Summit of Possibilities
PEOPLE, COMMUNITY AND PROGRESS

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SELA Transportation: Critical Choices Ahead

California COMMUNITY Foundation

PAT BROWN INSTITUTE FOR PUBLIC AFFAIRS
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SOUTHEAST LA COLLABORATIVE

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Southeast LA (SELA) Transportation Study

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Objectives of the study:

- Analyze existing Southeast Los Angeles transportation system
- Provide overview of larger socioeconomic context
- Present impending and future key decisions

Key Findings:

- More manufacturing and warehousing jobs and fewer service jobs in SELA than in Los Angeles County
- The Southeast likely to become a prime target for development in light of housing affordability crisis throughout the county and general economic growth
- Key safety hot spots located both within and near the Southeast for pedestrian and truck accidents
- Heavy truck activity due to industry and ports corridor
- More carpool and public transit use than Los Angeles County
- Bus frequency and on-time performance lower than county average
- Commutes shorter than Los Angeles County as a whole, likely due to high job access

Key Decisions:

- *Planning for density*
  - Reassessment of municipal general plans for growth management
  - Identification of areas vulnerable to gentrification
  - Identification of areas that merit historical preservation
  - Identification of areas with best potential for mixed-use, multifamily and transit-oriented development
  - Assessment of zoning provisions for higher-density development near major transit nodes
- *Improving public transportation*
  - Identification of problems via an in-depth analysis of transit supply and demand as well as a SELA travel survey
  - Realignment of public transit services to better match existing travel patterns and to improve service quality and reliability
  - Embracing emerging bus transit technologies and participation in LA Metro's transit enhancement project as a demonstration site
  - Identification and creation of special zones/districts for high-density transit-oriented development
- *Reducing impacts of heavy trucks*
  - Assessment of local corridors with high truck traffic
  - Assessment of truck traffic encroachment on school, hospital and residential areas

- Participation in South Coast Air Quality Management District's (SCAQMD) demonstration study of zero- and near-zero-emission heavy-duty trucks

- *Improving pedestrian safety*
  - Identification of problems associated with pedestrian-vehicle accident hot spots
  - Assessment of pedestrian threat hot spots using accident and crime data

- *Coordinating traffic communications via emerging technology trends*

GOALS OF THE STUDY

As part of the 2017 Summit of Possibilities for Southeast LA (SELA), the Pat Brown Institute for Public Affairs at Cal State LA charged the METRANS Transportation Center with performing a comprehensive analysis of the transportation assets and deficiencies within the communities near the I-710 corridor, termed Southeast Los Angeles (SELA). Our analysis is intended to identify transportation assets and deficiencies and examine them in the larger context of demographic, housing and air quality trends.

The first goal of the research was to survey the state of the existing SELA transportation system. Wherever possible, available data were disaggregated to correspond precisely with the grouping of census tracts that defined the I-710 corridor study area in the previous Beacon Economics study conducted for the Pat Brown Institute.[1] Transportation assets were broken down by mode including highways, surface streets, bus and fixed rail transit and biking infrastructure. Safety statistics were analyzed, including pedestrian accidents and truck-involved crashes.

The socioeconomic context of the region was assessed by examining factors such as median income, the alignment of population and job density, job access and total employment. Specific employment sectors, such as manufacturing, were analyzed based on the extent to which they deviated from the regional (generally the county) average. Housing conditions were examined with a specific focus on trends in rental rates and affordability.

Finally, we surveyed upcoming public policy decisions likely to impact transportation in the Southeast. Our goal is both to support evidence-based public policy and to encourage community participation in the decision-making process around these critical junctures.

PART I: STUDY AREA

The previous study directed by the Pat Brown Institute and conducted by Beacon Economics for the 2016 SELA Summit of Possibilities, *Central 710 Freeway Corridor: An Asset Based Analysis*, specified the study area (Figure 1). It includes the following municipalities: Bell, Bell Gardens, Commerce, Compton, Cudahy, Huntington Park, Lynwood, Maywood, Paramount, South Gate and Vernon. It also includes the unincorporated communities of East Los Angeles, Florence, Rancho Dominguez and East Compton. There is one difference between the study area in this report and that of the Beacon Economics study. Because we are reliant on census tract data, we deleted an area of approximately 1.3 square miles south of State Route 91.[2] It is part of a large tract that is mostly outside the study area and including it within our study would have skewed our results.

The study area covers approximately 62 square miles. It consists of 166 census tracts. Los Angeles County has 2,341 census tracts; of these 70 are rural census tracts as defined by the 2010 US Census. The remaining 2,105 urban tracts not in our study area serve as the reference area in our analysis. Part I: A Portrait of the Southeast

1. High Population Density

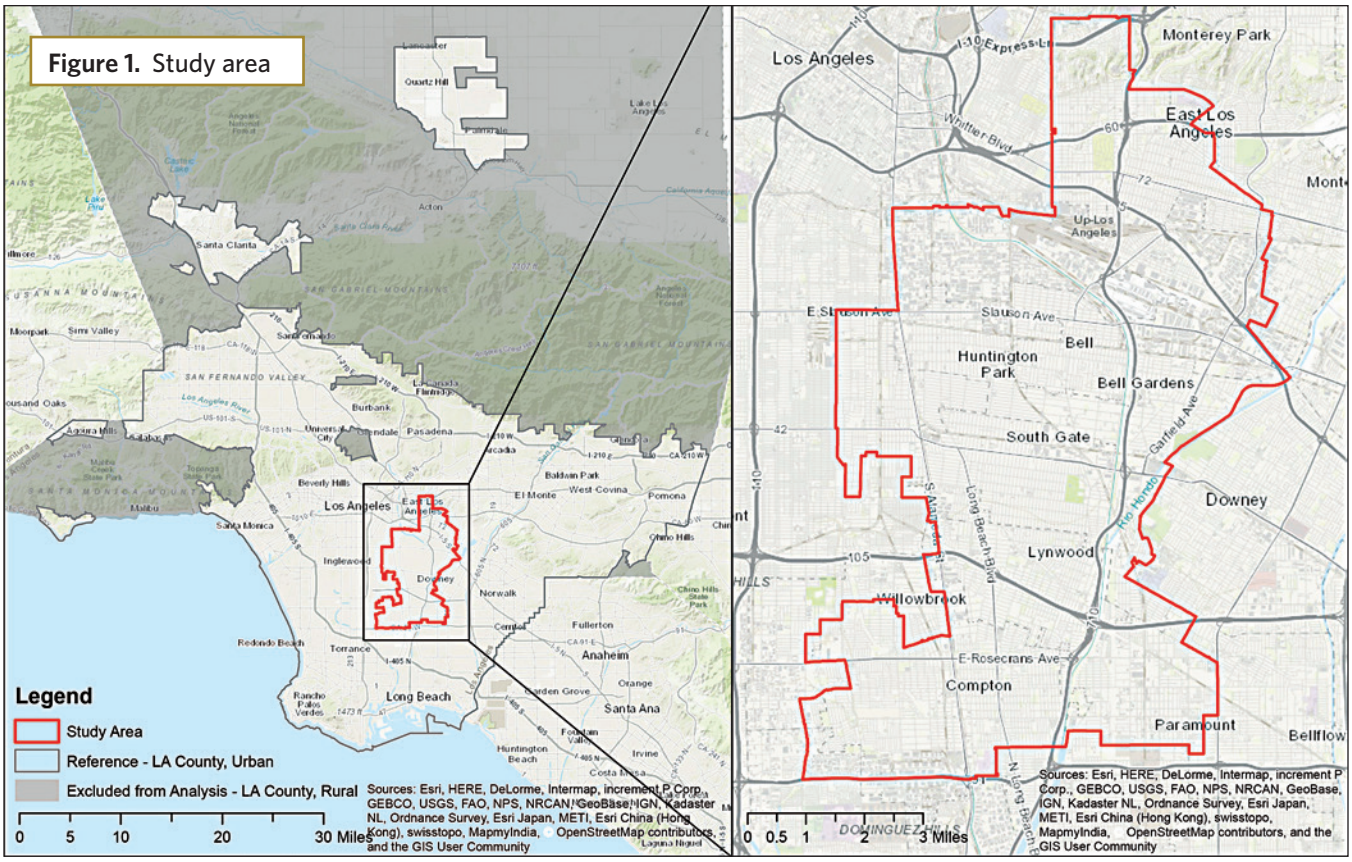
The Southeast is densely populated. Table 1 compares population and population density between the study and reference areas. There are 751,000 residents (7.5% of Los Angeles County's population) in the study area, which accounts for just 1.6% of the land area in the county. Its population density (27.33 people per acre) is significantly higher than the county average (20.91). Figure 2 shows a large contiguous area in Westlake, Hollywood and Central Los Angeles with higher population density. A large portion of that area is included in the SELA area.

2. Lower Job Density

As shown in Figure 3, the locations with high employment concentration are outside the study area—from

1 http://development.patbrowninstitute.org/wp-content/uploads/2017/02/710-Corridor-FWY-Report.pdf

2 This area is included in the "SELA Transportation: Critical Choices Ahead" summary report.



downtown Los Angeles along the Wilshire Corridor through Hollywood, West Los Angeles and Santa Monica, as well as locations in the San Pedro Bay ports, LAX, Burbank and Pasadena. These locations have very high employment-density census tracts (over 20 jobs per acre, blue in the figure). Northern parts of the Southeast community (Vernon, Bell, Bell Gardens and Commerce) also have several census tracts with high employment density (10-20 jobs per acre). This area is heavily oriented toward manufacturing. The study area includes 249,633 jobs with 4.5 jobs per acre, which is lower than the county and reference area averages (Table 2). This is partly due to the types of jobs (manufacturing, transportation and warehousing) available.

3. More Manufacturing Jobs Compared to Service Jobs

We further analyze the industry sector composition in and out of the study area. We particularly focus on two sectors: manufacturing (NAICS 31-33) and professional services (NAICS 51-56). Professional services include information, finance, real estate, professional, manage-

Table 1. Population and population density statistics

	LA County (N=2,341)	**Study Area (N=166)**	Reference (N=2,105)	Rural (N=70)
Area (square miles)	3,926.7	**62.0**	1,293.0	2,571.7
Share	100.0%	**1.6%**	32.9%	65.5%
Population	10,034,324	**750,665**	9,046,633	237,026
Share	100.0%	**7.5%**	90.2%	2.4%
Mean Population Density (people/acre)	20.91	**27.33**	21.08	0.60

Figure 2. Population density *(American Community Survey, 2011-2015, persons/acre)*

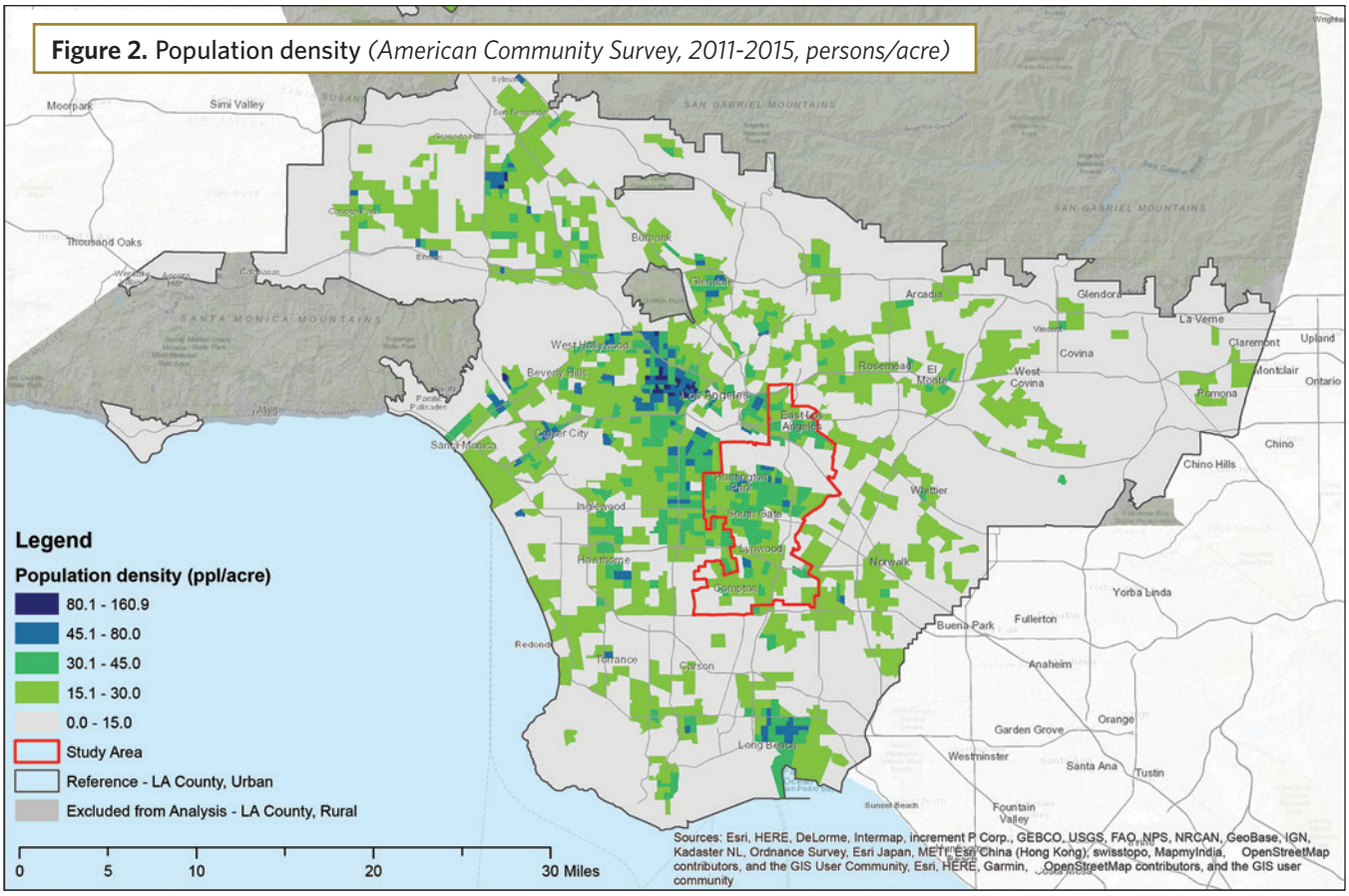
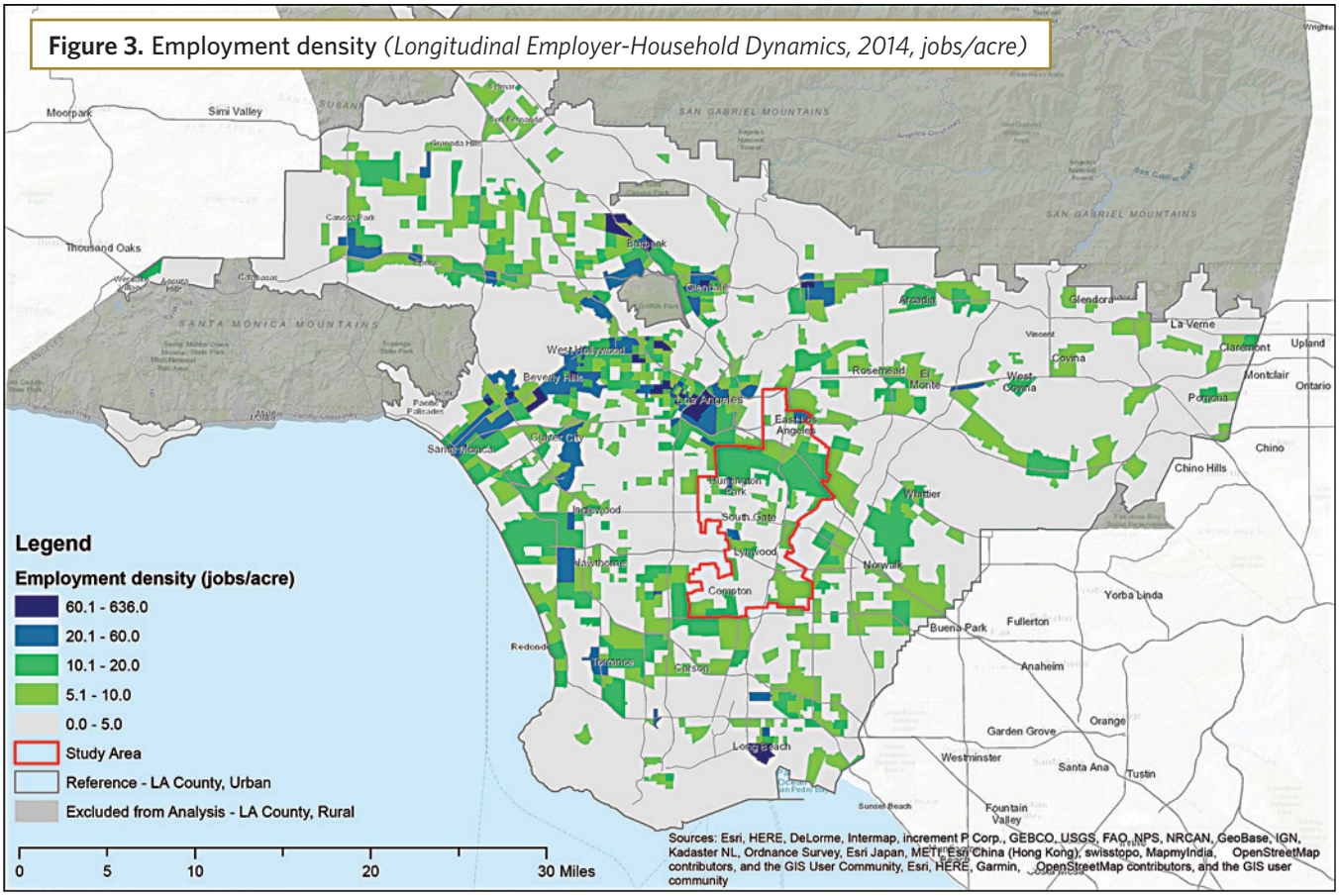


