

CONNECT SOCIAL

The 2024–2050 Regional Transportation Plan/Sustainable Communities Strategy
of the Southern California Association of Governments

Goods Movement

TECHNICAL REPORT

DRAFT | NOVEMBER 2, 2023



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INTRODUCTION	1
WHY GOODS MOVEMENT IS ESSENTIAL	2
GUIDING POLICY AND PLANNING FRAMEWORK	39
NEW TRENDS AND TECHNOLOGIES	59
GOODS MOVEMENT CHALLENGES	82
VISION, POLICIES, AND IMPLEMENTATION STRATEGIES	125
IMPLEMENTATION STRATEGIES AND INITIATIVES	130
ENDNOTES	193

1. INTRODUCTION

The Southern California Association of Governments (SCAG) region is home to 19.1 million residents, over 48 percent of the state’s population and generating \$1.2 trillion in regional gross domestic product (GDP) ranking as the 15th largest economy worldwide. The SCAG region represents the largest goods movement area in the U.S. when factoring for its combined seaports, railroads, air cargo, interstates and highways, local roadway access, trucking services, border crossings, and industrial footprint with nearly 2 billion square feet in inventory. Since the adoption of Connect SoCal 2020, there have been substantial drivers of change across goods movement industries, most notably the COVID-19 pandemic, war between Russia and Ukraine, geopolitical tensions with China, inflationary pressures, and increasing state regulations towards clean technologies. The resiliency of freight system infrastructure and facilities have been tested to extreme degrees the last several years to support increasing complexity across supply chains, rapidly changing technologies, and evolving consumer trends.

During this time, SCAG led coordination and collaboration efforts with key regional partners and stakeholders, including state and federal representatives. These efforts culminated with a call-to-action for the development of a Goods Movement Resolution¹, which was approved by the SCAG Regional Council in March 2023. Concurrently, SCAG participated in and supported regional partners on numerous state and federal funding program opportunities, notably the Trade Corridor Enhancement Program (TCEP) and Port and Freight Infrastructure Program (PFIP). Numerous state efforts were critical as part of the development of goods movement policies and SCAG represented the region in working closely with the State through the California Freight Advisory Committee (CFAC) and on the California Freight Mobility Plan (CFMP), California State Rail Plan (CSRP), California Transportation Commission’s (CTC) Senate Bill 671 Clean Freight Corridor Efficiency Assessment, California Public Utilities Commission’s (CPUC) Freight Infrastructure Planning, and California Governor’s Office of Business and Economic Development (GO-Biz) Critical Minerals in California panel, as well as with other efforts. SCAG also worked with the U.S. Department of Transportation (U.S. DOT) on national peer-exchange collaboration to discuss key freight technology programs and studies amid new supply chain challenges.

As part of the 2020 Plan implementation, SCAG developed new program and study efforts, while leveraging and enhancing existing work critical to advancing clean technologies and providing regional expertise with respect to supply chain analyses on goods movement supply and demand characteristics directly impacting system infrastructure and facilities. These included:

- The Last Mile Freight Program (LMFP)
- Zero Emission Truck Infrastructure Study (ZETI)
- Goods Movement Communities Opportunities Assessment
- Curb Space Management Study
- Integrated Passenger and Freight Rail Forecast Study
- Last Mile Freight Delivery Study (LMFS)
- Industrial Warehouse Study

Increasing supply chain complexities continue to challenge public agency and community understandings and decision-making processes, and yet just as goods need to be shipped and delivered, policy changes at the federal, state, and local levels will occur. The Goods Movement Technical Report is meant to:

- Define goods movement including system components;
- Establish policy and planning framework for goods movement;
- Propose implementation strategies and initiatives;
- Set the vision, policies, and implementation strategies;
- Assess new trends and technologies;
- Identify critical challenges;

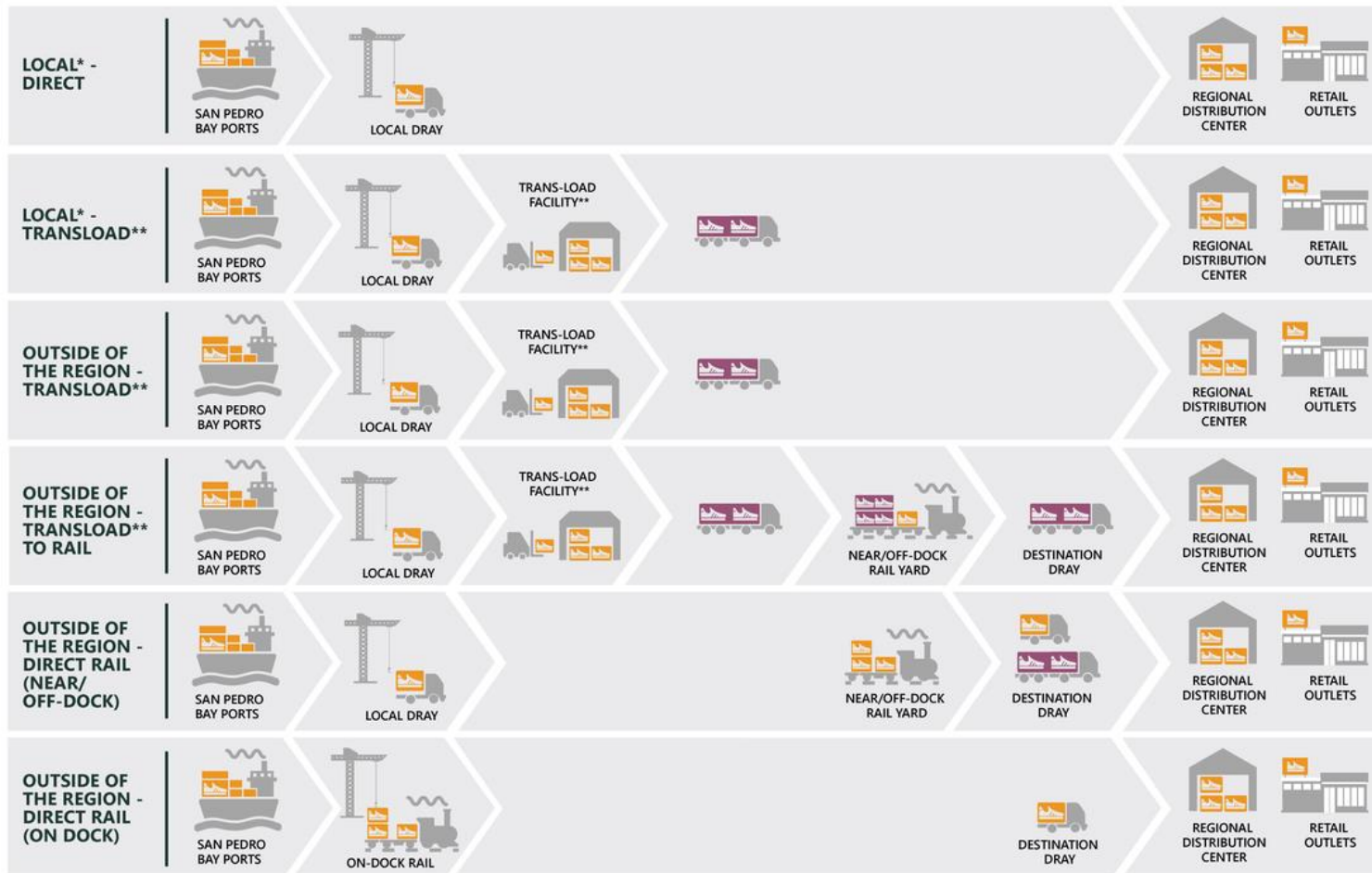
2. WHY GOODS MOVEMENT IS ESSENTIAL

In today's globally integrated economy, goods movement provides access to international gateways, supports local manufacturing activities, serves the needs of local businesses and residents, and supports a thriving logistics industry. In short, the movement of goods is an important driver of the economy and directly contributes to the needs for every business and resident.

KEY TAKEAWAYS:

- The impacts of the COVID-19 pandemic on supply chains have resulted in increased consumer activity and inflationary volatility, significantly affecting freight infrastructure and facilities.
- With a substantial majority of retail and food services sales related to transportation, food, home goods, health, and other essential needs, there is a clear nexus on the importance of goods movement jobs and system infrastructure and facilities supporting the delivery of these needs to businesses and residents, notably during times of extreme duress.
- Proximity to major trade gateways like the Ports of Los Angeles and Long Beach, or San Pedro Bay Ports (SPBPs) generates significant freight activity, however, the Inland Empire continues to see the most robust industrial growth to support supply chain capacity needs. SCAG's industrial footprint includes 2 billion in square feet inventory, and economic growth will continue to result from business and resident activity.
- The SPBPs continue to lead the country in containerized cargo activity supporting both local and national cargo demand. Southern California and U.S. and Canada West Coast seaports are seeing continued impacts from containerized cargo diversion to East and Gulf seaports, consistent with industrial growth outpacing many of the same areas outside the SCAG region.
- The SCAG rail system is operated by the largest Class I railroads in North America with Southern California accounting for a large majority of intermodal rail cargo across these railroads. Intermodal rail facilities have shifted to the Inland Empire with BNSF's announcement of the Barstow International Gateway (BIG) and Union Pacific's Inland Empire Intermodal Terminal (IEIT).
- The SCAG highway and local roadway network serves most intermodal facilities including seaports, airports, railyards, cross-border, and industrial facilities supporting manufacturing, retail and wholesale trade, transportation and warehousing and all other goods movement sectors. With 80 percent of local tonnage and 75 percent of tonnage entering, exiting, and passing through the region being moved by trucks, major freight corridors and local roadways supporting first- and last-mile shipments will remain pivotal.
- The transportation sector accounts for one-third of domestic GHG emissions in the U.S. and affects the health and wellbeing of millions of Americans, particularly those in historically underserved communities. The SCAG region continues to look to balance the need to work closely with communities, while also supporting workforce

Figure 1. Import Container Flow by Mode, Handling Process, and Destination



*Geographical areas included in Local Market are Southern California, Southern Nevada, Arizona, New Mexico, and southern portions of Utah and Colorado for which the San Pedro Bay Ports serve as the closest container ports with the lowest land-side transportation costs.

**Transloading is broadly defined as activities that involve the deconsolidation of the contents of marine containers, which are usually forty-foot equivalent units (FEUs), and reloading of their contents into 53-foot domestic trailers. Transloading allows for the movement of increased amounts of goods while utilizing less equipment, resulting in transportation cost savings through economies of scale. Transloading sometimes provides value-added services as well.

LEGEND

 **MARINE**
(40 feet in length)

 **DOMESTIC**
(53 feet in length)

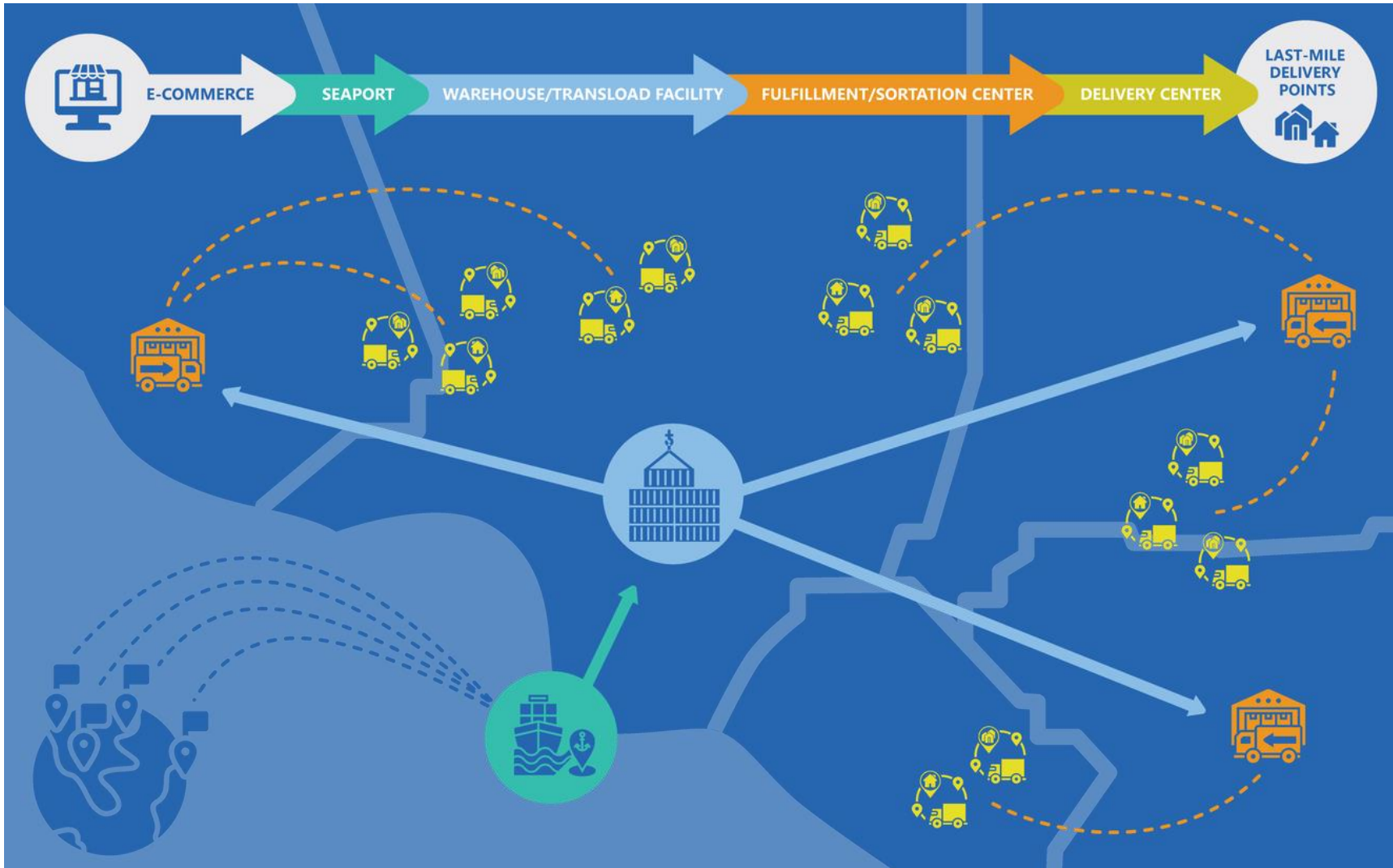
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Source: SCAG 2023

The SCAG region has a strong connection with global trade, as the region is the largest trade gateway in the U.S. There are multiple supply chain linkages with respect to how goods are distributed both locally and outside of the region (Figure 1). These linkages connect seaports via local drayage to warehouses and transload facilities, from transload facilities to railyards and distribution centers, as well as through drayage and on-dock rail moves supporting direct freight flows to destinations, with rail playing a primary role for trips entering and exiting the region.

These goods movement interchanges have a similar inverse relationship to products that come through other seaport, airport, and border crossing trade gateways by adjacent states, East and Gulf coast regions and into the SCAG region to businesses and residents, and as exports through the region's key trade gateways. Consumption by local businesses and residents in the SCAG region supports economies of scale and will continue to grow, thus increasing freight demand irrespective of how it flows globally into and across the U.S. to local destinations, including the SCAG region.

Figure 2. E-commerce Import Supply Chain Flow by Facility, Interchange Process, and Local Destination



Source: SCAG 2023

Looking at the local distribution side (Figure 2), there has been an increasing amount of complexity, especially stemming from e-commerce and omnichannel retail growth. Today, a typical shipment purchased digitally that has been imported will move from the seaports to a warehouse/transload facility (blue designated icon), to a fulfillment/sortation center (orange designated icon), and then to a delivery center (yellow designated icon) where it will be delivered on a route serving businesses and residents. Additionally, consumers can digitally order goods and pick them up at a retail store, or have them delivered from the same retail location, exponentially increasing last-mile delivery points from hundreds to thousands.

Domestic Import Example: New child's toy and batteries ordered off Amazon to Los Angeles example. Toy and batteries are manufactured in Asia and are imported through the SPBPs via containership. Truck takes the containers to a warehouse near the port where they are transferred to a 53-foot Amazon trailer and transported to an Amazon Fulfillment/Sortation Center in Ontario or Chino. From there, the goods are trucked to a Delivery Center Warehouse in Burbank or Los Angeles. A last-mile delivery van transports the toy and batteries on a route to the resident.

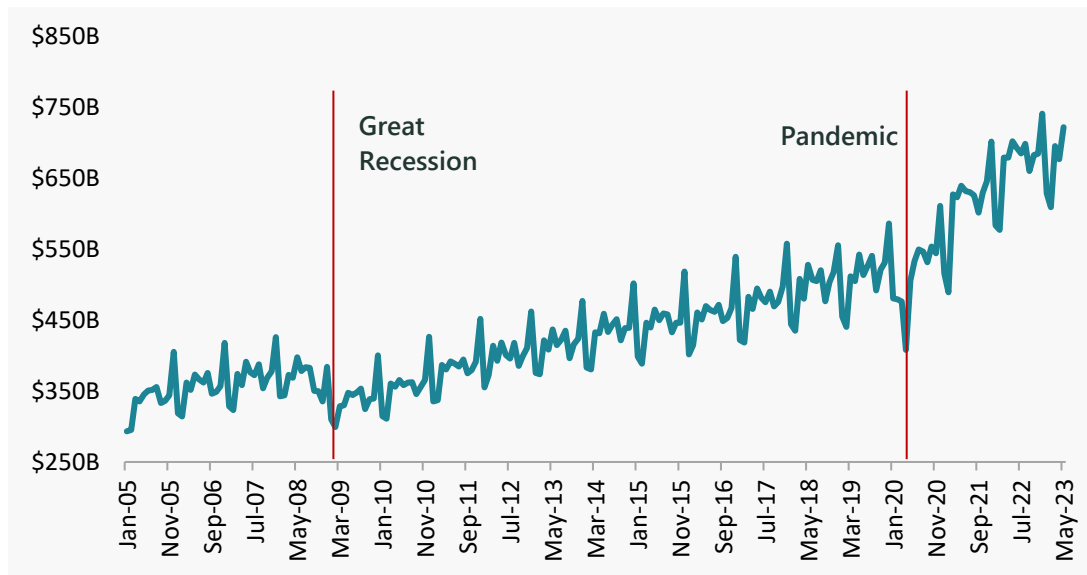
International Export Example: Cotton bales in an international container example. Raw cotton produced at a farm in Texas, trucked to a cotton cross-dock facility, trucked to an intermodal railyard, shipped by rail from Texas directly to the Ports of Los Angeles and Long Beach, or SPBPs exported to Vietnam via containership. Vietnam serves as a value-add interchange (converting raw cotton to yarn and/or fabric) prior to a clothing item being manufactured and exported from China back to the U.S., as a full production-consumption product cycle example.

2.1 IMPORTANCE OF GOODS MOVEMENT TO THE ECONOMY AND CONSUMER

Consumption of products by residents and businesses as consumers in the SCAG region and throughout the U.S. is the core driver of goods movement. From a supply chain perspective, the activity created by both businesses and residents is what is key for goods movement shipments and flows. Equally important are the business-to-business (B2B) relationships. While a company like General Mills will manufacture and distribute cereal that is consumed locally at a grocery store, the retail sales of these goods encompass the wholesale cost of the B2B move.

This section provides a review of national retail and food services sales trends, including how goods movement industries contribute to the economy. By SCAG serving as the largest trade gateway, both local and national trends tend to have strong correlation, in addition to the direct goods flowing from the region to national destinations, as such, both are important to understand as they impact the Southern California region.

Figure 3. Retail and Food Services Sales, Total (monthly in millions)



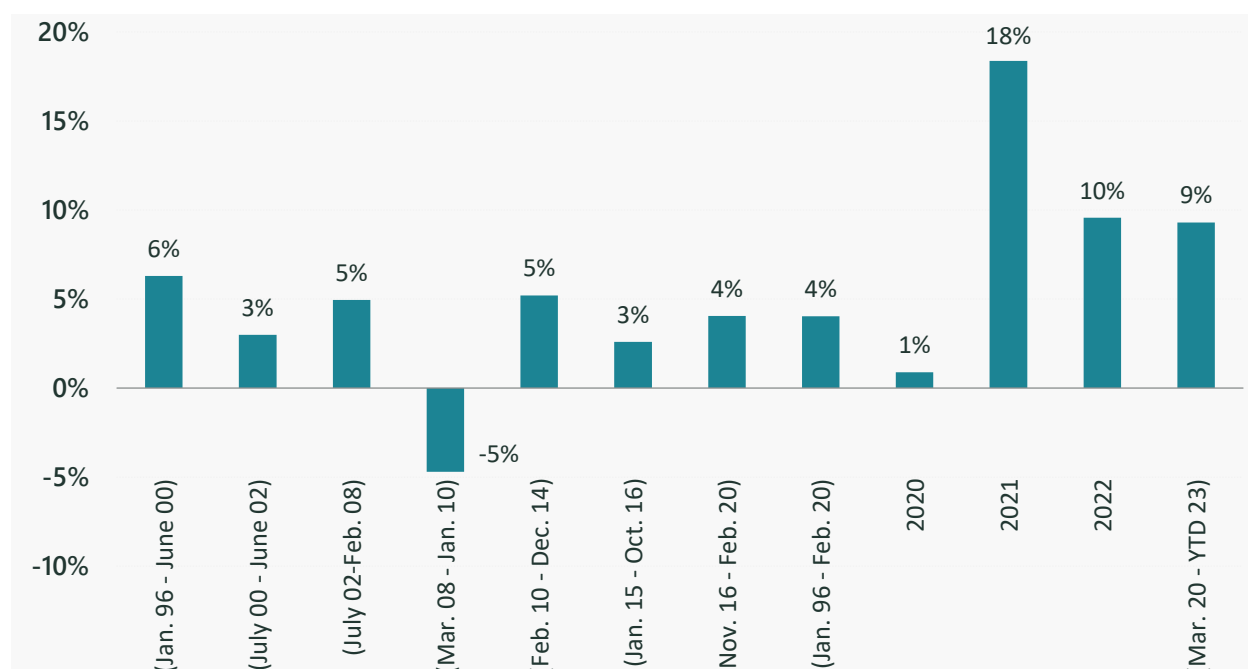
Source: U.S. Census Monthly Retail Trade

Retail and food services sales include nominal rather than seasonal data trends, to capture pricing versus activity relationships. Total retail and food services sales in 2022 reflected \$8.1 trillion across the entire U.S., accounting for approximately 32 percent of total GDP (Figure 3). Leading sales categories account for approximately 79 percent of the overall total, and include:

- Motor vehicle and parts dealers, 19 percent
- Non-store retailers, 15.8 percent
- Food services and drinking places, 12.1 percent
- Food and beverage stores, 11.9 percent
- General merchandise stores, 10.6 percent
- Gasoline stations, 9.2 percent

Most retail sales for motor vehicle and parts dealers were made up of new and used car dealers, with new car dealers reflecting 74 percent of this total (\$1.1 trillion). Approximately 90 percent of non-store retailers' sales were made up of e-commerce companies like Amazon (\$1 trillion). Food and drinking-related retail sales were nearly evenly split across food services and drinking places and food and beverage stores. For the former, nearly 90 percent occurred at restaurants and other eating places (\$873 billion), while for the latter, 90 percent occurred at grocery stores (\$864 billion). For general merchandise stores, 73 percent of retail sales were from warehouse clubs and superstores like Costco, Walmart, and Sam's Club (\$617 billion). Gasoline station sales totaled \$739 billion.

Figure 4. U.S. Retail and Food Services Sales, Total, Average Monthly Growth



Source: U.S. Census Monthly Retail Trade

Since the mid-1990s, the growth in retail and food services sales has been much lower than the COVID-19 pandemic period (March 2020 – To Date). There have been three recessions and various economic cycles during this time, and Figure 4 and Table 1 are meant to illustrate the nature of longer-term performance versus what has been witnessed over the past three years.

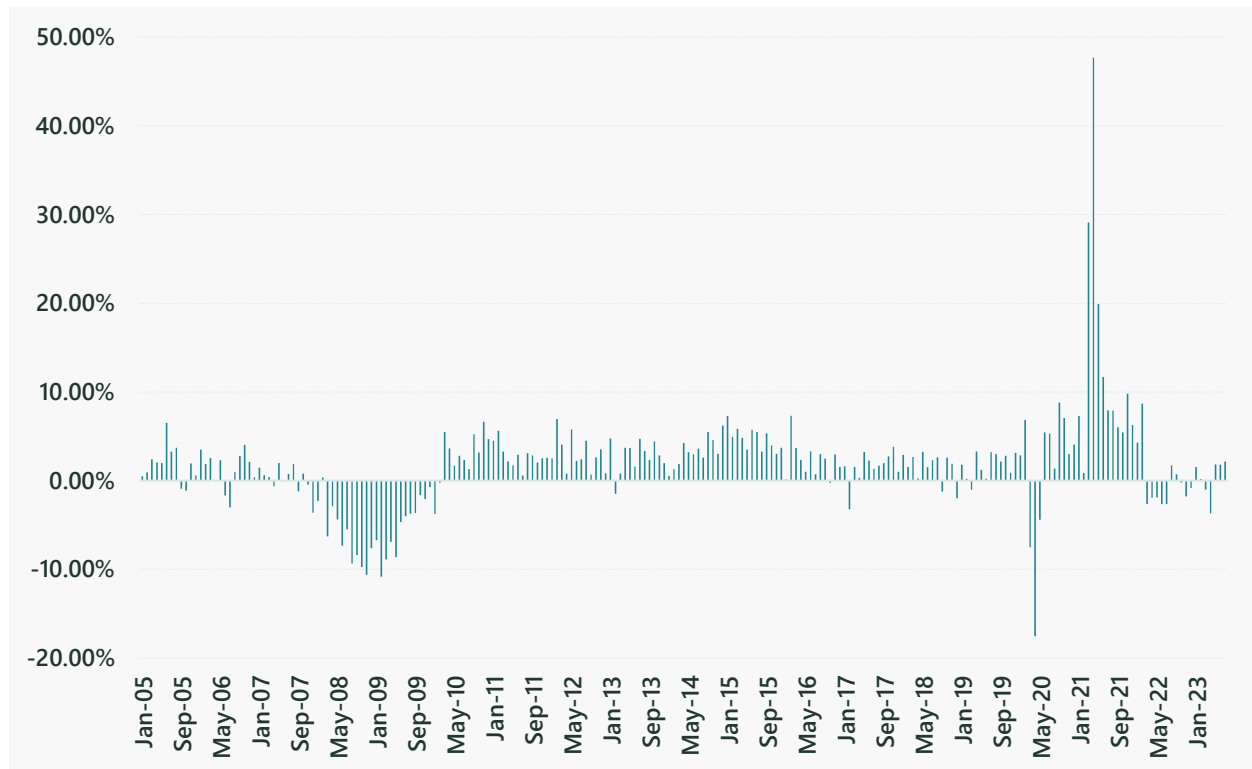
Table 1. U.S. Retail and Food Service Sales, Economic Cycle and Duration

Period	Economic Cycle Description	Duration of Months
January 1996 – June 2000	Pre-Dotcom Bubble	54
July 2000 – June 2002	Dotcom Recession	24
July 2002 – February 2008	Pre-Great Recession	68
March 2008 – January 2010	Great Recession	23
February 2010 – December 2014	Pre-Commodity Recession	59
January 2015 – October 2016	Commodity Recession	22
November 2016 – February 2020	Pre-Pandemic	40
January 1996 – February 2020	Overall Pre-Pandemic	290
2020	N/A	12
2021	N/A	12
2022	N/A	12
March 2020 – To Date	Pandemic Era	40

Source: U.S. Census Monthly Retail Trade

The Overall Pre-Pandemic (January 1996 – February 2020) period average retail and food services sales growth rate was four percent. The duration of this period witnessed two recessions, the Dotcom and Great Recession periods reflecting a 290-month total duration. The Great Recession clearly had the greatest degree of impact on retail and food services sales performance, while other pre-recession periods witnessed average growth rates higher towards five and six percent. Average monthly growth during the pandemic period (March 2020 – To Date) has been just below 9-percent, nearly double some of the prior fastest growth periods over the last 25-plus years. The consumer serves as a very important and resilient aspect of the economy, notably during the Dotcom Recession (July 2000 – June 2002) and earliest part of the pandemic (through all of 2020), both witnessing recessions while retail and food services sales remained positive.

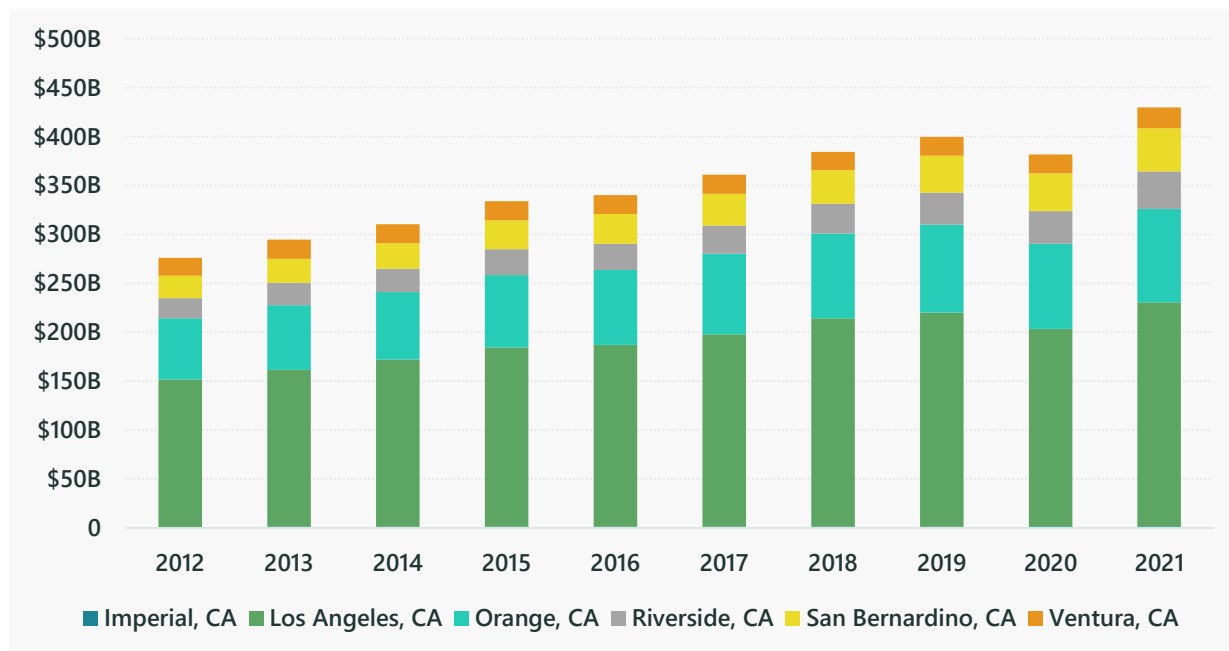
Figure 5. Retail and Food Services Sales Activity Growth Proxy



Source: U.S. Census Bureau Monthly Retail Trade and U.S. Bureau of Labor Statistics Consumer Price Index

Both pricing and activity are important for retail and food services sales as there is a direct correlation to freight-related services and capacity needs with respect to infrastructure and facilities. The key difference in Figure 5 is that it focuses on activity and the trends illustrate monthly performance versus Figure 4’s longer duration monthly average. The Great Recession and Pandemic periods stand out as major outliers for activity-related impacts. During the middle and latter half of 2020 and through early 2022, activity related to consumer spending increased exponentially. More recently consumers have decreased their spending, with a corresponding impact on activity as inflation has increased to levels not seen since the late 1970s and early 1980s. While spending-related activity was the core driver through early 2022, pricing increases across nearly all retail and food services sales categories has been the leading component for overall sales performance since the spring of 2022, with activity clearly declining and even turning negative for most of 2022.

Figure 6. Goods Movement Industries GDP in SCAG Region



Source: U.S. Bureau of Economic Analysis, “CAGDP2 Gross domestic product (GDP) by county and metropolitan area 1/” Accessed Wednesday, August 23, 2023).

In 2021, goods movement-dependent industries (manufacturing, construction, retail, wholesale, and transportation and warehousing) employed close to 2.4 million people in the SCAG region, reflecting 29 percent of all employees. In the same year, goods movement-dependent industries contributed nearly \$430 billion to regional GDP – just below 40 percent of the region total and roughly 13 and 2 percent of GDP at the state and national level respectively (Figure 6). These sectors provide well-paying jobs adding diversity to workforce options and serve as a key component of the Southern California economy. With a substantial majority of retail and food services sales related to transportation, food, home goods, health, and other essential needs, there is a clear nexus on the importance of goods movement jobs and system infrastructure and facilities supporting the delivery of these needs to businesses and residents, notably during times of extreme duress.

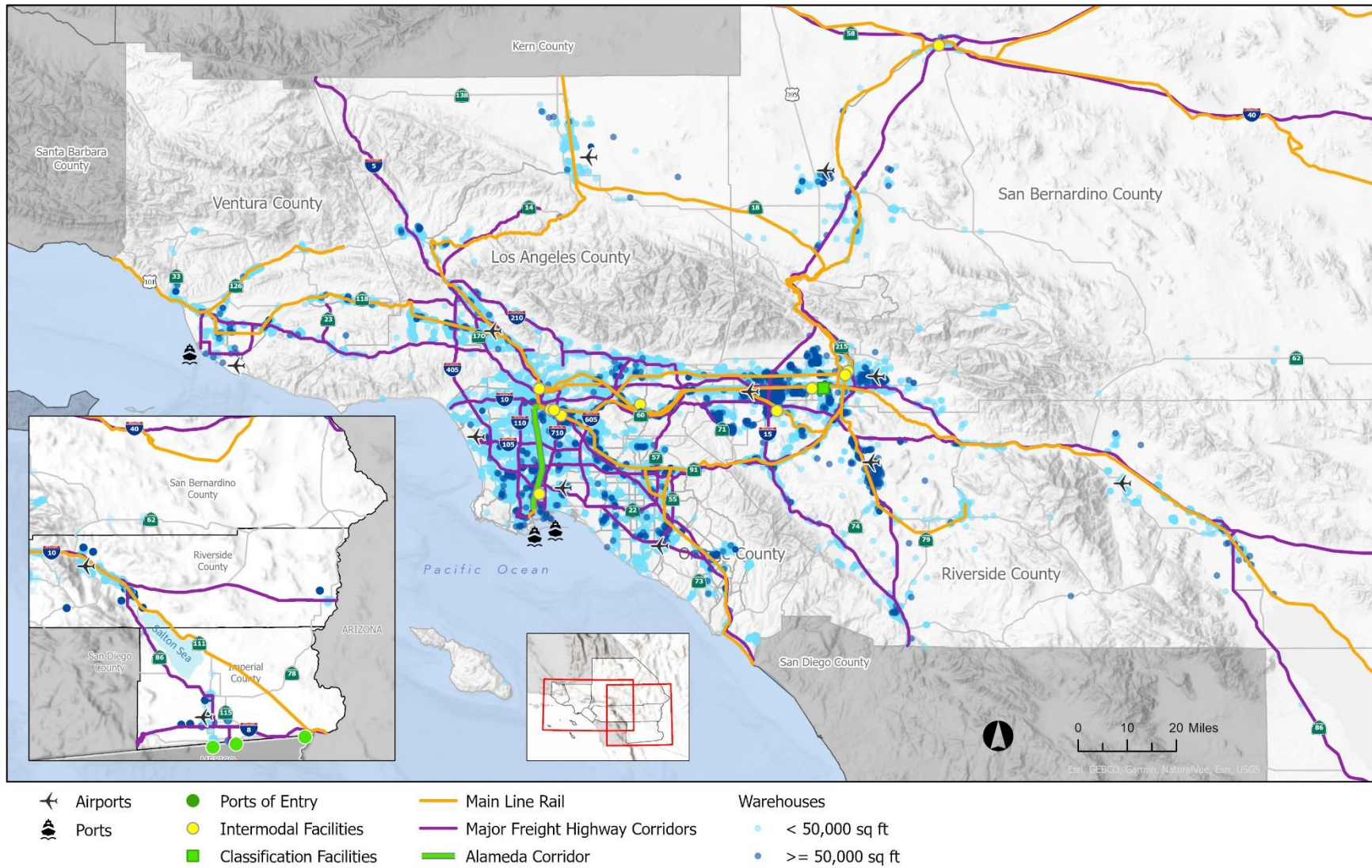
2.2 HOW DOES THE GOODS MOVEMENT SYSTEM WORK?

For the goods movement system to function efficiently, continued investment in infrastructure and facilities is necessary to both remain economically competitive with other regions in the U.S. and to provide reliable services to businesses and residents, while factoring for technology shifts and public impacts. The interconnected nature of the system’s components requires comprehensive planning and assessments to determine optimal implementation strategies. In the private sector, this occurs within company budgets and capital determinations, while on the public side, SCAG is directly involved in all planning aspects supporting the region’s transportation infrastructure needs. Increasing complexity of the goods movement system, advancing shifts toward clean technologies, and balancing community impacts are critical areas where SCAG works to engage and support the region.

Goods movement encompasses a wide array of activities involved in moving products from producers to businesses and residents. As consumers, many in the region are familiar with purchasing products whether digitally or physically, whether durable or non-durable. On the production side, there are many different production and manufacturing facilities, equipment types, and services required to create and distribute these products. Changes in technology, both for purchasing and producing goods, has had a profound impact on supply chains, most clearly on the efficiencies of production and timing of delivery. These technological advancements have led to increasing just-in-time and e-commerce-based fulfillment services. Impacts have been stark, as consequences of not enhancing supply chain efficiencies to compete has led to numerous bankruptcies across industries.

Recognizing these factors, goods movement is fundamental to supporting the economy and quality of life in the SCAG region, and by extension, the U.S. To support consumer demand and technological advancements, the regional goods movement system is organized through an intermodal, coordinated network that includes deep-water marine ports, international border crossings, Class I rail lines and intermodal and carload railyards, interstate highways, state routes and local connector roads, air cargo facilities, and distribution and warehousing clusters (Map 1).

Map 1. Existing Regional Goods Movement System



Source: SCAG

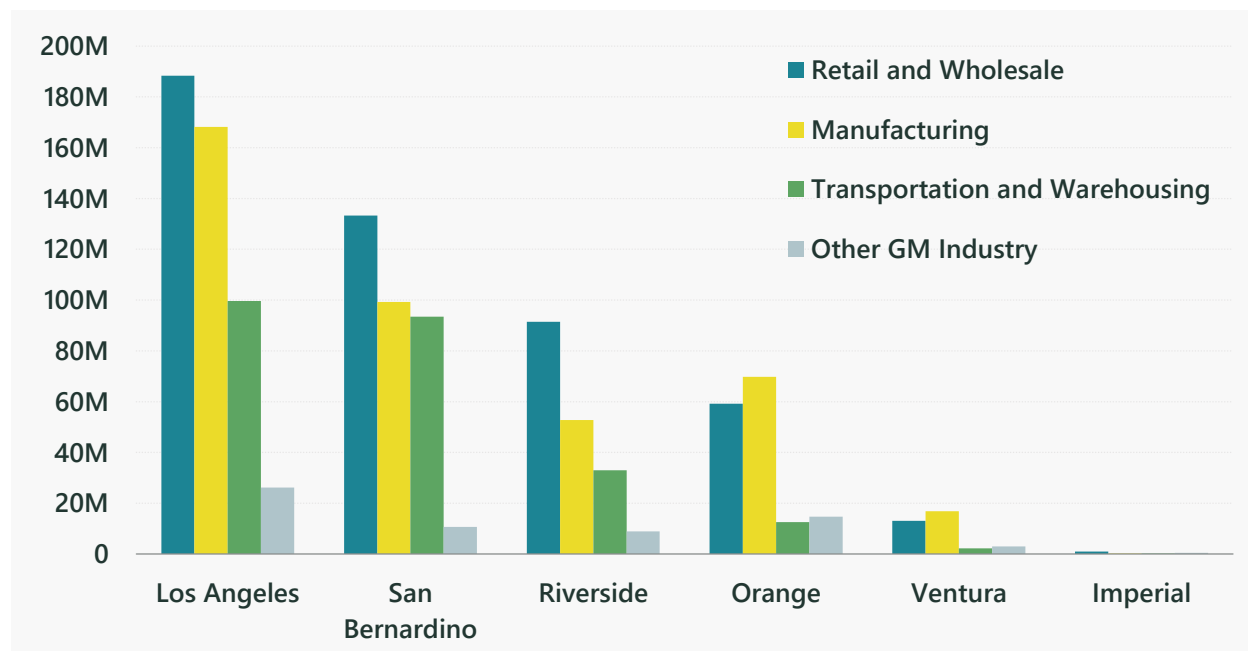
The SCAG region is home to the largest two ports in the country and as a result, imported goods serve as a key driver of shipment activity across freight modes. According to the Freight Analysis Framework (FAF) version 5.5, the truck mode accounts for approximately 75 percent of all tonnage moved throughout the U.S. to, from, and within the SCAG region. While seaports, airports, and railyards offer shipment alternatives, the truck mode touches most aspects of shipments whether directly or through interchange. Additionally, there is always a pricing consideration with respect to how goods ship. This consideration can vary across freight modes depending on economic and/or freight cycles. If trucking capacity is tight, or well below demand, railroads will look to convert some of this demand to their services and vice-versa. Irrespective of these shifts, the truck mode remains the most resilient and critical aspect for freight shipments, with 80 percent of tonnage connected directly to truck moves exclusively for local shipments within the SCAG region per the FAF data.

This section provides a review of major industrial facilities, seaports, railroads, the highway system, airports, and border crossings.

2.2.1 MAJOR INDUSTRIAL FACILITIES

For goods movement, manufacturing, and retail and wholesale trade is an important driver of economic competitiveness due to the globally integrated nature of supply chains. Industrial facilities provide the supply chain capacity to facilitate the import and export of goods for consumption locally, statewide, and nationally. This is a fundamental aspect of the goods movement system as global connections are made through seaports, border crossings, and airports for international trade, with air, rail, and trucking services supporting domestic local, regional, and national freight flows from these trade gateways. Industrial facility capacity supports freight flows through manufacturing, warehousing, distribution, and fulfillment to businesses and residents across the goods movement system.

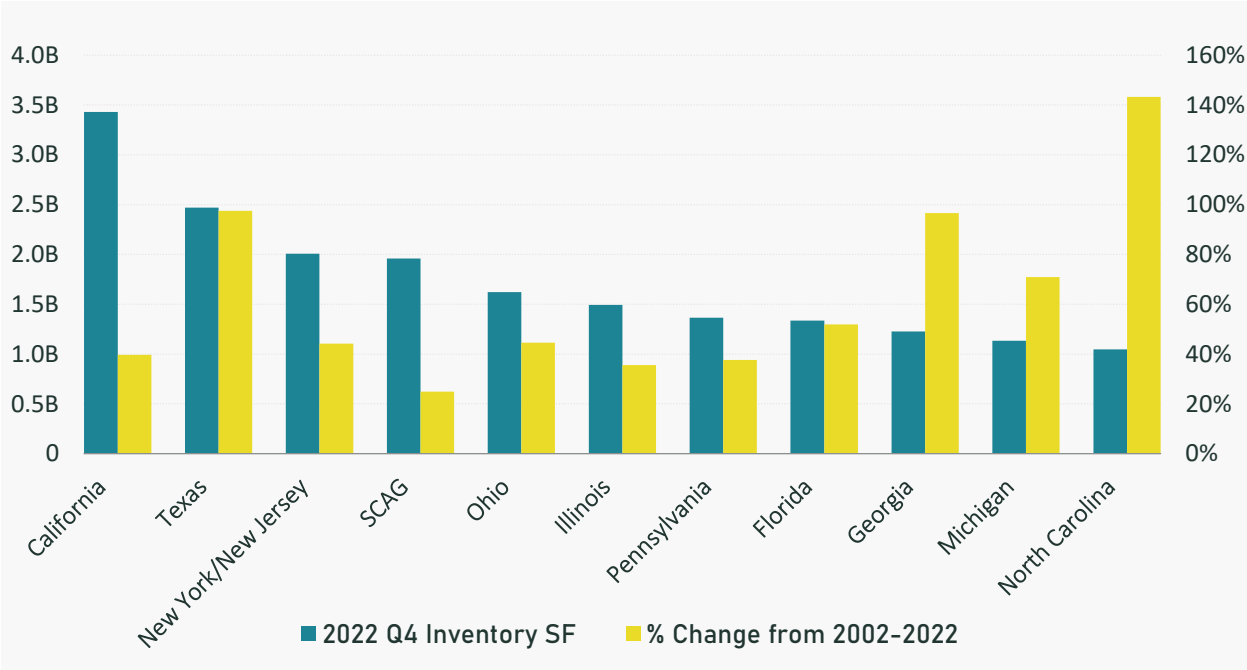
Figure 7. Square Footage by Industry Type Among All Goods Movement Industrial Properties in SCAG Counties



Source: CoStar (2023)

There are four major industrial categories: manufacturing, retail and wholesale trade, transportation and warehousing, with other goods movement industrial areas like construction being much more fragmented (Figure 7). At the end of 2022, the SCAG region encompassed 2 billion inventory square feet for industrial facilities, or approximately 57 percent of California’s total of 3.4 billion inventory square feet. It should be noted that variables impacting industrial use changes are included – existing, under construction/renovation, demolished, converted, proposed/planned, deferred, and abandoned. Categories such as demolished, converted, or abandoned have been reflected to change or reduce the amount of square footage. This approach best reflects change over time. Figure 7 provides a static snapshot serving as a baseline across SCAG counties, with an explicit focus on existing facilities and conditions.

Figure 8. Top States Industrial Square Footage



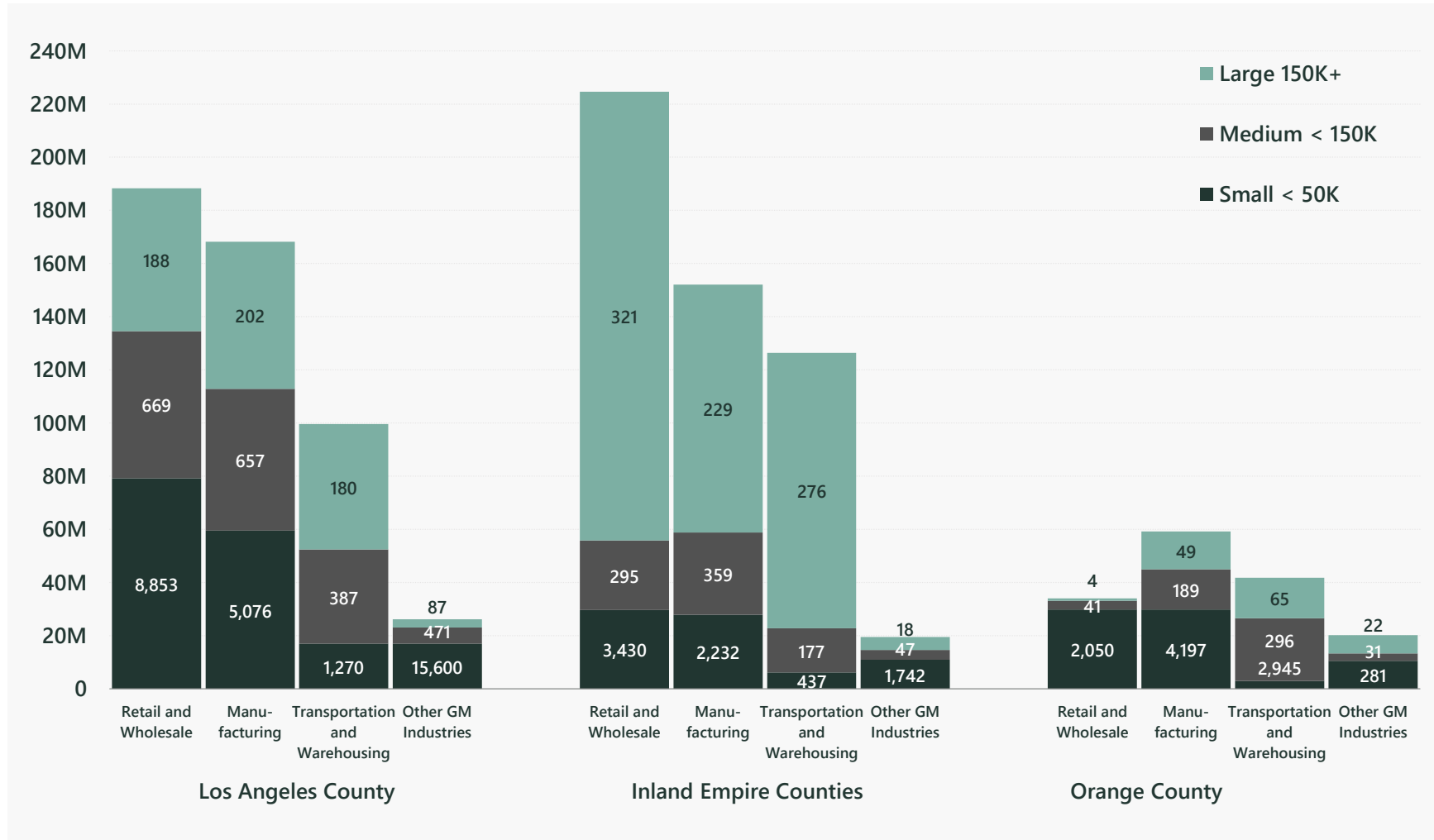
Source: CoStar (2023). Accessed July 2023.

California reflects the largest industrial footprint (3.4 billion) in the U.S. followed by Texas (2.5 billion), the New York/New Jersey region (2 billion), Ohio (1.6 billion), Illinois (1.5 billion), and Florida (1.3 billion) respectively (Figure 8). Collectively and as of 2022, inventory in California is up over 40 percent over the past 20 years, with 25 percent growth specific to the SCAG region. The Central Valley is driving a large portion of this growth in California, with a 251 percent increase in square footage over the 20-year period. The top three industries--grocery, food and beverage manufacturing, and e-commerce fulfillment--represent under 20 percent of total industrial square footage in the Central Valley, demonstrating the region's diversified industrial growth. During this time, states with high industrial square footage experienced robust growth: Texas (98 percent), New York/New Jersey (44 percent), Ohio (45 percent), Illinois (36 percent), and Florida (52 percent).

Since peaking during the fourth quarter of 2008, SCAG region manufacturing facility inventory has been on a very marginal decline being down 3 percent at the end of 2022 to just over 500 million square feet of inventory, or approximately 50 percent of the State’s 1 billion total. Leading manufacturing industries in the SCAG region include metal, food and beverage, paper products and publishing, aircrafts and automobiles, and circuits and electrical equipment. Excluding California, the SCAG region ranks fifth

against other overall states including New York/New Jersey (620 million), Texas (595 million), Ohio (594 million), and Michigan (557 million). Over the past 20 years these states witnessed stronger manufacturing inventory growth than the SCAG region and California; New York/New Jersey (57 percent), Texas (56 percent), Ohio (37 percent), and Michigan (68 percent) versus the SCAG region (1 percent) and California (12 percent).

Figure 9. Distribution of Square Footage by Size and Industry in Los Angeles County, Inland Empire Counties (San Bernardino and Riverside), and Orange County

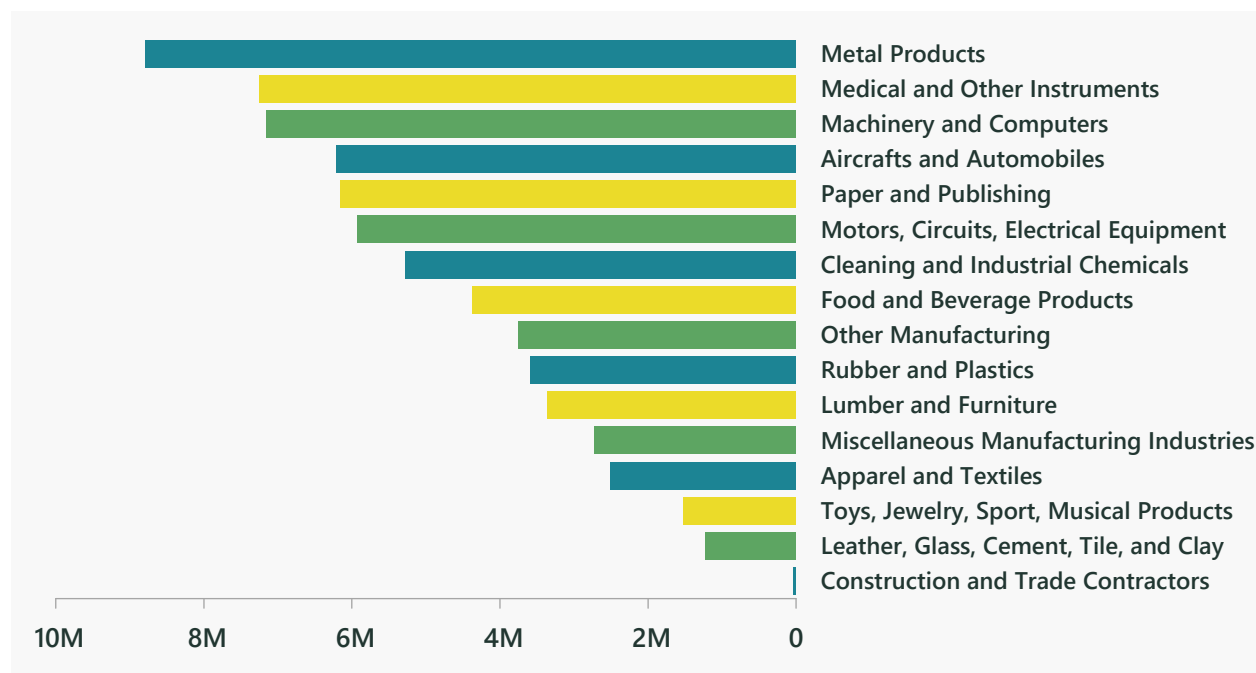


Source: CoStar (2023). Accessed January 2023.

Per Figure 9, Los Angeles County has the highest industrial inventory square feet for all four industrial categories combined. The Inland Empire (Riverside and San Bernardino Counties combined) has a larger amount of retail and wholesale and transportation and warehousing inventory square feet stemming mostly from a much larger average size of industrial facilities, and higher rate of growth for industrial property development. Towards 2020 and through the COVID-2019 pandemic, a substantial increase in industrial facilities occurred with the majority being in the Inland Empire.

Per the Los Angeles County Economic Development Corporation (LAEDC), key industries relying upon this footprint include aerospace, trade, EV and advanced transportation, design, and fashion and apparel. For the Inland Empire, key industries include trade, construction, and grocery and restaurants.

Figure 10. Square Footage of Orange County Manufacturing Sectors



Source: CoStar (2023). Accessed January 2023.

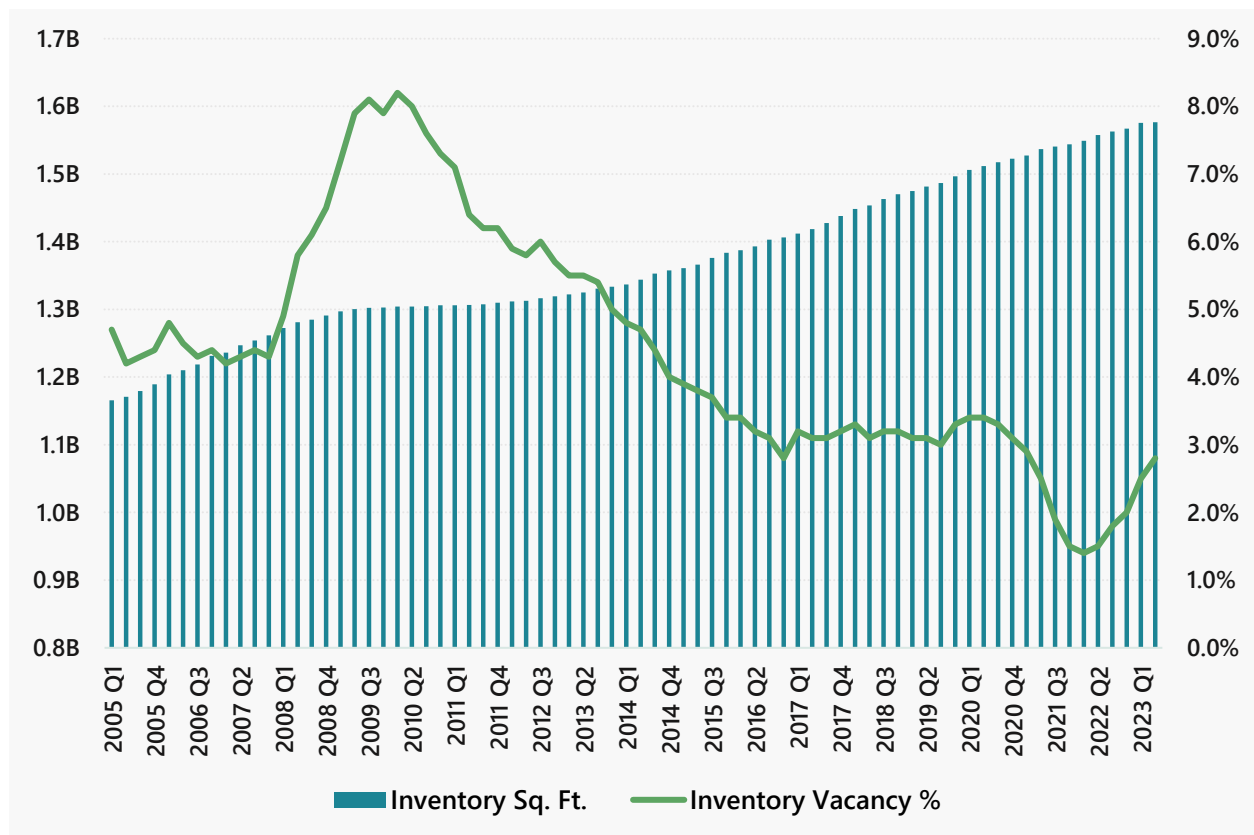
Orange County is the only county in the SCAG region with a larger share of manufacturing square footage than retail and wholesale (Figure 9). Sectors with the highest manufacturing square footage are represented by numerous companies in fields related to technology and medicine (Figure 10). Examples of some of the companies that have the largest presence in these top sectors include Parker Hannifin (Metal Products), and Edwards Lifesciences (Medical Instruments), Kingston Technology (Machinery and Computers), and Hartwell Corporation (Aircrafts). However, the companies with the largest overall square footage are in different sectors: Cambro (Rubber and Plastics), American Woodmark (Lumber), and Shaw Industries (Textiles).

The SCAG region is a major contributor to research and development for highly innovative industries such as clean technologies. Both Rivian Automotive, Inc., and Lucid Group, among others in the zero-emission technology space, have their headquarters and major product development teams located in the SCAG region. As a direct example, Rivian, with its headquarters and research and development located in Irvine, California is competing to lead the development of U.S. and global last-mile freight delivery vehicles and

is expected to deliver 100,000 delivery vans to Amazon in the coming years. Amazon’s industrial square footage is approaching 40 million just within the SCAG region, nearly four times greater than the next closest individual company total.

Together Imperial and Ventura counties reflect 3 percent of overall industrial square feet in the SCAG region. Per the Imperial Valley Economic Development Corporation (IVEDC), Imperial County serves as a major agricultural hub, while also being the second largest freight border crossing in Southern California. Imperial County is the top North America region in renewable energy production. Ventura County similarly has a large agricultural sector and connects to Port Hueneme serving core cargo such as finished automobile imports and fruit and perishable imported products. As such, these counties reflect smaller portions of the region’s industrial footprint.

Figure 11. Square Footage of SCAG Region Distribution and Warehouse Facilities



Source: CoStar (2023). All Properties Quarterly Analytics Data (raw data). Accessed on July 27, 2023.

The majority of the SCAG region’s industrial footprint is connected to retail and wholesale trade distribution and transportation and warehousing facilities. Retail and wholesale trade reflects the largest amount of industrial square feet directly tied to the over 19 million residents and approximately 342,000 business establishments in the SCAG region. It should be noted this capacity also supports much of San Diego County, bringing the southern California population total to greater than 22 million and over half of California’s total. These industrial categories grew at a much faster rate than manufacturing for the SCAG region, increasing inventory by 33 percent over the past twenty years.

The industrial market is defined by being tight or loose. During times where vacancy percentages are very low, the market is at a tight point that typically leads to increasing rent per square foot and slowing inventory growth. Before the Great Recession, the SCAG industrial warehouse and distribution market saw vacancy percentages in the 4-5 percent range. Since 2014, this percent dropped to a new-normal of 3 percent, and during the pandemic, hit extreme tightness below 2 percent. A return towards the 3 percent level has been occurring (Figure 11).

Industrial warehouse and distribution facilities support a wide range of uses from intermediary interchanges for national distribution, to both B2B and business-to-consumer (B2C) local consumption. Transportation and warehousing facilities are vital in supporting both local and national consumption. Retail trade is relatable to most as a B2C example, notably for e-commerce and omnichannel. B2B sometimes is not as clear, and a good example is within the automotive industry as it is the leading retail and food service sales category. While e-commerce-based retail sales grew exponentially by 250 percent the past decade, automotive retail sales also grew by a solid 75 percent. Many companies like AutoZone, O'Reilly's, or service centers at dealerships like Honda, etc., rely upon third-party suppliers and/or direct distribution centers to fulfill their product needs. This can occur either from industrial facility to facility and/or from industrial facility to retail store or service center location. From an equipment perspective, while many retail-based and national shipment interchanges occur within Los Angeles County due to lower cost/proximity to the SPBPs, many automotive suppliers throughout the SCAG region rely upon marine containers being drayed by truck to their warehouse and distribution facilities regardless of county location. Depending on industries and products beyond the automotive industry, international container drayage moves can go beyond the Los Angeles County area throughout Southern California, and even to other state and international markets such as Phoenix and Mexico that can be categorized within the region's local market.

2.2.2 SEAPORTS

Seaports in the SCAG region serve as a major trade gateway connecting businesses and residents to their products. On-terminal improvements targeting equipment storage, vessel unloading/loading, rail and truck capacity and access, among others are essential to provide the throughput capacity required to effectively transfer shipments to the rail and trucking services taking these products to their shipment locations. Connecting rail and roadway access improvements to port terminals are equally important to serve these shipment needs to alleviate chokepoints. Considerations for equipment positioning and repositioning (e.g., containers, chassis, etc.) for containerized ships, railroads, and trucks is directly related to these improvement needs.

The SCAG region is home to three deep-water ports: the SPBPs and Port of Hueneme in Ventura County. The SPBPs are the largest container complex (by volume) in the U.S. and ninth busiest in the world. The Port of Hueneme is owned and operated by the Oxnard Harbor District and specializes in moving automobiles, produce, and other break bulk and project cargo.

Neighboring one-another, the SPBPs are each governed by their respective cities and operated by an appointed Board of Harbor Commissioners. The Ports generate revenues from leasing their facilities and charging shipping service fees to private companies. Collectively, the two ports encompass approximately 11,000 acres. The complex contains America's most extensive and modern network of on-dock and near-dock rail services connecting U.S. imports and exports to international markets. About 35 percent of the Port of Los Angeles's intermodal containers utilize the SPBPs rail network while up to 28 percent of containers are moved via rail at the Port of Long Beach.^{ii,iii} On-road transportation to and from the ports

utilizes Interstate 710 (I-710), which points north-south and offers connections to nearly every major east-west highway locally. These ports play a vital role in the local economy, with one out of every nine jobs in Southern California connected to the SPBPs.

The SPBPs import traffic is organized into categories based on the mode and/or destination of the cargo. Inland Point Intermodal (IPI) is shipped intact in marine containers by rail from the ports to inland destinations, notably Chicago as a major lane example. This traffic can be segregated into on-dock IPI, including containers loaded and unloaded in the ports, and off-dock IPI, including containers moved to and from off-dock intermodal rail yards. Import cargo transloaded to rail includes cargo that is unloaded from marine containers in the SCAG region and reloaded into 53-foot domestic containers or trailers, and then is delivered to off-dock intermodal rail yards for rail shipment to inland destinations. Cargo may also be unloaded from marine containers in the region and reloaded to truck trailers and delivered to local destinations, typically including California, Oregon, Nevada, and Arizona. Local cargo is directly trucked from the SPBPs to these same destinations (Figure 1).

Figure 12. SCAG Region Asia Containerized Trade Value (in Billions of US Dollars)

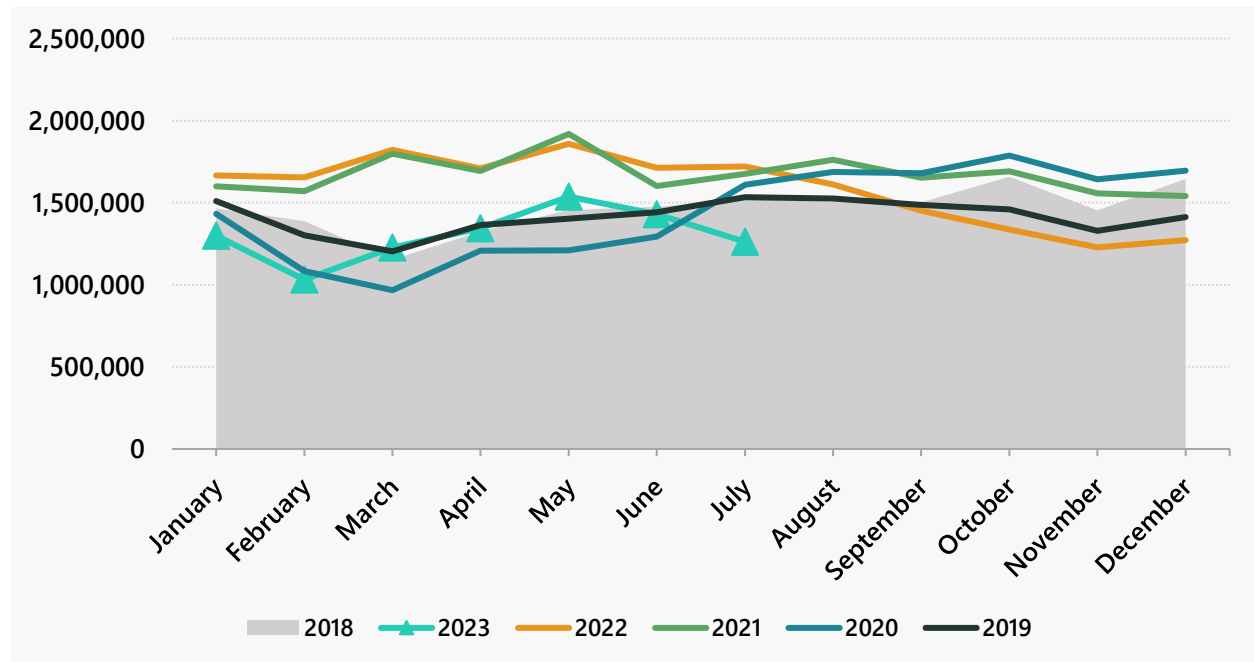


Source: United States Census USA Trade Online

Containerized trade between the U.S. and Asia constitutes most of the international cargo transiting the SCAG region (Figure 12). Southern California is critical to serving Asian markets with East Asian trade accounting for over 90 percent of activity in and out of the San Pedro Bay port complex.^{iv} Per the United States Census Bureau, Asia containerized trade value has increased by 17 percent over the past decade to just below \$360 billion as of 2022, supporting a wide variety of intermediary components and finished

products. During the same time, non-Asia containerized trade value has increased by 42 percent to just below \$30 billion. Trade across Asia has shifted as China’s proportion of containerized imported trade has dropped from 57 percent to 49 percent as of 2022. Exports have remained stable with China accounting for nearly 28.5 percent versus just below 30 percent back in 2012. Other southeast Asian countries have benefitted from shifts away from China.

Figure 13. San Pedro Bay Ports Monthly Container Volume, 2018-2023



Source: Port of Long Beach Port Statistics (2023). Port of Los Angeles Container Statistics (2023). Accessed in July 2023.

After an all-time peak of over 20 million twenty-foot containerized units (TEUs) in 2021, the SPBPs witnessed a return towards 2019 performance in the back-half of 2022 finishing with 19 million TEUs moved for the entirety of the year (Figure 13). Combined, the SPBPs terminals handle 35-percent of all waterborne containers entering and exiting the U.S.^y Most major seaports across the U.S. also witnessed similar declining trends towards pre-pandemic levels. However, performance over the past five years has not been equal across U.S. regions, Canada, and Mexico (organized by 2022 TEU volume, highest to lowest and five-year TEU performance –Table 2).

