 – C
3. Centinela Ave / Florence Ave	103.7 – F	98.1 – F
4. Prairie Ave / Florence Ave	83.6 – F	28.7 – C

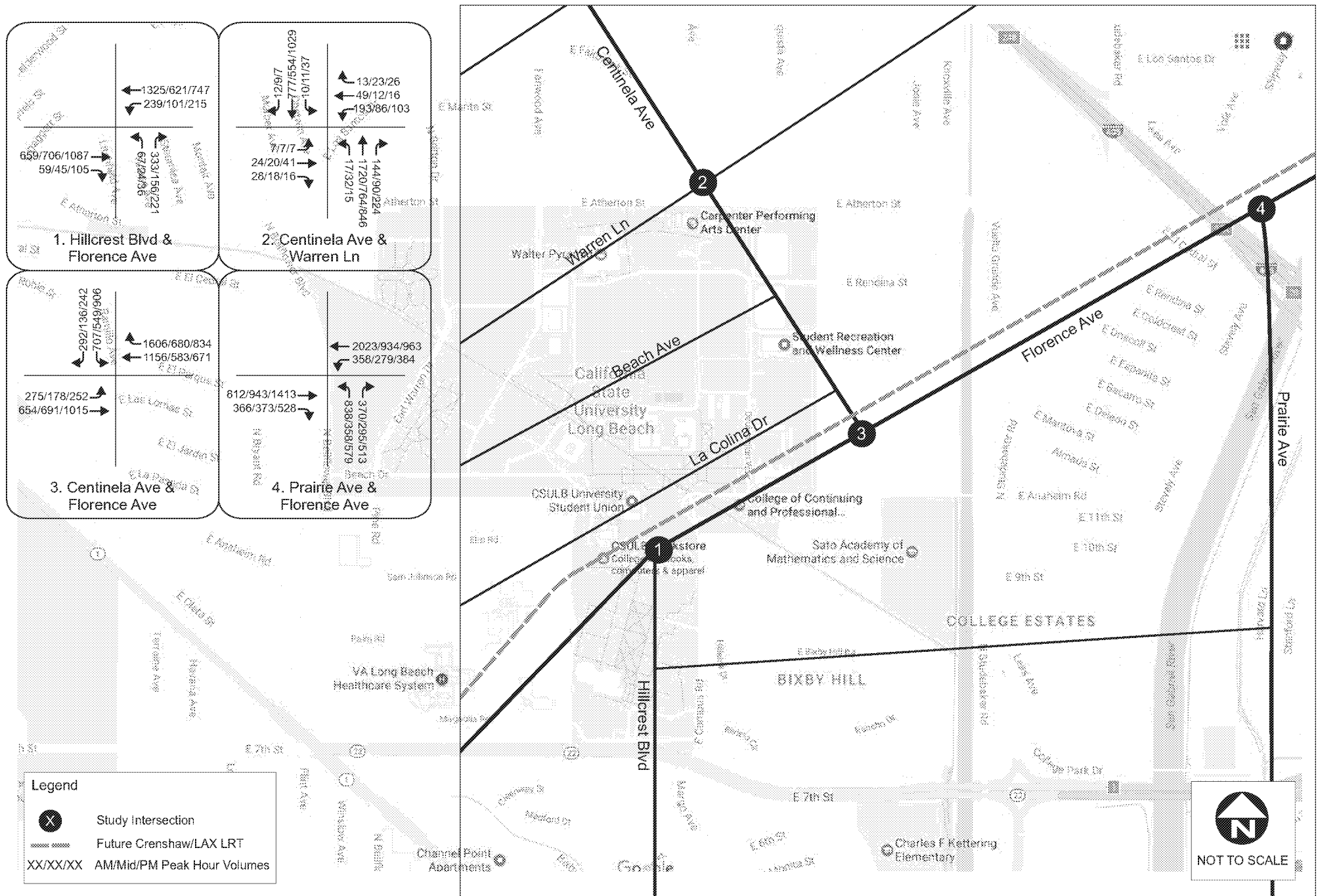


Table 7: Opening Year 2019 with At-Grade Crossing Intersection Peak Hour Queues

Intersection - Movement		Storage Capacity (ft)	AM Peak Hour		PM Peak Hour	
			Ave. Queue (ft)	Max. Queue (ft)	Ave. Queue (ft)	Max. Queue (ft)
1. Hillcrest Blvd / Florence Ave	WB Left-turn	230	50	230	80	400
	WB Through	475	40	490	30	420
2. Centinela Ave / Warren Ln	NB Through (Influence Zone)	560*	30	450	30	370
3. Centinela Ave / Florence Ave	SB Left-turn (Gate Spillback)	520*	260	> 520	300	> 520
	SB Right-turn (Gate Spillback)	230	280	> 520	310	> 520
	EB Left-turn	150	500	590	530	600
	WB Right-turn	250	780	1,060	90	510
4. Prairie Ave / Florence Ave	EB Through	940	700	480	140	650
	EB Right-turn	175	60	470	100	660

Note:

*SB Centinela queue storage capacity is shorter than that of the NB direction due to the placement of the SB approach stop bar (north of La Colina). In addition, SB Centinela queue storage capacity in this scenario is shorter than existing and grade-separated conditions for the same reason.

Bold font: projected queue length exceeds the storage capacity.

As shown in **Table 6**, in the near-term, with 5-minute headways, 2-car trains, and slightly higher background traffic conditions, this intersection LOS would change from LOS C or better under existing (assuming no Crenshaw/LAX Line) to LOS F conditions with the LRT in both the a.m. and p.m. peak hours. The vehicle queues at Centinela/Florence may accumulate and begin to spill back from the LRT tracks to the three adjacent intersections periodically (Warren to the north, Prairie to the east, and Hillcrest to the west).

As shown in **Table 7**, the distance from the Centinela Avenue/Warren Lane intersection back to the future at-grade crossing (influence zone area) is approximately 560 feet. The influence zone queues, resulting from vehicle back-up at the northbound approach of the Centinela Avenue/Warren Lane intersection, are forecast to be under 100 feet on average. Thus, based on the planning-level safety assessment, no salient safety issue is anticipated for this at-grade crossing because the influence zone queue from the adjacent intersections is projected to be within the storage capacity on Florence and on Centinela.

6.2 Opening Year 2019 Traffic Operations with Grade-Separated Crossing

This section presents an analysis of the effect that a grade separation would have on traffic operations in the study area. Utilizing the same traffic volumes as the 2019 at-grade crossing analysis, the network was analyzed assuming no signal phasing or timing would be dedicated to a crossing train (i.e., no pre-emption or gate down time). Also, the dedicated pedestrian-only phase across Florence Avenue was removed. Thus, the signal timing and phasing would resemble existing conditions. The lane configurations were assumed to be the same as the 2019 at-grade condition. **Table 8** summarizes the opening year 2019 with grade-separated LOS results at the study intersections for the weekday peak hours. Detailed LOS output data is provided in **Appendix C**.

Table 8: Opening Year 2019 with Grade-Separated Crossing Intersection Peak Hour LOS

Intersection	AM Peak Hour Ave. Vehicle Delay (seconds) - LOS	PM Peak Hour Ave. Vehicle Delay (seconds) - LOS
1. Hillcrest Blvd / Florence Ave	14.0 – B	12.4 – B
2. Centinela Ave / Warren Ln	11.2 – B	9.4 – A
3. Centinela Ave / Florence Ave	20.1 – C	15.3 – B
4. Prairie Ave / Florence Ave	24.7 – C	30.6 – C

As shown in **Table 8**, with the potential grade-separated crossing in opening year 2019, the Centinela Avenue/Florence Avenue intersection is forecast to operate at comparable LOS as the existing conditions (LOS C in the a.m. and LOS B in the p.m). The remaining three study intersections are expected to operate at LOS C or better.

Table 9 summarizes the opening year 2019 with grade-separated crossing average and maximum queues at the critical intersection movements. Under this year 2019 scenario with grade-separate crossing, the projected vehicle queue length at Centinela/Florence is slightly longer than the queue length under 2017 baseline (no LRT) conditions.

Table 9: Opening Year 2019 with Grade-Separated Crossing Intersection Peak Hour Queues

Intersection - Movement		Storage Capacity (ft)	AM Peak Hour		PM Peak Hour	
			Ave. Queue (ft)	Max. Queue (ft)	Ave. Queue (ft)	Max. Queue (ft)
1. Hillcrest Blvd / Florence Ave	WB Left-turn	230	60	350	50	230
	WB Through	475	20	460	10	100
2. Centinela Ave / Warren Ln	NB Through (Influence Zone)	600	40	390	20	230
3. Centinela Ave / Florence Ave	SB Left-turn (Gate Spillback)	600	40	200	50	230
	SB Right-turn (Gate Spillback)	230	60	340	20	180
	EB Left-turn	150	50	200	40	140
	WB Right-turn	250	30	230	10	140
4. Prairie Ave / Florence Ave	EB Through	940	90	420	270	850
	EB Right-turn	175	30	260	100	760

Bold font: projected queue length exceeds the storage capacity.

7.0 FUTURE YEAR 2040 ANALYSIS

This section presents the methodology for developing future traffic volumes for the study area, as well as the analysis results for future year 2040.

7.1 Traffic Forecasting Methodology

In coordination with the City of Inglewood, the 2016 SCAG RTP/SCS travel demand model was used as a basis for developing long-range traffic forecasts for the study area intersections. The socio-economic data in the forecast year was refined and adjusted to reflect several future developments. These include:

- Hollywood Park Project which includes an 80,000-seat sport stadium, 6,000-seat performance venue, 2,500 residential dwelling units, 890,000 square feet of retail; 780,000 square feet of office; 120,000 square foot casino, and a 300-room hotel
- The TOD plans around the future Crenshaw/LAX Line stations (Downtown Inglewood, Fairview Heights, Westchester/Veterans) on either side of the project area
- The TOD plan around the Metro Green Line station at Imperial/Crenshaw
- Proposed Inglewood Basketball and Entertainment Center (Clippers Arena) at Yukon Avenue/Century Boulevard

A full list of future development projects included in the future year forecasting is provided in **Appendix D**. Two model runs were completed, using TransCAD software, for this analysis:

- Existing Year (2016); and
- Forecast Year (2040).