Figure 3. Employment density *(Longitudinal Employer-Household Dynamics, 2014, jobs/acre)*



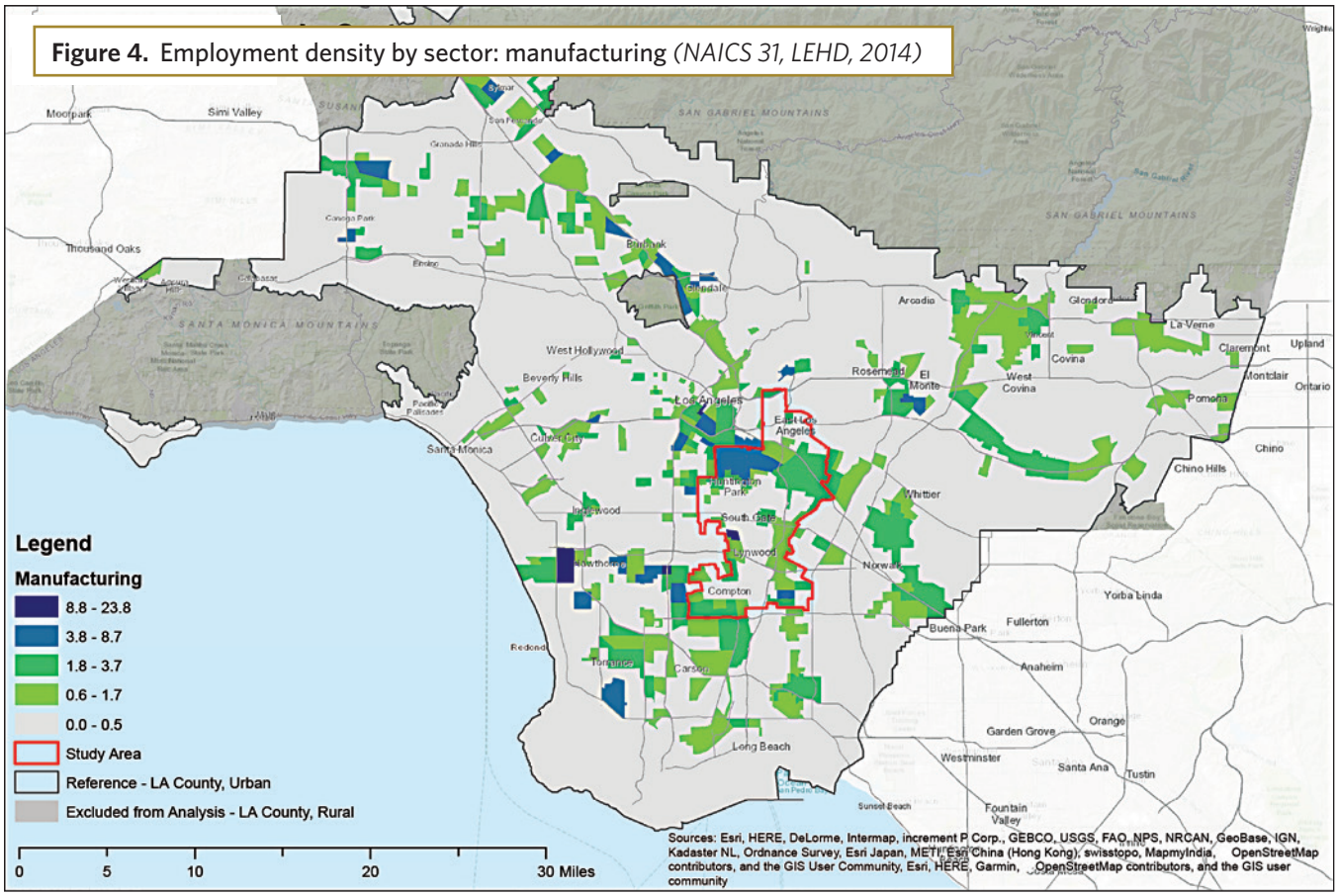


Figure 4. Employment density by sector: manufacturing *(NAICS 31, LEHD, 2014)*

ment and administrative services. Table 3 provides the two sectors' statistics. Relative to the shares of population and employment in the study area (7.5% and 5.7% respectively, as presented in Tables 1 and 2), the concentration of manufacturing jobs (16.1%) is quite high. Manufacturing employment density is twice as high as that of the reference area. Figure 4 shows that the locations with high employment density within the study area documented in Figure 3 are in fact mostly manufacturing industrial zones. Compton and Torrance, just south of the study area, are also heavily based on manufacturing. The spatial distribution of professional services shows an entirely different pattern. Professional service sectors are located mainly in high-density employment clusters. In the SELA community, there are 37,376 service sector jobs, which account for just 3.2% of all service jobs in the county, substantially lower than the community's population or employment share.

4. Lower Median Household Income

The Southeast community has a relatively low median household income: approximately $40,000, compared to the county average of $61,000 (Table 4). Figure 6 presents the spatial distribution of median income in five categories. Census tracts with the lowest median income (less than $40,000) are mostly concentrated

Table 2. Employment and employment density statistics

	LA County (N=2,341)	**Study Area (N=166)**	Reference (N=2,105)	Rural (N=70)
Employment	4,369,174	**249,633**	4,048,443	71,098
Share	100.0%	**5.7%**	92.7%	1.6%
Mean employment density (jobs/acre)	6.85	**4.53**	7.25	0.16

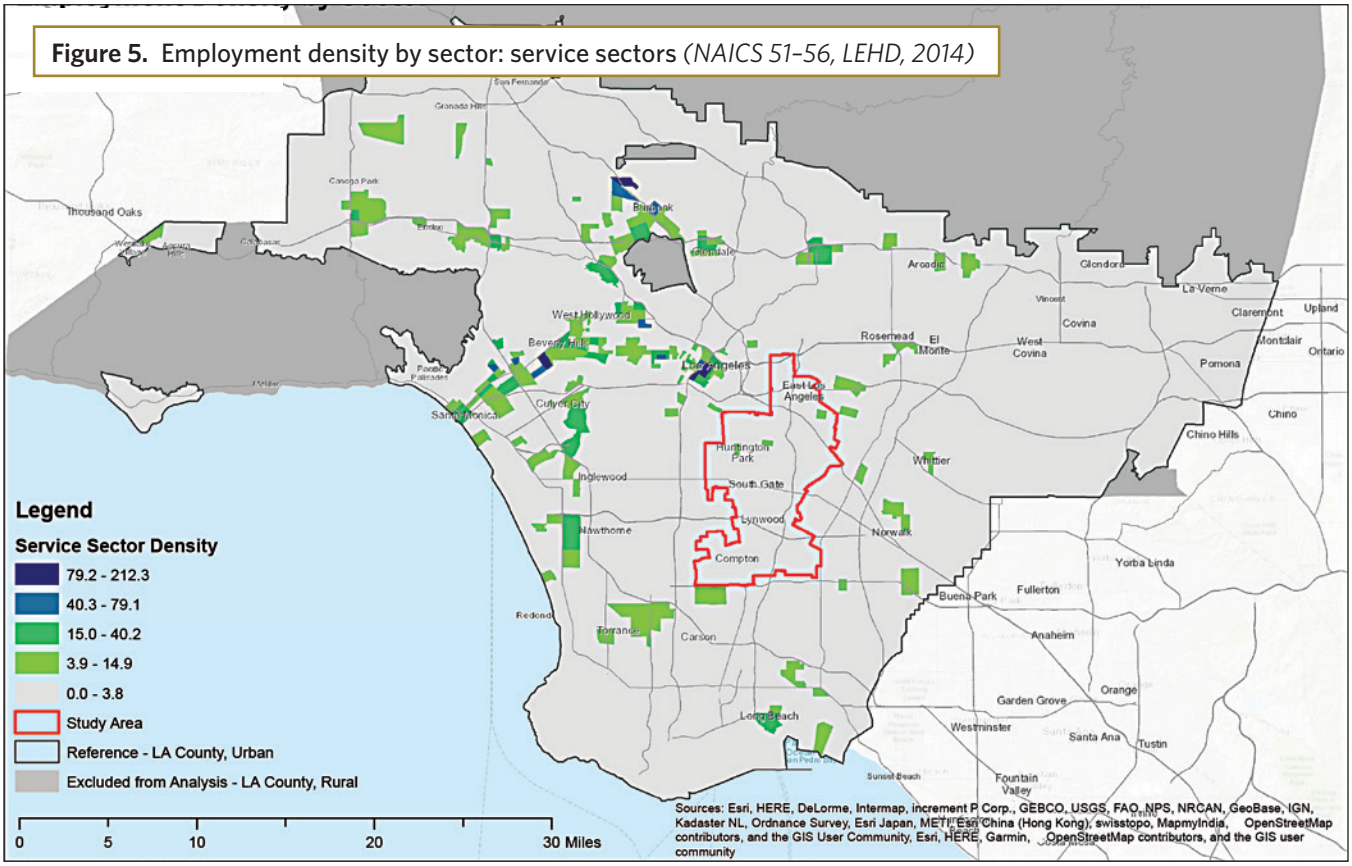


Table 3. Number and share of employment by industry sector

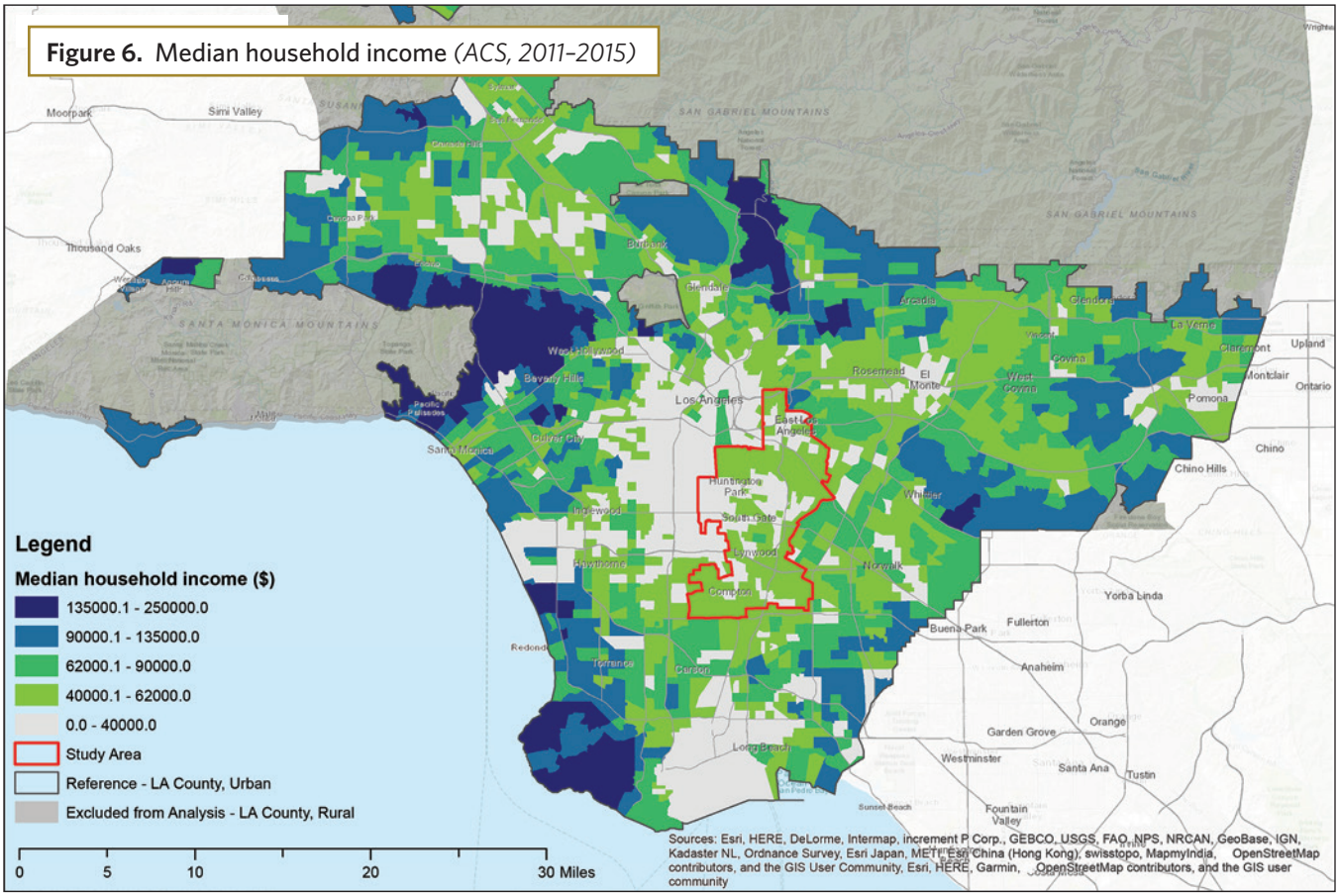
	LA County (N=2,341)	**Study Area (N=166)**	Reference (N=2,105)	Rural (N=70)
Manufacturing	368,095	**59,183**	302,917	5,995
Share	100.0%	**16.1%**	82.3%	1.6%
Density (jobs/acre)	0.33	**0.66**	0.32	0.01
All service	1,182,518	**37,376**	1,125,147	19,995
Share	100.0%	**3.2%**	95.1%	1.7%
Density (jobs/acre)	1.83	**0.60**	1.98	0.05

Table 4. Median household income statistics

	LA County (N=2,341)	**Study Area (N=166)**	Reference (N=2,105)	Rural (N=70)
Mean of median household income	$61,213	**$40,306**	$61,929	$91,313

Table 5. Car ownership statistics

	LA County (N=2,341)	**Study Area (N=166)**	Reference (N=2,105)	Rural (N=70)
Mean of household vehicles per capita	0.71	**0.59**	0.70	0.83



around downtown Los Angeles, Westlake, South-Central and Long Beach. Almost all of the study area falls into the two lowest categories, i.e. below the county median.

