GOODS MOVEMENT

System Vision 1

The Regional Goods Movement System 2

Components of the Regional Goods Movement System 2
The Supply Chain System and Southern California 4
Key Functions and Markets 6
Modal Segmentation 8
Goods Movement Trends and Drivers 12

2012 RTP Goods Movement Strategies 12

2012 RTP Background 12
Highway Strategies 13
Rail Strategies 22
Other Strategies 29
Goods Movement Environmental Strategy 31
System Vision

Goods movement and freight transportation are essential to supporting 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 and services 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 RTP.

### 2012 RTP 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 strives to improve 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 RTP proposes a plan for the goods movement system in Southern California with regional initiatives and projects totaling nearly $50 billion through 2035. Key regional initiatives include a comprehensive system of zero-emission freight corridors, alleviation of major bottlenecks, a regional rail package, and an environmental strategy to address emissions. The comprehensive system of zero-emission freight corridors includes I-710, an east-west corridor, and an initial segment of I-15. The regional rail package includes main line capacity enhancements, on-dock and near-dock rail facility improvements, and grade separations. In addition, critical projects underway include strategies 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.

This plan was developed as part of the SCAG multi-year Comprehensive Regional Goods Movement Plan and Implementation Strategy, which began in 2008. Through this effort, SCAG has worked with diverse regional stakeholders to conduct in-depth evaluation of regional freight patterns to identify a multimodal regional freight plan.

This appendix includes an overview of regional goods movement activities and specifically identifies initiatives to facilitate our vision for a world class goods movement system. The first section provides an introduction to the regional goods movement system and describes key system components and how they work together to support the regional economy. The following section describes key markets served by the regional goods movement system and how these markets depend on transportation infrastructure. The final section details regional initiatives and projects, including an action plan to support the development and commercialization of technologies necessary for a 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 regional and national consumer demand. Numerous demand factors (e.g., types of products, destinations, urgency, costs, etc.) create unique markets that must be accommodated through different 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 far-away destinations across the U.S. These markets depend heavily upon an extensive regional infrastructure 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 to develop a comprehensive plan to enhance the regional freight system.

Components of the Regional Goods Movement System

Both international and domestic trade thrives 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:** In 2010, the ports in the SCAG region (Los Angeles, Long Beach, and Hueneme) handled 76 million tons, or $269 billion of imports, and 44 million tons, or $67 billion of exports. 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. 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. 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. 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. 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 rail yards 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).

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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


Warehousing and Distribution Centers: As of 2008, the region had about 837 million square feet of warehousing space. Another 185 million square feet could be developed on vacant land that is zoned for warehousing. In 2008, an estimated 15 percent of the occupied warehouse space served port-related uses while the remaining 85 percent supports a mix of domestic and international cargo. Many of these warehouses are clustered along key goods movement corridors. Port-related warehousing tends to be concentrated in the Gateway Cities subregion while national and regional distribution facilities tend to be located in 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 industries in Southern California is critical for making decisions to support the regional economy. While supply chains vary by industry and product, they can generally be grouped into broad categories:

1. Extraction Industries: These industries generally prefer supply chains structures with low unit transportation costs and high-asset utilization. Examples include industries that ship forest products, grain, and coal.

2. Manufacturing Industries: These 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 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 prefer supply chain structures with the ability to handle high velocities and provide flexible service.

In the SCAG region, manufacturing and retail trade are two major regional industries that are significantly dependent upon goods movement activities. As shown in TABLE 1, these industries 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).

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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.
11 SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy
### TABLE 1  
Regional GDP and Employment Contribution of Key Goods Movement Dependent Industries (2010)

<table>
<thead>
<tr>
<th>Key Industries</th>
<th>Regional Contribution</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2010 Jobs (in Thousands)</td>
<td>2010 GDP (Billions)</td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>744</td>
<td>$88</td>
<td></td>
</tr>
<tr>
<td>Retail Trade</td>
<td>950</td>
<td>$54</td>
<td></td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>429</td>
<td>$51</td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>431</td>
<td>$21</td>
<td></td>
</tr>
<tr>
<td>Transportation and Warehousing</td>
<td>330</td>
<td>$20</td>
<td></td>
</tr>
<tr>
<td>Other Goods Producing</td>
<td>70</td>
<td>$12</td>
<td></td>
</tr>
</tbody>
</table>

Source: SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy

Despite the recent economic downturn, the region’s manufacturing sector remains one of the largest in the nation with Los Angeles County ranked 1st, Orange County ranked 10th, and the Riverside-San Bernardino area ranked 15th.\(^{12}\) 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 the sales output from SCAG’s manufacturing industries was international, 38 percent of the sales were within the U.S. outside the SCAG region, and 27 percent was sold locally within the SCAG region.\(^{13}\)

As a whole, manufacturing industries 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. Therefore, even lower-value products are increasingly dependent on 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).

### TABLE 2  
Expenditures on Transportation by Manufacturing Industries (2010)

<table>
<thead>
<tr>
<th>Transportation Mode</th>
<th>Spending on Different Transportation Modes (Insourced and Outsourced)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Millions of Dollars</td>
</tr>
<tr>
<td>Truck</td>
<td>$3,711</td>
</tr>
<tr>
<td>Rail</td>
<td>$3,261</td>
</tr>
<tr>
<td>Air</td>
<td>$5,116</td>
</tr>
<tr>
<td>Water</td>
<td>$2,471</td>
</tr>
<tr>
<td>Courier</td>
<td>$2,101</td>
</tr>
<tr>
<td>Warehousing and Storage</td>
<td>$876</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$17,536</strong></td>
</tr>
</tbody>
</table>

Source: SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy

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 output was to local markets, with 14 percent of sales to other domestic U.S. locations, and less than 1 percent to international locations. Retail industries in the SCAG region depend heavily on the region’s transportation system to move goods to market. Expenditures on transportation industries by the sector industries in the SCAG region totaled nearly $11 billion in 2010 (TABLE 3).