The completion of the Crenshaw/LAX Line was included as a baseline assumption in the forecast year model run. While the SCAG model includes the Crenshaw/LAX Line as a baseline assumption for travel mode share, the delay along at the Centinela Avenue/Florence Avenue intersection related to the at-grade crossing is not accounted for in the model's trip route determination. Thus intersection-level delays that may be caused by the at-grade crossing do not influence trip diversion to other routes in the SCAG model. No manual adjustments were made to account for trip diversion.

An NCHRP-255 delta process was used for post-processing raw link volumes to produce the refined and adjusted turning movements used in the VISSIM analysis. The delta process took existing count information as a baseline, and calculated link volume growth between the existing year travel model (2016) and the future year model scenario (2040). The model growth was then applied to the existing intersection turning movement count data. Average annual growth in traffic was calculated to be approximately 0.8%.

7.2 Future Year 2040 Traffic Operations with At-Grade Crossing

An LOS and queue analysis was conducted to evaluate future year 2040 intersection operations using the 2040 traffic volumes. The following assumptions for the operation of the Crenshaw/LAX Line in this scenario are as follows:

- 5-minute headways per direction during peak hours;
- 3-car trains;
- Trains speeds of 35 – 45 mph in the westbound direction and 40 – 50 mph in eastbound direction.

Table 10 summarizes the future year 2040 LOS at the study intersections for the weekday peak hours. Detailed LOS output data is provided in **Appendix C. Table 11** summarizes the future year 2040 with at-grade crossing average and maximum queues at the critical intersection movements.

Table 10: Future Year 2040 with At-Grade Crossing Intersection Peak Hour LOS

Intersection	AM Peak Hour Ave. Vehicle Delay (seconds) - LOS	PM Peak Hour Ave. Vehicle Delay (seconds)- LOS
1. Hillcrest Blvd / Florence Ave	99.3 – F	77.2 – F
2. Centinela Ave / Warren Ln	82.3 – F	87.9 – F*
3. Centinela Ave / Florence Ave	117.9 – F	108.5 – F
4. Prairie Ave / Florence Ave	85.3 – F	70.7 – E

Table 11: Future Year 2040 with At-Grade Crossing Intersection Peak Hour Queues

Intersection - Movement		Storage Capacity (ft)	AM Peak Hour		PM Peak Hour	
			Ave. Queue (ft)	Max. Queue (ft)	Ave. Queue (ft)	Max. Queue (ft)
1. Hillcrest Blvd / Florence Ave	WB Left-turn	230	50	390	70	460
	WB Through	475	50	580	20	380
2. Centinela Ave / Warren Ln	NB Through (Influence Zone)	560*	40	380	60	470
3. Centinela Ave / Florence Ave	SB Left-turn (Gate Spillback)	520*	470	> 520	470	> 520
	SB Right-turn (Gate Spillback)	230	490	> 520	410	> 520
	EB Left-turn	150	530	590	520	600
	WB Right-turn	250	750	1,060	700	1,060
4. Prairie Ave / Florence Ave	EB Through	940	50	450	150	670
	EB Right-turn	175	20	460	60	620

Note:

*SB Centinela queue storage capacity is shorter than that of the NB direction due to the placement of the SB approach stop bar (north of La Colina). In addition, SB Centinela queue storage capacity in this scenario is shorter than existing and grade-separated conditions for the same reason.

Bold font: projected queue length exceeds the storage capacity.

As shown in **Table 10**, due to the cumulative traffic growth, 5-minute headway and 3-car train services, this intersection LOS would deteriorate from existing LOS C or better without the Crenshaw/LAX Line to over-saturated LOS F with the LRT in both the a.m. and p.m. peak hours.

Traffic movements approaching the at-grade crossings (southbound, eastbound left turn and westbound right-turn) may experience extensive delays and queue lengths, and motorists may have to wait for more than one signal cycle before they can safely cross the LRT tracks. These traffic movements could potentially spill back from the LRT tracks to the adjacent intersections (Warren, Prairie, and Hillcrest) frequently. Based on the projected average vehicle delay, it is estimated that approximately between 1 and 2 cycles may potentially be needed to clear the average southbound Centinela Avenue queue, of approximately 470 feet, at Florence Avenue during both the typical weekday a.m. and p.m. peak hours.

Note that in Table 10, for the Hillcrest Boulevard/Florence Avenue intersection, the average vehicle delay projected for future year 2040 p.m. peak hour condition is slightly lower than the estimated vehicle delay for the opening year 2019 peak hour condition (Table 6). This is a result of the potential metering effect of the increased congestion at the upstream Centinela Avenue/Florence Avenue intersection, affecting the arrival patterns of the vehicles approaching the Hillcrest Boulevard/Florence Avenue intersection.

As shown in **Table 11**, the influence zone queues, resulting from vehicle back-up at the northbound approach of the Centinela Avenue/Warren Lane intersection, during the a.m. and p.m. peak hours, are forecast to be under 100 feet on average. The distance from the Centinela Avenue/Warren Lane intersection back to the future at-grade crossing (influence zone area) is approximately 560 feet. Thus, no salient safety issue is anticipated with the influence zone queue. Similar to the average intersection delays, in some instances average queues may be reported as lower in 2040 compared to opening year 2019. This is a result of the potential metering effect of the increased congestion at the Centinela Avenue/Florence Avenue intersection, reducing the number of vehicles that flow through an adjacent intersection, such as Prairie Avenue/Florence Avenue, during the peak hour.

The following is a summary of the most critical movements at the Centinela Avenue/Florence Avenue intersection:

- **AM Peak Hour**
 - The eastbound left-turn movement is forecast to experience the highest average delay at the intersection, approximately 420 seconds per vehicle. This means that the eastbound left turn movement would be over-saturated under 2040 with LRT conditions. Motorists may experience significant wait time in a long queue for several signal cycles before they can exit the intersection. Due to the frequent LRT operations (every five minutes in each direction), this movement would not receive a sufficient amount of green time to serve the projected left-turn vehicle demand due to other competing movements (such as the westbound right-turn movement and the southbound movement) that also require green time to cross the LRT tracks.
 - The southbound right-turn movement is forecast to experience an average delay of approximately 161 seconds. The VISSIM analysis assumes one right-turn lane with three left-turn lanes. This right-turn movement delay could potentially be improved by

modifying the approach to include one right-turn lane, one shared left-turn/right-turn lane, and two left-turn lanes. However, the southbound left-turn movement would then experience additional delay. Therefore, it is recommended that the three dedicated left-turn configuration be implemented as it provides the optimal overall intersection operation.

- **PM Peak Hour**
 - Similar to the AM peak hour conditions, with the frequent LRT operations, the eastbound left-turn movement would also experience over-saturated conditions during the PM peak hour, at approximately 250 seconds per vehicle.
 - The southbound right-turn movement is forecast to experience the next highest average delay at the intersection, approximately 169 seconds. Similar to the a.m. peak hour analysis, it is recommended that the three dedicated left-turn configuration be implemented as it provides the optimal overall intersection operation in the p.m. peak hour.
- During both a.m. and p.m. peak hours, the eastbound Florence Avenue through movement and westbound Florence Avenue right-turn movement are forecast to generally have the lowest average delays. These lower delays are due to the number of lanes provided at each approach as well as the amount of green time allocated during the course of a peak hour. The westbound right-turn movement, in particular, would experience lower delays than other movements, mostly due to the overlap with the southbound movement.

7.3 Initial Grade Crossing Policy Analysis – Future Year 2040 Conditions

Figure 9 shows the future year 2040 weekday peak hour intersection volumes, and **Table 12** shows the highest bi-directional cross street traffic volume per lane for the a.m. peak hour and p.m. peak hour. Using 2040 volumes, the Initial Screening assessment was re-visited. In **Figures 10** and **11**, these values are plotted on the same nomograph as previously shown in Section 5.3.

Table 12: Future Year 2040 Cross-Street Traffic Volume per Lane – AM and PM Peak Hour

At-Grade Crossing	Cross-Street # of Lanes		Highest Cross-Street Volume/Lane
	NB	SB	Future Year 2040
Centinela Ave (north of Florence Ave)	2	4*	1,020 vehicles/lane (a.m.) 820 vehicles/lane (p.m.)

* Proposed configuration with at-grade crossing

Peak hour headways of five (5) minutes per direction are anticipated for the Metro Crenshaw Line/LAX Line. This frequency equates to 12 trains per hour for the peak hour.

Figure 10 – Nomograph for Initial Screening – Future Year 2040 AM Peak Hour (Typical Weekday)

