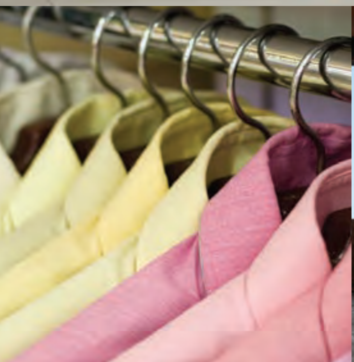


ON THE MOVE

SOUTHERN CALIFORNIA DELIVERS THE GOODS

SOUTHERN CALIFORNIA
ASSOCIATION of GOVERNMENTS

FREIGHTWORKS
SOUTHERN CALIFORNIA DELIVERS THE GOODS

Comprehensive Regional Goods Movement Plan and Implementation Strategy

ON THE MOVE

SOUTHERN CALIFORNIA DELIVERS THE GOODS

Comprehensive Regional Goods Movement Plan
and Implementation Strategy

final
report

prepared for

The Southern California Association of Governments

prepared by

Cambridge Systematics, Inc.

with

Arellano Associates

Diverse Strategies for Organizing, Inc.

Economics and Politics, Inc.

ICF International

Leachman and Associates

**METRANS Transportation Center –
University of Southern California and
California State University at Long Beach**

Public Financial Management, Inc.

URS Corporation

Wiltec, Inc.

February 2013

The preparation of this report was financed in part through grants from the United States Department of Transportation (U.S. DOT).

4 Existing and Future Conditions and Needs of the Southern California Goods Movement System

The goods movement system in Southern California must undergo significant improvement if it is going to meet the needs of users, support economic growth, and address environmental and community concerns. The projected growth in freight transportation in the region is significant, but the system's performance and capacity are lagging behind. This chapter presents current conditions and forecasts of freight traffic by mode, and outlines the compelling reasons for taking action to address capacity needs. The analysis of freight traffic and needs is presented with reference to major markets that drive demand for goods movement services and to the four major functions that were presented in Chapter 2. This helps to illustrate how current and projected conditions will affect the users of the system and those who depend on it for delivering goods from suppliers and to markets.

Chapter 3 described how the different modal elements of the SCAG goods movement system serve the different functions that were introduced in Chapter 2. In this chapter, we describe the volume of traffic on each of the modal systems and how this is related to the modal markets and submarkets that drive demand for goods movement, how growth in these markets will affect future traffic levels, and how this growth will affect future system performance. As appropriate, modal system performance will also be related to the broader functions of the goods movement system which are:

- Supporting regional manufacturing activities;
- Providing access to international gateways;
- Serving the needs of local business and residents; and
- Supporting a thriving logistics industry.

The chapter is organized as follows: highways, rail lines and yards, ports, airports, border crossings, and warehouses. However, it is important to keep in mind when reviewing conditions and projections for modal systems that they are linked together to serve the key goods movement functions. Thus, the condition of intermodal connections is also important to the overall performance of the goods movement system.

4.1 Highways

4.1.1 Truck Traffic Markets as Drivers of Truck Traffic Demand

Mirroring the diversity of the SCAG regional economy, the truck traffic on the SCAG regional highway system represents many different submarkets. In this chapter, these submarkets are defined based on how they are represented in the SCAG Heavy-Duty Truck (HDT) Model, the principal tool used in this study to estimate truck traffic volumes on each roadway.

Table 4.1 illustrates a breakdown of daily truck trips in the SCAG region in 2008 by the submarket segments as described by the SCAG HDT Model. The SCAG HDT model was originally developed in 1997 and was one of the first metropolitan truck models to recognize the role that different trucking submarkets play in generating truck traffic. Different components of the model represent the different truck trip generation and trip flow patterns of each of the submarkets. Over the years since the model was first developed, different trucking submarkets have been added to the original model structure. In addition to substantial new data collection and improvements to the model logic, the updates to the SCAG HDT model developed for the Comprehensive Regional Goods Movement Strategy and Implementation Plan included the addition of a domestic intermodal (IMX) submarket and a secondary port trip submarket model as described below. The submarket segments as defined in the HDT model and their relationship to the 4 main goods movement functions described throughout this report is presented below.

- Internal[1] – These truck trips have both the origin and destination within the region. They are associated with functions such as local distribution and service trucking but also include some manufacturing and logistics-related traffic. As defined in the SCAG HDT model, this submarket does not include international gateway traffic associated with the region's container ports. In analysis of the users of the major truck routes in the region it is possible to further divide this submarket based on the types of industries/land uses that generate the truck trips within the region including manufacturing, wholesale and retail trade, transportation and warehousing, construction, households, agriculture, and mining/forestry/fishing.
- External[2] – These are inter-regional trips associated with functions including manufacturing supply chains, inter-regional distribution of consumer products (logistics activity), and the movement of international gateway traffic that is shipped inter-regionally by truck (including shipments across the international land borders).
- Port – These are truck trips where at least one end of the trip is at either the Port of Los Angeles or the Port of Long Beach. This includes trips involving marine containers between the ports and the intermodal rail terminals. This is all international gateway traffic.
- IMX – These are truck trips to and from the intermodal rail terminals where the cargo is being shipped in a domestic container or trailer. This consists of shipments to and from regional manufacturers with some traffic associated with local distribution and service businesses (for example, UPS traffic that moves to and from the region by rail). This also includes international cargo that has been transloaded and moved to an intermodal terminal for inland shipment. It does not include any off-dock intermodal trips moving directly from the ports.
- Secondary – These are truck trips involving international cargo where the cargo has already been moved from the ports to a transload, cross-dock or container storage yard. The secondary trip is the trip from the transload, cross-dock or container storage yard to another warehouse or distribution center within the region (cargo transloaded to rail is included in the IMX submarket).

---

[1] Note that truck trips with origins or destinations at the port, intermodal terminals, and secondary port trips are not included in this category even though these types of trips often have both the origin and destination within the region.

[2] "Through" traffic where both the origin and destination of the trip are located outside of the SCAG region are not included in the table. Also inter-regional truck trips associated with the ports and the intermodal terminals are not included in the table because they represent an extremely small fraction of regional truck traffic.

Table 4.1 Daily Truck Trips (Origins) by Market and by County, *2008*

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

Source: SCAG Heavy-Duty Truck Model, 2012.

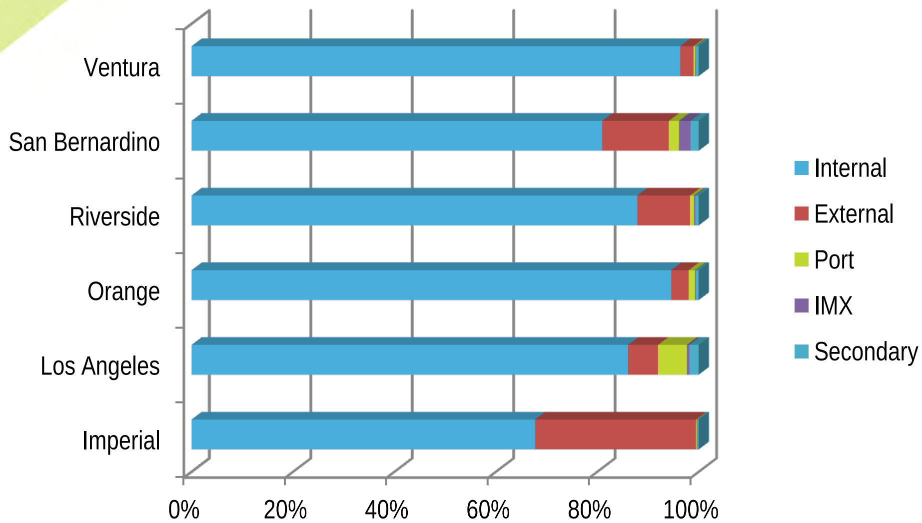
In addition to categorizing truck traffic in terms of submarkets, the HDT Model also divides truck traffic into three weight class categories consistent with the way emissions modeling for trucks is conducted by the U.S. E.P.A. and the California ARB (see Chapter 3 for more information about the types of trucks that fall into each category):

- Light Heavy Trucks have a gross vehicle weight rating of 8001 lbs. to 14,000 lbs;
- Medium-Heavy Trucks have a gross vehicle weight rating of 14,001 lbs. to 33,000 lbs; and
- Heavy-Heavy Trucks have a gross vehicle weight rating of over 33,000 lbs.

Internal truck trips accounted for the vast majority (87 percent) of truck trips in 2008. Over 60 percent of these trips were made by light-heavy and medium-heavy trucks, whereas all of the other categories are dominated by heavy-heavy trucks. In fact, external, port, IMX, and secondary truck trips represent 27 percent of the region's heavy-heavy truck trips in 2008 but only 13 percent of total daily truck traffic.

The table also shows that Los Angeles County accounted for over half (56.4 percent) of the total daily truck trips. Internal truck trips in Los Angeles County amounted to 562,841 trips per day, or 64.5 percent of all internal trips, and nearly half (48.5 percent) of all truck trips in the region. Although there is a general public perception that port-related truck trips dominate congestion, pollution, and accident-related issues associated with goods movement, this is not actually true. In fact, the ports generated only 3.7 percent of all truck trips in the region in 2008. Figure 4.1 shows the same data in bar graph form. External trips make up a larger share of the trips that have origins or destinations in Imperial, Riverside and San Bernardino Counties and port trips make up a larger share of truck trips in Los Angeles County than the overall regional share of these types of truck trips.

Figure 4.1 Daily Truck Trips by Type and by County, *2008*



Source: SCAG Heavy-Duty Truck Model.