5. Lower Rate of Car Ownership

The spatial distribution of car ownership rates generally follows the pattern of median household income. The Southeast community has on average 0.59 vehicles per adult, significantly lower than the county average of 0.71.

6. Jobs Are Accessible

The Southeast has very high job accessibility.[3] We measure accessibility as the sum of the number of jobs available within 10 miles of the center of each census tract in the study area. Average job accessibility of the study area is approximately 1.37 million jobs, substantially greater than that of the reference area (0.98 million jobs) (Table 6). Figure 8 shows that job accessibility is highest in the central core and declines in concentric rings. Most of the study area is located in the second-highest category. Potential workers have access to the large concentration of jobs to the northwest.

We note that this measure is based on straight-line distance and best corresponds to car accessibility. Those using transit would incur much longer travel times for the same distance, even considering road congestion. In Part II, we examine public transit service levels and discuss potential job access problems of transit commuters.

7. Manufacturing Leads to Higher Number of Trucks

Manufacturing is associated with more intensive truck activity. Data on truck traffic are very limited. As a measure of freight traffic associated with different industry

3 Job accessibility at census tract (i) is the sum of employment of all other census tracts (k) that are within 10 Euclidean miles. The mathematical function is as follows:

$$JOB\ ACCESSIBILITY_i = \sum_{k=1}^{K} d_{ik} \times EMP_k$$

Where, $d_{ik} = 1$ if distance between i and $k < 10$ miles; $d_{ik} = 0$ if the distance > 10 miles. Distance has been calculated as the Euclidean distance between the centroids of two census tracts. EMP = number of employment in census tract k. We used 2014 LEHD. More detailed description of the methodology is available in Shen (1998 and 2001).

Figure 7. Car ownership *(Vehicles per adult, ACS, 2011–2015)*

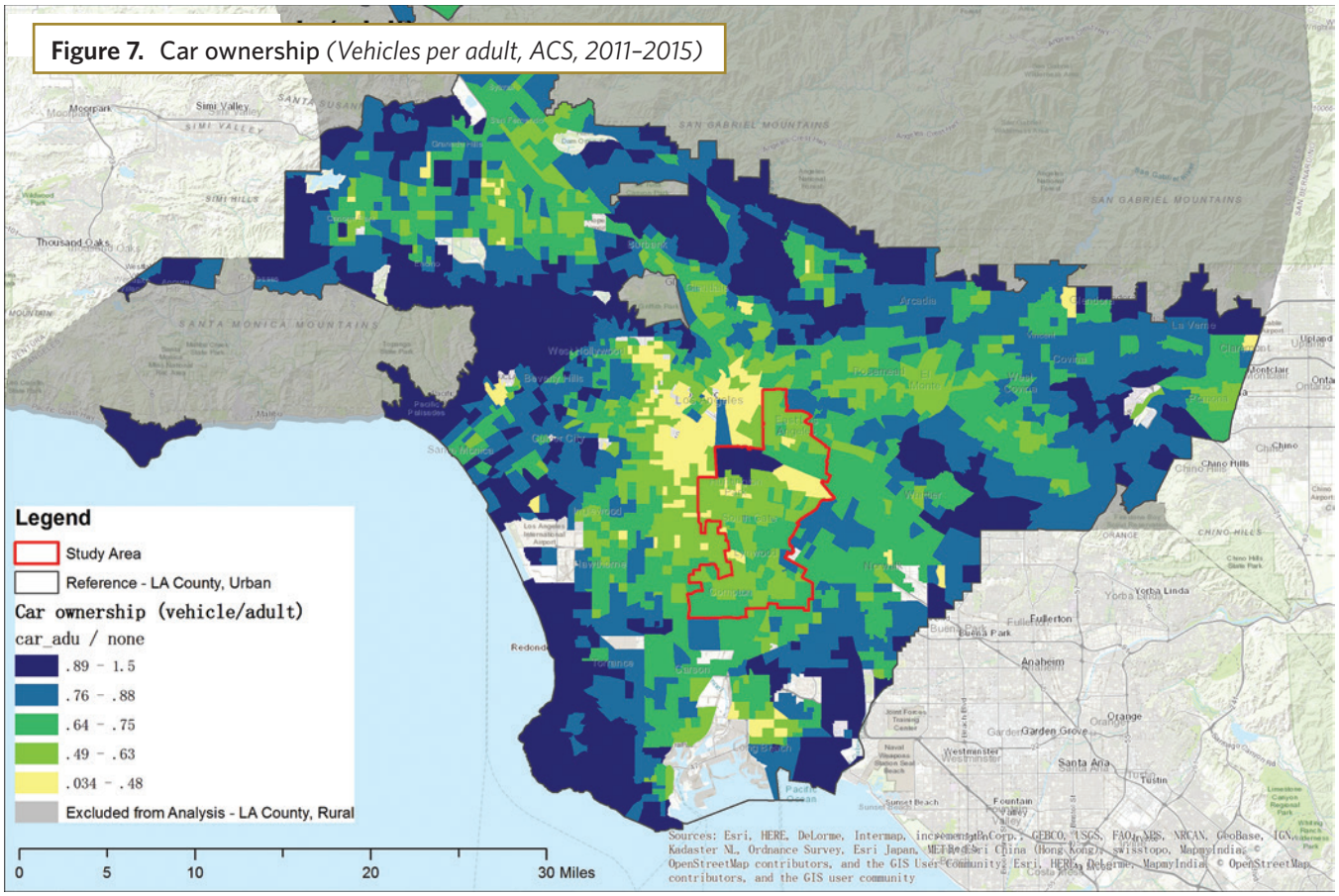


Figure 8. Job accessibility

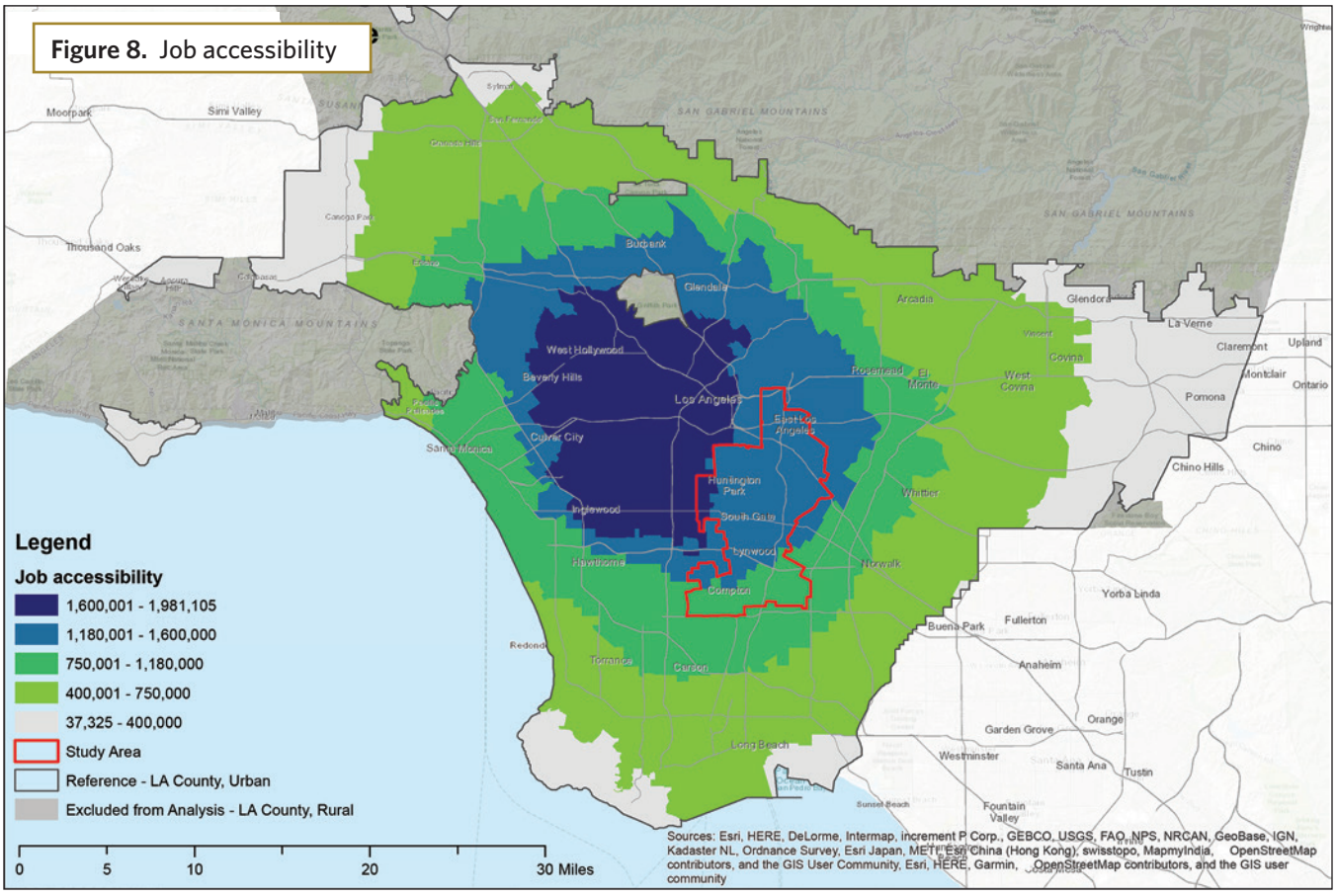


Table 6. Job accessibility statistics

	LA County (N=2,341)	**Study Area (N=166)**	Reference (N=2,105)	Rural (N=70)
Mean absolute job access	984,404	**1,365,118**	981,494	169,090

sectors, we use heavy-duty truck trip-generation rates developed by the Southern California Association of Governments (SCAG). The freight trip generation rate (FTG) is estimated from survey data and measured as the number of trips per employee per day. Government and services have the lowest rates (0.0594 and 0.0357 respectively). The manufacturing rate is 0.2192, and transportation and wholesaling has the highest rate, at 0.6608. The economic mix of the study area is reflected in its higher share of county heavy-duty truck trips than its share of employment (Table 7).

Freight trip generation is mapped in Figure 9. The cities straddling I-5, particularly Vernon and Commerce, have particularly high FTG. In addition to extensive industrial activity, three major intermodal terminals are located in or near the area, UP East Los Angeles, BNSF Hobart Yard and BNSF Commerce. These terminals are the main points for exchanging truck and rail cargo and hence generate large numbers of daily heavy-duty truck trips.

8. Increasing Demand for Housing and Business Locations

The Great Recession led to several years of depressed housing prices. However, once the economic recovery was in place, prices began to climb. From about 2014, housing prices have increased more rapidly throughout Southern California. Housing demand delayed by the recession, employment and population growth and limited housing supply are some of the explanations (Green et al., 2017). With more households priced out of ownership, apartment demand has also increased; the result is rapidly rising rental rates (Khouri, 2016).

Historically, the Southeast submarket has had among the lowest multifamily-housing rental rates in Los Angeles County (Green et al., 2017) and is now one of the few places where relatively low rents can be found. Even so, its rental rates between 2010 and 2017 increased more than 37%. Housing price per square foot over the same period increased more than 73%.[4]

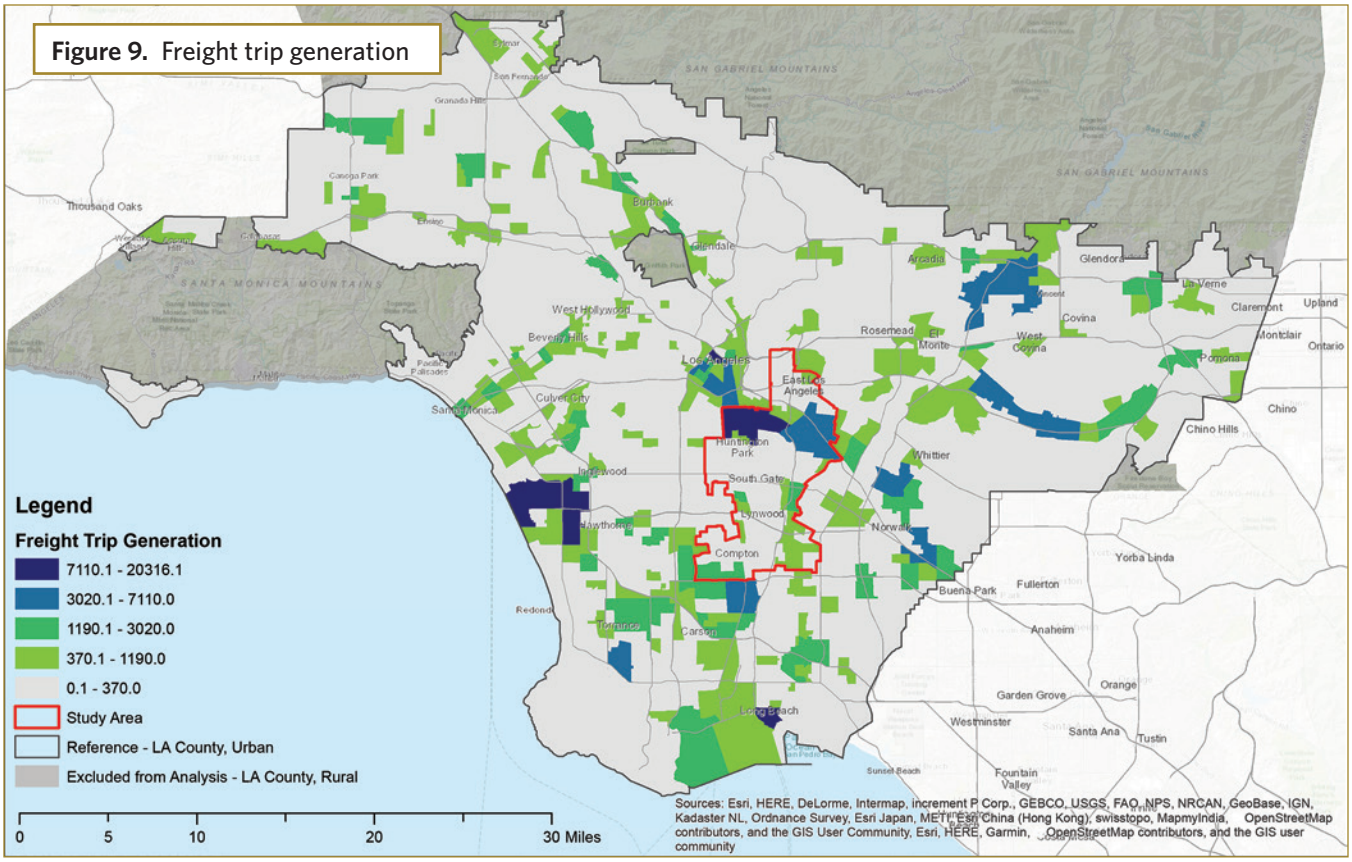
Given the growing housing affordability crisis, we expect that demand for affordable housing, wherever located, will increase. There are many older neighborhoods and communities in the SELA area with housing stock that might draw developers. Some areas date back to the 1940s, and most of the housing was built between 1950 and 1965. Figure 10 gives two examples of residential streets with intact older housing stock. Historic neighborhoods located so close to central Los Angeles will become targets for gentrification.