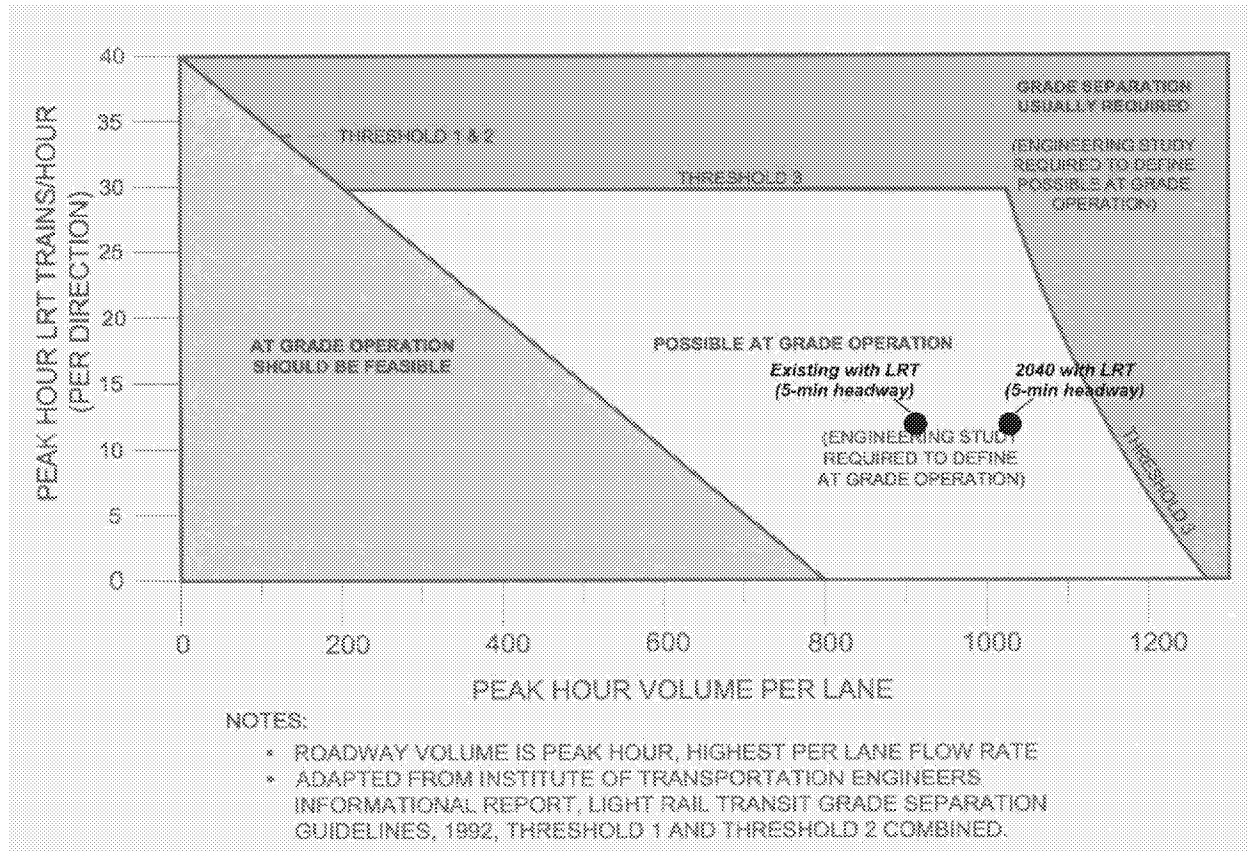
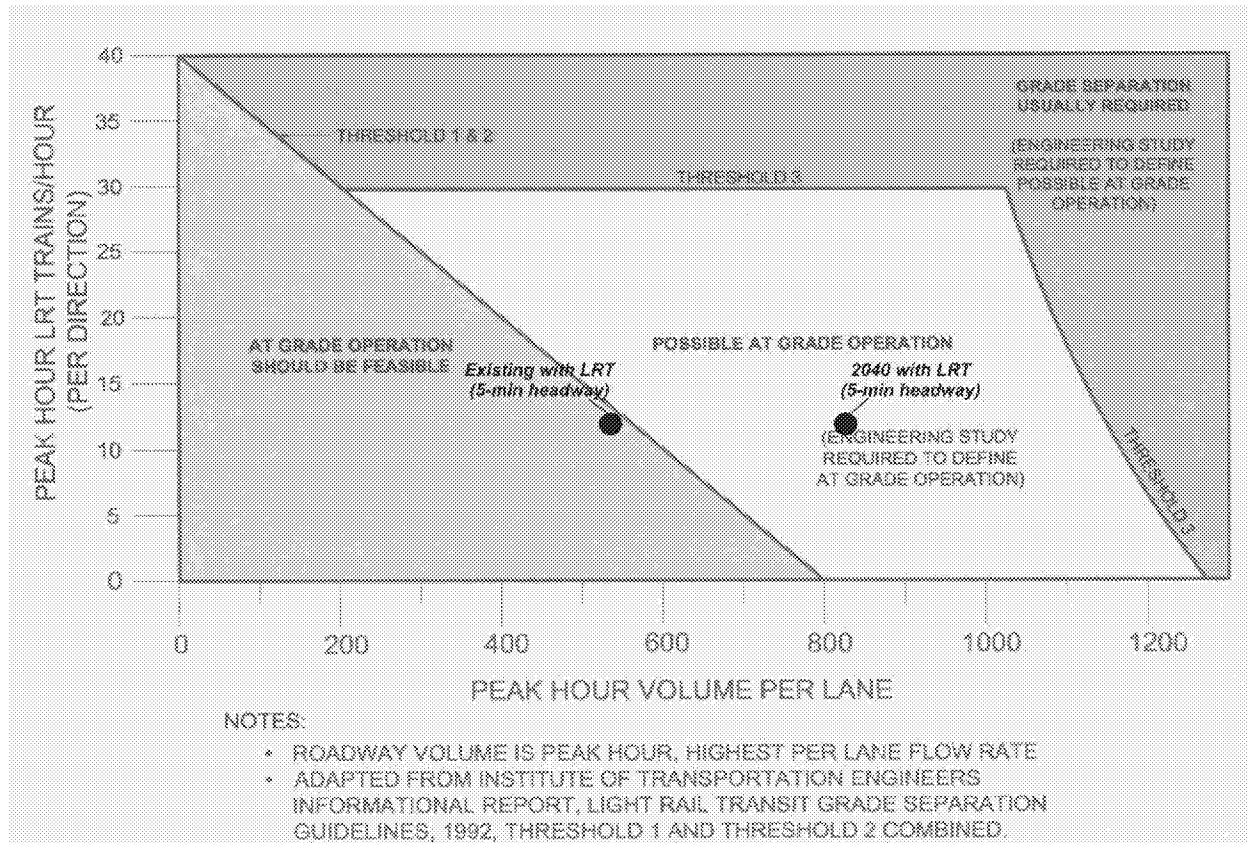


Figure 11 – Nomograph for Initial Screening – Future Year 2040 PM Peak Hour (Typical Weekday)



As shown in **Figure 10**, in existing traffic forecasts for the a.m. peak hour, approximately 900 cars per hour per lane are anticipated to cross the Centinela/Florence crossing with maximum train frequency of every 5 minutes in each direction for the LRT. Due to increased development, traffic is anticipated to increase to over 1,000 cars per hour per lane in future year 2040.

As shown in **Figure 11**, under the existing traffic conditions for the p.m. peak hour, over 500 cars per hour per lane are anticipated to cross the Centinela/Florence crossing with maximum train frequency of every 5 minutes in each direction for the LRT. Due to increased development, traffic is anticipated to increase to over 800 cars per hour per lane in future year 2040.

As shown in **Figures 10 and 11**, even though potential maximum queue may spill back one to two blocks from the intersection, application of the Metro Grade Crossing Policy indicated that the Centinela Avenue crossing continues to be categorized as a “possible at-grade operation” under the typical weekday traffic conditions (without the special event traffic surge).

7.4 Future Year 2040 Traffic Operations with Grade-Separated Crossing

This section presents an analysis of the effect that a grade separation would have on traffic operations in the study area. Utilizing the same traffic volumes as the 2040 at-grade crossing analysis, the network was analyzed assuming no signal phasing or timing would be dedicated to a crossing train (i.e., no pre-emption or gate down time). Thus, the signal timing and phasing would resemble existing conditions. The lane configurations were assumed to be the same as the 2040 at-grade condition. **Table 13** summarizes the future year 2040 with grade-separated crossing LOS at the study intersections for the weekday peak hours. Detailed LOS output data is provided in **Appendix C**.

Table 13: Future Year 2040 with Grade-Separated Crossing Intersection Peak Hour LOS

Intersection	AM Peak Hour Ave. Vehicle Delay (seconds) - LOS	PM Peak Hour Ave. Vehicle Delay (seconds) - LOS
1. Hillcrest Blvd / Florence Ave	13.6 – B	32.8 – C
2. Centinela Ave / Warren Ln	34.9 – C	42.7 – D
3. Centinela Ave / Florence Ave	31.7 – C	55.3 – E
4. Prairie Ave / Florence Ave	25.4 – C	43.2 – D

As shown in **Table 13**, with the potential grade-separated crossing, due to the cumulative traffic growth, the Centinela Avenue/Florence Avenue intersection is forecast to operate at LOS C in the a.m. peak hour and LOS E in the p.m. peak hour. The remaining three study intersections are expected to operate at LOS D or better.

Table 14 summarizes the future year 2040 with grade-separated crossing average and maximum queues at the most critical intersection movements.

The average traffic queue for the southbound left turn and right turn queue may be extensive and begin to spill back to Warren to the north. The average eastbound and westbound movement queues can be generally accommodated within one block of the at-grade crossing, but the maximum queue may begin to spill back to Prairie and to Hillcrest periodically.

Table 14: Future Year 2040 with Grade-Separated Crossing Intersection Peak Hour Queues

Intersection - Movement		Storage Capacity (ft)	AM Peak Hour		PM Peak Hour	
			Ave. Queue (ft)	Max. Queue (ft)	Ave. Queue (ft)	Max. Queue (ft)
1. Hillcrest Blvd / Florence Ave	WB Left-turn	230	70	270	50	240
	WB Through	475	20	480	10	130
2. Centinela Ave / Warren Ln	NB Through (Influence Zone)	600	60	450	60	410
3. Centinela Ave / Florence Ave	SB Left-turn (Gate Spillback)	600	130	530	370	> 600
	SB Right-turn (Gate Spillback)	230	460	> 600	160	> 600
	EB Left-turn	150	60	240	280	590
	WB Right-turn	250	30	270	20	180
4. Prairie Ave / Florence Ave	EB Through	940	120	620	840	1,120
	EB Right-turn	175	30	250	250	840

Bold font: projected queue length exceeds the storage capacity.

8.0 SAFETY EVALUATION

A planning-level safety assessment was performed as described in the Metro Grade Crossing Safety Policy to help determine whether adverse safety conditions would suggest and support a grade-separated solution. While several factors may be used as part of a preliminary safety review, the main intent of this traffic analysis is to reevaluate the need for a grade separation at the Centinela Avenue crossing due to increased development in the City of Inglewood. Therefore, the safety evaluation conducted in this report will only focus on the one element that is relevant to this changed condition: safety issues related to traffic queuing. **Figures 12 and 13** show a comparison of existing average queue lengths and 2040 with at-grade crossing average queue lengths at the intersection approaches, during the a.m. and p.m. peak hours respectively.

