GOODS MOVEMENT APPENDIX




REGIONAL TRANSPORTATION PLAN
2012–2035 RTP
SUSTAINABLE COMMUNITIES STRATEGY
Towards a Sustainable Future



Southern California Association of Governments

ADOPTED APRIL 2012

GOODS MOVEMENT

System Vision

Goods movement and freight transportation are essential to support the SCAG regional economy and quality of life. The goods movement system in the SCAG region is a multimodal, coordinated network that includes deep-water marine ports, international border crossings, Class I rail lines, interstate highways, state routes and local roads, air cargo facilities, intermodal facilities, and regional distribution and warehousing clusters. In 2010, over 1.15 billion tons of cargo valued at almost $2 trillion[1] moved across the region's transportation system. Whether carrying imported goods from the San Pedro Bay Ports to regional distribution centers, supplying materials for local manufacturers, or delivering consumer goods to SCAG residents, the movement of freight provides the goods needed to sustain regional industries and consumers on a daily basis.

Working with its public and private partners, SCAG has established a vision for a comprehensive regional goods movement system that is reflected in the 2012–2035 RTP/SCS.

RTP/SCS Goods Movement Vision Statement

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 the quality of life for our communities

This vision promotes the improvement of the goods movement system by:

- Maintaining the long-term economic competitiveness of the region
- Promoting local and regional job creation and retention
- Increasing freight and passenger mobility
- Improving the safety of goods movement activities
- Mitigating environmental impacts of goods movement operations

In support of this vision, the 2012–2035 RTP/SCS describes a goods movement system with regional initiatives and projects totaling nearly $50 billion through 2035. Key regional initiatives include a comprehensive system of zero- and/or near-zero-emission freight corridors, alleviation of major bottlenecks, a rail package totaling approximately $12 billion, and an environmental strategy to address emissions through both near term initiatives and a long term action plan for technology advancement. The comprehensive system of zero- and/or near-zero-emission freight corridors includes I-710, which is currently undergoing environmental review, and an east west corridor extending to an initial segment of I-15. The rail package includes main line capacity enhancements, on-dock and near-dock rail facility improvements, and 71 grade separations. In addition, critical projects to facilitate access to the San Pedro Bay Ports (e.g., improvements to the Gerald Desmond Bridge) and the Port of Hueneme, and to alleviate congestion at critical border crossings, are underway.

This plan was developed as part of the SCAG multi-year Comprehensive Regional Goods Movement Plan and Implementation Strategy. Through this effort, SCAG has worked with diverse regional stakeholders to develop a multimodal regional freight plan. A final version of the Comprehensive Regional Goods Movement Plan and Implementation Strategy, documenting the full breadth of study findings, will be released in coordination with adoption of the 2012–2035 RTP/SCS.

This appendix includes an overview of regional goods movement activities and specific initiatives to facilitate a world-class goods movement system. The first section provides an introduction to the regional goods movement system, describing key components and how they work together to support the regional economy. The following section describes critical markets served by the regional goods movement system and how these markets depend on transportation infrastructure. The final section identifies regional strategies and initiatives, including an action plan to support the development and commercialization of technologies necessary for a zero- and near-zero emissions goods movement system.

[1] FHWA Freight Analysis Framework: http://faf.ornl.gov/fafweb/Extraction0.aspx.

The Regional Goods Movement System

The goods movement system in the SCAG region is a complex series of interconnected infrastructure components designed to serve commercial activities spurred by regional and national demand. This goods movement system provides the backbone for the movement of goods between businesses and consumers. Numerous demand factors (e.g., types of products, destinations, urgency, costs, etc.) create unique markets that must be accommodated by varying types of goods movement activities. Markets in the SCAG region range from those that move goods directly from manufacturing centers to local consumers, to those traveling from the San Pedro Bay Ports, to distant destinations across the U.S. These markets depend heavily upon an extensive regional transportation network that provides the mobility necessary to ensure economic growth. These mobility needs, coupled with the accompanying air quality, environmental, and community challenges posed by regional goods movement activities, serve as the driving force for developing a comprehensive plan to enhance the regional freight system.

Components of the Regional Goods Movement System

Both international and domestic trade thrive in Southern California in large part due to the extensive existing transportation and goods movement infrastructure in the SCAG region (**EXHIBIT 1**). This system is comprised of the following major elements:

- **Seaports:** The ports in the SCAG region (Los Angeles, Long Beach, and Hueneme) handled just under 120 million metric tons of cargo imports and exports, valued at $336 billion in 2010.[2] The Ports of Los Angeles and Long Beach represent the largest container port complex in the U.S., and the sixth largest in the world. In 2010 the San Pedro Bay Ports handled 14.1 million twenty-foot equivalent units (TEUs) of containerized cargo. The Port of Hueneme, in Ventura County, specializes in the import and export of automobiles, fresh fruit, and produce, and serves as the primary support facility for the offshore oil industry.
- **Land Ports:** The international border crossings in Imperial County (Calexico West-Mexicali I, Calexico East-Mexicali II and Andrade-Los Algodones) are busy commercial land ports responsible for over $10.4 billion in trade in 2010 despite the recent economic downturn.[3] Driven by the maquiladora trade and movement of agricultural products, the volume of goods passing through these international ports of entry is expected to increase over the time horizon of the RTP.
- **Air Cargo Facilities:** The SCAG region is home to numerous air cargo facilities, including Los Angeles International Airport (LAX) and Ontario International Airport (ONT), which combined handled over 96 percent of the region's air cargo in 2010.
- **Interstate, Highways, and Local Roads:** The region has about 53,400 road miles, 1,630 miles of which are interstate and freeway type.[4] Sections of I-710, I-605, SR-60, and SR-91 carry the highest volumes of truck traffic in the region, averaging over 25,000 trucks per day in 2008.[5] Other major components of the regional highway network also serve significant numbers of trucks, including I-5, I-10, I-15, and I-210, with some sections carrying over 20,000 trucks per day.[6] These roads carry a mix of local, domestic trade, and international cargoes. The arterial roadway system also plays a critical role, providing "last mile" connections to the ports, manufacturing facilities, intermodal terminals, warehouses, and distribution centers.
- **Railroads:** Two Class I railroads, the Burlington Northern Santa Fe Railway (BNSF) and Union Pacific (UP), carry international and domestic cargo to and from distant parts of the country. The BNSF operates on the Transcontinental Line (Cajon and San Bernardino Subdivisions) as well as the Orange and Olive Subdivisions. The UP operates on the Coast, Santa Clarita, Alhambra, Los Angeles, Mojave, and Yuma Subdivisions. Both railroads operate on the Alameda Corridor that connects directly to the San Pedro Bay Ports. The railroads are served by six major intermodal terminals in the region as well as multiple on-dock railyards at the Ports of Los Angeles and Long Beach. The SCAG region also has Class III railroads (Pacific Harbor Line, Los Angeles Junction Railway, and the Ventura County Railway).

2 U.S. Census Bureau, Exhibit 1: U.S. Exports – Domestic and Foreign Merchandise by Customs District and Method of Transportation and Exhibit 6a – U.S. General Imports by Customs District and Method of Transportation, Vessel data only, for calendar year 2010.

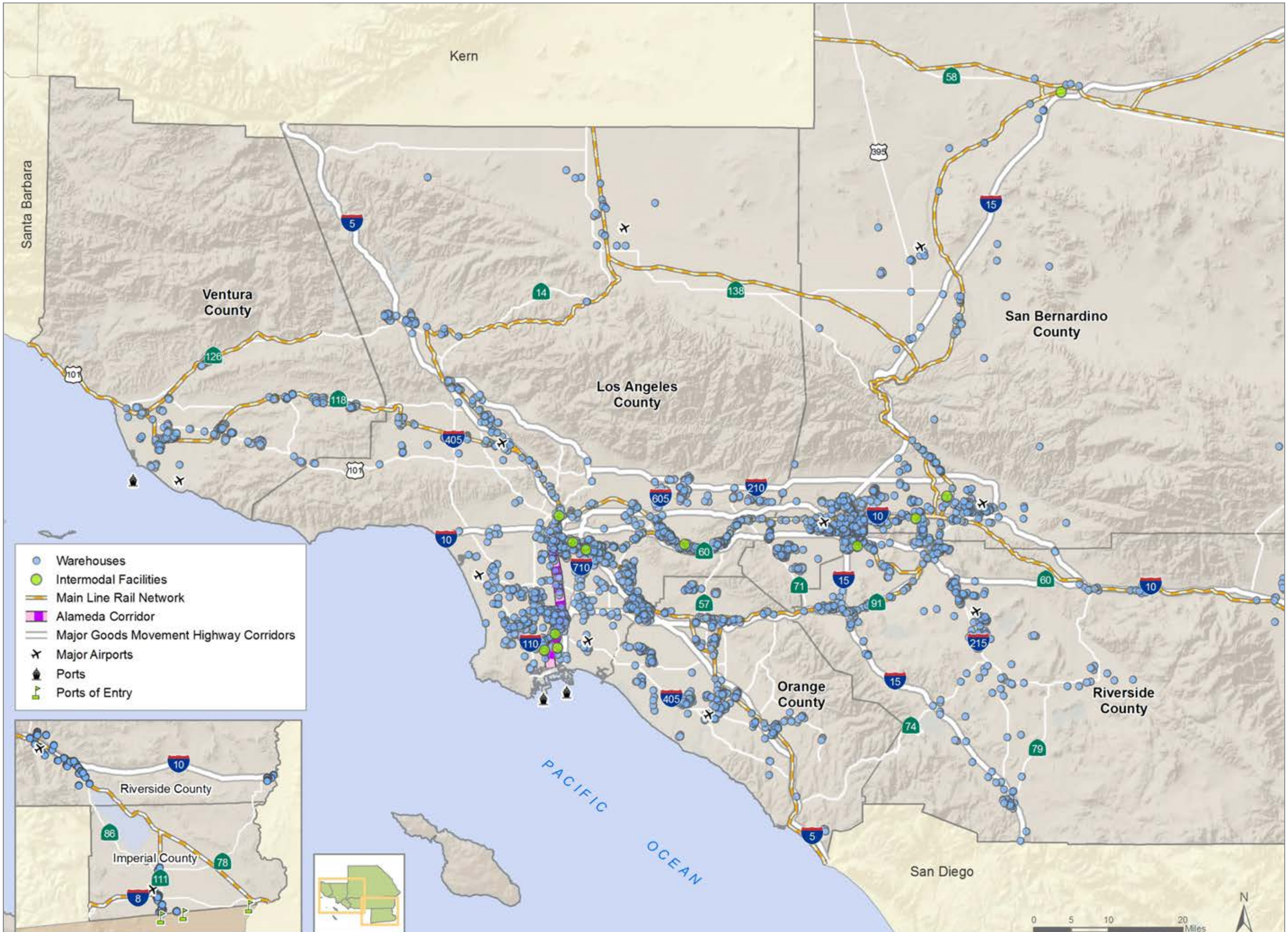
3 Source: U.S. Department of Transportation, Bureau of Transportation Statistics, Transborder Surface Freight Data.

4 http://www.dot.ca.gov/hq/tsip/hpms/hpmslibrary/hpmspdf/2009PRD.pdf (last accessed on December 10, 2010).

5 2008 Annual Average Daily Truck Traffic on the California State Highway System, Traffic and Vehicle Data Systems, California Department of Transportation, September 2009.

6 2008 Annual Average Daily Truck Traffic on the California State Highway System, Traffic and Vehicle Data Systems, California Department of Transportation, September 2009.

EXHIBIT 1 Existing SCAG Regional Goods Movement System



Sources: SCAG, ESRI Shaded Relief, Tele Atlas

- **Warehousing and Distribution Centers:** As of 2008, the region had about 837 million square feet of warehousing space. Another 185 million square feet[7] could be developed on vacant land that is zoned for warehousing. In 2008, an estimated 15 percent of the occupied warehouse space[8] served port-related uses while the remaining 85 percent supported a mix of domestic and international cargo.[9] Many of these warehouses are clustered along key goods movement corridors. Port-related warehousing tends to be concentrated near the Ports, while distribution facilities for domestic cargo tend to be located in areas farther away from the Ports including the Inland Empire.

The Supply Chain System and Southern California

As previously mentioned, regional transportation infrastructure supports the movement of goods to discrete markets dependent upon diverse business and consumer needs. The goods movement system in Southern California provides critical network connections between freight origins and destinations. Transportation infrastructure in the SCAG region facilitates multiple types of supply chains (also called logistics or supply networks). These supply chains are coordinated systems of organizations, people, activities, information, and resources involved in moving products from suppliers to customers.

All industries depend on reliable and efficient transportation services to meet their business objectives. Understanding the impacts and linkages between improvements in the transportation system and typical supply chains for key goods movement-dependent businesses in Southern California is critical for making decisions to support the regional economy. Supply chains are dependent on many variables, including the weight, size, and perishability of raw materials or finished product, as well as the availability and cost of different transportation modes. However, it is possible to summarize some general supply chain characteristics for key goods movement industries in the SCAG region:[10]

1. **Extraction Industries:** This sector includes industries that ship forest products, grain, and coal. In general, raw materials and products associated with these industries are heavy and not as time-sensitive as other products. Therefore, they generally prefer supply chains structures with low unit transportation costs and high asset utilization.
2. **Manufacturing Industries:** These industries – and their inputs / outputs – vary widely. In the SCAG region, top manufacturing subsectors include computer and electronic product manufacturing, fabricated metal products, apparel, food, and transportation equipment manufacturing. Each of these industry subsectors has different supply chain needs, depending on the weight, size, and time-sensitive nature of their raw inputs or products. However, in general, manufacturing industries are characterized by companies that run continuous processing facilities. They typically have few sites and highly specialized equipment, such as chemical and plastic companies. These industries generally prefer supply chain structures with low unit transportation costs and a high degree of service reliability.
3. **Make-to-Stock Industries:** These industries typically have multiple sites and a complex set of inbound and outbound product flows, and use roughly equal parts of labor and machinery. Industry examples include lumber and paper shippers, auto assembly plants, and heavy machinery manufacturers. These industries generally prefer supply chain structures with consistent and reliable service.
4. **Make-to-Order Industries:** Supply chains for this technologically advanced industry group are typified by few sites with limited flows of inbound and outbound materials. Examples include airplane manufacturers or the defense industry. These industries generally prefer supply chain structures with reliable service and fast delivery.
5. **Distribution Industries:** Industries in this group have many locations, numerous transactions, and product flows in various quantities. Many shipments are small and rely on the use of a number of vehicles. Examples might include small-package carriers and specialty electronics and aftermarket parts distributors. These industries generally prefer supply chain structures with predictability and reliable service.
6. **Retail Industries:** This includes all retail sales products. These supply chains tend to be the longest and most far reaching, usually requiring transportation flexibility, agility, and the ability to respond to forecast changes quickly. Examples include computer makers, discount retailers, and grocery stores. These industries generally

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7 Potentially developable warehouse space estimates are based upon suitable land that is zoned for warehouse development.

8 SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy.

9 Some domestic warehouse space may include international goods as well.

10 There are many approaches to categorizing supply chain types. This particular approach is based on an approach developed by Boston Logistics Group, Inc. and is referenced in "Guide to Quantifying the Economic Impacts of Federal Investments in Large-Scale Freight Transportation Projects," prepared by Cambridge Systematics, Economic Development Research Group, and Boston Logistics Group for the Office of the Secretary, U.S. Department of Transportation, August 2006.

prefer supply chain structures with the ability to handle high velocities and provide flexible service.

These goods movement industries contribute substantial public benefits to the region. As shown in **TABLE 1**, manufacturing and retail trade, alone, are responsible for approximately $142 billion in overall regional GDP (over 18 percent) and almost 1.7 million jobs (nearly 20 percent of all regional jobs).[11] In fact, despite the recent economic downturn, SCAG's manufacturing sector remains one of the largest in the nation. In 2009, Los Angeles County was ranked as the top manufacturing center in the country in terms of manufacturing shipment volume, with Orange County and Riverside-San Bernardino also ranked in the top 15 manufacturing centers nationally.[12] Understanding the supply chain characteristics of key industries helps to target transportation system investments into projects that support key job and GDP-producing industries. This is particularly critical as goods movement-dependent industries are projected to grow. Between 2009-2035, manufacturing is projected to grow at 3.4 percent annually, retail trade at 2.9 percent annually, and transportation and warehousing at 2.7 percent. The transportation system demands of these industries will also grow steadily throughout this time period.

TABLE 1 Regional GDP and Employment Contribution of Key Goods Movement-Dependent Industries (2010)

Key Industries	Regional Contribution	
	Jobs (in Thousands)	GDP (Billions)
Manufacturing	744	$88
Retail Trade	950	$54
Wholesale Trade	429	$51
Construction	431	$21
Transportation and Warehousing	330	$20
Other Goods Producing	70	$12

Source: SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy

11 SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy.

12 Source: Bureau of Labor Statistics, QCEW Data as found in *Manufacturing: Still a Force in Southern California* completed by the Los Angeles County Economic Development Corporation, Kyser Center for Economic Research, 2011.

MANUFACTURING AND RETAIL TRADE SUPPLY CHAINS

Trade splits for manufacturing output in the SCAG region suggest that the region develops products that are in demand by local, national, and international markets. In 2010, 35 percent of sales from SCAG's manufacturing industries was destined for international markets, compared to 38 percent of sales with other regions in the U.S. and 27 percent of sales within the SCAG region itself.[13] The geographic distribution of sales for manufacturing industries means that they will benefit from investments into the local and regional transportation systems, including their connections to national and international markets.

As a whole, higher-value manufacturing industries (such as computer and electronics manufacturing–the top subsector in the SCAG region) have increasingly adopted "just-in-time" inventory strategies that are focused on delivering goods as needed, with very little inventory requirements. Though this strategy lowers the costs of carrying inventory, it requires a high level of flexibility from suppliers and responsiveness in the supply chain. Goods that are part of "just-in-time" supply chains are extremely time-sensitive, as missing parts may cause disruptions in the manufacturing process. These products are increasingly dependent on an efficient, reliable, and safe freight movement and transportation infrastructure. Expenditures on transportation industries by the manufacturing sector in the SCAG region totaled over $17.5 million in 2010 (**TABLE 2**).

13 SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy.

TABLE 2 Expenditures on Transportation by Manufacturing Industries (2010)

Transportation Mode	Spending on Different Transportation Modes (Insourced and Outsourced)	
	Millions of Dollars	Percent of Total
Truck	$3,711	21%
Rail	$3,261	19%
Air	$5,116	29%
Water	$2,471	14%
Courier	$2,101	12%
Warehousing and Storage	$876	5%
Total	**$17,536**	**100%**

Source: SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy

Retail industries also include a wide variety of subsectors (including clothing and household goods). In general, retail industries are heavily dependent on international trade to receive materials and products, usually through containerized cargo imported through the San Pedro Bay Ports. The output sales of retail industries in the SCAG region are dominated by local markets. In 2010, roughly 86 percent of sales was to local markets, compared to 14 percent of sales to other domestic U.S. locations and less than 1 percent to international locations. Retail industries in the SCAG region therefore depend heavily on the region's transportation system to move goods to market, and will benefit from investments into local connector facilities, access roads, and other facilities providing interregional mobility. Expenditures on transportation by the retail sector in the SCAG region totaled nearly $11 billion in 2010 (**TABLE 3**).

TABLE 3 Expenditures on Transportation by Retail Industries (2010)

Transportation Mode	Spending on Different Transportation Modes (Insourced and Outsourced)	
	Millions of Dollars	Percent of Total
Truck	$7,136	65%
Rail	$542	5%
Air	$1,619	15%
Water	$709	6%
Courier	$506	5%
Warehousing and Storage	$416	4%
Total	**$10,929**	**100%**

Source: SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy

Though individual shippers utilize different types of supply chains, lowering transportation costs and improving reliability across logistics networks are a critical and constant focus. While significant investments in processes, technologies, and assets have made supply chains increasingly productive and cost-efficient, shippers regularly evaluate transportation costs to drive business decisions. Given the impact of transportation infrastructure on efficiencies, and thereby operating costs of supply chains, a world-class goods movement system is crucial to attract and retain businesses in Southern California. Through ongoing dialogue with regional transportation interests, the 2012–2035 RTP/SCS offers a portfolio of initiatives and projects to ensure that the SCAG region continues to benefit from goods movement activities.

Key Functions and Markets

The goods movement system has developed in the SCAG region to serve a wide range of user markets. Each of these markets has unique performance needs that dictate the components of the system that they will use. A brief summary of international, domestic, and local trade, follows.

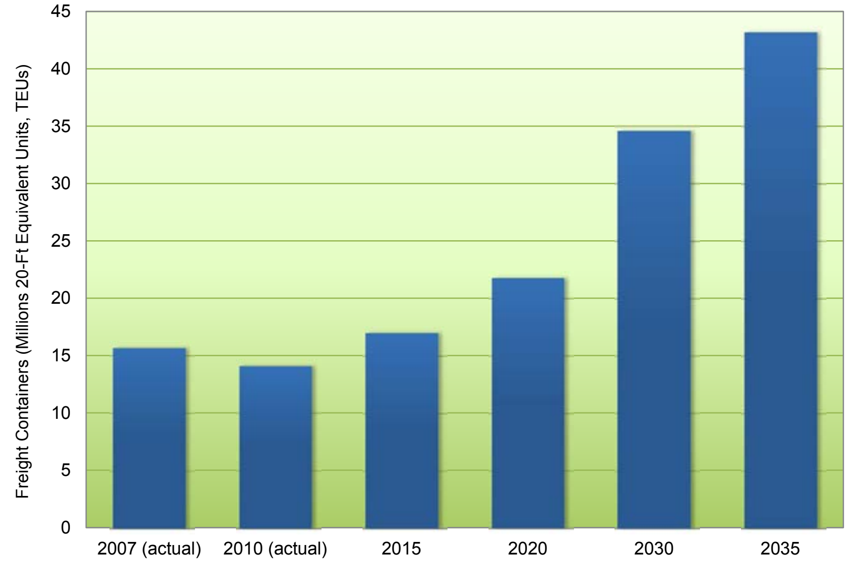
INTERNATIONAL TRADE

The SCAG region is the largest international trade gateway in the U.S. International trade moving through the San Pedro Bay Ports, international border crossings with Mexico, and regional airports is supported by an extensive transportation system that includes a highly developed network of roadways and railroads, air cargo facilities, intermodal facilities, and an abundance of regional distribution and warehousing clusters. While the SCAG region has made great strides in building infrastructure and planning for the future, significant investment is needed to support the expected growth in the nation's largest and most important integrated freight system.

San Pedro Bay Ports

Containerized trade between the U.S. and Asia comprises the majority of international cargo entering the SCAG region, with over 31 percent of all containers in the U.S. moving through the San Pedro Bay Ports.[14] While there has been a modest shift recently in container volumes to other U.S., Canadian, and Mexican ports, total container volume for the San Pedro Bay Ports is still expected to grow to 43 million by 2035, more than three times current volumes (**FIGURE 1**). This projected increase in freight moving through the region will place greater strain on an already congested transportation system, directly affecting residents and businesses alike.

FIGURE 1 San Pedro Bay Ports Containerized Cargo Forecasts



Imports, which constitute most of the containers that move through the San Pedro Bay Ports, may be categorized as local or discretionary. Local containerized traffic is that which is ultimately consumed in a geographical area local to the San Pedro Bay Ports (Southern California, Southern Nevada, Arizona and New Mexico, and southern portions of Utah and Colorado). Discretionary containerized traffic is that which terminates outside this region. Recent analysis indicates that local traffic accounts for approximately 23 percent of San Pedro Bay Ports' total traffic. The other 77 percent is assumed to be discretionary traffic, routed through the San Pedro Bay Ports for economic reasons.[15]

Imports can be further categorized as Local, Direct Shipping or Transloaded. When containers arrive at the San Pedro Bay Ports, the way they move are determined by the economics of inventory and transportation costs (see **TABLE 4**).

14 Source: American Association of Port Authorities (AAPA), North American Container Traffic (1990-2010), http://aapa.files.cms-plus.com/PDFs/CONTAINER%20TRAFFIC%20NORTH%20AMERICA%20 1990%20-%202010%20for%20the%20web.pdf.

15 SCAG Port and Modal Elasticity Study, Phase II.

TABLE 4 Modal Strategies for Imported Cargo

Import Cargo Type	Modal Strategy
Local: Imports consumed within the greater region (i.e., imports consumed within Southern California, Southern Nevada, Arizona, New Mexico and southern portions of Utah and Colorado) for which San Pedro Bay serves as the closest container port with the lowest land-side transportation costs.	1. Movement of marine containers to destinations within the greater SCAG region using local trucks.
Direct-shipping: Imports moving to destinations outside the SCAG region that simply pass through Southern California while remaining intact in the original marine container.[1]	1. Direct movement of marine containers to destinations outside the greater SCAG region (e.g., Chicago, Kansas City, etc.) using on-dock rail facilities found at the San Pedro Bay Ports. These containers are then moved to their final destinations by local dray trucks upon arrival via rail. 2. Direct movement of marine containers to destinations outside the greater SCAG region using near-dock or off-dock rail facilities at locations in the SCAG region (usually close to the San Pedro Bay Ports). The container requires movement from the port terminal to the origin rail terminal using a local dray truck. These containers are then moved to their final destinations via rail plus a local dray at the destination end.
Transloaded:[2] Imports that are unloaded from the original marine container in Southern California and moved to local warehouses where the contents are reloaded into larger domestic containers or trailers for reshipment. A portion of transloaded imports are reloaded immediately using a cross-dock facility, but most are warehoused in Southern California for some time before reshipment.	1. Movement of marine containers to an import warehouse/transloading facility within the SCAG region using local dray trucks. This is followed by the final movement of the newly transloaded domestic container to destinations both within and outside the greater SCAG region using trucks. 2. Movement of marine containers to an import warehouse/transloading facility within the SCAG region using local dray trucks. This is followed by the movement of the newly transloaded domestic container to a local rail terminal using local dray trucks where it is transported using an intermodal train.

[1] This type of import movement is also known as inland point intermodal (IPI) movement.

[2] In the 2012 RTP, 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 that can be transported by trucks. Transloading allows for the movement of increased amounts of goods while utilizing less equipment, resulting in significant cost savings through economies of scale and other transportation-related savings. Transloading sometimes provides value-added services as well. Existing infrastructure, equipment, and trade flows in the SCAG region provide a substantial competitive advantage and serve as a major economic incentive for importers to move freight requiring transloading through Southern California.

Drivers of Modal Decisions

The SCAG region consists of broad modal segments. Transportation mode choice is often a complicated process that reflects the type of industry being served.[16] Considerations include:

- **Product Characteristics (including the size, weight, value, and perishability of the commodity):** Commodities that are perishable, high value, or small tend to be carried by air cargo or truck modes, but will likely not make sense as a rail commodity. Similarly, heavy, low-value, or bulky materials will likely be carried by rail or truck, but are highly unlikely to be an air cargo commodity. Construction materials—including sand, gravel, and wood—are generally best moved by trucks because of their flexibility and ability to carry heavy loads. High-tech manufacturing components normally favor truck or air cargo modes to provide safe shipment for high-value, lightweight materials.
- **Trip Characteristics (including the length of the trip being made and product demand):** According to the 2007 Commodity Flow Survey, the average length haul of U.S freight shipments was over 600 miles. However, the average rail shipment was over 850 miles in length, air-truck combination was almost 1,100 miles in length, and truck trips were about 200 miles.