The Southeast is well-located for warehousing and distribution (W&D) activity. Located just 15 miles from the San Pedro Bay ports and along the freight corridor leading to the intermodal terminals east of downtown

4 Rent and price data from Zillow real estate listings service for the ZIP codes 90001, 90002, 90022, 90023, 90040, 90063, 90201, 90220, 90221, 90222, 90255, 90262, 90270, 90280 and 90723. All fully or partially overlap the study area.

Table 7. Freight trip generation statistics

	LA County (N=2,341)	**Study Area (N=166)**	Reference (N=2,105)	Rural (N=70)
Total freight trip generation	602,918.4	**48,874.1**	544,228.2	9,816.0
Share	100.0%	**8.1%**	90.3%	1.6%
Mean freight trip generation per day	257.5	**294.4**	258.5	140.2



Los Angeles, it is a convenient location for import/export warehousing. Drayage trips are relatively short, making it possible for trucks to make multiple port runs per day. Its proximity to the county's consumers makes it increasingly accessible for local distribution and fulfillment facilities. As Amazon and others promise ever-shorter delivery times, it becomes more important to be located close to residential customers. For example, Kroger, a supermarket chain (Ralphs/Food4Less) that has 440,000 employees nationwide, opened an automated distribution center for dry goods in Paramount in 2009 and another fully automated distribution center for perishables and frozen food in Compton in 2011.[5] The Southeast's convenient location is reflected in rents and vacancy rates; the area has some of the highest rents per square foot, and the vacancy rate is near zero. Finally, it is well-located for international trade businesses such as third party logistics, freight forwarding and customs broker services.

Table 8 shows that W&D businesses in the Southeast expanded more than twice as much (21.1%) as the reference area (10.1%) in the ten years from 2003 to 2013. In fact, the Southeast accounts for more than half of all the additional facilities that emerged over the decade.

5 *http://www.mwpvl.com/html/grocery_automation.html*

Table 8. Statistics of warehousing and distribution centers *(ZIP Code Business Patterns 2003 and 2013)*

	LA County (N=504)	**Study Area (N=19)**	Reference (N=469)	Rural (N=16)
W&Ds in 2003	431	**95**	335	1
W&Ds in 2013	486	**115**	369	2
N Change	55	**20**	34	1
% Change	12.8%	**21.1%**	10.1%	100.0%



Figure 10. Older, well-maintained housing stock in the study area

Figure 11 shows that in Los Angeles County, W&Ds expanded most significantly in the San Pedro Bay port area, along the I-710 and I-605 corridors and in the City of Industry area.

9. Poor Air Quality

The Southeast suffers from both high pollution burden and high population burden based on the CalEnviroScreen methodology, meaning that the generally low-income and minority population is exposed to greater than average health risks from pollution.

The air quality of the SELA area was compared to the region's as a whole. As shown in Table 9, the environmental quality of the study area is worse than that of the county average in most categories. Particularly notable is higher exposure to PM-2.5, ultrafine diesel particulate matter, which is associated with significant health impacts. The last pollution measure in the table is the pollution burden, an aggregate statistic that combines different criteria of pollutants, water quality, pesticides and other toxics, traffic volume and hazardous materials.[6]

The lower panel of Table 9 gives two examples of health outcomes. It can be seen that both the asthma rate and the cardiovascular disease rate are higher than the reference group and the county as a whole, consistent with more exposure to air pollutants. Figure 12 gives a graphic representation of the pollution burden as experienced

6 See *https://oehha.ca.gov/calenviroscreen/maps-data* for details.

Table 9. Comparison of pollution levels for the study area compared to the L.A. metro area

	LA County (N=2,341)	**Study Area (N=166)**	Reference (N=2,105)	Rural (N=70)
Ozone (parts per million)	0.05	**0.05**	0.05	0.06
PM2.5 (µg/m^3)	11.51	**12.13**	11.57	8.50
Diesel PM (kg/day)	24.47	**26.69**	24.97	4.20
Hazardous waste (facilities per census tract)	0.64	**1.06**	0.62	0.19
Pollution burden (percentile)	50.30	**57.42**	50.28	33.91
Asthma (emergency visits per 10,000 population)	51.60	**59.36**	51.49	36.32
Cardiovascular disease (emergency visits per 10,000 population)	8.29	**10.61**	8.13	7.72

Figure 11. Distribution of warehousing and distribution centers
(NAICS 493 warehousing and storage, ZIP code Business patterns, 2013)

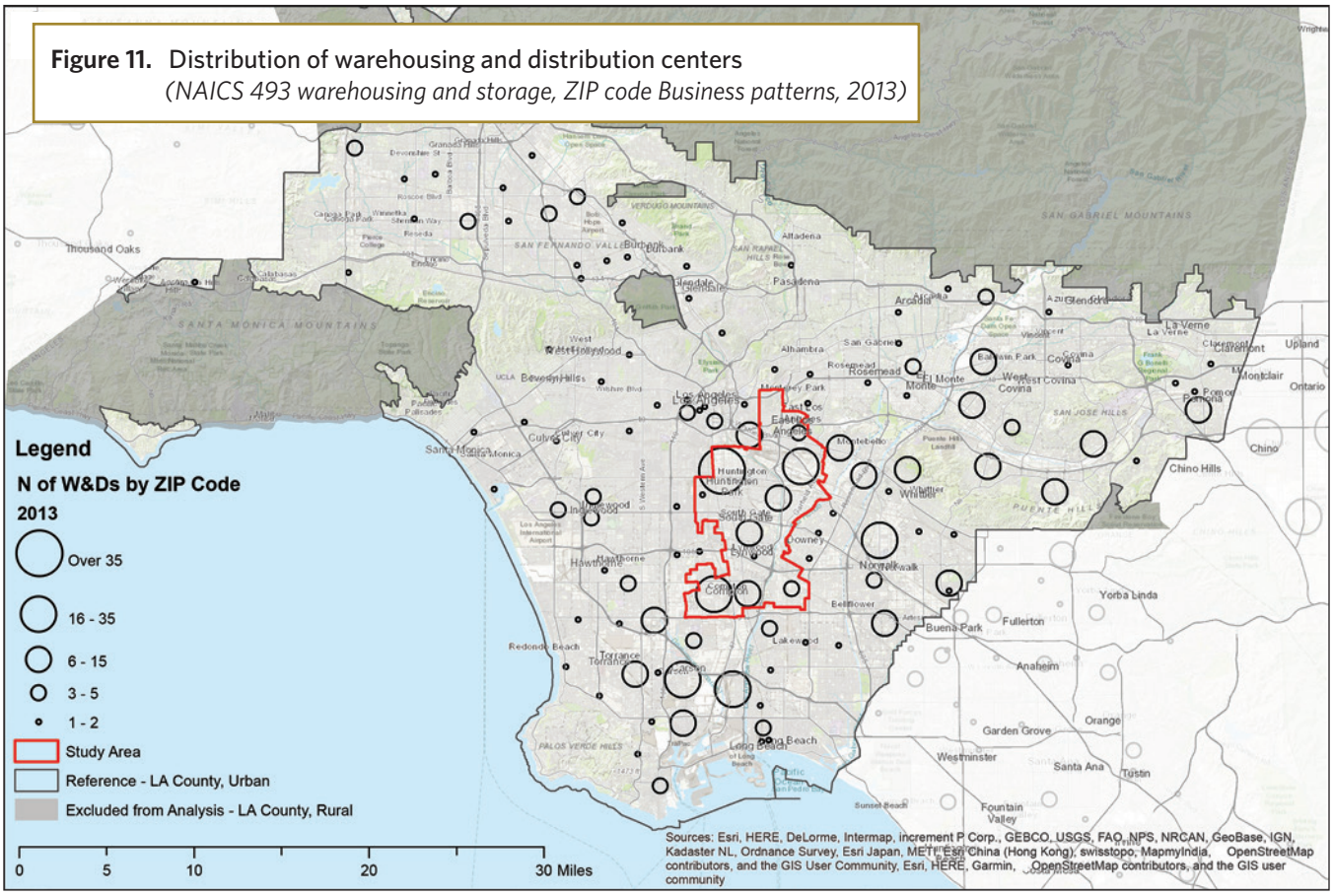
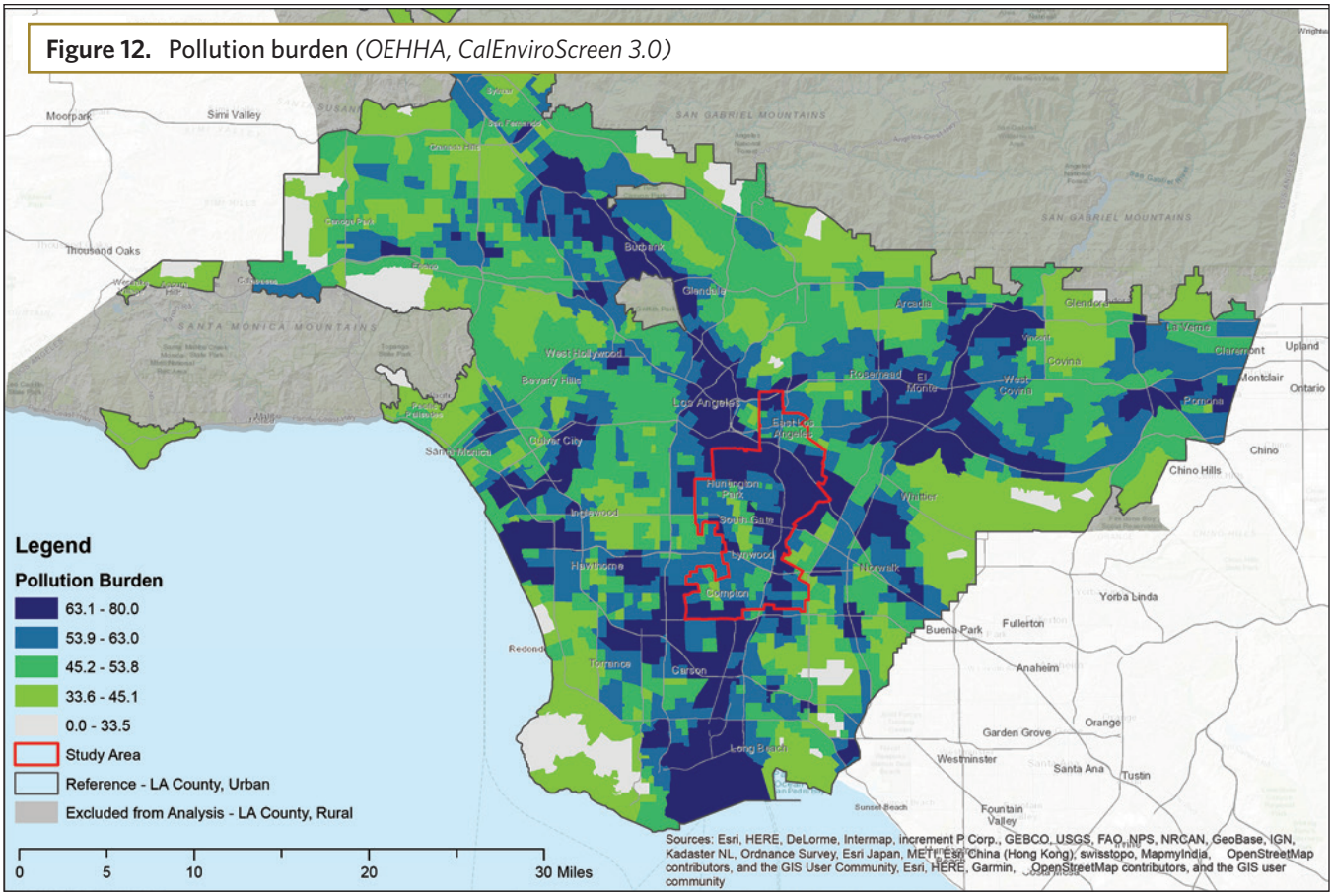


