3.0 TRANSPORTATION ANALYSIS

This chapter describes the current transportation system in the PEROW/WSAB Corridor Study Area that would be affected by the proposed project alternatives under consideration. It provides an overview of the existing freeway, arterial, and transit systems, their existing and future conditions, and planned highway and transit projects. This chapter presents the transportation system consequences resulting from the implementation of each of the alternatives under consideration. These effects are presented for the Corridor's highway and transit systems, and are primarily discussed in terms of traffic impacts and ridership forecasts.

3.1 Affected Environment

The existing Corridor transportation system can be characterized as heavily automobile-oriented with 86 percent of work-related trips made by automobile whether in a single-occupant vehicle (SOV) or by carpool. The study area is served by an extensive freeway and arterial system, with transit access provided primarily by bus and circulator service with some rail service. Currently severe congestion is experienced by automobile and bus transit users alike as many Corridor highways operate near or at capacity during both peak periods. Auto travelers are negatively impacted by delays, while transit users experience slowing bus travel on the same congested highway system.

The ability to move quickly and efficiently in the PEROW/WSAB Corridor, both now and in the future, can be expressed in terms of freeway and arterial congestion, along with transportation system accessibility and choice. As discussed in Chapter 1.0 of this document, this densely populated Corridor faces significant mobility challenges in the future with the forecasted growth in population, employment, and travel demand, along with changing employment patterns. By 2035, more than 12.8 million additional daily trips will occur in the Corridor straining the existing transportation network. Without additional transportation system improvements, the Corridor's Mobility Problem can be described in terms of:

- **Freeway and arterial congestion** – Currently, the freeway system serving the Corridor is highly congested resulting in travel time delays for a significant portion of each day. Correspondingly, a large percentage of the study area's major arterial intersections operate at or beyond capacity during both peak travel periods.
- **Transit system constraints** – The study area lacks transit system connections both within the Corridor, and beyond the Corridor to the regional urban and commuter rail system.
- **Limited travel options** – Corridor residents have limited travel options available resulting in a high percentage of work and other trips made by automobile.

The Corridor's congested freeway and arterial street system, together with the limited bus and rail service, offer limited capacity and travel options to accommodate the forecasted increase in travel. Development of an effective multi-modal, high-capacity transportation system is essential to meet the future mobility needs of Corridor residents and businesses.

3.2 Traffic

The ability to move quickly and efficiently in the PEROW/WSAB Corridor can be expressed in terms of freeway and arterial congestion, along with transportation system accessibility and choice. The following discussion presents an overview of current and future conditions, and future highway system plans.

3.2.1 Freeway Network

The PEROW/WSAB Corridor is served by an extensive freeway system that provides a high degree of access to areas throughout Los Angeles and Orange counties and to destinations beyond. When operating effectively, these freeways are capable of moving high volumes of vehicles. As presented in Figure 3.1, the following seven freeways are located in or frame the boundaries of the study area:

- ***I-5/Santa Ana Freeway*** – This freeway runs at a northwest-southeast diagonal parallel to and north of the PEROW/WSAB Corridor, and forms a majority of the eastern study area boundary. The I-5 connects Los Angeles and Orange counties internally and north to the Central Valley and Sacramento, and south to San Diego.
- ***I-405/San Diego Freeway*** – This freeway operates at a northwest-southeast diagonal parallel to and south of the PEROW/WSAB Corridor, and forms a large portion of the southern study area boundary. The I-405 serves Los Angeles and Orange counties, and joins the I-5 to the north in the San Fernando Valley, and to the south in Irvine.
- ***I-710/Long Beach Freeway*** – This north-south freeway runs through the western portion of the study area and connects Long Beach and the ports of Long Beach and Los Angeles north to its current terminus in Alhambra in the San Gabriel Valley.
- ***I-605/San Gabriel Freeway*** – This north-south freeway passes through the heart of the study area, and connects north to the I-210 in the San Gabriel Valley, and south to the I-405 at the boundary between Los Angeles and Orange counties.
- ***I-105/Glenn Anderson or Century Freeway*** – This east-west freeway connects the I-605 in Norwalk west to the I-405 in the Los Angeles International Airport (LAX) area. The Metro Green Line operates in the freeway median west from Norwalk to the LAX area.
- ***SR-22/Garden Grove Freeway*** – This east-west freeway operates through the southern portion of the study area from the SR-1/Pacific Coast Highway in Long Beach east to the SR-55 located in Santa Ana and Tustin.
- ***SR-91/Artesia Freeway*** – This east-west freeway operates through the heart of the study area, and connects Los Angeles, Orange, Riverside, and San Bernardino counties from the I-110/Harbor Freeway in the South Bay Cities east to downtown San Bernardino.

There are three north-south-oriented freeways adjacent to the study area: in Los Angeles County, the I-110/Harbor Freeway to the west connects the South Bay with downtown Los Angeles and the San Gabriel Valley; and in Orange County, the SR-55/Costa Mesa and SR-57/Orange freeways to the east provides connections from the central portion of the county north to the SR-91 and I-10 respectively.

Figure 3.1 – Current Regional Highway System

3.2.1.1 Existing and Future Conditions

The Los Angeles-Santa Ana metropolitan area contains the most congested roadways in the country according to the Texas Transportation Institute's *2009 Urban Mobility Report*. The PEROW/WSAB Corridor freeways are no exception, and often lead the list of the region's most congested facilities. Between now and 2035, these congested conditions are forecast to worsen limiting the ability of the study area's highway system to serve future travel demand. The Metro Travel Demand Model was used to evaluate current and future freeway levels of service in the Corridor. The results are presented as Level of Service (LOS) estimates, where LOS is defined as the roadway's volume compared with its carrying capacity as shown in Table 3.1. Roadways operating at LOS E are nearing or are at capacity, while LOS F indicates a highway operating beyond the identified system capacity resulting in significant delays for travelers.

Table 3.1 – Level of Service Definition

Level of Service (LOS)	Volume/Capacity	Description of Traffic Flow
A	0.000 – 0.600	Free flow
B	0.601 – 0.700	Free flow with periodic slowing
C	0.701 – 0.800	Start of congestion
D	0.801 – 0.900	Traffic volumes approaching capacity
E	0.901 – 1.000	System near or at capacity resulting in unstable flow
F	> 1.000	System beyond capacity with stop and go traffic

Source: *Highway Capacity Model*, 2000.

Based on 2006 and 2035 information from the Metro travel demand model, the study area freeways operating at an LOS of E or F were identified and are presented in Table 3.2, with freeways operating totally at LOS F indicated in bold. The percentage shown represents the length of each freeway in the study area operating near, at, or beyond capacity. In 2006, all of the Corridor freeways experienced LOS E or F along a portion of their alignments during the morning (7:00-9:00 AM) and evening (4:00-6:00 PM) peak periods, except for the I-710. During the morning peak period in 2035, all of the freeways will operate at LOS E or F along 75 percent or more of their study area length, except for the eastbound I-105 and the I-710. Evening congestion will be more severe, with all of the study area freeways, except for the I-710, operating at LOS E or F along 80 percent or more of their Corridor length.

A freeway-specific overview of current and forecast operations shows the following current and future levels of congestion:

- **I-5 Freeway** – In 2006, the I-5 experienced LOS E or F operations along 40 to 50 percent of its length during the morning and evening peak periods. In 2035, segments with congestion will double, with 90 to 100 percent of the I-5 in the study area experiencing LOS E or F operations. In the morning, northbound travelers into downtown Los Angeles will drive in LOS F conditions along 95 to 100 percent of the Corridor freeway route, and again as they return home.

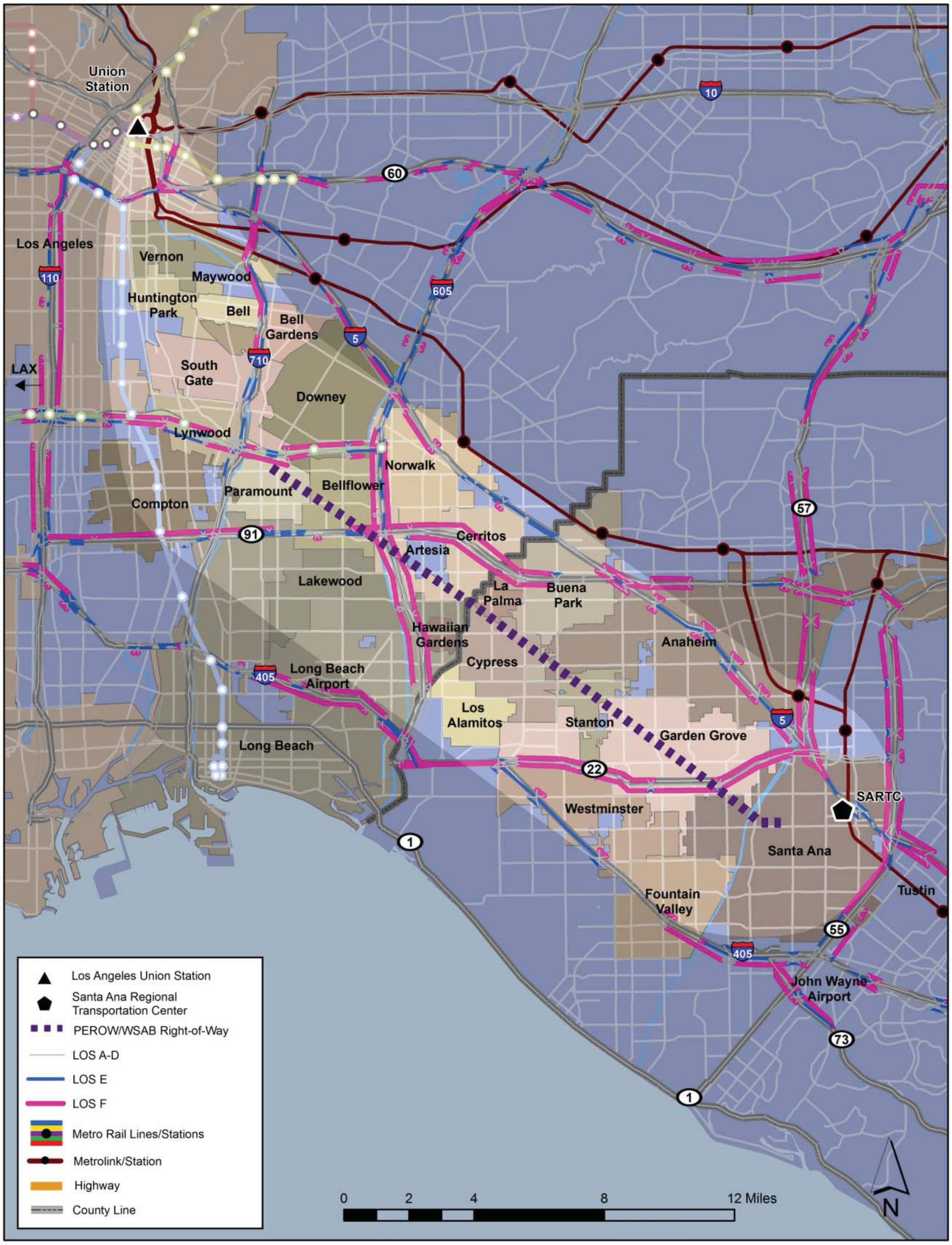
Table 3.2 – Corridor Study Area Freeways Operating at Level of Service E or F

Freeways		AM Peak Period		PM Peak Period	
		2006	2035	2006	2035
I-5	NB	45-50%	**95-100%**	45-50%	95-100%
	SB	40-45%	90-95%	40-45%	**95-100%**
I-405	NB	**90%**	90-95%	**90%**	90-95%
	SB	**90%**	95-100%	**90%**	95-100%
I-710	NB	5%	5-10%	--	5-10%
	SB	--	10-15%	5%	10-15%
I-605	NB	75%	80-85%	80-85%	**80-85%**
	SB	**50-55%**	**80-85%**	80-85%	**80-85%**
I-105	EB	40-45%	65-70%	90-95%	95-100%
	WB	90%	95-100%	50-55%	95-100%
SR-22	EB	**15-20%**	75-80%	15-20%	85-90%
	WB	**15-20%**	75-80%	15-20%	85-90%
SR-91	EB	50-55%	**85-90%**	**90%**	**85-90%**
	WB	90%	**90-95%**	80-85%	**90-95%**

Source: Metro Model, 2006. **Bold** numbers indicates LOS F only.

- **I-405 Freeway** – In 2006, the I-405 experienced LOS F service in both the northbound and southbound directions along 90 percent of its study area length during both peak periods. In 2035, with completion of planned capacity improvements, travel is forecasted to improve with more LOS E conditions in both directions during peak travel periods.
- **I-710 Freeway** – During both peak periods, the I-710 operated at LOS D or better, with the exception of one segment between Firestone Boulevard and Florence Avenue. In 2035, the I-710 is forecasted to experience LOS E or F service along 5 to 15 percent of its Corridor length.
- **I-605 Freeway** – During the 2006 morning peak period, this freeway experienced a combination of LOS E and F operations along 75 percent of its northbound study area length, while 50-55 percent of the Corridor's southbound travel experienced LOS F conditions. Operations will worsen in 2035, with 80 to 85 percent of this freeway's study area length experiencing LOS E or F operations in the northbound direction in the morning, and LOS F operations along 80 to 85 percent of its study area length in the morning southbound direction, and LOS F operations in both directions during evening travel.
- **I-I05 Freeway** – In 2006, travel on the I-105 was primarily constrained in the westbound direction in the morning, and the eastbound direction in the evening. Future congestion will become more severe with forecasted LOS E or F operations along 95 to 100 percent of its Corridor length in both directions in the evening peak, and in the westbound direction in the morning peak.
- **SR-22 Freeway** – In 2006, the SR-22 operated at LOS F along 15 to 20 percent of its study area length in the morning peak, and at LOS E or F conditions along 15 to 20 percent during the evening peak. In 2035, congestion will worsen with 75 to 90 percent of the portion of the SR-22 in the study area operating at LOS E or F during both peak periods.

Figure 3.2 – Corridor Freeway Level of Service (2035)



- **SR-91 Freeway** – In 2006, travelers on the SR-91 experienced a significant level of congestion and delay with LOS E or F operations along 90 percent of its length in the westbound direction during the morning peak. In the evening, the freeway operated at LOS F along 90 percent of the eastbound study area portion, and LOS E or F along 80 to 85 percent of its westbound length. In 2035, this freeway is forecasted to operate at LOS F for 85 to 95 percent of its study area length in both directions during both peak travel periods.

3.2.1.2 Future System Improvements

A wide range of freeway and arterial projects are proposed for implementation in the study area as identified in the Metro and OCTA LRTPs and SCAG's RTIP. In addition to the projects discussed below, three current highway studies and projects in or adjacent to the PEROW/WSAB Corridor may impact future freeway and arterial operations:

- **Interstate 710 South EIR/EIS** – The I-710 South Environmental Impact Report/Environmental Impact Study (EIR/EIS) is evaluating how to better serve this vital travel route, while reducing congestion and related environmental impacts on communities along the freeway. The alternatives under consideration include the addition of four truck lanes and widening to ten general travel lanes from the ports north to the SR-60 in the San Gabriel Valley.
- **Interstate 405 Studies and Plans** – Widening the I-405 between the SR-73 and I-605 has been the subject of several OCTA and California Department of Transportation (Caltrans) studies. OCTA led a Major Investment Study (MIS) to evaluate proposed improvements to increase capacity and improve interchange operations. In 2005, two alternatives were adopted by the OCTA Board: No Build and a Build Alternative comprised of adding two mixed-flow lanes in each direction. Following completion of the MIS, OCTA and Caltrans prepared a Project Study Report in 2008, which recommended that the two alternatives be carried forward into the environmental review phase. A draft EIR/EIS is being prepared that considers four build alternatives: 1) add one general lane; 2) add two general lanes; 3) widen to provide an express facility with two High Occupancy Toll (HOT) lanes and one general lane; and 4) implement TSM/Transportation Demand Management /Mass Transit. The draft document is planned for completion in late 2011, with the final document in mid-2012, and the Record of Decision/Notice of Determination anticipated in late 2012.
- **Interstate 5 Studies and Plans** – Since the passage of Measure M in 1990, Orange County has been widening and improving this freeway from its junction with the I-405 to the Los Angeles County border. There are currently two construction efforts and one planning study underway:
    1. ***Santa Ana Freeway (I-5) Gateway Project*** – This project widened the remaining two miles of the I-5 Freeway in Orange County between the SR-91 and the Los Angeles County line. Completed in the fall of 2010, the project included new travel and HOV lanes, overpasses/underpasses at selected locations, and related improvements.
    2. ***I-5 Widening and HOV Project*** – This project is an extension of the Santa Ana Freeway Gateway Project north into Los Angeles County from the county line to the I-605. Planned

improvements along the 6.7-mile segment include the provision of new mixed-flow and HOV lanes, and construction or reconstruction of overpasses/underpasses and interchanges at selected locations. This project is approximately 50 percent designed, and construction is slated to begin in June 2011 with completion targeted for December 2016.

3. ***I-5 Improvements between the I-605 and I-710 Freeways*** – This project's intent is to evaluate alternatives for widening the I-5 to provide mixed-flow and HOV lanes. Currently, the study effort is in the environmental clearance phase; project design, construction cost estimates, and an implementation schedule have not been identified.

Even with currently planned freeway projects identified in the adopted Metro and OCTA LRTPs and the SCAG RTIP, included in the No Build Alternative described in the previous chapter, the Corridor's freeway system capacity will not keep pace with the growing travel needs, and auto travelers will experience continuing and worsening congestion in the future.

3.2.2 Arterial Network

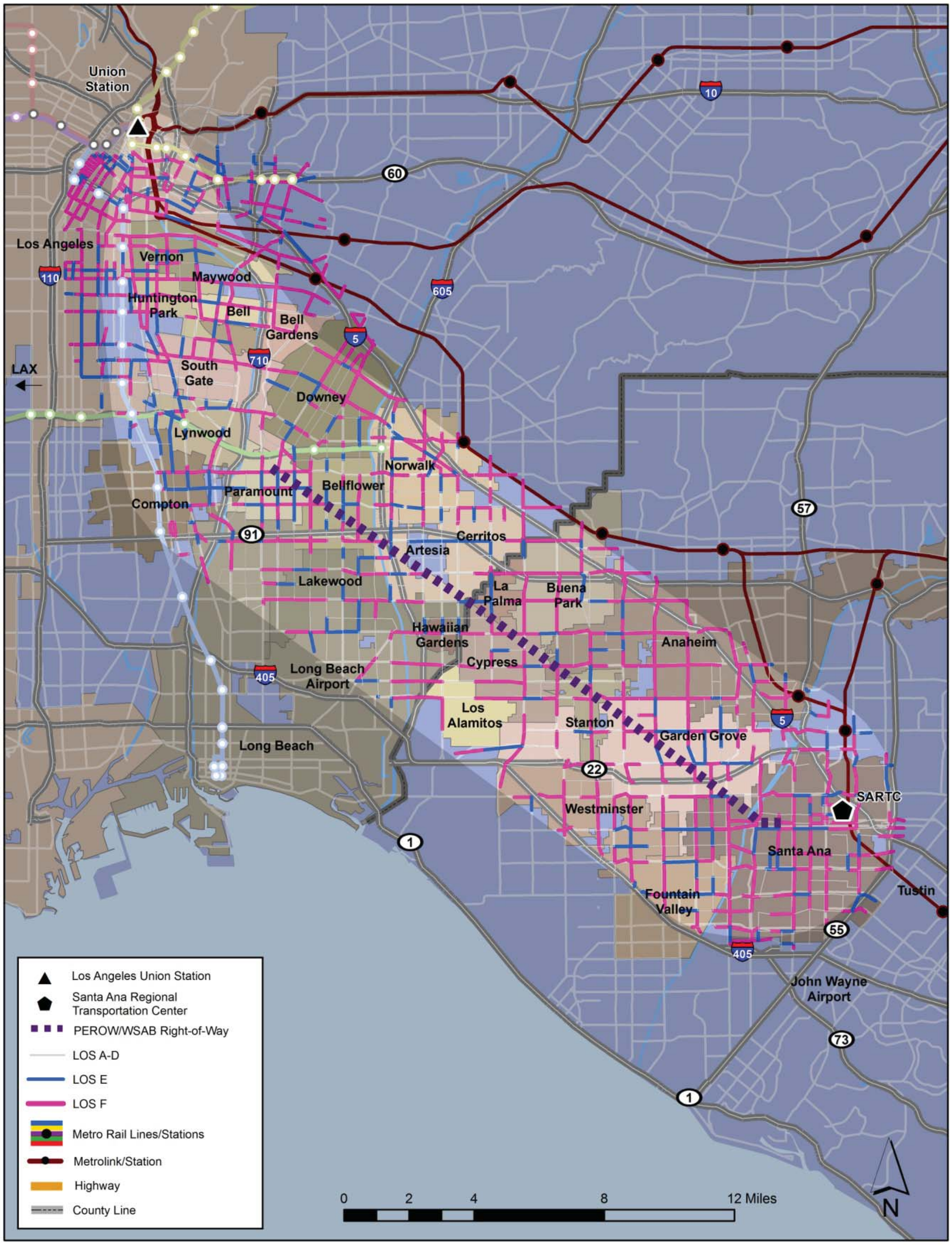
Local streets and roads account for over 80 percent of the total road network in the study area and they carry much of the area's traffic. Arterials often serve as freeway access routes and as alternative parallel routes to congested freeway corridors. The Corridor's arterial street system covers portions of 21 cities, all with their own street standards and plans, but with similar current and future challenges.