Figure 12 – Comparison of Existing and 2040 AM Queue Lengths at Centinela/Florence

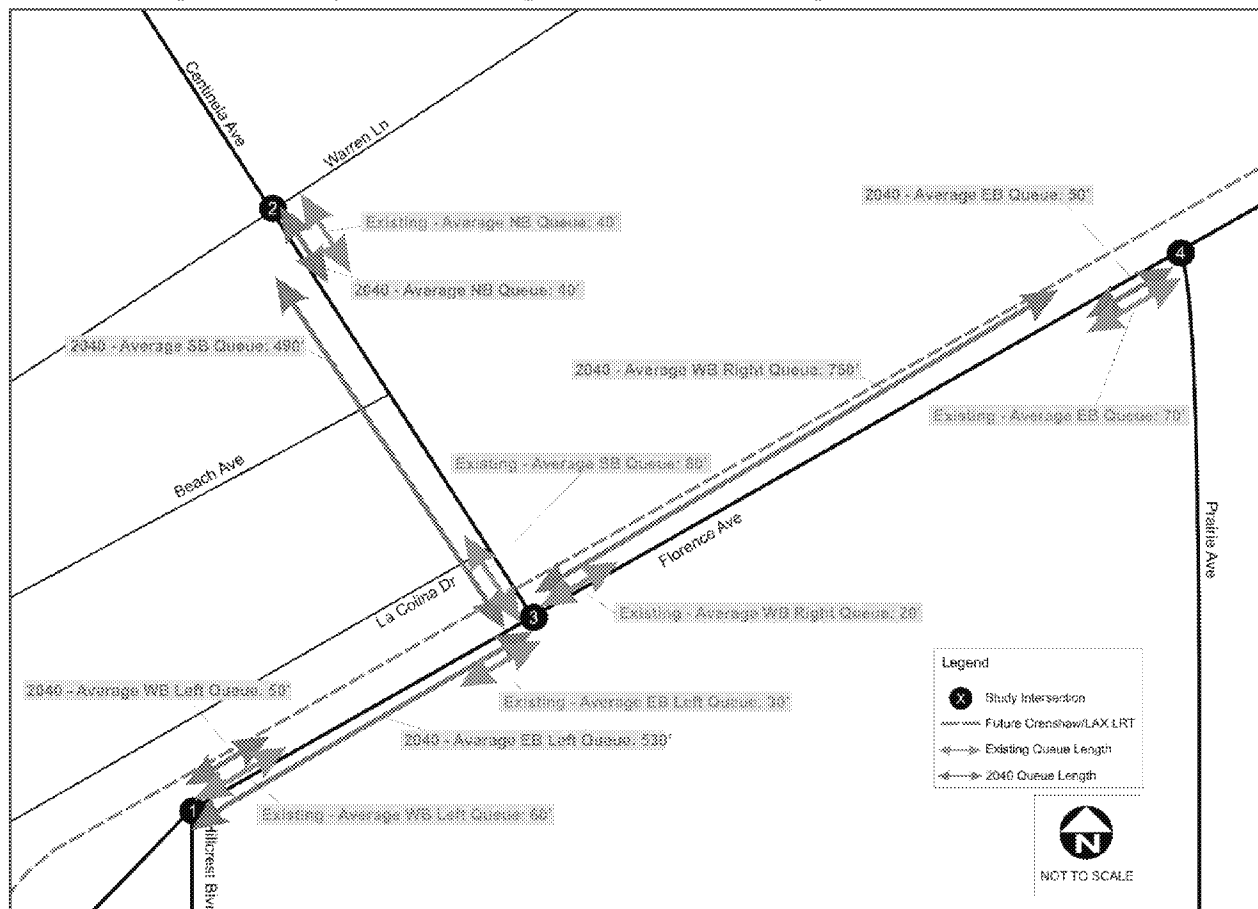
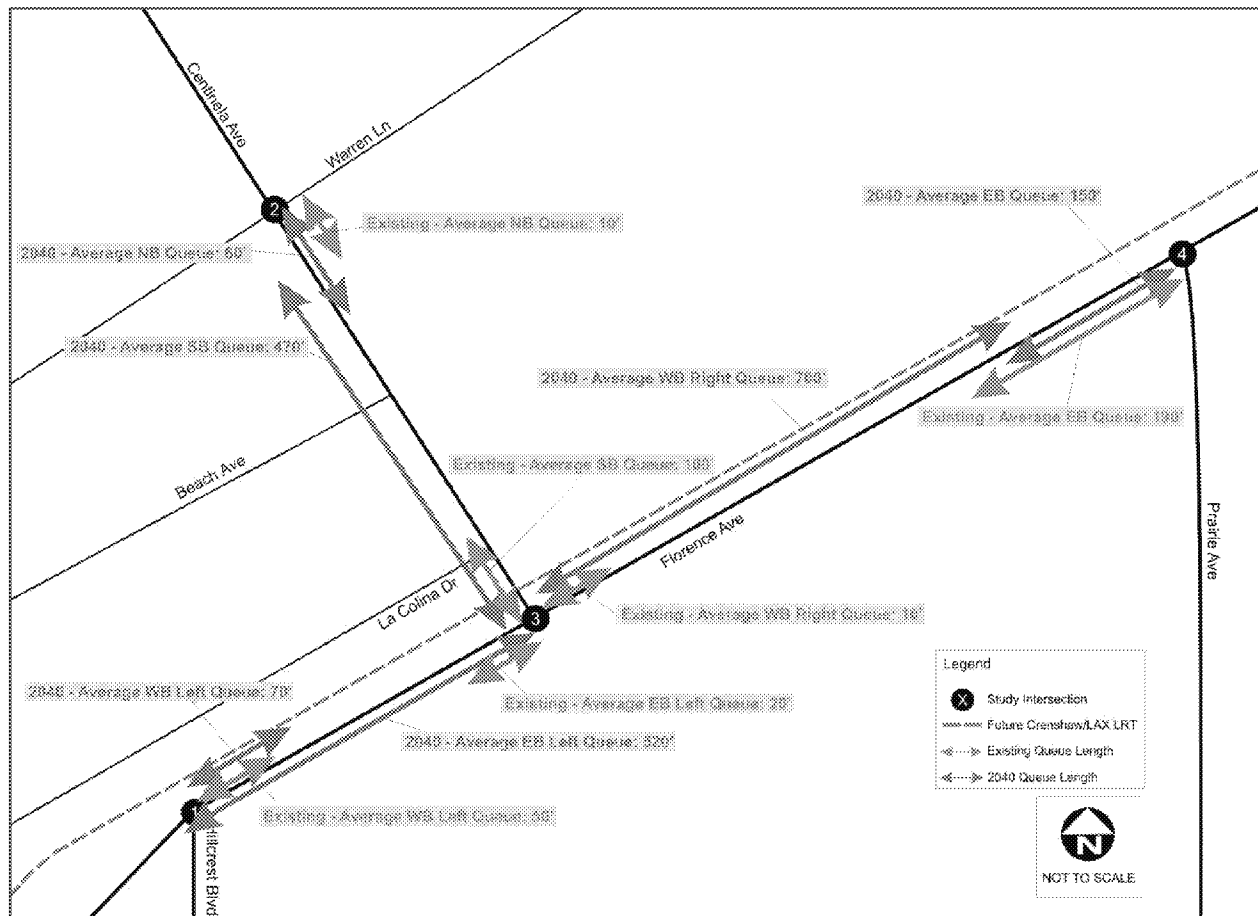


Figure 13 – Comparison of Existing and 2040 PM Queue Lengths at Centinela/Florence



As shown in **Figures 12 and 13**, in 2040, the average influence zone traffic queues are not expected to extend from the adjacent intersections to across the Crenshaw/LAX Line tracks at the Centinela/Florence intersection.

As discussed above, the queues resulting from vehicle back-up at the northbound approach of the Centinela Avenue/Warren Lane intersection (i.e., influence zone queue), is forecast to be under 100 feet on average during the two peak time periods on typical weekdays. The distance from the Centinela Avenue/Warren Lane intersection back to the future at-grade crossing is approximately 560 feet. Thus, no salient safety issue associated with the influence zone queue conditions is anticipated for this location with northbound vehicles potentially blocking the LRT tracks.

Similarly, westbound vehicles at the Hillcrest Boulevard/Florence Avenue intersection and eastbound vehicles at the Prairie Avenue/Florence Avenue intersection are not anticipated to back up onto the LRT tracks at the Centinela Avenue/Florence Avenue intersection during the two peak periods on typical weekdays.

In addition, based on the VISSIM analysis, adequate track clearance times are provided for the southbound Centinela Avenue approach volumes, as well as volumes that turn onto Centinela Avenue from La Colina Drive in all analyzed at-grade scenarios.

9.0 SPECIAL EVENT CONDITIONS (STEP 2 ANALYSIS)

This section provides a high-level qualitative analysis of the potential traffic increases in the study area resulting from traffic related to special events. As mentioned, the City of Inglewood is in the process of becoming a major sports and entertainment center in the greater Los Angeles region. The Inglewood Sports and Entertainment District (ISED), located east of Prairie Avenue and south of Manchester Avenue, would ultimately consist of four major venues:

- The Forum (existing venue);
- NFL Football Stadium as part of the Hollywood Park project (under construction);
- Performance Arena as part of the Hollywood Park project (under construction); and
- Proposed Inglewood Basketball and Entertainment Center (Clippers Arena).

The venues anticipate small, medium and large events throughout the year. The event surge analysis looked at multiple event scenarios at Hollywood Park, at the Stadium, the Forum, the proposed Clippers Arena, and the Performance Arena. The City is currently developing a Transportation Management and Operations Plan for these venues that may have simultaneous events. Special event traffic at NFL size venues in the United States normally require special traffic and access management to these venues during events that go beyond the normal traffic control devices at intersection crossings. Such plans have not yet been fully developed by the City of Inglewood and can therefore not be analyzed in relation to the Centinela/Florence crossing. The event surge analysis also assumed a worst-case scenario that the Crenshaw/LAX line would operate at the most frequent 5-minute headway per direction during p.m. peak and night-time periods during NFL game seasons.

The analysis utilized the anticipated trip generation of each event venue as well as the trip arrival and departure patterns provided by the City of Inglewood. The analysis assumed the worst-case scenario of when there are “full house” events happening at each of these venues. **Table 15** provides a summary of the anticipated frequency of special events at the multiple venues within the ISED, during weekdays and weekends.