Figure 12. Pollution burden *(OEHHA, CalEnviroScreen 3.0)*



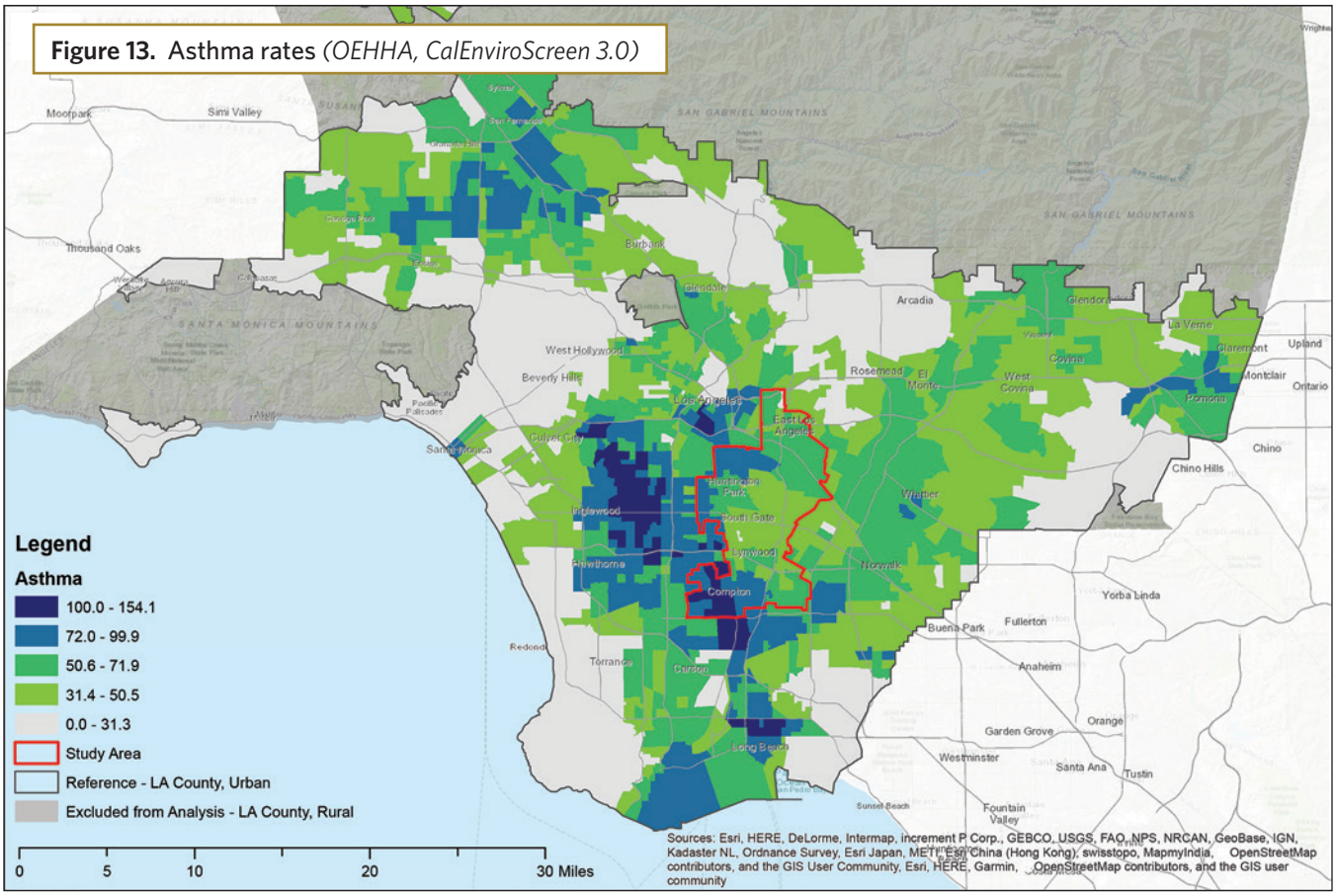


Figure 13. Asthma rates *(OEHHA, CalEnviroScreen 3.0)*

by different census tracts within the study area. We see significant spatial variation in exposure. Based on the specific location of point source polluters, along with external factors like prevailing winds, the less polluted census tracts experience a burden that is half that of the more polluted tracts.

Variations in pollution burden by specific geography are even sharper when we examine differences in asthma rates. Figure 13 clearly shows that the City of Compton is an island of high asthma rates compared to the metro area and the overall study area. This may reflect the duration of exposure to smog and smog precursors over a long period of time.

PART II: A PORTRAIT OF TRANSPORTATION IN THE SOUTHEAST

1. Highway Traffic Volume

It is widely known that Los Angeles County contains a number of extremely busy highways, some of which are the most congested in the nation, particularly during peak hours. Highway traffic not only greatly affects local transport networks, but also generates air pollutants that pose a health threat to nearby residents. The study area is located close to the heart of the region and has access to major highways. A major freight corridor, I-710, traverses the area. It connects the port complex and the East LA industrial zone. Significant portions of two other major highways, I-5 and I-105, also cross the Southeast. The I-10, SR-60 and SR-91 run across the periphery.

Figure 14 shows the total state highway traffic volume in each census tract during the p.m. peak hours for the urbanized portion of Los Angeles County.[7] Peak traffic volume is a rough proxy for congestion. The figure indicates that traffic volumes are comparable inside and outside the Southeast. The major freeways throughout the county have high traffic levels. Within the SELA area, high volumes are observed primarily around the northern portion of I-5, SR-91 and the southern portion of I-710.

7 The data are from the Southern California Association of Governments Regional Transportation Plan model results.

Figure 14. General traffic volumes on highways in the study area and entire region *(source: Southern California Association of Governments)*

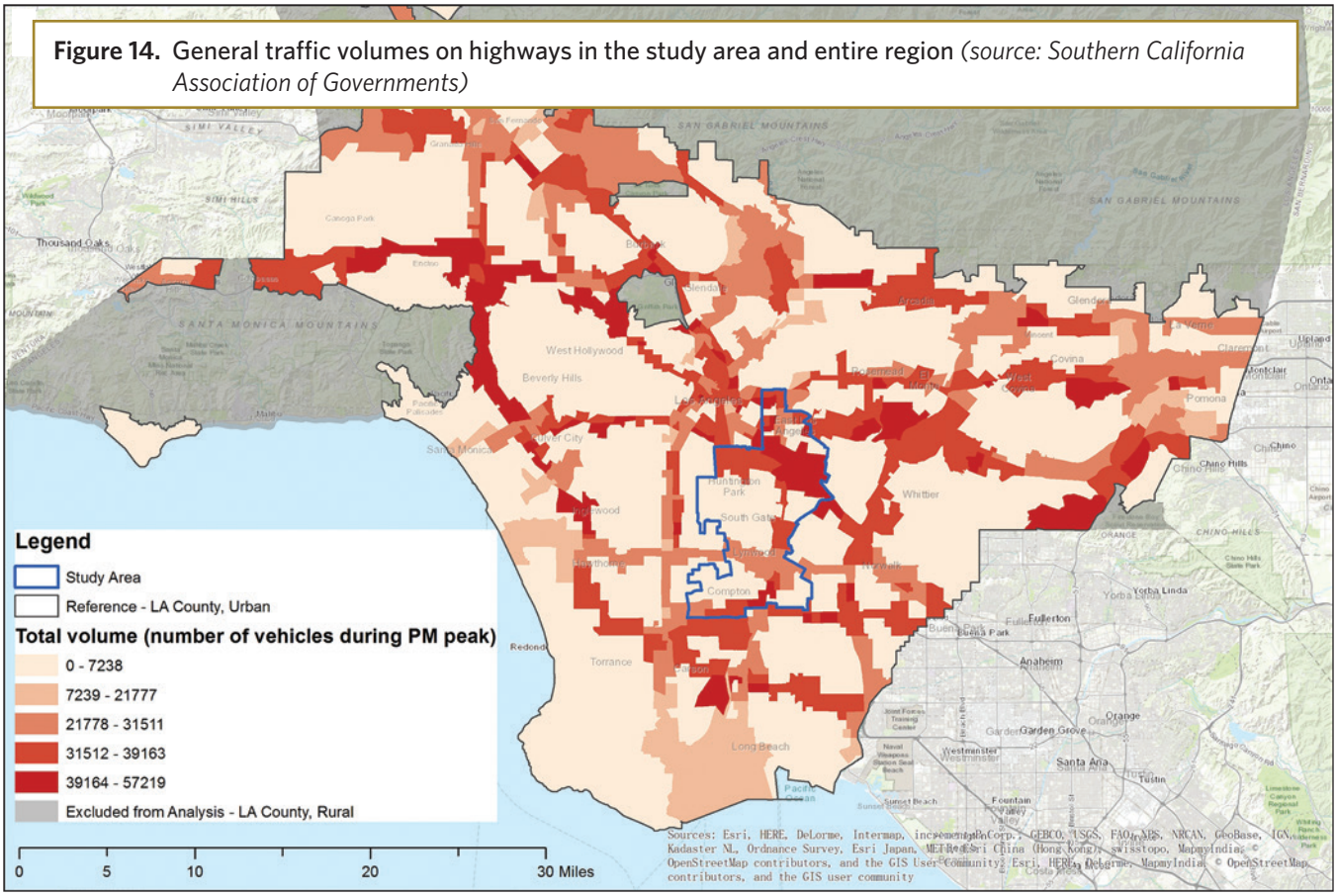


Figure 15. Truck share on highways in the study area and entire region *(source: Southern California Association of Governments)*

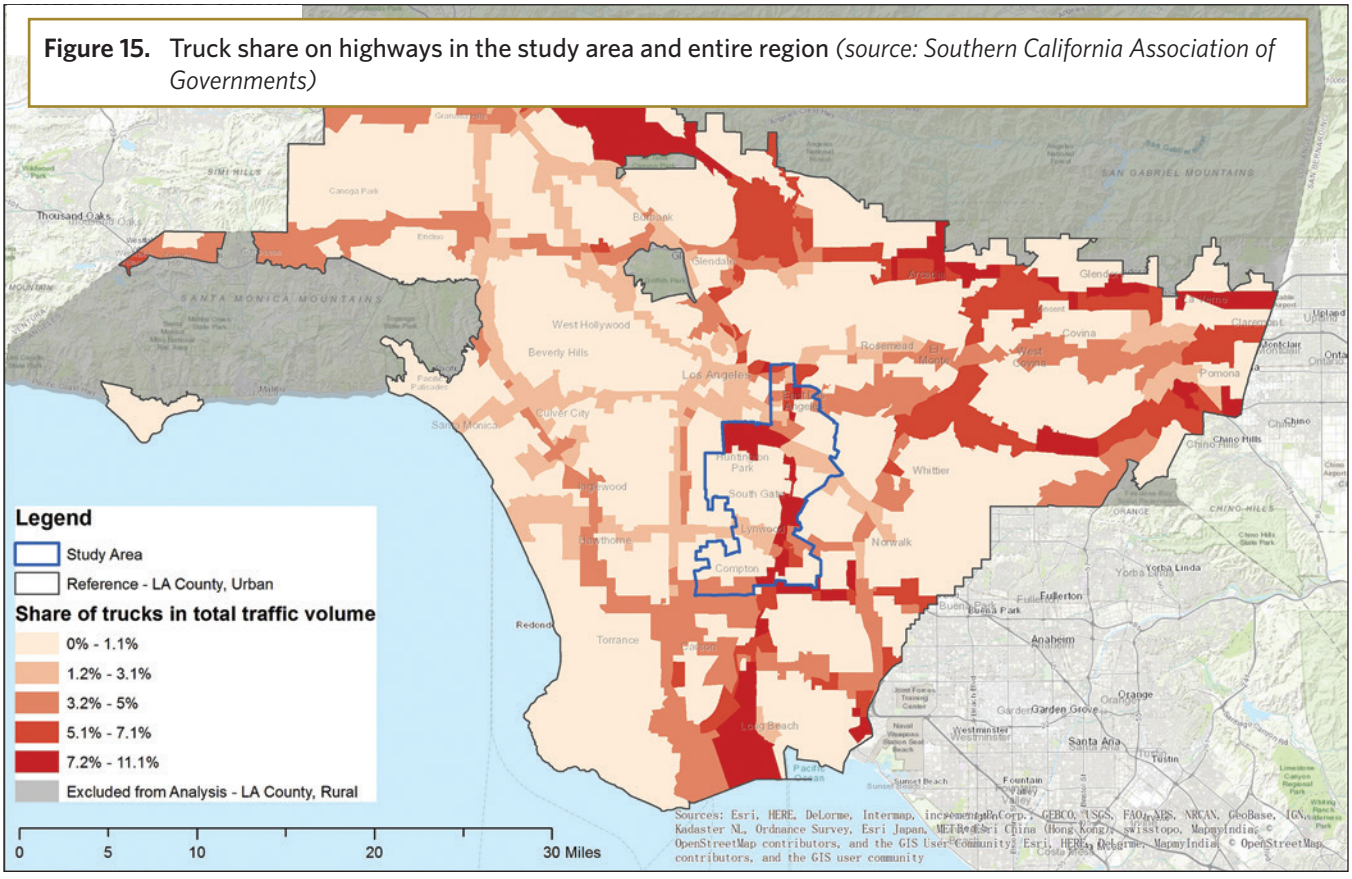
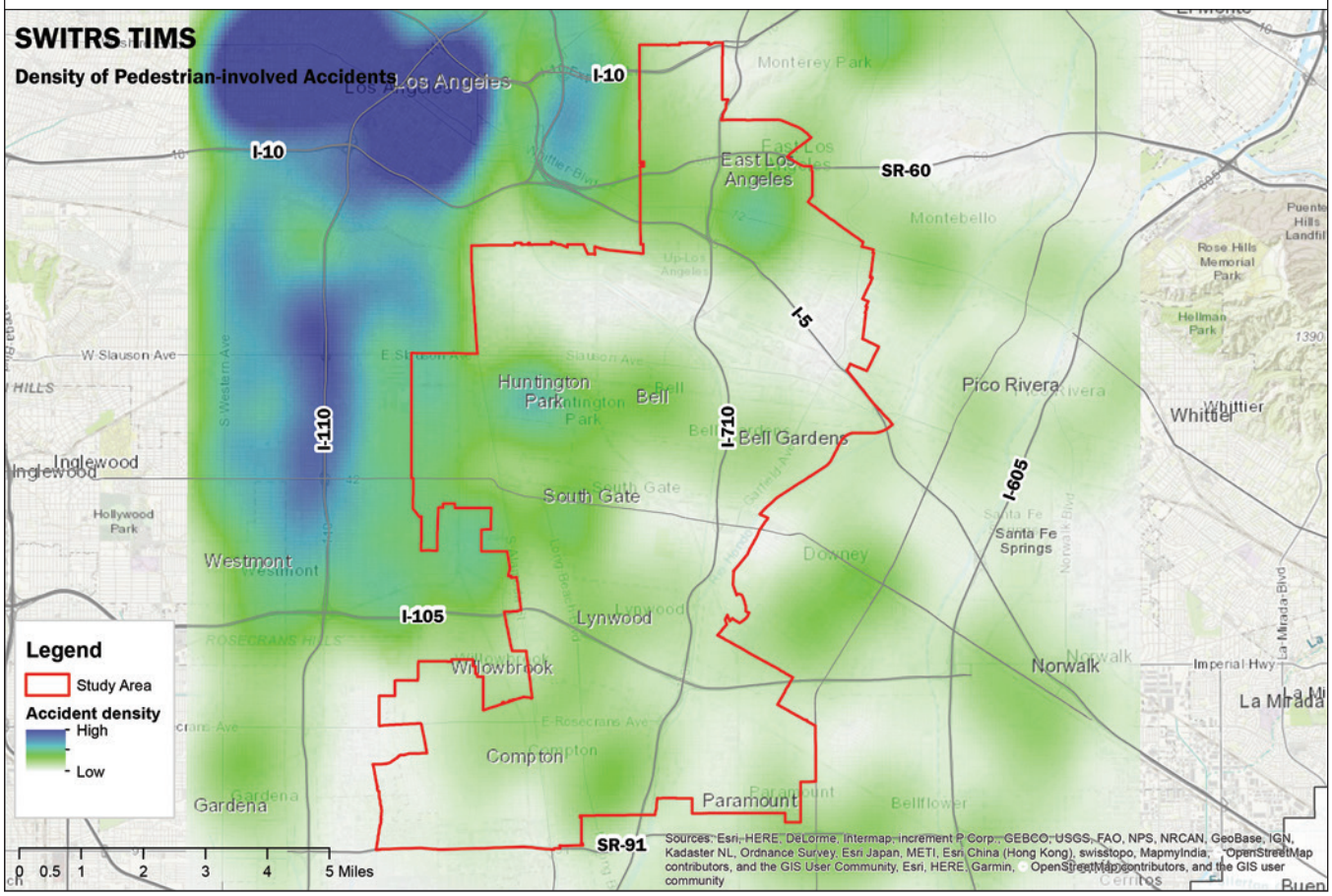


Figure 16. Density of pedestrian-related traffic accidents in the study area and surrounding region
(source: SWITRS TIMS; method: point density)



We noted earlier that the study area has more manufacturing and warehousing activity, industry sectors that have high truck-trip generation rates. Figure 15 shows the truck share of total volume in each census tract during the afternoon peak hours. As expected, the I-710 appears to be one of the busiest trucking routes in the region. The truck share is also high on the I-5 near Commerce, as well as the I-5 north of Los Angeles, the I-10 and SR 60. These are the major trade corridors into and out of the Los Angeles region. Communities near these freight corridors are more likely to suffer from severe air pollution, and residents are at a higher risk of developing respiratory diseases than other county residents (Figure 13).