3.2.2.1 Existing and Future Conditions

The Metro model was used to assess the existing and projected operating conditions on the study area's arterial street system. In most locations the arterials adjacent to the freeways, and offering access to and from the freeways, are the most congested. The freeways creating a majority of the arterial impacts are the I-5, SR-22, I-710, and I-605. The analysis shows that a number of arterial routes providing access to these freeways are currently operating at LOS E or F, and that the resulting congestion extends from the freeways for several blocks in the morning, and one to two miles in the evening.

In 2035, total miles traveled on the study area's arterial roadway network are expected to increase significantly, severely impacting arterial performance throughout the Corridor. As shown in Figure 3.3, there will be a corresponding increase in the number of arterial segments operating at LOS E or F during both peak periods. During the morning peak period, arterial congestion will remain highest on streets providing access to and from the area's freeways and the congestion will expand in severity. In some cases, arterial congestion from one freeway will start to impact the arterial street congestion resulting from another freeway. For example, congestion on the north-south streets between the SR-22 and I-405 is projected to be almost continuous, and will begin to impact cross streets. During the morning peak period, approximately 25 percent of the area's streets are forecasted to operate at LOS E or F. Evening peak period projections show more than 60 percent of the study area's arterial network operating at LOS E and F.

Figure 3.3 – Corridor Arterial System: Level of Service (2035)



3.2.2.2 Future System Improvements

The current levels of congestion and the forecast increase indicate the need for additional capacity either through highway improvements, or alternative travel options. In mature urban areas such as the Corridor study area, there is little right-of-way available for capacity enhancements, and operational and technological improvements are used to maximize system performance. Typical tools to improve traffic flow, such as signal timing adjustments, signal synchronization, and Intelligent Transportation Systems (ITS), allow traffic engineers to monitor traffic flow and adjust signals in real time to resolve increasing congestion resulting from heavy traffic due to peak period travel, accidents, and/or special events.

County and regional plans include more than $1.5 billion for arterial improvements in Los Angeles County and $2.0 billion in Orange County to be completed by 2035. While these arterial improvement projects are currently in planning, design, and construction, it is anticipated that due to the forecast growth in population, employment, and related daily travel, these projects are not expected to create long-lasting mobility benefits, or address the Corridor's transportation needs on their own. The forecast increase in freeway and arterial system congestion, with most systems operating beyond capacity, demonstrate the increasing need for an alternative travel option.

3.2.3 Highway System Impacts

This section presents a comparative assessment of the impacts the project alternatives may have on the Corridor's highway system operations. Of the proposed alternatives:

- The TSM Alternative would operate entirely at-grade in city streets and freeway HOV lanes.
- The BRT Alternatives would operate primarily in city streets and freeway HOV lanes with dedicated lane operations on the PEROW/WSAB ROW where supported by Corridor cities. BRT street running operations would be located curbside with signal priority for both alternatives.
- The Street Car and LRT alternatives would operate primarily in a dedicated ROW along the PEROW/WSAB ROW, along with: 1) railroad ROW-running operations (shared and not) utilizing several active and inactive railroad ROWs such as the Ports-owned ROW, the Metro-owned Harbor Subdivision, or the median of Randolph Street; and 2) street-running operations in either at-grade or grade-separated operations through the cities of Los Angeles and Vernon, and at-grade operations through the City of Santa Ana.
- The Low Speed Maglev Alternative would run as a totally grade-separated system due to system operational requirements.

As all of the alternatives under consideration are planned to operate on the Corridor's arterial system and railroad ROWs, they would have a negligible impact on freeway system operations. They may have a congestion benefit as a portion of the study area's projected trip growth would travel by the proposed transit system. The only alternative with potential freeway system impacts would be the BRT HOV Lane-Running Alternative where it enters and exits HOV lanes, along with possible capacity impacts to the I-110/Harbor Transitway and I-105 HOV lanes.

Whether the proposed transit system operates at-grade or in a grade-separated configuration, introduction of a high-capacity transportation system would impact city street operations. At the AA-level of analysis, a conceptual level of assessment was performed due to the initial level of system design and the high number of modal and alignment alternatives. During any subsequent preliminary engineering and environmental review efforts, more detailed analysis would be performed.

As discussed below in detail, at-grade operations may result in impacts to traffic capacity and flow, and the removal of on-street parking. The proposed LRT Alternative would be similar to Metro's at-grade service which operates in either: 1) a street-running configuration, where the trains operate along with vehicular traffic and are controlled by the same traffic controls and have the same speed as vehicular traffic; or 2) a dedicated right-of-way where trains can operate at speeds of up to 55 mph. Based on the Los Angeles experience, fast-moving trains may have operational and safety issues related to other vehicular traffic, pedestrians, and bicyclists, particularly along the PEROW/WSAB ROW with the diagonal crossing of roadway segments and two intersections. The decision on whether to grade separate LRT, and possibly Street Car, service in Los Angeles County would be guided by Metro's *Grade Crossing Policy for LRT*, which provides a structured process for making grade-separated versus at-grade operation decisions based on highway system impacts. Grade-separated systems may result in the loss of street capacity, left-turn lanes, and on-street parking due to column placement. All of the options would impact the Corridor's arterial system operations due to increased station area vehicular activity related to drop-off and parking circulation, along with feeder bus and circulator services. Arterial system impacts resulting from implementation of the alternatives are discussed below.

3.2.3.1 Impacts by Alignment Alternative

An overview of the possible impacts resulting from implementation of each of the transit system alignment alternatives on the Corridor's arterial system is presented below. The purpose of the assessment was to identify potential geometric and operational impacts to the local street system, particularly at intersections, with construction and operation of a future transit project. The following discussion provides an overview of the impact assessment methodology used, possible traffic system impacts, and the assumptions that the analysis was based on, along with an identification of Corridor intersections that may be impacted along with proposed mitigation measures.

Possible arterial system impacts to some street cross-sections resulting from implementation of a transit system include:

- Reduction in street capacity due to the conversion of an existing travel lane to a dedicated transit lane either permanently, or for peak period-only transit operations.
- Reduction in capacity for intersecting (cross) traffic due to increased traffic and transit volumes and/or traffic signal priority granted to transit vehicles.
- Conflicts between transit (bus or rail) vehicles and mixed flow vehicular traffic at intersections and mid-block locations.

- Increased delay and congestion due to additional signal phases providing more green time for transit vehicles and/or new signals to accommodate and protect left-turning vehicles.
- Loss of left and right turn movements due to transit facilities resulting in redistribution of traffic on parallel streets, including residential streets.

The potential for Corridor traffic-related impacts was assessed both from an operational and a geometric or intersection layout perspective. For grade-separated locations, the only operational impacts would be related to the potential for column placement to affect median left-turn operations. The analysis identified the following operational Impacts related to at-grade operations:

1. **Current signalized intersections**
   - Minimal effects when trains run concurrently with parallel streets.
   - Shortening or elimination of turn phases with pre-emption may cause queuing impacts.
   - Locations where the guideway alignment would turn would require an all-red signal phase, which would impact intersection operating conditions.
   - Locations where the transit alignment would cross diagonally through an intersection would require an all-red phase, which would impact intersection operating conditions.
2. **Current unsignalized intersections and driveways**
   - With new signalized intersections, minimal effects would occur when transit vehicles run concurrently with parallel streets.
   - None anticipated with closed or right-in/right-out locations.
3. **Mid-block crossings**
   - Queues formed at these locations may spill-back to upstream intersections impacting street operations; traffic queues formed at upstream/downstream intersections may spill-back to impact at-grade transit crossing.
   - Transit vehicles crossing diagonally adjacent to a major intersection may require signalization changes to reduce potential for traffic queues at the at-grade crossing, which would impact intersection operations and may impact queues in other directions.

From a geometric perspective, the assessment identified locations where physical changes may be required for the affected intersections and roadways. At grade-separated locations, the only impact would be potential column placement effecting median left-turn configurations. Potential geometric impacts included:

1. **Current signalized intersections**
   - Reduction in through lanes would likely negatively impact intersection Level of Service (LOS).
   - Shared left-through lanes would need to be converted to left-turn pockets with exclusive signal phases; right-turn pockets would be required for side-aligned configurations.
   - Any reduction in left-turn pockets or elimination of right-turn pockets would likely negatively impact intersection LOS.

- Locations where track alignment must turn could have impacts due to the loss of through lanes or turn pockets.
- Locations where track alignment crosses diagonally through intersection could have impacts due to through lane or turn pocket eliminations.

2. **Current unsignalized intersections and driveways**
   - Signalization of intersections for safety purposes may result in unacceptable conditions.
   - Restriction from full intersection movements to right-in/right-out configurations or full closures could negatively affect circulation and access for the affected streets/driveways, depending upon use of street, availability of supplemental access, and potential for u-turns.
3. **Mid-block crossings**
   - Modifications to turn pocket lengths could result in longer traffic queues blocking through travel lanes.
   - Minor streets and driveways within the crossing area may need to be closed or converted to right-in/right-out configurations, which could negatively affect circulation and access for the affected streets/driveways.

For the evaluation of potential geometric and operational impacts, the analysis was based on the following assumptions:

- All grade-separated locations would have no impacts to intersection/roadway configurations and operations, unless noted.
- Transitions to a grade-separated configuration (tunnel portals or grades to/from aerial segments) could fit within the alignment right-of-way, and would not result in additional geometric changes.
- For the at-grade median alignments, all unsignalized intersections would be signalized, unless proposed for closure.
- Any newly signalized intersection would likely be actuated for the minor streets, thereby reducing the potential for an impacted intersection.
- All signalized intersections would have transit signal priority treatments to facilitate train operations, and would require minimal changes to existing signal timing.
- Side-aligned alignments would require signalization of adjacent unsignalized intersections.
- Train operations assume that no gates are provided at intersections; trains would run concurrently with the parallel streets.

The arterial system assessment was based on the proposed vertical configurations shown in Table 3.3 and illustrated in Figure 3.4 through Figure 3.7, with five different grade-separated configurations and ten at-grade configurations, all of which will result in varied traffic impacts.

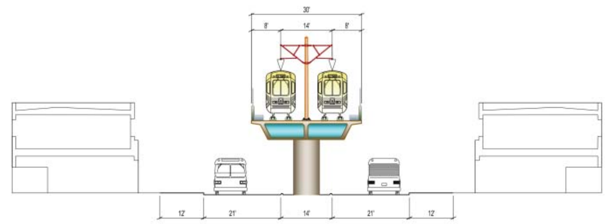
Table 3.3 – Project Vertical Configurations

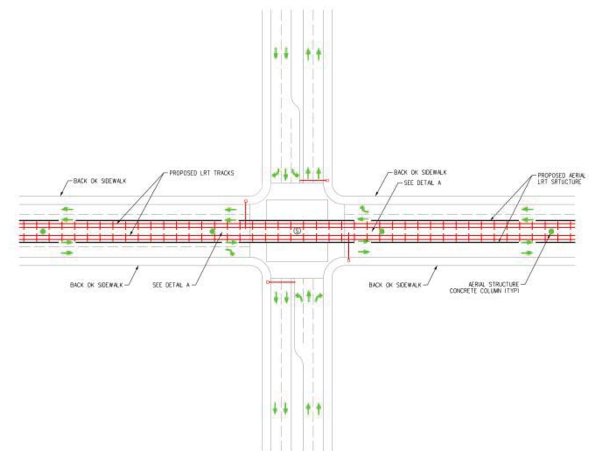
Configuration Type	Description
G1	Grade-separated aerial structure – center running above median
G2	Grade-separated aerial structure – side aligned or crossing street
G3	Grade-separated aerial structure – diagonally across intersection
G4	Grade-separated – undercrossing or bridge structure
G5	Grade-separated – tunnel
A1	At-grade – median running through existing signalized intersection
A2	At-grade – median running through existing unsignalized intersection converted to signalized
A3	At-grade – median running through existing unsignalized intersection – intersection closed or converted to right-in/right-out only
A4	At-grade – side aligned adjacent to signalized intersection
A5	At-grade – side aligned adjacent to unsignalized intersection – intersection converted to signalized
A6	At-grade – diagonally across signalized intersection
A7	At- grade – training turning through signalized intersection
A8	At-grade – mid-block crossing with no adjacent signalized intersections
A9	At-grade – mid-block crossing with adjacent signalized intersection(s)
A10	At-grade – mid-block crossing diagonally at corner of intersection

Figure 3.4 – Intersection Types

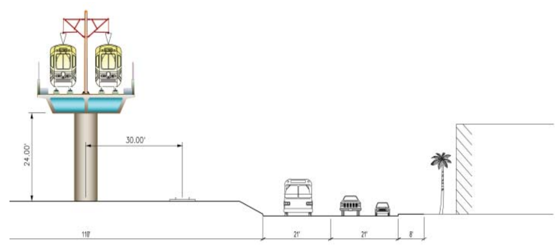
Configuration Type and Description

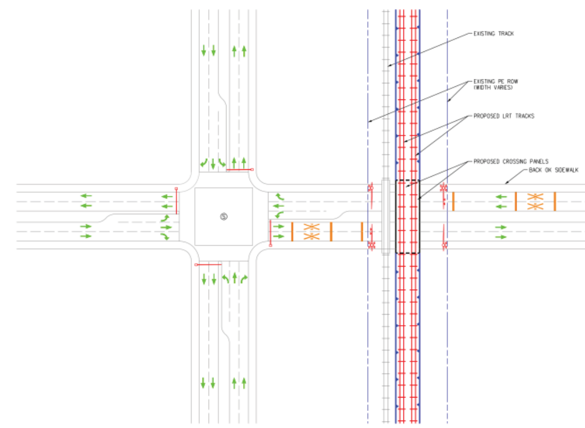
G1: Grade-separated aerial structure – center running above median





G2: Grade-separated aerial structure – side aligned or crossing street





G3: Grade-separated aerial structure – diagonally across intersection

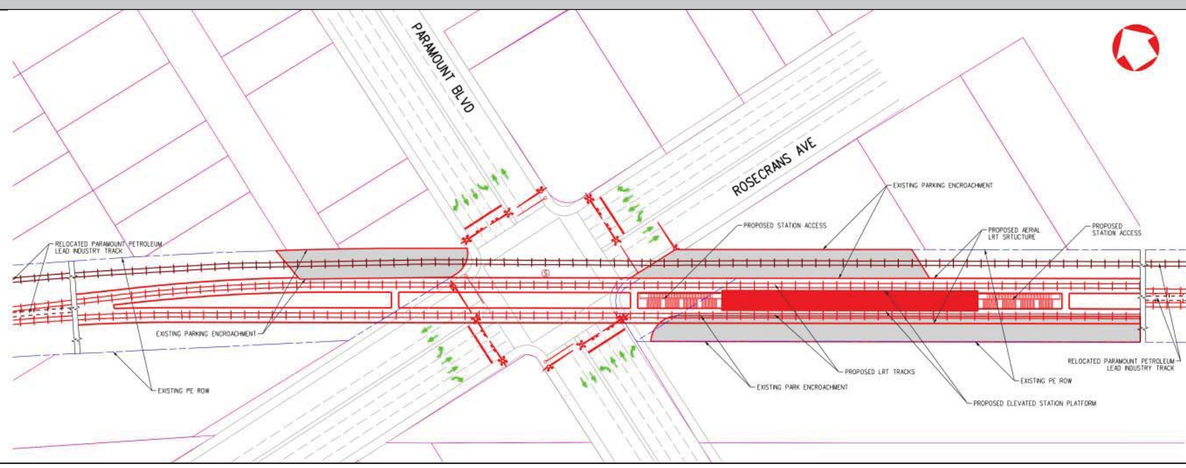
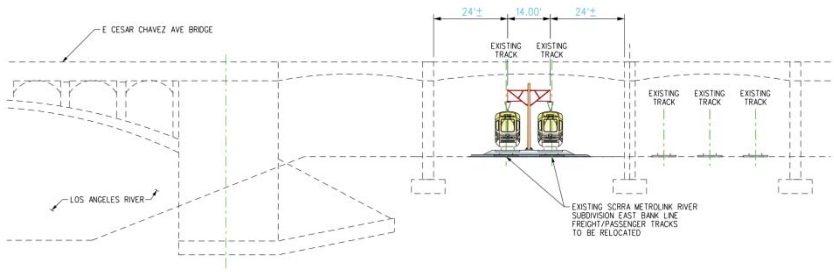


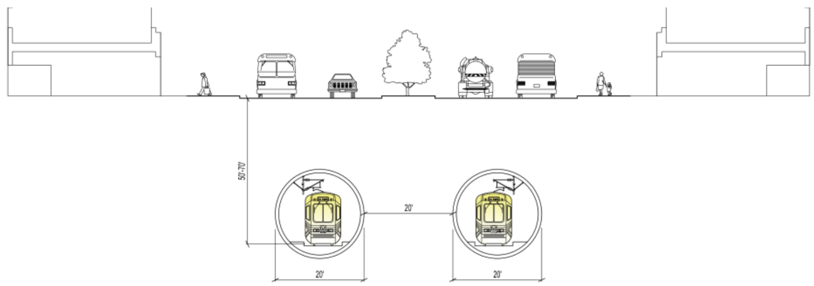
Figure 3.5 – Intersection Types

Configuration Type and Description

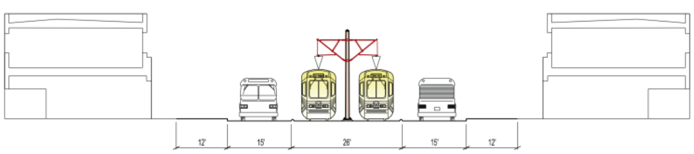
G4: Grade-separated – undercrossing or bridge structure



G5: Grade-separated – tunnel



A1: At-grade – median running through existing signalized intersection
A2: At-grade – median running through existing unsignalized intersection converted to signalized



