Appendix D

CAMBRIDGE SYSTEMATICS

I-105 Corridor Sustainability Study: Future Baseline Conditions

Task 5

prepared for

Southern California Association of Governments (SCAG)

INNOVATING FOR A BETTER TOMORROW

prepared by

Cambridge Systematics, Inc.

December 18, 2018

www.camsys.com

report

I-105 Corridor Sustainability Study: Future Baseline Conditions

Task 5

prepared for

Southern California Association of Governments (SCAG)

prepared by

Cambridge Systematics, Inc.
515 S. Figueroa Street, Suite 1975
Los Angeles, CA 90071

date

December 18, 2018

Table of Contents

List of Figures

List of Tables

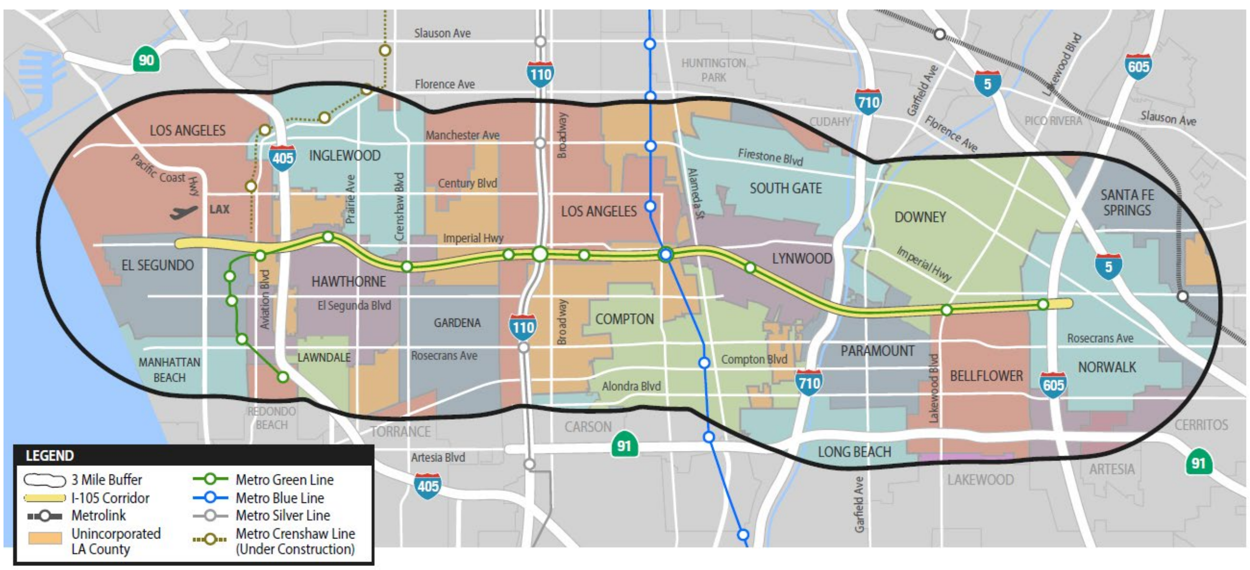
1.0 Introduction

Task 2 of the I-105 Corridor Sustainability Study (CSS) resulted in the definition of the study area as well as the development of a framework for assessment of current and future conditions. Task 2 also included recommendations for the multi-modal performance measures to be used to assess proposed corridor improvements. Task 4 of the study included completion of the study area current conditions assessment covering all modes. Task 5, as detailed in this memo, builds on the work of Task 2 and 4 and includes a future baseline conditions assessment of the study area covering future changes in land use/demographics, roadway (arterial and freeway), transit, active transportation and overall system performance.

The intent of Task 5 is to use available tools and data sources such as the SCAG RTP/SCS 2016 and 2040 models and prior models and analysis of the I-105 corridor to forecast future baseline conditions within the I-105 Corridor Sustainability Study Area (I-105 Study Area), leading to the identification of multi-modal needs accounting for population growth and future travel demands. Task 5 analysis of future baseline conditions is necessarily more focused than Task 4, as it is not possible to forecast future conditions for all of the system elements covered in the current conditions assessment (for example safety and state of good repair are not included in Task 5 future baseline conditions assessment).

As shown in **Figure 1-1**, the I-105 Study Area includes an area covering three miles on either side of the I-105 freeway, from its western terminus two miles west of I-405 in El Segundo, to its eastern terminus 0.3 miles east of I-605 in Norwalk.

Figure 1-1 I-105 Study Area



The remainder of this report is structured as follows:

- Section 2.0 Demographic and Land Use Assessment
- Section 3.0 Roadway Assessment
- Section 4.0 Transit Assessment

- Section 5.0 Active Transportation Assessment
- Section 6.0 Systemwide Performance
- Section 7.0 Summary and Conclusions

2.0 Demographics and Land Use Assessment

2.1 Population Change

In 2040, the population of LA County is projected to be over 11.5 million people, a 13.7% percent increase from 2016.[1] 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 (see **Table 2.1**). This equates to a compound annual growth rate of 0.54% for LA County and less than 0.3% for the I-105 Study Area.

Table 2.1 Population Change, 2016 to 2040

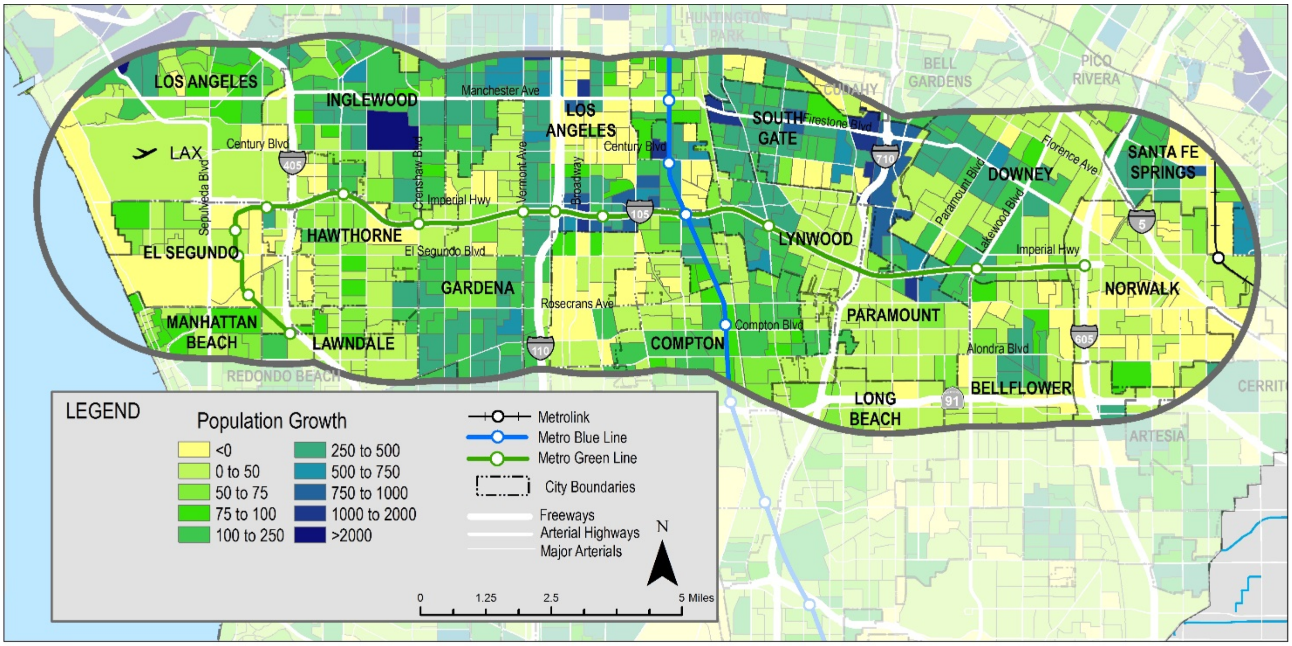
	I-105 Study Area			LA County		
	2016	2040	% Change	2016	2040	% Change
Population	1,441,189	1,543,862	7.1%	10,120,135	11,508,896	13.7%
Households	408,909	444,149	8.6%	3,373,745	3,944,036	16.9%

Source: SCAG 2016 RTP/SCS

There is geographic variability in the population growth. **Figure 2.1** highlights total population growth, and **Figure 2.2** shows the change in population relative to the 2016 population. Taken together, these two maps show that, with the exception of a few cases, 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. Other areas that show high growth rates, such as round LAX and El Segundo, have lower population densities and therefore the total change in population is insignificant.

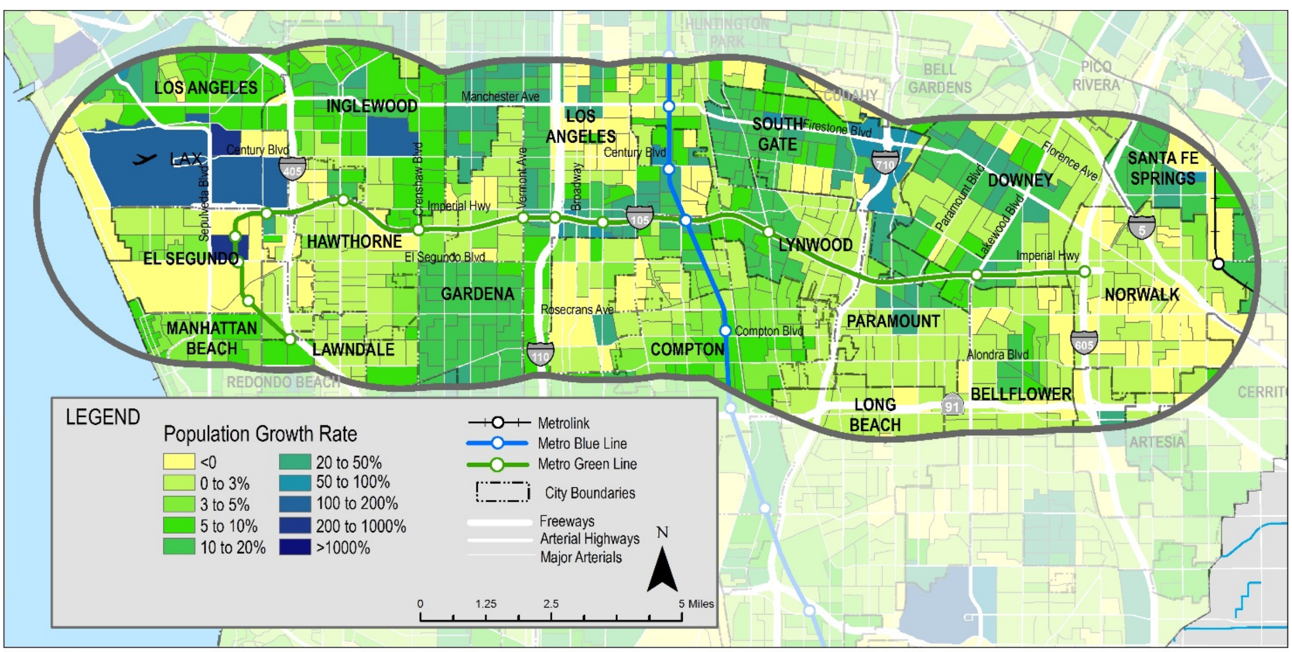
[1] SCAG 2016 RTP/SCS Model

Figure 2.1 I-105 Study Area Population Growth, 2016 - 2040



Source: SCAG 2016 RTP/SCS

Figure 2.2 I-105 Study Area Population Growth Rate, 2016 - 2040



Source: SCAG 2016 RTP/SCS

Table 2.2 shows the population growth in the I-105 Study Area by jurisdiction. Certain jurisdictions, such as the cities of Los Angeles, Inglewood, South Gate, Gardena, Santa Fe Springs, Downey, and Lynwood are projected to grow at rates higher than the average rate of 7.1% for the I-105 Study Area. In fact, 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).

Table 2.2 I-105 Study Area Population Growth by Jurisdiction, 2016 - 2040

Jurisdiction	2016 Population	2040 Population	Growth in Jurisdiction	% of Total Growth in I-105 Study Area
Bellflower	74,367	76,608	3.0%	2.2%
Compton	100,596	104,082	3.5%	3.4%
Downey	103,001	110,933	7.7%	7.7%
El Segundo	16,714	17,195	2.9%	0.5%
Gardena	48,926	56,107	14.7%	7.0%
Hawthorne	86,630	88,313	1.9%	1.6%
Inglewood	108,275	120,946	11.7%	12.3%
LA County	200,430	207,282	3.4%	6.7%
Lawndale	22,694	23,297	2.7%	0.6%
Los Angeles	251,922	281,997	11.9%	29.3%
Lynwood	68,257	73,260	7.3%	4.9%
Manhattan Beach	21,945	23,020	4.9%	1.0%
Norwalk	106,128	106,453	0.3%	0.3%
Paramount	54,752	58,109	6.1%	3.3%
Santa Fe Springs	11,490	13,937	21.3%	2.4%
South Gate	95,375	110,163	15.5%	14.4%
Other Cities*	69,687	72,160	3.5%	2.4%

Source: SCAG 2016 RTP/SCS
*Other cities include: Carson, Cerritos, Cudahy, Huntington Park, Pico Rivera, Redondo Beach, and Torrance

2.2 Employment Change

Total employment growth in the I-105 Study Area is also projected to be slower than the county average (see **Table 2.3**). 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 by over 17%, or 0.67% annually.

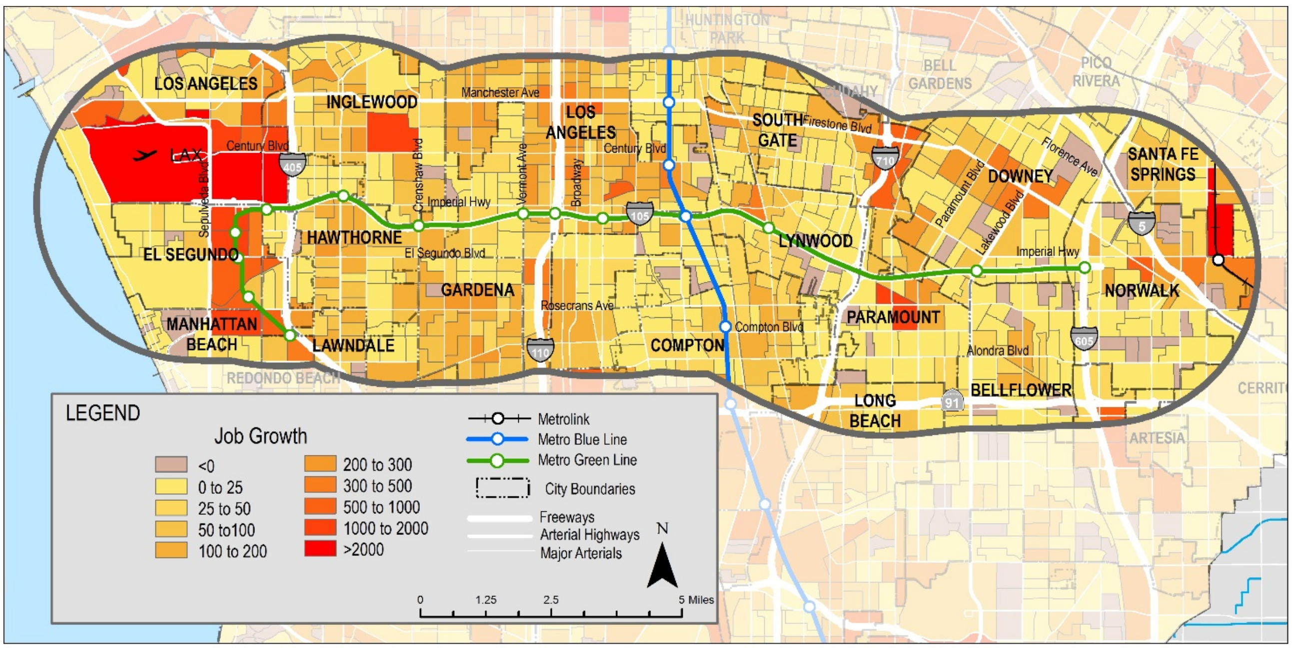
Table 2.3 Employment Change, 2016 to 2040

	I-105 Study Area			LA County		
	2016	2040	% Change	2016	2040	% Change
Employment	465,593	534,896	14.9%	4,450,704	5,221,748	17.3%

Source: SCAG 2016 RTP/SCS

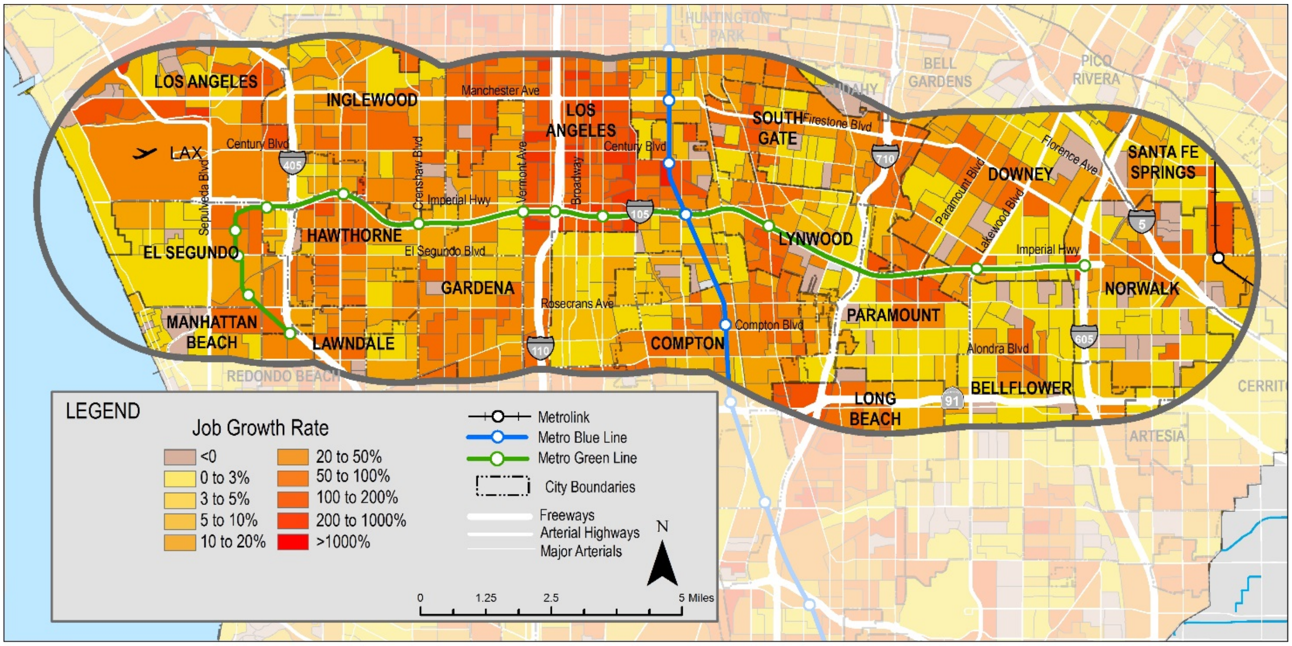
The majority of employment growth is isolated in a few areas. **Figure 2.3** shows the total employment growth by geographic area. The greatest total increase in jobs is projected to be clustered around LAX and neighboring parts of El Segundo and Manhattan Beach. Areas in Inglewood, Paramount, and Santa Fe Springs are also projected to have significant employment growth. **Figure 2.4** shows the employment growth rate as a percent of the 2016 employment. This highlights that areas experiencing the highest total growth already have significant levels of employment. There are areas in the South LA neighborhoods in the City of Los Angeles that are projected to experience very high growth rates, and while the total jobs added to these areas are modest, the City of Los Angeles is responsible for a significant portion of the total projected job growth. Table 2.4 shows the employment growth by jurisdiction. 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.