Supply Chain Characteristics: Many companies now operate using a "just-in-time" logistics strategy where on-site inventory is limited and a constant supply of goods serves to replenish raw materials. A product that is part of a "just-in-time" supply chain process will select a transportation mode that is fairly fast, such as truck or air. Inventory-rich industries requiring materials that are not as time-sensitive may use a transportation mode such as rail.

16 Source: The Center for Urban Transportation Research at the University of South Florida, 2002. Analysis of Freight Movement Mode Choice Factors. Florida Department of Transportation.

International Border Crossings

International border crossings between the U.S. and Mexico are critical components of the freight transportation system in Southern California. Mexico is the third-largest trading partner of the U.S. behind Canada and China, with a $367.5 billion trade volume in 2008, accounting for 11 percent of total U.S. foreign trade. It is also the largest market for exports of goods made in California, accounting for approximately $20.5 billion (14.1 percent) of California's overall goods exports in 2008. Most of the merchandise flows in the California-Baja California region are made by truck, often to support the export-oriented manufacturing and maquiladora industries that lie on the Mexican side of the international border.

Increased trade across the border has been bolstered by the existence of multiple free trade zones (FTZs). As a result of the associated tax savings and lower wages in Mexico, FTZs have been used by U.S. companies to export raw materials into Mexican manufacturing firms (maquiladoras), where goods are processed or assembled, and then exported back in their finished state to the U.S.[17] The ability to transfer goods from one FTZ to another within Mexican territory without losing any of the fiscal incentives (tax savings) is slowly creating a logistic and manufacturing network of FTZs that is expected to boost Mexican foreign trade with the U.S. (Intermodal México, 2010).

The future economic performance of Mexico faces strong competition as low-wage manufacturing jobs from Asia have eroded the maquiladoras' once-traditional competitive advantage. However, studies show that some maquiladoras have evolved from primarily labor-intensive factories to organizations with greater complexity, technology utilization, and research and skill specialization. As such, the future of the maquiladora industry in the Baja California region is likely to have a positive future.[18]

Accommodating expected growth in cross-border trade will require close coordination and partnership among federal, state, regional, and local agencies on both sides of the

17 Originally these FTZs were located primarily along the border, but recent changes to the Mexican Customs Law now allow them to operate anywhere in the Mexican territory, and several FTZs have opened in mainland Mexico, creating logistic hubs such as San Luis Potosí and Guanajuato.

18 Carrillo, Jorge and Arturo Lara (2005). "Mexican Maquiladoras: New Capabilities of Coordination and the Emergence of a New Generation of Companies." *Innovation: Management, Policy & Practice*, vol. 7/2 - April 2005.

border. This coordination must consider investment in transportation infrastructure to maintain the regional economic benefits provided by these international border crossings.

International Air Cargo

Los Angeles International Airport (LAX) handled over 1.8 million tons of cargo in 2010, making it the fifth-busiest cargo airport in the United States and the 13th busiest in the world.[19] Most often used for time-sensitive and higher-value goods, international air cargo plays a significant role in the regional economy, with $78 billion in trade.[20] Over 82 percent of the international air cargo at LAX is handled by scheduled passenger airlines or their cargo divisions that operate freighter aircraft. According to the recent air cargo forecast completed for SCAG, air cargo activity has been steadily declining over the past decade. However, this decline has been entirely confined to domestic air cargo. International air cargo reached a peak in 2007, declined in 2008 and 2009 with the recession, then recovered in 2010. It seems likely that international air cargo will continue to grow in the future.

DOMESTIC AND LOCAL GOODS MOVEMENT

While the region is a major gateway for international container movements, local and domestic freight is dominant. An overwhelming majority of goods movement activity in the SCAG region is generated by local businesses moving goods to local customers and serving national domestic trade systems. These local goods movement-dependent industries rely on transportation as a key part of their business model and generally utilize a more geographically dispersed transportation network than the international container market. Over 85 percent of truck trips are associated with intra-regional goods movement. Domestic manufacturers, wholesalers, and retailers also use the rail system and the air cargo system, though to a much more limited extent than international shippers.

The regional transportation system provides the infrastructure to allow these businesses to ship and receive the materials necessary to perform daily operations. Examples include shipments of raw supplies to support manufacturing processes and the delivery of refined or finished products to market. Major goods movement-dependent industries include those related to the manufacturing, wholesale trade, construction, transportation and warehousing, and mining sectors.

In 2010, local goods movement-dependent industries employed over 2.9 million people throughout the region (**FIGURE 2**), and contributed $253 billion to the regional GDP (**FIGURE 3**). These industries are anticipated to grow substantially by 2035 (**FIGURE 4**).

[19] Almost all international air cargo moves through LAX. Ontario International Airport (ONT) handles a very small proportion (about 3 percent in 2010) and the other regional airports handle the remainder.

[20] International Trade Trends and Impacts, The Southern California Region, Los Angeles Economic Development Corporation Kyser Center for Economic Research and World Trade Center Association, Los Angeles, Long Beach.

FIGURE 2 2010 Employment Contribution of Goods Movement-Dependent Industries (in Billions)

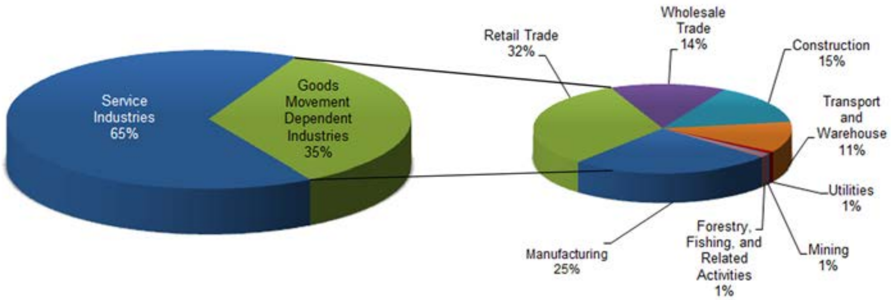
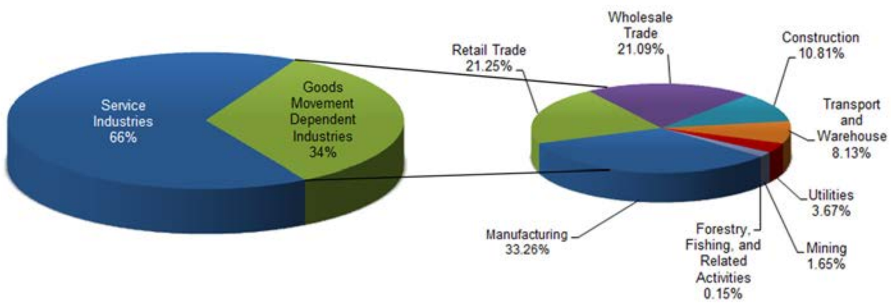


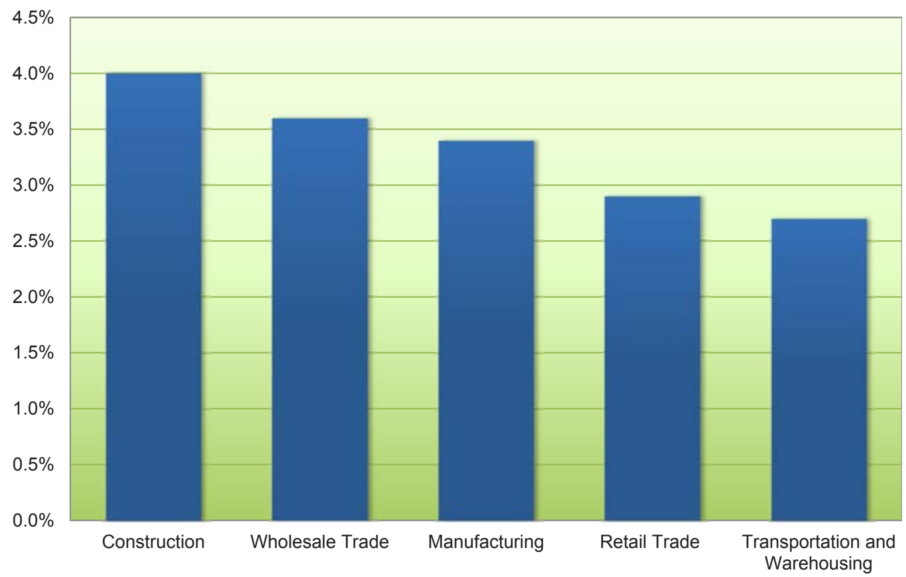
FIGURE 3 2010 Economic Contribution of Goods Movement-Dependent Industries (in Billions)



Regional GDP is a broad indicator of the level and strength of economic activity in a region. In the long term, the region's GDP is projected to grow steadily through 2035 at a rate slightly faster than the U.S. economy as a whole. The region's total GDP was $792 billion in 2009 and is projected to top $1.59 trillion by 2035, growing by over 100 percent at an average rate of 3.9 percent between these years. In comparison, the U.S. economy (U.S. GDP) is expected to grow about 99 percent from 2009 to 2035 (about 3.8 percent annually).[21]

Mirroring national trends, this GDP growth is anticipated to be accompanied by an increasing transition toward a higher value-added manufacturing and service economy. The highest-growth industry sectors from 2009 to 2035 include the manufacturing, wholesale trade, and construction sectors, all of which are highly dependent on the regional goods movement system. All three of these sectors will more than double in size in the next two decades and will contribute a combined $380 billion to regional GDP by 2035 (**FIGURE 4**).

FIGURE 4 2010–2035 Average Real Annual Growth Rates by Major Goods Movement-Dependent Sectors



[21] Bureau of Economic Analysis (www.bea.gov) for 2009 and 2010 data; REMI PI+v1.2.4 forecasts for future year projections. Growth in U.S. GDP was based on REMI data in percentage terms pivoting base year (2009) and future year (2035).

Goods Movement Trends and Drivers

There are a number of key trends that are anticipated to have major impacts on the goods movement system over the RTP horizon. These trends include:

- **Population and Economic Growth:** As previously referenced, regional population and employment in the SCAG region, key indicators of economic health, are both projected to grow rapidly in the next two decades. The 2010 Census revealed that the SCAG region is home to just over 18 million people, or about 48 percent of the entire population of the state of California.[22] Despite the current economic downturn brought on by challenging global conditions, population and employment in the SCAG region are expected to grow by 24 percent and 22 percent by 2035, respectively. This growing population will be accompanied, after an initially slow period of growth, by healthy job creation.[23] However, employment in California has suffered recently, declining by 1.3 percent in 2008 and 6 percent in 2009.[24] Though unemployment rates in the state, as a whole, will remain high in the foreseeable future, employment in the SCAG region is projected to climb steadily.[25] This growth will create increased consumer demand for products and the goods movement services that provide them. The increased demand will drive stronger growth in freight traffic on shared highway and rail facilities.
- **Recovery and Expansion of International Trade:** Within the RTP time horizon, international trade is anticipated to recover with renewed demand for both import and export capabilities. Despite competition with other North American ports and the expansion of the Panama Canal, the San Pedro Bay Ports anticipate cargo volumes to grow to 43 million containers annually by 2035 – more than tripling from today's levels. This will create the need to expand marine terminal facilities, improve highway connections (particularly those connecting directly to the San Pedro Bay Ports, like I-710 and SR-47), and address on-dock and off-dock intermodal terminal capacities. If port-related rail traffic and commuter demand are to be satisfied, additional main line capacity improvements will be required. Mitigating the impacts of increased train traffic on communities will continue to be a considerable challenge.
- **Continued Expansion of Warehouse and Logistics Activity:** Southern California is an ideal place for expanded distribution and logistics activity and will continue to be a significant source of well-paying jobs in the region through 2035.[26] Demand for port-related warehouse space is projected to grow at a faster pace than demand for domestic warehousing. As space near the San Pedro Bay Ports reaches capacity, port warehousing will push out to the Inland Empire and other parts of the region. Expansion in national and regional distribution facilities is also likely to occur in the Inland Empire, resulting in substantial congestion problems due to the increased truck volumes on regional highways. By 2035, the region may experience a shortfall of more than 228 million square feet in warehouse space relative to demand.[27]
- **Air Quality Issues:** Much of the SCAG region does not meet federal ozone and fine particulate matter ($PM_{2.5}$) air quality standards. Goods movement is a major source of emissions that contribute to these regional air pollution problems (NO_X and $PM_{2.5}$). While emissions from goods movement are being decreased through efforts such as the San Pedro Bay Ports Clean Air Action Plan, these reductions are unlikely to be sufficient to meet regional air quality goals.

22 http://factfinder2.census.gov (last accessed on July 3, 2011).
23 SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy.
24 California Regional Progress Report, November 2010. http://www.scag.ca.gov/publications/pdf/2010/CARegionalProgress2010.pdf.
25 SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy.
26 SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy.
27 SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy.

2012–2035 RTP/SCS Goods Movement Strategies

Infrastructure in the SCAG region must serve a variety of markets and be able to support diverse supply chains, each having distinct operational needs to continue to ensure continued economic growth. In addition, various policy strategies must be developed to address many of the impacts of regional goods movement including air quality, environmental, and communities concerns. To realize the benefits of efficient and sustainable goods movement, it is critical to identify strategies and projects that address expected growth trends.

2012–2035 RTP/SCS Background

In May 2004, SCAG, the six county transportation commissions in the SCAG region, San Diego County, and Caltrans began development of a plan to deal with regional goods movement challenges. This plan, also known as the Multi-County Goods Movement Action Plan (MCGMAP), identified freight movement constraints and included strategies that would lessen community and environmental impacts. Using the MCGMAP as a foundation, SCAG completed additional analyses to develop policies reflected in the 2008 RTP. The goods movement portion of the 2008 RTP identified a number of strategies aimed at facilitating regional freight movement in an economically viable and responsible manner.

Following the completion of the 2008 RTP, SCAG began the multi-year Comprehensive Regional Goods Movement Plan and Implementation Strategy to develop a refined regional goods movement plan along with an accompanying implementation strategy. Through this effort, SCAG has worked with diverse regional stakeholders to conduct in-depth evaluation of the region's goods movement system and associated regional freight patterns. A final version of the Comprehensive Regional Goods Movement Plan and Implementation Strategy documenting the full breadth of study findings will be released in coordination with adoption of the 2012–2035 RTP/SCS. The study integrates existing strategies and projects with newly developed regional initiatives advanced through recent analyses. The following sections highlight key regional initiatives evaluated for the 2012–2035 RTP/SCS.

Highway Strategies

EXISTING AND PROJECTED HIGHWAY CONDITIONS

Due to continued growth in freight and market demands, regional truck-related activities are expected to increase over the RTP time horizon. Trucks must be able to efficiently carry freight between businesses and consumers throughout the SCAG region to ensure that Southern California continues to capture the economic benefits of goods movement.

As part of the SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy, considerable enhancements were made to SCAG's existing heavy-duty truck (HDT) model to support the region's goods movement policy decisions. The HDT model is the primary analysis tool 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 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 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.
- **Port Truck Trips:** These are truck trips with an origin or 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 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 rail terminals. These truck trips do not include those that have either an origin or destination at the San Pedro Bay Ports.

TABLE 5 shows the number of regional truck trips in 2008 by category and county.

TABLE 5 Daily Regional Truck Trips by Category by County

	Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	Total	Percent
Internal	10,271	562,841	186,547	94,469	111,621	46,244	**1,011,993**	**87.3%**
External	4,816	38,794	6,815	11,183	18,140	1,271	**81,019**	**7.0%**
Port	25	37,060	2,499	855	2,752	165	**43,356**	**3.7%**
Intermodal (IMX)	17	3,376	306	271	3,143	57	**7,170**	**0.6%**
Secondary	37	11,944	1,102	714	2,224	268	**16,289**	**1.4%**
Total	**15,166**	**654,015**	**197,269**	**107,492**	**137,880**	**48,005**	**1,159,827**	
Percent	**1.3%**	**56.4%**	**17.0%**	**9.3%**	**11.9%**	**4.1%**		

In 2008, the San Pedro Bay Ports were responsible for approximately 50,000 direct daily regional truck trips.[28] As shown in **TABLE 5**, this consitutes only 3.7 percent of regional truck trips. That number is expected to grow to approximately 120,000 daily regional truck trips, an increase of nearly 150 percent, by 2035. Recent data indicates that the vast majority of trips leaving the San Pedro Bay Ports are destined for locations in the southern Gateway Cities, off-dock railyards near downtown Los Angeles, and other locations along the I-710 corridor (**EXHIBIT 2**). Although most truck trips originating at the San Pedro Bay Ports remain in the port vicinity, some still move to destinations throughout the SCAG region, contributing to local challenges on area transportation networks.

However, this pattern is expected to shift in the future with an increase in the number of daily trucks traveling to warehouses in the San Gabriel Valley and the Inland Empire. For example, in 2008, 0.5 percent and 2.3 percent of all truck trips from the San Pedro Bay Ports moved to eastern San Bernardino Valley and western San Bernardino Valley, respectively. By 2035, it is anticipated that 8.8 percent and 7 percent of those truck trips will move to eastern San Bernardino Valley and western San Bernardino Valley, respectively.

Although some areas may show a decline in the percentage of daily truck trips from the San Pedro Bay Ports, all areas will experience higher truck volumes in absolute terms.

All key regional highway corridors used to move goods are expected to see an increase in overall truck volumes by 2035 (**EXHIBIT 3** reflects 2035 baseline conditions). At the corridor level, the highest growth in truck traffic is expected on I-710 as a result of significant growth in port-related traffic. While considerable growth in truck traffic is anticipated on I-10 and I-210, overall growth on SR-60 is forecast to be the highest of all of the east-west corridors. **EXHIBIT 4** illustrates expected speeds on the regional highway network during the PM Peak period in 2035 if no action is taken.

28 This figure includes inter-terminal truck trips that do not move on the regional highway system, while the figure provided in the table includes only trips on the regional highway system.

EXHIBIT 2 San Pedro Bay Ports Truck Distribution

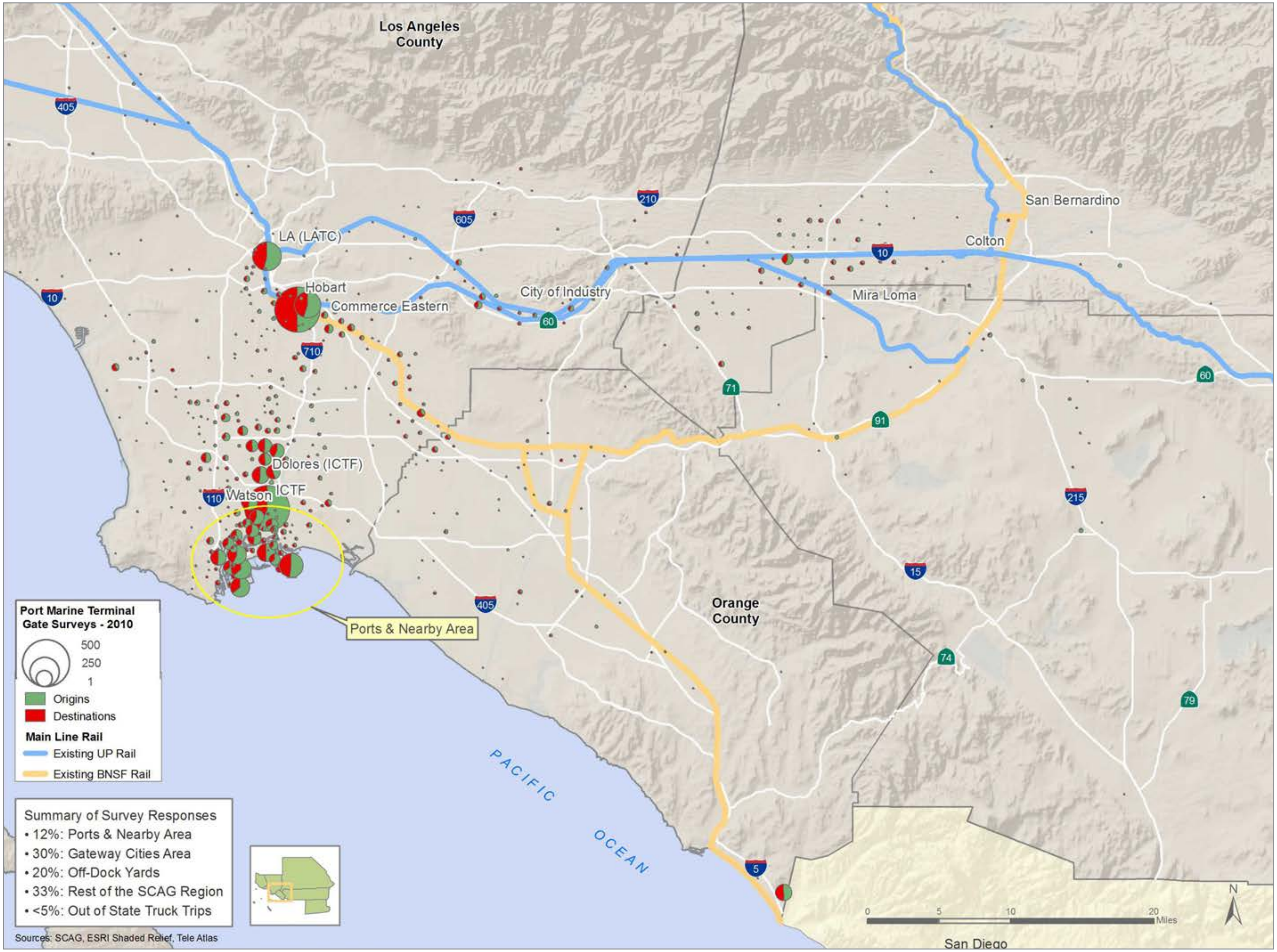


EXHIBIT 3 Rising Truck Volumes on Key Truck Corridors (2008 and 2035 Baseline)

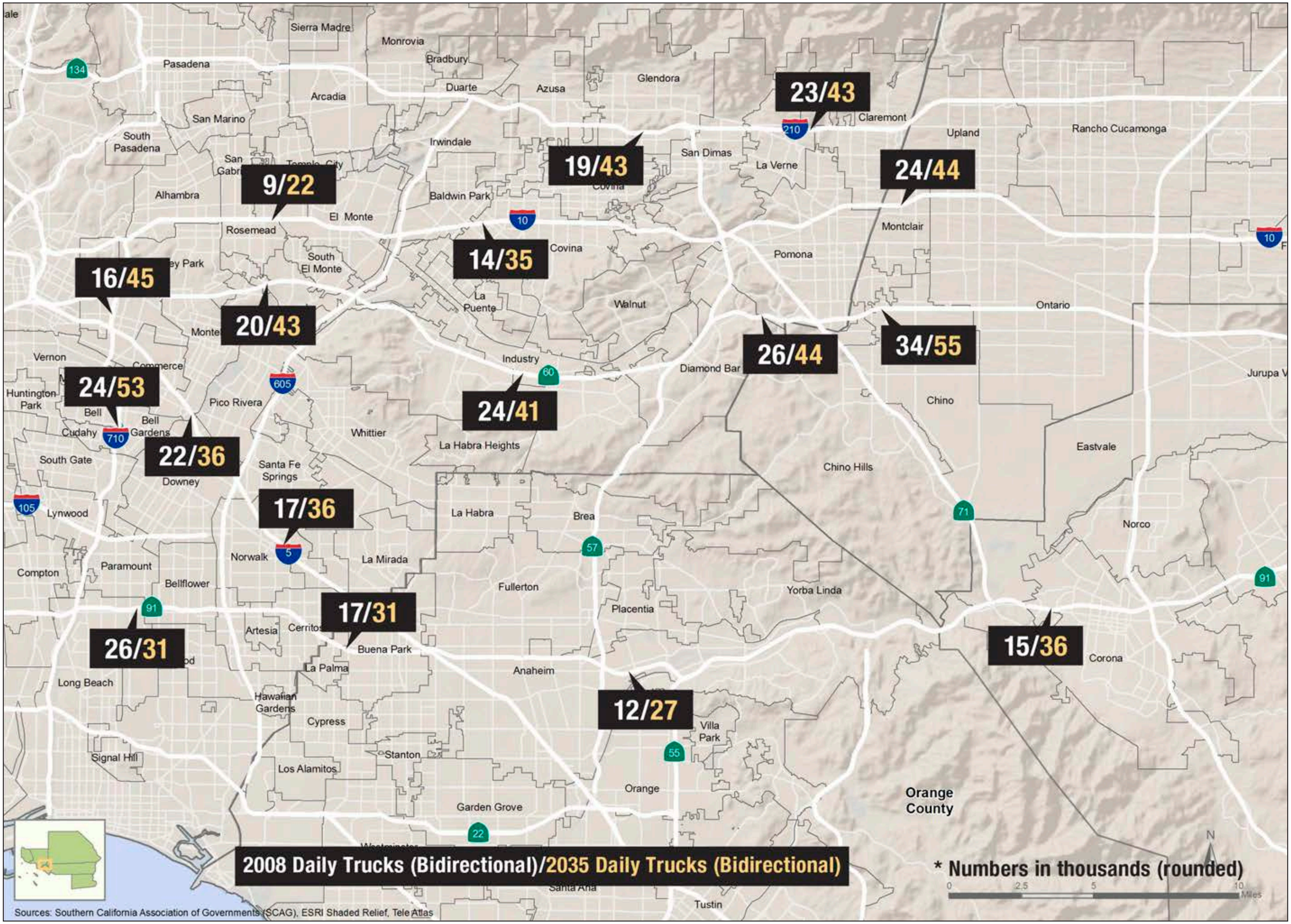


EXHIBIT 4 Baseline 2035 Highway Speeds – PM Peak

REGIONAL HIGHWAY STRATEGIES

As truck volumes continue to increase, especially eastward beyond the traditional service areas surrounding I-710, it is critical that regional infrastructure accommodate and mitigate the impacts of this growth. As part of the 2012–2035 RTP/SCS, SCAG has identified strategies to relieve congestion, reduce delay and harmful emissions, and improve safety on major truck corridors.