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\(^{13}\) SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy
TABLE 3  Expenditures on Transportation by Retail Industries (2010)

<table>
<thead>
<tr>
<th>Transportation Mode</th>
<th>Spending on Different Transportation Modes (Insourced and Outsourced)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Millions of Dollars</td>
<td>Percent of Total</td>
</tr>
<tr>
<td>Truck</td>
<td>$7,136</td>
<td>65%</td>
</tr>
<tr>
<td>Rail</td>
<td>$ 542</td>
<td>5%</td>
</tr>
<tr>
<td>Air</td>
<td>$1,619</td>
<td>15%</td>
</tr>
<tr>
<td>Water</td>
<td>$ 709</td>
<td>6%</td>
</tr>
<tr>
<td>Courier</td>
<td>$ 506</td>
<td>5%</td>
</tr>
<tr>
<td>Warehousing and Storage</td>
<td>$ 416</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$10,929</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

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 is 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 RTP 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 these markets, both for international 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. This system involves 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 33 percent of all containers in the U.S. moving through the San Pedro Bay Ports.14 While there has been modest shift recently in container volumes to other U.S., Canadian, and Mexican ports, the number of containers entering the San Pedro Bay Ports is still expected to reach over 42 million by 2035, more than three times current volumes (FIGURE 1). This forecast increase in freight moving through the region will place even greater strain on an already-congested transportation system directly affecting residents and businesses alike.

Container flows through the San Pedro Ports may be categorized as local or discretionary. Local containerized traffic is that which is ultimately consumed (imports) or originally produced (exports) 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 or originates 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.\textsuperscript{15}

Imports, which constitute most of the containers that move through the San Pedro Bay Ports, can be categorized as:

1. **Local:** Imports consumed within the greater region for which San Pedro Bay serves as the closest container port with the lowest landside transportation costs (i.e., imports consumed within Southern California, Southern Nevada, Arizona, New Mexico and southern portions of Utah and Colorado);
2. **Direct-shipping:** Imports moving to destinations outside the SCAG region that simply pass through Southern California while remaining intact in the original marine container;\textsuperscript{16}
3. **Transloaded:**\textsuperscript{17} Imports consumed in destinations outside the SCAG region 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 to other regions. 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.

\textsuperscript{15} SCAG Port and Modal Elasticity Study, Phase II

\textsuperscript{16} This type of import movement is also known as Inland Point Intermodal (IPI) movement.

\textsuperscript{17} 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.
Modal Segmentation

When containers arrive at the San Pedro Bay Ports, their initial and ultimate destinations, and the way they move to those destinations, are determined based upon the economics of inventory and transportation costs from the importers’ points of view. The pursuit of achieving low costs while meeting customer needs has led to the emergence of numerous goods movement strategies utilizing various transportation modes to meet market demands. Driven by these market demands, the import strategies most frequently exercised in the SCAG region include:

1. Direct movement of marine containers to destinations within the SCAG region using local trucks.
2. Direct movement of marine containers to destinations outside the SCAG region using long-haul trucks. Shippers employing this strategy generally serve geographic markets within a 700-mile radius of the San Pedro Bay Ports.
3. Direct movement of marine containers to destinations far outside the SCAG (e.g., Chicago, Kansas City, etc.) region 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.
4. Direct movement of marine containers to destinations far outside the SCAG region using near-dock or off-dock rail facilities at locations in the SCAG region (usually close to the San Pedro Bay Ports). In this type of movement, existing on-dock rail infrastructure is not used. This means that 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.
5. Direct 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 the SCAG region and/or within an estimated 700-mile radius of the SCAG region using trucks.
6. Direct 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.

Drivers of Modal Decisions

The SCAG region consists of broad modal segments. Transportation modal choice is often a complicated process that reflects the type of industry being served.\(^1\) 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—generally prefer trucks to move goods 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 and reliable, such as truck or air. Materials that are supplying a more traditional, inventory-rich industry will not be as time-sensitive, and may potentially choose a slower transportation mode such as rail.

\(^1\) 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 $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). In these zones, foreign goods are temporarily introduced and can benefit from tax savings based upon how they are used (including for transformations or repairs among other things). 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. 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. 

The future economic performance of Mexico faces strong competition from Asia (especially China) as low-wage manufacturing jobs in those areas have eroded the maquiladoras once-traditional competitive advantage. However, studies show that some maquiladoras have evolved from the usual labor-intensive activities to greater degrees of organization complexity, technology utilization, and research and skill specialization and are even incorporating new activities based on coordination and information technologies to survive in the current global market. As such, the future of the manufacturing and maquiladora industry in the Baja California region has a potential positive future.

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 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. Most often used for time-sensitive and higher-valued goods, international air cargo plays a significant role in the regional economy with over $65 billion in trade. 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 complete by Aviation System Consulting 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.

Local Goods Movement

While the region is a major gateway for international container movements, local and domestic freight is dominant. An overwhelming majority of the goods movement activity in the SCAG region is generated by local businesses moving goods to local customers and

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19 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 Potosi and Guanajuato.


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

23 International Trade Trends and Impacts, The Southern California Region, Los Angeles Economic Development Corporation Keyser Center for Economic Research and World Trade Center Association, Los Angeles, Long Beach
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 dispersed transportation network than the international container market. Over 85 percent of truck trips in the SCAG are related to goods movement dependent industries. 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.

In 2010, local goods movement dependent industries, including manufacturing, wholesale and retail trade, construction and warehousing, 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.