Table 2. Top U.S. Seaport Performance from 2017 to 2022

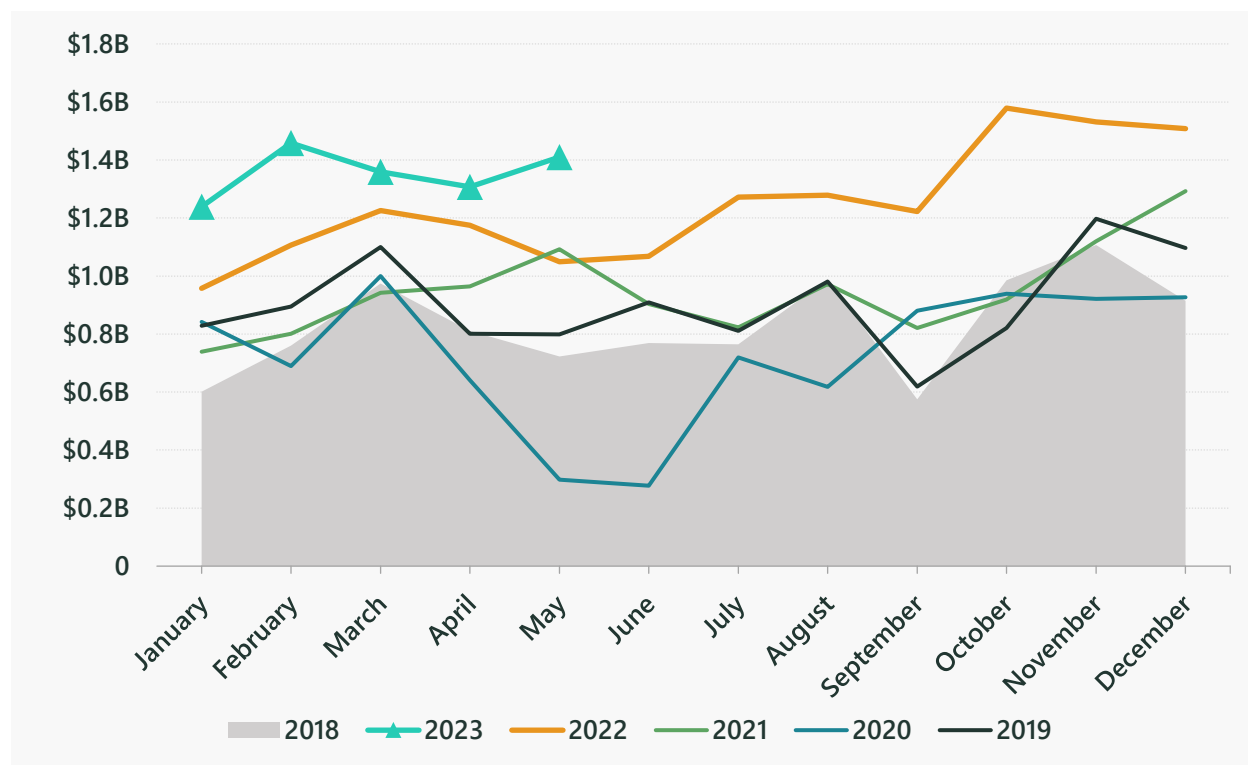
Seaport	2022 TEUs	2017-2022 Performance
SPBPs, California	19 million	12.8%
New York/New Jersey	9.5 million	41.5%
Savannah, Georgia	5.9 million	45.6%
Houston, Texas	4 million	61.6%
Virginia	3.7 million	30.4%
Vancouver, Canada	3.6 million	9.4%
Manzanillo	3.5 million	22.7%
Northwest Seaport Alliance (NSA), Seattle/Tacoma	3.4 million	-8.6%
South Carolina	2.8 million	28.2%
Oakland, California	2.3 million	-3.5%
Lazaro Cardenas, Mexico	2 million	76.8%
Jaxport, Florida	1.3 million	8.2%
Miami, Florida	1.2 million	12.3%
Prince Rupert, Canada	1 million	11.8%

Source: Seaport Websites for Monthly TEU Information

This list is not comprehensive, but West Coast seaports in the U.S. and Canada are growing at a much slower rate than their Mexico West Coast and Gulf and East Coast competitors over the past five years. Any increase in West Coast seaports in Mexico will result in imports increasing through cross-border trade via Texas. Considering the industrial inventory square feet growth in the SCAG region versus some of the fastest growing states, there is correlation with supply chain capacity growth of industrial inventory and TEU performance at major seaports within states, notably for Houston and New York/New Jersey. Other states with top seaport TEUs have witnessed robust industrial inventory square feet growth over the past 20 years as well including Georgia (97 percent) and Virginia (over 400 percent).

The Port of Hueneme is near Highway 101, which provides access south to the rest of the SCAG region and north to Santa Barbara and the central California coast. As a shared port between Naval Base Ventura County (NBVC) and the Oxnard Harbor District, the U.S. Navy has over 4,500 feet of berthing space for various ship platforms for use by tenant commands of NBVC at the Port of Hueneme.

Figure 14. Port of Hueneme Monthly Trade Value (Imports-Exports), 2018-2023



Source: United States Census USA Trade Online. Accessed in July 2023.

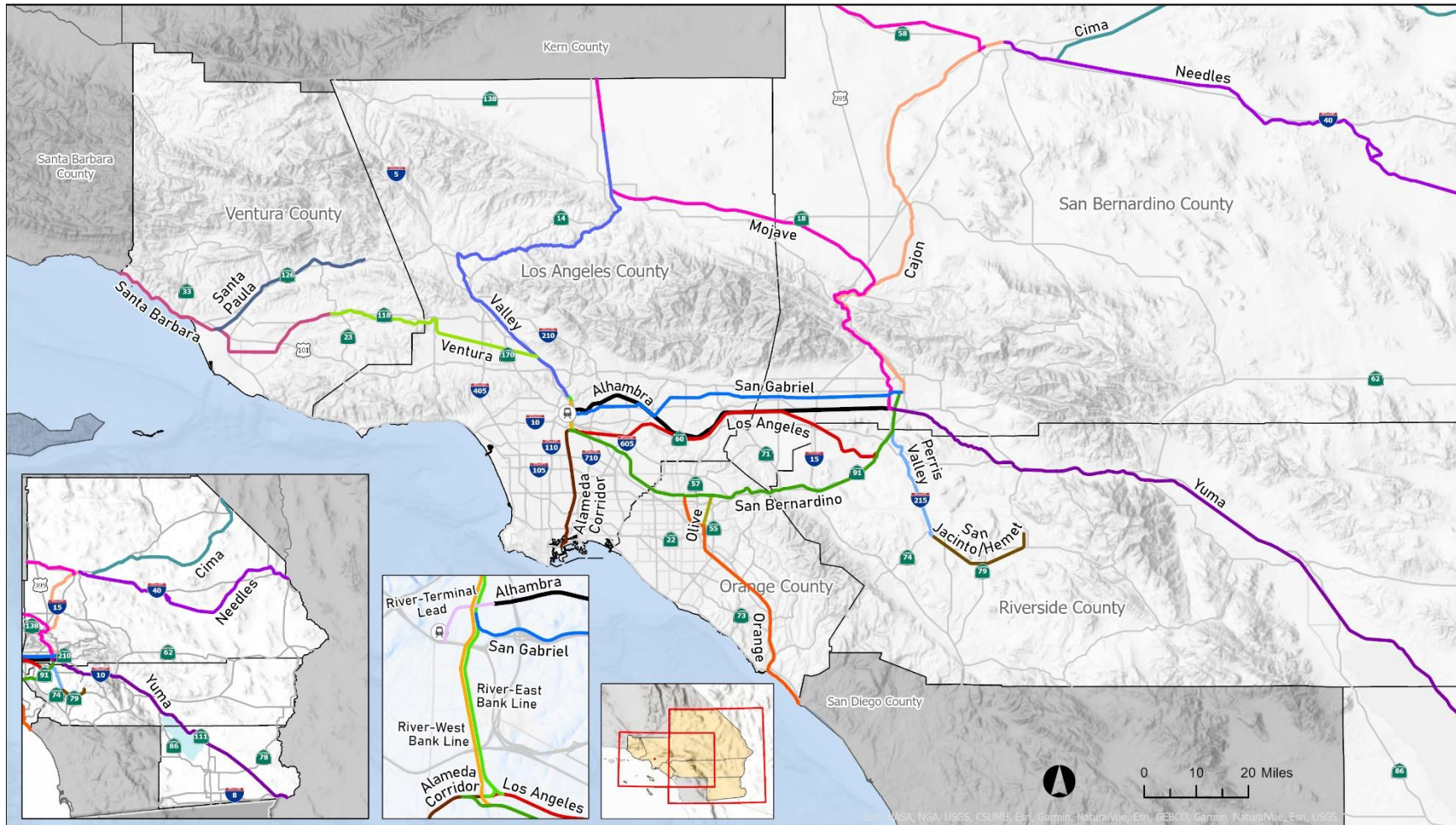
In 2022 the Port of Hueneme ranked 32nd among all seaports in trade by value, with an estimated \$15 billion in imports and exports.^{vi} Trade value has continued to perform above peak levels most recently with approximately 89 percent of this trade value derived from imports with new automotive vehicles accounting for the substantial majority at \$9.8 billion (Figure 14). The Port’s top trade partners include South Korea, Germany, the United Kingdom, Japan, and Mexico. The Port owns a Class III short-line railroad with a 12-mile loop track through Port Hueneme and south Oxnard that is operated by the Ventura County Railroad (VCRR). This rail line connects nationally to the Coast Route of Union Pacific.

2.2.3 RAILROADS

To accommodate the growing demands of freight transportation, ongoing investments are made in rail infrastructure within the SCAG region. Grade separation projects, upgrades to tracks, construction of additional sidings, and integration between freight and passenger railway are undertaken to enhance capacity and ensure the smooth flow of goods, while also accommodating passenger rail operational needs. These infrastructure improvements contribute to reducing congestion, optimizing the supply chain, and supporting economic growth.

The SCAG region is served by an extensive freight railroad system. This infrastructure serves as a vital component of the goods movement system, facilitating the transportation of goods and commodities across the region and beyond, notably for IPI. Key rail facilities include intermodal rail yards, automotive facilities, and classification yards. As mentioned earlier, the SCAG region sees a substantial amount of import/export cargo through the SPBPs, with containerized shipments being the lion’s share. This naturally translates to rail cargo being mostly focused on containerized services.

Map 2. Regional Rail Segments



- | | | | | | |
|-----------------------|-------------|----------------------|----------------------|-------------------|---------------|
| Rail line subdivision | Cima | Olive | River-Terminal Lead | San Jacinto/Hemet | Ventura |
| Alameda Corridor | Los Angeles | Orange | River-West Bank Line | Santa Barbara | Yuma |
| Alhambra | Mojave | Perris Valley | San Bernardino | Santa Paul | Union Station |
| Cajon | Needles | River-East Bank Line | San Gabriel | Valley | |

Source: SCAG 2022

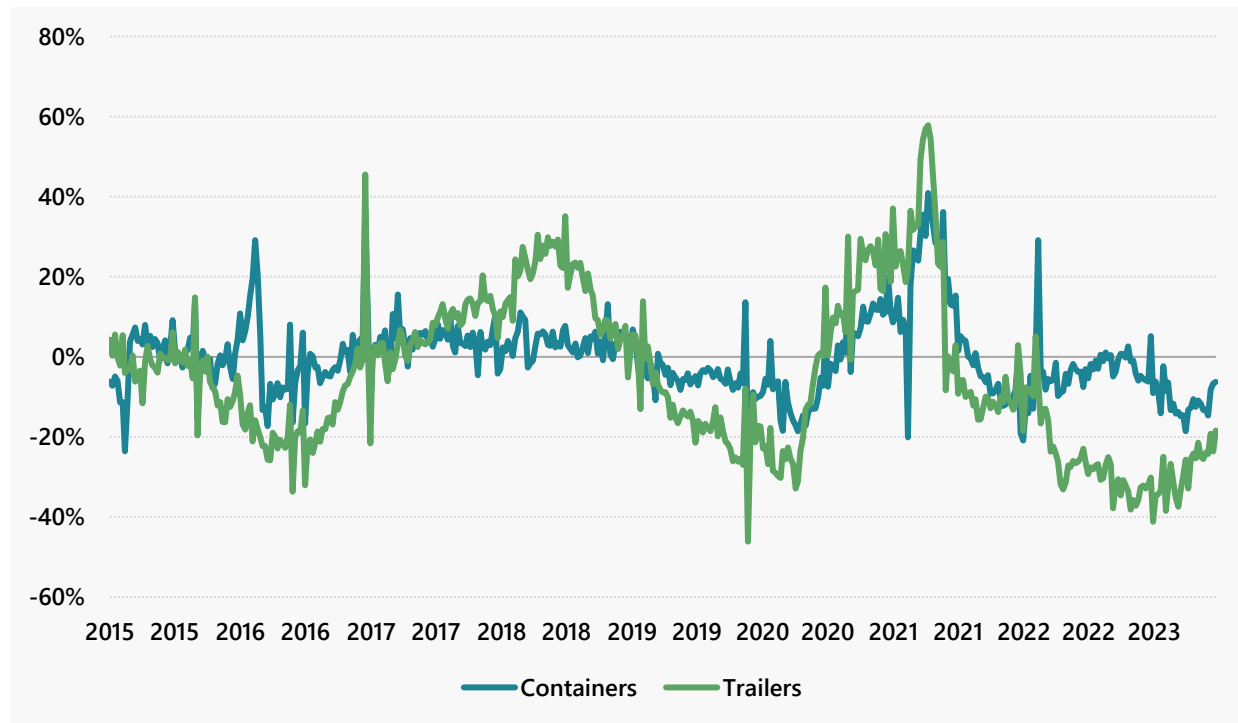
SCAG has two Class I railroads, including BNSF Railway (BNSF) and Union Pacific Corporation (UP). These Class I railroads operate comprehensive networks of tracks, connecting the region to major national freight corridors (Map 2). For example, they connect the SPBPs via the Alameda Corridor and Alameda Corridor East, with on-dock rail terminals and with seven major intermodal terminals; they connect the automotive industry through two core automotive facilities; and they connect non-containerized cargo via classification yards and other intermodal/interchange yards, and rail spurs throughout the region. Of late, BNSF has announced plans to develop a \$1.5 billion intermodal project in Barstow, BIG. This project is anticipated to serve the SPBPs by railing international containers to Barstow, where they will be transloaded for eastbound U.S. destinations. UP also opened the Inland Empire Intermodal Terminal (IEIT) in 2021. Approximately 30-percent of containers at the SPBPs are associated with IPI meaning they flow through the SCAG region to inland shipment locations. For containerized trade supported by off-dock intermodal yards, railroads are completely dependent on truck drayage services for both customer shipments and equipment repositioning. For many tank car products including liquids and pellets, trucking services are also necessary to transport these products the final mile.

Three Class III railroads operate in the region and provide short-haul services: Pacific Harbor Line (PHL), Los Angeles Junction Railway (LAJ) and VCRR. PHL provides rail transportation, maintenance, and dispatching services within the SPBPs area. The LAJ provides industrial switching services in the Cities of Vernon, Maywood, Bell, and Commerce. The LAJ also provides connection to both BNSF and UP. The VCRR extends for just over 12 miles on four branches serving the industrial areas of south Oxnard, the Port of Hueneme and U.S. Naval Base Ventura County Port Hueneme Division and connects with the UP-Coast Maine Line in downtown Oxnard.

There are numerous industrial, distribution, and commercial sites in the region connected to the freight rail network through rail spurs or industrial sidings, which are frequently extended from the main rail lines. These extensions allow for direct access to the regional, national, and even international rail network, while facilitating the seamless loading and unloading of goods and commodities at the facility itself. These locations are used to offer convenient and efficient means for industries to receive raw materials for their production processes. Manufacturers with direct rail connections benefit from the reduction of trucking operations, allowing goods to be directly transported by rail to and from industrial facilities.

Compared to other modes of transportation such as trucks or airplanes, freight railroads are generally more fuel-efficient.^{vii} This helps reduce overall GHG emissions and contributes to improved air quality. Still, freight locomotives traditionally rely on diesel engine technologies, which produce pollutants such as nitrogen oxides (NOx), particulate matter (PM), and sulfur dioxide (SO₂). These emissions can contribute to local air pollution and have adverse effects on air quality, particularly in areas near rail lines or rail yards. Many Class I railroads across North America are testing multiple locomotive technologies to transition towards zero-emission capabilities.

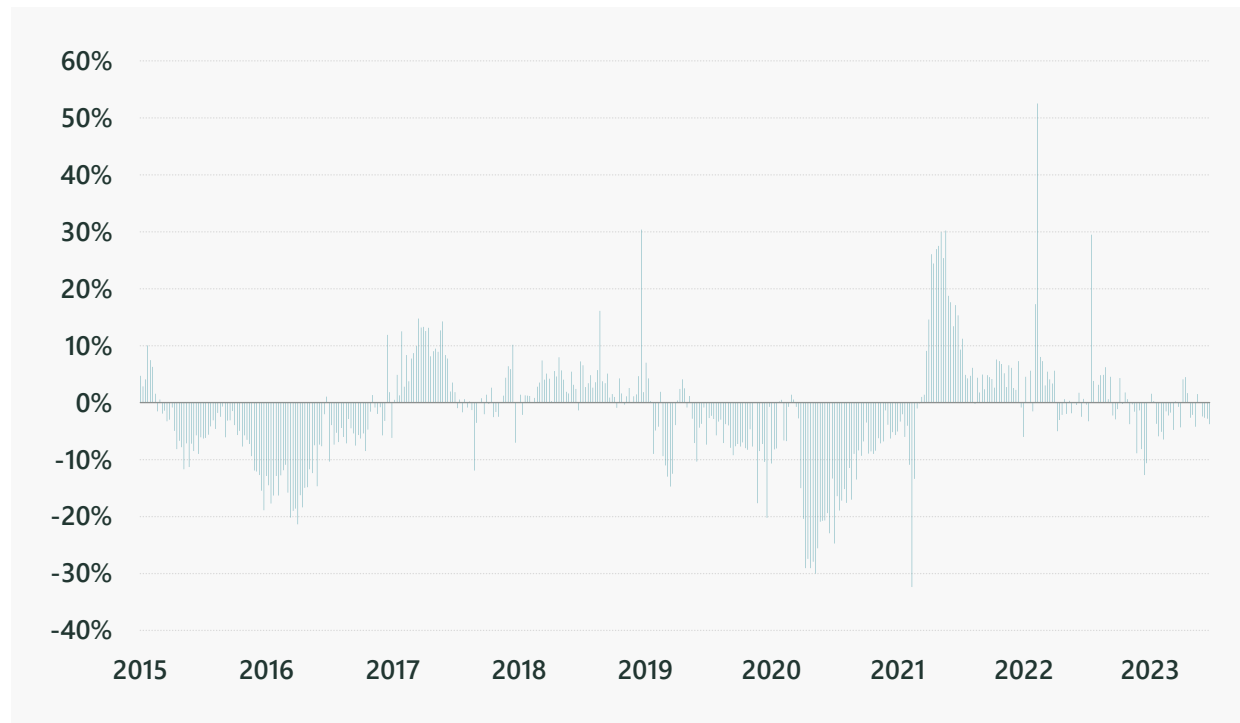
Figure 15. BNSF – UP Container/Trailer Units



Source: BNSF and Union Pacific Weekly Intermodal Units Accessed Directly from Websites

BNSF and UP intermodal rail performance has been challenged over the past decade. Impacts have been notable resulting from national tariff policies, freight recessions, the COVID-19 pandemic, and other geopolitical tensions. All business sectors have felt the recent impacts from inflation, both for pricing of their products and for their operational costs. BNSF and UP have essentially witnessed flat intermodal performance since 2014 and through 2022, with extreme cycles of volume fluctuations being the norm as shown in Figure 15.

Figure 16. BNSF – UP Total Carloads



Source: BNSF and Union Pacific Weekly Carloads Accessed Directly from Websites

Carload performance excluding intermodal units has witnessed declining volume since 2014 by just above two percent (Figure 16). Similarly, carload results have been impacted by extreme commodity and industrial contraction, freight recessions, the COVID-19 pandemic, and more recently weakening industrial demand.

2.2.4 HIGHWAY SYSTEM

According to the California Public Road Data 2021, the SCAG region has 57,699 total road miles, and 12,170 lane miles (which includes local roads, arterials, and connector facilities). This roadway system provides mobility for truck trips of all types to locations in the region and connections outside it. The regional roadway system serves multiple functions and can be thought of as the connecting tissue that ties together the intermodal freight transportation system in Southern California, providing critical last mile connections to intermodal terminals, marine terminals, airports, border crossings, warehouses and distribution centers, and manufacturing facilities. The highway system allows trucks to perform many critical roles that support goods movement in the region.

Southern California remains a leading manufacturing center in the U.S. While the region provides many non-transportation advantages to manufacturers (such as access to a large consumer market), its access to efficient and reliable transportation, especially the regional roadway system, contributes to its attractiveness for certain types of manufacturing. Trucking connections to suppliers and markets are an important element in many manufacturing supply chains. These involve both intraregional connections to clusters of related businesses and long-haul corridors. Significant amounts of regional manufacturing are located along key roadway corridors that facilitate connections to the Interstate system, intermodal rail

facilities and air cargo facilities. Another critical roadway function that supports regional manufacturing is the ability to make interregional connections. The Interstate highway system serves as the primary connection between the region, national markets, and suppliers with significant support from several state routes. These interregional corridors are also important to regional and national distribution centers that are significant components of growing logistics activities in Southern California. Arterial highways throughout the region provide direct connections to commercial centers and residential areas that allow for deliveries to stores, homes, construction sites and service businesses. For this system to function effectively, it must rely on a core set of highways that facilitate east-west and north-south connections. These are like the routes that support regional manufacturing but also include roads serving population clusters.

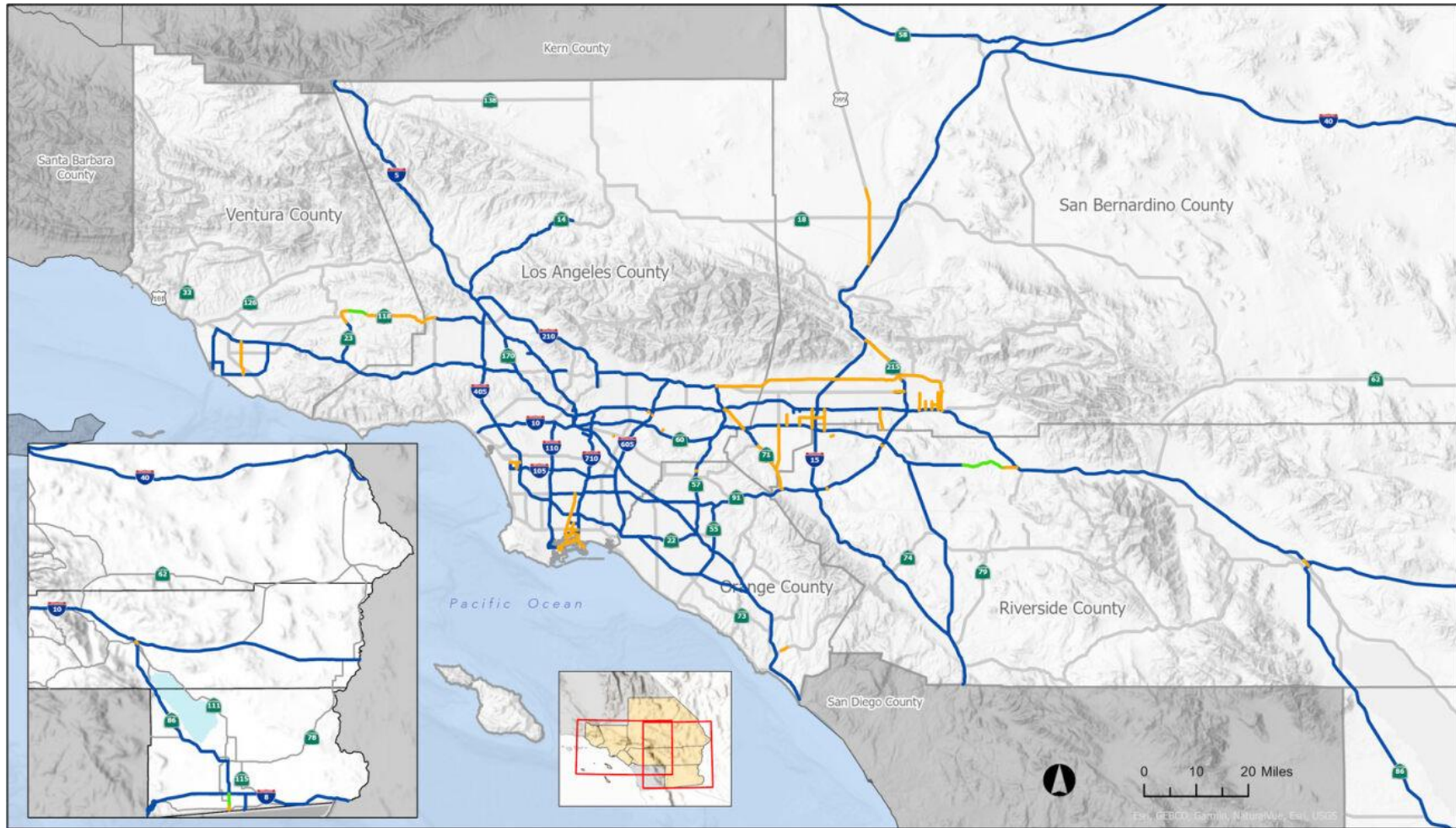
Major regional international gateways in the region rely on roadway connections. Interstate 710 offers direct access to the SPBPs, as well as points north and connections to almost every major east-west highway. It acts as a primary access corridor to the intermodal rail terminals that handle most of the international intermodal cargo (ICTF near the seaports, and Hobart Yard, East Los Angeles Yard, and LATIC in downtown Los Angeles), marine terminals at the SPBPs and large concentrations of warehouses, transloading facilities and logistics service providers in the Gateway Cities subregion. Similarly, Interstate 110 (I-110) provides access to certain marine terminals at the Port of Los Angeles. In addition, the local arterial roadway system plays a critical role providing “last mile” connections to the SPBPs and intermodal terminals. State Route 47 (SR-47)/State Route (SR-103) near the SPBPs is an example of this type of facility. There are three bridges connecting the roadway system to Terminal Island: Vincent Thomas Bridge on the west, Commodore Schuyler F. Heim Bridge on the north, and Long Beach International Gateway Bridge on the east.

The primary access route to the Port of Hueneme is Highway 101, along with the secondary routes of State Route 126 (SR-126) and State Route 1 (SR-1). As specified in the City of Oxnard’s General Plan, the preferred arterial access route for trucks is Hueneme Road and Rice Avenue. Two of the largest air cargo complexes at Los Angeles International Airport (LAX) are located along West Century Boulevard and State Route 90 (SR-90/Imperial Highway). Along with La Cienega Boulevard (connecting Century Boulevard and Imperial Highway), these roadways were identified by the Los Angeles Department of Transportation as the major arterial truck routes serving air cargo at LAX. Major freeway connections are provided by Interstate 405 (I-405) and Interstate 105 (I-105).

Many of the region’s warehouse and distribution facilities are clustered along key goods movement highway freight corridors:

- I-405 provides access to clusters of air cargo facilities where sorting and consolidation/de-consolidation activities occur near LAX;
- I-710 provides access to logistics service providers, truck terminals and transload facilities serving the San Pedro Bay Ports, as well as providing connections to the warehouse concentrations in Downtown Los Angeles and East Los Angeles.
- Interstate 5 (I-5) provides access to warehouse clusters in the Gateway Cities subregion and in areas in northern Orange County (such as warehousing clusters in Anaheim); and
- East-west corridors, including State Route 60 (SR-60) and Interstate 10 (I-10), provide access to major warehouse clusters in the San Gabriel Valley (especially in the City of Industry) and the Inland Empire (including major concentrations in Ontario, Fontana, and Mira Loma); SR-60 is a primary access route to many of these locations with over 50 percent of the region’s warehouse space located within five miles of the highway.

Map 3. Primary Highway Freight System



— Primary Highway Freight System (PHFS) — Critical Urban Freight Corridors (CUFCs) — Critical Rural Freight Corridors (CRFCs)

Note: Map includes recent submittals of CUFC/CRFC segments to FHWA
Source: U.S. Department of Transportation, SCAG

Table 3. Primary Highway Freight Network – Southern California Summary

County	Total Miles of Primary Freight Network	Regional Share
Imperial	173.59	11%
Los Angeles	465.64	29%
Orange	125.89	8%
Riverside	311.38	20%
San Bernardino	454.67	29%
Ventura	53.21	3%
Grand Total	1584.38	100%

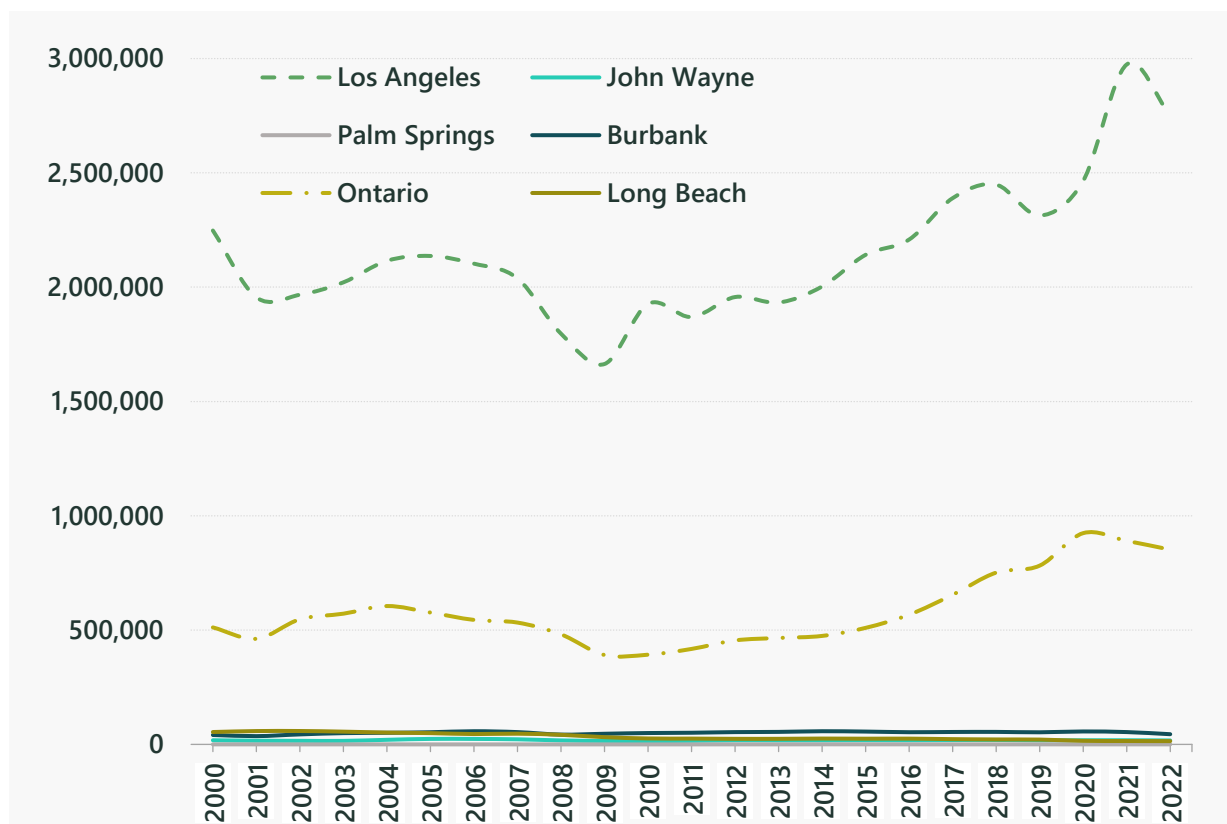
Source: U.S. Department of Transportation. Table includes recent submittals of CUFC/CRFC segments to FHWA

Sections of I-10, Interstate 15 (I-15), SR-60 and State Route 91 (SR-91), which carry the highest volumes of truck traffic in the region, averaged more than 17,000 trucks per day in 2019. Other major components of the regional highway network also serve significant numbers of trucks. These include I-5, I-405 and Interstate (I-210). More than 16,000 trucks per day travel on some sections these roadways. These roads carry a mix of cargo types, including local, domestic, and international. The arterial roadway system also plays a critical role in goods movement, providing first and last-mile connections to regional ports, manufacturing facilities, intermodal terminals, warehousing and distribution centers and retail outlets. Previous federal legislation and transportation reauthorizations directed the Federal Highway Administration (FHWA) to create the Primary Freight Network (PFN), a component of the National Freight Network (NFN), intended to “assist states in strategically directing resources toward improved system performance for the efficient movement of freight on the highway portion of the nation’s freight transportation system.” With the passage of the Fixing America’s Surface Transportation (FAST) Act, the Primary Highway Freight System (PHFS) was designated using a 41,000-mile highway network. In the SCAG region, about 1,584 miles of highways were designated as a part of the PHFS, with Los Angeles and San Bernardino Counties accounting for approximately 60 percent of the total coverage. Table 3 shows the breakdown of the PHFS miles by county within the SCAG region.

2.2.5 AIRPORTS

All regional airports handling cargo in the SCAG region have direct access via major interstates and highways to the region’s vast industrial warehouse facilities and direct connections for domestic and national cargo via rail and truck modes. Like seaports, air cargo facilities that are on-terminal require improvements to improve throughput capacity, while connecting access roads that support regional shipment flows, and equipment positioning and repositioning are equally important.

Figure 17. Total Cargo Tonnage, 2012-2022 (LAX, SNA, PSP, BUR, ONT, LGB)



Source: Website Activity Reports (LAWA, LGB, ONT, PSP, SNA) Caltrans Division of Aeronautics quarterly reports.

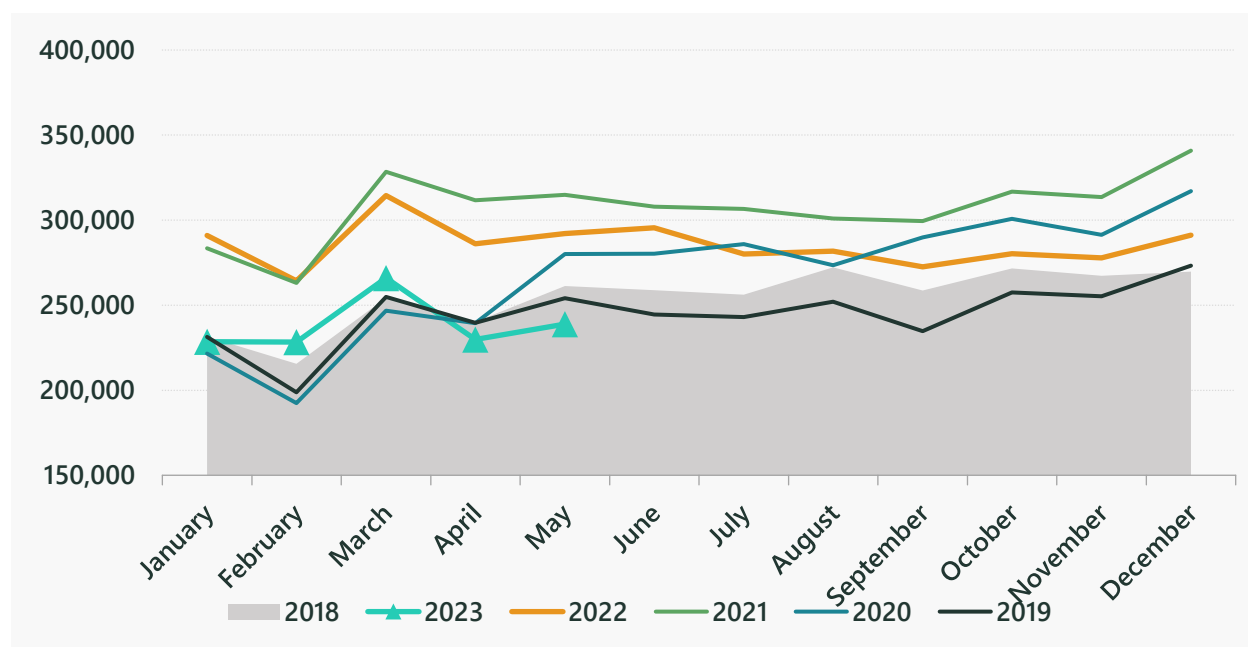
There are nine airports that provide air cargo services in the SCAG region. In 2012, the region’s air cargo services handled over 2.5 million tons, reflecting an increase in cargo tonnage of approximately 75 percent over the last decade to nearly 4 million tons in 2022 (Figure 17). The largest share of this cargo is handled by Los Angeles International Airport (LAX). LAX has a large cargo operation that includes over two million square feet of air cargo space comprised of the 98-acre Century Cargo complex, the 57.4-acre Imperial Cargo complex, the Imperial Cargo Center and a number of terminals on the south side of the airport. These facilities include 27 buildings, including distribution and sortation facilities, air cargo containers, ground equipment, and air freighter cargo loading and unloading spaces. Notably, these facilities range from 20 to 80 years old, with many approaching the end of their useful life. To address this, Los Angeles World Airports (LAWA) aims to deliver the airport’s next Cargo Modernization Program, which is scheduled to start environmental review in the third quarter of 2024.^{viii}

The next highest share is Ontario International Airport (ONT). ONT has almost three acres of cargo building and office space to support all cargo and air mail. UPS has a 156-acre West Coast Distribution Center adjacent to the airport, including air freighter storage for loading and unloading, directly connected to the airport and warehouse and distribution facilities, and direct service to China. Recent air cargo developments have included new Air Prime cargo services operated by Amazon, and FedEx’s \$100 million 251,000 square-foot complex on the northwest portion of the airport.

In addition to operations at LAX and ONT, air cargo activity takes place at Hollywood Burbank Airport (BUR), Imperial County Airport (IPL), Long Beach Airport (LGB), Palm Springs International Airport (PSP), San Bernardino Airport (SBD), and John Wayne/Orange County Airport (SNA). There are two other airports in the region that have plans to implement improvements to their air cargo operations: First, the March Air Force Base/March Inland Port (MIP) entered into agreement with Amazon with operations beginning late 2018. MIP provides access to major interstate highways as well as being located within a foreign trade zone. To read more about air cargo trends within the region, refer to the Aviation and Airport Ground Access Technical Report.

Second, in spring 2020, the approximately 2,200-acre Southern California Logistics Airport (SCLA) in Victorville was used to store hundreds of unused planes operated by Southwest, FedEx, and other major commercial and cargo carriers as a response to the dramatic decrease in passenger flights due to the COVID-19 pandemic. However, this area is set to develop into major domestic and international air cargo hub, housing tenants such as Boeing, General Electric, and Amazon. There is also an “off-airport” facility known as the Southern California Logistics Centre (SCLC) where, along non-aeronautical facilities owned and operated by the SCLA, Prologis has development rights to approximately 1,300 acres that are being transformed into a logistics centered industrial park.

Figure 18. LAX-ONT Monthly Freight Tons, 2018-2023



Source: LAWA, LAX Website Activity Reports. Ontario International Airport, ONT Website Activity Reports.

Per Figure 18, air cargo at LAX has returned towards pre-COVID-19 pandemic levels to over 2.7 million tons in 2022. Unlike air passenger activity, the COVID-19 Pandemic did not have as lasting of an effect on air cargo demand at LAX. In 2022, international trade at Los Angeles International Airport was valued at \$153 billion, an increase of 10-percent compared to 2021. Exports totaled \$61.5 billion, up 8 percent while imports were valued at \$92 billion, up 11-percent^{ix}. Los Angeles International Airport ranked No. 9 by value and No. 80 by tonnage among the nation’s 450-plus airports, seaports, and border crossings. Ranking it just against other airports, it ranked No. 3 by value and No. 5 by tonnage within the U.S. Major

international trade partners include countries throughout Asia and Europe, with the top five trade by value being China, Taiwan, Japan, India, and Vietnam in 2022.^x

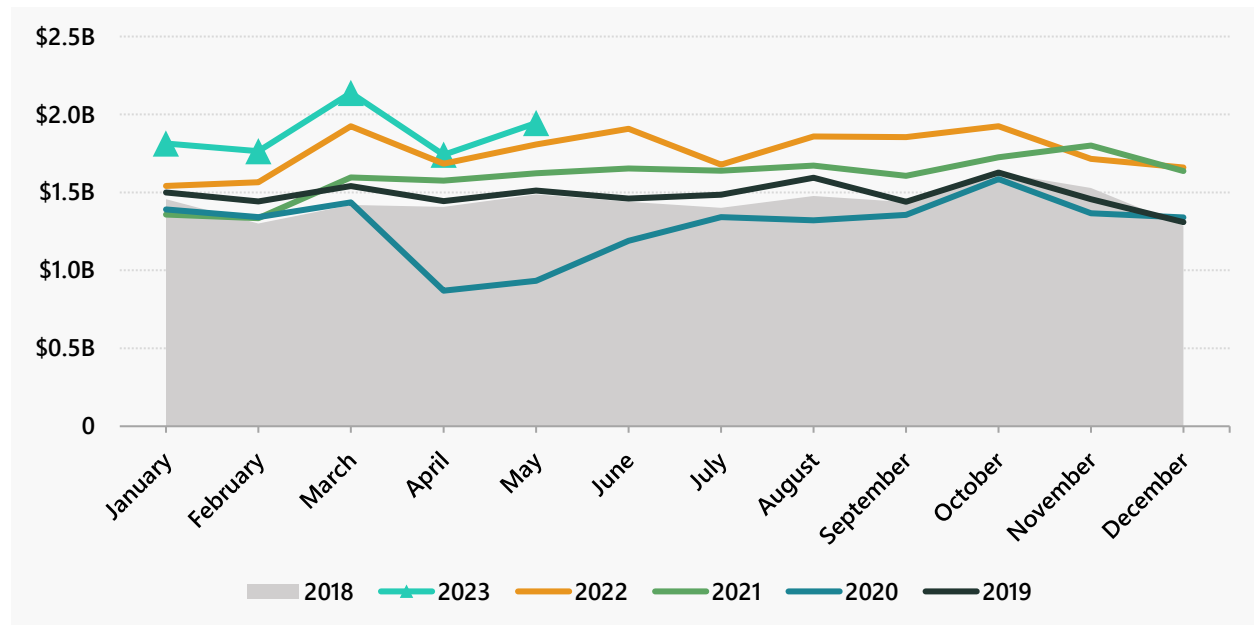
The COVID-19 pandemic led to a spike in cargo activity of 924,160 tons in 2020 for ONT, but that figure has steadily decreased in subsequent years. In 2022 ONT moved 851,889 tons of cargo with the majority being domestic and with international trade valued at nearly \$300 million. San Bernardino International Airport moved nearly the same amount in international trade including 669,428 tons of cargo.

2.2.6 BORDER CROSSINGS

International border crossings between the U.S. and Mexico are critical components of the freight transportation system in Southern California as they link near-shore supply chains. Key infrastructure improvements near the border involve Port of Entry processing throughput and inspection capacity and improvements to major connecting freight corridors across Imperial County. As Imperial County serves as a major agricultural producing and renewable energy development region it is important to balance the infrastructure needs for both domestic production and import and export trade. The Otay Mesa East new border crossing project in San Diego County will also create further capacity for cross-border trade between California and Mexico, relying upon industrial distribution and warehouse facilities within the SCAG region.

The SCAG region hosts international truck and rail border crossings with Mexico in Imperial County. There are currently three land Ports of Entry (POEs) in the county that process commercial truck and rail traffic – Calexico West-Mexicali I, Calexico East- Mexicali II, and Andrade-Los Algodones. Most trucks, which handle most of the trade flow between the U.S. and Mexico, cross the border at Calexico East-Mexicali II. This POE is located approximately 130 miles east of San Diego and 60 miles west of Yuma, Arizona and includes nine passenger lanes, four pedestrian lanes, and three commercial lanes (including one FAST lane). The Calexico-East Mexicali II POE is connected to the regional freight truck network via State Route 7 (SR-7), which directly serves the POE and connects to Interstate 8 (I-8). State Route 86 (SR-86) is the major truck corridor connecting Calexico to the rest of the SCAG region.

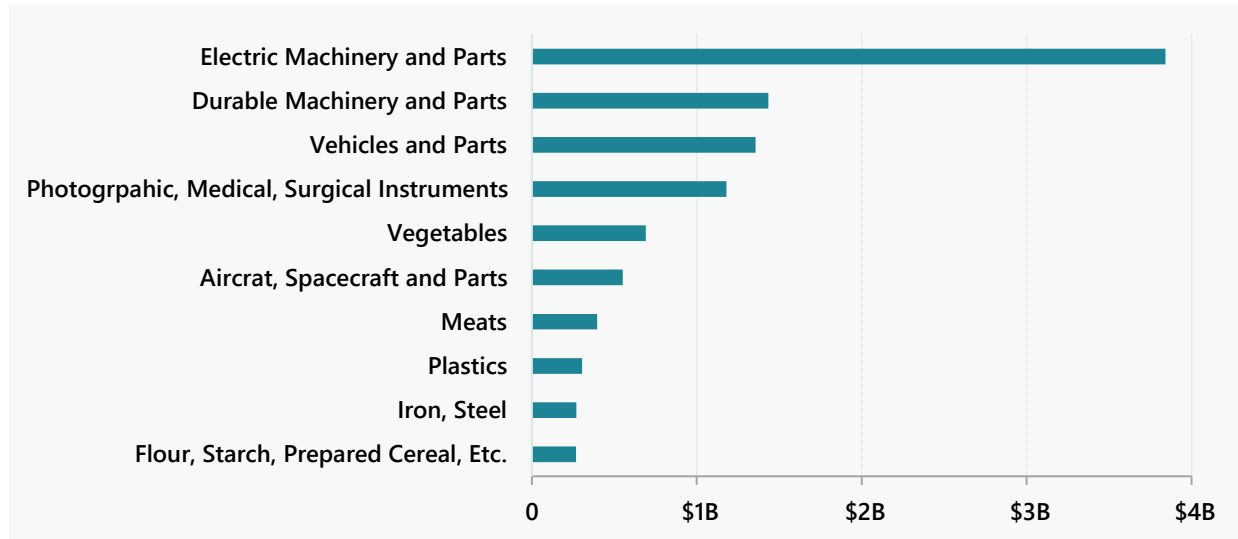
Figure 19. Calexico POEs Monthly Trade Value (Imports-Exports), 2018-2023



Source: United States Census Bureau, USA Trade Online

International cross-border trade has continued to grow, driven by factories and warehouse and distribution facility developments on both sides of the border. During 2022, Calexico East imports and exports totaled over \$21 billion in international trade value (Figure 19). While much of the most current volumes are down at major seaports and airports across the U.S., border crossing trends with Mexico continue to remain near all-time peak levels, an indication of reshoring and near-shoring activities to North America. Imperial County has also witnessed increasing agricultural exports, notably for alfalfa hay bales through the SPBPs totaling nearly 1.5 million tons. Northbound truck crossings have continued to set new records each year since the beginning of the COVID-19 pandemic, consistent with trade data trends.

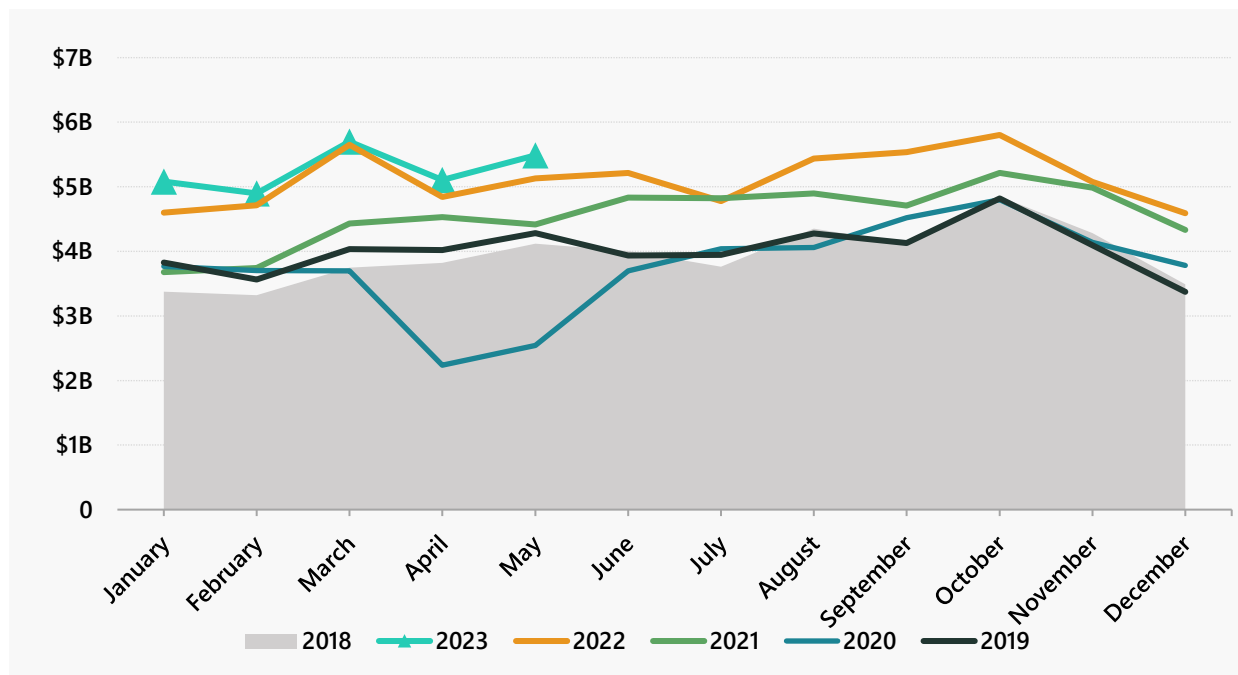
Figure 20. Calexico East Top 10 Commodity Imports – 2022



Source: United States Census Bureau, USA Trade Online

Top commodities imported through the Calexico East border crossing during 2022 heavily skewed towards electric and heavy-duty machinery and parts, vehicles and parts, and photographic, medical, and surgical instruments. These imported goods reflected just below 63 percent of the \$12.5 billion in trade value for 2022 (Figure 20).

Figure 21. Otay Mesa-Tecate POEs Monthly Trade Value (Imports-Exports), 2018-2023



Source: United States Census Bureau, USA Trade Online

While not a part of the SCAG region, San Diego County's Otay Mesa border crossing is an important contributor to many supply chain dynamics impacting multiple counties within the SCAG region. Like the Calexico East border crossing commodity mix, top import categories included electric and heavy-duty machinery and parts and vehicles and parts. During 2022, electric and heavy-duty machinery and parts and vehicles and parts reflected just below 55 percent of the total approximately \$38 billion imported trade value (Figure 21).

Of the \$13 billion in imported electric machinery and parts, \$8.1 billion included flatscreen televisions (TVs) and monitors with approximately \$7 billion associated with 50-inch flatscreen TVs, totaling 15.5 million units at an average unit cost of \$447. Per Mordor Intelligence^{xi}, the U.S. Smart TV market is expected to reach 31.3 million units in 2023, so the Southern California region's imports reflected nearly 50 percent of the nation's total during 2022, while not accounting for any possible flows to Canada. Many of the components exported through the California-Mexico border to manufacture the finished Smart TVs are imported through the SPBPs and trucked southbound, with imported finished products trucked northbound to the Inland Empire for local consumption and/or transfer to eastbound intermodal rail moves.

Of the \$7.4 billion in imported vehicles and parts, \$4.3 billion included Toyota Tacoma pick-up trucks, with 146,149 units at an average unit cost of \$29,200. Units produced represented a 160 percent increase over the past decade with pricing increasing by 22 percent. Imported pick-up trucks are taken to a BNSF rail yard adjacent to the Tenth Avenue Marine Terminal where eastbound rail moves are made, while trucking companies distribute trucks to local dealerships throughout Southern California. Per GoodCarBadCar^{xii}, during 2022, 215,853 Toyota Tacoma trucks were sold across the U.S., with the Southern California region supplying nearly 70 percent of this total, again, not accounting for any trade with Canada.

For Smart TVs, both Otay Mesa and Calexico East import finished products, with most coming from Otay Mesa. Regardless, the California-Mexico border is a major activity generator supporting both local and national consumption needs. As a result, there are strong system connections from I-5 and I-15, SR-7, I-8, and SR-86 supporting a high volume of goods movement flows between California and Mexico and throughout the SCAG region.

2.3 COMMUNITY IMPACTS

The transportation sector accounts for one-third of domestic GHG emissions in the U.S. and affects the health and wellbeing of millions of Americans, particularly those in historically underserved communities. Southern California leaders believe it is critical to direct investment to the region to accelerate the transition to a zero-emission goods movement system. This is particularly important given the region's air quality challenges and the associated disproportionate health impacts on low-income communities and communities of color. More than half of all Americans exposed to PM2.5 pollution exceeding the national standard reside in the SCAG region. Poor air quality is a concern as it leads to premature deaths, hospitalizations, and other public health impacts such as asthma and bronchitis.

There are also equity concerns when it comes to health and air quality considerations. Often, air quality disproportionately impacts disadvantaged and low-income residents. For instance, findings from the Ventura County Freight Corridors Study suggest that "six percent of the County's population – nearly 49,000 people – live within 500 feet of a roadway that carries more than 1,000 trucks per day." According to the Study, "historic siting of low-income housing adjacent to industrial land uses and transportation

facilities led to disproportionate burdens of the freight system being placed on disadvantaged residents nationwide and in Ventura County.^{xiii}

Per CalEnviroScreen, Southern California contains the top two counties with the greatest share of SB 535 Disadvantaged Communities census tracts: Los Angeles and San Bernardino. Riverside and San Bernardino rank as the two counties nationally with the highest rates of ozone pollution and in the top ten for particulate pollution rates.^{xiv} The Center for Community Action and Environmental Justice (CCA EJ) analyzed local conditions in Jurupa Valley, finding high levels of freight truck traffic and numerous elementary schools located near freeways.

Southern California's extensive warehousing and logistics sector, vital for the regional economy, imposes significant environmental and health burdens on surrounding communities. Goods movement, particularly heavy-duty trucks, contributes to 50 percent of NOX emissions and 18 percent of PM2.5 emissions in the region. These pollutants disproportionately affect vulnerable communities, leading to health risks such as respiratory diseases, cancer, and premature death. Furthermore, neighborhoods hosting warehouses and distribution centers experience high levels of toxic releases, intensifying the environmental injustice faced by communities of color and historically disadvantaged areas. Such exposures pose great public health risks, such as cancer, respiratory illness, and premature death.^{xv} The top ten communities that have warehouses/distribution centers also contain the highest areas of toxic releases, disproportionately burdening communities of color and economically disadvantaged areas.^{xvi} To learn more about the equity impacts of freight and goods movement, including emissions, noise, and rail-related impacts, refer to the Equity Analysis Technical Report.

There are a variety of air quality measures aimed at reducing the effect of freight and goods movement on local communities. These measures are focused on minimizing exposure to freight related noise, emissions, and greenhouse gases. The following measures are options to address these issues:

- Open space landscaped buffers and increasing vegetation such as trees as feasible
- Heating, ventilation, and air conditioning (HVAC) upgrades such as modern equipment and better-quality air filters
- Greater investment in zero emission vehicles and their supporting infrastructure and use of incentives for local businesses
- Low emission delivery zones
- Air quality monitoring studies with more stringent thresholds
- Noise buffers, sound walls, raised banks
- Noise insulation – window/glass upgrades in buildings at sensitive locations
- Public information programs designed to reduce exposure to emissions

Communities also benefit economically from business and employment opportunities generated by goods movement industries. Virtually every industry in the world depends on some aspect of the goods movement supply chain, whether it be the sourcing of raw materials for manufacturing, manufacturing those materials into usable products, or distributing those products to retail centers or consumers. These activities both provide communities with the goods and services necessary engage in normal day-to-day activities. Whether directly or indirectly, these aspects simultaneously help generate employment opportunities for those same communities. Of note are industries like manufacturing, transportation and warehousing where the diversity of jobs ranges from entry-level positions that can be pursued directly from high school to advancement opportunities towards management, to some of the top research and development and company administration jobs across the region.

Trucking, cargo handling and logistics services may be the most visible occupations tied to trade, but the presence of a diverse trade sector in Southern California has broader economic benefits. Companies that depend upon transportation and logistics services rely upon several positions to facilitate the flow of goods and to ensure operating efficiencies. These jobs range in title and support front and back-office operations, company management, data management, operations and maintenance, and compliance. While most of these roles are held among private freight companies, the freight sector also impacts the need for skilled workers in the public sector: Engineers who understand the impact of truck traffic on state highways are needed by State Departments of Transportation. Planners and economists are valuable to port authorities assessing trends and preparing plans for both short term and long-term growth. Fleet managers in both the public and private sector will be more valuable to their employers if they are able to manage the transition to zero emission technology mandated by California regulations. The SCAG region serves as a major manufacturing area supporting numerous companies making products that are distributed from their facilities to customers. Many leading clean technology and other innovative companies have and continue to locate within the region.

Furthermore, active policies to replace higher-emitting combustion engines with clean technology alternatives have demonstrated potential to improve air quality and related health outcomes for communities located near major transportation routes or distribution centers. The emergence of goods movement innovations also supports workforce development in areas such as research and development, manufacturing, operations, and maintenance, adding to the diversity of the region's employment opportunities. The adoption of new technologies may require specialized skills and training, which can create a technological divide between communities with access to training opportunities and those without. As such, it is crucial to expand access to education and training programs to reduce disparities in employment opportunities throughout the evolving freight industry.

3. GUIDING POLICY AND PLANNING FRAMEWORK

As the region's Metropolitan Planning Organization (MPO), SCAG's goods movement planning work is guided by federal and state mandates and processes with respect to policy development, funding programs, and regulatory requirements. In addition to these guiding elements, collaborative work throughout the region across partners, member agencies, and freight stakeholders and communities serves as a major component establishing the region's planning context.

KEY TAKEAWAYS:

- SCAG continues to build tools and resources to navigate state and federal goods movement policies and programs, including state regulations, while collaborating on the development of these policies and programs to support the region's interests.
- SCAG serves as a forum for the region's partner and member agencies policy discussions on goods movement areas encompassing numerous aspects for equity and air quality initiatives.
- SCAG's planning context is informed by, and representative of, state and federal policies, programs, and regulations, and includes extensive regional programs, plans, and studies with well-integrated regional partner, member agency, public and private stakeholder, and community engagement.

3.1 FEDERAL AND STATE POLICIES, PROGRAMS, AND REQUIREMENTS

As part of Federal Highway Administration's (FHWA) Title 23 code of federal regulations for developing the metropolitan transportation plan (23 CFR Section 450.324), goods movement activities include long-range and short-range strategies/actions that provide for the development of an integrated multimodal transportation system while facilitating safe and efficient movement in addressing current and future transportation demand. As part of this process, air quality transportation conformity is required for both federal and state standards.

As per the regulations, MPOs must consider the efficient movement of goods in the metropolitan area when developing their transportation plans^{xvii}. This involves coordination with relevant public and private stakeholders involved in goods movement, data collection and analysis related to freight movement, and identifying freight infrastructure needs. The transportation plan should be consistent and coordinated with relevant state freight plans, establish performance measures related to goods movement, and be tailored to the specific needs of the region^{xviii}. By adhering to these regulations, transportation planners aim to improve the effectiveness and sustainability of goods movement within the metropolitan area.

The Connect SoCal 2024 Goods Movement Technical Report fulfills these requirements by providing identification and discussion about key freight transportation facilities, implementation strategies, and system performance based on consultation with state and local agencies as well as input from stakeholders.

SCAG works very closely with both federal and state agencies as part of its goods movement activities culminating in each Connect SoCal cycle. Various levels of government have many different roles and perspectives when it comes to the importance of freight and goods movement planning. This is especially true as the goods movement system is comprised of many different components requiring planning analyses and implementation strategies to support transportation infrastructure and facility needs, as well as factor for public impacts and benefits across communities and other freight stakeholders.

3.1.1 FEDERAL

SCAG continues to work with the federal government on its goods movement planning efforts. In collaboration with the FWHA's Office of Freight Management and Operations, SCAG participated in the 2022 Freight and Technology Peer Exchange to convene with a variety of public and private stakeholders across the nation. SCAG has also presented at Talking Freight webinars multiple times and established numerous relationships with many federal agencies to collaborate on data development and planning analysis to ensure that federal approaches to freight planning and implementation are well understood and considered for the Southern California region. At the last MPO certification review with U.S. DOT, SCAG received highly positive feedback on its Last Mile Freight Program (LMFP) and continues to leverage this program's work for federal opportunities.

BIPARTISAN INFRASTRUCTURE LAW

On November 15, 2021, President Biden signed the Infrastructure Investment and Jobs Act (IIJA) (Public Law 117-58, also known as the "Bipartisan Infrastructure Law") into law. The Bipartisan Infrastructure Law (BIL) provides \$550 billion over fiscal years 2022 through 2026 in new Federal investment in infrastructure, including in roads, bridges, and mass transit, water infrastructure, resilience, and broadband. The BIL has continued programs stemming from the FAST Act and established new programs with a direct connection to support state, regional, and local freight activities for planning, piloting, deployment, and implementation.

Continued Programs of Interest

The BIL continues the National Highway Freight Program (NHFP) with \$7.15 billion in contract authority for fiscal years 2022 through 2026 to improve the efficient movement of freight on the National Highway Freight Network (NHFN) and support several goals, including:

- Investing in infrastructure and operational improvements that strengthen economic competitiveness, reduce congestion, reduce the cost of freight transportation, improve reliability, and increase productivity;
- Improving the safety, security, efficiency, and resiliency of freight transportation in rural and urban areas;
- Improving the state of good repair of the NHFN;
- Using innovation and advanced technology to improve NHFN safety, efficiency, and reliability;
- Improving the efficiency and productivity of the NHFN;
- Improving State flexibility to support multi-State corridor planning and address highway freight connectivity; and
- Reducing the environmental impacts of freight movement on the NHFN. [23 U.S.C. 167(a) and (b)]

This sustains the California federal portion for the Trade Corridor Enhancement Program (TCEP), discussed further below in the state section. Additionally, the BIL increases the maximum number of miles of

highway that a state may designate as critical rural freight corridors (CRFC) and increases the maximum number of miles that may be designated as critical urban freight corridors (CUFC) in a state to 150 miles of highways versus the prior 75 miles or 10 percent of the Primary Highway Freight System (PHFS) mileage in the state, by whichever is greater.

The BIL continues the Railway-Highway Crossings Program (RHCP) with \$1.23 billion in contract authority for fiscal years 2022 through 2026, which provides funds for safety improvements to reduce the number of fatalities, injuries, and crashes at public railway-highway grade crossings.

The BIL amended the Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) grant program and renamed it the Advanced Transportation Technologies and Innovative Mobility Deployment Program. In implementing BIL, FHWA will refer to this program as the Advanced Transportation Technologies and Innovation (ATTAIN) program. The ATTAIN program provides competitive grants with \$300 million in authorization for fiscal years 2022 through 2026 to deploy, install, and operate advanced transportation technologies to improve safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment.

New Programs of Interest

The BIL establishes the Carbon Reduction Program (CRP) with \$6.4 billion in contract authority for fiscal years 2022 through 2026, which provides funds for projects designed to reduce transportation emissions, defined as carbon dioxide (CO₂) emissions from on-road highway sources.

The BIL establishes a National Electric Vehicle Infrastructure Formula Program (NEVI) with \$5 billion in advance appropriation (general fund) for fiscal years 2022 through 2026 to provide funding to states to strategically deploy electric vehicle (EV) charging infrastructure and to establish an interconnected network to facilitate data collection, access, and reliability.

The BIL establishes the Reduction of Truck Emissions at Port Facilities program with \$400 million for fiscal years 2022 through 2026 to study and provide grants to reduce idling at port facilities, including through the electrification of port operations.

As part of the BIL and these programs, there have also been numerous discretionary grant opportunities supporting freight including:

- Charging and Fueling Infrastructure (CFI) Discretionary Grant Program
- Consolidated Rail Infrastructure and Safety Improvements (CRISI) Program
- Federal-State Partnership (FSP) for Intercity Passenger Rail Grant Program
- Multimodal Project Discretionary Grant Program (MPDG)
- Port Infrastructure Development Program (PIDP)
- Railroad Crossing Elimination (RCE) Grant Program
- Rebuilding American Infrastructure with Sustainability and Equity (RAISE)
- Reduction of Truck Emissions at Port Facilities (RTEPF) Grant Program

INFLATION REDUCTION ACT

On August 16, 2022, President Biden signed the Inflation Reduction Act (IRA) into law, marking the most significant action Congress has taken on clean energy and climate change in the nation's history. Within its energy and climate provisions, IRA appropriates approximately \$11.7 billion in total for the Loan

Programs Office (LPO) to support issuing new loans. These amounts increase loan authority in LPO's existing loan programs by approximately \$100 billion. The IRA also adds a new loan program, the Energy Infrastructure Reinvestment (EIR) Program (section 1706), to help retool, repower, repurpose, or replace energy infrastructure that has ceased operations or to improve the efficiency of infrastructure that is currently operating. The wide-ranging impacts of these new and expanded authorities are further described:

- \$3.6 billion for Innovative Clean Energy Loan Guarantees: This new loan authority is open to all currently eligible Title 17 Innovative Clean Energy technology categories, including fossil energy and nuclear energy.
- \$5 billion for Energy Infrastructure Reinvestment Program: Potential projects could include repurposing shuttered fossil energy facilities for clean energy production, retooling infrastructure from power plants that have ceased operations for new clean energy uses, or updating operating energy infrastructure with emissions control technologies, including carbon capture, utilization, and storage (CCUS).
- \$3 billion for Advanced Technology Vehicles Manufacturing (ATVM) Direct Loan Program: Expanded uses include medium- and heavy-duty vehicles, locomotives, maritime vessels including offshore wind vessels, aviation, and hyperloop.
- \$75 million for Tribal Energy Loan Guarantee Program: To provide partial guarantees of commercial or other qualified loans made for energy development to a federally recognized Indian tribe, Alaska Native Corporation, or tribal energy development organization.

Through the IRA, there are a series of tax credits equating to created credits and/or subsidized costs related to zero emission vehicles purchases and investment capital and funding directly connected to other area components. Of note are credits related to the reduction in costs for new commercial clean vehicles Classes 1-3 and Classes 4 and above; as well as for grants to reduce air pollution at ports.

NATIONAL FREIGHT STRATEGIC PLAN

The National Freight Strategic Plan (NFSP) was last updated in September 2020 and defines the U.S. DOT's vision and goals for the Nation's multimodal freight system and defines strategies to achieve those goals. The Department developed this Plan through a multi-agency effort involving extensive consultation with freight stakeholders in both the public and private sectors. The Department will use it to guide national freight policy, programs, initiatives, and investments. The Plan will also be used to inform state freight plans and identify freight data and research needs. Additionally, it provides a framework for increased cross-sector, multijurisdictional, and multimodal coordination and partnerships. This Plan meets the requirement of the FAST Act and remains consistent with the BIL to develop a strategic plan to implement the goals of the new National Multimodal Freight Policy.

FHWA OFFICE OF FREIGHT MANAGEMENT AND OPERATIONS

The FHWA's Office of Freight Management and Operations works to improve goods movement on the U.S. transportation system and across borders. To advance this mission, the Office administers programs and activities including:

- National Freight Program implementation: Develop and update guidance; coordinate reviews of State Freight Plans and certification of Critical Urban and Critical Rural Freight Corridors; manage mapping activities for the National Highway Freight Network, Primary Highway Freight System,

and highway elements of the National Multimodal Freight Network; and conduct freight conditions and performance reporting.

- **Funding Programs:** Oversee the federal aid apportionments for the National Highway Freight Program (formula program for State DOTs). Manage FHWA freight-related discretionary grant programs, including application reviews and grant oversight/implementation for RAISE, formerly known as the Better Utilizing Investments to Leverage Development (BUILD) Program and TIGER Program, and the MPDG formerly known as the Infrastructure for Rebuilding America (INFRA) Program, and FASTLANE or the Nationally Significant Freight and Highway Projects Program. Conduct oversight of legacy programs including Projects of National and Regional Significance, National Corridor Infrastructure Improvement, Freight Intermodal Distribution Pilot, and Truck Parking Facilities Program.
- **Freight Data and Analysis:** Develop new and improved analytical tools and data to support freight planning and prioritization, including the Freight Analysis Framework; bottlenecks identification; performance measurement; reliability on the Interstate Highway System; supply chain fluidity analysis; intermodal connectors analysis; etc.
- **Freight Planning, Program Development, and Partnerships:** Assist transportation and planning professionals in developing freight knowledge and skills, including through the compilation of best practices in urban goods movement, truck permitting/pilot car/oversize-overweight vehicles, emergency routing; and leadership in truck parking solutions through the management of the National Coalition on Truck Parking and administration of the Jason's Law Truck Parking Survey and Assessment; partnership and peer-to-peer activities in corridor planning, off-hours delivery, and other topics.
- **Research:** Initiate projects to support strategic focus areas of truck size and weight; freight infrastructure; network efficiency; automation; and environmental considerations of freight operations.
- **Vehicle Size and Weight Regulatory Requirements:** Certify state compliance with Federal size and weight standards for commercial motor vehicles. Provide information on state enforcement activities, reporting requirements, state truck permitting contacts, and Stafford Act authorities in the event of a Presidentially declared emergency. Handle requests for technical assistance relating to length requirements on the National Network and weight requirements on the Interstate Highway System.