Understanding the growth trends underlying the four main functions for goods movement in the region is useful in forecasting future truck traffic growth and the patterns of this growth both in terms of where growth will occur and which types of trucks will experience the greatest levels of growth. Local service and distribution truck traffic (which is a major component of the internal truck submarket) should grow at rates that are similar but slightly higher than general population growth reflecting the impacts of income growth; i.e.; increased personal consumption and the related increase in trucking to serve this growing consumption. Increased use of e-commerce by consumers is also expected to impact local service and distribution driving it to higher growth rates than general population growth. Movements to and from manufacturers in the region are likely to grow more as a function of manufacturing's contribution to Gross Regional Product (GRP) than manufacturing employment (employment in manufacturing is expected to declining whereas manufacturing GRP is expected to continue to grow). Regional manufacturing is a major contributor to the external truck submarket. Port traffic in general and traffic to transload facilities, import warehouses, and regional distribution centers in particular is expected to grow at a very high rate based on projected growth in port cargo – about a tripling from 2010 to 2035. The growth in transloading traffic (which generates a growing share of port-related truck traffic) is based in part on an increasing acceptance of transloading by small and medium sized importers (See Section 4.2.1 on Rail Markets as Drivers of Demand). Growth in the region's logistics businesses is also expected to drive significant growth in inter-regional trucking activity as the Southern California continues to expand as a national and western regional distribution location. These last three trends – growth in port activity, increased use of transloading (a subset of the port growth trend), and growth in logistics activities – represent important trends in the regional economy. Logistics and trade related businesses will provide an increasingly important source of employment – but they will also provide a growing share of regional truck traffic. The spreading out of the warehouse and logistics infrastructure along major truck corridors in the region coupled with continued growth in higher value manufacturing output that relies on high quality trucking services, will make these sectors – regional manufacturing, international trade, and logistics industry activity – important drivers of truck demand in the future. In fact, by 2035, external, port, IMX, and secondary port trips will grow to represent almost 24 percent of the truck trips in the region (up from just under 14 percent in 2008) and will represent over 40 percent of heavy-heavy duty truck trips. The concentration of manufacturing facilities and warehousing along the region's major central highway corridors will fuel high levels of growth in truck traffic along these corridors. As the demand characteristics of these trucking submarkets favor the use of heavy-heavy trucks which utilize more roadway capacity per vehicle than lighter trucks and autos, these demand trends should lead higher levels of truck-related congestion on the major central highway corridors. These corridors will also continue to have some of the highest levels of truck-involved accidents and will be major sources of pollution from diesel fuels.

The following section uses the information about market growth along particular corridors to identify which corridors have high levels of truck traffic, truck traffic growth, and congestion. This identification of corridor-level needs is an important factor in determining where and what types of strategies will be necessary to preserve goods movement mobility, ensure safe transportation, and mitigate environmental/community impacts.

4.1.2 Current and Projected Truck Traffic on Major Corridors

As described in Chapter 2, trucks support each of the key goods movement functions and they carry the largest fraction of goods moved, both in terms of ton-miles and cargo value, of all of the goods movement modes. They do this on a roadway system that also carries a growing volume of passenger traffic.

In order to understand where there will be growing needs for truck capacity and operational improvements, the Comprehensive Regional Goods Movement Plan and Implementation Study examined current and future truck traffic volumes on the key truck corridors, and analyzed current and future congestion levels on these corridors. As presented in Chapter 3, a system of critical truck corridors was identified by evaluating which facilities are most heavily used by trucks. A map of these corridors can be found in Chapter 3. For these 15 corridors the locations with the highest daily five-axle truck volumes in 2008 are shown in Table 4.2. The highest five-axle plus truck volume recorded in 2008 was on I-10 at the Jefferson Street/Indio Boulevard interchange near Bermuda Dunes, California.

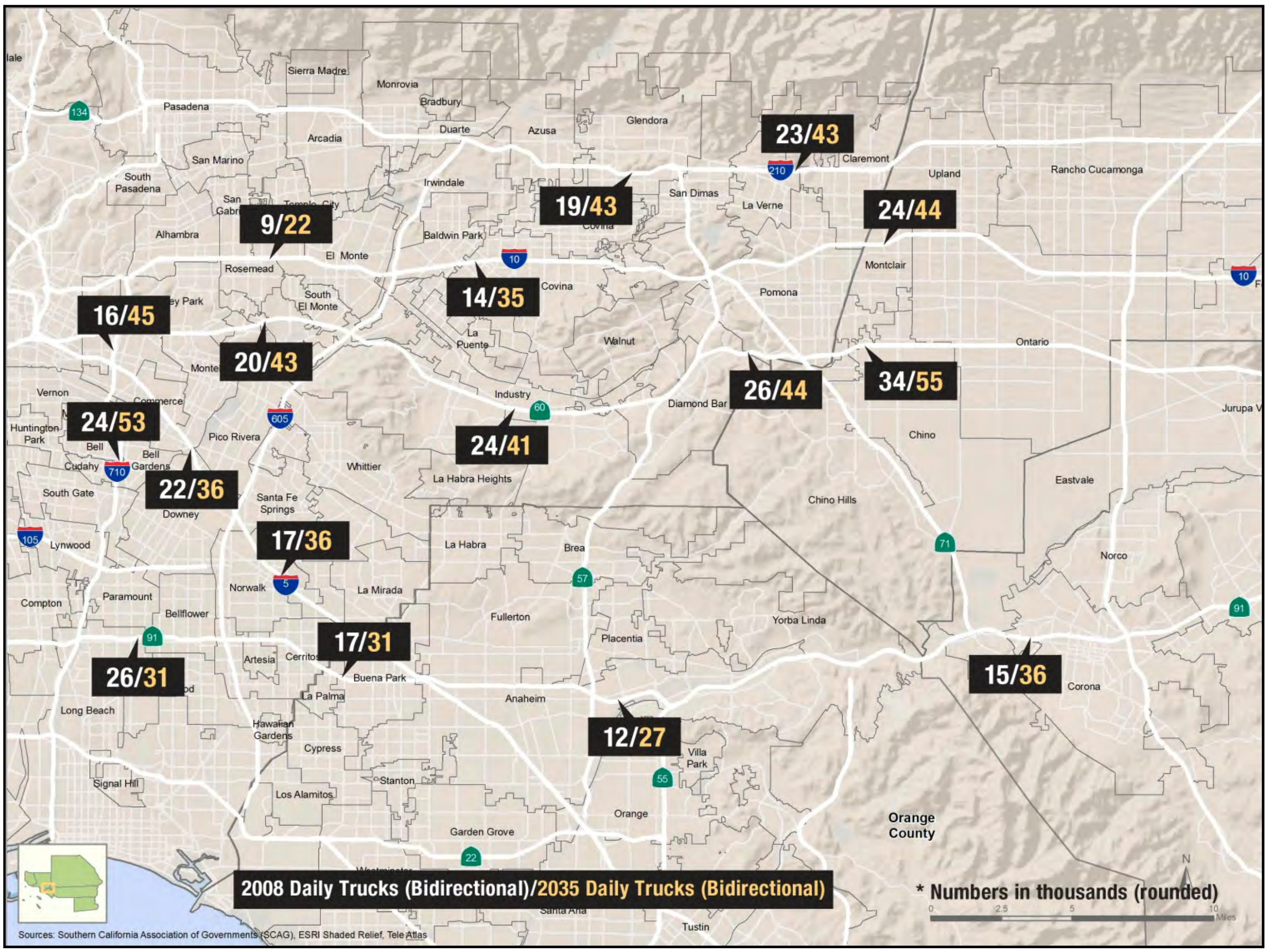
Table 4.2 Maximum Daily Truck Traffic Volumes (5-Axle Trucks) for the Most Significant Truck Routes in the SCAG Region, *2008*

Route	Location	2008 Annual Average Daily Truck Volume (Five-Axle Trucks)
I-5	Junction SR 14	15,338
I-10	Jefferson Street/Indio Boulevard	21,526
I-15	Junction I-215	13,379
SR 40	Barstow, Junction I-15	6,565
SR 60	Ontario, Junction SR 83	16,777
SR 91	Long Beach, Junction I-710	14,935
U.S. 101	Los Angeles, Junction I-405	9,000
I-105	Lynwood, Junction I-710	9,491
I-110	Los Angeles, Junction SR 91	11,853
I-210	Duarte, Junction I-605	12,649
I-215	Junction SR 60 East	9,302
I-405	Long Beach, Lakewood Blvd. Interchange	6,689
I-605	Santa Fe Springs, Junction I-5	13,861
I-710	Long Beach, Begin I-710	17,938
SR 57	Orange, Junction I-5 and SR 22	15,010

Source: Caltrans, http://traffic-counts.dot.ca.gov/.

Truck traffic in the region is expected to grow at a very high rate – much higher than auto traffic – and will use an increasing share of the region's highway capacity. Figure 4.2 shows 2008 and 2035 forecasts for all trucks (not just five-axle trucks). It is expected that total truck traffic on the major truck corridors will grow by 80-100 percent between 2008 to 2035. Most of these routes are already very congested and will continue to be congested in the future. This will cause increasing delay for the trucking industry and increasing costs to shippers and ultimately to consumers. The highest volumes of truck traffic and truck traffic growth will be experienced on I-710 and SR 60 followed closely by I-210, portions of I-10, and portions of I-5. All of these segments will experience high levels of congestion in the future. They are among the most-congested truck corridors in the region.

Figure 4.2 Growth of Truck Traffic on Major Freeways,
2008 to 2035



4.1.3 Truck Bottlenecks

As noted previously, the preponderance of truck traffic in the SCAG region is intraregional traffic. The sources of this trucking demand includes almost every aspect of economic activity in the region and thus, intraregional trucking occurs on all major highways and many connecting arterial roadways. While the demand for intraregional trucking may not be growing as rapidly as some other trucking submarkets, it represents such a large share of regional goods movement that its effects on highway system must be considered in any goods movement plan.