**Goods Movement-Dependent Industries** include the manufacturing, wholesale trade, construction, transportation and warehousing, and mining sectors. These businesses rely on transportation as a key part of their business model and daily operations. They may receive daily shipments of raw supplies to support their manufacturing process, or daily delivery of refined or finished product to market. Despite the recent downturn in the economy, goods movement dependent industries remain the foundation for many local area economies within the region.

**Service Industries** include government, education, health care, and other professional categories. These businesses are not as dependent on the movement of raw or manufactured materials, but do rely on shipments of materials, office products, or other small shipments of goods and supplies.

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

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

Regional GDP is one measure of the value added to products and services by businesses and industries. It 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 that is slightly faster than the U.S. economy as a whole. As shown in FIGURE 4, 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
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 contribute a combined $380 billion to regional GDP by 2035 (FIGURE 5).

The SCAG region hosts one of the largest clusters of logistics activity in North America. Logistics activities, and the jobs that go with them, depend on a network of warehousing and distribution facilities, highway and rail connections, and intermodal rail yards. In addition to carrying needed inventories, many warehouses and distribution centers in the SCAG region provide transloading services, or the deconsolidation and reloading of freight from marine containers to domestic containers. The deconsolidation of cargo arriving in marine containers and the subsequent reloading of that content into the larger domestic vehicles enables importers to realize significant cost savings through economies of scale. Transloading provides numerous regional revenue and jobs. 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. Trucking access is particularly critical to warehousing and logistics businesses. However, national distribution centers also need access to rail intermodal terminals and air cargo facilities.

24 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. 25 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. 26 However, employment in California has suffered recently, declining by 1.3 percent in 2008 and 6 percent in 2009. 27 Though unemployment rates in the state, as a whole, are expected to remain high in the foreseeable future, employment in the SCAG region is projected to climb steadily. 28 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 mainline capacity improvements will be required. Mitigating the impacts of increased train traffic on communities will continue 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. 29 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. 30

- **Air Quality Issues:** Much of the SCAG region does not meet federal ozone and fine particulate (PM_{2.5}) air quality standards. Goods movement is a major source of emissions that contribute to these regional air pollution problems (NOx 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.

2012 RTP Goods Movement Strategies

Infrastructure in the SCAG region must serve a variety of markets and be able to support a diversity of supply chains, each having distinct operational needs, to ensure continued economic growth. Various policy strategies must be developed to address many of the consequences of regional goods movements impacts on air quality, the environment, and on local communities. To realize the benefits of efficient and sustainable goods movement, it is critical to identify strategies and projects that address expected growth trends.

2012 RTP 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 address regional goods

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25 http://factfinder2.census.gov (last accessed on July 3, 2011)
26 SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy
28 SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy
29 SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy
30 SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy
movement challenges. This plan, also known as the Multi-County Goods Movement Acton Plan (MCGMAP), identified freight movement constraints and included strategies intended to 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 an in-depth evaluation of the region’s goods movement system and associated regional freight patterns. 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 RTP.

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 can be grouped into the following categories:

- **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 inter-regional 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 4** shows the number of regional truck trips in 2008 by category and county. The overwhelming majority of truck trips in the region are local truck trips. While the San Pedro Bay Ports account for a substantial amount of cargo moved to and from the SCAG region, much of this cargo is moved by intermodal rail to its final destination.

**TABLE 4 Daily Regional Truck Trips by Category by County**

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

In 2008, the San Pedro Bay Ports were responsible for approximately 50,000 direct daily regional truck trips. As shown in **TABLE 4**, this constitutes 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 **TABLE 4** includes only trips on the regional highway system.
vast majority of trips leaving the San Pedro Bay Ports are destined for locations in the southern Gateway Cities, off-dock rail yards 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). 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 highest of all of the east-west corridors.

High annual growth rates in truck volumes will result in an increased share of trucks as a portion of total traffic on many regional corridors by 2035. Without an accompanying increase in capacity along these routes, truck delay, truck emissions, and total vehicle hours of delay will rise. EXHIBIT 4 illustrates expected congestion levels on the regional transportation system during the PM Peak period in 2035 if no action is taken.

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 RTP, SCAG has identified strategies to relieve congestion, reduce delay and harmful emissions, and improve safety on major truck corridors.
EXHIBIT 2  San Pedro Ports Truck Distribution

Port Marine Terminal Gate Surveys - 2010

500
250
1

- Origins
- Destinations

Main Line Rail

Existing UP Rail

Existing BNSF Rail

Summary of Survey Responses
- 12%: Ports & Nearby Area
- 30%: Gateway Cities Area
- 20%: Off-Dock Yards
- 33%: Rest of the SCAG Region
- <5%: Out of State Truck Trips

Source: SCAG, EBP, Shaded Relief, Tari Aman
EXHIBIT 3  Forecasted Growth in Truck Traffic on Key Corridors

2008 Daily Trucks (Bi-Directional)/2035 Daily Trucks (Bi-Directional)

*Numbers in thousands (rounded)
EXHIBIT 4  Congested Speeds in 2035 No Action PM Period
Comprehensive Zero-Emission 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 the I-710, connecting to an east-west segment, and finally reaching the 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 negative impacts on communities and the environment. Physically separated from mixed flow traffic and with less ingress/egress points than typical urban freeways, truck-only freight corridors effectively add capacity in congested corridors, improve truck operations and increase safety by separating trucks and autos.

SCAG recognizes the 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 clean trucks on the I-710. In the 2012 RTP, SCAG identifies an east-west corridor concept that would complement existing efforts to create a comprehensive, zero-emission, truck-only freight corridor system.

EAST-WEST FREIGHT CORRIDOR

The 2012 RTP identifies a corridor concept that would connect to the north end of the I-710 freight corridor, 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). 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 grade separated, bi-directional corridor would be restricted to truck traffic and have limited ingress/egress points. The East-West Freight Corridor would help catalyze the use of zero-emission truck technologies, improving air quality for communities near the corridor and throughout the region. As technology evolves, zero-emission technologies would be applied to the corridor.