Table 15: Inglewood Sports and Entertainment District Event Profiles

Venue	Event Type	Number of Events			Source
		Weekday	Saturday	Sunday	
1. NFL Stadium					
	Rams NFL Game	1	2	8	LA Rams 2017 Season Home Games
	Chargers NFL Game	1	2	8	LA Chargers 2017 Season Home Games
	Medium-sized event	4	2	2	Transportation & Parking Plan - Hollywood Park Stadium Alternative Project (LLG February 2015)
	Small-sized event	10	5	5	Same as above
2. The Forum					
	Large event	22	11	4	The Forum 2017 Event Calendar
	Medium-sized event	14	10	5	The Forum 2017 Event Calendar
	Small-sized event	6	6	4	The Forum 2017 Event Calendar
3. IBEC (Clippers)					
	Clippers game	29	9	6	LA Clippers 2017 Season Home Games
	Large-sized event	20	5	6	Staples Center 2017 Event Calendar
	Medium-sized event	9	1	3	Staples Center 2017 Event Calendar
	Small-sized event	3	6	8	Staples Center 2017 Event Calendar
4. Performance Arena					
	Event	37	18	20	Transportation & Parking Plan - Hollywood Park Stadium Alternative Project (LLG February 2015)
Total by days		156	77	79	
Weekday & Weekend TOTAL		312 yearly events			

Source: City of Inglewood and Raju Associates, Inc. (August 1, 2018).

As shown in **Table 15**, out of the 312 yearly events, a total of 156 events are anticipated to be held during weekday (evening) conditions in a typical year. In addition, up to 77 events are anticipated to occur on Saturdays and 79 events on Sundays in various venues. A number of these events could potentially occur at the same time in two or more venues on numerous occasions during a calendar year. Most of the weekday events would likely have a start time between 6:00 and 8:00 p.m. The arrival times of the patrons at these venues would potentially coincide with the evening peak hour of commuter traffic on weekdays.

Table 16 summarizes the anticipated trip generation of each venue provided by the City of Inglewood. The City's data includes anticipated number of patrons and employees when there are "full house" events happening at each of these venues.

The following summarizes the frequency and trip generation estimates for each of the four venues.

- **NFL Stadium:** For the NFL games, the pre-season and regular season games generally occur between August and December. A total of approximately 50 events per year are anticipated at

the Stadium, including 11 Rams NFL games, 11 Chargers NFL games and 28 small-size to mid-size events. The maximum vehicular volumes in one peak hour, based on arrival and departure profiles during an NFL game event are projected to be approximately 14,780 vehicles after an NFL game (including autos, buses and shuttles). Two of the 22 large-scale NFL games are expected to occur on a weekday evening with the remaining events occurring on Saturday or Sunday. For an NFL event that occurs on a weekday, the event traffic may arrive as early as two hours prior to the game and the surge of the arrival traffic may account for 55% to 60% of the total trip generation (approximately 8,460 vehicles in one peak hour). Departure traffic of an NFL game (up to 14,800 vehicles when tickets are sold out) may surge in one hour.

- **The Forum:** Forum is a concert venue having hosted over 70 concerts in 2017, along with family shows and other types of events. The City estimated up to 82 events may occur throughout the year. The Forum could generate approximately 3,298 vehicles in one peak hour during the arrivals and 4,209 vehicles in one peak hour during the departures.
- **IBEC (Clippers):** The NBA pre-season and regular season games usually start in late September through to April. The proposed IBEC, if approved by the City, is anticipated to host the Clippers Basketball home games, concerts and other events adding up to over 100 events per year, with over 60 weekday events. The proposed IBEC could generate 3,489 vehicles in one peak hour during the arrivals and 4,452 vehicles in one peak hour during the departures.
- **Performance Arena:** The Hollywood Park Performance Arena is anticipated to host over 75 events per year, half of which are anticipated to occur over the weekdays. The vehicles generated at the Performance Arena could be approximately 1,133 vehicles in one peak hour during the arrivals and 1,442 vehicles in one peak hour during the departures.

Note that the above mentioned trip generation estimates are subject to refinement as the IBEC Project is being developed and analyzed by the City and the special event traffic operations and parking management plan that is also being developed by the City.

Event patrons and employees may use various travel modes to access the Hollywood Park development area. Metro's regional transit system including the new Crenshaw/LAX line will allow for transfers/connections to the local bus routes or event shuttle buses to the event venues. In addition, the City of Inglewood initiated an environmental study in July 2018 for a proposed automated people mover system (APM) to transport riders from the Metro's Crenshaw/LAX Line Downtown Inglewood station to Downtown Inglewood, the Forum, NFL Stadium/Inglewood Sports and Entertainment District, and the proposed Inglewood Basketball and Entertainment Center (Clippers Arena).

Table 16: Summary of Event Day Vehicle Trip Generation within The Inglewood Sports and Entertainment District (ISED)

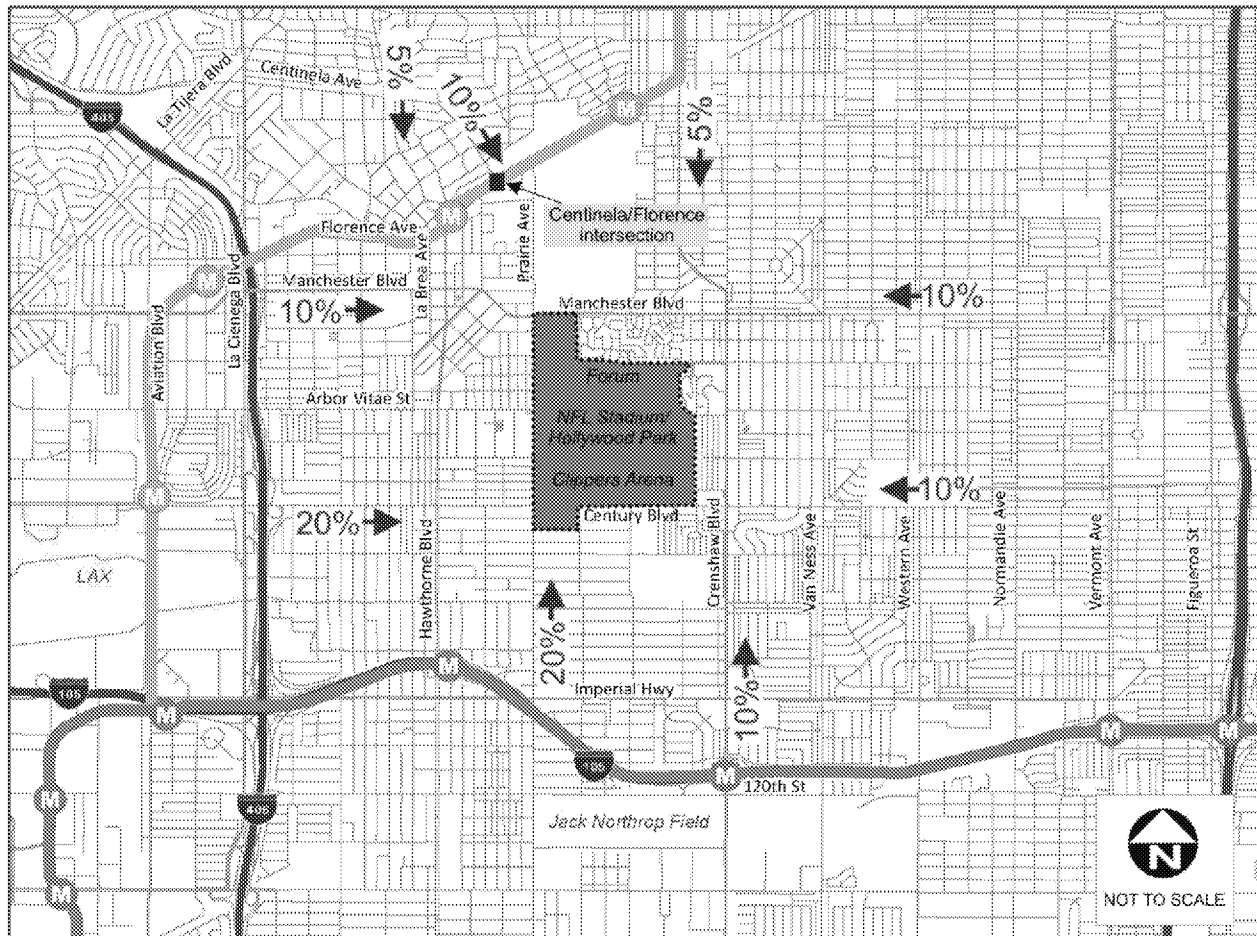
Venue / Key Events	# of Attendees	Auto (85%)*	Bus (10%)	Shuttles (5%)	Total	Arrival Trip Generation (5:15-6:15pm)				Departure Trip Generation (9:00-10:00pm)			
						Auto Pk Hr	Bus Peak Hr	Shuttles Peak Hr	Total Peak Hr	Auto Pk Hr	Bus Peak Hr	Shuttles Peak Hr	Total Peak Hr
NFL Stadium													
NFL Game Event													
Patrons	72,000	20,400	160	120	20,680	7,956	104	78	8,138	13,260	128	96	13,484
Employees	6,000	3,214	13	10	3,237	321	1	1	323	1,286	5	4	1,295
Total		23,614	173	130	23,917	8,277	105	79	8,461	14,546	133	100	14,779
The Forum													
Large Events													
Patrons	17,500	4,958	39	29	5,026	2,975	23	17	3,015	3,966	31	23	4,020
Employees	875	469	2	1	472	281	1	1	283	188	1	0	189
Total		5,427	41	30	5,498	3,256	24	18	3,298	4,154	32	23	4,209
IBEC (Clippers)													
NBA Games													
Patrons	18,500	5,242	41	31	5,314	3,145	25	19	3,189	4,194	33	25	4,252
Employees	925	496	2	2	500	298	1	1	300	198	1	1	200
Total		5,738	43	33	5,814	3,443	26	20	3,489	4,392	34	26	4,452
Performance Arena													
Events													
Patrons	6,000	1,700	13	10	1,723	1,020	8	6	1,034	1,360	10	8	1,378
Employees	300	161	1	1	163	97	1	1	99	64	0	0	64
Total		1,861	14	11	1,886	1,117	9	7	1,133	1,424	10	8	1,442

Source: City of Inglewood (August 1, 2018)

*Assumptions for mode split: 85% auto, 10% bus, and 5% shuttle; Assumptions for average vehicle occupancy (AVO): 3.0 for patrons and 1.6 for employees.