Another approach to identifying needs for truck-related highway improvements that is more apt to account for the widespread effects of intraregional trucking is to identify bottlenecks or congestion "hot spots" using measured roadway speed data and truck counts. The advantage of this approach is that the speed data is more accurate for individual roadway segments than can be obtained with a regional travel demand model like the HDT Model (the volume/speed relationships in the model are based on regional averages and do not take into account actual operational conditions in a particular location). The disadvantage of using measured speed data is that it can only identify congestion hot spots for current conditions. For corridors that may not experience relatively high levels of congestion today but are anticipated to experience much higher than average levels of truck traffic growth, using current conditions is likely to underestimate bottleneck problems.

The truck bottleneck analysis conducted for the Comprehensive Regional Goods Movement Plan and Implementation Study used data on roadway speeds by time period obtained from INRIX and PeMS (see call out box describing data collection for the study for an explanation of these databases) and truck volume data obtained from the Caltrans truck count database[3]. Through a detailed process using these data, a set of almost 200 candidate truck bottleneck locations were identified. "Daily Congested Truck Delay" (DCTD) in vehicle hours was then calculated in order to rank the severity of bottlenecks, and to prioritize them according to a common scale. [4]

Using the DCTD metric, congested areas/bottlenecks were ranked, and the top truck bottleneck locations were identified as high priority truck bottlenecks based on the amount of daily congested truck delay that they experience.[5] This list of high-priority truck bottlenecks was adjusted to include bottlenecks on critical corridors identified in Caltrans' Corridor System Master Plans (CSMP) and several bottlenecks identified by regional stakeholders for which there was insufficient detailed speed data available in either the INRIX or PeMS databases.

Approximately 50 priority truck bottlenecks were identified. This is highlighted in Table 4.3 below, and shown graphically in Figure 4.3. Improvements that address these truck bottlenecks would improve truck mobility, reduce accidents, and benefit all sectors of the economy that rely on trucking services. The benefits of a bottleneck alleviation strategy, and the types of projects that would part of this strategy, are discussed in Chapter 6 of this study.

---

[3] Truck Traffic (Annual Average Daily Truck Traffic) on California State Highways, 2008 Booklet, published by the Traffic Data Branch of the California Department of Transportation.

[4] A more detailed description of the procedures used to filter the potential bottlenecks and of the data used in the analysis is included in a white paper that is included in the appendices accompanying this report.

[5] Annual congested truck delay values were computed from daily congested truck delay values using 250 days per year operation of trucks.

Truck Data for Comprehensive Regional Goods Movement Plan and Implementation Study

As part of the study, several data sources were used to assess highway system usage and performance, including commodity flow databases, traffic counts, surveys, GPS data, and road speed data. These data sources were used to improve the accuracy of the Heavy Duty Truck Model and to provide a better understanding of how goods flow in the region. The Heavy Duty Tuck Model estimates the number of truck trips by type. A complete listing of these data sources is shown below.

Commodity Flow Data – SCAG purchased a proprietary data base (Transearch) from IHS-Global Insight (a leading economic data firm) that provides information about the tonnage and value of goods moving in the region. The database classifies the types of goods moved, the mode used, and the origins and destinations of the movements. The data are compiled from a variety of public databases, proprietary economic models, and a rich database of truck movements provided by major national and regional motor carriers.

Establishment Surveys – A statistical survey of businesses throughout the region was conducted to determine the number of truck trips arriving and departing these businesses by industry type and the type of trucks that are used.

Truck GPS Data – Many trucking fleets now use Global Positioning Systems (GPS) to track the activity of the trucks they own. SCAG purchased these GPS data from two different vendors of these tracking systems. This provided a database that could be used to track where trucks in the region stop and what routes they use.

Gate Surveys – Surveys were conducted at the marine terminal gates at the Ports of Los Angeles and Long Beach to determine the origins and destinations of trucks calling at the ports at different times of day. In addition, the Plan draws on surveys of major domestic intermodal rail shippers conducted by LA Metro to determine the origin and destination patterns of trucks moving to and from the region's intermodal terminals.

Logistics Surveys – Surveys were conducted of shippers, logistics service providers, and licensed motor carriers who handle international marine cargo to understand their logistics practices and provide insight on where secondary port trips occur in the region.

Traffic Counts – An extensive program of traffic counts around the region was conducted to determine truck traffic volumes by truck type. This was supplemented with the regular count data provided by Caltrans and data from the Caltrans operated Weigh-in-Motion stations.

Road Speed Data – SCAG purchased an extensive set of traffic data from INRIX, a company that combines data from privately owned and reliable "crowd sourcing" technologies such as GPS-enabled cars and mobile devices with public data sources. The dataset includes detailed data on truck and auto speeds throughout the regional roadway system that were used along with Caltrans' Performance Measurement System (PeMS) roadway detector data to identify critical truck chokepoints and congestion hot spots.

Table 4.3 High-Priority Truck Bottlenecks/Congested Areas in the SCAG Region

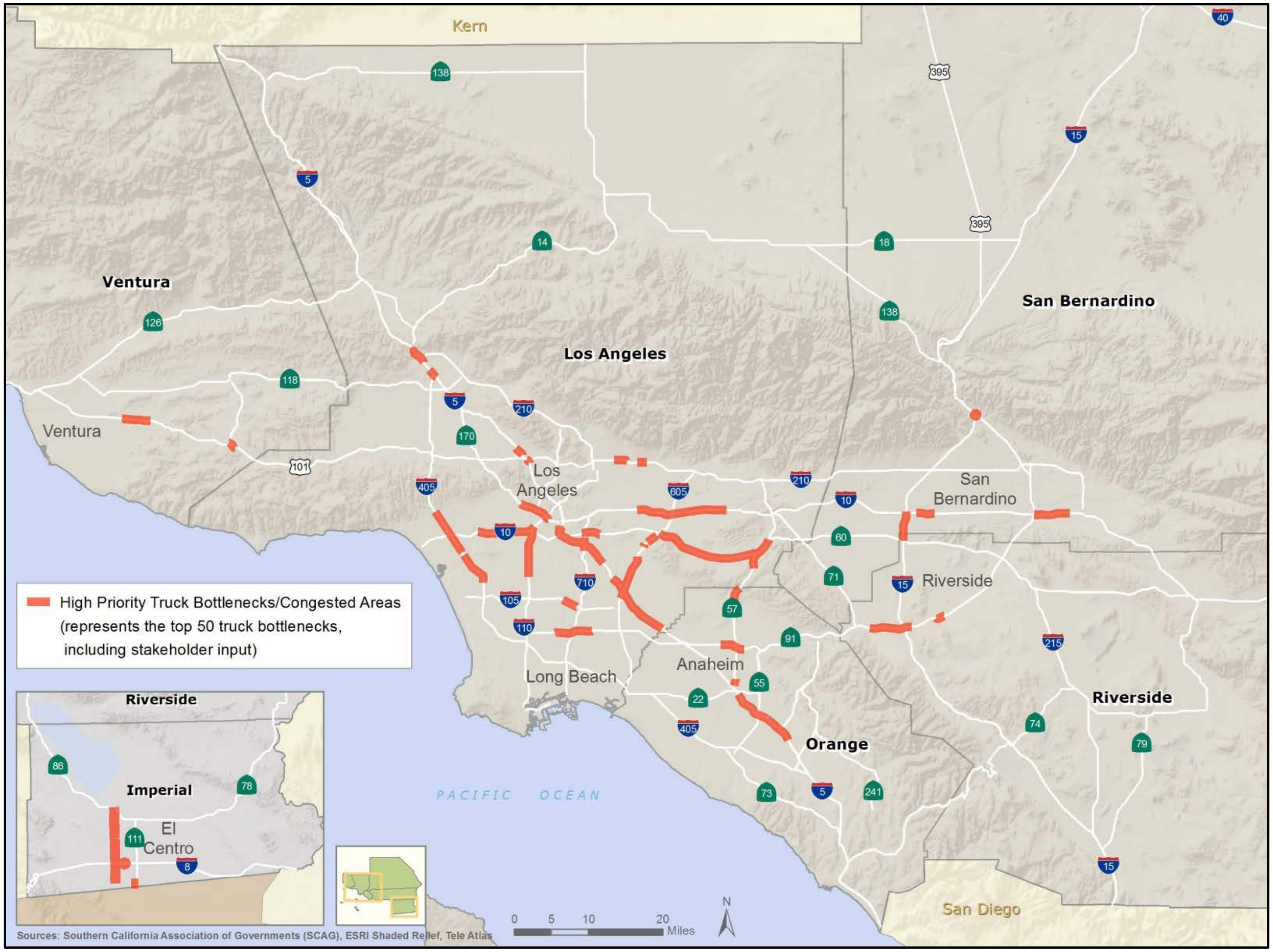
Bottleneck No	Data Source	Hwy	Dir	Milepost	County	Annual Congested Truck Delay (ACTD) in Hours
1	INRIX	605	SB	13.8	Los Angeles	53,008
2	INRIX	5	NB	117.8	Los Angeles	44,895
3	INRIX	405	NB	46.5	Los Angeles	39,674
4	INRIX	101	SB	4.1	Los Angeles	38,720
5	PeMS	5	NB	124.9	Los Angeles	37,578
6	PeMS	605	NB	17.5	Los Angeles	37,288
7	PeMS	60	EB	18.3	Los Angeles	36,996
8	INRIX	110	NB	16.1	Los Angeles	33,046
9	INRIX	10	EB	25.6	Los Angeles	32,684
10	INRIX	91	WB	3.9	Los Angeles	31,973
11	PeMS	60	EB	21.6	Los Angeles	31,317
12	INRIX	110	SB	17.8	Los Angeles	30,638
13	INRIX	60	EB	19.3	Los Angeles	30,529
14	PeMS	10	WB	32.0	Los Angeles	29,682
15	INRIX	405	NB	50.8	Los Angeles	28,438
16	PeMS	60	EB	5.1	Los Angeles	28,089
17	INRIX	60	EB	8.2	Los Angeles	27,327
18	PeMS	91	WB	42.7	Los Angeles	27,147
19	INRIX	101	NB	132.4	Los Angeles	25,354
20	INRIX	5	SB	128.5	Los Angeles	25,193
21	PeMS	5	NB	101.5	Orange	24,867
22	PeMS	605	NB	19.2	Los Angeles	23,936
23	INRIX	5	SB	132.3	Los Angeles	23,712
24	INRIX	210	WB	31.0	Los Angeles	22,928
25	PeMS	60	WB	13.0	Los Angeles	22,550
26	PeMS	91	WB	40.9	Riverside	22,404
27	INRIX	5	NB	160.8	Los Angeles	22,271
28	INRIX	10	WB	30.1	Los Angeles	21,869
29	INRIX	10	EB	6.6	Los Angeles	21,585