Regional Clean Freight Corridor System

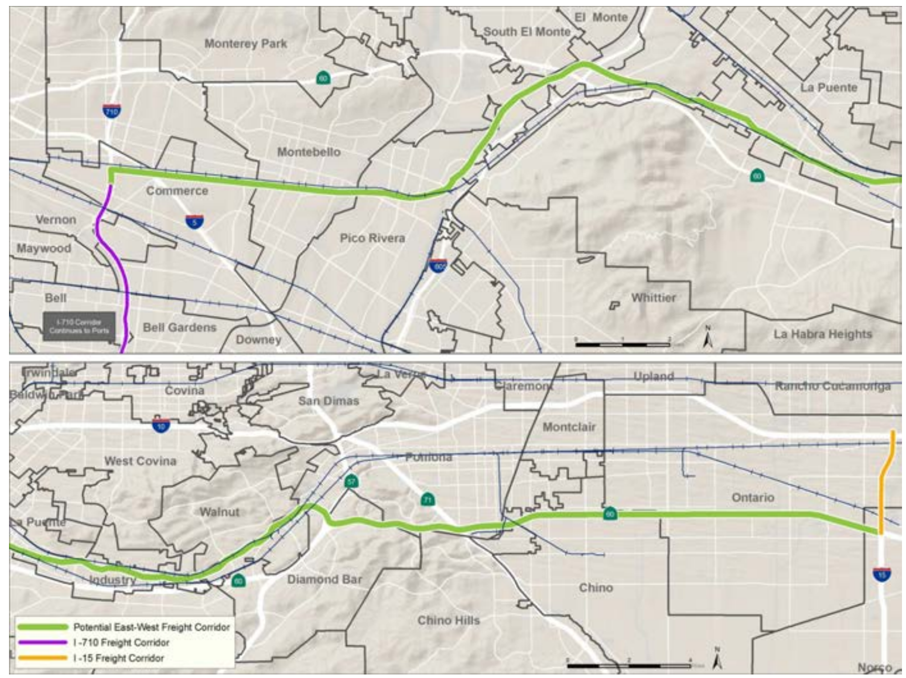
In past RTPs, SCAG has envisioned a system of truck-only lanes extending from the San Pedro Bay Ports to downtown Los Angeles along I-710, connecting to an east-west segment, and finally reaching I-15 in San Bernardino County. Such a system would address the growing truck traffic on core highways throughout the region and serve key goods movement industries in a manner that mitigates impacts on communities and the environment. Physically separated from mixed-flow traffic and with fewer ingress/egress points than typical urban freeways, truck-only freight corridors effectively add capacity in congested corridors, improve truck operations, increase safety by separating trucks and autos, and provide a platform for the introduction and adoption of zero- and/or near-zero emission technologies

SCAG recognizes I-710 as the first segment of a comprehensive regional system of truck-only freight corridors. In the 2008 RTP, SCAG recommended the inclusion of dedicated lanes for zero-emission trucks on I-710. Since that time, significant progress has been made on I-710 as evidenced by recent work on an environmental impact report (EIR) that is expected to be completed in 2013. In the 2012–2035 RTP/SCS, SCAG identifies a refined east-west corridor concept and connections to an initial segment of I-15.

EAST-WEST FREIGHT CORRIDOR

The 2012–2035 RTP/SCS identifies a corridor concept that would connect to the north end of the I-710 freight corridor and roughly parallel the Union Pacific Railroad Los Angeles Subdivision before finally following a route adjacent to SR-60 just east of SR-57 (**EXHIBIT 5**). While numerous east-west freight corridor options were examined, the RTP/SCS identifies a corridor concept to be explored further. The potential use of two non-roadway routes provides an opportunity to move the facility away from neighborhoods and closer to the industrial activities that it would serve. Utilizing a right-of-way of approximately 100 feet, the bi-directional corridor would be restricted to truck traffic and have limited ingress/egress points. The East-West Freight Corridor would be a catalyst for the use of zero-and/or near-emission truck technologies, improving air quality for communities near the corridor and throughout the region.

EXHIBIT 5 Potential East-West Freight Corridor

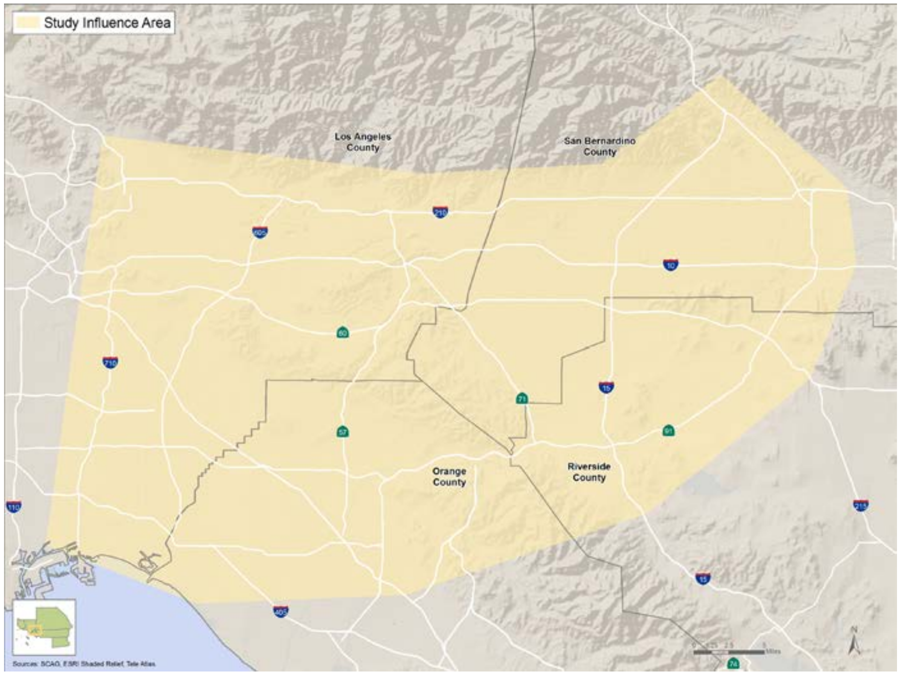


Following adoption of the 2012–2035 RTP/SCS, additional study of this alignment concept, will be conducted. Additional work for the East-West Freight Corridor would be explored through a full environmental impact report. This would provide substantial opportunity for further community input.

IDENTIFICATION OF THE EAST-WEST FREIGHT CORRIDOR

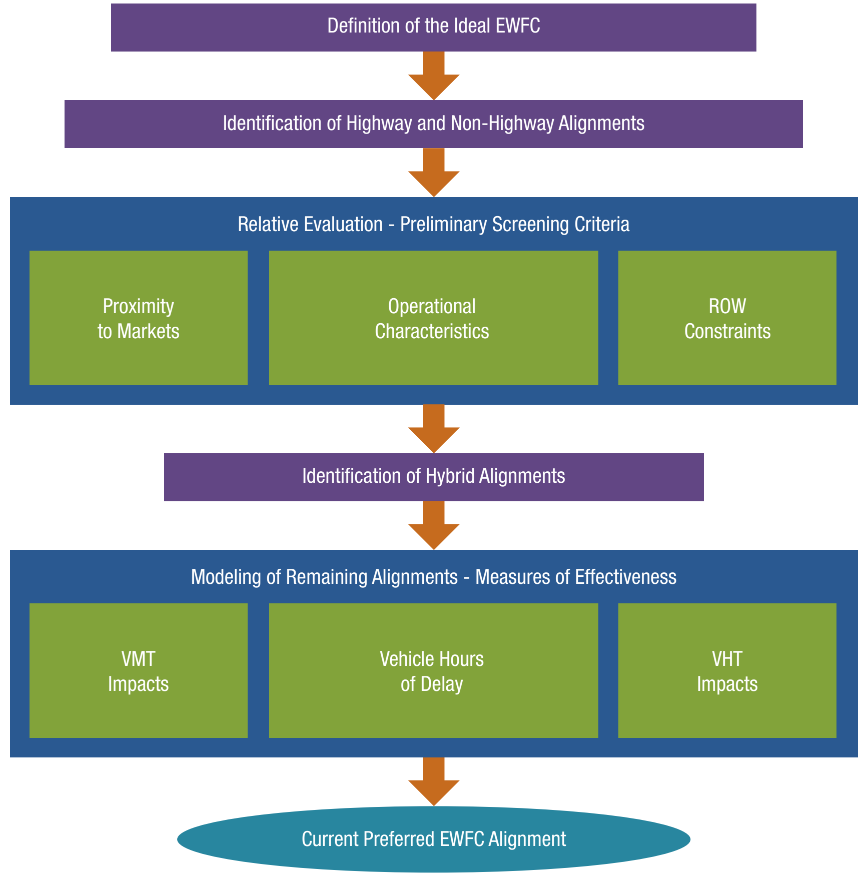
The preferred East-West Freight Corridor concept included in the 2012–2035 RTP/SCS is the culmination of extensive analysis and stakeholder feedback. **EXHIBIT 6** shows the area most likely to be influenced by the development of the East-West Freight Corridor.

EXHIBIT 6 East-West Corridor Analysis Influence Area



Steps to identify the East-West Freight Corridor are summarized in **FIGURE 5** and explained further below.

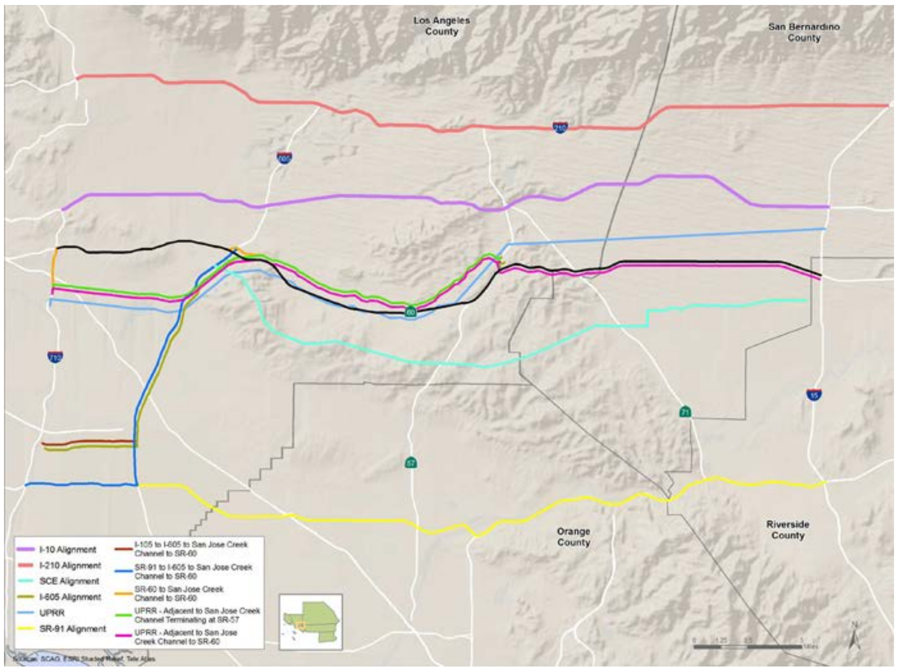
FIGURE 5 Process for Idenfication of the East-West Freight Corridor



Step 1: Definition of the ideal characteristics for the East-West Freight Corridor. An ideal East-West Freight Corridor would support mobility for key industries; serve goods movement markets efficiently; be acceptable to neighboring communities; satisfy regional environmental goals; contribute to regional congestion mitigation; and not conflict with other regional projects under consideration. Satisfying all of these criteria may be a significant challenge, but any East-West Freight Corridor should satisfy as many as possible.

Step 2: Identification of the highway and non-highway alignments that could serve as the East-West Freight Corridor. This included highway corridors such as I-210, I-10, SR-60, and SR-91. It also included an SCE utility Right-of-Way (ROW) and a UPRR-adjacent facility, including the San Jose Creek Alignment. These facilities are identified in **EXHIBIT 7**.

EXHIBIT 7 Initial East-West Freight Corridor Alignments



Step 3: Relative comparison of corridors against initial screening criteria. The potential corridors were evaluated for their proximity to current and future markets, their ROW feasibility and constraints, and corridor operational characteristics including the volume of trucks carried and the incidence rate of truck-involved accidents.

Step 4: Creation of new "hybrid" alignments that minimized community impacts. Following initial screening, the facilities identified below were further analyzed:

- UPRR-adjacent to San Jose Creek to SR-60
- UPRR-adjacent to San Jose Creek terminating at SR-57
- SR-60 to San Jose Creek to SR-60
- SR-91 to I-605 to San Jose Creek to SR-60
- I-105 to I-605 to San Jose Creek to SR-60

Step 5: Modeling of five remaining corridor alignments with the SCAG HDT model, including their impacts on Measures of Effectiveness (MOEs): VMT, VHT, and VHD. MOEs were calculated for the influence area. Results of the modeling analysis are summarized in **TABLE 6**.

Based on this analysis, Alternative 1 (UPRR-adjacent to San Jose Creek Channel to SR-60) was identified as the preferred corridor for further analysis and refinement. It is anticipated that this corridor concept could fall within a five-mile span of Alternative 1 (route illustrated in **EXHIBIT 5**.)

TABLE 6 Modeling/Summary Comparison of Six Potential East-West Freight Corridor Alignments

ID	Alignment	Summary/Key Points
1	UPRR-Adjacent to San Jose Creek Channel to SR-60	Carries the second-highest truck volumes – within 5% of Alt. 5
		Reduces truck traffic on SR-60 by 65%–85%
		Shows greatest reduction in total delay for all traffic (-4.3%) in influence area, as well as highest reduction (-10%) for heavy-duty truck delay
2	UPRR-Adjacent to San Jose Creek Channel Terminating at SR-57	Results in negative traffic impacts – 18% more traffic on SR-60 east of SR-57
		Shows increase in total delay for all traffic (1%) in influence area, as well as the medium reduction for heavy-duty truck delay
3	SR-60 to San Jose Creek Channel to SR-60	Carries the same truck volume as Alt. 1 – within 5% of Alt. 5
		Reduces truck traffic on SR-60 by 70%–85%
		Shows high reduction in total delay for all traffic (-3.7%) in influence area, as well as high reduction (-9%) for heavy-duty truck delay
4a	SR-91 to I-605 to San Jose Creek Channel to SR-60	Carries lower truck volumes than Alt. 1, 3, 4b, and 5
		Shows greatest heavy-duty truck delay reduction (-10.9%) but fairly low (-1.3%) overall total delay for traffic
4b	I-105 to I-605 to San Jose Creek Channel to SR-60	Shows high heavy-duty truck delay reduction (-10.7%) but fairly low (-1%) overall total delay for traffic
5	SR-91	Carries the most trucks of all screenlines – up to 57,780 (two-way volumes)
		Has little impact on parallel freeways east of SR-57
		Shows high heavy-duty truck delay reduction (-10.5%) but fairly low (-1%) overall total delay for traffic

BENEFITS OF THE EAST-WEST FREIGHT CORRIDOR

Continuing to move freight efficiently is critical to retain Southern California's trade competitiveness. The East-West Freight Corridor (Alternative 1) offers the opportunity to address many of the goods movement challenges, including congestion, air quality, and safety concerns. The East-West Freight Corridor will support mobility for key industries, serve goods movement markets in an efficient manner, promote the region's environmental goals, and contribute to alleviating the region's congestion. In addition, it will not conflict with other major regional projects under consideration. Analysis completed as part of the SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy for the 2012–2035 RTP/SCS indicates that major benefits of the potential East-West Freight Corridor include:

- **Mitigation of Future Truck Traffic:** Truck traffic is projected to grow significantly on all existing key east-west freeway segments. These dramatic increases in truck traffic on east-west corridors will cause increased congestion and longer delays to both trucks and general traffic on existing routes. The construction of the East-West Freight Corridor would increase capacity to accommodate the projected growth in truck activity. The corridor's traffic mitigation impacts would be significant, especially considering that some segments of the East-West Freight Corridor are forecast to carry between 58,000 and 78,000 trucks per day in 2035.
- **Reduction in Regional Delay:** The East-West Freight Corridor is projected to result in substantial delay reduction for both trucks and autos. Within the identified influence area, all traffic is expected to experience a reduction of approximately 4.3 percent, with heavy-duty trucks seeing a nearly 10 percent decrease. This reduced delay would provide demonstrable travel time savings as well as reduce emissions from idling vehicles on congested roadways.
- **Impact on Parallel Routes:** The East-West Freight Corridor is projected to draw significant volumes of truck traffic away from parallel routes, easing congestion and creating capacity for other vehicles on general purpose lanes. Estimates indicate that the East-West Freight Corridor could reduce daily traffic on portions of SR-60 (between 42–82 percent), I-10 (up to 33 percent), SR-91 (up to 19 percent), I-210 (up to 17 percent), and major regional arterials (up to 21 percent).

- **Mobility Benefits for Critical Markets:** The East-West Freight Corridor would offer considerable benefits to regional businesses and industries served by the numerous clusters of warehousing and manufacturing facilities near the route. Portions of the recommended potential East-West Freight Corridor lie within a five-mile radius of 52 percent of the region's warehousing square footage and 27 percent of regional manufacturing employment. Supplemental **EXHIBITS A1–A6** show the proximity of major truck corridors to regional warehousing and manufacturing.
- **Reduction of Truck-Involved Accidents:** The East-West Freight Corridor offers the potential to reduce truck-involved crashes as a result of the separation between trucks and other vehicles. Safety analysis revealed that several existing east-west corridors have high rates of truck-involved crashes, including segments of SR-60, SR-91, and I-10. Over a five-year period, the average of truck-involved crashes on key east-west corridors showed that SR-60 between I-605 and SR-57 has the highest average number of truck accidents—10 to 15 truck crashes per mile on an annual basis. A short segment near the intersection of SR-60 and SR-57 had an average of 20 to 30 crashes per mile annually. The East-West freight corridor designed specifically for use by heavy duty trucks has the potential to improve safety and decrease the number of accidents for trucks and autos on parallel routes.
- **Preservation of Jobs and Income:** Increasing congestion is making Southern California a less attractive place to do business, threatening jobs and the positive economic impacts of the goods movement sector. The East-West Freight Corridor delivers a transportation system with greater capacity and less congestion in support of industries that depend on efficient freight movement throughout the SCAG region.
- **Reduction of Harmful Emissions:** The East-West Freight Corridor provides an opportunity to reduce harmful pollutants through the use of zero- and/or near-zero -emission technologies for freight transportation. Although the technology to be used will be determined as the market evolves, the East-West Freight Corridor offers a significant opportunity to catalyze development, deployment, and commercialization of zero- and/or nearemission technologies for freight transportation.

TABLE 7 Benefits of an East-West Corridor Strategy

Mobility	▪ Truck delay reduction of approximately 11% ▪ All traffic delay reduction of approximately 4.3% ▪ Reduces truck volumes on general purpose lanes—42–82% reduction on SR-60
Safety	▪ Reduced truck/automobile accidents (up to 20–30 per year on some segments)
Environment	▪ 100% zero-emission truck utilization removes: 4.7 tons NO_X, 0.16 tons $PM_{2.5}$, and 2,401 tons CO_2 daily
Community	▪ Preferred alignment has least impact on communities ▪ Removes traffic from other freeways ▪ Zero-emission technology (ZET)—reduces localized health impacts
Economic	▪ Supports mobility for goods movement industries, which comprise 34% of SCAG regional economy and jobs

Bottleneck Strategy

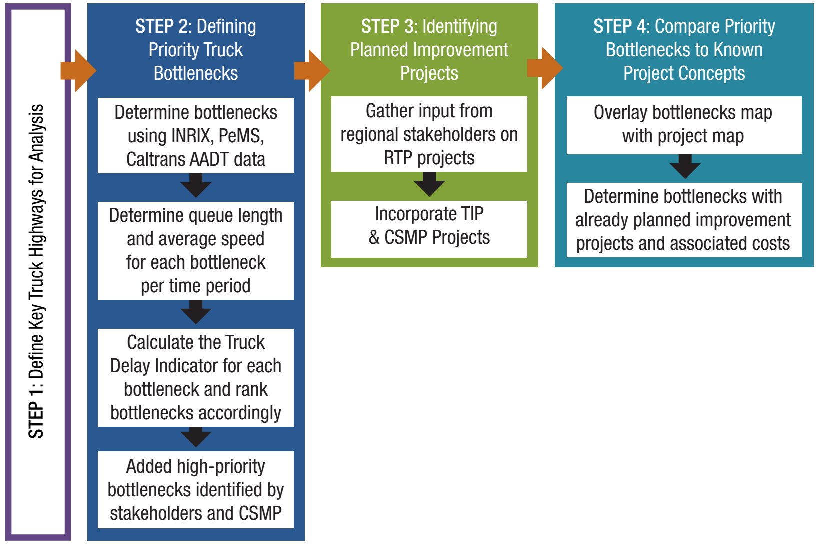
In a recent analysis of critical issues affecting the trucking industry conducted by the American Transportation Research Institute (ATRI), traffic congestion ranked near the top in 2011 after being less of a concern in 2009–2010 as a result of the economic downturn.[29] Besides causing delays to other highway users, heavy truck congestion results in wasted labor hours and fuel. In 2010, it was estimated that the cost of truck congestion in 439 major urban areas was approximately $23 billion.[30] Truck congestion in urban areas within the SCAG region resulted in approximately $2.6 billion in costs.[31] Given that driver wages and fuel costs represent over 50 percent of total motor carrier costs, truck congestion has major impacts on the bottom line of the trucking industry. Truck bottlenecks are also emission "hot spots" and generally have significantly degraded localized air quality caused by increased idling from passenger vehicles and trucks.

A coordinated strategy to address the top-priority truck bottlenecks may be a cost-effective way to improve the efficiency of goods movement in the SCAG region. Additionally, the East-West Freight Corridor concept, alone, will not address congestion on all the major truck corridors; the bottleneck strategy reduces congestion in areas outside of the East-West Freight Corridor. Though some bottleneck projects (such as auxiliary lanes) are large, capital-intensive, projects, others (such as ramp metering) are less complex and would therefore be relatively easier to implement. Regardless of their complexity, bottleneck alleviation projects positively contribute to the region's environmental goals (by reducing emissions "hotspots"), and result in substantial, tangible benefits to commuters and goods movement industries alike.

SCAG recently studied regional truck bottlenecks through a four-step process (**FIGURE 6**) that utilized Caltrans truck data, INRIX and PeMS truck traffic data, feedback from key regional stakeholders, and information from the completed Corridor System Management Plans (CSMPs).

This analysis resulted in a list of the top 44 regional priority bottlenecks (**EXHIBIT 8**). Top priority bottlenecks include those that had the highest truck-related annual delay according to the bottleneck assessment performed with INRIX and PeMS data.[32] Also included on this list are high-priority bottlenecks identified through the CSMP process and stakeholder involvement process.

FIGURE 6 Key Steps in the Bottleneck Analysis



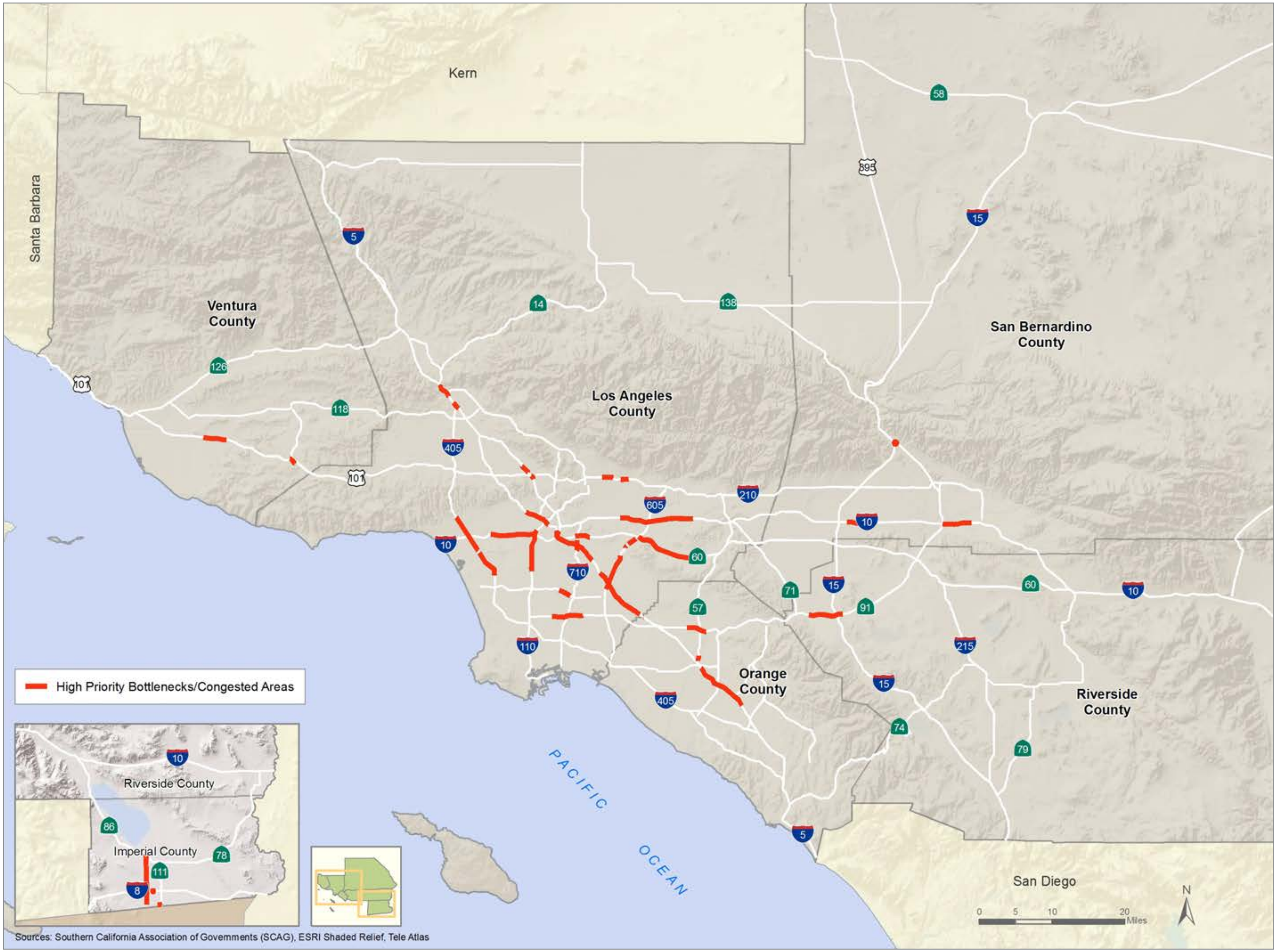
The 2012–2035 RTP/SCS allocates an estimated $5 billion toward goods movement bottleneck relief strategies. Examples of bottleneck relief strategies include ramp metering, extension of merging lanes, ramp and interchange improvements, capacity improvements, and auxiliary lane additions. Some bottleneck relief concepts have been identified through the CSMP process and others are currently programmed for implementation. Additional project concepts will continue to be refined through SCAG's Comprehensive Regional Goods Movement Plan and Implementation Strategy.

The top 44 congested areas and bottlenecks in the SCAG region, combined, contribute over 1 million hours of truck delay annually to SCAG regional roadways in congested time periods. Addressing these congested areas and bottlenecks could contribute to a reduction in this delay, as well as associated emissions and air pollution benefits.

29 http://www.atri-online.org/2011_top_industry_issues.pdf.
30 Texas Transportation Institute 2011 Urban Mobility Report.
31 Texas Transportation Institute 2011 Urban Mobility Report. Urban areas as defined in the report include Los Angeles-Long Beach-Santa Ana, Riverside-San Bernardino, Lancaster-Palmdale, Bakersfield, Indio-Cathedral City-Palm Springs, and Oxnard-Ventura.

32 "Highest annual delay" is defined as all bottlenecks that exhibited 20,000 or more hours of truck-related delay on an annual basis.

EXHIBIT 8 Priority Truck Bottlenecks in the SCAG Region



Rail Strategies

The health of the Southern California economy depends on an efficient rail system with the capacity to accommodate projected growth in international and domestic freight. The rail system in the SCAG region provides a critical connection between the largest port complex in the country and producers and consumers throughout the U.S. Over half of the international cargo arriving at the San Pedro Bay Ports utilizes rail, including on-, near-, and off-dock rail. Regional rail also serves domestic industries, predominantly for long-haul freight leaving the region. The extensive rail network in the SCAG region is a critical link in the regional supply chain that offers shippers the ability to move large volumes of goods over long distances at lower costs versus other transportation options. As part of the 2012–2035 RTP/SCS, SCAG has highlighted a comprehensive package of improvements to the regional rail system. The rail package includes goals such as long-term economic competitiveness, job creation and retention, increased freight and passenger rail mobility, improved safety of at-grade crossings, and mitigation of environmental impacts of rail operations. By presenting these goals as a complete rail package, SCAG aims to promote collaboration and coalition building and to develop a unified message to attract leadership support for the program.

