I-105 Corridor Sustainability Study

Final Report

prepared for

Southern California Association of Governments

SCAG™

INNOVATING FOR A BETTER TOMORROW

prepared by

CAMBRIDGE SYSTEMATICS

with

Arellano Associates

JMDiaz, Inc.

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Executive Summary

The Southern California Association of Governments (SCAG) was awarded a Caltrans Sustainable Transportation Planning Grant to examine the multi-modal I-105 corridor and to assess its future potential through a Corridor Sustainability Study (I-105 CSS). Historically, SCAG, working in partnership with Caltrans, has developed Corridor System Management Plans (CSMPs) and other planning efforts for a number of freeway corridors throughout the region. Freeway corridor planning has traditionally focused on delay due to congestion along the mainline highway. The I-105 CSS goes beyond the traditional planning framework and examines the entire I-105 corridor from a multi-modal perspective.

Simultaneous with the development of the I-105 CSS, Caltrans developed their Corridor Planning Guidebook and the California Transportation Commission (CTC) developed and published their Comprehensive Multimodal Corridor Plan (CMCP) guidelines. These corridor planning guides are intended to provide the framework for assessing transportation improvement projects as part of the Road Repair and Accountability Act of 2017, or Senate Bill (SB) 1. SB 1 requires that funding shall be available for projects that make specific performance improvements and are part of a comprehensive corridor plan designed to reduce congestion in highly traveled corridors by providing more transportation choices for residents, commuters, and visitors to the area of the corridor while preserving the character of the local community and creating opportunities for neighborhood enhancement projects. The I-105 CSS closely follows both the Caltrans and CTC corridor planning guides, and Caltrans was a partner agency in the development of the I-105 CSS.

Key tasks completed as part of the I-105 CSS included:

- Defined the study area based upon technical and policy considerations, including input from key stakeholders.
- Developed and implemented a stakeholder engagement strategy
- Conducted data collection and analysis as part of current conditions and future baseline conditions assessment
- Identified planned investments and recommended additional projects to address known deficiencies
- Developed an evaluation framework to assess the current conditions and future baseline conditions, and to evaluate the potential improvements
- Determined the funding need and available resources to support corridor investments

The results of the I-105 CSS, included in this report, include a detailed assessment of the corridor conditions, a list of projects to improve corridor conditions, and a framework for evaluating the potential improvements.

To understand the transportation issues facing the corridor and to inform the recommendations of the study, the I-105 CSS included detailed assessments of both current and projected transportation future conditions. This effort included an analysis of all modes (roadway, transit, active transportation, and freight) as well as cross-cutting themes like safety, complete streets, and emerging technologies. Projects included in the I-105 CSS were evaluated based on how well they further the objectives of the study and how well they addressed the identified deficiencies in the transportation system described in Section 2.0 below. Table ES 1 presents a high level summary of key identified deficiencies and the types of projects that will help to address those deficiencies.

I-105 Corridor System Deficiencies	Key Project Types to Address I-105 Corridor Deficiencies
Peak Period Freeway Congestion Higher than county average collision rates on I-105	I-105 System Improvements (such as Express Lanes, spot operational improvements, ramp improvements, interchange improvements, integrated corridor management)
High Congestion and VMT on arterials Firestone, Vermont, Western, Van Ness, Rosecrans, Sepulveda, Lakewood, Manchester, Imperial Highway, Artesia	Arterial Intelligent Transportation Systems projects including traffic signal synchronization, interconnect Spot intersection improvements including lane additions and signal timing modifications Arterial/rail grade separations Access management projects
Low Transit Mode Share and declining ridership countywide	Major transit projects including West Santa Ana Branch transit corridor project, Green Line extension, Vermont Transit Corridor and bus rapid transit corridors Metrolink Commuter Rail program enhancements Green Line capital and operational improvements including adding rail tracks and crossovers and extending station platforms to allow 3-car trains Tram link to Inglewood stadium Local transit service improvements Enhance airport express bus service Expansion of park-and-ride
Lack of bicycle routes in much of the corridor and low bicycle usage in some areas	Implement multiple city bike plans First/Last Mile Projects Bike/Pedestrian bridges Eco-rapid transit bike trail Rails to trails corridor
Bicycle collision concentrations mid-corridor	Implement city and county bike projects including Class 1, 2 and protected bike lanes (Class 4) Freeway ramp terminus pedestrian and bicycle enhancements (implement Caltrans Interchange Control Evaluation – ICE process)
Arterial roadway pavement deterioration	Resurfacing and reconstruction projects
Truck collision concentrations	Grade separation and crossing projects Truck oriented intersection improvements (curb return widening, signal improvements oriented to trucks, etc.)
Significant low income population and vulnerable communities areas	Increase transit options via bus restructuring Implement transit enhancements and projects noted above

Table ES.1 Summary of Corridor Deficiencies and Key Project Recommendations

A total of 425 projects were identified for inclusion in the I-105 CSS. These projects were identified though: 1) A review of existing plans and studies from Metro, Caltrans, SCAG, corridor cities, and the County of Los Angeles and 2) New projects proposed through the input and guidance from the Technical Advisory Committee and the Project Development Team. The project team compiled and shared project lists with corridor city staff to ensure projects were consistent with current city priorities and plans, and to identify any new projects not included in existing plans or studies. The projects were then evaluated based on the evaluation framework, shown in Figure ES 1 below, based on the goals and objectives of the I-105 CSS and input from stakeholders early in the process.

The process for evaluating potential improvements included:

1) Project Categorization, 2) Qualitative Performance Evaluation, 3) Quantitative Performance Evaluation, and 4) Organization.

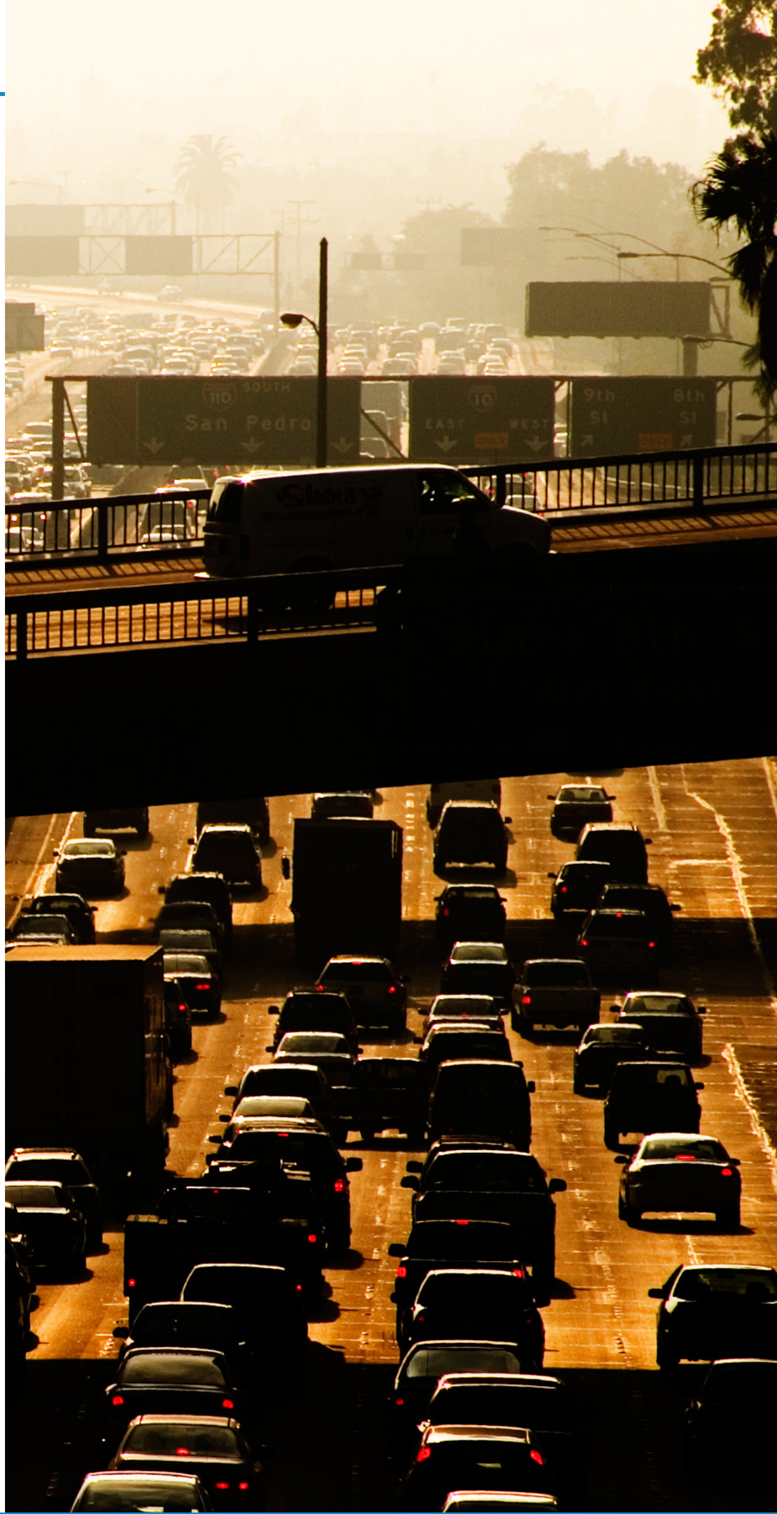
Figure ES.1 Performance Evaluation Process

Described in Section 4.0, the results of the project evaluation are organized by implementation time frame (the basis of each "scenario") and grouped by evaluation tiers (high performing, middle tier, and lower performing). More than half of the projects are near-term, about a quarter are mid-term, and only 20 are long-term projects. Over half of the projects fall in the middle tier in terms of performance and roughly one quarter of all projects are included in both the top and bottom performance tiers. The funding needed to implement all the projects included in the I-105 CSS exceeds $21 billion.

1.0 Study Overview

The Interstate 105 (I-105), also referred to as the Glenn Anderson Freeway or Century Freeway, is a major east-west freeway located in the southern part of Los Angeles County. It is considered an essential component of the California Freeway and Expressway System, as it provides for both interregional and intraregional travel and connects several major north-south corridors, including I-405, I-110, I-710, and I-605. It also provides a connection to the Los Angeles International Airport (LAX), the largest and busiest airport in California. The freeway originates in the City of El Segundo, west of I-405, and terminates at Studebaker Road, east of I-605 in the City of Norwalk. The freeway spans 18 miles and it ranges from six to eight lanes, including six general purpose lanes and two high-occupancy vehicle (HOV) lanes at maximum capacity, in addition to auxiliary lanes between most on-ramps and off-ramps.

In 2016, the Southern California Association of Governments (SCAG) was awarded a Caltrans Sustainable Transportation Planning Grant to examine the multimodal performance of the I-105 corridor through a Corridor Sustainability Study (I-105 CSS). While Caltrans regularly studies operational conditions along freeway corridors, the I-105 CSS was designed to go well beyond typical freeway studies and examine I-105 and the surrounding corridor from a multimodal perspective. In an effort to improve overall mobility and safety throughout the corridor, the I-105 CSS integrates new planning frameworks and sustainable strategies that go beyond the traditional approach of adding freeway lane capacity, including, but not limited to: complete streets concepts, transit alternatives, active transportation alternatives, managed lanes, arterial street improvements and advanced operational strategies. The I-105 CSS study area includes three miles on either side of I-105 (see Figure 1.1) and includes parts of the City of Los Angeles (including LAX), parts of unincorporated Los Angeles County, and portions of several cities along the corridor. The geographic limits of the study area were defined by the project team working with the Technical Advisory Committee (TAC), and considering travel patterns and transportation system linkages in the region.



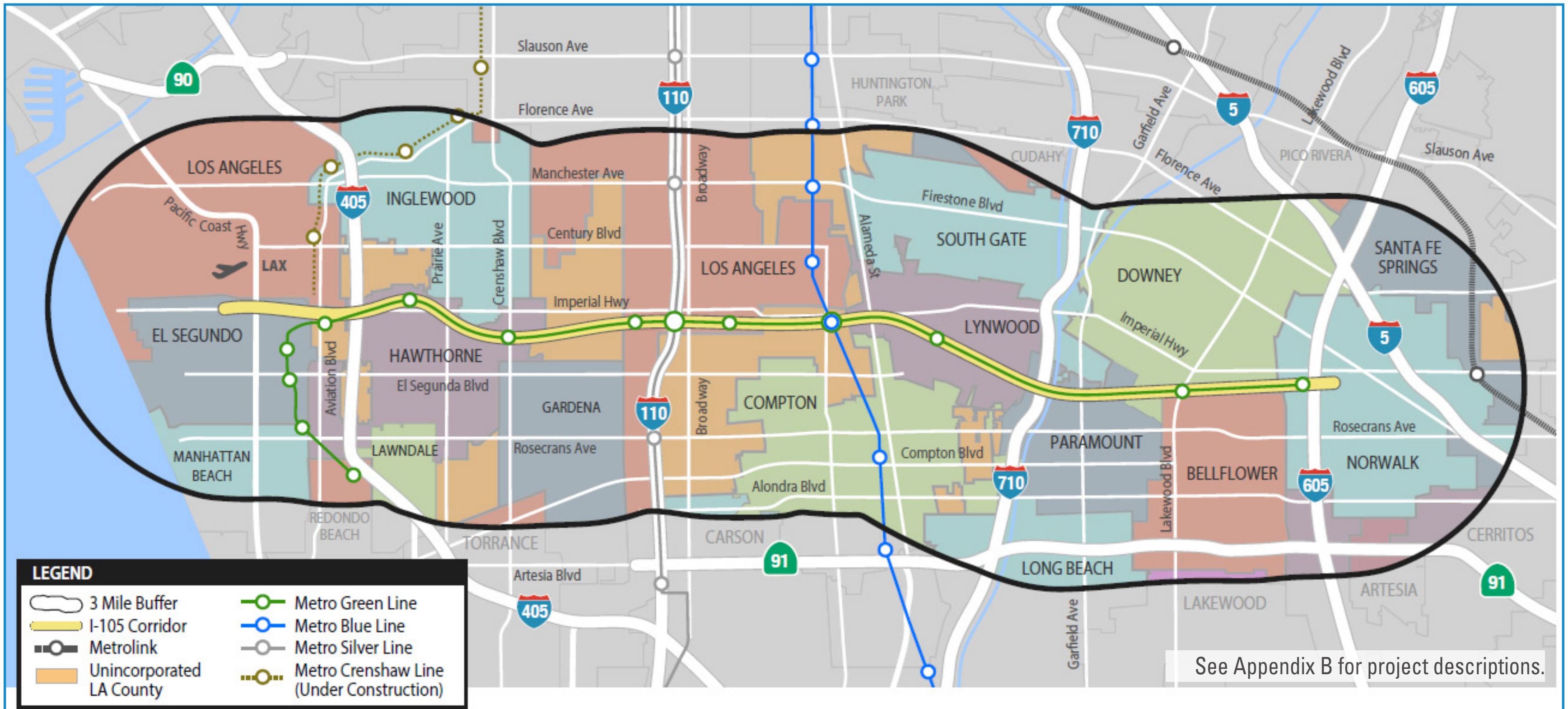


Figure 1.1 I-105 CSS Study Area

On a typical day, the freeway carries more than 270,000 vehicles at its most heavily traveled location including more than 17,000 vehicles during the highest peak hour of the day. On an annual basis, it is estimated that these motorists experience more than 3.7 million hours of delay. The California Department of Transportation (Caltrans) notes that current daily traffic demand on some sections of the freeway exceeds capacity. There is heavy travel demand on both weekdays and weekends, and the existing traffic on the mixed flow and HOV lanes exceeds the capacity during peak hours. Caltrans found in its I-105 Transportation Concept Report that, over the course of the next 20 years, traffic volumes are forecasted to increase on the I-105 and future improvements are needed in order to improve mobility along the corridor. Although improvements to the corridor are needed, environmental, right-of-way and financial constraints, make it very difficult to add capacity to the freeway.

There is a network of arterial streets surrounding the I-105 that serve local destinations, connect to travelers to I-105, and provide alternative routes to travelers wishing to avoid peak hour congestion on the freeway. Currently, some of the parallel streets fail to provide effective alternatives due to high travel demand as well as physical capacity and operational constraints, numerous traffic signals, access conflicts, and peak hour congestion. In addition to parallel arterial roadways, the Metro Green Line light rail (LRT) offers a high capacity alternative to driving, running for the majority of the route in the median of the freeway. Green line stations are located at several locations and they allow for transit transfer access to the Metro Blue Line, Metro Silver Line and other transit services along city streets. Although the Metro Green Line carries an average of 40,000 riders daily, it is considered under-utilized and it has capacity to carry additional transit patrons. The eastern terminus of the Green Line is located approximately 2.8 miles short of the Norwalk/Santa Fe Springs Metrolink Station. The possibility of an alignment extension further east to provide direct connectivity to Metrolink station is currently being explored in a separate study.

The purpose of this study is to identify and recommend multimodal transportation investments options that would improve overall corridor mobility while balancing safety and environmental considerations. The goals of this corridor are as follows:

- **Mobility**—Improve multimodal mobility by reducing travel times and enhancing the efficiency and reliability of the multimodal corridor.
- **Accessibility & Equity**—Enhance system connectivity through improved access to non-single occupancy vehicle modes; improved service to low-income and transit-dependent populations throughout the corridor; and more equitable distribution of investments throughout the study area.
- **Safety**—Improve corridor safety by promoting investments that address collision hotspots and help to reduce serious injuries and fatalities on the multimodal transportation system.
- **State of Good Repair**—Promote a state of good repair on the multimodal transportation system, improving and preserving existing system assets wherever possible.
- **Sustainability**—Promote a more sustainable, livable corridor by reducing harmful emissions and improving air quality and public health for all residents.

The development of the I-105 CSS has been a joint effort involving key agencies including SCAG, Caltrans, the Los Angeles County Metropolitan Transportation Authority (Metro), and the corridor cities. This summary report provides an overall description of the performance measurement methodology, existing and conditions analysis, future conditions analysis, and scenario results. It is organized as follows:

- **Section 2.0**. The I-105 CSS included a detailed assessment of study area land use, demographics, and the key transportation modes and facilities, including the freeway system, arterial street network, transit network, bikeway network, pedestrian travel patterns, and goods movement.
- **Section 3.0**. The evaluation framework, developed with input from the Technical Advisory Committee (TAC), was used to quantify the performance of the transportation system and evaluate potential improvements. The framework and the potential improvements are described in Section 3.0 and Appendix B.
- **Section 4.0**. The results of the I-105 CSS include an evaluation of various transportation improvement scenarios. The results include the estimated cost of each scenario and potential funding sources to implement the priority improvements.

2.0 Transportation System Performance

To understand the transportation issues facing the corridor and to inform the recommendations of the study, the I-105 CSS included detailed assessments of both current and projected transportation future conditions. This effort included an analysis of all modes (roadway, transit, active transportation, and freight) as well as cross-cutting themes like safety, complete streets, and emerging technologies. Finally, a system-wide analysis explored how the transportation system as a whole performs relative to the I-105 CSS' established performance measures, described in Section 3.1 below. This section highlights some of the key takeaways from the detailed assessments found in Appendix C and Appendix D.

- **Land Use and Demographics**. This section presents an overview of the current and projected population and employment, the mix of land uses, and other factors that influence travel behavior.
- **Roadway**. This section highlights existing and future I-105 freeway and arterial conditions including congestion, safety, and state of good repair.
- **Transit**. This section details the existing transit coverage and ridership for Metro bus, municipal buses, Metro rail, and Metrolink commuter rail.
- **Active Transportation**. This section highlights existing and future bicycle and pedestrian infrastructure, current demand, and connectivity issues.
- **Emerging Technologies**. This section explores new and emerging technologies, such as autonomous vehicles and mobility-on-demand, and how it might impact the I-105 study area.

Land Use and Demographics: Current Conditions

The I-105 study area encompasses an area that stretches almost 25 miles, from the Pacific Ocean to within a few miles of the Orange County border. Within the corridor is a diversity of land uses, employment types and characteristics, destination and activity centers, and population characteristics. Some of the important trends are:

- The majority of the land use in the I-105 study area is single-family residential, though there are pockets of high density residential towards the middle of the corridor in South Los Angeles, Paramount, Bellflower, Hawthorne, Inglewood, Lynwood, and South Gate[1]. Industrial land uses also make up a significant portion of the study area, with concentrations of industrial development in various locations throughout the corridor including in Gardena, South Los Angeles, Paramount , El Segundo, South Gate and Santa Fe Springs. Figure 2.1 displays the existing land use patterns in the study area.

- The western and eastern ends of the I-105 study area have the greatest density of employment. The I-105 study area contained roughly 465,600 jobs in 2016, which is slightly more than 10% of all the jobs in LA County[2]. Education & healthcare represent the largest share of corridor jobs (20%), followed by professional and business services (13%); manufacturing (11%); and transportation, warehousing and utilities (11%). For most industries, these percentages are similar to the job profile across the entire County, with a few notable exceptions. Due to the proximity to the Port complex and LAX, the share of transportation, warehousing, and utilities (11%) is significantly higher than the countywide average (5%). Additionally, the share of professional/business services in the Study Area (13%) is lower than the county average (16%).