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



Source: SCAG 2016 RTP/SCS

Figure 2.4 I-105 Study Area Employment Growth Rate, 2016 - 2040



Source: SCAG 2016 RTP/SCS

Table 2.4 I-105 Study Area Employment Change by Jurisdiction, 2016 - 2040

Jurisdiction	2016 Employment	2040 Employment	Growth in Jurisdiction	% of Total Growth in I-105 Study Area
Bellflower	13,213	14,093	1.1%	1.3%
Compton	18,142	19,823	1.6%	2.4%
Downey	47,753	51,964	3.8%	6.1%
El Segundo	40,257	45,448	30.2%	7.5%
Gardena	25,198	27,911	4.8%	3.9%
Hawthorne	26,850	30,514	4.1%	5.3%
Inglewood	31,186	35,435	3.5%	6.1%
LA County	37,966	40,028	1.0%	3.0%
Lawndale	5,968	6,815	3.6%	1.2%
Los Angeles	92,954	121,188	10.0%	40.7%
Lynwood	9,439	10,795	1.9%	2.0%
Manhattan Beach	11,552	13,522	8.6%	2.8%
Norwalk	24,261	26,774	2.4%	3.6%
Paramount	20,332	22,355	3.5%	2.9%

Santa Fe Springs	22,067	24,841	19.9%	4.0%
South Gate	20,933	23,583	2.4%	3.8%
Other Cities*	17,522	19,807	3.2%	3.3%

Source: SCAG 2016 RTP/SCS
*Other cities include: Carson, Cerritos, Cudahy, Huntington Park, Pico Rivera, Redondo Beach, and Torrance

2.3 Travel Behavior

The projected mode share in 2040 is displayed in **Table 2.5** below based on SCAG's regional travel demand model. This shows modest changes in the I-105 Study Area and LA County as a whole, with a slight shift towards modes other than driving alone.

Table 2.5 Mode Share, 2016 vs 2040

	I-105 Study Area		LA County	
Mode	2016	2040	2016	2040
Single Occupant Vehicle (SOV)	39.2%	38.4%	40.2%	38.7%
High Occupant Vehicle (HOV)	37.9%	38.4%	43.4%	44.1%
Transit (including school bus)	3.8%	3.5%	3.9%	4.3%
Bike + Walk	19.0%	19.7%	12.4%	13.0%

Source: SCAG 2016 RTP/SCS

The travel demand model, however, does not specifically account for the changes in technologies that shift how the modes operate (e.g. connected and autonomous vehicles) nor can it accurately 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. The model does have some assumptions for 2040 regarding reductions in auto trips due to various factors such as increased ridesharing or increased telecommuting, but those factors are not tied to particular technological changes or events.

In LA County, the percent of employed adults who regularly work from home in 2016 was only 5.2%. However, this number has increased steadily since 2000, when it was just 3.5%.[2] The percentage of workers who telecommute occasionally is much higher. A 2015 nationwide Gallup poll found that 37% of all workers had telecommuted at least once, up from 9% in 1995.[3] Additionally, for workers who have ever telecommuted, they telecommute over six days per month on average. Aided by enhancements in technology, the telecommuting trend may continue to grow in the future, though at present it represents a small share of the overall commute market.

[2] US Census Bureau. American Community Survey 2016 and Decennial Census 2000.

[3] https://news.gallup.com/poll/184649/telecommuting-work-climbs.aspx

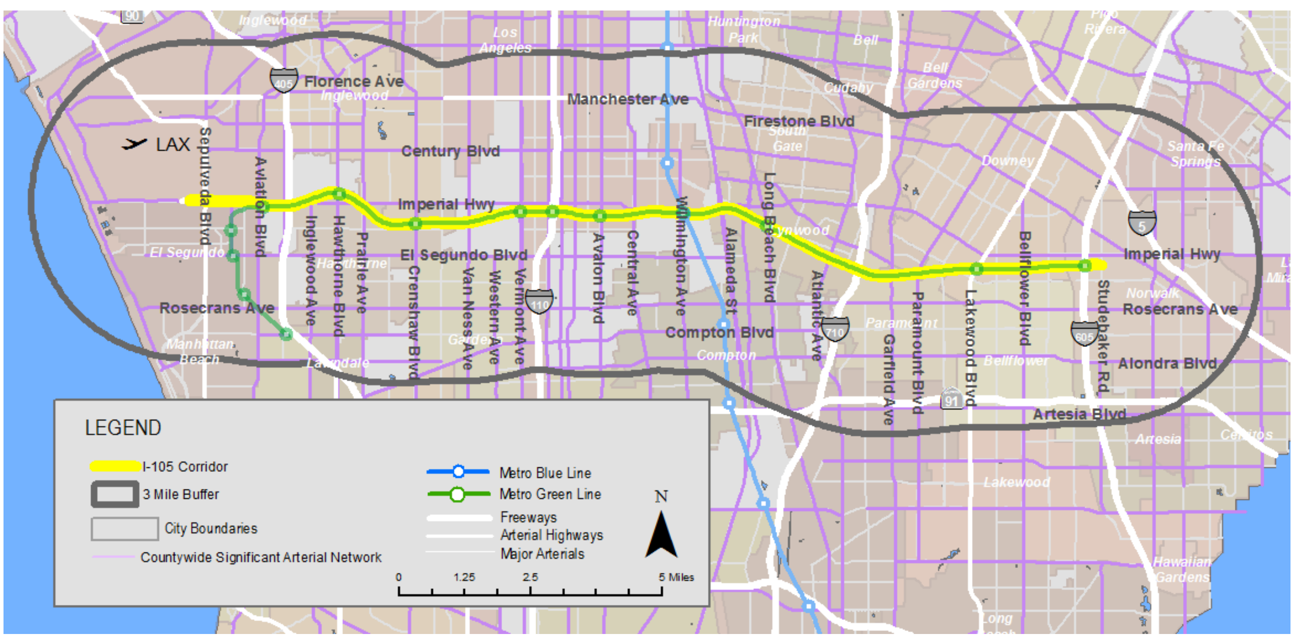
(Footnote continued on next page...)

The popularity of online shopping has increased significantly over the past two decades. Data from the U.S. Census Bureau indicated that e-commerce made up less than 1% of all retail sales in 2000 and over 9% in the first quarter of 2018.[4] During the same period, overall retail sales grew by an average of 3.2%, while the e-commerce grew by 17.5% annually, even with a downturn during the Great Recession. The online shopping trend initially replaced trips that would have occurred to traditional retail establishments; however, with the introduction of same-day delivery, trips to grocery stores and other purposes may be impacted. While personal travel for errands may decrease with the rise in online shopping, the overall burden on the transportation system is unknown due to the increase in freight and door-to-door delivery services.

3.0 Roadway Assessment

The purpose of this section is to identify future baseline I-105 freeway and arterial conditions including areas of major growth within the I-105 Study Area. The roadway assessment examines trends on the entire I-105 freeway plus major arterials (see **Figure 3.1**), as well as the truck arterial network (see **Figure 3.2**). This section summarizes the future conditions of the I-105 freeway and the major arterial facilities that are identified as part of the Countywide Significant Arterial Network (CSAN) and Countywide Strategic Truck Arterial Network (CSTAN), which are defined by Los Angeles County Metropolitan Transportation Authority (Metro). The CSAN and CSTAN networks represent the most important arterial facilities for countywide and inter-jurisdictional planning, and they exclude smaller streets such as collector roads and local streets which are typically designed for local inter-city travel only.

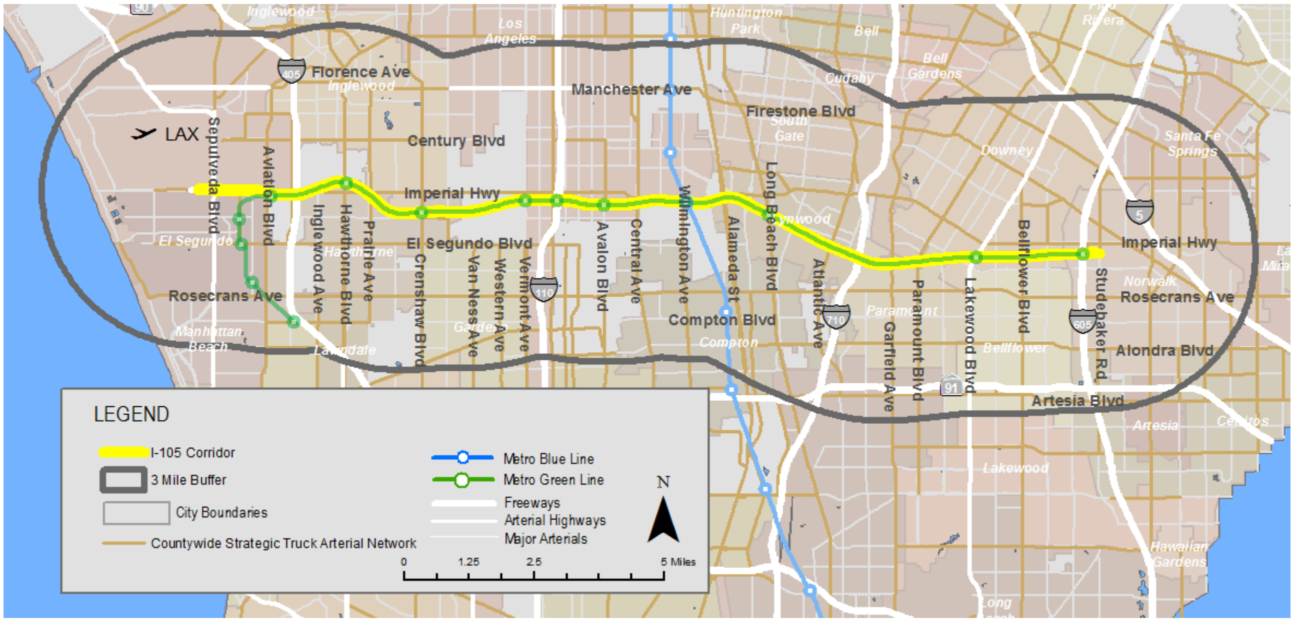
Figure 3.1 I-105 Study Area – Countywide Significant Arterial Network (CSAN)



Source: Metro

[4] US Census Bureau. Monthly Retail Trade: https://census.gov/retail/index.html

Figure 3.2 I-105 Study Area – Countywide Strategic Truck Arterial Network (CSTAN)



Source: Metro

The roadway assessment contains the following sections:

- I-105 Freeway Assessment including forecast growth in travel demand and future operating conditions on the freeway
- Arterial Assessment including forecast growth in travel demand and future operating conditions on the CSAN and CSTAN
- Truck Assessment including forecast growth in Port-bound truck trips and other non-Port related truck trips

3.1 I-105 Freeway Future Baseline Assessment

Interstate 105 traverses portions of the cities of Los Angeles, El Segundo, Inglewood, Hawthorne, Lynwood, South Gate, Paramount, Downey, Bellflower, Norwalk, and portions of unincorporated Los Angeles County, all within Los Angeles County, California.

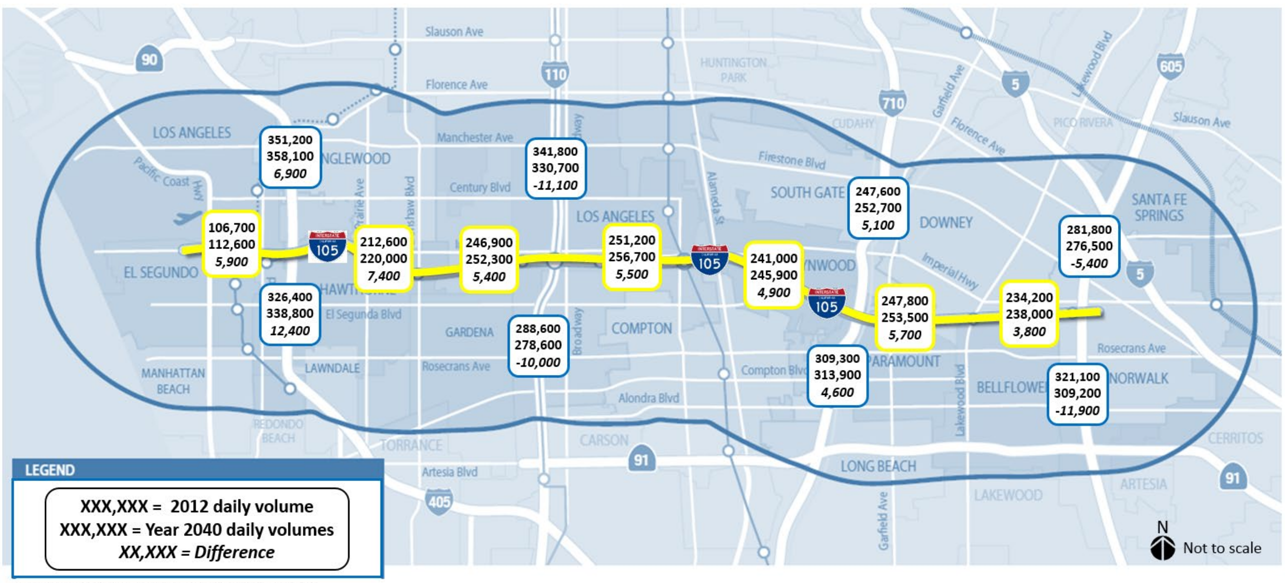
Figure 3.3 compares the SCAG 2016 RTP model base year daily traffic volumes with the forecasted daily volumes for year 2040 along I-105 and the four freeways that intersect the freeway corridor. These are model generated representations of current and future volumes from the regional travel model; more detailed existing conditions data for the freeway is presented in the Task 4 report, and Metro is completing a current existing conditions analysis of I-105 for the I-105 ExpressLanes Project (Approval/Environmental Document).

The estimated growth along I-105 ranges from about 3,800 additional daily vehicles at the eastern end of I-105 near Bellflower Boulevard to approximately 7,400 additional vehicles in the segment near Hawthorne Boulevard, towards the western end of the corridor. The percentage growth ranges from under 2 percent to nearly 6 percent, depending on location. Although I-105 freeway traffic flows are lowest at the west end of the I-105 Study Area, the SCAG regional travel demand model anticipates the highest percentage of growth to be near the west end of the freeway around Los Angeles International Airport (LAX), with an increase of

5.5%, or 5,900, daily vehicles. The anticipated growth is lower in the eastern end of the study corridor along the I-105 freeway, with less than 2% growth.

The four freeways that intersect I-105 generally carry higher volumes than I-105, due to the fact that they are all longer distance facilities that carry a greater proportion of regional trips. On average, these freeways carry over 300,000 daily vehicles. I-405 and I-710 are anticipated to experience moderate growth (approximately 1-3%) both north and south of the I-105. The model shows no growth (or negative growth) on the segments of I-110 and I-605 within the I-105 Study Area. This is likely due to proposed future improvements on the parallel I-710 which will shift some of the travel demand from those facilities to I-710 in the future.