EXISTING AND PROJECTED RAIL CONDITIONS

Southern California is served by two Class I railroads:[33] Union Pacific Railroad (UP) and the Burlington Northern Santa Fe Railway (BNSF). Pacific Harbor Line, Inc. (PHL), a Class III railroad, provides rail transportation, maintenance, and dispatching services within the San Pedro Bay Ports area. The Port of Hueneme is served by the Ventura County Railway (VCR), a Class III railroad, which connects to the UP Coast main line in Oxnard. Another Class III line, the Los Angeles Junction Railway (LAJ), provides industrial switching services in the Cities of Vernon, Maywood, Bell, and Commerce. The LAJ provides connections to both UP and BNSF. **EXHIBIT 9** shows key segments of the rail system described in more detail below.

North of the Ports of Los Angeles and Long Beach, UP and BNSF trains operate on the Alameda Corridor, which was completed in 2002. All harbor-related trains of the UP and BNSF use the Alameda Corridor to access the rail main lines that originate near downtown Los Angeles. East of downtown Los Angeles, freight trains operate on the BNSF San Bernardino Subdivision, the UP Los Angeles Subdivision, or the UP Alhambra Subdivision. North and west of Los Angeles, freight trains operate on the UP Coast line toward Santa Barbara, the Antelope Valley line from the San Fernando Valley to Palmdale, or the UP Mojave Subdivision from West Colton to Palmdale.

To transition from the Alameda Corridor to the Alhambra Subdivision, the UP utilizes trackage rights over Metrolink's East Bank Line, which runs parallel to the Los Angeles River on the east side of downtown Los Angeles. The UP Los Angeles Subdivision terminates at West Riverside Junction where it joins the BNSF San Bernardino Subdivision. The BNSF San Bernardino Subdivision continues north of Colton Crossing and transitions to the BNSF Cajon Subdivision. The Cajon line continues north to Barstow and Daggett, and then east toward Needles, CA, and beyond. UP trains exercise trackage rights over the BNSF San Bernardino Subdivision from West Riverside Junction to San Bernardino and over the Cajon Subdivision from San Bernardino to Daggett, which is a short distance east of Barstow. UP trains continue north of Daggett on the UP Cima Subdivision to Las Vegas.

The UP Alhambra Subdivision and the BNSF San Bernardino Subdivision cross at Colton Crossing in San Bernardino County. East of Colton Crossing, the UP operates its transcontinental Sunset Route main line, also known as the UP Yuma Subdivision. The Yuma Subdivision passes through the Palm Springs area, Indio, and continues to Arizona and beyond.

The UP Yuma Subdivision has two main tracks from Colton to Indio. East of Indio, the Sunset Route still has stretches of single track, but construction of a second main track is underway.

The BNSF San Bernardino Subdivision has at least two main tracks with segments of triple track between Hobart and Fullerton. On the Cajon Subdivision, the BNSF recently completed a third main track from San Bernardino to the summit of Cajon Pass.

The UP Alhambra Subdivision is mostly single track, while the UP Los Angeles Subdivision has two main tracks west of Pomona and a mixture of one and two tracks east of Pomona.

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33 For purposes of accounting and reporting, the Surface Transportation Board designates three classes of freight railroads based upon their operating revenues for three consecutive years using the following scale: Class I–$250 million or more; Class II–less than $250 million but more than $20 million; and Class III–$20 million or less. These operating revenue thresholds are stated in 1991 dollars and are adjusted annually for inflation using a Railroad Freight Price Index developed by the Bureau of Labor Statistics (BLS).

North from West Colton, the single-track UP Mojave Subdivision closely parallels the BNSF Cajon Subdivision as the two lines climb the south slope of Cajon Pass. There are connections at Keenbrook and Silverwood to enable UP trains to enter/exit the main tracks of the BNSF Cajon Subdivision. Beyond Silverwood to Palmdale, the UP Mojave Subdivision has very little train traffic. UP uses this line to reach points in Northern California and the Pacific Northwest.

The BNSF operates intermodal terminals for containers and trailers at Hobart Yard (in the City of Commerce) and at San Bernardino. UP operates intermodal terminals at:

- East Los Angeles Yard at the west end of the UP Los Angeles Subdivision
- Los Angeles Transportation Center (LATC) at the west end of the UP Alhambra Subdivision
- City of Industry on the UP Alhambra Subdivision, and the
- Intermodal Container Transfer Facility (ICTF) near the south end of the Alameda Corridor

In addition, both UP and BNSF operate trains hauling marine containers that originate or terminate at on-dock terminals within the Ports of Los Angeles and Long Beach.

UP also has a large carload freight classification yard at West Colton (at the east end of the Alhambra Subdivision). A large automobile unloading terminal is located at Mira Loma (mid-way between Pomona and West Riverside on the Los Angeles Subdivision).

CURRENT AND FUTURE VOLUMES AND POTENTIAL CAPACITY CONSTRAINTS

Rail is expected to continue to play a key role in goods movement transportation in the SCAG region. Significant growth in passenger and freight rail traffic is expected on most segments of the SCAG regional rail system by 2035. This anticipated growth is highlighted in **TABLE 8**, which shows 2010, and the projected 2035 peak day train volumes on key segments. Freight train volumes include container trains, also called intermodal trains (marine and domestic), and non-intermodal trains (unit automobile trains, unit oil trains, unit bulk, and carload trains). Passenger trains include Amtrak and Metrolink service. Increases in railroad traffic will require ongoing infrastructure investment to maintain current levels of service. Increased rail traffic also has an impact on highway traffic and congestion, as more trains will result in increased wait times for vehicles at at-grade crossings.

TABLE 8 Peak Day Train Volumes 2010, 2035 (Metrolink Volumes in Parenthesis)

Line Segments	Type	2010	2035
BNSF San Bernardino Subdivision *Hobart–Fullerton*	Passenger	54(28)	77(51)
	Freight	45	90
BNSF San Bernardino Subdivision *Atwood–W. Riverside*	Passenger	26(24)	42(40)
	Freight	49	99
BNSF San Bernardino Subdivision *W. Riverside–Colton*	Passenger	10(8)	42(40)
	Freight	67	147
BNSF Cajon Subdivision *San Bernardino–Silverwood PLUS* UP Mojave Subdivision *W. Colton–Silverwood*	Passenger	2(0)	2(0)
	Freight	93	147
UP Los Angeles Subdivision *East LA–Pomona PLUS* UP Alhambra Subdivision *Yuma Jct.–Pomona*	Passenger	13(12)	21(20)
	Freight	52	98
UP Los Angeles Subdivision *Pomona–W. Riverside PLUS* UP Alhambra Subdivision *Pomona–West Colton*	Passenger	13(12)	21(20)
	Freight	51	109
UP Yuma Subdivision *Colton–Indio*	Passenger	1(0)	1(0)
	Freight	45	93

Note: A "peak day" experiences the 90th percentile of the distribution of daily train movements.
Source: 2011 Regional Rail Simulation Study, SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy. Forecasts performed through rail simulation conducted by Dr. Robert Leachman, Leachman and Associates, LLC. These numbers do not represent forecasts made by BNSF Railway or UP Railroad. Passenger volume totals include Amtrak and Metrolink.

REGIONAL RAIL STRATEGIES

The proposed regional rail package has several components. These include main line rail improvements (rail-to-rail grade separations, double or triple tracking, new signal systems, universal crossovers, new sidings, etc.) that would benefit both freight rail and passenger rail service depending on their location; rail yard improvements (upgrades to existing yards as well as construction of new yards); rail operation safety improvements such as Positive Train Control (PTC) that could greatly reduce the risk of rail collisions and increase capacity; grade separations; and emissions reduction strategies.

Main Line Capacity Enhancements

The 2011 SCAG Regional Rail Simulation Study updates the 2005 Inland Empire Main Line Rail Study. The effort evaluates the main line capacity requirements for projected levels of train traffic on the BNSF and UP lines by considering routing alternatives to meet the following goals:

- Reduce capital costs
- Reduce safety risks and impacts
- Reduce train volumes through the worst bottleneck (Riverside–Colton)
- Avoid the most costly line expansion (UP Pomona–Riverside line)
- Separate Metrolink from heavy UP traffic
- Route freight lines where most environmentally friendly (but sustain service to all rail terminals)

Currently, the UP Alhambra and Los Angeles Subdivisions are used to some extent as a paired double track, with eastbound trains operating via the Los Angeles Subdivision from Redondo Junction or East Los Angeles to West Riverside, via trackage rights over the BNSF line through Riverside to Colton (**FIGURE 7**). Because of the locations of certain rail terminals, approximately one-fourth of the UP trains must move against the current of traffic. **FIGURE 7** shows the existing routing of the UP Alhambra and Los Angeles Subdivisions. As an example, trains carrying automobiles that terminate at Mira Loma must use trackage rights over BNSF Colton–West Riverside and then operate westbound over the Los Angeles Subdivision to Mira Loma.

EXHIBIT 9 Regional Rail Segments

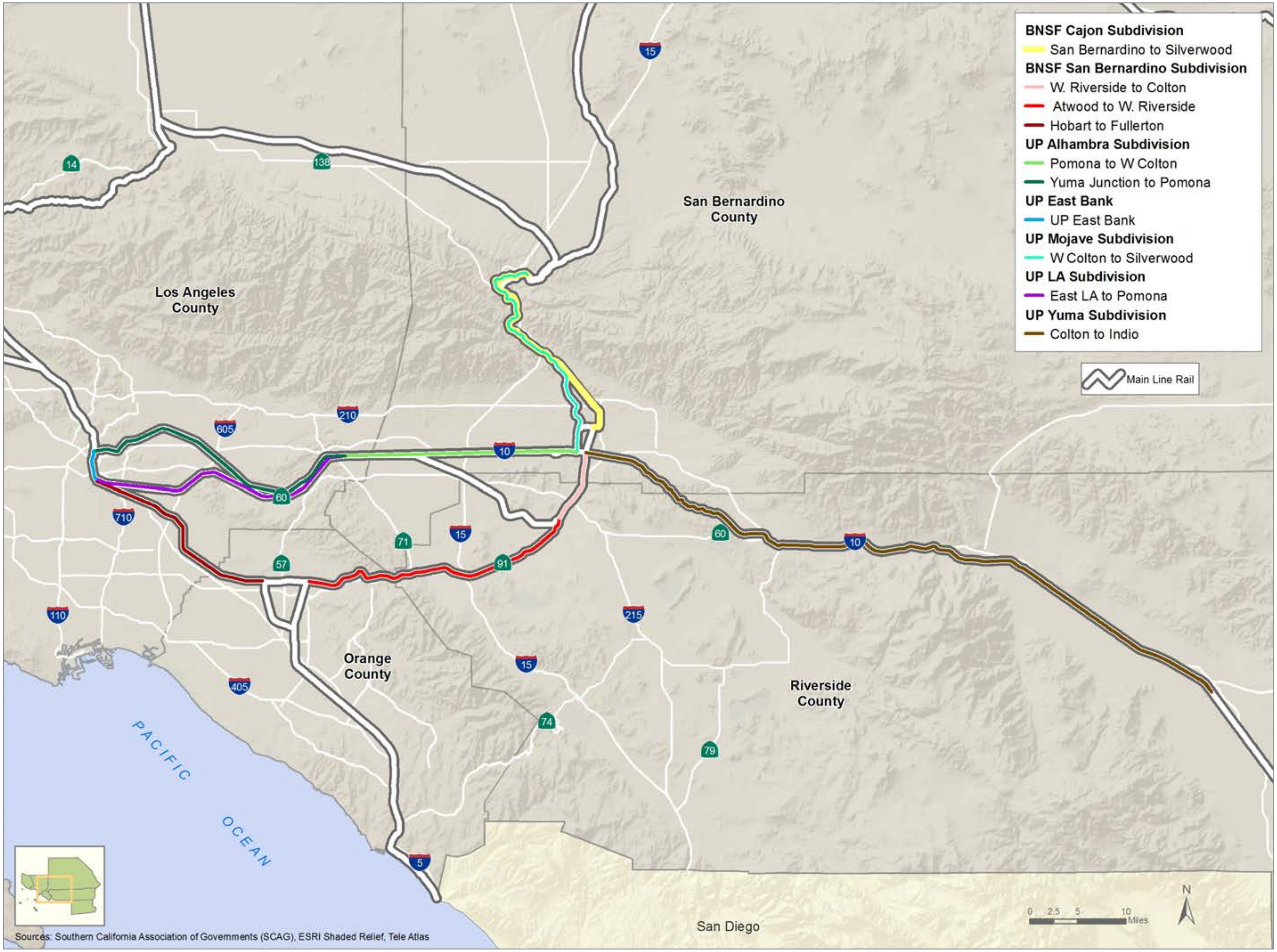
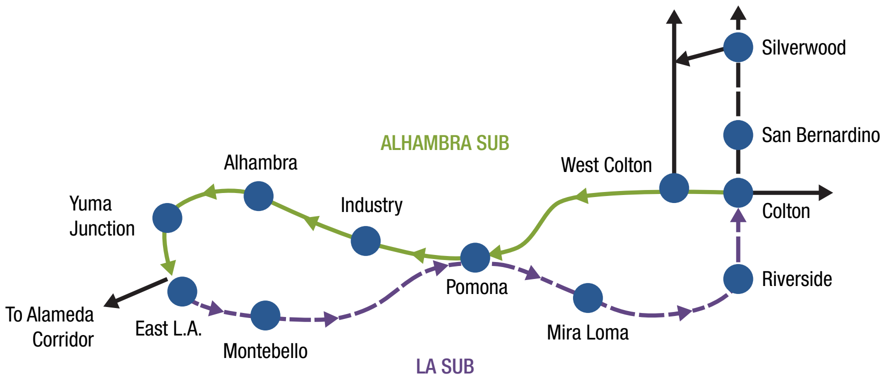
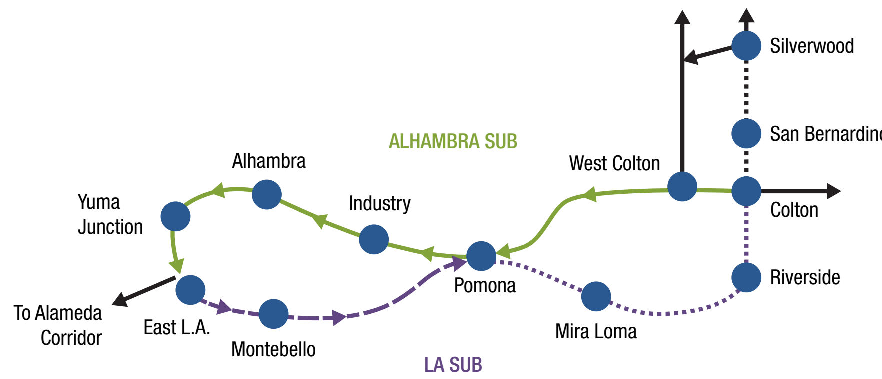


FIGURE 7 Schematic of Status Quo Routing of Union Pacific Trains



Source: 2011 Regional Rail Study completed by Dr. Robert Leachman, Leachman and Associates, LLC for SCAG

FIGURE 8 Schematic of Modified Status Quo Routing of Union Pacific Trains



Source: 2011 Regional Rail Study completed by Dr. Robert Leachman, Leachman and Associates, LLC for SCAG

A complete description of the various routing alternatives considered can be found in the 2011 Regional Rail Simulation Study. One option studied was the Modified Status Quo (**FIGURE 8**). Operations west of Pomona are the same as in the Status Quo (i.e., most UP trains follow a one-way loop westbound on the Alhambra Subdivision and eastbound on the Los Angeles Subdivision). East of Pomona, however, trains that do not have to use the Los Angeles Subdivision are routed via the Alhambra Subdivision from Pomona to West Colton. The Modified Status Quo alternative reduces the total through-train counts in 2035 through downtown Riverside and downtown San Bernardino by 41 and 10 trains, respectively. This alternative concentrates about 92 percent of UP through-train movements via West Colton versus only 8 percent via the UP Los Angeles Subdivision through Riverside.

There are a number of key advantages to the Modified Status Quo routing scenario:

- Routing trains via the UP Los Angeles Subdivision involves use of trackage rights over the BNSF San Bernardino Subdivision between Colton Crossing and West Riverside. This is the most heavily utilized line segment in the Los Angeles Basin. Expansion of the capacity of this segment to accommodate 2035 traffic levels is relatively difficult and expensive under the Status Quo alternative, requiring a fourth main track plus flying junctions to enter and exit BNSF tracks. Moreover, double tracking the remaining portions of the UP Los Angeles Subdivision would be very costly, involving duplication of the lengthy Santa Ana River Bridge and significant property-taking and earth removal in Riverside.
- The cost of main line rail improvements under Modified Status Quo routing is $670 million less costly than the improvements needed under Status Quo routing. Expansion of capacity along the UP Alhambra Subdivision between West Colton and Pomona is much less costly and is consistent with UP's stated capital investment plans.

- Shifting UP trains operating between Cajon Pass and Pomona off the BNSF line and the UP Los Angeles Subdivision and onto the UP Mojave and UP Alhambra Subdivisions reduces conflicts between Metrolink commuter trains and UP freight operations.

For these reasons, the main line track improvements in the 2012–2035 RTP/SCS update are associated with the Modified Status Quo alternative. It is recognized, however, that only UP controls the actual routing of UP trains. While neither BNSF nor UP have committed to route trains as assumed in the study, UP investments to date suggest that the Modified Status Quo represents their plans.

Estimated costs of the recommended main line track improvements are shown in **TABLE 9**. The Colton Crossing rail-to-rail grade separation (already programmed with state, federal, and private funds) involves elevating the east-west Union Pacific tracks over the north-south BNSF line. This project is funded by a $33.8 million TIGER[34] I grant, $91 million from Prop 1B TCIF,[35] and railroad funds.

Improvements to the BNSF Cajon Subdivision include installing a third main track and a fourth main track on specific segments, exceptional earthmoving, crossovers, and bridges across multiple culverts.

Improvements to the BNSF San Bernardino Subdivision include a third main track, as well as a fourth main track along the Hobart to Fullerton segment. Caltrans has provided $121.8 million for the triple tracking from Serapis (MP 151.1) to Valley View (MP 158.7).

Improvements to the UP Mojave Subdivision include a second main track over a key segment and a "flying junction" at Rancho (West Colton).

Improvements to the UP Alhambra Subdivision include double tracking key segments and route connections in Pomona.

34 Transportation Investment Generating Economic Recovery.
35 Trade Corridor Improvement Fund.

TABLE 9 Estimated Cost of Main Line Rail Improvements (Millions of Nominal Dollars)

Main Line Rail Improvements	Estimated Costs
Colton rail-to-rail grade separation–BNSF Cajon Subdivision	$243.60
Barstow to Keenbrook–BNSF San Bernardino Subdivision	$762.10
Colton Crossing to Redondo Junction–UP Mojave Subdivision	$1,188.70
Devore Road to West Colton (inc. Rancho Flying Junction)–UP Alhambra Subdivision	$522.00
West Colton to City of Industry–UP Los Angeles Subdivision	$376.10
UP Yuma Subdivision	$0
Total Main Line Rail Improvements	**$3,092.40**

Note: Estimates consistent with Modified Status Quo Alternative. Colton Crossing grade separation cost updated. Estimates have been escalated to nominal dollars using 3.2 percent annual inflation rate. Source: 2011 Regional Rail Simulation Study, SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy.

On-Dock/Near-Dock Rail Capacity Enhancements

In 2010, approximately 35 percent of the Ports' containers were shipped by rail "intact," meaning the cargo was moved by rail in marine containers without being transloaded or deconsolidated first (**TABLE 10**). An additional market segment is transloaded into 53-foot domestic containers or trailers at deconsolidation facilities in the region. The larger containers are then trucked to off-dock rail yards for loading onto trains and transported out of the region. The 53-foot wheeled trailers are also typically transported out of the region. Containers that are neither shipped by rail intact nor transloaded are trucked directly to/from local warehouses or distribution facilities.

TABLE 10 shows the percentage of direct intermodal cargo handled at on-dock and near-dock rail yards. In 2010, 23.5 percent of direct intermodal cargo was handled using on-dock rail. Containers moved using on-dock rail do not have to be trucked to/from more distant rail yards. In 2010, 11.7 percent of port containers were handled at off-dock yards (e.g., Hobart, East Los Angeles) or existing near-dock yards (i.e., ICTF). These containers must be trucked to/from these yards.

TABLE 10 San Pedro Bay Ports Direct Intermodal Volumes as a Percentage of Total Port Container Throughput (2003–2010)

	2003	2004	2005	2006	2007	2008	2009	2010
% On-Dock	15.9%	18.1%	20.7%	24.1%	23.0%	23.7%	24.6%	23.5%
% Near-/ Off-Dock	23.4%	21.2%	19.5%	18.7%	18.4%	18.5%	15.3%	11.7%
Total % Direct Intermodal	**39.3%**	**39.3%**	**40.2%**	**42.8%**	**41.4%**	**42.2%**	**39.9%**	**35.2%**
Total Throughput (POLA + POLB) Millions of TEUs	**11.8**	**13.1**	**14.2**	**15.8**	**15.7**	**14.3**	**11.8**	**14.1**

Source: Ports of Los Angeles and Long Beach

PORT AREA RAIL INFRASTRUCTURE IMPROVEMENTS

The Ports of Los Angeles and Long Beach have proposed almost $2.7 billion in rail improvements within the harbor area (**TABLE 11**). These projects are designed to facilitate an increase in on-dock rail service, to reduce railroad delay associated with train meets and passes, and to reduce conflicts with highway traffic. By allowing more on-dock rail, truck traffic between the San Pedro Bay Ports and distant rail yards can be reduced. Use of on-dock rail eliminates truck vehicle miles of travel (VMT) and associated emissions by allowing trains to be loaded and unloaded inside marine terminals.

Assuming the proposed improvements to on-dock infrastructure are made, on-dock rail is estimated to account for the movement of approximately 30 percent of all port TEUs by 2035. On-dock rail is not expected to be able to accommodate 100 percent of direct intermodal moves. It is limited by factors such as shipper/steamship line logistics (trans-loading, transportation costs, etc.), railroad operations (equipment availability, the need to generate destination-specific unit trains, train schedules, and steamship line contracts/arrangements), and terminal operation and congestion.

TABLE 11 Estimated Cost of Port-Area Rail Improvement (Millions of Nominal Dollars)

Port Area Rail Improvements (excluding SCIG and ICTF)	Estimated Costs
Port of Long Beach	
On-Dock Railyards	$765.30
Rail Infrastructure Outside Marine Terminals	$1,321.80
Subtotal Port of Long Beach	$2,087.10
Port of Los Angeles	
On-Dock Railyards	$232.80
Rail Infrastructure Outside Marine Terminals	$216.10
Subtotal Port of Los Angeles	$448.90
Alameda Corridor Transportation Authority (ACTA)	$152.40
Total Port Area	**$2,688.50**

Source: Ports of Los Angeles and Long Beach. Cost estimates in 2011 dollars were escalated for five years at 3.2 percent per year

The "Rail Infrastructure Outside Marine Terminals" category in **TABLE 11** includes the following key projects.

- On-dock Rail Support Facility on Pier B (POLB)
- Cerritos Channel Bridge (triple tracking)
- Third Track at Thenard Junction
- Reconfiguration of Control Point (CP) Mole on Terminal Island
- Reeves Avenue Grade Separation
- Wilmington Avenue Grade Separation
- Pier F Support Yard
- Terminal Island Wye
- Track Realignment at Ocean Boulevard
- Pier 400 Second Lead
- West Basin Rail Improvements

EXHIBIT 10 Regional Mainline Rail Enhancements

EXPANSION OF NEAR-DOCK RAIL

Additional lift capacity at near-dock yards is needed to accommodate projected demand and to reduce the number of truck trips to off-dock yards. Near-dock rail terminals provide rail accessibility to import and export cargo, using drayage trucks for the connection to and from port terminals. Expansion of near-dock rail will reduce truck VMT and emissions by eliminating the need to access more distant off-dock rail facilities. Two near-dock rail projects are currently undergoing environmental review: BNSF's Southern California International Gateway (SCIG) and modernization of UP's Intermodal Container Transfer Facility (ICTF). Potential benefits of these railyards include a reduction in regional VMT and therefore emissions. Without the SCIG and ICTF expansion, it is estimated that the growth in Marine IPI container volumes would require that at least 1.5 million container lifts would have to be handled at different yards throughout the SCAG region. While the number of truck trips would not be significantly changed, VMT would be reduced due to the shorter distance from the ports to the SCIG terminal (3–4 miles), versus the distance to Hobart and East Los Angeles yards terminal (20 miles). The Alameda Corridor has sufficient capacity to handle the projected increase in railroad traffic from the ICTF and SCIG. Although regionally beneficial, local congestion and emission impacts may affect the communities near the railyards. However, the ongoing environmental review process will identify these impacts and require that they be mitigated to the extent possible.

Intermodal Transfer Container Facility (ICTF)

The UP has proposed to invest $500 million in a modernization project that will increase container throughput at the ICTF even as it reduces the size of the existing facility from 277 to 233 acres. The project will include the replacement of diesel cranes and yard hostlers with electric ones as well as the addition of six new railroad tracks totaling 50,000 ft. Clean technologies will be utilized to cut facility emissions by 74 percent. An EIR is currently being prepared for this project.