- The I-105 study area has a diversity of activity centers and destinations spread throughout the corridor cities, including several colleges, parks, shopping areas, and community resources. Notable destinations include LAX, the beach communities, shopping centers such as the Plaza El Segundo, the Plaza Mexico, Crenshaw Imperial Plaza, and Azalea Regional Shopping Center, the Forum and soon to be completed NFL stadium in Inglewood, the Watts Towers Cultural Center, and several colleges and universities, including Southwest Los Angeles College, El Camino Community College, Loyola Marymount University, and Cerritos College.

- Roughly 14% of the County's population, totaling 1.43 million people, lives in the I-105 study area[3]. This population is predominately non-White (90%); roughly 65% of the residents are Hispanic/Latino and 18% African American. The population is also predominately lower income. Only 28% of the households have an income higher than $75,000, and 21% of the households have incomes below the federal poverty level (as compared to 17% in LA County as a whole). Thus, the percent of people below the poverty level is 20 percent higher in the I-105 Study area than the County.

- As defined by the CalEnviroScreen, an index of exposure that takes into account environmental and socioeconomic factors[4], 76% of the census tracts in the I-105 study area are considered "disadvantaged communities," which are the top 25% most vulnerable census tracts according to the index. As shown in Figure 2.2, the central portion of the study area has the highest concentration of disadvantaged census tracts. These areas overlap with SCAG's Communities of Concern[5] designation, an indicator of high levels of lower income and minority populations, and also tend to be the areas with the highest transit ridership and lowest income levels.

- Despite demographic differences between the study area and the County overall commute travel patterns and car ownership rates are similar, except for a slightly higher carpooling rate[6].

Currently, 14% of the County population lives in the study area and is expected to increase 7% by 2040.

Source: SCAG Travel Demand Model for RTP/SCS 2016: http://rtpscs.scag.ca.gov/.

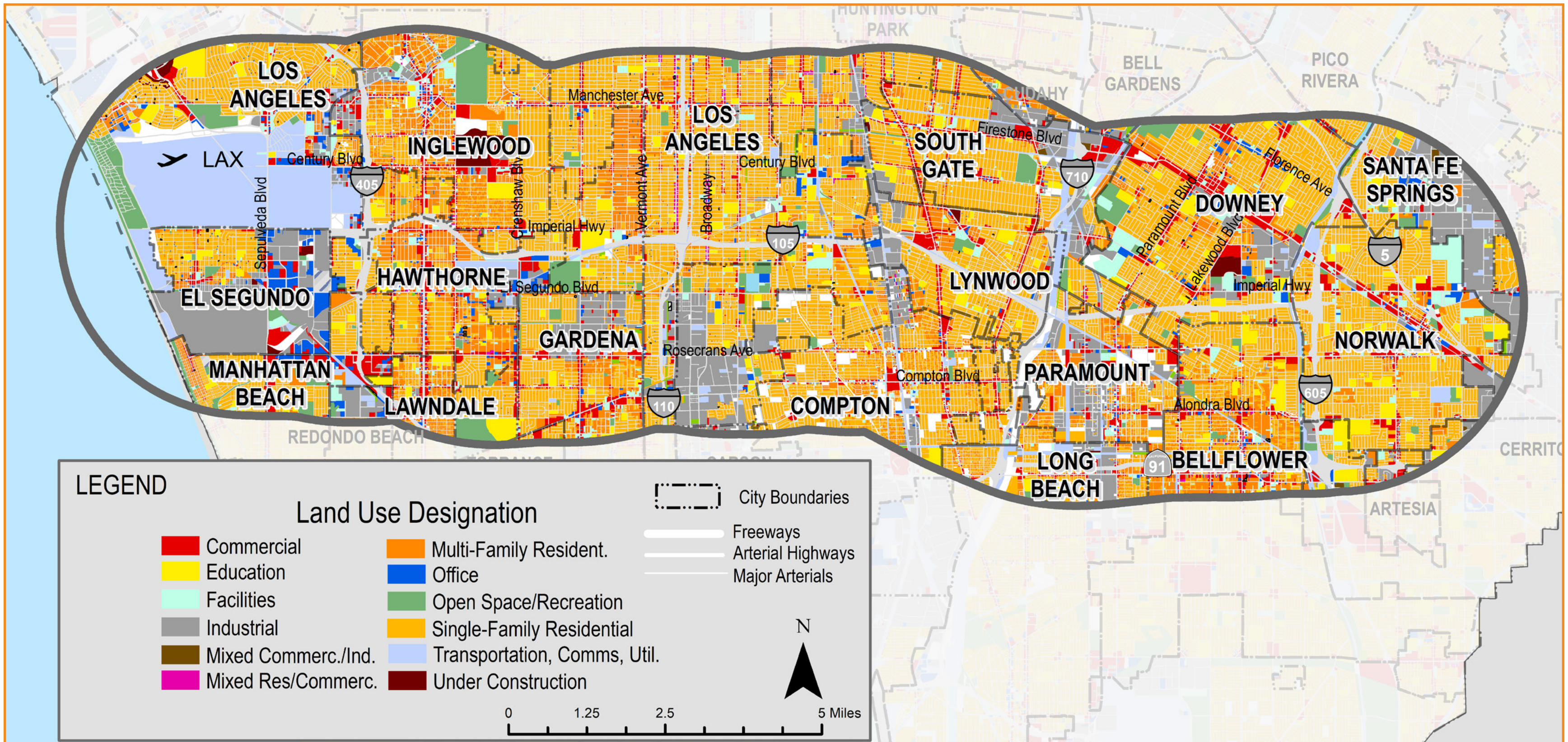


Figure 2.1 Existing Land Use

Source: SCAG 2012 Countywide Land Use.

As defined by the CalEnviroScreen, 76% of the Census Tracts in the I-105 Study Area are considered "disadvantaged communities" and 21% of households are below the federal poverty level.

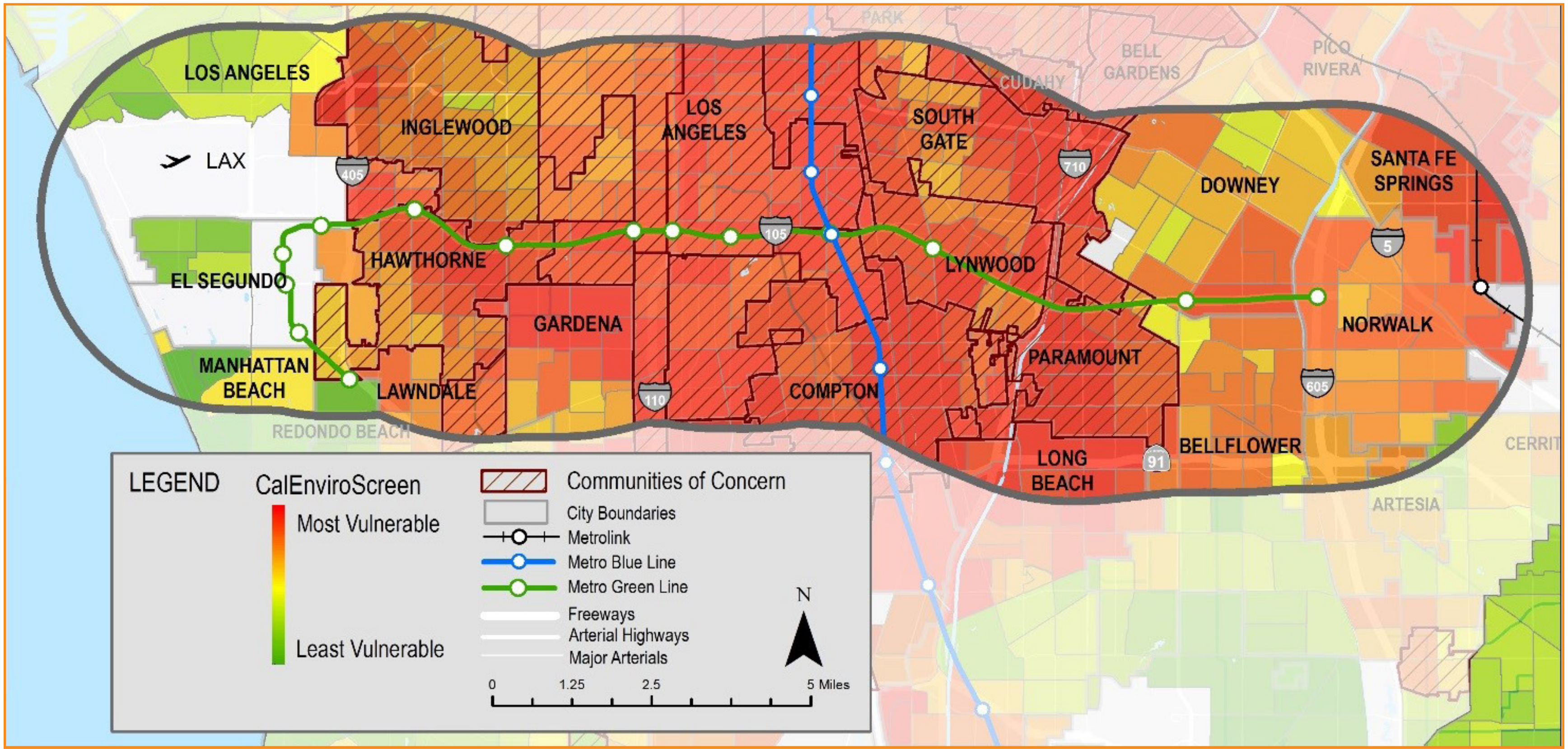


Figure 2.2 CalEnviroScreen and SCAG Communities of Concern

Source: CalEPA CalEnviroScreen 3.0; SCAG 2016 RTP.

Land Use and Demographics: Future Conditions

- In 2040, the population of LA County is projected to be over 11.5 million people, a 13.7% percent increase from 2016[7]. In the I-105 study area, the population increase is expected to be considerably lower than the county average, with a 7.1% increase from 2016 to 2040. The majority of the projected growth in LA County is anticipated in areas that are experiencing densification, such as Downtown Los Angeles, or areas that are not already developed, like the Antelope Valley. Figure 2.3 displays the study area projected population growth.
- Most of the growth is anticipated in areas that already have moderate levels of population density. The two notable exceptions are in Inglewood, where the Hollywood Race track is being redeveloped into an entertainment, retail, and housing development, and an area in Cudahy and Bell Gardens near where I-710 passes Florence Blvd.
- The majority of the population growth in the I-105 study area will occur in just three cities: Los Angeles (17% of 2016 population and 29% of growth), Inglewood (8% of 2016 population and 12% of growth), and South Gate (7% of 2016 population and 14% of growth)[8].
- Jobs in the I-105 study area are projected to grow by 15% between 2016 and 2040, a rate of 0.58% annually, whereas the county is projected to grow 17%, or 0.67% annually.
- The greatest total increase in jobs is projected to be clustered around LAX and neighboring parts of El Segundo and Manhattan Beach. Areas in Inglewood, Paramount, and Santa Fe Springs are also projected to have significant employment growth, areas that already have significant levels of employment.
- The City of El Segundo has the highest total growth rate (30%), but this accounts for only 9% of the employment growth in the I-105 study area. The City of Los Angeles, which had 20% of the jobs in the I-105 study area in 2016, accounts for over 40% of the projected employment increase.
- The projected mode share in 2040 based on SCAG's regional travel demand model shows only slight changes from 2016, with a small shift towards modes other than driving alone.
- The travel demand model, however, does not account for the changes in technologies that shift how the modes operate (e.g. connected and autonomous vehicles) nor does it account for changes in technologies that will impact overall trip-making. Two phenomena that have the potential to dramatically alter trip making are the increase in telecommuting and on-line shopping and delivery.

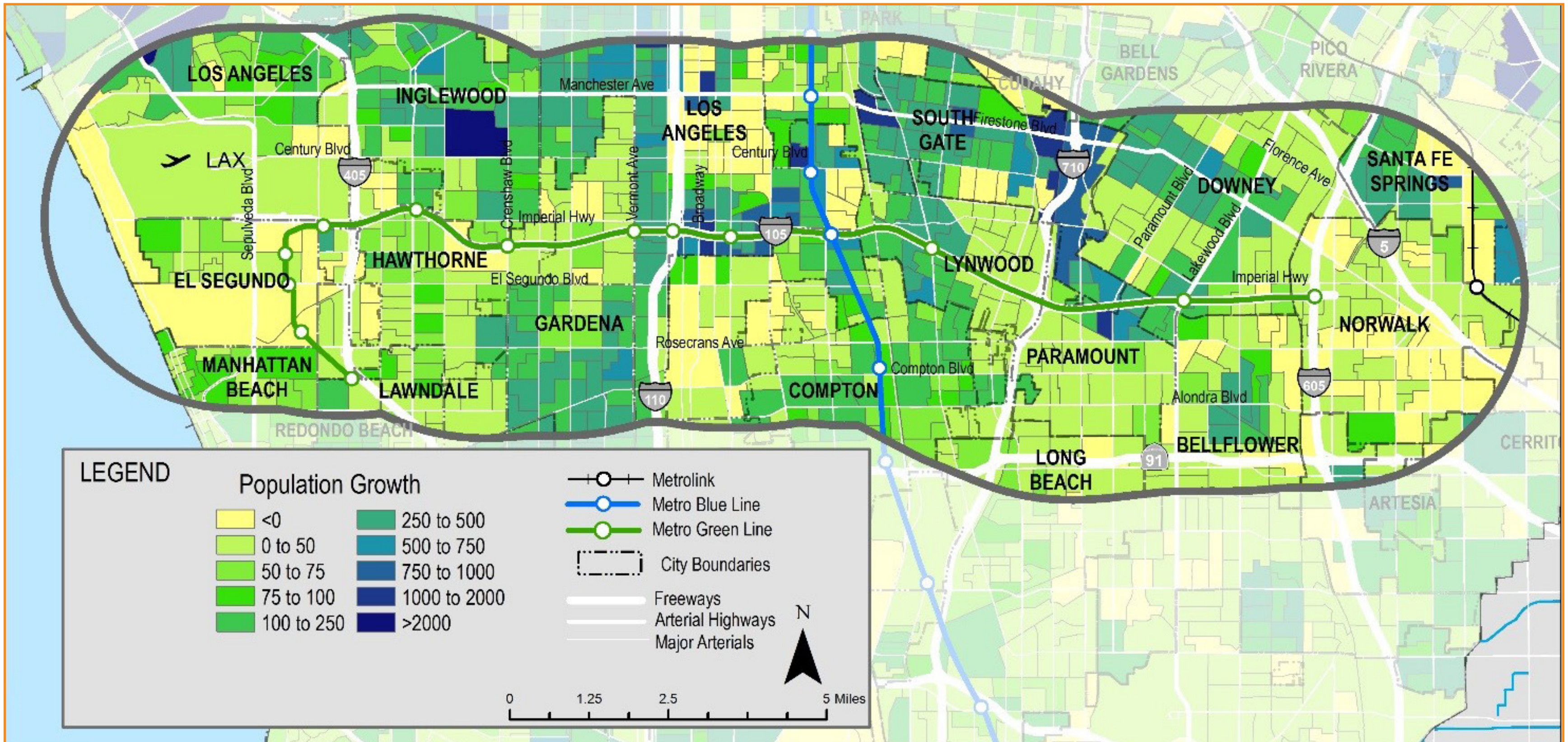


Figure 2.3 I-105 Study Area Population Growth, 2016 - 2040

Source: SCAG 2016 RTP/SCS.

Roadway System: Current Conditions

I-105 and the surrounding arterial network support high vehicle and truck volumes during peak and non-peak periods. The I-105 serves as an important backbone for the movement of goods and people to and from residential neighborhoods, employment centers, commercial areas and more Some of the key characteristics of the roadway system in the study area include:

Freeway Conditions

» The greatest congestion, highest volumes, and lowest speeds on I-105 occurs westbound in the AM peak period and eastbound in the PM peak period. Figure 2.4 displays the I-105 freeway speed contour, which highlights areas of slowing in the eastbound direction during the PM peak hour. Similar information for the westbound direction is provided in Appendix C.

- Overall, highest vehicle volumes occur in the westbound direction, in the AM peak hour when the congestion level is low and motorists are able to drive near the posted speed limit. During that time, traffic flow exceeds 2,100 vehicles per hour[9], which is near capacity of the system.
- Eastbound travel during the PM peak period, which occurs from 2 PM to 8 PM, experiences the worst congestion from west of I-110 to Long Beach Boulevard[10].
- Congestion bottlenecks along the I-105 are often related to a confluence of arterial on-ramps or freeway interchanges, as well as geometric conditions.
- The average vehicle occupancy in the HOV lanes is around 2.1 persons per vehicle, compared to only 1.1 persons per vehicle in the general purpose lanes[11].

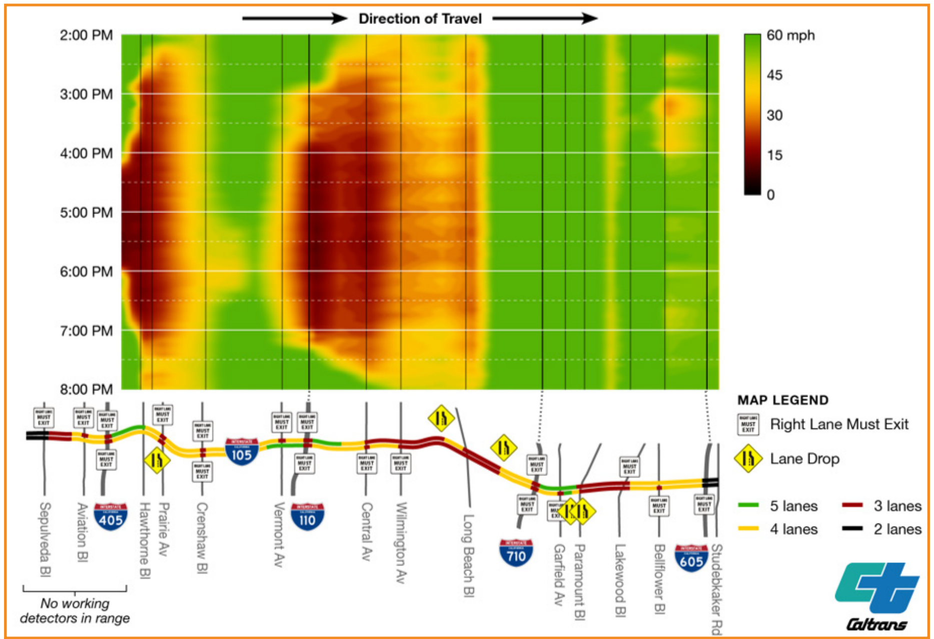


Figure 2.4 Speed Contours EB PM Peak

Source: Cambridge Systematics. Active Traffic Management Congestion Relief Analysis Study, May 2014.

The I-105 experiences the highest level of congestion during the evening peak period in the eastbound direction.
In recent years, fatalities and serious injuries in the study area have remained relatively constant while minor injuries have nearly doubled.

- HOV lane speeds during the AM peak hour are lower in the westbound direction then the eastbound direction, with westbound speeds falling to under 40 miles per hour in some portions of the corridor in the morning[12]. Eastbound HOV lane speeds are consistently above 60 miles per hour. Average PM peak hour speeds in the HOV lanes have greater variability in both the eastbound direction, with segments between Vermont and I-110 and to I-710 to Lakewood Boulevard experiencing speeds around or lower than 40 mph, while eastbound HOV speeds also exceed 65 miles per hour in the afternoon between Central Avenue and Long Beach Boulevard. Westbound, PM HOV lane speeds are generally in the range of 50 to 60 miles per hour.
- I-105 east of I-710 is a major route for trucks that are destined to and from the ports of Long Beach and Los Angeles (such as trucks with loaded or empty ocean containers), carrying approximately 20,700 total Heavy Duty Trucks today, 6,600 of which being port truck trips[13].

» Compared to other Los Angeles area freeways, I-105 collision rates slightly exceed the Los Angeles County average. Based on the Caltrans Performance Measurement System (PeMS) data, I-105 experiences a collision rate of just under 2.0 collisions per million vehicle miles traveled, as compared to the Los Angeles County average of about 1.75 collisions per million vehicle miles traveled (based on one year of data reported).

The I-105 freeway is generally in a state of good repair, but the local arterial roadways experience significant deterioration in pavement and overall condition.

» Concentrations of collisions in the westbound direction occur around Long Beach Boulevard, I-110, Vermont Avenue, Crenshaw Boulevard and the highest concentration around I-710. This location has a significantly higher rate than the other hot-spot locations, with a rate nearly double the other collision hot spots in the westbound direction. In the eastbound direction, the higher collision concentrations occur near Vermont/I-110, Central Avenue, Long Beach Boulevard, and between Lakewood Boulevard and Bellflower Boulevard.

» Unlike fatalities and severe injury rates, which remain relatively stable, there was a clear upward trend in overall collisions involving injuries from 2012 to 2016. Minor injury crashes, in particular, experienced a significant increase from 204 to 388 between 2012 and 2016[14].

» Primary Collision Factors on I-105 Freeway and ramps (as reported by SWITRS data) are Unsafe Speed (60%), Improper turning (15%) and Unsafe Lane Change (13%)[15].

» In general, the I-105 freeway has better pavement quality than the local arterial system. Based on Caltrans' MAP-21 Condition Category Pre-Treatment rating, approximately 75% of the I-105 freeway is considered to be in good conditions, with about 25% in fair condition and no portions in poor condition[16].

Arterial Conditions

» For arterials within three miles of I-105, during the PM peak hour, the eastbound travel times are higher, matching the eastbound congestion found on I-105, thus indicating a general eastbound pattern of demand and resultant congestion in the afternoon peak period throughout the corridor[17]. Figure 2.5 displays the bidirectional daily vehicle miles of travel on the study area arterial system.