OTHER FEDERAL AGENCY COORDINATION

In addition to the BIL, U.S. DOT's guiding freight planning vision, and FHWA's Office supporting freight management and operations, there are a wide variety of federal agency departments, administrations, associations, and regulatory entities that serve as important agencies to engage with. This includes performing research, to directly obtaining data and information, to collaboration and coordination on planning and implementation. Examples where SCAG has worked directly with these federal agencies includes:

- American Association of Port Authorities (AAPA)
- American Trucking Association (ATA)

- American Trucking Research Institute (ATRI)
- Federal Aviation Administration (FAA)
- Federal Highway Administration (FHWA) Office of Freight Management and Operations
- Federal Motor Carriers Safety Administration (FMCSA)
- Federal Railroad Administration (FRA)
- Maritime Administration (MARAD)
- Surface Transportation Board (STB)
- United States Army Corps of Engineers (USACE)
- United State Bureau of Labor Statistics (BLS)
- United States Census Bureau International Trade
- United States Census Bureau Monthly Retail Trade
- United States Department of Agriculture (USDA)
- United States Department of Energy (DOE)

3.1.2 STATE

SCAG has a very clear and vested role with the California Department of Transportation (Caltrans) through direct coordination and collaboration on numerous policy, planning, and implementation efforts. Connect SoCal serves as a core input to many statewide plans and processes, and in turn state plans and requirements inform regional goods movement planning efforts. SCAG and the Caltrans Districts are aligned across SCAG's counties and coordinated work includes goods movement studies and projects, as well as district representation on Project Advisory Committee (PAC) and Technical Advisory Committee (TAC) guiding committees on these same goods movement studies and projects. Recently, SCAG has coordinated with the Caltrans Districts to initiate quarterly meetings to collaborate on state and regional efforts with the primary objective of creating transparency for current work, and visibility on what is coming in the near-term. In the Caltrans section below are key goods movement-related efforts on which SCAG regularly collaborates with the state.

In addition to working on numerous policy, planning, and implementation components of goods movement with Caltrans, SCAG is engaged with numerous state agencies including:

- California Air Resources Board (CARB)
- California Energy Commission (CEC)
- California Governor's Office of Business and Economic Development (GO-Biz)
- California Public Utilities Commission (CPUC)
- California State Transportation Agency (CalSTA)
- California Transportation Commission (CTC)

CALTRANS

Caltrans manages more than 50,000 miles of California's highway and freeway lanes, provides inter-city rail services, permits more than 400 public-use airports and special-use hospital heliports, and works with local agencies. Caltrans carries out its mission with six primary programs: Aeronautics, Highway Transportation, Mass Transportation, Transportation Planning, Administration, and the Equipment Service Center. The Caltrans 2020-2024 Strategic Plan provides its vision, mission, and values, and core goals and strategic imperatives to deliver a world-class transportation system for one of the nation's most populous, innovative, and diverse states.

California Freight Advisory Committee

In 2013, Caltrans established the California Freight Advisory Committee (CFAC) in collaboration with the California Transportation Agency (CalSTA). The CFAC is a charter member advisory body representing public and private sector freight stakeholders, including representatives of ports, shippers, carriers, freight-related associations, the freight industry workforce, the transportation department of the State, and local governments. The CFAC provides extensive dialogue across the state with respect to goods movement policies, plans and programs, and many other pertinent issues to goods movement.

California Sustainable Freight Action Plan

In July 2015, Governor Brown issued Executive Order B-32-15, which provided a vision for California's transition to a more efficient, more economically competitive, and less polluting freight transport system. This transition of California's freight transport system is essential to supporting the State's economic development in coming decades while reducing harmful pollution affecting many California communities. As a key first step, the Governor's Executive Order directed the CalSTA, California Environmental Protection Agency (CEPA), Natural Resources Agency (NRA), CARB, Caltrans, CEC, and GO-Biz to develop a California Sustainable Freight Action Plan (Action Plan), by July 2016. This Action Plan is an unprecedented effort, intended to integrate investments, policies, and programs across several State agencies to help realize a singular vision for California's freight transport system. This Action Plan provides a recommendation on a high-level vision and broad direction to the Governor to consider for State agencies to utilize when developing specific investments, policies, and programs related to the freight transport system that serves our State's transportation, environmental, and economic interests. The Action Plan includes recommendations on:

- A long-term 2050 Vision and Guiding Principles for California's future freight transport system.
- Targets for 2030 to guide the State toward meeting the Vision.
- Opportunities to leverage State freight transport system investments.
- Actions to initiate over the next five years to make progress towards the Targets and the Vision.
- Pilot projects to achieve on-the-ground progress in the near-term.
- Additional concepts for further exploration and development, if viable.

California Transportation Plan

The California Transportation Plan 2050 is the State's statutorily fiscally unconstrained long-range transportation roadmap for positive change that:

- Provides a unifying and foundational policy framework for making effective, transparent, and transformational transportation decisions in California;
- Addresses the varied transportation needs of urban, suburban, rural, and Tribal communities; and
- Emphasizes implementation and identifies a timeline, roles, and responsibilities for each plan recommendation.

The CTP does not contain projects, but policies and strategies required to close the gap between what the regional transportation plans (RTP) aim to achieve and how much more is required to meet 2050 goals.

California Freight Mobility Plan

The California Freight Mobility Plan (CFMP) 2023 is a comprehensive plan that governs the immediate and long-range planning activities and capital investments by the state with respect to freight movement. Caltrans is developing the CFMP 2023 to provide a long-term vision for California's freight future. The

CFMP 2023 was developed in collaboration with various State, regional and local partners, public and private sectors, and the members of the CFAC. The CFMP also complies with California State Government Code Section 13978.8(b)(1) (Assembly Bill 14, Lowenthal) and the provisions of United States Code 49 USC 70202: State freight plans (Infrastructure Investment and Jobs Act, or IIJA), which requires each state that receives funding under the National Highway Freight Program to develop a State Freight Plan every four years.

California State Rail Plan

The California State Rail Plan (Rail Plan) reaffirms the State’s Vision for an integrated, statewide rail and transit network that delivers on California’s ambitious, yet vital, economic, environmental, and equity goals. In line with California Transportation Plan 2050 (CTP 2050) and the Climate Action Plan for Transportation Infrastructure (CAPTI), an integrated statewide rail network supports economic growth, improves environmental outcomes, and increases equity by providing the seamless mobility Californians need and shifts travel demand to zero-emission, high-capacity transport that supports efficient, sustainable land use. Regional implementation planning and project delivery build on the Rail Plan, as communities realize improved service, develop regional networks, and set land use recommendations that leverage enhanced connectivity. The rail plan is the strategic funding and programming document for rail in California. In compliance with federal and state laws, the Rail Plan proposes a unified statewide network that aligns needs for passenger and freight service and connects passenger rail to other modes. The network will capture an increasing share of passenger and freight travel by rail to support economic, environmental, and equity goals.

OTHER STATE AGENCY COORDINATION

In addition to the direct coordination between SCAG and Caltrans, SCAG has coordinated on numerous efforts with other state agencies to ensure that the SCAG region remains engaged and well-represented throughout recurring programs as well as with new opportunities.

CTC – Trade Corridor Enhancement Program

The purpose of the TCEP is to provide funding for infrastructure improvements on federally designated Trade Corridors of National and Regional Significance, on California's portion of the NHFN, as identified in CFMP, and along other corridors that have a high volume of freight movement. The TCEP will also support the goals of the NHFP, the CFMP, and the guiding principles in the state’s Action Plan. This statewide, competitive program will provide approximately \$400 million per year in state funding and approximately \$125 million in NHFP funds, as part of the BIL.

Eligible applicants apply for program funds through the nomination of projects. All projects nominated must be identified in a currently adopted regional transportation plan. The Commission is required to evaluate and select submitted applications based on the following criteria:

- Freight System Factors – Throughput, Velocity, and Reliability;
- Transportation System Factors – Safety, Congestion Reduction/Mitigation, Key Transportation Bottleneck Relief, Multi-Modal Strategy, Interregional Benefits, and Advanced Technology;
- Community Impact Factors – Air Quality Impact, Community Impact Mitigation, and Economic/Jobs Growth;
- The overall need, benefits, and cost of the project
- Project Readiness – ability to complete the project in a timely manner;
- Demonstration of the required 30 percent matching funds;

- The leveraging and coordination of funds from multiple sources; and
- Jointly nominated and/or jointly funded.

The TCEP includes a two-year funding cycle that is revisited through a formal process prior to each program guidelines development process. Program guidelines are created in consultation with agencies identified in Governor’s Executive Order B-32-15, regional transportation planning agencies, local governments, private industry, and other advocates. Prior to adoption of the guidelines, the Commission conducts numerous public workshops throughout the state to solicit input and feedback.

CTC – Senate Bill 671 Clean Freight Corridor Efficiency Assessment

The Commission, in coordination with CARB, CPUC, State Energy Resources Conservation and Development Commission, and GO-Biz, shall develop the Clean Freight Corridor Efficiency Assessment. The goal of the assessment is to identify freight corridors, or segments of freight corridors, and infrastructure needed to support the deployment of zero-emission medium- and heavy-duty vehicles. The commission shall consider the potential for emission-reductions, infrastructure needed for charging and alternative fueling, including parking facilities, congestion reduction, improved road safety and resiliency, and impacts to neighboring communities. The commission shall consult with the department, local governments, metropolitan planning organizations, regional transportation planning agencies, and other stakeholders, including, but not limited to, the freight industry, stakeholders from low-income and disadvantaged communities, environmental organizations, public health representatives, and academia, to develop the assessment. In developing the assessment, the commission shall identify all of the following:

- Freight corridors, or segments of freight corridors, throughout the state that would be priority candidates for the deployment of zero-emission medium- and heavy-duty vehicles.
- The top five freight corridors, or segments of freight corridors, with the heaviest freight volume and near-source exposure to diesel exhaust and other contaminants.
- Projects that would achieve the goals of the assessment, including, but not limited to, all of the following projects:
 - Medium- and heavy-duty vehicle charging and fueling infrastructure.
 - Highway improvements needed to accommodate charging and fueling infrastructure, including parking facilities.
 - Highway improvements on the corridor to increase safety and throughput, such as dedicated truck lanes.
 - Improvements to local or connector streets and roads to support the corridor.
 - An identification of areas where micro-grids or similar technologies could be deployed for zero-emission vehicle charging or fueling.
- Potential sponsors of projects to achieve the goals of the assessment, including, but not limited to, the department, regional transportation agencies, local governments, the freight industry, and nonprofit organizations.
- Barriers and potential solutions to achieving the goals of the assessment and the deployment of zero-emission medium- and heavy-duty vehicles.
- The impact on roads and bridges due to the increased weight of zero-emission vehicles.
- Methods to avoid displacement of residents and businesses on the freight corridor when considering projects that achieve the goals of the assessment.
- Potential funding opportunities for project types.
- Benefits from the deployment of zero-emission medium- and heavy-duty vehicles, including, but not limited to, environmental, air quality, public health, and highway safety benefits, and economic competitiveness.

The commission shall submit a report detailing the assessment and its recommendations for the deployment of zero-emission medium- and heavy-duty vehicles to the relevant policy and fiscal committees of the Legislature on or before December 1, 2023.

Caltrans/CEC – Charging and Fueling Infrastructure Grant Program

As part of the CFI fiscal year 2022 and 2023 \$700 million funding opportunity, SCAG coordinated across regional partners and state agencies to develop a scope for the state’s West Coast Truck Charging and Fueling Corridor Project application submission. This multistate project will support early deployment of infrastructure for zero-emission trucks along the West Coast. This first-of-its-kind project will create a network of charging and hydrogen fueling stations and enable zero-emission trucking from Mexico to Canada, linking ports and major freight centers in California, Oregon, and Washington. The project will play a critical role in alleviating significant air pollution and global warming emissions associated with medium- and heavy-duty vehicles GHG. The cities and regions that will benefit from this project constitute many of the most polluted areas in the United States, based on the major categories of air pollution tracked by the American Lung Association. This project will further support key policy actions in California, Oregon, and Washington that require the sale of zero-emission trucks beginning in model year 2024. This project will be critical to scaling the zero-emission truck industry and job creation expected with this transition.

CPUC – Freight Investment Planning

SCAG is coordinating with the CPUC’s Freight Investment Planning (FIP) efforts by participating in the development process. SCAG is leveraging work from its Zero Emission Truck Infrastructure Study (ZETI) to coordinate and collaborate on zero-emission infrastructure planning, development, and implementation.

GO-Biz – Critical Minerals in California

SCAG participated on the Critical Minerals in California Building the Supply Chain for Tomorrow panel. California is home to one of the densest ecosystems of critical minerals on Earth. These critical minerals include rare earths, lithium, boron, and others. California is uniquely equipped to accelerate the nation’s supply chain goals for clean technologies, semiconductors, and defense applications. State and federal funding have been released and/or announced to support critical mineral ecosystem development. This dialogue included many stakeholders both from federal and state levels of government and across public and private sectors to better understand the business cases, while also discussing challenges and concerns based on the economic opportunity.

CalSTA – Southern California Integrated Rail Approach

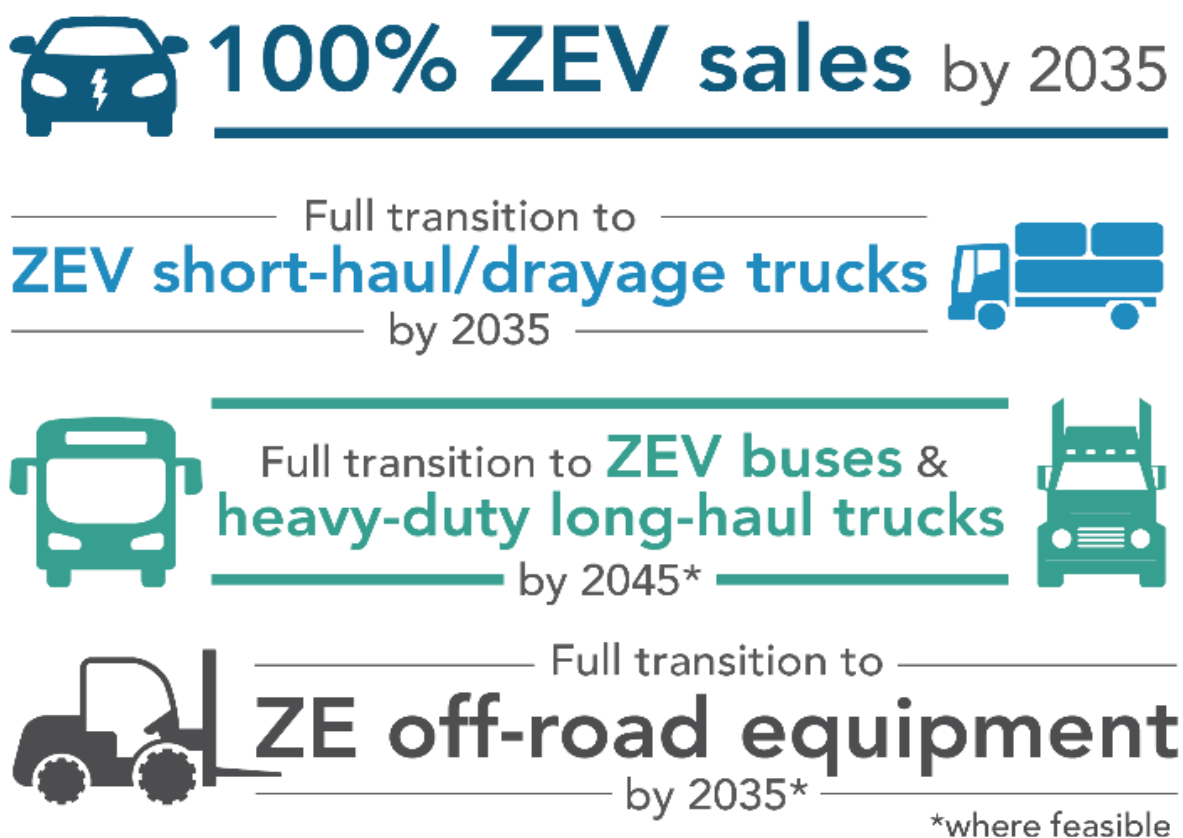
SCAG coordinated with CalSTA to initiate listening sessions early in 2022 to respond to the extreme supply disruptions from the COVID-19 pandemic within Southern California. Executives from various agencies in the region convened to discuss project priorities and initiatives. Leveraging work from SCAG’s Integrated Passenger and Freight Rail Forecast Study, SCAG is supporting collaboration efforts across key rail stakeholders to ensure that the region will remain competitive for future funding program opportunities.

STATE REGULATION

In an effort to combat climate change and improve air quality, the state implemented a number of measures aimed at accelerating the adoption of zero emission vehicles (ZEV) and near-zero emission

vehicles (NZEV). These include mandates requiring automakers to produce a certain percentage of zero emission vehicles, financial incentives for consumers who purchase such vehicles, and investments in charging and fueling infrastructure. In September 2020, Governor Newsom signed Executive Order No. N-79-20 which directs state agencies to develop strategies to transition all medium- and heavy-duty vehicles to ZEVs by 2045. The order also includes directives for accelerating the deployment of charging infrastructure, increasing the number of ZEVs in public fleets, and promoting increased consumer awareness and adoption of EVs.^{xix} This executive order sets the stage for the state to implement policies to accomplish these ambitious targets. A number of regulations have already gone into effect, which were designed to address all vehicle modes, including light-, medium-, heavy-duty, and transit vehicles as well as rail. Table 4 below summarizes the most significant of these regulations.

Figure 22. Zero Emission Vehicles Adoption Timeline



Source: California Air Resources Board

Table 4. California Regulations Supporting ZEV Deployment

Regulation	Description
Advanced Clean Trucks Regulation	The ACT regulation requires manufacturers of medium- and heavy-duty vehicles to sell increasing percentages of ZEVs in California, culminating in a requirement for 100% ZEV sales by 2045.
Advanced Clean Fleets Regulation	The regulation requires fleets operating in California to transition to zero emission technology with the goal of transitioning all drayage trucks to zero emission by 2035 and the rest of the MD-HD vehicles to zero emission by 2045. Starting in 2036, manufacturers can only sell zero-emission medium- and heavy-duty vehicles. From January 1, 2024, trucks participating in drayage activities in California must be registered with the CARB Online System, with only zero-emission trucks allowed to register from 2024 onwards. All drayage trucks must be zero-emission by 2035. High priority and federal fleets must either follow the Model Year Schedule, buying only ZEVs from 2024 and phasing out internal combustion vehicles that have passed their useful life starting in 2025, or the optional ZEV Milestones Option, meeting phased-in ZEV targets. State and local government fleets must have 50% ZEV purchases from 2024 and 100% by 2027, although small government fleets and certain counties can start their ZEV purchases in 2027.
Low NOx Omnibus Regulation	The HD Omnibus Regulation requires heavy-duty engines of model year 2024-2026 to meet a 0.05 g/bhp-hr NOx standard, with more stringent standards for subsequent model years, aimed at ensuring real-world emissions performance critical for attaining federal health-based air quality standards for ozone in 2031. The regulation is expected to make clean diesel technology commercially available nationwide in the next 3-5 years.
In-Use Locomotive Regulation	The proposed in-use locomotive regulation would require locomotive operators in California to fund a spending account based on emissions and use the funds to purchase or upgrade to the cleanest locomotives. Starting in 2030, only locomotives less than 23 years old and those with an original engine build date of 2030 or newer would be allowed to operate in California, and by 2035, all Class I line haul locomotives with an original engine build date of 2035 or newer would need to operate in a zero-emission configuration.
Zero Emission Truck Measure	This measure, as proposed in 2022 State SIP Strategy, would seek to accelerate the number of zero-emissions (ZE) trucks beyond existing measures (including the proposed Advanced Clean Fleets regulation). The measure seeks to upgrade the remaining heavy-duty combustion trucks to new or used ZE trucks rather than cleaner combustion engines. CARB has committed to implement regulatory strategies to achieve this goal, such as differentiated registration fees, restrictions and fees for combustion trucks entering low and ZE zones, or indirect source rules (ISR). Alternatively, the measure could require combustion truck fleets to be scrapped and replaced with ZE trucks at the end of their useful lives. The measure would potentially be heard by the Board in 2028 as part of the comprehensive strategy to achieve zero-emissions medium- and heavy-duty vehicles by 2045.

Source: SCAG Clean Technology Compendium

To facilitate the transition of on-road and rail transportation to zero and near-zero emission technology, the State also implemented a number of incentive programs (Table 5). These include rebate programs, vehicle replacement programs, point-of-sale incentives, and infrastructure incentives. The table below lists incentive programs that are currently in effect and are directly supporting the expansion of ZEVs and infrastructure in the SCAG region.

Table 5. California Incentive Program for Clean Technology Adoption

Incentive Programs	Description
Clean Vehicle Rebate Project (CVRP)	The CVRP provides rebates to California residents who purchase or lease eligible clean vehicles. The amount of the rebates offered by CVRP varies depending on the type of vehicle and its all-electric range, but they generally range from \$1,500 to \$7,000 for most eligible vehicles. The CVRP rebate can be combined with federal, state, or local agency incentives as well as Administrator match funding, if available, to help further buy-down an eligible vehicle’s cost
California HVIP	HVIP is a point-of-sale incentive program that provides a voucher up to \$120,000 for zero-emission trucks. At the time of drafting this report, the program has supported the purchase of 2,400 natural gas and 1,800 battery-electric trucks since 2010 (redeemed vouchers), and over half of all voucher requests have come from disadvantaged communities seeking DPM reductions.
CEC Clean Transportation Program	The program provides funding for a range of projects, including research and development, pilot projects, and infrastructure deployment. The amount of funding each applicant receives from the varies depending on the specific project and the type of funding requested. Generally, applicants can receive funding for up to 100% of their project costs, although some funding programs require a cost share or matching funds from the applicant. The maximum award amount for some programs can be up to several million dollars, while others may provide smaller grants or loans. The specific funding amount for each project is determined through a competitive application process, with awards granted based on project feasibility, environmental benefits, and other factors.
Low Carbon Fuel Standard LCFS	The LCFS is a California regulation that creates a market mechanism that incentivizes low carbon fuels. The regulation requires the carbon intensity of California’s transportation fuels to decrease by 20 percent through the 2030 timeframe and maintains the standard afterwards. The number of credits that a fleet generates is based on the amount of electricity used to charge and the carbon intensity of that electricity. Fleets that strategically use renewable electricity for charging, or purchase renewable energy certificates (RECs), can further increase their LCFS revenue streams. In addition to generating LCFS credit for dispensed fuel, the eligible hydrogen station, or DC fast charger can generate infrastructure credits based on the capacity of the station or charger minus the quantity of dispensed fuel. Currently stations intended for light duty vehicles (<1,200 kg/day for hydrogen stations and <350 kW per charger for charging stations) are eligible for the capacity credits. As more ZEVs use the station and the station utilization increases, the site will generate more LCFS fuel credits and fewer infrastructure credits.

Source: SCAG Clean Technology Compendium

3.2 REGIONAL AND LOCAL POLICIES

The SCAG region is a leader in local actions to promote zero-emission and clean technologies. These include local regulations pertaining to warehouses, ports, rail and intermodal facilities. South Coast AQMD's Warehouse Actions and Investments to Reduce Emissions (WAIRE) program, also known as Rule 2305, or the Warehouse Indirect Source Rule (ISR), requires large warehouses to reduce their emissions by either implementing specific measures to reduce emissions on site or by investing in off-site projects that achieve equivalent emissions reductions. The program aims to reduce the amount of air pollution generated by the warehousing industry, particularly in communities disproportionately impacted by air pollution. The proposed Indirect Source Rule (ISR) for Commercial Marine Ports is also another potential regulatory actions that intends to reduce emissions from equipment, vehicles and vessels operating at marine ports in Southern California. This program requires that ports develop and implement emission reduction plans that include measures such as equipment turnover and electrification, incentives for the use of cleaner vehicles and equipment, and traffic management strategies. South Coast AQMD is also considering another ISR, designed to prioritize new and current rail yards and intermodal facilities. This ISR mandates owners and operators to develop plans to decrease emissions from locomotives, cargo handling machinery, and trucks used in and around these facilities. The ISR offers various choices for compliance, which includes using zero-emission technology, alternative fuels, and operational improvements to minimize idling and other practices that contribute to emissions.

In addition to policy drivers at the state and regional levels, cities are also taking action to support reducing emissions from the transportation sector. For example, the City of Los Angeles released its Green New Deal Plan,^{xx} which highlights its commitment to reducing GHG emissions and transitioning to a carbon-neutral economy by 2050. The plan outlines strategies to accelerate the adoption of ZEVs, including increasing charging infrastructure and providing incentives for both individual and fleet purchases of EVs. The plan also aims to electrify the City's entire bus fleet by 2028.

As the impacts of climate change become increasingly evident, many local entities in the SCAG region are taking action to reduce GHG emissions by implementing a variety of policies and programs. Here is a list of some of the key actions:

- The Clean Air Action Plan^{xxi} (CAAP) is a joint initiative between the Ports of Long Beach and Los Angeles to improve air quality in the region by reducing emissions from port-related sources. The CAAP includes a range of strategies aimed at reducing emissions from ships, trucks, cargo handling equipment, locomotives, and harbor craft operating in and around the ports, including the adoption of clean technologies such as zero-emission equipment and vehicles, the expansion of on-dock rail infrastructure, and the development of emissions reduction targets and reporting requirements for port tenants and operators. The goal of the CAAP is to promote sustainable growth and reduce the environmental impact of port operations on nearby communities, while maintaining the economic competitiveness of the ports. As part of the CAAP the Clean Truck Fund was established which provides funding to help trucking companies purchase low-emission or zero-emission trucks, with the amount of funding varying depending on the type of truck being purchased. The program is funded through a tariff on containers moving through the ports and is designed to help trucking companies transition to cleaner technologies while improving air quality in the surrounding communities. The program is scheduled to run through 2023 and has provided over \$78 million in funding to help replace older, high-emitting trucks with cleaner alternatives.^{xxii}

- The Los Angeles County Metropolitan Transportation Authority (LA Metro) released the I-710 Clean Truck Program^{xxiii} in 2020, with the goal of introducing 4,000 zero- and near-zero emissions trucks to the I-710 freeway and reducing the number of diesel trucks traveling through I-710 communities. This program is part of the larger I-710 Project, which includes various initiatives like the I-710 Early Action Soundwall Program, I-710 Community Health Benefit Program, and I-710 Congestion Relief Program. In 2020, the LA Metro Board authorized \$50 million for the program and directed staff to develop elements of the program and seek additional state and federal discretionary funding to reach a minimum target of \$200 million. In response to this direction, the I-710 Zero Emission Truck Program working group was established by LA Metro in November 2021 and includes partner agencies and community advocacy groups.
- The Los Angeles Cleantech Incubator (LACI) has established the Transportation Electrification Partnership to accelerate transportation electrification and zero-emissions goods movement in the Greater Los Angeles region, ahead of the 2028 Olympic and Paralympic Games. This partnership, which involves local, regional, and state stakeholders, aims to achieve a 25 percent reduction in GHG emissions and air pollution beyond existing commitments by 2028. To achieve this goal, the partnership has set specific targets, such as having 30 percent of all light-duty passenger vehicles on the road and 80 percent of passenger vehicle sales be electric by 2028 and having 40 percent of all drayage and short haul trucks and 60 percent of medium-duty delivery trucks be electric. The partnership aims to have 84,000 public and workplace chargers available for single occupancy vehicles and 95,000 available for medium and heavy-duty trucks by 2028.
- Southern California Edison (SCE), the largest electricity provider in the region, has created the Charge Ready Program, which provides funding for the installation of charging stations, as well as ongoing support and maintenance. Participants can choose from a variety of charging station options and customize the program to meet their specific needs. The program is designed to support the growth of EV adoption and increase the availability of charging stations, which in turn can help reduce GHG emissions from transportation. The Charge Ready program is part of SCE's broader efforts to promote clean energy and support the transition to a low-carbon future.^{xxiv}
- Southern California Gas Company (SoCal Gas) is also involved in various clean transportation applications^{xxv}, including developing near-zero emission heavy-duty truck engines and compressed natural gas (CNG) hybrid heavy-duty drayage trucks to reduce GHG emissions and improve air quality in the Los Angeles area, particularly in the I-710 corridor, the Port of Los Angeles, and the Port of Long Beach. The company has also worked on demonstrating the benefits of in-home refueling for natural gas vehicles and supporting the development of advanced storage tank technologies that offer higher capacity and a smaller ecological footprint. These tanks will allow natural gas vehicles (NGVs) to have a trunk carrying capacity that is equivalent to gasoline vehicles, while still providing the benefits of using a cheaper and cleaner alternative fuel. This effort is part of SoCalGas's broader commitment to promoting the adoption of NGVs as a means of reducing GHG emissions and improving air quality.

3.3 PLANNING CONTEXT

SCAG serves as the region's MPO and one of the key values this role provides regional partners, member agencies, and key freight stakeholders including communities, is the connection with federal, state, regional, and local policies, programs and processes, planning tools and analyses, and other information and resources. As a regional body, SCAG is committed to creating transparency through data-driven

decisions, while taking a holistic and comprehensive review of goods movement. SCAG is able to accomplish this in multiple ways adding value to the region's goods movement planning needs.

3.3.1 FEDERAL AND STATE PROGRAMS

SCAG plays an essential role in federal and state programs. SCAG regularly participates in strategic planning development for the NFSP, represents the region on the CFAC, and supports state planning efforts regarding the CTP, the Action Plan, and CFMP. SCAG regularly participates in the development of the TCEP guidelines and serves as the MPO designated to confirm consistency with Connect SoCal with respect to the project nomination process, including a comprehensive listing of such projects. SCAG has regularly participated on the SB 671 Clean Freight Corridor Efficiency Assessment supporting the region in identifying priority freight corridors and zero-emission infrastructure project-related information. In addition, SCAG continues to support the region across many other federal and state programs whether through sponsorship and partnerships on grant program opportunities, support letters to highlight critical projects seeking funding awards, or working with federal and state program staff to discuss key topics and analyses leading to policy considerations.

3.3.2 REGIONAL PARTNER COORDINATION

As part of SCAG's planning efforts, SCAG regularly discusses key freight issues and topics with its regional partners. SCAG coordinates on many efforts with the region's county transportation commissions, and the SPBPs and Port Hueneme on a regular basis to ensure regional collaboration is fluid. SCAG participates on transportation plan development at the county level across these commissions, as well as on port-related studies. Meetings are also held at the executive level to align key vision and goals and implementation strategies across these staff-led discussions and goods movement planning work. Additionally, SCAG engages with academic institutions throughout the region to present and participate on numerous efforts supporting goods movement programs and funding opportunities.

3.3.3 REGIONAL PROGRAMS AND STUDIES

SCAG leads many research efforts, studies, projects, and has multiple programs in place supporting goods movement work throughout the region. Recent work has involved numerous efforts as further described below.

LAST MILE FREIGHT PROGRAM

SCAG has partnered with the Mobile Source Air Pollution Reduction Review Committee (MSRC) to establish the LMFP. SCAG has developed a two-phased approach for the LMFP.

Phase 1

Projects have been selected and is currently in implementation phase. Focusing on the commercial deployment of zero-emission or near-zero emission (ZE/NZE) heavy and/or medium duty on road trucks (including ZE/NZE equipment and supporting infrastructure).

Phase 2

Further expanding Phase 1 projects through coordination with both public and private sector stakeholders to deploy broader innovative technologies currently being demonstrated by leading last mile delivery companies, particularly in e-commerce use-cases.

A total of \$16.8 million has been approved for Phase 1 project implementation that includes 26 projects. These projects reflect a diverse range of industry participants from small independent owner operators (1 to 10 truck operations) to newer small business start-ups for Truck-as-a-Service and Fleet-as-a-Service business models, to some of the largest companies in the world for their respective markets like Sysco Corporation, and PepsiCo, Inc., and Penske, to other major players like Quality Custom Distribution. The LMFP serves as a regional mechanism to support the transition to zero-emission technologies, while establishing and sustaining critical public-private partnerships to improve understandings with respect to these new technologies. Key goals of the program include providing public air quality benefits and identifying industry return on investment sufficient to scale these technologies further.

ZERO EMISSION TRUCK INFRASTRUCTURE STUDY

The ZETI is meant to help envision a regional network of zero emission truck charging and fueling infrastructure. Planning and construction of medium- and heavy-duty truck charging stations strategically located throughout Southern California is needed to improve air quality, reduce greenhouse gas (GHG) emissions, and meet state and federal goals and requirements, while supporting the goods movement industry. This study is working towards creating a blueprint and action plan to realize this goal and answer key questions about how stations in the region may operate to serve different truck markets and how charging infrastructure may operate business functions.

The studies primary objectives are to:

- Develop a regional plan for charging and fueling infrastructure for zero-emission trucks based on an extensive study of needs throughout Southern California.
- Include a truck market study to calculate the expected energy demand for charging and fueling stations for future year scenarios.
- Perform phased mapping of proposed station locations.
- Consider existing public and private sector plans from around the region.
- Include engagement with truck drivers, fleet operators and warehouse operators, developers, operator of terminals and intermodal facilities, and community organizations.
- Create high-level plans for 10-12 site specific station locations.

This study's findings and products will be incorporated into the Electric Truck Research and Utilization Center (eTRUC) Project, funded by the CEC Research Hub for Electric Technologies in Truck Applications (RHETTA) Program and led by the Electric Power Research Institute (EPRI). The ZETI is a great example of SCAG's comprehensive approach to regional planning and strong coordination with state and regional partners on the public, private, and community sides to ensure that a holistic perspective is achieved.

INTEGRATED PASSENGER AND FREIGHT RAIL FORECAST

The SCAG Integrated Passenger and Freight Rail Forecast Study served as an initial approach for the region to assess freight and passenger rail in a comprehensive manner. The study evaluated existing and future rail volumes, identified infrastructure needs and prepared a strategic vision for implementation

strategies in the region. The study was developed during the COVID- 19 pandemic and considered current assumptions about rail shipments and passenger service levels. The study provides recommendations on service expansion and capital improvements and serves as a resource to position the region for rail-related funding opportunities, aligning with core principles of SCAG's Goods Movement Resolution.

This study forecasted future passenger and freight rail train volumes through 2050; evaluated future passenger and freight train movements and identified track capacity improvements; estimated cost of rail infrastructure improvements; developed funding strategies to accommodate future needs; and provided a mechanism to identify strategic corridors to increase grant funding prospects. The forecast also suggested that to accommodate future service levels and the integration of the California High-Speed Rail project by 2035, there is approximately \$20 billion in investment needs.

SCAG remains directly engaged with the region's rail stakeholders to advance the forecast's findings into the funding and implementation phase. SCAG will continue to convene stakeholders to further develop the Strategic Corridors Vision and the development of a phased/programmatic investment plan. This will position rail stakeholders in the region, through collaboration with state and federal agencies, to identify funding programs and opportunities to further implementation needs. Collaboration with CalSTA, Southern California Regional Rail Authority, LOSSAN Agency, the region's county transportation commissions and Class I freight railroads, among others, will need to be coordinated to fully support the phasing and implementation of these identified improvements.

CURB SPACE MANAGEMENT

SCAG is focusing on curb-related analyses notably through work done from the LMFS and CSMS. The LMFS served as the initial last-mile delivery assessment establishing a baseline approach to reviewing the complexities and challenges associated with this final mile of freight activity. The CSMS provided a more holistic assessment of all curb uses as the LMFS quickly determined that analyzing freight activity in a vacuum was not conducive to determining toolkits and strategies. The CSMS focused on taking this holistic approach and applying broad-based recommendations to ensure that placement of last-mile delivery utilization at the curb would also consider passenger-related and curb activity characteristics. Building off the work done in these efforts, the Curb Space Data Collection and Inventory Study (CSDI) is working to identify key policies, strategies, and technological solutions to address curb management issues further. This study also looks at multimodal approach to curb space including modes like personal vehicles, transit, pedestrians, bicyclists, freight delivery vehicles, etc. Strategies and pilot project concepts will be developed collaboratively between SCAG and the cities with input from the communities, transit agencies, key private sector stakeholders including last mile commercial delivery companies, TNCs, etc. The study will result in data- driven, real-world implementation plans maximizing technologies where appropriate. The CSDI is part of SCAG's Sustainable Communities Program (SCP).

SCAG serves as a sub-recipient to the Los Angeles Cleantech Incubator (LACI) on the Curb Management and Integrated Strategies to Catalyze Market Adoption of Electric Vehicles under the United States Department of Energy's (DOE) Vehicle Technologies Office Fiscal Year 2021 Research Funding Opportunity. The study is aimed at reducing carbon dioxide (CO₂) emissions from passenger cars and light- and heavy-duty trucks. The project builds upon pre-existing traffic data and curb management deployments in two metropolitan areas, Los Angeles, CA and Pittsburgh, PA, including delivery and ride-hail use cases. The results of this proposal would provide cities across the United States with a roadmap to accelerate zero-emission transportation adoption and lower VMT within the commercial activities responsible for the largest impacts on inefficient energy use, congestion, and pollution.

COMMUNITY ENGAGEMENT

SCAG is engaged with community representatives throughout much of its goods movement planning efforts. To focus exclusively on community freight-associated issues, the Southern California Goods Movement Communities Opportunities Assessment aimed to better understand goods movement communities' perspectives and opportunities. While the benefits of goods movement are broadly dispersed in support of our consumption and economic activity, impacts are often concentrated, having disproportionate impacts on certain communities. It is therefore important to ensure that those most impacted are benefiting from the economic opportunities generated by the region's goods movement industry.

This study looked to improve the ability of communities to capture the economic benefits of goods movement through a closer look at workforce development initiatives. It focused on public health, workforce development, and communications best practices. Key products included a best practices toolkit for impacted communities, recommendations for impacted communities and the region, and a communications strategy for SCAG goods movement outreach^{xxxvi}.

As SCAG continues to develop products, policy recommendations and solutions, the agency remains committed to working with local communities to strengthen partnerships through relationships, improved knowledge, and trusted perspectives.

SUPPLY CHAIN ANALYSIS

SCAG has been strongly involved in analyzing supply chains across the comprehensive intermodal freight components of the goods movement system, notably with the Comprehensive Regional Goods Movement Plan and Implementation Strategy (On the Move). Recent efforts have included SCAG's Industrial Warehouse Study that looked to better understand industrial facility use-types and to estimate expected industrial square footage growth over time. While supply chains remain highly complex from a company-by-company stance and freight flow relationship due to the many shipment interchanges and moves both locally and nationally, there are clear relationships across trade gateways and major supporting nodes such as intermodal rail yards, major truck terminal facilities, and air cargo operations. SCAG is working on developing and refining data and information to balance an optimal approach to deconstruct the supply chain for the SCAG region, while also having valuable analysis regarding competitive aspects of industrial development to ensure that policy decisions can have clear visibility on major issues, informing policy decisions. As part of this process, SCAG is leveraging work from the LMFP, ZETI, CSDI and other efforts to improve public-private stakeholder relationships to ensure that these practices and tools will remain sustainable. These tools will serve as a foundation as SCAG will be looking to update On the Move immediately following Connect SoCal 2024.

3.3.4 MEMBER AGENCY COORDINATION

The SCAG region encompasses six counties (Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura) and 191 cities in an area covering more than 38,000 square miles. The agency develops long-range regional transportation plans including sustainable communities strategy and growth forecast components, regional transportation improvement programs, regional housing needs allocations and a portion of the South Coast Air Quality management plans. In 1992, SCAG expanded its governing body, the Executive Committee, to a 70-member Regional Council to help accommodate new responsibilities mandated by the federal and state governments, as well as to provide more broad-based representation

of Southern California's cities and counties. With its expanded membership structure, SCAG created regional districts to provide for more diverse representation. The districts were formed with the intent to serve equal populations and communities of interest. Currently, the Regional Council consists of 86 members.

As a major part of SCAG's regional programs and studies, as well as in other areas of support, SCAG provides many opportunities to directly work with its member agencies. This occurs with examples through the LMFS, CSMS, and CSDI where SCAG included nearly 10 cities as partners within these study efforts, providing consultant services to directly assess their local jurisdictions on the studies' core topics of focus, including recommendations, strategies, and pilot project conceptual developments.

SCAG serves in a support role across a range of issues and interests due to its goods movement expertise. SCAG has participated on task force groups with cities, leveraged studies to accommodate policy interests regarding economic development, provided one-on-one discussions with respect to regional planning work including aspects specific to areas within the region, worked directly with cities regarding funding program applications and awards, coordinated with cities regarding zero-emission infrastructure placement, among many other areas of coordination.

4. NEW TRENDS AND TECHNOLOGIES

As part of understanding the goods movement system and its components, it is critical to identify and consider how new trends and technologies are affecting freight flows across the system. New trends and technology advancements can have a substantial impact on how policy decisions are made and how planning for future infrastructure and facility capacity needs can translate to implementation strategies.

In this section a review of international trade flows, e-commerce, curb space management and last mile freight, and emerging freight technologies is provided.

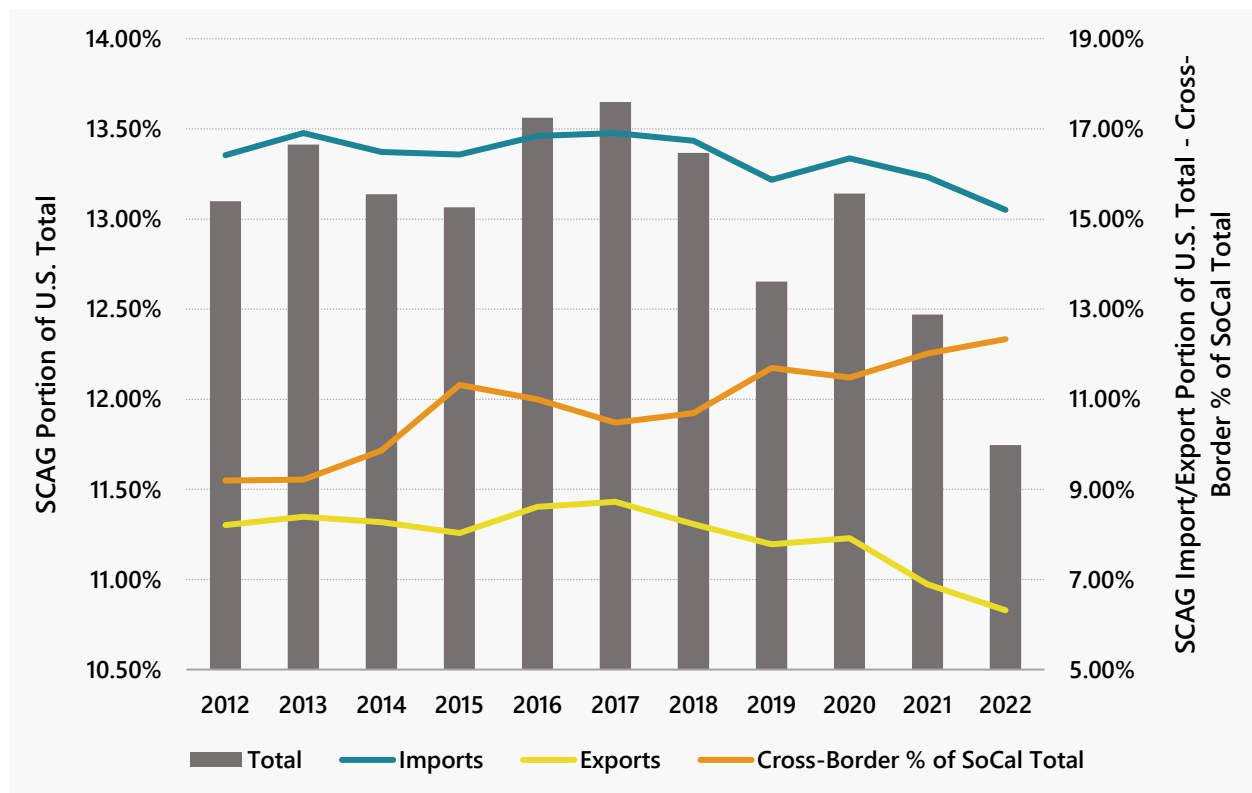
KEY TAKEAWAYS:

- Over the past ten years, the SCAG region has witnessed a declining share of international trade across the U.S. At the same time, cross-border trade has increasingly grown its share as a portion of the Southern California international trade total.
- Import and export markets have shifted over the last ten years with major changes including declining imports from China and increasing imports from Taiwan, South Korea, and Southeast Asia.
- For both imports and exports, U.S. overall performance remains more robust than the SCAG region, especially for key Asia trade partners, while remaining more diverse and less dependent upon trade from Asia overall. Export markets have displayed the most divergent performance between the U.S. and the SCAG region, with the SCAG region underperforming.
- With the expectation for e-commerce to continue to grow faster and increase penetration within overall retail and food services sales, the SCAG region will likely see increasing industrial facility capacity to meet the needs to fulfill and deliver shipments to last-mile business and resident customers.
- Last-mile freight related facilities have witnessed some of the fastest growth over the past few years, largely driven by increases in industrial fulfillment/sortation and deliver centers. Curb management strategies have become an increasing focus across the SCAG region because of last-mile freight activities, as local jurisdictions are looking to further improve and optimize asset management.
- The SCAG region continues to be involved with many moving pieces related to emerging goods movement technologies, notably through strong partnerships and support of ZE and NZE clean technologies. Shifting to clean technologies remains a core focus, however, scalability of supporting infrastructure and timing of development remain key challenges.
- Other technologies that are on the radar for continued assessment include air cargo facilities and advanced air mobility, automation and robotics, smart infrastructure and connected technologies, autonomous trucking, and tunneling and hyperloop.

4.1 INTERNATIONAL TRADE FLOWS

International trade is a large driver for much of the freight activity that occurs within the region. The SCAG region generates approximately \$1.2 trillion in GDP, and in 2022, the region generated \$623 billion in international trade value. Nearly 80 percent of this trade value was imported so the substantial majority reflects a decrease for GDP, but these imports relate to activity supporting the supply chain B2B process and consumption expenditures for GDP. It is estimated that the SCAG region generated approximately \$375 billion in retail and food services sales including digital transactions during 2022, just below the 32 percent portion of national GDP from a regional standpoint. International trade flows are very fluid and sensitive with respect to variables outside of the control of the region, and any shift in trends over the short-term should be taken with caution.

Figure 23. SCAG Region Portion of U.S. International Trade – Cross-border % of SoCal Total Trade



Source: United States Census Bureau, USA Trade Online

Over the past ten years, the SCAG region has witnessed a declining share of international trade across the U.S. At the same time, cross-border trade has increasingly grown its share as a portion of the Southern California international trade total (Figure 23). Factoring for total international trade value across the SCAG region and all Southern California (imports and exports) in 2022, and total trade reflected \$623 billion and \$695 billion, respectively. The SCAG region witnessed a peak in 2017 with its international trade reflecting 13.7 percent of the U.S. total. As of 2022, this proportion has declined to 11.8 percent (Figure 23). At the same time, cross-border trade with Mexico as a percent of the Southern California international trade total (Cross-Border Percentage of SoCal Total) increased from 10.5 percent to 12.3 percent. Cross-border trade value through the SCAG region and all Southern California in 2022 reflected \$21 billion and \$85.7 billion, respectively. Most of the region’s international trade is impacted by the

seaports and air cargo with the SPBPs driving much of this. The decline in proportional trade value within the SCAG Region is further evidence of shifts in trade across the U.S., Canada, and Mexico.

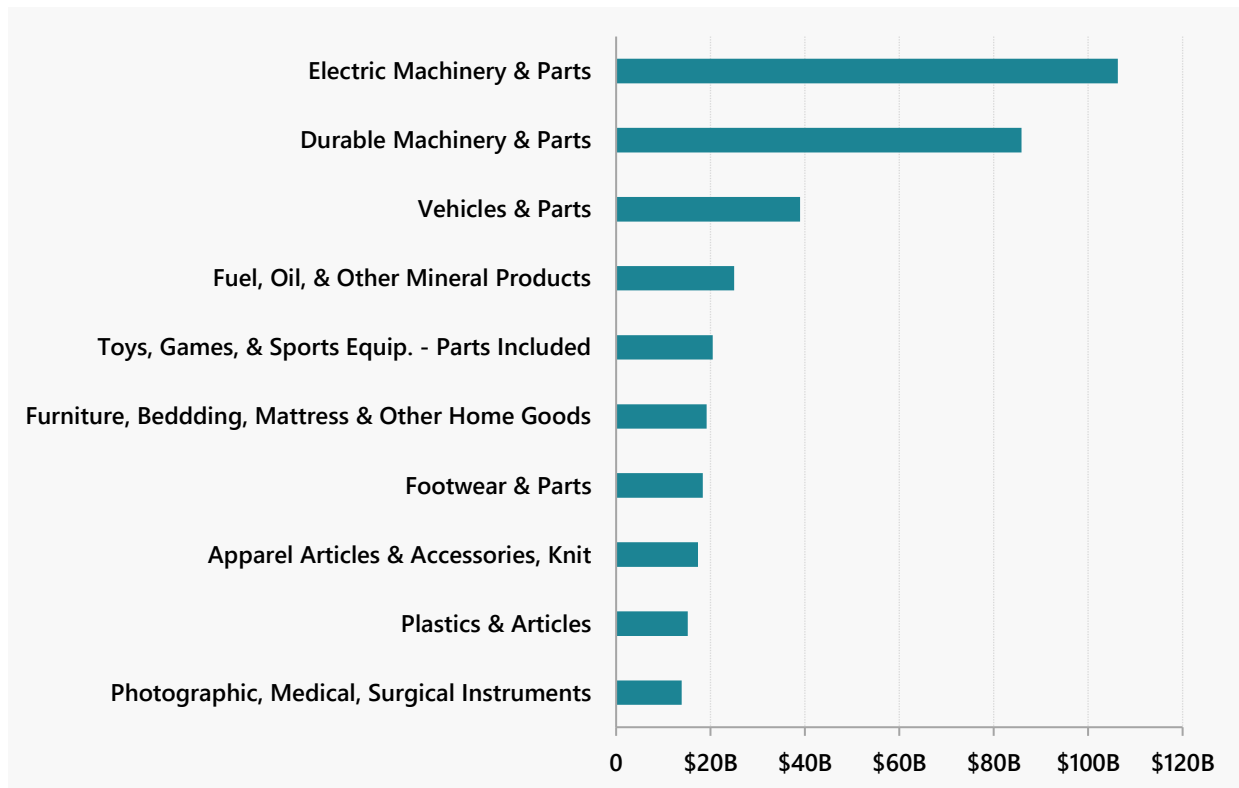
Table 6. National and Regional Trade Value Growth (2012–2022)

Geography	2022 Total Trade Value	7-Year Annualized Growth (2012 – 2019)	3-Year Annualized Growth (2019 – 2022)	10-Year Total Growth
United States	\$5.3 Trillion	1.1%	8.7%	38.9%
SCAG Region	\$623 Billion	0.6%	6%	24.5%
Southern California	\$695 Billion	0.9%	6.2%	27.6%
Southern California Border	\$85.7 Billion	4.4%	8.1%	71.2%

Source: United States Census Bureau, USA Trade Online

As of 2022, the U.S. generated \$5.3 trillion in international trade value (Table 6). The seven-year period before the COVID-19 pandemic witnessed marginal growth, while the last three years has witnessed exponentially higher performance driven largely by inflation since early 2022. When comparing pre-COVID-19 pandemic growth rates, all areas were very modest with the Southern California border region being the exception growing four times or greater than the U.S., SCAG, and overall Southern California regions. During the COVID-19 pandemic period, all regions have grown at an exponentially faster rate with the U.S. collectively growing the fastest. The substantial increase in growth speaks to the extreme changes in consumer activity and inflationary pricing pressures across the economy. Inflationary pressures have affected prices for raw inputs into manufacturing, costs of production, costs of freight movements, and costs of distribution and storage of inventory across the supply chain.

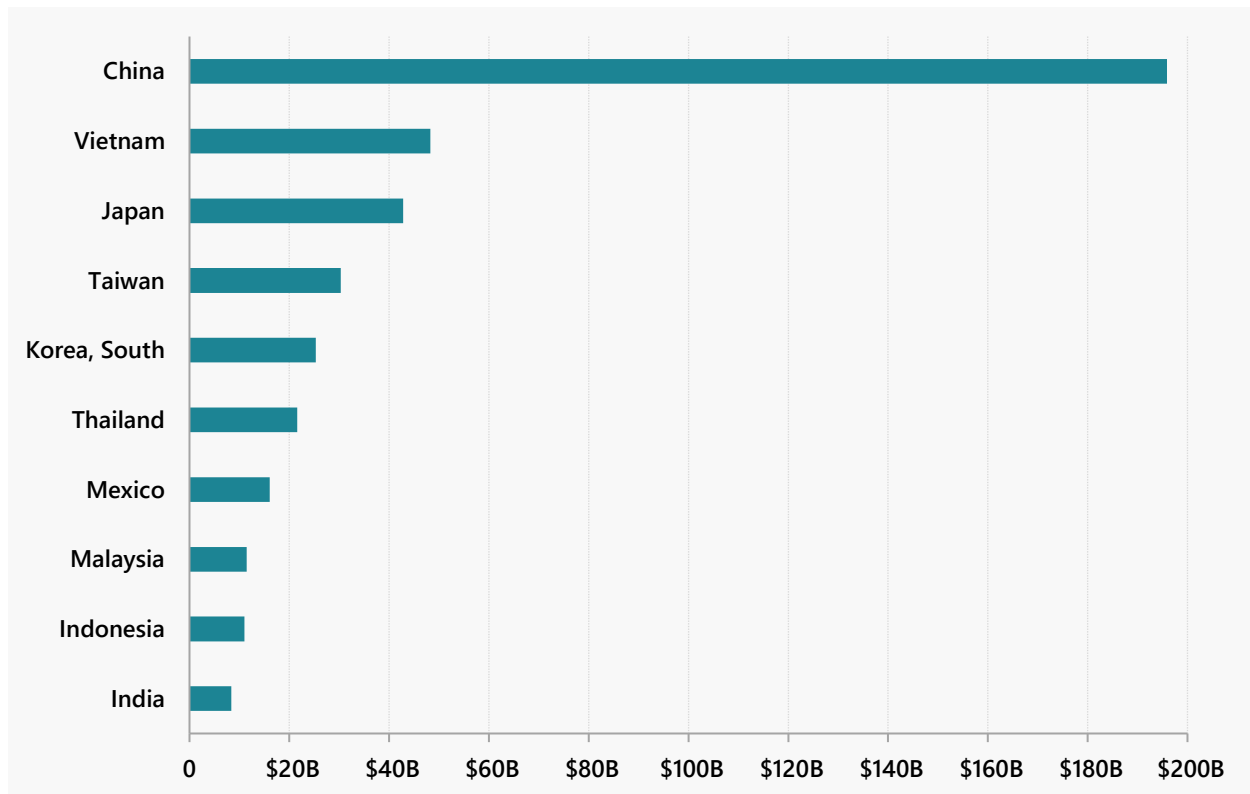
Figure 24. SCAG Region Top 10 Commodities (Imports) – 2022



Source: United States Census Bureau, USA Trade Online

The mix in top ten commodities imported for the SCAG region has not deviated that much from 2017 through 2022 with \$360 billion in value representing growth of 26.5 percent and 73 percent of all imports during 2022 (Figure 24). Key changes were the 77 percent increase for fuel, oil, and other mineral products and the addition of plastics and articles which replaced apparel articles and accessories, not knit from five years ago. The fastest growth categories after fuel, oil, and other mineral products were toys, games, and sports equipment (60 percent), electric machinery and parts (43 percent), plastics and articles (38 percent), photographic, medical, surgical instruments (23.5 percent), and footwear and parts (21 percent).

Figure 25. SCAG Region Top 10 Trade Partners (Imports) - 2022

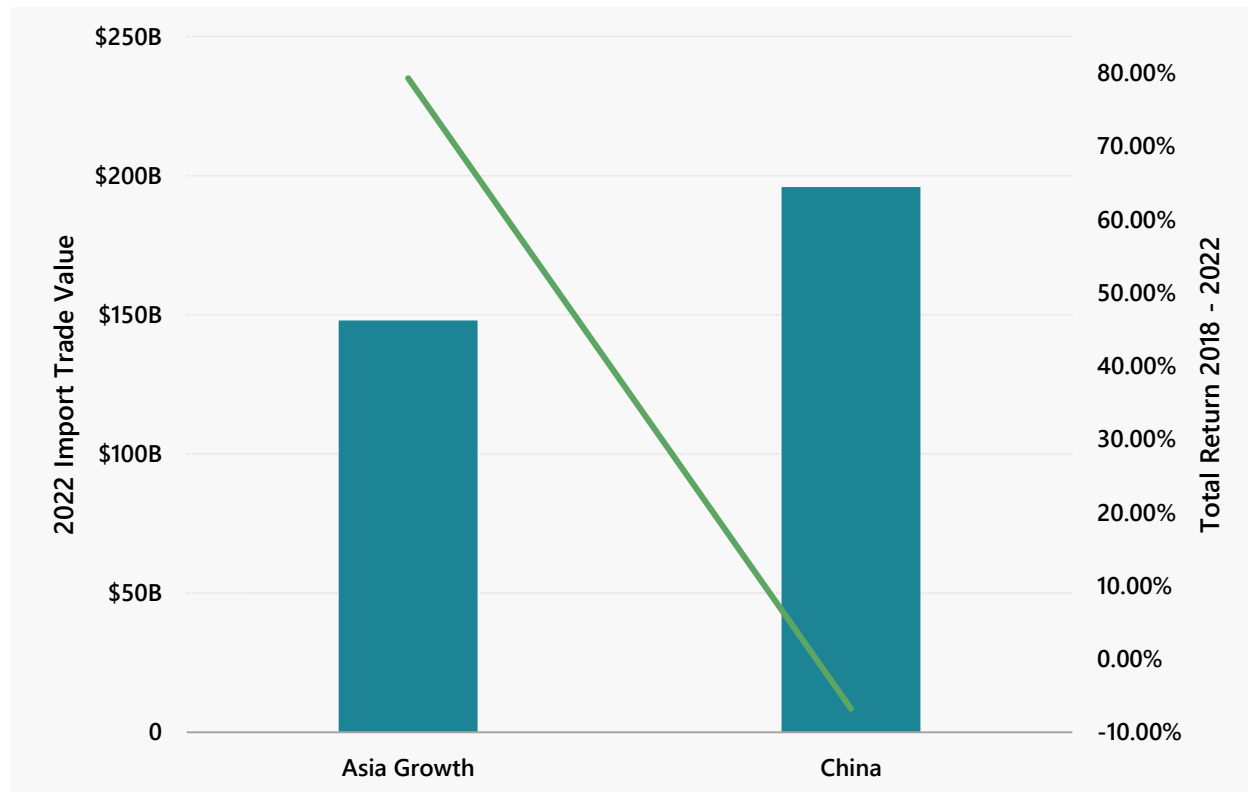


Source: United States Census Bureau, USA Trade Online

International trade partner relationships are increasingly impacted as geopolitical tensions have increased, notably between the U.S. and China. Imported trade value between China and the SCAG region peaked in 2018 at \$210 billion, As of 2022, the top ten trade partners for imports with the SCAG region generated \$411 billion in value, an increase of 15.6 percent from 2018 reflecting 83 percent of all total import trade value in the region (Figure 25). The SCAG region is heavily dependent upon trade with Asia as 83.5 percent of the top ten import value was from Asia.

Compared to the U.S., SCAG region top ten trade partner performance was less robust as the U.S.'s top ten trade partners witnessed growth of 25.7 percent from 2018, while generating \$2.2 trillion in trade value. The U.S. is more diverse than the SCAG region which is to be expected as the top ten trade partners reflected only 69 percent of all imported trade across the nation. Additionally, the U.S.'s top ten trade partners are not as exposed to trade with Asia as trade with Asia reflected only 39 percent of the top ten total. In 2022, the top three trade partners for U.S. imports were China, Mexico, and Canada with Germany, India, and Ireland also making the top ten.

Figure 26. China v. Asia Growth (Imports) – 2022

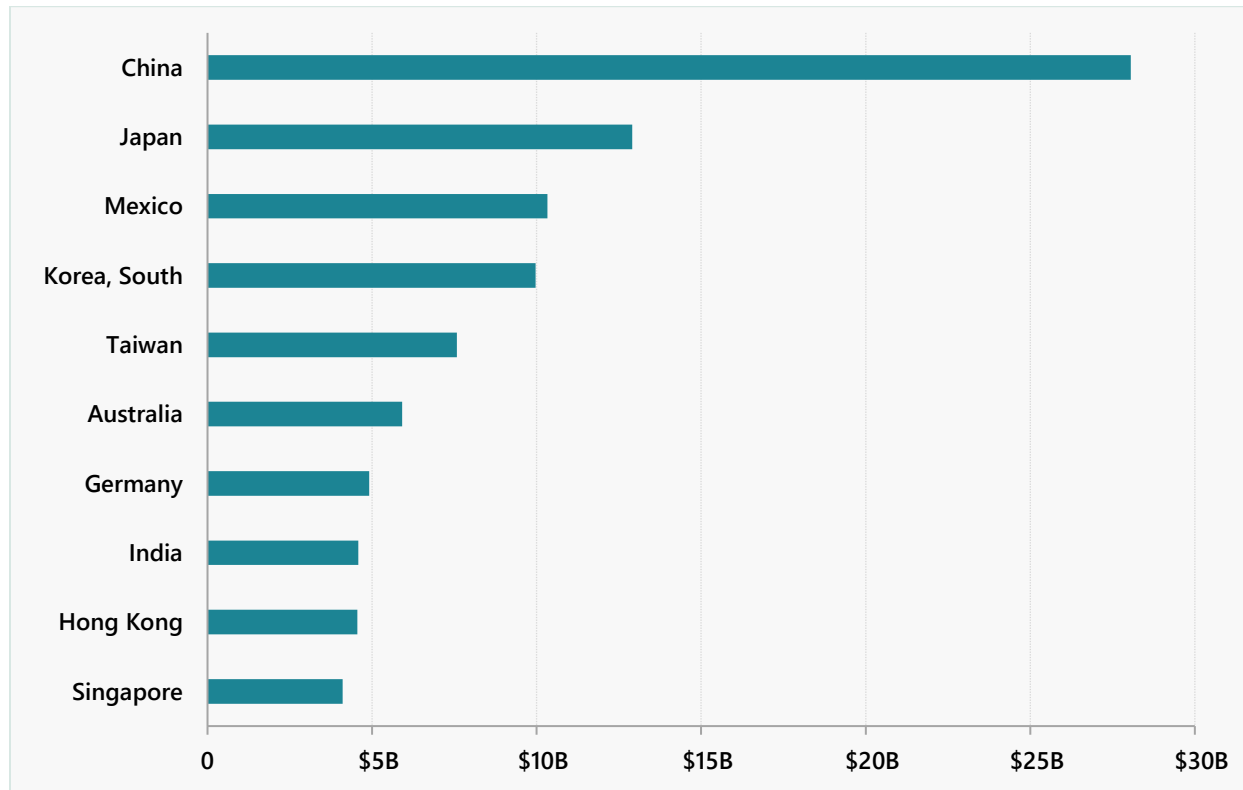


Source: United States Census Bureau, USA Trade Online

As trade relationships shifted, the SCAG region witnessed a very strong transition of increasing import trade with Taiwan, South Korea, and Southeast Asia led by Vietnam. Since 2018, there has been a stark contrast in performance with six of the top ten Asian trade partners (Asia Growth) and China. As of 2022, Asia Growth trade partners witnessed a 79 percent increase in trade value, while China declined by nearly 7 percent (Figure 26). In total Asia Growth trade partners generated \$148 billion versus China’s \$196 billion in trade value during 2022. Leading Asia Growth trade partner import value performance from 2018 was as follows, Vietnam (120 percent), Taiwan (80 percent), Thailand (79 percent), Malaysia (71 percent), Indonesia (57 percent), and South Korea (40.5 percent).

Despite this robust performance, the U.S. witnessed overall greater performance for some of these same trade partners within its own top ten, suggesting that other areas across the nation are seeing stronger growth. U.S. import trade value performance was as follows from 2018, Vietnam (159.5 percent), Taiwan (101 percent), Thailand (84 percent), Indonesia (66 percent), and South Korea (55 percent). Overall equivalent Asia Growth trade partners in the U.S. have collectively witnessed 84.5 percent performance from 2018.

Figure 27. SCAG Region Top 10 Trade Partners (Exports) - 2022



Source: United States Census Bureau, USA Trade Online

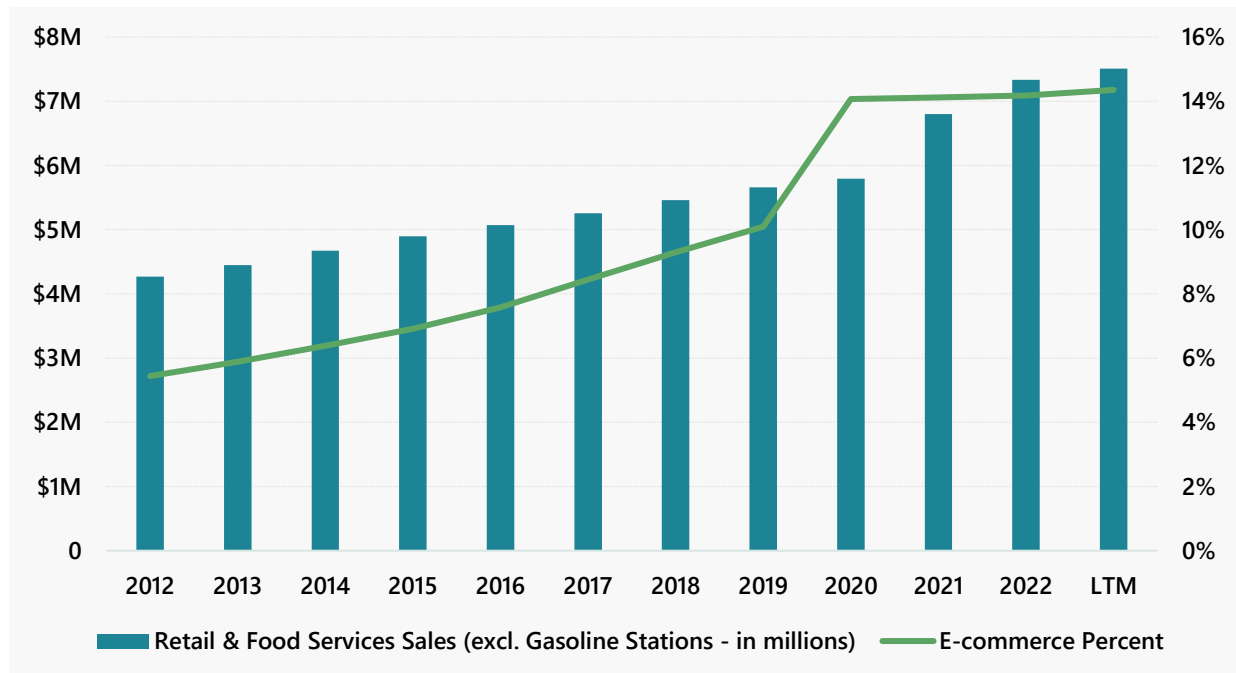
SCAG region top ten trade partners for exports have witnessed much weaker performance versus those on the import side. As of 2022, these trade partners generated \$93 billion in export value reflecting a 5.5 percent decline from 2018, and 71 percent of total exports from the region (Figure 27). The portion exported to Asia reflected 72 percent of the top ten trade partner total. Export trade performance was positive as follows, Germany (28.5 percent), Taiwan (20.5 percent), Mexico (11.5 percent), and China (9 percent). Trade performance was down substantially for Hong Kong (-52 percent), Japan (-20 percent), Australia (-15 percent), India (-15 percent), and South Korea (-10 percent).

The U.S. collectively witnessed its top ten trade partners generate \$1.3 trillion in export value reflecting a 23 percent increase from 2018, and 63.5 percent of total exports for the nation. The portion exported to Asia reflected 23 percent of the top ten trade partner total, a decline from 27 percent in 2018. Contrastingly, the U.S. as a whole saw stronger performance versus most of the SCAG region’s same trade partners for exports as follows, Mexico (22 percent), China (28 percent), Japan (7 percent), India (42 percent), and South Korea (28 percent). Mexico is understandable as Texas is the largest trade gateway between the U.S. and Mexico, and India has multiple trade route options for both the Gulf and East coasts. However, stronger performance outside of the SCAG region for trade with Asia is an important trend to monitor as eastbound containerized rail moves from imports to the SPBPs to the rest of the nation are dependent upon market opportunities to fill back-haul containers with shipments, notably for exports to Asia.