Utilizing the trip generation estimates provided by the City shown in **Table 16**, an evaluation of the potential event-related trips at the Centinela Avenue/Florence Avenue intersection was performed. The approximate trip distribution of inbound and outbound traffic to the venues was obtained from the Hollywood Park Stadium Alternative Project Traffic Impact Analysis (*Linscott Law & Greenspan, February 2015*) report. The trip distribution pattern, for the inbound/pre-event scenario, is shown in **Figure 14**.

Figure 14 – Event Trip Distribution



As shown in **Figure 14**, event patrons traveling by car will likely utilize the regional freeway system (I-405, I-105, and I-110 Freeways) and major arterials (such as Manchester Boulevard, Prairie Avenue, Century Boulevard, Crenshaw Boulevard, La Brea Avenue, Centinela Avenue, and Florence Avenue) to access the ISED on-site parking facilities along Prairie Avenue. Approximately 10 percent of the inbound event traffic is estimated to potentially travel through the Centinela Avenue/Florence Avenue intersection, primarily using the southbound left turn approach of this intersection. Similarly, approximately 10% of the post-event outbound traffic was assumed to utilize the Centinela Avenue/Florence Avenue intersection for the purpose of this analysis.

The event surge analysis looked at multiple event scenarios at Hollywood Park, at the Stadium, the Forum, the proposed Clippers Arena, and the Performance Arena. The event traffic volume calculations include scenarios in which a single event occurs on a weekday evening as well as the possibility that multiple events occur simultaneously. Due to frequency of venue use, some event combinations are more likely to occur than others. The 11 analyzed event scenarios are shown in **Table 17**.

Table 17: Analyzed Event Scenarios

Scenario ID	Event Scenario*	Frequency (Times/Yr)
1	Performance Arena (PA) Event	Up to 75 times per year
2	Forum Event	Up to 40 times per year
3	NBA Game	Up to 45 times per year
4	Forum Event + PA Event	Up to 40 times per year
5	NBA Game + PA Event	Up to 45 times per year
6	NBA Game + Forum Event	Up to 40 times per year
7	NBA + Large Forum + PA Event	Up to 40 times per year
8	NFL Game	Up to 22 times per year
9	NFL Game + PA Event	Up to 22 times per year
10	NFL Game + Forum Event	Up to 22 times per year
11	NFL+ NBA Game	Up to 22 times per year

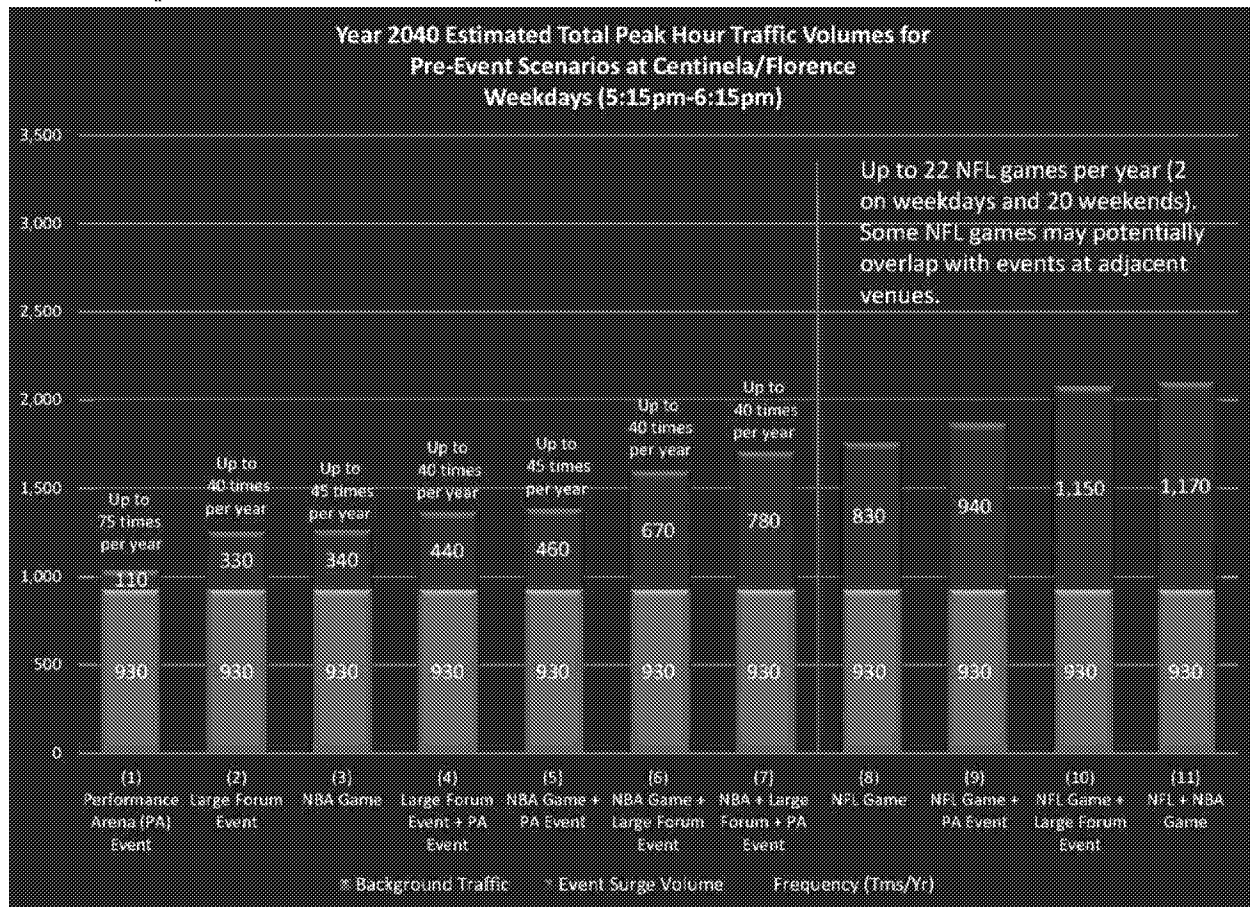
Note: assuming the worst-case of “full house”, large events to occur at each venue in each scenario.

Pre-Event Traffic Conditions

Based on the trip distribution percentage and trip generation for each event, the total volumes at the southbound approach to the Centinela Avenue/Florence Avenue intersection were calculated for the pre-event condition which coincides with the weekday p.m. peak hour for all 11 event scenarios. Thus, the pre-event volumes would add to typical weekday p.m. peak background commuter traffic volumes shown in **Figure 9**.

Figure 15 shows a bar chart depicting the anticipated pre-event surge traffic volumes at the Centinela Avenue/Florence Avenue intersection. The volume shown in **Figure 15** is the estimated southbound left-turn movement per hour per lane for each scenario and it includes the patron-only traffic volumes (red bars) and the background non-event related traffic volumes (blue bars). The chart shows traffic data for 11 different combinations of solo or overlapping events at the four venues in the Hollywood Park Development area. Up to 22 NFL games may occur during a calendar year and some of these events may potentially overlap with the activities at the Forum, the IBEC and the Performance Arena (scenarios 8, 9, 10, and 11).

Figure 15 – Southbound Centinela Ave Intersection Arrival Volumes – Pre-event Peak Hour



As shown in **Figure 15**, the scenarios with the largest combined traffic volumes at the intersection would include an NFL game at the stadium, as a result of the stadium having the largest seating capacity of the four venues. During the NFL game pre-event conditions, the southbound approach at the Centinela Avenue/Florence Avenue intersection is anticipated to experience a roughly 90% to 120% increase in traffic volumes compared to typical weekday peak hour conditions. Again, this analysis assuming no special event control is in place in the study area. Traffic volume calculations per event scenario are provided in **Appendix E**.