» There are similarities between the arterials that carry the largest volumes of vehicles in terms of VMT, that experience the greatest vehicle hours of delay (VHD), and that have the highest travel time indices, where travel times are significantly higher than free-flow conditions. Table 2.1 displays the corridors with the highest VMT, VHT and Travel Times.

Vehicle Miles of Travel are projected to increase by 3% to 6%, but delay and travel time will increase proportionately more due to higher congestion in the future.

	Corridors with highest:		
Arterial	**VMT**	**VHT**	**Travel Time Index**
Firestone Boulevard	X	X	
Garfield Avenue		X	
Imperial Highway		X	X
Lakewood Boulevard	X	X	X
Long Beach Boulevard		X	
Manchester Avenue		X	
Rosecrans Boulevard	X		X
Sepulveda Boulevard	X		
Van Ness Avenue	X	X	
Vermont Avenue	X		
Western Avenue	X		

Table 2.1 Arterial Performance Indicators

Source: LA Metro Arterial Performance Monitoring Tool.

» Total injury collisions on arterials increased each year between 2012 and 2016 with minor injuries and fatalities showing a steady upward trend. There were nearly 28,000 reported arterial collisions (involving all modes) between 2012 and 2016, of which 1% resulted in fatalities, 5% in severe injuries, 26% in other visible injuries and 68% in minor injuries[18].

» Collisions involving bicyclists and pedestrians are spread throughout the I-105 study area, however, the highest density of collisions are concentrated in neighborhoods of South Los Angeles around the interchange of I-105 and I-110. Figure 2.6 displays the collisions involving bicyclists for the period from 2012 to 2016.

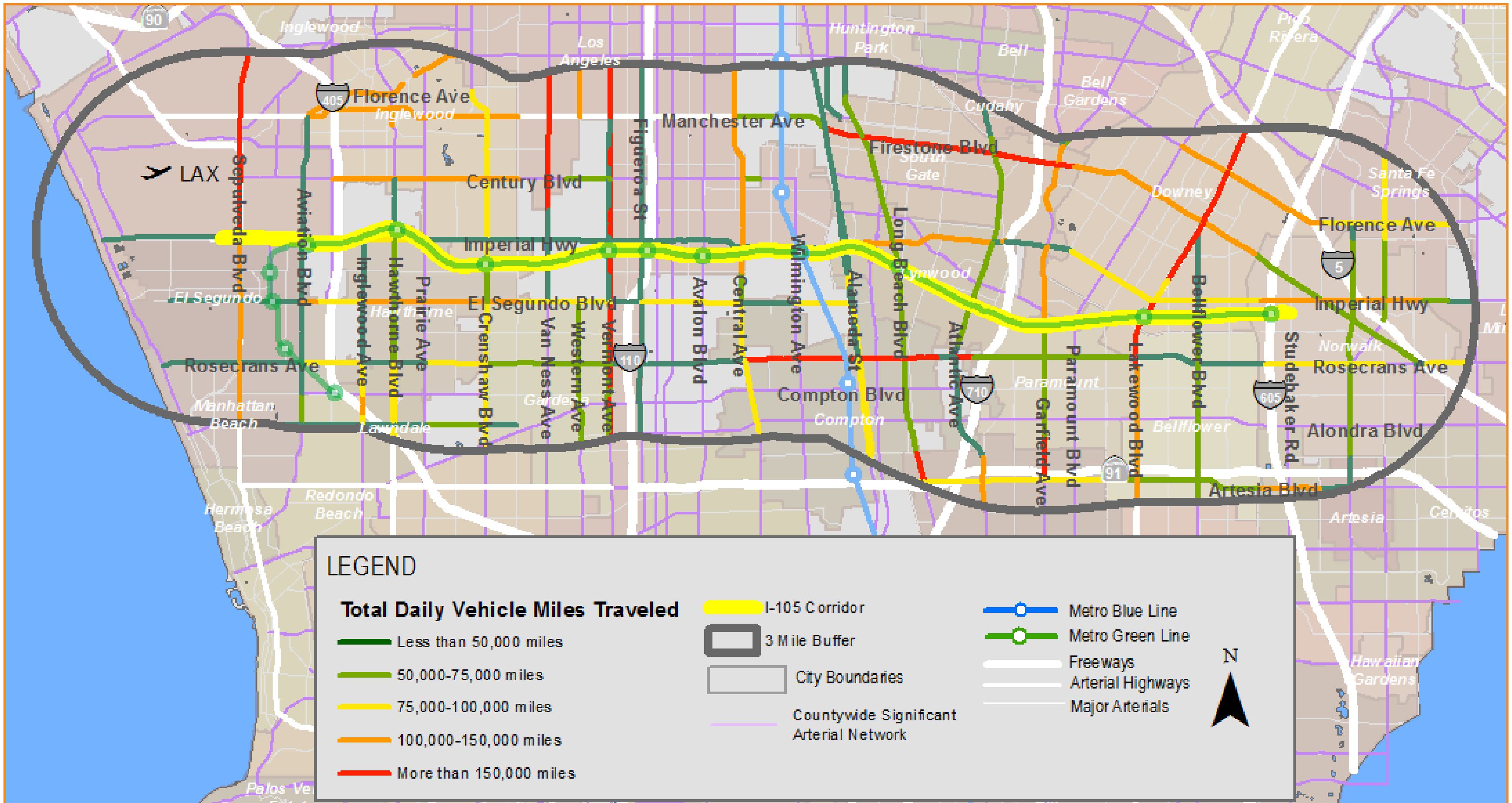


Figure 2.5 Arterial Bidirectional Daily Vehicle Miles Traveled, 2017

Source: Los Angeles County Metropolitan Transportation Authority. Metro Arterial Performance Measurement Tool, 2017.

- The highest concentration of truck collisions occurs in Gardena, southwest of the I-105 and I-110 interchange. Other areas of high truck collision frequency include Santa Fe Springs and along I-105 in Paramount, Bellflower, and Downey.

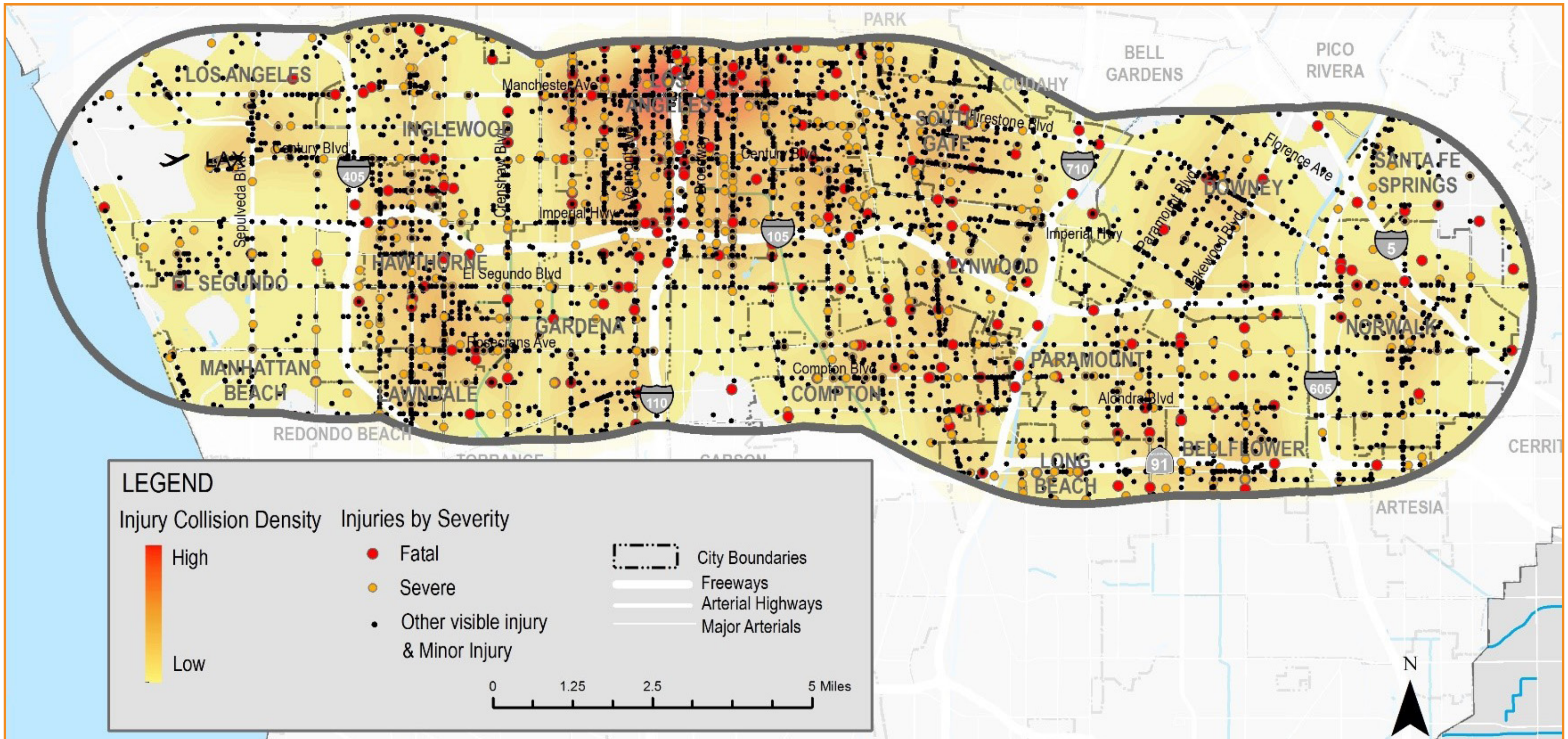


Figure 2.6 Collisions Involving Bicycles and Pedestrians, 2012-2016

Source: California Statewide Integrated Traffic Records System (SWITRS).

Roadway System: Future Conditions

» By 2040, daily trips on I-105 will increase between 2% to 6% depending on location along the freeway. While this does not seem like a large increase in volume, the effects on congestion will be exponentially greater because a small amount of added volume to an already congested facility disproportionately impacts congestion, speed and safety. As shown in Figure 2.7, most of the freeway system, including the I-105 and connecting freeways are already mostly at level of service (LOS) F (LOS F is shown as segments with volume-to-capacity ratios above 1.0 and with very high levels of congestion and slow speeds) during the PM peak period, and the LOS F conditions will increase. Figure 2.7 shows the base year and projected year 2040 levels of service on I-105 and the other freeways, and it shows that mostly during the PM peak hour the conditions are highly congested today and increasing in the future.

PM Volume-to-capacity ratios

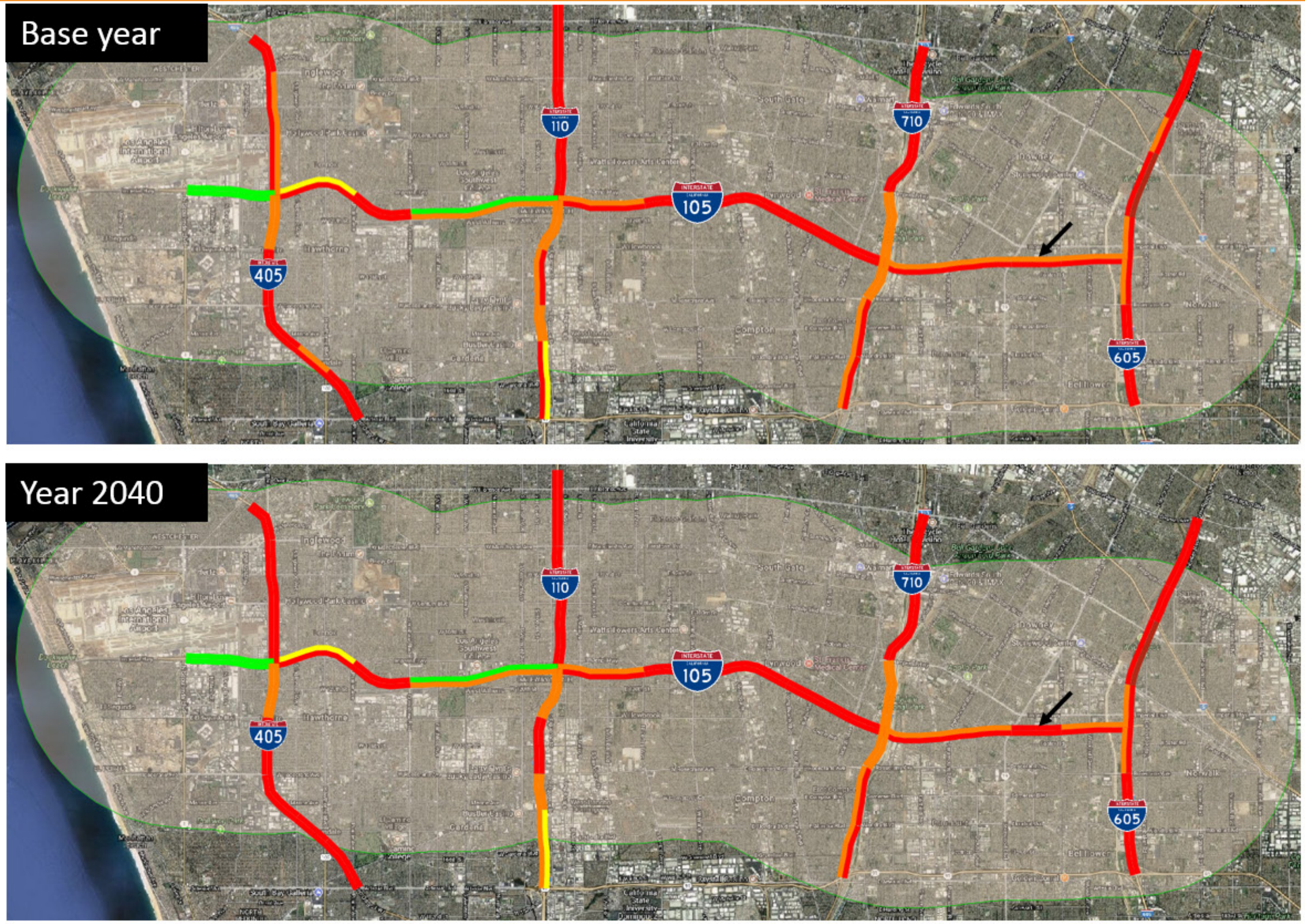
Observation
Very few differences between base and future year. Differences are pointed with small black arrows.

KEY

- 0.6 and below (1)
- 0.6 to 0.8 (1)
- 0.8 to 1.0 (8)
- 1.0 to 1.2 (26)
- 1.2 and above (1)

Not to scale

N



Please note: these are raw model results from SCAG 2016 RTP model

Date prepared: 2/27/2018

Figure 2.7 I-105 Study Area Freeway Volume-to-Capacity Ratios AM Peak Period, 2012 and 2040

- VMT throughout the study area are projected to increase by 6% by 2040[19]. On the I-105 freeway alone (excluding arterial roadways) the increase in VMT is projected to be a 3% increase.
- VHT is projected to increase proportionately greater than VMT. This is due to increases in congested conditions which result in more delay and longer travel times. The VHT is projected to increase by 7% on the entire system by 2040 and by 5% on I-105 freeway[20].

- Trip growth on most major arterials will be less than 10%, but a few will experience larger increases up to 30% in travel demand.
- The operational conditions on the arterial system will worsen in selected locations with deterioration to level of service E and F, but there are not expected to be significant changes over most of the arterial system.
- Table 2.2 shows the projected growth for the freeway and arterial systems for vehicle miles traveled and vehicle hours traveled.

	Existing Baseline	2040	Difference	Percent Difference
I-105 Study Area (Freeway and Arterials)				
Vehicle Miles Traveled	27.3M	28.9M	1.6M	6%
Vehicle Hours Traveled	789,000	847,000	58,000	7%
I-105 Freeway Only				
Vehicle Miles Traveled	3.51M	3.59M	88,000	3%
Vehicle Hours Traveled	72,000	76,000	4,000	5%

Table 2.2 Growth in Vehicle Miles Traveled and Vehicle Hours Traveled in I-105 Study Area (existing baseline to 2040)

Source: SCAG Travel Demand Model for RTP/SCS 2016: http://rtpscs.scag.ca.gov/.

Figure 2.8 displays the difference in volumes between 2012 and 2040, representing estimated growth on the Countywide Significant Arterial System (CSAN) . This illustrates roadway segments with four levels of growth; no-growth, up to 10% growth in trips, over 10% to 30%, and over 30%, with the highest growth shown in red. As shown in Figure 2.8, the majority of the arterials within the I-105 study area will experience growth in travel demand by 2040. The largest proportion of the roadway segments will experience less than 10% growth, followed by 10% to 30% growth, and fewer experience in over 30% growth in trips. The highest concentration of growth greater than 30% can be found on arterials in the proximity of LAX and the roadways near I-110.

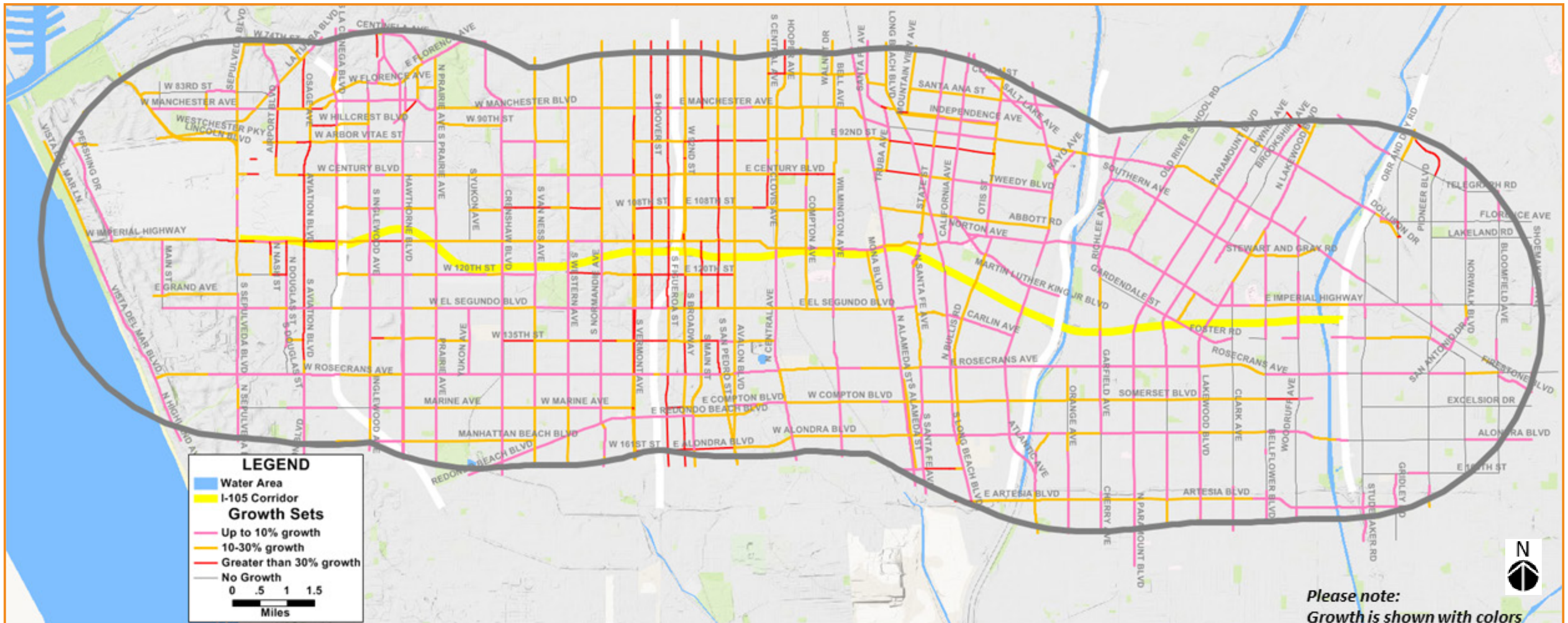


Figure 2.8 I-105 Study Area Arterial Volume Growth - Daily, between 2012 and 2040

Source: Cambridge Systematics, SCAG 2016 RTP model based.

» Truck trips on I-105 will increase in greater proportion, mostly due to a larger increases in port-bound trips. Port-bound truck trips will increase significantly in the segment of I-105 from I-710 to I-605, by nearly 5,000 truck trips per day[21]. Truck trip growth west of I-710 on I-105 will be much lower as that portion of the freeway is not affected by the growth in port truck trips, which all are destined to and from the east.

Transit System: Current Conditions

The I-105 study area is served by a variety of public transit services and providers. These services include LA Metro bus and rail service, municipal and local bus services, and Metrolink commuter rail service. The transit assessment presents an overview of the availability and performance of the rail and bus services in the I-105 study area. Some of the key findings from this effort include:

The Metro bus ridership in the Study Area represents more than 12% of Metro's weekday bus boardings.