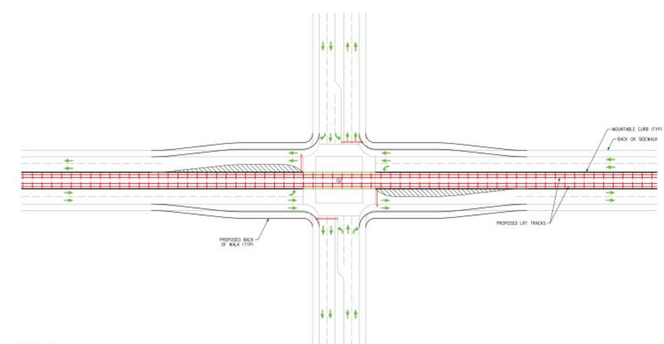
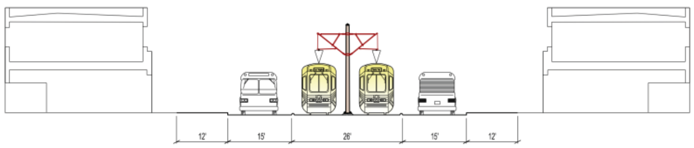
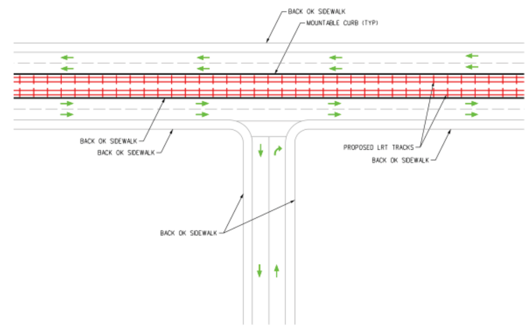


Figure 3.6 – Intersection Types

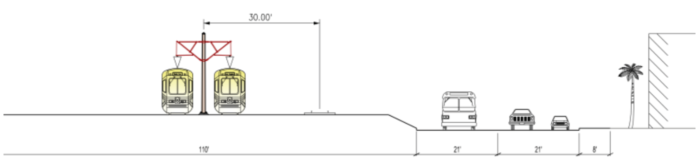
Configuration Type and Description

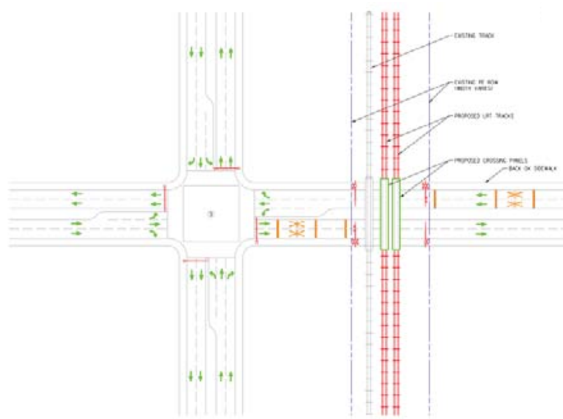
A3: At-grade – median running through existing unsignalized intersection – intersection closed or converted to right-in/right-out only





A4: At-grade – side aligned adjacent to signalized intersection
A5: At-grade – side aligned adjacent to unsignalized intersection – intersection converted to signalized





A6: At-grade – diagonally across signalized intersection

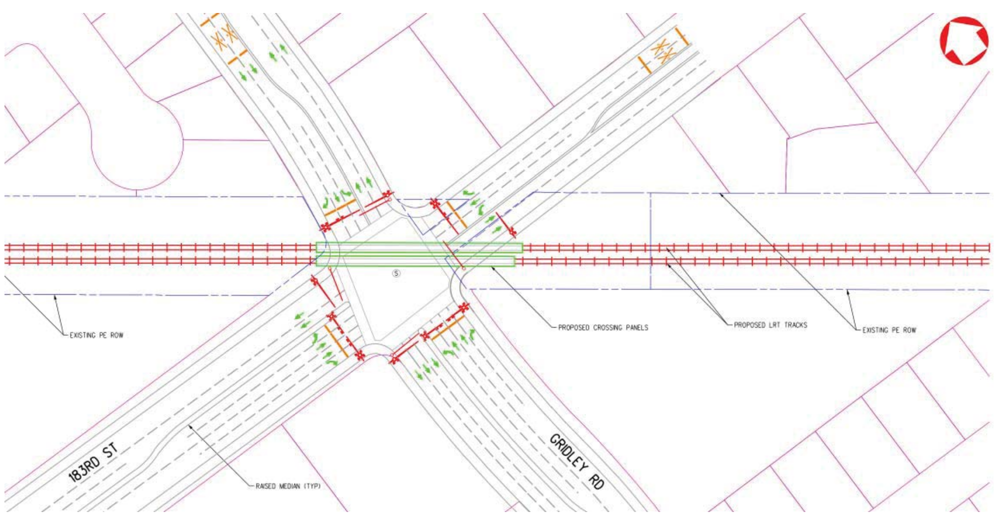
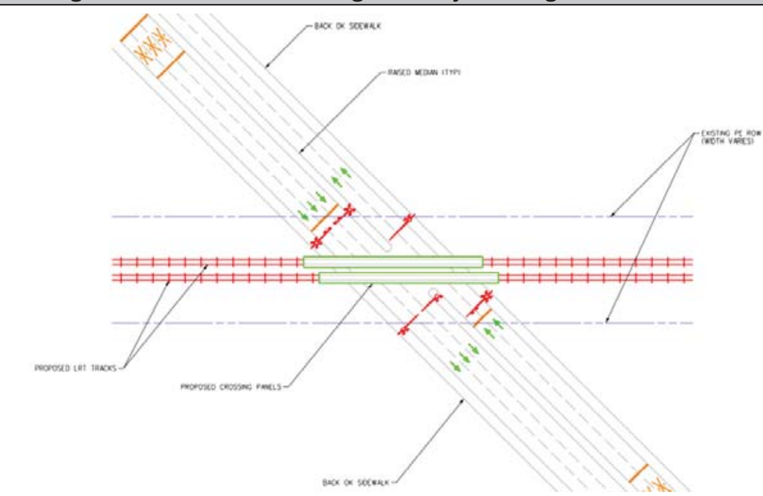
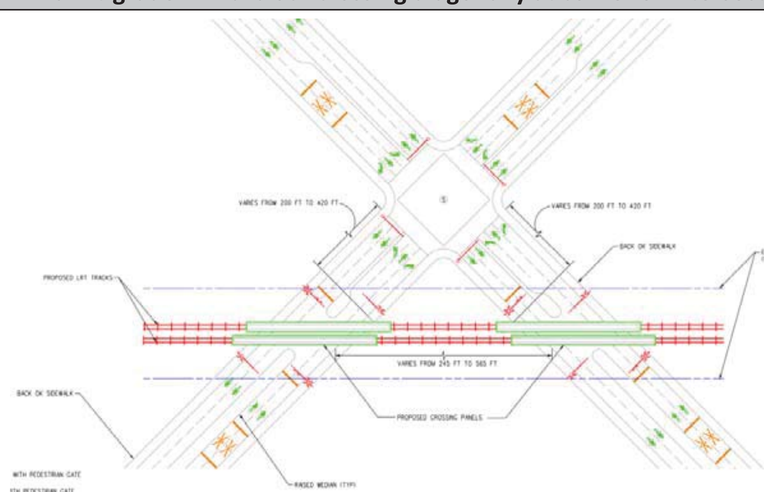


Figure 3.7 – Intersection Types

Configuration Type and Description
A7: At-grade – training turning through signalized intersection

A8: At-grade – mid-block crossing with no adjacent signalized intersections **A9: At-grade – mid-block crossing with adjacent signalized intersection(s)**

A10: At-grade – mid-block crossing diagonally at corner of intersection


The resulting geometric and operational impacts for the identified intersection configuration types are presented in Table 3.4. The following criteria were used for the general determination of impacts: 1) ***Yes*** – Impacts are likely to occur; 2) ***Potential*** – Impacts may occur depending on the final system design (vertical and horizontal configuration) and operational plans; and 3) ***No*** – No impacts or only minor impacts are anticipated.

Table 3.4 – Intersection Impact Determination Criteria

Intersection Type	Geometric Impact Criteria	Operational Impact Criteria
G1	N/A	N/A
G2	N/A	N/A
G3	N/A	N/A
G4	N/A	N/A
G5	N/A	N/A
A1	• **Yes:** Would require elimination of through travel lanes, left-turn pockets, or right-turn pockets along arterials. • **Potential:** May require elimination of through travel lanes, left-turn pockets, or right-turn pockets along minor streets, or could eliminate affected turning movements. • **No:** No intersection configuration change.	• **Yes:** Train pre-emption would require substantial modification to intersection signalization plan and would affect signal coordination along corridor. • **Potential:** Train pre-emption may result in shortened times for some movements, or minimal effects to corridor coordination. • **No:** Only minor signalization adjustments.
A2	• **Yes:** Would require elimination of through travel lanes, left-turn pockets, or right-turn pockets along arterials, and at intersection with a major cross-street. • **Potential:** Would require elimination of through travel lanes, left-turn pockets, or right-turn pockets along minor streets, or at an intersection with a minor cross-street or driveway. • **No:** Not anticipated to change intersection configuration, with exception of new signal.	• **Yes:** Train pre-emption would require substantial modification to intersection signalization plan and would affect signal coordination along corridor. • **Potential:** Train pre-emption may result in shortened times for some movements, or minimal effects to corridor coordination along corridor would be minimally affected. • **No:** Only minor signalization adjustments.
A3	• **Yes:** Street or driveway provides only access into area, provides direct connection to adjacent major destination, or no nearby u-turn possible. • **Potential:** Alternative access possible but inconvenient, or u-turn provided several streets away. • **No:** Minor access point with adjacent access available, or u-turn provided at next major street.	• **Yes:** Train pre-emption would require substantial modification to intersection signalization plan and would affect signal coordination along corridor. • **Potential:** Train pre-emption may result in shortened times for some movements, or coordination along corridor would be minimally affected. • **No:** Only minor signalization adjustments.

Table 3.4 – Intersection Impact Determination Criteria

Intersection Type	Geometric Impact Criteria	Operational Impact Criteria
A4	• **Yes:** Would require reconfiguration of intersection to provide left-turn and right-turn pockets. • **Potential:** Required turning pockets may fit within existing right-of-way. • **No:** No intersection configuration change.	• **Yes:** Train pre-emption would require substantial modification to intersection signalization plan and would affect signal coordination along corridor. • **Potential:** Train pre-emption may result in shortened movement times, or corridor coordination would be minimally affected. • **No:** Only minor signalization adjustments.
A5	• **Yes:** Would require reconfiguration of intersection to provide left-turn/right-turn pockets and implementation of new signal, or signalization would require geometric changes. • **Potential:** Required pockets may fit within existing right-of-way, or signalization may result in other geometric changes. • **No:** No change to intersection configuration except addition of new signal.	• **Yes:** Train pre-emption would require substantial modification to intersection signalization plan and would affect signal coordination along corridor. • **Potential:** Train pre-emption may result in shortened times for some movements, or coordination along corridor would be minimally affected. • **No:** Only minor signalization adjustments.
A6	• **Yes:** Would require elimination of through travel lanes, left-turn/right-turn pockets. • **Potential:** May require elimination of through travel lanes or left-turn/right-turn pockets. • **No:** No change to intersection configuration.	• **Yes:** Train crossing would require use of lengthy all-red phase for train clearance. • **Potential:** Train crossing would require use of short all-red phase for train clearance, or intersection could accommodate modifications without substantially affecting operations. • **No:** Only minor signalization adjustments.
A7	• **Yes:** Would require elimination of through travel lanes, left-turn/right-turn pockets. • **Potential:** May require elimination of through lanes or left-turn/right-turn pockets. • **No:** No change to intersection configuration.	• **Yes:** Train crossing would require use of lengthy all-red phase for train clearance. • **Potential:** Train crossing would require use of short all-red phase for train clearance, or intersection could accommodate modifications without substantially affecting operations. • **No:** Only minor signalization adjustments.
A8	• **Yes:** Would require modifications to turn pockets or elimination of driveways and/or minor street access. • **Potential:** May require modifications to turn pockets or elimination of driveways and/or minor street access. • **No:** No change to street configuration or close access to driveways or minor streets.	• **Yes:** Queues at gates would block or substantially impair access to upstream minor streets or driveways. • **Potential:** Queues at gates may block or impair access to upstream minor streets or driveways. • **No:** Minimal effects to street operations or nearby intersections.

Table 3.4 – Intersection Impact Determination Criteria

Intersection Type	Geometric Impact Criteria	Operational Impact Criteria
A9	• **Yes:** Would require substantial modifications to turn pockets or eliminate key driveways or minor street access. • **Potential:** May require modifications to turn pockets or eliminate driveways and/or minor street access. • **No:** No change to street configuration or comparable access to driveways or minor streets provided nearby.	• **Yes:** Queues at gates would likely spill back to upstream signalized intersection, or queues at downstream intersection would likely spill back to gate area – primarily when crossing a short distance from intersection or across major street. • **Potential:** Queues at gates may spill back to upstream signalized intersection, or queues at downstream intersection may spill back to gate area – primarily when crossing a further distance from intersection or across a minor street. • **No:** Minimal effects to street operations or nearby intersections.
A10	• **Yes:** Would require substantial modifications to turn pockets or eliminate key driveways or minor street access. • **Potential:** May require modifications to turn pockets or eliminate driveways or minor street access that have possible alternative access. • **No:** No change to street configuration or comparable access to driveways or minor streets provided nearby.	• **Yes:** Queues at gates would spill back to upstream signalized intersection, or queues at downstream intersection would spill back to gate area, or crossing would necessitate extensive changes to signalization plan to reduce queuing potential. • **Potential:** Queues at gates may spill back to upstream signalized intersection, or queues at downstream intersection may spill back to gate area or crossing would necessitate minor changes to signalization plan to reduce queuing potential. • **No:** Minimal effects to street operations or nearby intersections.

Northern Connection Area – Current Conditions and Potential Impacts

From Union Station to the Metro Green Line/I-105 Freeway, the proposed Street Car and LRT alternatives would operate in a combination of at-grade and grade-separated operations, while the Low Speed Maglev option would be entirely grade-separated. All of the guideway options have a common segment along the San Pedro Subdivision from the Metro Green Line north to Randolph Street in Huntington Park. From this point, the East Bank and West Bank 1 alternatives would continue north to operate within existing railroad ROWs or along the edge of the Los Angeles River, while the West Bank 2 and 3 alternatives would turn west to operate in the median of Randolph Street, and then continue north via city streets and Metro-owned rail ROWs.

This study area section is served by a generally north-south and east-west street grid with multiple crossings of freeways, flood channels, and railroad lines. Major streets typically have four to eight through lanes, with turn pockets at the intersections along with mid-block center turn pockets (or dual left-turn lanes) between major intersections. Many streets have multiple driveways and minor streets located between major intersections. In this Corridor segment, possible impacts are identified in the following three categories: 1) mid-block center turn pockets; 2) intersections, and 3) side-aligned intersections where the transit system would operate along the eastern edge of the street ROW, rather than in the center.

More than 60 percent of this segment's intersections are type G4 with the future transit system operating in a grade-separated configuration either as an undercrossing or a bridge structure. Based on the analytical methodology described above, an assessment of the geometric and operational impacts to this segment's intersections along each of the proposed alignments was completed and is summarized in Table 3.5 and with impacted intersections presented in Table 3.6 and Figure 3.8.

Table 3.5 –Northern Connection Area: Summarized Impacted Intersections

Alignment Alternatives	Intersections	Geometric Impacts			Operational Impacts		
		Yes	Potential	Percent	Yes	Potential	Percent
East Bank	42	4	5	21%	1	8	21%
West Bank 1	40	4	5	23%	2	8	25%
West Bank 2	58	6	7	22%	3	7	17%
West Bank 3	79	12	8	25%	4	8	15%

Approximately 15 to 25 percent of the Northern Connection Area intersections would be impacted with the implementation of a transit system. Three intersections were identified as having both geometric and operational impacts:

- Salt Lake Avenue/Florence Avenue (common section) – located in Huntington Park and Bell;
- Pacific Boulevard/Randolph Street (West Bank 2) – located in Huntington Park; and
- Santa Fe Avenue/Hunter Street (West Bank 1) – located in Los Angeles.

Table 3.6 – Northern Connection Area: Impacted Intersections

N/S Street	E/W Street	City	Type	Geometric Impact	Operational Impact
Common Segment					
Salt Lake Ave.	Gage Ave.	Huntington Park	A4	Potential	No
	Bell Ave.	Bell/Huntington Park	A5	Potential	No
	Florence Ave.	Huntington Park/Bell	A4	Yes	Yes
Otis Ave.	Salt Lake Ave.	Huntington Park/Cudahy	A5	Yes	Potential
	Santa Ana St.	Huntington Park/ Cudahy/South Gate	A8	Potential	No
	Ardine St.	South Gate/Cudahy	A5	Yes	No
Atlantic Ave.	Firestone Blvd.	South Gate	A8	Potential	Yes
Rutchi/Garfield	Imperial Hwy.		A4	No	Potential
Garfield Ave.	ROW		A9	No	Potential
	Main St.		A8	No	Potential
East Bank and West Bank 1 Alignments					
Downey Rd.	Fruitland Ave.	Vernon	A4	Yes	Potential
	Slauson Ave.	Vernon/Maywood/ Huntington Park	A4	Potential	Potential
West Bank 2 Alignment					
Pacific Blvd.	Slauson Ave.	Huntington Park	A1	Yes	No
	Belgrave Ave.		A1	Yes	No
	Randolph St.		A7	Yes	Yes
Arbutus Ave.	Randolph St.		A2	Potential	No
Randolph St.	ROW		A2	Potential	Potential
	State St.	Vernon/Huntington Park	A4	Potential	No
West Bank 3 Alignment					
Alameda St.	1st St.	Los Angeles	A4	No	Potential
Santa Fe Ave.	Hunter St.		A2	Yes	Yes
	Porter St.		G1	Potential	No
Pacific Blvd.	Leonis Blvd.	Vernon	A1	Yes	No
	Fruitland Ave.		A1	Yes	No
	55th St.	Huntington Park	A1	Yes	No
	Slauson Ave.		A1	Yes	No

Figure 3.8 – Northern Connection Area 1: Impacted Intersections

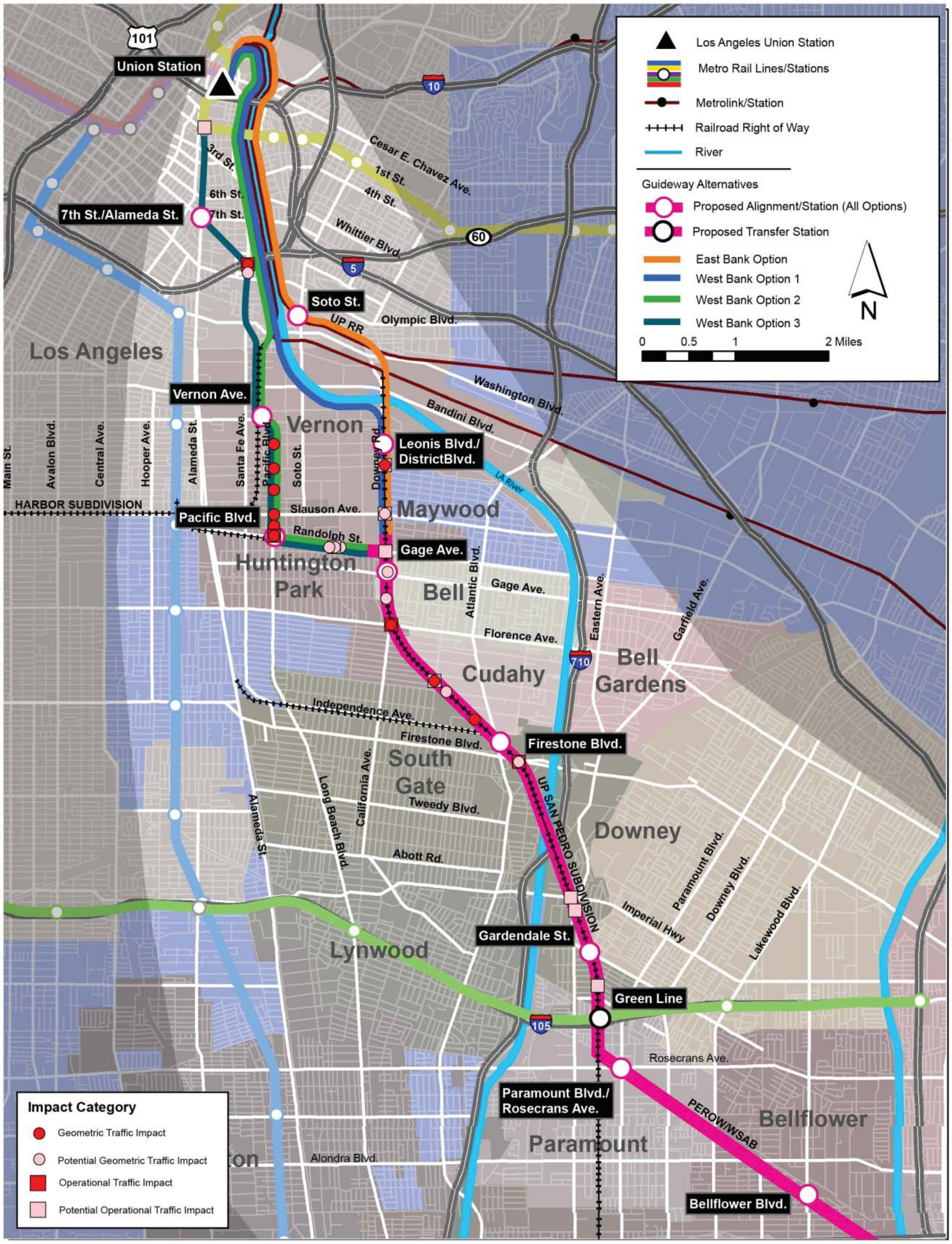


Table 3.7 presents the proposed geometric and operational street system changes that could be implemented to mitigate the intersection impacts resulting from implementation of a transit system in this segment of the Corridor.