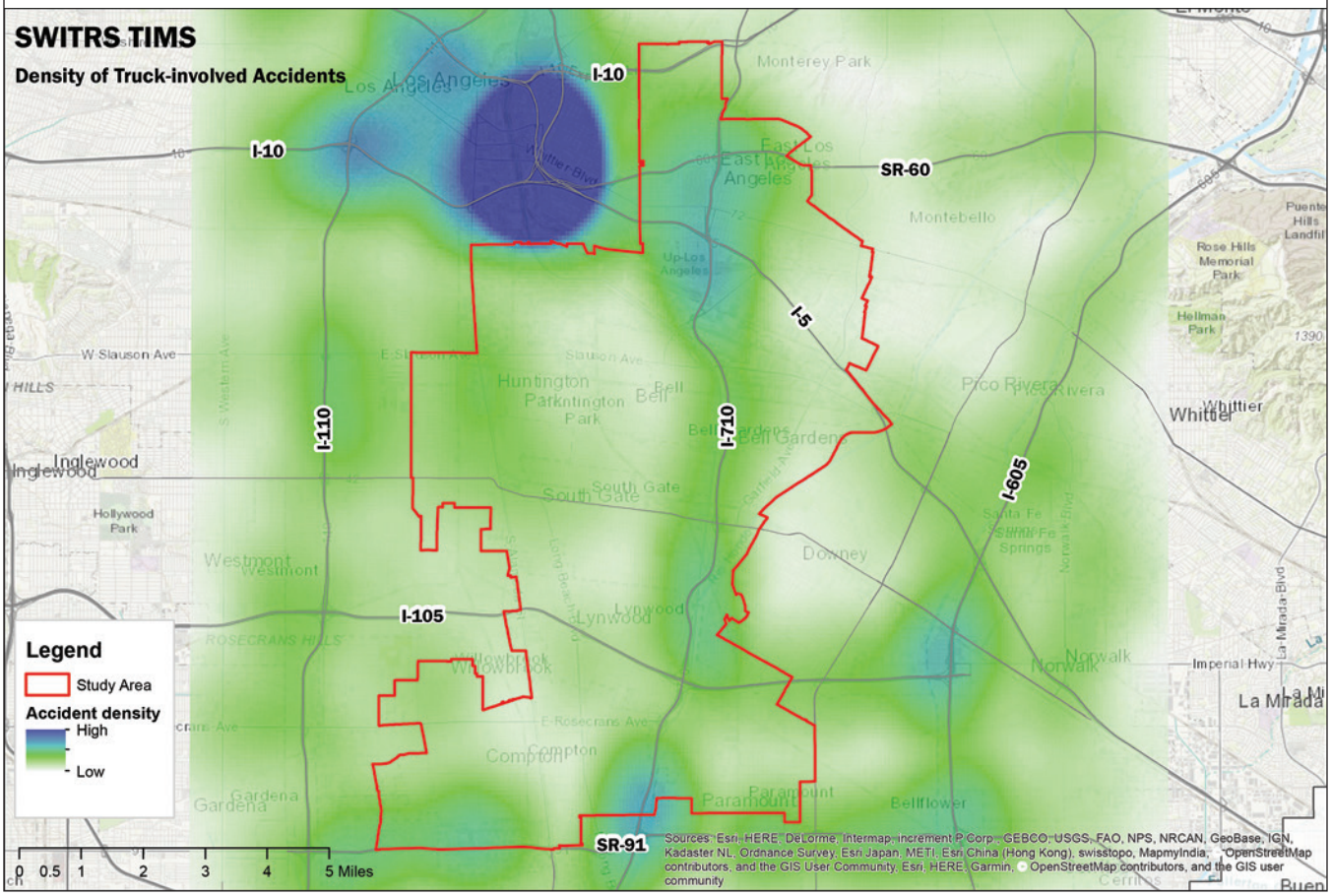
2. Traffic Safety

In the Southeast, where general traffic and freight traffic are both significant, traffic safety concerns are worth a careful examination. We use the Transportation Injury Mapping System (TIMS) database to track the locations of traffic accidents. Accident records are collected and maintained by the California Statewide Integrated Traffic Records System (SWITRS). SafeTREC, a University of California, Berkeley, research center for transportation safety, with funding from the California Office of Traffic Safety (OTS), greatly enhanced the accuracy of geocoding of accident records in SWITRS. TIMS is the result.

Figure 16 shows the density of pedestrian-related traffic accidents. Blue is the highest density, and no added color is the lowest density. Downtown Los Angeles has the highest density, reflecting both high rates of pedestrian activity and concentrated vehicle traffic. Within the study area, there are distinct hot spots in Huntington Park, South Gate, East LA and Florence. Additional analysis on the walking environment in these spots would be helpful for understanding these patterns in more detail.

Given the high truck volumes in the study area, another concern is truck-involved accidents. Although truck-in-

Figure 17. Density of truck-related traffic accidents in the study area and surrounding region *(source: SWITRS TIMS; method: point density)*



volved accidents are far less frequent than passenger car accidents, they tend to be more severe and take longer to clear, adding to highway congestion. Figure 17 shows the density of truck-involved traffic accidents. The highest concentration is around the East LA Interchange where trucks change from one highway to another in heavily congested conditions. Within the study area, hot spots are located at the intersections of I-5/I-710 and SR-91/I-710 as well as along the I-710 corridor. The higher incidence of truck involved crashes on the I-710 is consistent with high truck volumes.

3. Commuting Patterns

How do residents in the study area get to work? How much time do they spend on commuting every day? As Table 10 illustrates, 72% of workers drive alone to work and another 10% carpool to work; thus the vast majority (82%) of resident workers use private vehicles for commuting. Public transit has a 7.5% share, the same as "other," which is mainly working at home.

The total private vehicle share is the same for the study area, but there is more carpooling and less driving alone. This is consistent with lower incomes and lower rates of car ownership. The public transit share is only

Table 10. Commuting modes of residents in the study and the entire county *(source: 2011–2015 American Community Survey)*

Mode	Study Area	LA County
Drive alone	69.0%	72.0%
Carpool	14.2%	10.1%
Public Transit	8.9%	7.5%
Walk	3.2%	3.0%
Bicycle	0.9%	1.0%
Other	4.7%	7.4%

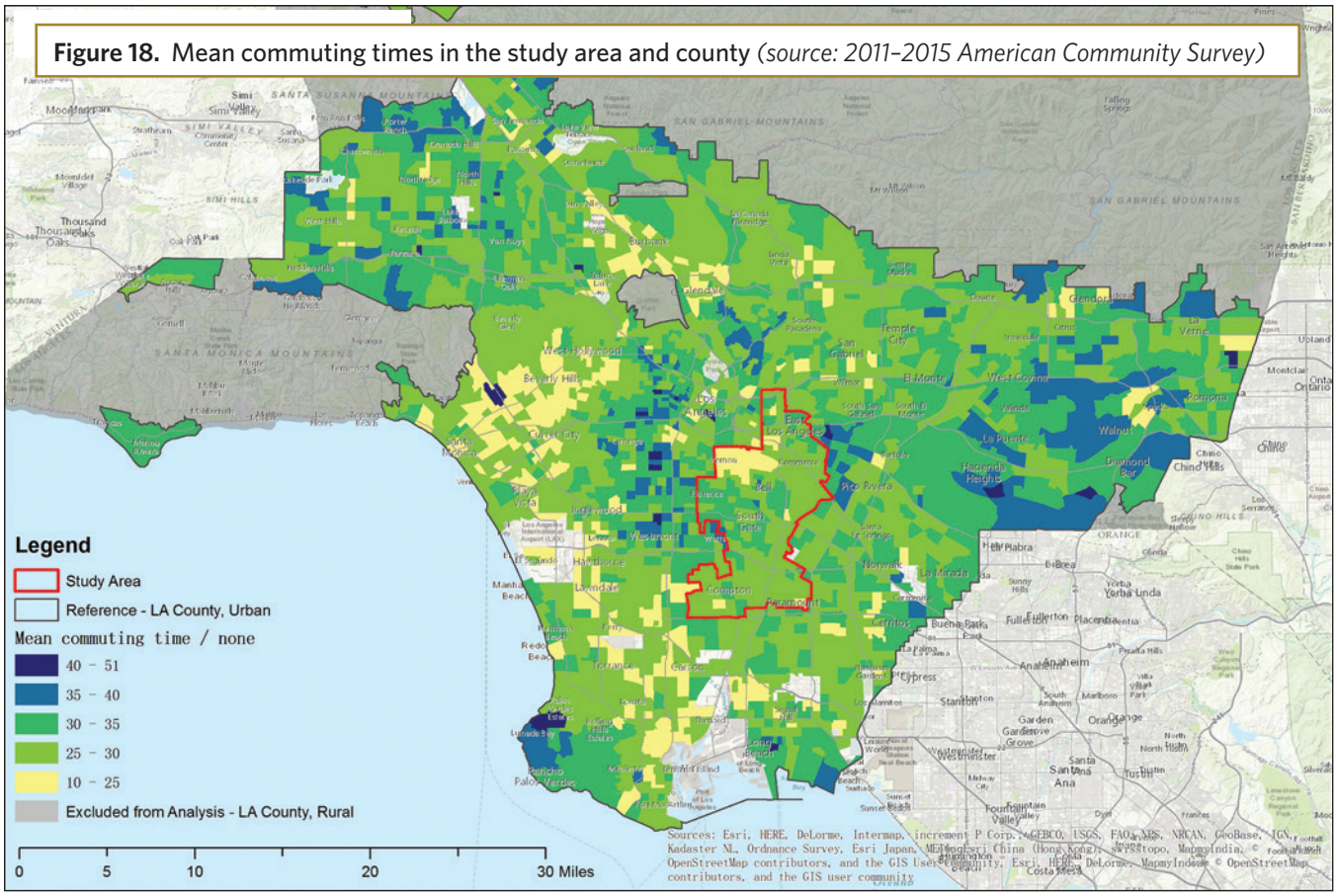


Figure 18. Mean commuting times in the study area and county *(source: 2011–2015 American Community Survey)*

slightly higher than the county average, somewhat surprising given the household income levels of these communities. One possible explanation is given in recent research, which found that car ownership has greatly increased among lower-income households over the past decade (Manville, Taylor and Blumenberg, 2018). Another is that transit services are not well matched with travel patterns. The "other" share is about half of the county average, reflecting the lower share of professional or white-collar jobs in the study area.

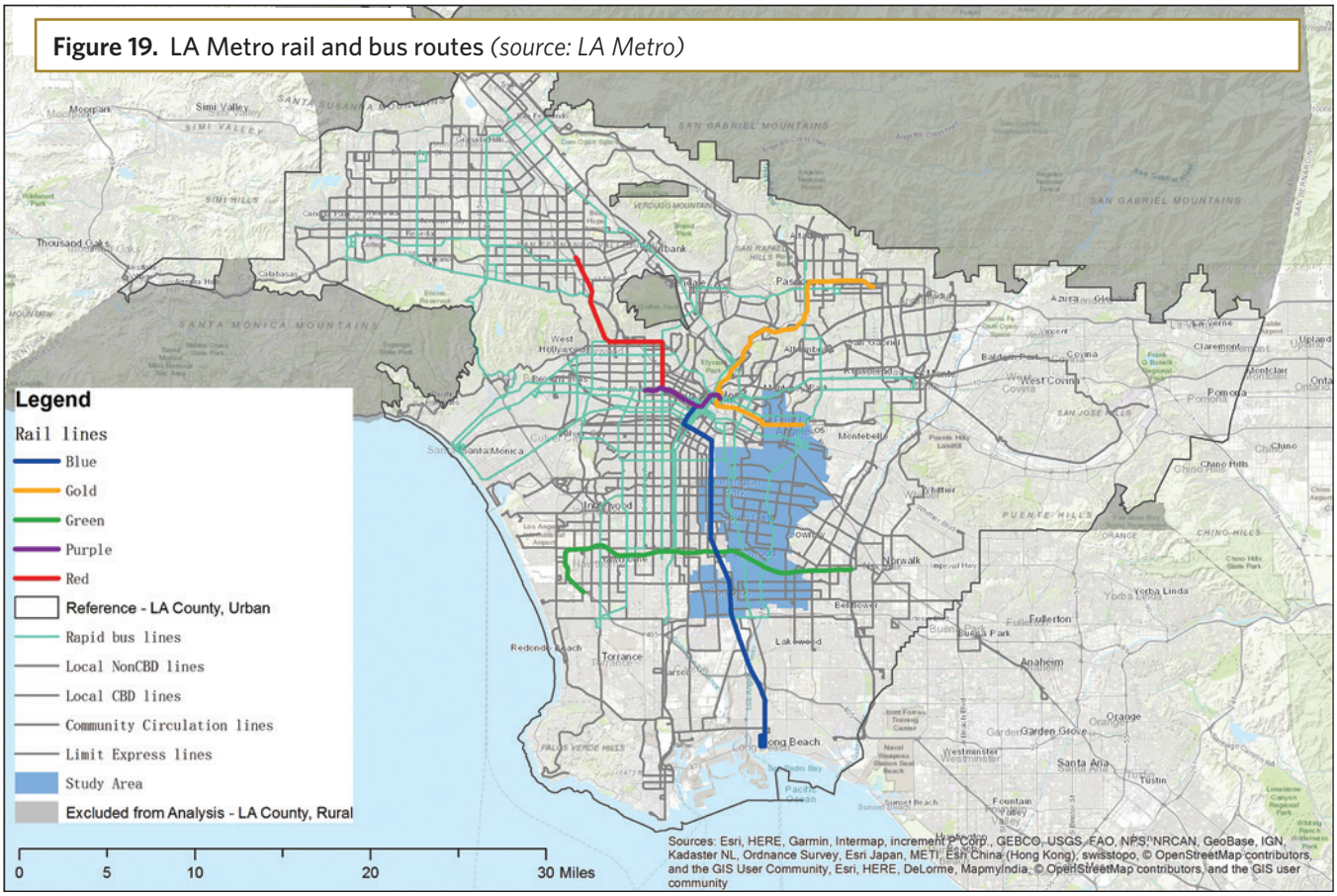
As mentioned above, traffic congestion is widespread throughout the region. As a result, many workers spend a very long time commuting to and from work. Figure 18 shows mean commuting time by census tract. The census tract value is the mean of all commuters in the tract. Thus we do not separately examine very short or very long commutes, nor does our study offer as much variation across tracts as we would with individual data. Nevertheless there are some differences across tracts. Figure 18 shows that long commutes are common in the region, especially for people living on the east side of the county. Relative to the county as a whole, though, the study area has few extremely long commutes. Only a tiny proportion of the neighborhoods in the study area have a mean commuting time of more than 40 minutes. Longer average commute time may be associated with more commuting by public transit. Almost all residents are able to limit their commuting time to 30 minutes. Shorter commute time is associated with high job accessibility; with many jobs nearby, it is easier to find an acceptable job close to home. In fact, about 20% of those who live in the study area also work in it.[8]