Table 4.3 High-Priority Truck Bottlenecks/Congested Areas in the SCAG Region *(continued)*

Bottleneck No	Data Source	Hwy	Dir	Milepost	County	Annual Congested Truck Delay (ACTD) in Hours
30	INRIX	105	WB	12.9	Los Angeles	21,529
31	PeMS	5	NB	119.2	Los Angeles	21,027
32	INRIX	60	WB	16.4	Los Angeles	20,531
33	PeMS	710	SB	17.5	Los Angeles	20,169
34	PeMS	91	WB	23.6	Orange	20,068
35	CSMP	5	SB	144.3	Los Angeles	NA
36	CSMP	10	EB	70.5	San Bernardino	NA
37	CSMP	57	SB	12.3	Orange	NA
38	CSMP	91	WB	46.9	Riverside	NA
39	CSMP	210	WB	28.8	Los Angeles	NA
40	Stakeholder	215	NB/SB	NA	San Bernardino	NA
41	Stakeholder	10	EB	57.5	San Bernardino	NA
42	Stakeholder	101	NB	53.2	Ventura	NA
43	Stakeholder	101	NB	42.1	Ventura	NA
44	Stakeholder	98			Imperial	NA
45	Stakeholder	Forrester Road			Imperial	NA
46	Stakeholder	8			Imperial	NA
47	Stakeholder	57	NB	24.4	Los Angeles	NA
48	Stakeholder	710	NB	0.5	Los Angeles	NA

Note: Annual congested truck delay values were computed from daily congested truck delay values using 250 days/year operation of trucks.

Figure 4.3 Map of High-Priority SCAG Region Truck Bottlenecks/Congested Areas



4.1.4 Truck Safety

A critical concern about growing truck traffic in the region is truck-involved accidents. According to the California Highway Patrol's Statewide Integrated Traffic Records System (SWITRS), there were 99 fatal truck-involved crashes in the SCAG region in 2009, and 2,564 truck-involved crashes that resulted in injuries[6]. Each one of these accidents is tragic, disruptive, and costly. The average cost per fatal crash for commercial vehicles has been estimated at $7.2 million.[7]

Safety analysis performed for this study revealed that several key highway corridors in the SCAG region have high rates of truck-involved crashes, including segments of SR 60, SR 91, and I-10. Mapping a five-year average of truck-involved crashes[8] on key highway corridors (see Figure 4.4) reveals that SR 60 between I-605 and SR 57 has 10-15 truck crashes per mile yearly, which represents the highest average annual truck crash rate of any corridor. A short segment near the intersection of SR 60 and SR 57 experiences 20-30 crashes per mile yearly. In addition, there are several interchanges on key highway corridors that have relatively high crash rates, including the SR 91/I-710 and the SR 60/I-5 interchanges.

According to the trucking industry, studies show that truck-involved accidents are often the result of interactions with autos where auto drivers underestimate the maneuverability of trucks. Truck drivers are generally well-trained but certain roadway geometrics (e.g., short or tightly curved-ramps, short merge-weave sections) increase the probability of incidents. These incidents tend to be among the most serious and can have significant impacts on roadway reliability. Separating trucks and autos, while at the same time addressing congestion at deficient interchanges and ramps, could save many lives.

---

[6] http://www.chp.ca.gov/switrs/switrs2000.html#section6.

[7] http://www.fmcsa.dot.gov/facts-research/art-safety-progress-report.htm.

[8] Statewide Integrated Traffic Records System (SWITRS), 2004.

Figure 4.4 Mean Total Annual Heavy-Duty Truck Accidents on Key Regional Corridors[9]

4.1.5 Summary of Highway Goods Movement Needs and Deficiencies

The analysis of existing and projected future conditions on the regional highway system highlights several key themes that will be the focus of goods movement strategy development as presented in Chapter 6. These themes are summarized below.

High Growth In Truck Traffic On Critical Central Corridors

Truck traffic in Southern California is expected to grow significantly through 2035, using an increasing share of the region's highway capacity. Truck vehicle-miles-traveled (VMT) on the regional highways is projected to grow by 80 percent between 2008 and 2035, an increase from 6.8 percent to over 10 percent of total regional VMT.

Economic activity associated with regional high-value manufacturing, the growing logistics industry, and international trade will be major drivers of growth in truck traffic along these routes. The largest clusters of these activities are along the east-west corridors, namely SR 60 and I-10, as shown in Table 4.4.

[9] Data is a five-year (January 2005 - December 2009) average from 2004-2008 California Highway Patrol's Statewide Integrated Traffic Records System (CHP-SWITRS) data.

Table 4.4 Warehouse Square Footage and Manufacturing Employment Along East-West Highways

East-West Highways	Total Warehouse Sq. Feet (In Millions, Within 5 Miles)	Percent of Regional Total Warehousing	Manufacturing Employees (in Thousands)	Percentage of Regional Jobs
	Warehousing		*Manufacturing*	
SR 60	509.9	50%	227	27%
I-10	442.9	43%	156	19%
SR 91	188.9	18%	166	20%
I-210	171.2	17%	60.9	7%

Truck traffic from the San Pedro Bay Ports has major movements along I-710, SR 91, and SR 60. Future growth in warehousing and manufacturing around these corridors, and continuing shifts in warehousing to the Inland Empire, will lead to increasing concentrations of truck traffic growth along these routes. In the future, the highest volumes of truck traffic will be experienced on the southern part of I-710 and SR 60. Several segments of I-210, I-10, and I-5 will experience high levels of congestion and will be among the most congested truck corridors in the region.

While operational efficiencies and demand management strategies may help reduce the impact of this high level of truck traffic growth in the central highway corridors, there is a need for more roadway capacity. If at least some of this capacity could be dedicated to trucks the analysis of existing and projected future conditions indicates that there would be sufficient demand to highly utilize this additional capacity. Providing a high efficiency trucking route to serve the critical trucking submarkets that are located along these corridors would provide significant benefits to the businesses that comprise these submarkets. While it will not be feasible to build dedicated truck lanes in all central corridors, focusing on providing access to key markets in addition to looking for suitable right-of-way should guide the selection of appropriate corridors in which to examine the feasibility of this type of solution.

Providing For Important Intraregional Trucking

Truck traffic in the region is dominated by intraregional movements that consist primarily of local service and distribution traffic throughout the region. Examples include movements that link regional distribution centers with population centers, local manufacturers and warehouses to customers, and port traffic to transload sites, import warehouses, regional distribution centers, and off-dock rail yards.

Intraregional trucking represents more than 87 percent of the truck trips generated in the region. Although other modes will remain important to the SCAG region, movements by trucks will continue to be the dominant mode because of flexibility, adaptability for short haul goods movement, and general speed and reliability for moving high-value manufactured products to support "just-in-time" delivery.

While significant portions of port and warehouse traffic occur along the central east-west corridors, local service and distribution traffic, and some manufacturing traffic, follow a more dispersed pattern around the region. This leads to congestion hot-spots on a wide variety of corridors that are responsible for over 1 million hours of truck delay per year. In addition to the corridors described above, service and distribution traffic also moves along key north-south corridors on the west side of the region.

There are a variety of approaches that can be taken to address trucking related bottlenecks that range from major capacity additions to less expensive operational improvements interchanges (such as lengthening merge and weave sections or adding auxiliary lanes and spot capacity improvements). An approach to addressing the most significant regional truck bottlenecks is described further in Chapter 6.

Growing Truck Traffic And Safety In The Region

The growing volumes of truck traffic on the region's roadways will inevitably lead to more truck involved crashes. This chapter has shown locations on the regional roadway system that experience the greatest truck-related safety problems today and these problems will only grow worse unless action is taken. Many of the same strategies that can address the capacity needs in central corridors or the truck bottlenecks throughout the region can also be useful in improving truck safety in the region. Separating trucks and autos and improving the operational characteristics of certain high volume interchanges are potentially effective truck safety strategies that will be described in Chapter 6.

4.2 Rail

The rail network in the SCAG region faces many of the same congestion and safety issues as the highway system. Without major infrastructure improvements, growth in rail traffic through 2035 will put significant strain on the railroad system. In addition to rising freight volumes, growth in commuter rail traffic will stress mainline rail capacity. Improving rail service and capacity will be critical for maintaining the region's mobility and economic competitiveness.

Train traffic can also divide communities. It creates vehicular delays at crossings (including delays to emergency vehicles), increases the potential for train-auto collisions, increases train-related noise, and causes emissions from idling vehicles. Addressing these community issues is also an important priority for the region.

This section discusses how growth in the various rail markets will drive demand for future rail services and affect needs for improvements to the facilities that serve them (i.e., railroad yards and the mainline rail network).

4.2.1 Rail Markets as Drivers of Demand

Chapters 2 and 3 introduced some of the key rail market concepts (intermodal versus carload, IPI versus transload intermodal) and the commodities and industries that are served by rail. In this chapter we will refer to these terms to describe the market components of rail traffic in Southern California today and in the future.