- Commute mode share for transit trips is equal to the County average, however, parts of the study area, particularly in South Los Angeles in the central/north portion of the study area adjacent to the Blue Line, have very high rates of transit commuters[22].
- The Metro Blue and Green Line provide frequent and reliable service traveling east/west and north/south through the study area. While those are the most notable transit services in the corridor, they make up only 10% of Metro weekday trips in the study area and ridership on the Blue and Green Line has declined steadily over the past 5 years[23]. Boardings are highest at Willowbrook/Rosa Parks Station (the transfer station from the Metro Blue Line), Norwalk Station (the eastern terminus of the Metro Green Line), and at Aviation/LAX Station (which is a high employment area).
- The Metro bus ridership in the study area represents more than 12% of Metro's weekday bus boardings. While Metro has seen bus ridership decline in recent years, the ridership in the study area increased slightly between 2016 and 2017, though the increase was not uniform across the routes in the region. Rapid buses and express buses see higher ridership per stop, but frequent local services parallel to I-105 (Routes 115 and 117) have the highest total ridership in the study area. Figure 2.9 displays Metro bus ridership by stop based on October 2017 data.
- Two Metrolink routes stop at the Norwalk/Santa Fe Springs station, offering 30 minute service to Union Station every 16 minutes (on average) in the morning peak period.
- The municipal and local transit operators complement Metro's bus transit service, particularly for east/west travel and for transit trips south of I-105.

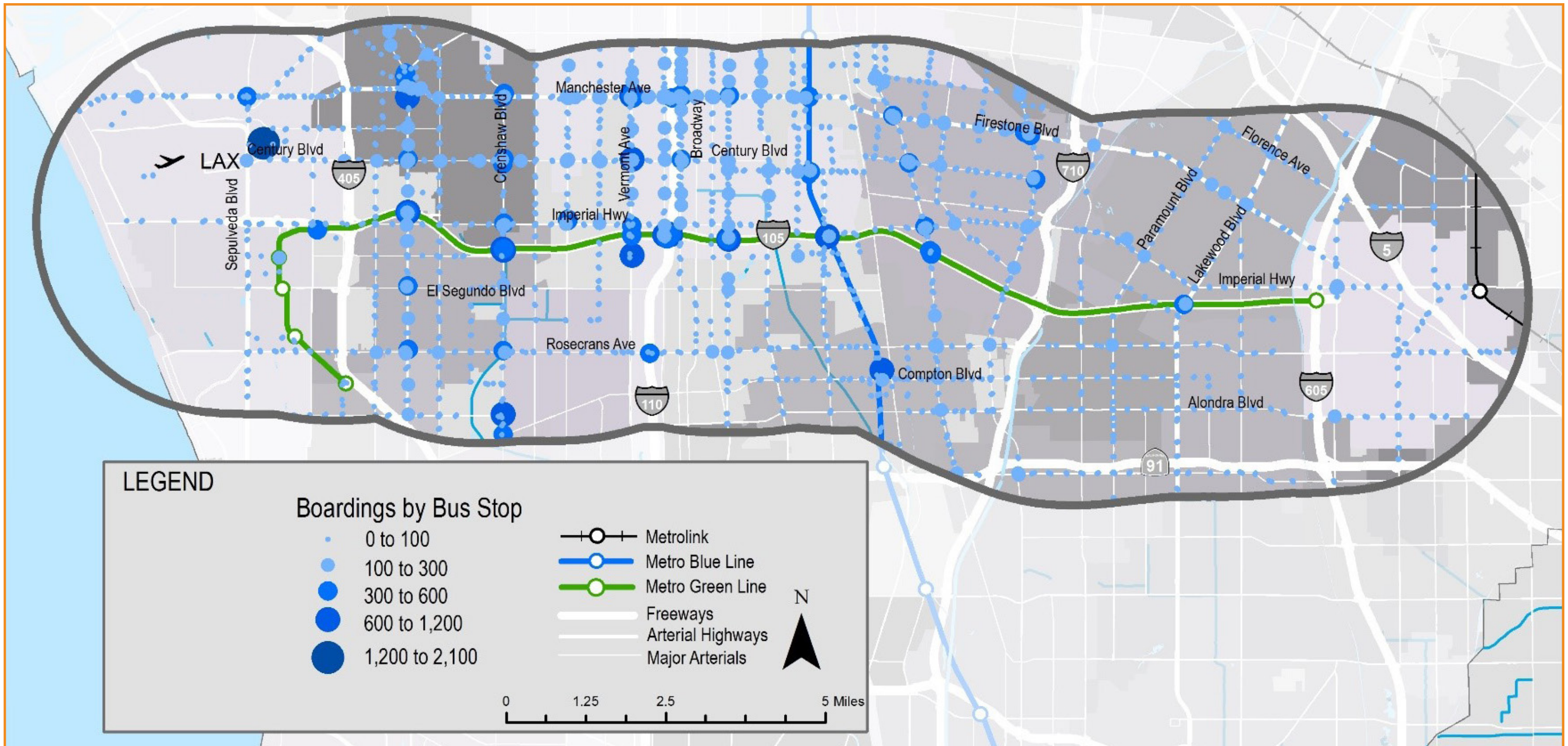


Figure 2.9 Metro Bus Ridership By Stop

Source: LA Metro, October 2017 Ridership Data.

Transit System: Future Conditions

» The SCAG model projects a modest increase in transit mode share by 2040, from 3.3% to 3.7% of all trips (excluding school bus trips). The major transit projects funded through Measure M (and the 2008 Measure R) relevant to the I-105 study area include the Crenshaw Line, West Santa Ana Branch Transit Corridor, Vermont Transit Corridor, Green Line Extension to Torrance, Green Line Extension to Norwalk, Lincoln Boulevard BRT, and the Sepulveda Pass Transit Corridor. Figure 2.10 displays LA Metro Measure M funded transit projects.

» As part of its NextGen Bus Study, LA Metro is studying how it can modernize its bus system and improve service in order to attract new riders and prevent future declines in ridership, their first major restructuring effort in over 20 years, and other local and municipal operators are implementing similar studies.

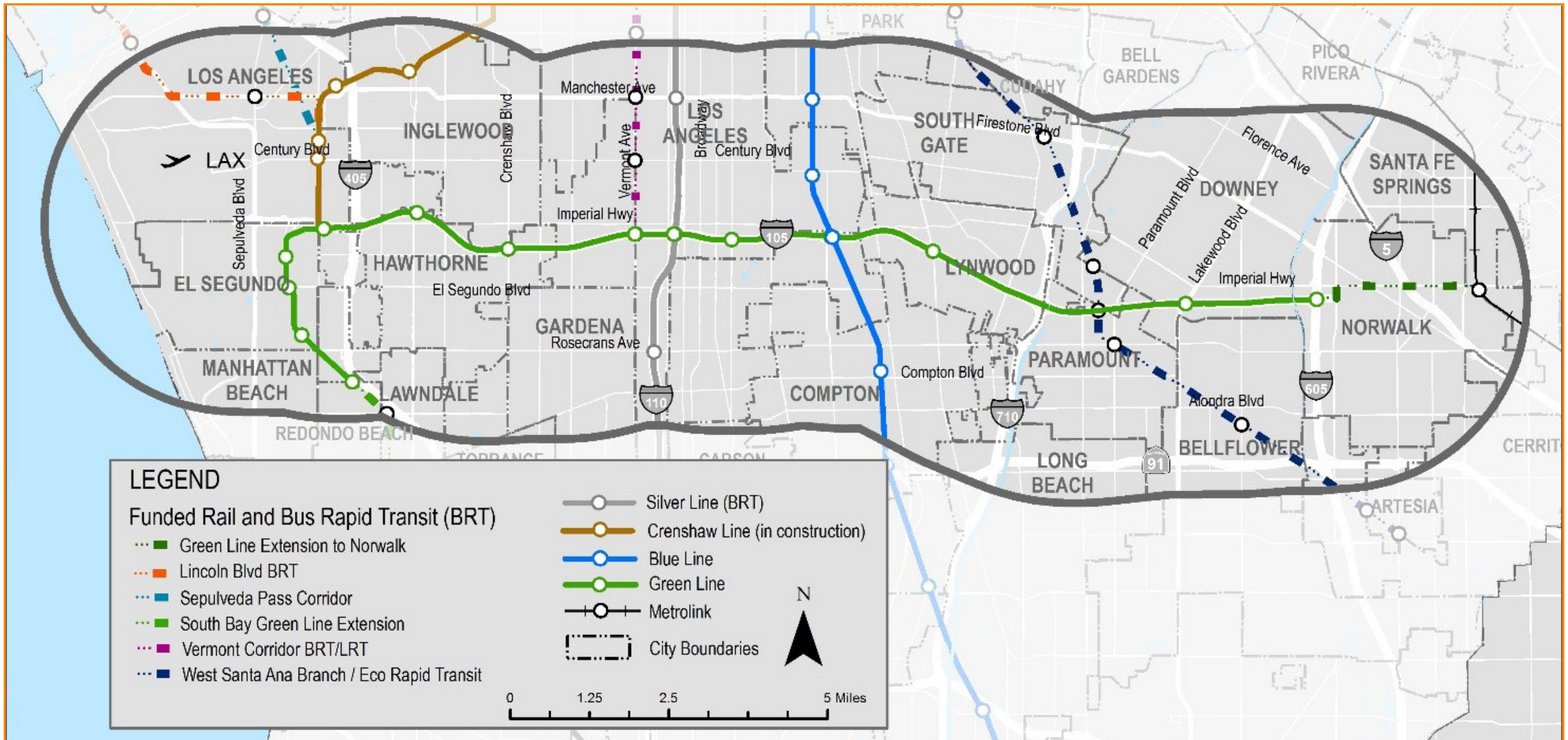


Figure 2.10 LA Metro Measure M Funded Transit Projects

Source: LA Metro 2016, Measure M Expenditure Plan.

Active Transportation

Active transportation includes bicycling, walking, and other non-motorized modes of transportation. These modes are often underrepresented in transportation planning studies due to data limitations. Some of the key findings from this effort include:

- Data on bicycle and pedestrian volume is limited. There are some census block groups in the I-105 study area with high rates of bicycling and walking to work[24]; however, this provides no information on route selection and obstacles to address.

» Active transportation is key to supporting transit riders. Metro found that 83% of bus riders and 68% of train riders start their journey on foot[25]. Only 10% of the households in the I-105 study area are within one-half mile of train station. Metro found that 4% of train riders bike to the station, but in the I-105 study area, bike lanes and paths are not as prevalent around train stations compared to the rest of LA County[26].

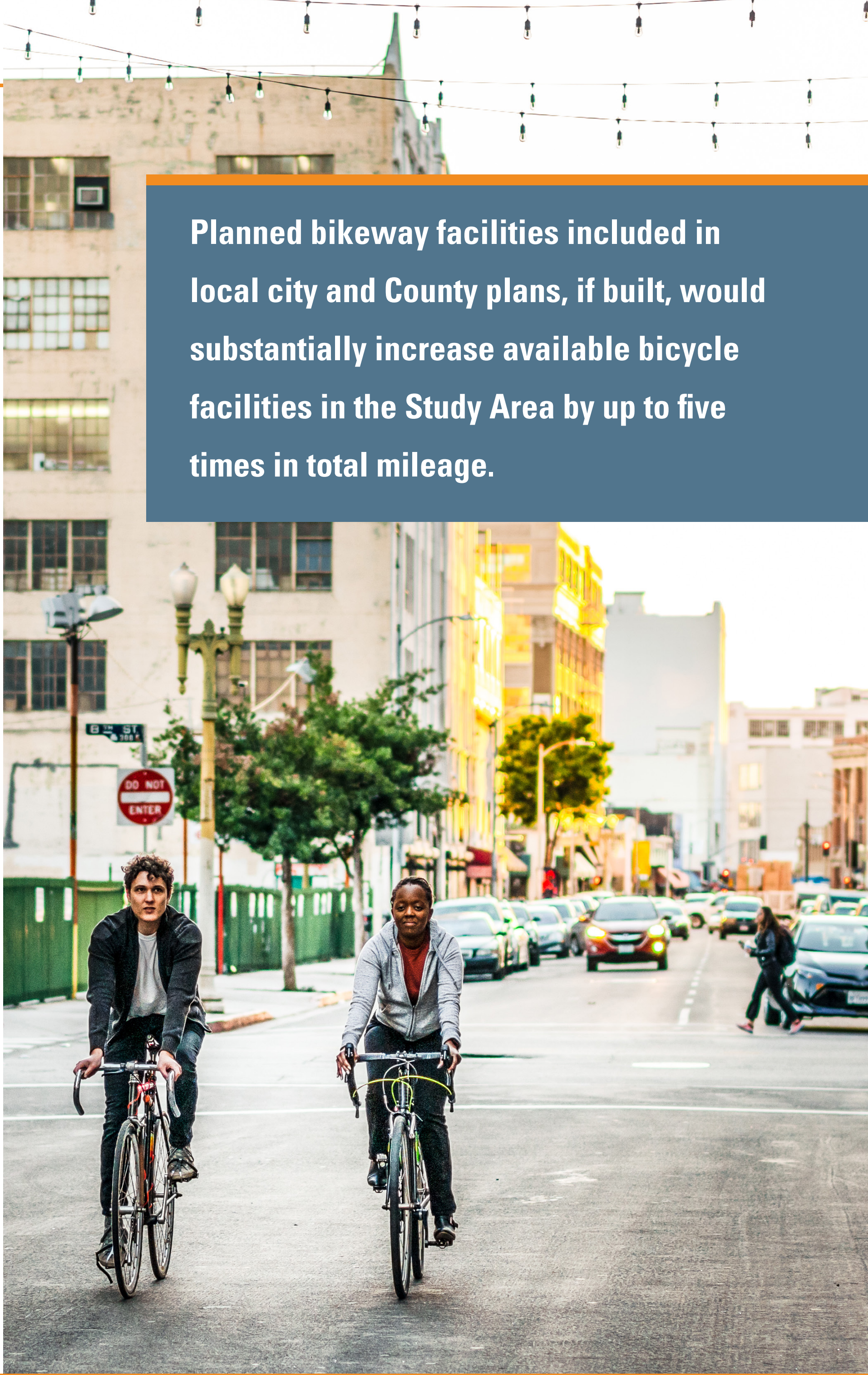
» Only 14% of the jobs in the I-105 study area are within one-half mile of a fixed guideway station, but 44% are within one-quarter mile of high frequency LA Metro bus service[27].

» Safety is a major concern for bicycling, and the lack of dedicated bicycle facilities is a hindrance to more bicycling in the I-105 study area. While there is little information on the availability of sidewalks in the I-105 study area, the Metro Blue Line First/Last Mile Plan (March 2018)[28] highlights an abundance of inadequate sidewalks around the four Blue Line stations.

» The number of injury collisions involving pedestrians remained fairly consistent between 2012 and 2016. Fatal collisions involving bicyclists, while a small number, were significantly higher in 2015 and 2016 than previous years[29].

» If all the various planned city and County bicycle facility plans are implemented, the bikeway mileage in the I-105 study area will increase substantially. Many cities in the corridor have plans to increase Class I bike paths (paths entirely separated from roadway traffic) as well as Class II bike lanes (striped bike paths on street) and Class III bike routes (bike routes with signs but no separation from traffic). This equates to an almost doubling of bike path mileage, close to three times the bike lane mileage, almost five times the bike route mileage, and the addition of 35 miles of cycle tracks (separated bike lanes adjacent to streets) in an area where there are currently none[30]. Figure 2.11 displays the existing and planned bikeways in the study area.

» New mobility options have the potential to complement bicycling and walking, by limiting the need to own a personal vehicle, or could replace biking and walking with new modes. Established bikeshare systems, dockless bikeshare systems, and electric scooter share programs are already available in many parts of LA County.



Planned bikeway facilities included in local city and County plans, if built, would substantially increase available bicycle facilities in the Study Area by up to five times in total mileage.

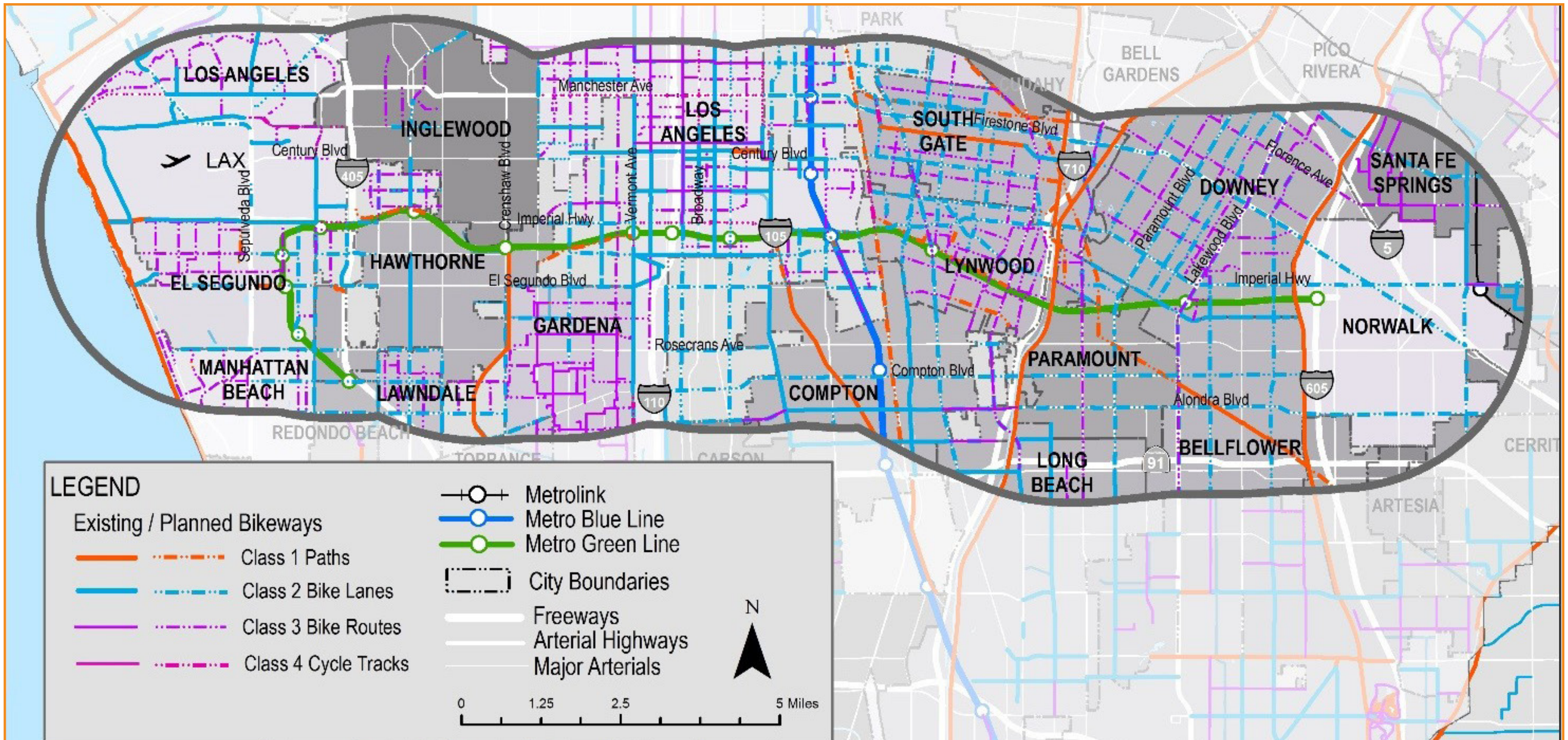


Figure 2.11 Existing and Planned Bikeways Network in Study Area

Source: SCAG 2016, Self-reported by local jurisdictions.

Emerging Technologies

Emerging technologies have the power to disrupt mobility as we know it by offering innovative ways to solve transportation challenges; however, there is tremendous uncertainty associated with the timing and level of technology impacts on travel behavior. The range of technologies in transportation include emerging modes, shared mobility, and infrastructure upgrades. Examples of improvements within these categories are in shown in Table 2.3. As many of these concepts are emerging and changing rapidly (availability, price, perceived safety, convenience, social image/stigma, etc.), it will be important to discern their potential downsides and benefits in the region and within the I-105 Corridor.

» Potential challenges with emerging technologies:

- Uncertainties regarding Connected and Autonomous Vehicles (CAVs) could result in additional problems such as competition for curb space, detection challenges that put non-motorized road users at risk, equity issues related to where the technology is first deployed, and distracted driving in the phases of partial automation.
- Competition for curb space will increase as emerging modes, including bikesharing and ridehailing, become popular and are deployed.
- Lags in adaptability of existing infrastructure to meet the needs of emerging technology could greatly inhibit solutions such as dynamic messaging and advanced signal systems.
- Increasing technology in the roadway and full transportation network allows for increasing data security challenges.

» Potential benefits of emerging technologies:

- New technologies could recognize the presence of vulnerable road users through improved detection, ultimately improving safety for non-motorized road users.
- Connected and Autonomous Vehicles (CAVs) could have technologies to communicate with other road users to improve predictability, follow speed limits, reduce driver error, increase efficiency and reduce congestion, and enhance public space by reducing the need for parking lots.
- Other emerging modes and shared mobility, such as carsharing, ridehailing, and bikesharing, have the potential to reduce VMT by reducing SOV mode share and increasing bike and HOV mode share.
- New transportation infrastructure can for example, create mobility hubs, spaces where a number of modes converge to encourage multimodalism.