Figure 3.3 I-105 Study Area Projected Daily Traffic Volumes, 2012 and 2040



Source: Cambridge Systematics, SCAG 2016 RTP model
Raw model numbers (not post-processed). Numbers are rounded to nearest hundred
Date prepared: 2/27/2018

Figure 3.4 I-105 Study Area Freeway Volume-to-Capacity Ratios AM Peak Period, 2012 and 2040

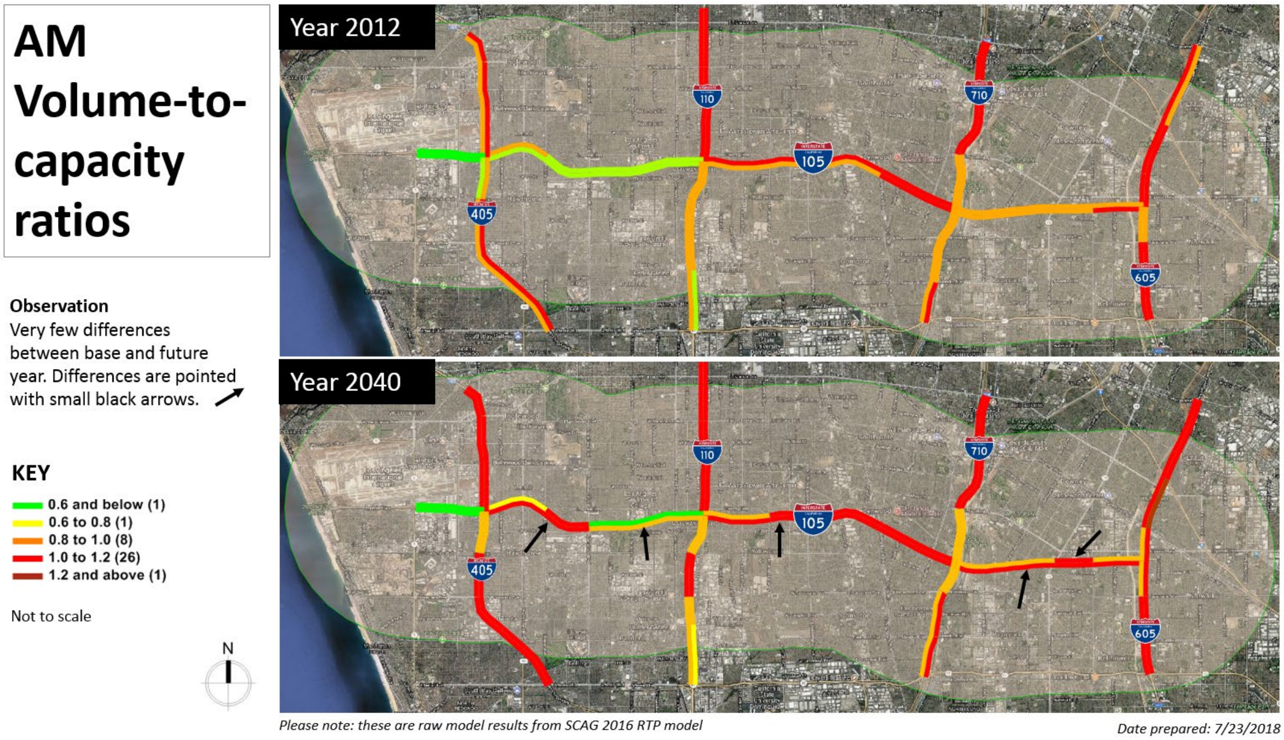


Figure 3.4 and **Figure 3.5** highlight areas with potential bottlenecks and congestion issues during the AM and PM peak periods, respectively. All freeway segments indicated in red or dark red show areas of the major freeways in the I-105 Study Area where current or forecasted volumes exceed capacity (volume-to-capacity or v/c ratio above 1.0), whereas segments in green, yellow and orange (v/c ratio below 1.0) can support some additional traffic during this time period without exceeding capacity. Black arrows highlight significant differences between the base year and future year 2040. The current conditions of these segments are nearing capacity, but the projected volumes are expected to exceed capacity in 2040. The model projects the conditions to generally worsen more in the AM peak as compared to the PM peak. This is likely due to the greater congestion already experienced during the PM peak period, whereas the AM peak period has fewer areas with v/c of 1.0 or greater. Note that these are planning level estimates of future operations. More detailed analytical techniques such as the application of the Highway Capacity Manual or microsimulation would be required to accurately forecast operating conditions along the freeway. Such work is being undertaken by the I-105 ExpressLanes Project Approval/Environmental Document.

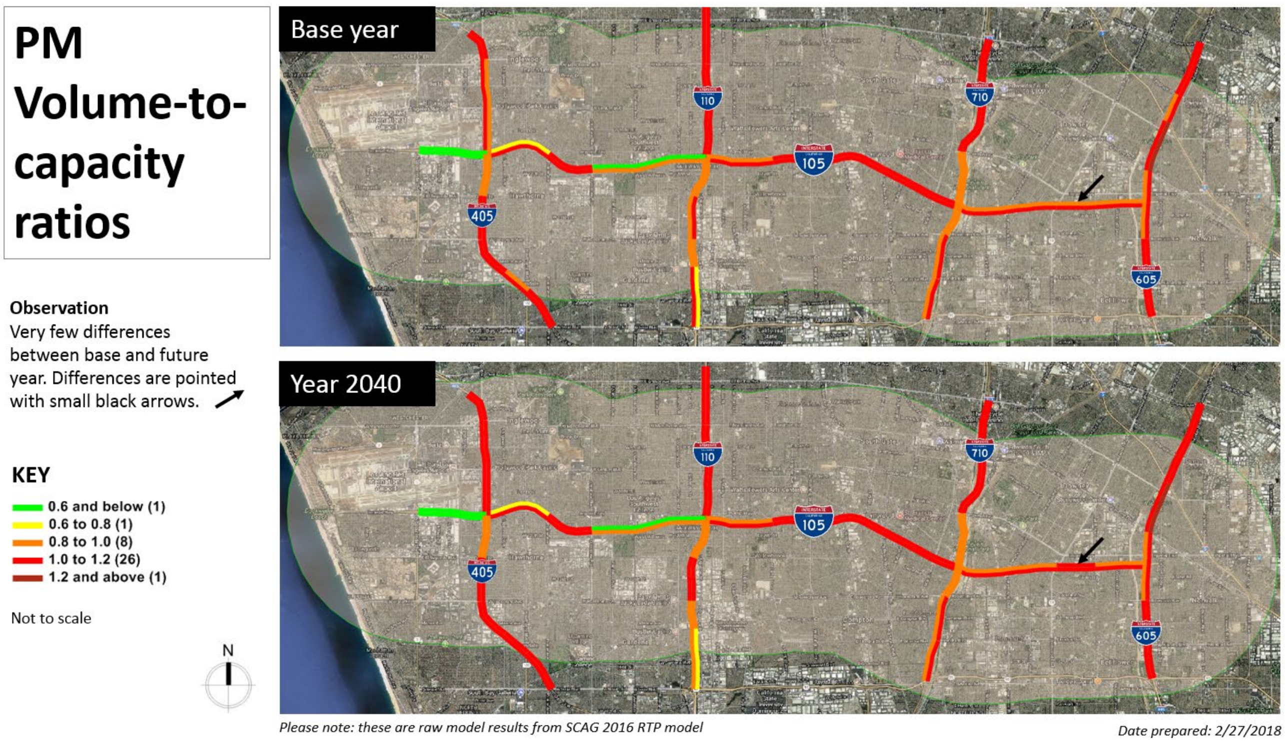
The segments of I-105 that are expected to significantly worsen during the AM peak by 2040 (based on the SCAG model) include:

- From I-405 to Crenshaw Boulevard – worsening to v/c 1.0 and over eastbound, and a portion of this segment worsening to v/c 1.0 westbound
- From I-110 to Long Beach Boulevard – worsening to v/c 1.0 eastbound
- From I-710 to Bellflower Boulevard – worsening to v/c 1.0 eastbound
- From Bellflower Boulevard to Lakewood Boulevard – worsening to v/c 1.0 westbound

The segments of I-105 that are expected to significantly worsen during the PM peak by 2040 include:

- From Bellflower Boulevard to Lakewood Boulevard – worsening to v/c 1.0 westbound

Figure 3.5 I-105 Study Area Freeway Volume-to-Capacity Ratios PM Peak Period, 2012 and 2040



To combat the heavy demand during peak commute hours, Los Angeles Metropolitan Transportation Authority (Metro) and the California Department of Transportation (Caltrans) are currently conducting planning, environmental and engineering studies to examine the potential implementation of Express Lanes along I-105 between I-405 and I-605. Alternatives include a no build alternative, conversion of the existing high occupancy vehicle (HOV) lane into Express Lanes, and the addition of a second Express Lane in each direction. The project will also study the I-105 west of the I-405 to Sepulveda Boulevard and east of the I-605 to Studebaker Road to identify potential signage locations and access points into the Express Lanes.

Table 3.1 illustrates the growth in travel on the roadway system as projected by the SCAG model. As shown, all roadways in the study area (freeway and arterials combined) are projected to experience a 6% increase in Vehicle Miles Travelled (VMT) and a 7% increase in Vehicle Hours Travelled (VHT) by 2040. The larger proportionate growth in VHT is due to the current and future congestion causing delay and resulting in higher travel times and slower speeds as traffic increases. For the I-105 freeway itself, the increases are somewhat smaller, with the freeway VMT projected to increase by 3% and freeway VHT projected to increase by 5%. Although these growth rates are relatively small, where there is congestion or level of service E conditions at present day, this amount of increased travel demand could push some segments to level of service F conditions (with significant delay and poor operating conditions)

Table 3.1 Growth in Vehicle Miles Traveled and Vehicle Hours Traveled in I-105 Study Area (existing baseline to 2040)

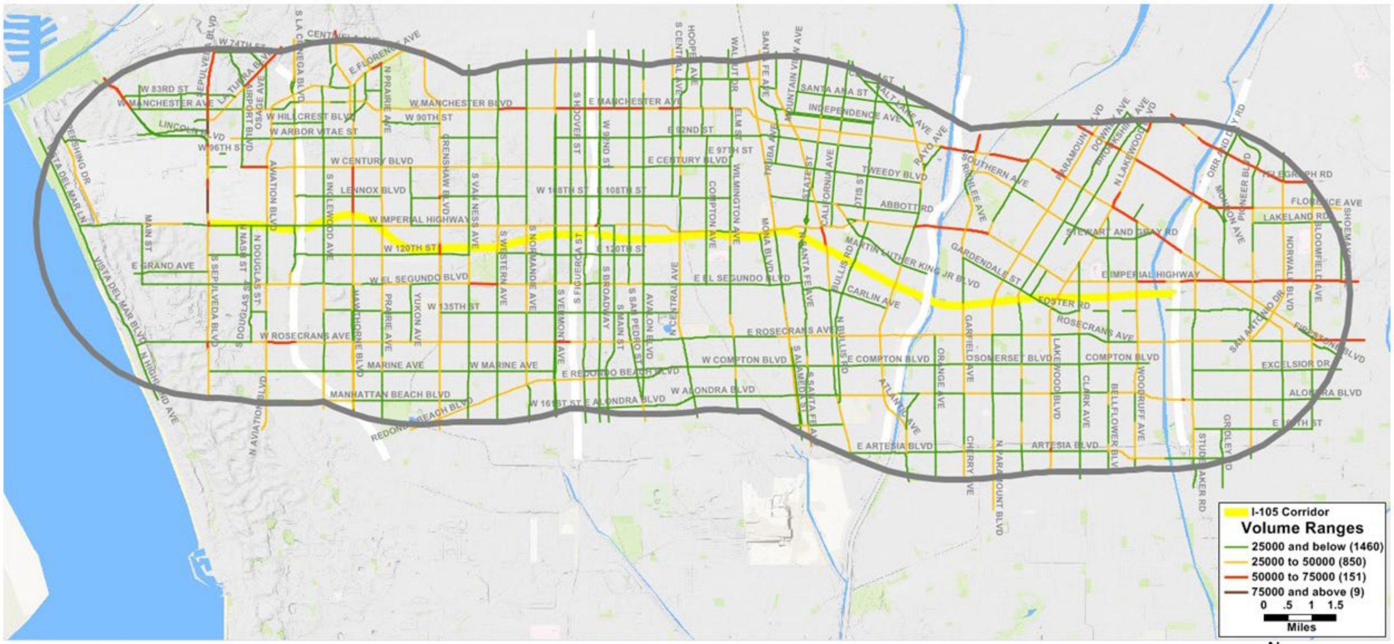
	Existing Baseline	2040	Difference	Percent Difference
I-105 Study Area (Freeway and Arterials)				
Vehicle Miles Traveled	27.3M	28.9M	1.6M	6%
Vehicle Hours Traveled	789,000	847,000	58,000	7%
I-105 Freeway Only				
Vehicle Miles Traveled	3.51M	3.59M	88,000	3%
Vehicle Hours Traveled	72,000	76,000	4,000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

3.2 Arterial Future Baseline Assessment

Daily Traffic Growth

Figure 3.6 shows the I-105 study area daily volumes on the CSAN network and shows the model daily volume projections for 2040. **Figure 3.8** displays the difference in volumes between 2012 and 2040, representing estimated growth on the CSAN arterial system. 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 3.8,** 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. The arterials east of I-605 are projected to experience proportionately less growth in daily traffic by 2040 than the rest of the study area.

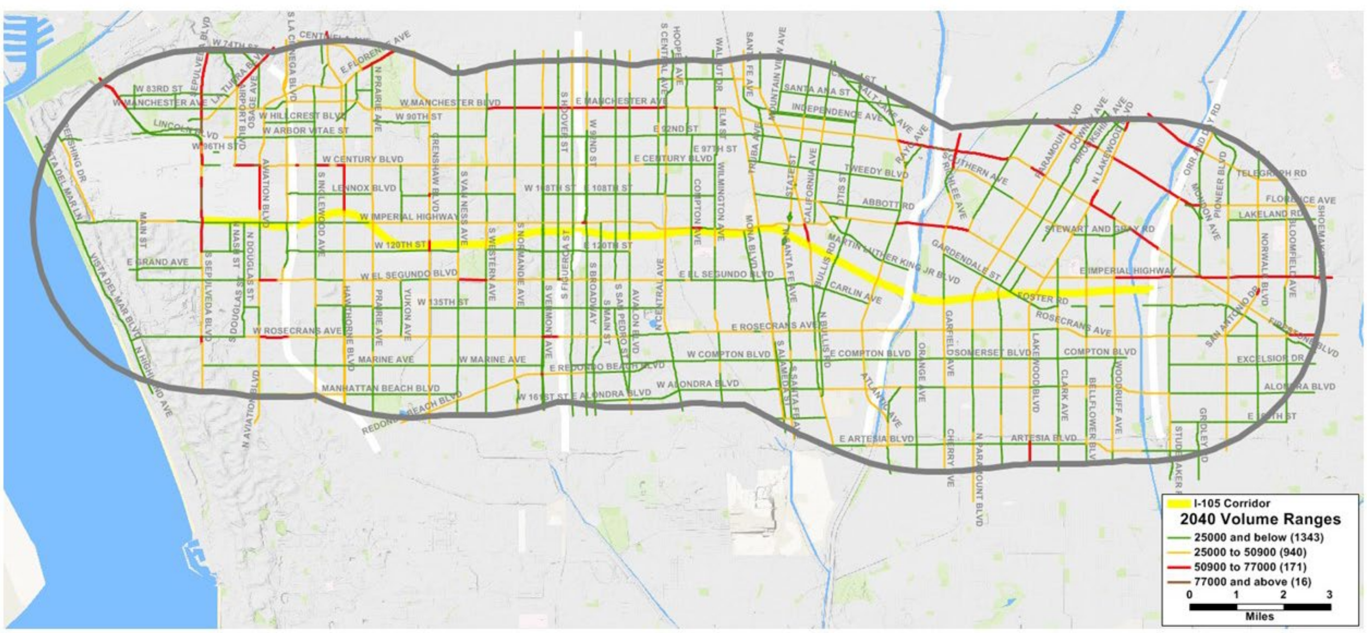
Figure 3.6 I-105 Study Area Arterial Volumes - Daily, 2012



Source: Cambridge Systematics, SCAG 2016 RTP model based
Date prepared: 5/03/2018

N Not to scale

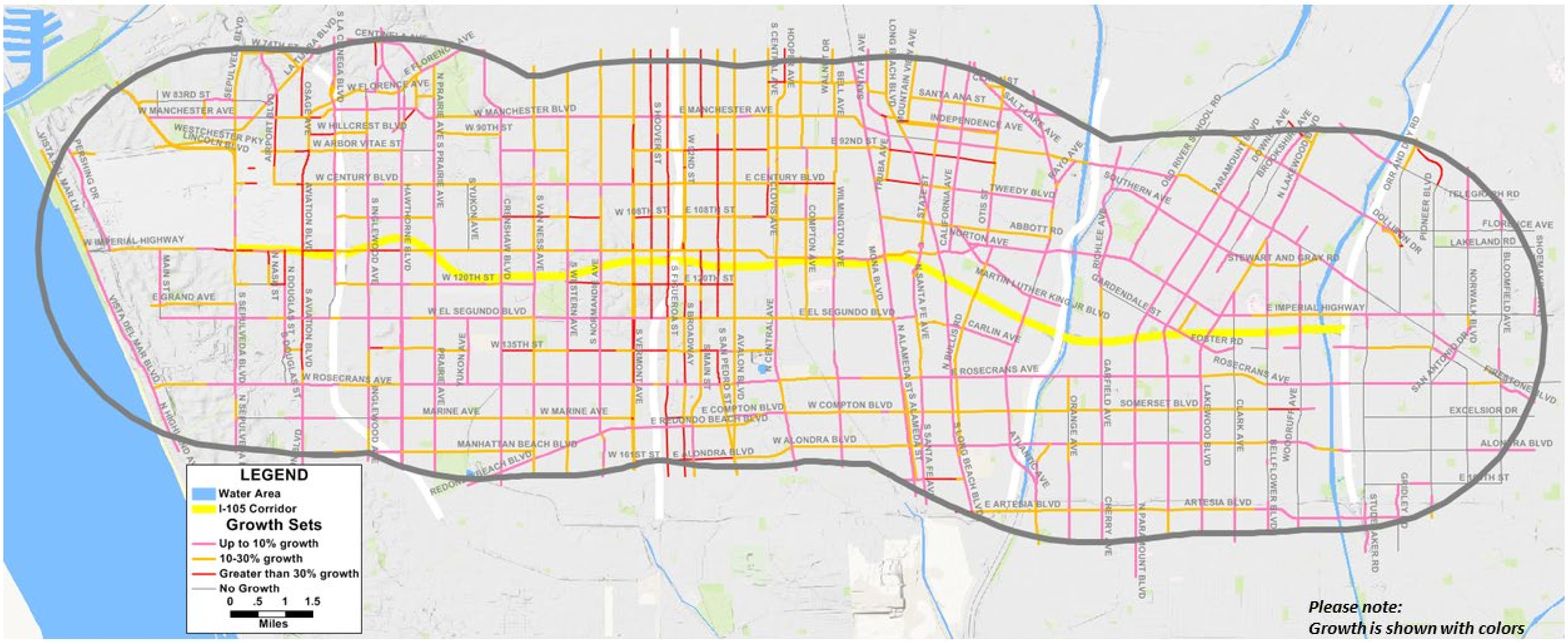
Figure 3.7 I-105 Study Area Arterial Volumes - Daily, 2040