4. Public Transit Services

Public transit is critical for those with no or limited access to private vehicles. We measure transit supply in terms of bus lines and stops, and rail lines and stops. Figure 19 shows LA Metro bus and rail service in the county. We do not include local municipal operations, as they account for a very small proportion of total transit service. The rail lines are shown by color, and bus lines are color coded by type of service. The Blue,

8 Source: Local Employment and Household Dynamics data, 2015

Figure 19. LA Metro rail and bus routes *(source: LA Metro)*



Green and Gold Lines pass through the Southeast, but much of the area still lacks convenient access to rail transit. Five rail stations on the Blue Line, four stations on the Gold Line and one station on the Green Line are located within the study area. Almost all these stations are on the periphery, suggesting that most SELA residents do not have good access to the rail system. For the bus lines, the turquoise lines are rapid or express lines; the others are various types of local services. Most of the bus lines provide local service. There are three rapid bus lines that serve the Southeast. Looking simply at network density, the SELA area appears to be in a second tier of service, lower than the downtown core, and comparable to southwest LA and the San Fernando Valley.

Figure 20 shows the density of stops and stations, a rough proxy for service density. The SELA area does not appear to be as well served as southwest Los Angeles, and remains comparable to the San Fernando Valley.

Table 11 gives patronage and productivity measures for the rail stations in the Southeast and in LA County. Rail transit use in the study area is significantly lower than the county average. This translates into lower than average productivity in terms of car load and train load. It is likely that rail transit supply and demand are not spatially matched. The rail system's poor coverage of the Southeast limits the use of rail transit services among the local residents.

Similar findings are observed for bus transit. Table 12 gives monthly average boardings and alightings by time period for weekdays. The number of riders per bus is lower in every case for the SELA area. Given that vehicle ownership and household income are lower in the SELA area than the county average, there appears

Table 11. Weekday patronage statistics of rail services in the study area and county

Patronage	Study Area	LA County
Daily boarding	2,589	4,253
Daily alighting	2,571	4,259
Average car load	26.1	27.1
Average train load	67.0	81.0

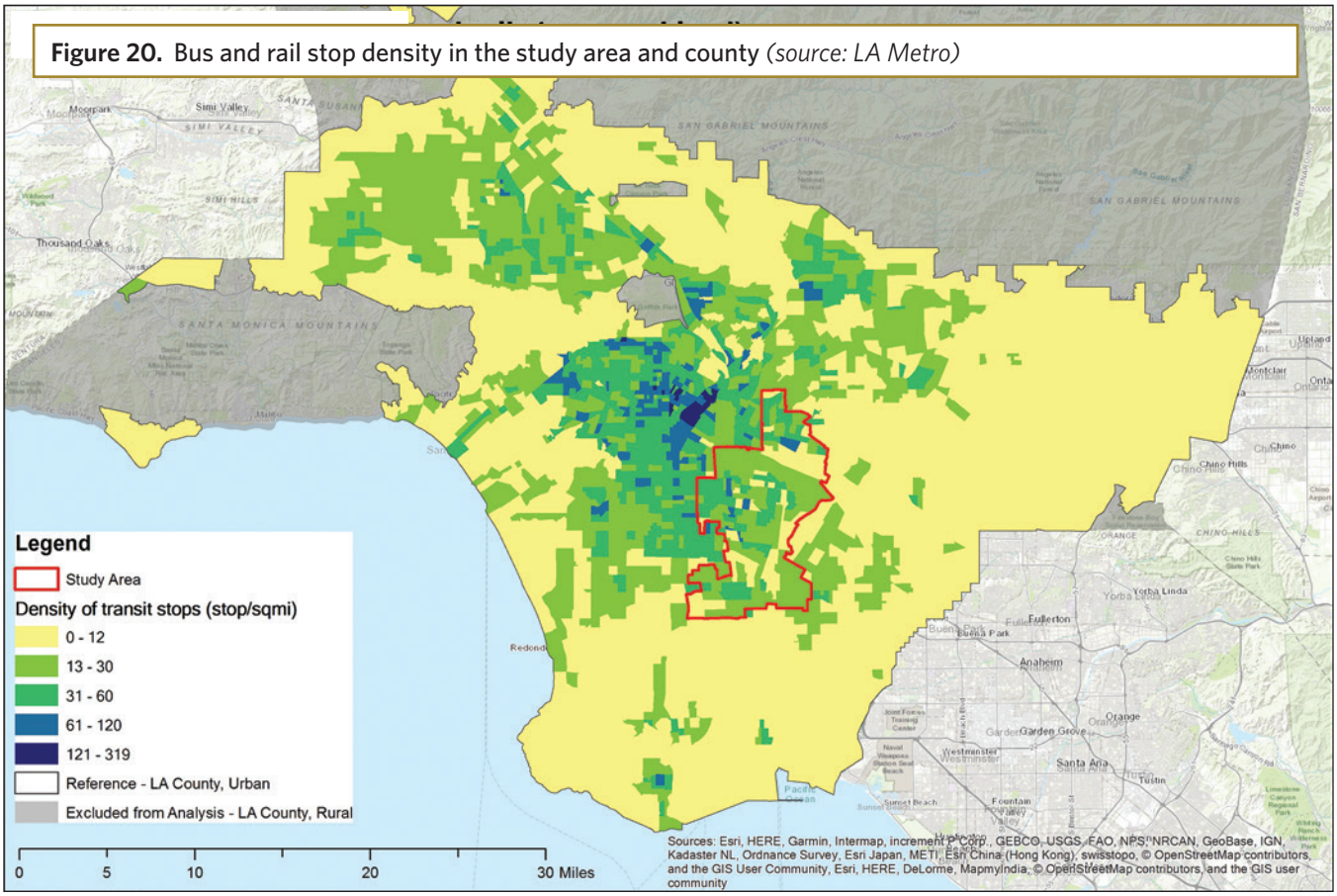


Figure 20. Bus and rail stop density in the study area and county *(source: LA Metro)*

to be a mismatch between potential transit demand and actual patronage.

One aspect of service quality is connectivity: How easy is it to transfer between bus routes, and between bus and rail routes? Rail lines are trunk lines intended to serve high-demand corridors. In order for them to work effectively, they must be well connected to bus routes that in effect serve as last-mile feeder services. We mapped the number of bus stops within 1,000 feet of each rail station, assuming that any stop within the area could be a transfer location. The average number of stops per station for the entire rail system is seven (Figure 21). Stations within the SELA area have a relatively low number of stops. Of the 10 stations, just three have an above-average number of stops.

Table 12. Weekday patronage statistics of bus services (number of riders per bus) in the study area and county

Patronage	Study Area	LA County
AM boarding	9.4	11.0
AM alighting	8.4	10.8
PM boarding	12.6	15.8
PM Alighting	13.4	16.0

Service frequency and reliability are major factors in the choice to use public transit. Service frequency is measured as headway, the time interval between each bus arrival (serving the same route) at a given stop. Thus a route that has buses arriving at a given stop every 15 minutes has a 15-minute headway. The perceived quality of transit service changes abruptly after 10- to 15-minute headways. With headways within 15 minutes, one does not need to schedule arrival at the bus stop. Whenever the customer arrives, the average expected wait will be 5 to 7 minutes, and the longest wait will be 15 minutes. Average weekday headway by line during p.m. peak hours is mapped in Figure 22. Bus service frequency appears to be relatively low compared to the county as a whole. Quite a few bus lines have headways of more than 20 minutes, and several of them have headways of more than 40 minutes. As headways approach 30 minutes, random arrival is no

Figure 21. Number of bus stops within 1,000 feet of a rail station

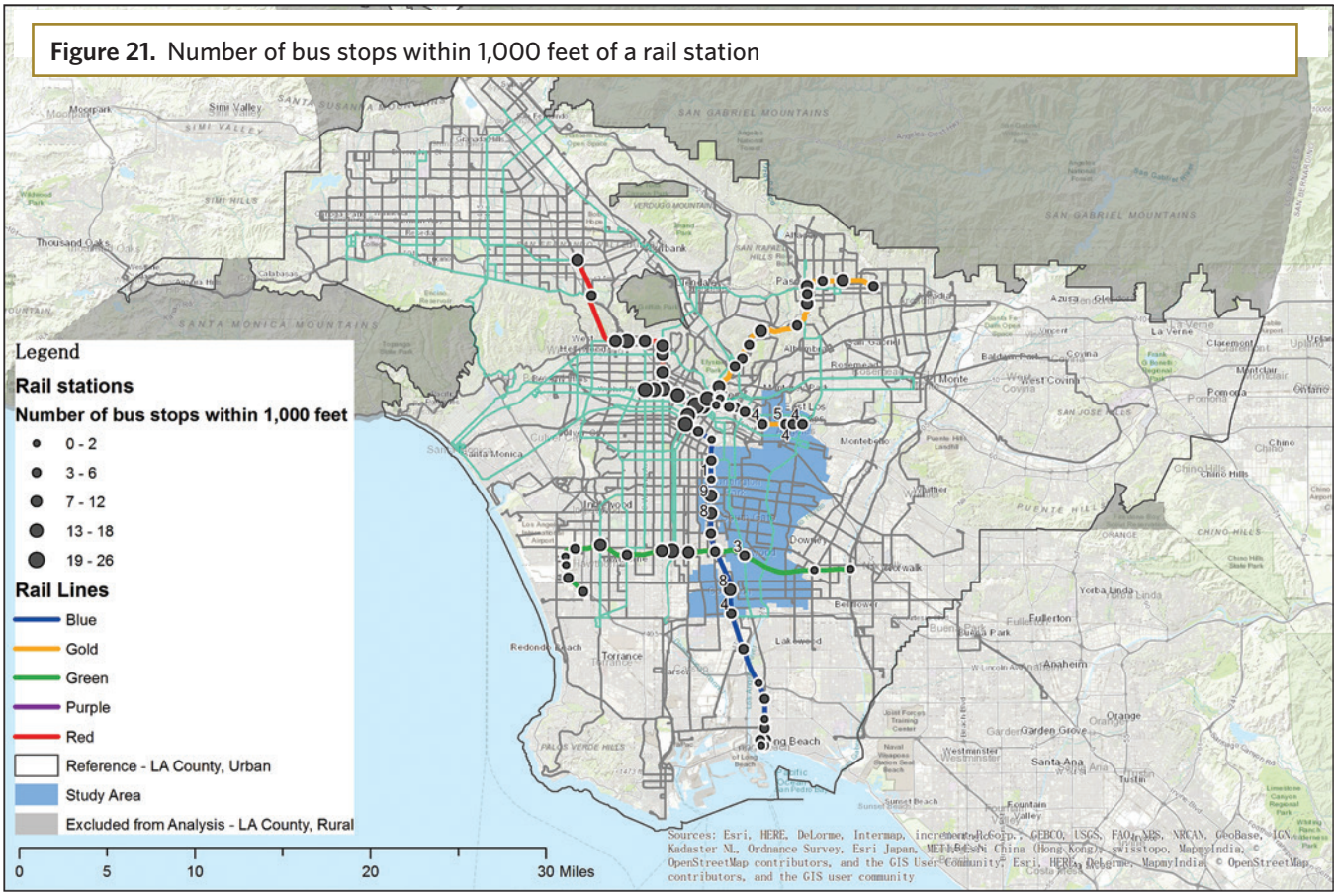
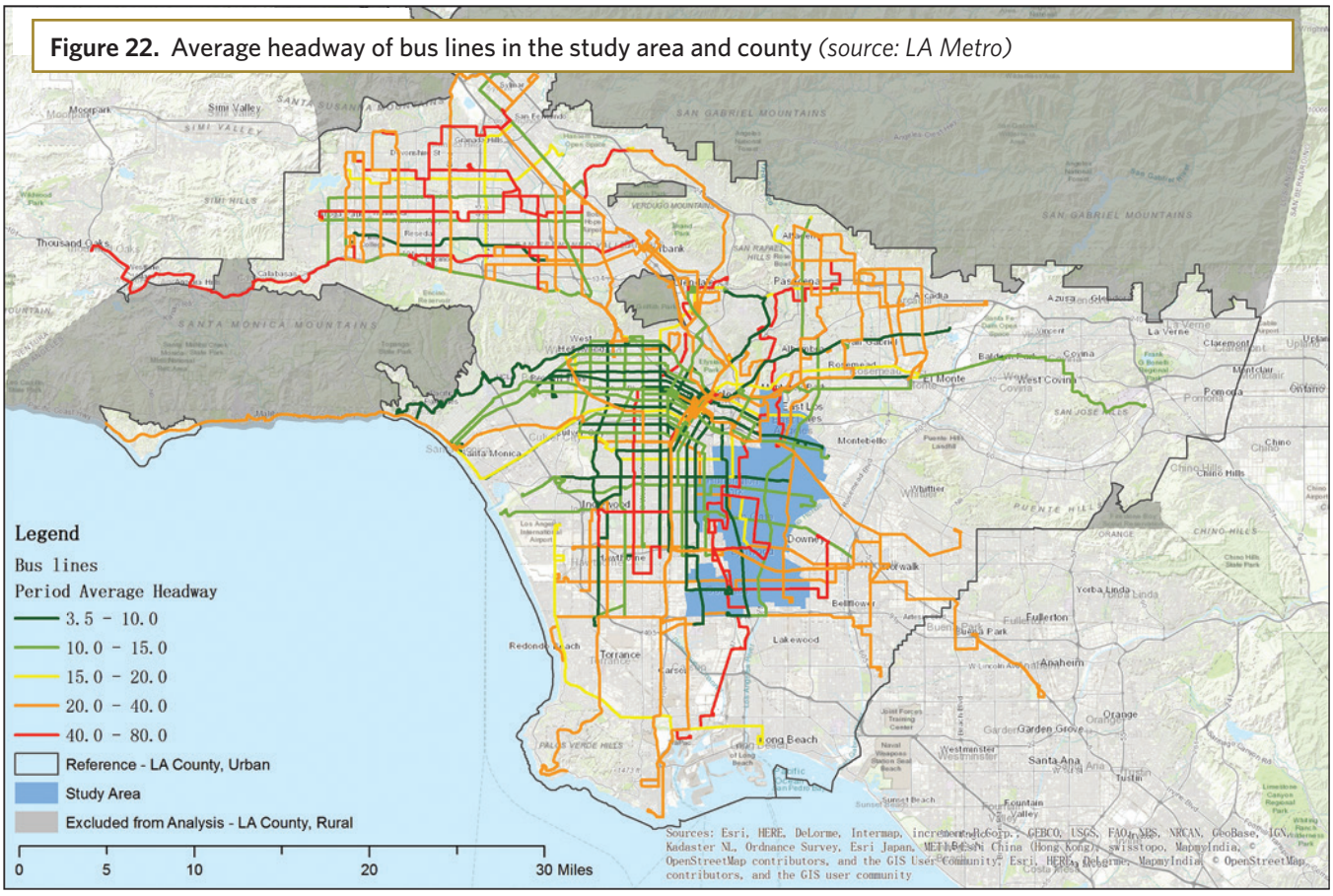