4.2 E-COMMERCE AND SHIFTING BUSINESS MODELS

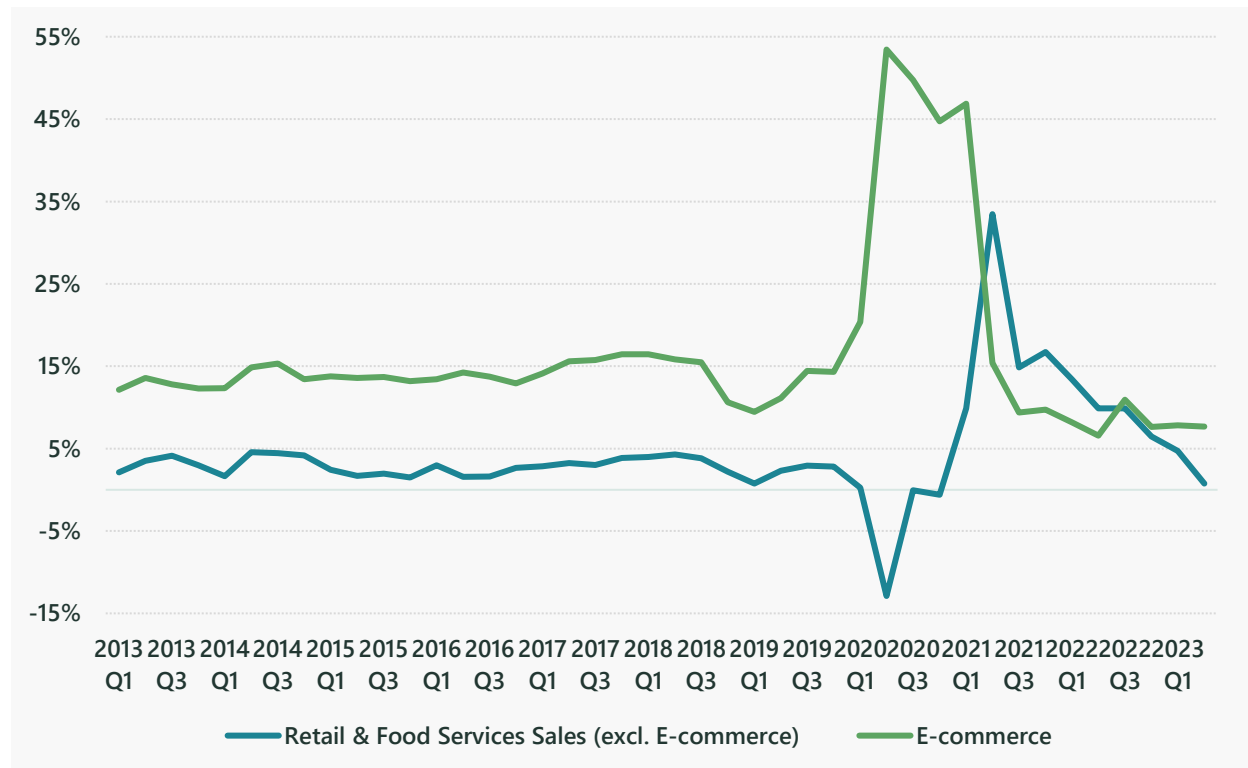
During the COVID-19 pandemic, there were substantial impacts to how consumers purchased goods both directly through e-commerce platforms, and through ordering online and picking up items purchased, also known as omnichannel. This culminated in an extreme jump in the penetration of e-commerce sales with respect to total retail and food services sales during 2020 (Figure 28). Government shutdowns placed a high dependence upon digital ordering for essential and all other items, which continued through 2021. E-commerce penetration has since flat-lined over the past couple of years as during 2021 and through 2022 the relationship between digital and physical retail and food services sales underwent much more volatility than past trends.

Figure 28. U.S. E-Commerce Penetration



Since 2012 and through 2019, e-commerce averaged an annualized growth rate of 13.7 percent equating to a nearly 150 percent increase to \$571 billion. The three years following, this annualized average jumped to 22 percent and for the first time ever, e-commerce sales have broken the \$1 trillion mark. During the same pre-COVID-19 pandemic period retail and food services sales excluding gasoline stations and e-commerce sales averaged an annualized growth rate of 3.5 percent equating to a 27 percent increase to \$4.9 trillion. Since then, the annualized average jumped to 7.3 percent with overall sales hitting \$6.1 trillion. During 2020, e-commerce sales penetration of retail and food services sales excluding gasoline stations jumped 40 percent to 14 percent. Since this time, e-commerce penetration remained flat as both traditional and digital sales benefitted from increasing inflationary pressures from early 2022.

Figure 29. Retail Sales and Food Services (excl. E-commerce) V. E-commerce Sales Percent Change by Quarter (2013-2023)



Source: United States Census Monthly Retail Trade – Quarterly E-Commerce

Prior to the COVID-19 pandemic and on a quarterly basis, e-commerce sales performance average 5.5 times higher than retail and food services sales excluding e-commerce for prior year sales results. For the four quarters through 2020 and first quarter of 2021, this performance exponentially increased as average quarterly growth for e-commerce jumped to 43 percent (Figure 29). During this same time, retail and food services sales growth averaged -0.7 percent growth. The remaining three quarters during 2021 and first two quarters during 2022 witnessed the first time in history where e-commerce sales fell below retail and food services sales with the former only averaging growth of 9.9 percent and the latter averaging growth of 17.7 percent. Since then, e-commerce sales have again returned to higher growth averaging 8.5 percent, while retail and food services sales have declined to 0.8 percent as of the most recent quarter.

Despite performance for e-commerce versus physical retail seeing more volatility over the past three years, the expectation is for digitally driven purchases to continue to grow at a higher rate than traditional retail. Collectively this demonstrates a continued shift in buying patterns, where business models are changing from physical retail to direct-to-consumer. Omnichannel commerce has introduced new seamless ways for a consumer to purchase products from multiple platforms on any device. Several cloud-based Application Program Interfaces (APIs) allow services at different stages of the transaction to communicate with each other, providing the consumer with real-time updates to pricing, shipping, and inventory information. APIs make it possible to verify card information, calculate and schedule delivery, and send a confirmation email with package tracking information within minutes. Such a model allows customers to buy while scrolling on a social media platform such as Instagram or TikTok, all without leaving the app, and being anywhere they prefer whether within a store, mall, home, or any other location.

Per Commercetools^{xxvii}, omnichannel comprises two elements: One, customers use the channels they're comfortable with. And two, they seamlessly switch channels without disruption across the user interface. As a result, brands capitalize on fluid shopping experiences, to convert more sales, and increase revenue streams. Key information from surveys based on consumer preferences include:

- U.S. adults want personalization from retailers with multiple personalized touchpoints, including a mobile app, digital displays, and more – 80 percent.
- Consumers expect a personal and consistent customer experience across multiple physical and digital channels – 69 percent.
- Shoppers want to see, touch, feel, and try out items in-store – 75 percent.
- Global retail sales by 2026 are expected to be in-store – 76 percent.
- Shoppers used buy online pick-up in store (BOPIS) shopping in 2022 – 67 percent.
- Customers prefer to return online purchases at a retail location – 61 percent.
- People who first tried self-checkout during the pandemic say they'll use it again – 70 percent.
- U.S. consumers use their mobile devices to research products while shopping in physical stores – 68 percent.
- Consumers say they will likely become repeat buyers after a personalized shopping experience with a retailer – 60 percent.
- Organizations see accurate, real-time customer data as the biggest challenge to their personalization efforts – 43 percent.

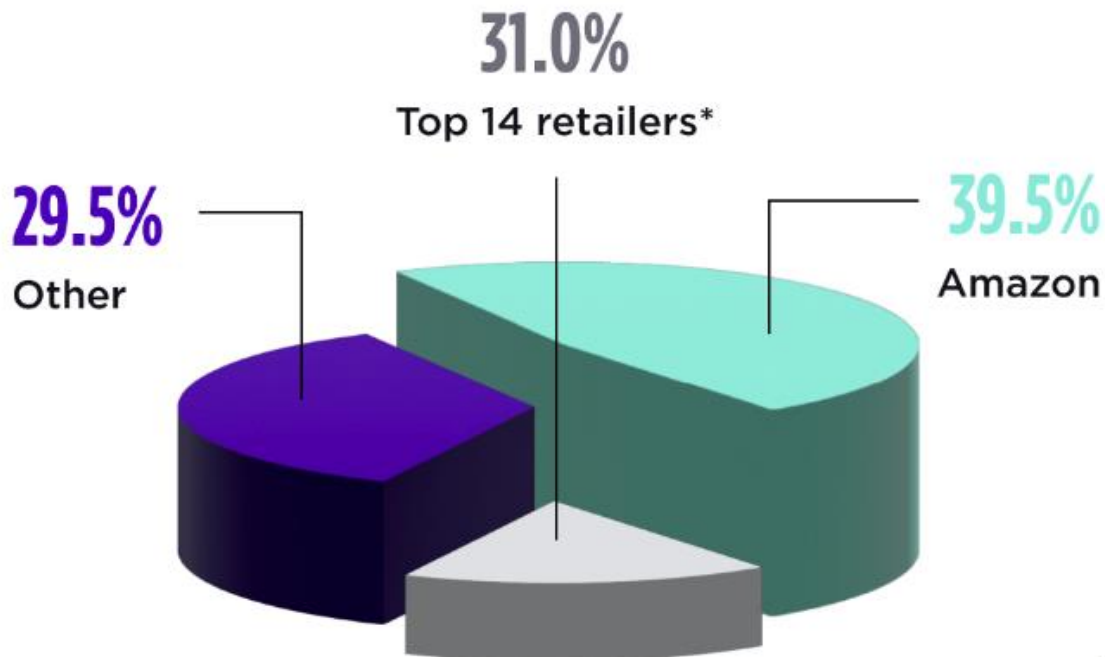
Other key areas of interest for the SCAG region include supply chain impacts, job relationships, and global shifts. A key area of focus with respect to supply chains is the shortening effect of the product life cycle that e-commerce has had. The product life cycle can be defined through four stages, product introduction, growth, maturity, and decline. As a result of this, producers have gravitated towards broader assortments of products, or stock-keeping units (SKUs). The impact tends to be larger amounts of SKUs moving in and out of warehouses. This has necessitated the need to initiate value-added services such as:

- Separation of stock/storage for online versus retail sales including calculation forecasts and replenishment of stock separately for online and in-store.
- Different packaging services to optimize pack-and-pack software for seamless shipment of orders.
- Inventory/logistics oversight to improve inventory management.

E-commerce employment is one of the fastest growing sectors with growth estimated to have increased by 32 percent during 2022 from 28 percent in 2021. According to the Bureau of Labor Statistics (BLS), computer jobs are projected to increase by 13.4 percent through 2030 which is much faster than the 7.7 percent average for all occupations.

Figure 30. U.S. Retail E-commerce Percentage Sales, 2022

BY COMPANY, 2022 (% OF TOTAL RETAIL ECOMMERCE SALES)



Source: eMarketer, Feb 2022

*Walmart Inc. Apple, eBay, Target, The Home Depot, Best Buy, Carvana, Costco Wholesale, The Kroger Co., Chewy, Wayfair, Macy's, Etsy Inc., Lowe's



Source: <https://www.bigcommerce.com/articles/ecommerce/>

Even as e-commerce sales continue to grow, Amazon continues to reflect nearly 40 percent of the U.S. total, whereas this proportion was 41 percent in 2018 (Figure 30). The top 15 companies including Amazon reflected greater than 70 percent of the overall e-commerce sales total in 2022. When factoring for gross merchandise volume (GMV), the top companies with operations in the U.S. for e-commerce sales include Amazon, Shopify, and Walmart. The nature of businesses continues to evolve with startups, small businesses, mid-market businesses, and major enterprises all shifting towards e-commerce and omnichannel services and allowing for companies like Shopify and its small and mid-sized focus, Amazon's third-party seller business, among others to provide services expanding the e-commerce footprint. Types of e-commerce are shifting to selling physical and digital goods and services across more models including:

- B2C: Transactions made between a business and a consumer. B2C is one of the most popular sales models in the ecommerce context. For example, when buying shoes from an online retailer, it's a business-to-consumer ecommerce transaction.
- B2B: Unlike B2C, B2B ecommerce encompasses sales made between businesses, such as a manufacturer and a wholesaler or retailer. B2B is not consumer-facing and happens only between businesses.

- Consumer-to-Consumer (C2C): One of the earliest forms of ecommerce, consumer-to-customer ecommerce relates to the sale of products or services between customers. This includes C2C selling relationships, such as those seen on eBay or Amazon, also known as third-party or 3P.
- Direct-to-Consumer (D2C): A newer model of ecommerce, D2C refers to a business that sells products directly to the end customer instead of going through a retailer, distributor or wholesaler. One common example of D2C ecommerce is a subscription-based brand such as Netflix or Dollar Shave Club.
- Consumer-to-Business (C2B): C2B reverses the traditional retail model, meaning individual consumers make their products or services available for business buyers. One example of a C2B ecommerce business is iStock, an online store where stock photos are available for purchase directly from different photographers.
- Business-to-Administration (B2A): B2A covers the transactions made between online businesses and administrations. An example would be the products and services related to legal documents, social security, etc.
- Consumer-to-Administration (C2A): C2A is like B2A, but instead, consumers sell products or services to an administration. C2A can include online consulting for education, online tax preparation, etc.

According to BigCommerce and Statista, in 2021, over 2.1 billion people worldwide were estimated to shop online, up from 1.7 billion global digital buyers in 2016^{xxviii}. Chinese ecommerce platform, Taobao, is the largest online marketplace with a GMV of \$711 billion. For context, Tmall and Amazon ranked second and third with \$672 billion and \$390 billion GMV in annual third-party global market value, respectively. With so many ecommerce platforms, marketplaces, and digital solutions available, there are practically no limits for merchants looking to sell online, which makes it easier than ever for businesses to go global. Ecommerce revenue is expected to show a yearly growth rate of 14.6 percent, resulting in a projected market volume of \$1.4 billion by 2025 in the U.S.

Especially with the rise of omnichannel shopping experiences, digital buyers should expect to be able to research, browse, shop and purchase seamlessly between different devices and on various commerce platforms. Other trends to watch for in the future of ecommerce include:

- Robust customer journeys and personalization
- Artificial intelligence-enabled shopping
- Social shopping
- Mobile commerce
- Digital currencies, such as mobile wallets and cryptocurrency

Overall, ecommerce is still new in the big picture of retail with expectations for penetration to continue growing. Irrespective of the future opportunities, the success and continuation for digital channels will depend largely on buyers' preferences as they continue to evolve. While inflation continues to impact results, the expectation is for e-commerce to return towards double-digit annualized growth.

4.3 LAST-MILE FREIGHT AND CURB SPACE MANAGEMENT

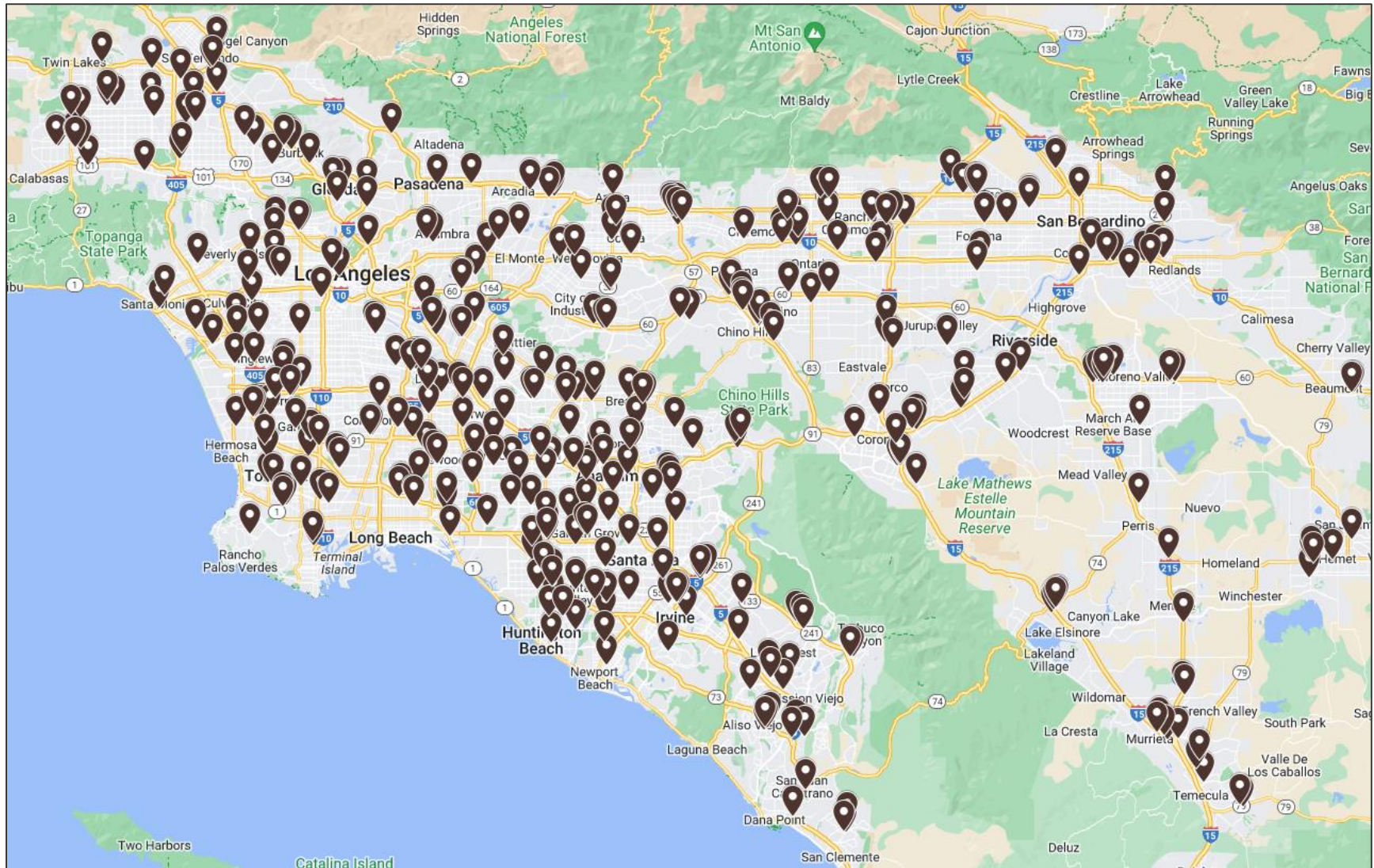
The changing nature of e-commerce and omnichannel trends has had a direct impact on last-mile freight deliveries, as well as with broader curbspace usage and management. There are numerous areas of interest including the increasing industrial growth of delivery centers, multimodal perspectives of curbspace usage and varying intensities across the SCAG region, and growing interest in better understanding the utility and value of the curb at the local level.

Curb space management is the deliberate design, organization, and governance of the curb space – the space on the street that is closest to the curb. In recent years, the curb space has become a battle ground between traditional uses, such as parking, last-mile freight delivery, transit, and bike lanes, and new users, such as rideshare, and micromobility. The lines have blurred between last-mile freight delivery and rideshare as similar light-duty vehicles have increasingly morphed into both worlds. Services such as Uber and Lyft have grown to provide passenger needs, while companies like Instacart and Doordash have focused on restaurant online orders and grocery shopping list deliveries. These changing uses of the curb have led to a confluence of complexities depending upon each unique area based on typologies with varying densities and intensities.

4.3.1 LAST MILE FREIGHT DELIVERY

One of the biggest impacts from the progression of last-mile freight deliveries is the changing utilization of industrial and retail facilities and spaces. Industrial capacity to support the growth of e-commerce has been much faster than average industrial warehouse and distribution growth. Amazon's industrial facilities grew 204 percent and square footage grew 173 percent since 2019, much faster than the overall average 33 percent growth for the SCAG region over the past 20 years, and even faster than the region's 3 percent growth since 2019. Amazon has also witnessed a substantial increase in Delivery Centers across the SCAG region and Southern California growing from its first in 2012 to 46 as of 2022. This accounts for 17 percent of Amazon's overall square feet, where 78 percent of these delivery centers have been established since 2020. With the expectation for e-commerce to continue to grow faster and increase penetration within overall retail and food services sales, the SCAG region will likely see increasing facility capacity to meet the needs to fulfill and deliver shipments to their last-mile business and resident customers. Much of these growth expectations on the facility and infrastructure side are driven by consumer preferences and changing e-commerce business models following suit.

Figure 31. Retail Locations for Walmart, Target, Home Depot, Sam's Club, Costco, and Lowe's



Source: Costar (2023). Accessed August 15, 2023. Visualized through Google Maps

At the same time, other major retailers have had to adjust existing industrial facilities to segregate both e-commerce fulfillment and in-store inventory stocking needs. But a much larger impact has been on the retail side as big-box companies like Walmart, Target, Home Depot, Sam's Club, Costco, and Lowe's have become last-mile delivery and pick-up points changing traffic and travel patterns for both commercial vehicles and residents (Figure 31). With Instacart and Doordash among other companies focusing on the substantial number of restaurants and grocery stores, the proliferation of last-mile delivery and pick-up locations has continued to exponentially increase.

The last mile delivery journey is the most intricate, costly, and crucial phase. Its importance greatly escalated in 2020, especially due to the surge in e-commerce and home deliveries. By the third quarter of 2022, e-commerce sales in the United States reached \$250 billion, marking a 10 percent increase from Q3 2021. As we enter 2023, the significance of the last mile in the delivery process will continue to be paramount. The ongoing rapid expansion of e-commerce necessitates a flawless system to meet customer expectations, but various obstacles have added complexity to this task.^{xxix}

From SCAG's Last Mile Freight Delivery Study, major delivery industry challenges and trends are exacerbating following issues^{xxx}:

- Smaller, more frequent shipments for business customers.
- "Densification" of commercial and industrial space.
- Trucking industry issues of driver shortage, hours of service, driver retention, electronic logging mandates, and truck parking.
- Urban congestion affecting deliveries.
- E-commerce increasing the frequency of small deliveries, and rapid delivery through fulfillment systems.
- Alternate systems and modes such as drones, robots, 3D printing, cargo bikes, and autonomous vehicles.
- "Uberization" and "gig economy" participants.

The last mile delivery, which constitutes 53% of the overall shipping expenses, is becoming costlier due to persistent inflation. The growth of e-commerce has given rise to the necessity for third-party logistics companies (3PLs) to bridge delivery gaps, but this has also introduced greater complexity for shippers. Fluctuating fuel costs and rising labor expenditures further compound these challenges. Couriers and 3PLs must delicately navigate these obstacles to remain agile and adapt to the ever-evolving landscape of last-mile delivery.^{xxxi}

The key last-mile delivery trends include^{xxxii}:

- Sustainability and Environmental Initiatives: More focus on eco-friendly delivery options, including electric vehicles and sustainable packaging.
- Micro-Fulfillment Centers: Smaller, localized distribution centers to speed up last-mile deliveries and reduce transit times.
- Advanced Automation: Increased use of robotics, AI, and machine learning to optimize delivery routes and enhance efficiency.
- Same-Day and Instant Delivery: Growing demand for rapid delivery options, including same-day and instant delivery services.
- Driverless and Autonomous Vehicles: Continued development and adoption of autonomous delivery vehicles.
- Drones and Aerial Delivery: Expanding use of drones for last-mile deliveries in select areas.

- Contactless Delivery: Ongoing preference for contactless and touchless delivery methods, especially in the wake of the pandemic.
- Urban Logistics Solutions: Innovative approaches to address urban delivery challenges, such as congestion and limited parking.
- Enhanced Customer Tracking: Improved tracking and visibility for customers to monitor their deliveries in real-time.
- Data Analytics and Demand Forecasting: Greater reliance on data analytics to predict delivery demands and optimize supply chain operations.

These trends reflect the evolving landscape of last-mile delivery and the increasing emphasis on speed, efficiency, and sustainability in the industry.

4.3.2 CURB SPACE MANAGEMENT

Post Connect SoCal 2020, SCAG studies and efforts led to several strategies to achieve transportation mode shift and reduce GHG emissions. Many of these strategies directly impact the curbside supportive infrastructure such as drop-off spaces, dedicated lanes, charging, and parking for shared ride hailing car sharing, bike sharing, and scooter sharing. Particularly for dense urban areas with many different curb uses competing for the same space, it is becoming integral to manage the curb space to allow safe access for low-speed modes, ride sourcing providers, parking, and local deliveries. It also includes several high-level policy goals that will affect land use and off-street parking.

Goods Movement provides a critical lens for understanding curb management needs. Phenomena such as the rise of e-commerce and growth of new warehousing and industrial centers illustrate ways in which the growing demand of goods movement creates stresses on the transportation system, especially in terms of last mile freight. Last mile freight, often referred to as last mile delivery, generally refers to the very last step of the delivery process when a parcel is moved from a transportation hub to its final destination—which is typically personal residence or retail facility. Especially in more dense environments, this stretch of the journey presents a wide array of challenges for delivery companies and their customers due to the vast and unique set of problems that can emerge as a carrier approaches the curb.

Across the globe, goods movement systems have been forced to adapt as many of these problems have continued or worsened since the onset of the COVID-19 pandemic. While more consumers started of purchasing goods online due to public health concerns and restrictions, those same consumer behaviors have sustained despite health restrictions being lifted and stores reopening. The shift from visiting retail locations to opting for the delivery of those same products means more brick-and-mortar businesses are closing, perpetuating a reliance on e-commerce and pressuring companies to develop new solutions to meet growing demand.

Since the release of Connect SoCal 2020, SCAG continues to conduct studies and pilots to evaluate innovative curb space management strategies and inform the region of best practices. While last mile freight is not the only curb-related use considered in these studies, it serves as a central focus for understanding the problems and goals of each effort. Collectively, these projects provide a holistic understanding of interconnected factors affecting the design, use, and management of curb space and last mile delivery solutions. Each project leverages complementary data and technology solutions to collect and analyze information related to curb space utilization, traffic flow, and demand. All foster collaboration among stakeholders, including local governments, delivery companies, researchers, and

community organizations. These projects also promote sustainable last mile delivery practices, such as encouraging the use of electric or low-emission vehicles and exploring alternative delivery models.

From an e-commerce and last-mile delivery perspective, the City of Los Angeles will soon host two major events: the 2026 FIFA World Cup and the 2028 Summer Olympics. Both are likely to cause significant system disruptions on local and regional supply chain networks, requiring innovative solutions. SCAG has instituted programs and studies that engage with a diverse spectrum of companies ranging from the largest foodservice providers in the country to the smallest independent owner operators, and it will be critical to get ahead of these major events to successfully plan for last-mile deliveries, as well as broader inventory store fulfillment and supply chain operations. SCAG recognizes that these major efforts and events will play a crucial role in the development of strategies.

SCAG also serves as a project partner on the study, "Testing and Evaluation of Curb Management and Integrated Strategies to Catalyze Market Adoption of Electric Vehicles" under the United States Department of Energy's (DOE's) Vehicle Technologies Office Fiscal Year 2021 Research Funding Opportunity aimed at reducing carbon dioxide (CO₂) emissions from passenger cars and light- and heavy-duty trucks. The project builds upon pre-existing traffic data and curb management deployments in two metropolitan areas, Los Angeles, CA and Pittsburgh, PA, including delivery and ride-hail use cases. The project will provide cities across the United States with a roadmap to accelerate zero-emission transportation adoption and lower VMT within the commercial transportation activities responsible for impacts on inefficient energy use, congestion, and pollution.

4.4 EMERGING TECHNOLOGIES AND ADVANCEMENTS

The advancement of emerging technologies is expected to have considerable impacts throughout regional supply chains. In response to changes in e-commerce trends, air quality impacts, among others, ongoing developments and demonstrations of new technologies will alter the goods movement environment with far-reaching impacts ranging from employment to public health. To combat climate change and improve air quality, the state has implemented several regulatory rules aimed at accelerating the adoption of ZEVs and NZEVs. These include mandates requiring automakers to produce a certain percentage of zero emission vehicles with that percentage increasing over time, financial incentives for consumers who purchase such vehicles, lower-emissions requirements for fleet owners and operators, and investments in charging and fueling infrastructure. Given the heavy investment in zero-emissions technologies by the State and their potential for improving environmental and public health, these technologies, including battery electric and hydrogen options. SCAG will continue assessing and evaluating promising clean technologies for goods movement vehicles and equipment while maintaining a technology agnostic approach.

SCAG's goods movement system has experienced a consistent increase in freight demand, driven by factors such as population growth, e-commerce, and global trade. This growth has placed strain on existing infrastructure and led to increases in traffic congestion. Critical infrastructure, including highways, railroads, ports, and intermodal facilities, must adjust to the increasing volume of freight. While technology advancements will play a central role in optimizing the existing system, the selection and implementation of different technologies and strategies will depend on evolving contexts, considerations, and demands.

Robotics, drones, autonomous vehicles, additive manufacturing, and other "smart" technologies have continued to display various use cases for further automation in the freight sector. The use of technology

to perform tasks with reduced human assistance are at the forefront of industrial planning and labor-management negotiations. Such innovations' disruptive nature and implications for workforce impacts have both generated excitement for their potential to increase economic productivity and reluctance amongst groups concerned for workers' job security. Furthermore, most of these technologies are being developed with lower emissions standards in mind, following demands for more ZE and NZE solutions.

The sections below will provide a review of ZE and NZE vehicles and supporting infrastructure, air cargo facilities and advanced air mobility, automation and robotics, smart infrastructure and connected technologies, autonomous trucking, and tunneling and hyperloop.

4.4.1 ZERO AND NEAR-ZERO EMISSIONS VEHICLES

The SCAG region supports accelerated deployment of existing and proven technologies that will serve to improve the region's air quality, while aggressively pursuing investment to achieve the long-term goal of a zero-emission goods movement system where technically feasible and economically viable. The region requires investment in charging and fueling infrastructure, further development of existing prototypes to bring down costs and address operational challenges, and incentives for the full commercial deployment of zero-emission vehicles. Similarly, the region requires support for near-term emission reductions through immediate deployment of existing near-zero-emission technologies and their supporting infrastructure. In addition to funding, supporting policies that address the full life cycle impacts of new vehicles and their disposal, expedited permitting, education and workforce development, among others, will need to be in place to holistically support a transition to zero-emission technologies.

The goods movement industry continues to evolve, particularly with the emergence of innovative freight technologies and clean transportation standards. To achieve health protective ambient air quality standards and the climate goals established in Governor's Executive Order N-79-20,^{xxxiii} CARB has set ambitious goals to accelerate the transition to zero-emission medium- and heavy-duty vehicles (MHDV) via the Advance Clean Trucks (ACT) and Advance Clean Fleets (ACF) regulations. For freight railroads, CARB has established the In-Use Locomotive rule. Additionally, the South Coast Air Quality Management District (SCAQMD) has established Rule 2305, known as the Warehouse Indirect Source Rule (ISR), requiring warehouses greater than 100,000 square feet to directly reduce nitrogen oxide (NOx) and diesel particulate matter (PM) emissions, or to otherwise reduce emissions and exposure of these pollutants in nearby communities. The advancement of zero-emission technologies such as battery electric and hydrogen fuel cell trucks, trailers, and locomotives is critical to these regulations.

In the freight rail industry, locomotives are essential for moving trains on tracks. In the US, they're typically powered by diesel engines, with two main types: switch locomotives for short distances throughout or outside the railyards, and line haul locomotives for long distances across the country. Unfortunately, communities near railyards experience a disproportionate burden of exposure to harmful air pollutants including PM2.5 and NOx due to locomotive operations. As of 2022, in California, locomotives are projected to produce over 640 tons per year of PM2.5 and 29,800 tons per year of NOx.^{xxxiv} On April 27, 2023, CARB approved the In-Use Locomotive Regulation that aims to cut emissions by eliminating locomotive engines more than 23 years old by 2030 and promoting zero-emissions technology in seaports and railyards. It would also prohibit locomotives in the state from idling longer than 30 minutes if they are equipped with an automatic shutoff. Approval from the Biden administration would be required for the standards to move forward. In the SCAG region, the two Class I railroad operators, BNSF and UP, have started to test and adopt cleaner Tier 4 locomotives in certain routes. To achieve the region's

emission reduction goals in the freight rail industry, we need to continue to collaborate with stakeholders to deploy zero-emission technology and the supporting infrastructure.

The deployment of advanced technologies in heavy-duty vehicles, such as electric and fuel cell technologies, necessitates a supportive infrastructure for fuel or power supply. Electric vehicles rely on a network of charging stations specifically designed for heavy-duty vehicles, while fuel cell vehicles require a network of fueling stations. Additionally, wayside power systems are emerging as an innovative solution that allows vehicles to charge while in motion, potentially extending their range. These systems aim for seamless integration with regular trucks and offer the advantage of supplementing power during travel. An example of such a system is the Overhead Catenary System (OCS) demonstrated in the City of Carson. However, it's important to note that in-road or distributed charging systems still draw power, which may result in emissions during electricity generation.

The state of zero and near-zero emission technologies has advanced in the past four years with progress made in the commercial deployment of vehicles. Continued investment is still needed to further deploy these technologies, and to provide the infrastructure needed to support them. Additionally, remaining challenges with battery-electric vehicles include long charging times, limited driving range, and a lack of readily available charging and fueling infrastructure. Similar challenges exist with hydrogen fuel cell vehicles, although they are known to have faster refueled times and longer range (depending on fuel tank size).

Although the long-term goal is to develop and deploy zero-emission trucks, several near-zero emission alternative fuels exist today including compressed and liquefied natural gas (CNG, LNG), liquefied petroleum gas (LPG, i.e., propane), ethanol, methanol, dimethyl ether (DME), hydrogen and nonpetroleum biodiesel fuels. LNG and CN heavy-duty vehicles have been deployed and can yield significant emission benefits. However, there remains limited availability of fueling stations. Emissions benefits range greatly depending on the fuel.

Opportunities exist for integrating micromobility solutions enabling quick and efficient transportation within city centers or dense urban areas. For instance, electric cargo bikes equipped with large cargo containers or trailers have been employed for local deliveries in urban areas. These bikes offer a sustainable and efficient way to transport goods while navigating congested city streets. They can carry significant loads, including packages, groceries, and small freight. Electric scooters, particularly those designed with cargo compartments or attachments, can be employed for small-scale deliveries as well, providing an option for carrying lightweight parcels, food deliveries, or documents. Integrating these technologies into freight and delivery is still relatively limited. However, these approaches offer potential benefits in terms of reducing traffic congestion, emissions, and increasing the efficiency of urban logistics, especially when integrating these technologies into existing freight and logistics networks as a first- and last-mile solution.

4.4.2 AIR CARGO FACILITIES AND ADVANCED AIR MOBILITY (AAM)

Airports are embracing technologies and innovations to reduce their carbon footprint and improve operational efficiencies. Examples include installing LED lighting, fixed electrical ground power, electric ground support equipment, vehicles running on renewable fuels, investing in electric ground vehicles and energy microgrids. Notably, to encourage The Ground Service Equipment (GSE) operators to reduce emissions, Los Angeles World Airports (LAWA) adopted the LAX Electric Ground Support Equipment Incentive Program in 2019.^{xxxv} As of June 2023, LAWA approved \$500,000 to assist GSE operators in

accelerating the replacement of older conventionally fueled GSE with electric alternatives as part of the Electric Ground Support Equipment Incentive Program.^{xxxvi} Many of these GSE operators are integral to air cargo operations, include cargo transporters and parcel handlers.

Both electric and hydrogen-powered aircraft are feasible, but present major challenges for large aircraft. With the need for a significant change in airport infrastructure globally, it is likely to be a long time before we see hydrogen-powered aircraft operating on a commercial scale. For manufacturers and airlines to commit to making it work, there would need to be a shift from the whole industry. Battery power has its limits, too, with significant advances in battery technology and the size needed for large aircraft. Hybrid aircraft can be developed in the interim, though, which should help with emissions reduction and research and development.^{xxxvii}

Advanced air mobility (AAM), which includes smaller aircraft, is expected to have a significant impact on goods movement and freight. While AAM technology has traditionally been discussed in the context of passenger-focused transportation as a solution for congestion, the field has gained traction as a possible solution for challenges in goods movement. AAM technologies, and delivery drones in particular, offer a series of possible benefits including:

- Faster and more direct delivery of goods through bypassing ground-based transportation constraints such as traffic congestion. Drones can also access hard-to-reach locations, making it possible to transport goods more efficiently.
- AAM technology also has the potential to reduce costs associated with traditional freight transportation methods. Drones can operate with lower labor costs and require less infrastructure, making them an attractive option for small businesses and e-commerce retailers. Drones can operate autonomously and with less risk of human error, which could potentially reduce accidents and injuries associated with traditional freight transportation methods.

AAM technology has the potential to reduce emissions associated with traditional freight transportation methods with electric drones already available and able to transport smaller loads. However, there are also challenges that need to be addressed before AAM can be widely adopted for freight transportation. These challenges include regulatory frameworks, air traffic management systems, construction and design of vertical take-off and landing (VTOL) areas, and public acceptance of these new technologies.

4.4.3 AUTOMATION AND ROBOTICS

The advancement of automation is expected to have considerable impacts throughout regional supply chains. Warehouses are increasingly integrating automation to improve operational efficiencies in response to the dramatic surge in direct-to-consumer e-commerce. Continued developments and demonstrations of automated truck technologies will alter the goods movement environment with far-reaching impacts ranging from employment to highway safety. As automation is adopted more holistically, the region faces serious labor challenges as many jobs may change or become redundant with increased automation playing a larger role in many facets of freight operations.

Similarly, semi-automated marine terminals and warehouses and the increasing use of robotics are increasing as they look to target improving supply chain efficiencies and workplace safety. Ongoing policy development around these technologies is necessary to understand and respond to the ways these technologies will impact the freight industry and its workforce. While these advancements may also provide benefits to the transportation system through improvements in efficiency, reliability, and safety, concerns remain regarding how automation may adversely affect the lives of those currently working in

the field. While some are worried that the widespread adoption of these technologies may lead to redundancy and job displacement, most agree that job retention interventions and worker reclassification will be required.

At the San Pedro Bay Ports, automation offers considerable operational, economic, and environmental benefits. Remotely controlled software-assisted cranes unload ships around the clock; autonomous vehicles efficiently move containers around the terminal; automated mobile cranes stack them, organizing the container yard overnight for fast, efficient loading onto on trucks and trains the next morning; and digital checkpoints reduce delays for trucks. From an operations standpoint, as throughput grows, GHG emissions should decline thanks to the combination of zero-emission electric cargo-handling equipment and more-efficient logistics.^{xxxviii} The SPBPs are currently piloting a variety of automated technologies on their property as part of their Technology Advancement Program to showcase and test the effectiveness of these technologies.^{xxxix}

The first two fully automated container terminals in the U.S. are located at the SPBPs. Both have electrified their Ship to Shore (STS) cranes, Automated Guided Vehicles (AGV), and automated stacking cranes.^{xi} POLB's Long Beach Container Terminal at Middle Harbor includes a 4,200-foot long wharf where up to three 14,000-TEU ships can plug into shore power and be worked simultaneously; 14 tandem-lift dual-hoist ship-to-shore cranes; 102 electrified automated guided vehicles that transport containers between the docks and the yard; and 72 electric automatic stacking cranes that manage container staging, priorities and movements.^{xii} APM Terminal (Pier 400) at the Port of Los Angeles is also trialing automated straddle carriers (referred to as "auto-strads") on roughly a quarter of their 440-acre facility to help reduce operating costs.^{xiii}

4.4.4 SMART INFRASTRUCTURE AND CONNECTED TECHNOLOGIES

By leveraging data-driven SMART technologies (which generally refer to data-driven systems and applications that utilize artificial intelligence, internet connectivity and other advanced technologies), delivery companies can improve efficiency, reduce congestion, and contribute to a more sustainable and accessible transportation network. Cities can leverage these technologies to encourage driving behaviors in alignment with city goals, improve parking enforcement, and maximize the use and revenue generation of available curb space for last-mile deliveries. Examples of employing these technologies include:

- Real-time data collection: Install sensors or use existing infrastructure to gather real-time data on curb availability, parking occupancy, and delivery zones. This data can be collected through various means such as cameras, Internet of Things (IoT) devices, or mobile applications.
- Predictive analytics: Utilize historical and real-time data to develop predictive analytics models. These models can estimate the demand for parking and curb space at different times of the day or week, helping companies plan their operations more efficiently. Furthermore, this integration can provide access to additional datasets, such as traffic flow data, weather conditions, and event schedules, enabling more comprehensive and informed decision-making.
- Route optimization: Implement intelligent routing algorithms that consider real-time data on curb availability, traffic conditions, and delivery schedules. This enables companies to optimize their delivery routes, minimizing travel time and maximizing the utilization of curb space.
- Dynamic pricing: Employ dynamic pricing strategies based on demand and availability of curb space. By analyzing data patterns, companies can adjust pricing for parking and curb access in real-time, encouraging efficient use of limited space and incentivizing behavior that reduces congestion.

- Mobile applications and IoT integration: Develop mobile applications that enable drivers to access real-time information about available parking spots, delivery zones, and curb regulations. Integration with IoT devices can provide additional features like remote monitoring of vehicle status and automated check-in/check-out processes.

4.4.5 AUTONOMOUS TRUCKING

Currently the California Department of Motor Vehicles (DMV) has approved the Office of Administrative Law revising regulations and allowing for the testing and deployment of autonomous motor trucks (delivery vehicles) weighing less than 10,001 pounds on California's public roads with an approved permit from DMV. DMV regulations continue to exclude the autonomous testing or deployment of vehicles weighing more than 10,001 pounds. For autonomous trucking, there are several well-defined stages in vehicle automation, from minimal driver assistance (Level 1) to fully autonomous vehicles with no driver options (Level 5). Autonomous vehicles rely on a range of technologies such as cameras, LiDAR, and radar to feed data to a computer, which in turn controls the vehicle using data gathered through training and simulation. Early research suggests that adopting autonomous vehicle technology could help in addressing driver shortages and improve fuel efficiency. However, as is the case with other forms of automation, the technology's impact driver job security in the long term remains a prevalent concern.

Autonomous driving technology for freight-carrying trucks is rapidly advancing, with a focus on testing routes that predominantly use interstates, where it's safer for unmanned operation due to reduced traffic and obstacles. These autonomous trucks rely on sophisticated sensor technology, such as LiDAR, which calculates object distances using light-based measurements. Trucks, with their higher position and larger surface area, are well-suited for installing LiDAR sensors, enabling faster sensing of potential risks. In recent years, there has been progress in the deployment and development of this technology, with several major truck manufacturers and tech companies forming partnerships to advance autonomous trucking technology.

However, there are several challenges and opportunities to address before fully deploying autonomous truck fleets. Necessary infrastructure, including remote control centers and sensor-equipped trucks, must be established, and safety testing should demonstrate acceptable success rates. While autonomous trucks have shown benefits like reduced accidents, fuel savings, and streamlined shipping processes, there are concerns over public safety and potential job displacement for drivers. To launch a successful autonomous truck fleet, extensive research, testing, and troubleshooting are essential. Legislation and regulations should address public safety, road impacts, and freight routes. Liability concerns in case of accidents involving autonomous trucks need to be addressed as well. Retrofitting existing trucks with LiDAR technology and gradually producing autonomous freight trucks as the standard can help demonstrate the full benefits across the industry. California has taken a more conservative approach to autonomous truck testing and demonstration, and development for enhancing efficiency and safety in goods movement through autonomous vehicles will similarly continue to move forward on various paths.

4.4.6 TUBE-BASED CARGO TRANSPORTATION

SCAG actively explores alternative and innovative approaches to manage truck movements in the region, and one promising solution is the utilization of tunnels and tube-based technologies for goods transportation. Tunneling involves the construction of underground passages to facilitate the movement of vehicles, and the technology has evolved significantly over the years, making it feasible for various

types of traffic, including heavy rail transit systems and cars. In Southern California, tunnels can be strategically built in locations close to sea level, submerged in water, and even in seismically active areas like the Bay Area Rapid Transit (BART) passenger rail system in the San Francisco Bay Area.

Hyperloop system tube-based technologies are capable of increasing capacity and efficiency while decreasing pollution and congestion at seaports worldwide. This transportation system allows for transport of goods between seaports, dry ports, and logistics centers on short, medium, and long distances at up to 380 mph. Capsules levitate inside a tube using passive magnetic levitation technology eliminating friction and the low-pressure environment and electromagnetic propulsion system propels the capsule. This allows for faster speeds and a safer, cleaner, and quieter form of energy efficient transport. Such systems can be powered by renewable energy which can be designed to be net-energy positive on an annual basis. Such transport systems are typically engineered to transport between 2,800 to 8,400 TEUs daily in a fully enclosed operating environment that is immune to weather conditions, and eliminates at-grade crossings to increase reliability, efficiency, and worker and public safety. Such technologies can offer several advantages:

- **Reliability:** Infrastructure is protected from weather and track interference eliminating delays and damaged cargo.
- **Speed:** Reduces ground cargo travel time across long distances from hours to minutes at the cost of rail.
- **Sustainability:** Energy efficient technology powered by renewable energy creates high-speed emission-free connectivity.
- **Flexibility:** Automation and capsule per container movements create a highly flexible system capable of seamlessly delivering cargo.
- **Capacity:** On-demand operation creates a scalable system capable of responding to high cargo volumes.

Keeping the current regional freight challenges in mind along with the advantages of a tube-based system, there is a potential of high-speed cargo transport from the SPBPs to the Inland Empire. While ultra-high speed is not essential, reliability and capacity are critical.

5. GOODS MOVEMENT CHALLENGES

There are a variety of challenges facing goods movement industries, stakeholders, and regional communities. Some of these challenges are isolated, but many are also connected to impacts directly related to public benefits whether economic or health oriented. There are challenges that are outside the control of the region, especially with respect to global trade and supply chain relationships necessitating resiliency throughout the system. There are challenges from policy and regulatory rules which are geared to support public health needs and are placing increasing pressure on goods movement industries across the state. There are challenges from economic perspectives including highway and roadway congestion and delay and workforce issues. There are challenges related to communities, public safety and security, as well as specific industry areas such as truck parking and rail services. These challenges are important to understand as variables continue to shift, while helping frame implementation strategies and initiatives.

This section provides a review of challenges including supply chain perspectives, the regulatory environment, highway and roadway congestion and delay, freight corridor bottlenecks, truck parking issues, freight rail service issues, community and environmental impacts, land use trends, safety and security, and workforce sustainability.

KEY TAKEAWAYS:

- It is important to note that freight market cycles in contraction or recession do not always correlate with overall economic performance.
- The cost to move freight remains elevated to varying degrees depending upon freight mode of transport, and whether contracted or spot market based. This is a clear sign that while shipment levels have normalized back to longer-term pre-COVID-19 pandemic trends, freight supply chains are still grappling with constraints and degrees of instability contributing to the current higher inflationary economic cycle.
- As the world focuses on climate change and continues to shift towards zero-emission policies, the surge in critical mineral components has also become an increasingly contentious area where the U.S. has developed policies to shift inputs and materials into U.S. clean technology manufactured components and products versus relying solely on China.
- Resilience is a direct illustration of how, despite freight markets being highly cyclical, it is imperative to continue to invest in infrastructure and facilities supporting the system to optimize operating efficiencies capable of absorbing unforeseen impacts. As performance of supply chains have illustrated throughout the COVID-19 pandemic, the pace of growth in capacity will be informative as to the resilience of Southern California's freight systems.
- State zero emission rules, notably ACF present challenges across trucking industries with independent owner operators being the most difficult to address. The nature of independent owner operator domicile locations and trips are complex ranging from moves closer Los Angeles County to much further trips to San Bernardino and Riverside, and even outside of the state to adjacent states like Arizona and Nevada, or internationally to Mexico.
- Freight corridors will continue to experience a confluence of increasing passenger and freight demand impacting trucking and rail services. Truck parking continues to be an issue as parking needs exceed ideal placement, while rail services are grappling with infrastructure capacity challenges.
- Public safety remains at the forefront of public agency initiatives for roadways and rail grade crossings, while the increase in sophisticated theft and hacking of systems continues to threaten goods movement and supply chain security.
- Local community impacts require further stakeholder engagement and knowledge-building to address the amount of issues across the region. Having a diverse economy is the most sustainable approach to ensuring that workforce opportunities continue to grow and benefit from technological change and innovation.

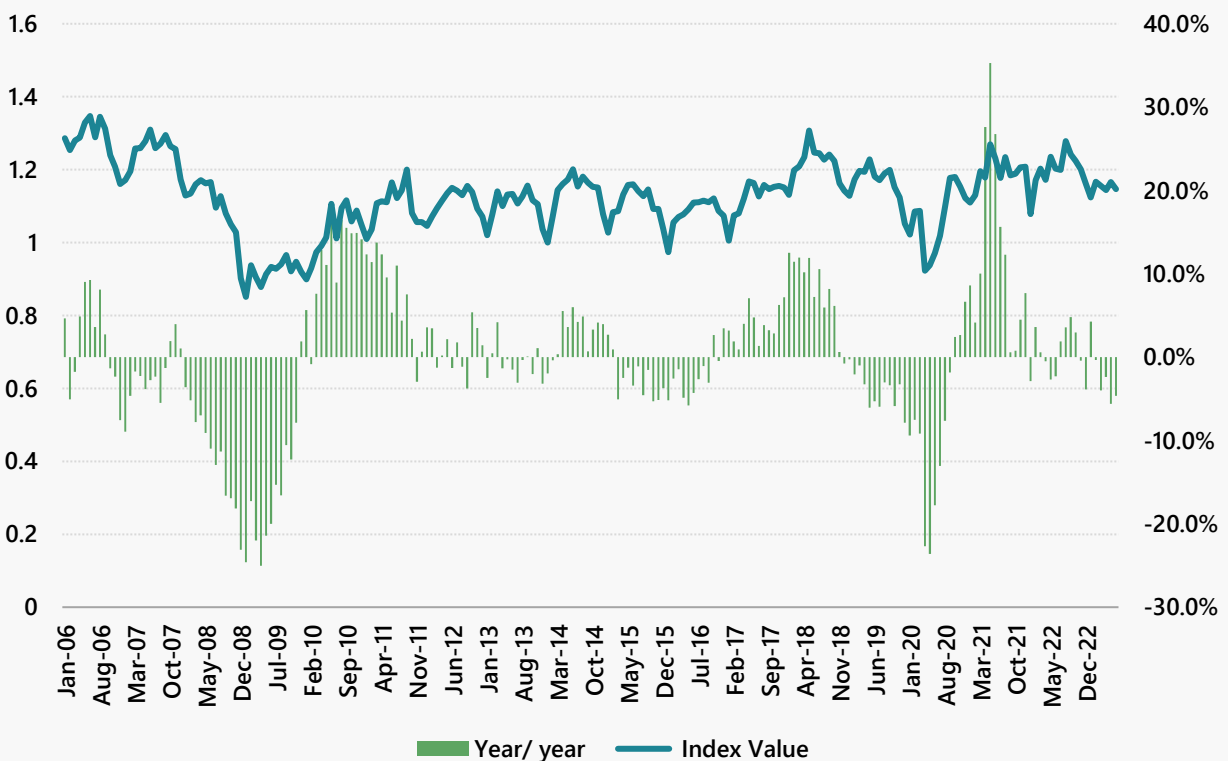
5.1 SUPPLY CHAIN PERSPECTIVES

While the supply chain is essential to support business and resident needs, it also is very sensitive to impacts that effect the global process from manufacturing to distribution, to the sales of goods whether digital or physical. It is important to recognize that the cyclical nature of freight markets has a lot to do with variables beyond the control of the SCAG region with the last six years witnessing national tariff policies, the COVID-19 pandemic, war between Russia and Ukraine, and many other increasing geopolitical tensions, none more notable than with the U.S. and China. As market volatility has ensued, a clear trend has emerged where many freight volume indicators have returned to pre-COVID-19 pandemic levels. As part of this trend, inflationary pressures continue to persist in an atypical fashion as longer-term structural issues remain from supply chain breakdowns.

5.1.1 FREIGHT CYCLES

The COVID-19 pandemic began in March 2020 in the U.S. and while this event has had the strongest impact on supply chains over the past few years, it is important to recognize that historically, the goods movement system has been affected by numerous freight cycles. The two core components of freight activity and pricing illustrate how each different freight cycle has performed, which translates directly to the duration and degree of impacts on freight infrastructure and facilities.

Figure 32. Cass Freight Index - Shipments



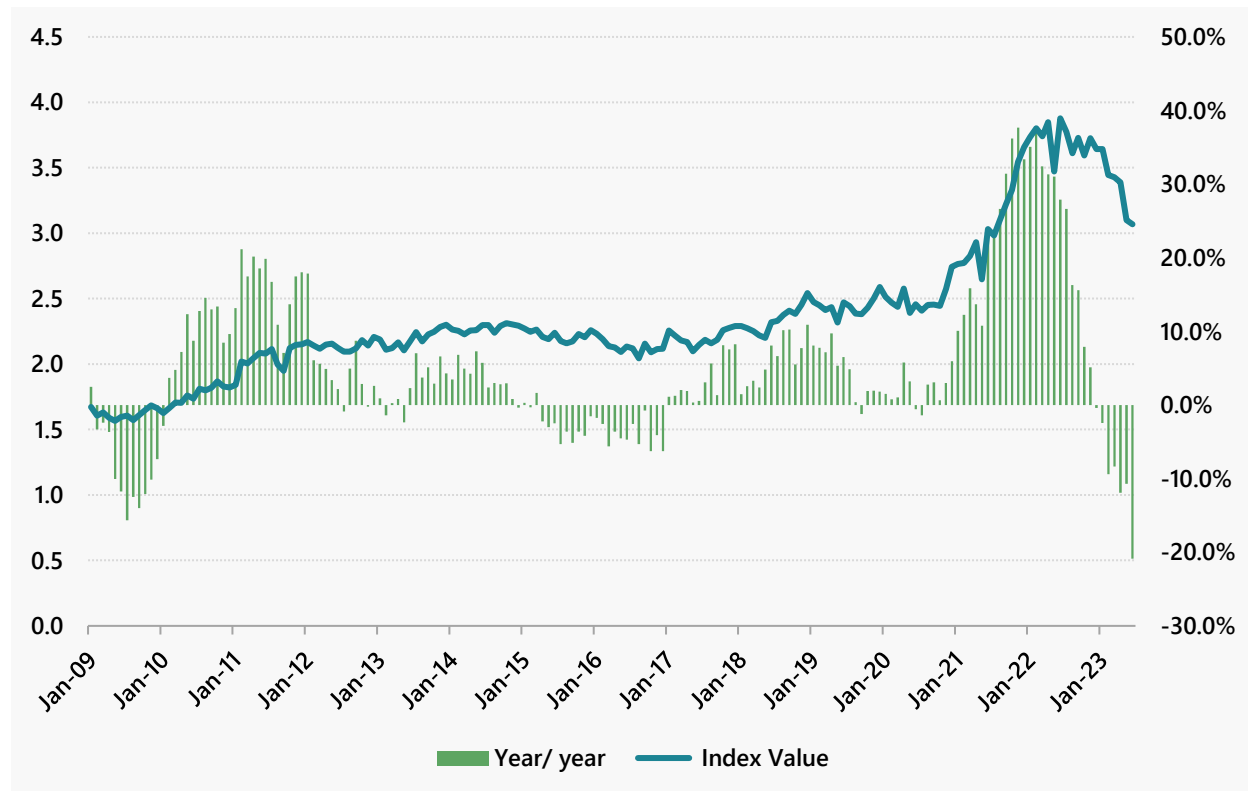
Source: *The Cass Freight Index*

The Cass Freight Index estimates the volume of freight moved across all domestic freight modes and is derived from 36 million invoices and \$44 billion in spend processed by Cass annually on behalf of its client

base of hundreds of large shippers. These companies represent a broad sampling of industries including consumer packaged goods (CPG), food, automotive, chemical, medical/pharma, original equipment manufacturers (OEMs), retail, and heavy equipment. Annual freight volume per organization ranges from \$40 million to over \$2 billion. The diversity of shippers and aggregate volume provide a statistically valid representation of North American shipping activity, with the U.S. being the largest driver.

Shipment activity performance since 2005 has witnessed six very distinct freight recessions including the current one (Figure 32). This compares with two official U.S. economic recessions over the same period, so it is important to note that freight market cycles in contraction or recession do not necessarily need to correlate with overall economic performance. In fact, a peak freight market cycle had occurred through 2018 with a freight recession immediately following in 2019, prior to the COVID-19 pandemic. While the Great Recession and COVID-19 pandemic recession stand out as major years where trucking company bankruptcies surged, 1,100 companies went bankrupt during 2019 alone reflecting approximately 24,000 truck drivers, with broader volumes for seaport, rail services, and air cargo all witnessing declines as well. The COVID-19 pandemic exacerbated this recession during 2020, however, it soon led to the strongest monthly shipment performance since 2005 during April through June 2021, reflecting performance from the most stringent lock down months in 2020 and 2021. As shipment activity has returned to pre-COVID-19 pandemic levels, it is important to note that this current level is indicative of the trend of performance during 2011 through 2017, with 2018 serving as a freight peak cycle based on shipment activity index value.

Figure 33. Cass Freight Index - Inferred Rates

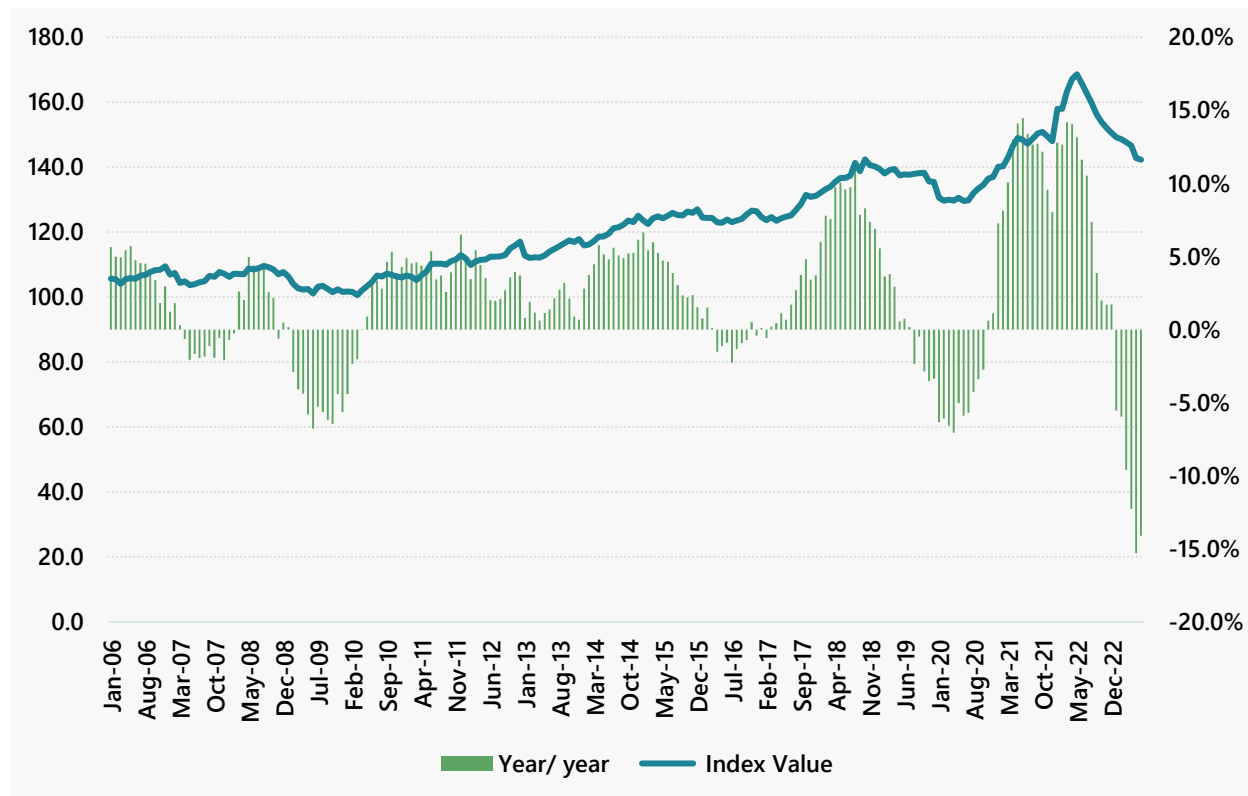


Source: The Cass Freight Index

The cost of moving freight is equally as important as monitoring freight shipment activity as there are many relationships as to where freight enters the U.S. and by what freight mode based on this cost. Cass

Inferred Freight Rates are a simple calculation of the Cass Freight Index data—expenditures divided by shipments—producing a data set that explains the overall movement in cost per shipment. The data set is diversified among all modes, with truckload (TL) representing more than half of the dollars, followed by less-than-truckload (LTL), rail, parcel, and so on. While inferred rates have dropped substantially of late mirroring weakening shipment demand, the current index value remains 26 percent higher than the 2019 monthly average (Figure 33). Current inferred rates are up 43 percent from the 2012 monthly average levels leading to an annualized increase of six percent since 2019. During the 2012 through 2019 period when looking at monthly averages, inferred rates witnessed an annualized 1.9 percent growth rate.

Figure 34. Cass Truckload Linehaul Index



Source: *The Cass Freight Index*

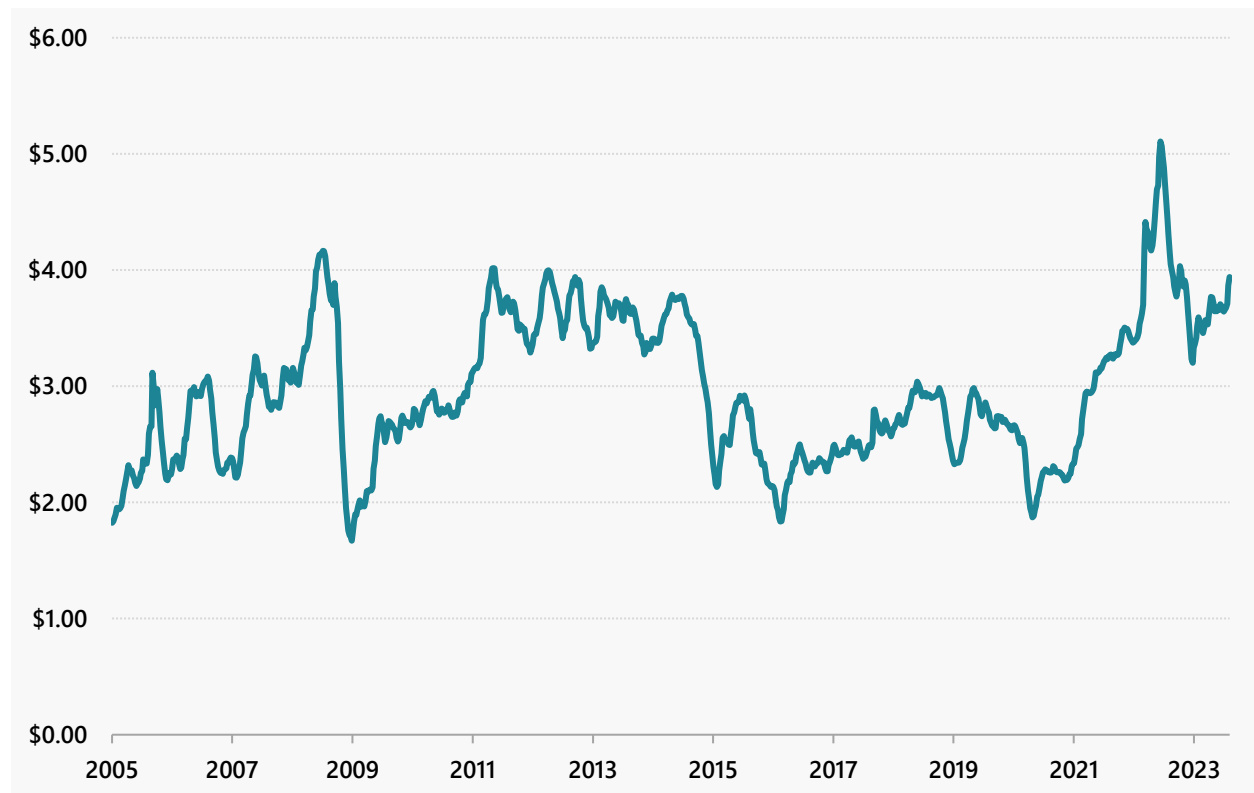
The Cass Truckload Linehaul Index, which measures the per-mile change in linehaul rates also displays a similar occurrence as despite some of the worst declines since 2005, the index value remains three percent higher than the 2019 monthly average (Figure 34). In short, the cost to move freight remains elevated to varying degrees depending upon freight mode of transport, and whether contracted or spot market based. This is a clear sign that while shipment levels have normalized back to longer-term pre-COVID-19 pandemic trends, freight supply chains are still grappling with constraints and degrees of instability contributing to the current higher inflationary economic cycle.

5.1.2 GEOPOLITICS

Geopolitics represents the primary variable that typically leads to multiple areas outside of the control of the region. This tangibly transfers to shipment activity and freight cost relationships, and inevitably impacts freight infrastructure and facility capacity and operations across the goods movement system.

The relationship between the U.S. and China is a core example of this as differing lock-down cadences throughout the COVID-19 pandemic and policies towards health-related responses to the COVID-19 pandemic were primary drivers impacting supply chain disruptions. Additionally, as the world focuses on climate change and continues to shift towards zero-emission policies, the surge in critical mineral components has also become an increasingly contentious area where the U.S. has developed policies to shift inputs and materials into U.S. clean technology manufactured components and products versus relying solely on China. There are numerous areas within Southern California including San Bernardino County and the Salton Sea as well as adjacent states like Nevada and Arizona where critical mineral resource extraction development is occurring.

Figure 35. Weekly U.S. All Grades All Formulations Retail Gasoline Prices (Dollar per Gallon)



Source: United States Energy Information Administration

The war between Russia and Ukraine has not been a direct engagement with the U.S. But there are impacts that have contributed to inflationary energy changes within the U.S. This has impacted freight costs across all areas of supply chain activity. In February of 2022, Russia invaded Ukraine and subsequent gasoline prices in the U.S. increased by 37 percent four months later in June before moderating back below the \$4 national level (Figure 35). Exceeding the \$5 level was a first since 2005 as just over the \$4 level was the prior peak during this period. During the peak in June of 2022, retail gasoline prices had increased by 88 percent versus the 2019 weekly average.

5.1.3 RESILIENCE

Ultimately, the resiliency of the goods movement system in Southern California is a necessity. Resilience is a direct illustration of how, despite freight markets being highly cyclical, it is imperative to continue to

invest in infrastructure and facilities supporting the system to optimize operating efficiencies capable of absorbing unforeseen impacts. This is no clearer than with the examples of the COVID-19 pandemic and Hawaii wildfires in Maui that have shown the importance of this system for essential needs during times of crisis. As performance of supply chains have illustrated throughout the COVID-19 pandemic, the pace of growth in capacity will be informative as to the resilience of Southern California's freight systems.

When it comes to the durability and resilience of the goods movement system, key challenges have involved impacts to capacity and operational efficiencies from unforeseen events as well as cyclical labor impacts all being critical to sustain overall regional competitiveness. Over the past three years, the greatest shock on the goods movement system and supply chains has been the COVID-19 pandemic. The supply chain disruptions from the COVID-19 pandemic led to extreme volatility with respect to the flow of goods, culminating in as many as 100 reported containerships being anchored off the SPBPs in the fall of 2021 with issues cycling through early 2022. This surge in containerized cargo needing to be offloaded at the ports had a cascading effect across the Southern California supply chain and goods movement system, impacting some of the most critical items including food, healthcare, and many other basic needs. To measure the magnitude of impact, one of the core metrics used to assess operating efficiency is dwell time. Dwell time typically refers to the time container/trailer equipment hauling shipments of goods remains at key interchange points. Major areas where dwell time is measured include the SPBPs and Port Hueneme terminals, intermodal railyard terminals, warehouse and distribution facilities, fulfillment/sortation/delivery centers, among others. Essentially every point of interchange relies on efficiencies of process for in-take and output of shipments adding value to customers and the overall supply chain.

During 2021 and through 2022 both overall container dwell times and rail-related dwell times serving the SPBPs witnessed substantial increases for container equipment. As these increases led to bottlenecks at the waterfront, moving containers from the seaports also led to further congestion issues for both rail and trucking operations within their respective facilities, including across warehouse and distribution facilities. Combined with the large swings in consumer activity driving these demand surges initially, and overstocked inventory levels have created further complications even with reduced demand. There are still stressors across the system as capacity is being impacted by slowing trends like industrial growth, while other equipment trends and the need to move inventories remain high. As an example, many operators especially trucking companies have not been able to receive their equipment needs for trucks and trailers quickly enough to increase capacity more in line with recent demand surges. The COVID-19 pandemic has substantially impacted procurement and delivery of equipment orders well beyond typical expectations and continued equipment deliveries are a direct result of this, even as volumes have declined.

While the magnitude of the COVID-19 pandemic may continue to have implications for the foreseeable future, other major shocks and stressors the system has encountered the past few years have included the war between Russia and Ukraine, as well as most recently the Hawaii wildfires in Maui. Each different event includes a separate host of variables and implications for how goods are distributed globally and locally. While most of the associated impacts from the war between Russia and Ukraine were related to increased energy costs upon U.S. businesses and residents, the Maui fires offer a completely more serious impact with respect to loss of life and extreme destruction of properties. The need for immediate delivery of essential goods by containership, barge, air cargo or any means available have been relied upon to get communities emergency-related items, as well as materials to begin the rebuilding process. Pandemics, war, fires, and other natural disasters remain core risks for the future movement of goods in the SCAG region, and as the COVID-19 pandemic has illustrated how shocks and stressors can be dealt with is further risk to how impacts occur globally as well as locally.