Table 4.5 shows the number of trains per day in Southern California by rail market in 2010 and 2035 respectively. This information is presented for each major rail subdivision in the Southern California system. The table breaks the train traffic down in terms of intermodal container trains, unit bulk cargo trains, unit auto trains, carload train, and the two categories of passenger train (Metrolink commuter rail and Amtrak intercity trains). It should also be noted that the train volumes of each train type are for the location at which the maximum number of trains of that type occur (not the same location on the subdivision for each train type – therefore, the numbers should not be added across the columns). These show that intermodal trains dominate rail service in Southern California although there continues to be an active market for bulk, auto, and carload shipments. The dominance of intermodal traffic is largely serving the international trade market, with cargo coming from the Ports of Los Angeles and Long Beach. As noted elsewhere in this report, over 70 percent of the international trade through the San Pedro Bay ports is destined for inland markets outside of the western U.S. and almost all of this cargo travels by rail to take advantage of the lower cost and high efficiency of intermodal rail service.

Table 4.5 Maximum Trains Volumes on Major Railroad Mainlines, *2010 and 2035*

Year	Trains per Day	Container	Unit Bulk	Unit Auto	Carload	Metrolink	Amtrak
2010	UPRR LA Sub	13.8	0.0	3.7	1.7	12.0	0.0
	UPRR Alhambra Sub	17.0	0.6	0.7	14.5	36.0	0.8
	UPRR Mojave (Palmdale) Sub	2.1	1.3	0.7	15.1	0.0	0.0
	UPRR Yuma Sub	23.4	0.0	3.7	14.5	0.0	0.8
	BNSF San Bernardino Sub	41.4	3.0	6.4	9.9	35.0	26.0
	BNSF Cajon Sub	39.8	4.3	2.3	25.1	0.0	2.0
2035	UPRR LA Sub	37.1	4.0	8.0	6.0	12.0	0.0
	UPRR Alhambra Sub	44.6	4.0	1.0	20.0	42.0	0.8
	UPRR Mojave (Palmdale) Sub	5.6	4.0	0.0	15.0	0.0	0.0
	UPRR Yuma Sub	63.1	0.0	9.0	23.0	0.0	0.8
	BNSF San Bernardino Sub	104.3	9.0	15.0	12.0	52.0	26.0
	BNSF Cajon Sub	86.3	13.0	9.0	29.0	0.0	2.0

Source: Cambridge Systematics, Inc., QuickTrip-TrainBuilder spreadsheet, October 25, 2012.

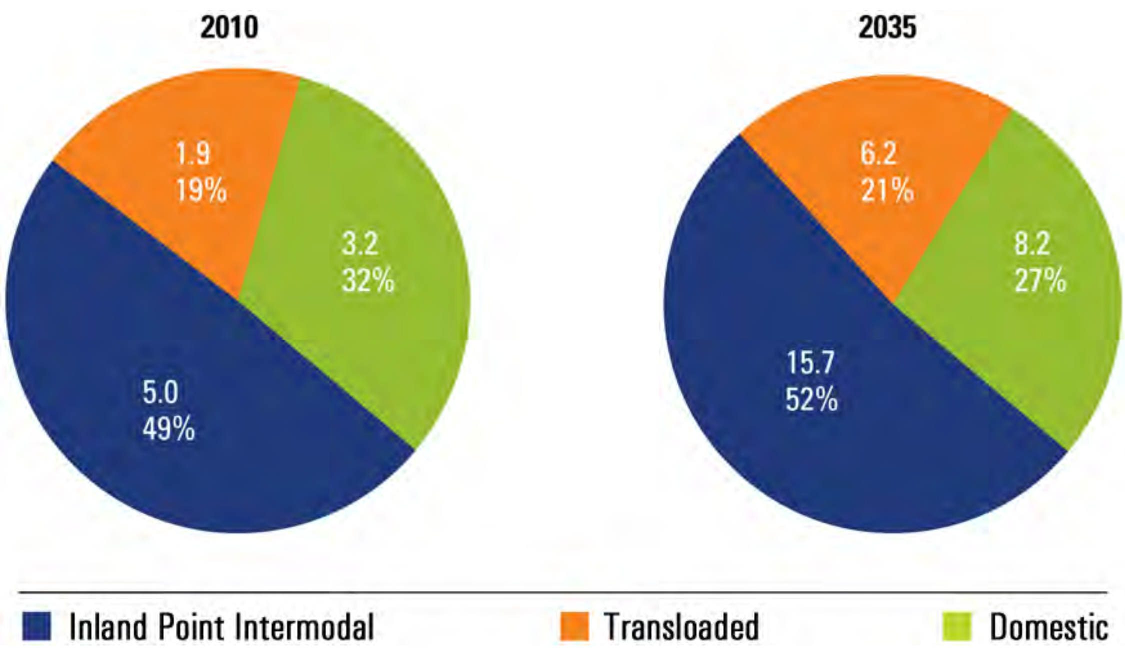
Note: Values cannot be added because maximum values occur on different segments along each subdivision, and trains use more than one subdivision.

Table 4.5 also shows that while overall rail markets are expected to experience high levels of growth, the largest share of that growth will be contributed by intermodal, again, being driven largely by growth in international trade through the ports.

To understand some of the drivers behind intermodal rail growth, it is important to understand the different markets that are served by intermodal rail: inland point intermodal (IPI), transload, and domestic. Figure 4.5 shows the breakdown of total rail traffic in the SCAG region by these market segments for 2010 and 2035. As noted in Chapter 2, IPI containers are loaded either on-dock or at near-dock or off-dock rail yards. For environmental and congestion-relief reasons, it is desirable to load as many marine intermodal containers at on-dock yards as possible, but it is not possible to move 100 percent of the IPI traffic on-dock. If there is insufficient on-dock capacity, the spillover effect to near-dock and off-dock yards is more traffic on I-710 and more truck-related emissions. Trucks have a greater environmental impact per ton-mile than trains. Similarly, more near-dock rail loading reduces truck vehicle miles of travel and emissions relative to loading at off-dock terminals because near-dock rail yards are less than 5 miles from the ports, while the off-dock yards near downtown Los Angeles are about 20 miles from the ports.

IPI's primary economic benefits to the region are the direct, indirect, and induced jobs and output (sales) associated with port and rail activity. It is also possible that the presence of a strong IPI market creates the volumes of traffic that justify the frequent and high quality service that all intermodal shippers in the region enjoy. In the future, intermodal terminal capacity and mainline capacity issues discussed later in this chapter are less likely to impact the IPI market than the transload or domestic intermodal markets due to the types and locations of additional capacity that the ports and railroads are planning to add to the system, but all of these markets could be affected by capacity constraints.

Figure 4.5 Rail Intermodal Market Split in SCAG Region
(in millions of Annual TEUs)



IPI demand is quite sensitive to price because it is truly discretionary cargo – that is if total logistics costs of shipping cargo through the Southern California ports rises relative to other ports, it is easy for shippers to move their cargo through another port to avoid these costs. Even so, if there were inadequate yard and mainline capacity, shippers may have no choice but to divert this cargo to other ports. This would result in higher costs to rail shippers throughout in other parts of the U.S. and losses to the national economy. More detailed analysis of these potential impacts to the national economy are described in Chapter 7 of this report.

Transloading is clearly important to the region economically because of the value-added services and employment it provides. Transloading to rail currently accounts for about 27 percent of all loaded imports through the San Pedro Bay Ports, and transloading to truck accounts for about 13 percent. Transloading is growing and that's good for the region as long as there is adequate capacity at rail yards and warehouses to serve this important market.

SCAG commissioned a study of the price elasticity of demand for port and modal services at the Ports of Los Angeles and Long Beach that examined the effects of port-related fees on potential diversion of port traffic.[10] The study showed that fees would have different diversionary effects on different rail markets. The study also looked at what the effects would be if the fees were used to pursue an aggressive program of congestion relief. In the case of transloaded cargo, the congestion relief would offset some of the diversion effects associated with the higher cost fees whereas it would have little or no effect on diversion of IPI cargo. This suggests that investments in the rail system that ensure fluid movements of cargo are especially important to transload cargo. As this type of logistics activity is an important contributor to the Southern California economy, this finding indicates the importance of ensuring reliable and efficient rail access for this market.

[10] Dr. Robert C. Leachman, Port and Modal Elasticity Study, Phase II, prepared for SCAG, September 14, 2010.

It is also important to note that railroads in the SCAG region do not currently handle transloaded intermodal cargo at on-dock or near-dock terminals, whereas other ports such as the Port of Oakland and the Port of Tacoma are increasingly ensuring that they provide this capability. In thinking about the long term strategic investments needed to keep the Southern California ports competitive, it will be important to re-think whether or not strategies to ensure access to on-dock and near-dock intermodal terminals for transloaders would be desirable.

As illustrated in Table 4.5 earlier in this chapter, freight rail traffic often shares limited track capacity with passenger rail traffic (Metrolink and Amtrak). Even with limited expansion of passenger services in the region, there are some potential capacity constraints identified in SCAG's Regional Rail Simulation Update prepared for the Comprehensive Regional Goods Movement Strategy and Implementation Plan.[11] As discussed later, there are several critical mainline capacity constraints in the region. When desired passenger train growth is taken into account there will be significant needs for new rail line capacity throughout the SCAG region.

The remainder of the discussion of rail system needs focuses on current and future traffic levels on/at specific rail facilities, such as yards and mainline tracks. It also describes needs and deficiencies in the system that need to be addressed in order to preserve high quality rail service in the region.

4.2.3 Intermodal Rail Loadings by Market and Yard, 2010 and 2035

Chapter 3 described the intermodal rail terminals in the SCAG region and indicated their capacity. Table 4.6 shows estimates of the volume of container lifts and twenty-foot equivalent units (TEUs) by market type for 2010 and 2035.