Source: Cambridge Systematics, SCAG 2016 RTP model based
Date prepared: 5/03/2018

N Not to scale

Figure 3.8 I-105 Study Area Arterial Volume Growth - Daily, between 2012 and 2040



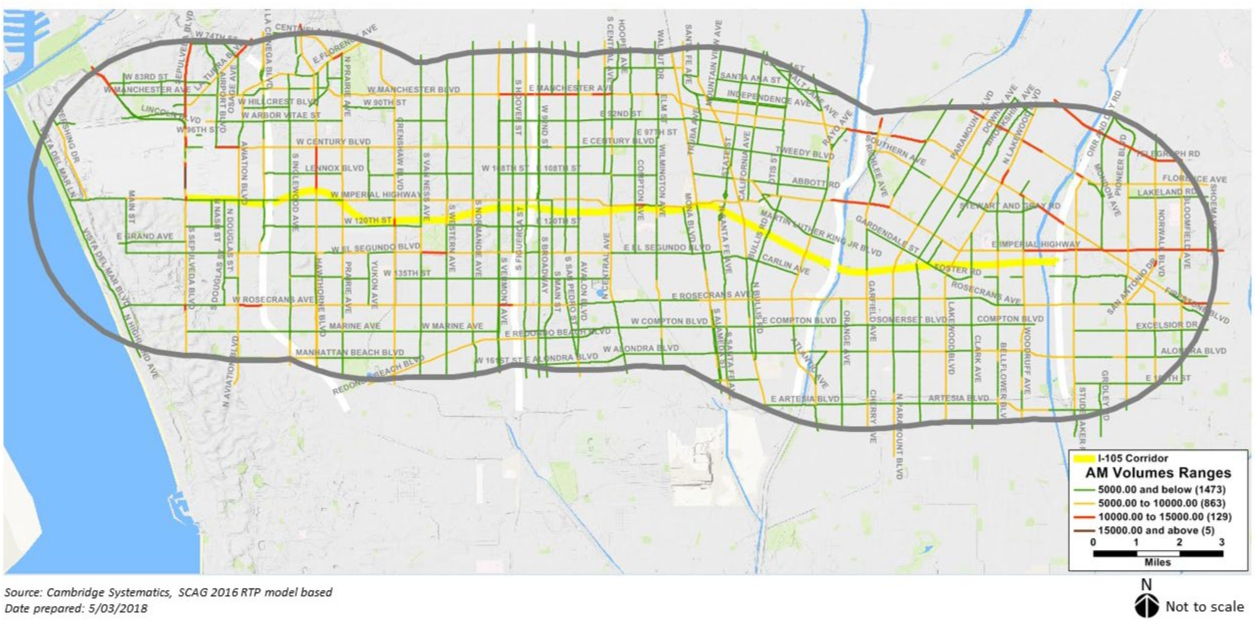
Source: Cambridge Systematics, SCAG 2016 RTP model based
Date prepared: 5/03/2018

N
Not to scale

AM and PM Peak Period Traffic Growth

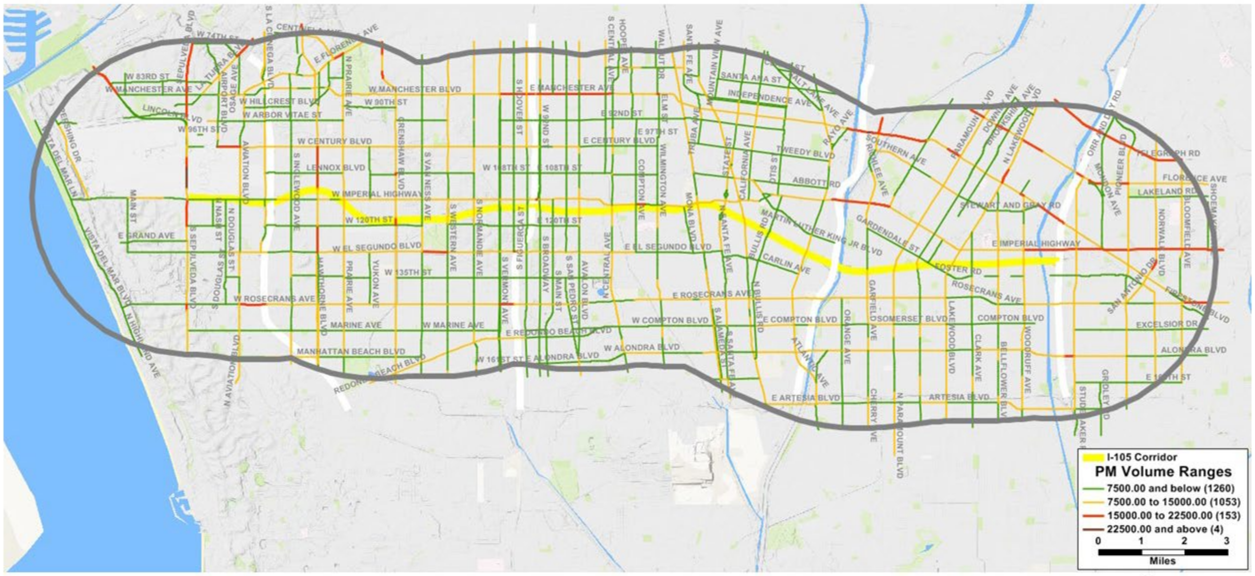
Figure 3.9 and **Figure 3.10** show the I-105 study area AM and PM peak period volumes on the CSAN network from the SCAG model for 2012. **Figure 3.11** and **Figure 3.12** show the forecasted AM and PM peak period volume projections for 2040 and **Figure 3.13** and **Figure 3.14** display the differences in volumes between 2012 and 2040, representing estimated growth on the CSAN arterial system. These maps illustrate 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. The growth patterns for the AM and PM peak period are very similar to those shown for daily trips. 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. The arterials east of I-605 are projected to experience proportionately less growth in peak period traffic than the rest of the study area.

Figure 3.9 I-105 Study Area Arterial Volumes – AM Peak Period, 2012



Source: Cambridge Systematics, SCAG 2016 RTP model based
Date prepared: 5/03/2018

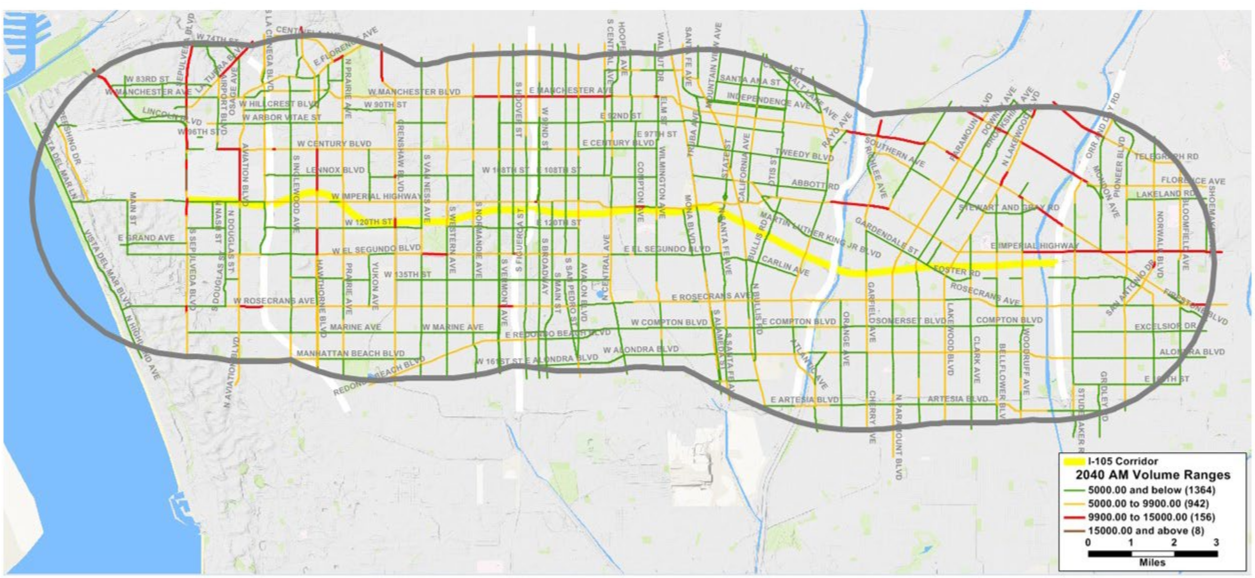
Figure 3.10 I-105 Study Area Arterial Volumes – PM Peak Period, 2012



Source: Cambridge Systematics, SCAG 2016 RTP model based
Date prepared: 5/03/2018

N
Not to scale

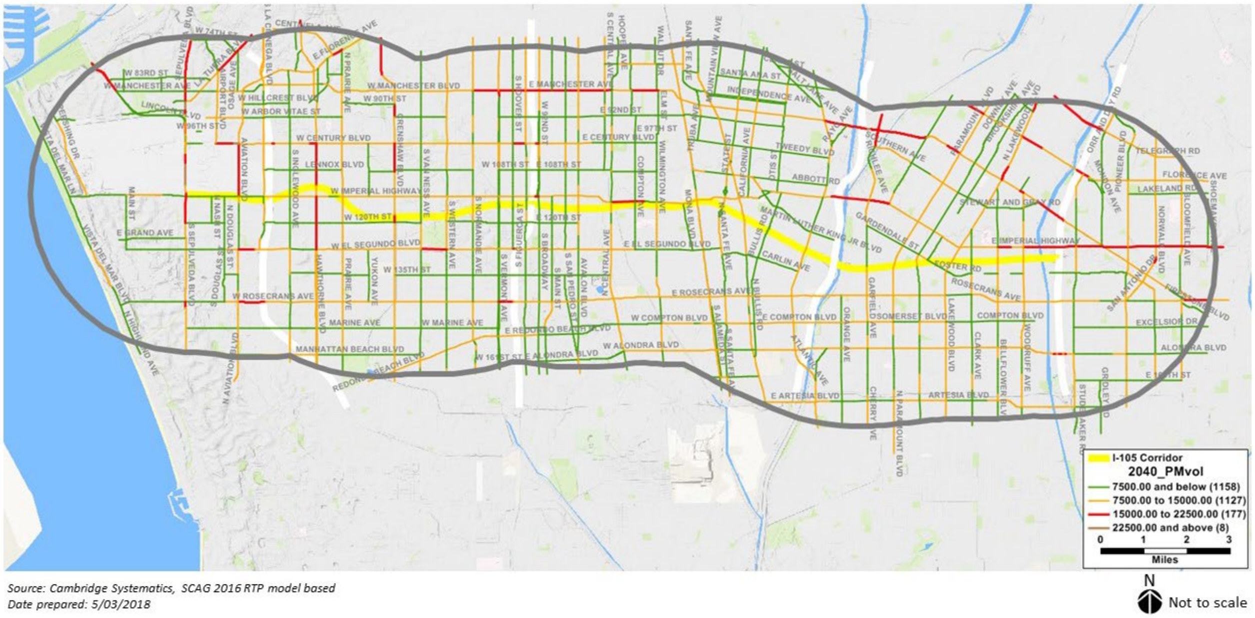
Figure 3.11 I-105 Study Area Arterial Volumes – AM Peak Period, 2040



Source: Cambridge Systematics, SCAG 2016 RTP model based
Date prepared: 5/03/2018

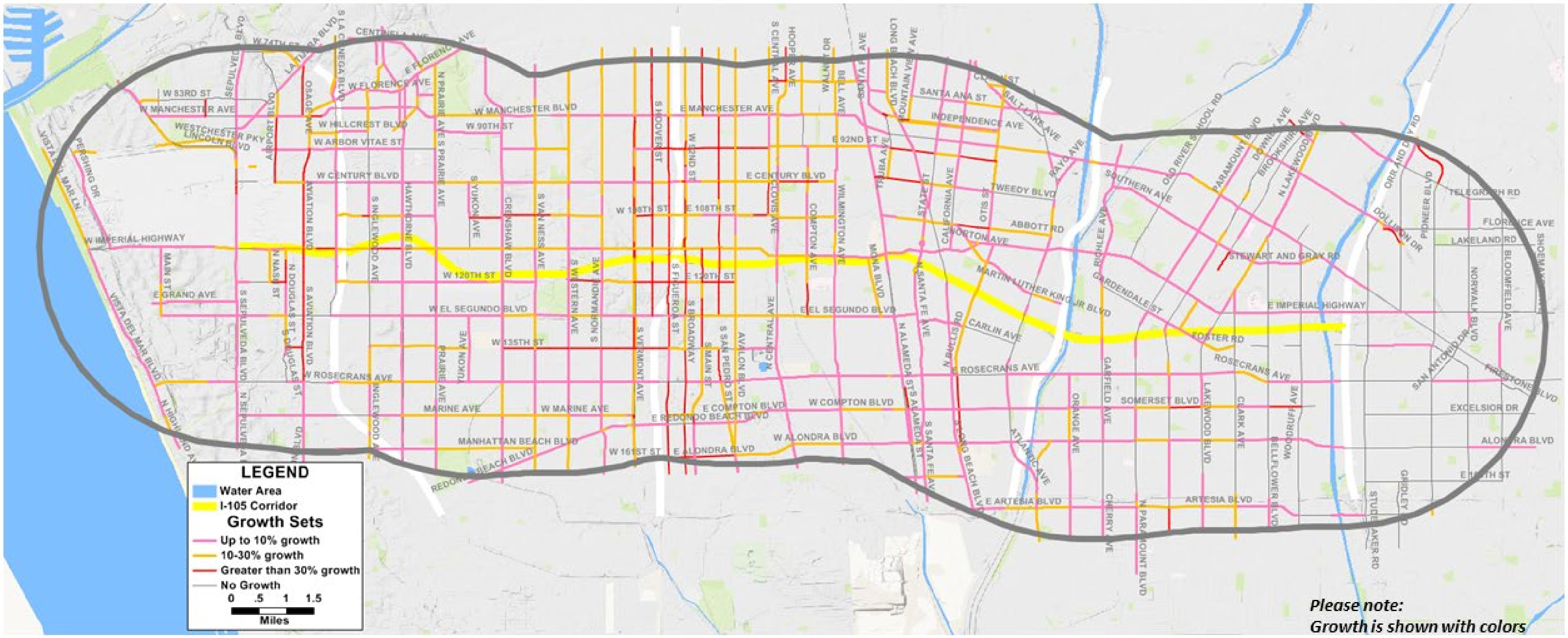
N
Not to scale

Figure 3.12 I-105 Study Area Arterial Volumes – PM Peak Period, 2040



Source: Cambridge Systematics, SCAG 2016 RTP model based
Date prepared: 5/03/2018

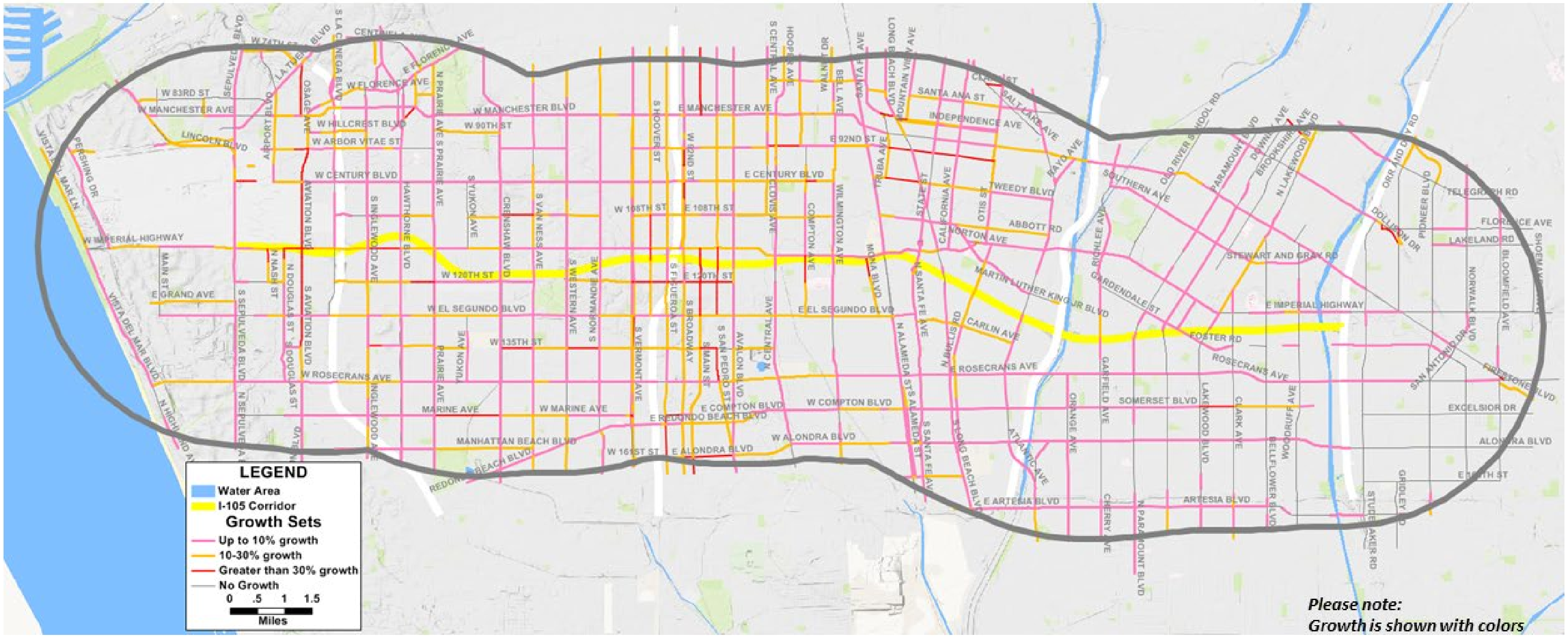
Figure 3.13 I-105 Study Area Arterial Volume Growth – AM Peak Period, between 2012 and 2040