Southern California International Gateway (SCIG)

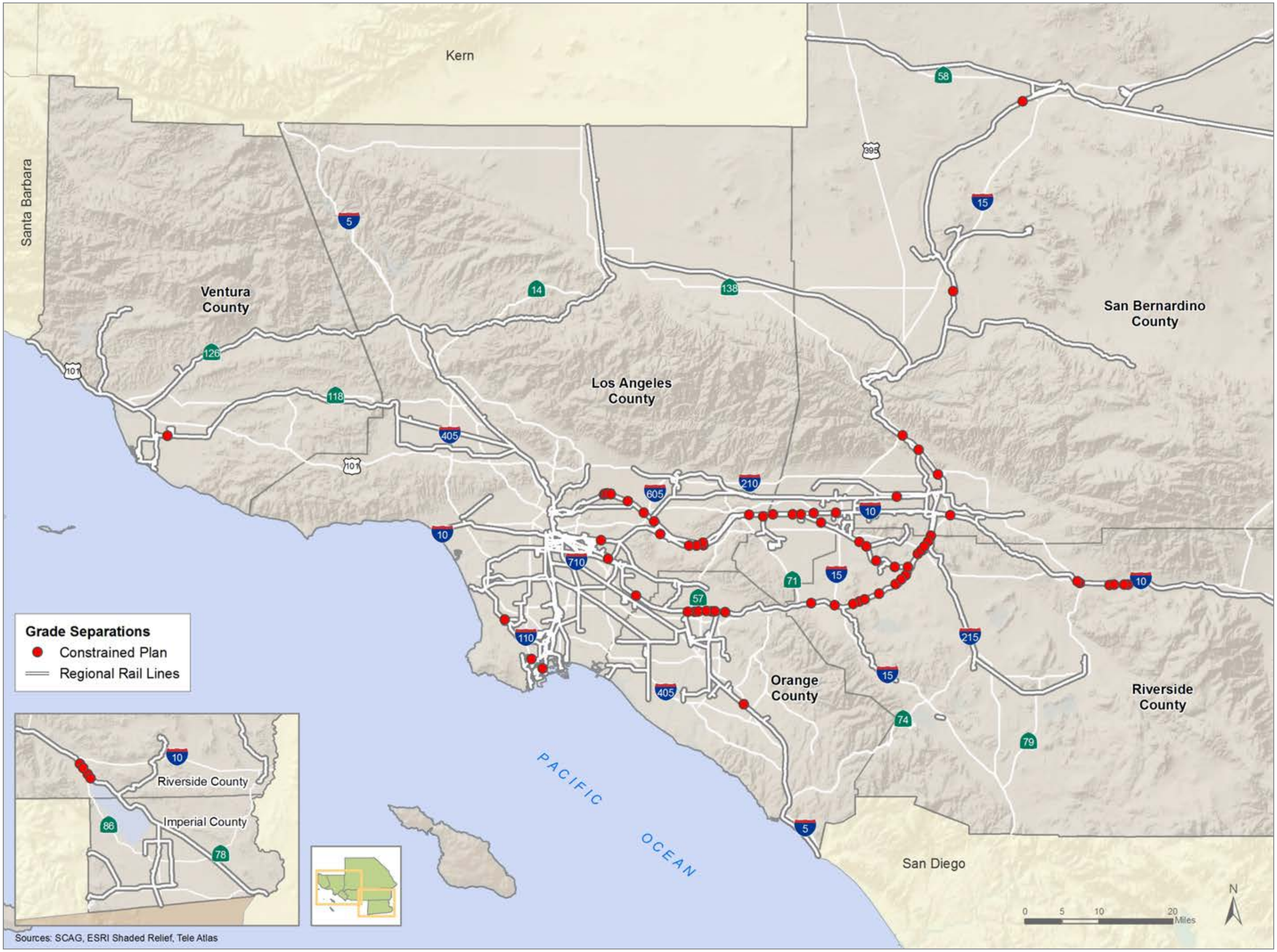
SCIG is a $500 million project that will create a new near-dock facility for the BNSF adjacent to the San Pedro Bay Ports with direct access to the Alameda Corridor. BNSF forecasts the new facility will take millions of truck-miles off regional freeways, easing congestion and reducing air pollution. Although on-dock rail capacity is expected to increase, on-dock rail expansion alone will not be sufficient to keep up with projected growth in demand. The SCIG will include the use of electric and low-emission equipment and requirements that only lower emission trucks serve the facility. The draft EIR for this project was released in September 2011.

Rail Grade Separations

Due to increasing railroad and highway traffic, vehicle delays at grade crossings are expected to increase substantially from 2010 to 2035. Allowing two intersecting axes of traffic to move concurrently, grade crossings eliminate vehicle delay and decrease associated emissions by reducing vehicle idling times. Grade separations reduce traffic congestion and delays, as well as emissions from idling vehicles, and address other critical rail crossing–related concerns such as noise and safety.

Seventy-one grade crossings throughout the SCAG region were identified for inclusion in the financially constrained 2012–2035 RTP/SCS as shown in **EXIBIT 11**. Constrained and strategic grade separation projects are included at the end of this Technical Appendix, along with constrained grade separation maps by county (**EXHIBITS B1–B6**). Another 56 projects were identified for inclusion in the Strategic Plan. The estimated costs of the grade separations in the financially constrained plan total approximately $5.6 billion.

EXHIBIT 11 Regional Grade Separations – Constrained



RAIL PACKAGE SUMMARY

As shown in **TABLE 12**, the combined rail package has been estimated to cost approximately $12.3 billion, including main line rail improvements, port area rail improvements, near-dock railyard improvements, and rail-highway grade separations.

TABLE 12 Estimated Cost of the Proposed Package of Rail Projects, by Major Category (Millions of Nominal Dollars)

Category	Estimated Costs
Main Line Rail Improvements	$3,092.40
Port Area Rail Improvements	$2,688.50
Near-Dock Railyard Improvements	$1,000.00
Rail-Highway Grade Separations	$5,568.90
Total	**$12,349.80**

BENEFITS OF THE REGIONAL RAIL STRATEGIES

The benefits of the rail strategies to the region are considerable, and include mobility, safety, and environmental gains. As shown in **TABLE 13**, these strategies could eliminate almost 6,000 hours of vehicle delay per day at grade crossings, decrease emissions (NO_X, CO_2, and $PM_{2.5}$) by almost 23,000 lb. per day, and reduce overall train delay to 2000 levels.

The capacity enhancements in the rail package would reduce delay so that it does not exceed 2000 levels and provides enough capacity to handle projected tripling of intermodal cargo at the San Pedro Bay Ports. The delay per train is reduced depending on the train type and railroad line. For instance, trains on UP lines would experience almost 50 percent less delay per train, as compared to trains on UP lines in 2000. The rail package therefore allows more cargo to move with less delay than in previous years even with expected rail volume increases.

TABLE 13 Benefits of the SCAG Regional Rail Strategy

Mobility	▪ Reduces train delay to 2000 levels ▪ Provides main line capacity to handle projected demand in 2035 (includes 43.2 million twenty foot equivalent units, or TEUs, port throughput) ▪ Eliminates 5,782 vehicle hours of delay per day at grade crossings in 2035
Safety	▪ Eliminates 71 at-grade railroad crossings
Environment	▪ Reduces 22,789 lb. of emissions per day (CO_2, NO_X, and $PM_{2.5}$ combined) from idling vehicles at grade crossings ▪ Facilitates on-dock rail ▪ Reduces truck trips to downtown railyards and associated emissions

Other Strategies

San Pedro Bay Ports Access Projects

Landside access to the San Pedro Bay Ports is provided by highway facilities, including I-110 and I-710, and the Vincent Thomas (SR-47), Commodore Schuyler Heim (SR-103), and the Gerald Desmond Bridges. The San Pedro Bay Ports have long worked with regional and state transportation planning organizations to identify and promote projects that will alleviate congestion to and from port areas and improve air quality in the region.

Some key projects to improve direct access to the San Pedro Bay Ports are already underway, including:

- The Gerald Desmond Bridge replacement – The bridge, which has been designated as a National Highway System Intermodal Connector Route and part of the Strategic Highway Network, carries nearly 15 percent of the nation's waterborne cargo and is a critical access route for the Port of Long Beach, the Port of Los Angeles, downtown Long Beach, and surrounding communities. A final EIR for the bridge replacement was recently certified by the POLB Board of Harbor Commissioners and the California Department of Transportation (CALTRANS). They have identified the North-side Alignment Alternative as the preferred alternative linking Terminal Island to I-710. This project is important, as it improves the safety of the bridge, which was previously deemed to be seismically deficient. In addition, the new bridge will be able to accommodate increased vehicular and vessel traffic. Moreover, the new bridge will provide additional vertical clearance for vessels passing through the Back Channel to the Inner Harbor.
- The I-110/SR-47 Connectors Improvement Program is composed of three major projects that will improve freeway access to port facilities and surrounding neighborhoods, reduce congestion and conflicts between truck and rail traffic, and improve safety. The port has already begun collecting public comments on this project.
- The Schuyler Heim Bridge Replacement and SR-47 Expressway Project includes replacement of the seismically deficient bridge and development of a truck expressway that will transport port truck traffic on an elevated structure from the new bridge 1.7 miles northwest to Alameda Street. This project is already in the design phase. This project will improve safety (by bypassing three signalized intersections and five rail at-grade crossings) and reduce congestion and delay at many of the Port of Los Angeles' terminals.
- South Wilmington Grade Separation. This project will eliminate the conflict between vehicular traffic and two existing at-grade railroad crossings and provide unimpeded grade-separated vehicular access to the South Wilmington area (including for emergency vehicles), eliminate truck queues on surrounding streets, reduce accidents, and improve safety in the area.
- C Street/I-110 Access Ramp Improvements. This will consolidate two closely spaced intersections and improve connectivity to Figueroa Street and Harry Bridges Boulevard and access to several shipping terminals.
- I-110/SR-47 Interchange & John S. Gibson Intersection/NB I-110 Ramp Access. This project will provide an additional lane from the SR-47 connector to NB I-110 and extend the existing off-ramp at John S. Gibson Boulevard. It will eliminate weaving between the slow-moving, on-ramp traffic from San Pedro and the fast-moving bridge traffic from Long Beach to improve the connection between SR-47 and the I-110 Freeway.

Port of Hueneme Access Projects

In addition to the Ports of Los Angeles and Long Beach, the SCAG region is also home to the Port of Hueneme in Ventura County. Although smaller, the Port of Hueneme supports important economic activities in the region, generating over $650 million for Ventura County's economy every year and supporting 4,500 jobs. The Port of Hueneme Harbor District estimates that $7 billion in trade moves through the port annually. Unlike the San Pedro Bay Ports, the Port of Hueneme does not focus on containerized cargo. Instead, its primary imports and exports are refrigerated goods and produce, automobiles, bulk cargo, and fuels.

Data collected in 2008 indicated that the Port of Hueneme generated approximately 25 percent of truck trips in areas close to the Port. Many of these trucks use the interchanges close to U.S. 101. Average daily traffic counts of heavy-duty trucks on local routes range between 400 and 2,600 trucks per day. In a 2008 study, six out of 25 intersections evaluated had a level of service (LOS) grade of D or F in the AM and PM peak periods.

As residential areas expand into previously agricultural areas in Ventura County, a greater number of people will be exposed to noise, vibration, and pollution impacts of truck traffic along key routes. Encouraging trucks to remain on truck routes through additional signage or restrictions and strategic design of proposed developments can reduce these impacts.

The following projects and strategies are among those anticipated to reduce truck congestion and other impacts:

- Hueneme Road widening between Ventura Road and Rice Avenue
- Reconfiguring the interchange at Rice Avenue and U.S. 101
- Rice Avenue UP Grade Separation
- Rose Avenue UP Grade Separation
- SR-118/Coast Line Grade Separation Maintain Port Hueneme Road/Hueneme Road and Rice Avenue as the primary truck access corridors to the Port of Hueneme and encourage trucks to use this route through additional signage

Imperial County International Ports of Entry

As discussed previously, international border crossings between the U.S. and Mexico in Imperial County are critical components of the freight transportation system in Southern California. Within Imperial County, the three ports of entry (POEs)–Calexico West-Mexicali I, Calexico East-Mexicali II, and Andrade-Los Algodones–accounted for over $10 billion in international trade in 2010.[36]

While most goods in Imperial County move by truck, the border areas also are served by the UP and Carrizo Gorge Railway (CGR). The Calexico East border crossing is the only international rail crossing in the SCAG region and provides the only rail connection from California into Central Mexico.

According to the Overall Economic Development Commission (OEDC), there are a number of challenges in Imperial County that could constrain future economic development.[37] A significant concern is the lack of adequate transportation infrastructure, especially at the U.S.-Mexico border. Some of the most noticeable gaps in the county's truck network include:[38]

- The lack of direct freeway connections to railyards and intermodal facilities;
- The lack of dedicated truck lanes, passing lanes, and truck bypass routes;
- High truck traffic through urban areas including Brawley and Westmorland; and
- Empty trucks returning to Mexico after unloading their cargo in Calexico.

Key transportation strategies identified to date to improve the flow of goods in the area include:

- Improving interchanges and developing bypasses to the "main streets" in the region
- The Brawley Bypass (SR-78/SR-111) (an eight-mile, four-lane divided expressway connecting SR-86 north of Brawley to 1.5 miles south of the eastern junction of SR-111 and SR-78)–expected completion in 2013.
- The I-8/Imperial Avenue Interchange reconstruction and Imperial Avenue Extension projects in the City of El Centro and expansion of the Calexico East POE

High Desert Corridor

Some trucks in the region traverse SR-138, linking the Antelope and Victor Valleys. However, SR-138 currently lacks adequate infrastructure to handle heavy truck volumes. The proposed High Desert Corridor between I-15 and I-5 is anticipated to accommodate an expected three- to six-fold increase in traffic, providing a new level of accessibility, carrying trucks and other through traffic.

Truck Climbing Lanes

Additional highway projects that would facilitate goods movement activities in the region include truck climbing lanes. Examples of corridors identified suitable for truck climbing

[36] The vast majority of goods traded between the U.S. and Mexico through Imperial County are transported through the Calexico East-Mexicali II port of entry, including nearly all Mexican imports to the U.S. amongst these POEs. The Calexico West-Mexicali I and Andrade-Los Algodones POEs serve significantly less commercial traffic, handling only exports from the U.S. to Mexico.

[37] Imperial County (2009), Planning and Development Services Department, Comprehensive Economic Development Strategy 2008–2009, September 2009.

[38] Imperial Valley Association of Governments (2008), Imperial County 2007 Transportation Plan Highway Element. Prepared by KOA Corporation, March 2008.

lanes and currently programmed with funding and/or under construction include I-15, SR-57, and SR-60. Truck climbing lanes are additional lanes located outside mixed-flow lanes, which permit slower-moving trucks to operate at their own pace. This enables other vehicles to move at a faster pace, thereby reducing congestion. These lanes are typically placed where slow-moving trucks would cause an obstruction to other vehicles, such as hillsides or other areas with significant grade increases.

Goods Movement Environmental Strategy

EXISTING AND PROJECTED ENVIRONMENTAL CONDITIONS

It is a regional priority to reduce and mitigate the environmental impacts of moving goods through our region. Ships, trucks, trains and other goods movement equipment are among the largest contributors to regional air pollution, which must be reduced to comply with federal law. Freight emissions contribute to local health risks, which have raised community concerns and opposition, challenging some freight infrastructure projects. Criteria pollutants such as as NO_X, $PM_{2.5}$, SO_X, and CO can have significant public health impacts, including asthma and other respiratory ailments, increased stress, and increased cancer risk. In addition, noise, safety issues, aesthetic changes, vibrations, and natural resource depletion impact quality of life and may have health implications. Freight transport is also a major producer of greenhouse gas emissions and a user of energy in the form of diesel fuel; cleaner sources of secure, reliable energy must be part of the solution.

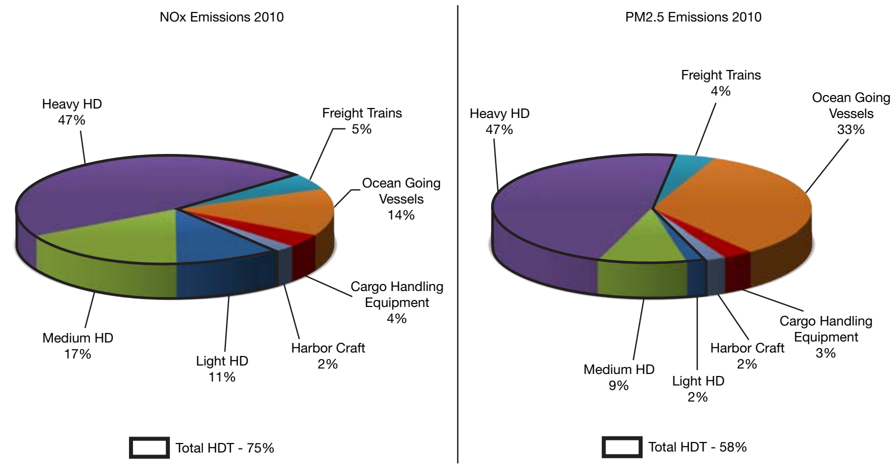
Much of the SCAG region does not meet federal ozone and fine particulate air quality standards as mandated by the federal Clean Air Act. NO_X released from goods movement activities combines with volatile organic compounds (VOCs) in the atmosphere to form ozone pollution. In the South Coast Air Basin,[39] there is a strict deadline to reduce ozone concentrations to 80 parts per billion (ppb) by 2023 with a future deadline of 75 ppb by approximately 2031.[40] Failure to adopt sufficient measures to attain these standards in a timely manner will trigger federal sanctions such as curtailment of transportation funds. To attain the federal ozone standards, the region will need broad deployment of zero-and near-zero-emission technologies in the 2023 to 2035 timeframe.

39 Los Angeles, Orange, and non-desert portions of Riverside and San Bernardino Counties.

40 The attainment deadline for the 75 ppb standard (adopted in 2008) has not yet been established by U.S. EPA, but is expected to be by approximately 2031.

Goods movement sources include trucks, locomotives, cargo handling equipment, marine vessels, and aircraft. These sources, combined with all mobile sources in the region, emit approximately 90 percent of regional NO_X.[41] Currently, heavy-duty trucks contribute 58 and 75 percent of $PM_{2.5}$ and NO_X emissions, respectively, and locomotives contribute 4 and 5 percent, respectively, from goods movement related sources. **FIGURE 9** shows the distribution of emissions from various goods movement sources.

FIGURE 9 Goods Movement NO_X and $PM_{2.5}$ Emissions in SCAB by Source



Source: ICF analysis based on EMFAC 2007 (modified for recession effects), ARB regulatory documents for marine fuel requirements, ARB emission inventory, ARB Goods Movement Plan, ARB and U.S. EPA locomotive analyses. Work completed for SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy.

Goods movement activities are also a source of GHG emissions. Although a reduction in goods movement related GHG emissions is not required under SB 375, which focuses solely on light-duty vehicle emissions, the State has established GHG reduction goals under AB 32 as have a number of local governments. Several measures have been passed by the EPA and the California Air Resource Board (CARB) to reduce GHG from heavy-duty

41 South Coast Air Quality Management District, The Need for Zero-Emission Technologies, presentation for Zero-Emission Transportation and Roundtable Discussion, April 20, 2011.

trucks and rail. Despite reductions attributable to these measures, GHG from heavy-duty trucks in the SCAG region are expected to increase by 30 percent from current levels by 2023 and 60 percent from current levels by 2035. GHG emissions from rail in the South Coast Air Basin (SCAB) are expected to increase by 50 percent from 2010 levels by 2023 and by 123 percent from 2010 levels by 2035.[42]

Heavy-duty trucks are usually powered by diesel, which contributes to regional NO_X and PM emissions. As shown in **TABLE 14**, federal and state regulations will contribute to a decrease in NO_X and $PM_{2.5}$, but as VMT increases, these gains become relatively smaller over time. In addition, these regulations do not lead to reductions in CO_2 emissions. In the 2008 RTP, recommendations for truck emissions strategies included truck replacement, engine repowering, exhaust treatment device retrofits, and alternative fuels. CARB's truck and bus regulation, as well as state and local incentive programs, were put into place to accelerate the introduction of cleaner technology.[43] By 2023, nearly all HDVs will be model year 2010 or newer. But further reductions in truck emissions are critical to the region's air quality and must come from the introduction of advanced technology HDVs.

TABLE 14 Percent Change in Truck Emissions from 2010 Measurements (Tons per Day)

	2010 (Tons per Day)	2023	2035
NO_X	352.59	-67%	-58%
$PM_{2.5}$	12.00	-65%	-53%
CO_2	64,319	30%+	60%+

Source: SCAG Regional Comprehensive Goods Movement Study

It is a regional priority to reduce rail pollutants and work toward the objective of a zero-emission freight rail system as well. Reduction of emissions from rail would help eliminate pollution hotspots and would improve associated health impacts in neighboring communities. At the federal level, regulations are in place that will contribute to future reductions in rail emissions, including the U.S. EPA Locomotive Engine Standards, the 2008 EPA rulemaking to reduce locomotive idling, and the EPA non-road locomotive and marine (NRLM) fuel sulfur rule. At the state level, the CARB has passed an intrastate locomotive fuel use regulation and has several agreements with the railroads such as a 1998 MOU between CARB and the railroads to accelerate Tier 2 locomotive use and a 2005 agreement to reduce railyard emissions. In addition, the CARB is finalizing a series of 2010 commitments that will further reduce diesel $PM_{2.5}$ at four high-priority railyards. These regulations will lead to a reduction in $PM_{2.5}$ emissions and a smaller reduction in NO_X emissions, as shown in **TABLE 15**. These regulations, however, do not address reductions in CO_2 emissions.

TABLE 15 Percent Change in Rail Emissions from 2010 Measurements (Tons per Day)

	2010	2023	2035
NO_X	16	-3%	-18%
$PM_{2.5}$	0.62	-47%	-61%
CO_2	1,313	50%+	123%+

Source: SCAG Regional Comprehensive Goods Movement Study

42 SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy.

43 Regulations such as the California truck and bus rule that requires all trucks to have a 2010 or cleaner engine by 2023; HHDT GHG regulation; truck idling limit; low carbon fuel standard, and the EPA's HDV fuel economy and GHG standards will contribute to a decrease in truck emissions over time.

In the South Coast Air Basin, attaining the national ozone standards will require reductions in emissions of nitrogen oxides (NO_X) well beyond reductions resulting from current rules, programs, and commercially-available technologies.[44] Because most significant sources are already controlled by over 90 percent, attainment of the ozone standards will require broad deployment of zero- and near-zero-emission[45] technologies in the 2023 to 2031 timeframe. With the projected changes in both truck and rail emissions, greater advancements in technology are needed to meet regional attainment objectives. As such, the 2012–2035 RTP/SCS includes an action plan to facilitate technology development and reduce emissions.

This RTP Goods Movement Environmental Strategy was developed to address community health concerns, federal attainment requirements, and climate change issues, while contributing to our economic and energy security goals. Accordingly, the strategy emphasizes coordinated solutions for mobility, economy, energy, and environment so that investments can provide multiple benefits. A two-pronged approach for achieving such a strategy is identified. For the near term, the regional strategy supports the deployment of commercially available lower-emission trucks and locomotives while centering on continued investments in improved system efficiencies. In the longer term, the strategy focuses on taking critical steps now toward phased implementation of a zero- and near-zero emission freight system. This includes planning for new infrastructure to incorporate evolving technologies—to fuel vehicles as well as to charge batteries and provide power.

44 Preliminary SCAQMD projections indicate a need to reduce regional NO_X emissions by about two-thirds by 2023 and three quarters by approximately 2030. South Coast Air Quality Management District, The Need for Zero-Emission Technologies, presentation for Zero-Emission Transportation and Roundtable Discussion, April 20, 2011.

45 The term "near zero-emissions" refers to emissions approaching zero and will be delineated for individual source categories through the process of developing the Air Quality Management Plan/State Implementation Plan. Based on current analyses, on-land transportation sources will need to achieve zero-emissions where possible, and otherwise will need to be substantially below adopted emission standards-including standards with future effective dates. Near-zero-emissions technologies can help meet this need, particularly if they support a path toward zero emissions (e.g., electric/fossil fuel hybrids with all-electric range).

GOODS MOVEMENT ENVIRONMENTAL STRATEGY AND ACTION PLAN

In order to implement this strategy with both near-and long-term objectives, the 2012–2035 RTP/SCS includes a four-phased action plan with key milestones. This plan calls for collaborative decision-making about how to advance research, development, and deployment of new technologies and expands on the use of existing technologies. Where needed, evaluation will be conducted to better understand costs and operational impacts to guide decision-making. The timeline for this action plan is shown in **FIGURE 10**. The four phases of the action plan are:

Phase 1 – **Project Scoping and Evaluation of Existing Work**

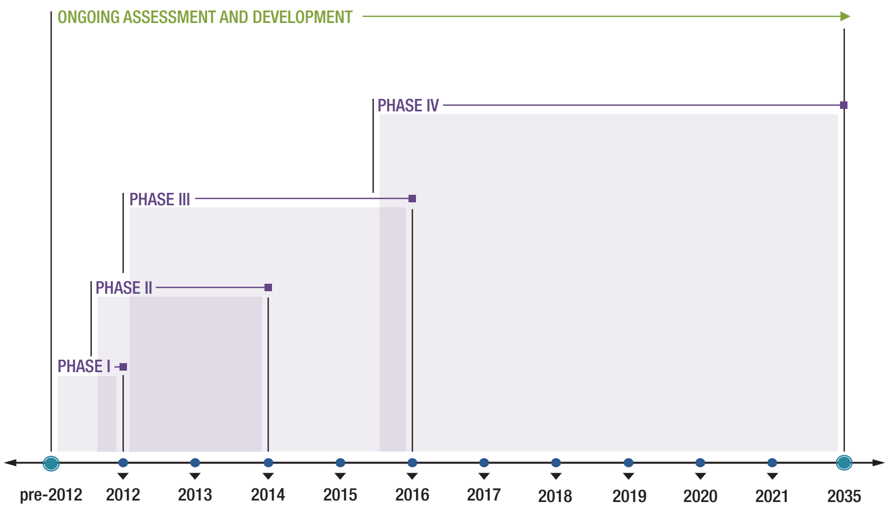
Phase 2 – **Evaluation, Development, and Prototype Demonstrations**

Phase 3 – **Initial Deployment and Operational Demonstration**

Phase 4 – **Full-Scale Demonstrations and Commercial Deployment**

The phases above provide a structured means to further develop, evaluate and deploy the technologies that will help the region to meet the objective of a zero-emissions goods movement system. The timeframe represents an estimation of when various technologies may be available for full deployment. However, the development and evaluation process may vary depending on the technology. As this plan is technology neutral, this proposed timeline serves as a general framework for making the decisions necessary to advance technology in the region. It is acknowledged that the timeframe may be subject to further revisions as additional information about specific technologies becomes available with further research and development as well as stakeholder input. The ability to create partnerships and procure funding for research and development efforts may help to accelerate the timeline for specific technologies. As explained below, this plan of technology development, evaluation and eventual deployment will be undertaken in close cooperation with all goods movement stakeholders.

FIGURE 10 Timeline to Implement a Zero-and Near-Zero-Emission Freight System



- 2012 – Identify potential funding to support truck, wayside power, and rail evaluation and prototype demonstration efforts; incorporate into financially constrained RTP
- 2012 – Implement plan of advocacy to secure action by federal or other governments
- 2012–2013 – Continue to evaluate truck technology implementation and funding mechanisms; initiate testing of zero-emission container movement system along the Terminal Island Freeway and connecting routes to the Ports (or alternative routes serving the same locations)
- 2012-2013 – Continue to evaluate practicability of applying electrified rail or other zero-/near-zero-emission technologies, and evaluate funding and implementation mechanisms
- 2015–2016 – Resolve need for wayside power for trucks (in 2015) and incorporate decisions on wayside power and technology direction, including strategy, funding, and timeframe into 2016 RTP update and SIP revisions; if existing rail technologies are practicable for freight, identify technologies, infrastructure, and implementation mechanisms in RTP update and SIP
- 2015–2020 – Begin deployment of appropriate zero- and near-zero-emission trucks and continue operational demonstration
- 2018–2020 – If existing rail applications were determined not practicable for freight, resolve need for wayside power for new rail technologies (in 2018) and incorporate planning into the 2020 RTP and next major SIP
- 2017–2035 – Full deployment of appropriate zero-and near-zero-emission trucks for substantially all regional transport; if existing electrified rail technologies can be practicably applied to the region, fully deploy such technologies

ACTION PLAN FOR ADVANCEMENT OF ZERO-EMISSION TECHNOLOGY

Phase 1: Project Scoping and Evaluation of Existing Work

Key Action Step:

- Continue to research goods movement user-markets and associated infrastructure needs while exploring a range of technologies as appropriate with equipment manufacturers

The first phase of this environmental strategy has already been initiated through the cooperative efforts of regional stakeholders. Our long-term objective of an economically viable zero-emission freight transport system requires continued coordinated efforts and funding from multiple stakeholders. In addition to the work SCAG has recently undertaken with the Comprehensive Regional Goods Movement Plan and Implementation Strategy, other organizations such as the Ports of Long Beach and Los Angeles, CALSTART, and Los Angeles County Metro are working toward the objective of zero-emission freight transport.[46] [47]

Over the last several years, numerous studies have evaluated our regional transportation corridors that carry high volumes of freight truck traffic. Recent assessment of the I-710 corridor identifies key freight segments as high priority for the introduction of zero-emission technology.[48] Selection of an east-west freight corridor and evaluation of the potential regional penetration of zero-and/or near-zero-emission technology are ongoing additional priorities.