Table 3.7 – Northern Connection Area: Proposed Street System Changes

Geometric Changes	Operational Changes
At-Grade Alignments	
Mid-block locations • Establish an at-grade crossing zone. • Provide signalization or full/partial closure of mid-block driveways and minor streets. Intersection locations • Establish at-grade crossing through intersection. • Restripe approaches to minimize conflicts with shared lanes. • Close minor cross-streets. Side-aligned locations • Restripe approaches to provide exclusive left-turn and right-turn pockets. • Signalize adjacent unsignalized intersections.	Mid-block locations • Provide independent at-grade crossing phase. • Implement modifications to upstream and downstream signals, if present. Intersection locations • Provide at-grade crossing phases tied into intersection signalization (pre-emption). • Provide all-red phase for train operations. Side-aligned locations • Provide at-grade crossing phases tied into intersection signalization (pre-emption).
Grade-Separated Alignments	
Aerial structures • Provide modifications to left-turn pockets and median dual left-turn lanes for columns. Undercrossings or bridge structures • None anticipated. Tunnels • None anticipated.	Aerial structures • None anticipated. Undercrossings or bridge structures • None anticipated. Tunnels • None anticipated.

PEROW/WSAB Area – Current Conditions and Potential Impacts

Along the former PE Railway ROW, the proposed Street Car and LRT alternatives would operate in a combination of at-grade and grade-separated operations, while the Low Speed Maglev option would be entirely grade-separated and operate to a terminus at the future Santa Ana Street Car Harbor Boulevard Station.

In this section of the Corridor, the study area is served by a generally north-south and east-west street grid with multiple crossings of river and flood channel crossings, two freeways (SR-91 and I-605) in the Los Angeles County portion, and one freeway (SR-22) in Orange County. Major streets typically have four to eight through lanes with turn pockets at the intersections along with mid-block center turn pockets (or dual left-turn lanes) between major intersections. The challenge of this Corridor section is the diagonal crossing of the proposed transit system ROW of many major streets especially in the

Orange County portion. In this segment, possible impacts were identified in the following three categories: 1) mid-block center turn pockets; 2) intersections, and 3) corner locations. More than 60 percent of the PEROW/WSAB Area intersections are type A8 and A10 reflecting the large number of proposed at-grade mid-block crossings in this Corridor section. Based on the analytical methodology described above, an assessment of the geometric and operational impacts to this segment's intersections along each of the proposed alignments was completed and is summarized in Table 3.8 and presented in Table 3.9 and Figure 3.9.

Table 3.8 – PEROW/WSAB Area: Summarized Impacted Intersections

Alignment	Number of Intersections	Geometric Impacts			Operational Impacts		
		Yes	Potential	Percent	Yes	Potential	Percent
WSAB/PEROW	63	9	24	52%	12	19	49%

An initial assessment identified that 40 of the 63 intersections in the PEROW/WSAB Area may be impacted with implementation of a transit system. Approximately 50 percent of the intersections may have geometric and/or operational impacts that would require mitigation. Three intersections were identified as having both geometric and operational impacts:

- Gridley Road /183rd Street – located in Cerritos and Artesia;
- Gilbert Street/WSAB/PEROW – located in Garden Grove; and
- Nelson Street/Garden Grove Boulevard – located in Garden Grove.

Table 3.9 – PEROW/WSAB Area: Intersection Impacts

N/S Street	E/W Street	City	Type	Geometric Impact	Operational Impact
WSAB/PEROW Corridor					
ROW	Artesia Blvd.	Cerritos	A9	Potential	Potential
Gridley Rd.	183rd St.	Cerritos/Artesia	A6	Yes	Yes
	186th St.	Artesia	A3	Potential	No
	187th St.		A3	Potential	No
Pioneer Blvd.	ROW		A9	No	Potential
	South St.	Artesia/Cerritos	A9	Potential	Potential
Norwalk Blvd.	ROW		A10	Potential	Yes
	195th St.		A10	Potential	Yes
Bloomfield Ave.	ROW	Cerritos	A8	Potential	No
Coyote Creek	Crescent Ave.	La Palma/Cypress	A10	Potential	Yes
Moody St.	ROW		A10	Potential	Yes
Walker St.	ROW	Cypress	A10	Potential	Potential
	Lincoln Ave.		A10	No	Potential

Figure 3.9 – PEROW/WSAB Area: Impacted Intersections

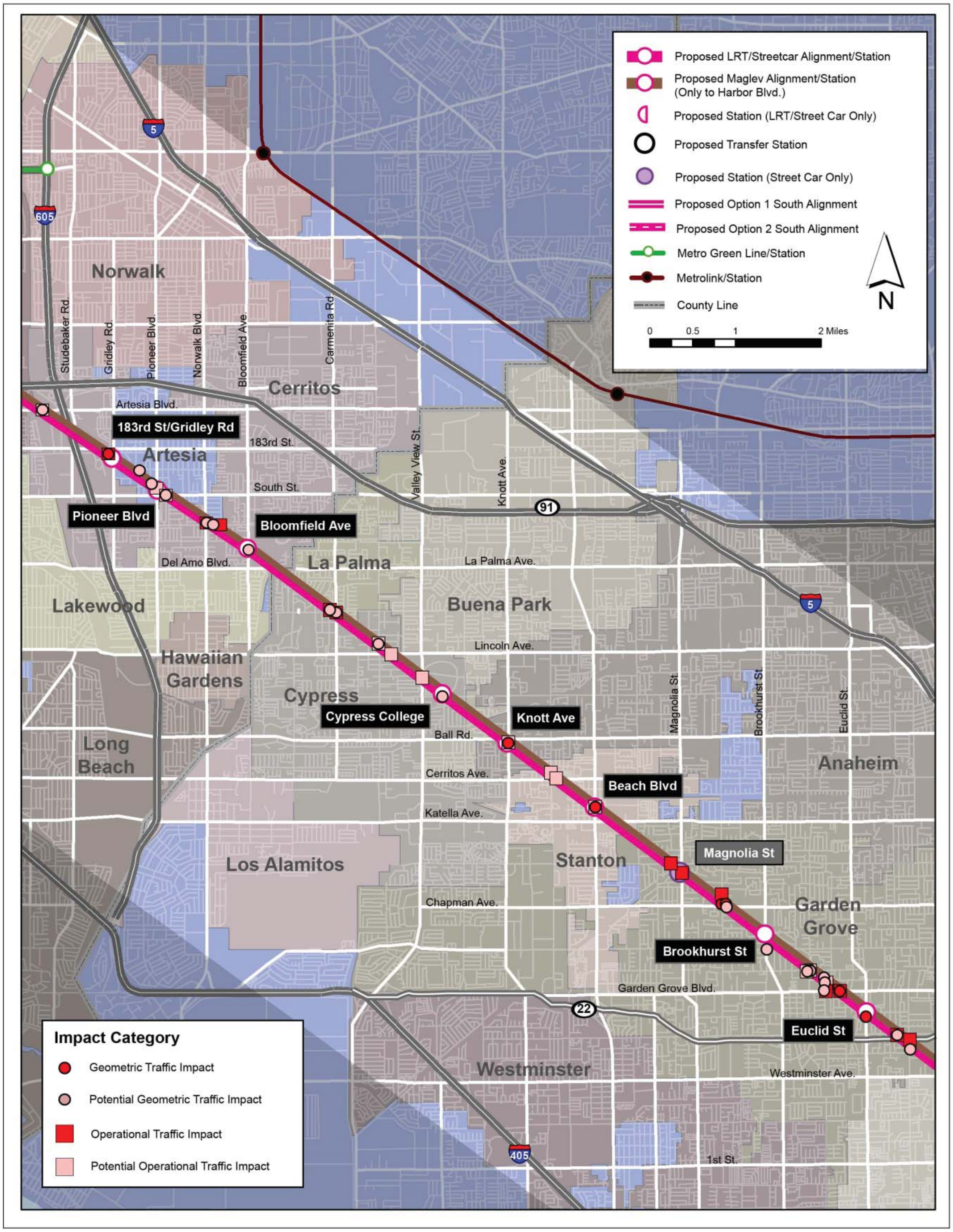


Table 3.9 – PEROW/WSAB Area: Intersection Impacts

N/S Street	E/W Street	City	Type	Geometric Impact	Operational Impact
WSAB/PEROW					
Valley View St.	ROW	Cypress	A8	No	Potential
	Orange Ave.		A8	Potential	No
ROW	Ball Rd.	Anaheim	A10	Potential	Potential
Knott Ave.	ROW	Anaheim	A10	Yes	Potential
Western Ave.	ROW	Stanton	A10	No	Potential
	Cerritos Ave.		A10	No	Potential
Beach Blvd.	ROW		A8	Yes	Potential
Dale St.	Orangewood Av.	Garden Grove	A10	No	Yes
Magnolia Ave.	ROW		A10	No	Yes
Gilbert St.	ROW		A9	Yes	Yes
Garden Grove development	Former ROW		A3	Yes	No
	Chapman Ave.	Garden Grove	A8	Potential	No
Brookhurst Ave.	Lampson Ave.	Garden Grove	A8	Potential	No
Nutwood St.	ROW		A10	Potential	Potential
	Stanford Ave.		A10	Potential	Potential
Nelson St.	ROW		A10	Potential	No
	Acacia Pkwy.		A10	Potential	Potential
	Garden Grove		A10	Potential	Yes
Grove/Taft St.	ROW		A10	Yes	Yes
Euclid St.	ROW		A8	Yes	No
	Trask Ave.		A10	Potential	Yes
Newhope St.	ROW		A10	Potential	Yes

Table 3.10 presents the proposed geometric and operational street system changes that could be implemented to mitigate the intersection impacts resulting from implementation of a transit system in this segment of the Corridor. During any subsequent engineering and environmental efforts, the decision on whether to totally grade-separate the Street Car or LRT alternative in Los Angeles County, which would reduce arterial system impacts, would be studied further and may be guided by Metro's *Grade Crossing Policy for LRT*.

Table 3.10 – PEROW/WSAB Area: Proposed Street System Changes

Geometric Changes	Operational Changes
At-Grade Alignments	
Mid-block locations • Establish at-grade crossing zone. • Provide signalization or full/partial closure of mid-block driveways and minor streets.	Mid-block locations • Establish Independent at-grade crossing phase. • Provide modifications to upstream and downstream signals, if present.

Table 3.10 – PEROW/WSAB Area: Proposed Street System Changes

Geometric Changes	Operational Changes
At-Grade Alignments	
Corner locations • Establish at-grade crossing zone. • Shorten left-turn pockets at adjacent intersections. • Provide full or partial closure of mid-block driveways and minor streets. Intersection locations • Establish at-grade crossing diagonally through intersection. • Restripe approaches to minimize conflicts with shared lanes.	Corner locations • Establish at-grade crossing phases tied into intersection signalization (pre-emption). • Provide modifications to signal plans to reduce potential for gate queues. Intersection locations • Establish at-grade crossing phases tied into intersection signalization (pre-emption). • Provide all-red phase for train operations.
Grade-Separated Alignments	
Aerial structures • Provide modifications to left-turn pockets and median dual left-turn lanes for columns. Undercrossings or bridge structures • None anticipated.	Aerial structures • None anticipated. Undercrossings or bridge structures • None anticipated.

Southern Connection Area – Current Conditions and Potential Impacts

In this segment, Low Speed Maglev Alternative service would end at the future Harbor Boulevard Station with passengers transferring to the Santa Ana Street Car system to reach Santa Ana and the SARTC. The proposed Street Car and LRT alternatives have been analyzed as operating along two alignment alternatives, with the following configurations, through Santa Ana:

1. **Westminster Boulevard/17th Street/Main Street**
   - Westminster Boulevard /W. 17th Street
     - Three through lanes in each direction;
     - Single left-turn pockets at full intersections, with occasional double left-turn pockets;
     - Single right-turn pockets at some locations; and
     - Combination of fixed median and continuous left-turn lane between intersections, with some dedicated mid-block left-turns at driveways.
   - N. Main Street
     - Two through lanes in each direction;
     - Single left-turn pockets at full intersections;
     - Continuous left-turn lane between intersections; and
     - On-street parallel parking (in general) on both sides of street.
2. **Harbor Boulevard/1st Street/SARTC**
   - N. Harbor Boulevard
     - Three through lanes in each direction;

- Single left-turn pockets at full intersections, with occasional double left-turn pockets; and
- Combination of fixed median and continuous left-turn lane between intersections, with some dedicated mid-block left-turns at driveways.

- W. 1st Street
  - Three through lanes in each direction, with a section at the Santa Ana River crossing reduced to two through lanes in each direction;
  - Single left-turn pockets at full intersections; and
  - Combination of fixed median and continuous left-turn lane between intersections, with some dedicated mid-block left-turns at driveways.
- Santiago Street
  - New realigned street north past the SARTC.

The Street Car and LRT alternatives were analyzed as operating within the existing street ROW and primarily in at-grade operations with a minor aerial segment for the Harbor Boulevard/1st Street/SARTC Alignment. Future engineering and environmental efforts may evaluate taking of property to maintain the existing street ROW and lane configuration, and/or building the system in a grade-separated structure.

In the City of Santa Ana, the study area is served by a generally north-south and east-west street grid. Major streets typically have four to eight through lanes with turn pockets at the intersections along with mid-block center turn pockets (or dual left-turn lanes) between major intersections. Possible impacts were identified in the following three categories: 1) mid-block center turn pockets; 2) intersections, and 3) corner locations for smaller, unsignalized streets. More than 70 percent of the Westminster Boulevard/17th Street/Main Street Alignment and 85 percent of the intersections along the Harbor Boulevard/1st Street/SARTC Alignment are either type A1 or A3 reflecting the large number of proposed at-grade, median-running operations in this section of the Corridor.

Based on the analytical methodology described above, an assessment of the geometric and operational impacts to this segment's intersections along both of the proposed alignments was completed and is summarized in Table 3.11 and presented in Table 3.12 and Figure 3.10.

Table 3.11 – Southern Connection Area: Impacted Intersections

Alignment Alternatives	Intersections	Geometric Impacts			Operational Impacts		
		Yes	Potential	Percent	Yes	Potential	Percent
Westminster Boulevard/ 17th Street/Main Street	35	17	14	89%	1	0	3%
Harbor Boulevard/1st Street/SARTC	48	19	6	52%	1	0	2%

An initial assessment identified the following impacts for the two alignment alternatives with implementation of a transit system:

- **Westminster Boulevard/17th Street/Main Street Alignment** – Approximately 90 percent of this alternative's intersections may have geometric impacts, and three percent may have operational impacts that would require mitigation.
- **Harbor Boulevard/1st Street/SARTC Alignment** – More than 50 percent of this alternative's intersections may have geometric impacts, and two percent may have operational impacts that would require mitigation.

Two intersections were identified as having both geometric and operational impacts: 17th Street/Main Street; and Harbor Boulevard /1st Street.

Table 3.12 – Southern Connection Area: Intersection Impacts

N/S Street	E/W Street	City	Type	Geometric Impact	Operational Impact
Westminster Boulevard/17th Street/Main Street					
Westminster Boulevard	Harper/Susan	Garden Grove/ Santa Ana	A3	Potential	No
	Clinton St.		A1	Yes	No
	Roxey Dr.	Garden Grove	A1	Potential	No
	Buena St.		A3	Potential	No
	MarLes/Sydney St.	Garden Grove/ Santa Ana	A3	Yes	No
	Fairview St.	Santa Ana	A1	Yes	No
17th Street	Private drive		A3	Potential	No
	King St.		A3	Potential	No
	English St.		A1	Yes	No
	Alona St.		A1	Yes	No
	College Ave.		A1	Yes	No
	Bristol Mkpl.		A1	Yes	No
	Bristol St.		A1	Yes	No
	Towner St.		A3	Potential	No
	Freeman St.		A3	Potential	No
	Fire station		A2	Potential	No
	Flower St.		A1	Yes	No
	Ross St.		A1	Yes	No
	Broadway		A1	Yes	No
	Main St.		A7	Yes	Yes
Main Street	16th St.		A3	Potential	No
	15th St.		A3	Potential	No
	14th St.		A3	Potential	No
	Washington Av		A1	Yes	No
	12th St.		A3	Potential	No