Emerging Modes and Shared Mobility	Real Time Data and Traveler Information	Transportation Infrastructure
» Carsharing » Ridehailing » Ridesharing » Microtransit » Bikesharing/Scooter-sharing » Mobility as a service » Connected and Autonomous Vehicles (CAV)	» Smart phone applications that provide real-time travel and cost information » Continuous managed lanes » Alternative HOV occupancy requirements » Real-time dynamic tolling; » Additional and expanded park-and-ride lots with real-time availability and reservation systems; » Allowing the use of shoulder lanes; » Peer-to-peer carpool apps that provide cohort matching	» Refined system maintenance and preservation operations and priorities » Deployment of new roadside infrastructure such as advanced signal system and dynamic messaging signs » Operational changes to existing infrastructure such as changing vehicular access standards for HOT lanes etc. » Deploying completely new infrastructure such as bike sharing stations. » Mobility hubs

Table 2.3 Examples of Emerging Technologies

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3.0 Develop and Evaluate Improvement Scenarios

The primary purpose of the I-105 CSS is to identify and evaluate potential multimodal improvements to the transportation system in the I-105 study area. To do so, the I-105 CSS undertook the following steps:

1. **Develop a performance-based evaluation framework**. This framework, described in Section 3.1 below, was used to assess the current transportation conditions and determine how well a project concept might benefit the overall corridor.
2. **Meaningfully engage stakeholders**. Stakeholder engagement occurred throughout the process and was crucial for guiding the process, for providing input on the objectives of the I-105 CSS, and for identifying issues and potential solutions to improve the corridor conditions.
3. **Identify and collect project ideas.** Section 3.3 highlights the projects included in the I-105 CSS and discusses the process for identifying the potential improvements.
4. **Evaluate projects and improvement scenarios.** Finally, Section 3.4 describes how each project was categorized and each improvement scenario evaluated.

Evaluation Framework

The evaluation framework, highlighted in Figure 3.1, was established with input from the Technical Advisory Committee (TAC). This framework consists of a set of goals, objectives, and performance measures that lay out a vision for the I-105 corridor and how to measure success towards achieving that vision. The framework was used for two purposes in the I-105 CSS. First, it was used to determine how well the current and projected future transportation system is performing. Then, the framework was used to evaluate each project in order to assess how well a given transportation investment, relative to the established goals, would benefit the overall corridor performance.

Goals	Objectives	Performance Measures
Mobility	• Improve multimodal system efficiency • Improve transit ridership • Reduce congestion	• Transit ridership/mode share • High-occupant vehicle (HOV) mode share • Total person throughput • Travel time by mode • Vehicle/person hours of delay (VHD/PHD) • Truck VHD
Accessibility & Equity	• Improve system connectivity and access to non-SOV modes • Increase service to social equity focus (SEF) populations • Promote geographic equity throughout the corridor	• Households within 1/2-mile of high quality transit access • Jobs within 1/2-mile of high quality transit access • Bicycle facility density within 1/2-mile of high quality transit access • Healthcare, schools and activity centers accessible by low-stress bicycle/pedestrian facilities • Travel time by mode for social equity focus (SEF) populations • SEF households with access to high quality transit • Geographic equity
Safety	• Reduce safety collisions and hazards	• Serious injury crash rates (by mode) • Fatal collision rate (by mode)
State of Good Repair	• Improve & preserve system conditions	• Pavement in good, fair, and poor condition • NHS bridges in good, fair, and poor condition
Sustainability	• Improve air quality and public health • Reduce emissions	• Greenhouse gas (GHG) emissions • Air quality criteria pollutant emissions • Bicycle and walk mode share • Non-single occupant vehicle (SOV) mode share • Parks, recreation & open space accessible by low-stress bike/ped facilities, complete streets, and/or high quality transit • Vehicle miles traveled (VMT)

Figure 3.1 I-105 CSS Performance Evaluation Framework

Stakeholder Engagement

The I-105 CSS included a significant stakeholder outreach effort that was designed to gather input from a wide range of corridor stakeholders with interests across all modes of transportation. The outreach process included the following components:

- Project Development Team (PDT) – this core team consisted of SCAG, Caltrans, and LA Metro and met regularly to review the study processes, interim findings and deliverables, and make recommendations as the study progressed;
- Technical Advisory Committee (TAC) – the TAC included all corridor jurisdictions (cities and County of Los Angeles) as well as other interested stakeholders such as Los Angeles World Airport, LA Metro, Caltrans, the South Bay Cities Council of Governments, and the Gateway Cities Council of Governments;
- One-on-one and small group stakeholder meetings were held with representatives from cities, local transit providers and community advocacy groups interested in transportation issues in the corridor;
- On-line and in-person survey – a survey instrument was developed and circulated to gather opinions of corridor users and interested parties regarding current transportation conditions as well as proposed improvements;
- Direct public outreach – the project team attended public meetings to provide information on the I-105 CSS effort as well as to gather information and feedback from local residents;
- Other outreach materials including project fact sheets, news briefs, and a project website were developed to provide information and to assist in the outreach to the interested communities.

Using these combined outreach strategies, the team was able to obtain opinions regarding current transportation issues as well as ideas for project improvement recommendations as well as to inform the community about the I-105 CSS. The information as used in the development of the final project ideas and improvement scenarios.

Public engagement at El Segundo farmers market

Potential Transportation Improvements

A total of 425 projects were identified for inclusion in the I-105 CSS. These projects were identified though:

1. A review of existing plans and studies from Metro, Caltrans, SCAG, corridor cities, and the County of Los Angeles;
2. New projects proposed through the input and guidance from the Technical Advisory Committee and the Project Development Team.

Two recent Metro-funded subregional strategic transportation plans provided the majority of these project concepts: the Gateway Cities Strategic Transportation Plan (2016) and the South Bay Cities Mobility Matrix (2015). The project team compiled, mapped, and shared project lists with corridor city staff to ensure projects were consistent with current city priorities and plans, and to identify any new projects not captured by the original project scan. Nearly one-half of the identified projects are arterial projects, followed by highway (22%), active transportation 22%), transit (7%), and goods movement (2%) projects (see Figure 3.2 and project maps below). Figures 3.3 through 3.12 below highlight the active transportation, arterial, goods movement, highway, and transit projects included in the improvement scenarios. Project descriptions can be found in Appendix B.

Active transportation projects considered in this assessment include bikeway Class 1, 2, 3 and 4 projects, bikeshare programs, first/last mile projects, new sidewalks, new trails, bike/pedestrian bridges, complete streets projects and other miscellaneous pedestrian improvements. Metro's Rail to River bicycle and pedestrian path, a planned 10-mile path that parallels the study area to the north on Slauson Avenue, will provide a safe bicycle connection between downtown Inglewood and the LA River to the east. Arterial projects considered in this assessment include Intelligent Transportation Systems (ITS) improvements (signal system upgrades, interconnect, signal timing, motorist information, etc.), other operational improvements, bridges and grade separations, intersection improvements, capacity enhancement projects, arterial corridor improvements (consisting of multiple improvements along a corridor including traffic signal improvements, spot capacity enhancements, intersection improvements and other). Goods movement projects considered in this assessment include grade separations and grade crossing improvements for freight corridors.

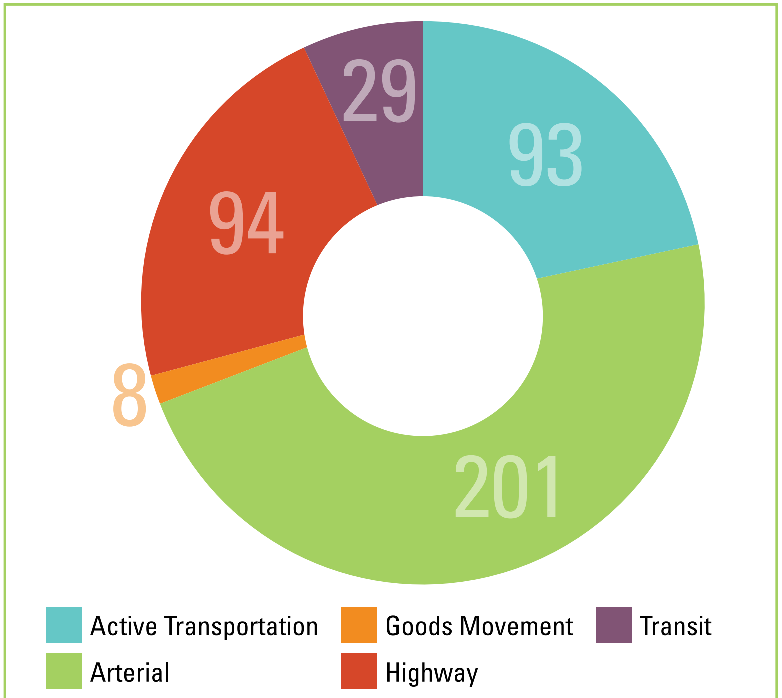

Figure 3.2 I-105 CSS Projects By Type

Highway projects considered in this assessment include Express Lanes, auxiliary lanes, ramp improvements, interchange enhancements, ITS/operational improvements, capacity enhancements and Integrated Corridor Management (ICM). Transit projects considered in this assessment include new bus rapid transit (BRT), new fixed rail service, transit centers, park and ride, bus stations and new bus services. Highway projects considered in this assessment include Express Lanes, auxiliary lanes, ramp improvements, interchange enhancements, ITS/operational improvements, capacity enhancements and Integrated Corridor Management (ICM). Transit projects considered in this assessment include new bus rapid transit (BRT), new fixed rail service, transit centers, park and ride, bus stations and new bus services.

Highway and transit represent some of the major improvements that will fall into the mid and long term horizons and have relatively higher cost, while the arterial and active transportation improvements tend to be smaller, more localized, and can be implemented sooner for lower cost. Some of the major regional highway projects considered in this assessment include:

» **I-105 ExpressLanes**[31]. Metro and Caltrans are conducting a Preliminary Engineering and Environmental Document for ExpressLanes on I-105 between I-405 and I-605. The three alternatives that are currently being studied are a no build scenario, the conversion of the existing HOV lane to ExpressLane, and the conversion of the HOV lane to ExpressLanes along with an additional ExpressLane (with non-standard widths). The final environmental document is scheduled for release in early 2020.

» **I-710 South Corridor**[32]. The I-710 Corridor Project, known as I-710 South, recirculated a draft environmental document in 2017. The Metro board recommended the modernization alternative as their preferred alternative and a final environmental document is underway. The I-710 connects to I-105 and truck traffic to and from I-105 is a significant issue in the I-105 corridor, especially to the east.

» **I-405 South Bay Curve Bottleneck Improvements**[33]. Auxiliary lanes will be added at on and off-ramps to improve traffic flow from Florence Avenue to the I-110. This segment is approximately ten miles long and the project's expected completion date is 2047.

» **I-605 Corridor Improvement Program**[34]. This study is evaluating several alternatives, including converting HOV to ExpressLanes, adding a general purpose lane, and adding a new HOV or ExpressLane. The draft EIR/EIS is scheduled for release in summer 2019.

Major regional and subregional transit projects considered in this assessment include:

» **Crenshaw Line**[35]. Scheduled to be opened in 2019, the Crenshaw Line will connect the Green Line and the Expo Line. The project will add eight new stations including five new stations in the I-105 study area. The Airport Metro Connector (AMC) station at 96th Street/Aviation Boulevard will connect Metro to the planned LAX automated people mover.

» **West Santa Ana Branch Transit Corridor**[36]. This 20-mile corridor connects downtown Los Angeles to Cerritos, in the southeastern corner of the county. Metro is currently studying a new station to connect to the existing Metro Green Line. The project is anticipated to break ground in 2022, according to the Measure M expenditure plan, and Metro is currently in the Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR) phase of the project.

- **Vermont Transit Corridor**[37]. The Vermont Transit Corridor would connect the Green Line to the Expo Line, Red/Purple Line at Wilshire, and continue on to the Red Line station at Hollywood and Vermont. The corridor has been studied as a Bus Rapid Transit (BRT), but Metro is studying the possibility of converting it to rail in the future. Construction for this project, according to the Measure M expenditure plan, is set to break ground in 2024.

- **Green Line Extension to Torrance**[38]. The South Bay extension of the Green Line is a four mile transit corridor from the current southern terminus in Redondo Beach to a proposed transit center in Torrance next to the South Bay Galleria. Metro is completing a Supplemental Alternatives Analysis to refine and update the 2009 study and recommend a new or refined preferred alternative. Construction for this project, according to the Measure M expenditure plan, is set to break ground in 2026.

- **Green Line Extension to Norwalk**[39]. This project, still in early planning stages, will extend the Green Line from its terminus at the Norwalk Station to the Norwalk/Santa Fe Springs Metrolink station. Measure M designated $200 million towards the implementation of the project, with a projected groundbreaking date in 2046. Various alignments will be considered.

- **Lincoln Boulevard BRT**. This project, funded through Measure M and expected to break ground in 2043, will connect the LAX AMC station to the Expo Line in downtown Santa Monica via Lincoln Boulevard. It is funded as a BRT project but may be converted to LRT if the ridership demand outgrows BRT capacity.

- **Sepulveda Pass Transit Corridor**[40]. Phase 3, expected to break ground in 2048, will extend the Sepulveda Pass Transit project south from Westwood to LAX. The proposed alignment follows Sepulveda Boulevard; however, the mode will be dependent on Phase 1 of the project which is currently undergoing a Feasibility Study.

Projects included in the I-105 CSS were evaluated based on how well they further the objectives of the study and how well they addressed identified deficiencies in the transportation system described in Section 2.0 above. Table 3.1 presents a high level summary of key identified deficiencies and the types of projects that will help to address those deficiencies. Not every project in the improvement scenarios is included in the table, but the table is intended to highlight the major transportation system deficiencies and the key types of projects that will address those deficiencies. The evaluation process used to quantify how well the projects meet the goals and objectives of the I-105 CSS is described in detail in Section 3.4 below.

I-105 Corridor System Deficiencies	Key Project Types to Address I-105 Corridor Deficiencies
Peak Period Freeway Congestion Higher than county average collision rates on I-105	I-105 System Improvements (such as Express Lanes, spot operational improvements, ramp improvements, interchange improvements, integrated corridor management)
High Congestion and VMT on arterials Firestone, Vermont, Western, Van Ness, Rosecrans, Sepulveda, Lakewood, Manchester, Imperial Highway, Artesia	Arterial Intelligent Transportation Systems projects including traffic signal synchronization, interconnect Spot intersection improvements including lane additions and signal timing modifications Arterial/rail grade separations Access management projects
Low Transit Mode Share and declining ridership countywide	Major transit projects including West Santa Ana Branch transit corridor project, Green Line extension, Vermont Transit Corridor and bus rapid transit corridors Metrolink Commuter Rail program enhancements Green Line capital and operational improvements including adding rail tracks and crossovers and extending station platforms to allow 3-car trains Tram link to Inglewood stadium Local transit service improvements Enhance airport express bus service Expansion of park-and-ride
Lack of bicycle routes in much of the corridor and low bicycle usage in some areas	Implement multiple city bike plans First/Last Mile Projects Bike/Pedestrian bridges Eco-rapid transit bike trail Rails to trails corridor
Bicycle collision concentrations mid-corridor	Implement city and county bike projects including Class 1, 2 and protected bike lanes (Class 4) Freeway ramp terminus pedestrian and bicycle enhancements (implement Caltrans Interchange Control Evaluation – ICE process)
Arterial roadway pavement deterioration	Resurfacing and reconstruction projects
Truck collision concentrations	Grade separation and crossing projects Truck oriented intersection improvements (curb return widening, signal improvements oriented to trucks, etc.)
Significant low income population and vulnerable communities areas	Increase transit options via bus restructuring Implement transit enhancements and projects noted above

Table 3.1 Summary of Corridor Deficiencies and Key Project Recommendations

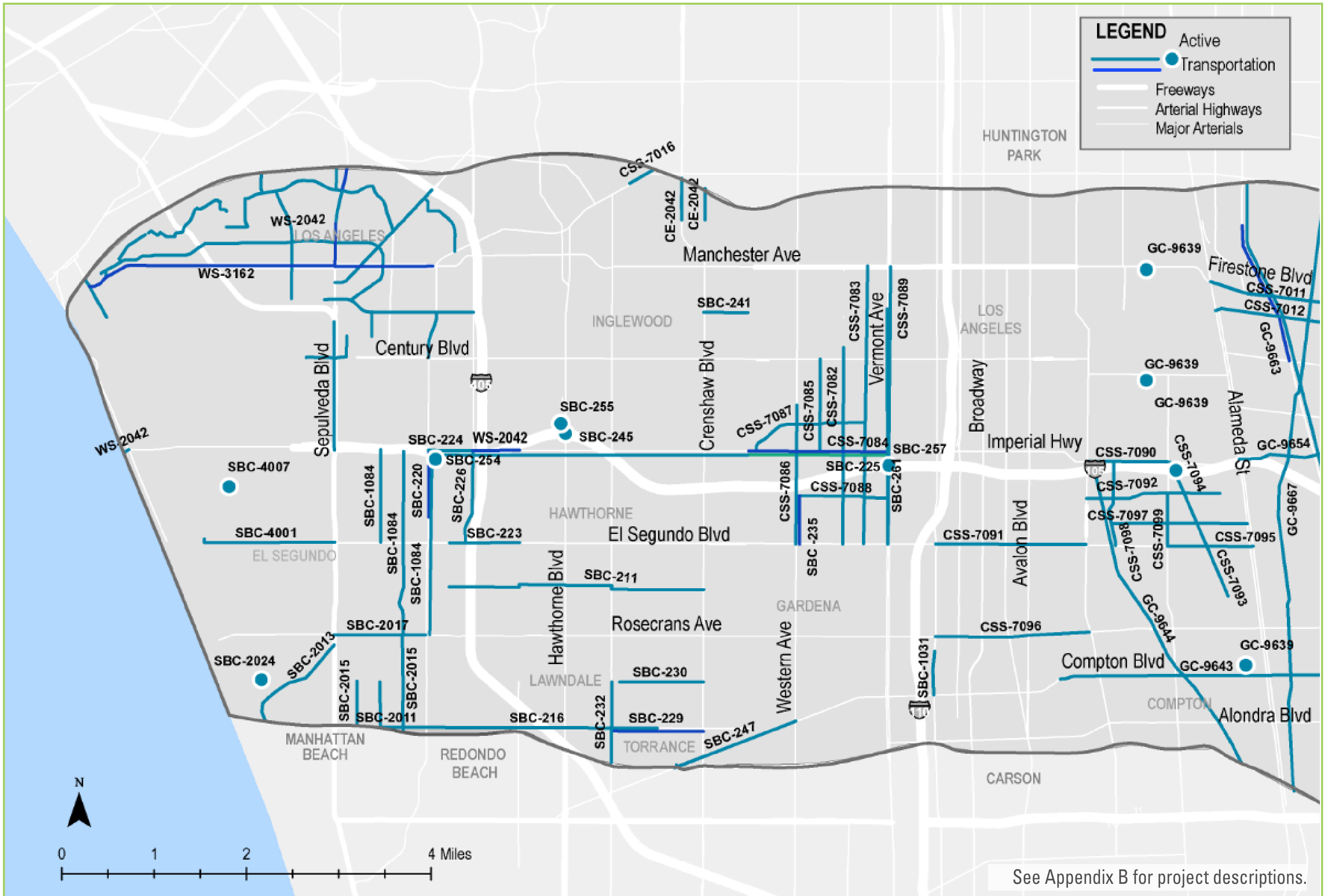

Figure 3.3 Potential Active Transportation Projects (Western Portion)

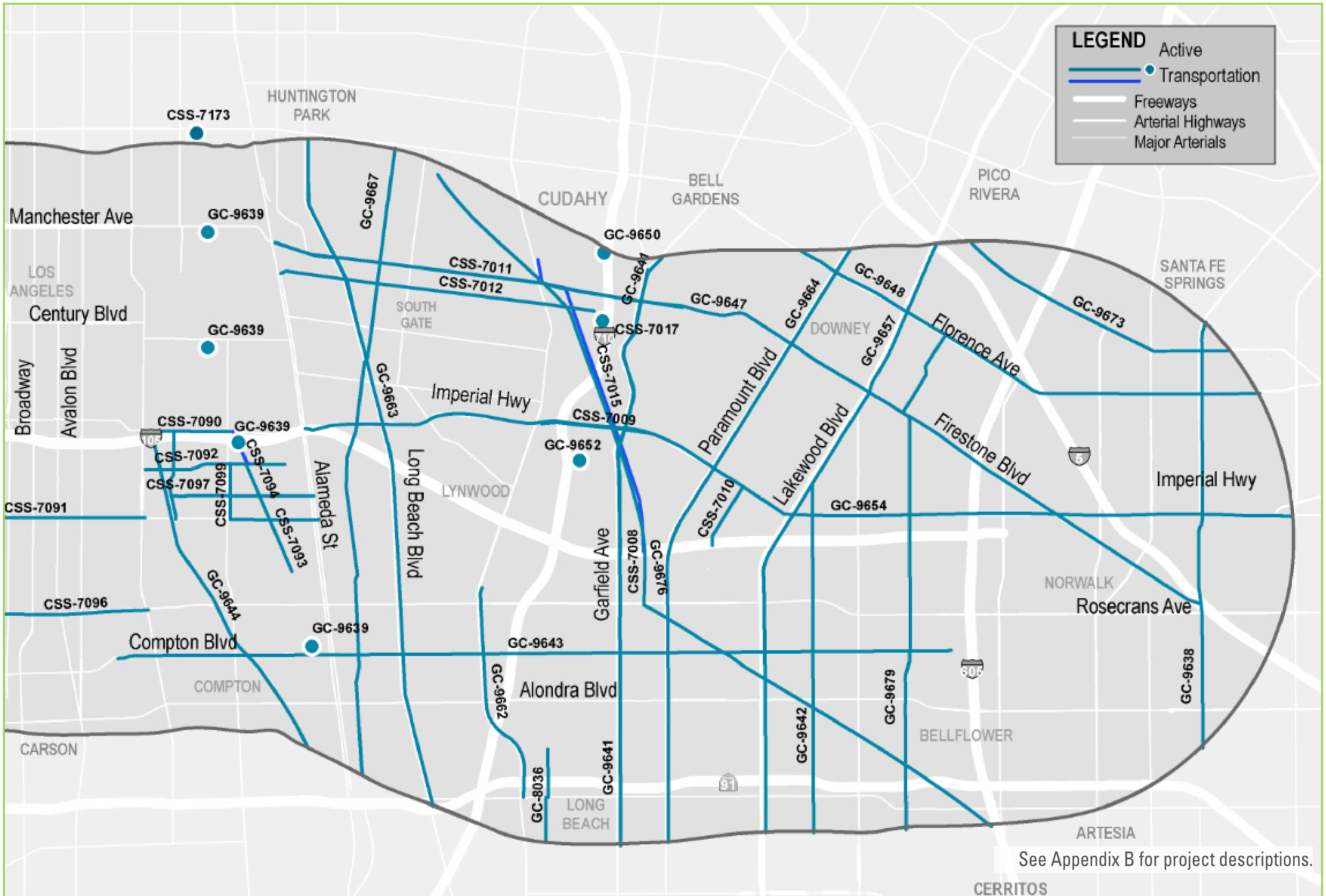

Figure 3.4 Potential Active Transportation Projects (Eastern Portion)