Source: Cambridge Systematics, SCAG 2016 RTP model based
Date prepared: 5/03/2018

N
Not to scale

Figure 3.14 I-105 Study Area Arterial Volume Growth – PM Peak Period, between 2012 and 2040



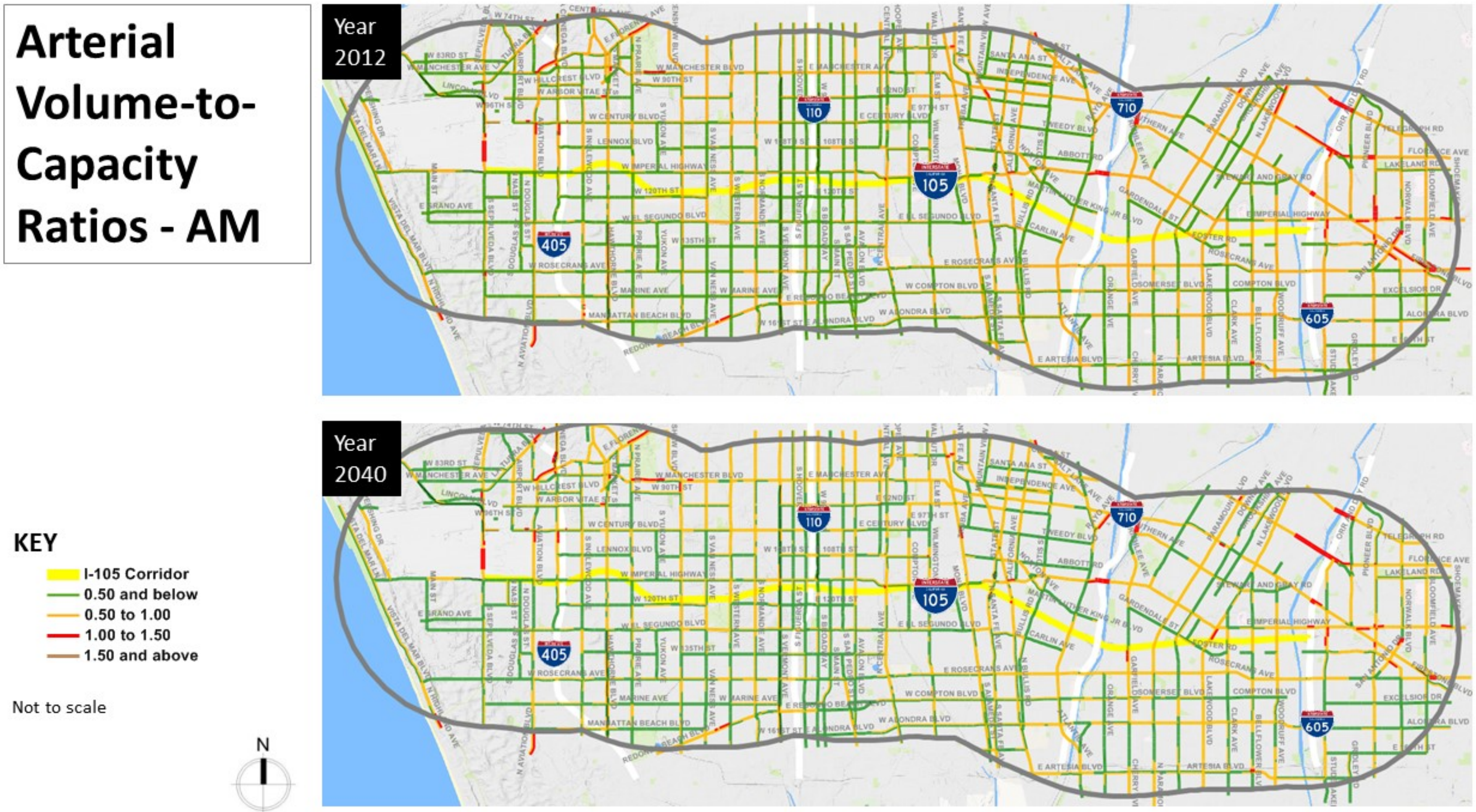
Source: Cambridge Systematics, SCAG 2016 RTP model based
Date prepared: 5/03/2018

N
Not to scale

AM and PM Peak Period Congestion Growth

Figure 3.15 and **Figure 3.16** display the 2012 and estimated 2040 v/c ratios on the CSAN system for the AM and PM peak period. The red colored segments show v/c over 1.0 to 1.5, indicating a high level of demand for the segment and likely congestion at that location. Comparing the 2012 and 2040 maps indicates relatively minor changes in segments with a projected v/c over 1.0. Thus, while there will be change in travel demand on many arterials, the level of change is not expected to result in a significant worsening of operating conditions on the arterial system in the AM or PM peak period.

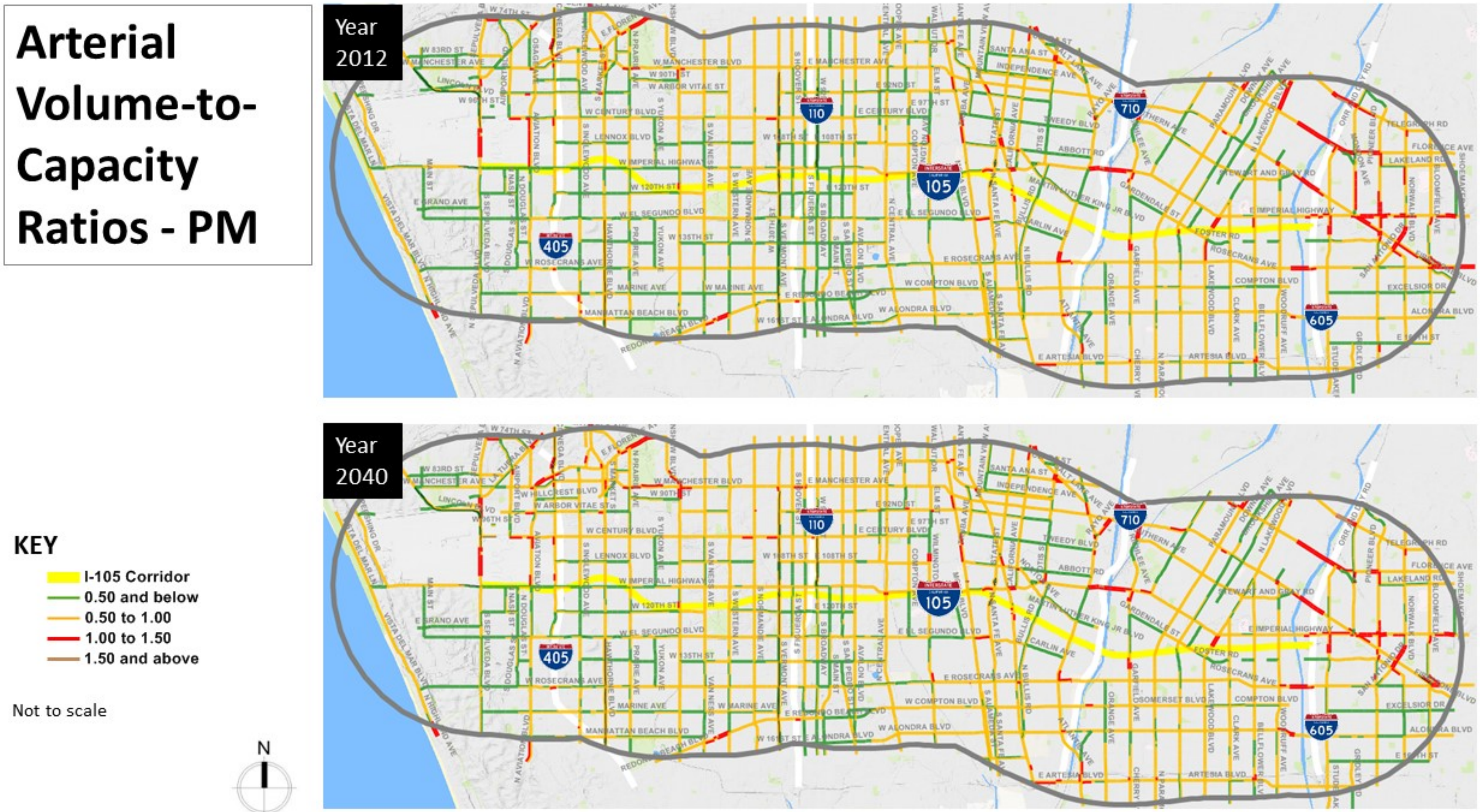
Figure 3.15 I-105 Study Area Arterial Volume-to-Capacity Ratios AM Peak Period, 2012 and 2040



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

Date prepared: 7/23/2018

Figure 3.16 I-105 Study Area Arterial Volume-to-Capacity Ratios PM Peak Period, 2012 and 2040



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

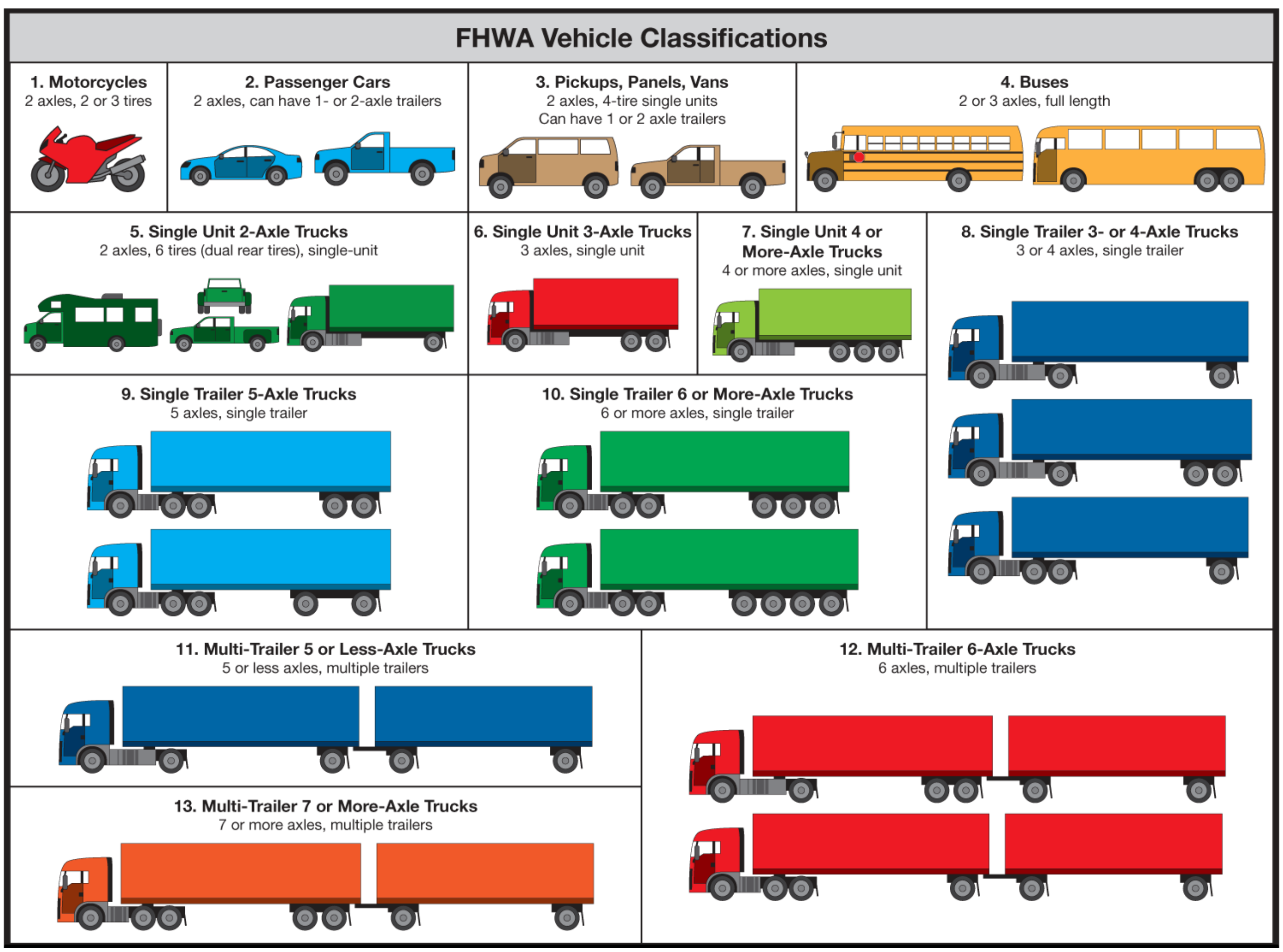
Date prepared: 7/23/2018

3.3 Truck Assessment

Figure 3.18 displays the base year (2012) daily truck volumes against the projected truck volumes for 2040 from SCAG's 2016 RTP model. These truck volumes include Class 5-13 vehicles (see **Figure 3.17** for classification categories). Throughout the corridor, truck volumes are projected to grow by 15% (I-105 east of I-405), up to almost 65% (I-405 north of I-105). The only freeway segment expected to experience a decrease in truck volumes is I-105 west of I-405, near LAX. Daily truck volumes are anticipated to exceed 40,000 daily trucks on segments of the I-405, I-710, and I-605. The maximum projected volume of daily trucks along the I-105 occurs east of I-710, for a total of 26,300 trucks. About two-thirds of the truck trip increase between I-710 and I-605 will be Port-bound trucks, which are those trips that have at least one trip end at the Ports of Los Angeles or Long Beach. A large number of port-related trips currently use I-710 to I-105 to reach northbound I-605, and the model projects that this pattern will continue in the future.

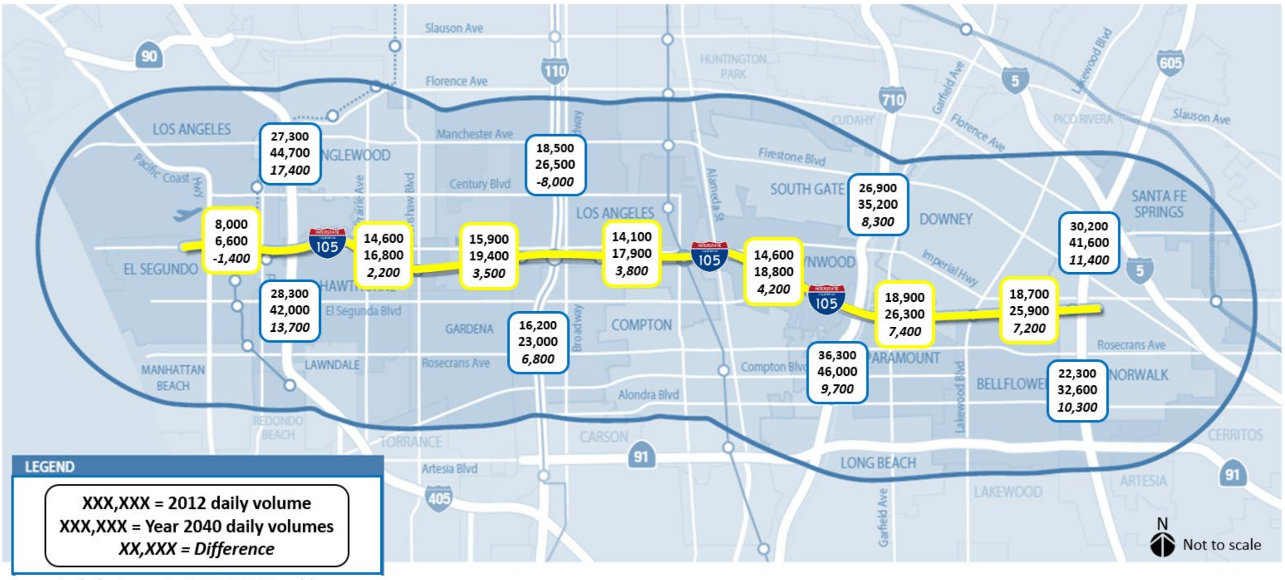
Figure 3.19 shows the results from a separate PortTAM Year 2016 model run. PortTAM's database contains more accurate volumes and forecasts with respect to Port-bound trucks. PortTAM's base year is 2016 and the future year is 2045. As shown, a large increase in port-bound trucks is expected on I-105 between I-710 and I-605 with nearly 5,000 additional Port-bound truck movements (over 70% increase in Port-bound trucks). Few additional Port-bound trucks are expected on I-105 west of I-710.