5.2 REGULATORY ENVIRONMENT

The State of California Governor's Executive Order N-79-20 requires that by 2035, all new passenger cars and trucks sold in California be zero-emission vehicles. Under the order, CARB is mandated to develop and propose strategies to achieve 100 percent zero-emissions from medium and heavy-duty on-road vehicles in the state by 2045 where feasible and by 2035 from drayage trucks. Since Connect SoCal 2020, there have been multiple rules passed by CARB including the Advanced Clean Trucks (ACT) rule in June 2020, the In-Use Locomotive rule in April 2023, and the Advanced Clean Fleets (ACF) rule in April of 2023 as well. Additionally, the South Coast AQMD passed the Warehouse Indirect Source Rule (ISR) in May 2021.

There are many opportunities to offset the costs of zero emission vehicles and infrastructure from state incentive programs and from federal grant programs. Additionally, the SCAG region has many agencies involved in supporting the state's objectives including SCAG's LMFP and ZETI study, the SPBPs Clean Air Action Program (CAAP), Clean Truck Program (CTP), and Technology Advancement Program (TAP), AQMD's Voucher Incentive Program (VIP), Mobile Source Air Pollution Reduction Review Committee (MSRC) work program, Los Angeles Cleantech Incubator (LACI) programs and county transportation commissions' programs and projects, among others.

Many of these programs, studies, and projects have led to very successful public-private partnerships to implement near-zero and zero emission commercial deployment of vehicles, equipment, and supporting infrastructure. The core challenge moving forward is predicated on the targets established as part of the rules that have been passed, notably for ACT and ACF.

Originally, the ACT targeted 2024 to begin requiring lower NOx emissions. In July 2023 it was announced that the ACT would follow the Environmental Protection Agency's (EPA) plans for reduction of NOx in 2027. Additionally, under the ACT, CARB agreed to:

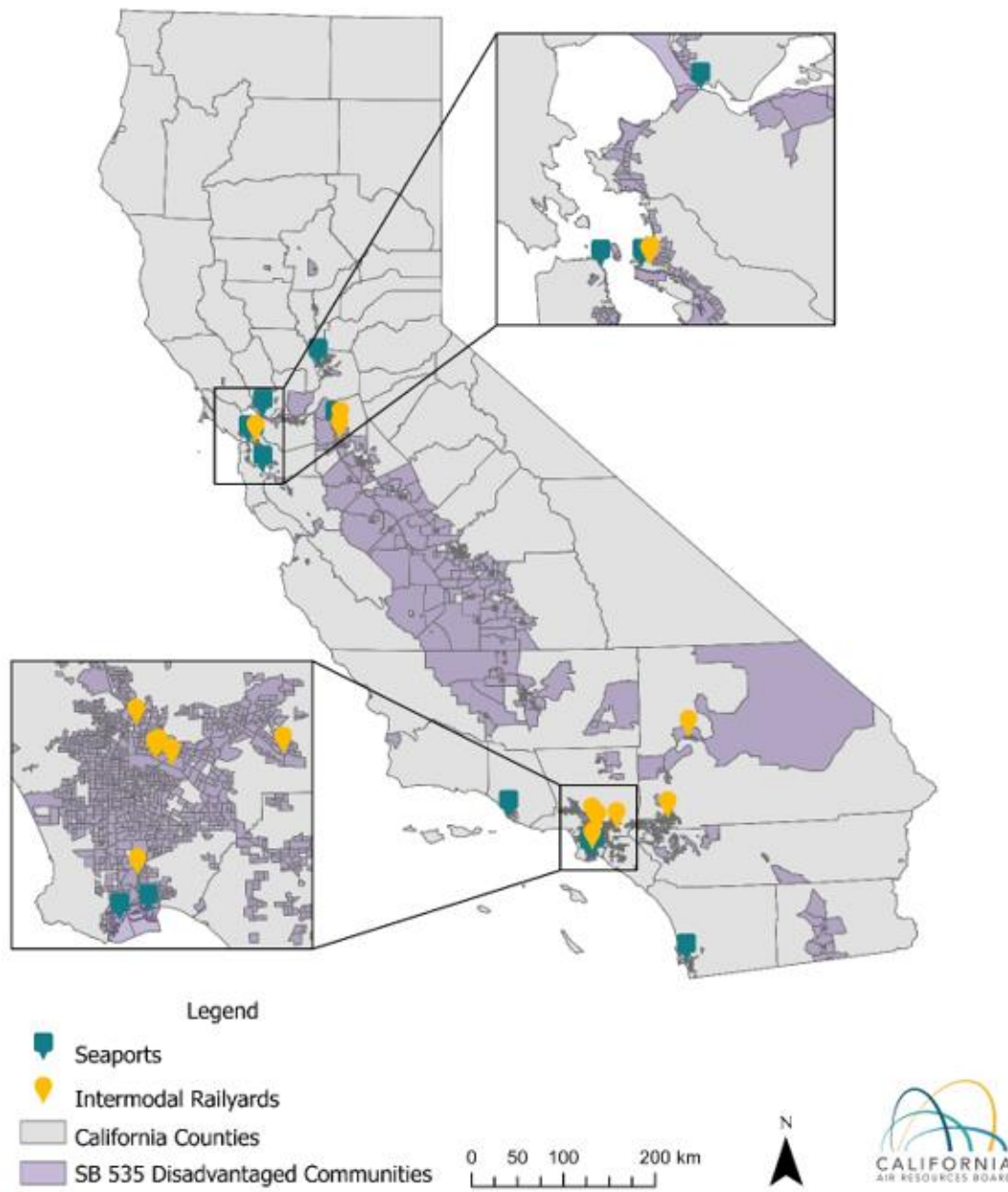
- Align with EPA's 2027 regulations for NOx emissions and modify elements of the 2024 NOx emission regulations for which manufacturers will provide offsets as needed to meet California's emission targets.
- Provide no less than four years lead time and at least three years of regulatory stability before imposing new requirements.
- Support the development of necessary zero emissions vehicle infrastructure.

It is to the last bullet that there remains a challenge to scale and increase the rate of zero emission vehicle production and deliveries in Southern California. Multiple state agencies including CARB, the CEC, CPUC, and CTC via SB 671 continue to assess and quantify wide-scale cost implications, grid capacity, and other impacts from the infrastructure side for zero emission targets. More recently, the ACF as adopted has incorporated key mandates with impacts to the drayage trucks transporting cargo to and from the state's intermodal seaports and railyards including:

- Beginning January 1, 2023, drayage trucks must be compliant with the Truck and Bus Regulation and meet a 2010 or newer model year engine standard.
- Drayage trucks will be required to start transitioning to zero-emission technology beginning in 2024, with full implementation by 2035.
- All drayage trucks intending to begin or continue operations at a California seaport or intermodal railyard must be registered with CARB (Figure 36).
- Combustion powered trucks (non-zero-emission) must register in the CARB Online System by 12/31/23.

- Only zero-emission drayage trucks can register in the CARB Online System beginning 1/1/24.
- Non-zero-emission drayage trucks in the CARB Online System, with a 2010 or newer model year engine and that visit a seaport or intermodal railyard at least once in a year, would remain in the system until they reach either 800,000 miles or the engine is older than 18 years, whichever comes first.
- Beginning in 2025, non-zero-emission trucks will be removed from the CARB Online System if they did not meet the annual visit requirement, or if they have exceeded their minimum useful life requirements.
- Beginning in 2035, all trucks in the CARB Online System will be required to be zero-emission.

Figure 36. Seaport and Intermodal Railyards in California



Source: California Air Resources Board

It is not clear whether the shift with the ACT rule to 2027 will have an impact on ACF as fleets are clearly dependent upon OEMs to delivery their vehicles. Additionally, for fleets outside of the drayage industry, there are options with respect to the percentage of vehicles that must be zero emissions within these fleets over time (Table 7).

Table 7. ZEV Fleet Milestones by Milestone Group and Year

Percentage of vehicles that must be zero-emission	10%	25%	50%	75%	100%
Milestone Group 1: Box trucks, vans, buses with two axles, yard tractors, light-duty package delivery vehicles	2025	2028	2031	2033	2035 and beyond
Milestone Group 2: Work trucks, day cab tractors, buses with three axles	2027	2030	2033	2036	2039 and beyond
Milestone Group 3: Sleeper cab tractors and specialty vehicles	2030	2033	2036	2039	2042 and beyond

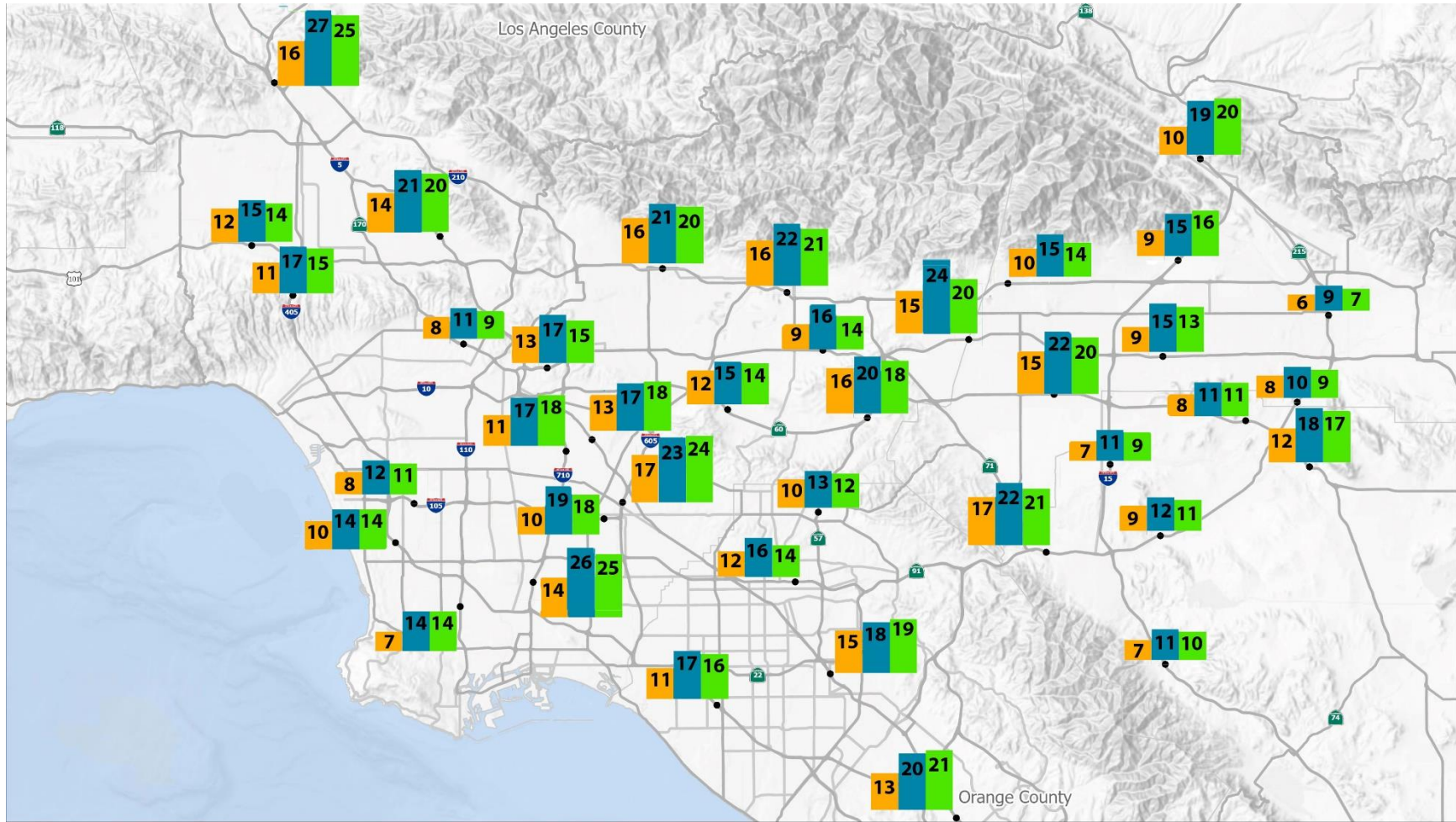
Source: California Air Resources Board

There is also anecdotal evidence suggesting that the push to acquire internal combustion engine drayage tractors prior to these dates has increased, which may lead to longer use of the technology. Additionally, information has also shown that some independent owner operators have either left the state to do business somewhere else or ceased operations entirely. There have also been impacts with OEMs halting production and deliveries for certain customers in the procurement process placing their ability to upgrade at risk. Independent owner operators serving the drayage market are the most important truck market consideration with respect to zero emission infrastructure as many do not domicile their tractors in the same fashion. Examples can range from a residence whether single family or multi-family, a rental storage location, to an equipment-based leasing location. The nature of independent owner operator trips also is complex ranging from moves closer Los Angeles County to much further trips to San Bernardino and Riverside, and even outside of the state to adjacent states like Arizona and Nevada, or internationally to Mexico.

5.3 HIGHWAY AND ROADWAY CONGESTION AND DELAY

Trucks carry the largest fraction of goods moved, both in terms of ton-miles and cargo value, of all goods movement modes on a roadway system that also carries growing passenger traffic. To better understand the locations that will demand greater truck efficiency and operational improvements, Connect SoCal considers current and future truck traffic volumes on key freight corridors. Truck traffic in the region is expected to grow at a very high rate, much higher than auto traffic, and will use an increasing share of the region’s highway facilities. The most heavily used routes are already extremely congested as described in the Freight Corridor Bottleneck Analysis section below and will continue to be in the future. This will cause increasing delay for the trucking industry and related transport modes that will ultimately increase costs to shippers and consumers.

Map 4. Truck Volumes on Key Corridors (2019, 2050 Baseline and 2050 Plan)



Daily Truck Volumes (Bidirectional)

Numbers in thousands (rounded)

2019

2050 Baseline

2050 Plan

Source: SCAG 2022

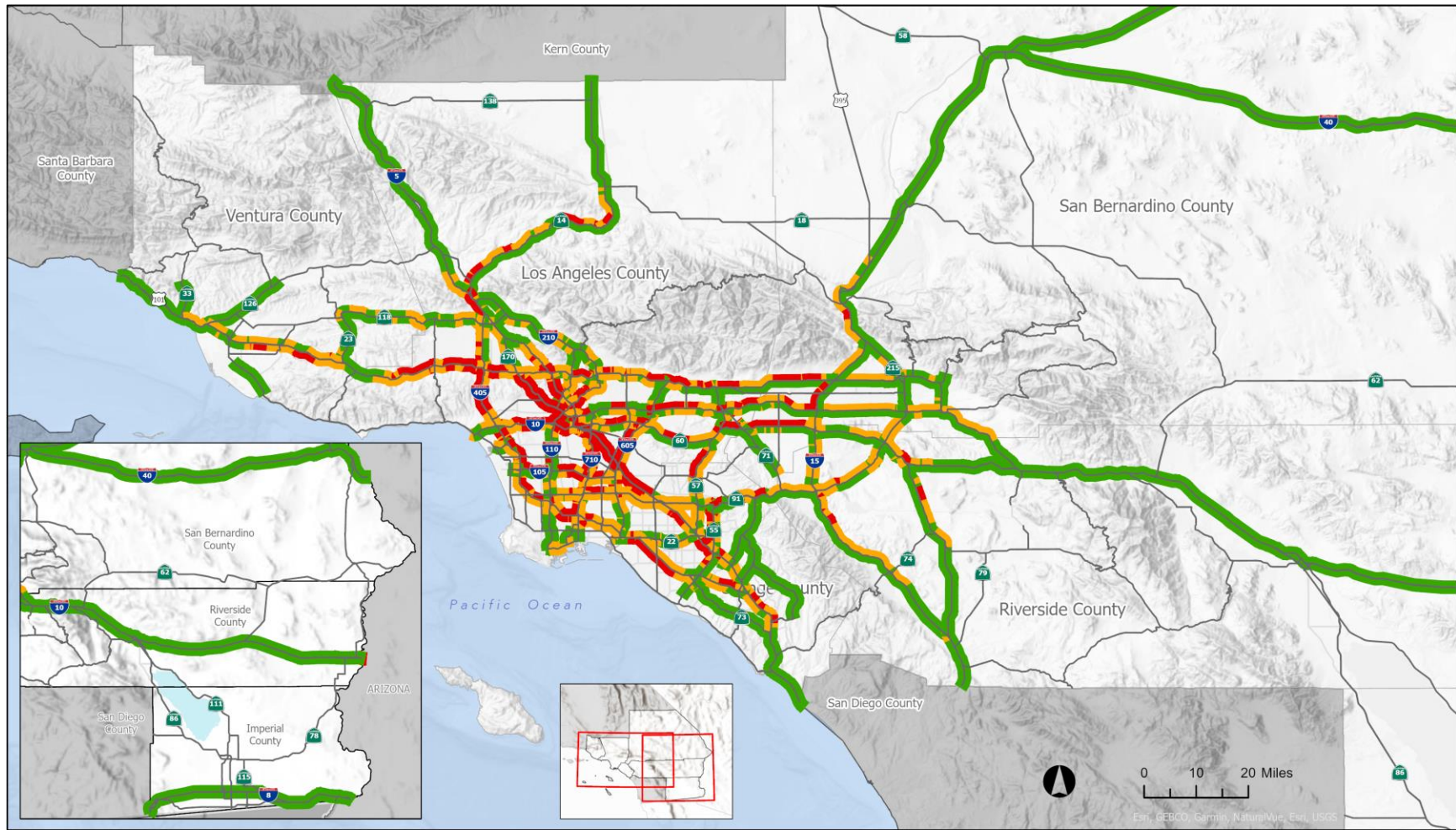
Because the highways and local roads currently accommodate all goods movement through the SCAG region, improving the highway system is a primary need for improving goods movement in the SCAG region and beyond. Truck restrictions on major freight corridors make shipping by truck less competitive. Moreover, this can make the port less competitive, and in some cases make other intermodal transport systems less competitive as well. As described in Map 4, there are rapidly increasing daily truck volumes on all major freight corridors in the region based on projected future horizon years. Although there are some freight corridors with similar truck trip volume from both forecasted baseline and plan scenarios most of the major congested freight corridors (I-5, SR-91, and SR-60) demonstrate significantly improving truck volume reduction through the corridor enhancement projects and policies implementations in the region.

In addition to truck volume-related improvements from Plan enhancements, there are also meaningful improvements on truck speed changes on major freight corridors from the freight planning model analysis. As part of the freight planning process, SCAG staff analyzed the data to identify critical freight corridors and their forecasting freight demands that provide regional access between existing freight clusters and regional connecting corridors.

The following maps demonstrate improvements in both AM and PM peak periods including less congested truck volumes that lead to higher truck speed on the major freight corridors in the forecasting baseline and plan scenarios resulting from freight related projects and implementation strategies. When comparing the modeling results between base year (2019) and forecasting years (2050), there is a significant improvement in the major corridors that stretch out from the SPBPs and Downtown Los Angeles to the Inland Empire (IE) region and beyond in-land regions. Although there are some corridors that show the improved speed in the forecasting baseline year, this trend was derived from the decreased demands of the population and workers forecast that could increase the speed on the major freight segments under the condition with no change on the supply side such as highway capacity improvement or higher infrastructure utilizations.

As series of truck speed maps shown below, for the horizon year have improved truck speeds on most major freight corridors, and particularly, AM and PM peak truck speeds forecasted from the 2050 Plan model results. These maps demonstrate around a 50 mph and above truck speed in most highways that include the gateway access highway segments near the SPBPs.

Map 6. Average 2019 Weekday Truck Speeds on Highways –AM Peak Period

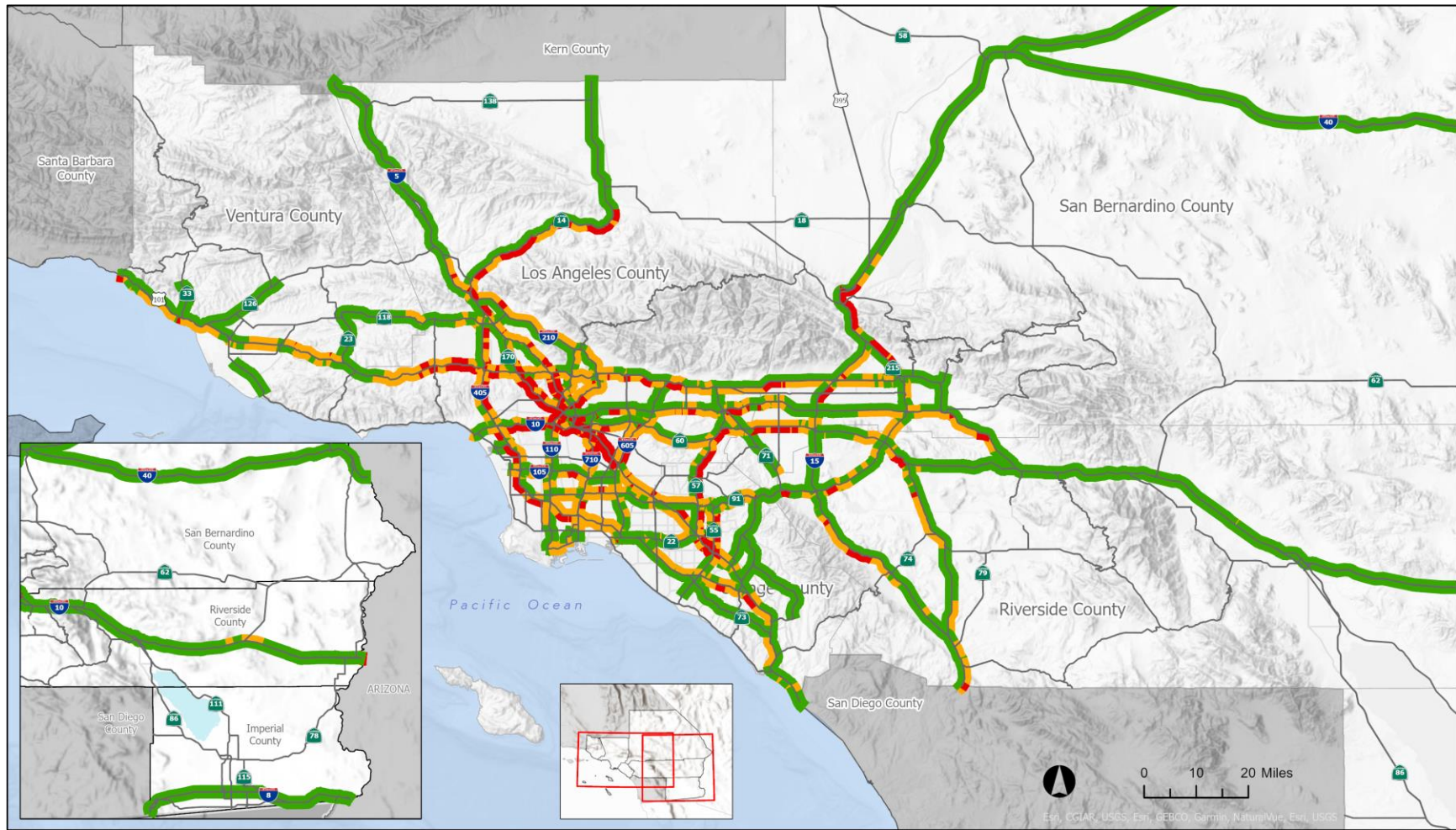


AM Peak Speed (mph) 2019

- Less than 35
- 35 to 50
- Greater than 50

Source: SCAG

Map 7. Baseline 2050 Weekday Truck Speeds on Highways –PM Peak Period

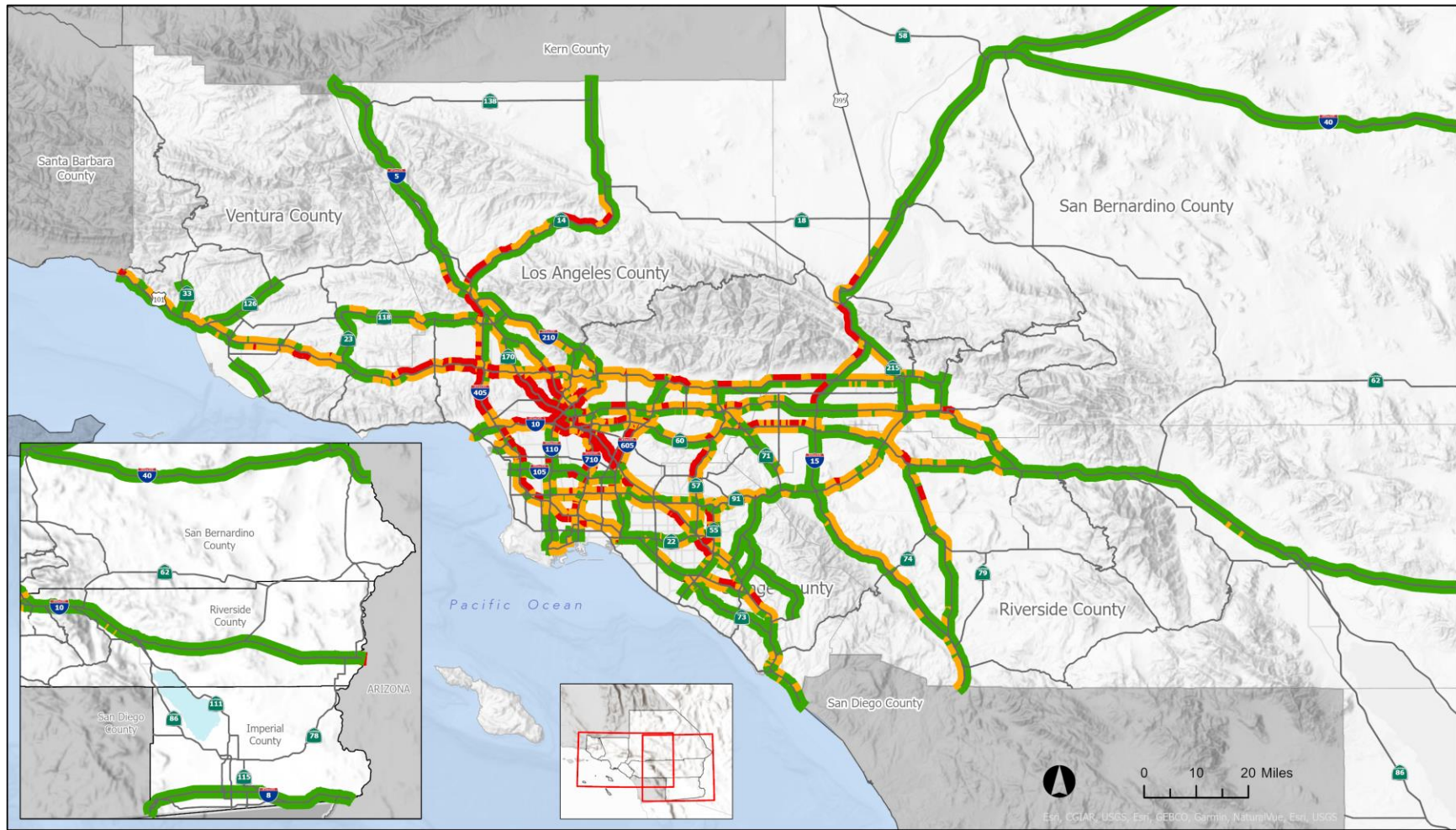


PM Peak Speed (mph) 2050

- Less than 35
- 35 to 50
- Greater than 50

Source: SCAG

Map 8. Baseline 2050 Weekday Truck Speeds on Highways –AM Peak Period

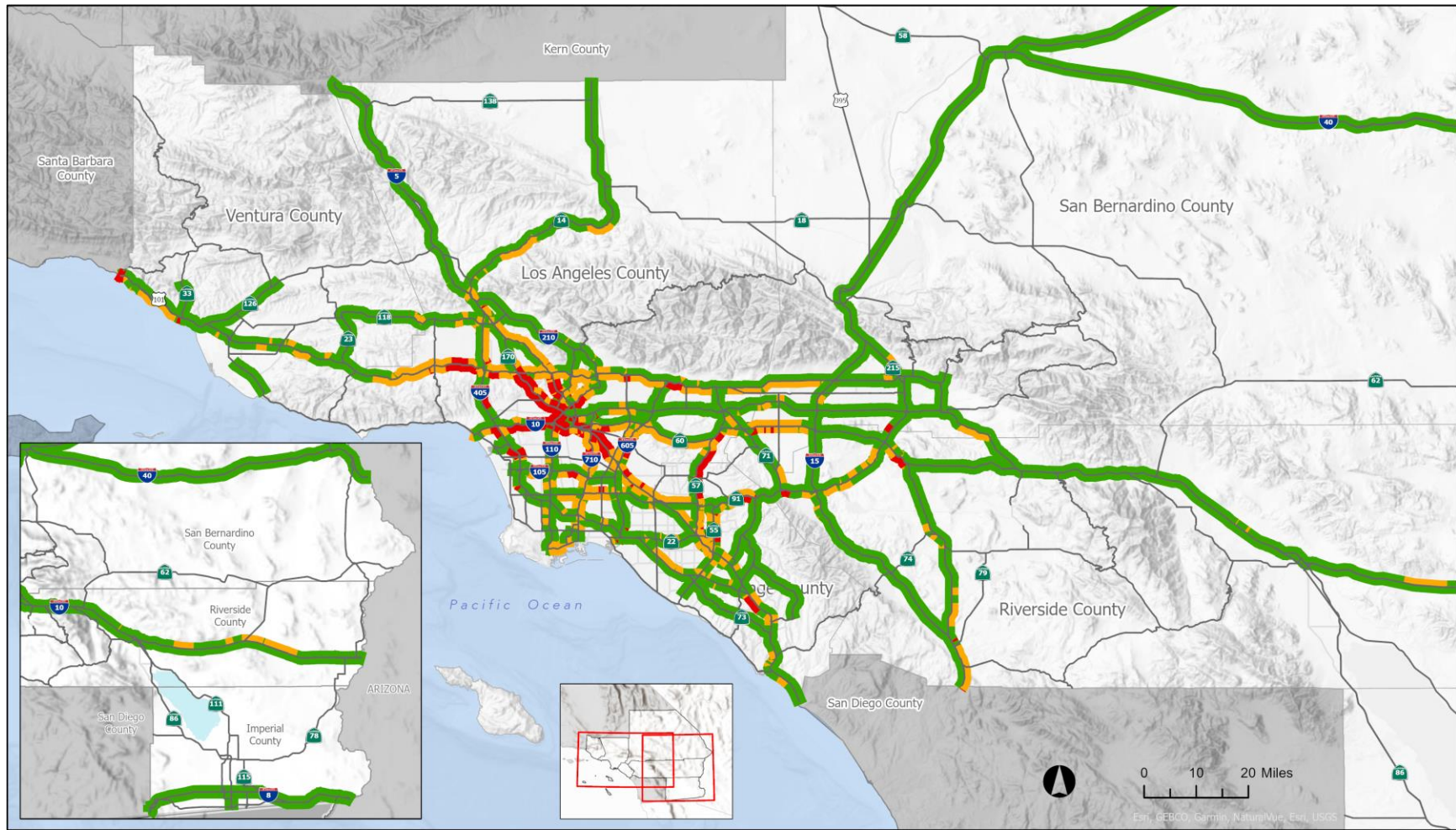


AM Peak Speed (mph) 2050

- Less than 35
- 35 to 50
- Greater than 50

Source: SCAG

Map 9. Plan 2050 Weekday Truck Speeds on Highways –PM Peak Period

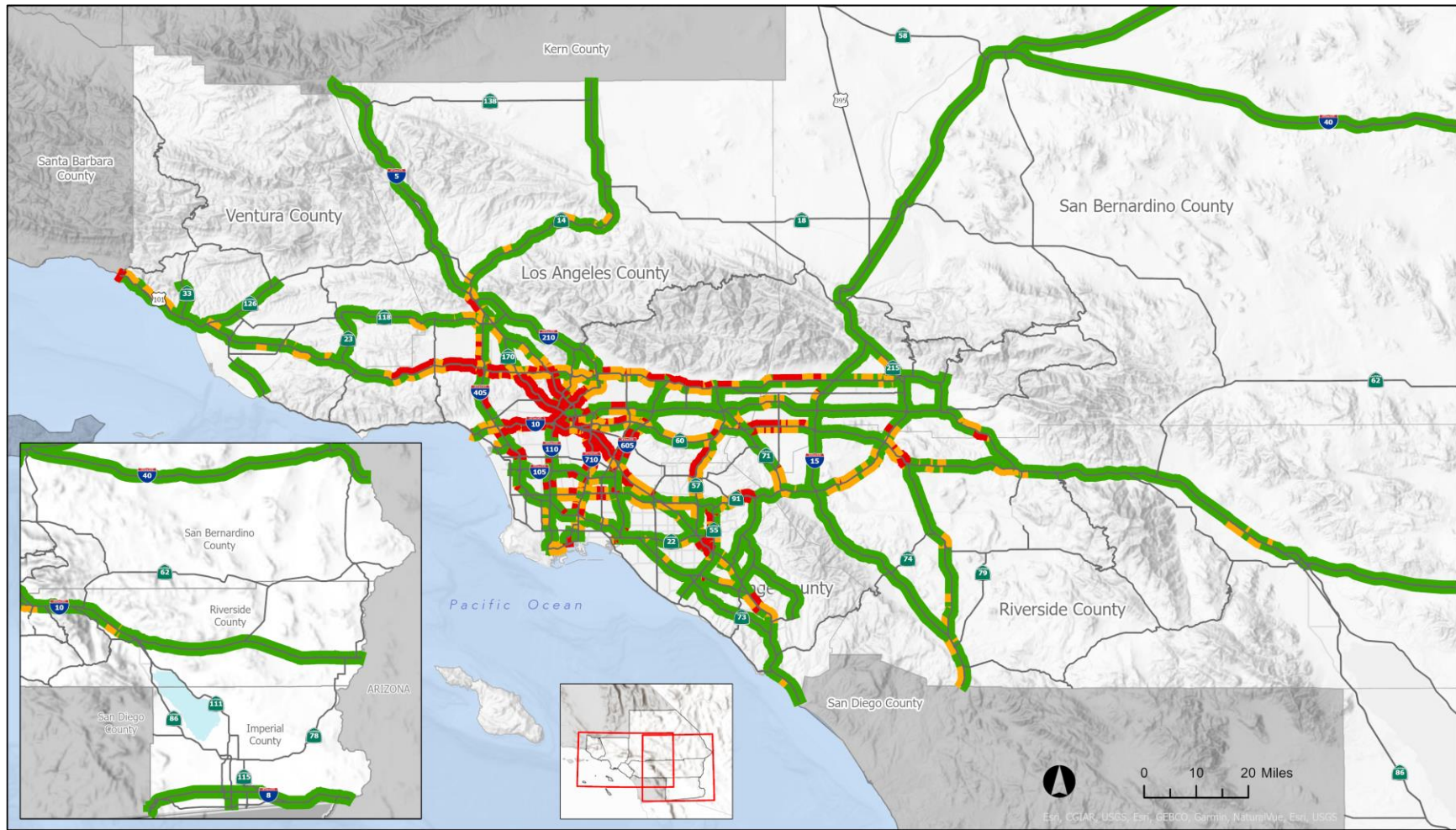


PM Peak Speed (mph) 2050 Plan

- Less than 35
- 35 to 50
- Greater than 50

Source: SCAG

Map 10. Plan 2050 Weekday Truck Speeds on Highways –AM Peak Period



AM Peak Speed (mph) 2050 Plan

█ Less than 30
 █ 35 to 50
 █ Greater than 50

Source: SCAG

5.4 FREIGHT CORRIDOR BOTTLENECK ANALYSIS

Connect SoCal 2024 uses much of the similar Connect SoCal 2020 methodology with updates for the bottleneck analysis including baseline 2019 INRIX data and 2019 Caltrans AADTT data. In addition, this analysis used INRIX truck-specific speeds rather than speeds averaged over all vehicle classifications, which is a departure from the previous analysis. This improves the analysis because only truck average speeds are used in the calculations. To account for the fact that truck speed limits are 55 miles per hour (mph) on all freeways, a congested threshold speed of 50mph was used for calculation delays. This is analogous to the 60mph threshold for typical congestion calculations being used even though many freeway corridors have posted speed limits of 65 or 70mph for passenger vehicles.

The 2019 baseline analysis used the FHWA NPMRDS Traffic Message Channel (TMC) network segmentation that have longer roadway segments than the SCAG-purchased more detailed INRIX-XD network segmentation. Although there are some limitations in this dataset, it provides the nation-wide database of probe-vehicle-based speed and travel time data that allows agencies to estimate baseline mobility conditions on the segment. Since the INRIX data was the basis of the NPMRDS dataset it provides the consistency to compare SCAG's previous bottleneck analysis that used the purchased INRIX dataset. For the 2019 baseline analysis, average weekday, and hourly HDT delay was estimated for each available INRIX segment, and this delay was aggregated to the AM, Midday, PM, and Off-Peak time periods. Total annual vehicle hours of delay (AVHD) were summarized by bottleneck location, and total regional HDT delay was estimated. Any bottleneck exceeding 20,000 HDT AVHD was considered a significant regional bottleneck location.

provides the locations of the bottleneck with route information and direction and jurisdiction information AADTT through the bottleneck, the annual delay.

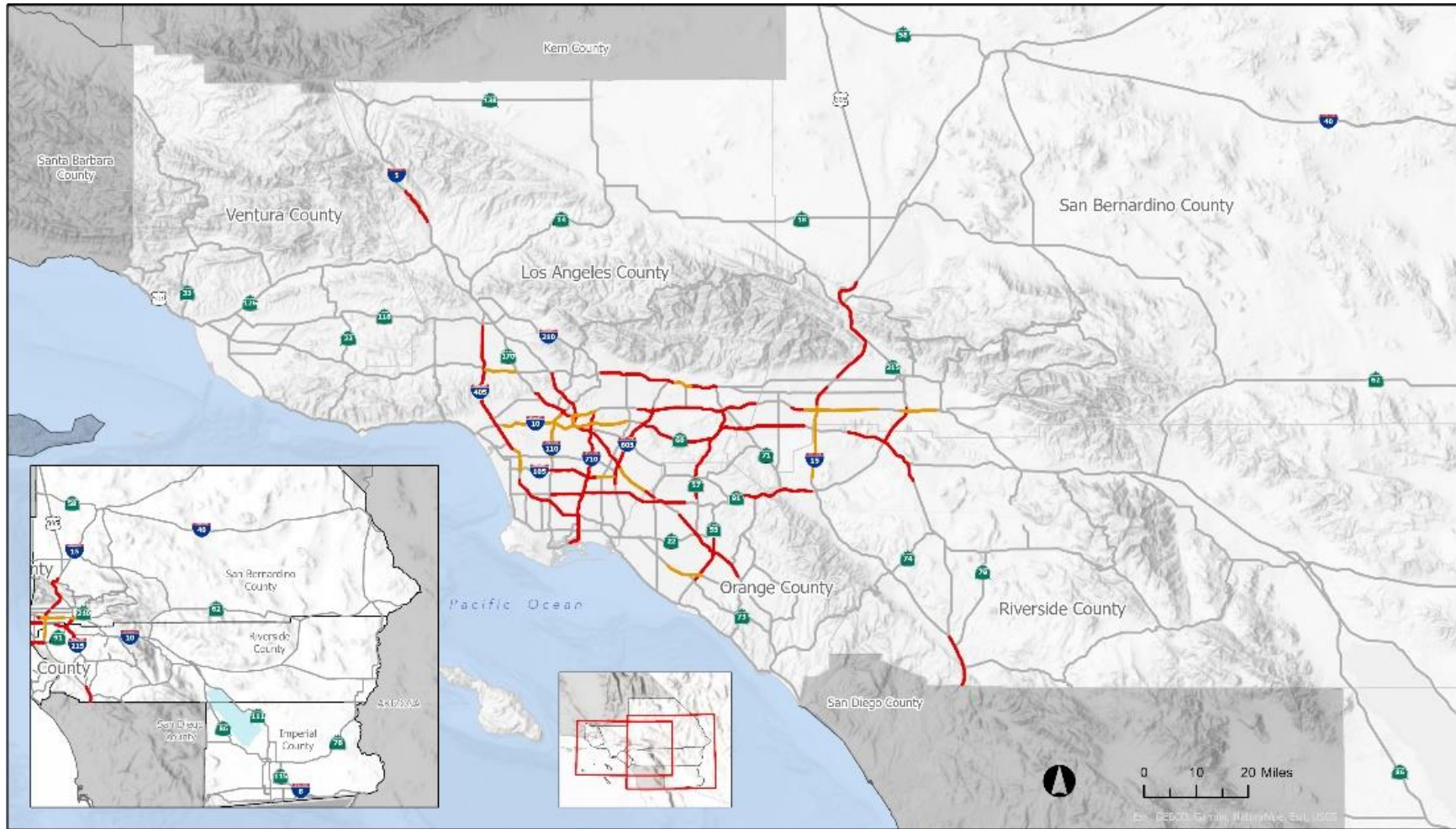
Table 8. Listing of Bottlenecks in SCAG Region

Route	Direction	Distance (miles)	County
SR-60	Eastbound	13	Los Angeles
SR-57	Northbound	5.1	Los Angeles / Orange
I-5	Southbound	10.3	Los Angeles
I-5	Northbound	6.3	Los Angeles
SR-60	Westbound	11.2	Los Angeles / San Bernardino
SR-57	Southbound	2.9	Los Angeles
I-215	Northbound	6.6	Riverside
I-5	Northbound	7.4	Los Angeles / Orange
I-5	Northbound	10.1	Orange
I-5	Southbound	5.5	Los Angeles
I-15	Northbound	8.5	Riverside / San Bernardino
SR-605	Northbound	4	Los Angeles
SR-710	Southbound	8.4	Los Angeles
SR-57	Southbound	9.9	Los Angeles / Orange
I-10	Eastbound	9	San Bernardino
SR-91	Eastbound	8.5	Orange / Riverside
I-215	Eastbound	10.4	Los Angeles
SR-110	Northbound	7.8	Los Angeles
SR-60	Eastbound	14.2	Los Angeles / San Bernardino
I-10	Eastbound	7.9	Los Angeles
SR-605	Southbound	6.9	Los Angeles
SR-91	Westbound	11.1	Los Angeles / Orange
I-405	Southbound	12.7	Los Angeles
I-10	Eastbound	6	Los Angeles
I-15	Northbound	17.5	San Bernardino
SR-710	Northbound	5.1	Los Angeles
SR-710	Southbound	8.5	Los Angeles
SR-60	Westbound	7.6	Los Angeles
SR-91	Westbound	7.9	Orange / Riverside
I-215	Southbound	5.3	Riverside
I-5	Northbound	5.9	Los Angeles
SR-91	Eastbound	8.4	Los Angeles
SR-210	Westbound	6.8	Los Angeles
I-15	Northbound	8.2	Riverside
SR-710	Northbound	4.5	Los Angeles
SR-210	Westbound	6.3	Los Angeles
I-405	Southbound	6.6	Los Angeles
US-101	Southbound	4.9	Los Angeles
SR-60	Eastbound	6.7	Riverside
I-405	Southbound	10.3	Los Angeles
I-10	Westbound	11.3	Los Angeles
SR-210	Westbound	5.9	Los Angeles
I-105	Eastbound	7.7	Los Angeles
I-5	Northbound	4.1	Los Angeles
I-215	Southbound	6	Riverside / San Bernardino
US-101	Northbound	5.6	Los Angeles
SR-1	Southbound	26.3	Los Angeles / Orange
I-405	Northbound	4.2	Los Angeles

Route	Direction	Distance (miles)	County
I-405	Northbound	14.8	Los Angeles
I-105	Eastbound	3	Los Angeles
I-5	Southbound	7.7	Orange
I-105	Westbound	3.2	Los Angeles
SR-91	Westbound	7	Los Angeles
SR-55	Northbound	7.5	Orange
I-405	Northbound	10.9	Los Angeles
I-5	Northbound	6.6	Los Angeles
SR-605	Northbound	8.3	Los Angeles

Map 11 provides a regional map to depict heavy-duty truck high priority bottlenecks for the 2019 baseline throughout the SCAG region. Each bottleneck segment area is distinguished by AVHD from 15,000 to 20,000 (yellow designation) or above 20,000 (red designation) for the most extreme bottleneck locations.

Map 11. 2019 SCAG Region Heavy-Duty Truck High Priority Highway Bottlenecks



Annual Vehicle Hours of Delay (AVHD)

15,000 - 20,000

Above 20,000

Source: SCAG

In 2019 heavy duty trucks experienced more 3.8 million AVHD in the SCAG region as summarized in Table 9 and the analysis also identified 39 HDT bottlenecks that accounted for 50 percent of total regional AVHD (Table 8).

Table 9 reports the total HDT AVHD by highway. These 20 highways represent nearly 95% of the HDT AVHD in 2019. I-5 experienced 626,610 AVHD in 2019, which is 17% of the regional congestion. I-10 is the second most congested freeway with 366,930 AVHD (10%) with SR-60 being the third most congested with 337,890 AVHD (9%).

Table 9. HDT Annual Vehicle Hours of Delay on Key Routes

Route	HDT Annual Vehicle-Hours of Delay (AVHD)
I-5	626,610
I-10	366,930
SR-60	337,890
I-405	285,110
SR-91	282,250
I-15	240,070
I-710	214,730
I-210	208,310
I-215	173,170
I-605	145,920
US-101	140,880
I-105	136,360
SR-57	130,390
I-110	91,490
US-1	49,810
SR-55	43,730
SR-86	29,440
SR-74	25,270
US-395	22,340
SR-18	21,970

Source: SCAG 2023

Some key findings from this analysis are:

- In general, the bottleneck locations are similar to those found in Connect SoCal 2020 even though a different methodology was used.
- The most congested bottleneck is at the interchange of eastbound SR-60 and northbound SR-57 (both routes share the same signed route). Combined, the two freeways at that location experienced 112,450 AVHD in 2019 accounting for 3 percent of total regional HDT delay (shown in Table 9). This bottleneck was also the worst bottleneck identified in Connect SoCal 2020 and

was ranked as the fourth worst truck bottleneck in the country based on the 2019 ATRI annual report and has since been ranked as the seventh worst bottleneck by ATRI on the 2022 report.

- Southbound I-5 at the I-605 interchange in Downey was the second most congested bottleneck with just over 89,000 AVHD (2 percent of regional truck congestion). A similar bottleneck just north of I-605 was identified in Connect SoCal 2020 and was the third ranked bottleneck at that time. On I-605, just south of the I-605/I-5 interchange is one of the top 20 bottlenecks with 48,150 AVHD. These two independent bottlenecks near the same interchange account for approximately 3 percent of regional truck congestion.
- The third most congested bottleneck is northbound I-5 at State Route 2/Glendale Boulevard in Los Angeles with just over 87,700 AVHD. This location was the fifth ranked bottleneck in the Connect SoCal 2020 analysis.
- The fourth most congested bottleneck is at the same location as the worst regional HDT bottleneck at the SR-57/SR-60 interchange, but in the westbound/southbound directions. This location experienced 85,600 AVHD in 2019 accounting for just under 2 percent of total regional HDT delay (shown in Table 9). The SR-57/SR-60 location in both directions alone account for approximately 5 percent of all SCAG regional HDT congestion.
- The fifth most congested bottleneck is on northbound I-215 just north of University Avenue, with nearly 73,400 AVHD. This bottleneck was ranked twentieth in the 2016 analysis.
- Rounding out the top five bottlenecks, I-5 northbound at the I-605 interchange added 60,200 AVHD.
- Combined, these five bottlenecks account for around 11 percent of all HDT AVHD in the region. The top ten bottlenecks account for nearly 32 percent of all truck congestion, and the top 40 bottlenecks account for more than 50 percent of all HDT congestion in the region.

With an established set of performance measures, heavy-duty truck bottleneck analysis provides current conditions of the regional freight network that includes major highways and corridor segments regarding the mobility and reliability of the regional goods movement system **Error! Reference source not found.** It will be critical to continue to assess numerous approaches towards key roadway chokepoints as part of a comprehensive trucking and rail service approach to optimally determine a blend of project improvements and enhancements to alleviate bottlenecks. Connect SoCal has identified \$5 billion in investments over the long-term as a result to strategically focus on these areas.

5.5 TRUCK PARKING

As stated in the California Sustainable Freight Action Plan (CSFAP), sufficient, safe commercial truck parking is a thorny issue in the freight planning field, particularly regarding roadway safety, public health, and monetary costs expended from extra travel time spent searching for safe and legal available truck parking spots. Studies indicate that the consequences of truck parking shortages also threaten lane capacity and economic productivity due to the increasing amount of unauthorized truck parking on streets. Due to recent freight market trend changes resulting from significant increases in online market growth, truck parking issues have been exacerbated by rapidly increasing freight movement volume and subsequent truck trip increases in, through, and beyond neighborhoods adjacent to industrial clusters. In addition, since the Federal and State Hours of Service (HOS) regulations require drivers to meet a minimum number of resting hours at a safe parking spot, many of drivers encounter the challenges of illegally exceeding the maximum hours of permitted driving time by cruising neighborhoods trying to find

a safe and legal location to park. Ultimately these cases may produce more unauthorized parking demands due to the shortage of legitimate parking spaces near truck dispatching origin and destinations.

Compared to other states, California is also experiencing truck parking shortages at both public rest areas and commercial truck stops, which is leading to unauthorized and illegal truck parking along freeway shoulders and interchanges, at weigh stations, and in even local commercial areas and communities. Key statistics from the California's most recent Jason's Law survey are shown in Table 10.

Table 10. Truck Parking Infrastructure Inventory of State California from the FHWA survey

Key Indicator	Value	Key Indicator	Value
Number of Public Facilities	87	Public Spaces per 100K Daily Truck VMT	5.1
Public Truck Spaces	1252	Private Spaces per 100K Daily Truck VMT	48.6
Number Private Truck Stops	197	All Spaces per 100K Daily Truck VMT	53.7
Private Truck Spaces	11,892	Public Spaces per 100 miles of NHS	8.6
Ratio of Private to Public Spaces	9.5	Private Spaces per 100 Miles of NHS	82
Total Spaces	13,144	All Spaces per 100 Miles of NHS	90.6

Source: https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/jasons_law/truckparkingsurvey/ch3.htm#s361.

In the summer of 2020, the California Department of Transportation (Caltrans) initiated the State of California Truck Parking Study. The study evaluated truck parking supply and demand throughout the State, including private and public parking facilities, and existing rest area locations outside the major metropolitan areas. Through a series of stakeholder meetings, there was consensus on truck parking supply and demand gaps in industrial cluster areas, and there were specific needs identified with respect to driver safety and freight travel time reliability. Subsequently, SCAG utilized truck parking dwell time data to identify locations within the region that currently face an unmet need for truck parking.

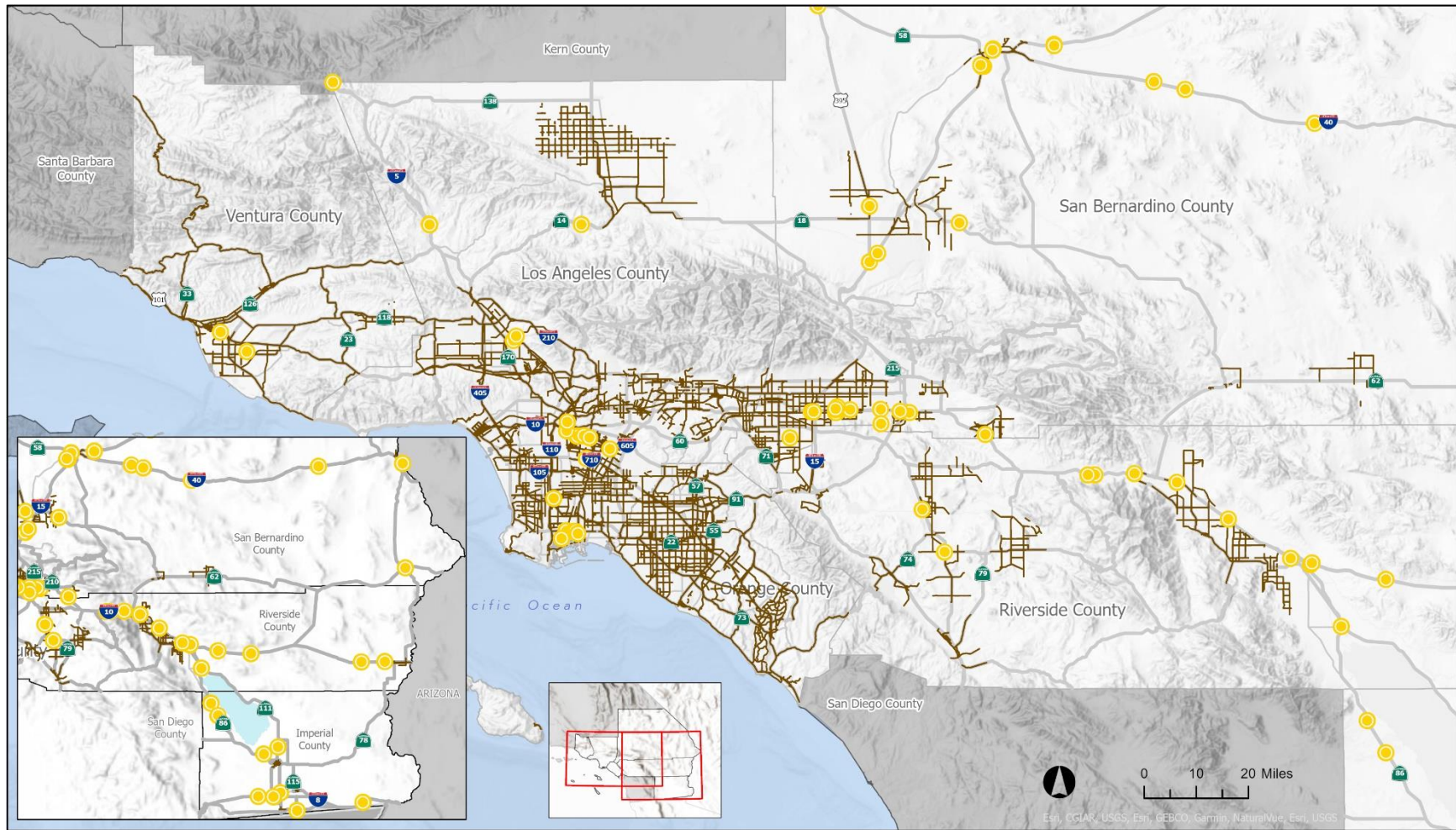
To be consistent with the State of California Truck Parking Study, this effort involved more focus on the off-highway network and existing industrial clusters by locating and quantifying the demand for truck parking at the local level. Specifically, the analysis focused on the medium and heavy-duty truck trips that affect the quality of life of residents of disadvantaged communities with greater emissions and truck traffic near major truck trip generators such as mega distribution centers (DCs) and warehouses and major container seaports in the region.

SCAG investigated and incorporated findings from previous efforts, including previous truck parking surveys and databases of Caltrans and local agencies. As noted, demand for truck parking in the SCAG region has resulted from rapidly increasing freight movement volume driven by growth at the SPBPs, the nation's busiest seaports, that serve local and national supply chains. However, as shown in the Map 12, there are sparse public and private truck parking locations in the SCAG region. In addition, these locations are mostly owned by private companies with their brand gas stations or convenient store with truck parking lots and there are largely decreasing supply of the public truck parking and truck resting locations available on interstates or the state highway that has encountered location closures or diminished

capacities. Eventually, these truck parking shortages precipitate the influx of illegal truck parking demands in off-highway locations and neighborhood streets.

SCAG's analysis identified clusters of truck parking locations and demands by levels of spatial boundaries (1km by 1km analysis boundary).

Map 12. Public and Private Truck Parking Locations in the SCAG region



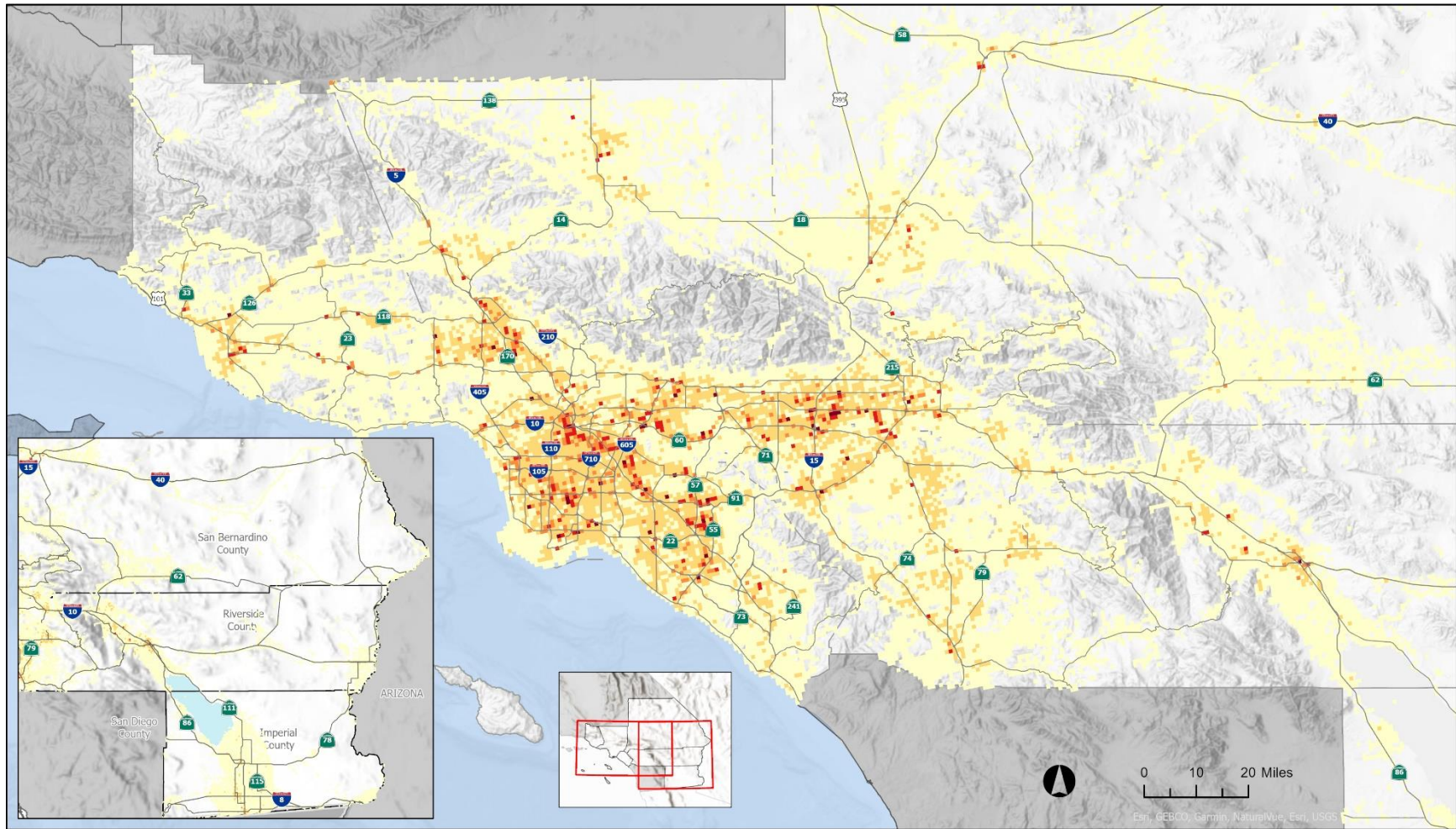
— Truck Related Routes ● Truck Parking

Source: SCAG 2022

For the assessment of truck parking supply and demand, the analysis considered public parking data and proprietary truck parking location data, particularly aggregated spatial location data of medium and heavy duty truck parking in the region. While most current identified truck parking spaces are located near interstates and state highways, and nearby gas stations and/or resting areas, collected truck parking location data of long-term (more than 6 hours) truck parking locations are widely distributed in clusters of industrial areas with warehouses and distribution centers (Map 13). As shown in the map, those long-term truck parking locations are not just located near the freeway or major freight corridors but they are largely located near the truck trip generators that reside far from the freeway or major corridors that provides authorized public and private truck parking lots or truck resting stations. With that, some truck drivers need to find their own parking location in the neighborhood streets or on the side way of truck prohibited routes to meet their delivery schedules.

This eventually brings negative impacts to disadvantaged communities adjacent to these areas in terms of decreased safety and degraded quality of life from the increased volume of truck trips and their emitted emissions as the cruise to find suitable parking spaces to take a rest or stay the night to meet the dispatching schedules. For this reason, identifying and building up the database of long-term or unauthorized truck parking locations is critical to mitigate overcrowded truck parking issues at the regional and local levels. Map 13

Map 13. Long-term truck parking in the neighborhood



Number of Medium- and Heavy-Duty Trucks Parking Longer than 6 Hours

1 - 2,000 2,001 - 10,000 10,001 - 20,000 20,001 - 50,000 >= 50,001

Source: SCAG 2022

5.6 FREIGHT RAIL SERVICE

Rail intermodal involves transporting shipping containers and truck trailers over long distances by rail, often coupled with truck or water movement at the origin or destination. A single train, powered by four locomotives and carrying 130 double-stacked containers, can effectively replace 260 trucks on the road, reducing both greenhouse gas emissions and traffic congestion. Intermodal facilities, therefore, serve as a vital node for seamless transition between different transportation modes, as well as for a sustainable and reliable supply chain. An efficient intermodal facility requires not just smooth rail yard operations for loading and unloading, but also extensive highway systems for truck drayage services.

The freight rail system has employed precision scheduled railroading (PSR) as a strategy to enhance network efficiency. PSR prioritizes individual train car movement by using a first-in, first-out model for loaded cars at rail yards, shifting away from the traditional approach of treating a long train as a single moving unit. While reducing train car waiting times and allowing more flexibility and efficiency for moving train cars, this strategy requires more capacity in intermodal facilities. In SCAG region, many intermodal rail yards serving Class I railroads are situated near the SPBPs or in urban environments near downtown Los Angeles and San Bernardino with little capacity to expand their footprint. Such capacity constraints may cause extended wait times for trucks at rail yards which could worsen air pollution, traffic congestion, and thus diminish residents' quality of life in the vicinity. It may also hinder the ability of these facilities to integrate new equipment, tracks, and technologies to improve operations.

Congestion and limited landside access also pose notable obstacles for intermodal rail terminals as well as seaports. Given that many drayage carriers primarily operate during daytime hours when labor costs are lower, they must compete for road space with other vehicular traffic on highways and access routes to railyards. The bottlenecks on highways in the LA basin slows the drayage trucks, reducing reliability and predictability of the supply chain while increasing GHGs and operation costs. In addition to the challenges discussed above, intermodal facilities have also grappled with labor shortages, notably exacerbated by the COVID-19 pandemic. The implementation of automated equipment, including both machinery and process automation, could mitigate this challenge, however labor disputes on balancing jobs versus automation continue to pose challenges.

In some busy intermodal facilities, the persistent threat of cargo theft presents a considerable concern. This risk has been particularly pronounced during the COVID-19 pandemic, which witnessed a surge in maritime imports and an elevated inflation environment. Los Angeles, being a major hub in the global logistics landscape, has become a top target for such theft, impacting commodities like electronics, food, and household goods.^{xliii} To combat the theft, Union Pacific has worked with the LAPD, California Highway Patrol and the L.A. County Sheriff's Department and set up a task force.^{xliv} For example, UP has people patrolling along routes from Yuma, Ariz., to L.A. It also deployed drones and erected fencing.^{xlv} Cargo theft usually takes two primary forms: fictitious pickups at intermodal facilities and container break-ins within railyards or on moving trains. The adoption of advanced digital security measures, including real-time cargo tracking technology, can be a solution to this issue. Bolstering security infrastructure at intermodal facilities through enhanced surveillance and access controls can also act as a deterrent to mitigate theft.

5.7 COMMUNITY AND ENVIRONMENTAL IMPACTS

Southern California is a federal non-attainment area, failing to meet National Ambient Air Quality Standards for excessive pollutants. A large portion of dangerous pollutants, like NOX, are created by

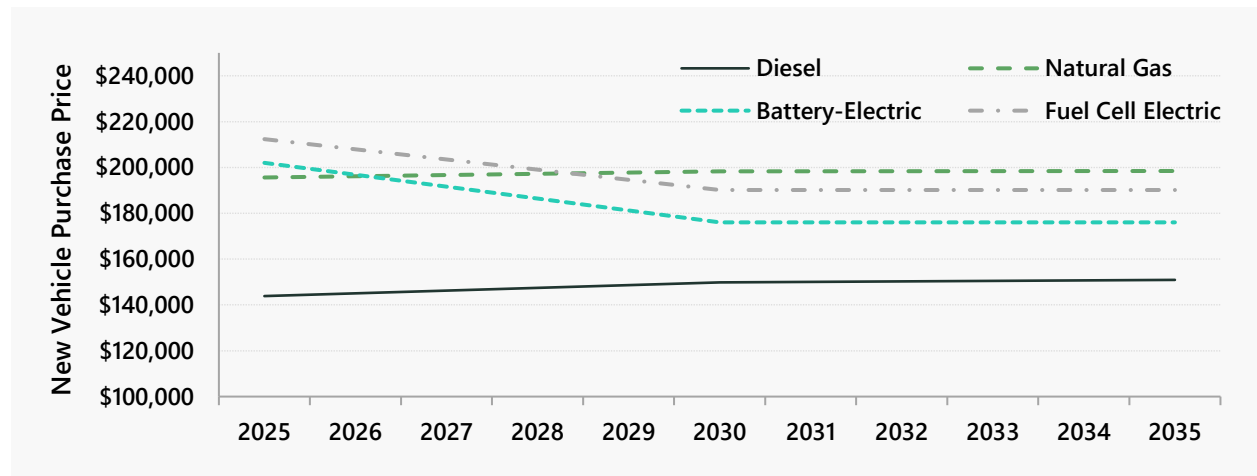
mobile sources like trucks and ships (i.e., diesel emissions)^{xlvi}. Any new system capacity must justify that it will not negatively change air quality, which may serve as major constraint to growth in the freight transportation system. Goods movement overall is responsible for 50 percent all NOX emissions and 18 percent of PM2.5 within Southern California. Heavy-duty trucks alone account for 71 percent of all NOX emissions in Southern California^{xlvii} and there are major equity concerns related to health and air quality related to these emissions. Impacted communities, particularly those near transportation corridors and distribution centers, often bear the disproportionate burden of poor air quality and its associated health risks. For more discussion on emission impacts through an equity lens, see the Equity Analysis Technical Report.

This disparity underscores the importance of addressing the equity implications of goods movement and ensuring that informed measures are taken to protect the health and well-being of vulnerable communities. An example of this is CARB's Community Air Protection Program (CAPP)^{xlviii} which was established in response to Assembly Bill (AB) 617^{xlix}. The CAPP provides communities with funding to address localized air pollution through targeted incentive funding to deploy cleaner technologies in these communities, as well as grants to support community participation. This provides community members an opportunity to contribute to decision making and interact local governments, Air District representatives, and other local stakeholders through the development of Community Emissions Reductions Programs (CERP).

Local, state, and federal entities are actively investing in lower-emissions vehicles and their supporting infrastructure as a strategy to combat the transportation sector's adverse environmental impact. While ZE and NZE technologies have demonstrated their potential for improving public health outcomes by improving air quality, pushing toward industry-wide investment in these technologies presents significant economic and operational challenges that may take time to overcome. Sensitivities attributable to this are due to the cost and logistical hurdles associated with large-scale infrastructure buildouts, operational performance challenges, and production limitations associated with these new technologies.

The high cost of these technologies is driven by a number of factors, including the cost of research and development, the need for specialized materials and components, and the limited scale of production. As production volumes increase, the cost of manufacturing can be reduced through economies of scale. However, when production volumes are low, the cost of manufacturing is higher, which can drive up the cost of the final product. Current CARB regulations set targets and fleet sales requirements, providing a signal for manufactures to scale up production. As indicated in the chart below, the purchase price for clean technology vehicles is not anticipated to reach parity with that of their conventional counterparts.¹ Nonetheless, some of these technologies present significant cost savings when evaluated based on their lower Total Cost of Ownership.

Figure 37. Class 8 Day Cab Tractor New Vehicle Price Forecast



Source: SCAG Clean Technology Compendium

Although some technologies are commercially available, many others are in their early stages of development and may not be as reliable as conventional vehicles/equipment. For example, one of the primary challenges in the development of ultra high-power charging systems is the lack of reliable technology that can withstand the high-power demands of charging electric vehicles quickly. These charging systems require advanced power electronics and cooling systems to manage the high-power levels involved. In addition, existing technologies can also be further improved to ensure industry sustainability and business profitability. In another example, the large size and weight of freight trains pose unique challenges for zero-emission technology and battery-electric systems may not have the necessary range or power to meet the demands of heavy freight trains without frequent recharging, which significantly impacts operations.