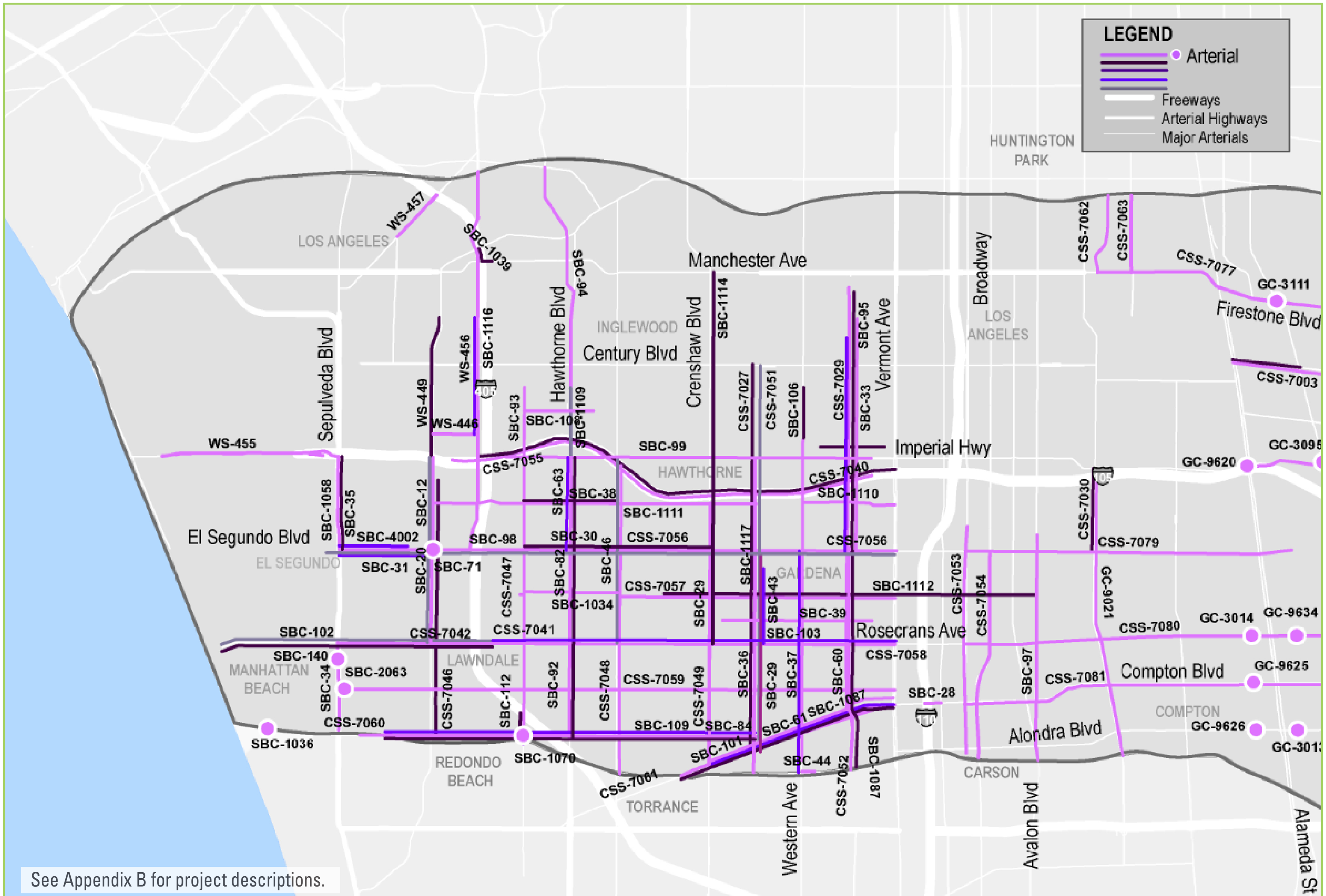

Figure 3.5 Potential Arterial Projects (Western Portion)

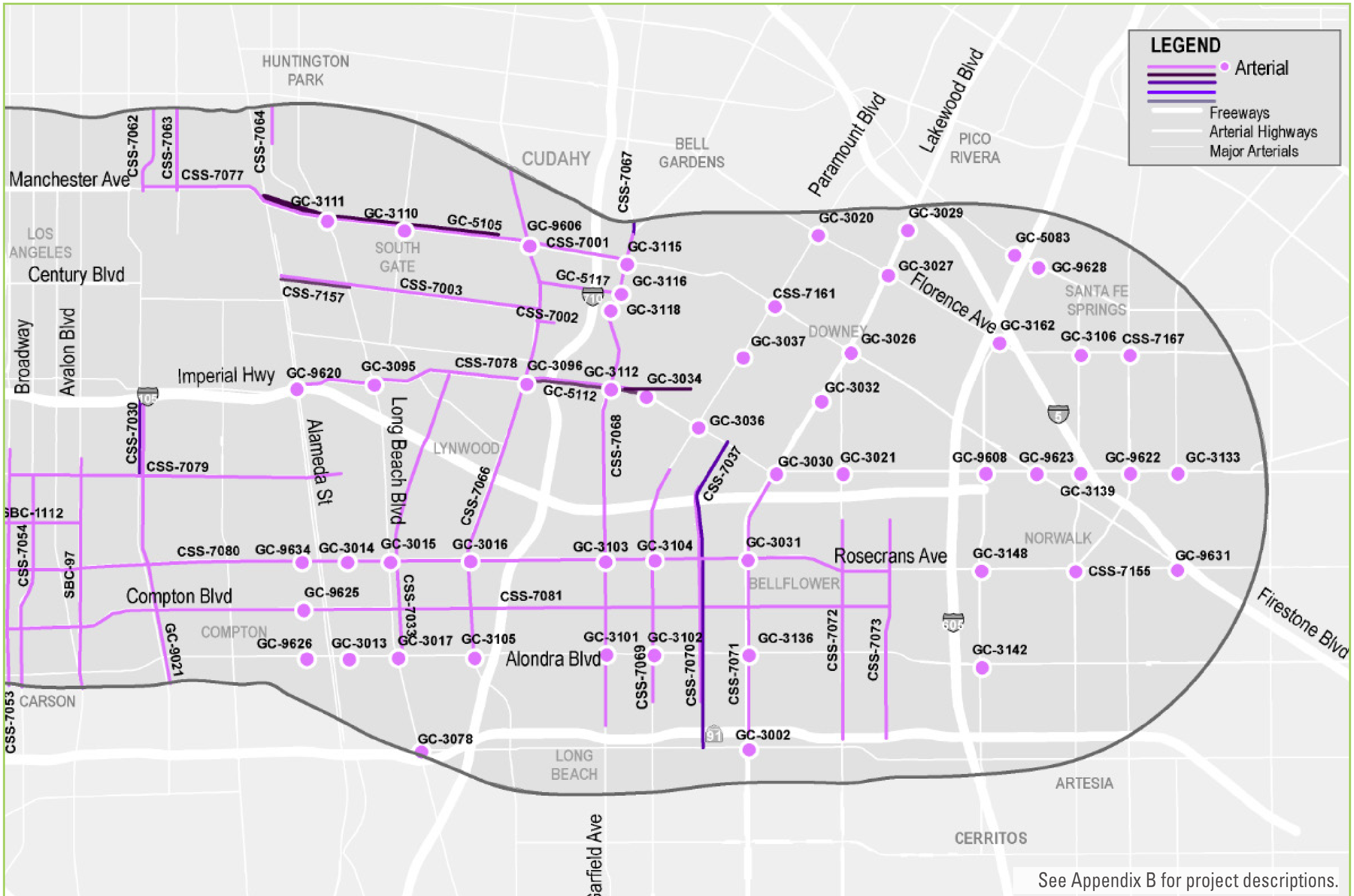

Figure 3.6 Potential Arterial Projects (Eastern Portion)

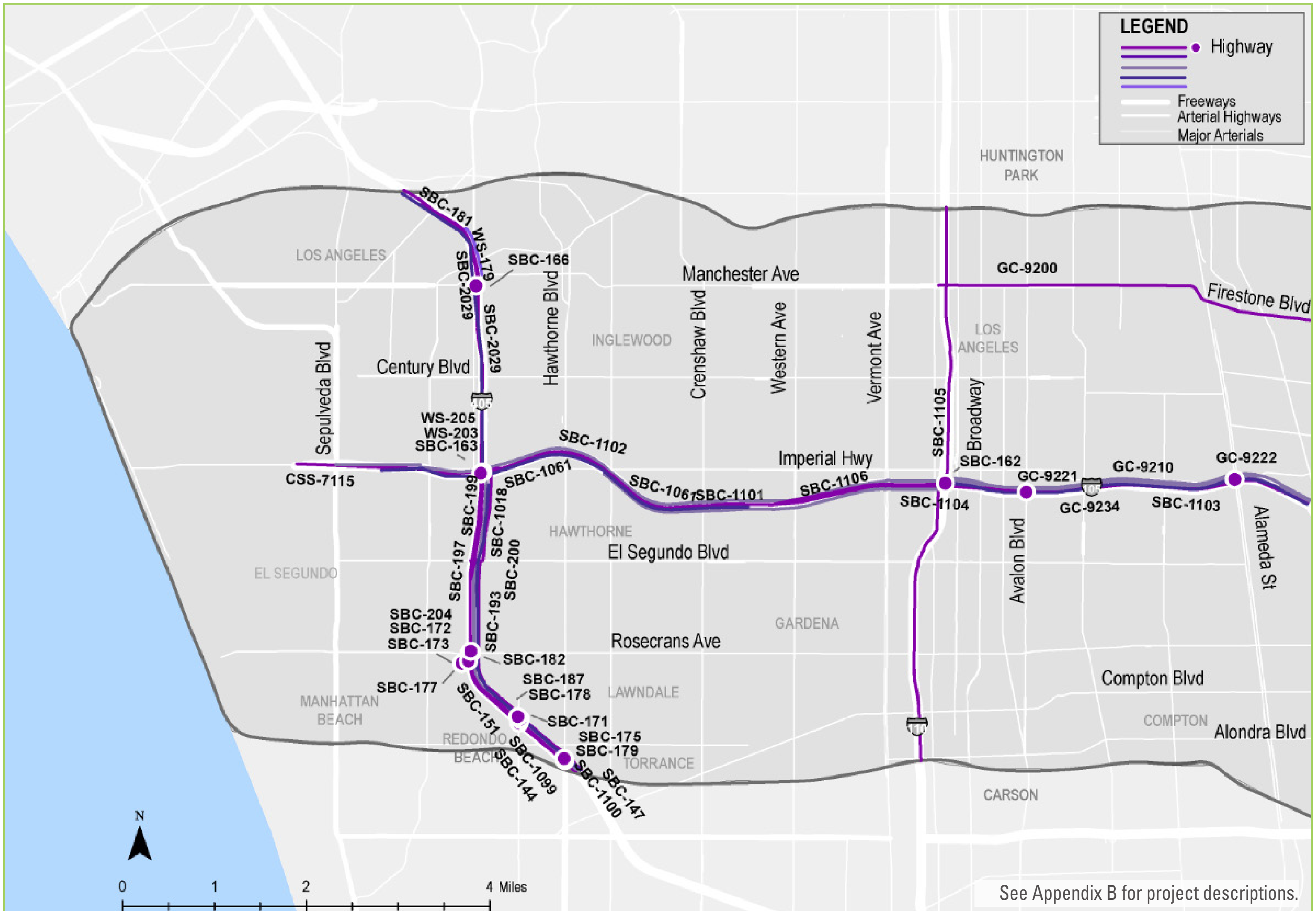

Figure 3.7 Potential Highway Projects (Western Portion)

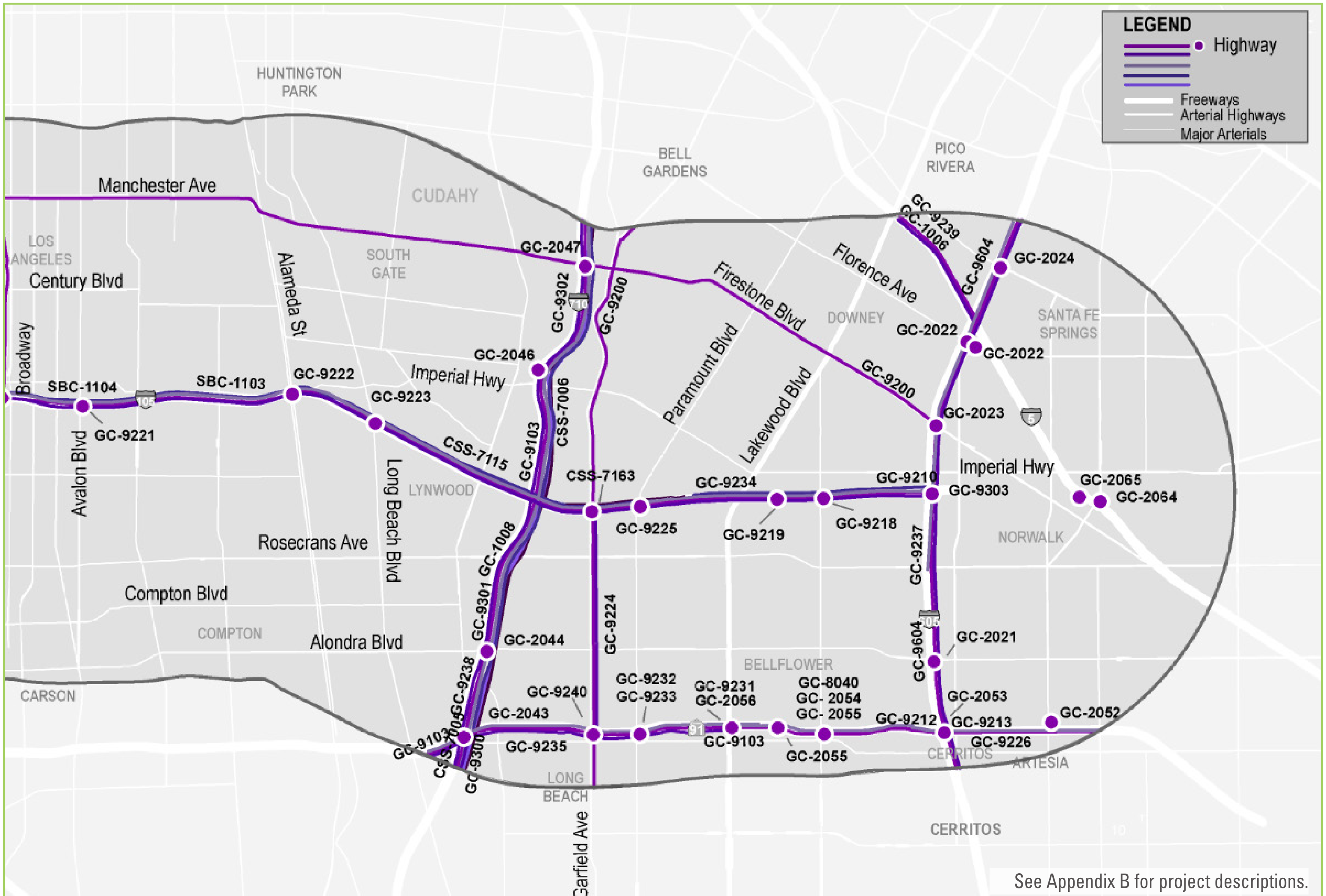

Figure 3.8 Potential Highway Projects (Eastern Portion)

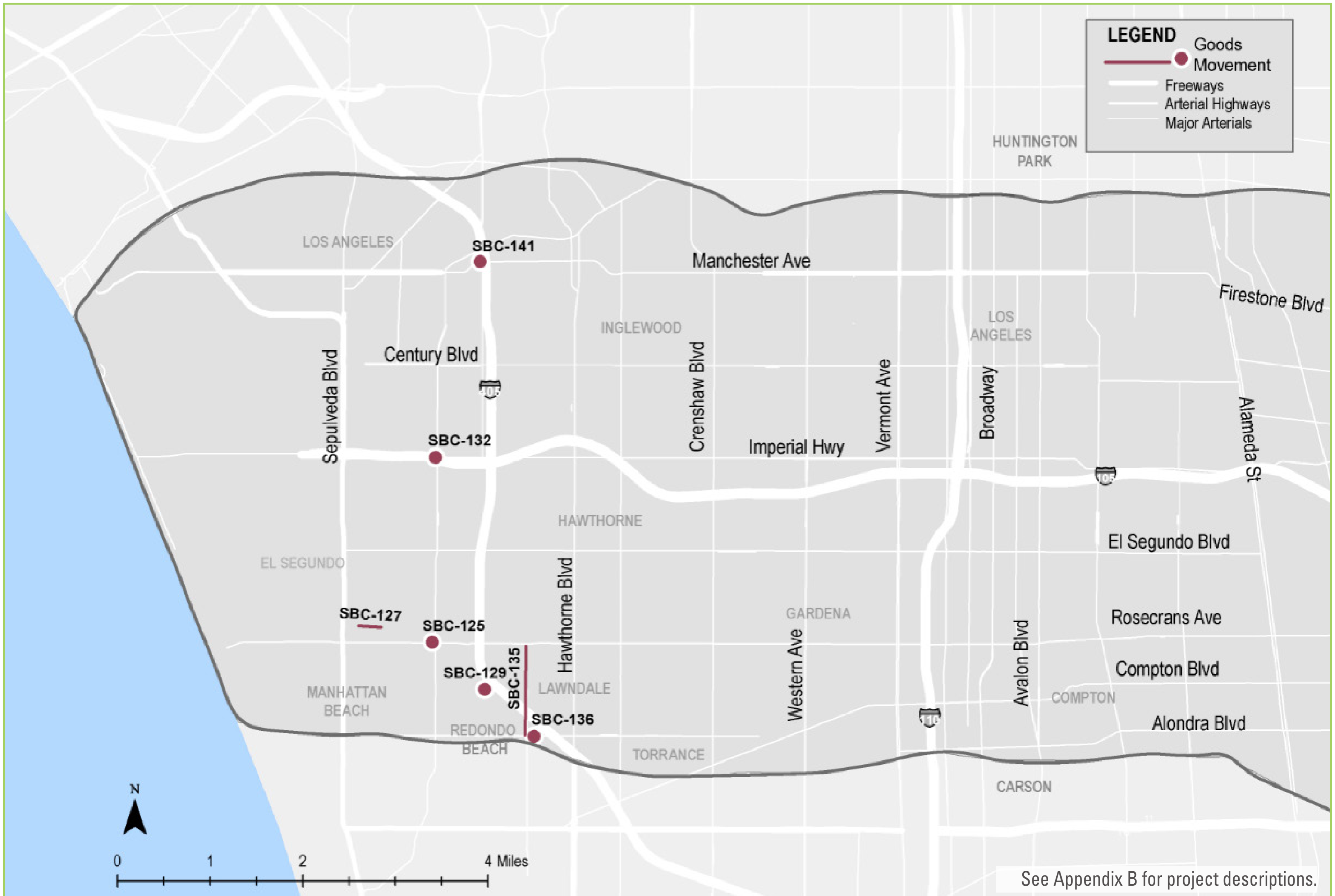

Figure 3.9 Potential Goods Movement Projects (Western Portion)