[11] Dr. Robert C. Leachman, Regional Rail Simulation Update, Summary Report for SCAG, November 2011.

Table 4.6 Estimates of the Volume of Container Lifts and 20-Foot Equivalent Units (TEUs) by Market Type for 2010 and 2035

	DEMAND in Lifts[a]	IPI	TL L	Dom L+E	Total Lifts
2010	On-Dock Yards	1,840,321			1,840,321
	Off-Dock Yards	912,306	639,251	1,091,004	2,642,561
	Total	2,752,627	639,251	1,091,004	4,482,882
2035	On-Dock Yards	6,315,517			6,315,517
	Off-Dock Yards	2,194,321	2,054,153	2,747,446	6,995,920
	Total	8,509,838	2,054,153	2,747,446	13,311,437

[a] *A "lift" is the movement of a container on or off of a train.*

	DEMAND in TEUs[b]	IPI	TL L	Dom L+E	Total TEUs
2010	On-Dock Yards	3,312,578			3,312,578
	Off-Dock Yards	1,642,151	1,917,754	3,195,640	6,775,545
	Total	4,954,729	1,917,754	3,195,640	10,068,123
2035	On-Dock Yards	11,683,706			11,683,706
	Off-Dock Yards	4,059,494	6,162,460	8,242,338	18,464,292
	Total	15,743,200	6,162,460	8,242,338	30,147,998

[b] *TEUs are expressed in "Marine TEU Equivalents", which accounts for varying cargo carrying capacity of marine containers and domestic containers and trailers. Abbreviations in the tables are: IPI: Inland Point Intermodal (includes loaded and empty containers in both directions). TL L: Transloaded Containers (Loaded Eastbound). DOM L+E: "Pure" Domestic Containers and Trailers (Loaded and Empty in both directions).*

In 2010 the San Pedro Bay Ports handled over 14 million TEUs of containerized cargo, including import loads, export loads, and empty containers. About 3.3 million TEUs were handled at on-dock rail yards, including loads and empties (23.5 percent of total port TEUs). Another 1.6 million IPI TEUs were handled at off-dock rail yards (11.7 percent of total port TEUs). An estimated 1.9 million marine TEU equivalents were transloaded to rail in 53-foot domestic containers. In addition about 3.2 million marine TEU equivalents of domestic containers and trailers (including loads and empties) were handled at off-dock yards, or approximately 24 percent of the intermodal lifts in the region. Many of the eastbound 53-foot transload containers return to the West Coast loaded with domestic cargo.

Table 4.6 also shows the rail cargo allocated to on-dock and off-dock yards in 2035, based on the potential demand for on-dock shipments that could be developed at the ports to handle this on-dock intermodal demand. Included is the forecast for true domestic intermodal rail shipments. The table shows total unconstrained demand, i.e., the amount of cargo that could be expected to be shipped by intermodal rail assuming there was sufficient terminal and mainline capacity. Total demand for intermodal lifts is expected to nearly triple between 2010 and 2035, driven largely by growth in international intermodal rail movements. Transload movements are expect to experience the biggest increase (over 221 percent) while IPI volumes are projected to increase by about 209 percent. True domestic cargo movements will also grow substantially (by over 150 percent) but will decline as a share of total intermodal cargo moved in the region. Both of the ports and both Class I railroads have plans to build additional intermodal terminals in order to accommodate the expected demand. These projects and some of the challenges they face are discussed further in Chapter 6 as they represent important elements of the Comprehensive Regional Goods Movement Plan.

4.2.4 Rail Traffic on the Southern California Mainlines – Current Conditions and Forecasted Demand

Intermodal Rail Traffic

In order to determine if there will be capacity expansion needs in the Southern California rail system, the Comprehensive Goods Movement Plan and Implementation Strategy started by compiling data on existing (2010) train volumes by market/train type for each Class I railroad and each mainline. Train traffic is presented in terms of trains per day.

Given the projected allocations of lifts and TEUs by rail yard, it is possible to estimate the number of intermodal trains generated at those locations. This information can then be used to route the trains through the Southern California system to develop forecasts for each line segment. Additional information, such as the assumed distribution of trains by length (railroads are operating longer intermodal trains and this is leading to longer term operational efficiencies), average rail car length (depends on the mix of cars of varying lengths that make up the trains), locomotive length, number of locomotives per train, and slot utilization[12], is taken into account in developing the forecasts by line segment.

Nonintermodal Rail Traffic

Estimates of nonintermodal freight train volumes were based on values in the 2011 mainline rail simulation update prepared for the Comprehensive Regional Goods Movement Study by Dr. Robert Leachman.[13] This study also included simulations of the rail system to determine capacity constraints after the train forecasts were developed. Types and lengths of trains included unit bulk (5,000 feet), unit auto (6,000 feet), and carload (6,500 feet). Train counts were assigned in the same manner as intermodal trains.

Passenger Trains

For 2010, Amtrak and Metrolink train volumes were tabulated from published timetables. For 2035 the Mainline Rail Simulation Update (2011) obtained commuter train forecasts from Metrolink.[14]

Train Traffic by Type, Length, and Segment of Track

Figure 4.6 shows the estimated number of freight trains and passenger trains by segment of track for 2010 and 2035. The tables clearly show the extent of shared corridor operations by the freight railroads, Metrolink and Amtrak.

---

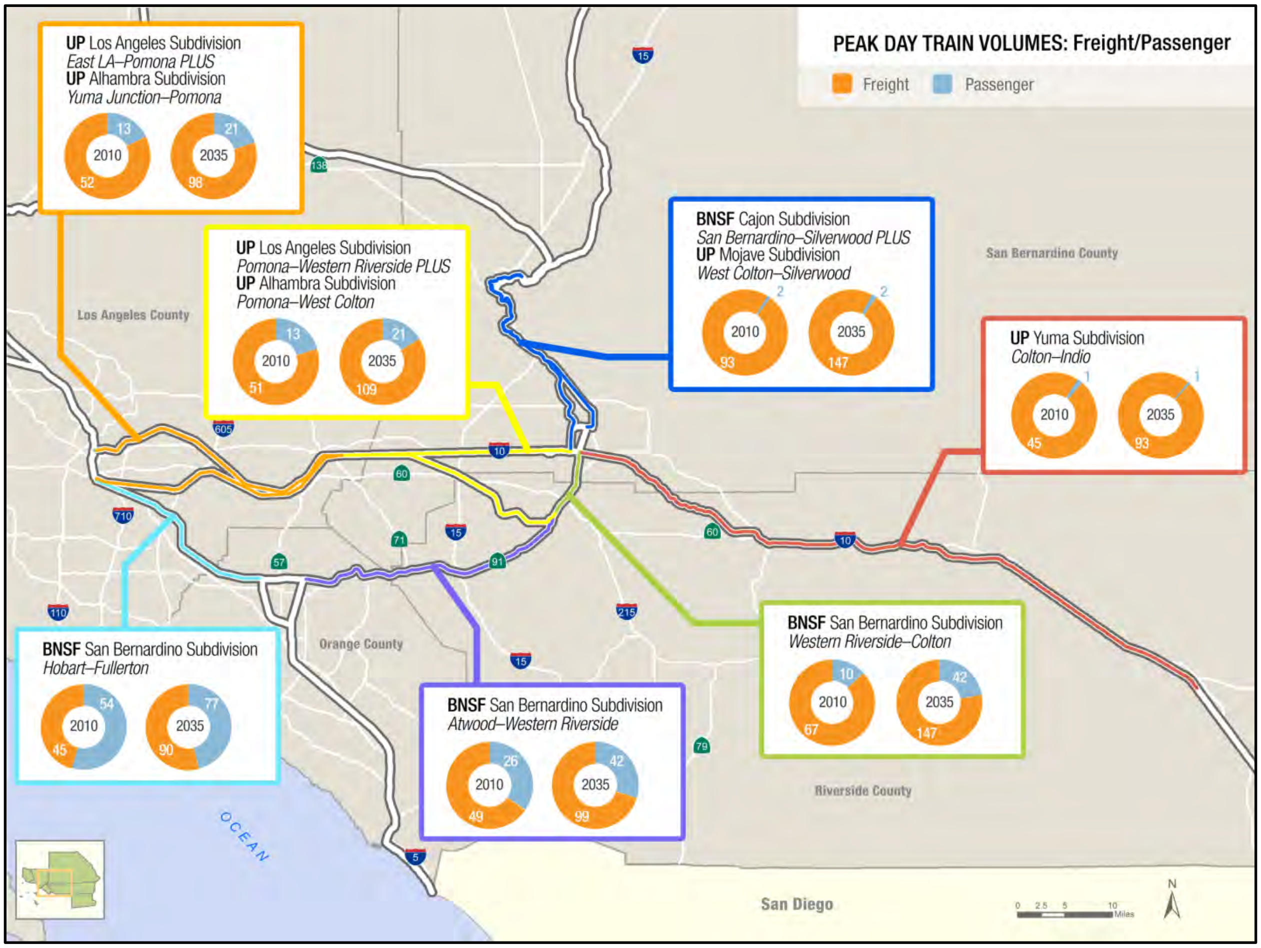
[12] The slot utilization is the percentage of rail car capacity that is actually used by containers. For example, a 265-foot long, five-well rail car can carry ten 40-foot double-stacked marine containers. If only nine containers are loaded onto the car, then the slot utilization is 90 percent. For the same number of containers, a lower slot utilization implies a longer train. CS consistently assumed a slot utilization of 90 percent in this analysis.

[13] Robert C. Leachman, PhD, Regional Rail Simulation Update, prepared for Southern California Association of Governments, November 2011.

[14] The MetroLink forecasts were capped at 2025 levels to limit growth in commuter rail to what was assumed to be potentially achievable with likely investments. Actual 2035 forecasts provided by Metrolink exceeded those used in this study. See Leachman, *Op cit*, for further detail.