Figure 3.10 – Southern Connection Area: Impacted Intersections

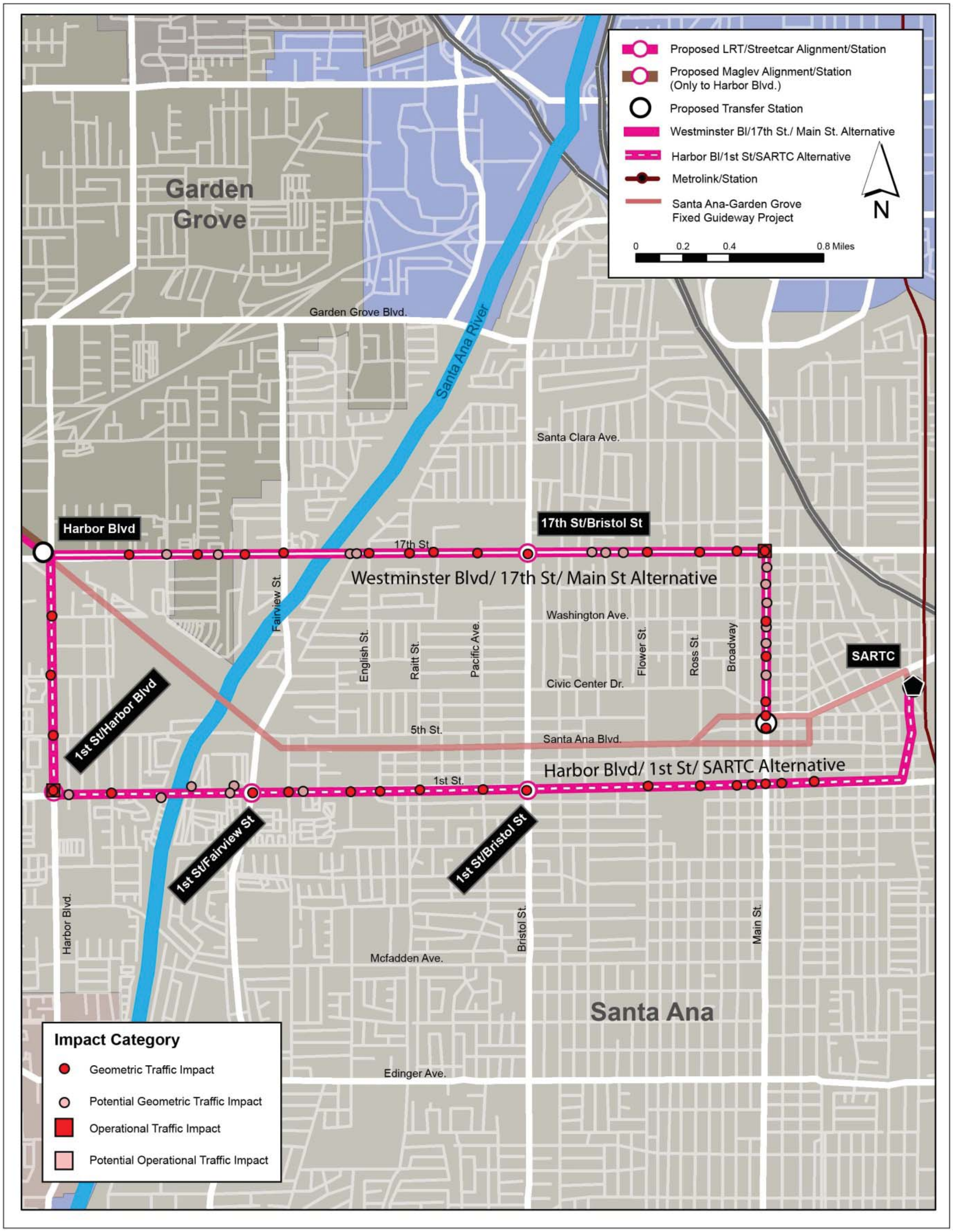


Table 3.12 – Southern Connection Area: Intersection Impacts

N/S Street	E/W Street	City	Type	Geometric Impact	Operational Impact
Westminster Boulevard/17th Street/Main Street					
Main Street	11th St.		A3	Potential	No
	10th St.		A1	Yes	No
	9th St.		A3	Potential	No
	8th St.		A2	No	No
	Civic Center Dr		G1	Yes	No
	Santa Ana Blvd		G1	Yes	No
	5th St.		G1	Yes	No
Harbor Boulevard/1st Street/SARTC					
Harbor Blvd.	Washington Av	Santa Ana	A3	Yes	No
	Hazard Ave.		A1	Yes	No
	5th St.		A1	Yes	No
	1st St.		A7	Yes	Yes
	Figueroa St.		A3	Potential	No
1st Street	Jackson St.		A1	Yes	No
	Quiet Village St		A3	Potential	No
	Private Road		A3	Potential	No
	Monaco Dr.		A3	Potential	No
	Banana Blvd.		A3	Potential	No
	Fairview St.		A1	Yes	No
	Sullivan St.		A1	Yes	No
	Driveway		A3	Potential	No
	Center St.		A1	Yes	No
	Townsend		A1	Yes	No
	Raitt St.		A1	Yes	No
	Pacific Ave.		A1	Yes	No
	Bristol St.		A1	Yes	No
	Flower St.		A1	Yes	No
	Ross St.		A1	Yes	No
	Broadway		A1	Yes	No
1st Street	Sycamore St.		A1	Yes	No
	Main St.		A1	Yes	No
	Cypress Ave.		A1	Yes	No
	Commercial St.		A1	Yes	No

Table 3.13 presents the proposed geometric and operational street system changes that could be implemented to mitigate the intersection impacts resulting from implementation of a primarily at-grade system operating within the existing street ROW in this segment of the Corridor. Future planning efforts may evaluate taking of property to maintain the existing street ROW, and/or building the system in a grade-separated configuration.

Table 3.13 – Southern Connection Area: Proposed Street System Changes

Geometric Changes	Operational Changes
At-Grade Alignments	
Signalized intersections • Provide two through lanes with single left-turn pocket. • Eliminate right-turn pockets.	Signalized intersections • Independent at-grade crossing phase. • Potential modifications to upstream and downstream signal, if present.
Unsignalized intersections • Eliminate left-turns to major streets. • Convert to right-in/right-out only.	Unsignalized intersections • None anticipated.
Grade-Separated Alignments	
Aerial structures • Potential modifications to left-turn pockets and median dual left-turn lanes for columns. Undercrossings or bridge structures • None anticipated.	Aerial structures • None anticipated. Undercrossings or bridge structures • None anticipated.

3.3 Transit

Currently, bus transit service is the predominant transit service available to Corridor residents with minor rail transit service also provided. The regional Metrolink commuter rail system is accessible only at the northernmost and southernmost ends of the study area as illustrated in Figure 3.11. While the Metro Green Line is located in the Los Angeles County portion of the study area, its east-west operations do not adequately serve the Corridor's primarily north-south travel patterns, or its destinations and activity centers. With the forecast growth in population, employment, and resulting daily travel, along with the high level of low income and transit-dependent households, improving Corridor accessibility and mobility will become of increasing importance.

3.3.1 Existing Transit Service

Within the study area, bus transit service is provided by Metro, OCTA, and various Los Angeles County municipal operators including, Long Beach Transit, Norwalk Transit, and Montebello Transit. City-based circulator service is provided by Bellflower Bus, Bell Gardens Transit, Cerritos Transit, Downey LINK, Lynwood Trolley, and Paramount Easy Rider. Corridor Metro bus service in Los Angeles County is illustrated in Figure 3.12, and OCTA service in Orange County is presented in Figure 3.13.

Rail service is provided by Metro on two lines that operate through portions of the Corridor Study Area:

- ***Metro Green Line*** – This LRT line operates predominantly east-west in the median of the I-105 Freeway through the northern portion of the study area. This line runs between Redondo Beach and Norwalk, and provides connections to downtown Los Angeles and Long Beach by way of the Metro Blue Line. Study area Metro Green Line stations are located at the Norwalk Transit Center, Lakewood Boulevard in Downey, and Long Beach Boulevard in Lynwood.

- ***Metro Blue Line*** – Forming the western study area boundary, this LRT line provides north-south rail service between downtown Long Beach and 7th Street/Metro Center in downtown Los Angeles. The study area contains nine Metro Blue Line stations: two located in Compton, and seven in Los Angeles. One of the stations – Imperial/Wilmington – provides a transfer to and from the Metro Green Line.

Regional Metrolink and Amtrak rail service operates along an alignment to the north of the WSAB/PEROW Corridor boundaries. Metrolink provides commuter access throughout a five-county service area, and Amtrak operates intercity service from San Luis Obispo to San Diego, as well as long-distance connections. Both systems are accessible to Corridor Study Area residents only from Union Station at the northern terminus of the study area, and the SARTC at the southern terminus.

3.3.2 Future Transit System Improvements

Within the PEROW/WSAB Corridor, no transit infrastructure improvements are planned beyond several bus service increases and a new rail system connection, which will improve mobility, but only in limited portions of the study area, and will not address the Corridor's growing travel needs. As presented in Section 2.0, approved Corridor transit projects identified from the adopted county and regional plans include the following to be implemented by 2035: an LRT system connection in downtown Los Angeles; three BRT lines in Orange County; and more frequent Long Beach Transit bus service connecting Long Beach and Orange County. In addition, a Street Car system is being planned to serve Santa Ana and Garden Grove, and master plans are being developed for Union Station and the SARTC.

All of the transit alternatives would provide benefits for Corridor travel by providing a new modal option with additional capacity to serve forecasted 2035 travel demand. The following discussion presents information on: vehicle assumptions; the operating assumptions and plans, including service span and frequency; run times; and resulting ridership projections for all of the alternatives.

3.3.2.1 Operating Assumptions and Plans

The following provides a summary of the general operating assumptions and plans for each of the PEROW/WSAB Corridor alternatives. Detailed information is provided in *Appendix E: Operating and Cost Estimate and Financial Analysis Technical Memorandum*.

Vehicle Assumptions

The vehicles for the BRT Alternatives were assumed to be as follows:

- **HOV Lane-Running** Option – 45 foot NABI vehicles similar to those used for Metro Silver Line service, with the decision on whether to use the 60 foot articulated Metro Orange Line vehicles deferred to the future as ridership expands; and
- **Street-Running Option** – 40 foot NABI vehicles similar to those used for Metro Rapid service.

Figure 3.11 – Existing Rail Transit Service

Figure 3.12 – Existing Los Angeles County Transit Service

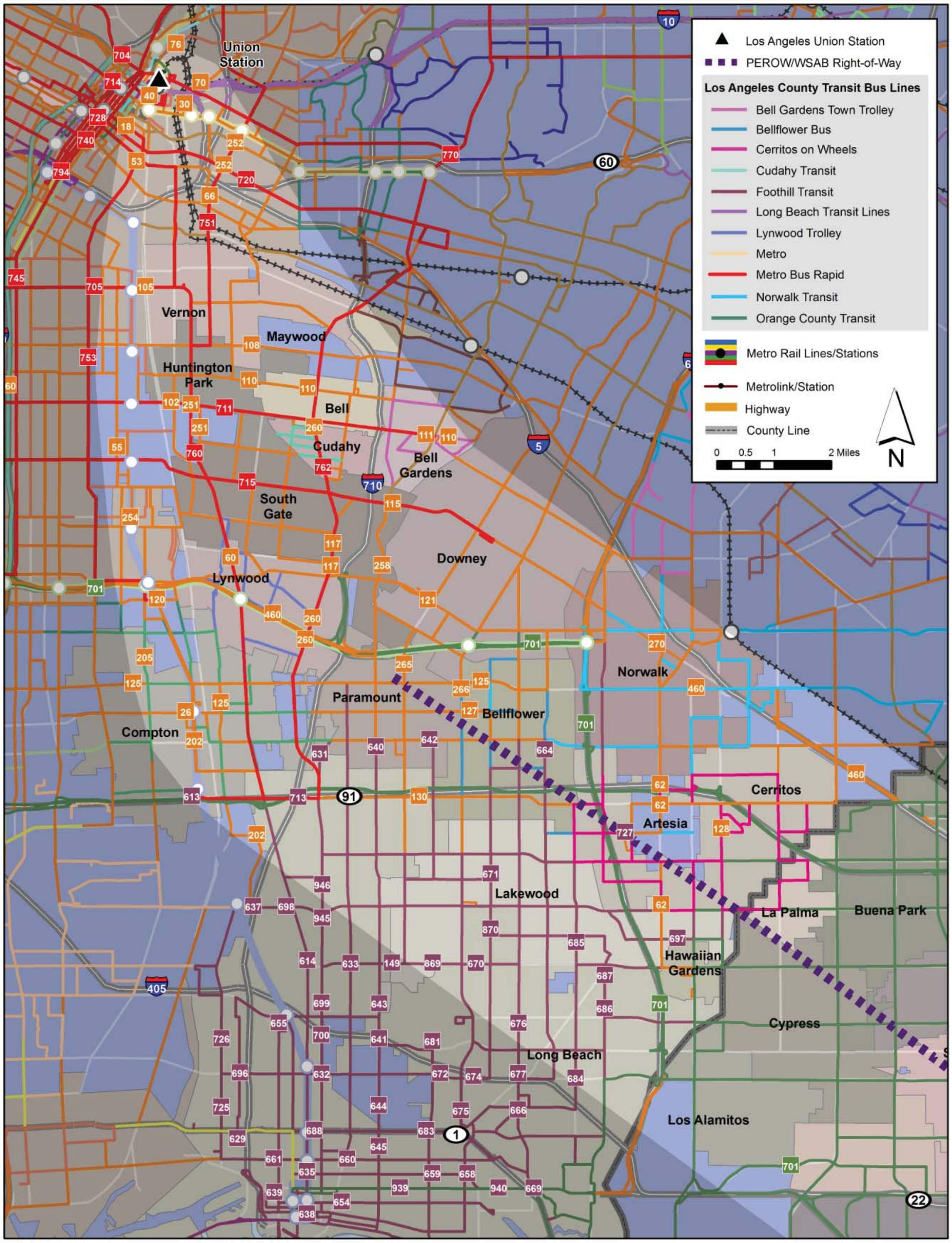
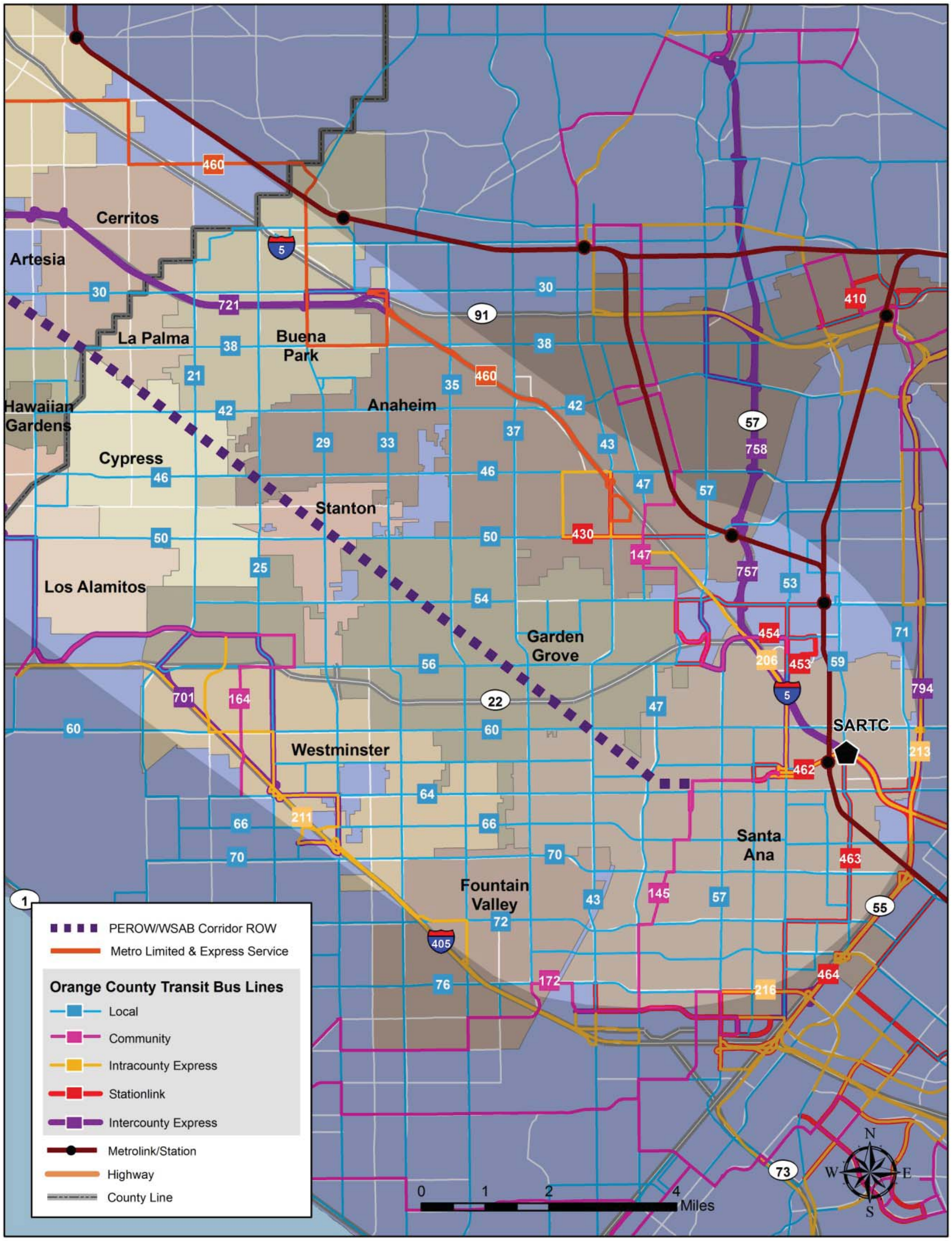


Figure 3.13 – Existing Orange County Transit Service



The Guideway Alternatives vehicle assumptions are as follows:

- **Street Car** – Reflecting the anticipated Santa Ana Street Car system, analysis was based on the Siemens S70 Street Car low-floor vehicle, 79'-1" in length with a double-articulated design, and proposed to be operated singly;
- **LRT Option** – Vehicles similar to those used by Metro for their current LRT service, which are Breda 90' 2550 LRV vehicles and typically operated by Metro in a three-car consist in length; and
- **Low Speed Maglev Option** – Vehicles used by the Linimo system in Nagoya, Japan, which are Nippon Sharyo HSST-100L vehicles built as an integrated, three-car consist 134'-7" in length.

Service Span and Frequency

Existing bus services in the PEROW/WSAB Corridor are primarily operated by Metro and OCTA, while existing urban rail service is operated by Metro. For the AA-level of analysis, Metro was assumed to be the operating agency for the BRT Alternatives based on their experience in operating both proposed service types, as well as for the guideway alternatives. During subsequent planning efforts, the operator decisions may be revised to reflect evolving operator capabilities. The service frequency for the BRT alternatives was identified based on: the HOV Lane-Running Option on the Metro Orange Line, and the Street-Running Alternatives on the Metro Silver Line as shown in Table 3.14.

Table 3.14 – Service Frequency (BRT Alternative)

Day of Week	Frequency	Hours
BRT Street-Running Alternative		
Weekday	10 minutes	6:00 – 9:00 AM 3:00 – 6:00 PM
	20 minutes	4:30 – 6:30 AM 9:00 AM – 3:00 PM 6:00 – 11:00 PM
Weekend	20 minutes	5:30 AM – 11:00 PM
BRT HOV Lane-Running Alternative		
Weekday	5 minutes	6:00 – 9:00 AM 3:00 – 7:00 PM
	10 minutes	9:00 AM – 3:00 PM
	15 minutes	4:30 – 6:00 AM 7:00 – 9:00 PM
	20 minutes	9:00 – 11:00 PM
Weekend	10 minutes	5:30 AM – 7:00 PM
	20 minutes	7:00 – 11:00 PM

Table 3.14 – Service Frequency (Guideway Alternatives)

Day of Week	Frequency	Hours
All Guideway Alternatives		
Weekday	5 minutes	6:30 – 8:30 AM 4:00 – 7:00 PM
	10 minutes	8:30 AM – 4:00 PM 7:00 – 8:00 PM
	15 minutes	4:00 – 6:30 AM 8:00 PM – 1:30 AM
Weekend	12 minutes	9:00 AM – 6:30 PM
	15 minutes	7:00 – 9:00 AM 6:30 – 7:30 PM
	20 minutes	4:00 – 7:00 AM 7:30 PM – 1:00 AM

Run Time Estimates

A first step in developing ridership projections was identifying run times for each of the alternatives. Travel times for the alternatives were calculated using a spreadsheet simulation model based on the performance characteristics of Metro's current fleet of BRT and LRT vehicles, and manufacturer information for the Street Car and Low Speed Maglev options. Inputs to the run time model included:

- **Speed restrictions for operations** – Speeds used reflected existing Metro operational information and manufacturer information based on operation in three configurations: mixed-flow at-grade guided by the traffic signal system; exclusive right-of-way at-grade; and aerial alignment;
- **Horizontal curves** – Utilized alignment curve radii identified by conceptual engineering plans;
- **Distances between stations** – Calculated from the Conceptual Engineering plans;
- **Dwell and layover times** – reflected Metro operations policy of: BRT dwell time of 20 seconds and layover time of 60 seconds at end of line; and LRT dwell time of 20 seconds and layover time of 60 seconds at the line terminus; and
- **Vehicle performance characteristics** – utilized acceleration and deceleration rates and maximum operating speeds from current fleet vehicles and manufacturer's information for those not currently in operation.

Using the alternative definition documented in Chapter 2.0 and the operating inputs identified above, the alternative number of stations, length, end-to-end run times, and the resulting average speed was identified and is summarized in Table 3.15. Modal- and alignment-specific results are discussed below.