Following adoption of the 2012 RTP, it is anticipated that additional study of this alignment concept, along with significant dialogue with local communities and stakeholders, will continue to 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

Significant analysis and stakeholder consultation completed since the 2008 RTP led to the identification of a potential alignment for the East-West Freight Corridor. Routes analyzed for consideration as potential alignments for the East-West Freight Corridor included all existing east-west freeways along with non-freeway and “hybrid” alternatives.
Through detailed analysis and traffic modeling, the corridor concept was identified using several evaluation criteria including:

- **Proximity to Current and Future Markets:** One of the key characteristics of an east-west freight corridor is that it should serve current and future freight markets and the local economy by supporting key regional industries, interregional domestic trade, production facilities (including manufacturing and warehouse clusters), and the San Pedro Bay Ports. Analysis suggests that freight flow patterns on regional east-west corridors are generated by various market segments. These include truck traffic associated with domestic warehousing and manufacturing (including both inter and intraregional traffic), port truck traffic (and secondary traffic), construction, and service trucking.

- **Feasibility and Right-of-Way (ROW) Constraints:** These criteria were evaluated in broad terms of constructability and the severity of physical impacts to land uses adjacent to the corridors under consideration. A key aspect of the right-of-way assessment was whether an east-west freight corridor could be accommodated within existing public rights-of-way.

- **Future Truck Volumes:** Using the updated SCAG Heavy-Duty Truck (HDT) model, the anticipated growth on key regional corridors between 2008 and 2035 was estimated to determine the potential impact an east-west freight corridor.

- **Incidence Rates of Truck-Involved Accidents:** A potential benefit of an east-west freight corridor is the ability to reduce truck-involved crashes because of the separation of trucks and other vehicles. Safety analysis performed for this study revealed that several east-west corridors have high rates of truck-involved crashes, including segments of SR 60, SR 91, and along I-10.

Using the SCAG Heavy-Duty Truck Model, the performance for the six potential east-west freight corridor options remaining after the initial screening was assessed and compared. The following measures of effectiveness (MOEs) were used:

- The volumes of trucks that would be carried by a potential east-west freight corridor in 2035
- Impact on delay of all traffic within the influence area
- Impact on delay of heavy-heavy truck traffic within the influence area
- The impact of an east-west freight corridor on parallel routes (i.e., the effectiveness of each alignment to reduce the truck volumes and congestion on parallel routes)
- The type of truck trips (i.e., markets) that would benefit from an east-west freight corridor.
## TABLE 5  Modeling/Summary Comparison of Six Potential East-West Freight Corridor Alignments

<table>
<thead>
<tr>
<th>ID</th>
<th>Alignment</th>
<th>Summary/Key Points</th>
</tr>
</thead>
</table>
| 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 offers the opportunity to address many regional 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 RTP indicate 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 to 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 11 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 the 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.

- **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. 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 had 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 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-emission technologies for freight transportation. Though the zero-emission 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-emission technologies for freight transportation.

<table>
<thead>
<tr>
<th>Benefits of an East-West Corridor Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mobility</strong></td>
</tr>
<tr>
<td>- Truck delay reduction of approximately 11%</td>
</tr>
<tr>
<td>- All traffic delay reduction of of approximately 4.3%</td>
</tr>
<tr>
<td>- Reduces truck volumes on general purpose lanes—42–82% reduction on SR-60</td>
</tr>
<tr>
<td><strong>Safety</strong></td>
</tr>
<tr>
<td>- Reduced truck/automobile accidents (up to 20–30 per year on some segments)</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
</tr>
<tr>
<td>- 50% clean truck utilization removes: 2.4 tons NOx, 0.08 tons PM_{2.5}, and 2,001 tons CO_{2} daily (2.7–6% of region’s total)</td>
</tr>
<tr>
<td><strong>Community</strong></td>
</tr>
<tr>
<td>- Preferred alignment has least impact on communities</td>
</tr>
<tr>
<td>- Removes traffic from other freeways</td>
</tr>
<tr>
<td>- Zero-emissions technology (ZET)—reduces localized health impacts</td>
</tr>
<tr>
<td><strong>Economic</strong></td>
</tr>
<tr>
<td>- Supports mobility for goods movement industries—comprise 34% of SCAG regional economy and jobs</td>
</tr>
</tbody>
</table>
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. 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. Truck congestion in urban areas within the SCAG region resulted in approximately $2.6 billion in costs. 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 is a cost-effective way to improve the efficiency of goods movement in the SCAG region. Bottleneck projects may also be easier to implement since they are often less intrusive than other types of projects, contribute to the region’s environmental goals (by reducing emissions “hot spots”), and result in substantial, tangible benefits to commuters and goods movement industries alike.

SCAG recently studied key regional truck bottlenecks and associated projects. Through this analysis, project concepts to address the highest priority truck bottlenecks and have the most significant impact on delay were identified and continue to be evaluated. The 2012 RTP allocates an estimated $5 billion to address 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. Annually, 3.6 million hours of heavy truck delay during the most congested time periods on area roadways could be eliminated if the highest priority truck bottlenecks in the region were addressed.

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 rail. 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 RTP, SCAG has highlighted a comprehensive package of improvements to 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 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: 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.

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33 Texas Transportation Institute 2011 Urban Mobility Report
34 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.
35 For purposes of accounting and reporting, the Surface Transportation Board designates 3 classes of freight railroads based upon their operating revenues for 3 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 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 mainlines 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 the 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.

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).