Figure 3.17 Federal Highway Administration Vehicle Classifications



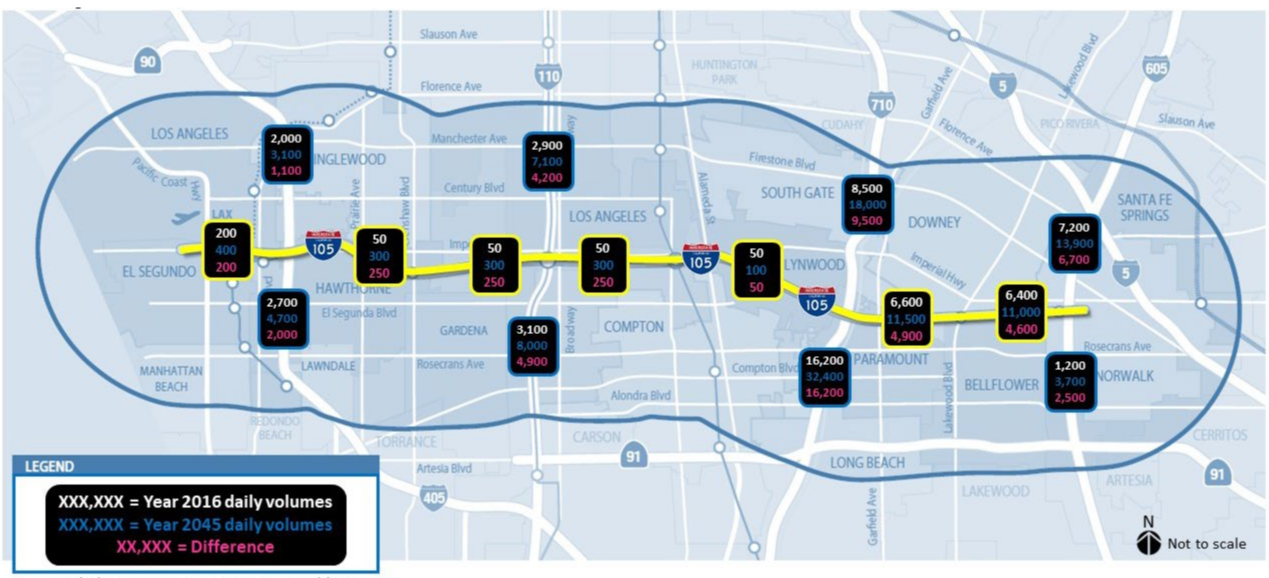
Source: Federal Highway Administration

Figure 3.18 I-105 Study Area Projected Daily Truck Volumes, 2012 and 2040



Source: Cambridge Systematics, SCAG 2016 RTP model
Raw model numbers (not post-processed). Numbers are rounded to nearest hundred
Date prepared: 2/27/2018

Figure 3.19 I-105 Study Area Projected Daily Port Truck Volumes, 2016 and 2045



Source: Cambridge Systematics, PortTAM Year 2016 model run
Raw model numbers (not post-processed). Numbers are rounded to nearest hundred and in some cases to nearest fifty
Date prepared: January 25, 2018

4.0 Transit Future Baseline Assessment

As noted in the existing conditions analysis in Task 4, transit ridership as a whole in LA County has declined dramatically over the past few years, and per capita transit began to decline a decade ago. In the short-term, 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.[5] Many of the local and municipal operators have already initiated similar studies; Santa Monica's Big Blue Bus recently implemented a comprehensive operation analysis to accommodate the opening of the Expo Line, LADOT finished their service analysis in the Fall of 2017[6], and Long Beach Transit is almost finished with a study of their own.[7]

In more distant future, the 2016 SCAG RTP/SCS model projects a modest increase in transit mode share by 2040, from 3.3% to 3.7% of all trips (excluding school buses).[8] The LA region has seen significant transit investment in recent years, and this pattern will continue in large part due to LA County's "Measure M" transportation sales tax of 2016. Measure M added ½ cent to the sales tax to fund specific transportation projects, with a total investment of roughly $120 billion over 40 years.[9] There are several major transit projects funded through Measure M (and Measure R of 2008) relevant to the I-105 Study Area. including:

- Crenshaw Line.[10] Schedule to be opened in 2019, the Crenshaw Line will connect the Green Line and the Expo Line. The project will add eight new stations and two connecting stations at Aviation/Imperial and Expo/Crenshaw. There will be five new stations in the I-105 Study Area, including the separately funded Airport Metro Connector station at 96th Street/Aviation Boulevard that will connect Metro to the planned LAX automated people mover.

- West Santa Ana Branch/ Eco Rapid Transit.[11] This 20-mile corridor connects downtown Los Angeles to Cerritos, in the southeastern corner of the county. 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. For the northern portion of the project, as the corridor enters downtown Los Angeles, the precise alignment is undergoing additional analysis and public input. However, for the portion of the corridor in the I-105 Study Area, the alignment and the recommended station locations are unlikely to change significantly. SCAG's Alternative Analysis, published in 2012, evaluated the corridor between Los Angeles and Anaheim. Orange County may continue the rail corridor from the LA County border to the south.

---

[5] LA Metro NextGen: www.metro.net/nextgen

[6] LADOT Transit: www.ladottransit.com/movingforwardtogether/routes.html

[7] Long Beach Transit: http://lbtstar.com

[8] SCAG 2016 RTP/SCS: http://scagrtpscs.net/Documents/2016/final/f2016RTPSCS_Transit.pdf

[9] LA Metro Measure M: www.metro.net/theplan

[10] LA Metro Crenshaw Corridor Project: www.metro.net/projects/crenshaw_corridor/

[11] LA Metro West Santa Ana Project: https://www.metro.net/projects/west-santa-ana/

(Footnote continued on next page...)

- Vermont Transit Corridor.[12] 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 to rail in the future. Current concepts for BRT include center-running, side-running, curb-side, and peak period only options. Construction for this project, according to the Measure M expenditure plan, is set to break ground in 2024.

- Green Line Extension to Torrance.[13] 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.[14] 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.[15] 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.

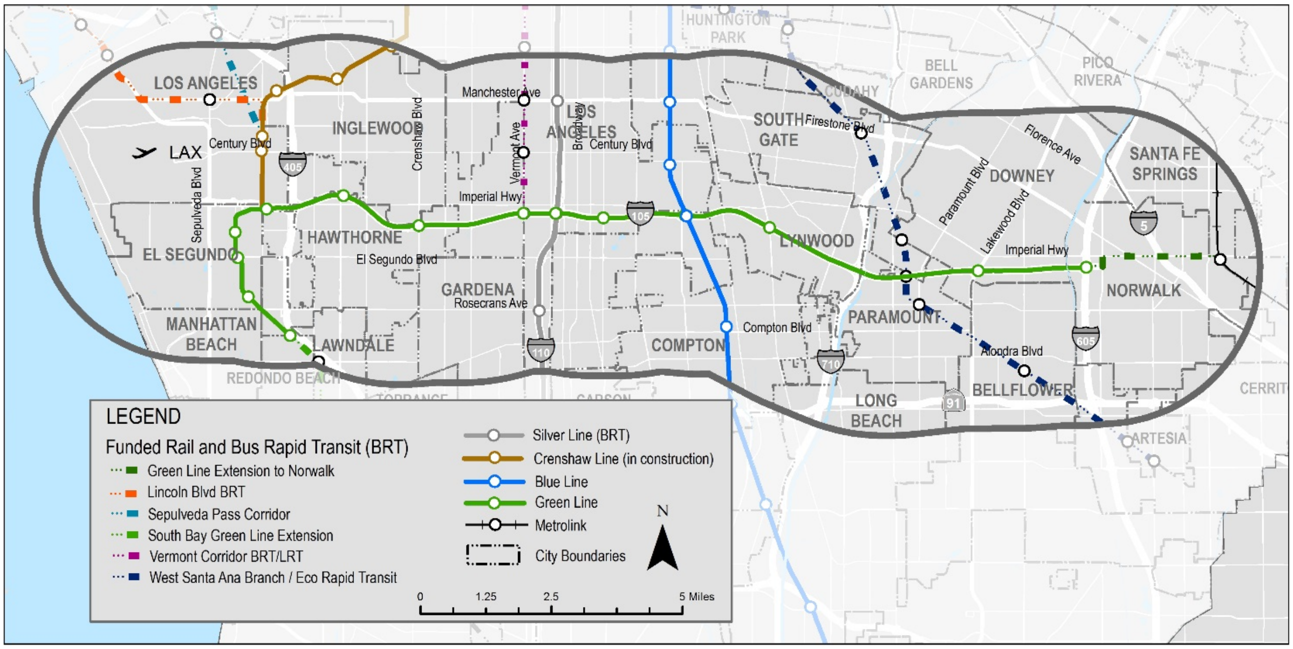
[12] LA Metro Crenshaw Vermont Corridor: https://www.metro.net/projects/vermont-corridor/vermont-corridor/

[13] Metro Green Line Southbay Extension: https://www.metro.net/projects/green-line-extension/

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

[15] Metro Sepulveda Corridor project https://www.metro.net/projects/sepulvedacorridor/

Figure 4.1 LA Metro Measure M Funded Transit Projects



Source: LA Metro 2016, Measure M Expenditure Plan

In the long-term, there are policies and directives that may encourage transit ridership, such as transit oriented development, greenhouse gas reduction targets, and incentives for alternatives to single-occupant vehicle travel. However, it is difficult to predict how changes in technology, demographics, and economics will shape the future of transit usage in the I-105 Study Area. For one, the rise of Transportation Network Companies (TNCs) like Uber and Lyft poses new challenges and potential opportunities for transit providers. For many trips, TNCs compete with transit, however, for longer trips, TNCs can help transit by providing the first/last mile connection. A UC Davis study found that after TNCs arrived in US cities, the average net transit ridership declined 6% while commuter rail ridership increased 3%.[16] However, the rise of the TNC companies also coincided with a decrease in transit ridership that began before TNCs were introduced.[17] Some transit agencies, paratransit providers, and municipalities have partnered with Uber and Lyft to offer subsidized rides. One example in Southern California is the City of Monrovia, where they offer $3.00 Lyft rides and $0.50 shared Lyft rides to and from anywhere within the city limits.[18] Larger agencies are looking to on-demand services as a way to serve areas that are not served well by fixed route transit. LA Metro is currently in the planning stages for developing a "microtransit" pilot program and the Orange County Transportation Authority (OCTA) recently awarded a contract for the development of their OC Flex microtransit program.

---

[16] Disruptive Transportation: The Adoption, Utilization, and Impacts of Ride-Hailing in the United States. 2017

[17] UCLA/SCAG 2018. Falling Transit Ridership

[18] GoMonrovia: https://www.cityofmonrovia.org/your-government/public-works/transportation/gomonrovia

5.0 Active Transportation Future Baseline Assessment

The future of walking and biking in the I-105 Study Area is difficult to predict. There are likely to be many changes in transportation, such as autonomous and connected vehicles, that will have far reaching impacts on personal travel. New mobility options in the future 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. Some emerging new mobility options are already established in LA County. Bike share systems already exist in many areas in LA County, including Los Angeles (downtown, Venice, Westwood), Santa Monica, Long Beach, Pasadena, West Hollywood, and Beverly Hills, and a system in Culver City is planned to debut at some point in 2018. At the same time, new "dockless" bike share systems, common in other cities throughout the world, are emerging on local roadways. LimeBike, a company based in California, is available in parts of the City of Los Angeles, Santa Monica, and Monrovia. Additionally, LimeBike makes an electric scooter that competes with the Venice-based company Bird, which has become extremely popular and controversial in the westside communities of Santa Monica, Venice, Culver City and Playa Vista. Cities throughout the region have proposed new regulations for scooter companies to limit the number of scooters, address safety concerns, and incentivize companies to operate in underserved communities. Uber, Inc.'s recent purchase of JUMP Bikes and their investment in Lime scooters further highlights the private sector's interest in short-distance shared mobility solutions, an industry that will continue to evolve dramatically in the near future.

5.1 Planned Active Transportation Network

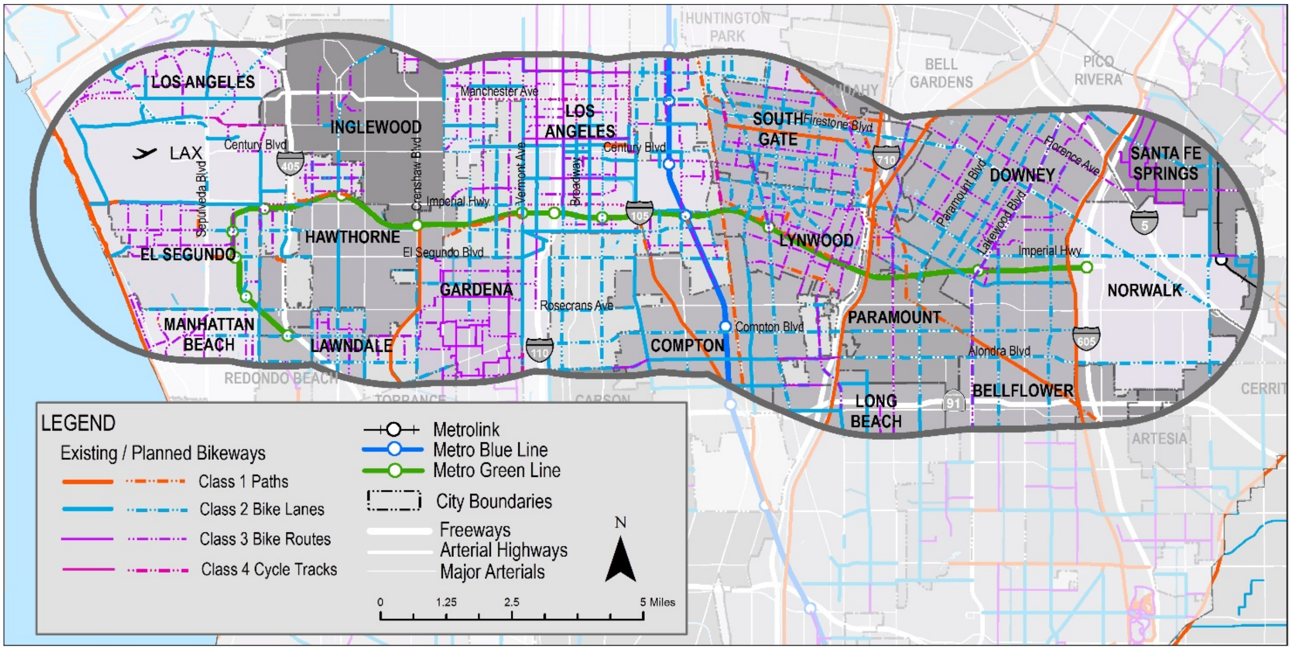
While it is difficult to predict the future rates of bicycling and walking, it is possible to highlight the planned future bicycle infrastructure. Planned bikeways are those that are included in local bike plans or mobility elements and were submitted to SCAG or LA Metro through regional data collection processes. The mileage of existing and planned bikeways is shown in **Table 5.1**. This mileage does not include the priority bikeway network recommended in the Metro Active Transportation Strategic Plan (ATSP) or Gateway Cities Council of Government (GCCOG) Strategic Transportation Plan (STP), though many of planned projects are consistent with those regional project ideas. If all the planned facilities are implemented, the bikeway mileage in the I-105 Study Area will increase substantially. 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 in an area where there are currently none. The locations of these planned facilities are displayed below in **Figure 5.1**, while **Figure 5.2** highlights the regionally significant project ideas included in the Metro ATSP and GCCOG STP. Finally, **Figure 5.3** displays a proposed network of "slow speed" lanes for the South Bay Cities subregion. Slow speed lanes would be accessible to bicycles, pedestrians, scooters, and other slow speed devices (operating at speeds less than 25 mph) including neighborhood electric vehicles (NEVs).

Table 5.1 Existing and Future Bikeway Mileage in I-105 Study Area

Facility Type	Existing Mileage	Planned Mileage
Class 1 - Path	36	30
Class 2 – Bike lanes	89	239
Class 3 – Bike route	41	189
Class 4 – Cycle track	0	35

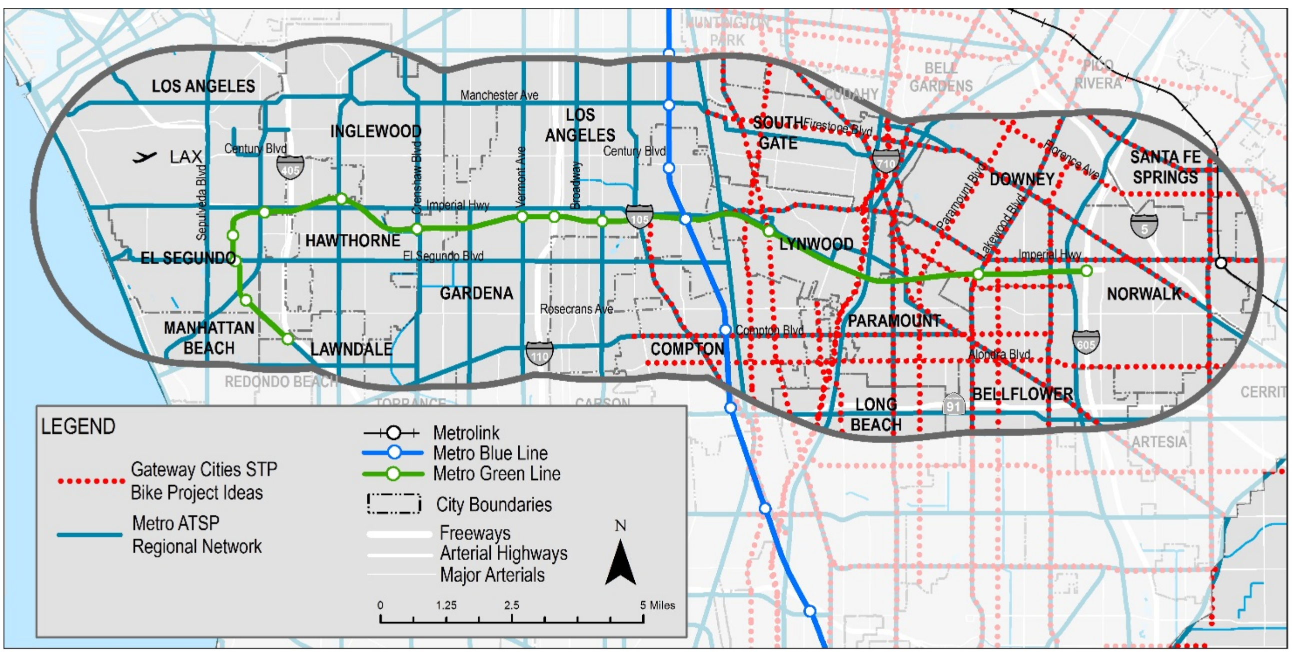
Source: SCAG 2016, Self-reported by local jurisdictions