Additionally, significant effort has gone into analyzing the options for a zero- and/or near-zero emission rail system in the Basin. These include recent efforts by the Ports of Los Angeles and Long Beach in their Roadmap study[49] and by SCAG in the freight rail electrification report.[50] Each of these efforts highlights the technical opportunities and the need to pursue a zero-emission freight transportation system for the future. However, they also highlight the difficult challenges associated with this sector, especially with regard to operational needs, integration of the technologies into the national rail system, federal safety requirements, and costs. These challenges will be addressed through various phases of the environmental strategy. Further discussion of potential technologies for locomotives and trucks are addressed in later sections of this appendix.

Phase 1 requires the continued effort of various stakeholders to work through the technical, operational, practical and financial issues to define a long-term zero-emission freight system for the SCAG region. This scoping work will be done by the conclusion of 2012, however communication among stakeholders about various regional efforts will continue throughout the technology development process.

Phase 2: Evaluation, Development, and Prototype Demonstrations

Key Action Steps:

- Convene logistics working groups
- Determine a set of market criteria to move truck vehicles forward to successful commercialization.
- Secure funding commitments for the development of vehicle prototypes and infrastructure demonstrations
- Advance pathway technologies through regulatory, financial, and marketing mechanisms
- Develop and demonstrate truck and truck wayside power prototypes

46 Port of Long Beach and Port of Los Angeles, *Roadmap for Moving Forward with Zero-Emissiona Technologies at the Ports of Long Beach and Los Angeles*, Technical Report, August 2011.

47 California Hybrid, Efficient and Advanced Truck Research Center (CalHEAT), *Vehicle and Technologies Characterization and Baseline*. Draft Report. January 31, 2011.

48 Los Angeles County Metropolitan Transportation Authority, *Alternative Goods Movement Technology Analysis-Initial Feasibility Study Report. Final Report. I-710 Corridor Project EIR/EIS*. Prepared by URS. January 6, 2009.

49 Port of Long Beach and Port of Los Angeles, *Roadmap for Moving forward with Zero-Emission Technologies at the Ports of Long Beach and Los Angeles*, Technical Report, August 2011.

50 Southern California Association of Governments. *Task 8.2 Analysis of Freight Rail Electrification in the SCAG Region*, Technical Memorandum. Draft Version, Prepared by Cambridge Systematics, August 26, 2011.

- Further study operational impacts of zero-emission rail technologies
- Evaluate practicability of applying existing electrified rail technologies
- Select truck technologies for continued fleet evaluation under Phase 3
- Identify vehicle technologies and wayside power applications to be tested under operational demonstrations in Phase 3

Phase 2 involves the development, design validation, and initial demonstration of several types of advanced prototype vehicles (trucks). Phase 2, and Phase 3 if necessary, also includes initial proof of concept and testing of several types of zero-emission locomotive technologies and supporting infrastructure.

To foster regional collaboration during this phase, a logistics working group will be convened to assess logistics decisions and efficiencies as they relate to changes with a long-term freight system. Two additional groups will be formed, one to focus on trucking, the other on rail. One responsibility of these groups will be to collaborate with public and private partners to secure funding commitments for the development of vehicle prototypes and infrastructure demonstrations. These groups may overlap with or draw upon membership from existing regional forums. For instance, the Southern California National Freight Gateway Collaboration provides a forum composed of leaders from regional transportation as well as state and federal resource agencies. One mission of this group is to advocate for a first-class goods movement system and the funding necessary to support such a system.

Phase 2 includes performance assessment of new technologies, including addressing market risks/uncertainties. As prototypes are developed and demonstrated, significant evaluation will also occur. For instance, a truck corridor market mechanism study will assess effective models for financial and regulatory structures to support and enable zero- and/or near-zero-emission truck commercialization and widespread deployment. Models may include incentives, buy-down rebates, preferred or exclusive access to port service, exclusive or preferred access to corridors, regulatory inducements, etc. Truck manufacturers and technology developers will be included to determine a set of market criteria–minimum market size and volumes of vehicles needed to move forward to successful commercialization.

For rail, uncertainties associated with new technologies would be addressed through a rail operational assessment study that evaluates the potential operational impacts of a zero- and/or near-zero rail system both within the Basin and on the larger national freight railroad system. This study would build on the work of SCAG's 2011 Rail Electrification Study, but would further clarify total capital and operating costs for such a system. Because overhead catenary systems have already been proven for passenger and some freight applications, this study would also evaluate the practicability of utilizing existing technologies for rail service.

For rail technologies, initial demonstration would include technology optimization along prescribed routes under conditions applicable to goods movement activities. An initial step in Phase 2 or Phase 3 if necessary, would entail creating a test track to allow for the demonstration of various technologies to move containers. For rail prototypes, basic performance requirements include, but are not limited to, sufficient tractive power to haul a double-stacked railcar, adequate braking capability and other parameters to support safe operation, and the ability to operate in zero-emission mode.

For trucks, certain pathway technologies are currently available but have had limited applications to date. For example, plug-in hybrid technologies are being demonstrated in parcel delivery and utility bucket truck applications; these systems could be scaled to larger vehicles for drayage and local service.

Additionally, the 2012–2035 RTP/SCS includes demonstration and initial deployment for zero-emission truck technologies along the Terminal Island Freeway and connecting routes to the Ports, (or alternative routes serving the same locations.) The shorter distance (approximately 5 miles) reduces technological and cost obstacles and is an important part of the initial effort to develop a regional zero- and/or near-zero freight transportation system. Please see the text box for more information on this important near-term project.

At the conclusion of Phase 2, efforts would be evaluated and technologies selected to continue into Phase 3.

Phase 3: Initial Deployment and Operational Demonstration

Key Action Steps:

- For trucks, scale up efforts to develop, deploy, and evaluate full truck fleets
- Demonstrate wayside power and ability for multiple trucks to enter, exit, and be powered on a corridor
- Conduct advanced technology locomotive demonstrations on test tracks that have sufficient length, switches, and grades to validate operational feasibility within the Basin
- Move the most promising technologies to initial demonstration of operational service
- Select advanced locomotive technologies for Phase 4 initial deployment
- Select truck technologies and infrastructure for Phase 4 deployment and incorporate needed infrastructure into financially constrained RTP for high-priority corridors

In Phase 3, technologies that have been advanced by the Logistics Working Group will be further tested in an operational demonstration. This phase entails initial deployment of multiple vehicles or test tracks as appropriate, with on-going data collection and analysis for rapid iterative design improvement.

Phase 4: Full Scale Demonstrations, Commercial Deployment, and Infrastructure Construction (if wayside power is needed)

Key Action Steps:

- Continue to launch and expand commercialization of zero-emission trucks using regulatory and market mechanisms identified in prior phases
- Continue expanding plans for any needed wayside power infrastructure along high-priority corridors (e.g., the East-West Freight Corridor)
- Foster integration of advanced technologies into regional transportation networks
- Advance rail technologies from small-scale demonstration to full-scale demonstration in operational service, as locomotive technologies will likely require additional field demonstrations prior to full commercialization
- Coordinate locomotive technology deployment with any needed infrastructure improvements

The prior stages of technology testing and demonstrations will have prepared the region for Phase 4 deployment using the commercialization, regulatory, and market steps determined in prior phases. Any new technology deployment must be coordinated with infrastructure planning, and key decisions will be incorporated into RTP updates and future SIP revisions. During Phase 4, technologies will be deployed as they meet the criteria for deployment established by regional stakeholders. As various technologies are currently in different stages of readiness, it is assumed that their deployment will be staggered throughout Phase 4.

Near-Term Zero-Emission Technology Demonstration and Initial Deployment

Description: This project is for near-term demonstration and, if successful, initial operational deployment of zero-emission trucks receiving wayside electric power.

Location: The project will be located in Los Angeles County along the Terminal Island Freeway and connecting routes to the Ports, (or alternative routes serving the same locations).

Schedule:

- By 2013 – Demonstration: Develop and build trucks and wayside power infrastructure sufficient for demonstration within the transport corridor consisting of the Terminal Island Freeway and connecting routes to the Ports (or alternative routes serving the same locations); commence demonstration upon completion of trucks and infrastructure.
- By 2015 – Initial Operational Deployment: Build wayside power infrastructure sufficient for operation on the Terminal Island Freeway and connecting routes to the Ports (or alternative routes serving the same locations), and build maximum number of trucks for initial operational deployment allowed by available funding (with all feasible leveraging of private resources), unless a zero-emission technology not utilizing wayside power is determined to be superior and can be implemented in a similar or earlier timeframe. In the latter case, remaining funds allocated to this project will be applied to demonstration and deployment of zero-emission trucks not utilizing wayside power.

Cost: Project cost is $35 million, for both demonstration and initial operational deployment phases. This includes construction of infrastructure, design and build of demonstration trucks, and acquisition of a small fleet for initial operational deployment.

Funding: AQMD will actively partner in supporting this effort by providing available funding for vehicle technology or infrastructure (staff will make a proposal to the AQMD Board in 2012), seeking funding partners, and developing other support. Additionally, SCAG will work with local transportation agencies, the Ports, and other private and public stakeholders in 2012 to identify funding for this project. Other potential co-funding sources include:

- California Energy Commission AB 118 program
- California Air Resources Board
- California greenhouse gas cap and trade auction revenues
- Federal grants
- In-kind contributions and public private partnerships with technology developers, drayage companies, etc.
- Funds available for project mitigation

Project Rationale: The Ports, vehicle manufacturers, and other entities are currently demonstrating new zero-emission truck technologies, including battery-electric, fuel-cell, and hybrid-electric trucks with all electric range (AER). The purpose of this project is to demonstrate and initially deploy wayside power technology to provide power to these and other types of vehicles along certain high-volume corridors, thus allowing extended zero-emission range. Wayside technology has been used for many decades to power electric buses, mining trucks, and rail systems. It is thus a particularly proven and promising technological approach to achieving zero-emission transport. If coupled with hybrid AER technologies currently in use for passenger cars and now being demonstrated for heavy trucks, wayside power could provide flexibility, range, and compatibility with current port, railyard, and warehouse operations. Hybrid AER trucks could produce zero-emissions along key high-volume corridors (e.g. Terminal Island Freeway, I-710, east-west freight corridor), but could operate off the electrified corridor powered by conventional natural gas or diesel fuels, by fuel cells, or—within certain range—by batteries. Such vehicles thus could provide zero emissions where most needed, and would have range to travel long distances in other modes. The Terminal Island Freeway corridor, as a short, high-volume transport corridor with substantial air pollution impacts to local communities, is an important and ideal venue to initially deploy such technology. Deployment of wayside power technology is compatible with, and builds upon, the current Port efforts to develop and demonstrate electric and hybrid-electric trucks.

AGENCY ROLES AND RESPONSIBILITIES FOR ACTION

TABLES 16 and **17** describe the actions needed by SCAG and its air quality partner agencies to develop plan revisions and implementation mechanisms (e.g. funding and regulatory mechanisms) to deploy zero and near-zero-emission truck and rail technologies as part of a long-term freight system that meets the performance objectives described earlier. These actions will be made through an open process with the collaboration of our stakeholders.

TABLE 16 Trucks: Agency Major Implementation Actions

Year(s)	Agency	Agency Action
2012	SCAG	▪ Incorporate "footprint" for regional truck lanes to accommodate potential use of wayside power in financially constrained 2012 RTP ▪ Include funding to support truck and wayside power evaluation and demonstration efforts into financially constrained RTP See text box for more information. ▪ Implement plan of advocacy to secure action by federal or other governments where required to implement any related elements of the SIP or RTP; include evaluation of impacts of zero- and/or near-zero-emission technologies on national priorities, (e.g. energy security, energy cost certainty, interstate transportation, climate protection).
2012–2014	SCAG, with AQMD/ARB on SIP, other transportation agencies and private sector partners on demonstration and funding efforts	▪ Evaluate potential truck technology implementation and funding mechanisms, including: regulatory requirements; incentives (local, state, federal, interstate cooperative); differential tolls; and public-private partnerships ▪ Evaluate potential funding mechanisms for truck infrastructure (e.g. wayside power), including federal, state, local government funding; tolling; public-private partnerships; and electric utility funding of corridor construction ▪ Demonstrate trucks and wayside power infrastructure sufficient along the Terminal Island Freeway and connecting routes to the Ports, (or alternative routes serving the same locations)

2015	SCAG, with AQMD/ARB on SIP, other transportation agencies and private sector partners on demonstration and funding efforts	▪ Resolve need for wayside power infrastructure for trucks on I-710 and other corridors beyond near-dock rail yards, including East-West Freight Corridor; decision would be based upon whether zero-and near-zero-emission technologies would have sufficient range without wayside power; if wayside power is needed, incorporate such technology description into RTP constrained plan and next major SIP
		▪ Build wayside power infrastructure sufficient for operation along the Terminal Island Freeway and connecting routes to the Ports, (or alternative routes serving the same locations), and build maximum number of trucks for initial operational deployment allowed by available funding (with all feasible leveraging of private resources), unless a zero-emission technology not utilizing wayside power is determined to be superior and can be implemented in a similar or earlier timeframe
		▪ Develop and incorporate recommendations regarding type of funding and implementation mechanisms (including infrastructure needed) into RTP constrained plan and next major SIP, including:
		  ▪ Strategy description and timeframe for any rules
		  ▪ Strategy description, potential funding sources and timeframe for any incentives

TABLE 17 Locomotive/Rail: Agency Major Implementation Actions

Year(s)	Agency	Agency Action
2012	SCAG, with AQMD/ARB on SIP, other transportation agencies and private sector partners (UP/BNSF) on demonstration and funding efforts	▪ Identify funding to support rail evaluation and demonstration efforts ▪ Implement plan of advocacy to secure action by federal or other governments where required to implement any related elements of the SIP or RTP; include evaluation of impacts of zero and near-zero-emission technologies on national priorities, (e.g. energy security, energy cost certainty, interstate transportation, climate protection)
2012–2014	SCAG, with AQMD/ARB on SIP, other transportation agencies and private sector partners (UP/BNSF) on demonstration and funding efforts	▪ Evaluate and determine practicability of applying existing electrified rail technologies to region (by 2013) ▪ Evaluate potential funding and implementation mechanisms for zero-and/or near-zero-emission locomotives, and wayside power, including: Private (railroads); federal, state, local governments; public-private partnerships; electric utilities
2015–2016	SCAG, with AQMD/ARB on SIP, other transportation agencies and private sector partners (UP/BNSF) on demonstration and funding efforts	▪ If existing electrified rail technologies are determined practicable for the region, identify technologies, infrastructure, and implementation mechanisms in RTP amendment and next major SIP

2018–2020	SCAG, with AQMD/ARB on SIP, other transportation agencies and private sector partners (UP/BNSF) on demonstration and funding efforts	▪ If existing electrified rail technologies were determined to not be practicable for the region, resolve need for wayside power for new rail technologies; decision would be based upon whether new technologies can achieve sufficient zero-or near-zero-emission range without wayside power
		▪ If wayside power is needed, include planning for wayside power for rail lines into 2018 constrained RTP
		▪ Include recommendations regarding type of funding and implementation mechanisms into constrained RTP and next major SIP, including:
		  ▪ Strategy description and timeframe for any rules
		  ▪ Strategy description, potential funding sources. and timeframe for any incentives.

Near-Term and Long-Term Technologies for Commercial Deployment

The 2012–2035 RTP/SCS recommends a two-pronged environmental strategy to be implemented in the four phases outlined in the previous section. SCAG recognizes that not all technologies have advanced to the stage where they can be implemented immediately. As the region works to advance and deploy current prototype technologies, focus should be placed on commercializing and implementing existing solutions as well. For trucks, an aggressive program to bring more currently available clean-fuel and hybrid trucks into service represents the best near-term strategy. In the longer term, our infrastructure can serve as a catalyst for the development of longer-range hybrid, dual-mode or battery-operated trucks. For rail, near-term technologies for switcher locomotives can reduce emissions at railyards. A longer-term objective of a zero-emission rail system can be reached through further technology development. This section will briefly describe both near- and long-term technologies that have the potential to reduce emissions and help the region meet attainment deadlines. The technologies identified in this section serve as examples of potential near- and long-term options for further study and do not constitute specific technologies under the financially constrained RTP/SCS.

NEAR-TERM TRUCK TECHNOLOGIES

Natural gas trucks use compressed natural gas (CNG) or liquefied natural gas (LNG) to power an internal combustion engine. Natural gas trucks have already been deployed at the Ports, and have the potential for greater deployment based on provision of fueling infrastructure. Range can be a concern due to limited on board fuel storage; however, adequate fueling infrastructure and/or the use of LNG could address the range issue. Several efforts are underway to expand use of natural gas trucks in the region as a near-term solution. Southern California Clean Cities Coalition is currently assisting with the marketing and education outreach for three projects funded through U.S. Department of Energy (DOE) Clean Cities ARRA 2009 Petroleum Reduction Technology Projects solicitation. These projects include the UPS Ontario–Las Vegas LNG Corridor Expansion Project and the Heavy-Duty Natural Gas Drayage Truck Replacement Initiative, both with the South Coast Air Quality Management District (SCAQMD). A third project is being implemented in partnership with the San Bernardino Associated Governments (SANBAG) and Ryder Truck Rental, Inc. to deploy 202 heavy-duty natural gas trucks and construct two liquefied natural gas fueling stations.

Hybrid-electric trucks contain an internal combustion engine as well as an electric motor, generator, and energy storage device (e.g., a battery). The electric motor and generator absorb energy via regenerative braking and store that energy to offset acceleration and power demands of the vehicle. Several hundred hybrid-electric trucks are on the road due to the ARB's Hybrid Truck and Bus Voucher Incentive Project (HVIP). The incremental cost of this truck is its largest barrier to market penetration; some of this has the potential to be offset through incentive programs or reduced fuel costs for operators.

NEAR-TERM TRUCK OPERATIONAL STRATEGIES

In addition to deployment of new technologies, several programs that address truck operations have the potential to reduce emissions, including increased enforcement of anti-idling regulations, truck inspection and maintenance programs, and use of conditional use permits for warehouses. These are operational changes that do not require new technologies, but may require changes in business practice and enforcement of these changes. Many of these strategies may also reduce noise and vibration impacts.

LONG-TERM TRUCK TECHNOLOGIES

Plug-in hybrid-electric trucks and battery-electric trucks are examples of technologies that may be used in the future. Plug-in hybrid-electric trucks differ from hybrid-electric trucks in that they have a larger battery and can draw energy from the electric grid. This enables the truck to travel under all-electric power when on electrified corridors. These trucks are currently in the development and demonstration stage. The cost and weight of the battery is the most significant barrier to further developing this truck type. Currently, plug-in hybrid technologies are being demonstrated in parcel delivery and utility bucket truck applications; as previously discussed, these systems could be scaled to larger vehicles for drayage and local service. Arvin Meritor is currently developing a dual-mode hybrid, and Vision Motor Corporation has a contract with the Port of Los Angeles to test units made specifically for drayage, using a combination of lithium-ion batteries and fuel cells.

Battery-electric trucks replace the entire engine and drive train of a conventional vehicle with an electric motor and generator. Battery-electric trucks could run entirely on battery packs that are charged when the vehicle is plugged into the grid and via regenerative braking or possibly using an on-board hydrogen fuel cell. Alternatively, these trucks could receive power from an external power source in the roadway, such as an overhead catenary system or through electromagnetic induction from a contact-less power system embedded in the roadway. Zero- and near-zero-emission truck prototype testing is underway with funding from the Port of Los Angeles, the Port of Long Beach, and AQMD. For instance, a demonstration of the Balqon lead-acid battery-electric truck was initiated in 2007. The battery was upgraded to a lithium-ion battery, and testing of the upgraded system is underway. Balqon has a contract at the Port of Los Angeles to test five on-road drayage trucks.

TRUCK TECHNOLOGIES FOR ZERO-EMISSION FREIGHT CORRIDORS

Development of both the proposed I-710 freight corridor and East-West Freight Corridor provide opportunities to commercialize technologies and create incentives for development. Recent studies, such as the I-710 EIR/EIS, research completed by the San Pedro Bay Ports, and the SCAG Comprehensive Goods Movement Study, suggest that fixed guideway systems are less practical to serve the region's needs, as they lack the flexibility to serve the various markets. Zero-emission trucks, however, that either charge through wayside power infrastructure, at charging stations off the system, or through fuel cell systems, show promise for goods movement corridors.

Wayside power offers a potential advantage to trucks that move on key freight corridors as it offers the potential to extend the range of the vehicle while operating in a zero-or near-zero-emissions mode. There is always a tradeoff between the weight of battery systems (which reduce payload carrying capacity) and the range of the vehicle. Current battery technologies have range limitations of approximately 40 miles in common truck duty cycles. A wayside power system on a freight corridor (truck lanes), for example, could charge batteries so that the truck can continue to operate with a 40-mile range when it leaves the freight corridor. This could provide a more extended range system than would charge stations located at truck stops and fuel stations similar to the current fueling infrastructure. Ongoing efforts are underway to evaluate the costs and operational parameters associated with either method.

Wayside power technologies include overhead catenary, in-road power such as third rail or linear synchronous motor (LSM), and fast charging. All three technologies must be integrated closely with the zero and/or near-zero-emission trucks, and all have the potential to significantly increase the functionality and range of trucks utilizing batteries, including dual-mode hybrids. (It is unlikely that fuel cell trucks would need wayside power, due to their range and relatively quick refueling capability.) In overhead catenary systems, power is delivered from the electrical grid through the overhead wire to a pantograph on the vehicle itself. Catenary systems are well-established and efficient in light-rail applications, trolley cars and buses, and even mining trucks. For in-road power, the roadway itself provides power to the vehicles, which must be equipped with pick-up devices. Alternatively, fast charging is a high-power charging system used to quickly recharge the batteries in an electric vehicle at destination points, e.g., rail yards or distribution centers. While technically not “wayside” power, fast charging is similarly grouped with other approaches that require infrastructure to be designed and built into the freight facilities and corridors. These systems have different operational requirements. Ideally, the system would allow for trucks to enter and exit the system seamlessly, change lanes and could be shared with standard trucks.

NEAR-TERM RAIL EMISSION REDUCTION STRATEGIES

Switcher locomotives contribute only a small share of total locomotive emissions; however, their activity is concentrated in railyards and greatly impacts surrounding communities. Nevertheless, low-emission technologies are available, or soon to be available, and have relatively low costs. To reduce emissions from switcher locomotives, one option is to replace remaining Tier 0+ switchers with cleaner engines, such as Tier 4 switchers when they become available. NO_X and $PM_{2.5}$ emission rates from a Tier 4 switcher would be approximately 10–15 times lower than a Tier 0+ engine. Another option is to rebuild existing Genset switchers with engines that meet the U.S. EPA Tier 4 non-road emission standards, which could cut NO_X and $PM_{2.5}$ emissions by a factor of 10. The emission reductions of these strategies could reduce emissions for switcher engines between 27 and 53 percent. However, since switchers are a small part of the overall fleet, these two switcher strategies would reduce total freight locomotive NO_X and $PM_{2.5}$ emissions by only 1 to 3 percent. Tier 4 engines are not currently available, but are required by the EPA for all new purchases after 2015. **TABLES 18** and **19** show emissions reductions associated with upgrading all engines to Tier 4 after 2015. Such a strategy can be implemented on a voluntary basis, subject to funding availability. This strategy is presented for illustrative purposes and is not part of the financially constrained RTP/SCS.

TABLE 18 Emission Reductions from Replacing Tier 0 with Tier 4 Switchers (Tons per Day)

	NO_X			$PM_{2.5}$			CO_2		
Year	Switcher baseline	With Strategy	% Change	Switcher baseline	With Strategy	% Change	Switcher baseline	With Strategy	% Change
2010	1.37	1.37	0%	0.041	0.041	0%	94	94	0%
2023	0.68	0.35	-49%	0.017	0.001	-45%	123	123	0%
2035	0.37	0.37	0%	0.010	0.010	0%	153	153	0%

Source: SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy

TABLE 19 Emission Reductions from Repowering Gensets with Tier 4 Non-Road Engines (Tons per Day)

	NO_X			$PM_{2.5}$			CO_2		
Year	Switcher baseline	With Strategy	% Change	Switcher baseline	With Strategy	% Change	Switcher baseline	With Strategy	% Change
2010	1.37	1.37	0%	0.041	0.041	0%	94	94	0%
2023	0.68	0.50	-27%	0.017	0.011	-36%	123	123	0%
2035	0.37	0.18	-50%	0.010	0.004	-62%	153	153	0%

Source: SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy

LONG TERM EMISSION REDUCTIONS STRATEGIES FOR RAIL

Electrification

Several U.S. commuter rail systems use overhead lines to power electric trains, and electrified systems for both passenger and freight trains are common throughout Europe and Asia. There are no major electrified freight rail systems in North America. Electrification technologies require further evaluation to more precisely address questions about cost, funding, and how to best implement such systems with minimal operational impacts. Because of the cost and potential operational challenges associated with main line electrification, such a strategy should be considered a longer-term initiative, requiring further studies as well as proof of concept and prototype testing of zero-emission locomotive technologies which have the potential to minimize cost and operational impacts, as discussed under the phased implementation section of this Appendix.

Three electrification options were analyzed for consideration in SCAG's recent rail electrification study, each with varying costs and levels of technological readiness. Electric catenary rail systems are perhaps the most technologically ready. Dual-mode locomotives are in use for passenger service and, if they could be adapted for freight, could reduce the operational difficulties of removing and switching locomotives, as they can operate both on a catenary or with traditional diesel power. A third option would use linear synchronous motors in the railway to generate a propulsive force by creating an electromagnetic field, thereby avoiding the need to acquire or switch electric locomotives. Construction of any electrified rail system in Southern California would be a large investment, and would need the participation of the BNSF and UP railways.

Electrification of the railroad main lines would reduce line-haul NO_X and $PM_{2.5}$ emissions produced in the SCAG region by introducing cleaner, more efficient electric-powered locomotives and also by shifting the location of emissions to power plants. Although some emissions would still be produced in electricity generation, power plants are highly regulated and release fewer emissions. Furthermore, all power plants in the SCAB region are natural gas powered and also release fewer emissions. Most power plants are located outside the SCAB region and therefore emissions from these sources would be further from population centers.