The availability and accessibility of infrastructure needed to power clean technologies, such as charging or hydrogen refueling stations can also be a major barrier to adoption. The insufficient access to infrastructure can significantly limit the practicality of using these technologies. The lack of charging access poses severe concerns of regional transition to zero-emission medium and heavy-duty vehicles as the high-power demands and limited range of these vehicles require specialized charging infrastructure. In addition, to successfully transition line-haul trucks operating interstate to zero-emission technologies, a national network of charging or fueling infrastructure is a necessity. These heavy-duty trucks, often traveling vast distances across states, will rely heavily on the availability and accessibility of charging or refueling stations. Due to inconsistent ZEV adoption targets across the country, the time alignment for infrastructure buildout will also be difficult to navigate. The installation of charging and refueling infrastructure for medium and heavy-duty vehicles can be costly and complex, requiring significant investment in electrical infrastructure and coordination among government agencies, utility companies, and private sector stakeholders.

Solving the complex and interrelated environmental issues surrounding goods movement will require new approaches. It will require that new highway and rail projects incorporate sophisticated environmental mitigation strategies, and that the public agencies and freight industry work cooperatively to build and operate a goods movement system that is both efficient and clean. The goods movement system can and must improve its operations in a way that provides for a healthy environment and livable communities. In

alignment with California’s Advanced Clean Trucks and Advanced Clean Fleets^{li} regulations, a zero and near-zero emissions goods movement system is a focus of Connect SoCal. Significant investment is needed to reach this goal, as are market-based incentives, regulatory and market certainty, and investments in supporting infrastructure to help promote clean goods movement technologies. Solving the complex and interrelated environmental issues surrounding goods movement will require new approaches.

5.8 SAFETY AND SECURITY

The provision of a safe transportation system is a major goal of regional planning. However, the interaction of passenger and freight transportation creates significant safety concerns, especially on high truck volume freeways and at rail-highway crossings. A critical concern about growing truck traffic in the region is truck-involved accidents. According to the California Highway Patrol’s Statewide Integrated Traffic Records System (SWITRS), there were 153 fatal truck-involved crashes in the SCAG region in 2019, and 3,683 truck-involved crashes that resulted in injuries^{lii}. Large trucks have operating limitations such as large blind spots, long stopping distances, and limited maneuverability that make it essential for other vehicles to put extra focus on safety^{liii}. Truck drivers are generally well-trained but certain roadway geometrics (e.g., short or tightly curved-ramps, short merge-weave sections) increase the probability of incidents. These incidents tend to be among the most serious and can have significant impacts on roadway reliability.

Rail safety is also a significant concern in Southern California, where rail tracks are shared by both freight and passenger services, traversing urban, suburban, and rural regions. Key safety issues include preventing trespassing on tracks, enhancing crossing notifications and barriers, and eliminating conflicts at at-grade crossings.

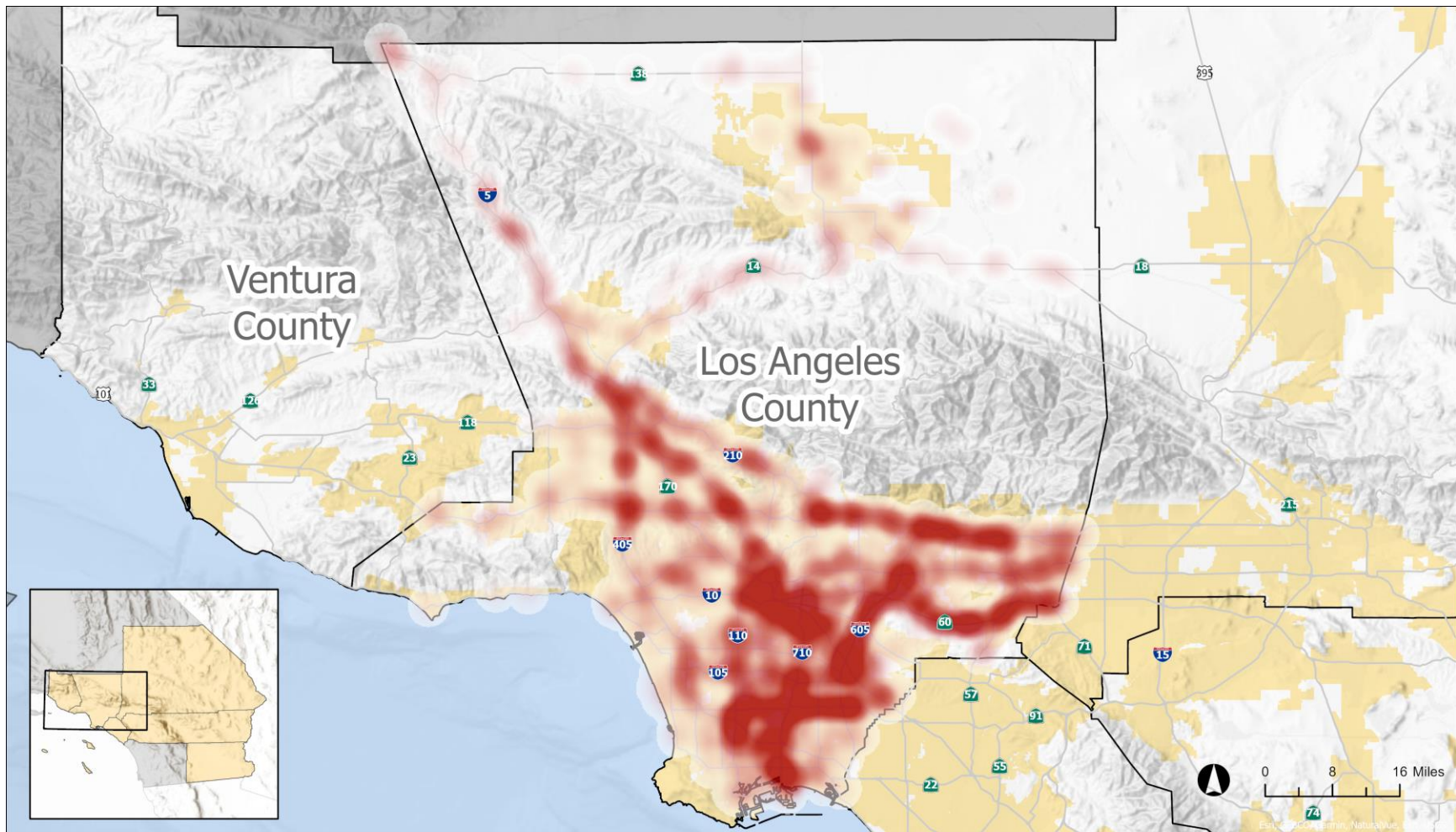
Areas of concern include:

- In urban areas, with both trespasser incidents and at-grade crossing issues.
- Trespassing on significant railroad bridges.
- Throughout specific corridors.
- At various highway-rail crossings in different regions.

In Southern California, there are numerous open highway/rail crossings, including both at-grade and grade-separated ones. They vary in terms of control measures, with some lacking controls, some having passive controls (signs only), others equipped with flashers, and some featuring gates.

Parking availability and competition between different vehicle types for space is dealt with in a variety of ways across communities in the SCAG region. With increased goods movement activity, parking for trucks stopping while enroute and between deliveries can spill into local communities, causing issues with idling fumes, line of sight for drivers, and parking availability for passenger vehicles. The presence of large commercial trucks parking in lots and metered spaces impacts the availability of parking for customers of local businesses. Trucks parking near schools can obstruct visibility and compromise the safety of students walking and biking to school. When trucks are parked improperly, residents often face difficulties in identifying the appropriate channels to address these parking issues. There is a prevalent observation that trucks are frequently parked on residential streets and in areas where they should not be, leading to potentially unsafe situations for drivers, especially in terms of cargo theft or unauthorized access to vehicles.

Map 14. Truck Collisions in Los Angeles County

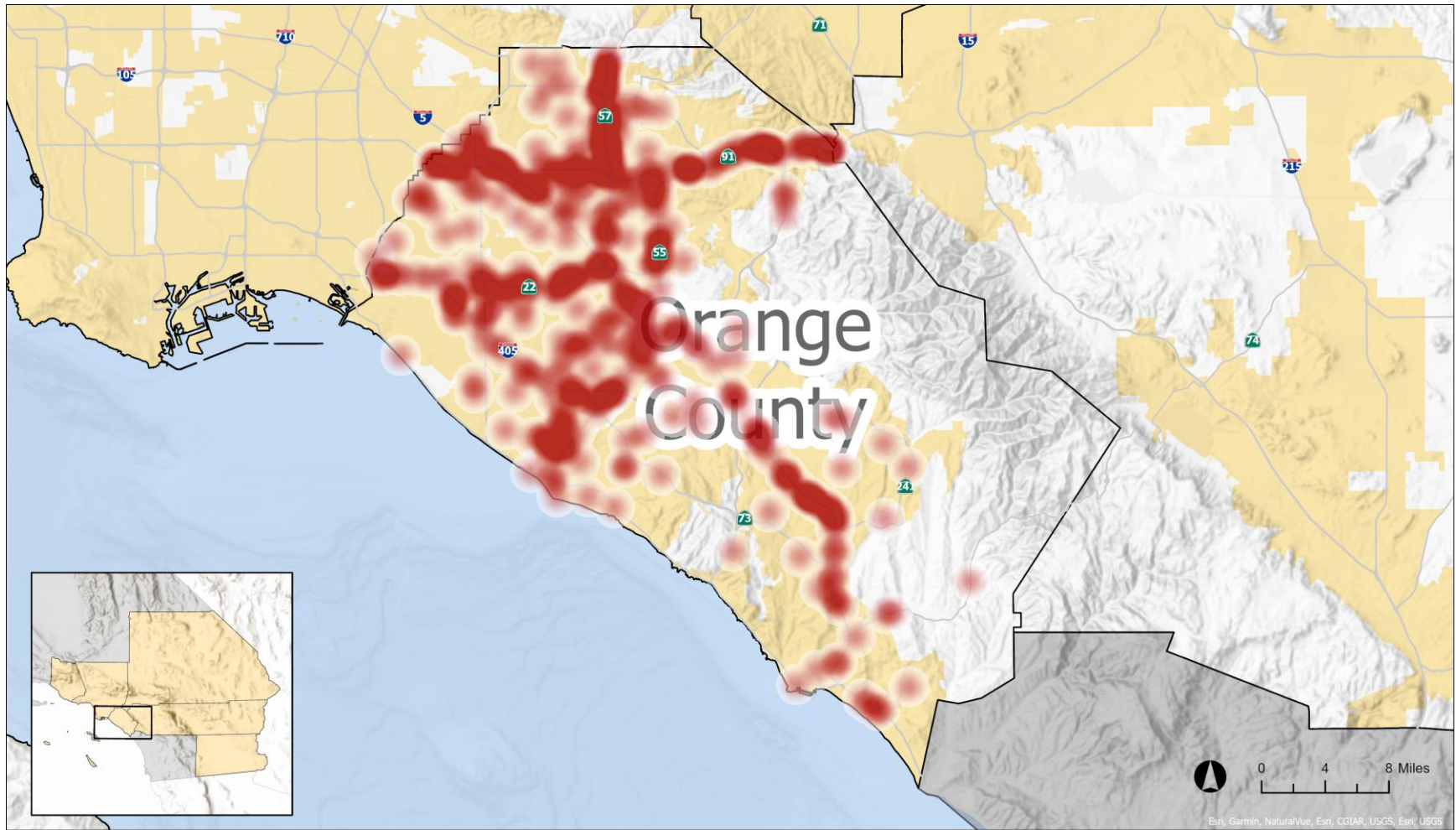


Collision Density — Freeway City Boundary SCAG Region

■ Sparse
■ Dense

Source: SCAG 2022, TIMS 2022

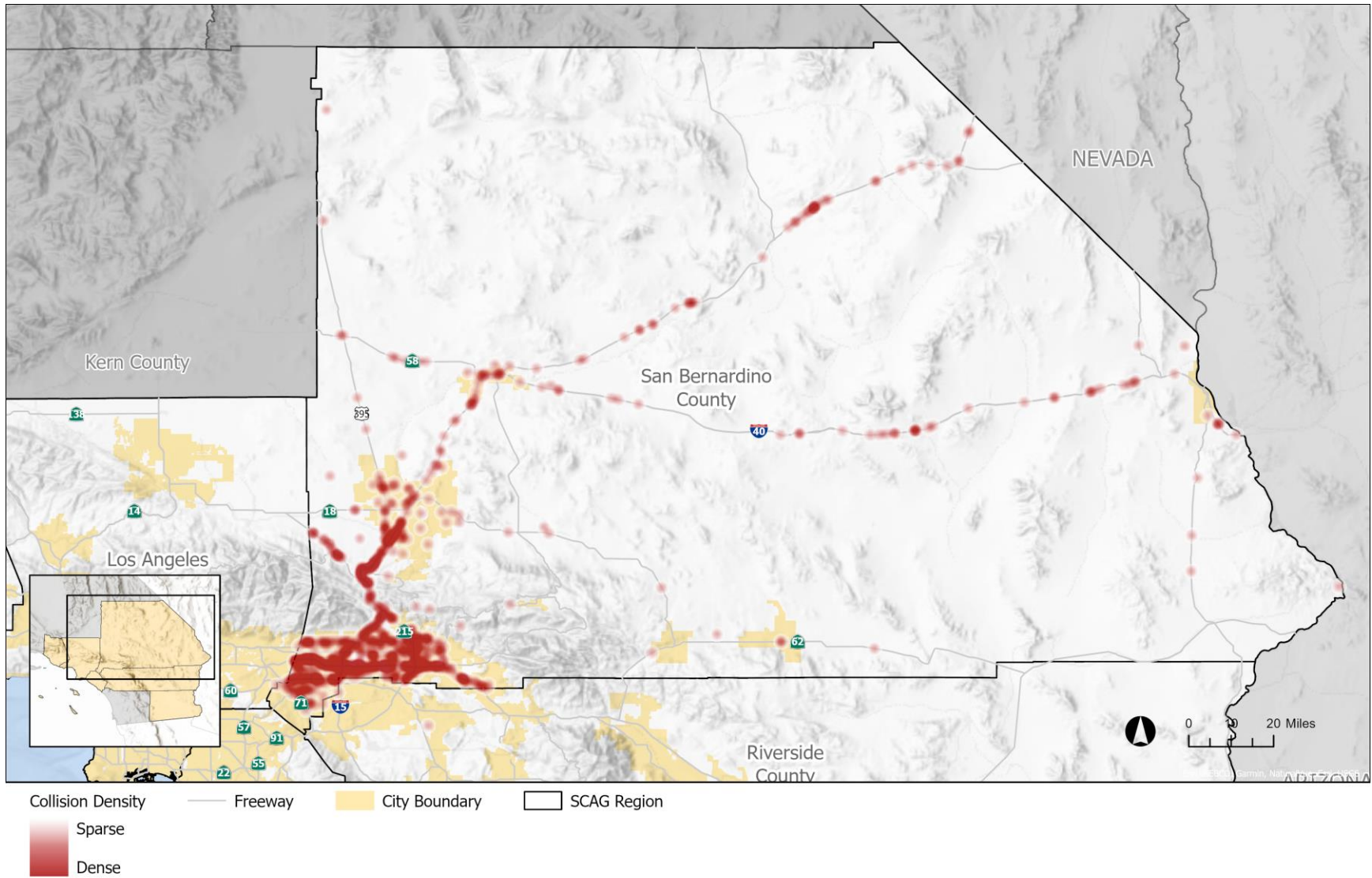
Map 15. Truck Collisions in Orange County



Collision Density — Freeway City Boundary SCAG Region
Sparse
Dense

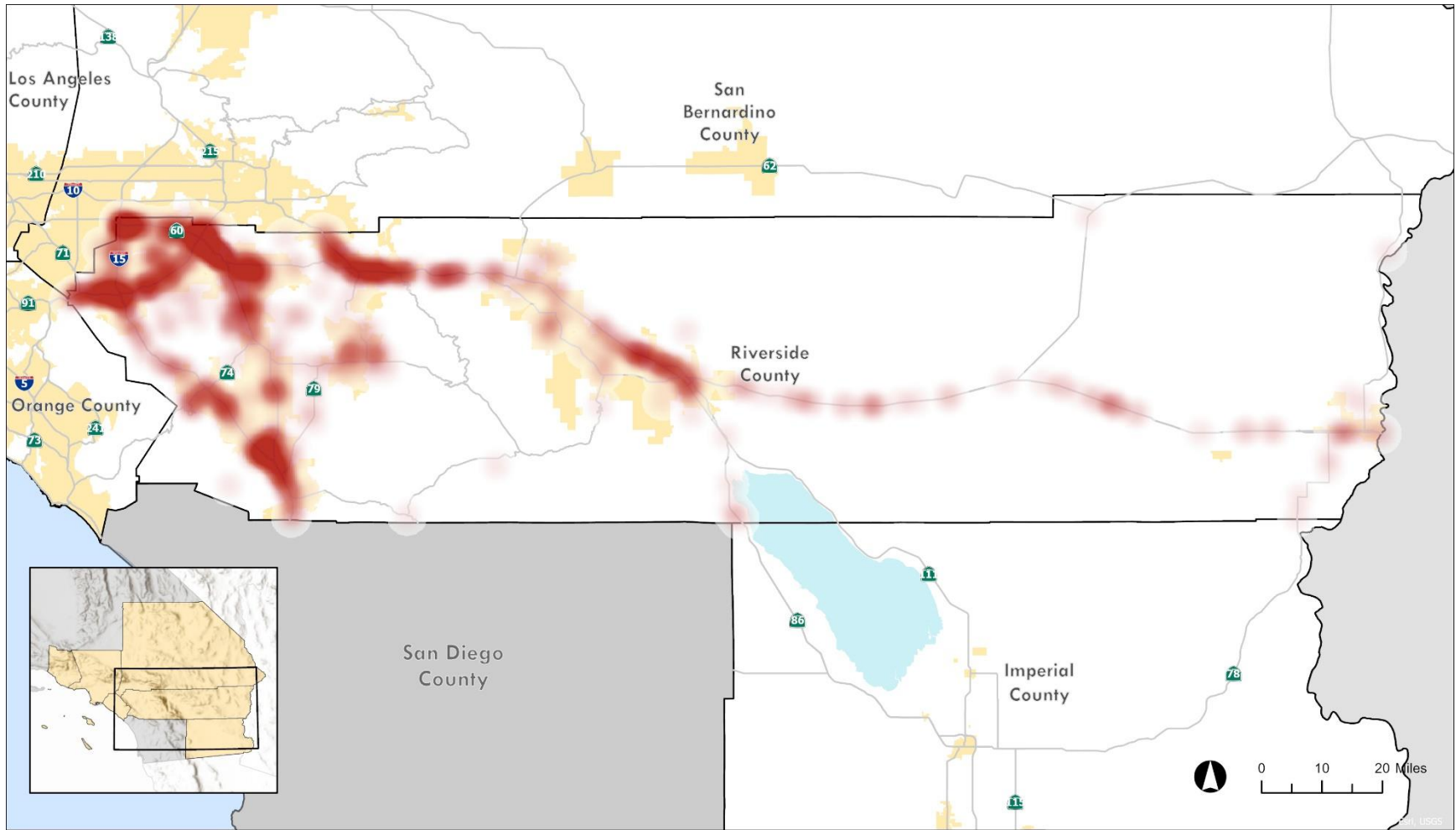
Source: SCAG 2022, TIMS 2022

Map 16. Truck Collisions in San Bernardino County



Source: SCAG 2022, TIMS 2022

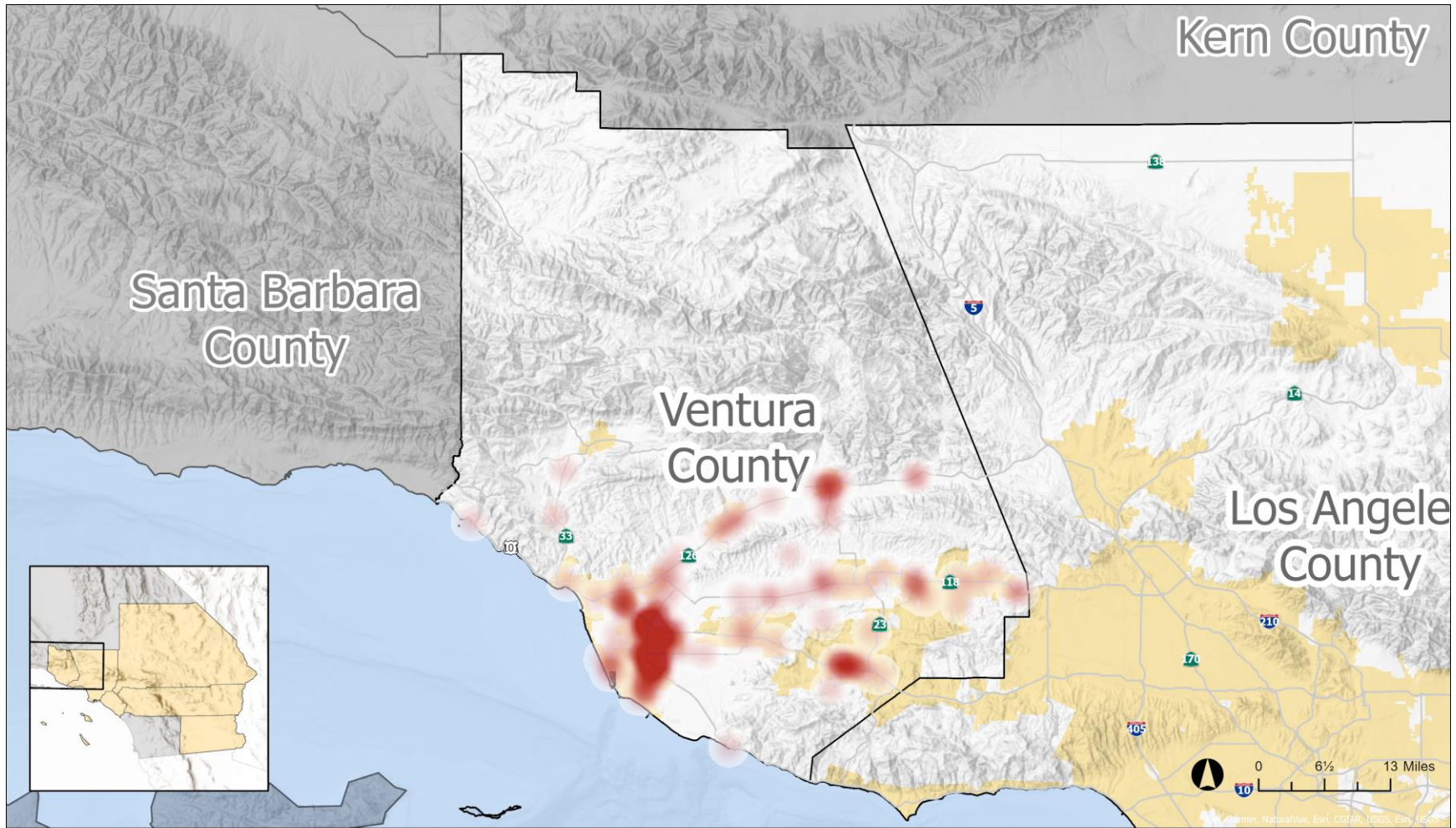
Map 17. Truck Collisions in Riverside County



Collision Density Freeway City Boundary SCAG Region
Sparse
Dense

Source: SCAG 2022, TIMS 2022

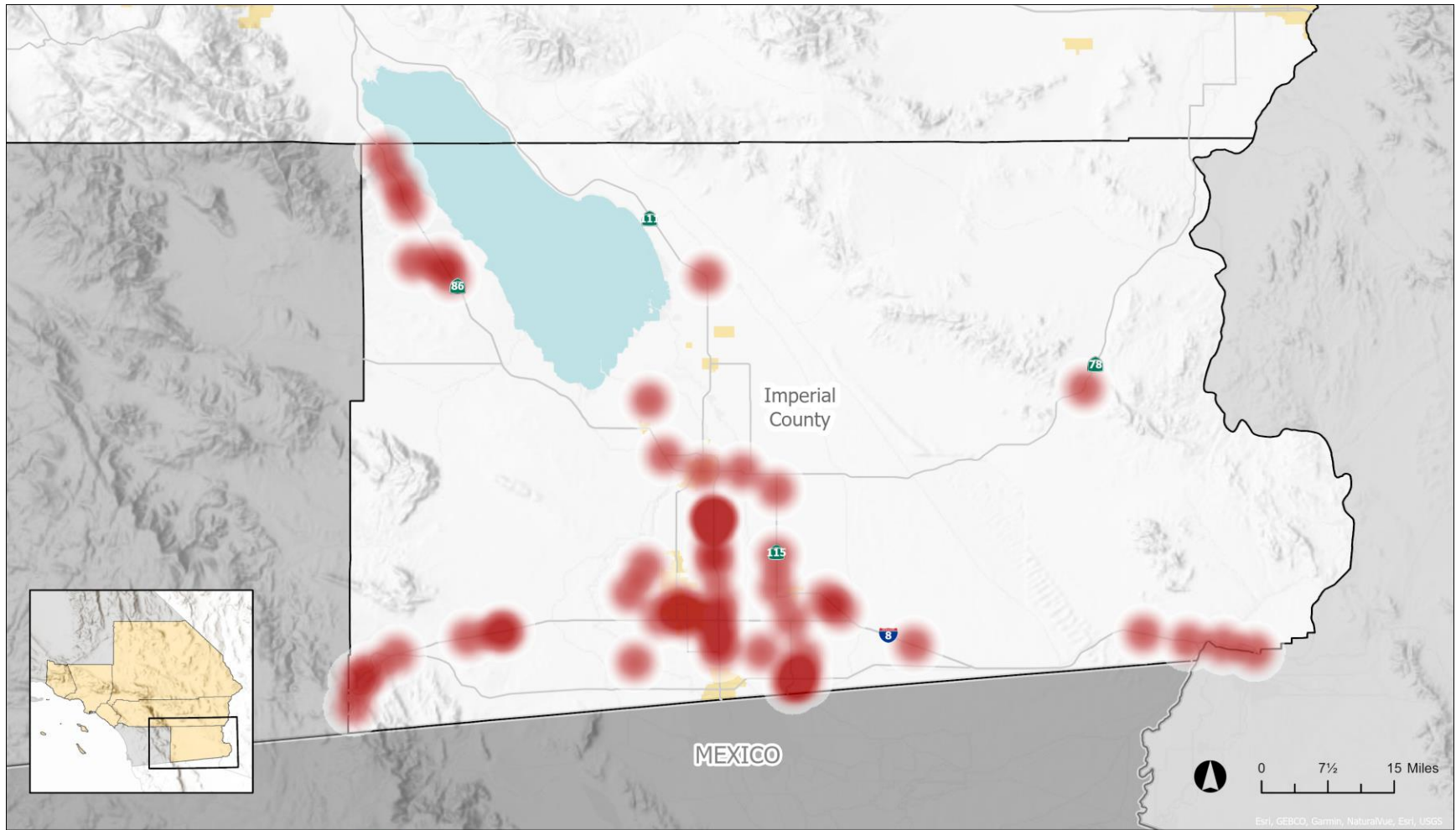
Map 18. Truck Collisions in Ventura County



Collision Density Freeway City Boundary SCAG Region
Sparse
Dense

Source: SCAG 2022, TIMS 2022

Map 19. Truck Collisions in Imperial County



Collision Density Freeway City Boundary SCAG Region
Sparse
Dense

Source: SCAG 2022, TIMS 2022

Like other modes of transportation, the goods movement system requires consideration for key security vulnerabilities. As alluded to earlier, individuals or groups may target shipments, particularly high-value goods, and steal them during transit or from warehouses. Implementing proper access control, surveillance systems, and tracking technologies have become standard to help mitigate this risk. The freight industry may also be a target for terrorist activities or deliberate sabotage. Because attacks on transportation infrastructure, such as ports or rail systems, can disrupt operations and cause widespread economic damage, implementing security protocols, conducting risk assessments, and collaborating with law enforcement agencies can help mitigate these risks. With increasing integration of digital systems and technologies in the freight industry, cyber threats have become a major concern. Hackers may attempt to gain unauthorized access to systems, disrupt operations, or steal sensitive information. Especially as freight technologies continue to advance and become even more connected, robust cybersecurity measures are critical to protect against cyber-attacks.

5.9 WORKFORCE SUSTAINABILITY

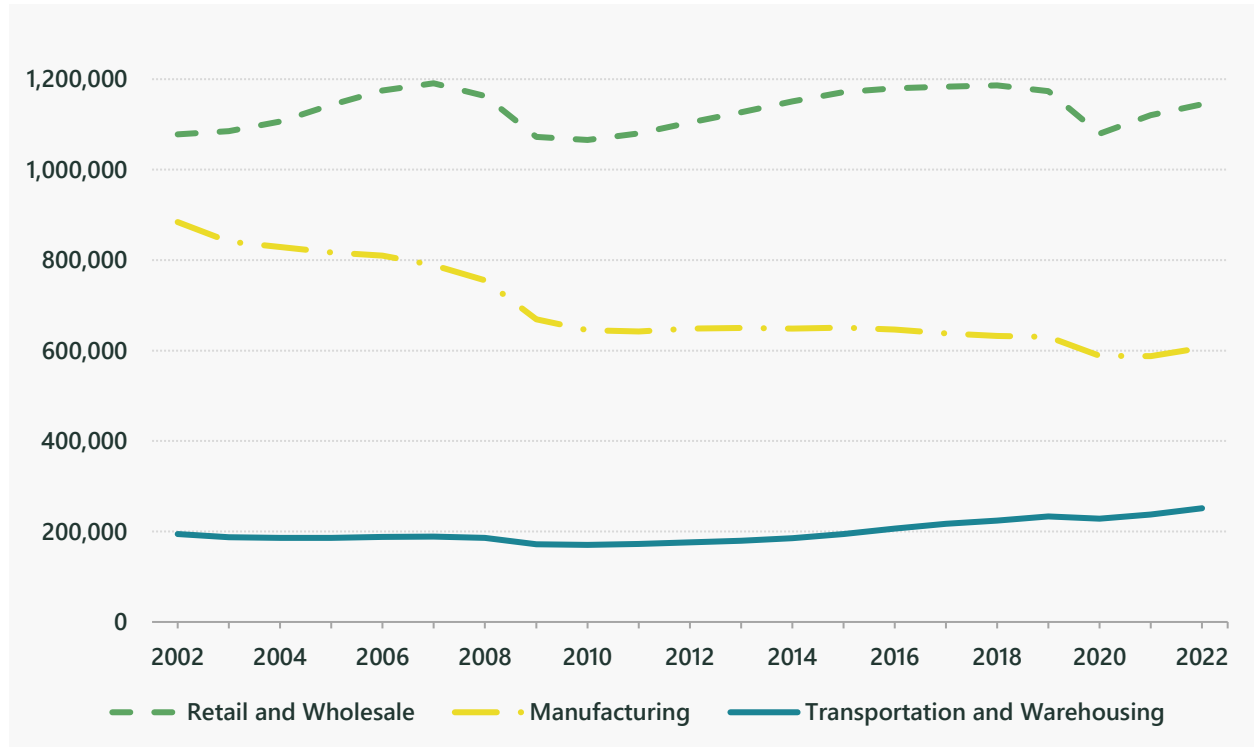
Goods movement industries are supported by an extensive workforce including 2.4 million employees within the SCAG region. As with any industry, there are spectrums of opportunity for job types and career advancement. For manufacturing, emerging areas include many cleantech solutions ranging from production of ZE and NZE vehicles, to ZE and NZE infrastructure and the supportive systems required, to renewable energy solutions, among others. These trends have created many employment-related opportunities ranging from the manufacturing and production side to the research and development and design side, to the operator side of newer technology vehicles, equipment, and supporting infrastructure, to maintenance technicians and specialists for many newer technology components and operational characteristics. These industries often provide opportunities for employees to begin their careers right out of high school or from attending trade or higher education programs, while offering multiple paths for advancement depending on each employees' unique situation.

Newer technology trends, notably automation continue to challenge how the sustainability of the workforce evolves over time. Different industries like trucking and rail have experienced divergent employment trends as trucking has continued to offer a much higher proportion of goods movement jobs serving as a more stable opportunity for consideration, versus rail which has witnessed a steady decline since the 1970s. Leading growth in distribution and warehouse facilities has led to a substantial increase in employment opportunities, and other freight arrangement and logistics jobs have also been on the rise, while port-related jobs have also remained stable. Many of these areas aside from trucking and rail have continued to increasingly focus on automation, notably with examples of Amazon fulfillment centers and XPO Logistics warehouses, while still utilizing healthy levels of employees to compliment these increasing automated efficiencies. For example, Amazon's AWS integration into its fulfillment centers has led to automated efficiencies for picking and sorting products to shipment orders. Robots carry picking packets from truck deliveries to locations where employees relying upon automated transferred information to arrange items into totes that are packaged by employees from further automated transferred information, before going through another automated process for scanning, labeling, and routing to outgoing truck delivery bays. There are also many technicians that trouble shoot issues that arise as part of the mechanized and automated functions.

Other areas of interest for workforce sustainability include educational programs that target supply chain industries and opportunities, as well as programs that help employees who have already committed a significant amount of their career to other important areas like military service, or simply need resources transitioning from an older legacy industry or company to a newer opportunity. With the wide variety of

local communities throughout the SCAG region, having a diverse economy is the most sustainable approach to ensuring that workforce opportunities continue to grow and benefit from technological change and innovation.

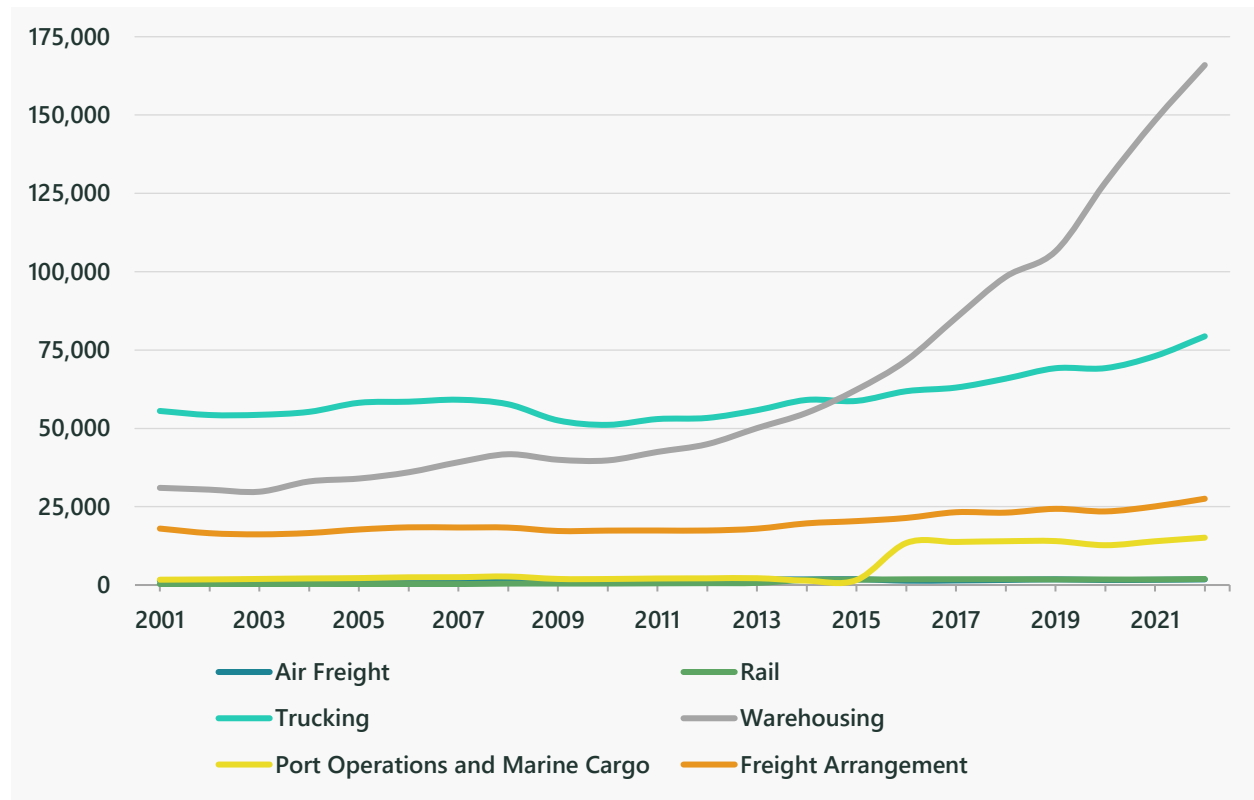
Figure 38. Employment in Top Goods Movement Industries



Source: California Employment Development Department

Employment in retail and wholesale industries in the SCAG region reflect economic activity, where jobs declined from 2007-2010 during the Great Recession, and again during the early COVID-19 pandemic from 2019-2020, with a faster recovery period from 2020 to present. Similarly for the manufacturing industry, the Great Recession amplified a decline in manufacturing jobs, and levels remained stable until a slight drop during the COVID-19 pandemic. There is a direct correlation with the trends in manufacturing with respect to employment and industrial square footage. However, the past two years have shown signs of recovery, with manufacturing jobs approaching pre-pandemic levels. Despite the negative impacts of the COVID-19 pandemic on employment in the manufacturing and retail and wholesale industries, transportation and warehousing jobs in the SCAG region have continued to grow at a steady pace. Employment within the transportation and warehousing industry have experienced the largest growth over the past decade, with 43% more jobs from about 175,000 jobs in 2012 to over 250,000 in 2022 (Figure 39).

Figure 39. SCAG Employment within Select Areas of the Transportation and Warehousing Industry



Source: US Bureau of Labor Statistics

Within the transportation and warehousing industry, trends have been positive across many areas with the most notable being warehousing which has increased by almost 270 percent since 2012 through 2022 (Figure 39). Within the past decade, warehousing has increasingly grown with the COVID-19 pandemic period being the fastest growing segment with growth increasing by 56 percent from 2019. Trucking also has displayed increasing employment growth through 2022, while other areas including air freight and rail employment have remained flat. Note that e-commerce fulfillment-related warehousing jobs from online retailers are not included in these categories and are instead captured in retail and wholesale employment (Figure 38).

6. VISION, POLICIES, AND IMPLEMENTATION STRATEGIES

Establishing the goods movement vision is critical to frame policies and implementation strategies. As part of this process, it is equally important to recognize what has transpired the past few years and where things stand today. The future will remain unknown, however, a sense of directionality for where things may be headed is helpful to inform policies and implementation strategies.

6.1 WHERE ARE WE HEADED?

SCAG faces the enormous responsibility of identifying and promoting effective policies and strategies to improve economic competitiveness while also mitigating the associated impacts of goods movement. For Southern California, there is not often a clear answer as there are many stakeholders with differing views and priorities. Below is a review of major events and issues that have transpired. Key questions and statements are highlighted as important elements as part of the vision, policies, and implementation strategies process.

The COVID-19 pandemic has had a significant impact on freight and goods movement in Southern California, as it has had on many other regions around the world. Global supply chains were disrupted by factory closures, shipping delays, and other logistical challenges, which led to shortages of certain products and increased demand for others. The COVID-19 pandemic also had an impact on transportation infrastructure, as stay-at-home orders and other restrictions led to changes in traffic patterns and reduced demand for certain types of transportation, especially for passenger-focused modes. On the goods movement side, freight activity witnessed a strong and consistent increase through the early part of 2022.

With a clear freight recession cycle still afoot, supply chains have remained in flux stemming from labor shortages and other variables out of the control of the region. These variables have included impacts related to national trade tariff policies, war beginning in 2022, intensifying inflationary pressures, and worsening geopolitical tensions across the globe having far-reaching implications on freight movement regionally and nationally as well. The resiliency of the system has been tested to an extreme degree and uncertainties remain based on these variables as to how the future will continue to unfold.

New trends in technology with respect to e-commerce and omnichannel growth, freight technology platforms, automation and workforce, and zero-emission technologies also continue to present challenges for goods movement activity. New technology advancements continue to push against legacy business models serving to challenge the sustainability of companies that are not able to keep up with change. Similarly, the volatility of freight cycles continues to have strong impacts on freight operations for many smaller companies, as extreme changes to pricing has a profound impact on equipment capacity. Labor unions have been challenging companies and threatening with strikes as an indication of the pressures that have been placed on workers, notably for essential daily services required for the economy to remain stable.

State regulations for zero-emission vehicles has placed increasing pressure on freight industries, especially as the infrastructure needed to support these rules are not yet available and the cost to purchase vehicles remains much more expensive versus current technologies. For many large companies across freight industry verticals, navigating through higher investment needs for technologies, platforms, and equipment, and dealing with labor unions, among other challenges can be absorbed to a degree. But for

smaller and mid-sized businesses, navigating these challenges can become a much higher burden, with bankruptcy and business shutdowns being a tangible risk.

Other factors needing consideration involve reshoring and near-shoring becoming more prevalent resulting from worsening geopolitical tensions. The U.S. government has taken a stronger stance against trade relationships with China which for the West Coast region, has traditionally reflected the highest volumes of import and export trade. Further reshoring and near-shoring positions North America more strongly for future growth in industrial capacity to strengthen supply chains. For Southern California, it places pressure on economic competitiveness as trends have illustrated declines in manufacturing and community pushback has increased with respect to major infrastructure such as intermodal railyards and warehouse and distribution facilities.

Important questions for the region that cannot be answered today, but remain critical as part of the policy dialogue, include:

- How will regulatory impacts effect trucking industry markets, especially larger companies versus independent owner operators?
- Will zero-emission rules meet today's targets based on infrastructure needs and grid capacity?
- What are the consequences if smaller and mid-sized logistics businesses decline, and larger ones survive?
- How will the state's zero-emission rules factor for trade with Mexico and un-aligned adjacent and non-adjacent states?
- How much industrial growth will occur throughout the region, and will it simply shift further inland leading to more supply chain sprawl and increased freight VMT?
- What considerations are being made for the potential of increasing industrial growth inland correlating to increasing manufacturing and jobs being developed farther inland as well?
- Depending on industrial facility regulation progression, how will this further impact containerized trade diversion outside of the region?
- Is the state and Southern California region considering consequences of containerized trade diversion impacts to other U.S. region communities?
- As freight rail intermodal facility capacity grows farther inland, what truck-related impacts will be the result?

There are some areas with more clarity, which can help inform policies and implementation strategies, but these need to be monitored and revisited over time due to the nature and frequency with which change can occur.

- E-commerce will continue to grow, likely at a higher rate than traditional retail.
- Trends towards reshoring and near-shoring will likely continue within the U.S., especially with respect to technology advancement across major manufacturing and industrial sectors.
- Foreign investment into the U.S. will likely increase resulting from reshoring.
- State-level coalitions divided on technology advancement will likely remain.
- Economic development will likely be most conducive within states with less strenuous regulations.
- Increasing regulations will lead to more focus on expanding unionized labor, resulting from rising costs to do business.

The most important factor for the region to consider remains and deserves repeating, that goods movement demand and associated system infrastructure and facility capacity needs are directly tied to consumption by businesses and residents. Consumption is largely a factor of population as the core driver for employment and households. As the most populous state in the nation, there is clear correlation to

the largest GDP in California, with Southern California (San Diego included) reflecting more than half of the State's population. When including adjacent growing regions within Mexico, Arizona and Nevada, this larger region's local demand for freight will only continue to increase over time. Whether goods increasingly move from the seaports in Southern California or from the Gulf and East coast interchange points, deliveries to businesses and residents will be dependent upon major intermodal and warehouse and distribution facilities to serve the final mile.

6.2 REGIONAL VISION

SCAG serves the region in many capacities, none more important than providing a forum for dialogue on goods movement issues and needs with a direct connection to the Connect SoCal vision, policies, and implementation strategies. Connect SoCal development incorporates collaboration and coordination across the region's diverse set of public and private stakeholders on goods movement within the development period prior to draft circulation. During 2021 and 2022 as freight supply chains experienced some of the most challenging issues stemming from the COVID-19 pandemic, SCAG coordinated across the region with leading freight stakeholders on all sides of the spectrum. Additionally, SCAG worked with the state to convene listening sessions that culminated in the desire for the region to develop a goods movement resolution.

At the March 2, 2023, Regional Council meeting, the Goods Movement Resolution was adopted affirming a call-to-action due to increasing supply chain volatility and complexity in the SCAG region. This Resolution includes a strong commitment to ongoing collaboration with local, state, and federal partners to plan, fund, and implement projects and strategies that ensure a safe, resilient, and efficient supply chain and goods movement system. SCAG presented the goods movement approach for Connect SoCal to the Transportation Committee for discussion and feedback as part of this process. The sections below include the goods movement vision, policies, and implementation strategies.

6.2.1 VISION

A world-class, coordinated Southern California goods movement system that accommodates growth in the throughput of freight to the region and nation in ways that support the region's economic vitality, attainment of clean air standards, and quality of life for our communities.

MAINTAINING THE LONG-TERM ECONOMIC COMPETITIVENESS OF THE REGION

Goods movement is fundamental to the SCAG economy and plays a vital role in the Californian and national economies. Connect SoCal strives to ensure that regional businesses have access to the transportation services necessary to grow and thrive in Southern California. Some of these businesses, particularly national manufacturing firms and consumer products distributors (who maintain large import warehouses and national distribution centers in the region), form much of Southern California's export base. These businesses consider many factors in making location and expansion decisions, and transportation cost and service reliability are among those factors. Ensuring that the future system can meet the needs of these businesses is a critical objective of Connect SoCal.

Investment in improvements to the regional transportation system also facilitates service to regional markets. A substantial fraction of goods movement demand in Southern California is associated with providing goods and services to residents.

PROMOTING LOCAL AND REGIONAL JOB CREATION AND RETENTION

Ensuring that Southern California has the port and landside transportation infrastructure necessary to handle increasing growth is important for the U.S. as trade through Southern California's container ports supports jobs throughout the nation. International trade activity is important to the regional economy, creating well-paying jobs in the logistics services sector as well as new opportunities for both import and export-oriented firms in Southern California. Connect SoCal endeavors to ensure that those jobs stay in Southern California by providing the modern, high-efficiency transportation connections that meet the needs of the nation's importers and exporters. However, changing supply chain paradigms and the emergence of new technologies will push the region to conduct regular evaluations and updates to goods movement strategies to address their impacts on the regional goods movement workforce.

INCREASING FREIGHT AND PASSENGER MOBILITY

The fluid movement of goods and people that meets user needs and expectations is essential for the region to achieve a world class transportation system. A fundamental objective of Connect SoCal is to allow for growth without deterioration in the overall performance of the goods movement system. This means ensuring that rail volumes can grow without exceeding acceptable delay levels and addressing truck delays through the development of a highway bottleneck relief strategy and other congestion mitigation strategies and projects to increase efficiency on the transportation network.

IMPROVING THE SAFETY OF GOODS MOVEMENT ACTIVITIES

In the year 2022, the SCAG region witnessed a total of 3,880 reported truck collisions, reflecting the complexities of the transportation landscape. A detailed breakdown of these incidents highlights specific collision counts across the counties look like: Imperial encountered 106 collisions, Los Angeles saw 1,830 collisions, Orange reported 394 collisions, Riverside saw 626 collisions, San Bernardino accounted for 800 collisions, and Ventura reported 124 collisions. Tragically, this cumulative collision data also encompasses 154 incidents resulting in fatalities across the region. When compared with the figures from 2016, where the SCAG region experienced around 3,700 collisions and 124 fatalities, it is evident that these challenges persist and necessitate robust efforts to enhance road safety. Such efforts are underscored by initiatives like Connect SoCal, which aim to safeguard the well-being and mobility of all individuals within the region's diverse transportation ecosystem. An essential strategy to enhance safety for all users involves establishing a greater separation between passenger and goods movement, ultimately creating a safer transportation system for everyone.

MITIGATING IMPACTS OF GOODS MOVEMENT OPERATIONS

The goods movement system can and must improve its operations in a way that provides for a healthy environment and livable communities. A zero and near-zero emissions goods movement system is a critical part of this vision. This will be achieved in part by the development, deployment and commercialization of zero and near-zero emission technologies. Significant investment is needed to reach this goal, as are market-based incentives, regulatory and market certainty and investments in supporting infrastructure to help promote clean goods movement technologies.

6.2.2 POLICIES

1. Leverage and prioritize investments particularly where there are mutual co-benefits to both freight and passenger/commuter rail.
2. Prioritize community and environmental justice concerns together with economic needs and support workforce development opportunities particularly around deployment of zero-emission and clean technologies, and their supporting infrastructure.
3. Explore and advance the transition toward zero-emissions and clean technologies and other transformative technologies where viable.
4. Advance comprehensive systems-level planning of corridor/supply chain operational strategies, integrated with road and rail infrastructure, and inland port concepts.
5. Ensure continued, significant investment in a safe, secure, clean and efficient transportation system, including both highways and rail, to support the intermodal movement of goods across the region.

6.2.3 IMPLEMENTATION STRATEGIES

1. Leverage the Last Mile Freight Program (LMFP) to develop and implement operational concepts with a core focus on last-mile delivery strategies across urban and rural communities.
2. Manage the implementation and transition to near zero and zero-emission technologies for medium and heavy-duty vehicles and supporting infrastructure.
3. Facilitate the development of integrated rail partnerships between passenger/commuter rail and private rail operators and public agencies to advance investment opportunities.
4. Engage communities throughout the SCAG region on environmental justice concerns, economic needs, and workforce development priorities.
5. Perform a complete update to the SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy, including assessment of innovative strategies and concepts.
6. Continue to coordinate with federal and state partners on goods movement planning efforts, including the LMFP, to position the SCAG region for further funding opportunities.

7. IMPLEMENTATION STRATEGIES AND INITIATIVES

As part of SCAG's policies and implementation strategies, the region is focused on establishing an approach towards meeting stringent air quality targets, maintaining economic competitiveness, promoting job creation and retention, improving mobility and safety, and supporting diverse communities across the region's six counties.

Since Connect SoCal 2020 the region has continued to implement prior investment initiatives, while also competing further for federal and state funding programs. This has related directly to traditional infrastructure and facilities for seaports, railroads, and highways and access roads. Additionally, zero emission infrastructure has more recently become an increasing focus within many of these same funding programs. SCAG has continued to support many regional and local partners and member agencies with their project nominations and applications for funding program opportunities, whether through sponsorship, partnerships, or supported alignment. Additionally, SCAG has provided numerous resources to develop comprehensive studies and analyses to enrich the region's collective knowledge and to inform the decision-making process for policies and actions.

SCAG's Goods Movement Resolution that was adopted in March 2023 serves as the region's primary guiding policy stance towards implementation strategies and initiatives. Each policy is highlighted below including its implementation strategies, followed by a review of key components and actionable steps towards these strategies. Policies 1 and 2 include implementation strategies which are focused on partnering and collaborating on competing specifically for rail investments and building stronger relationships through community engagement. Policy 3 focuses on leveraging SCAG's LMFP to support regional initiatives targeting ZE and NZE piloting/testing, demonstration, commercial deployment, and implementation opportunities. Policy 4 includes SCAG's next steps with respect to comprehensive planning efforts. Lastly, Policy 5 provides an extensive focus on freight mode key investment strategies for seaports, rail, highway and local roadways, and cross-border areas.

7.1 POLICY 1 – RAIL INVESTMENT

POLICY 1:

Leverage and prioritize investments particularly where there are mutual co-benefits to both freight and passenger/commuter rail.

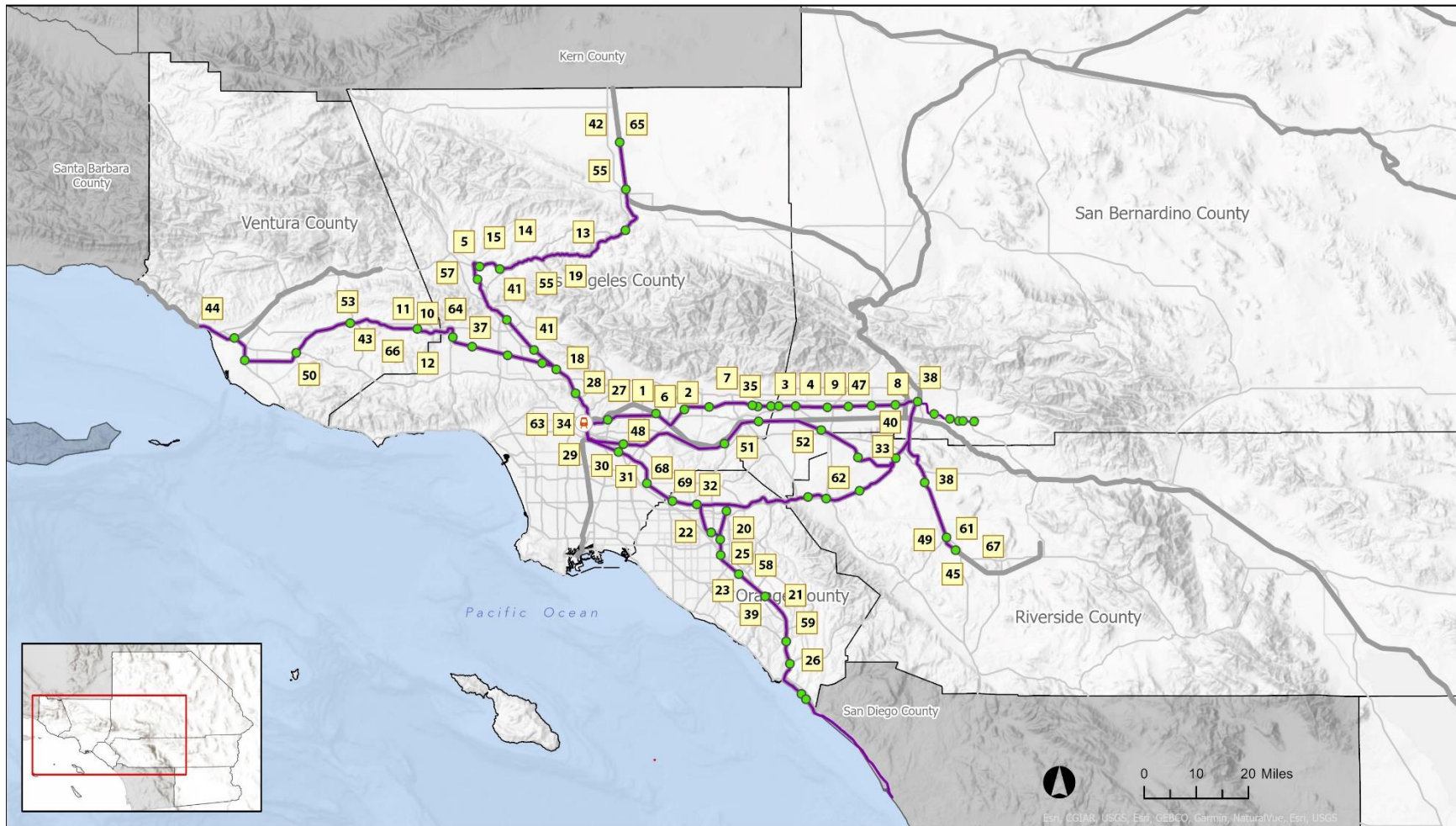
IMPLEMENTATION STRATEGIES

- Facilitate the development of integrated rail partnerships between passenger/commuter rail and private rail operators and public agencies to advance investment opportunities.

To accommodate future passenger and freight train service levels and integration of the California High-Speed Rail project by 2035, SCAG's Integrated Passenger and Freight Rail Study identified approximately \$20 billion in line capacity and other investment needs including the \$10.2 billion Metrolink Southern California Optimized Rail Expansion (SCORE) program. This study is the most comprehensive for the region to date and included major passenger services for Metrolink, High-Speed Rail, LOSSAN, Amtrak,

and Brightline, while factoring for the growth in freight rail volumes for both containerized and non-containerized cargo.

Map 20. Future SCORE Program Map



- SCORE Project
- Existing Metrolink Station
- Main Line Rail
- Commuter Rail
- Union Station

Source: SCAG

SCAG serves the region as a major convener and forum for multiple transportation policy efforts including goods movement and is serving in a similar fashion working with CalSTA, the FRA, and numerous regional partners and key rail stakeholders. The core objective of this coordination is to orchestrate a partnership mechanism to position the SCAG region as competitively as possible for future federal and state funding program opportunities. Numerous rail corridors operate through shared-use agreements between rail right-of-way owners and passenger and freight operators. Organizing freight rail investments where public and private benefits from investments can be achieved will be beneficial to optimize joint contributions to pursue funding programs, as well as informing a phased approach towards rail implementation for the SCAG region. Major funding program opportunities include, among others:

- Federal: Consolidated Rail Infrastructure and Safety Improvements Program (CRISI)
- Federal: Federal-State Partnership for Intercity Passenger Rail Grant Program (FSP)
- Federal: Multimodal Project Discretionary Grant Program (MPDG)
- Federal: Railroad Crossing Elimination Grant Program (RCE)
- Federal: Rebuilding American Infrastructure with Sustainability and Equity (RAISE)
- State: Trade Corridor Enhancement Program (TCEP)

Map 21. Beyond SCORE Projects



Source: SCAG

Collectively and dependent upon funding program cycles for these identified programs, approximately \$9.5 billion nationally and within the state of California will be available on an annual basis for rail-related implementation opportunities, with \$5 billion exclusively for rail infrastructure investments. SCAG will continue to facilitate the development of integrated rail partnerships between passenger/commuter rail and private rail operators and public agencies to advance these investment opportunities through:

- Creating and leading regular interagency-stakeholder coordination meetings with state, regional, and local representatives, and rail stakeholders.
- Sharing use of planning studies and research to inform technical and planning processes.
- Strengthening relationships with Class I railroads.

7.2 POLICY 2 – COMMUNITY AND ENVIRONMENTAL JUSTICE

POLICY 2:

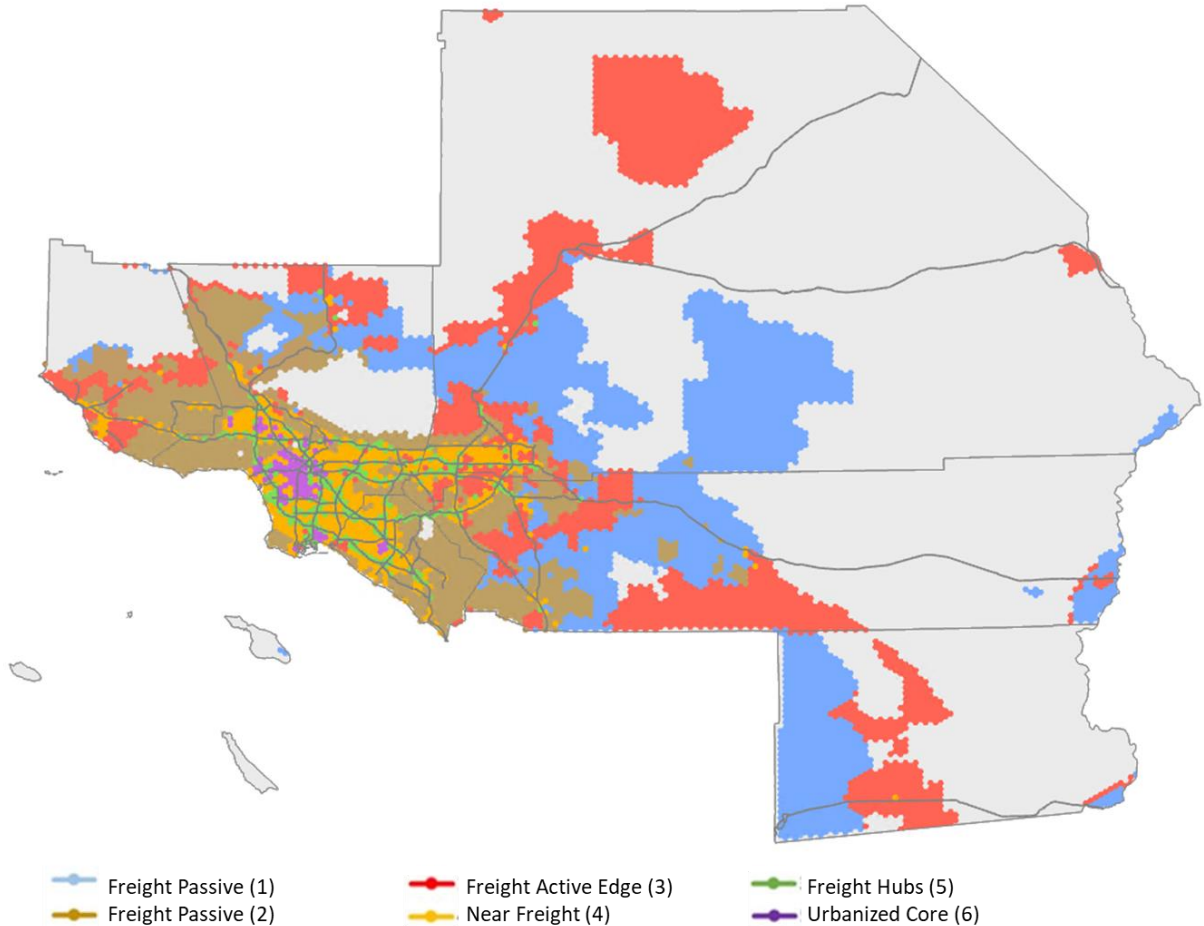
Prioritize community and environmental justice concerns together with economic needs and support workforce development opportunities particularly around deployment of zero-emission and clean technologies, and their supporting infrastructure.

IMPLEMENTATION STRATEGIES

- Engage communities throughout the SCAG region on environmental justice concerns, economic needs, and workforce development priorities.

SCAG's Southern California Goods Movement Communities Opportunities Assessment aimed to facilitate connections between communities and provide them with practical and effective steps and resources to engage with agencies and policymakers, ultimately aiding in mitigating freight impacts and accessing opportunities. The assessment focused on understanding both the positive and negative impacts of goods movement, as well as how these impacts and opportunities are experienced by communities. The study highlighted best practices and recommendations for health and air quality, infrastructure maintenance and improved operations, communications and engagement, and economic and workforce development. Additionally, the study has developed ArcGIS StoryMap communications toolkit for communities and local jurisdictions as resource for use within communities^{liv}.

Figure 40. Freight Communities in SCAG Region



Source: Southern California Goods Movement Communities Opportunities Assessment

Building further upon the Goods Movement Communities Opportunities Assessment, SCAG staff continues to participate across the region through community engagement such as on the Long Beach – East Los Angeles Corridor Plan, while fostering healthy dialogues with supporting academic institutions and partner regional planning agencies. There will be many ongoing opportunities and areas of focus where SCAG will continue to strengthen community partnerships through engagement on environmental justice concerns, economic needs, and workforce development, including:

- Facilitating knowledge-based workshops and sessions on goods movement topics and current trends.
- Performing community engagement to address disparities in clean technology access and adverse environmental impacts.
- Providing resources to promote Environmental Justice as it relates to goods movement.
- Leveraging the region’s workforce development programs to inform communities regarding prospective skillset needs that logistics employers are looking for when they consider a new development location.

7.3 POLICY 3 – ZERO-EMISSION AND CLEAN TECHNOLOGY

POLICY 3:

Explore and advance the transition toward zero-emissions and clean technologies and other transformative technologies where viable.

IMPLEMENTATION STRATEGIES

- Leverage the Last Mile Freight Program (LMFP) to develop and implement operational concepts with a core focus on last-mile delivery strategies across urban and rural communities.
- Manage the implementation and transition to near zero and zero-emission technologies for medium and heavy-duty vehicles and supporting infrastructure.

With the State’s actions through recent clean-air regulations targeting nearly all truck-related services, it is becoming increasingly important for the region to advance its zero-emission strategies. The LMFP is a partnership with the MSRC, including 26 projects totaling just below \$17 million in award funds and \$100 million in total project implementation. Phase I of the LMFP includes a diverse set of projects focusing on the commercial deployment of near-zero and zero-emission vehicles and supporting infrastructure. These projects range from multi-billion dollar companies like Sysco Corporation, PepsiCo, Inc., and Penske, to newer market entrants focusing on Truck-as-a-Service and Fleet-as-a-Service business models, to some of the smallest independent owner-operators (1 to 10 trucks). While improving air quality is the core objective, understanding the private sectors operational and investment return needs is equally important to achieve realistic and scalable expectations. To this point, as the LMFP will be progressing to a Phase II element that will be focused on leveraging existing partnerships, while testing newer innovative operational concepts such as low-emission delivery zones, off-peak delivery strategies, and other e-commerce-based use cases.

SCAG has also recently partnered with Caltrans through the TCEP’s recently awarded EV Oasis South project that will be implementing microgrid-enabled electric charging equipment for heavy-duty trucks at existing TravelCenters of America (TA) and Petro travel centers in Southern California. The project estimates charging up to 82 trucks per day in the first five years with the capacity to charge more as adoption and demand increases over time. By providing more accessible medium- and heavy-duty vehicle charging, the development of EV Oasis will support significant GHG reductions, resulting in better air quality and local public health outcomes.

SCAG will continue to assess local and regional funding opportunities to further advance demonstration and piloting initiatives across the region including those that are within goods movement industries. As part of these implementation strategies looking to leverage the LMFP further and to manage implementation and transition to near-zero and zero emission technologies, SCAG will continue to leverage the LMFP and manage the implementation and transition to near-zero and zero emission technologies by:

- Developing a process for public-private partnerships that can be streamlined for use across multiple federal, state, regional, and local funding programs.

- Focusing on innovative operational strategies that can be applied to major events coming to the Los Angeles area including the FIFA World Cup and Summer Olympics in 2026 and 2028, respectively.
- Strengthening SCAG’s relationship with industry stakeholders through higher visible engagement at industry conferences through panel and presentation opportunities.

7.4 POLICY 4 – COMPREHENSIVE SYSTEM-LEVEL PLANNING

POLICY 4:

Advance comprehensive systems-level planning of corridor/supply chain operational strategies, integrated with road and rail infrastructure, and inland port concepts.

IMPLEMENTATION STRATEGIES

- Perform a complete update to the SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy, including assessment of innovative strategies and concepts.

SCAG supports a world-class, coordinated Southern California goods movement system that accommodates growth in freight throughput to the region and nation in ways that support the region’s economic vitality, attainment of clean air standards, and quality of life for our communities. Simultaneously, SCAG faces enormous responsibility to identify and promote effective policies and strategies to mitigate the associated impacts of goods movement. Consequently, SCAG recognizes the critical importance of updating its Comprehensive Regional Goods Movement Plan and Implementation Strategy. Much of the information that has been included within Connect SoCal provides an opportunity as well as the foundation for the more detailed analysis required within such an update of the Comprehensive Goods Movement Plan. As an example, there are areas such as truck parking and inland ports needing more technical analyses, as well as newer innovative concepts such as hyperloop that will need further feasibility analysis. As each cycle for Connect SoCal is developed, the Comprehensive Goods Movement Plan Update will have the core objective of incorporating all the core elements from Connect SoCal and bridging newer areas, including a holistic approach to enhancing the Heavy-Duty Truck model. Key areas of focus within the Comprehensive Goods Movement Plan update will include, but will not be limited to:

- Organizing a holistic Southern California Technical Advisory Committee (TAC).
- Establishing a new rail volume baseline and forecast.
- Developing industrial forecasts organized by manufacturing, retail and wholesale, and transportation and warehousing.
- Assessing competitive seaport markets across the U.S., Canada, and Mexico.
- Deconstructing supply chains further across industries including import/export markets and domestic relationships.
- Enhancing the SCAG Heavy-Duty Truck (HDT) model.
- Assessing state clean technology rules and progress based on industry technology development.
- Formulating further visioning, policy development, and implementation strategies and initiatives.

As demonstrated through the LMFP, there are multiple approaches towards implementing both private and publicly accessible zero-emission infrastructure. SCAG's Zero-Emission Truck Supporting Infrastructure (ZETI) Study serves as a critical comprehensive system-level planning approach towards zero-emission infrastructure needs. This comprehensive approach is focused on further analyzing numerous demand characteristics of truck and market segments, while explicitly assessing publicly accessible zero-emission infrastructure needs to further build a strong representation of what is needed for the region's infrastructure in the current regulatory environment. With the large number of independent owner-operators representing most of the trucking sector, it will be important to develop zero-emission infrastructure in a way to accommodate small and large fleets. There has been an increasing focus on zero-emission publicly accessible infrastructure with numerous local, state, and federal funding programs. There have also been numerous zero-emission infrastructure assessments across the state and within the SCAG region. There will be multiple funding program cycles to compete for the SCAG region and this Study will provide a phased development plan serving as a strong resource to benefit both local/regional and state needs for a guiding roadmap, while also serving to inform discretionary grant inputs to compete.