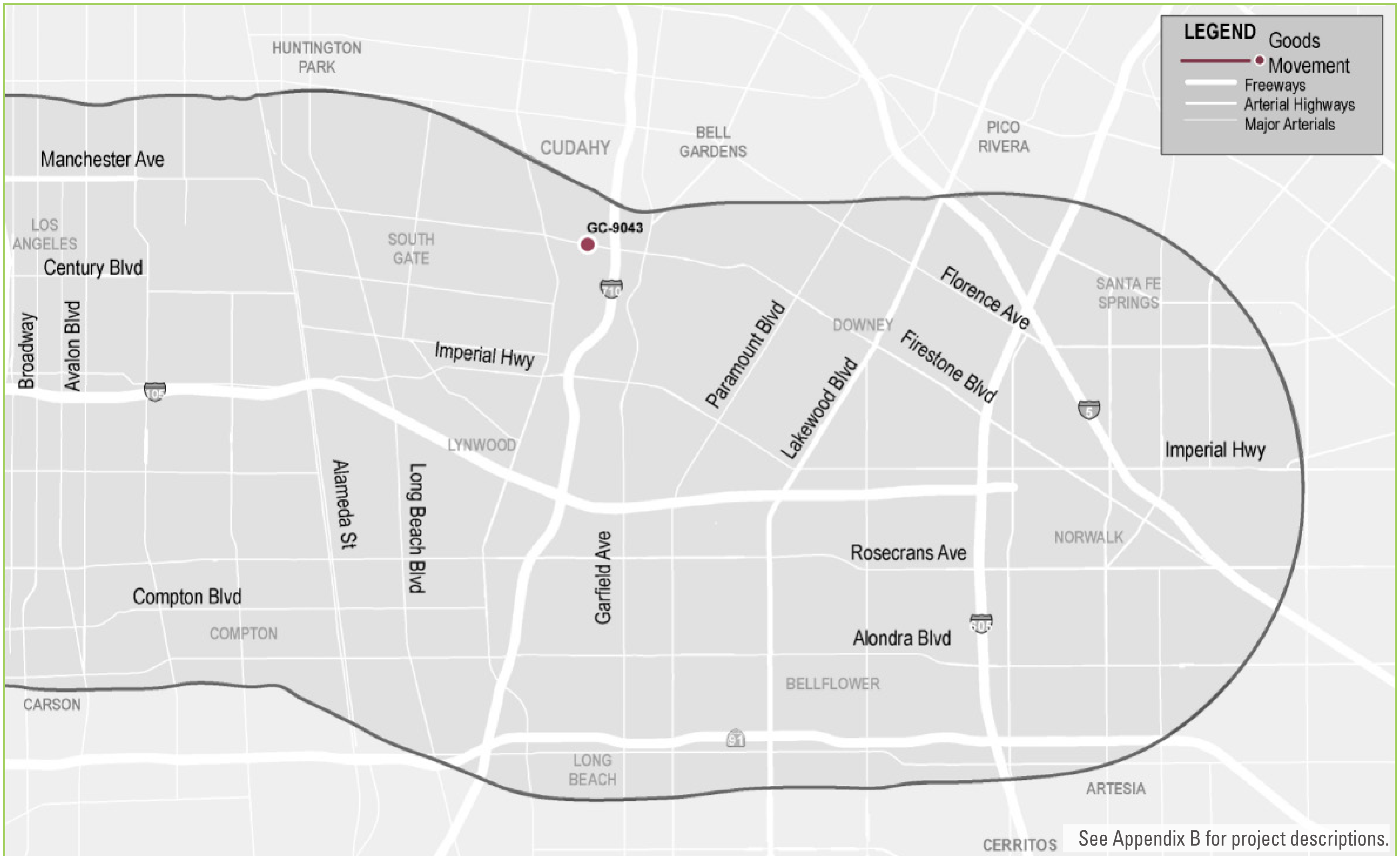

Figure 3.10 Potential Goods Movement Projects (Eastern Portion)

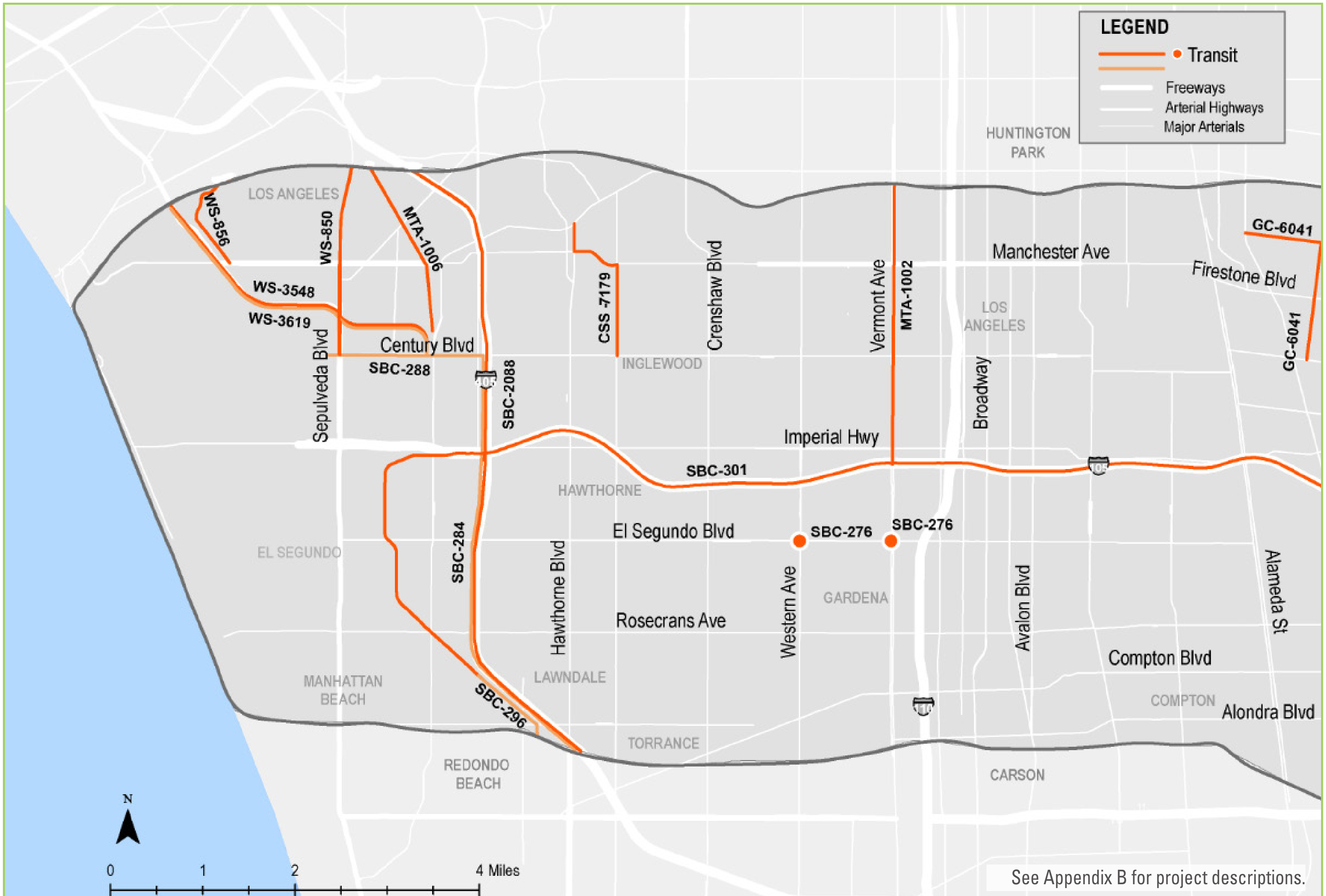

Figure 3.11 Potential Transit Projects (Western Portion)

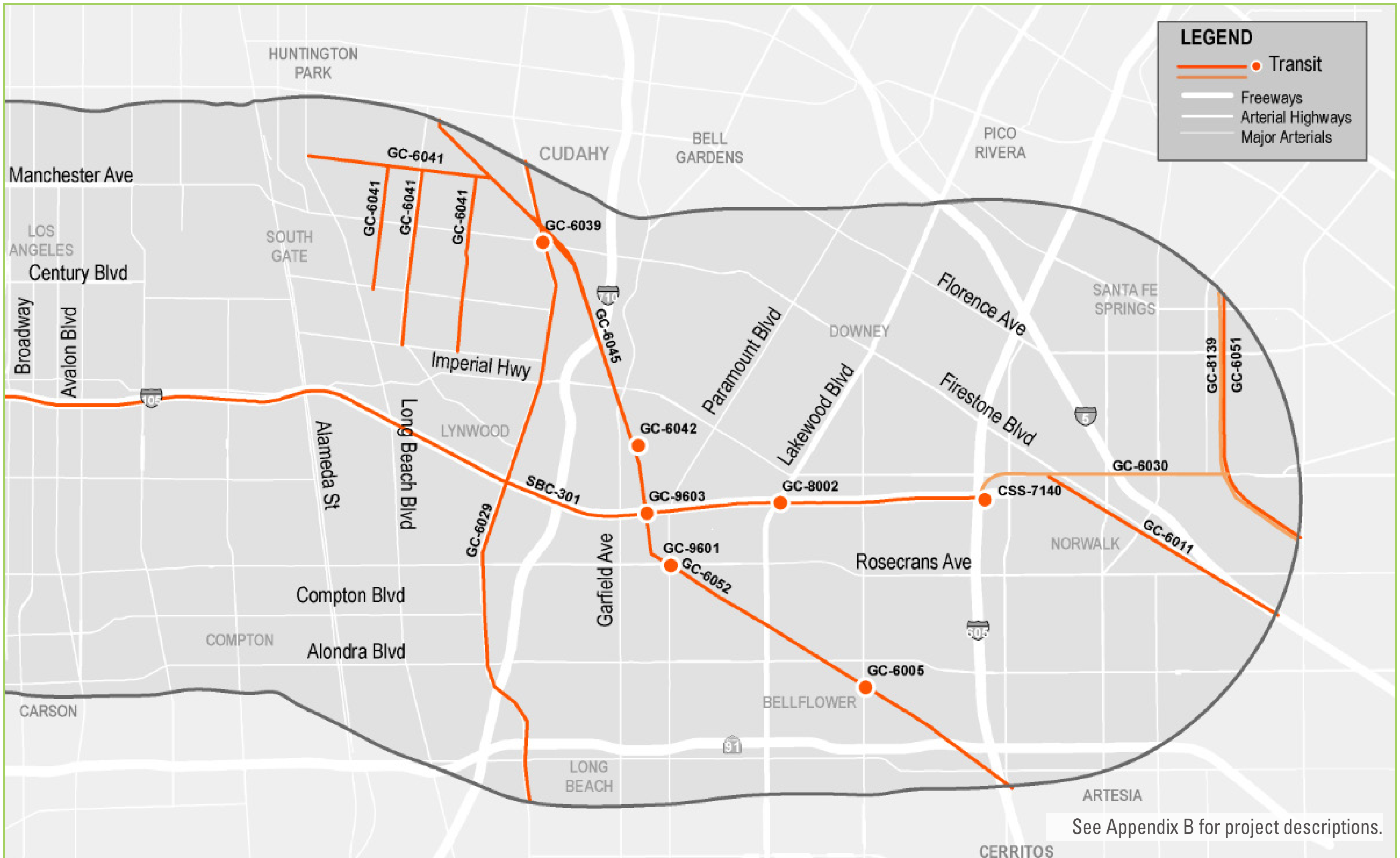

Figure 3.12 Potential Transit Projects (Eastern Portion)

Evaluation of Projects and Improvement Scenarios

The section below describes the process of evaluating each project included in the I-105 CSS. The evaluation followed a four-step process that included: 1) Project Categorization, 2) Qualitative Performance Evaluation, 3) Quantitative Performance Evaluation, and 4) Organization. These steps are displayed visually in Figure 3.13 and described in detail below.

Figure 3.13 Performance Evaluation Process

Step One: Project Categorization

In this step of the process, each project was categorized by type and subtype (See Table 3.2). For instance, a striped bicycle lane project would receive t project type “Active Transportation” and the subtype “Bikeway – Class 2”. Then, each project was assigned to three scenarios for evaluation based on the implementation timeline. These scenarios include:

- **Near term**—Less than 5 years
- **Mid-term**—Between 5—15 years
- **Long-term**—More than 15 years

Implementation timelines were selected based on ease of implementation, relative project need, and the scope and cost of the project. Most of the projects were considered feasible for implementation in the near-term while a few project types are more complex and require more advanced study, environmental review and design, such as rail transit projects. Just a handful of projects were designated the long-term scenario.

Type	Subtype	Near/Mid/Long
Active Transportation	Bikeshare Bikeway—Class 2 Bikeway—Class 3 or Unspecified Education and Promotion Beautification/Open Space Pedestrian Improvements First/Last Mile	Near
	Bikeway—Class 1 or 4 Bike/Ped Bridges Complete Streets New Sidewalk/Trail	Mid
Arterial	Capacity Enhancement (arterial) Intersection Improvement State of Good Repair ITS/Operational Improvements (arterial)	Near
	Arterial Corridor Improvement	Mid
	Bridge and Grade Separation	
Goods Movement	Goods Movement, Logistics & Technology	Mid
	Grade Separation and Crossing Projects	Long
Highway	ITS/Operational Improvements (highway)	Near
	Auxiliary Lane HOV/HOT/Express Lanes Integrated Corridor Management Interchange Enhancement Ramp Improvements Soundwalls	Mid
	Major Capacity Enhancement (highway)	Long
Transit	Bus Replacement/Transit Maintenance/Transit Operations New Bus	Near
	Metrolink Commuter Rail Program Enhancements New BRT Transit Centers/Park and Ride/Bus stations/Bus stops	Mid
	New Rail	Long

Table 3.2 Project Implementation Timelines by Type and Subtype

Step Two: Qualitative Performance Evaluation

The first phase of performance evaluation was qualitative. In this phase, projects were evaluated based on how well they met the objectives of the I-105 CSS. Each subtype was assigned to a high, medium, or low tier based on how well it met each objective in the performance evaluation framework (Figure 3.1). For example, a capacity enhancement arterial project scores in the medium or high tier for a number of mobility and connectivity objectives, such as total person throughput, travel time by mode, and vehicle and truck hours of delay. Conversely, for the Safety, State of Good Repair, and Sustainability and Quality of Life goals, capacity enhancing arterial projects score in the lowest tier. The detailed scoring methodology can be found in Appendix A.

Step Three: Quantitative Performance Evaluation

The second phase of project evaluation examined the specific conditions in the I-105 study area. Projects were evaluated to determine if they address specific deficiencies identified earlier in the project. Arterial, active transportation, and transit projects received the secondary evaluation. For instance, active transportation projects are expected to provide additional benefit relative to other similar projects if they: are in an area with higher population density; are in close proximity to transit, schools, hospitals, and commercial land uses; address a gap in the bike network; or are located in an area with significant bicycle and pedestrian collisions. Transit projects score higher for similar criteria: they serve high population density areas, are located in commercial and employment centers, are located in disadvantaged communities, and provide access to parks. Arterial projects on high volume, more highly congested, and major east-west arterials are expected to provide more corridor benefits than projects not on routes with those conditions. The detailed scoring methodology can be found in Appendix A.

Step Four: Organization

The combination of the two evaluation phases, Steps three and four, resulted in a composite score for each project across the performance objectives. The aggregate score for each project was compared to the scores of similar projects (e.g. arterial projects, transit projects, etc.) in order to determine its low, medium, or high performance classification tier. Each project was then organized by its performance classification and its implementation scenario (near, mid, long). The results of this analysis is summarized in Section 4.0 below.

4.0 I-105 CSS Improvement Scenarios

The results of the project evaluation, organized by implementation timeframe (the basis of each "scenario"), are summarized below. Performance evaluation tiers are groupings of similar projects (arterials vs transit) into the highest performing, the middle tier, and the lower performing grouping of projects." To "Performance evaluation tiers are the highest performing, the middle tier, and the lower performing projects of similar types (arterials vs transit). It should be noted that the categorization of projects as near-term, mid-term, and long-term is not intended to be used to prioritize funding and implementation. Instead, the project list is intended to assist decision makers in understanding the relative benefits and challenges associated with types of projects. Ultimately, project implementation will be decided by the project sponsor(s) and jurisdiction(s) the project is located in.

Improvement Scenario Results

As shown in Figure 4.1, more than half of the projects are near-term, about a quarter are mid-term, and a small number are defined as long-term projects. In the near and mid-term categories, the majority of projects fall in the middle performance evaluation tier, but nearly a quarter of projects that are near or midterm are the highest performers, meaning they are considered likely to better enhance the sustainability of the corridor. These highest tier projects include bikeways and trails, complete streets, first/last mile improvements, bridge and grade separation, new bus rapid transit (BRT), transit centers, arterial ITS and operational improvements, and new rail projects. Some of these will take much longer to implement, such as new rail, despite its many benefits. Other projects, such as implementing new Class II bikeways, could be implemented in less time and would thus make an impact in the corridor in the near-term by closing critical gaps and improving non-motorized transportation options in the I-105 study area.

Ultimately, project implementation will be decided by the project sponsors and jurisdictions the projects are located in.

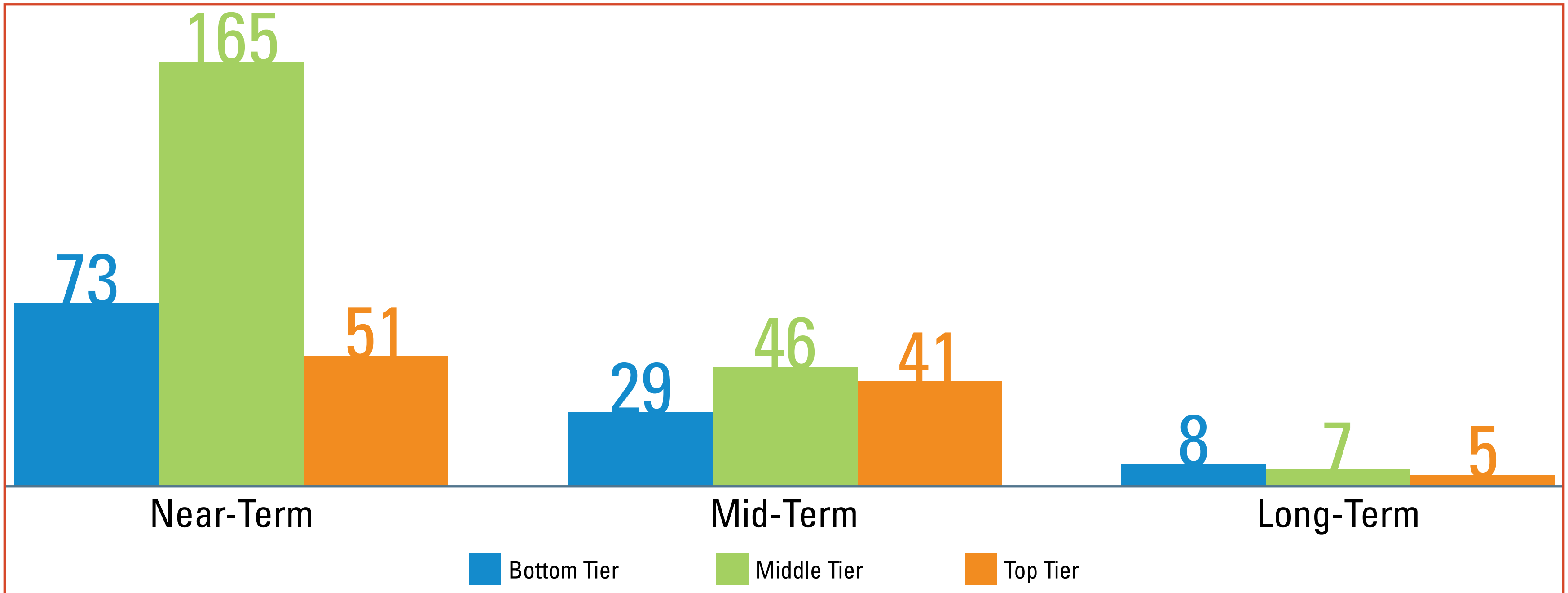

Figure 4.1 Projects by Implementation Timeframe and Performance Evaluation Tier

Near-Term Projects Scenario

» Near-term project improvements include the greatest variety of project types. As shown in Table 4.1, the majority of active transportation and arterial improvements lie within the near-term timeframe. This is explained by the relative ease with which many active transportation projects are implemented and the shorter timelines needed for arterial intersection improvements and ITS operational projects, as opposed to major capital projects, which require right-of-way and environmental review. There are 51 near-term projects that fall in the top tier. Amongst near term projects, only active transportation projects and arterial projects are classified in the highest performing tier. There are many more lower and medium tier projects that can be completed relatively quickly, with 165 medium tier projects and 73 low tier projects.

Project Type	Project Subtype	Evaluation Tier: Bottom	Evaluation Tier: Middle	Evaluation Tier: Top	Total
Active Transportation	First/Last Mile			3	70 (75% of active transportation projects)
	Beautification/Open Space	1			
	Bikeshare			1	
	Bikeway - Class 2		17	6	
	Bikeway - Class 3 or Unspecified	29	1	1	
	Pedestrian Improvements		11		
Arterial	Capacity Enhancement (arterial)	3	5		178 (89% of arterial projects)
	Intersection Improvement	1	49		
	ITS/Operational Improvements (arterial)		41	40	
	State of Good Repair	36	3		
Highway	ITS/Operational Improvements (highway)		32		28 (34% of highway projects)
Transit	Bus Replacement/Transit Maintenance/ Transit Operations	3			9 (31% of transit projects)
	New Bus		6		
Total		73	165	51	Total Projects: 289

Table 4.1 Near-Term Projects (Estimated Less than 5 Years)

Mid-Term Projects Scenario

Highway projects make up nearly half of the mid-term project scenario, as shown in Table 4.2. Many of these types of improvements, such as adding express lanes, ramp improvements, and soundwalls are larger infrastructure undertakings that require numerous levels of approval, years of planning, environmental review and major construction. A number of transit projects, 52%, are also considered mid-term including Metrolink commuter rail enhancements, new BRT, and transit centers and park and ride facilities. New BRT, HOV/Express lanes, bridge and grade separation, new sidewalk/trail, complete streets and class one or four bikeways are top tier projects that will improve accessibility, mobility, sustainability, and safety of the corridor and could likely be completed in five to fifteen years.