Figure 5.1 Existing and Planned Bikeways in I-105 Study Area



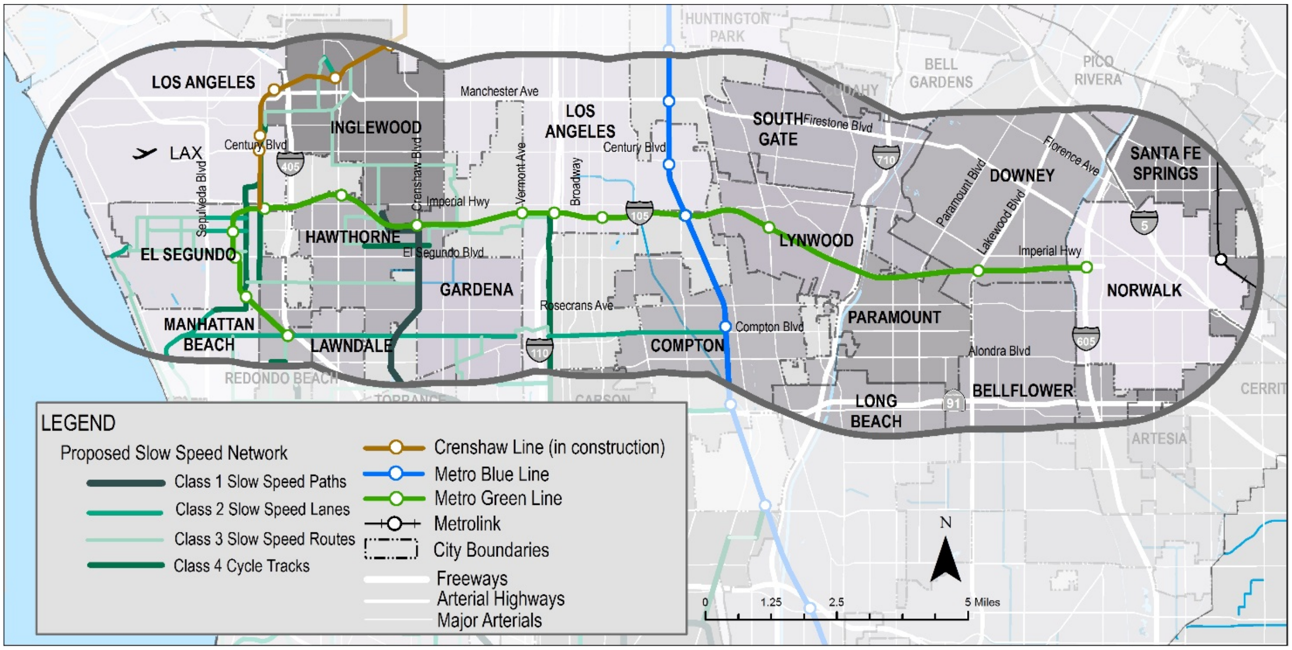
Source: SCAG 2016, Self-reported by local jurisdictions

Figure 5.2 Significant Bicycle Project Ideas from Metro ATSP and GCCOG STP



Source: Metro Active Transportation Strategic Plan 2016; Gateway Cities Strategic Transportation Plan 2016

Figure 5.3 South Bay Cities Proposed Slow Speed Network



Source: Metro. Slow Speed Network Strategic Plan for the South Bay. 2017

6.0 Emerging Technologies

As stated in the “Blueprint for Autonomous Urbanism” by the National Association of City Transportation Officials (NACTO):

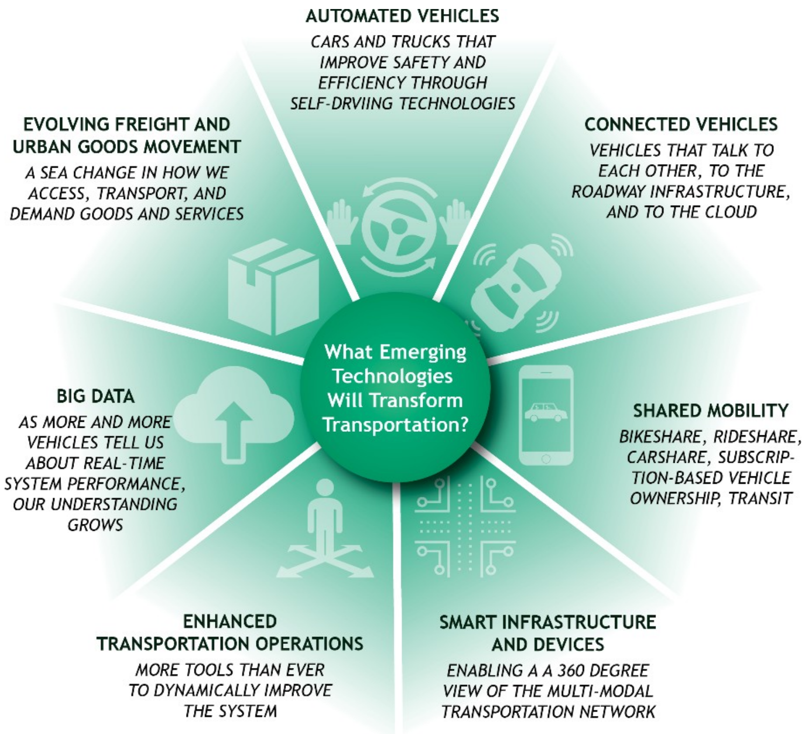
“Drastic advances in automated and connected vehicle technology will upend the way people move around cities, presenting sweeping opportunities as well as serious risks. This is a future shaped by proactive urban policy, in which the footprint of vehicular travel is reduced, every transit vehicle supports high occupancy trips, and safe spaces for walking and cycling are abundant. With the right policies, automation can enable newfound dynamism in mobility, and make it easier than ever to access quick, affordable, equitable and sustainable transportation options throughout cities.”

Emerging technologies have the power to disrupt mobility as we know it by offering innovative ways to solve transportation challenges in the region and in the I-105 corridor, consequently the manner in which public agencies plan for and provide mobility can be expected to change. Adding to the disruptive potential of emerging technologies is tremendous uncertainty associated with the timing and level of technology impacts on travel behavior. Steve Polzin noted in the recent Vehicle Miles Traveled Trends and Implications for the U.S. Interstate Highway System paper for The Future Interstate Study Committee of the Transportation Research Board:

“A host of issues ranging from the pace of technology development and refinement to the legal and political context for deployment to market acceptance and economic considerations are likely to influence the magnitude of the impact of technology on transportation.”

The FHWA has identified the need for a better grasp of emerging information technologies on personal travel to help agencies identify policies whose innovations benefit the public while mitigating any negative impacts. **Figure 6.1** illustrates the range of emerging technologies in transportation, including emerging modes, shared mobility, and infrastructure upgrades.

Figure 6.1 Emerging Technologies in Transportation



Source: FWHA

Areas of interest include;

- the trends relating to use of emerging technologies,
- how these emerging technologies are shaping travel behavior, including the impact of available information on travel destinations, and
- what agencies can do to harness benefits and mitigate negative externalities associated with these impacts.

6.1 Real Time and Traveler Information

Impacts on supply and demand are complex and are influenced by technological changes. The evolution of traveler information includes smart phone applications that provide real-time travel time and cost information for multimodal options. Increasingly real-time data and predictive algorithms have the potential to increase supply by optimizing routings, shifting traffic from congested roadways, and providing customers with more accurate information on their choices. Improved real-time information influences virtually every aspect of traditional travel decision-making. This can include decisions that influence what is typically considered trip generation—whether to forgo a trip by substituting communications, rescheduling it, or integrating it into a trip tour/chain. Trip distribution changes as travelers become aware of more travel destinations and can select destinations based on both transportation option characteristics and considerations such as inventory availability at the destination.

Solutions such as 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; better travel time information, peer-to-peer carpool apps that provide cohort matching; and a robust portfolio of other ATM and TDM strategies are being evaluated in many areas and could be considered in the I-105 corridor. Future efforts can evaluate the performance and investment returns of these strategies to determine how traveler information is influencing the nature and volume of personal travel in the corridor. Some of this will happen as part of the Metro/Caltrans I-105 Express Lanes Project.

6.2 Emerging Modes and Shared Mobility

Disruptive technologies and evolving demographics are changing the way people live, work, and travel. New passenger transportation options, collectively called shared mobility, have been introduced and some have seen significant growth. Shared mobility transportation solutions, enabled by emerging technologies and wireless connectivity, allow for more convenient, efficient, and flexible travel. Carsharing, ridehailing, ridesharing, microtransit, bikesharing, and mobility-as-a-service are innovative mobility services that impact the way people live, work, play, and the way they travel.

As many of these service concepts are emerging and changing rapidly (availability, price, perceived safety, convenience, social image/stigma, etc.), it will be important to discern the best available knowledge regarding behavioral response to core attributes of these technologies and business models and how they apply to the I-105 corridor. In particular, it will be important to understand if travel time and cost as impacted by these modes produces travel responses consistent with those observed in other modeling contexts. In addition, it will be important to understand aspects of convenience, reliability, self-determination, autonomy, image, and other characteristics of these modes and their influence on travel behavior. Existing stated-preference studies, and other literature regarding travel behavior changes in response to these characteristics can be evaluated in future efforts in the corridor.

6.3 Upgrades to Transportation Infrastructure

Transportation infrastructure can and will need to evolve to accommodate shifting travel behavior and mobility demands. This can include elements such as 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., and deploying completely new infrastructure such as bike sharing stations. Caltrans has evaluated freeway operational enhancements throughout the corridor as part of past studies, and Mero/Caltrans are evaluating Express Lanes and associated operational improvements as part of the Express Lanes project.

Another critical consideration will be to understand the adaptability of transportation infrastructure to accommodate emerging technologies and transitional business models. This might include a host of strategies such as reversible lanes, managed lanes, changing lane widths over time, segregating traffic to provide exclusive operations for automated vehicles for roadways and exploring redeployment of parking space, treatment of vehicle pickup drop-off and queueing space, and modifications of current concepts of complete streets to address the prospect of the emergence of automated shuttle vehicles, electric bicycles, and other electric personal vehicles for short trips and line haul access/egress. For one example, infrastructure changes can be made to accommodate the evolving shared mobility environment such as development of "mobility hubs." Mobility hubs include elements such as traveler information, bicycle and pedestrian improvements, and mandated spaces for carsharing, bikesharing, and carpooling. By developing infrastructure that encourages shared mobility, agencies can encourage multimodalism, transit, and others alternatives to costly SOV trips.

6.4 Connected and Autonomous Vehicles Effects on Active Transportation

Existing and future technology related to connected and autonomous vehicles offer the potential to improve traffic safety in general, which will benefit all users. This section provides an overview of possible benefits.

6.4.1 Improved Detection

Detection, warning, and avoidance technologies are being developed to improve CAVs' situational awareness and their ability to recognize the presence of vulnerable road users. Key terms and definitions related to improved detection include:

- **Machine vision systems** which refers to camera technology that allows CAVs to recognize and interpret features of the built environment—including other road users—for more informed decision-making.
- **Lidar** which stands for Light Detection and Ranging, creates detailed mapping of CAVs' surrounding environment using laser technology.
- **V2X technology** is a catchall term for Vehicle-to-Vehicle (V2V), Vehicle-to-Pedestrian (V2P), Vehicle-to-Infrastructure (V2I), and Pedestrian-to-Infrastructure (P2I) technology. V2X uses short range communication devices to inform CAVs and smart infrastructure about the presence of pedestrians and bicyclists. Users would need to carry this technology to be detected, using a V2X beacon or via existing cell phone technology. The technology is in its infancy, and there are several challenges that must be overcome before it can be widely used, including poor location accuracy and equity issues for users who are unable to afford the technology.

6.4.2 Warning of Proximity, Crossing, and Safe Passing

CAVs will need to have a set of control instructions to enable them to operate in a way that is predictable and comfortable for bicyclists and pedestrians. Standardized and interpretable interactions between CAVs and active transportation users will encourage confidence in the technology as its safety benefits become more evident.[19] Many communication methods could be used to standardize interactions. Vehicles could communicate with visual symbols, lights, text, or audible warnings to convey their intent to other road users. For example, a CAV approaching a crosswalk could convey its intent to yield to pedestrians waiting to cross via dynamic message signs on the vehicle's exterior.

Existing V2X technology known as the Pedestrian in Signalized Crosswalk application alerts motorists when a pedestrian is crossing the street. This warning system is popular with transit agencies to reduce blind spots

[19] Sandt, L. & Owens, J.M. (August 2017). Discussion Guide for Automated and Connected Vehicles, Pedestrians, and Bicyclists. *Pedestrian and Bicycle Information Center*. Chapel Hill, NC.

(Footnote continued on next page...)

for bus operators.[20] Ensuring that ADS and AVs yield accordingly when receiving warnings is the next step in this technology's evolution.

Similarly, CAVs programmed to yield to crossing pedestrians according to current laws could increase pedestrian confidence and vehicle predictability, and may encourage the same behavior in human drivers. Prioritizing pedestrians in certain environments, such as high-density urban areas, may allow for more flexible crossing locations than marked crosswalks or signalized intersections, further increasing pedestrian mobility and convenience.[21]

6.4.3 Speed Control

Currently, motorists control vehicle speed based on personal preference, roadway conditions, and posted speed limits. This reliance on user preference creates unpredictable and sometimes dangerous travel environments. CAVs could be programmed to abide by speed limits, which would standardize the travel environment and make vehicle movement more predictable, especially in mixed traffic. As more CAVs and V2I technology are deployed, standard speed limits may be replaced by variable speed limits, which adapt to real-time traffic conditions and could be programmed to consider the presence of active transportation users.

The likelihood of a vehicle-pedestrian crash resulting in injury or death rises exponentially as speeds increase above 20 miles per hour (mph). According to a study by the AAA Foundation for Traffic Safety,[22] the average risk of death for a pedestrian reaches 10 percent at an impact speed of 23 mph, 25 percent at 32 mph, 50 percent at 42 mph, 75 percent at 50 mph, and 90 percent at 58 mph.

CAV, ADS, and AV technologies could significantly reduce pedestrian injuries and fatalities by reducing the speed of vehicle and active transportation user interactions. Reducing speed limits and programming vehicles to maintain low speeds when sharing the road with bicyclists and pedestrians would increase safety and comfort for all users;[23] this could be achieved with little change in travel time for motorized traffic, if optimized vehicle routing and intersection management compensate for slower speeds.[24]

6.4.4 Reduced Driver Error

Many factors cause traffic crashes, but the majority can be attributed to roadway design and driver error. Strategies such as Complete Streets and Vision Zero seek to improve roadway design to safely accommodate all users, including people walking and bicycling. Lane departure warning systems, collision avoidance systems, obstacle detection, and other existing CAV technology have the potential to reduce

---

[20] Safety—Pedestrian in Signalized Crosswalk, Office of the Assistant Secretary for Research and Technology, U.S. DOT, retrieved from https://www.its.dot.gov/infographs/pedestrian_signalized_crosswalk.htm

[21] Sandt, L. & Owens, J.M. (August 2017). Discussion Guide for Automated and Connected Vehicles, Pedestrians, and Bicyclists. *Pedestrian and Bicycle Information Center*. Chapel Hill, NC.

[22] Tefft, B.C. (2011). Impact Speed and a Pedestrian's Risk of Severe Injury or Death. *AAA Foundation for Traffic Safety*. Retrieved from http://aaafoundation.org/impact-speed-pedestrians-risk-severe-injury-death/

[23] Hopkinson, P., & Wardman, M. (1996). Evaluating the demand for new cycle facilities. *Transport Policy*, *3*(4), 241–249. doi: https://10.1016/S0967-070X(96)00020-0

[24] Sandt, L. & Owens, J.M. (August 2017). Discussion Guide for Automated and Connected Vehicles, Pedestrians, and Bicyclists. *Pedestrian and Bicycle Information Center*. Chapel Hill, NC.

(Footnote continued on next page...)

crashes caused by driver error today. While it is still many years away, Level 5 fully autonomous vehicles will remove humans from the decision-making process and could have major safety benefits for all users.

6.4.5 Enhanced Public Realm

In addition to the technology-based safety improvements described above, CAVs may instigate broader societal trends that could also benefit active transportation users. Accelerating the shift to shared mobility through highly efficient driverless ride hailing services[25] has the potential to reduce vehicle miles traveled and the number of vehicles on the road. If private vehicle ownership declines and most people rely on shared mobility services, road capacity and parking needs would decrease.[26] Regardless, driverless vehicles should take up less space on the road by more efficient platooning. Extra space could be repurposed for active transportation users, which would encourage more walking and bicycling. While curbside is the default location for most active transportation facilities (e.g., sidewalks and bike lanes), the location of this infrastructure may be more adaptable in the future. Extra roadway space could accommodate facilities such as center median cycle tracks, separated from traffic by tree lawns, or shared streets, where very low-speed motorized traffic mixes with people walking and bicycling. However, during the transition to a fully driverless system, conflicts over curbside space may arise between modes.

6.5 Potential Problems with CAV for Active Transportation

While technology has the potential to achieve the goals described above, it could also conceivably make the environment for walking and bicycling significantly worse without proper planning and regulation. This section explains the potential threats to active transportation users that could result from poor oversight and lack of planning.

6.5.1 Competition for Space

The popularity of ride hailing services, such as Uber, has caused an increase in pickup/dropoff movements. The need for short-term parking will only increase as driverless mobility services evolve. The curbside space needed to accommodate this activity is also the default location of many active transportation facilities. This may exacerbate existing conflicts, such as dooring of bicyclists by drivers who are exiting vehicles parked next to a bicycle facility. Best practices in curbside management must be developed to regulate this increased activity and ensure a safe travel environment for bicyclists and pedestrians.

6.5.2 Detection and Prediction Challenges

Like all road users, people walking and bicycling often engage in unpredictable behavior. For example, bicyclists transition from the road to the sidewalk based on comfort and risk, and pedestrians cross at

[25] Spieser, K. et al. (2014) Toward a Systematic Approach to the Design and Evaluation of Automated Mobility-on-Demand Systems: A Case Study in Singapore. *Road Vehicle Automation*. Retrieved from http://hdl.handle.net/1721.1/82904

[26] Corporate Partnership Board Report. (March 31, 2015). Urban Mobility System Upgrade: How shared self-driving cars could change city traffic. Retrieved from http://www.internationaltransportforum.org/Pub/pdf/15CPB_Self-drivingcars.pdf

(Footnote continued on next page...)

unsignalized, unmarked, or midblock crossings as a matter of convenience and safety. If these behaviors prove difficult for CAVs to predict, bicyclist and pedestrian movements may be restricted in favor of CAVs.