The travel times for the BRT options shown represent the total travel time between Union Station and the SARTC for the Street-Running Alternative, and between 7th/Metro Center Station and the SARTC for the HOV Lane-Running Alternative. Due to similar alignments, operating speeds, and number of stations

Table 3.15 – Alternative Definition and Resulting Operational Information

Alternative	Number of Stations[1]	Distance[2] (Miles)	Run Time	Average Speed (mph)
BRT				
HOV Lane-Running	22	39.0	1:18:30	32.6
Street-Running	27	38.2	1:21:11	30.3
Street Car				
East Bank 1	23	35.2	1:09:55	30.7
West Bank 1	22	35.2	1:08:20	31.6
West Bank 2	23	35.6	1:10:36	30.7
West Bank 3	24	34.5	1:07:15	31.1
LRT				
East Bank 1	22	35.2	1:02:09	35.3
West Bank 1	21	35.2	1:00:55	35.8
West Bank 2	22	35.6	1:03:45	34.4
West Bank 3	23	34.5	1:00:12	35.5
Low Speed Maglev				
East Bank 1	17	29.7	43:06	40.2
West Bank 1	16	29.6	42:39	41.0
West Bank 2	17	29.9	44:18	40.0
West Bank 3	18	29.2	43:00	40.2

[1] Represents the Harbor Boulevard/1st Street/SARTC Alternative in the Southern Connection Area.
[2] Low Speed Maglev Alternative ends at Harbor Boulevard; does not continue through Santa Ana.

the run times for the PEROW/WSAB and Southern Connection areas are similar for both alternatives, with a faster average speed on the dedicated lanes along the PEROW/WSAB ROW than operating in Santa Ana city streets primarily due to more frequent signalized intersections.

In the Northern Connection Area, the HOV Lane-Running Alternative operates at a faster average speed of 35 mph than the Street-Running Option (30 mph). The BRT HOV Lane-Running Alternative has a slightly longer alignment distance (0.8 miles), but has fewer station stops (six) than the Street-Running Option with 11 proposed station stops. The average speed for the Street-Running Alternative may be overstated as current Soto Street Metro Rapid operations operate at an average of 14 mph due to congestion. There is a minimal difference between the overall average speeds of the BRT alternatives, though the HOV Alternative may provide riders with a faster and smoother ride with less stop-and-go operations.

Table 3.16 – BRT Alternatives: Run Times

Alternative	Run Time	Distance (Miles)	Average Speed (mph)
HOV Lane-Running			
Northern Connection Area	31:25	18.2	34.8
PEROW/WSAB Area	32:36	15.7	32.8
Southern Area	14:29	5.1	21.2
Total (Minutes)	**78:30**	**39.0**	**32.6**
Total in (Hours)	**1:18:30**		
Street-Running			
Northern Connection Area	34:06	17.4	29.6
PEROW/WSAB Area	32:36	15.7	32.8
Southern Area	14:29	5.1	21.2
Total (Minutes)	**81:11**	**38.2**	**30.3**
Total (Hours)	**1:21:11**		

Using the alternative definitions and operating inputs identified above, end-to-end run times were identified for the Guideway alternatives and are presented in Table 3.17. The travel times for the Street Car and LRT options represent the total travel time between Union Station and the SARTC, while the Low Speed Maglev Alternative run time is calculated from Union Station to a future Santa Ana Street Car Harbor Boulevard Station.

Among the guideway alternatives, the Low Speed Maglev options would provide a faster average operating speed (40.3 mph) and travel time between Union Station and the Harbor Boulevard Station than the other two guideway alternatives primarily due to entirely grade-separated system. The LRT alternatives have a higher average speed of 35.3 mph compared to 31.0 mph for the Street Car Alternatives resulting in a shorter run time of approximately seven minutes for the three West Bank alignment options and approximately eight minutes for the East Bank alignment, due to higher maximum operating speed and fewer stations.

Among the alignment alternatives, the West Bank 3 option would be the fastest for all of the guideway alternatives, followed by the West Bank 1 alternative. For the Low Speed Maglev Alternative, the West Bank 1 and 3 alignment options are the fastest.

Table 3.17 – Guideway Alternatives: Run Times

Alternative	Street Car			LRT			Low Speed Maglev		
	Run Time	Distance (Miles)	Avg. Speed (mph)	Run Time	Distance (Miles)	Avg. Speed (mph)	Run Time	Distance (Miles)	Avg. Speed (mph)
East Bank 1									
Northern	23:55	12.5	32.1	21:45	12.5	35.3	17:56	12.0	40.1
PEROW/WSAB	32:47	17.6	32.2	27:53	17.6	37.5	25:10	17.7	41.0
Southern	13:13	5.1	17.7	12:31	5.1	24.5			
Total (Minutes)	**69:55**	**35.2**	**30.7**	**62:09**	**35.2**	**35.3**	**43:06**	**29.7**	**40.2**
Total (Hours)	**1:09:55**			**1:02:09**			**43:06**		
West Bank 1									
Northern	22:20	12.5	34.4	20:31	12.5	36.6	17:29	11.9	41.0
PEROW/WSAB	32:47	17.6	32.2	27:53	17.6	37.5	25:10	17.7	41.0
Southern	13:13	5.1	17.7	12:31	5.1	24.5			
Total (Minutes)	**68:20**	**35.2**	**31.6**	**60:55**	**35.2**	**35.8**	**42:39**	**29.6**	**41.0**
Total (Hours)	**1:08:20**			**1:00:55**			**42:39**		
West Bank 2									
Northern	24:36	12.9	32.1	23:21	12.9	33.1	19:08	12.2	38.4
PEROW/WSAB	32:47	17.6	32.2	27:53	17.6	37.5	25:10	17.7	41.0
Southern	13:13	5.1	17.7	12:31	5.1	24.5			
Total (Minutes)	**70:36**	**35.6**	**30.7**	**63:45**	**35.6**	**34.4**	**44:18**	**29.9**	**40.0**
Total (Hours)	**1:10:36**			**1:03:45**			**44:18**		
West Bank 3									
Northern	21:15	11. 8	33.2	19:48	11. 8	35.8	17:50	11.5	38.9
PEROW/WSAB	32:47	17.6	32.2	27:53	17.6	37.5	25:10	17.7	41.0
Southern	13:13	5.1	17.7	12:31	5.1	24.5			
Total (Minutes)	**67:15**	**34.5**	**31.1**	**60:12**	**34.5**	**35.5**	**43:00**	**29.2**	**40.2**
Total (Hours)	**1:07:15**			**1:00:12**			**43:00**		

Travel times could be further reduced for the Street Car and LRT alternatives by operating them in an entirely grade-separated system similar to the Low Speed Maglev Option. Based on an AA-level of system design, the end-to-end travel time from Union Station to the SARTC for the LRT West Bank 3 Alternative would be shortened by just over three minutes as shown below in Table 3.18. The minor increase represents several constraints and assumptions. At this level of analysis, the run time for both PEROW/WSAB Area alignment alternatives is the same as the current LRT alignment has a major curve (PEROW/WSAB ROW to the San Pedro Subdivision) that requires a speed reduction whether in at-grade or grade-separated operations. This connection could be modified to run faster, but would require major residential property acquisition to do so. In addition, the run time for the combination alternative was based on an assumption of new signals in roadway segments (96 percent of ROW crossings occur in roadway segments rather than intersections) adjacent to stations and signal priority at all other crossings. Also, the West Bank 3 combination alignment alternative was already designed with a 27 percent grade-separated configuration. Analyzing the trade-offs related to grade separation would be refined during any subsequent engineering work based on the Metro *Grade Crossing Policy* which provides a process for making grade separation decisions based on more detailed highway system analysis and transit system design.

Table 3.18 – LRT West Bank 3 Alternative: All Grade-Separated System Travel Times

Operational Alternative	Northern Connection Area (Minutes:Seconds)	PEROW/WSAB Area (Minutes:Seconds)	Southern Connection Area (Minutes:Seconds)	Total Trip[1] (Minutes:Seconds)
Combination: at-grade and grade-separated	19:48	27:53	12:31	60:12
All grade-separated	18:30	27:53	10:47	57:10

[1] Represents time to complete one-way trip from Union Station to SARTC.

Currently, the guideway alternatives have an average station spacing of approximately of two miles between stations as shown in Figures 3.14 and 3.15. If peak period express or skip-stop service with a five-mile station spacing were implemented, an end-to-end travel time savings of eight minutes could result as shown in Table 3.19. The proposed major stations considered in this analysis were Union Station, Pacific Boulevard, Firestone Boulevard, the Metro Green Line, 183rd Street/Gridley Road, Beach Boulevard, Harbor Boulevard, and SARTC. Further evaluation of express service and the stations to be included may be studied through possible future study efforts, though it is not current Metro policy.

Table 3.19 – LRT West Bank 3: Skip Stop System Travel Times

Operational Sections	All Proposed Station Stops (Minutes:Seconds)	Possible Skip Stop Stations (Minutes:Seconds)
Northern Connection Area	19:48	17:28
PEROW/WSAB Area	27:53	24:04
Southern Connection Area	12:31	10:34
Total	**60:12**	**52:06**

Given the approximately 34-mile length of the proposed project and its location within two counties, the decision may be made to construct the project in several segments over time reflecting issues such as county priorities and funding availability. The Corridor has been divided into four Minimum Operable Segments (MOSs), which refers to a proposed phase of project implementation. Each MOS can be built independently, it connects logical termini, and its usefulness as a transportation investment does not depend upon implementation of subsequent phases. Construction of the Los Angeles County portion of the project was seen as occurring in two MOSs: 1) between Union Station and the Metro Green Line; and 2) the Metro Green Line and the county line. The Orange County portion also may be built in two MOSs: 1) the county line to Harbor Boulevard to interface with the future Santa Ana-Garden Grove Street Car Harbor Boulevard Station; and 2) from the Harbor Boulevard Station to the SARTC.

The resulting run times for the two MOS segments in Los Angeles County, using the LRT West Bank 3 alignment as a test case, is presented in Table 3.20. Two run times are presented for the Metro Green Line to the County Line segment:

1. **MOS 1A** – The first assumed construction of a stand-alone, initial operational segment along the PEROW/WSAB Corridor connecting north in the median of Lakewood Boulevard to provide a transfer to the existing Metro Green Line Lakewood Boulevard Station. It should be noted that the Lakewood Boulevard connection would be a "tear down" section if the decision were made to continue the transit system north to connect with Union Station. This MOS segment is 6.9 miles in length and has five stations, including the existing Metro Green Line Lakewood Boulevard Station and the Bellflower Boulevard, 183rd Street/Gridley Road, Pioneer Boulevard, and Bloomfield Avenue stations.
2. **MOS 1B** – The second run time was based on construction of a new Metro Green Line station interfacing with the proposed operational alignment north on the San Pedro Subdivision. This MOS segment is 7.3 or 7.5 miles in length and has six stations, including a new Metro Green Line Station and the Paramount Boulevard/Rosecrans Avenue, Bellflower Boulevard, 183rd Street/Gridley Road, Pioneer Boulevard, and Bloomfield Avenue stations.

Table 3.20 – Travel Times for Minimum Operable Segments in Los Angeles County

Alternative	MOS 1A Metro Green Line[1] (existing station) to County Line		MOS 1B Metro Green Line[2] (new station) to County Line		MOS 2 Union Station to Metro Green Line[2] (new station)		Total Union Station to County Line[2] (Using MOS 1B)	
	Minutes: Seconds	Miles	Minutes: Seconds	Miles	Minutes: Seconds	Miles	Minutes: Seconds	Miles
Street Car	12:39	6.9	14:05	7.5	21:15	11.8	35:20	19.3
LRT	10:53	6.9	12:20	7.5	18:30	11.8	30:50	19.3
Low Speed Maglev	10:53	6.9	11:14	7.3	17:50	11.5	29:05	18.8

[1] Based on connecting to the existing Metro Green Line Lakewood Boulevard Station.
[2] Based on new Metro Green Line Station to be accessed from the San Pedro Subdivision.

Figure 3.14 – Corridor Guideway Station Spacing

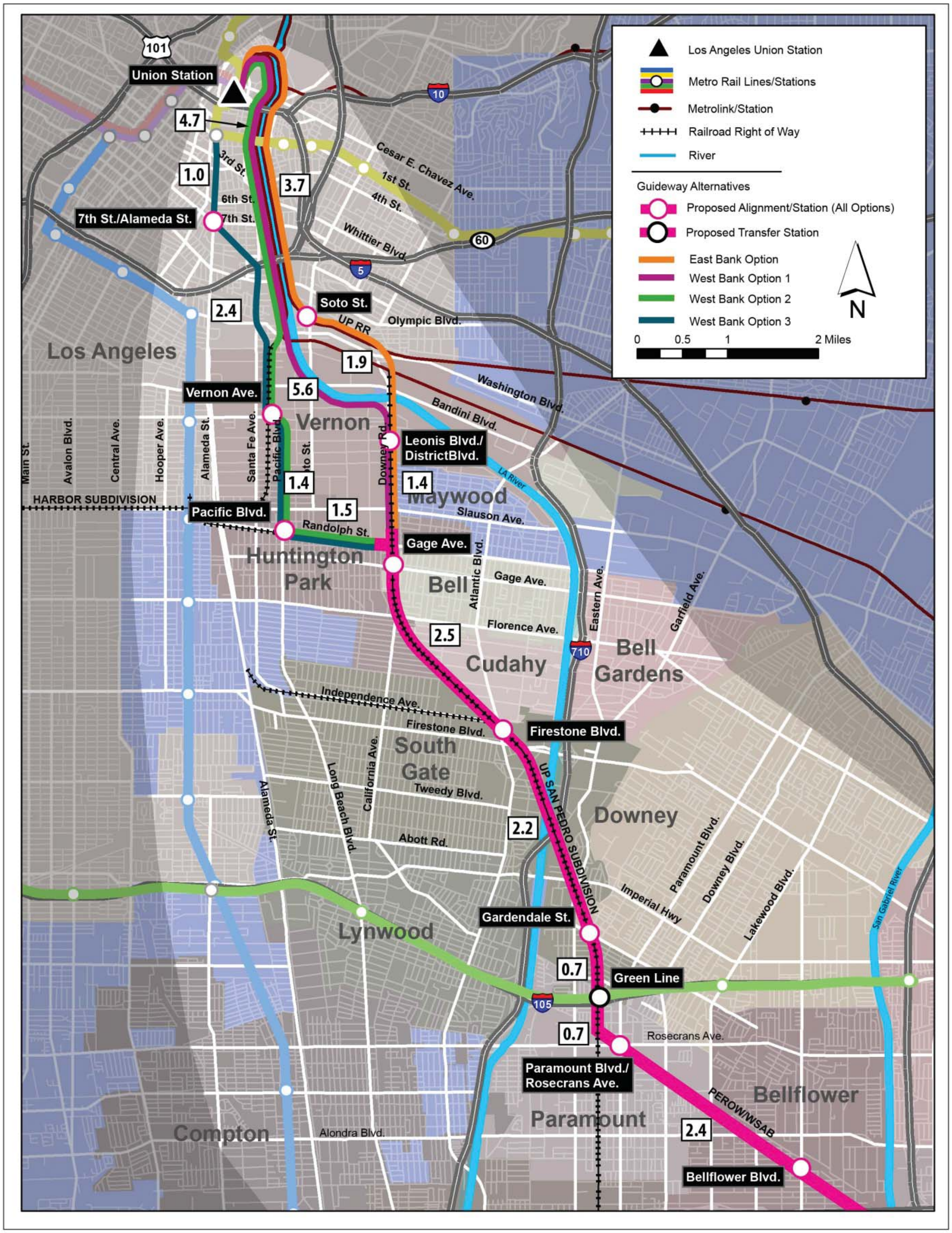
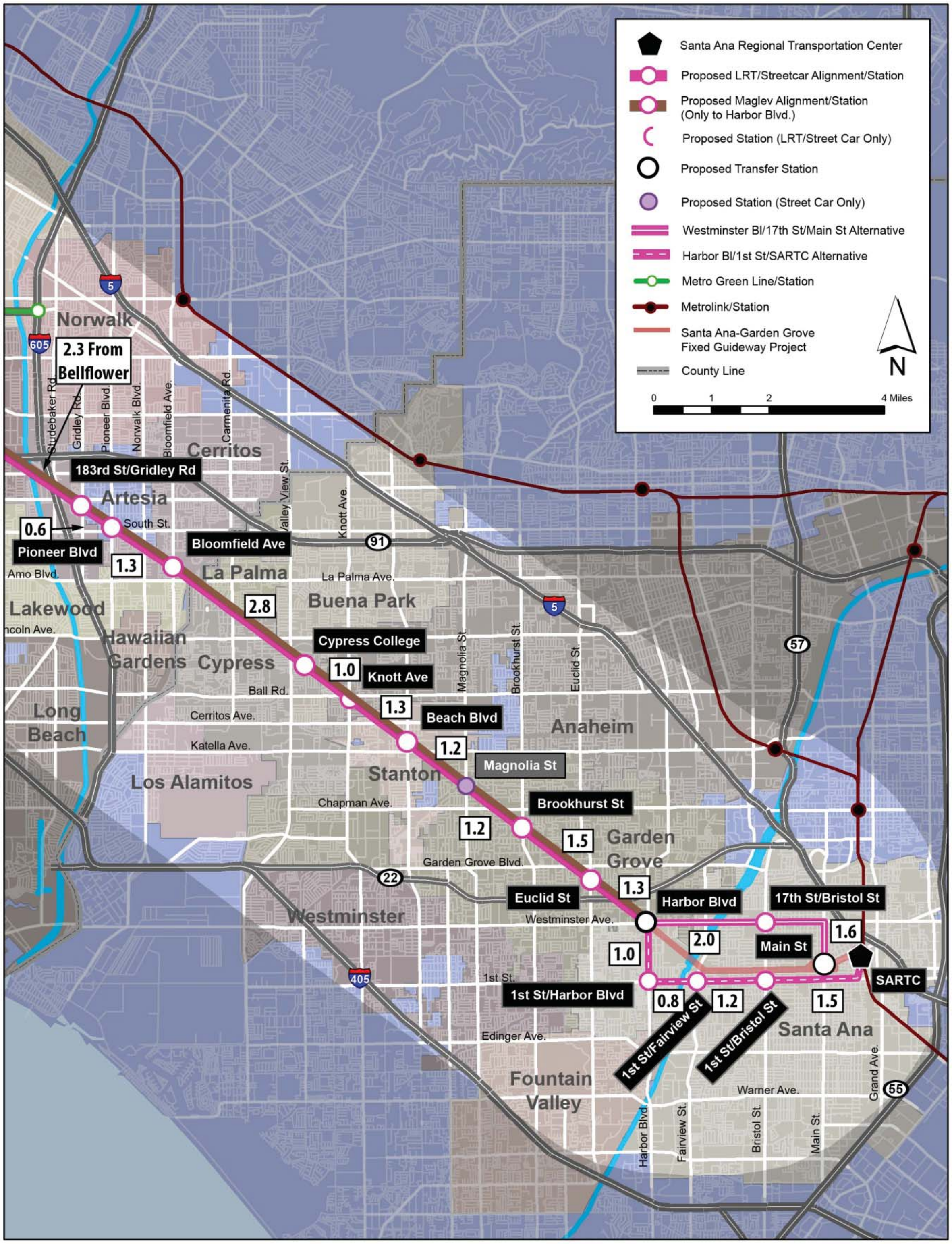


Figure 3.15 – Corridor Guideway Station Spacing


Santa Ana Regional Transportation Center
Proposed LRT/Streetcar Alignment/Station
Proposed Maglev Alignment/Station (Only to Harbor Blvd.)
Proposed Station (LRT/Street Car Only)
Proposed Transfer Station
Proposed Station (Street Car Only)
Westminster Bl/17th St/Main St Alternative
Harbor Bl/1st St/SARTC Alternative
Metro Green Line/Station
Metrolink/Station
Santa Ana-Garden Grove Fixed Guideway Project
County Line
0 1 2 4 Miles
N
2.3 From Bellflower
183rd St/Gridley Rd
Pioneer Blvd
Bloomfield Ave
Cypress College
Knott Ave
Beach Blvd
Magnolia St
Brookhurst St
Euclid St
Harbor Blvd
17th St/Bristol St
Main St
SARTC
1st St/Harbor Blvd
1st St/Fairview St
1st St/Bristol St
Norwalk
Cerritos
Artesia
La Palma
Buena Park
Lakewood
Hawaiian Gardens
Cypress
Long Beach
Los Alamitos
Stanton
Anaheim
Garden Grove
Westminster
Fountain Valley
Santa Ana

3.3.2.2 Ridership Projections

Ridership projections were prepared using a Corridor-specific model developed from the FTA-reviewed Metro travel demand model that was expanded to include both Los Angeles and Orange counties, and was validated for existing conditions. Projections for the year 2035 were identified for the TSM and four build alternatives, along with the No Build to provide a basis for comparison. Due to the significant number of modal and alignment alternatives, the decision was made to perform detailed coding and analysis of a set of base alternatives, along with a series of sensitivity tests to explore other alignment options and system decisions. Also, the West Bank 1 and 2 alignments were so similar in length, number of stations, and physical setting, that only the West Bank 2 was analyzed. The full model runs are indicated by a tone in Table 3.21 below that presents the forecast ridership and user benefits. A detailed discussion of the ridership analytical process and results is presented in *Appendix B: PEROW/WSAB Corridor AA Travel Demand Modeling Report.*

Table 3.21 – Forecast Ridership (2035)

Alternative	Total Daily Project Boardings	Daily New Transit Riders	Daily User Benefits Per Project Boarding (Minutes)	Daily User Benefits (Hours)
No Build	49,760	--	--	--
TSM				
‣ Core Service Project[1]	39,000	16,000[2]	N/A	N/A
‣ Corridor System	85,575	35,815	22.2	21,720
BRT Alternatives				
‣ Street-Running	57,340	18,120	13.2	12,605
‣ HOV Lane-Running	67,210	26,640	15.7	17,580
Street Car Alternatives				
‣ East Bank 1	77,545	28,900	18.9	23,240
‣ West Bank 2	75,750	27,550	18.5	24,365
‣ West Bank 3	79,600	28,945	18.6	24,635
LRT Alternatives				
‣ East Bank 1	84,895	32,730	18.9	26,780
‣ West Bank 2	82,930	31,200	18.5	25,540
‣ West Bank 3	87,150	32,870	18.6	27,075
Low Speed Maglev				
‣ East Bank 1	74,020	28,430	19.2	22,635
‣ West Bank 2	72,310	26,985	18.8	23,735
‣ West Bank 3	75,990	28,430	18.9	23,995

Notes: Colored tone identifies a coded model run; numbers with no tone were derived from sensitivity runs.
[1] Ridership for two bus service projects that represent the same travel corridor as the build alternatives.
[2] New ridership estimate based on same percentage increase as total daily boardings.