Battery Hybrid And Fuel Cell Rail Technologies

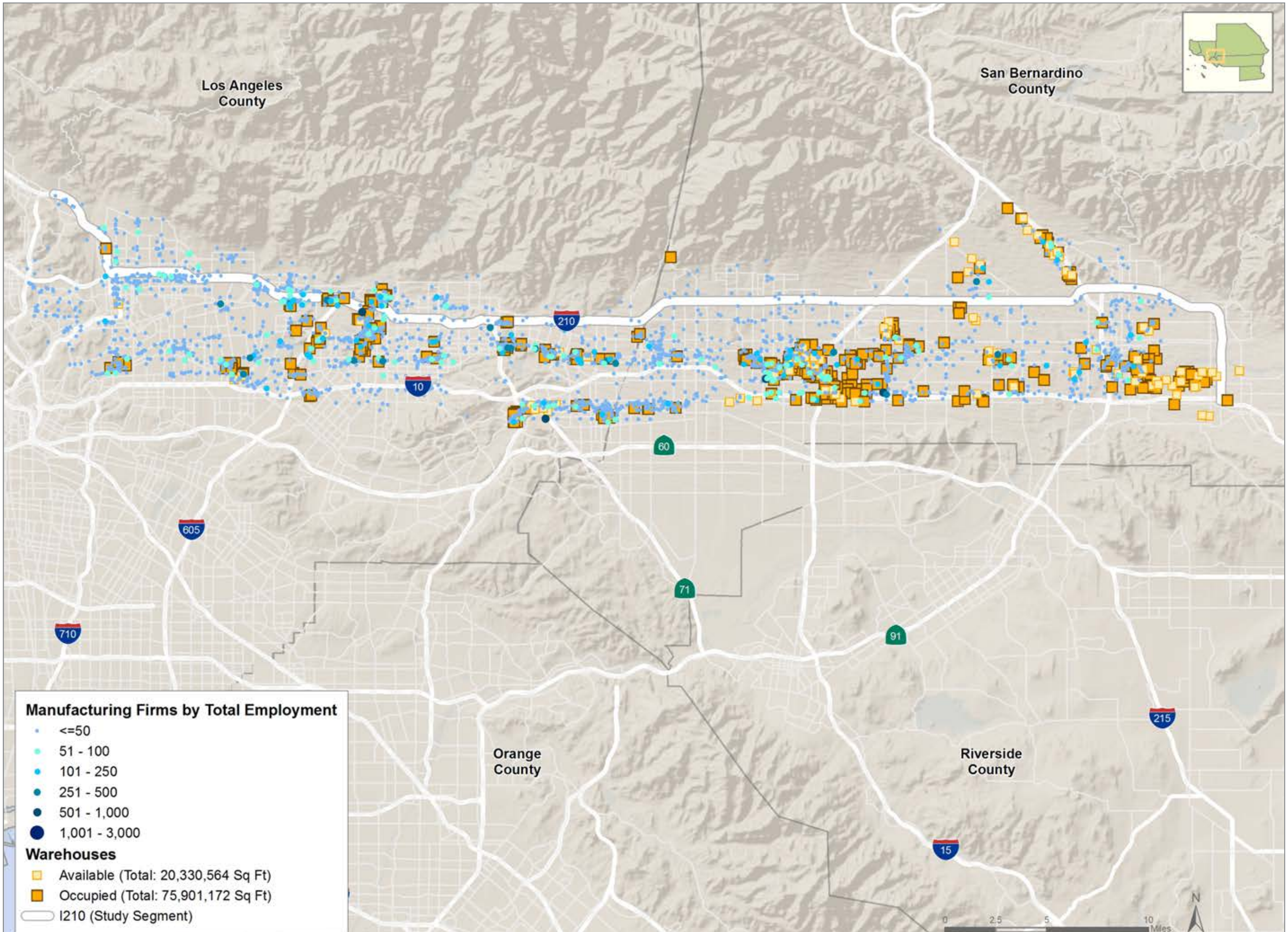
In future analyses, other additional viable technologies would be considered outside of electrification options. Two promising technologies that are under development include hybrid diesel-electric locomotives and battery-electric tender cars. Each requires additional development and a more thorough understanding of operational considerations. Hybrid diesel-electric locomotives (utilizing advanced batteries) are under development by General Electric (GE). The prototype is based on GE's Tier 2 Evolution locomotive platform (4,400 hp) that will capture energy dissipated during braking and store it in a series of sodium-nickel chloride batteries housed in the locomotive frame. Fuel savings would allow for a small fuel storage tank and provide space for storage of the necessary batteries on individual locomotives. The locomotives would therefore switch between Tier-4 diesel-electric and battery modes. The batteries would recharge as the locomotive is operating in diesel-electric mode.

Also, battery-electric tender car technology could be used with current locomotives. Battery tender cars would be placed behind diesel-electric locomotives and would carry batteries that could power locomotives through environmentally sensitive areas. Such a system could have many of the same advantages as the hybrid diesel-electric locomotives, including zero-emission operation, but would also have the added benefit of being compatible with current locomotives and reducing or eliminating the need for wayside power such as from overhead catenary wires.

IMPLEMENTING THE ENVIRONMENTAL STRATEGY

Broad deployment of zero-and near-zero-emission transportation technologies in the 2023 to 2035 timeframe is a critical and significant undertaking with technological, cost, and operational challenges. As outlined above, the 2012–2035 RTP/SCS delineates a path forward–a series of steps and decision points to move the region to that objective. Industry stakeholder participation will be necessary, including the efforts of numerous state and federal resources agencies, transportation agencies, along with commercial technology developers/manufacturers, and logistics experts. The 2012–2035 RTP/SCS, developed in coordination with many of these stakeholders, reaffirms zero- and near-zero-emission technologies as a priority and establishes the regional path forward to such a goods movement system.

EXHIBIT A.1 Manufacturing and Warehousing Concentrations Along I-210 (5-Mile Radius)



Sources: Southern California Association of Governments (SCAG), ESRI Shaded Relief, Tele Atlas

EXHIBIT A.2 Manufacturing and Warehousing Concentrations Along I-10 (5-Mile Radius)

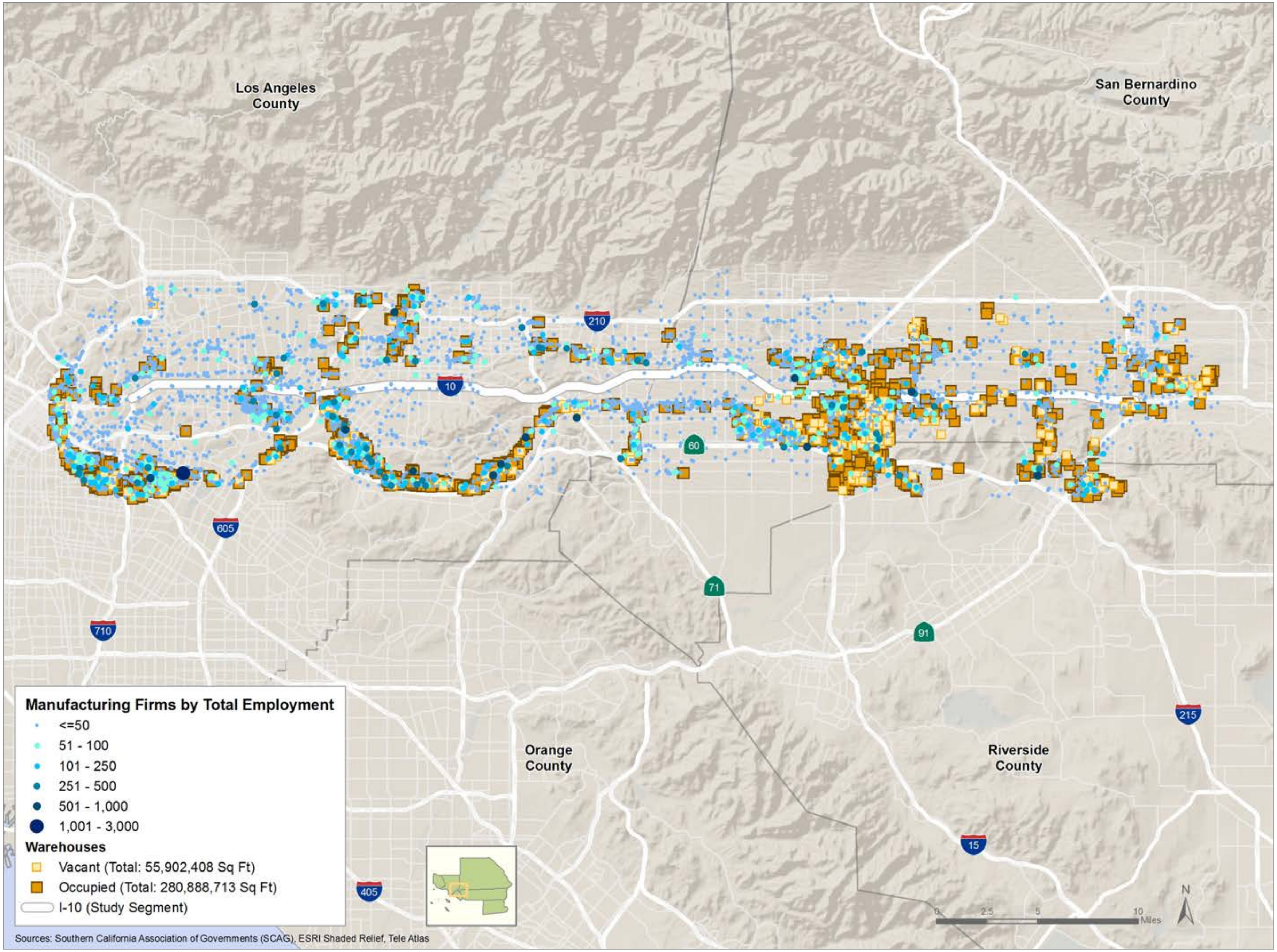


EXHIBIT A.3 Manufacturing and Warehousing Concentrations Along SR-60 (5-Mile Radius)

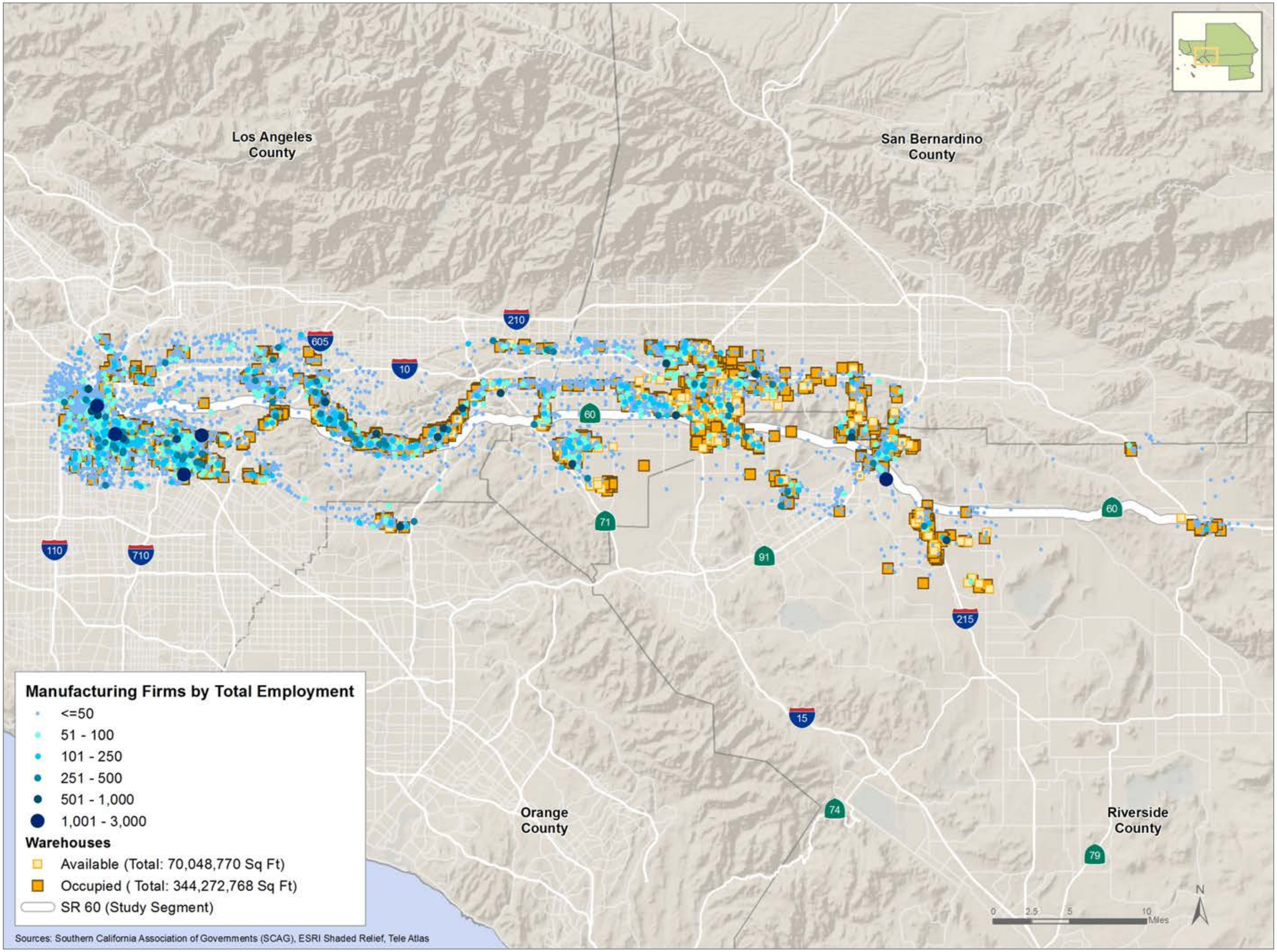


EXHIBIT A.4 Manufacturing and Warehousing Concentrations Along SR-91 (5-Mile Radius)

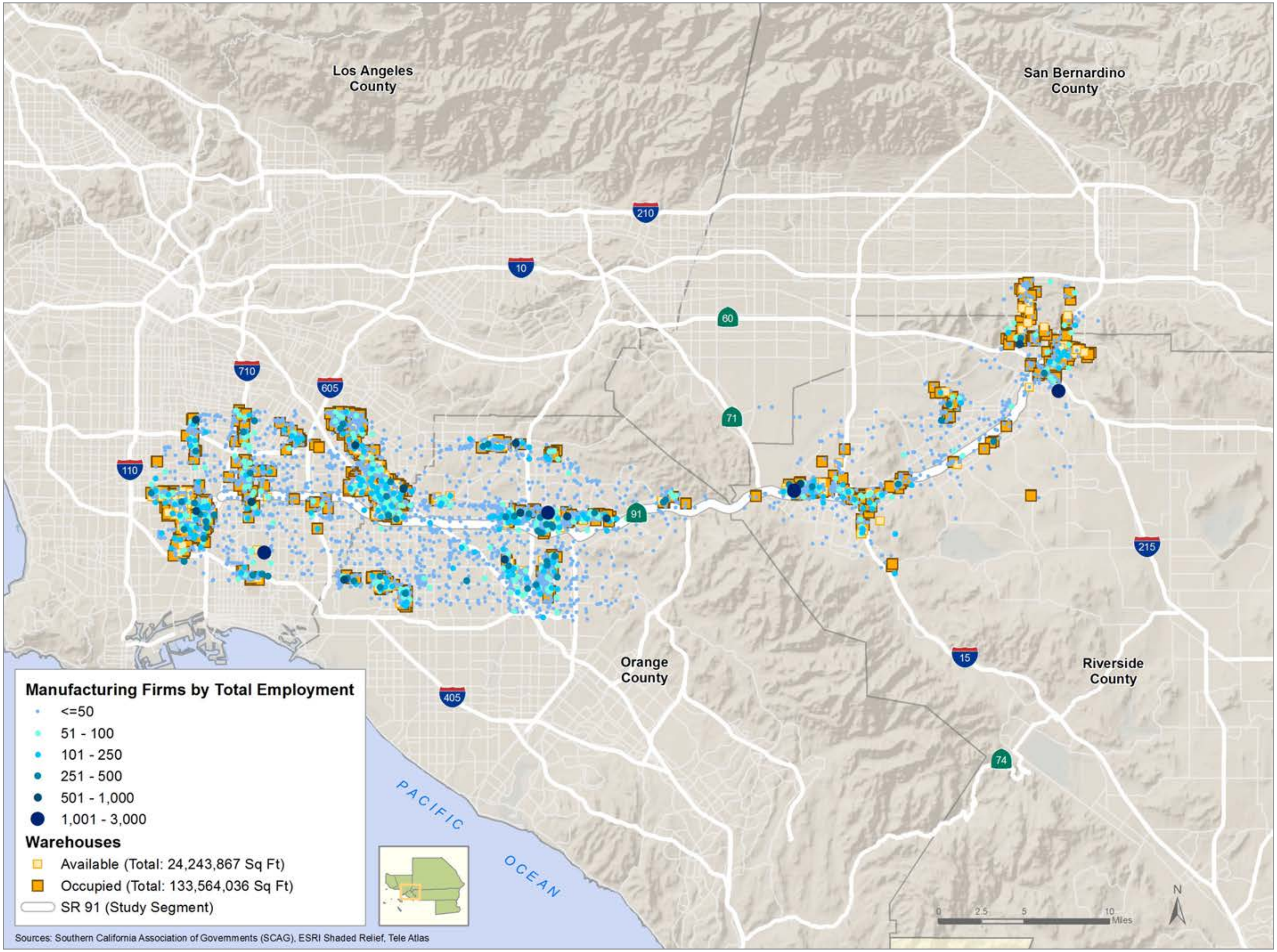
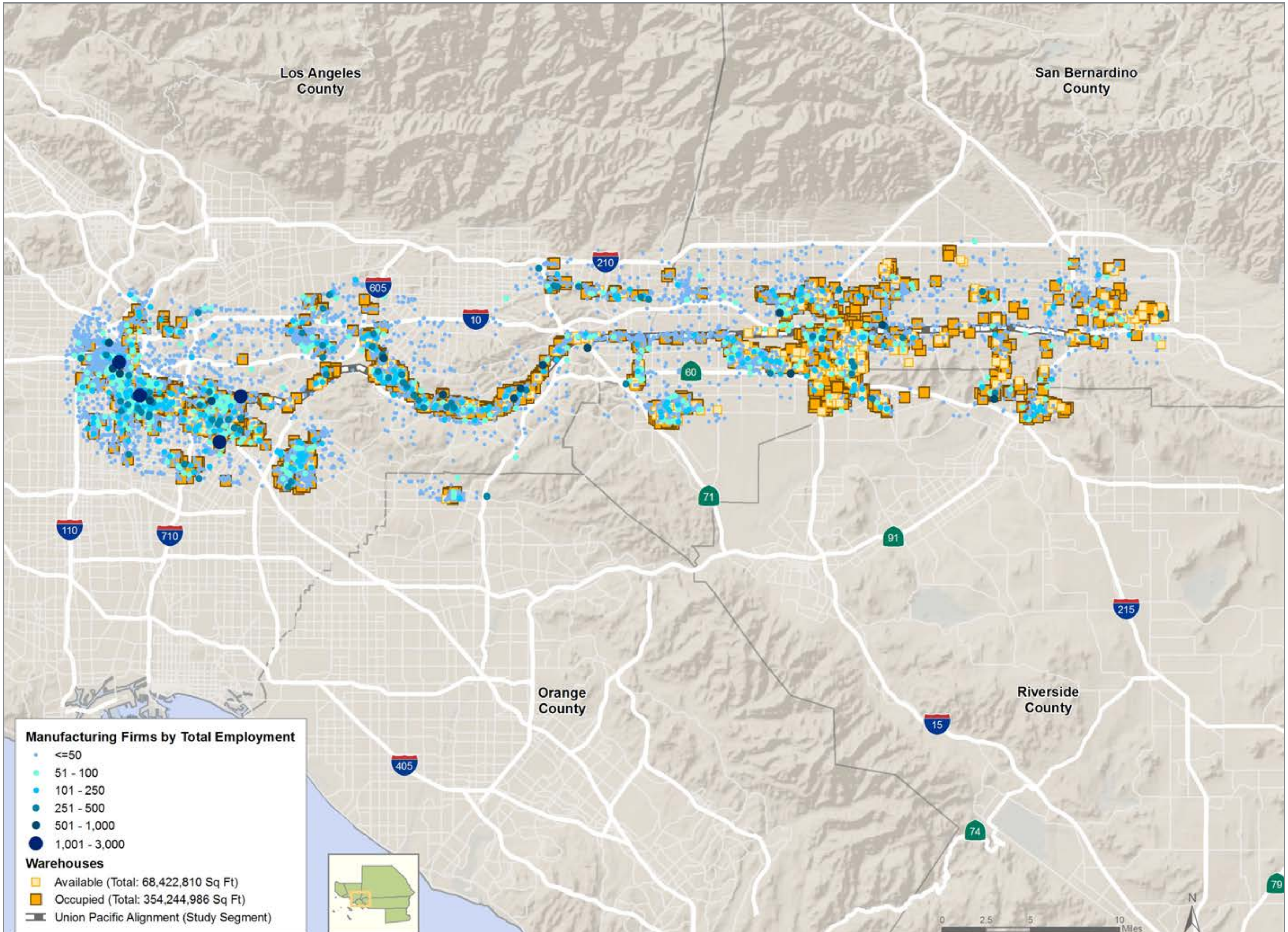
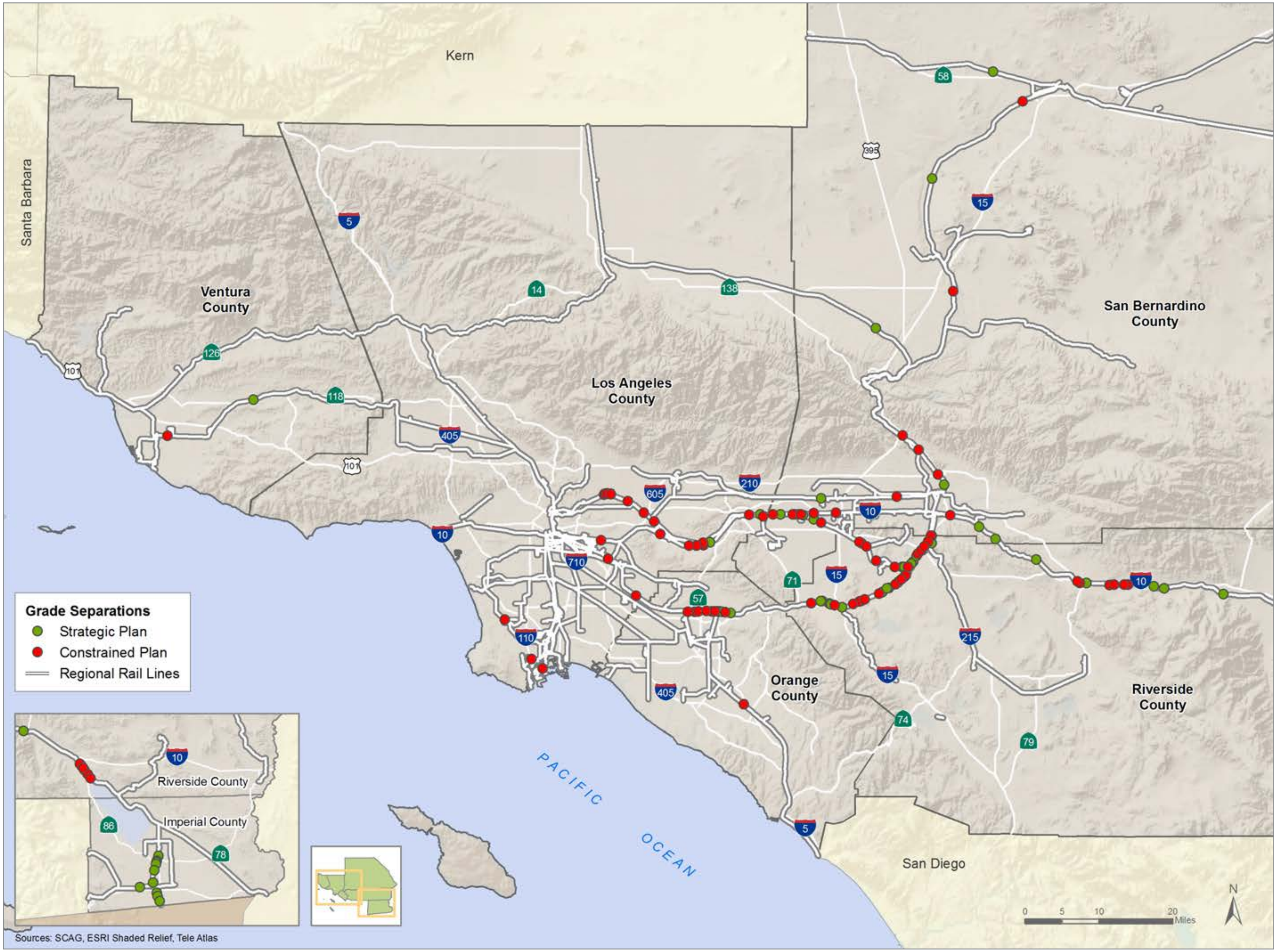


EXHIBIT A.5 Manufacturing and Warehousing Concentrations Along Union Pacific Railroad Adjacent Alignment (5-Mile Radius)



Sources: Southern California Association of Governments (SCAG), ESRI Shaded Relief, Tele Atlas

EXHIBIT B.1 Regional Grade Separations – Constrained and Strategic Plan



Sources: SCAG, ESRI Shaded Relief, Tele Atlas

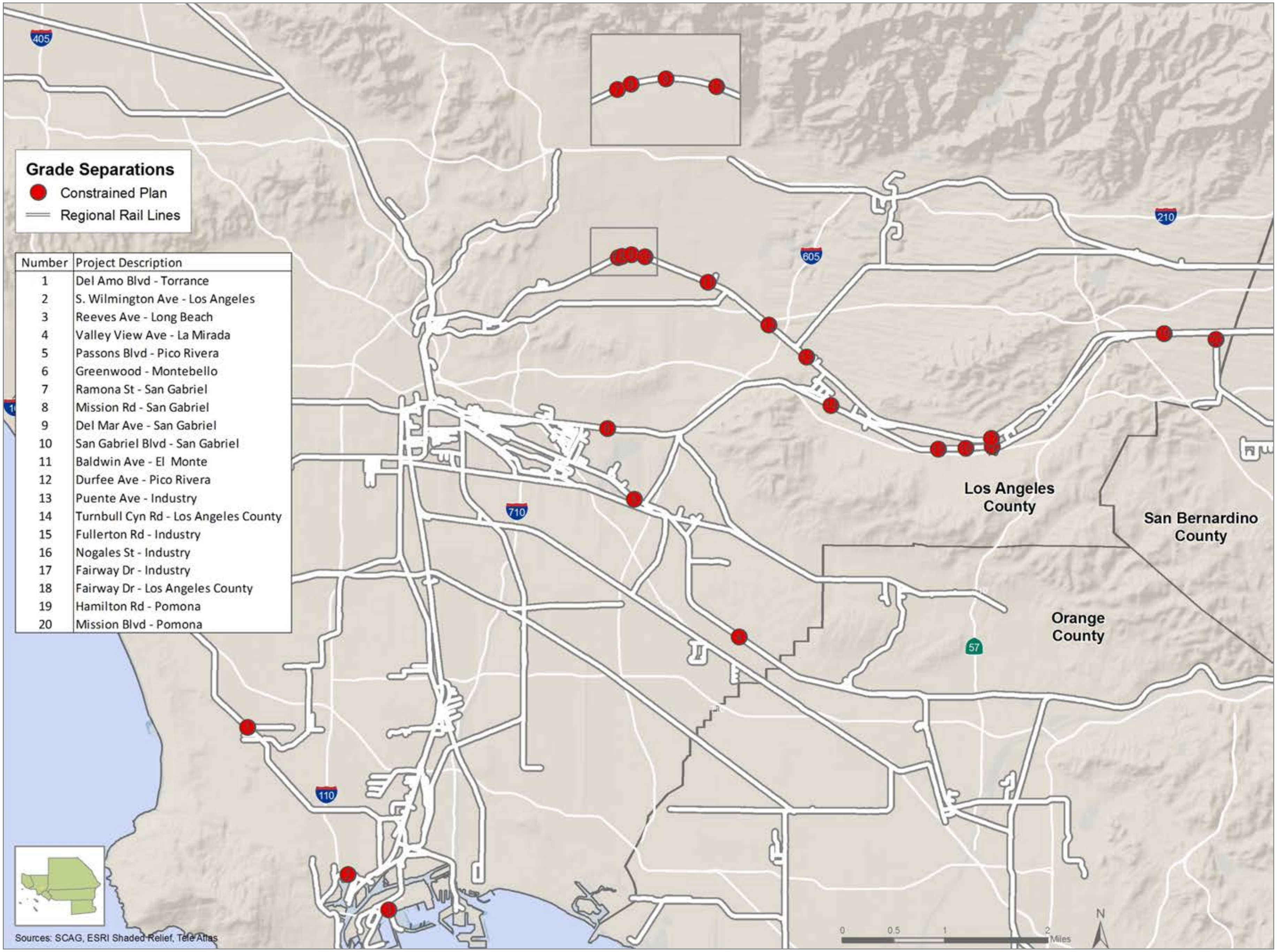
TABLE B.1 Constrained Grade Separations (Not Listed in Priority Order)