- Creating a regionally supported roadmap for medium/heavy duty zero emission truck fueling infrastructure that includes battery electric and hydrogen fuel cell trucks.
- Refining the understanding of truck markets, travel patterns, and relevant operational characteristics to recognize locational needs as well as energy demand.
- Assessing available land and distribution of stations by type, size, market served, ownership model, and other relevant characteristics.
- Developing regional maps showing deployment of stations throughout the region and how the infrastructure may be phased in over time.
- Analyzing key sites with specific recommendations on the equipment needs, roles and responsibilities, a plan for operations and an action plan to develop the station.
- Developing a regional action plan supported by stakeholders that shows the extent of the needed infrastructure and a sequence for phased development and recommendations.

7.5 POLICY 5 - ADVANCEMENT OF INTERMODAL FREIGHT INVESTMENTS

POLICY 5:

Ensure continued, significant investment in a safe, secure, clean and efficient transportation system, including both highways and rail, to support the intermodal movement of goods across the region.

IMPLEMENTATION STRATEGIES

- Continue to coordinate with federal and state partners on goods movement planning efforts, including the LMFP, to position the SCAG region for further funding opportunities.

Policies 1 through 4 and their implementation strategies include processes, programs, and comprehensive planning supported by SCAG. For Policy 5, SCAG's role includes similar coordination and collaboration across many regional partners and member agencies. The nuance is that these local entities have sole

jurisdiction and discretion over their administrative boundaries for developing collective strategies, initiatives, and programs and implementing projects. SCAG supports this process through Connect SoCal by engaging with stakeholders and considering each regional component holistically across key freight modes. This provides a project-based approach towards implementation strategies and initiatives, and in many cases, project implementation is also supported by other programs and processes including and not limited to the CAAP/TAP, service plans, and long-range plans.

Sections below are organized by major freight modal category and include:

- An overview for each freight mode, including recently implemented projects.
- Highlights of federal and state funding program awards for projects since Connect SoCal 2020.
- Projected growth expectations equating to needed infrastructure investments to maintain future service levels.
- Major projects of focus organized by short-term, mid-term and long-term.

As part of the funding program discussions, it should be noted that these are based solely on competitive state and federal programs and that it is recognized that seaports, rail operators, highways and border crossings all may have separate funding sources whether local or generated from fees or other sources that contribute to both capital and operating needs. All detailed project information can be reviewed in the Appendix A – Project List.

7.5.1 SEAPORT STRATEGIES

The SPBPS have long worked with regional and state transportation planning organizations to identify and promote projects that will mitigate vehicle delay to and from port areas, improve regional air quality and reduce collisions at rail-roadway crossings. The enhancement of critical freight corridors that connect the SPBPS, the Inland Empire, and outlying areas through multiple multimodal transfers are key components of access projects. The Port of Hueneme 2020 Strategic Plan highlights key strategies including focuses on business retention and growth, new business opportunities, waterside investments, project funding and fiscal planning, terminal efficiency, agency coordination, the environment, land use and logistical efficiencies, safety, and resiliency.

Since Connect SoCal 2020, there have been numerous projects completed providing access to the seaports as well as directly within their terminals. Examples have included:

- The Gerald Desmond Bridge, opened in October 2020, completing demolition, and being designated as the Long Beach International Gateway Bridge.
- The Middle Harbor Redevelopment Project, doubling the capacity of the two terminals replaced, and including electric-powered cargo-handling equipment.
- Port of Los Angeles Everport Terminal Improvement Project, improving container-handling efficiency and capacity of its existing terminal to accommodate the projected fleet mix of larger container vessels, encouraging fewer ship calls, and further reducing air emissions.
- Port of Los Angeles Shore to Shore Project, ten trucks in-service with fleet operators, Ontario Hydrogen Station online.
- Port Hueneme, deepening of the harbor as well as other projects including upgrading the Port's facilities, pavement improvements, and the modernization of cargo handling facilities.

Table 11. Seaport Projects – Awards from State and Federal Programs

Project Title	Project Description	Award Type	Award Amount	Total Project Cost
Fourth Track Rail Expansion	The project will add a new fourth track, realign and reconfigure 3,000 feet of three existing tracks and rail crossovers, and improve rail signals to increase the reliability and capacity of the connection between marine terminals and the Alameda Corridor.	TCEP 2020	\$8 million	\$24.8 million
Fenix Terminal Rail Expansion	The project entails adding five new working tracks just north of/parallel to the existing Fenix on-dock railyard, including tail track, including pavement and turnouts.	TCEP 2020	\$19.2 million	\$51.5 million
SR-47 – Seaside Avenue – Navy Way Interchange Improvement Project	The project augments an existing partial interchange at SR 47/Seaside Avenue/Navy Way and entails the following: removal of last traffic signal and at-grade intersection on Terminal Island/SR 47, between I-110 and I710, which is at the apex of largest port complex in the Western Hemisphere; new westbound auxiliary lane on SR 47, between Pier S Avenue and Navy Way; new eastbound, 2-lane collector-distributor road, all within the existing facility and ROW, between Ferry Street interchange eastbound on-ramp and Pier S Avenue interchange eastbound off-ramp; channelization improvements at Navy Way/Terminal Way intersection, and new 5th leg/westbound off-ramp termini. The project will improve safety, reduce emissions, and increase cargo flow through the port complexes.	PIDP 2020 / TCEP 2020 / PFIP 2023	\$9.9 million / \$13.4 million / \$41.8 million	\$65.1 million
Middle Harbor Terminal Zero Emission Conversion Project	The Project will fund the replacement of diesel yard tractors with approximately 60 electric yard tractors, construction of electric equipment charging infrastructure with energy load management software to enhance energy efficiency, and installation of software equipment to streamline cargo-handling operations within the terminal.	PIDP 2022	\$30.1 million	\$37.7 million
America’s Green Port Gateway: Pier B Early Rail	The Pier B Early Rail Enhancements Project is comprised of three stand-alone components, each having independent	PIDP 2021 TCEP 2022	\$52.3 million \$70.4 million	\$127 million

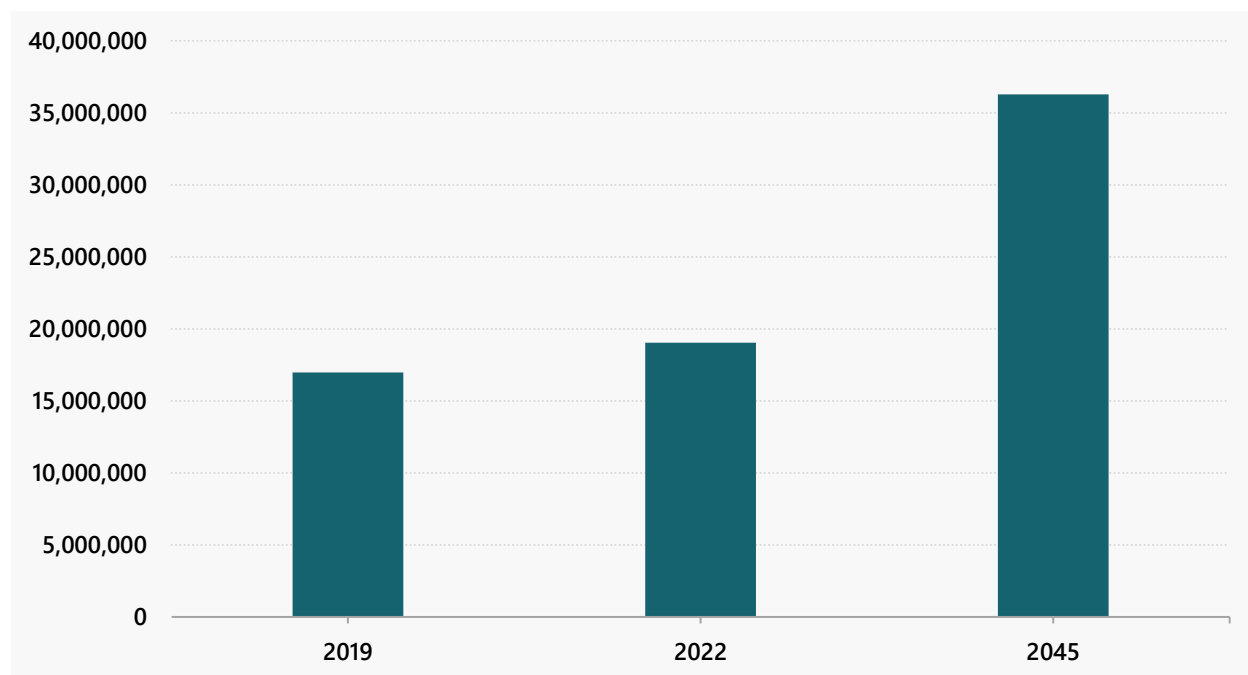
Project Title	Project Description	Award Type	Award Amount	Total Project Cost
	utility. POLB is seeking funding for two of the three components for TCEP Cycle 3. The first component, the East Expansion will provide staging for more and longer trains. It is comprised of two lengthened yard tracks, permanent closure of the Ninth Street At-Grade Crossing, and a new Interstate 710 (I-710) retaining wall at Pier C Street. The Locomotive Facility, the second component, includes a new 24-locomotive support facility with capacity to expand to 30 locomotives and a new fourth mainline creating a 10,000-foot support track enabling rail operators to separate motive power from rail cars without blocking adjacent tracks or trapping rail cars in on-dock terminals.			
Maritime Support Facility Access / Terminal Island Rail System Grade Separation Project	The project will construct a four-lane, rail-roadway grade separation that will eliminate a significant truck access impediment to an important container terminal support facility located on Terminal Island, at the center of Port of Los Angeles-Long Beach (POLA-POLB).	RAISE 2022 – TCEP 2022	\$20 million - \$14.9 million	\$39.8 million
System-Wide Investment in Freight Transport (SWIFT)	The SWIFT proposal touches every part of the goods movement logistics chain in the Port of Long Beach by building a new rail facility that maximizes on-dock rail capacity and reduces the need for local truck trips and by deploying new human-operated zero-emission equipment and permanent infrastructure. PFIP will fund elements of three related SWIFT projects: 1. Rail Efficiency and Advancement Project, including Pier B On-Dock Rail Support Facility (\$158.4 million) and Zero-Emission Locomotive Demonstration Program (\$50 million)), 2. Terminal Efficiency and Zero-Emission Transformation Project, including zero emission terminal equipment demonstration projects (LBCT Equipment Replacement/Charging, SSA Fuel-Cell Top Handlers, SSA Heavy Forklifts – Total: \$73 million), 3. Vessel Continuity and Anchorage-Reduction Project, including zero-emission harbor	PFIP 2023	\$383.4 million	\$2.2 billion

Project Title	Project Description	Award Type	Award Amount	Total Project Cost
	craft and shore power demonstration projects (Crowley Battery Hybrid Tug Boat, Tesoro T121, LBT and T2 Shore Power Demonstrations – Total: \$44.5 million). PFIP will also partially fund a Zero-Emission Terminal Transformation / Harbor Craft Emission Reduction port-administered program.			
Maritime Support Facility (MSF) Improvement – Expansion Project	The MSF is an existing important container terminal support facility located on Terminal Island, at the centroid of the Ports of Los Angeles-Long Beach (POLA/POLB). The existing MSF currently provides up to 30 acres of chassis and empty container storage, on a temporary surface that is inadequate for long-term use. The MSF will be improved and expanded to provide 71 net acres of chassis/empty container storage for all twelve container terminals located in the POLA-POLB. These terminals, combined, handle 35 percent of all waterborne containers entering and exiting the entire United States (U.S.). The MSF has been critical in mitigating the recent U.S. supply chain crisis since mid-2020 and is also important for accommodating future cargo growth.	PFIP 2023	\$149.3 million	\$198.3 million
Port of Los Angeles Rail Mainline / Wilmington Community – Waterfront Pedestrian Grade Separation Bridge	This project will construct a pedestrian bridge to connect the Wilmington community, which has eight schools within one mile, to the POLA's Wilmington Waterfront area and Banning's Landing Community Center. Currently, two freight mainline tracks in the POLA bifurcate the Wilmington Waterfront with the Wilmington community itself. The rail tracks being grade separated move six percent of all US waterborne containers. The project will provide a dedicated pedestrian/cycling bridge over these freight rail tracks and connect to the State designated California Coast Trail.	PFIP 2023	\$42.1 million	\$57.9 million
Port Action, Climate, and Environment Development (PACED)	The Port of Hueneme's Port Action, Climate, and Environment Development (PACED) program serves as the overarching long-term capital development plan for the Port. This program consists of multiple components, each of which will be	PFIP 2023	\$79.8 million	\$216.6 million

Project Title	Project Description	Award Type	Award Amount	Total Project Cost
	executed over the coming five years and beyond. Eight of the components will enhance the Port’s container line of business. Four of the components will enhance the Port’s automobile import/export line of business. The final three components will position the Port for an even more sustainable future by improving the Port’s ability to manage stormwater, developing a port-wide programmatic Environmental Impact Report (EIR) and enhancing Port led workforce development and training efforts.			
Total		N/A	\$934.6 million	\$3 billion

The SPBPs and Port Hueneme have successfully been awarded just below \$1 billion, including \$3 billion in total project cost, from PIDP, TCEP, RAISE, and PFIP programs reflecting a substantial amount of funding coming to the region in the short-term that will support much needed infrastructure investment. The PFIP reflected approximately 75 percent of the total funding and it will be important for the seaports and connecting access for freight corridors to continue to leverage these investments to compete across future cycle state and federal funding programs to ensure sustainable progress towards continued infrastructure and facility investment needs.

Figure 41. San Pedro Bay Ports Terminal TEUs Forecast

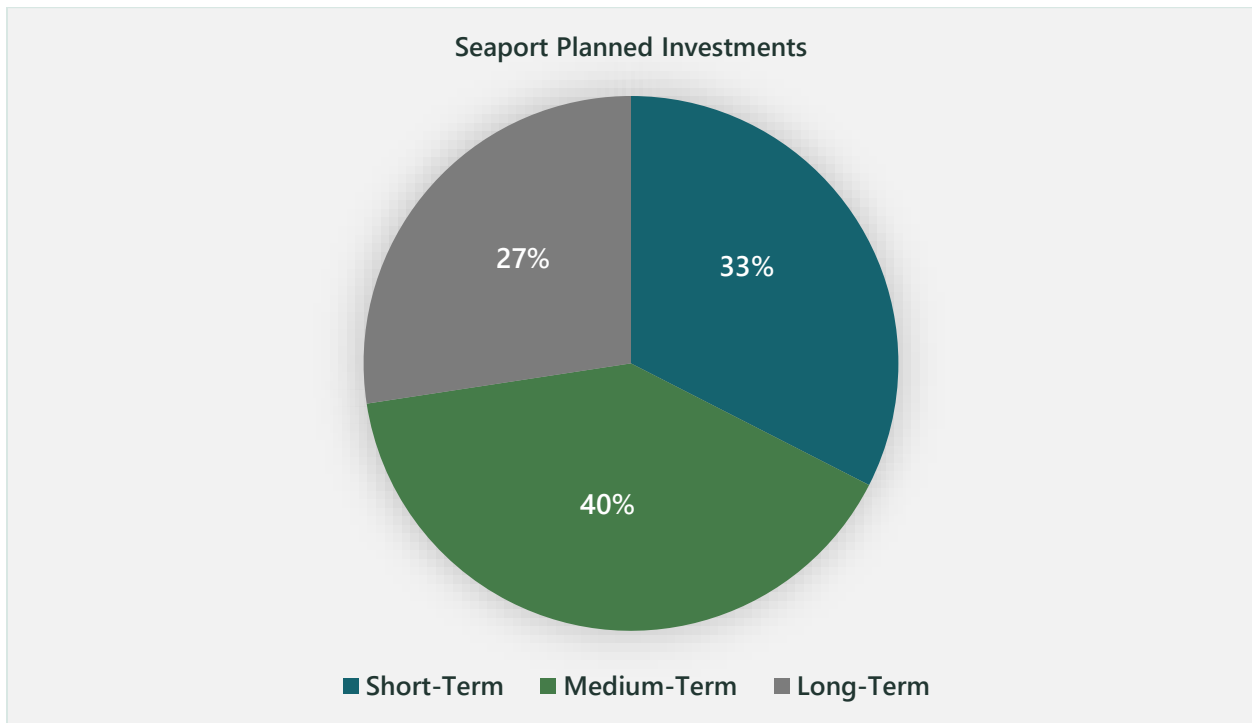


Source: SPBPs

Per the SPBP’s Port of Los Angeles and Long Beach Rail Study – December 2020, the most current containerized cargo forecast anticipates that TEU projected volumes based on both terminal and off-terminal capacity will grow at an annualized rate near 3 for the 2045 horizon year from the 2019 baseline. As part of this growth, it is anticipated that IPI cargo will increase market share growing at a faster rate versus local truck markets supporting further conversion to rail cargo.

Regardless of geopolitical tensions between the U.S. and China, trade with Asia will continue to be a large part of global supply chains for the SCAG region, local markets, and the U.S. As a result, the SPBPs will continue to require significant investments in seaport infrastructure and facilities as well as for connections to rail and trucking freight corridors to support the region’s goods movement fluidity needs and ultimately, to sustain the region’s economic competitiveness and continued job creation and retention.

Figure 42. Seaport Planned Investments

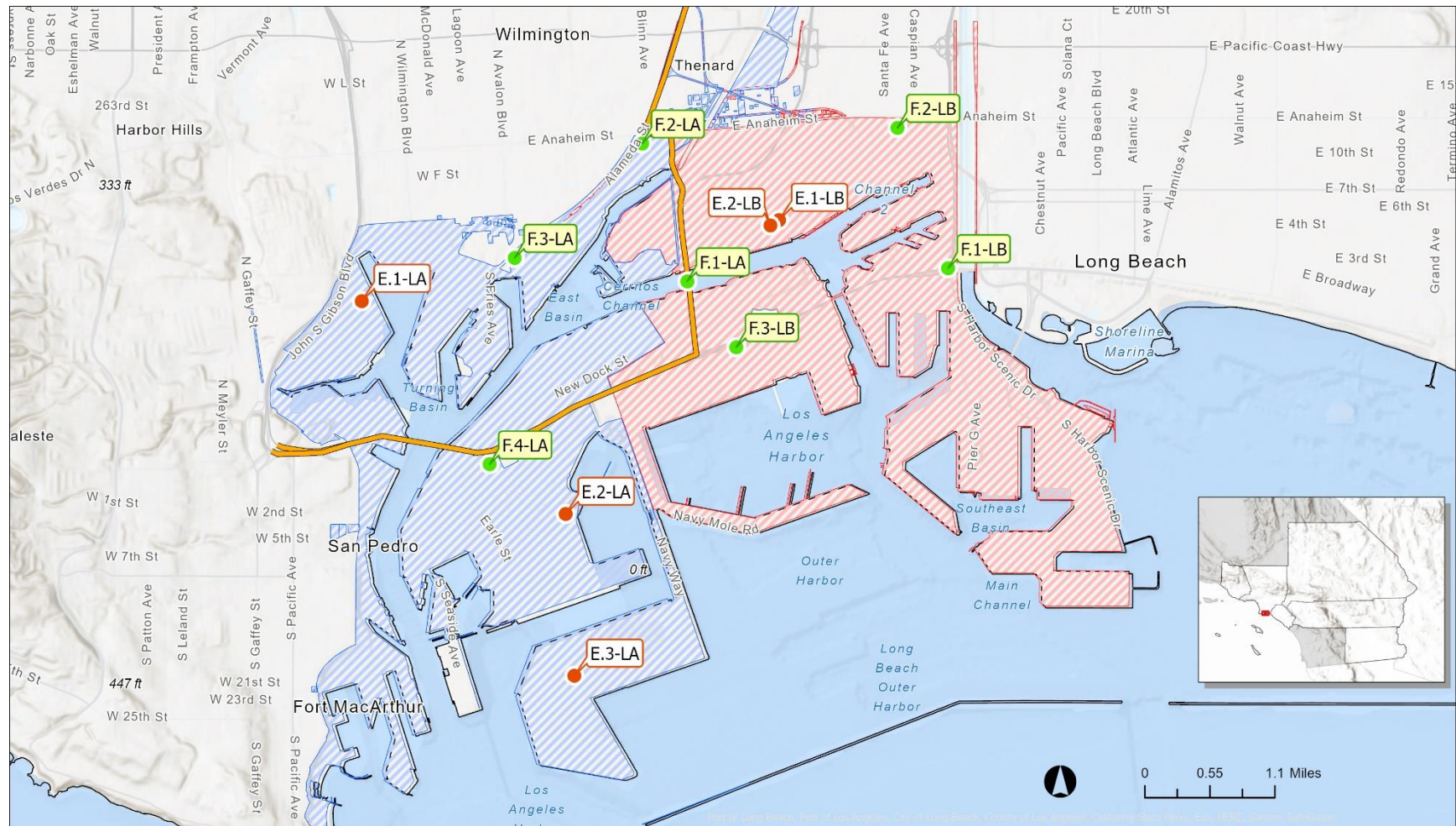


Source: SCAG

Over the horizon of Connect SoCal, seaport projects are currently expected to total \$4.6 billion in infrastructure, facility, and equipment investments. Prior to 2030, just over \$1.5 billion is anticipated including PFIP awarded projects with this amount expected to increase to \$3.4 billion resulting from expanded terminal projects. Through 2035 and including PFIP, seaport investments are expected to reflect 73 percent of the total need (Figure 42) with examples of key short-term projects in addition to PFIP awarded projects including:

- Pier D Street realignment project. Realign and reconstruct Pier D St. between Middle Harbor exit gate, Pico Ave., and reconfigure Broadway Ave.
- Terminal access project on Pico Ave. serving Middle Harbor. Widens and rebuilds Pico Ave. from Pier D Ave. to Pier E St.
- I-710 improvements/Shoemaker bridge replacement. Replace the existing Shoemaker bridge with a new bridge. The new bridge will be reduced to have two mixed-flow lanes in the northbound and in the southbound directions to tie the flow into I-710. The new bridge will also include pedestrian and bicycle access. Additionally, bicycle, pedestrian, and street enhancements will be provided on adjacent thoroughfares.
- Port of Los Angeles zero emission truck trip reduction/freight efficiency program. Pier 300 including railyard expansion/modernization and wharf expansion.
- Port of Los Angeles zero emission truck trip reduction/freight efficiency program. Berths 121-127 improvement.

Map 22. On-Dock Rail and Rail Access Improvement to Port of Long Beach and Los Angeles



- E - On-Dock Rail
- F - Rail Access Improvements to Ports of Long Beach and Los Angeles
- Port of Long Beach (LB)
- Port of Los Angeles (LA)
- SR-47

Source: SCAG 2022

As the region moves further towards 2030 and beyond, nearly \$3.1 billion in investments will be needed to continue to provide the capacity necessary to support the growing demand from local and national markets and corresponding freight increases, with nearly 60 percent of this total planned by 2035. Key mid-term projects include:

- SR-47 four-lane expressway and two-lane flyover to Schuyler Heim bridge, including bridge replacement.
- Port of Los Angeles zero emission truck trip reduction/freight efficiency program. New Cerritos Channel rail bridge.
- Port of Los Angeles zero emission truck trip reduction/freight efficiency program. Pier 400 rail expansion; Pier 300 rail expansion Phase II.
- Freight corridor enhancement project along Pier B Street, which involves realigning Pier B St. between Pico Ave. and Anaheim St. and widens to two lanes in each direction to improve goods movement mobility; realigning Pico Ave. to the west from Pier B St./I-710 ramps to Pier D St.; constructing new sidewalk on the south side of Pier B St. and along the west side of Pico Ave. for pedestrian safety; and closing the at-grade railroad crossing at 9th Street for rail efficiency.

7.5.2 RAIL STRATEGIES

The freight network, which is privately owned and market-driven, plays a significant role in facilitating the movement of goods. SCAG's rail infrastructure is crucial in effectively serving international ports, regional industries, and national markets. The competitiveness of freight rail is influenced by the reliability and efficiency of the rail network, particularly when compared to other transportation modes like highways and trucking. Rail connections between SCAG's seaports, logistics industry, manufacturers, and agricultural sector and the rest of North America are essential for ensuring their competitiveness and success.

The proposed regional rail package in Connect SoCal has several components:

- Mainline rail improvements (additional track capacity, rail-to-rail grade separations, new sidings, new signal systems, universal crossovers, rehabilitation, etc.) that would benefit both freight rail, and including passenger rail service depending on their location,
- Rail yard improvements (upgrades to existing yards as well as construction of new yards),
- Seaport on-dock rail improvements,
- Operational rail access improvements and,
- Road-rail grade separations.

Since Connect SoCal 2020, there have been numerous projects completed for rail improvements.

Examples have included:

- Alameda Corridor East (ACE): Durfee Avenue.
- Other Rail Grade Separations: Alameda Corridor Terminus/Terminal Way, Lakeview Ave, Raymond Ave, Orangethorpe Ave, McKinley St, Chicago Ave, Madison St, Jurupa Rd, Adams St, Avenue 66, Jurupa Rd and Ceda Grade Sep, Green Tree Blvd, Lenwood Rd, N. Vineyard Ave, S. Milliken Ave, Monte Vista.
- BNSF: Continued work on adding a new segment of triple-track for the Southern California Transcon route, other new track, improved efficiency initiatives at the San Bernardino Intermodal Facility, and property acquisitions in the Barstow area for BIG.
- UP: Completion of the Inland Empire Intermodal Terminal (IEIT).

Table 12. Rail Projects – Awards from State and Federal Programs

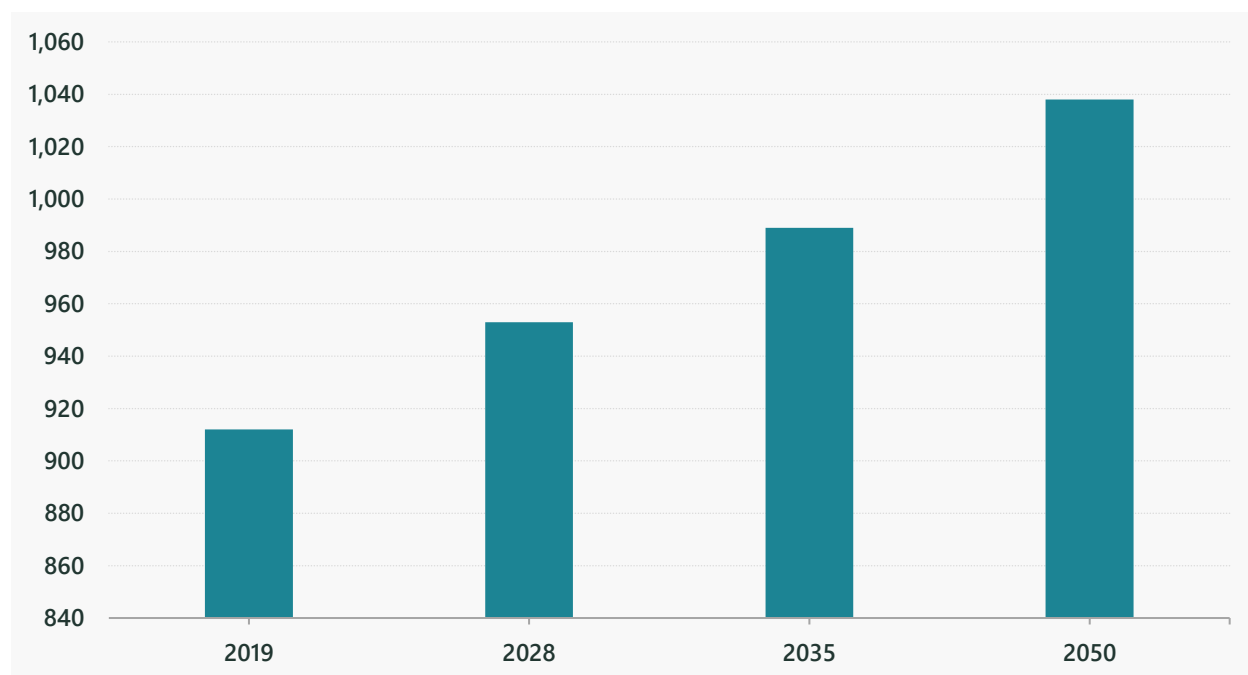
Project Title	Project Description	Award Type	Award Amount	Total Project Cost
Metrolink Antelope Valley Line and Service Improvements	This award builds on the investment in Phase 1 of the Southern California Optimized Rail Expansion (SCORE) Program awarded in 2018 and expands those benefits. This award accelerates delivery of key AVL Projects, which provide regional “bookend” capacity for state supported Intercity and High-Speed Rail, as well as significantly advances the County’s ability to integrate the regional rail system into the Metrolink station communities.	TIRCP 2020	\$107 million	\$220.9 million
McKinley Street Grade Separation	The McKinley Street Grade Separation Project proposes to construct a new four-lane overhead grade separation at the BNSF Railway double tracks near the McKinley Street intersection with Sampson Avenue. The project limits extend from the SR-91 interchange in the north to Magnolia Avenue in the south. The new tied arch bridge crosses over the railroad tracks and the Arlington Channel and Sampson Avenue, both located within 100 feet north of the tracks. The project will add a new loop road across from the SR-91 westbound ramps to connect McKinley Street to Sampson Avenue. The project also modifies the eastbound off-ramp, eastbound loop onramp, and the eastbound slip on-ramp at the SR-91 freeway.	TCEP 2020	\$10.3 million	\$108.3 million
High Desert Corridor Operational Efficiency Project	The project will construct two freight rail staging tracks and add a third main track to extend the existing triple track by 11 miles on the BNSF Cajon Subdivision in San Bernardino County between railroad control points (CP) Martinez and CP Thorn.	PFIP 2023	\$100.5 million	\$150.5 million
Hobart/Commerce IMF Leads Project	PFIP will provide requested PA&ED and PS&E funding to support construction of improvements to the shared use (both passenger and freight rail operations)	PFIP 2023	\$15 million	\$1.2 billion

Project Title	Project Description	Award Type	Award Amount	Total Project Cost
	rail corridor and to the lead tracks (connecting the mainline to the rail yard) and staging tracks in the adjacent Hobart Intermodal Facility (IMF), Commerce IMF, as well as staging tracks at C-Yard.			
Commerce Flyover Project	The project proposes to construct a two-track flyover (grade-separated rail bridge) on a rail corridor segment just east of downtown Los Angeles on the BNSF San Bernardino Subdivision (Commerce Corridor). The Project will construct improvements to separate two tracks to serve passenger rail service from the other main tracks, lead tracks, and staging tracks that serve the freight rail within this segment of the corridor. The award will fund final design and environmental clearance for the project.	PFIP 2023	\$12 million	\$939 million
Third Street Grade Separation Project	The project proposes to construct a new four-lane underpass to replace the existing at-grade crossing along the BNSF San Bernardino Subdivision near the Third Street intersection with Commerce Street in Riverside. Commerce St will be realigned as well.	PFIP 2023	\$22 million	\$74 million
Turnbull Canyon Road Grade Separation Project	The project is the last grade separation of the comprehensive Alameda Corridor-East (ACE) Program that improves safety and mitigates the effects of growing freight rail traffic to and from the San Pedro port complex. The proposed grade separation consists of eliminating the existing at-grade crossing at Turnbull Canyon Road between Salt Lake Avenue and Clark Avenue in the City of Industry and unincorporated Los Angeles County community of Hacienda Heights by constructing a two-lane roadway overpass to carry vehicles over the railroad tracks and a separate pedestrian bridge for bicyclists and pedestrians.	PFIP 2023	\$30 million	\$98 million
Rice Avenue Grade Separation	The project will construct a grade separation structure at the existing Rice Avenue (SR 1) and Fifth Street (SR 34) intersection in order to eliminate an existing at-grade railroad crossing to	PFIP 2023	\$15 million	\$132.5 million

Project Title	Project Description	Award Type	Award Amount	Total Project Cost
	improve safety, reduce congestion for trucks and vehicles traveling to and from the Port of Hueneme, and increase rail service reliability. Rice Avenue would be constructed over Fifth Street and the Union Pacific Railroad tracks.			
Total	N/A	N/A	\$311.8 million	\$2.9 billion

Since Connect SoCal 2020, railroad improvements have successfully been awarded just over \$310 million from TIRCP, TCEP, and PFIP programs totaling \$2.9 billion in project costs (Table 12). Like seaport projects, there is an opportunity for rail improvements to leverage state program awards to further increase funding from federal programs.

Figure 43. Weekly Freight Train Counts



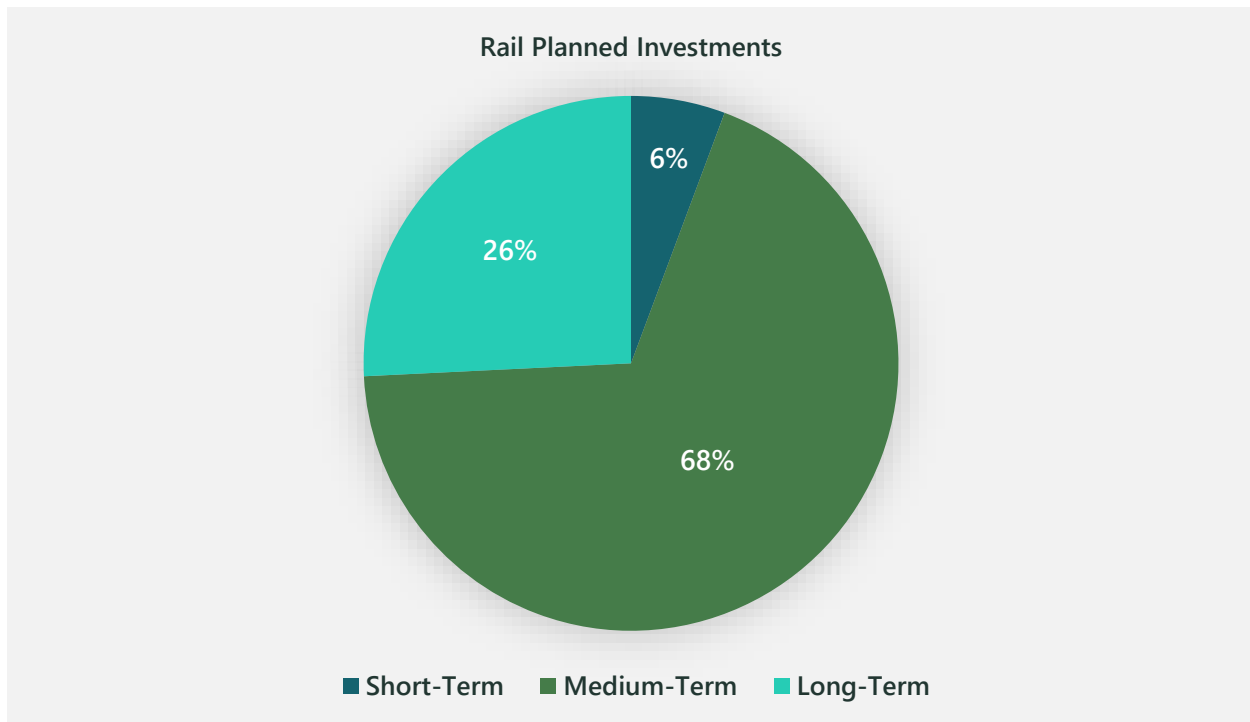
Source: SCAG Integrated Passenger and Freight Rail Study

Per SCAG's Integrated Passenger and Freight Rail Study, overall weekly freight train volumes are expected to grow at an annualized rate of 0.5 percent to nearly 1,040 trains by 2050 from the 2019 baseline (Figure 43). While the projection for containerized rail cargo TEUs is expected to grow much faster than this, the practice of lengthening double-stacked trains between 11,000 and 15,000 trailing feet while including distributed power units entrained will enable containerized cargo increases through greater rail operating efficiencies.

Freight trains entering and departing the LA Basin operate through four key subdivisions: Valley, Mojave, Cajon Pass/Cima, and Yuma. These subdivisions handle both imports and exports for seaports and locally produced goods, distributing them within the SCAG region, California, and across the nation. The Valley and Mojave subdivisions primarily move non-intermodal cargo with some auto carriers using Valley. The Cajon Pass Subdivision carries a diverse range of goods serving as one of two major eastbound/westbound routes for local and national freight traffic. These goods include autos, international and domestic containers, and non-intermodal freight. The Cajon Pass Subdivision connects to the San Bernardino subdivision, which links the Alameda Corridor and Los Angeles subdivisions, facilitating imports, exports, and empty containers from the SPBPs. The Yuma Subdivision serves as the other primary eastbound/westbound route similarly connecting to the SPBPs, Alameda Corridor, and Alhambra and Los Angeles subdivisions. For containerized cargo, the Cajon Pass (connecting Cima) and Yuma subdivisions provide the primary connections across the U.S. supported by San Bernardino,

Alhambra, and Los Angeles subdivisions, directly through IPI as well as transloaded cargo at numerous intermodal railyards throughout the SCAG region.

Figure 44. Rail Planned Investments



Source: SCAG 2023

Over the horizon of Connect SoCal, rail projects are currently expected to total \$27 billion in infrastructure, facility, and equipment investments. Rail-related projects are similar to seaports as over 70 percent of infrastructure investments will occur by 2035 (Figure 44), however, much of this amount is anticipated to occur within the 2030 to 2035 period. The significant increase in rail investments over the mid-term is necessitated due to the integrated needs to operate increasing passenger service while not degrading freight rail operations and maintaining optimal service levels. Additionally, just over 10 percent of total project costs were awarded by state sources since Connect SoCal 2020, a clear result of a lack of funding from federal programs. Seaport projects received 25 percent of their awarded funds from federal programs, while highway projects have benefited largely from the state’s TCEP. This is an important consideration and reason for the region’s Policy 1 Rail Investments inclusion from the goods movement resolution with a focus to continue to work on a cohesive rail investment plan to compete more strongly for federal funding programs.

Main line rail investments serve as critical throughput capacity arteries for the rail system. Operationally, there are many other project components to support throughput efficiency needs such as cross overs and turnouts, sidings, flyovers, etc. that support these investments. Much of the short-term rail improvements that are mutually beneficial to both freight and passenger operations have been funded through the CalSTA Transit and Intercity Rail Capital Program (TIRCP) for SCORE for the Valley Subdivision and through TCEP for the Cajon Pass/Cima Subdivision.

Short-Term Main Line Improvements - \$1.4 billion

- Brighton to Roxford Double Track: Adds 2nd track between Burbank and Sylmar on the Antelope Valley line, known as the Valley Subdivision.
- Antelope Valley Line Capacity Improvement Project: Add capacity between Los Angeles Union Station and Lancaster.
- Lone Hill Avenue to Control Point White: Double track between Lone Hill Ave. and CP Central.
- Freight – Desert Rail Infrastructure Improvement Project: Rehabilitates mainline track on the Arizona and California Railroad Cadiz Subdivision between Cadiz, California and Parker, Arizona.
- Freight – High Desert Corridor Operational Efficiency Project: Construct staging tracks and extend main track.

As described above, most freight rail investments will be designated to support major expansion and operational improvements by 2035 to account for passenger rail services including the Southern California Regional Rail Authority (SCRRA), also known as Metrolink, California High-Speed Rail, Brightline, and LOSSAN and Amtrak services. While passenger rail service remains a key priority for the SCAG region, much of the mainline right-of-way is owned by the Class I freight railroads and county transportation commissions requiring considerations to maintain critical freight service operation levels and support operational cost needs across other public agencies. SCAG’s Integrated Passenger & Freight Rail Study has further identified additional freight and passenger rail enhancements required to accommodate these operational needs by 2035. Below is a review of SCORE (Map 20) and additional freight and passenger rail enhancement rail investments (Map 21) with these projects including mutual benefits to passenger and freight rail services, as well as freight-specific projects. While the SCORE program identified many rail improvements across freight subdivisions, the additional rail enhancements have further identified rail improvements across these initial subdivisions, notably, to accommodate the increasing complexities of passenger and freight rail operations within major urban corridors, while also further defining needs across additional freight subdivisions.

SCORE PROGRAM \$7.6 billion

- Santa Barbara Subdivision: Main track improvements (adding track/sidings).
- Valley Subdivision: Main track improvements (adding track/sidings) and signal respacing.
- San Bernardino Subdivision: Main track improvements (adding track/sidings/reconfigurations).

Additional Freight and Passenger Rail Enhancements - \$5.7 billion

- San Bernardino Subdivision: Main track improvements (adding track/sidings), passenger and freight flyovers, crossovers and turnouts, and station improvements.
- Alhambra Subdivision: Main track improvements (adding track/sidings).
- Los Angeles Subdivision: Main track improvements (adding track/sidings).
- Santa Barbara Subdivision: Main track improvements (adding track/sidings).
- Orange Subdivision: Main track improvements (adding track/sidings).

The SPBPs represent a critical component of rail investments for both on-dock and rail access improvements (Map 22). Additionally, off dock and near dock intermodal rail yards continue to be an important focus of rail capacity needs. Below are a subset of key investments targeting the 2035 period including overall category costs through the 2050 horizon year.

On-Dock Rail - \$1.5 billion

- Port of Los Angeles Zero Emission Truck Trip Reduction/Freight Efficiency Program: West Basin container terminal railyard modernization.
- Port of Los Angeles Zero Emission Truck Trip Reduction/Freight Efficiency Program: Pier 300 rail expansion Phase I.
- Port of Los Angeles Zero Emission Truck Trip Reduction/Freight Efficiency Program: Pier 400 rail expansion and Pier 300 rail expansion Phase II.

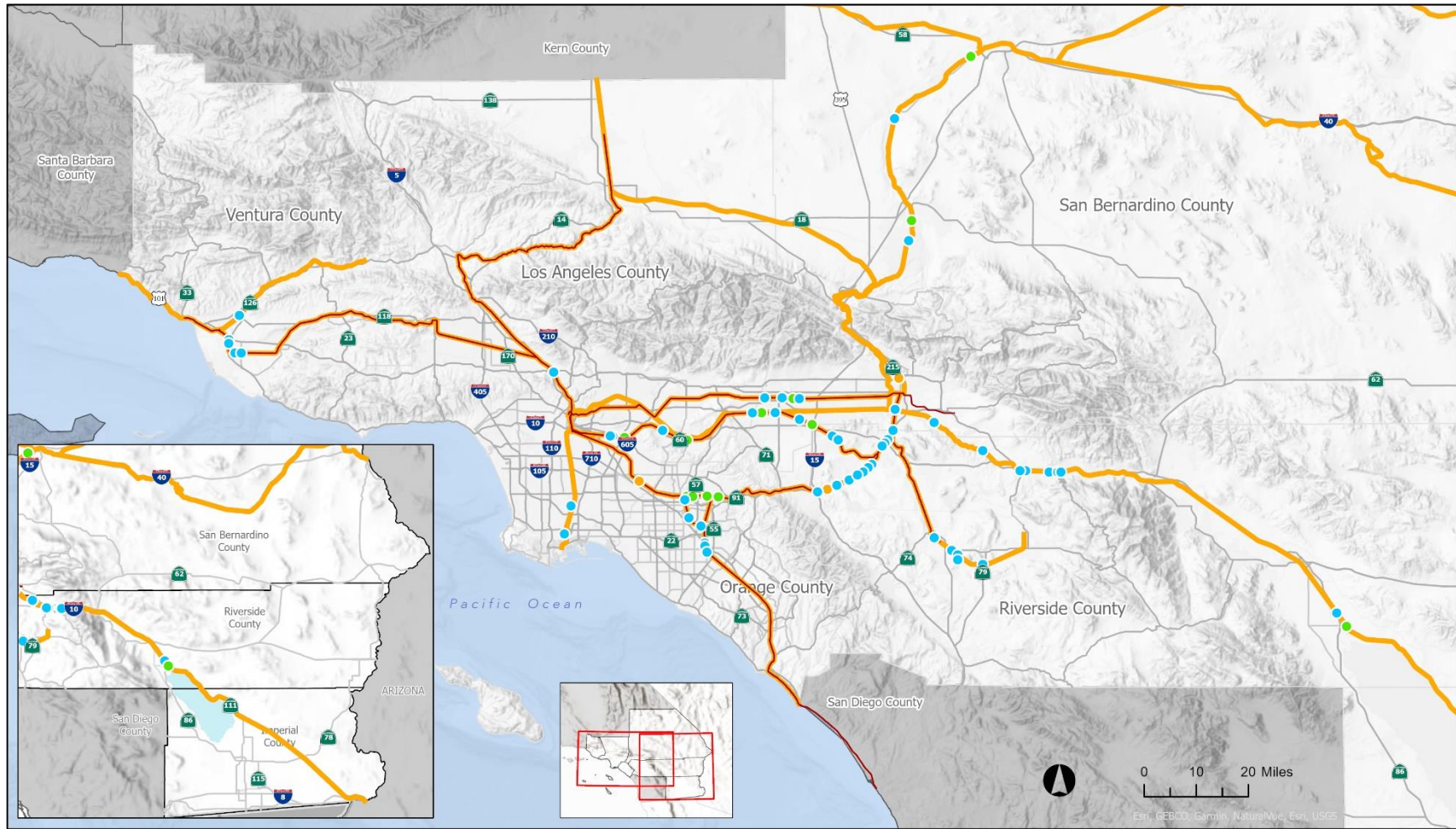
Rail Access Improvements - \$778 million

- Port of Los Angeles Zero Emission Truck Trip Reduction/Freight Efficiency Program: Terminal Island on-dock railyard expansion.
- Alameda Corridor Terminus Enhancement: New Cerritos Channel bridge.
- Pier B On-Dock Rail Support Facility: Expand Pier B intermodal railyard to facilitate additional rail shipments.

Off Dock and Near Dock Intermodal Yard - \$1.8 billion

- San Bernardino Track and Intermodal Yard Improvements (Phases 1 through 4)
- Los Angeles County Intermodal Facilities

Map 23. Grade Separation Projects in SCAG Region



- Complete
- Planned
- Under construction
- Commuter Rail
- Regional Rail Lines

Source: SCAG 2022

An additional \$4.2 billion will also be required for rail grade separations located throughout the SCAG region (Map 23). The ACE program totaling nearly \$2 billion in grade separation costs has constructed most crossing separations with remaining crossings expected to be completed in the short-term including:

- Montebello Blvd., Turnbull Canyon Rd., Fullerton Rd., and Pomona at-grade crossing.

Other non-ACE rail grade separation investments through 2035 will support major freight corridors within the Los Angeles Basin including the San Bernardino Subdivision, Alhambra Subdivision, and Los Angeles Subdivision connecting to the Cajon Pass/Cima and Yuma subdivision national freight corridors. Total non-ACE rail grade separation investments through the 2050 horizon year total \$3.7 billion.

7.5.3 HIGHWAY STRATEGIES

Trucks carry the largest fraction of goods moved, both in terms of ton-miles and cargo value, of all goods movement modes on a roadway system that also carries growing passenger traffic. To better understand the locations that will demand greater truck efficiency and operational improvements, Connect SoCal considers current and future truck traffic volumes (Map 4) on the key roadway corridors. Truck traffic in the region is expected to grow at a very high rate, much higher than auto traffic, and will use an increasing share of the region's highway facilities. The most heavily used routes are already extremely congested and will continue to be in the future. This will cause increasing delay for the trucking industry, increasing costs to shippers and ultimately to consumers, and associated community and environmental impacts.

Table 13. Highway Projects – Awards from State and Federal Programs

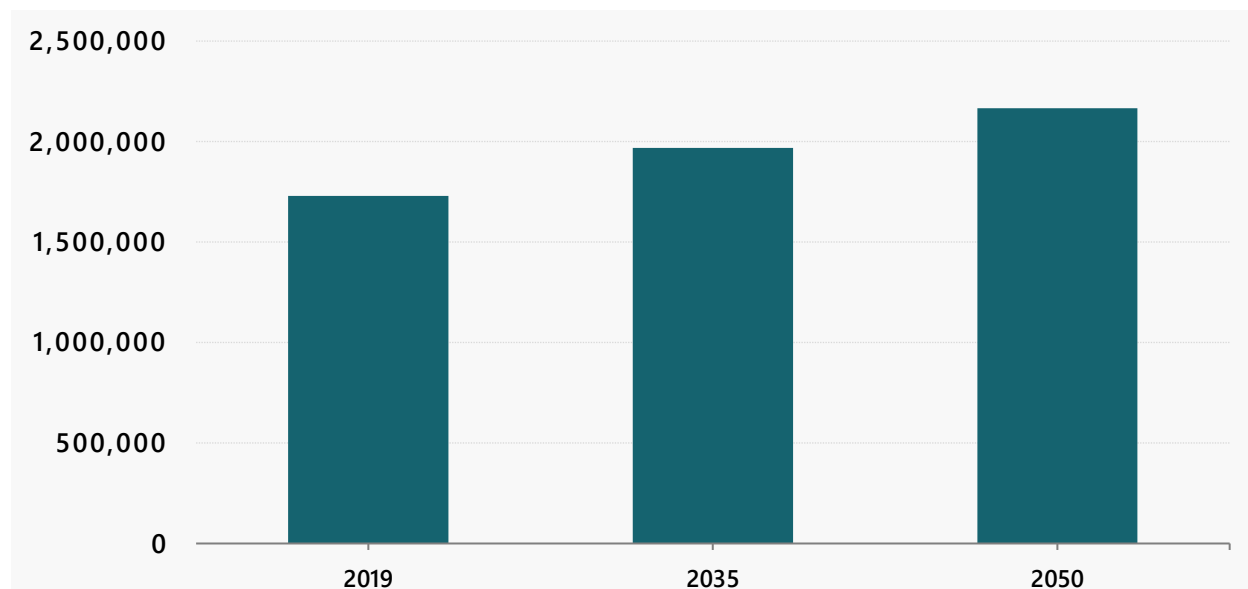
Project Title	Project Description	Award Type	Award Amount	Total Project Cost
I-10 Truck Climbing Lane	Project includes two miles of truck climbing lane, plus a one-mile approach to the upgrade.	TCEP 2020	\$24.1 million	\$36.5 million
SR-71/SR-91 Interchange Connector	The project replaces existing single lane loop connection between eastbound SR-91 and northbound SR-71 with new two-lane direct connector ramp. Adds eastbound auxiliary lane south of and parallel to SR-91 and realigns eastbound entrance ramp from Green River Rd.	TCEP 2020	\$58.1 million	\$148.2 million
SR-57/SR-60 Interchange & Other Improvements	The project will construct highway improvements and bypass connectors on approximately 2.5 miles of a heavily traveled freight highway to alleviate a truck bottleneck critical to the operation of Southern California’s ports, intermodal, warehousing and manufacturing facilities, and export-dependent industries across the nation.	TCEP 2020	\$217.9 million	\$420.2 million
Goods Movement Corridor – SR-91 Atlantic to Cherry	The project includes two of Metro’s SR-91 Early Action Projects (EAPs) which are part of the I-605 “Hot Spots” Program. These include I-605/SR-91 interchange improvements and the eastbound SR-91 Atlantic Avenue to Cherry Avenue projects.	TCEP 2020	\$48.3 million	\$86.6 million
SR-55 Improvements	The project includes SR-55 improvements for general purpose lanes, HOV, and auxiliary lanes.	TCEP 2020	\$115 million	\$349.2 million
I-15 Lanes San Bernardino	The project looks to improve traffic efficiency, operations, and safety at a nationally significant freight bottleneck. The segment extends from Cantu-Galleano Ranch Road in Riverside County to Foothill Blvd. in San Bernardino County, with	TCEP 2020	\$118.7 million	\$307.2 million

Project Title	Project Description	Award Type	Award Amount	Total Project Cost
	the I-15/I-10 interchange in the mid-section, a critical bottleneck for freight.			
Goods Movement Corridor – I-605/SR-91 Interchange Improvement	The project includes two of Metro’s SR-91 Early Action Projects (EAPs) which are part of the I-605 “Hot Spots” Program. These include I-605/SR-91 interchange improvements and the eastbound SR-91 Atlantic Avenue to Cherry Avenue projects.	TCEP 2020	\$69.7 million	\$154.3 million
I-10 Corridor Freight & Managed Lane Project	The project looks to improve efficiency, operations, and safety by taking a “managed lane” approach to 1) address a nationally significant freight bottleneck and 2) provide incentives for use of transit and shared rides that do not currently exist on this section of I-10.	TCEP 2022	\$85 million	\$806 million
I-605 Valley Blvd. Interchange Improvements	The project includes reconfiguring the freeway on and off ramps, reconstructing, repaving, and widening local streets (Valley Blvd. and Temple Avenue); upgrading signals/devices; constructing retaining walls and sound walls; installing new streetlights for safety and security; new signage; and implementing ADA infrastructure upgrades.	TCEP 2022	\$33.6 million	\$53.3 million
SR-91 Operational & Multimodal Improvements	The project will improve operations, reliability, safety, and throughput including constructing a new ramp for dedicated access to southbound SR-55, separating traffic, replacing the Lakeview Avenue bridge, improving bicycle/pedestrian facilities, and reconfiguring ramps.	TCEP 2022	\$42.6 million	\$107.7 million
I-710 Integrated Corridor Management (ICM)	The project will integrate and upgrade the I-710 freeway and the local arterial network into one cohesive system using intelligent transportation	TCEP 2022	\$27.8 million	\$40.2 million

Project Title	Project Description	Award Type	Award Amount	Total Project Cost
	system (ITS), technology, and traveler information and data, currently managed by local agencies and Caltrans along the I-710 corridor.			
SR-60 Potrero Blvd. Interchange	The project will add off ramps, loop on ramps, and traffic signals to the interchange improving freight access to existing and future fulfillment and distribution centers off Portero Blvd.	TCEP 2022	\$33.5 million	\$50 million
U.S.-395 Freight Mobility & Safety Project	The project address a critical freight bottleneck by converting the facility from two lanes to four lanes, with a raised median between I-15 and SR-18, approximately seven miles.	TCEP 2022	\$35 million	\$79.6 million
Total	N/A	N/A	\$909.3 million	\$2.6 billion

Since Connect SoCal 2020, highway improvements have successfully been awarded just over \$900 million from TCEP totaling \$2.6 billion in project costs. From a freight perspective, the SCAG region is challenged with policies looking to reduce vehicle miles travelled (VMT) versus the likelihood of freight demand continuing to increase locally within the region and through adjacent areas including Arizona, Nevada, and Mexico. Balancing ITS, and operational strategies as part of the throughput and capacity needs will be an important focal point to address this challenge.

Figure 45. Heavy Duty Daily Truck Trips



Source: SCAG

To the point of growth in freight demand, regional truck-related activities will increase over Connect SoCal's horizon. Overall heavy-duty daily truck trips across the region are expected to increase at an annualized rate of 0.73% percent from 2019 through the 2050 horizon year. SCAG's Heavy-Duty Truck (HDT) model is the primary analysis tool used to evaluate the impacts of truck traffic and highway goods movement strategies on the regional transportation network. Major sources of truck traffic are grouped into the following categories in SCAG's HDT model:

- Internal Truck Trips: These are intraregional truck trips that have both an origin and a destination within the SCAG region and are generated by local industries, construction sites, domestic warehouses and manufacturing sites and distribution centers and truck terminals and residences.
- External Truck Trips: These are interregional truck trips that reflect trade between the SCAG region and the rest of the U.S. based on the firm synthesis model which reflects business establishments and employment growth factors in the SCAG region.
- Port Truck Trips: These are truck trips with an origin and destination at the San Pedro Bay Ports
- Secondary Port Truck Trips: These are truck trips with an initial origin or destination at the San Pedro Bay Ports and IMX that are moved a second time after the first trip to or from the San Pedro Bay Ports. Transloading trips are in this category.
- Intermodal (IMX) Truck Trips: These are domestic intermodal truck trips that have origins or destinations at regional intermodal facilities in the SCAG region. These truck trips do not include

those that have either an origin or destination at the San Pedro Bay Ports as they were modeled by Port HDT Model.

Error! Reference source not found. As shown in Figure 45, there are continuously increasing heavy-duty truck (HDT) trips in the region over the forecasting horizon years. And the HDT trips include Internal HDT trips and External HDT trips and even Airport and Seaport related HDT trips such as secondary port truck trips and intermodal truck trip that connects to the rail transport facilities.

In 2019, the SPBPs were responsible for approximately 69,157 direct daily regional truck trips. As shown in Table 14, this constitutes only about 4 percent of regional truck trips. That number is expected to grow to approximately 113,134 daily regional truck trips, an increase to nearly 8 percent, by 2050.

Table 14: Regional Truck Trips

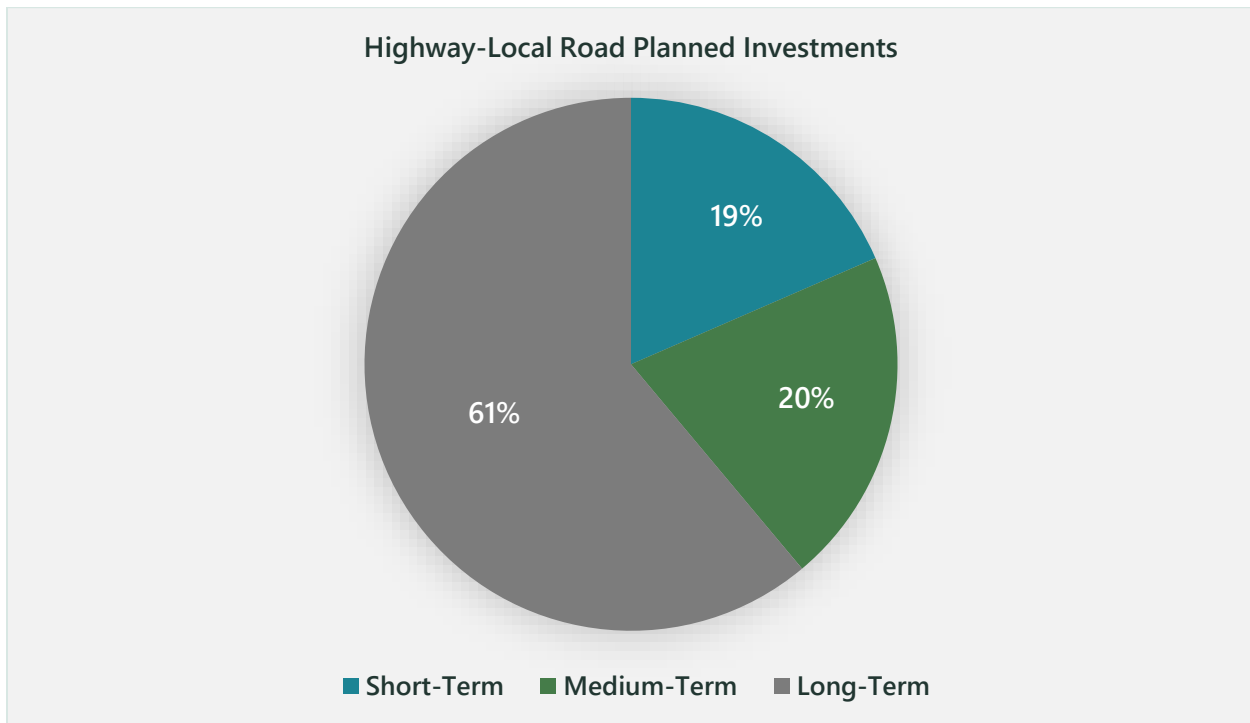
Type of Truck Trip	Imperial County	Los Angeles County	Orange County	Riverside County	San Bernardino County	Ventura County	Total	Percent
Internal	11,031	841,533	282,179	166,985	183,606	59,662	1,544,996	89.8%
External	4,884	30,731	6,362	17,200	26,030	4,789	89,996	5.2%
Port	2	65,907	251	1,387	1,605	5	69,156	4.0%
Intermodal (IMX)	9	5567	373	295	1920	63	8,228	0.5%
Secondary	2	7270	189	325	1205	25	9,015	0.5%
Total	15,929	951,008	289,353	186,192	214,366	64,544	1,721,391	100.0%
Percent	0.9%	55.2%	16.8%	10.8%	12.5%	3.7%	100.0%	

Source: SCAG

Internal truck trips accounted for the vast majority (90.5 percent) of truck trips in 2019. Over 60 percent of these trips were made by light-heavy and medium heavy trucks, whereas all the other categories are dominated by heavy-heavy trucks. In 2019, internal truck trips in Los Angeles County amounted to 841,533 trips per day, or 54.5 percent of all internal trips, and 55.2 percent of all truck trips in the region. Although there is a general public perception that port-related truck trips are the dominant causes of congestion, pollution, and accident-related issues associated with goods movement, the SPBPs generated only 4.0 percent of all truck trips in the region in 2019. External trips make up a larger share of the trips that have origins or destinations in Imperial, Riverside and San Bernardino Counties. Port trips make up a dominant share of truck trips (95.3 percent) in Los Angeles County than the overall regional share of these types of truck trips.

All key regional highway corridors used to move goods are expected to see an increase in overall truck volumes by 2050. Map 5 through Map 10 show existing truck speeds on the regional highway network during the AM and PM Peak periods, respectively. The expected speeds on the regional highway network during the PM Peak period in 2050, if no action is taken, is also included. Map 4 illustrates truck volume trends for the 2019 baseline and 2050 plan on the major truck corridors in the region. Most of the corridors show significantly increased truck volumes in the no-plan scenario while minor improvements are shown in the plan scenario map.

Figure 46. Highway-Local Road Planned Investments



Source: SCAG

Over the horizon of Connect SoCal, highway projects are currently expected to total \$49.4 billion in infrastructure investments. Unlike seaport and rail projects, only less than 40 percent of this total is anticipated to occur by 2035 (Figure 46). This speaks to shifting policies and changes related to capacity improvements of freight corridors with some of the most ambitious projects remaining towards the latter part of the Plan as a result. Regardless, the substantial amount of investment required to support highway infrastructure through 2035 remains costly at just below \$20 billion. All highway and roadway access project improvements are included in Map 24. Below are a subset of key investments for each period, cost information is comprehensive of all projects.

Below are select highlights for both short-term, mid-term, and long-term highway improvements.

Short-Term Improvements - \$9.2 billion:

- I-10: Express Lane: Implement Express Lanes widening, interchange improvements, and truck climbing lanes.
- I-15: Express Lane: Implement Express Lane widening.
- SR-57/SR-60 Confluence Chokepoint Relief Program: Reconstruction of overcrossing, connector, bypass off-ramp, tunnel, and entrance ramp, and construction of loop entrance ramp and entrance ramp.
- SR-91 Operational Improvements: Includes auxiliary lanes, interchange improvements, general purpose lanes, and on/off ramps.
- SR-71: Expressway to Freeway Conversion: Includes the addition of one HOV lane and one mixed flow lane.

- US-395: Interim Widening: Includes widening from near I-15 to SR-18 from two to four lanes and other operational improvements.
- I-5 HOV Lanes: Extend lanes from the SR-14 interchange to just south of the Parker Road interchange.
- I-405 Lane Improvements: Includes widening between SR-73 to I-605 adding one mixed flow lane in each direction and additional improvements converting existing HOV to HOT lanes and one additional HOT lane in each direction.
- SR-55: Lane Improvements: Includes widening between I-405 and I-5 adding one mixed flow lane and one HOV lane in each direction and other operational improvements.

Mid-Term Improvements - \$10.1 billion:

- I-605 Lane Improvements: Includes multiple segments adding general purpose, HOT or HOV lanes and converting HOV to HOT lanes and other operational improvements.
- SR-91 Lane Improvements: Includes adding one mixed flow lane from SR-55 to SR-57 and other operational improvements.
- I-10 Lane Improvements: Includes construction of two lanes to provide a bypass network facility and other operational improvements.
- I-5 Lane Improvements: Includes multiple segment improvements for truck only enhancements and mixed flow lanes.
- SR-57: Truck Climbing Lane: Includes additional lane from Lambert to Los Angeles County line.
- SR-111 Lane Improvements: Includes widening to six lane freeway and other operational improvements.

Long-Term Improvements - \$30.2 billion:

- East-West Freight Corridor: SR-60 segments 1-3 and I-15 from SR-60 to I-10.
- Bottleneck Relief Strategy
- ITS Strategy
- Zero-Emission Vehicles and Infrastructure
- Freight Arterial Operations and Maintenance

Many of the long-term improvements are reflective of regional initiatives provided by SCAG to support further strategy needs within goods movement systems. These investment strategies should be viewed as flexible with respect to the timing of implementation with a strong correlation with associated opportunities from various funding program availability.

The goods movement supply chain is organized by a comprehensive system comprised of various freight modes that are supported by essential infrastructure, facilities, and equipment. As the seaports continue to invest in capacity throughput, the north-south to east-west relationships of intermodal freight flows for both rail and highway freight corridors will continue to need complimentary investments to sustain freight throughput across the SCAG region supporting local and national freight demand. For both the rail and highway freight corridors, an increasing need to revisit and develop a cohesive implementation strategy for east-west infrastructure and facilities investment needs has once again become a critical point of focus. Shifts in state policies such as reducing vehicle-miles traveled (VMT) have impacted perceptions and actions, notably for approaches towards increases in highway freight corridor capacity. Like emerging freight technologies towards zero emission, there are challenges as to the timing to what can realistically be achieved. This is a core justification for Policy 4 Comprehensive System-Level Planning, where it will be highly important to recognize the trade-offs for rail and highway relationships from a multi-freight mode corridor perspective.

CLEAN FREIGHT CORRIDOR SYSTEM

SCAG and previous iterations of Connect SoCal and the Regional Transportation Plan have long recognized the need for a regional clean freight corridor system connecting key trade gateways at the SPBPs and industrial cluster areas in Los Angeles and the Inland Empire. This vision remains relevant today while evolving to reflect and incorporate local decision-making processes. The region remains focused on developing innovative strategies and solutions towards project concepts which can address growing truck traffic and safety issues on core highways throughout the region, serving key goods movement industries. This includes a continued focus with developments related to near-zero and zero emission technologies. SCAG will continue to leverage the LMFP, as well as progress through the ZETI Study. Through embarking on a comprehensive goods movement plan update, further aligning technology advancements with supply chain freight flows will be informative for the region's clean freight path forward.

LONG BEACH-EAST LOS ANGELES (LB-ELA) CORRIDOR MOBILITY INVESTMENT PLAN

In March 2018, the Metro Board of Directors selected Alternative 5C as the Locally Preferred Alternative (LPA) for the I-710 South Corridor. This alternative reduced the extent of the I-710 truck-only lanes to south of SR-91 at Del Amo Boulevard. In September 2021, Metro staff cited the Governor's Executive Orders on Climate Change, environmental legislation, equity considerations, and Caltrans' position on the I-710 project as reasons that the LPA will not gain approval from the State and identified the need to review the project's Purpose and Need. Metro subsequently launched the LB-ELA Corridor Plan process in Fall 2021 in response to community stakeholders who voiced a vision for mobility that advances equity and sustainability. A Task Force with several committees was established consisting of residents and a cross-section of stakeholders representing the various communities and industries along the I-710 South corridor. On July 11, 2022, the Task Force approved a project vision statement as, "An equitable, shared I-710 South Corridor transportation system that provides safe, quality multimodal options for moving people and goods that will foster clean air (zero emissions), healthy and sustainable communities, and economic empowerment for all residents, communities, and users in the corridor."^{iv}

EAST-WEST FREIGHT CORRIDOR

Connect SoCal continues to identify a corridor concept along the SR-60 connecting to I-15 known as the East-West Freight Corridor (EWFC). As a result of the shift in focus of the LB-ELA Corridor Plan, further

analysis will need to be performed to revisit the EWFC concept, including considerations and trade-offs for both rail and trucking services. These work efforts will be incorporated into the comprehensive goods movement plan update and may involve more direct stakeholder involvement regarding existing versus future operating environments of supply chains, and financial analysis considering newer asset monetization opportunities such as the monetization of right-of-way (ROW) for fiber and other communications equipment infrastructure as related to 5G, the Internet of Things (IoT) and blockchain. The EWFC may also consider pilot projects for the use of near-zero and zero emission truck technologies, with the goal of improving air quality for communities near the corridor and throughout the region.

BOTTLENECK RELIEF STRATEGY

Freight volumes are increasing on many segments of the transportation system, including across the major freight corridors. The SCAG region regularly ranks in the top ten across the nation for some of the most critical bottleneck locations including SR-60/SR-57, I-710 at I-105, and I-10 at I-15 per the American Transportation Research Institute (ATRI) Top 100 Truck Bottlenecks – 2023^{lv}. This growth brings with it challenges to freight movement and related concerns about environmental, economic impact, infrastructure condition, and transportation reliability.

ZERO EMISSION VEHICLES AND INFRASTRUCTURE

The state has continued to pass rules advancing the pace of zero emission investment across freight modes, notably and more recently for Class 8 trucks providing drayage services to seaports and intermodal rail yards. While there are state and federal incentive programs focused on supporting zero emission rules, the scale of infrastructure development needed as well as the processes and timing required to construct and operate on a company-by-company basis has led to substantial challenges across the region. The current environment includes state led planning efforts through the CEC's RHETTA program and CTC's SB 671 assessment with the CPUC looking to leverage this work through its FIP. At the regional level, SCAG is currently leading the ZETI study, which will identify priority locations for charging and fueling stations, as determined by travel and industry behaviors as well as stakeholder feedback. Concurrently, many companies are taking a project-by-project approach, which is quickly illuminating further challenges and risks. Through the LMFP, SCAG has the benefit of bridging both paths together as part of 7.3 Policy 3 – Zero-Emission and Clean Technology. Additionally, Connect SoCal has identified \$5 billion in investments over the long-term to support these needs to transition.