The modeling results show a strong increase in daily transit boardings in the PEROW/WSAB Corridor with implementation of any of the proposed transit system alternatives, clearly demonstrating the travel demand and need for more transit in the study area. At one end of the transit investment spectrum, the TSM Core Service Project option, which represents the two bus service lines (approximately 34 miles in length) that would serve the same travel corridor as the build alternatives: Union Station-Los Cerritos in Los Angeles County and the Katella Avenue BRT in Orange County. This option would attract and serve 39,000 daily Corridor boardings and approximately 16,000 new riders by the year 2035. A higher level of ridership would be served by the TSM Corridor System option, which includes a 206-mile system of new and enhanced bus services and arterial and intersection operational improvements. This alternative would attract and serve 85,575 daily Corridor boardings primarily in Orange County; only one new Metro bus line and one new Long Beach Transit line is proposed in Los Angeles County compared to improved service on three lines and provision of five new lines in Orange County. At the other end of the ridership spectrum, the approximately 35-mile long LRT alternatives would have the highest projected daily boardings among the guideway options with 82,900 to 87,150 daily boardings, and attracting up to 32,900 new transit riders.

The BRT Alternatives were forecasted to serve an additional 57,000 daily Corridor boardings for the Street-Running Alternative, and 67,000 daily boardings for the HOV Lane-Running Alternative. These two options would attract the lowest number of daily boardings and new riders among the proposed alternatives, other than TSM Core Service Project. The BRT HOV Lane-Running Alternative was projected to attract a higher level of ridership than the Street -Running Alternative primarily due to a faster average speed and providing direct service into downtown Los Angeles. For both BRT options, it should be noted that the projected ridership would significantly exceed the hourly and daily capacity typically provided by a BRT system. For example, the Metro Orange Line served 26,900 daily boardings in September 2011.

Construction of the Street Car alternatives was forecasted to serve from 77,545 to 79,600 daily Corridor boardings, and attract an average of 28,400 daily new transit riders. The Street Car user benefits were identified as equal to the LRT options on a per boarding level, but were approximately 10 percent lower when compared on a daily total user benefits level primarily due to slower operating speeds and longer end-to-end travel times. It should be noted that the forecasted ridership information was based on operating three-car trains using the same street car vehicle proposed for use by the Santa Ana Street Car system. Research identified that the vehicle cannot be coupled together into two or three car trains, but must be operated singly. The capacity provided by a system of single Street Car vehicles would not accommodate the Corridor’s forecasted ridership demand.

Daily boardings among the LRT alternatives were forecasted to be between 82,900 and 87,150 daily boardings, and would attract an average of 32,270 daily new riders. The West Bank 3 Alternative was projected to attract and serve the highest level of daily boardings (87,150) and new riders (32,900) due to having the fastest travel speeds and shortest end-to-end travel times. With a slightly longer run time of approximately two minutes and serving different communities, the East Bank Alternative was second with 84,900 daily boardings and 32,700 new transit riders. Looking at forecasted daily user benefits per project boarding, the LRT alternatives are similar to the Street Car and Low Speed Maglev options, but have the highest user benefits on a daily total user benefit basis among the alternatives.

A model run was performed to evaluate the ridership impact of operating the LRT Alternative from one identified in the run time analysis spreadsheets to a speed more comparable to actual Metro Rail operations experience. The Metro Blue Line section between the Washington and Willow stations was identified as having an operational configuration similar to that proposed for the PEROW/WSAB Corridor project. This segment operates northbound at 29.7 mph and southbound at 32.9 mph; the northbound speed was used in a run time analysis for the LRT West Bank 3 Alternative that resulted in an average speed of 29.9 mph due to the grade-separation in the northern portion of the alignment. The results presented in Table 3.22 show an increase in end-to-end run time (Union Station to SARTC) of more than five minutes. The eight percent reduction in average speed was forecasted to result in a corresponding eight percent decrease in daily corridor boardings (6,700 fewer riders) and a ten percent decrease in new riders (3,400 less).

Table 3.22 – Comparison of Forecast Ridership based on Metro Blue Line Operating Speed (2035)

Speed Alternative	Average Speed (mph)	Run Time[2] (Mins:Secs)	Total Daily Corridor Boardings	Daily New Transit Riders	Daily User Benefits Per Project Boarding (Minutes)	Daily Total User Benefits (Hours)
Run Time Analysis	35.5	1:00:12	87,150	32,870	18.6	27,075
Metro Blue Line[1]	29.9	1:05:49	80,460	29,435	18.5	24,810

[1] Based on run time analysis using FY2011 Metro Blue Line northbound average speed of 29.7 mph.
[2] End-to-end run time from Union Station to SARTC for LRT West Bank 3 Alternative.

The Low Speed Maglev alternatives were forecasted to serve from 72,300 to 76,000 daily boardings and attract an average of 27,950 daily new transit riders. The West Bank 3 Alternative was projected to attract and serve the highest level of daily boardings (76,000) primarily due to having the shortest alignment. With a longer alignment and run time (1.3 minutes) and the lowest average speed, the West Bank 2 Option would attract the lowest ridership among the Low Speed Maglev alternatives with 72,300 daily boardings. The East Bank Alternative has the highest user benefit per project boarding of all of the guideway alternatives, but on a daily total user benefit basis, all of the Low Speed Maglev alternatives are comparable to the Street Car options and lower than the LRT alternatives.

The Corridor benefits go beyond the project ridership identified as resulting from implementation of a transit project. Table 3.23 presents an overview of the resulting study area transit daily boardings in 2035 demonstrating that a transit project (the West Bank 3 alignment is used) would encourage a higher level of transit ridership throughout the Corridor. When identifying annual boardings (defined by Metro as multiplying the daily boardings by 325 days), the resulting numbers are significant – from 18.6 million annual project boardings for the BRT Street-Running Alternative to 28.3 for the LRT West Bank 3 Alternative.

Table 3.23 – Annual Corridor Daily Boardings (2035)

Boardings	TSM Core Service	BRT Street	BRT HOV Lane	Street Car	LRT	Low Speed Maglev
Daily Boardings	39,000	57,340	67,210	79,600	87,150	75,990
Annual Boardings (Millions)	12.7	18.6	21.8	25.9	28.3	24.7

An overview of the peak versus off-peak boarding access among the alternatives is presented in Table 3.24. Peak period access for the BRT alternatives would be different than the guideway alternatives, with the Street-Running alternative providing more all day service as shown by having the lowest percentage (63 percent) of peak boardings among the options, and the more commuter-oriented HOV Lane-Running Alternative having the highest percentage of peak period travel (75 percent). All of the guideway alternatives have a similar access breakdown with approximately 70 percent peak and 30 percent off-peak boardings.

Table 3.24 – Peak and Off-Peak Boarding Access (2035)

Alternative	BRT Street-Running	BRT HOV Lane-Running	Street Car	LRT	Low Speed Maglev
Peak Boardings	63%	75%	71%	72%	72%
Off-Peak Boardings	37%	25%	29%	28%	28%

When evaluating the mode of access to the system for each of the alternatives, the two BRT options vary slightly with the Street-Running Alternative having a higher percentage (82 percent) of walk, bus, and rail access than the HOV Lane-Running Option (71 percent), while the HOV Option has a higher drive access (29 percent). Table 3.25 presents an overview of the mode of access among the guideway alternatives using the West Bank 3 alignment. The access categories include walking to the station, transferring from a bus or community circulator, parking at the station (park-and-ride or PNR), being dropped off (kiss-and-ride or KNR), and transferring from a rail line (Metro, Metrolink, Amtrak, or the future Santa Ana Street Car system). While a majority of the access for the Street Car and LRT alternatives is similar, there is one difference: reflecting its more community-based service type, the Street Car alternatives would attract more walk access. For the Low Speed Maglev options, the analysis showed a low level of access by bus, and higher levels of drive and rail access than the other two guideway alternatives.

Table 3.25 – Guideway Alternatives: Mode of Access (2035)

Alternative	Walk	Bus	PNR	KNR	Rail
Street Car	35%	30%	11%	2%	22%
LRT	32%	31%	11%	3%	23%
Low Speed Maglev	32%	12%	18%	4%	34%

Based on the ridership projections, an overview of the busiest stations is presented in Table 3.26 for Los Angeles and Orange counties separately. The "asterisk" indicates that one station was identified as significantly more active than the other proposed stations. For example, Union Station typically attracted three times more boardings than the second busiest stations, and in many cases, would have four to five times the activity of the other stations. In Los Angeles County, the busiest stations would be in the cities of Los Angeles, South Gate, Cerritos, Huntington Park, and Bellfower. In Orange County, the SARTC, Harbor Boulevard, Cypress College, Beach Boulevard in Stanton, Knott Avenue in Anaheim, and Brookhurst Street in Garden Grove would be the most active. In Santa Ana, the BRT alternatives attract a high level of ridership at the 1st Street/Bristol Street Station serving the Civic Center Area. For the Guideway Alternatives, Santa Ana travelers would use the future Street Car system to reach their local destinations from the more regional service provided by the PEROW/WSAB Corridor system.

Table 3.26 – Forecasted Most Active Stations by Alternative and County (2035)

Alternative	Los Angeles County	Orange County
BRT Street-Running	* Metro Green Line 1. Union Station 2. Firestone/Long Beach Blvds. 3. Firestone/Lakewood Blvds. 4. 183rd St./Gridley Rd. 5. Bellflower Blvd.	* SARTC 1. Harbor Blvd. 2. Cypress College 3. 1st/Bristol Sts. 4. Knott Ave. 5. Beach Blvd.
BRT HOV Lane-Running	* 7th/Metro Center Station 1. Metro Green Line 2. Harbor Fwy./Century Blvd. 3. Harbor Fwy./Manchester Blvd. 4. Bloomfield Ave. 5. Bellflower Blvd.	* SARTC 1. Harbor Blvd. 2. 1st/Bristol Sts. 3. Cypress College 4. Knott Ave. 5. Beach Blvd.
Guideway Alternatives	* Union Station 1. Metro Green Line 2. Firestone/Atlantic Blvds. 3. 183rd St./Gridley Rd. 4. Pacific Blvd. or Gage Ave. 5. Bellflower Blvd.	* SARTC 1. Harbor Blvd. 2. Cypress College 3. Beach Blvd. 4. Brookhurst St. 5. Knott Ave.

Sensitivity Run Results

The following sensitivity runs were prepared to assess the effects of the following possible future system decisions:

- Fully grade separating the LRT Alternative;
- Fare-related ridership impacts for the Low Speed Maglev Alternative if a "private operator" fare was charged rather than a public agency fare; and
- MOS options in Los Angeles County.

The first sensitivity test evaluated the ridership impact of entirely grade separating the LRT Alternative using the West Bank Option 3 alignment as the test case. The base ridership projections previously presented in Table 3.21 for the LRT options were based on the construction of an alignment that was a combination of grade-separated and at-grade operations. For the West Bank 3 alignment, 27 percent of the Northern Connection Area was grade-separated, as were eight percent of the PEROW/WSAB and Southern Connection areas. Future system decisions may be made to entirely grade-separate the LRT alignment to improve system performance and reduce traffic impacts. The results of the sensitivity run, shown in Table 3.27, show a slight increase in daily boardings (three percent), new transit riders (four percent), user benefits (four percent), and user benefits per project boarding (two percent). The slight growth in ridership is due to a minor increase in operating speed and decrease in run time. Further travel time savings could be achieved with express or skip stop service as discussed above.

Table 3.27 – Sensitivity Test: Entirely Grade-Separated LRT Alternative (2035)

Statistic	Combination Alignment	Fully Grade-Separated Alignment
Daily Project Boardings	87,150	89,560
Daily New Riders	32,870	34,320
Daily User Benefits (Hours)	27,075	28,150
User Benefits Per Project Boarding (Minutes)	18.6	18.9

A second sensitivity test evaluated ridership impacts for the Low Speed Maglev Alternative based on whether this option was operated by a private operator rather than a public agency such as Metro or OCTA. This alternative differs from the other Low Speed Maglev alternatives only in the amount charged for passengers to use the system. The West Bank 3 alignment option was used as it had the highest forecasted ridership of the Low Speed Maglev alternatives and would represent the best case scenario.
The identified difference reflects the fare required to generate the operating revenue required to support a public-private partnership with different financing tools and return needs than an entirely publicly-funded project. A revised fare assuming private operations was calculated through financial analysis effort and then used in the Corridor model in place of the Metro rail system fare. The resulting

private operations fare was identified as $8.75, and the significant impact on project ridership is presented in Table 3.28. The analysis showed that the public fare-based ridership of 75,990 daily boardings was forecasted to be reduced by 89 percent to 8,255 boardings. The results show that in this Corridor, with a large number of low-income households, riders would find less expensive travel alternatives to avoid paying the higher fare.

Table 3.28 – Low Speed Maglev Alternative: Private Fare (2035)

Statistic	Public Fare-Based Ridership	Private Fare-Based Ridership
Daily Project Boardings	75,990	8,255
Daily New Riders	28,430	3,090
Daily User Benefits (Hours)	23,995	2,610
User Benefits Per Project Boarding (Minutes)	18.9	18.9

A final set of sensitivity tests evaluated the resulting ridership if the Corridor project were built in Los Angeles County with the following MOS segments using the LRT West Bank 3 Alternative:

- **MOS 1** – With a use agreement for the San Pedro Subdivision and construction of a new Metro Green Line station, implementation of the system section connecting north to Union Station;
- **MOS 2** – Implementation of the segment from the new Metro Green Line station along the WSAB Corridor ROW to the future Bloomfield Avenue Station located in Cerritos just west of the county line; and
- **Both** – If both MOSs were constructed from Union Station to the proposed Bloomfield Station in Cerritos and went into operation at the same time.

Table 3.29 – Ridership Projections for Minimum Operable Segments in Los Angeles County

Statistics	MOS 1 Union Station to Metro Green Line[1]	MOS 2 Metro Green Line[1] to County Line	Both Union Station to County Line
Daily Project Boardings	19,620	11,060	38,790
Daily Corridor Boardings	103,820	111,070	125,540
Daily New Riders	1,850	3,350	9,790
Daily User Benefits (Hours)	2,330	3,360	9,940
Daily User Benefits (Minutes)	7.1	18.2	15.4

[1] Based on new Metro Green Line Station to be accessed from the San Pedro Subdivision.

The ridership results presented in Table 3.29 show a strong level of ridership in the Union Station to Metro Green Line portion of the Corridor. This section currently has a high level of transit ridership (15 percent) and the low number of new riders indicates that the project would be primarily serving existing riders better with faster, more direct service. Building and operating MOS 2 alone would attract a lower level of total riders than MOS 1, but it would attract three times more new riders than MOS 1 resulting in a higher level of user benefits. The synergy resulting from completion and operation of both segments is demonstrated by a resulting higher level of ridership than if the ridership of the two segments were added together. Building both segments would result in three times more new riders than MOS 2 alone, and almost nine times more than only MOS 1. The total forecasted ridership for the Los Angeles County only portion of the Corridor system is strong, but not as significant as if a Corridor transit project were to provide service connecting the two counties and their jobs and destinations.

3.4 Other Modes

This section provides an initial assessment of possible impacts on study area pedestrian and bicyclists with implementation of each of the transit system alternatives under consideration as all of the trips made on the proposed alternatives will have a strong pedestrian component and may enhance Corridor bicycle usage.

3.4.1 Existing Pedestrian and Bicycle System

The PEROW/WSAB Corridor has an extensive street system lined with sidewalks and with many streets served with bus and circulator service generating current pedestrian activity. In addition, several cities have active mixed use pedestrian areas attracting residents and visitors, such as downtown Los Angeles, Pacific Boulevard in Huntington Park, Little India on Pioneer Boulevard in Artesia, and downtown Santa Ana. Cities typically provide sidewalk and related amenities, and implement pedestrian-related guidelines for commercial and residential areas, and in some cases, for transit station areas.

Within the Corridor, Metro, OCTA, and SCAG have adopted policies and projects that support bicycling as a transportation mode that improves air quality and congestion, and helps create healthy communities. Regional, county, and local policy and planning documents seek to increase the number of bicyclists who ride for commuting and other daily purposes. Bicyclists are encouraged on OCTA's bus system and Metro's bus and rail systems. Adopted Corridor bicycle facilities falling in the following classifications are presented in Figure 3.16:

- **Class I Bike Paths** – Off-road, two-way paths most often located along flood control channels, riverbanks, active or inactive rail ROWs, and utility ROWs.
- **Class II On-Street Bike Lanes** – Striped, one-way lanes on streets with posted signage.
- **Class III Bike Routes** – Bicycles operate in space shared with vehicles; typically designated by signage only.