County	Grade Separation
ORANGE	RAYMOND AVE
ORANGE	STATE COLLEGE BLVD
ORANGE	PLACENTIA AVE UNDER CROSSING
ORANGE	KRAEMER BLVD
ORANGE	ORANGETHORPE AVE
ORANGE	TUSTIN AVE / ROSE DR
ORANGE	LAKEVIEW AVE
ORANGE	JEFFERY RD
SAN BERNARDINO	LENWOOD RD
SAN BERNARDINO	GREEN TREE BLVD
SAN BERNARDINO	GLEN HELEN PARKWAY
SAN BERNARDINO	PALM AVE
SAN BERNARDINO	MT. VERNON AVE
SAN BERNARDINO	RAMONA AV
SAN BERNARDINO	SAN ANTONIO AVE
SAN BERNARDINO	CAMPUS AVE
SAN BERNARDINO	NORTH VINEYARD AVE
SAN BERNARDINO	SOUTH ARCHIBALD AVE
SAN BERNARDINO	S. MILLIKEN AVE
SAN BERNARDINO	LAUREL ST
SAN BERNARDINO	MAIN ST
SAN BERNARDINO	HUNTS LN
VENTURA	RICE AVE
RIVERSIDE	AUTO CENTER DRIVE
RIVERSIDE	JOY ST
RIVERSIDE	MCKINLEY ST
RIVERSIDE	MAGNOLIA AVE
RIVERSIDE	PIERCE ST
RIVERSIDE	BELLGRAVE AV
RIVERSIDE	JURUPA RD
RIVERSIDE	CLAY ST
RIVERSIDE	TYLER ST
RIVERSIDE	ADAMS ST
RIVERSIDE	STREETER AVE
RIVERSIDE	MADISON ST
RIVERSIDE	MARY ST
RIVERSIDE	RIVERSIDE AVE
RIVERSIDE	3RD STREET
RIVERSIDE	SPRUCE ST
RIVERSIDE	CHICAGO AVE
RIVERSIDE	IOWA AVE
RIVERSIDE	VIELE AVE
RIVERSIDE	CALIFORNIA AVE
RIVERSIDE	SUNSET AVE
RIVERSIDE	22ND ST
RIVERSIDE	SAN GORGONIO AV
RIVERSIDE	HARGRAVE ST
RIVERSIDE	AVENUE 52
RIVERSIDE	AVENUE 56
RIVERSIDE	AVENUE 62
RIVERSIDE	AVENUE 66
LOS ANGELES	DEL AMO BLVD
LOS ANGELES	SOUTH WILMINGTON AVE
LOS ANGELES	REEVES AVE
LOS ANGELES	VALLEY VIEW AVE
LOS ANGELES	PASSONS BLVD
LOS ANGELES	GREENWOOD AVE (MONTEBELLO)
LOS ANGELES	RAMONA ST (SAN GABRIEL)
LOS ANGELES	MISSION RD (SAN GABRIEL)
LOS ANGELES	DEL MAR AVE (SAN GABRIEL)
LOS ANGELES	SAN GABRIEL BLVD (SAN GABRIEL)
LOS ANGELES	BALDWIN AVENUE (EL MONTE)
LOS ANGELES	DURFEE AVE (PICO RIVERA)
LOS ANGELES	PUENTE AVENUE (INDUSTRY/LA COUNTY)
LOS ANGELES	TURNBULL CYN RD (INDUSTRY/LA COUNTY)
LOS ANGELES	FULLERTON RD (INDUSTY/LA COUNTY)
LOS ANGELES	NOGALES ST (INDUSTRY/LA COUNTY)
LOS ANGELES	FAIRWAY DRIVE (INDUSTRY/WALNUT)
LOS ANGELES	FAIRWAY DRIVE (INDUSTRY/LA COUNTY)
LOS ANGELES	HAMILTON BLVD (POMONA)
LOS ANGELES	MISSION BLVD (POMONA)

TABLE B.2 Strategic Grade Separations (Not Listed in Priority Order)

County	Grade Separation
IMPERIAL	WARD ROAD (IMPERIAL COUNTY)
IMPERIAL	SR-78/SR-111 (BRAWLEY)
IMPERIAL	MALAN STREET (BRAWLEY)
IMPERIAL	MEAD ROAD (BRAWLEY)
IMPERIAL	KEYSTONE ROAD (IMPERIAL COUNTY)
IMPERIAL	ATEN ROAD (IMPERIAL)
IMPERIAL	EVAN HEWES HIGHWAY (IMPERIAL COUNTY)
IMPERIAL	DOGWOOD ROAD (IMPERIAL COUNTY)
IMPERIAL	HEBER AVENUE (IMPERIAL COUNTY)
IMPERIAL	WEST COLE ROAD (CALEXICO)
LOS ANGELES	SAN ANTONIO AVE (POMONA)
LOS ANGELES	LEMON AVE (LA SUBDIVISION)
ORANGE	JEFFERSON ST (ANAHEIM)
ORANGE	VAN BUREN AVE (PLACENTIA)
ORANGE	RICHFIELD RD (PLACENTIA)
ORANGE	KELLOGG DRIVE UNDERCROSSING (ANAHEIM)
SAN BERNARDINO	HINCKLEY AVE (SAN BERNARDINO COUNTY)
SAN BERNARDINO	SHADOW MOUNTAIN RD (SAN BERNARDINO COUNTY)
SAN BERNARDINO	PHELAN RD (SAN BERNARDINO COUNTY)
SAN BERNARDINO	ARCHIBALD AVE (RANCHO CUCAMONGA)
SAN BERNARDINO	CENTRAL AVE (MONTCLAIR)
SAN BERNARDINO	VINE AVE (ONTARIO)
SAN BERNARDINO	SULTANA AVE (ONTARIO)
SAN BERNARDINO	BON VIEW AVE (ONTARIO)
SAN BERNARDINO	VINEYARD AVE (ONTARIO)
SAN BERNARDINO	OLIVE ST (SAN BERNARDINO)
SAN BERNARDINO	BEAUMONT AVE (SAN BERNARDINO COUNTY)
SAN BERNARDINO	ALESSANDRO RD (REDLANDS)
VENTURA	ROUTE 118 (VENTURA COUNTY)
RIVERSIDE	SMITH AVE (CORONA)
RIVERSIDE	RAILROAD ST (CORONA)
RIVERSIDE	COTA STREET (CORONA)
RIVERSIDE	RADIO ROAD (CORONA)
RIVERSIDE	BUCHANAN ST (RIVERSIDE)
RIVERSIDE	RUTILE STREET (JURUPA VALLEY)
RIVERSIDE	HARRISON STREET (RIVERSIDE)
RIVERSIDE	GIBSON STREET (RIVERSIDE)
RIVERSIDE	JACKSON STREET (RIVERSIDE)
RIVERSIDE	JEFFERSON STREET (RIVERSIDE)
RIVERSIDE	PALM AVE (RIVERSIDE)
RIVERSIDE	WASHINGTON STREET (RIVERSIDE)
RIVERSIDE	BROCKTON AVE (RIVERSIDE)
RIVERSIDE	APACHE TRAIL (RIVERSIDE COUNTY)
RIVERSIDE	PANORAMA ROAD (RIVERSIDE)
RIVERSIDE	CRIDGE STREET (RIVERSIDE)
RIVERSIDE	PALMYRITA AVE (RIVERSIDE)
RIVERSIDE	CENTER ST (RIVERSIDE COUNTY)
RIVERSIDE	MAIN STREET (RIVERSIDE COUNTY)
RIVERSIDE	SAN TIMOTEO CANYON (CALIMESA)
RIVERSIDE	SHERIDAN ST (CORONA)
RIVERSIDE	PENNSYLVANIA AVENUE (BEAUMONT)
RIVERSIDE	7TH ST (RIVERSIDE)
RIVERSIDE	BROADWAY (RIVERSIDE COUNTY)
RIVERSIDE	TIPTON ROAD (PALM SPRINGS)
RIVERSIDE	AVENUE 54 (COACHELLA)
RIVERSIDE	AVENUE 58 (RIVERSIDE COUNTY)

EXHIBIT B.2 Los Angeles County Grade Separations – Constrained Plan (Not Listed in Priority Order)



Number	Project Description
1	Del Amo Blvd - Torrance
2	S. Wilmington Ave - Los Angeles
3	Reeves Ave - Long Beach
4	Valley View Ave - La Mirada
5	Passons Blvd - Pico Rivera
6	Greenwood - Montebello
7	Ramona St - San Gabriel
8	Mission Rd - San Gabriel
9	Del Mar Ave - San Gabriel
10	San Gabriel Blvd - San Gabriel
11	Baldwin Ave - El Monte
12	Durfee Ave - Pico Rivera
13	Puente Ave - Industry
14	Turnbull Cyn Rd - Los Angeles County
15	Fullerton Rd - Industry
16	Nogales St - Industry
17	Fairway Dr - Industry
18	Fairway Dr - Los Angeles County
19	Hamilton Rd - Pomona
20	Mission Blvd - Pomona

EXHIBIT B.3 Orange County Grade Separations – Constrained Plan (Not Listed in Priority Order)

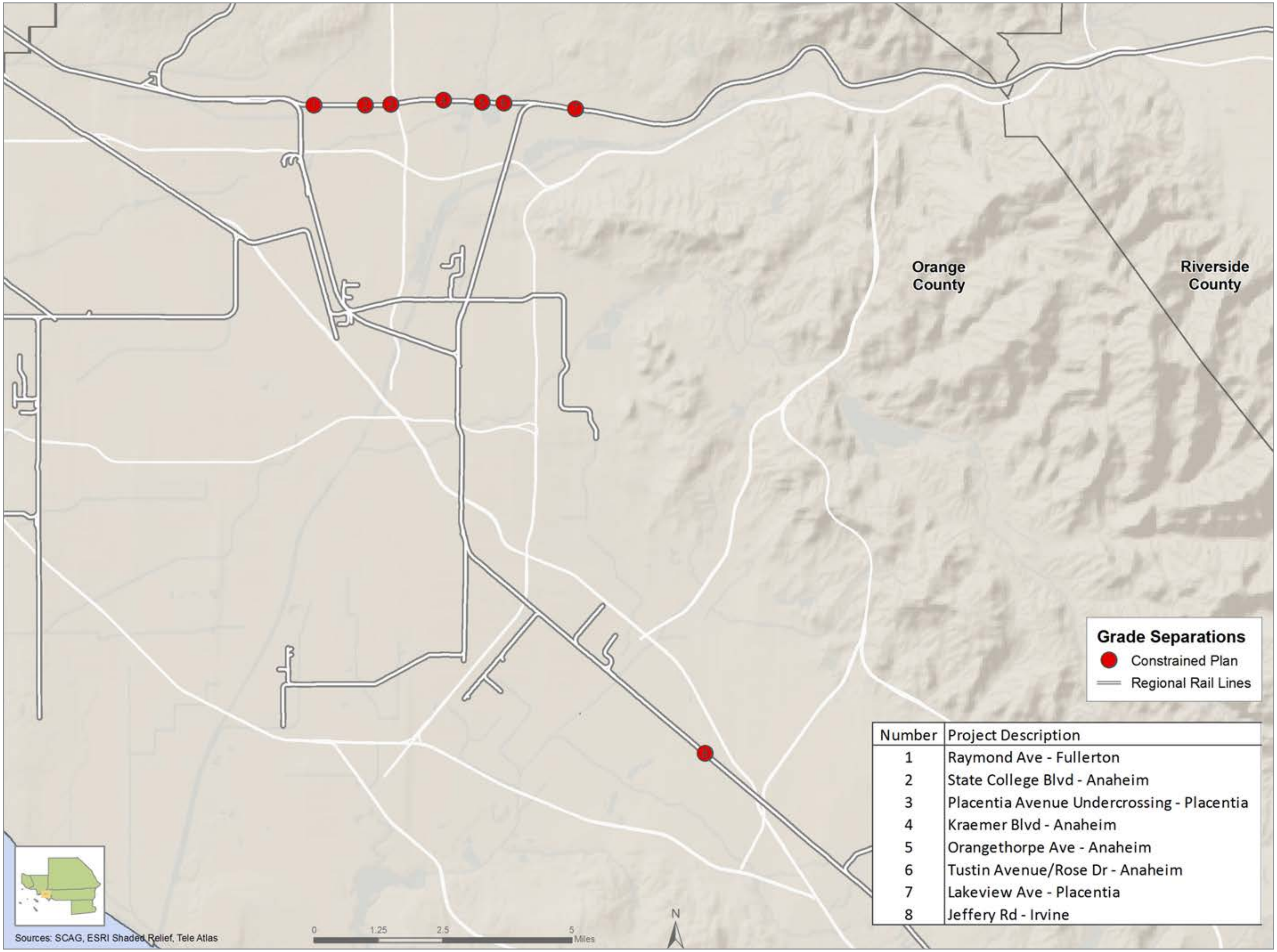
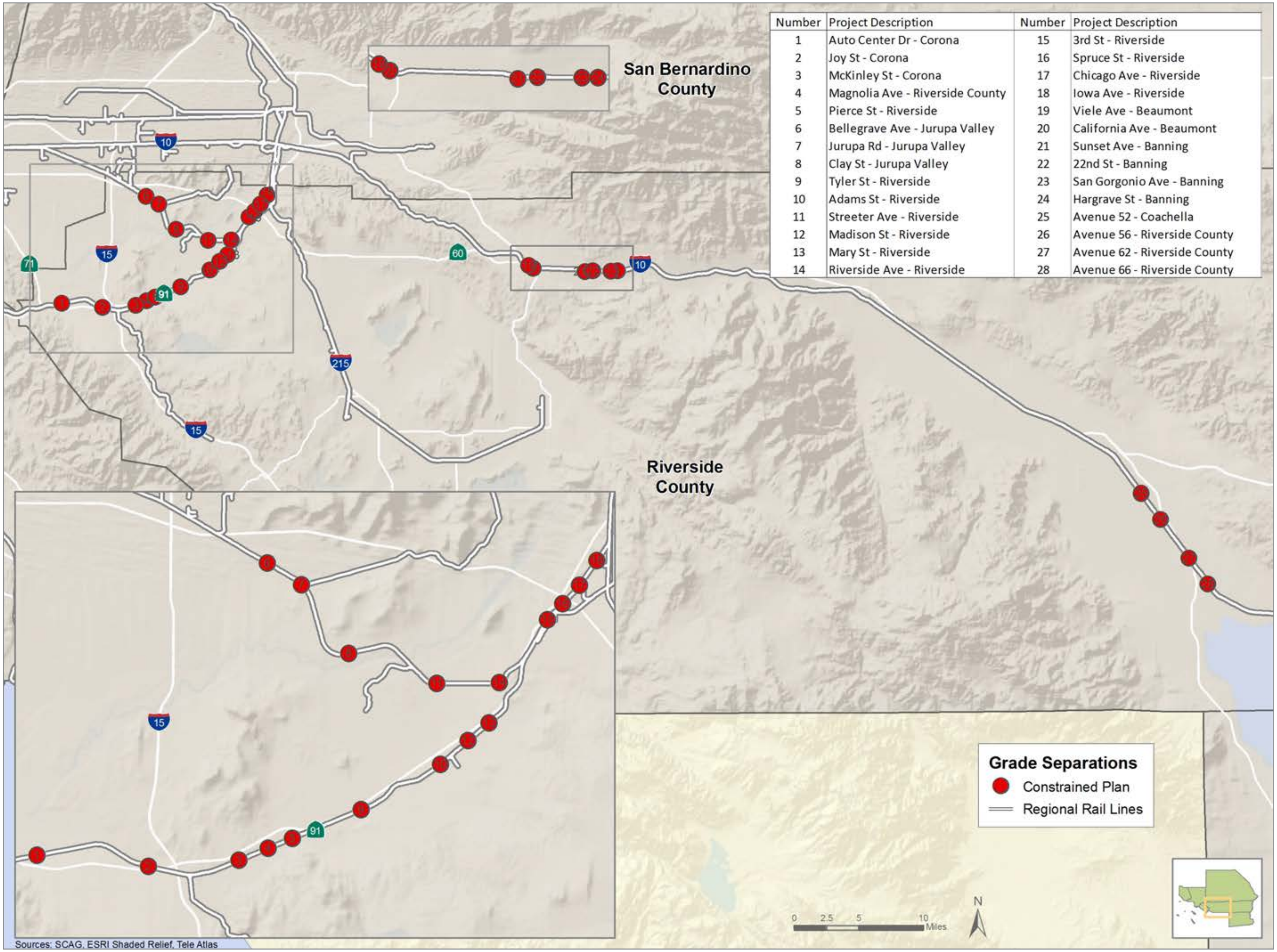
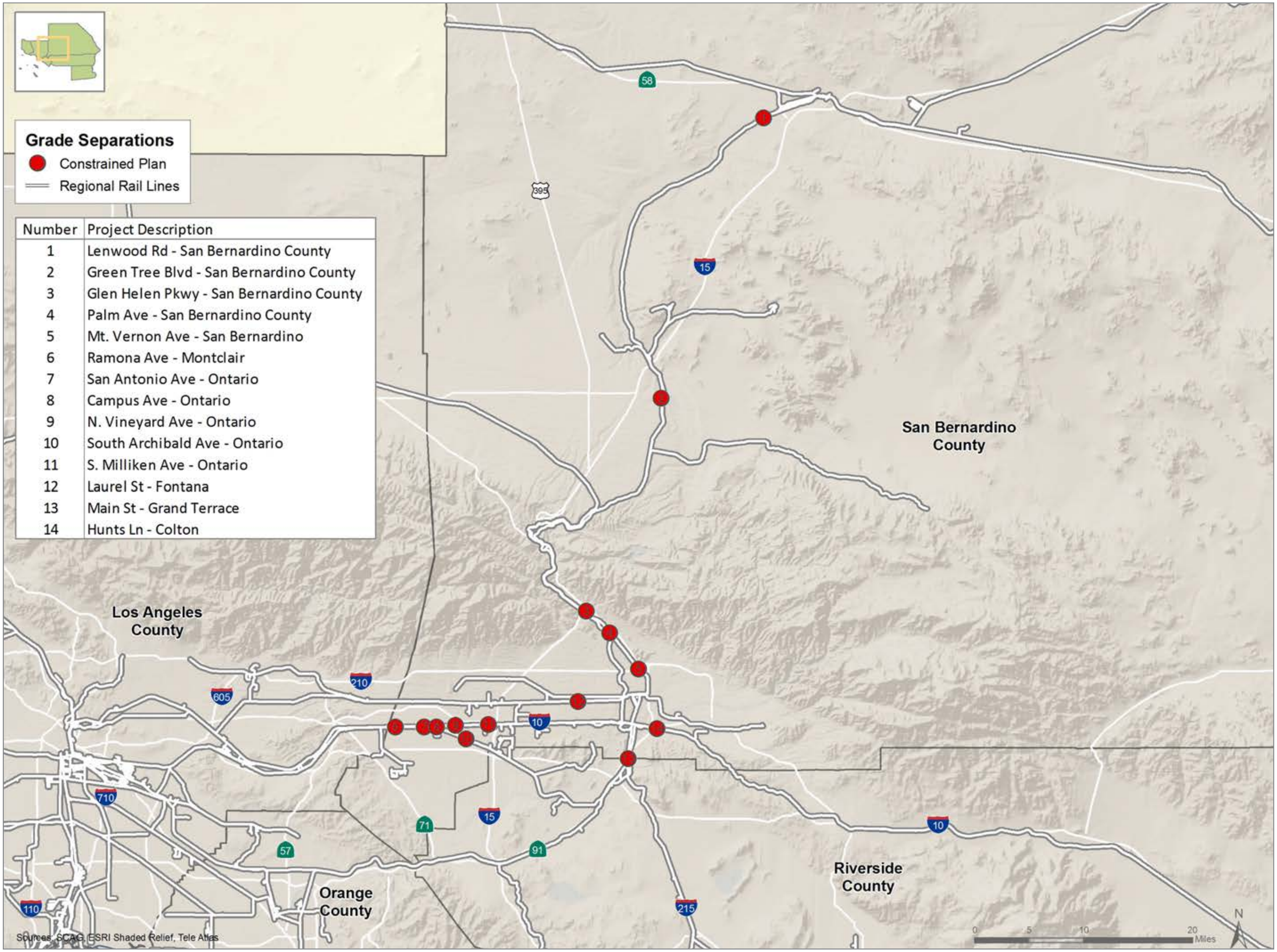


EXHIBIT B.4 Riverside County Grade Separations – Constrained Plan (Not Listed in Priority Order)



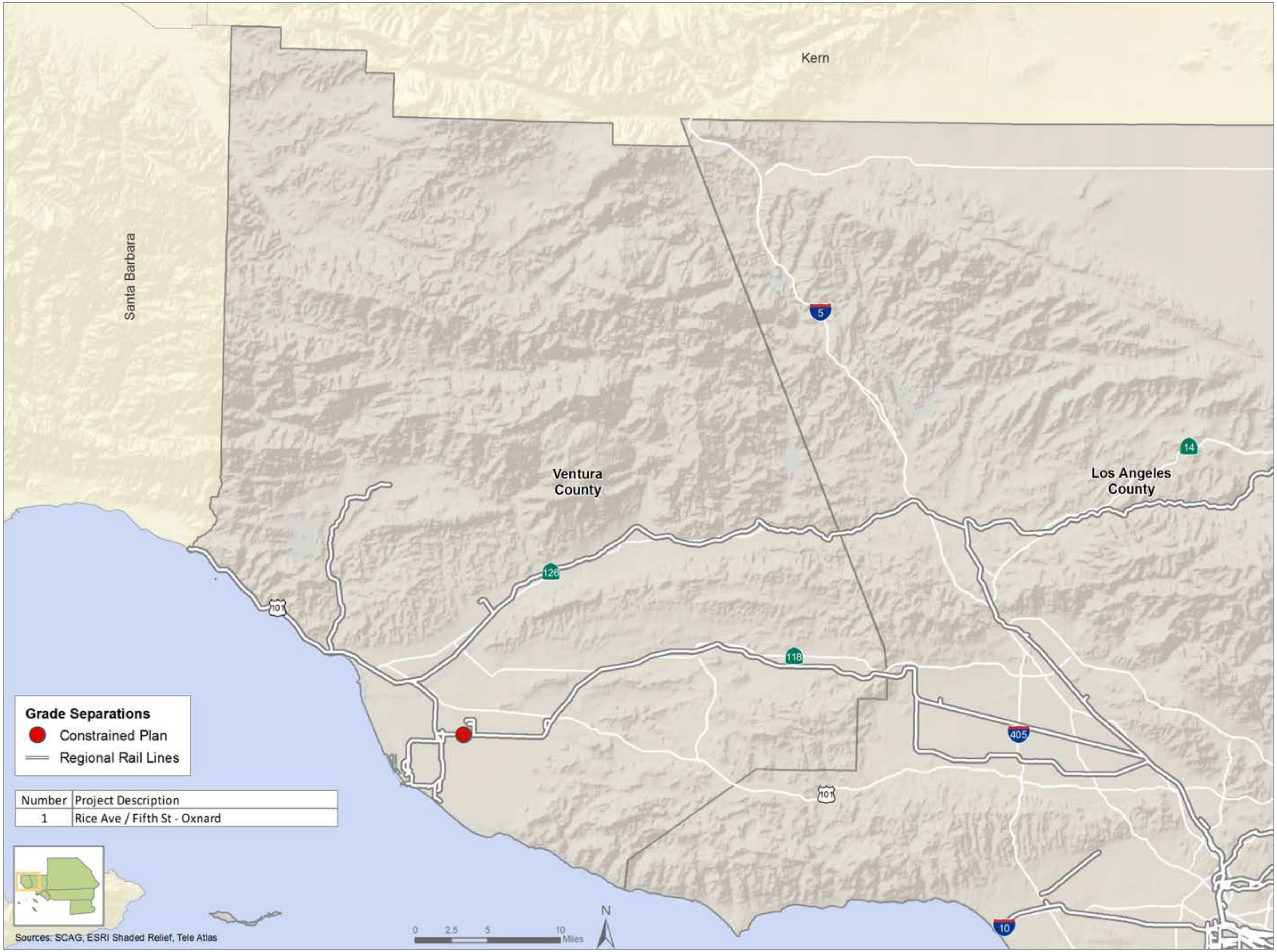
Number	Project Description	Number	Project Description
1	Auto Center Dr - Corona	15	3rd St - Riverside
2	Joy St - Corona	16	Spruce St - Riverside
3	McKinley St - Corona	17	Chicago Ave - Riverside
4	Magnolia Ave - Riverside County	18	Iowa Ave - Riverside
5	Pierce St - Riverside	19	Viele Ave - Beaumont
6	Bellegrave Ave - Jurupa Valley	20	California Ave - Beaumont
7	Jurupa Rd - Jurupa Valley	21	Sunset Ave - Banning
8	Clay St - Jurupa Valley	22	22nd St - Banning
9	Tyler St - Riverside	23	San Gorgonio Ave - Banning
10	Adams St - Riverside	24	Hargrave St - Banning
11	Streeter Ave - Riverside	25	Avenue 52 - Coachella
12	Madison St - Riverside	26	Avenue 56 - Riverside County
13	Mary St - Riverside	27	Avenue 62 - Riverside County
14	Riverside Ave - Riverside	28	Avenue 66 - Riverside County

EXHIBIT B.5 San Bernardino County Grade Separations – Constrained Plan (Not Listed in Priority Order)



Number	Project Description
1	Lenwood Rd - San Bernardino County
2	Green Tree Blvd - San Bernardino County
3	Glen Helen Pkwy - San Bernardino County
4	Palm Ave - San Bernardino County
5	Mt. Vernon Ave - San Bernardino
6	Ramona Ave - Montclair
7	San Antonio Ave - Ontario
8	Campus Ave - Ontario
9	N. Vineyard Ave - Ontario
10	South Archibald Ave - Ontario
11	S. Milliken Ave - Ontario
12	Laurel St - Fontana
13	Main St - Grand Terrace
14	Hunts Ln - Colton

EXHIBIT B.6 Ventura County Grade Separations – Constrained Plan



REGIONAL TRANSPORTATION PLAN
2012–2035 RTP
SUSTAINABLE COMMUNITIES STRATEGY
Towards a Sustainable Future

SOUTHERN CALIFORNIA
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