The segment of track with the heaviest concentration of passenger trains is the BNSF San Bernardino Subdivision from Hobart to Fullerton.

Figure 4.6 Peak Day Train Volumes by Segment
2010 to 2035



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

4.2.5 Mainline Capacity Requirements Based on Projected Rail Demand

Accommodating the projected growth in train traffic described in the previous section will require additional main line track capacity and rail-to-rail grade separations. Without such improvements, the economy of the region would suffer, international traffic would have to find other gateways into the United States, and domestic rail traffic might divert to long haul trucking, which would add to highway traffic congestion in the region.

In 2011, SCAG published a mainline capacity study prepared for the Comprehensive Regional Goods Movement Study and Implementation Plan.[15] The analysis examined railroad infrastructure needs to accommodate operations of both freight and passenger trains in Southern California between downtown Los Angeles on the west and Barstow and Indio on the east. A major objective of this study was to determine whether current capacity would be sufficient to meet future demand and if not, what improvements to the system would be required. For the 2035 simulation, track was added to the network as necessary in order to achieve Year 2000 levels of dispatching delay, which was assumed to be an acceptable level of service. Several alternative routings for future freight and passenger train operations were also assessed in order to determine whether it would be possible to meet future demand with more limited investments but with operational changes. The study did not seek to determine what the market implications of these operational changes would be for either the freight railroads or passenger rail operators.

The simulations for 2035 indicated that capacity would not be sufficient to meet all of the forecasted demand (both freight and passenger rail) and identified the need for several upgrades to the regional mainline rail system, including additional tracks on key segments as well as rail-to-rail grade separations (such as Colton Crossing).

Key findings with regard to capacity requirements are shown in Tables 4.7 through 4.11. The tables show the number of tracks by line segment for existing conditions (2010), the number of tracks required in 2035 (given projected demand) under the "Status Quo" routing, i.e., no change from current operations, and the number of tracks required in 2035 for a number of alternative routing options that are described in more detail in the report. The tables also provide information about potential changes needed at some key rail crossings and junctions. For example, on the BNSF San Bernardino Subdivision (Table 4.7) there are currently two or three mainline tracks, depending on the segment. By 2035, under "Status Quo" routing several segments would require additional tracks in order to keep dispatching delays down to Year 2000 levels, most notably the segment from Hobart to Fullerton which will need a total of four tracks. Another key segment is from West Riverside to Colton Crossing, a segment that is used by both UP and BNSF freight trains as well as commuter and AMTRAK trains. Under Status Quo routing the simulation indicated that four tracks would be needed in this segment as well as a "flying junction" at West Riverside, which would grade separate the UP and BNSF trains that currently cross at grade at that location. To avoid this congested segment through downtown Riverside, the UP could route their trains from Colton to Pomona via the Alhambra Subdivision instead. This approach is called the "Modified Status Quo" routing. Under this alternative routing scenario, the segment from West Riverside to Colton Crossing would need three tracks, not four, and the flying junction at West Riverside would not be required. This is an example of how the alternative routing scenarios can improve performance through operational changes, reducing the need for costly infrastructure improvements.

---

[15] Robert C. Leachman, PhD, Regional Rail Simulation Update, prepared for Southern California Association of Governments, November 2011. Dr. Leachman developed his own forecasts of train traffic. The intermodal train forecasts in Dr. Leachman's analysis differ from the volumes reported in Section 4.2.5 of this report, which represent a more detailed allocation of intermodal TEUs and trains to individual rail yards.

Table 4.7 **Summary of Required Track Capacity on BNSF San Bernardino Subdivision**
South and West of Colton Crossing

Line Segment	Existing in 2010	Status Quo 2035	Alternatives 2035
BNSF Line			
Hobart – Serapis	3	4	4
Serapis – Valley View	2	4	4
Valley View – Fullerton Junction	3	4	4
Fullerton Junction – Atwood	2	3	3
Atwood – Esperanza	2	3	3
Esperanza – Prado Dam	3	3	3
Prado Dam – West Riverside	2	3	3
West Riverside Junction with UP	At grade	Flying junction	At grade
West Riverside – Highgrove	3	4	3
Highgrove – Colton Crossing	2	4	3
Colton Crossing	At grade	Separated with flying junction to UP	Separated

Note: A "flying junction" allows connecting movements to proceed without fouling the route of opposing through traffic, much like a freeway interchange. Figures express required numbers of main tracks. Bolded figures represent an increase from existing conditions.

Table 4.8 Summary of Required Track Capacity on Lines North and East of West Colton

Line Segment	Existing in 2010	Status Quo 2035	Alternatives 2035
UP Yuma Subdivision			
Indio – Colton Crossing	2	2	2
Colton Crossing	At-grade	**Separated**	**Separated**
UP Mojave Subdivision			
West Colton – Devore Road (Keenbrook)	1	**2**	**2**
Devore Road (Keenbrook) – Silverwood	1	1	**1 integrated with BNSF**
BNSF Cajon Subdivision			
Colton Crossing – Rana	2	**3**	**3**
Rana – San Bernardino	4	4	4
San Bernardino – Verdemont	3	3	3
Verdemont – Devore Road	3	3	3
Devore Rd. (Keenbrook) connection	One-way connection	One-way connection	**Universal connections**
Devore Road – Cajon	3	**4**	3
Cajon – Silverwood	Two 2.2%, one 3%	**Two 2.2%, two 3%**	Two 2.2%,one 3%
Silverwood connection	One connection	One connection	One connection
Silverwood – Martinez	Three 2.2%	**Four 2.2%**	**Four 2.2%**
Martinez – Mojave Narrows	2	**4**	**4**
Mojave Narrows – Barstow	2	**3**	**3**

Note: "One connection" indicates only two out of four possible connecting movements are feasible. "Universal connections" indicates all four possible connecting movements are feasible. Figures express required numbers of main tracks. Percentages express track gradients. Bolded figures represent an increase from existing conditions.

Table 4.9 Summary of Required Track Capacity on UP Lines East of Pomona

Line Segment	Existing in 2010	Status Quo 2035	Alternatives 2035
UP Los Angeles Subdivision			
West Riverside – Streeter	1	**2**	1
Streeter – Arlington	2	2	2
Arlington – Limonite	1	**2**	1
Limonite – Bon View	2	2	2
Bon View – Pomona	1	**2**	1
UP Alhambra Subdivision			
Colton Crossing – Rancho (West Colton)	2	2	2
Jct. with Mojave Subdivision at Rancho (West Colton)	Partial Flying	**Full Flying**	**Full Flying**
Rancho – Riverside Avenue	1	**2**	**2**
Riverside Avenue – South Fontana	2	2	2
South Fontana – Pomona	1	**2**	**2**
Pomona route connections	At-grade cross-overs	At-grade cross-overs	**Metro-link fly-over (except Alt. 2)**

Note: A "flying junction" allows connecting movements to proceed without fouling the route of opposing through traffic, much like a freeway interchange. A "partial flying junction" partially eliminates conflicts between through and connecting movements. A "fly-over" is a grade-separated crossing of rail lines. Movements connecting between routes by using at-grade crossovers block through traffic. Figures express required numbers of main tracks. Bolded figures represent an increase from existing conditions.

Table 4.10 Summary of Required Track Capacity on UP Lines West of Pomona for Status Quo and Modified Status Quo Alternatives

Line Segment	Existing in 2010	2035
UP Los Angeles Subdivision		
Pomona – Redondo	2	2
UP Alhambra Subdivision		
Pomona – City of Industry	1	2
City of Industry – Alhambra	1	1
Alhambra – Yuma Junction	2	2
Yuma Junction – Pasadena Junction	1	1
Metrolink crossing at Pasadena Junction	At grade	At grade
Pasadena Junction – Ninth St.	2	2
Ninth St. – Redondo connection	1	1

Note: Figures express required numbers of main tracks. Bolded figures represent an increase from existing conditions.

The simulation study also evaluated alternative routing scenarios for UP lines west of Pomona, involving both UP freight trains and Metrolink passenger trains. For details on those options (alternatives 1a, 1b, and 2), refer to the detailed Regional Rail Simulation Update.

Table 4.11 Summary of Required Track Capacity on UP Lines West of Pomona for Alternatives 1a, 1b, and 2

	Existing in 2010	2035 Alt 1a	2035 Alt 1b	2035 Alt 2
Los Angeles Subdivision				
Pomona – Roselawn	1	3	2	2
Roselawn – Bartolo	2	3	2	2
Bartolo – Pico Rivera	1	3	2	2
Pico Rivera – Redondo	2	3	2	2
Alhambra Subdivision				
Pomona – City of Industry	1	2	2	2
City of Industry – Alhambra	1	1	1	2
Alhambra – Yuma Junction	2	2	2	2
Yuma Junction – Pasadena Junction	1	1	1	2
Metrolink crossing at Pasadena Junction	At grade	At grade	At grade	Fly-over
Pasadena Junction – Ninth St. Junction	2	2	2	3
Ninth St. Junction – Redondo connection	1	1	1	2

Note: A "fly-over" is a grade-separated crossing of rail lines. Figures express required numbers of main tracks. Bolded figures represent an increase from existing conditions.

4.2.6 Grade Crossing – Current and Projected Conditions

Grade crossings can be the source of significant delay to the traveling public, can hinder the movement of emergency vehicles, and also pose a serious risk of collisions between trains and vehicles. Furthermore, idling vehicles at grade crossings emit more pollution than when they are moving. Grade crossings can also block emergency vehicles in life-threatening situations.

As illustrated in the previous sections, railroad traffic is expected to increase dramatically between now and 2035. If nothing is done to alleviate the congestion at the blocked crossings, there would be serious impacts to the region's mobility, economy, environment, and quality of life.