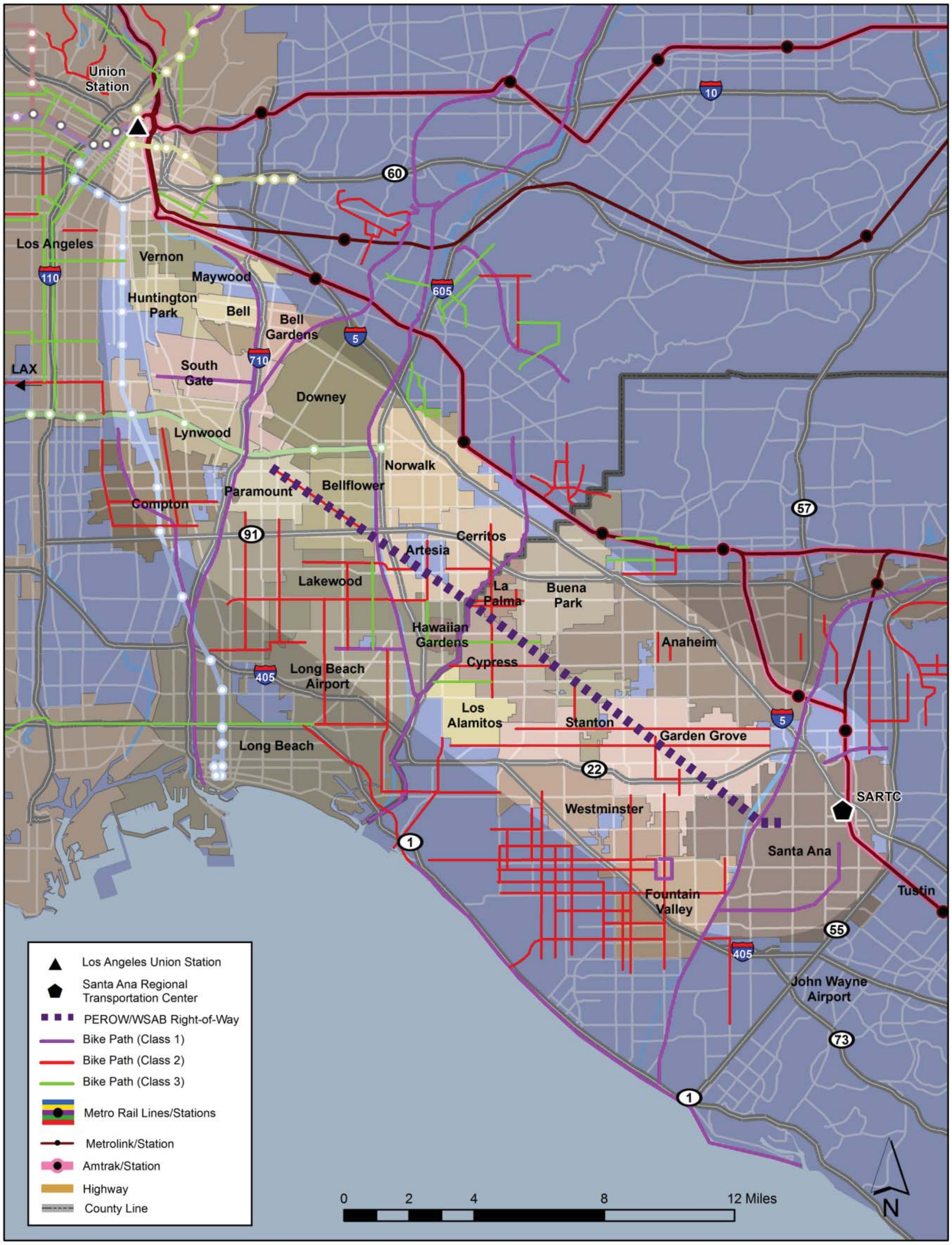
As shown in Table 3.30, any transportation improvement implemented in the Corridor would cross and/or interface with the following existing bicycle facilities:

- **Class I Bike Paths** – Five Class 1 facilities: Los Angeles River, San Gabriel River, Rio Hondo, Southern Avenue, and Bellflower Bike Trail;
- **Class II Bike Lanes** – Ten Class II facilities: Del Amo Boulevard, Woodruff Avenue, South Street, Crescent Avenue, Moody Street, Orangewood Avenue, Brookhurst Street, Lampson Avenue, Trask Avenue, and Newhope Street; and
- **Class III Bike Routes** – Four Class III facilities: Centralia Street, Pioneer Boulevard, Palo Verde Avenue, and Orange Avenue.

Table 3.30 – Summary of Bikeways Crossing the PEROW/WSAB Corridor

Bikeway	City	County
Class I Bike Paths		
Los Angeles River	Maywood/Bell/South Gate/Cudahy/Paramount	Los Angeles
San Gabriel River	Los Alamitos/Bellflower/Lakewood/Downey/Norwalk	Los Angeles
Coyote Creek	Cerritos/La Palma/Cypress/Los Alamitos	Los Angeles
Rio Hondo	Downey/Bell Gardens	Los Angeles
Southern Avenue	South Gate	Los Angeles
Bellflower Bike Trail	Bellflower	Los Angeles
Class II Bike Paths		
Del Amo Blvd.	Lakewood	Los Angeles
Woodruff Avenue	Lakewood	Los Angeles
South St. /Carmenita Rd.	Cerritos	Los Angeles
Crescent Avenue	La Palma/Cypress	Orange
Moody Street	Cypress/La Palma	Orange
Orangewood Avenue	Garden Grove	Orange
Brookhurst Street	Garden Grove	Orange
Lampson Avenue	Garden Grove	Orange
Trask Avenue	Garden Grove	Orange
Newhope Street	Garden Grove	Orange
Class III Bike Routes		
Centralia Street	Artesia	Los Angeles
Pioneer Blvd.	Artesia	Los Angeles
Palo Verde Avenue	Lakewood	Los Angeles
Orange Avenue	Cypress	Orange

Figure 3.16 – Existing Bikeways in Corridor Study Area



3.4.2 Future Pedestrian and Bicycle System Improvements

All of the trips made in the study area have a pedestrian component, with transit trips being dependent on safe, convenient, and pleasant walking connections, along with increased transit access by bicycle. Implementation of a carefully planned and designed pedestrian and bicycle access system through city policies and projects will be key components in the successful use of any of the transit options under consideration.

The PEROW/WSAB Corridor has the demonstrated population and employment density to support transit and related pedestrian activity. Implementation of design policies and projects that develop, protect, and foster the pedestrian-oriented nature of the proposed transit station areas and adjacent commercial and residential neighborhoods would encourage the pedestrian portion of the transit trip, and encourage transit system ridership. Cities typically provide pedestrian-related guidelines for commercial and residential areas, and in some cases, for transit station areas. For example, the City of Los Angeles identifies pedestrian requirements in the *Transportation Element of the General Plan* and the *Integrated Land Use and Transportation Policy* adopted with Metro. Both policies identify design objectives and guidelines such as minimum and preferred sidewalk widths in transit station areas, and calls for the establishment of Pedestrian Oriented Districts in higher use transit station areas. Many of the Corridor cities have adopted or are developing future plans to focus mixed use development in the proposed station areas to encourage and support increased pedestrian activity and transit access.

Provision of pedestrian and bicycle facilities in the PEROW/WSAB Corridor with any future transit system, such as the Class 1 Bikeway project successfully implemented by the City of Bellflower, can support pedestrian and bicyclist safety and encourage multi-modal travel to and from transit station areas, and interface with existing trails.

3.4.3 Pedestrian and Bicycle Impacts

Implementation of a new transit system with associated pedestrian and bicycle improvements would have benefits and impacts for Corridor pedestrians and bicyclists. Benefits could include proposed system-related improvements that would encourage and enhance pedestrian and bicycle activities through new improvements and increased safety tools and awareness. Possible benefits resulting from increased pedestrian and bicycle access to any new system may include:

- Reduced mobile source emissions and improved air quality and reduced Greenhouse Gas emissions.
- Reduced automobile traffic generated by a new transit system along with a possible decrease in related parking requirements.
- Increased pedestrian activity supporting land uses and activities and enhancing the sense of community in station areas and along the system's alignment.
- Enhanced community safety and security with more activity and "eyes" on the street.
- Improved health for study area residents.

All of the alternatives under consideration would have possible impacts on pedestrians and bicyclists with the introduction of a high-capacity transit system and related increased circulation activity in the station areas due to pedestrian, bicycle, bus or circulator, drop-off, or park-and-ride access activity. Possible impacts on pedestrian and bicyclist safety may include the following:

1. Conflicts between vehicular traffic and an increased number of pedestrians and bicyclists, particularly in station areas.
2. Conflicts between transit vehicles and bicyclists where they must share the street ROW.
3. Prevention of crossings of streets and rail tracks except at designated, protected locations for at-grade sections.
4. Concerns about the safety and convenience of pedestrians waiting in transit station areas.
5. Concerns about pedestrian crossing and waiting safety in areas with columns supporting grade-separated guideway sections.

3.4.3.1 Pedestrian Impacts

There are four primary areas of possible impacts to future transit pedestrians:

1. ***Street crossings*** – Address the safety and convenience of pedestrians interacting with transit and other vehicular traffic at crosswalks and other street crossings. It will be important to create identifiable and protected paths and zones dedicated to pedestrians that provide increased safety and capacity in crossing Corridor streets.
2. ***Sidewalks*** – Bus, BRT, and Street Car stations may be located on existing sidewalks, while LRT stations are operated in street medians or dedicated ROWs, whether at-grade or grade-separated, and Low Speed Maglev stations are all grade-separated. In order to create a successful pedestrian environment, provision of an appropriately-sized sidewalk and amenities such as shelters, lighting, and benches along with system information and fare machines as appropriate will be key to a successful transit system. Increased pedestrian activity and queuing needs may require additional sidewalk width in some station areas.
3. ***Walking to/from transit stations*** – This issue reflects the willingness of people to walk to/from their homes and jobs to transit stations when the pedestrian experience is safe and pleasant. This can be addressed by improving the safety and walkability of adjacent streets by creating a coordinated pedestrian system with related improvements including pedestrian crossing signage and signals along with cross walk improvements, street trees, lighting, and smooth pavement.
4. ***Crossing of transit tracks*** – Addresses the unique issue of transit operations with vehicles running at a high speed in some segments. The transit system components should be designed to encourage pedestrians and transit patrons to cross at protected crosswalk locations, while preventing crossing along the transit ROW between stations. Pedestrian access can be controlled through a combination of gates, signals, signage, walls, fences, and/or landscaping as appropriate.

3.4.3.2 Bicycle Impacts

Several of the alternatives under consideration would operate primarily at-grade within existing street ROWs which may have impacts on bicyclists including the following:

1. Conflicts between transit and automobile vehicular traffic and bicyclists, particularly on planned routes and in station areas.
2. Safety impacts due to the increased number of vehicles operating in station areas and along the Corridor alignment.
3. Safety and convenience of bicyclists at transit station areas.
4. Integration of Corridor bicycle facilities with existing and planned bicycle routes and trails.

3.5 Summary of Transportation Impacts

The following provides an overview of the highway system, pedestrian, and bicyclist impacts, including capacity constraints and safety impacts, possibly resulting from implementation of the No Build, TSM, and Guideway build alternatives. At this level of analysis, possible impacts have been noted, but are not specified nor are mitigation measures identified. The identified impacts are considered reasonably representative for the purpose of comparing alternatives. During any subsequent preliminary engineering work, the proposed system components and requirements would become more detailed, and impacts to Corridor vehicular traffic, pedestrians and bicyclists would be assessed accordingly, and described in any subsequent future environmental review efforts.

No Build Alternative

The No Build Alternative freeway and arterial improvement projects would have beneficial effects on the functioning of the Corridor's highway system. The transit component is comprised of the existing bus and rail systems with service and system improvements as required to meet projected 2035 ridership demands. The planned transit service improvements may have minor operational impacts on the functioning of the Corridor's arterial system, and conversely, are anticipated to have benefits with some daily trips shifting to transit. The minor increases in bus services may have a minor impact on Corridor highways, and pedestrian and bicycle facilities, and where necessary would be addressed in project-specific environmental documentation.

TSM Alternative

The TSM Alternative includes all of the projects in the No Build Alternative, plus the transit, arterial, and bikeway system improvement projects identified for implementation by 2035 with Metro and OCTA staff. The increase in bus transit services included in the TSM Alternative would operate along with the other vehicles in mixed-flow conditions on the Corridor's highway system, or in HOV lane conditions on the Corridor's freeway Transitway and HOV lane system. Implementation of related signal priority systems on arterials would facilitate the smooth flow of bus service, while minimizing the impact of the additional bus operations on arterial conditions. Freeway-based bus service may have some impact on freeway operations as the buses enter the freeway and circulate to and from the HOV lanes, but conversely may have highway system benefits with some daily trips shifting to transit. The Orange

County arterial improvements would have significant benefits on the arterial system and connections on to the SR-22 and I-5 freeways.

As this option would increase the number of buses operating in the study area over those identified under No Build conditions, implementation of the TSM Alternative may result in some or all of the following impacts:

1. Impacts to city street operations due to increased bus activity may result in impacts to traffic capacity and flow.
2. Conflicts between buses and pedestrians and bicyclists may occur due to the increased number of transit vehicles operating in the Corridor.
3. There may be an increase in conflicts between transit vehicles, other vehicles, pedestrians, and bicyclists along the arterial system and at crosswalks due to the anticipated increase in the number of transit patrons who would access the system as pedestrians or bicyclists.

BRT Alternatives

In the Corridor, the BRT Alternatives are defined as limited stop bus service operating in a combination of configurations:

- **Northern Connection Area** – street-running mixed-flow operations and/or freeway HOV lane operations;
- **PEROW/WSAB Area** – dedicated lane operations on the former PE Railway ROW; and
- **Southern Connection Area** – street-running mixed-flow operations.

In this AA study, the proposed BRT service consists of two alternatives: a Street-Running Alternative operating in mixed-flow conditions with signal priority improvements on city streets in the cities of Los Angeles, Vernon, Huntington Park, South Gate, Paramount, Bellflower, and Santa Ana; and a HOV Lane-Running Alternative primarily operating in HOV lanes on the I-110/Harbor Transitway and I-105 freeways, but with city street operations at both ends of study area. In the northern portion, this option would operate in Los Angeles north from the I-110/Harbor Transitway to the 7th/Metro Center Station serving the Metro Red, Purple, and Blue lines in existing peak period dedicated lanes (with some queue jumpers). In the southern end of the Corridor, this alternative would run on city streets with signal priority improvements through Santa Ana to connect with the SARTC.

Both of the BRT Alternatives would increase the number of buses operating in the study area over the No Build and TSM conditions. The Street-Running Alternative would be operated in 16 peak period 40-foot vehicles similar to the Metro Rapid system, and the HOV Lane-Running Alternative would utilize 32 peak period 45-foot vehicles similar to those used for the Metro Silver Line. When operating on city streets, a signal priority system would facilitate the smooth flow of bus service, while minimizing the impact of additional buses. In the Northern Connection Area, the impact of additional buses would have a negative impact on the operations along the physically-constrained Soto Street portion of the Street-Running Alternative alignment. Possible arterial impacts for some street cross-sections may include:

conflicts between buses and mixed flow traffic; some increase delay and congestion due to additional green time for BRT buses; and some impacts to automobile right turn movements at intersections. In addition, there may be some impact to the Corridor's arterial system operations due to increased station area vehicular activity related to drop-off and parking circulation. Detailed highway system impacts would be identified through possible future study efforts.

In the street-running sections, the BRT Alternative would utilize existing roadway space, and there may be some impacts to pedestrians and bicyclists along these street segments such as impacts to pedestrians crossing Corridor streets and bicyclists traveling along the streets. As this option would increase the number of buses operating in the study area over those identified under No Build conditions, implementation of the BRT Alternatives may result in some or all of the following impacts to Corridor pedestrians and bicyclists:

1. There may be an increase in conflicts between transit vehicles and pedestrians and bicyclists, particularly at crosswalks due to the anticipated increase in the number of transit patrons who would access the system as pedestrians or bicyclists.
2. Conflicts between vehicular traffic and pedestrians and bicyclists may occur due to the increased number of transit vehicles operating in the Corridor.
3. The safety and convenience of pedestrians and bicyclists at station stops, including the widening the sidewalks to accommodate lighting, shelters, emergency communication, fare equipment, and system information, provision of signage and striping improvement and/or bicycle rack or lockers, should be considered if more detailed plans are developed.

Guideway Alternatives

Introduction of a high-capacity transportation system improvement would have impacts to city street operations. In summary, at-grade systems may result in impacts to traffic capacity and flow, and the removal of on-street parking. Grade-separated systems may result in the loss of street capacity, left-turn lanes, and on-street parking due to column placement.

The Guideway alternatives consist of three modal alternatives: Street Car, LRT, and Low Speed Maglev options that are planned to operate in a range of street and active and inactive railroad ROWs. The guideway alternatives would have no impact on the study area's freeway system, and would have benefits with some daily trips shifting to transit. All three options would impact the Corridor's arterial system operations due to increased station area vehicular activity related to drop-off and parking circulation, along with feeder bus and circulator services.

As discussed above, the Low Speed Maglev Alternative would operate in an entirely grade-separated configuration and the only arterial system impacts would be related to the potential for column placement to affect on-street parking and median left-turn operations with some possible queuing impacts to street flow. During the AA study, the Street Car and LRT options were evaluated as operating in a combination of at-grade and grade-separated operations that would have impacts on the Corridor's arterial system. Possible impacts for some street cross-sections may include: conflicts between trains and vehicular traffic; reduction in street capacity; increased vehicular delays and congestion due to additional green time for trains, and/or new signals to accommodate and protect left-turning vehicles; and impacts to left and right turn movements due to transit facilities resulting in redistribution of traffic on parallel streets, including residential streets. Detailed highway system impacts and possible mitigation measures, along with resulting benefits, would be identified through future study efforts.

Street Car and LRT Alternatives

In the PEROW/WSAB Corridor, the Street Car Alternative was defined as rail service similar to that being planned by Santa Ana and operating in a combination of the following alignment configurations:

- **Northern Connection Area** – separate guideway in a combination of at-grade and grade-separated operations;
- **PEROW/WSAB Area** – dedicated guideway operations in either a combination of at-grade and grade-separated operations, or grade-separated operations-only on the former PE ROW; and
- **Southern Connection Area** – mixed-flow guideway operations in either an at-grade or a grade-separated configuration.

In the street-running operations in the cities of Los Angeles, Vernon, Huntington Park, and Santa Ana, the Street Car and LRT alternatives would utilize existing roadway space, and there may be some impacts to arterial traffic, pedestrians, and bicyclists along these street segments. There may also be some impacts to pedestrians crossing and bicyclists circulating along the streets. Along the PEROW/WSAB Corridor, there may be impacts due to the diagonal crossing of Corridor streets. Implementation of the Street Car or LRT alternative may result in some or all of the following impacts to Corridor pedestrians and bicyclists:

1. In the at-grade segments, there may be an increase in conflicts between transit vehicles and pedestrians and bicyclists, particularly at ROW crossings, particularly in the PEROW/WSAB Area. Pedestrians and bicyclists are accustomed to crossing a vacant ROW, and possible new hazards would be created with a rail system operating at an average speed of 30-35 mph. Vehicular and pedestrian gates, along with signs, signals, and noise devices, would be considered to reduce any impacts identified with the preparation of more detailed engineering and station plans.
2. There may conflicts between pedestrians and bicyclists and increasing station area vehicular traffic, due to bus, circulator, kiss-and-ride (drop-off), and park-and-ride access.
3. The safety and convenience of pedestrians circulating to and waiting at at-grade and grade-separated stations, including the widening of sidewalks and provision of street crossing improvements should be considered as more detailed plans are developed.
4. The safety and convenience of bicyclists in station areas, including the provision of signage and striping improvement and/or bicycle racks or lockers, should be considered as more detailed plans are developed.

Low Speed Maglev Alternative

In the Corridor, the Low Speed Maglev Alternative was defined as service similar to that operated as the Linimo system in Nagoya, Japan, and operating solely in a grade-separated configuration up to its Harbor Boulevard terminus. Implementation of the Low Speed Maglev Alternative may result in some or all of the following impacts to Corridor pedestrians and bicyclists:

1. There may conflicts between pedestrians and bicyclists and increasing station area vehicular traffic, due to bus, circulator, kiss-and-ride (drop-off), and park-and-ride access.
2. The safety and convenience of pedestrians circulating to (using stairs, escalators, and elevators) and waiting at grade-separated stations, including the widening of sidewalks and provision of street crossing improvements should be considered as more detailed plans are developed.
3. The safety and convenience of bicyclists in station areas, including the provision of signage and striping improvement and/or bicycle racks or lockers, should be considered as more detailed plans are developed.
4. The safety and convenience of bicyclists in station areas, including the provision of signage and striping improvement and/or bicycle racks or lockers, should be considered as more detailed plans are developed.