		Evaluation Tier			
Project Type	Project Subtype	Bottom	Middle	Top	Total
Active Transportation	Bike/Ped Bridges		3		23 (25% of all active transportation projects)
	Bikeway - Class 1 or 4			12	
	Complete Streets			7	
	New Sidewalk/Trail			1	
Arterial	Arterial Corridor Improvement	21			23 (11% of all arterial projects)
	Bridge and Grade Separation			2	
Goods Movement	Goods Movement, Logistics and Technology	1			1 (13% of all goods movement projects)
Highway	Auxiliary Lane	4			54 (57% of all highway projects)
	HOV/HOT/Express Lanes			14	
	Integrated Corridor Management		3		
	Interchange Enhancement		8		
	Ramp Improvements		22		
	Soundwalls	3			
Transit	Metrolink Commuter Rail Program Enhancements		1		15 (52% of all transit projects)
	New BRT			5	
	Transit Centers/Park and Ride/Bus stations/Bus stops		9		
Total		29	46	41	Total Projects: 116

Table 4.2 Mid-Term Projects (Estimated 5 to 15 years)

Long-Term Projects Scenario

There are far fewer projects that could take more than 15 years to implement. Among these 20 projects, there are major highway capacity enhancements, grade separations and crossings, and new rail projects. Capacity enhancement projects generally fall in the lower tier because they do not tend to advance sustainability in the same way as alternative modes. However, new rail facilities address more of the multimodal objectives of the study, so they performed higher despite their longer timeframe for implementation.

		Evaluation Tier			
Project Type	Project Subtype	Bottom	Middle	Top	Total
Goods Movement	Grade separation and crossing projects		7		7 (88% of goods movement projects)
Highway	Capacity Enhancement	8			10 (9% of all highway projects)
Transit	New Rail			5	5 (17% of transit projects)
Total		8	7	5	Total Projects: 20

Table 4.3 Long-term Projects (Estimated 15 or More Years)

Scenario Cost Estimates

Each near-, mid-, and long-term scenario requires billions of dollars of funding to implement. Taken together, the resulting project costs are sizable and will require generous funding. Recent project costs for similar projects were applied to each project, where feasible, to produce an order of magnitude cost estimate. Figure 4.2 displays estimated funding need by scenario. Note that the project improvements scenarios and the associated cost estimates include projects that are not located entirely within the boundaries of the study area, but will benefit mobility within the study area. These include, for example, proposed improvements on parallel and connecting freeways such as SR-91, I-605 and I-710. Similarly, for several major transit projects, they will connect to the study area, but some or most of their extent will fall outside of the study area itself. These will be important transportation options for residents and visitors to the I-105 CSS area, but again are not located entirely in the 3-mile area around I-105. To the extent feasible, the cost estimates are proportioned to include just the portion of the project that falls within the I-105 CSS area. For example, while the I-710 corridor improvement project is several billion dollars in cost, only the proportion located in this study area is included. This was done to more accurately represent the proportionate cost of improvements that will benefit the study area without including the entire cost of major regional projects which will also benefit other portions of the region.

Near-Term Cost Estimates

Near-term projects have the lowest total cost, when compared with other scenarios, despite making up nearly a quarter of the identified projects. This is reflective of the relative ease of implementation for these projects and the lower lead time and amount of review, design, and other associated costs. Across categories, near-term highway projects result in the largest total cost, while the seven transit projects have the lowest total cost within the category. The highway projects' higher costs stem from the many ITS improvements, like signal upgrades, which have high unit costs and are often not limited to a single roadway. The total estimated order of magnitude cost for near term projects is over $3.5 billion.

Mid-Term Cost Estimates

Mid-term projects have a combined total cost of 10.5 billion dollars. The transit category has by far the highest total costs for mid-term projects, despite having just 17 projects with estimated costs. Many of the highest cost projects are new BRT projects that could be implemented in the mid-term but often require substantial funding from a number of sources and extend for long distances.

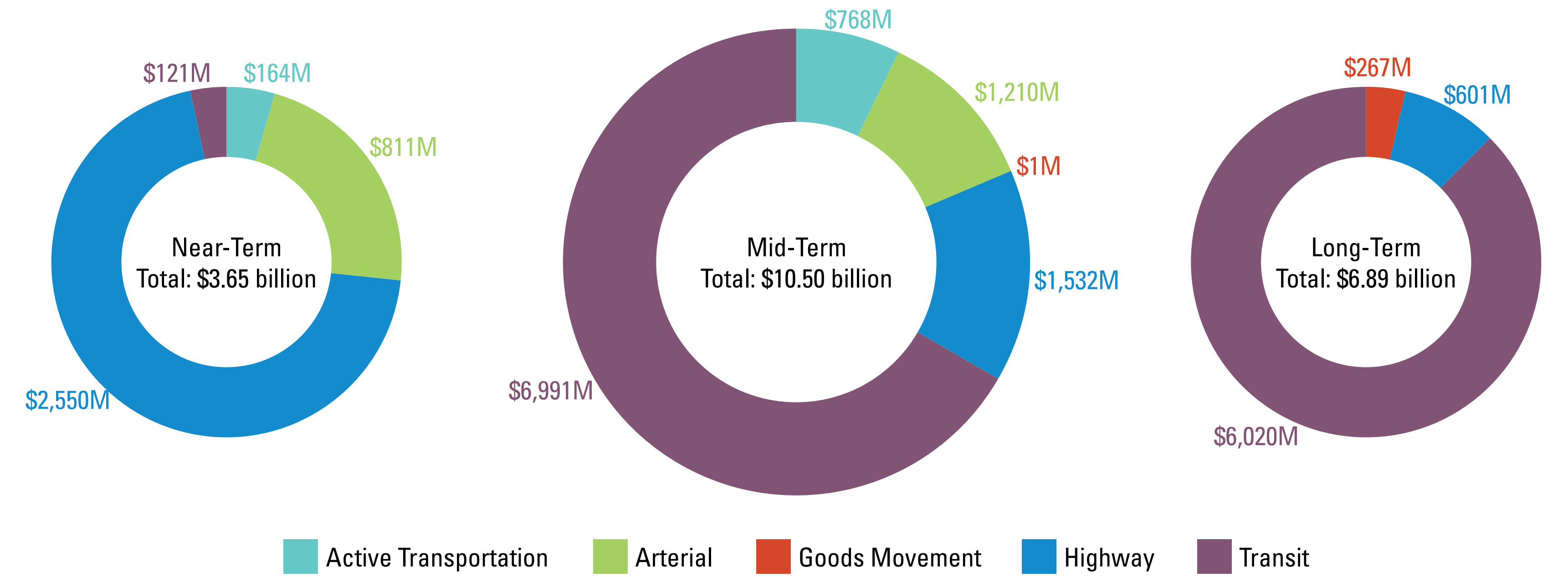

Figure 4.2 Funding Need by Scenario ($ millions)

**Note that some projects were not included in the cost estimates for various reasons including lack of sufficient project detail or description, or if the project is more programmatic or policy based.*

Long-Term Cost Estimates

The 19 long-term projects for which costs were developed have a combined projected cost exceeding the hundreds of near-term projects but far behind the mid-term project cost. These long-term projects, by definition, are more substantial efforts. Transit projects that involve rail are extremely costly, with four projects estimated to cost over six billion dollars. Similarly highway projects that involve adding capacity often require costly roadway overhauls needing billions of dollars of investment.

Funding Availability

Funding for transportation improvements is available through a series of Federal, State, and local sources. Depending on the source of funding, eligible projects vary by mode, scope, and project phase. Some funding programs allocate resources through competitive grant processes or other discretionary means, while other funds are distributed by formula to state, regional, or local governments. The section below summarizes some of the relevant funding sources available for projects in the I-105 CSS study area.

Federal Funding Sources

Federal transportation funding is administered by the U.S. Department of Transportation and authorized by the Federal transportation bill. The most recent transportation funding bill, Fixing America's Surface Transportation Act (FAST-Act), was signed into law in 2015.

Much of the funding available through the U.S. DOT's Highway Trust Account is allocated to California based on the state's population. The State of California, in turn, distributes those funds to local agencies by formula or through competitive grant programs. For instance, the majority of the Federally funded Surface Transportation Program funding in California is programmed through the STIP (Statewide Transportation Improvement Program). Additionally, California's Active Transportation Program consolidated most of the Federal and state funding sources for bicycle and pedestrian projects.

While there are many potential funding sources, there is still a large unfunded component of the potential improvements in the I-105 Study Area.

There are two Federal discretionary grant programs available for local agencies to apply for funding. These include the Better Utilizing Investments to Leverage Development program (BUILD—formerly TIGER) and the Infrastructure for Rebuilding America program (INFRA—formerly FASTLANE). Highlighted below in Table 4.4, these programs provide opportunities for the I-105 corridor cities and regional entities to apply for substantial funding amounts for regionally significant projects.

Name	Funding Estimate	Funding Type	Eligible Modes/Notes
INFRA	$1.5 B (nationwide)	Discretionary	A Federal discretionary grant program reviewed by U.S. DOT. Emphasis on highway and goods movement projects
BUILD	~$150 M (California)	Discretionary	A Federal discretionary grant program reviewed by U.S. DOT. Emphasis on multimodal projects.
New Starts and Small Starts (FTA Section 5309)	$2.3 B (nationwide)	Discretionary	Funds light rail, heavy rail, commuter rail, streetcar, and bus rapid transit projects
Highway Safety Improvement Program (HSIP)	~$150 M (California)	Discretionary	Federally allocated to the state by formula, the HSIP program is available for roadway safety projects through a competitive program administered by Caltrans
Congestion Mitigation Air Quality (CMAQ)	~ $455 M (California)	Formula	Federally designated air quality containment areas receive funding by formula to program local and regional projects. Metro programs the allocated CMAQ funding

Table 4.4 Relevant Federal Funding Sources

Source: United States Department of Transportation; California Department of Transportation.

State Funding Sources

With the passage of Senate Bill 1 (SB1), the Road Repair and Accountability Act of 2017, the State of California has additional transportation funding for local and regional projects. SB1 augmented existing sources of funding, such as the Active Transportation Program and State Highway Operation and Protection Program, and created entirely new funding programs, such as the Solutions for Congested Corridors and Trade Corridor Enhancement programs. Table 4.5 highlights the State funding sources that are most relevant to the I-105 CSS improvement scenarios.

Name	Funding Estimate	Funding Type	Eligible Modes/Notes
Local Streets and Roads	$1.5 B	Formula	Cities and counties for road maintenance, safety projects, railroad grade separations, complete streets, and traffic control devices.
Solutions for Congested Corridors (SCCP)	$250 M	Discretionary	Regional transportation authorities and Caltrans may nominate projects for funding. California Transportation Commission administers this program
Trade Corridor Enhancement (TCEP)	$ 1.3B	Discretionary	Caltrans and regional entities can be project sponsors. Funding is available for Bay Area, Central Valley, Central Coast, LA/Inland Empire, and San Diego/Border
Local Partnership Program (LPP)	$200 M	50% Discretionary 50% Formula	Eligible funding for "self-help" counties*. Most transportation improvements are eligible
Active Transportation Program (ATP)	$253 M	Grant (statewide and regional competitions)	Eligible projects include bicycle and pedestrian improvements and planning. SB1 augmented the ATP with an extra $100M per year
State Highway Operation and Protection Program (SHOPP)	$17.96 B (4 year program)	Discretionary	Projects are selected by Caltrans and adopted by the California Transportation Commission (CTC).
State Transportation Improvement Program (STIP)	Varies (5 year program)	Formula	Projects are proposed by regional transportation agencies and approved by the CTC on a bi-annual basis. The majority of the STIP funding comes from Federal sources.
Transit and Intercity Rail Capital Program (TIRCP)	$545 M	Discretionary	Discretionary program administered by Caltrans and the California State Transportation Agency (CalSTA)

Table 4.5 Relevant State Funding Sources

Source: California Department of Transportation, California Transportation Commission.
** Counties that have passed local option sales tax measures to fund transportation improvements*

Local Funding Sources

Los Angeles County has passed four countywide sales tax measures since 1980, including Proposition A (1980), Proposition C (1990), Measure R (2008), and Measure M (2016). Each measure added ½ cent to the county sales tax, and while Measure R included a sunset date, that ½ cent tax will continue on with the passage of Measure M, which has no sunset date. Because of these taxes, it is estimated that roughly 83% of the funding available for LA County over the next 40 years will come from these local sources[41]. LA Metro, as the Regional Transportation Planning Authority, programs much of the Federal and state apportioned funding that is allocated to LA County. However, local and subregional agencies have significant funding at their disposal through the Local Return and Multi-year Subregional Programs (MSP). Table 4.6 displays relevant local funding sources.

Name	Annual Funding Estimate	Funding Type	Eligible Modes/Notes
Measure M—Transit Construction	$279 M	Discretionary	Major transit capital projects included in the Measure M ordinance
Measure M—Highway Construction	$136 M	Discretionary	Major highway capital projects included in the Measure M ordinance
Local Return (Prop A, Prop C, Measure R, and Measure M)	$607 M	Formula	Funding given to local jurisdictions by formula for street resurfacing, rehabilitation and reconstruction, pothole repair, signals, bikeways, pedestrian improvements streetscapes, signal synchronization, and transit.
Measure M—Multi-year Subregional Program	Varies	Discretionary	Eligibility for Measure M Multi-year Subregional Programs vary by subregion. Projects are programmed by the subregional governing board.

Table 4.6 Relevant State Funding Sources

Source: LA Metro Funding Guide, Measure M Expenditure Plan.

Described in detail in Section 4.0 above, there are several major highway projects funded through Measure M (and the 2008 Measure R) relevant to the I-105 study area. These include the I-105 ExpressLane Project, the I-710 Corridor Project, the I-405 South Bay Curve Bottleneck Improvements, and the I-605 Corridor "Hot Spots" Program. Specific funding for I-605 projects in the Gateway Cities subregion is available through the Measure M Multi-year Subregional Program described below (See Table 4.7). Major transit projects relevant to the I-105 study area include the Crenshaw Line, the West Santa Ana Branch Transit Corridor, the Vermont Transit Corridor, the Green Line Extension to Torrance, the Green Line Extension to Norwalk, the Lincoln Boulevard BRT, and the Sepulveda Pass Transit Corridor.

In addition to the major capital projects, Measure M provides extra funding to subregional governments to program in their Multi-year Subregional Programs (MSP). Table 4.7 below highlights the MSP funding available for subregions in the I-105 study area. These funds will be made available, by Metro, on an annual basis for the subregional governments to fund local transportation projects.

Subregion	Program	Total Funding (FY18—FY57)
Gateway Cities	Active Transportation Program	TBD
	I-605 Corridor "Hot Spot" Interchange Improvements	$ 1 B
South Bay Cities	Transportation System and Mobility Improvement Program	$ 293.5 M
	South Bay Highway Operational Improvements	$ 500 M
	Transportation System and Mobility Improvement Program	$ 350 M
Westside Cities	Active Transportation First/Last Mile Connections Program	$ 361 M
Central City	Active Transportation, First/Last Mile, & Mobility Hubs	$ 215 M

Table 4.7 Measure M Multi-year Subregional Programs

Source: LA Metro Funding Guide, Measure M Expenditure Plan.

Next Steps

The I-105 CSS identified opportunities to improve the mobility and sustainability of the corridor surrounding Interstate 105. It established a framework and process for evaluating a the current conditions and potential improvements to the corridor from a multimodal perspective. Local agencies and Caltrans can leverage this report, in collaboration with surrounding jurisdictions, to guide future planning studies and to help identify and acquire funding for projects that will provide mobility benefits for a wide variety of corridor users. The final report and supporting research results can also be used by the jurisdictions in the subregion to support future transportation plans and to guide implementation of mobility improvements that are both multi-jurisdictional as well as multimodal.

While this effort began before California established their guidelines for Comprehensive Multimodal Corridor Plans, the I-105 CSS closely followed both the Caltrans and CTC corridor planning guides, and Caltrans was a partner agency in the development of the I-105 CSS. The CTC guidelines, adopted in December of 2018, lay out the following steps for corridor planning: 1) Developing Scope and Outreach Plan for Stakeholder Input; 2) Gathering Information; 3) Conducting Performance Assessment(s); 4) Identifying Potential Projects and Strategies; 5) Analyzing Improvements; 6) Selecting and Prioritizing Solutions; 7) Publishing the Corridor Plan; 8) Monitoring and Evaluating Progress[42]. The I-105 CSS completed each of first seven steps recommended by the CTC. In the future, project funding, implementation and on-going monitoring can occur to track the progress towards meeting the goals and objectives laid out in this report.

Appendix A: Evaluation Framework Scoring Methodology

Appendix B: Detailed Project List

Appendix C: Existing Conditions Assessment

Appendix D: Future Conditions Assessment

Endnotes

1 SCAG 2012 Countywide Land Use data: http://gisdata-scag.opendata.arcgis.com

2 SCAG Travel Demand Model for RTP/SCS 2016: http://rtpscs.scag.ca.gov/

3 American Community Survey, 2012-2016 5-Year Estimates. See Appendix C

4 CalEnviroScreen, CA Office of Environmental Health Hazard Assessment: https://oehha.ca.gov/calenviroscreen

5 SCAG. 2016 RTP/SCS Environmental Justice Appendix: http://scagrtpscs.net/Documents/2016/final/f2016RTPSCS_EnvironmentalJustice.pdf

6 American Community Survey, 2012-2016 5-Year Estimates. See Appendix C

7 SCAG Travel Demand Model for RTP/SCS 2016: http://rtpscs.scag.ca.gov/

8 SCAG Travel Demand Model for RTP/SCS 2016: http://rtpscs.scag.ca.gov/

9 California Department of Transportation. I-105 General Purpose – Managed Lanes Traffic Analysis: Traffic Operations Analysis Report, 2014.

10 California Department of Transportation. I-105 General Purpose – Managed Lanes Traffic Analysis: Traffic Operations Analysis Report, 2014.

11 Caltrans District 7 HOV Lane Operation reports: http://www.dot.ca.gov/d7/programs/managed-lanes/

12 California Department of Transportation. I-105 General Purpose – Managed Lanes Traffic Analysis: Traffic Operations Analysis Report, 2014.

13 Cambridge Systematics, PortTAM Year 2016 model run

14 California Department of Transportation. Traffic Accident Surveillance and Analysis System (TASAS) Table B – Selective Accident Rate Calculation Report.

15 California Statewide Integrated Traffic Records System, 2012-2016: http://iswitrs.chp.ca.gov/Reports/jsp/userLogin.jsp

16 California Department of Transportation Division of Maintenance Pavement Program. 2015 State of the Pavement Report, December 2015.

17 Los Angeles County Metropolitan Transportation Authority. Metro Arterial Performance Measurement Tool, 2017.

18 California Statewide Integrated Traffic Records System, 2012-2016: http://iswitrs.chp.ca.gov/Reports/jsp/userLogin.jsp

19 SCAG Travel Demand Model for RTP/SCS 2016: http://rtpscs.scag.ca.gov/

20 SCAG Travel Demand Model for RTP/SCS 2016: http://rtpscs.scag.ca.gov/

21 Cambridge Systematics, PortTAM Year 2016 model run

22 American Community Survey, 2012-2016 5-Year Estimates. See Appendix C

23 LA Metro Ridership Data (2017)

24 American Community Survey, 2012-2016 5-Year Estimates. See Appendix C

25 LA Metro On-Board Surveys: https://www.metro.net/news/research/

26 SCAG Regional Bikeways GIS Data, collected from local jurisdictions

27 Metro First/Last Mile https://www.metro.net/projects/sustainability-first-last/

28 Metro Blue Line First Last Mile Plan: https://www.metro.net/projects/transit-oriented-communities/blue-line-flm/

29 California Statewide Integrated Traffic Records System, 2012-2016: http://iswitrs.chp.ca.gov/Reports/jsp/userLogin.jsp

30 SCAG Regional Bikeways GIS Data, collected from local jurisdictions

31 Metro I-105 ExpressLanes: https://www.metro.net/projects/i105-expresslanes/

32 Metro I-710 project: https://www.metro.net/projects/i-710-corridor-project/

33 Metro Measure M Expenditure Plan: http://theplan.metro.net/

34 Metro I-605 project https://www.metro.net/projects/i-605/corridor-project/

35 Metro Crenshaw Line: www.metro.net/projects/crenshaw_corridor/

36 Metro West Santa Ana project: https://www.metro.net/projects/west-santa-ana/

37 Metro Vermont Corridor project: https://www.metro.net/projects/vermont-corridor/vermont-corridor/

38 Metro Green Line Southbay: https://www.metro.net/projects/green-line-extension/

39 Green Line Norwalk Extension: http://www.scag.ca.gov/programs/Pages/NorwalkGreenlineStudy.aspx

40 Metro Sepulveda Corridor project: https://www.metro.net/projects/sepulvedacorridor/

41 Metro Funding Guide 2017: https://www.metro.net/projects/funding/

42 CTC. Comprehensive Multimodal Corridor Plan Guidelines: http://www.catc.ca.gov/programs/sb1/sccp/corridor-plan/

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