ITS STRATEGY

The goods movement system will not solely be able to rely on capacity and throughput investments. Like automation-related improvements and efficiencies within facilities, Intelligent Transportation System (ITS) solutions will need to support operations of vehicles, infrastructure, and equipment, especially as technology platforms and systems become increasingly a part of operating assets. Connect SoCal has identified \$3 billion in investments over the long-term to support ITS strategies. Examples include the I-105 Integrated Corridor Management (ICM) and Active Traffic Management (ATM) elements; connected corridor approaches including Transportation Management Systems (TSMs), closed-circuit television cameras, ramp meter controllers and detection, electronic changeable message signs, and upgrades of existing communications systems to fiber optics communications; and the DrayFLEX Program which provides trucking companies the ability to efficiently plan daily container pick-ups and drop-offs at the seaports.

FREIGHT ARTERIAL OPERATIONS AND MAINTENANCE

As an extension of ITS strategies, Connect SoCal has identified \$5 billion in investments over the long-term to support freight arterial operations and maintenance. Changes in freight technologies are going to have implications for not only roadway operations, but also with maintenance, notably as freight vehicles utilizing battery electric technologies will be heavier versus current diesel and natural gas vehicles. This will add further to degradation on pavement surfaces with higher impacts occurring across major arterials serving industrial freight clusters. Even higher volume retail locations will experience increasing impacts from last-mile deliveries adding to issues for light-duty passenger vehicles. As freight corridors upgrade through ITS strategies, connections will be necessary for key last-mile roadway access arterials serving as direct corridor extensions to major industrial facilities including seaports, intermodal rail yards, and distribution centers and warehouses.

7.5.4 INTERNATIONAL POE – STRATEGIES

International border crossings between the U.S. and Mexico in Imperial County are critical components of the freight transportation system in Southern California. As discussed, Calexico East serves as the second largest truck crossing in Southern California, supporting a diverse mix of commodities being imported and exported into the U.S. In total, Imperial County roadway access investments supporting cross-border trade total \$1.7 billion through the 2050 Plan horizon year (Map 24). Key improvements for the short-term include expansion of the Calexico East Port of Entry and roadway widenings for Menvielle Road and SR-98. Mid-term investments include:

- SR-111 Widening: Improve to a six-lane freeway.
- Forrester Road: Widen and improve to four-lane state highway.
- SR-115 Widening: Construct four-lane expressway.
- SR-98 Widening: Widen and improve from four to six lanes.

7.6 PROJECT LIST

The comprehensive goods movement project list provides a universal snapshot of all the revenue constrained projects that are freight related. This list serves as an important component for projects seeking grant program awards to be consistent and included within Connect SoCal as means of meeting air quality conformity standards both at the federal and state level. While the freight modal categories above have provided a review of specific project developments, this section provides detailed information across these categories and the region to illustrate the balance of investments and their connection with supply chains.

The 2024 Goods Movement project list includes an updated list of transportation and freight infrastructure investment priorities by short-term, mid-term, and long-term periods for the SCAG region. This list includes goods movement-related investments conjunct with highway projects and road maintenance and operations among these projects, rail projects and airport and seaport, and critical freight infrastructures that include intermodal facilities and rail grade separation projects.

7.6.1 PROJECT LIST DEVELOPMENT

SCAG and regional partners work together through coordinating committees and communications to prioritize regional freight projects. The State Department of Transportation (Caltrans) and six Counties,

191 Cities, the County Transportation Commissions and Major Seaports and Airports partnered with SCAG staff to develop priority project lists. All projects submitted to the Regional Transportation Plan should come from adopted plans or strategies that had opportunities for public input.

Many of the investments in the 2020 Regional Transportation Plan Goods Movement projects were updated and carried forward into the 2024 Goods Movement project list based on the input information from participating partner agencies. And the Plan is also an opportunity to identify new priority projects that are under development or initiated by local jurisdictions. Categorized sections of the project list representative roadway access to major goods movement facilities, major freight corridor system, off dock and near dock intermodal yard projects, and mainline rail, on-dock rail projects, and rail access improvements to port of Long Beach and Los Angeles, rail-highway grade separations, bottleneck relief projects and technology and other goods movement initiatives in the region.

GOODS MOVEMENT PROJECT LIST

Table 15. Goods Movement Project List

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
A. ROADWAY ACCESS TO MAJOR GOODS MOVEMENT FACILITIES				
A.1	LOS ANGELES	THE PROJECT WILL EXTEND THE HOV LANES ON I-5 FROM THE SR-14 INTERCHANGE TO JUST SOUTH OF THE PARKER ROAD INTERCHANGE, INCORPORATING AN ADDITIONAL NORTHBOUND TRUCK CLIMBING LANE FROM SR-14 TO CALGROVE BOULEVARD AND AN ADDITIONAL SOUTHBOUND TRUCK CLIMBING LANE FROM PICO CANYON ROAD/LYONS AVENUE TO SR-14.	\$679,630	S
A.2	LOS ANGELES	SR-47 EXPRESSWAY: CONSTRUCT 4 LANE EXPRESSWAY AND 2-LANE FLYOVER TO SCHUYLER HEIM BRIDGE	\$420,000	M
A.3	LOS ANGELES	ROUTE 57/60 CONFLUENCE CHOKEPOINT RELIEF PROGRAM. RECONSTRUCT GRAND AVENUE OVERCROSSING. RECONSTRUCT NORTHBOUND SR-57 CONNECTOR TO EASTBOUND SR-60. CONSTRUCT EASTBOUND SR-60 BYPASS OFF-RAMP TO GRAND AVENUE. CONSTRUCT SOUTHBOUND GRAND AVENUE LOOP ENTRANCE RAMP TO EASTBOUND SR-60. CONSTRUCT GRAND AVENUE TO EASTBOUND SR-60 ENTRANCE RAMP. RECONSTRUCT THE DIAMOND BAR GOLF COURSE TUNNEL AND GOLF COURSE. RECONSTRUCT DIAMOND BAR BOULEVARD ENTRANCE RAMP TO EASTBOUND SR-60.	\$424,556	S
A.4	LOS ANGELES	SR 47/NAVY WAY INTERCHANGE: CONSTRUCTION OF INTERCHANGE AT SR-47 / NAVY WAY TO ELIMINATE TRAFFIC SIGNAL AND MOVEMENT CONFLICTS; PROJECT REMOVES LAST SIGNAL ON SR 47 BETWEEN DESMOND AND V. THOMAS BRIDGES; NHS INTERMODAL CONNECTOR ROUTE	\$63,000	S
A.5	LOS ANGELES	SE-47/VINCENT THOMAS BRIDGE ON/OFF RAMP IMPROVEMENTS: NEW WESTBOUND SR-47 ON- AND OFF-RAMPS AT FRONT STREET JUST WEST OF THE VINCENT THOMAS BRIDGE AND ELIMINATE THE EXISTING NON-	\$105,000	S

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
		STANDARD RAMP CONNECTION TO THE HARBOR BOULEVARD OFF-RAMP; FRONT STREET IS AN NHS CONNECTOR. THE PROJECT ALSO INCLUDES REALIGNED EASTBOUND AND WESTBOUND SR47 ON-RAMPS.		
A.6	LOS ANGELES	ALAMEDA STREET WIDENING FROM ANAHEIM STREET TO 300 FT. SOUTH OF PCH : (1) WIDENS ALAMEDA ST BETWEEN ANAHEIM ST AND 300 FT SOUTH OF PACIFIC COAST HIGHWAY FROM 2 TO 3 LANES IN EACH DIRECTION FOR CONGESTION RELIEF AND IMPROVE GOODS MOVEMENT MOBILITY.	\$14,572	S
A.7	LOS ANGELES	ALAMEDA CORRIDOR SOUTH TERMINUS/HENRY FORD AVE. RAIL CROSSING ADVANCED WARNING SYSTEM.	\$15,000	S
A.8	LOS ANGELES	TERMINAL ACCESS IMPROVEMENT ON HARBOR SCENIC DRIVE, CONNECTING I-710 AND INTERMODAL CONTAINER FACILITIES: (1) ROADWAY IMPROVEMENTS AND REHABILITATION FROM HARBOR PLAZA TO GRADE SEPARATION TO THE SOUTH, (2) CHANGEABLE MESSAGE SIGN INSTALLATION.	\$39,950	L
A.9	LOS ANGELES	FREIGHT CORRIDOR ENHANCEMENT PROJECT ALONG PIER B STREET, WHICH INVOLVES (1) REALIGNS PIER B ST. BETWEEN PICO AV. AND ANAHEIM ST. AND WIDENS TO 2 LANES IN EACH DIRECTION TO IMPROVE GOODS MOVEMENT MOBILITY; (2) REALIGNS PICO AVE TO THE WEST FROM PIER B ST/I-710 RAMPS TO PIER D ST.; (3) CONSTRUCTS NEW SIDEWALK ON THE SOUTH SIDE OF PIER B ST. AND ALONG THE WEST SIDE OF PICO AVE. FOR PEDESTRIAN SAFETY; AND (4) CLOSES THE AT-GRADE RAILROAD CROSSING AT 9TH STREET FOR RAIL EFFICIENCY	\$150,000	M
A.10	LOS ANGELES	PIER D STREET REALIGNMENT PROJECT. REALIGN AND RECONSTRUCT PIER D ST BETWEEN MIDDLE HARBOR EXIT GATE, PICO AVE, AND RECONFIGURE BROADWAY AVE. PROJECT SCOPE OF REALIGNS PIER D STREET AND INCLUDES RELOCATION OF AN EXISTING PUMP STATION, A NEW ROADWAY, STRIPING, SIGNAGE, & SIGNAL WORK.	\$44,500	S
A.11	LOS ANGELES	ENHANCE GOODS MOVEMENT BY INCREASING TURNING RADII, UPGRADING SIGNALS, ADDING LIGHTING & SIGNAGE, REMOVING OLD	\$12,027	S

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
		RAILROAD TRACKS, IMPROVING STORM DRAINS, & ELIMINATING HAZARDS.		
A.12	LOS ANGELES	TERMINAL ACCESS PROJECT ON PICO AVE SERVING MIDDLE HARBOR (FULLY MODERNIZED AND NATION'S GREENEST TERMINAL). WIDENS AND REBUILDS PICO AVE. FROM PIER D AVE. TO PIER E ST. PREPARE PS&E. WORK INCLUDES WIDENING, REPLACE EXISTING PAVEMENT POLB LEAD SIGNING/STRIPING ON AN NHS INTERMODAL CONNECTOR ROUTE.	\$10,750	S
A.13	LOS ANGELES	PIER G AVENUE REHABILITATION--ROADWAY IMPROVEMENTS AND UTILITY ENHANCEMENTS FOR WATER, STORMWATER, SEWER, AND STREET PAVEMENT. UTILITY IMPROVEMENTS ARE COMBINED WITH THE ROADWAY IMPROVEMENTS FOR PREVENTATIVE MAINTENANCE AND COST EFFICIENCY.	\$13,500	S
A.14	LOS ANGELES	ZERO EMISSION (ZE)/TRUCK TRIP REDUCTION/FREIGHT EFFICIENCY PROGRAM: TERMINAL ISLAND ON-DOCK RAILYARD EXPANSION (TICTF MODERNIZATION).	\$100,000	M
A.15	LOS ANGELES	ZERO EMISSION (ZE)/TRUCK TRIP REDUCTION/FREIGHT EFFICIENCY PROGRAM: NEW CERRITOS CHANNEL RAIL BRIDGE	\$400,000	M
A.16	LOS ANGELES	ZERO EMISSION (ZE)/TRUCK TRIP REDUCTION/FREIGHT EFFICIENCY PROGRAM: TRIPLE TRACK S/O THENARD	\$34,015	M
A.17	LOS ANGELES	PORT OF LOS ANGELES ZERO EMISSION (ZE)/TRUCK TRIP REDUCTION/FREIGHT EFFICIENCY PROGRAM: WEST BASIN CONTAINER TERMINAL RAILYARD EXPANSION/MODERNIZATION	\$110,000	M
A.18	LOS ANGELES	PORT OF LOS ANGELES ZERO EMISSION (ZE)/TRUCK TRIP REDUCTION/FREIGHT EFFICIENCY PROGRAM:POLA RAIL SYSTEM PROJECTS (CP MOLE, PIER 400 SECOND LEAD TRACK, WEST BASIN 2ND LEAD TRACK, B200 RAILYARD CONNECTION - 2ND TRACK)	\$70,000	S
A.19	LOS ANGELES	SR-60/7TH AVENUE INTERCHANGE IMPROVEMENT PROJECT.	\$23,075	S
A.20	LOS ANGELES	SR-91 ADD AUXILIARY LANE BETWEEN GORE POINTS, WESTBOUND FROM ACACIA AVENUE TO CENTRAL AVENUE	\$90,000	S

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
A.21	LOS ANGELES	FREIGHT CORRIDOR ENHANCEMENT PROJECT ALONG PIER B STREET, WHICH INVOLVES (1) REALIGNS PIER B ST. BETWEEN PICO AV. AND ANAHEIM ST. AND WIDENS TO 2 LANES IN EACH DIRECTION TO IMPROVE GOODS MOVEMENT MOBILITY; (2) REALIGNS PICO AVE TO THE WEST FROM PIER B ST/I-710 RAMPS TO PIER D ST.; (3) CONSTRUCTS NEW SIDEWALK ON THE SOUTH SIDE OF PIER B ST. AND ALONG THE WEST SIDE OF PICO AVE. FOR PEDESTRIAN SAFETY; AND (4) CLOSES THE AT-GRADE RAILROAD CROSSING AT 9TH STREET FOR RAIL EFFICIENCY	\$84,878	S
A.22	LOS ANGELES	SR-91 CENTRAL AVE INTERCHANGE IMPROVEMENTS. PROPOSED IMPROVEMENTS WOULD RECONFIGURE CENTRAL AVE. INTERCHANGE TO A MODIFIED DDI (DIVERGING DIAMOND INTERCHANGE)	\$49,000	S
A.23	LOS ANGELES	I-605 VALLEY BLVD INTERCHANGE IMPROVEMENTS: THE PROJECT INVOLVES THE RECONFIGURATION OF SB I-605 RAMP BY REMOVING THE HORSESHOE ON-RAMP AND ADDING TWO LANES TO THE ON-RAMP. THE PROJECT WILL ALSO RECONSTRUCT THE SB I-605 LOOP OFF AND ON-RAMPS. LASTLY, THE PROJECT WILL ADD A WB THROUGH LANE ON VALLEY BLVD WEST OF TEMPLE AVE AND ADD A TWO LANE LEFT TURN POCKET FOR SB I-605 ON-RAMP ON WB VALLEY BLVD.	\$17,031	S
A.24	LOS ANGELES	I-605 FROM FAIRTON ST. UC TO BRADWELL OH: ADD GP LANE, HOT, OR HOV LANE &/OR CONVERT HOV TO HOT LANE. I-105 FROM BELLFLOWER BLVD OC TO STUDEBAKER RD: ADD HOV LANE BOTH DIRECTIONS THROUGH THE I-605/I-5 INTERCHANGE. I-5 FROM FLORENCE AVE OC TO RIO HONDO CHANNEL: ADD HOT/HOV DIRECT CONNECTORS AT I-605/I-105 INTERCHANGE (NB TO WB, WB TO NB & SB TO WB, WB TO SB). IMPROVE I-605 & I-5 MAINLINE, RAMPS, INTERCHANGES, & AUX LANES.	\$2,200,000	M
A.25	LOS ANGELES	I-605 BRADWELL OH TO 0.5 MILE NORTH OF I-10: ADD GP, HOT, OR HOV LANE &/OR CONVERT HOV TO HOT LANE. SR-60 SANTA ANITA AVE OC TO 0.5 MILE EAST OF TURNBULL CYN RD UC: ADD GP LANE BOTH DIRECTIONS THROUGH I-605/SR-60 INTERCHANGE, AUX LANES FROM I-605/SR-60 INTERCHANGE TO 7TH AVE IN EB & HACIENDA BLVD IN WB. I-10 0.5 MILE WEST OF PECK RD UC TO AMAR RD OC: ADD HOT/HOV DIRECT	\$2,200,000	M

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
		CONNECTOR AT I-605/I-10 INTERCHANGE (NB TO WB/WB TO NB). IMPROVE I-605 & SR-60 MAINLINE, RAMPS, INTERCHANGES, & AUX LANES.		
A.26	LOS ANGELES	IMPROVEMENTS TO THE WESTBOUND SR-91 IMPROVEMENTS PROJECT CONSIST OF ADDING AN ADDITIONAL GENERAL PURPOSE LANE, ADDING AUXILIARY LANES, AND ON/OFF RAMP IMPROVEMENTS.	\$187,800	S
A.27	LOS ANGELES	ADD AUXILIARY LANES ALONG I-405 NORTHBOUND AND SOUTHBOUND BETWEEN ARTESIA BLVD AND EL SEGUNDO TO ALLEVIATE CONGESTION AND IMPROVE OPERATIONS.	\$141,534	S
A.28	LOS ANGELES	I-710 IMPROVEMENTS/SHOEMAKER BRIDGE REPLACEMENT: REPLACE THE EXISTING SHOEMAKER BRIDGE WITH A NEW BRIDGE. THE NEW BRIDGE WILL BE REDUCED TO HAVE TWO MIXED-FLOW LANES IN THE NB AND IN THE SB DIRECTIONS TO TIE THE FLOW INTO I-710. THE NEW BRIDGE WILL ALSO INCLUDE PEDESTRIAN AND BICYCLE ACCESS. ADDITIONALLY, BICYCLE, PEDESTRIAN, AND STREET ENHANCEMENTS WILL BE PROVIDED ON ADJACENT THOROUGHFARES.	\$37,900	S
A.29	LOS ANGELES	NORTHWEST 138 CORRIDOR IMPROVEMENT PROJECT – APPROXIMATELY 36 MILES, PROVIDING AN IMPROVED 4 TO 6-LANE FACILITY FROM I-5 TO SR-14.	\$600,000	M
A.30	LOS ANGELES	I-5 NORTH CAPACITY ENHANCEMENT (TRUCK ONLY)	\$373,100	M
A.31	LOS ANGELES	ROUTE 71: ROUTE 10 TO 0.14 MILE SOUTH SAN BERNARDINO COUNTY LINE - EXPRESSWAY TO FREEWAY CONVERSION - ADD 1 HOV LANE AND 1 MIXED FLOW LANE (2001 CFP 8349, TCRP #50) (EA# 210600, PPNO 2741) (TCRP #50)	\$326,392	S
A.32	LOS ANGELES	CALL FOR PROJECTS GOODS MOVEMENT MODE	\$765,026	M
A.33	LOS ANGELES	PORT OF LOS ANGELES TERMINAL ISLAND MARITIME SUPPORT FACILITY (MSF) ACCESS/TERMINAL ISLAND RAIL SYSTEM GRADE SEPARATION & MSF	\$224,000	S

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
A.34	LOS ANGELES	HIGHWAY DEMAND BASED PROG. (HOV EXT. & CONNECT.) (SAN GABRIEL VALLEY)	\$223,976	L
A.35	LOS ANGELES	IMPROVE 7TH AVENUE OFF RAMP AT WB SR-60. RECONFIGURE ON AND OFF RAMPS TO IMPROVE MOBILITY AND FREEWAY/ARTERIAL OPERATIONS.	\$23,075	S
A.36	LOS ANGELES	RECONSTRUCT SR 60/GRAND AV INTERCHANGE - WIDEN GRAND AV: SB ADD 1THRU LN (2 EXSTNG); NB ADD 1 THRU LN (3 EXSTNG), REPLACE GRAND AV OC, ADD EB LOOP ON-RAMP, CONSTRUCT ADDITIONAL EB THRU LN FROM GRAND AVE TRAP LN TO SR57 ADD LN, ADD TWO BYPASS RAMP CONNECTORS, ADD AUX LNS EB AND WB FROM EAST TO WEST JUNCTION OF THE CONFLUENCE.	\$257,900	S
A.37	LOS ANGELES	SR-47 EXPRESSWAY: CONSTRUCT 4 LANE EXPRESSWAY AND 2-LANE FLYOVER TO SCHUYLER HEIM BRIDGE LA0D45 IS SPLIT INTO TWO PROJECTS; LA0G45 (EXPRESS WAY & FLYOVER) AND LA0D45A (BRIDGE REPLACEMENT)	\$420,000	M
A.38	LOS ANGELES	PORT OF LOS ANGELES ZERO EMISSION (ZE)/TRUCK TRIP REDUCTION/FREIGHT EFFICIENCY PROGRAM:PIER 300 RAILYARD EXPANSION/MODERNIZATION PHASE 1	\$100,000	S
A.39	LOS ANGELES	PORT OF LOS ANGELES ZERO EMISSION (ZE)/TRUCK TRIP REDUCTION/FREIGHT EFFICIENCY PROGRAM: PIER 300 WHARF EXPANSION	\$246,500	S
A.40	LOS ANGELES	PORT OF LOS ANGELES ZERO EMISSION (ZE)/TRUCK TRIP REDUCTION/FREIGHT EFFICIENCY PROGRAM: BERTHS 121-127 IMPROVEMENT	\$335,100	S
A.41	LOS ANGELES	PORT OF LOS ANGELES RAIL MAINLINE/WILMINGTON COMMUNITY & WATERFRONT PEDESTRIAN GRADE SEPARATION BRIDGE	\$60,000	S
A.42	ORANGE	SR-57 TRUCK CLIMBING AUX LANE FROM LAMBERT TO LA COUNTY LINE (PPNO 3847A))	\$124,600	M
A.43	ORANGE	ADD 1 HOV LANE EACH DIRECTION (I-5 FROM SR-57 TO SR-91)	\$305,924	L
A.44	ORANGE	I-405 FROM SR-73 TO I-605 ADD 1 MF LANE IN EACH DIRECTION, AND ADDITIONAL CAPITAL IMPROVEMENTS (BY 2022), CONVERT EXISTING HOV TO HOT. ADD 1 ADDITIONAL HOT LANE EACH DIRECTION.	\$1,900,000	S

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
A.45	ORANGE	I-5 (I-405 TO SR-55) - IN THE CITIES OF IRVINE AND TUSTIN. ADD 1 MF LANE NB FROM TRUCK BYPASS ON RAMP TO SR-55, ADD 1 MF LANE SB FROM SR-55 TO ALTON AND 1 AUX LANE FROM ALTON TO TRUCK BYPASS. (PA&ED AND PS&E PHASE) PROJECT WILL UTILIZE TOLL CREDIT MATCH.	\$234,009	M
A.46	ORANGE	SR-91 ADD 1 MF LANE EB FROM 55 TO 57, AND 1 MF LANE WB FROM KRAEMER TO STATE COLLEGE; IMPROVE INTERCHANGES; AND MERGE FROM LAKEVIEW TO RAYMOND	\$456,190	M
A.47	ORANGE	SR-57 - ADD 1 MF LANE NB BETWEEN ORANGEWOOD AND KATELLA	\$47,690	M
A.48	ORANGE	ADD 1 MF LANE EACH DIRECTION FROM I-5 TO SR-55 AND ADD SB AUX LANES FROM SR-133 TO IRV CTR DR	\$323,600	M
A.49	ORANGE	SR-55 WIDENING BETWEEN I-405 AND I-5 - ADD 1 MF AND 1 HOV LANE EACH DIRECTION AND FIX CHOKEPOINTS FROM I-405 TO I-5; ADD 1 AUX LANE EA DIR BTWN SELECT ON/OFF RAMP AND NON-CAPACITY OPERATIONAL IMPROVEMENTS THROUGH PROJECT LIMITS	\$410,932	S
A.50	ORANGE	SR-74 ORTEGA HIGHWAY – IN SAN JUAN CAPISTRANO FROM CALLE ENTRADERO TO CITY/COUNTY LINE – WIDEN FROM 2 TO 4 LANES	\$77,120	S
A.51	RIVERSIDE	ON I-10 NEAR BEAUMONT: ADD/CONSTRUCT NEW EASTBOUND TRUCK CLIMBING LANE FROM SAN BERNARDINO COUNTY LINE TO 1-10/SR60 JCT (EA: 35300)	\$35,709	S
A.52	RIVERSIDE	I-10 CONSTRUCT NEW INTERCHANGE	\$282,443	M
A.53	RIVERSIDE	CONSTRUCT NEW IC AND RAMPS AND WIDEN OC FROM 2 TO 6 LANES	\$67,863	L
A.54	RIVERSIDE	CONSTRUCT NEW IC AND RAMPS AND WIDEN OC FROM 2 TO 6 LANES	\$68,423	L
A.55	RIVERSIDE	AT SR86S/AVENUE 50: WIDEN AND CONSTRUCT NEW 6 THROUGH LANE IC FROM E/O COACHELLA STORMWATER CHANNEL BRIDGE TO E/O TYLER ST. IMPROVEMENTS INCLUDE: EXTENDED RAMP ACCELERATION/DECELERATION LANES, RELOCATE/REALIGN AVE 50 AND TYLER ST, BIKE LANES, SIDEWALKS, SIDEWALKS, AND RECONSTRUCT TRAFFIC SIGNALS (SAFETEA LU 1702, CA583, #2543)(EA:OC970)	\$32,160	S
A.56	RIVERSIDE	IN WESTERN RIVERSIDE COUNTY IN THE CITY OF MORENO VALLEY ALONG SR 60 - WIDEN FROM TWO TO THREE LANES IN EACH DIRECTION IN THE	\$7,500	S

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
		EXISTING MEDIAN TO PROVIDE ONE ADDITIONAL GENERAL PURPOSE LANE IN EACH DIRECTION FROM REDLANDS BLVD. TO GILMAN SPRINGS RD.		
A.57	RIVERSIDE	CONSTRUCT 4 LANE BRIDGE/INTERCHANGE AND RAMPS ACROSS SR-86S	\$92,843	L
A.58	RIVERSIDE	RECONSTRUCT/WIDEN IC FROM 2 TO 4 LANES AND RECONSTRUCT/WIDEN RAMPS	\$26,851	S
A.59	RIVERSIDE	AT SR91/71 JCT: REPLACE EB 91 TO NB 71 CONNECTOR W/DIRECT CONNECTOR AND RECONSTRUCT THE GREEN RIVER ROAD EB ON-RAMP (EA: 0F541) (\$1,501/\$639/\$200 TOLL CREDITS WILL BE USED IN PS&E TO MATCH DEMO-SAFETEALU/DEMO-TEA21/STP, RESPECTIVELY. \$159 TOLL CREDITS WILL BE USED IN R/W TO MATCH DEMO-SAFETEALU)	\$127,000	S
A.60	RIVERSIDE	NEAR SR60 AND BEAUMONT W/O JCT SR60/I-10: CONSTRUCT NEW 4 LANE (2 LNS EACH DIR) POTRERO BLVD FROM SR 60 SOUTH & EAST TO SR79 (PA&ED/PRE-DESIGN)	\$800	M
A.61	RIVERSIDE	IN WESTERN RIVERSIDE COUNTY IN THE CITY OF MORENO VALLEY - EUCALYPTUS AVE. WIDENING/EXTENSION: CONSTRUCTION OF A 2ND EB LANE FROM REDLANDS BLVD. TO WORLD LOGISTICS CENTER PARKWAY ST & EXTENSION OF EUCALYPTUS AVE. TO REDLANDS BLVD., WITH A ROUNDABOUT INTERSECTION.	\$800	M
A.62	RIVERSIDE	IN WESTERN RIVERSIDE COUNTY FOR THE CITY OF CALIMESA (JOINT PROJECT WITH CITY OF YUCAIPA) – ON COUNTY LINE RD B/W PARK AV AND BRYANT ST, CONSTRUCT 4 SINGLE-LANE AND 1 MULTI-LANE ROUNDABOUTS; AND IMPROVEMENTS TO STREET, PEDESTRIAN FACILITIES, AND BICYCLE FACILITIES. (PA/ED ONLY)	\$10,500	M
A.63	RIVERSIDE	ADD 1 LANE EACH DIRECTION FROM SR-241 TO SR-71 AND OTHER OPERATIONAL IMPROVEMENTS (LINKED WITH RIV071250B)	\$292,530	M
A.64	RIVERSIDE	I-10 BYPASS SOUTH (FORMERLY RAMSEY ST EXT): CONSTRUCT TWO LANES OF AN ULTIMATE 4-LANE ROADWAY TO PROVIDE A BY-PASS/NETWORK FACILITY FOR THE I-10, APPROX. 1/2 MILE S/O I-10 BETWEEN THE EASTERN END OF THE CITY OF BANNING AND APACHE TRAIL IN CABAZON. OTHER IMPROVEMENTS INCLUDE THE	\$116,000	M

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
CONSTRUCTION OF BRIDGE CROSSINGS AT SMITH CREEK AND SAN GORGONIO RIVER.				
A.65	SAN BERNARDIN O	I-10 AT GROVE AVE AND 4TH ST: CONSTRUCT NEW INTERCHANGE AT I-10 AND GROVE AVE; CLOSE EXISTING I-10/FOURTH ST INTERCHANGE; AND LOCAL STREET IMPROVEMENTS ALONG GROVE AVE (CHILD PROJECT IS 20171102).	\$199,423	S
A.66	SAN BERNARDIN O	I-10 @ MT VERNON INTERCHANGE IMPROVEMENTS	\$38,500	M
A.67	SAN BERNARDIN O	COLTON: MT. VERNON AVE BRIDGE WIDENING OVER I-10: WIDEN MT. VERNON BRIDGE STRUCTURE (3-4 LANES; 1 NEW SB LANE) TO ACCOMMODATE NEW DEDICATED TURN AND BIKE LANES, WIDEN MT. VERNON AVE (2-4 LANES) FROM I-10 EB OFF/ON-RAMPS TO APPROX. 300 FT SOUTH ALONG MT. VERNON; REALIGN MT. VERNON & E VALLEY BLVD INTERSECTION; RELOCATE WB ON-RAMP (REMAINS 1 LANE AT THE MAINLINE).	\$53,869	S
A.68	SAN BERNARDIN O	I-10/MOUNTAIN VIEW AVE INTERCHANGE IMPROVEMENTS	\$37,800	L
A.69	SAN BERNARDIN O	I-10 @ CALIFORNIA ST INTERCHANGE IMPROVEMENTS	\$58,500	L
A.70	SAN BERNARDIN O	I-10 EB TRUCK CLIMBING LANE: CONTINUE THE EXISTING EASTBOUND TRUCK CLIMBING LANE ON I-10 FROM THE 16TH ST BRIDGE IN THE CITY OF YUCAIPA FOR ABOUT 3 MILES TO JUST EAST OF THE COUNTY LINE ROAD UNDERCROSSING. THE PROJECT INCLUDES A TRANSITION LANE TO ALLOW TRUCKS TO MERGE WITH GENERAL TRAFFIC AND MAY INCLUDE MINOR STRUCTURAL IMPROVEMENTS TO ACCOMMODATE FOR LANE WIDENING (PPNO 3009Q)	\$34,596	S

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
A.71	SAN BERNARDIN O	US-395 (HESPERIA, VICTORVILLE, & ADELANTO) FROM CHAMBERLAINE WAY TO 1.8 MI S/O DESERT FLOWER ROAD -INTERIM WIDENING-WIDEN FROM 2-4 LANES AND ADD LEFT TURN CHANNELIZATION AT INTERSECTIONS (EA 0F632 PHASE II SEQ 9)	\$24,000	M
A.72	SAN BERNARDIN O	US-395 (HESPERIA, VICTORVILLE, & ADELANTO) FROM 0.16 MI N/O INTERSTATE ROUTE 15 JUNCTION TO SR18 - INTERIM WIDENING - WIDEN FROM 2-4 LANES AND ADD LEFT TURN CHANNELIZATION AT INTERSECTIONS (EA 0F633)	\$58,000	S
A.73	SAN BERNARDIN O	SR-210/5TH ST IC IMPROVEMENTS: WIDEN & RESTRIPE 5TH ST (4-6 LANES) FROM EAST EDGE OF CITY CREEK BRDG TO THE EB SR-210 RAMPS W/ADD'L TURN POCKETS PLUS 2 TRUCK ACCESS LANES; WIDEN & RESTRIPE 5TH ST (6-8 LANES) UNDER SR-210 B/W EB & WB RAMPS, INCL. ADD'L THRU & TURN LANES; WIDEN THE EB & WB ON-RAMPS 2-3 LANES, WIDEN THE EB & WB OFF-RAMPS 1-2 LANES, ALL RAMPS REMAIN 1 LN AT THE MAINLINE. (COMBINES PRIOR PROJS 2011153 & 2011154)	\$9,661	S
A.74	SAN BERNARDIN O	I-10 CORRIDOR EXPRESS LANE WIDENING (CONTRACT 2): IMPLEMENT 2 EXPRESS LANES IN EACH DIRECTION FROM I-10/I-15 INTERCHANGE TO CALIFORNIA ST; IMPLEMENT 1 EXPRESS LANE IN EACH DIRECTION FROM CALIFORNIA ST TO FORD STREET IN REDLANDS FOR A TOTAL OF 10-12 LANES, AND AUX LANES, UNDERCROSSINGS, OVERCROSSINGS, RAMP RECONSTRUCTION AND LANE TRANSITIONS WHERE NEEDED. (PPNO 0314K)	\$1,214,607	S
A.75	SAN BERNARDIN O	I-15 EXPRESS LANES (CONTRACT 1): CONSTRUCT 1 EXP. LANE IN EACH DIRECTION BETWEEN CANTU-GALLEANO RANCH RD. AND SR-60 AND 2 EXP. LANES IN EACH DIRECTION BETWEEN SR-60 AND NORTH OF FOOTHILL BLVD. ADDITIONAL IMPROVEMENTS TO AUX LN WIDENING, UNDERCROSSING, AND RECONSTRUCTION OF RAMPS AND LANE TRANSITIONS WHERE NEEDED	\$427,000	S
A.76	SAN BERNARDIN O	I-15 EXPRESS LANES (CONTRACT 2): CONSTRUCT 2 EXP. LANES IN EACH DIRECTION BETWEEN FOOTHILL BLVD AND SR-210 AND 1 EXP. LANE IN EACH DIRECTION BETWEEN SR-210 AND DUNCAN CANYON RD.	\$183,000	S

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
		ADDITIONAL IMPROVEMENTS TO UNDERCROSSINGS AND RECONSTRUCTION OF RAMPS AND LANE TRANSITIONS WHERE NEEDED.		
A.77	SAN BERNARDINO	I-10 CORRIDOR CONTRACT 2: THE PROJECT WILL PROVIDE ONE EXPRESS LANE IN EACH DIRECTION FROM JUST EAST OF I-15 TO PEPPER AVENUE IN COLTON, CONNECTING TO THE I-10 CORRIDOR CONTRACT 1 EXPRESS LANES CURRENTLY UNDER CONSTRUCTION.	\$796,000	S
A.78	SAN BERNARDINO	I-10 CORRIDOR EXPRESS LANE WIDENING (CONTRACT 3A): IMPLEMENT 1 EXPRESS LANE IN EACH DIRECTION FROM PEPPER AVE TO FORD ST IN REDLANDS FOR A TOTAL OF 10 LANES, AND AUX LANES, UNDERCROSSINGS, OVERCROSSINGS, RAMP RECONSTRUCTION AND LANE TRANSITIONS WHERE NEEDED. (PPNO 0314K) PARENT PROJECT IS FTIP ID 20159903	\$1,030,000	S
A.79	SAN BERNARDINO	RIVERSIDE AVE. OVER UPRR MAINTRACKS & COLTON YARD, 0.1 MI S OF I-10 REMOVE AND REPLACE EXISTING 5 LANE BRIDGE WITH 7 LANE BRIDGE SCOPING FOR PROJECT. (#54C0062)(NON-CAPACITY PROJECT: THROUGH LANES WILL REMAIN 5. 2 TURN LANES ARE BEING EXTENDED.)	\$38,387	S
A.80	SAN BERNARDINO	WIDEN NATIONAL TRAILS HWY FROM AIR EXPRESSWAY TO 1.6 MILES N/O MOJAVE RIVER - 2 TO 4 LANES	\$4,400	L
A.81	SAN BERNARDINO	CONSTRUCT 6 LANE INTERCHANGE FOR I-15 @ MUSCATEL ST	\$65,900	M
A.82	SAN BERNARDINO	DOUBLE TRACKING OF METROLINK SAN BERNARDINO LINE BETWEEN CP LILAC AND CP RANCHO IN SAN BERNARDINO COUNTY	\$64,971	S
A.83	SAN BERNARDINO	I-215 @ PALM AVE INTERCHANGE IMPROVEMENTS	\$17,878	L
A.84	SAN BERNARDINO	I-215 @ CAMPUS PKWY NEW INTERCHANGE	\$60,000	L

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
A.85	SAN BERNARDINO	SR-60 @ CENTRAL AVE - ULTIMATE INTERCHANGE IMPROVEMENTS - POSSIBLE RAMP WIDENING AND AUXILIARY LANES	\$24,000	L
A.86	SAN BERNARDINO	SR-60 @ MOUNTAIN AVE INTERCHANGE RECONSTRUCTION	\$15,000	S
A.87	SAN BERNARDINO	SR-60 @ RAMONA AVE INTERCHANGE RECONSTRUCTION	\$30,000	S
A.88	SAN BERNARDINO	SR-60 @ GROVE AVENUE INTERCHANGE RECONSTRUCTION AND GROVE AVE. +/-300 FT. N/S OF SR 60-WIDEN FROM 4-6 LANES	\$7,621	S
A.89	SAN BERNARDINO	WIDEN SR-138 FROM SR-18 TO PHELAN RD FROM 2 TO 4 LANES (PHASE II)	\$92,738	M
A.90	SAN BERNARDINO	I-215 FROM SR-210 TO I-15; ADD 1 HOV LANE EACH DIRECTION	\$249,151	M
A.91	VENTURA	HUENEME RD FROM OXNARD CITY LIMITS TO RICE RD - WIDEN FROM 2 TO 4 LANES (PHASE I)	\$6,953	S
A.92	VENTURA	CONSTRUCT NEW COMMERCIAL VEHICLE WEIGH STATION ON SR-118 IN SOMIS	\$21,769	M
A.93	VENTURA	SR-118 SAFETY (NOT CAPACITY) IMPROVEMENTS IN SATICOY AREA. TURNING LANE AND SPOT IMPROVEMENTS TO REMOVE TURNING VEHICLES FROM TRAVEL LANE.	\$15,000	S
A.94	VENTURA	PORT INTERMODAL CORRIDOR (PIC) PROJECTS - RICE AVENUE RECONSTRUCTION (ALLOWING FOR STATE ROUTE DESIGNATION)	\$35,000	-
A.95	IMPERIAL	SR-111 WIDEN AND IMPROVE TO 6 LANE FREEWAY WITH INTERCHANGES AT HEBER, MCCABE, AND JASPER AND OVERPASS AT CHICK RD.	\$999,136	M
A.96	IMPERIAL	EXPANSION OF THE CALEXICO EAST PORT OF ENTRY - PHASE 1: WIDEN BRIDGE OVER THE ALL AMERICAN CANAL. PHASE 2: INCREASE THE	\$32,325	S

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
		NUMBER OF COMMERCIAL VEHICLE LANES FROM EXISTING 3 TO 6 LANES; ADD 6 NEW NORTHBOUND PRIVATELY OWNED VEHICLE (POV) LANES; PEDESTRIAN PATHWAY IMPROVEMENTS INCLUDING SHADED SIDEWALKS AND TRANSIT LOTS (PICK-UP AND DROP-OFF AREA).		
A.97	IMPERIAL	FORRESTER ROAD FROM I-8 TO SR-78. WIDEN AND IMPROVE TO FOUR-LANE STATE HIGHWAY. PHASE 1 OPERATIONAL IMPROVEMENTS. PHASE 2 TO INCLUDE A FOUR (4) LANE ROAD WIDENING AND WESTMORLAND BYPASS.	\$307,168	M
A.98	IMPERIAL	MENVIELLE ROAD FROM CARR ROAD TO SR-98. MENVIELLE ROAD WIDENING, FROM 2 TO 4 LANES BETWEEN CARR ROAD TO SR-98	\$6,000	S
A.99	IMPERIAL	SR-98 FROM ALL AMERICAN CANAL TO VV WILLIAMS AVENUE. PHASE 1A - FROM 30.9 TO 32.2 WIDEN FROM 2 TO 4 LANES	\$58,850	S
A.100	IMPERIAL	SR-115 FROM I-8/SR-7 INTERCHANGE TO EVAN HEWES HIGHWAY/SR-115 JUNCTION. CONSTRUCT 4-LANE EXPRESSWAY	\$232,157	M
A.101	IMPERIAL	SR-98 FROM SR-111 TO SR-7. WIDEN AND IMPROVE TO 4/6 LANES. ON EITHER JASPER ROAD OR SR-98	\$29,844	M
SUBTOTAL - - A. ROADWAY ACCESS TO MAJOR GOODS MOVEMENT FACILITIES			\$23,313,478	
B. FREIGHT CORRIDOR SYSTEM				
B.1	VARIOUS	EAST-WEST FREIGHT CORRIDOR SEGMENT 1 (FROM I-710 TO JUST WEST OF I-605)	\$2,413,086	L
B.2	VARIOUS	EAST-WEST FREIGHT CORRIDOR SEGMENT 2 (FROM JUST WEST OF I-605 TO JUST EAST OF SR-57)	\$9,102,359	L
B.3	VARIOUS	EAST-WEST FREIGHT CORRIDOR SEGMENT 3 (FROM JUST EAST OF SR-57 TO I-15)	\$3,777,816	L
B.4	VARIOUS	I-15 FREIGHT CORRIDOR (INITIAL SEGMENT) (SR-60 TO I-10)	\$856,570	L

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
SUBTOTAL – B. FREIGHT CORRIDOR SYSTEM			\$16,149,831	
C. OFF DOCK AND NEAR DOCK INTERMODAL YARD PROJECTS				
C.1	SAN BERNARDINO	TRACK AND INTERMODAL YARD IMPROVEMENTS (PHASES 1 THROUGH 4)	\$799,616	M
C.2	LOS ANGELES	INTERMODAL FACILITIES	\$1,000,000	M
SUBTOTAL -C. OFF DOCK AND NEAR DOCK INTERMODAL YARD PROJECTS			\$1,799,616	
D. MAINLINE RAIL				
D.1	VARIOUS	THE SOUTHERN CALIFORNIA OPTIMIZED RAIL EXPANSION (SCORE) PROGRAM EXPANDS CAPACITY OF THE ENTIRE METROLINK SYSTEM TO ACCOMMODATE SERVICE THAT IS MORE REGULAR AND FREQUENT, THROUGHOUT THE ENTIRE SERVICE DAY (FROM MORNING TO LATE EVENING). CAPITAL INVESTMENTS INCLUDE ADDITIONAL TRACK (E.G., SIDINGS, DOUBLE TRACK, TRIPLE TRACK, AND QUADRUPLE TRACK SEGMENTS), IMPROVED SIGNALING, EXPANDED AND LOWER EMISSIONS FLEET, UPGRADED AND ENLARGED MAINTENANCE FACILITIES, GRADE CROSSING TREATMENTS AND SEPARATIONS, FENCING AND SAFETY FEATURES, FEATURES TO SUPPORT READINESS FOR QUIET ZONES, AND REQUIRED ASSET REHABILITATION TO SUSTAIN CAPACITY.	\$7,570,736	M
D.2	VARIOUS	ADDITIONAL FREIGHT AND PASSENGER RAIL ENHANCEMENTS	\$5,678,000	M
D.3	LOS ANGELES	BRIGHTON TO ROXFORD DOUBLE TRACK: THIS PROJECT ADDS 11MILES OF 2ND TRACK BETWEEN BURBANK AND SYLMAR ON METROLINK'S ANTELOPE VALLEY LINE (AVL). THE PROJECT WILL ELIMINATE THE CURRENT BOTTLENECK AND IMPROVE ON TIME PERFORMANCE AND OPERATIONAL RELIABILITY ON THE AVL. THIS PROJECT WILL BE DESIGNED TO BE COMPATIBLE WITH THE POTENTIAL FUTURE HIGH SPEED RAIL ALIGNMENT	\$238,000	S

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
D.4	LOS ANGELES	ANTELOPE VALLEY LINE CAPACITY IMPROVEMENT PROJECT: ADD CAPACITY BETWEEN LOS ANGELES UNION STATION AND LANCASTER WHERE UP OPERATES FREIGHT TRAINS. PHASE I INCLUDES DOUBLE TRACK SECTIONS, BURBANK JUNCTION SPEED IMPROVEMENTS, AND SIGNAL RESPACING. THE PROJECT WILL ELIMINATE RAIL BOTTLENECKS AND IMPROVE TRAVEL TIME AND RELIABILITY FOR BOTH FREIGHT AND COMMUTER RAIL.	\$856,348	S
D.5	LOS ANGELES	LONE HILL AVENUE TO CONTROL POINT WHITE DOUBLE TRACK: ON METROLINK SAN BERNARDINO LINE, WHERE UP OPERATES FREIGHT RAIL, EXTEND AN EXISTING SIDING TO PROVIDE 8.1 MILES OF CONTINUOUS DOUBLE TRACK BETWEEN LONE HILL AVE AND CP CENTRAL TO IMPROVE TRAVEL TIME AND RELIABILITY FOR BOTH FREIGHT AND COMMUTER RAIL.	\$130,000	M
D.6	ORANGE	BNSF LINE - TRIPLE TRACK FROM FULLERTON TO ORANGE/RIVERSIDE COUNTY LINE; (INCLUDES RAYMOND TO CP ATWOOD AND CP ATWOOD TO CP ESPERANZA);	\$70,000	M
D.7	SAN BERNARDINO	THE DESERT RAIL INFRASTRUCTURE IMPROVEMENT PROJECT (THE PROJECT) REHABILITATES 44.5 MILES OF RAILROAD RIGHT-OF-WAY ON THE ARIZONA AND CALIFORNIA RAILROAD (ARZC) CADIZ SUBDIVISION BETWEEN CADIZ, CA AND PARKER, AZ. THE PROJECT ADDRESSES THE DETERIORATED STATE OF THE CADIZ SUBDIVISION AND IMPROVES VELOCITY FOR THE ENTIRE RAILROAD, INCREASES SAFETY AND EFFICIENCY, REDUCES TRACK SLOW ORDERS, AND ENSURES THE ARZC REMAINS A VALUABLE AND INTEGRAL FREIGHT CORRIDOR FOR YEARS TO COME.	\$40,553	S
D.8	SAN BERNARDINO	THIS PROJECT WILL CONSTRUCT TWO 22,500-FOOT-LONG STAGING TRACKS, AN 11.2 MILE EXTENSION OF MAIN TRACK 1 TO PROVIDE A THIRD TRACK AT THAT LOCATION, AND ASSOCIATED RAILROAD SIGNAL AND CIVIL, GRADING, AND DRAINAGE IMPROVEMENTS. FREIGHT RAIL SAFETY, VELOCITY, THROUGHPUT, AND RELIABILITY WILL BE IMPROVED BY ALLOWING TRAINS ROUTED BETWEEN THE LOS ANGELES BASIN, SAN BERNARDINO, AND BARSTOW VIA CAJON PASS TO OPERATE ON THE MAIN TRACKS WITHOUT SLOWING OR STOPPING TO MEET OR PASS STAGED TRAINS. THE TWO STAGING TRACKS WILL INCREASE OPERATIONAL	\$150,467	S

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
		FLEXIBILITY AND WILL REDUCE BOTH FREIGHT RAIL DELAYS AND DELAYS TO VEHICLES AT HIGHWAY-RAIL GRADE CROSSINGS BY ALLOWING TRAINS TO BE STAGED OUTSIDE OF THE LOS ANGELES BASIN INSTEAD OF REQUIRING THEM TO BE STAGED ON RAILROAD SIDINGS AT BOTTLENECK LOCATIONS ON THE SHARED-USE SEGMENTS OF THE BNSF NETWORK HOSTING AMTRAK AND METROLINK PASSENGER TRAINS. IT WILL ALLOW FURTHER IMPROVEMENTS TO FREIGHT RAIL IN LOS ANGELES AND SERVE AS THE CATALYST TO TRANSFORM FREIGHT RAIL IN SOUTHERN CALIFORNIA.		
SUBTOTAL – D. MAINLINE RAIL			\$14,734,104	
E. ON-DOCK RAIL				
-	LOS ANGELES	PORT OF LOS ANGELES		
E.1-LA		PORT OF LOS ANGELES ZERO EMISSION (ZE)/TRUCK TRIP REDUCTION/FREIGHT EFFICIENCY PROGRAM: WEST BASIN CONTAINER TERMINAL RAILYARD MODERNIZATION - RECONSTRUCT A 7 TRACK RAILYARD OPERATED WITH DIESEL POWERED TOP PICKS TO A 10 TRACK RAILYARD OPERATED ELECTRIFIED RAIL MOUNTED GANTRY CRANES.	\$60,000	S
E.2-LA		PORT OF LOS ANGELES ZERO EMISSION (ZE)/TRUCK TRIP REDUCTION/FREIGHT EFFICIENCY PROGRAM: PIER 300 RAIL EXPANSION PHASE I	\$56,000	S
E.3-LA		PORT OF LOS ANGELES ZERO EMISSION (ZE)/TRUCK TRIP REDUCTION/FREIGHT EFFICIENCY PROGRAM: PIER 400 RAIL EXPANSION; 2) PIER 300 RAIL EXPANSION PHASE II	\$200,000	M
-		PORT OF LONG BEACH		
E.1-LB		PIER A ON-DOCK RAIL YARD EXPANSION TO CARRACK.	\$156,355	L
E.2-LB		PIER A ON-DOCK RAIL YARD EAST OF CARRACK.	\$80,000	L
	VENTURA	PORT OF HUENEME		

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
E.3-HM		PORT LOGISTICS PARK DEVELOPMENT; AUTO, TRUCK & EV STAGING YARDS, MARKET STREET PROPERTY ACQUISITION & DEVELOPMENT; HARBOR PLAZA ACQUISITION; SUNKIST CIRCLE PROPERTY UPGRADES & REDEVELOPMENT; 267 MARKET STREET UPGRADES; ADDITIONAL PROPERTY ACQUISITIONS AND REDEVELOPMENTS FOR OUTSIDE THE GATE PORT EXPANSION	\$400,000	L
E.4-HM		ELECTRIC CRANE & EQUIPMENT PLUG-IN INFRASTRUCTURE; ADAPTIVE INFRASTRUCTURE TO REDUCE EMISSIONS (AIRE- DECARBONIZATION OF PORT FOR ALL VESSEL FLEETS); GREEN LOCOMOTIVE PROJECT (IMPROVEMENT TO ENGINE TIERS); ELECTRIC CRANE VAULTS, ELECTRIC YARD EQUIPMENT & CHARGING STATIONS; AUTOMOTIVE & TRUCKING EV CHARGING STATIONS; CLIMATE ACTION PLAN; ELECTRIC SWEEPER; PORT EIR UPDATE; STORM WATER CATCH BASIN FILTRATION SYSTEMS & EQUIPMENT; PORTABLE CHARGING UNITS; ZERO EMISSION HANDLING EQUIPMENT; ZERO EMISSION LOCOMOTIVES; ELECTRIC CRANES; LOW EMISSION VEHICLE FLEET AND CHARGING STATIONS; SOLAR PANEL INSTALLATION; GREEN HYDROGEN INFRASTRUCTURE; CLEAN ENERGY STORAGE	\$250,000	L
E.5-HM		COMMON OPERATING SYSTEM PLATFORM; CYBER SECURITY SOFTWARE & TRAINING; SECURITY CAMERAS (CCTV & OTHER ADVANCE SYSTEMS); SERVERS & ANALYTICS; PERMITTER FENCING; SOFT TARGET PROTECTION FACILITY IMPROVEMENTS; TABLETOPS, TRAINING & EXERCISES; WEATHER STATIONS; HAZARDS TO NAVIGATION EQUIPMENT; FATHOMWERX INNOVATION LAB INFRASTRUCTURE AND ENHANCEMENTS; DATA OPTIMIZATION SYSTEMS; TOSS SYSTEMS; DATA EFFICIENCY INFRASTRUCTURE, INTELLIGENT TRANSPORATION SYSTEMS (ITS)	\$18,000	L

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
E.6-HM		ON-PORT PARKING STRUCTURE ; DEMOLITION OF BUILDINGS/WAREHOUSES & SITE IMPROVEMENTS; STAGING AREA IMPROVEMENTS (FORMER NAVY LAND IMPROVEMENTS FOR PORT LAYDOWN AREA); UPGRADES, PROCUREMENT & INSTALLATION OF REEFER PLUGS; CHASSIS POOL PROCUREMENT; ILWU RELOCATION & CONSTRUCTION; PORTWIDE REHABILITATION PROCUREMENT (STAGING AND PAVEMENT IMPROVEMENTS); NORTH TERMINAL DEEPENING & WHARF IMPROVEMENTS; ELECTRIC GANTRY CRANES AND OFFLOADING EQUIPMENT;JOINT OPERATIONS SECURITY CENTER (MULTIPLE PORT BUILDINGS FOR ALL SECURITY PARTNERS); MULTI-TERMINAL MODERNIZATION	\$250,000	L
E.7-HM		WORKFORCE DEVELOPMENT & TRAINING; SIMULATORS FOR WORKFORCE TRAINING; MITIGATION PROJECTS FOR COMMUNITY-RESTORATION OF ORMAND BEACH & WORKFORCE TRAINING CENTER FOR MARITIME DOMAIN & OFFSHORE WIND PROJECTS (INCLUDES PROPERTY ACQUISITION)	\$60,000	L
SUBTOTAL – E. ON-DOCK RAIL			\$1,530,355	
F. RAIL ACCESS IMPROVEMENTS TO PORT OF LONG BEACH & PORT OF LOS ANGELES & PORT OF HUENEME				
F.1-LB	LOS ANGELES	RAIL BOTTLENECK RELIEF PROJECT ADDING A 4TH TRACK AT OCEAN BOULEVARD TO IMPROVE ON-DOCK RAIL OPERATIONS: (1) ADDS A 3,000-FOOT RAILROAD TRACK, (2) REALIGNS THE EXISTING LEAD TRACK, (3) RECONFIGURES CROSSOVERS AND TURNOUTS FOR STREAMLINING TRAIN MOVEMENTS, REDUCING DELAYS AND CONGESTION, AND IMPROVING SAFETY OF RAILROAD OPERATIONS.	\$24,800	S
F.2-LB	LOS ANGELES	PIER B ON-DOCK RAIL SUPPORT FACILITY PROJECT TO EXPAND PIER B INTERMODAL RAILYARD TO FACILITATE ADDITIONAL RAIL SHIPMENTS.	\$168,826	M
F.3-LB	LOS ANGELES	TERMINAL ISLAND WYE RAIL ENHANCEMENT PROJECT ADDS A DOUBLE TRACK ON THE SOUTH LEG OF THE WYE TO ACCOMMODATE	\$40,000	S

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
		SIMULTANEOUS TRAIN SWITCHING MOVES FROM VARIOUS ACTIVITIES ON TERMINAL ISLAND.		
F.1-LA	LOS ANGELES	ALAMEDA CORRIDOR TERMINUS ENHANCEMENT - NEW CERRITOS CHANNEL RAIL BRIDGE	\$400,000	M
F.2-LA	LOS ANGELES	ALAMEDA CORRIDOR ENHANCEMENT - TRIPLE TRACK S/O THENARD JUNCTION	\$20,000	M
F.3-LA	LOS ANGELES	ALAMEDA CORRIDOR TERMINUS/CALIFORNIA COASTAL TRAIL EXTENSION GRADE SEPARATION (PEDESTRIAN/CLASS I BICYCLE PATH BRIDGE OVER FREIGHT MAINLINE): PROVIDE A PEDESTRIAN/BICYCLE BRIDGE OVER TWO RAIL MAINLINE TRACKS TO PROVIDE A DIRECT CONNECTION BETWEEN THE WILMINGTON COMMUNITY AND THE WATERFRONT.	\$23,800	S
F.4-LA	LOS ANGELES	ZERO EMISSION (ZE)/TRUCK TRIP REDUCTION/FREIGHT EFFICIENCY PROGRAM: TERMINAL ISLAND ON-DOCK RAILYARD EXPANSION (TICTF MODERNIZATION)	\$100,000	S
F.5-HM	VENTURA	THE GREEN PORT LOCOMOTIVE PROJECT IS PROPOSED TO REPLACE THE PORT'S TWO LOCOMOTIVES WITH NEW CLEAN ENERGY TECHNOLOGY - ELECTRIC, GREEN HYDROGEN, SOLAR OPTIONS. MODERNIZE THE PORT'S CENTRAL RAIL LOCOMOTIVEBASED CAPABILITIES WITH THE MOST CURRENT, CLEANEST TECHNOLOGY AVAILABLE. THE RAILWAY'S HANDLING AND FACILITY EQUIPMENT WILL BE UPGRADED WITH ZERO EMISSION TECHNOLOGY. THE PROJECT PROMOTES REGIONAL FREIGHT CONNECTIVITY TO ONE OF THE LARGEST POPULATED REGIONS IN THE NATION. THIS PROJECT IS OF NATIONAL SIGNIFICANCE, IMPROVING A U.S. PORT OF ENTRY AND A U.S. DEPARTMENT OF DEFENSE STRATEGIC PORT'S ABILITY TO MOVE CARGO WITH MODERN, SUSTAINABLE TECHNOLOGY. UPON COMPLETION, THE PROJECT WILL HELP REDUCE AIR POLLUTION IN A BURDENED COMMUNITY, WHILE MODERNIZING THE VENTURA COUNTY RAILWAY CORPORATION'S ESSENTIAL CARGO MOVEMENT LOCOMOTIVES AND EQUIPEMENT.	\$500,000	L

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
SUBTOTAL – F. RAIL ACCESS IMPROVEMENTS TO PORT OF LONG BEACH & PORT OF LOS ANGELES			\$1,277,426	
G. RAIL-HIGHWAY GRADE SEPARATIONS				
SEE EXHIBITS B1 THROUGH B5	VARIOUS	RAIL PACKAGE- GRADE SEPARATIONS. (SEE DETAILED LIST)	\$6,464,345	L
SUBTOTAL – G. RAIL-HIGHWAY GRADE SEPARATIONS			\$4,206,710	
H. BOTTLENECK RELIEF PROJECTS				
H.1-H.22	VARIOUS	GOODS MOVEMENT - BOTTLENECK RELIEF STRATEGY	\$5,000,000	L
SUBTOTAL – H. BOTTLENECK RELIEF PROJECTS			\$5,000,000	
I. TECHNOLOGY & OTHER GOODS MOVEMENT INITIATIVES				
NA	VARIOUS	GOODS MOVEMENT - ITS STRATEGY (INCLUDES LOS ANGELES METRO'S ICM/ATM/TSM PROJECTS BELOW)	\$3,000,000	L
	LOS ANGELES	I-105 INTEGRATED CORRIDOR MANAGEMENT/ACTIVE TRAFFIC MANAGEMENT (ICM/ATM) ELEMENTS		

MAP ID	COUNTY	PROJECT DESCRIPTION	PROJECT COST (\$YOE, 000s)	TIMEFRAME (SHORT, MEDIUM, LONG)
	LOS ANGELES	THE PROJECT PROPOSES A CONNECTED CORRIDOR APPROACH ALONG A PORTION OF I-710 FROM SR-47 (POSTMILE 3.4) IN LONG BEACH TO I-10 (POSTMILE 26.5) FOR TRANSPORTATION MANAGEMENT SYSTEM (TMS) INSTALLATIONS AND UPGRADES AND FOR LIFE CYCLE REPLACEMENTS. THE PROJECT PROPOSES TO INSTALL CLOSED-CIRCUIT TELEVISION CAMERAS, UPGRADE RAMP METER CONTROLLERS AND DETECTION, REPLACE LOOP DETECTORS, INSTALL AND UPGRADE ELECTRONIC CHANGEABLE MESSAGE SIGNS, UPGRADE THE EXISTING COMMUNICATION SYSTEM TO ALL FIBER OPTICS COMMUNICATIONS, INSTALL RAMP METERS AND VEHICLE DETECTION STATIONS, AND PROVIDE LIFE CYCLE REPLACEMENT FOR TMS FIELD ELEMENTS WHERE NEEDED.		
	LOS ANGELES	FRATIS WILL PROVIDE TRUCKING COMPANIES THE ABILITY TO EFFICIENTLY PLAN DAILY CONTAINER PICK-UPS AND DROP-OFFS AT THE PORTS. FRATIS WILL USE INFORMATION FROM THE MARINE TERMINAL OPERATORS (MTO), TRUCKING COMPANIES, AND TRAVELER INFORMATION TO PROVIDE STATUS UPDATES ON CONTAINER AVAILABILITY, ENABLE TRUCKING COMPANIES TO SET UP AUTOMATED APPOINTMENTS, AND PROVIDE TRUCK DRIVERS THE BEST ROUTES TO USE TO AND FROM THE PORTS.		
NA	VARIOUS	ZERO-EMISSION GOODS MOVEMENT	\$5,000,000	L
NA	VARIOUS	FREIGHT ARTERIAL O&M	\$5,045,604	L
SUBTOTAL – I. RAIL-HIGHWAY GRADE SEPARATIONS			\$13,045,604	
TOTAL GOODS MOVEMENT PROJECTS			\$83,314,759	

Table 16. Grade Separations in SCAG Region (Under Construction, Complete, Planned)

COUNTY	CROSSING STREET	UNDER CONSTRUCTION	COMPLETE	PLANNED	PROJECT LIST PROJECT COST
LOS ANGELES	DORAN STREET			X	\$58,300
LOS ANGELES	MONTEBELLO BLVD			X	\$190,818
LOS ANGELES	TURNBULL CYN RD			X	\$98,106
LOS ANGELES	FULLERTON RD	X			\$223,748
LOS ANGELES	ROSECRANS AVE	X			\$156,437
LOS ANGELES	AT GRADE CROSSING SAFETY IMP (POMONA)			X	\$32,303
LOS ANGELES	AT GRADE CROSSING SAFETY IMP (MONTEBELLO)			X	\$4,400
LOS ANGELES	SALEM/SPERRY OVERPASS			X	\$251,700
LOS ANGELES	DORAN AT GRADE CROSSING SAFETY IMP (GLENDALE)			X	\$9,000
LOS ANGELES	DORAN STREET (ACTIVE TRANSPORTATION)			X	\$25,000
LOS ANGELES	REEVES AVE			X	\$110,580
ORANGE	STATE COLLEGE			X	\$92,000
ORANGE	17TH STREET (LOSSAN)			X	\$192,435
RIVERSIDE	MARY STREET (RIVERSIDE CITY)			X	\$45,000
RIVERSIDE	PIERCE ST (RIVERSIDE CITY)			X	\$49,848
RIVERSIDE	BELLGRAVE AV (JURUPA VALLEY)			X	\$188,241
RIVERSIDE	SPRUCE ST (RIVERSIDE CITY)			X	\$60,000
RIVERSIDE	TYLER ST (RIVERSIDE)			X	\$124,620
RIVERSIDE	RADIO RD (CORONA)			X	\$25,000
RIVERSIDE	22ND ST (BANNING)			X	\$52,668
RIVERSIDE	SAN GORGONIO AVE (BANNING)			X	\$68,541
RIVERSIDE	HARGRAVE ST (BANNING)			X	\$56,750
RIVERSIDE	AVENUE 62 (RIVERSIDE COUNTY)			X	\$163,395
RIVERSIDE	AVENUE 66 (RIVERSIDE COUNTY)		X		\$41,026
RIVERSIDE	3RD STREET (RIVERSIDE CITY)			X	\$74,000
RIVERSIDE	JACKSON ST/BNSF RAIL CROSSING (RIVERSIDE)			X	\$35,000
RIVERSIDE	CALIFORNIA AVE UPRR (BEAUMONT)			X	\$45,646
RIVERSIDE	PENNSYLVANIA AVE AND UPRR (BEAUMONT)			X	\$10,500
RIVERSIDE	ETHANAC RD (MENIFEE)			X	\$62,922
RIVERSIDE	MENIFEE RD (MENIFEE)			X	\$70,000

COUNTY	CROSSING STREET	UNDER CONSTRUCTION	COMPLETE	PLANNED	PROJECT LIST PROJECT COST
RIVERSIDE	ELLIS AVE (PERRIS)			X	\$27,075
RIVERSIDE	MCCALL BLVD/MENIFEE RD (MENIFEE)			X	\$116,629
RIVERSIDE	MCCALL BLVD/SR-79 (MENIFEE)			X	\$43,699
RIVERSIDE	4 LANES UNDER BNSF RR TRACKS			X	\$97,011
SAN BERNARDINO	GREEN TREE BLVD EXTENSION		X		\$41,478
SAN BERNARDINO	LENWOOD ROAD		X		\$31,590
SAN BERNARDINO	MT. VERNON VIADUCT	X			\$145,393
SAN BERNARDINO	MAIN ST			X	\$23,977
SAN BERNARDINO	N. VINEYARD AVE		X		\$55,195
SAN BERNARDINO	S. MILLIKEN AVE		X		\$81,986
SAN BERNARDINO	SOUTH ARCHIBALD AVE			X	\$57,932
SAN BERNARDINO	CAMPUS AVE			X	\$32,769
SAN BERNARDINO	SAN ANTONIO AVE			X	\$33,343
SAN BERNARDINO	MONTE VISTA		X		\$31,325
SAN BERNARDINO	BEAUMONT			X	\$29,690
SAN BERNARDINO	CENTRAL AVENUE (BRIDGE REHAP)			X	\$28,361
SAN BERNARDINO	VISTA ROAD			X	\$48,041
SAN BERNARDINO	FOGG ST (COLTON)			X	\$48,041
SAN BERNARDINO	VALLEY BLVD./BNSF COLTON			X	\$52,989
SAN BERNARDINO	ARCHIBALD AVE./UPRR ONTARIO			X	\$57,932
SAN BERNARDINO	BEAUMONT AVE/UPRR LOMA LINDA			X	\$29,690
SAN BERNARDINO	SAN TIMOTEO/UPRR REDLANDS			X	\$9,579
SAN BERNARDINO	EUCALYPTUS/BNSF			X	\$39,000
SAN BERNARDINO	SHADOW MOUNTAIN RD			X	\$53,264
VENTURA	RICE AVE/FIFTH STREET			X	\$79,192
VENTURA	VINEYARD AVENUE			X	\$20,000
VENTURA	ROSE AVENUE			X	\$27,000
VENTURA	GONZALES RD			X	\$21,001
VENTURA	LOS ANGELES AVENUE			X	\$93,000
VENTURA	COUNTYWIDE			X	\$132,544
					\$4,206,710

8. ENDNOTES

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- ⁱⁱ <https://lbbusinessjournal.com/news/new-facility-will-add-rail-capacity-out-of-san-pedro-bay-ports/#:~:text=During%20normal%20operations%2C%20Port%20of,that%20dropped%20closer%20to%2020%25.>
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- ^{vii} Wolff et al. (2021, December 16). *The European year of rail: Why rail can transport us to a greener future*. World Economic Forum. <https://www.weforum.org/agenda/2021/12/rail-freight-transport-climate-change/>
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- ^{xv} <https://ww2.arb.ca.gov/resources/health-air-pollution>
- ^{xvi} https://earthjustice.org/wp-content/uploads/warehouse_research_report_4.15.2021.pdf
- ^{xvii} Federal Highway Administration’s (FHWA) Title 23 code of federal regulations for developing the metropolitan transportation plan (23 CFR Section 450.324) <https://www.govinfo.gov/content/pkg/CFR-2017-title23-vol1/pdf/CFR-2017-title23-vol1-sec450-324.pdf>
- ^{xviii} 23 CFR Section 450.324 <https://www.govinfo.gov/content/pkg/CFR-2017-title23-vol1/pdf/CFR-2017-title23-vol1-sec450-324.pdf>
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- liiv <https://scag.ca.gov/socal-goods-movement-communities-opportunities-assessment>
- liv <https://www.metro.net/projects/lb-ela-corridor-plan/>
- lvi <https://truckingresearch.org/2023/02/top-100-truck-bottlenecks-2023/>





Main Office

900 Wilshire Blvd., Ste. 1700
Los Angeles, CA 90017
Tel: (213) 236-1800
www.scag.ca.gov

Regional Offices

Imperial County

1503 N. Imperial Ave., Ste. 104
El Centro, CA 92243
Tel: (213) 236-1967

Orange County

OCTA Building
600 S. Main St., Ste. 1143
Orange, CA 92868
Tel: (213) 630-1548

Riverside County

3403 10th St., Ste. 805
Riverside, CA 92501
Tel: (951) 784-1513

San Bernardino County

1170 W. Third St., Ste. 140
San Bernardino, CA 92410
Tel: (213) 630-1499

Ventura County

4001 Mission Oaks Blvd., Ste. L
Camarillo, CA 93012
Tel: (213) 236-1960