Because of their small profile and nimble operating characteristics, researchers consider bicyclists the most difficult detection problem for CAVs.[27] While some have suggested embedding V2X beacons on bicycles to aid in detection, this poses logistical, financial, and ethical issues. Would existing bicycles be retrofitted or would only new bicycles be detectable? Would manufacturers or the Government cover the cost or would it be passed onto the user? If the latter occurs, how will pedestrians and bicyclists who are unwilling or unable to afford the technology be detected by CAVs?

To avoid these and other dilemmas, the responsibility of detecting bicyclists and pedestrians should rest with the vehicle, just as it does today with human drivers. Extensive road-testing of CAV technology is needed to teach vehicles how to recognize people walking and bicycling and react appropriately.

6.5.3 Equity Issues

Our transportation system perpetuates systemic inequities related to health, race, income, and other issues. Connected and driverless vehicle technology has the potential to reduce and eventually eliminate such disparities, making roads safe for all users. However, it is equally possible that CAVs could make these problems much worse.

If CAVs and smart infrastructure are concentrated in high-income areas, they will exacerbate the inequities that burden disadvantaged communities, such as the more than three quarters of the I-105 study area that is disadvantaged. People walking and bicycling in low-income and minority neighborhoods would continue to be at greater risk of injury or death than transportation users in other areas. The implications are far-reaching, but not unlike our existing transportation system. Initially, access to CAVs and related technology (i.e., V2X) will be cost-prohibitive for most users. While production and manufacturing costs will eventually decline and make the technology less expensive, there may be a prolonged transition period during which the technology is affordable for some users, but not for others. If CAVs relied on V2X beacons to sense other users instead of onboard detection systems, people walking and bicycling without such technology would be much harder to detect, and at greater risk of injury or death. For this reason, active transportation advocates caution against overreliance on V2X technology. See Best Practices: Active Transportation Policy Positions on CAVs (page 8).

6.5.4 CAV Operating Characteristics

CAVs will be capable of maneuvers that are beyond the reach of human drivers. V2V and V2I communication will allow for higher and synchronized speeds, smaller gaps between vehicles (i.e., platooning), and reduce or eliminate the need for signalization and other common traffic control devices. While these performance benefits would be a boon to vehicle users, they may be a detriment to bicyclists and pedestrians. If CAVs are unable to operate at maximum efficiency because other road users are in the way, those users may be relegated to a second-class status.

[27] Fairley, P. (January 31, 2017). The Self-Driving Car's Bicycle Problem. *Institute of Electrical and Electronics Engineers*. Retrieved from https://spectrum.ieee.org/cars-that-think/transportation/self-driving/the-selfdriving-cars-bicycle-problem

(Footnote continued on next page...)

6.5.5 Driver Distraction

Distracted driving already claims thousands of lives every year.[28] These numbers could be exacerbated by partially automated vehicles (Levels 2 and 3), which will still require human attention and control at certain times. Vehicles that require human control in certain situations but not others have been shown to encourage distracted driving behavior, with an over-reliance on technology to prevent incidents.[29] Partially automated vehicles could pose severe dangers when sharing the road with non-motorized users.

6.5.6 Transition to Full Adoption

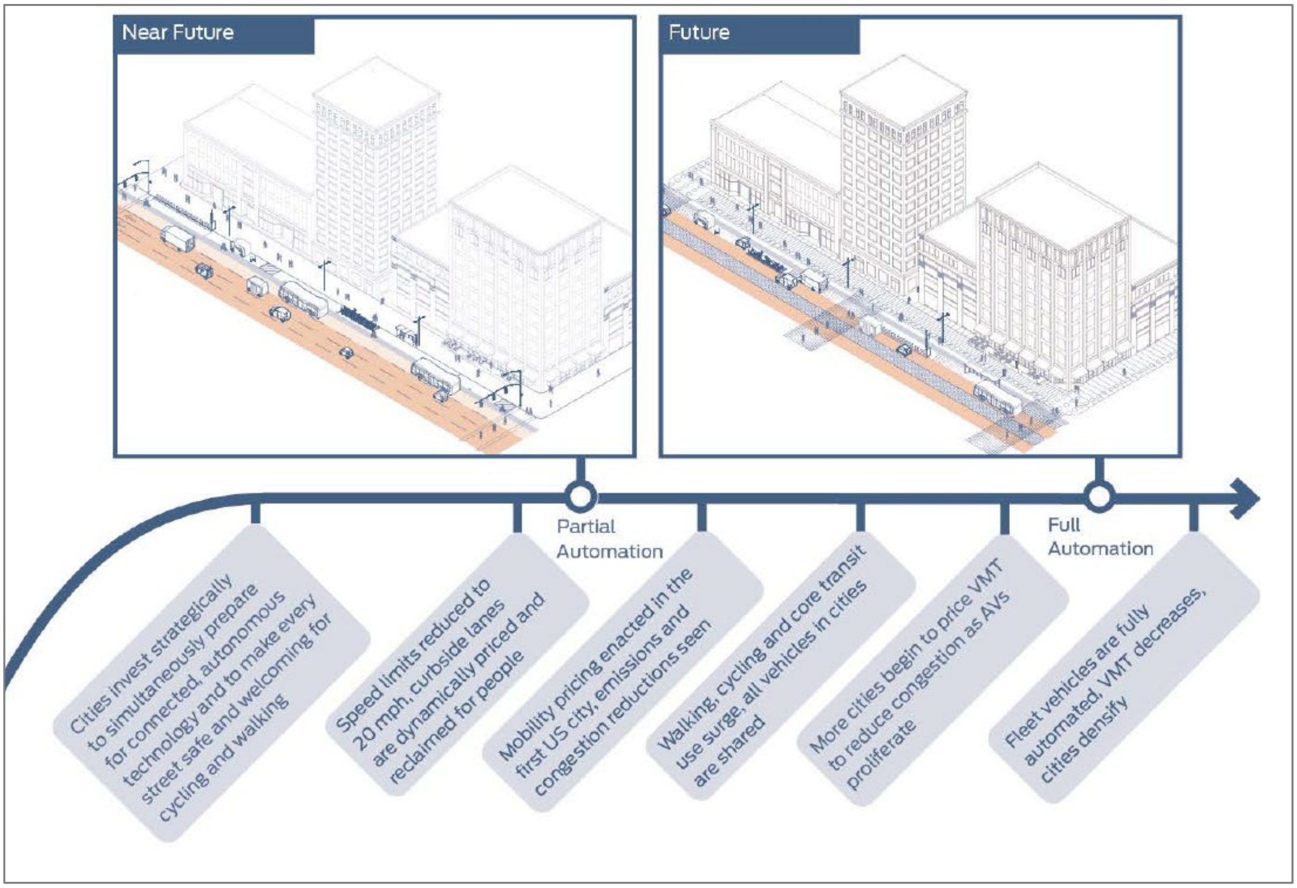
Forecasts for full CAV market penetration vary widely, but most agree that it remains several decades away. An oft-cited number based on a survey of industry experts from the Institute of Electrical and Electronics Engineers is that by 2040, driverless vehicles will comprise 75 percent of vehicles.[30] In the interim, people walking and bicycling will encounter a variety of vehicles on the road, from Level 1 (human controlled) to Level 5 (fully autonomous). It is an open question how people will discern a vehicle's capabilities and react accordingly. Standardized communication methods between CAVs and other users could help, as well as regulations such as a 25 mph universal speed limit in mixed traffic urban areas, which would facilitate communication between different users. **Figure 6.2** below illustrates a potential future pathway for automation.

[28] NHTSA. (n.d.). Distracted Driving. Retrieved from: https://www.nhtsa.gov/risky-driving/distracted-driving

[29] Christopher, N. (January 13, 2017). Mishaps: A Grief History of Driverless Car Crashes. *Economic Times.* Retrieved from https://economictimes.indiatimes.com/small-biz/security-tech/technology/driverless-crashes/articleshow/56510821.cms

[30] Institute of Electrical and Electronics Engineers. Look Ma, No Hands! https://www.ieee.org/about/news/2012/5september_2_2012.html

Figure 6.2 Pathway to Automation



Source: NACTO, 2017

7.0 Future Systemwide Performance

This section establishes the baseline systemwide performance of the transportation system in the I-105 Study Area. Along with the existing conditions, this section will be used to evaluate potential improvement scenarios. **Section 7.1** describes the goals and objectives of the I-105 CSS and the accompanying performance measures. **Section 7.2** highlights how the I-105 Study Area transportation network in the future is anticipated to perform relative to the established metrics.

7.1 I-105 CSS Goals, Objectives, and Performance Measures

The I-105 CSS seeks to address the following broad corridor goals:

- **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, to improve service to low-income and transit-dependent populations throughout the corridor; and to promote 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.

In order to make progress towards these goals, various objectives and associated performance measures were established to quantify the existing conditions and evaluate potential projects. **Table 7.1** below highlights the I-105 CSS objectives and how they relate to the broad corridor goals.

Table 7.1 I-105 CSS Objectives

Goals	Objectives
Mobility	• Improve multimodal system efficiency • Improve transit ridership • Reduce congestion
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
Safety	• Reduce safety collisions and hazards
State of Good Repair	• Improve & preserve system conditions
Sustainability	• Improve air quality and public health • Reduce emissions

Table 7.2 displays the selected performance measures, organized by goal, which will be the basis for the improvement scenario evaluation. These scenario evaluations will ultimately inform a proposed I-105 CSS Implementation Plan consisting of near-, mid-, and long-term corridor improvements that help further corridor goals, reflect stakeholder involvement and community needs, and can be integrated into SCAG's next

RTP/SCS. In **Section 7.2** below, where possible, the future baseline conditions are quantified in terms of these chosen performance measures.

Table 7.2 I-105 CSS Performance Measures

Goals	Performance Measures	Data & Tools
Mobility & Connectivity	• 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	• Travel Demand Model • Travel Demand Model/Aimsun • Travel Demand Model/Aimsun • Travel Demand Model/Aimsun • Travel Demand Model/Aimsun • Travel Demand Model
Accessibility & Equity	• 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	• Travel Demand Model/GIS • Travel Demand Model/GIS • GIS • Open Street Map/GIS • Travel Demand Model • Travel Demand Model/GIS • Qualitative
Safety	• Serious injury crash rates (by mode) • Fatal collision rate (by mode)	• SWITRS/GIS • SWITRS/GIS
State of Good Repair	• Pavement in good, fair, and poor condition • NHS bridges in good, fair, and poor condition	• Caltrans, Jurisdictions/GIS • FHWA National Bridge Inventory
Sustainability	• 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)	• Travel Demand Model • Travel Demand Model • Travel Demand Model • Travel Demand Model • Open Street Map/GIS • Travel Demand Model

Note: "Data & Tools" are potential data sources and may not be used in the ultimate evaluation of improvement scenarios

7.2 Future Systemwide Performance

The following section highlights the future baseline conditions in the I-105 Study Area based on the established performance measure framework. They are divided into the objectives that address the five CSS goals: Mobility, Accessibility and Equity, Safety, State of Good Repair, and Sustainability. For many measures, the future conditions cannot be forecasted or modeled; those performance measures are included in the existing conditions report but are not included below.

7.2.1 Mobility Performance Measures

Three of the I-105 CSS objectives address mobility in the I-105 Study Area: Improve Multimodal System Efficiency, Improve Transit Ridership, and Reduce Congestion. **Table 7.3** shows the system performance in terms of travel time, broken down by mode. **Table 7.4** shows the future system performance in terms of transit ridership, quantified in terms of transit mode share using SCAG's regional travel demand model. **Table 7.5** displays estimated future statistics related to traffic volume and congestion, including truck and auto delay and high occupant vehicle (HOV) mode share.

Table 7.3 Improve Multimodal System Efficiency

Measure	2016	2040	Source
2) Travel time by mode (minutes)			
• Auto – SOV	7.9	7.5	SCAG 2016 RTP/SCS Model
• Auto - HOV	8.1	8.0	
• Transit	Not available		
• Walk	30.3	31.3	
• Bike	14.1	15.2	

Table 7.4 Improve Transit Ridership

Measure	LA County 2016	LA County 2040	Source
3) Transit ridership/mode share			
• All Trips Mode Share (including school bus)	3.9%	4.3%	SCAG 2016 RTP/SCS Model

Table 7.5 Reduce Congestion

Measure	2016 (% of LA County)	2040 (% of LA County)	Source
4) Daily Auto Vehicle Hours of Delay (VHD)*	181,163 (10%)	178,672 (9%)	SCAG 2016 RTP/SCS Model

5) Daily Truck Vehicle Hours of Delay (VHD)*	10,949 (13%)	15,255 (10%)	
6) High Occupant Vehicle (HOV) Mode Share	37.9% (I-105) 43.4% (LA County)	38.4% (I-105) 44.1% (LA County)	

7.2.2 Accessibility and Equity Performance Measures

Accessibility and equity is quantified through two objectives: improving system connectivity and increasing service to social equity focus (SEF) populations. **Table 7.6** shows the projected future performance of the I-105 transportation system with regards to multimodal access to jobs and housing. However, given that it is difficult to forecast the spatial distribution of SEF populations, the future baseline accessibility for SEF populations is no different than current conditions.

Table 7.6 Improve System Connectivity

Measure	2016 (% of Study Area)	2040 (% of Study Area)	Source
8) Jobs near transit			
• Within ½ mile of fixed guideway transit	65,451 (14%)	138,000 (26%)	SCAG RTP/SCS 2016 Model / LA Metro
9) Households near transit			
• Within ½ mile of fixed guideway transit	40,906 (10%)	83,000 (19%)	SCAG RTP/SCS 2016 Model / LA Metro

7.2.3 Sustainability Performance Measures

There are two objectives that address sustainability goals: improving air quality and public health and reducing emissions. **Table 7.7** displays the baseline system performance for public health and livability. The metrics track the accessibility of parks and recreation and the prevalence of bicycling and walking. **Table 7.8** highlights the metrics that quantify emission reductions and air quality improvements. These metrics are primarily related to reducing vehicle miles traveled (VMT) and single occupant vehicle (SOV) trips; associated air quality and emissions benefits are related to reducing VMT and SOV trips.

Table 7.7 Improve air quality and public health

Measure	2016 (% of Study Area)	2040 (% of Study Area)	Source
17) Parks, recreation, and open space accessible by low-stress bike/ped facilities, complete streets, and/or high quality transit			
• Within ½ mile of fixed guideway transit*	200 acres (6%) 27 location (12%)	396 acres (12%) 60 location (27%)	LA County Dept of Parks and Recreation
18) Bicycle and walk mode share/trips*	**LA County**	**LA County**	
• Bike All Trips Mode Share	1.7%	1.7%	SCAG 2016 RTP/SCS Model
• Pedestrian All Trips Mode Share	17.4%	18.0%	

Table 7.8 Reduce Emissions

Measure	2016 (% of LA County)	2040 (% of LA County)	Source
19) Vehicle Miles Traveled (VMT)			
• Daily VMT	27,300,000 (12%)	28,900,000 (12%)	SCAG 2016 RTP/SCS Model
22) Non-SOV mode share	60.8% (I-105 Area) 59.8% (LA County)	61.6% (I-105 Area) 61.3% (LA County)	SCAG 2016 RTP/SCS Model

7.2.4 Other Measures

It was not possible to assess the future systemwide performance related to the Safety and State of Good Repair objectives and associated performance measures. These measures will be utilized in the evaluation of improvement scenarios, however, for establishing a future baseline of system performance the existing conditions are assumed to remain constant.

.

8.0 Summary and Conclusions

8.1 Land Use and Demographics

- In 2040, the population of LA County is projected to be over 11.5 million people, a 13.7% percent increase from 2016. 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.
- 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).
- 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 by over 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.

8.2 Roadways

- Daily trips on the I-105 Freeway will increase between 2% to 6% depending on location along the corridor.
- Vehicle Miles Travelled throughout the study area are projected to increase by 6% by 2040. On the I-105 freeway alone (excluding arterial roadways) the increase in VMT is projected to be lower with only a 3% increase.

- Vehicle Hours Travelled 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.

- 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.

- I-105 during the AM peak period will experience a greater impact in the future due to growth in travel demand, with more segments moving to a volume/capacity ratio over 1.0 with poor levels of service. While conditions will also deteriorate during the PM peak hour, the impact will be proportionately less than during the AM peak as the PM period is already highly congested in both directions.

- 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.

8.3 Transit

- 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.

- 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/Eco Rapid Transit, Vermont Transit Corridor, Green Line Extension to Torrance, Green Line Extension to Norwalk, Lincoln Boulevard BRT, and the Sepulveda Pass Transit Corridor.

- There are policies and directives that may encourage transit ridership, such as transit oriented development, greenhouse gas reduction targets, and incentives for alternatives to single-occupant vehicle travel. However, it is difficult to predict how changes in technology, demographics, and economics will shape the future of transit usage in the I-105 Study Area.

8.4 Active Transportation

- 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 bike share systems, dockless bike share systems, and electric scooter share programs are already available in many parts of LA County.

- If all the planned bicycle facilities are implemented, the bikeway mileage in the I-105 Study Area will increase substantially. 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 in an area where there are currently none.

8.5 Emerging Technologies

- Emerging technologies have the power to disrupt mobility as we know it by offering innovative ways to solve transportation challenges in the region and in the I-105 corridor. Adding to the disruptive potential of emerging technologies 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.

- There are number of uncertainties regarding CAVs that 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 more broadly is a challenge that all agencies will face as increasing emerging modes, including bikesharing and ridesharing, become popular and are deployed. Related to transportation infrastructure, there could be lags in adaptability of existing infrastructure to meet the needs of emerging technology which could greatly inhibit solutions such as dynamic messaging and advanced signal systems. Furthermore, increasing technology in the roadway and full transportation network allows for increasing data security challenges.

- There are many potential benefits for emerging technologies. New technologies could recognize the presence of vulnerable road users through improved detection, ultimately improving safety for non-motorized road users. Furthermore, CAVs could have technologies to communicate with other road users to improve predictability, better abide by speed limits, reduce driver error, and enhance public space by reducing the need for parking lots and creating efficient platooning that frees roadway space. 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.