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 7, which shows 2000, 2010 and projected 2035 peak-day train volumes on key segments. Freight train volumes include container 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 grade crossings.
TABLE 7 Peak Day Train Volumes 2000, 2010, 2035 (Metrolink Volumes in Parenthesis)

<table>
<thead>
<tr>
<th>Line Segments</th>
<th>Type</th>
<th>2000</th>
<th>2010</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNSF San Bernardino Subdivision</td>
<td>Passenger</td>
<td>46(19)</td>
<td>54(28)</td>
<td>77(51)</td>
</tr>
<tr>
<td>Hobart – Fullerton</td>
<td>Freight</td>
<td>50</td>
<td>45</td>
<td>90</td>
</tr>
<tr>
<td>BNSF San Bernardino Subdivision</td>
<td>Passenger</td>
<td>16(12)</td>
<td>26(24)</td>
<td>42(40)</td>
</tr>
<tr>
<td>Atwood – W. Riverside</td>
<td>Freight</td>
<td>57</td>
<td>49</td>
<td>99</td>
</tr>
<tr>
<td>BNSF San Bernardino Subdivision</td>
<td>Passenger</td>
<td>11(9 )</td>
<td>10(8 )</td>
<td>42(40)</td>
</tr>
<tr>
<td>W. Riverside – Colton</td>
<td>Freight</td>
<td>92</td>
<td>67</td>
<td>147</td>
</tr>
<tr>
<td>BNSF Cajon Subdivision</td>
<td>Passenger</td>
<td>2(0)</td>
<td>2(0)</td>
<td>2(0)</td>
</tr>
<tr>
<td>San Bernardino – Silverwood PLUS</td>
<td>Freight</td>
<td>94</td>
<td>93</td>
<td>147</td>
</tr>
<tr>
<td>UP Mojave Subdivision</td>
<td>Passenger</td>
<td>14(12)</td>
<td>13(12)</td>
<td>21(20)</td>
</tr>
<tr>
<td>W. Colton – Silverwood</td>
<td>Freight</td>
<td>55</td>
<td>52</td>
<td>98</td>
</tr>
<tr>
<td>UP Los Angeles Subdivision</td>
<td>Passenger</td>
<td>14(12)</td>
<td>13(12)</td>
<td>21(20)</td>
</tr>
<tr>
<td>East LA – Pomona PLUS</td>
<td>Freight</td>
<td>59</td>
<td>51</td>
<td>109</td>
</tr>
<tr>
<td>UP Alhambra Subdivision</td>
<td>Passenger</td>
<td>2(0)</td>
<td>1(0)</td>
<td>1(0)</td>
</tr>
<tr>
<td>Yuma Jct. – Pomona</td>
<td>Freight</td>
<td>42</td>
<td>45</td>
<td>93</td>
</tr>
</tbody>
</table>

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.

REGIONAL RAIL STRATEGIES

The 2011 Regional Rail Simulation Study updates the 2005 Inland Empire Main Line Rail Study. The effort evaluates the mainline 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)

Mainline Capacity Enhancements

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. Because of the locations of certain rail terminals, approximately one-fourth of the UP trains must move against the current of traffic. FIGURE 6 shows the existing routing of the UP Alhambra and Los Angeles Subdivisions. Existing capacity constraints pose significant challenges for the operation of freight trains. 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.
The complete description of the various routing alternatives considered can be found in the 2011 Regional Rail Simulation Study. One option studied to meet the identified goals is the Modified Status Quo (FIGURE 7). 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 mainline 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 mainline track improvements in the 2012 RTP update are associated with the Modified Status Quo alternative. It is recognized, however, that only the 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 mainline track improvements are shown in Table 8. 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 TIGER36 I grant, $91 million from Prop 1B TCIF37 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 Serapsis (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 (W. Colton).

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

<table>
<thead>
<tr>
<th>Mainline Rail Improvements</th>
<th>Estimated Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colton rail-to-rail grade separation – BNSF Cajon Subdivision</td>
<td>$243.60</td>
</tr>
<tr>
<td>Barstow to Keenbrook – BNSF San Bernardino Subdivision</td>
<td>$762.10</td>
</tr>
<tr>
<td>Colton Crossing to Redondo Junction – UP Mojave Subdivision</td>
<td>$1,188.70</td>
</tr>
<tr>
<td>Devore Road to West Colton (inc. Rancho Flying Junction) – UP</td>
<td>$522.00</td>
</tr>
<tr>
<td>Alhambra Subdivision</td>
<td></td>
</tr>
<tr>
<td>West Colton to City of Industry – UP Los Angeles Subdivision</td>
<td>$376.10</td>
</tr>
<tr>
<td>UP Yuma Subdivision</td>
<td>$0</td>
</tr>
<tr>
<td><strong>Total Mainline Rail Improvements</strong></td>
<td><strong>$3,092.40</strong></td>
</tr>
</tbody>
</table>

36  Transportation Investment Generating Economic Recovery
37  Trade Corridor Improvement Fund
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 9). 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 9 shows the percentage of direct intermodal cargo handled at on-dock and near-dock railyards. 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>
<thead>
<tr>
<th>TABLE 9</th>
<th>San Pedro Bay Ports Direct Intermodal Volumes as a Percentage of Total Port Container Throughput (2003–2010)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2003</td>
</tr>
<tr>
<td>% On-Dock</td>
<td>15.9%</td>
</tr>
<tr>
<td>% Near/Off-Dock</td>
<td>23.4%</td>
</tr>
<tr>
<td>Total % Direct Intermodal</td>
<td>39.3%</td>
</tr>
<tr>
<td>Total Throughput (POLA + POLB) Millions of TEUs</td>
<td>11.8</td>
</tr>
</tbody>
</table>