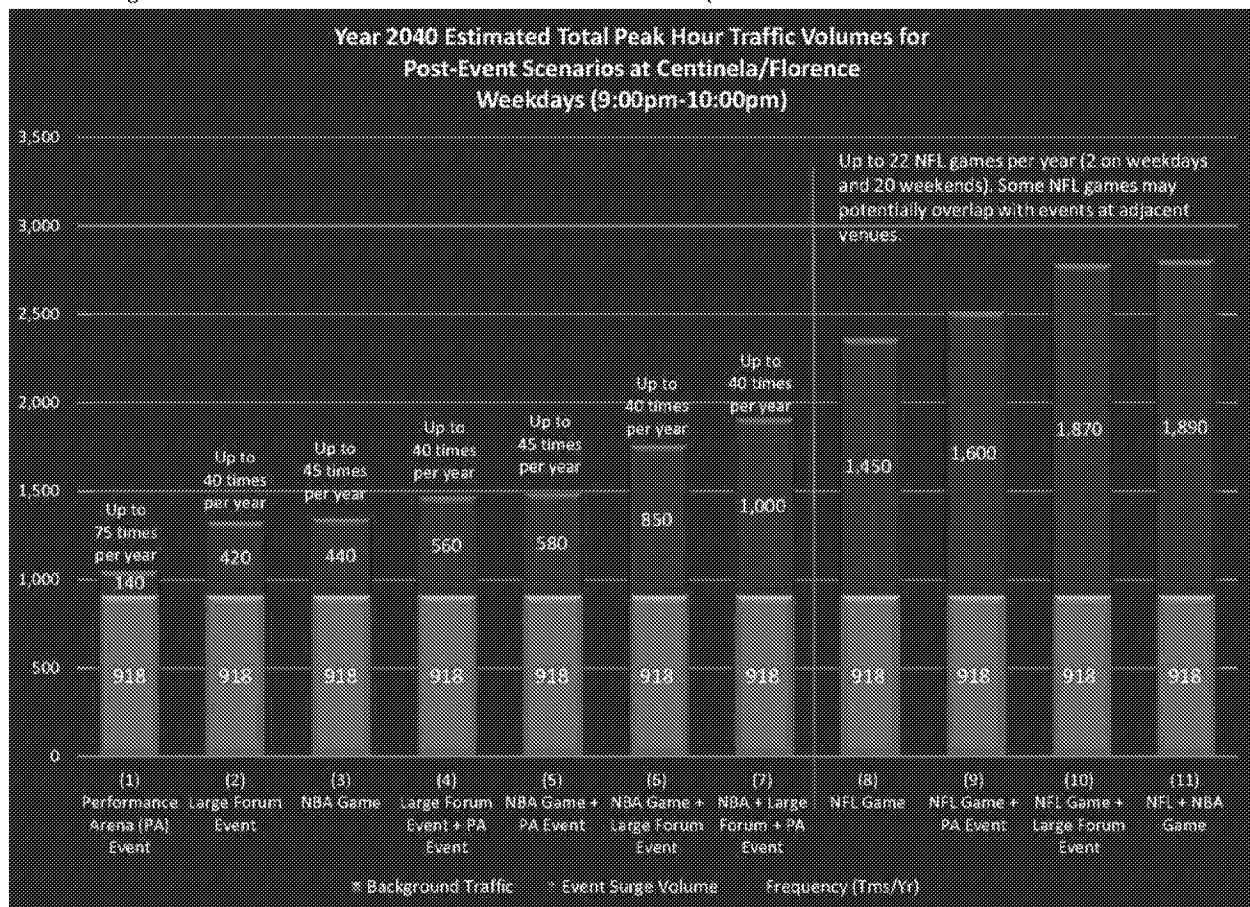
Post-Event Traffic Conditions

Based on the trip distribution percentage and trip generation for each event, the total outbound event traffic volumes, focusing on the northbound departure movements, at the Centinela Avenue/Florence Avenue intersection were calculated for the post-event condition. The post-event peak hour of traffic is anticipated to be 9:00 to 10:00 p.m., which is outside of the typical commuter peak traffic. Thus, background traffic volumes would be lower than volumes during the pre-event condition. A review of 24-

hour roadway volume data in the study area showed that traffic volumes during the 9:00 to 10:00 p.m. hour are approximately 44 percent lower than the p.m. peak hour volume.

Figure 16 shows a bar chart depicting the anticipated additional surge post-event traffic volumes at the Centinela Avenue/Florence Avenue intersection during the 9:00 to 10:00 p.m. hour. The volume shown in Figure 16 is the estimated intersection northbound departure movement (sum of westbound right-turn movement and eastbound left-turn movement) per hour per lane for each scenario.

Figure 16 – Northbound Centinela Ave Intersection Departure Volumes – Post-event Peak Hour



As shown in Figure 16, similar to the pre-event conditions, the scenarios with the largest combined post-event traffic volumes at the intersection would include an NFL game at the stadium, as a result of the stadium having the largest seating capacity of the four venues. During the NFL game post-event conditions, the northbound departure at the Centinela Avenue/Florence Avenue intersection is anticipated to experience a roughly 160% to 205% increase in traffic volumes compared to typical weekday late evening conditions. When a large NFL game and an NBA game happen simultaneously on the same day, the post-event traffic may be twice as high as the normal background traffic at this location. Again, this analysis assumes no special event traffic management control is in place in the study area.

Traffic volume calculations per event scenario are provided in **Appendix E**.

Grade Crossing Nomographs

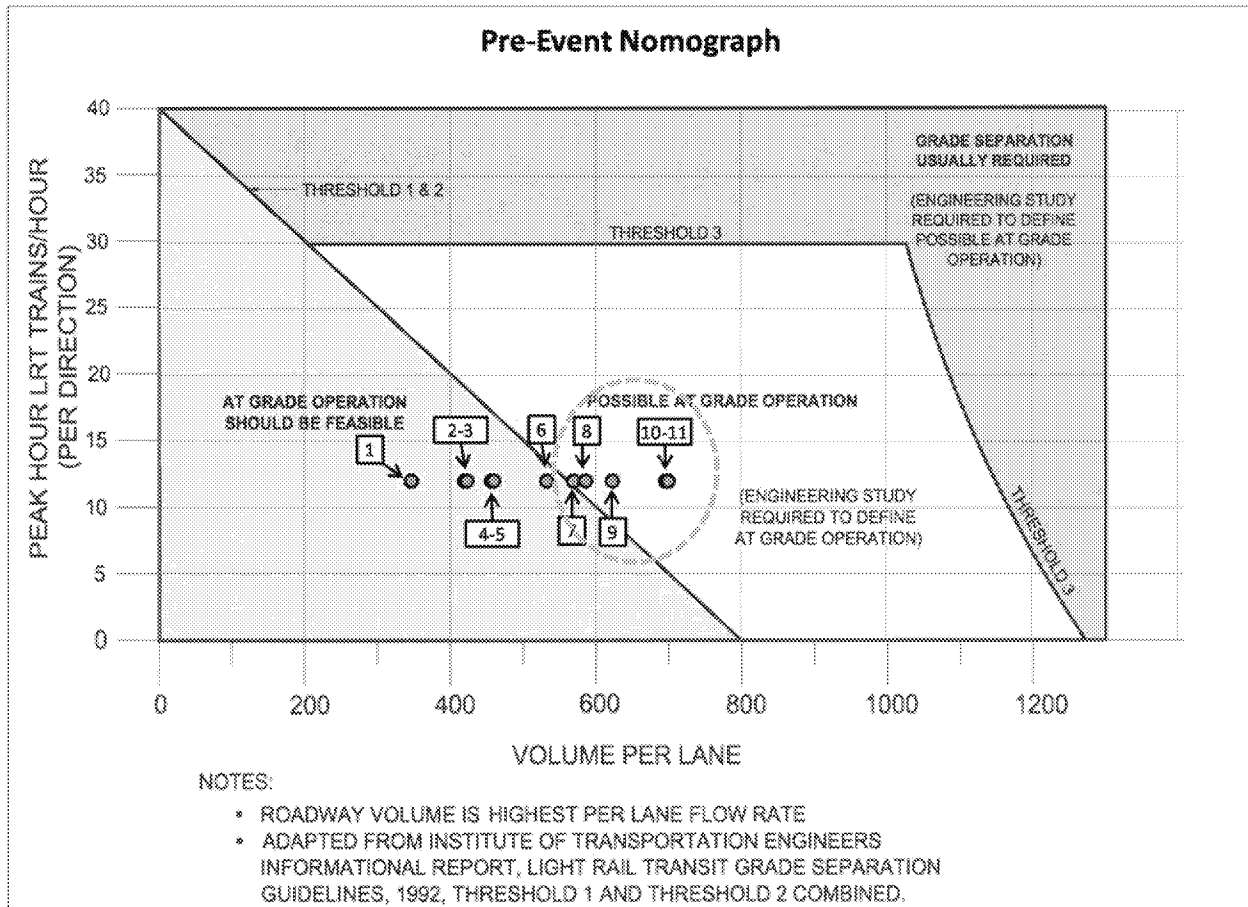
The analysis assesses the performance of the Centinela Avenue/Florence Avenue intersection according to Metro's Grade Crossing Safety Policy (October 2010), a screening tool for the evaluation of potential grade separation vs. at-grade operation along new light rail lines. As a decision threshold, Metro's Grade Crossing Policy is intended for peak hour analysis to guide design decisions for new projects and extensions. The policy is not normally used to analyze existing light rail at-grade crossings or special event traffic analysis; however, it was utilized for the Centinela/Florence crossing to understand the level of future traffic activity and provide a baseline for evaluating the need and feasibility of potential grade separation improvements at this location. Furthermore, a policy does not exist for growth and land use changes at existing Metro grade crossings.

Special event traffic at NFL size venues in the U.S. normally requires special traffic and access management to these venues during events that go beyond the normal traffic control devices at intersection crossings. The City is currently developing a Transportation Management and Operations Plan for these venues that may have simultaneous events. Such plans have not yet been fully developed by the City of Inglewood and can therefore not be analyzed in relation to the Centinela/Florence crossing. Furthermore, on a typical weekday or weekend night time, the operating frequency for the Metro rail services may range between 10 to 20 minutes. As the worst-case scenario, five minute headways on the Crenshaw Line are assumed for the special event conditions analysis.

Figure 17 shows the nomograph for the critical traffic movement per hour per lane at the Centinela/Florence crossing for the pre-event conditions. The pre-event nomograph shows that none of the 11 different combinations of event scenarios would trigger the grade separation criteria. Only up to 750 cars per hour per lane are anticipated to cross the Centinela/Florence crossing with maximum train frequency of every 5 minutes in each direction for the LRT.

Figure 18 shows the nomograph for the critical traffic movement for the post-event conditions. The post-NFL game traffic (9:00 – 10:00 p.m.) would meet the volume threshold for "Grade Separation Normally Required Category", if the Metro Grade Crossing Policy were applied. More than 1,200 cars per hour per lane are anticipated to cross Centinela/Florence after the approximately 22 NFL games. The post-event traffic may be significant and twice as high as the normal background traffic at this location when a large NFL game occurs by itself (scenario 8). Similarly, the post-event traffic may be significant when full house events occur simultaneously at the Forum, Performance Arena, or the IBEC on the same day of a large NFL game (scenarios 9, 10 and 11).