Figure 22. Average headway of bus lines in the study area and county *(source: LA Metro)*



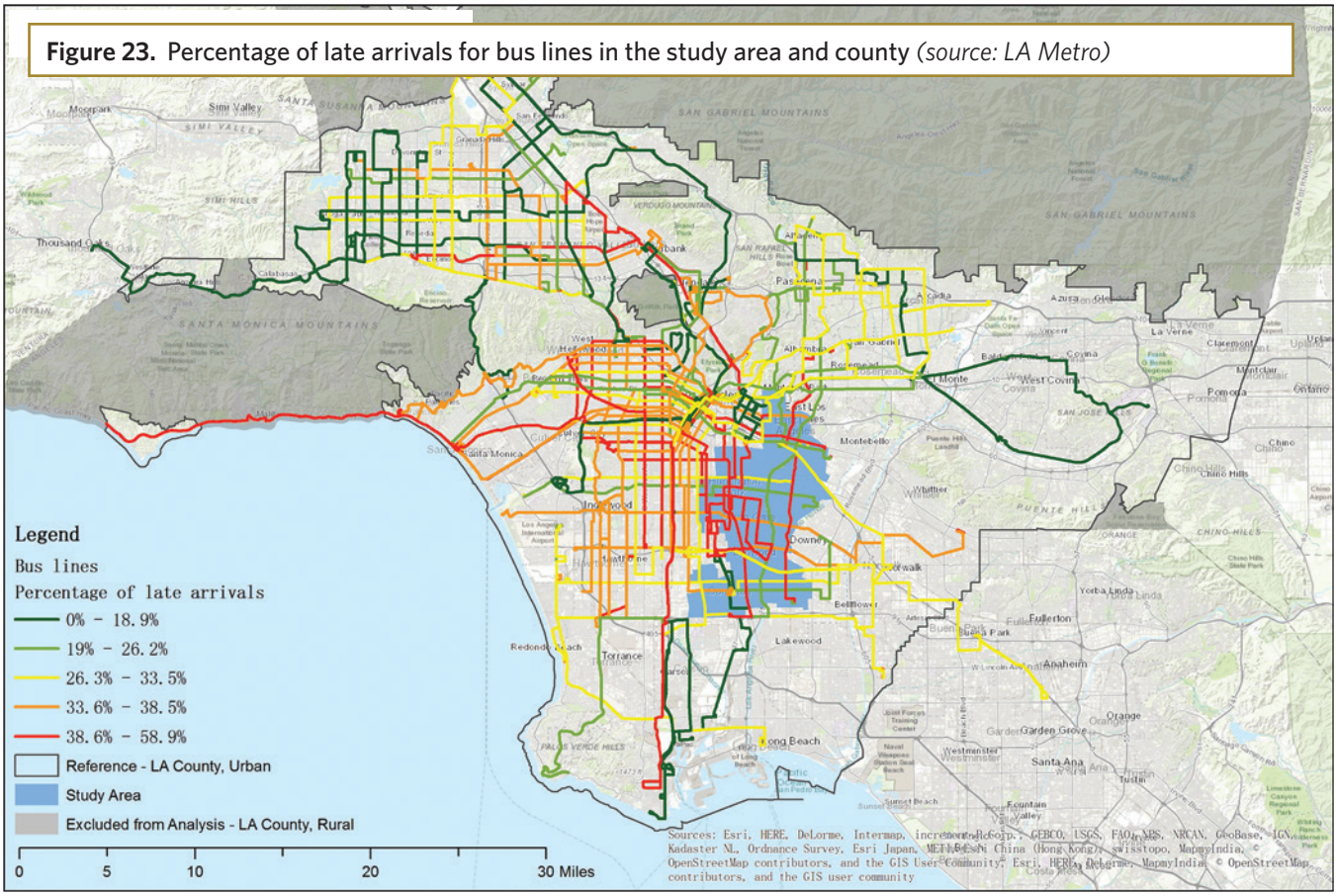


Figure 23. Percentage of late arrivals for bus lines in the study area and county *(source: LA Metro)*

longer a good strategy, as the average wait will be long, and arriving just after a bus has left results in a 30-minute delay. As customers must schedule their arrival at the stop in order to ensure the completion of their timely commute, this delay means that for many potential transit riders, the service level is no longer acceptable.

Reliability is also important. Reliability is measured as on-time performance: the share of all arrivals at stops or stations that are within a given interval of the scheduled arrival time. In the case of LA Metro data, reliability is defined as departing no more than one minute early or five minutes late at all time-points along a route.[9] In general, buses have lower reliability than trains, because trains operate on separate rights of way. Light rail is less reliable than heavy rail, because it must cross traffic at intersections. Nevertheless, according to LA Metro data, rail on-time performance is in the range of 95–99%, with the Blue Line lowest at 95%. In contrast, bus reliability is in the range of 75-80%.

It is a problem for buses to be early or late. If early, customers must wait for the next bus, and if late, customers are delayed by the added wait time. In either case, connections may be missed, or arrival at the destination may be late. Reliability becomes more important as headways increase. For routes with short headways, another bus will arrive in a few minutes. For routes with long headways, the entire journey is delayed. Unreliable service requires passengers to build in extra time to assure an on-time arrival at their destination. This adds to the travel-time disadvantage of transit and discourages transit use. Figure 23 maps reliability as the average percentage of late arrivals by line. On-time performance is quite poor in the study area relative to other parts of the county. The majority of the bus lines serving the area have a high percentage of late arrival: 40% of the buses on lines such as 612, 254 and 760 are late every day. The overall low quality of bus transit services may partly explain why people choose not to use these services even when bus stops are located nearby.

9 https://media.metro.net/images/service_changes_transit_service_policy.pdf

CONCLUSIONS

Manufacturing and trade-related employment continues to play a strong role in the Southeast's overall employment profile. The majority of census tracts were found to have household income below the county average; the spread of household income is relatively even, with most tracts in the range of $40,000 to $60,000 per household.

Average car ownership per capita is significantly lower than the county average. For residents who have reliable access to a vehicle, job accessibility was found to be very high. On the other hand, commuters in the study area must compete for road space with a high volume of commercial vehicles due to strong presence of manufacturing firms.

While the Southeast is still more affordable than many other areas in the county, the study area continues to see high rates of cost increase for both sale and rental properties that have outpaced growth in wage rates. The need to preserve historic structures within the study area may slow the effort to remake the overall urban form. Commercial real estate for warehousing and distribution is another growth area that is shifting the nature of the study area.

The air quality of the Southeast was found to be elevated compared to the county as a whole. Of specific concern is the higher level of particulates (including diesel) that corresponds to the study area's industrial character. These elevated rates were also correlated with higher rates of asthma.

The Southeast is subjected to a high volume of truck traffic that can produce negative impacts on the population. The elevated percentage of truck traffic results in significant potential safety impacts. The extent of the problem is uncertain given the lack of comprehensive reporting with the Statewide Integrated Traffic Records System (SWITRS) database. Truck-involved accidents are a particular concern given the higher probability of loss of life or severe injury.

The rate of transit use for the study area was found to be slightly higher than the county average but, given the low average income, not as high as might be expected. This may indicate a lack of adequate transit options. Most commuters were on the road for less than 30 minutes, despite the fact that only 20% of residents worked within the study area. Transit service was found to be unevenly distributed. An area of particular concern is the long bus headway for several key corridors. The percentage of total residents who were adequately served by rail transit is too small.

Recommendations

On the basis of these findings, we offer the following recommendations for improving the safety, sustainability and efficiency of transportation in the Southeast.

Planning for Density

The area's prime location, together with the housing shortage and escalating house and rental prices, will soon impact SELA. Entrepreneurs are already buying and rehabilitating houses to sell to buyers priced out of markets in communities such as Echo Park and the South Bay. This will only increase in the years ahead, and more neighborhoods will become vulnerable to gentrification. There will be increasing pressure to rezone for higher-density housing. It will be important for the SELA cities and communities to proactively address these trends. Specifically, we recommend:

- Revisit municipal and county general plans and determine whether the plans are sufficient for managing expected growth.
- Consider an analysis to identify areas particularly vulnerable to gentrification.
- Identify neighborhoods that merit protection from the elimination of housing stock, through historic designation, specific plans and other mechanisms.
- Identify areas with the best potential for increasing development density via multifamily housing, mixed use or commercial, taking into account transit and non-motorized travel access.
- Consider zoning and building provisions supportive of higher density around major transit nodes.

Improving Public Transportation

Given the density and demographics of the Southeast, the current rate of public transportation usage is low. Our analysis revealed that the overall supply of transit is modest, that ridership is lower than average on most lines, and that bus transit service reliability is poor. We

suspect that public transit as currently configured does not sufficiently match travel demand, and poor reliability is an additional deterrent.

Conduct an in-depth analysis

As a first step, we recommend that SELA work with LA Metro to conduct an in-depth analysis of transit supply and demand. What is the quality of connectivity between bus and rail, and among intersecting bus routes? How many passengers are making more than one transfer on a trip? Are there particular routes that have low ridership? Are some routes overcrowded? Similarly the reasons for chronic reliability problems should be explored. Has traffic congestion increased in certain locations? Are there problems with waiting for transfers from other lines? Is there a driver absentee problem?

LA Metro has already begun an analysis process. It is finishing up a first mile/last mile study of the Blue Line that looks at station access improvements. It has launched the NextGen project in bus operations, which is aimed at achieving a twenty-first century bus system. We believe these efforts should be bolstered and expanded.

On the demand side, we suggest a SELA travel survey. The last regional travel survey was conducted as part of the 2010-2012 California Household Transportation survey, and regional surveys do not have enough observations for small-area analysis. A travel survey would be valuable for understanding travel demand across all modes, as well as for helping to inform transit service improvements. Travel surveys are costly, but new methods of data collection are bringing costs down.

Realign and improve public transit services

Once the problems have been identified, the next step is to realign services to better match existing travel patterns. Strategies for improving service quality and reliability are numerous and well known. Examples include: boardings at both doors, no-touch fare cards, exclusive bus lanes, traffic signal pre-emption and a next-bus time information system.

There may need to be shifts in route or stop location, or changes in where routes intersect for transfers. These types of changes must be done cautiously, however, given that a significant percentage of the population is transit-dependent and would have existing trips disrupted by significant service changes.

Consider emerging technology and volunteer for demonstrations

Today's new private vehicles have lane departure warnings, adaptive cruise control and collision avoidance systems. These features could vastly improve bus transit service by improving schedule adherence (on-time performance), maintaining headways (by vehicle-to-vehicle communications), allowing for narrower bus lanes and reducing collisions. New forms of transit that are hybrids of traditional fixed route and ridesharing may help to solve station access problems and provide a more cost-effective means of serving trips in lower-demand areas.

LA Metro is beginning to experiment with new forms of transit. It will soon award contracts for planning different types of "micro-transit" services. We suggest that SELA communities volunteer as a demonstration site for the micro-transit demonstrations. This will give SELA the opportunity to directly participate in new service designs and hopefully gain better transit service.

Identify the best locations for transit-oriented development

While the realignment of transit lines and improved feeder services are appropriate for the short term, long term improvements in transit mode share will likely require addressing urban form. As noted earlier, we envision continued pressure for development and redevelopment in the SELA area. Specifically, we recommend the creation of special zones/districts where transport and other resources would be most appropriate for higher-density development. These target areas will be along the major rail and bus corridors. Collaboration among various Southeast cities should be encouraged. In addition, it will be important to implement supportive policies to reduce parking demand and improve pedestrian and bike access.

Reduce the impacts of heavy trucks

The SELA community continues to work diligently to reduce the air quality impacts of both rail and truck traffic. In addition to the very visible I-710 expansion project, there are local strategies worth consideration. We suggest a review of local truck routes to examine whether residential areas and sensitive facilities (schools

and hospitals) are as protected as possible from truck traffic. Access routes to warehouse or manufacturing clusters may need to be designed to avoid specific neighborhoods or facilities.

The SCAQMD has commissioned the manufacture of 43 zero- and near-zero-emission heavy-duty trucks. It is anticipated that the demonstration test of these vehicles will begin in late 2018. The SELA community may wish to participate in this demonstration, as such participation could help inform where and how current versions of zero-emission trucks may be deployed.

Improve pedestrian safety

Safety and perception of safety is a critical factor in an individual's choice of where and how to travel. Studies of public transit have shown that people who feel unsafe at stops or on vehicles are less inclined to use public transit. Children are less likely to walk to school if parents feel that they are at risk from traffic or violence from other people. Our research showed that there are distinct hot spots of pedestrian-vehicle accidents. We did not examine crime rates, presence of gangs or other risk factors.

First, we recommend a follow-on study to identify the problems associated with hot spot locations. The study would reveal accident location, type of accident, who is at fault, number and severity of injuries, whether any party was cited, etc. Such a study would make possible the development and implementation of customized solutions.

Second, we recommend combining our accident data with crime data to generate measures of overall pedestrian threat in the SELA area. It may be as important to put more "eyes on the street" to fix the problem of street crossing. If the travel survey is conducted, it will be possible to include questions of perceptions and map perceptions to the actual data. This will give a more nuanced picture of the challenges to increasing pedestrian and other non-motorized travel.

A final note on technology

More generally, as the Southeast prepares for the future, residents should also be cognizant of emerging technology trends that could challenge assumptions of future demand. While fully autonomous vehicles are not projected to be major factors for many years, communication between and among vehicles can provide the potential for enhanced safety and improved traffic flow. We recommend that SELA cities begin now to coordinate traffic communications and identify high-traffic corridors for vehicle-infrastructure integration pilot programs. Ideally, these technologies could improve public transit, reduce truck impacts and help to address the safety hot spots that currently affect the area.

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