Source: Ports of Los Angeles and Long Beach

PORT AREA RAIL INFRASTRUCTURE IMPROVEMENTS

The Port of Los Angeles and Long Beach have proposed almost $2.7 billion in rail improvements within the harbor area. (TABLE 10). 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 railyards 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 (transloading, 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>
<thead>
<tr>
<th>TABLE 10</th>
<th>Estimated Cost of Port-Area Rail Improvement (Millions of Nominal Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port Area Rail Improvements (excluding SCIG and ICTF)</td>
<td>Estimated Costs</td>
</tr>
<tr>
<td>Port of Long Beach</td>
<td></td>
</tr>
<tr>
<td>On-Dock Rail Yards</td>
<td>$765.30</td>
</tr>
<tr>
<td>Rail Infrastructure Outside Marine Terminals</td>
<td>$1,321.80</td>
</tr>
<tr>
<td>Subtotal Port of Long Beach</td>
<td>$2,087.10</td>
</tr>
<tr>
<td>Port of Los Angeles</td>
<td></td>
</tr>
<tr>
<td>On-Dock Rail Yards</td>
<td>$232.80</td>
</tr>
<tr>
<td>Rail Infrastructure Outside Marine Terminals</td>
<td>$216.10</td>
</tr>
<tr>
<td>Subtotal Port of Los Angeles</td>
<td>$448.90</td>
</tr>
<tr>
<td>Alameda Corridor Transportation Authority (ACTA)</td>
<td>$152.40</td>
</tr>
<tr>
<td>Total Port Area</td>
<td>$2,688.50</td>
</tr>
</tbody>
</table>

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 10** 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

**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 rail yards include a reduction in regional VMT and therefore emissions. 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 rail yards. 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 clean 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.

Sixty-nine grade crossings throughout the SCAG region were identified for inclusion in the financially constrained 2012 RTP. Another 61 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.
RAIL PACKAGE SUMMARY

As shown in Table 11, the combined rail package has been estimated to cost approximately $12.3 billion, including mainline rail improvements, port area rail improvements, near-dock rail yard improvements, and rail-highway grade separations.

Table 11: Estimated Cost of the Proposed Package of Rail Projects, by Major Category (Millions of Nominal Dollars)

<table>
<thead>
<tr>
<th>Category</th>
<th>Estimated Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainline Rail Improvements</td>
<td>$3,092.40</td>
</tr>
<tr>
<td>Port Area Rail Improvements</td>
<td>$2,688.50</td>
</tr>
<tr>
<td>Near Dock Rail Yard Improvements</td>
<td>$1,000.00</td>
</tr>
<tr>
<td>Rail-Highway Grade Separations</td>
<td>$5,568.90</td>
</tr>
<tr>
<td>Total</td>
<td>$12,349.80</td>
</tr>
</tbody>
</table>

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 12, these strategies could eliminate almost 6,000 hours of vehicle delay per day at grade crossings, decrease emissions (NOX, CO2, and PM2.5) by almost 23,000 lbs. of per day, and reduce overall train delay to 2005 levels.

Table 12: Benefits of the SCAG Regional Rail Strategy

<table>
<thead>
<tr>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduces train delay to 2005 levels.</td>
</tr>
<tr>
<td>Provides mainline capacity to handle projected demand in 2035 (includes 43.2 million twenty foot equivalent units, or TEU, port throughput)</td>
</tr>
<tr>
<td>Eliminates 5,782 vehicle hours of delay per day at grade crossings in 2035</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eliminates 79 at-grade railroad crossings.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduces 22,789 lbs of emissions per day (CO2, NOX and PM2.5 combined) from idling vehicles at grade crossings</td>
</tr>
<tr>
<td>Facilitates on-dock rail</td>
</tr>
<tr>
<td>Reduces truck trips to downtown rail yards and associated emissions.</td>
</tr>
</tbody>
</table>

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, the Vincent Thomas (CA-47), Commodore Schuyler Heim (CA-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, 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 the 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:** 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:** Replacement of the seismically deficient bridge and develop 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 St and Harry Bridges Boulevard and access to several shipping terminals.

- **110/SR-47 Interchange & John S. Gibson Intersection/NB I-110 Ramp Access Improvements:** This will provide an additional lane from the SR-47 connector to the NB I-110, extend the existing off-ramp at John S. Gibson Blvd., and 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 the SR-47 and 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. Though 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 the U.S.-101. Average daily traffic counts of heavy duty trucks on local routes range between over 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 Ave.
- Reconfiguring the interchange at Rice Avenue and U.S. 101
- Rice Ave UP Grade Separation
- Rose Ave 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, Calexico East and Andrade accounted for over $10 billion in international trade in 2010. 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 (ODEC), there are a number of challenges in Imperial County that could constrain future economic development. 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:

- The lack of direct freeway connections to rail yards 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)
- 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 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

The SCAG region faces long-term challenges to improve mobility, build a strong economy, attain air quality standards, ensure adequate energy supplies, and contribute to climate protection. Consistent with the Goods Movement Vision Statement, the 2012 RTP strategy will improve regional mobility and contribute to economic vitality while mitigating the environmental impacts of goods movement. 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 significant local health risks which have led to community opposition and litigation, challenging some freight infrastructure projects. Criteria pollutants such as NOX, PM, SOX, 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 negatively impact quality of life and may have health implications. Freight transport is also a major user of energy in the form of diesel fuel, and cleaner sources of secure, reliable energy must be part of the solution.
EXISTING AND PROJECTED ENVIRONMENTAL CONDITIONS

Much of the SCAG region does not meet federal ozone and fine particulate air quality standards as mandated by the federal Clean Air Act. NOX released from goods movement activities combines with Volatile Organic Compounds (VOCs) in the atmosphere to form ozone pollution. In the South Coast Air Basin, 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. 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.

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 NOX. Currently, heavy duty trucks contribute 58 and 75 percent of PM and NOX emissions respectively, and locomotives contribute 4 and 5 percent. FIGURE 8 shows the distribution of emissions from various goods movement sources.