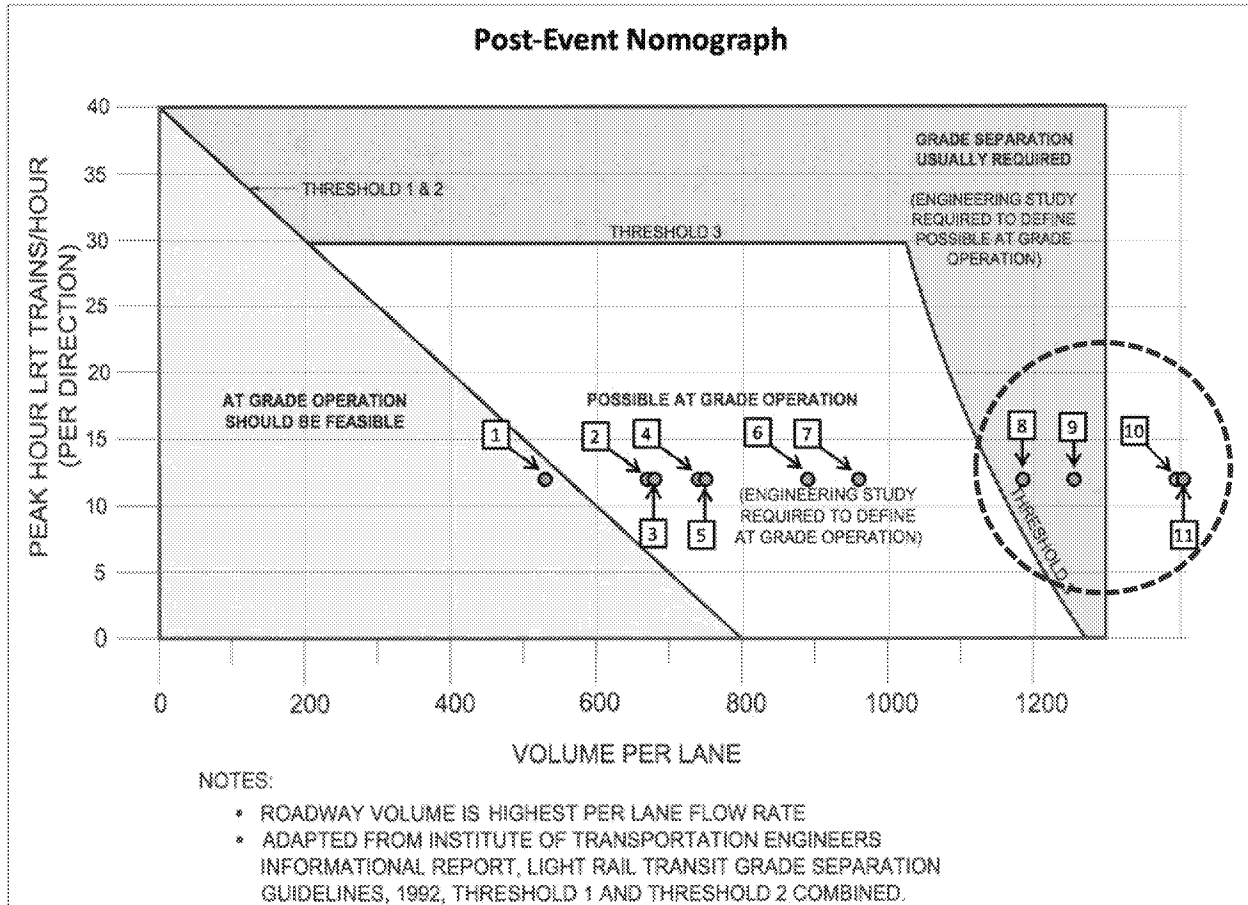
Figure 17– 2040 Nomograph – Pre-event Peak Hour (5:15 - 6:15 p.m.)



Note: Analyzed event scenarios are:

1. Performance Arena (PA) Event, up to 75 times per year
2. Forum Event, up to 40 times per year
3. NBA Game, up to 45 times per year
4. Forum Event + PA Event, up to 40 times per year
5. NBA Game + PA Event, up to 45 times per year
6. NBA Game + Forum Event, up to 40 times per year
7. NBA + Large Forum + PA Event, up to 40 times per year
8. NFL Game, up to 22 times per year
9. NFL Game + PA Event, up to 22 times per year
10. NFL Game + Forum Event, up to 22 times per year
11. NFL+ NBA Game, up to 22 times per year

Figure 18– 2040 Nomograph – Post-event Peak Hour (9:00 - 10:00 p.m.)



Note: Analyzed event scenarios are:

1. Performance Arena (PA) Event, up to 75 times per year
2. Forum Event, up to 40 times per year
3. NBA Game, up to 45 times per year
4. Forum Event + PA Event, up to 40 times per year
5. NBA Game + PA Event, up to 45 times per year
6. NBA Game + Forum Event, up to 40 times per year
7. NBA + Large Forum + PA Event, up to 40 times per year
8. NFL Game, up to 22 times per year
9. NFL Game + PA Event, up to 22 times per year
10. NFL Game + Forum Event, up to 22 times per year
11. NFL+ NBA Game, up to 22 times per year

10.0 CONCLUSIONS

The Crenshaw/LAX Light Rail Transit (LRT) Line is an under-construction light rail line that will run through southwest Los Angeles. Initial revenue service for the Crenshaw/LAX line is projected to begin by late 2019. The final EIR for the Crenshaw/LAX line was certified in September 2011 with an at-grade crossing at Centinela Avenue/Florence Avenue, just east of the Downtown Inglewood station. This study analyzes traffic at the Centinela Avenue and Florence Avenue intersection and assesses its performance according to the Metro Grade Crossing Safety Policy.

The Study took a two-step approach, including:

- Step 1 – A detailed intersection queuing analysis for the Centinela/Florence crossing for typical weekday commute peak periods and,
- Step 2 – A high-level assessment of the potential special large event surge traffic to and from the Hollywood Park, in response to the City's request.

Note that Metro's Grade Crossing Policy is applicable only to new projects or extensions and not designed for use on operating lines, it was nevertheless utilized as a baseline for understanding the need and feasibility of a potential grade separation at this location.

Step 1 Traffic Study Analysis Findings

In Step 1, the Study analyzed traffic conditions at four intersections, including the Centinela Avenue/Florence Avenue crossing intersection and the three adjacent intersections Centinela Avenue/Warren Lane, Hillcrest Boulevard/Florence Avenue, and Prairie Avenue/Florence Avenue. Traffic assessment was conducted for various traffic scenarios for the typical weekday a.m. and p.m. peak hours under existing (year 2017), future 2019 (opening year of the Crenshaw/LAX Line) and future 2040 conditions. Traffic queueing analysis was performed to compare the conditions for LRT at-grade vs. grade separation.

- **Existing (no LRT) Conditions scenario:** Under the pre-Crenshaw/LAX LRT conditions, the intersection operated at acceptable levels of service (LOS C) in the weekday a.m. and p.m. peak hours and no significant traffic queuing conditions under were identified based on the typical average queue lengths and field observations.
- **Existing Plus At-Grade Crossing scenario:** If the LRT tracks were in operations with 5-minute headways and 3-car trains with the current background traffic, this intersection LOS would change from LOS C or better to LOS F in both peak hours. Traffic movements in the southbound queue (left turn and right-turn), eastbound left turn queue and westbound right turn queue could potentially spill back from the LRT tracks to the adjacent intersections (Warren, Prairie, and Hillcrest). Yet, the influence zone queue length is not anticipated to extend from the adjacent intersections to cross the LRT tracks (i.e., no salient safety issue was identified).
- **Opening Year 2019 With At-Grade Crossing scenario:** In the near-term, with 5-minute headways, 2-car trains, and slightly higher background traffic conditions, this intersection LOS would change

from existing LOS C or better to LOS F conditions in both the a.m. and p.m. peak hours. The vehicle queues at Centinela/Florence may accumulate and begin to spill back from the LRT tracks to the three adjacent intersections periodically (Warren to the north, Prairie to the east, and Hillcrest to the west). However, no salient safety issue is anticipated for this at-grade crossing because the average influence zone queue from the adjacent intersections is projected to be within the storage capacity on Florence and on Centinela.

- **Opening Year 2019 With Grade-Separated Crossing scenario:** The intersection is anticipated to operate at comparable LOS and queuing conditions to the existing conditions.
- **Future Year 2040 With At-Grade Crossing scenario:** Due to the cumulative traffic growth, 5-minute headway per direction, and 3-car train services, this intersection LOS would deteriorate from existing LOS C or better to LOS F in both the a.m. and p.m. peak hours. Traffic movements approaching the at-grade crossings (southbound, eastbound left turn and westbound right-turn) may experience extensive delays and queue lengths and motorists may have to wait for more than one signal cycle before they can safely cross the LRT tracks. These traffic movements could potentially spill back from the LRT tracks to the adjacent intersections (Warren, Prairie, and Hillcrest) frequently. Based on the projected average vehicle delay, it is estimated that approximately between one and two cycles may potentially be needed to clear the southbound Centinela Avenue queue, of approximately 470 feet, at Florence Avenue during both the typical weekday a.m. and p.m. peak hours. However, no salient safety issue is anticipated for this at-grade crossing because the influence zone queue from the adjacent intersections is projected to be within the storage capacity on Florence and on Centinela.
- **Future Year 2040 With Grade-Separated Crossing scenario:** Due to the cumulative traffic growth, this intersection is projected to operate at LOS C in the a.m. peak hour and at the border line LOS E in the p.m. peak hour. The average traffic queue for the southbound left turn and right turn queue may be extensive and begin to spill back to Warren to the north. The average eastbound and westbound movement queues can be generally accommodated within one block of the at-grade crossing, but the maximum queue may begin to spill back to Prairie and to Hillcrest periodically.

The Step 1 analysis indicated that, without special large event traffic surge conditions, at-grade operation of the Crenshaw/LAX line is anticipated to be possible at the Centinela/Florence intersection in opening year 2019 and future 2040 conditions.

Step 2 Special Event Analysis

For the special event surge analysis, an evaluation of the potential event-related trips at the Centinela Avenue/Florence Avenue intersection was conducted utilizing Metro's Grade Crossing Policy as a baseline for understanding the need and feasibility of a potential grade separation. The event surge analysis looked at multiple event scenarios and considered that, on occasion, multiple events may take place simultaneously. The most-notable traffic impacts were generated during the approximately 22 large NFL games per year.

Special event traffic at NFL size venues in the United States normally requires special traffic and access management to these venues during events that go beyond the normal traffic control devices at intersection crossings. Such plans have not yet been fully developed by the City of Inglewood and therefore were not analyzed in relation to the Centinela/Florence crossing. The event surge analysis also assumed a worst-case scenario of the Crenshaw/LAX line operating at 5-minute headways during p.m. peak and night-time periods.

The special event surge analysis indicated that the post-NFL game traffic (9 p.m.-10 p.m.) would meet the volume threshold for “Grade Separation Normally Required Category”, if the Metro Grade Crossing Policy were applied. The analysis found that post-event traffic may be twice as high as the normal background traffic at this location.