Heavy-duty trucks are usually powered by diesel, which contributes to regional NOX and PM emissions. As shown in TABLE 13, federal and state regulations will contribute to a decrease in NOX and PM, but as VMT increases, these gains become relatively smaller over time. In addition, these regulations do not lead to reductions in CO2 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 in place to accelerate the introduction of cleaner technology. 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 introduction of advanced technology HDVs.

40 Los Angeles, Orange, and non-desert portions of Riverside and San Bernardino Counties
41 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.
TABLE 13  Percent Change in Truck Emissions from 2010 Measurements (Tons per Day)

<table>
<thead>
<tr>
<th></th>
<th>2010 (Tons per Day)</th>
<th>2023</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO\textsubscript{\textalpha}</td>
<td>352.589</td>
<td>-67%</td>
<td>-58%</td>
</tr>
<tr>
<td>PM\textsubscript{2.5}</td>
<td>12.003</td>
<td>-65%</td>
<td>-53%</td>
</tr>
<tr>
<td>CO\textsubscript{2}</td>
<td>64,319</td>
<td>30%+</td>
<td>60%+</td>
</tr>
</tbody>
</table>

Source: SCAG Regional Comprehensive Goods Movement Study

In the South Coast Air Basin, attaining the national ozone standards will require reductions in emissions of nitrogen oxides (NO\textsubscript{2}) well beyond reductions resulting from current rules, programs and commercially-available technologies.\textsuperscript{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\textsuperscript{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 RTP 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 single 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, low-emission trucks and locomotives while centering on continued investments into improved system efficiencies. In the longer term, the strategy is a more fundamental shift in technology—taking critical steps toward phased implementation of a near zero emission and zero emission freight system. This includes planning for new infrastructure to incorporate evolving technologies that will fuel vehicles, charge batteries, and provide power.

GOODS MOVEMENT ENVIRONMENTAL STRATEGY AND ACTION PLAN

In order to implement this strategy with both near and long term objectives, the 2012 RTP includes a four phased action plan with key milestones. This plan calls for collaborative

\textsuperscript{44} Preliminary SCAQMD projections indicate a need to reduce regional NO\textsubscript{2} 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.

\textsuperscript{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).

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

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2023</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO\textsubscript{\textalpha}</td>
<td>16</td>
<td>-3%</td>
<td>-18%</td>
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<tr>
<td>PM\textsubscript{2.5}</td>
<td>0.62</td>
<td>-47%</td>
<td>-61%</td>
</tr>
<tr>
<td>CO\textsubscript{2}</td>
<td>1313</td>
<td>50%+</td>
<td>123%+</td>
</tr>
</tbody>
</table>

Source: SCAG Regional Comprehensive Goods Movement Study
decision making about how to advance research development and deployment of new technologies and expands on the use of existing technologies. The timeline for this action plan is shown in Figure 9. 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

Figure 9 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 as appropriate
- 2012 – Implement plan of advocacy to secure action by federal or other governments
- 2012–2014 – Evaluate, develop, demonstrate, truck technology and wayside power; evaluate and develop funding and implementation mechanisms
- 2012–2014 – Continue to evaluate and determine practicability of applying existing electrified rail technologies (by 2013); evaluate, develop, test new prototype locomotives; and evaluate funding and implementation mechanisms
- 2015–2016 – Resolve need for wayside power for trucks (by 2015) and incorporate decisions on wayside power and technology direction, including strategy, funding and timeframe into 2016 RTP update and next major SIP revision; if existing rail technologies are practicable, identify technologies, infrastructure and implementation mechanisms in RTP update and SIP
- 2016–2020 – Full deployment of zero emission transport for all container drayage between ports and near-dock railyard(s)
- 2017 – 2035 – Full deployment of zero and near-zero-emission trucks for substantially all regional transport; if existing electrified rail technologies can be practically applied to the region, fully deploy such technologies
- 2018–2020 – If existing electrified rail technologies were determined not practicable, resolve need for wayside power for new rail technologies (by 2018) and incorporate planning into the 2020 RTP and next major SIP
- 2018–2035 – Full scale demonstrations of advanced zero or near zero emission rail technology; construction of any needed infrastructure; full operational deployment
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 and near-zero 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-emission technology are on-going additional priorities.

Additionally, significant effort has gone into analyzing the options for a zero-emission rail system in the Basin. These include recent efforts by the Ports of Los Angeles and Long Beach in their Roadmap study49 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. Further discussion of technology categories for locomotives and trucks are addressed in later sections of this appendix.

Phase 1 requires the continued effort among 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.

Phase 2: Evaluation, Development, and Prototype Demonstrations

Key Action Steps:

- Convene logistics working groups
- Secure funding commitments for the development of vehicle prototypes and infrastructure demonstrations
- Develop and demonstrate truck prototypes
- Develop truck wayside power prototypes
- Advance pathway technologies through regulatory, financial and marketing mechanisms
- Determine a set of market criteria to move truck vehicles forward to successful commercialization
- Further study operational impacts of zero emission rail technologies
- Evaluate practicability of implementing existing electrified rail technologies
- Develop locomotive prototypes and wayside power infrastructure, including design validation and initial proof of concept
- 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 also includes initial proof of concept and testing of several types of zero-emission locomotive technologies and supporting infrastructure. Demonstration would include technology optimization along prescribed routes under conditions applicable to goods movement activities. An initial step 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. 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. An important demonstration and initial deployment site advanced zero-emission truck technologies is the corridor between the Ports and near dock container yards. The shorter distance (approximately 5 miles) reduces technological and cost obstacles and should be an important part of the initial effort to develop a regional zero emissions transportation system.

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-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 or near zero-emission rail system both within the Basin and on the larger national freight railroad system. This study would build on the work of SCAG’s Rail Electrification Study, 2011. 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 in the South Coast Air Basin.
At the conclusion of Phase 2, locomotive and truck technologies would be selected for Phase 3 Demonstration.

**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 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:**
- 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

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.

**AGENCY ROLES AND RESPONSIBILITIES FOR ACTION**

This section describes 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.
### Table 15: Trucks: Agency Major Implementation Actions

<table>
<thead>
<tr>
<th>Year(s)</th>
<th>Agency</th>
<th>Agency Action</th>
</tr>
</thead>
</table>
| 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  
- 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-emission technologies on national priorities, (e.g. energy security, energy cost certainty, interstate transportation, climate protection). |
| 2012-2014     | SCAG, with AQMD/ARB on SIP | - 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 |
| 2015-2016     | SCAG, with AQMD/ARB on SIP | - Resolve need for wayside power infrastructure for trucks on I-710 and other corridors beyond near-dock railyards, including East-West 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  
- 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 16  Locomotive/Rail: Agency Major Implementation Actions

<table>
<thead>
<tr>
<th>Year(s)</th>
<th>Agency</th>
<th>Agency Action</th>
</tr>
</thead>
</table>
| 2012    | SCAG   | • Incorporate “footprint” and planning for wayside power into expansion of rail lines in financially constrained 2012 RTP  
|         |        | • Incorporate funding to support rail evaluation and demonstration efforts into financially constrained 2012 RTP  
|         |        | • 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-emission technologies on national priorities, (e.g. energy security, energy cost certainty, interstate transportation, climate protection)  
| 2012–2014 | SCAG, with AQMD/ARB on SIP | • Evaluate and determine practicability of applying existing electrified rail technologies to region (by 2013)  
|         |        | • Evaluate potential funding and implementation mechanisms for zero and near zero emission locomotives, and wayside power, including:  
|         |        | • Private (railroads); federal, state, local government; public-private partnerships; electric utility  
| 2015–2016 | SCAG, with AQMD/ARB on SIP | • If existing electrified rail technologies were 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 | • 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-emission range without wayside power  
|         |        | • If wayside power is needed, incorporate “footprint” and planning for wayside power into rail lines into 2020 RTP and next major SIP  
|         |        | • Incorporate 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

As described in the previous section, the 2012 RTP recommends a two pronged environmental strategy to be implemented in four phases. The air quality problems facing the region are immediate, yet 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, we must also work to commercialize and implement existing solutions. For trucks, an aggressive program to bring more currently available, clean fuel trucks 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. A regional freight corridor program represents an opportunity to commercialize zero-emission technologies and create incentives in the market. For rail, near term technologies exist for switcher locomotives to reduce emissions at rail yards. A longer term objective of a zero emission system will be reached through further technology development as described above. This section will briefly describe both near term and long term technologies that have the potential to reduce emissions and help the region meet attainment deadlines.

NEAR TERM TRUCK TECHNOLOGIES

In the near term, natural gas trucks and hybrid-electric trucks are both available technologies that produce fewer emissions than conventional trucks. 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; adequate fueling infrastructure and/or the use of LNG could address the range issue. 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.

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-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 5 on-road drayage trucks. The anticipated delivery date of these prototypes is December, 2011.

TRUCK TECHNOLOGIES FOR ZERO-EMISSION FREIGHT CORRIDORS

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 Regional Goods Movement Plan and Implementation Strategy, 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, shows promise for goods movement corridors.

Wayside power offers a potential advantage to trucks that move on key freight corridors, providing the ability 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 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., railyards 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.

**NEAR TERM RAIL EMISSION REDUCTIONS STRATEGIES**

Switcher locomotives contribute only a small share of total locomotive emissions; however, their activity is concentrated in rail yards and greatly impacts surrounding communities. Nevertheless, low-emission technologies are available and have relatively low costs. To reduce emissions from switcher locomotives, one option is to replace remaining Tier 0+ switchers with new Tier 4 switchers. Although there are only projected to be 29 Tier 0+ switchers in the Basin in 2023, they have high emission rates. NO₂ and PM₂.₅ 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 NO₂ and PM₂.₅ 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 NO₂ and PM₂.₅ emissions by 1–3 percent.

<table>
<thead>
<tr>
<th>Year</th>
<th>Switcher baseline</th>
<th>With Strategy</th>
<th>% Change</th>
<th>Switcher baseline</th>
<th>With Strategy</th>
<th>% Change</th>
<th>Switcher baseline</th>
<th>With Strategy</th>
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*Source: SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy*

<table>
<thead>
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<th>Year</th>
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<th>With Strategy</th>
<th>% Change</th>
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<td>-62%</td>
<td>153</td>
<td>153</td>
<td>0%</td>
</tr>
</tbody>
</table>

*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 mainline 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. General Atomics has a proposal for such a proof of concept to be performed on an existing track in San Diego. Construction of any electrified rail system in Southern California would require a large investment, as well as cooperation by the BNSF and UP railways.

Electrification of the railroad mainlines would reduce line-haul NO\textsubscript{X} and PM\textsubscript{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 less emissions. Furthermore, all power plants in the SCAB are natural gas powered, and also release fewer emissions. Most power plants are located outside the SCAB and therefore emissions from these sources will 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 the 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 applicable 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 but significant undertaking with technological, cost and operational challenges. As outlined above, the 2012 RTP delineates a path forward—a series of steps and decision points to move the region to achieve this objective. A near-zero/zero-emission freight transportation system requires industry stakeholder participation. Numerous state and federal resources agencies, transportation agencies, commercial technology developers/manufacturers and logistics experts must be involved. The 2012 RTP, developed in coordination with many of these stakeholders, reiterates this as a priority and establishes the regional path forward to such a system.