As part of the Comprehensive Regional Goods Movement Plan and Implementation Strategy, a model for estimating vehicular delays at highway-railroad grade crossings was developed. For individual streets crossing the rail line, the model predicts gate down times, vehicle hours of delay per day, and average peak hour delay per vehicle. A more detailed description of the methodology can be found in the Appendix, Grade Crossing Impact Documentation, 2010 and 2035, prepared for SCAG by Cambridge Systematics.

Grade crossing delays have been computed for all crossings between downtown Los Angeles and Barstow on the north and Indio on the east. The results for each mainline are summarized in Table 4.12. Detailed results by crossing are available in Grade Crossing Impact Documentation, 2010 and 2035. It is notable that grade crossing delays are expected to increase by an average of 269 percent between 2010 and 2035 for all lines combined. To put this in perspective, a doubling of delay is a 100 percent increase. A tripling of delay is a 200 percent increase, and a quadrupling of delay is a 300 percent increase.

Figure 4.7 Map of Regional Grade Crossing Locations

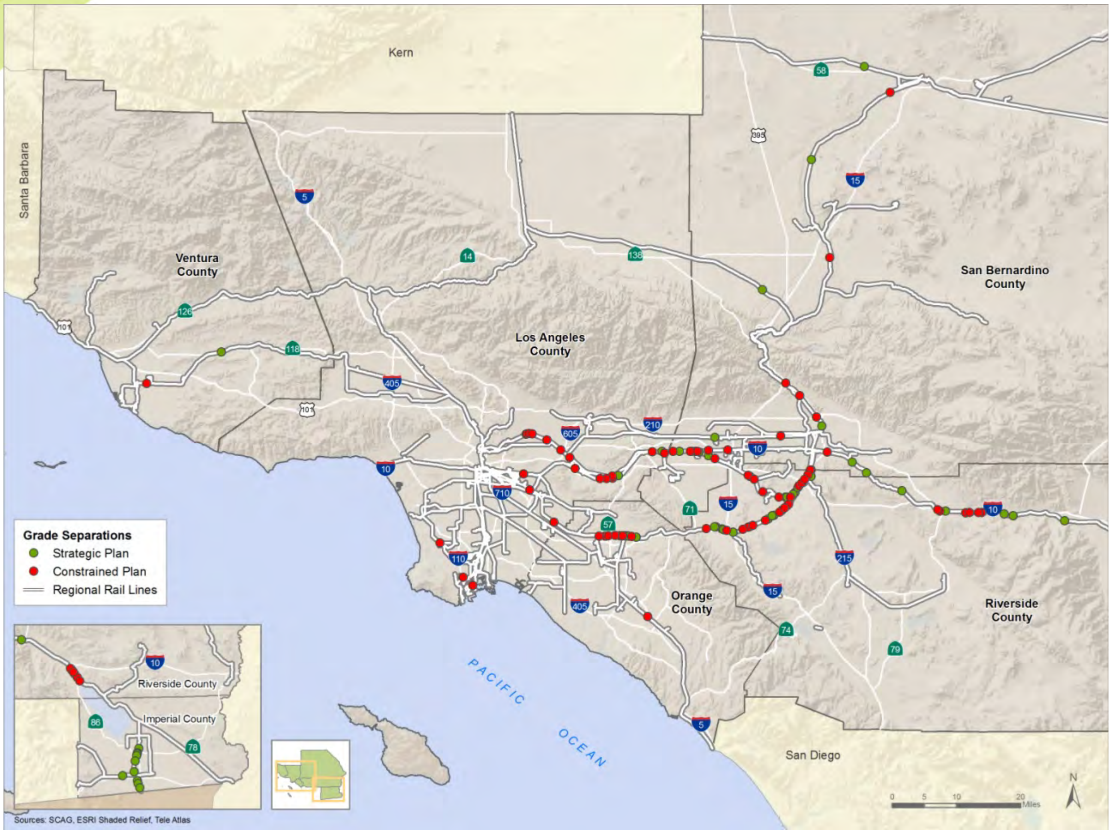


Table 4.12 Vehicle Hours of Delay per Day at At-Grade Crossings
by Line Segment, and Percent Growth, 2010 and 2035

	2010	2035	Percent Growth
BNSF Subdivisions			
San Bernardino (Hobart to San Bernardino)	1,049	4,034	285%
Cajon (San Bernardino to Barstow)	85	341	301%
Subtotal BNSF	*1,134*	*4,375*	*286%*
UP Subdivisions			
Alhambra (LATC to Colton Crossing)[a]	643	1,988	209%
Los Angeles (East Los Angeles Yard W. Riverside)[a]	287	1,075	275%
Combined Segment (Alhambra and LA Subdivisions, Pomona and Montclair Area)	132	411	211%
Yuma (Colton Crossing to Indio)	165	872	428%
Subtotal UP	*1,227*	*4,346*	*254%*
Total	2,361	8,721	269%

[a] *Excluding combined segment of Los Angeles and Alhambra subdivisions in Pomona and Montclair area.*

4.2.7 Summary of Rail Needs, Deficiencies, and Opportunities

By 2035 significant improvements to the railroad system in the SCAG region will be required to accommodate projected passenger and freight rail demand. These needs include:

- Additional on-dock and off-dock rail yard capacity. Even with expanded on-dock capacity, there will be IPI cargo that cannot be loaded on-dock because of the destination (there may be insufficient cargo on-dock to build a train and it may be more feasible to ship the cargo out of an off-dock yard where it can be combined with domestic cargo going to a similar destination) or other factors. With continued expansion of transload markets, there will also be increased demand for intermodal yard capacity for domestic cargo and this will likely require expansion of existing off-dock yards.
- Expanded mainline track capacity.
- Grade separations to mitigate traffic delays at grade crossings.

The proposed plan for these improvements is discussed in Chapter 6.

Major segments of track will need to be double or triple tracked, flying junctions will need to be installed at various locations, and the Colton Crossing will need to be separated. With train traffic projected to nearly triple by 2035, significant improvements to regional railyard capacity will also be required, including the construction of on-dock and near-dock intermodal terminals. Multiple grade separations will need to be built to reduce congestion, accidents, and emissions in the region.

The most significant driver of need for expanded intermodal rail terminal capacity in the region is the growth in port-related traffic. Both Inland Point Intermodal (IPI) and transload traffic are projected to almost triple over the forecast period, consistent with the growth in overall volumes of marine cargo growth. While the significant growth in transloading to rail is in part the result of increase in import cargo volume, it also reflects the increased use of transloading in global supply chains. If the region is able to accommodate this growth by investing in intermodal terminal capacity and track improvements, there are substantial economic benefits as transloading not only increases economic activity associated with logistics services and warehousing, but also creates other opportunities for value-added services. Although true domestic intermodal and non-intermodal rail traffic is not expected to grow as rapidly as the port-related traffic (about 2 percent per year for domestic and non-intermodal), it is important to accommodate this growth as it provides access to markets for local manufacturers and brings important products into the region (e.g., , food products, construction materials, and other domestic goods, etc.).

The need for increased mainline capacity will be driven by a number of factors. Similar to intermodal terminal capacity, the projected growth in port traffic is one of the largest contributors to the need for increased mainline capacity. The region's desire for increased commuter rail will also be a major driver for capacity improvements. On some segments of the BNSF mainline, passenger traffic is projected to grow by 60 percent-100 percent.

It may be tempting to look at this analysis and see the opportunity to limit rail investments to those that will support only the most economically attractive rail traffic from a regional policy perspective. For example, one strategy might be to try to use public investment to limit rail traffic to transloaded intermodal traffic (which brings with it jobs in logistics and value-added warehousing), domestic intermodal (serving local consumer markets and manufacturing), and commuter rail. This is likely to be a risky strategy. There is fierce national competition for import and export maritime trade with East and Gulf Coast ports hoping that the expansion of the Panama Canal will allow them to re-capture market share previously lost to West Coast ports. The Canadian Federal Government has been working with ports and provincial governments to increase its market share of Pacific Rim trade and there are several potentially significant projects in Mexico.[16] The UP and BNSF both consider the Southern California rail system to be a critical part of their respective networks and they will invest and price to keep market share in the face of these competitive pressures. These railroads have already made significant investments in the Southern California rail system. However, the railroads will prioritize their investments and in order to ensure that all of the needs identified in this chapter are met (IPI, transload, domestic intermodal, carload, and passenger rail terminal and mainline capacity requirements and grade crossing improvements) and to advance safety and environmental objectives, there will need to be broad regional partnerships. Chapter 6 describes the types of investments that could constitute a package of improvements that would maximize the benefits of the Southern California rail system for the public and private sectors.

4.3 Ports

The San Pedro Bay (SPB) Ports continue to be the dominant choice for port of entry for Pacific Rim trade with the U.S. and the demand for these ports is expected to continue to grow. Even with the revised cargo forecasts prepared in 2009, demand is expect to reach port capacity by 2035. Chapter 2 described many of the reasons why this growth in port activity is important to the SCAG region's economy. As noted in the discussion of rail issues, this port of entry with well-functioning infrastructure is also critical to the larger U.S. economy.

Current capacity at the ports is constrained and efforts will need to be undertaken to expand capacity if the future demand is to be met. This chapter discusses the various port improvement projects that are contemplated.

Access to the San Pedro Bay ports is likely to become a more significant issue in the future. As noted already in the discussion of rail, there is unlikely to be sufficient rail yard capacity to handle all of the growth in intermodal cargo. While it is desirable to have as much of this cargo loaded on-dock as possible, it is unlikely that all port cargo could ever be loaded on-dock (see discussion in Section 4.2.7 previously). This is because the railroads need to load "destination-specific" trains, and there is often not enough destination-specific volume generated at any one terminal to build a unit train. Thus, containers from multiple marine terminals going to one destination (e.g., Memphis) are often combined at near-dock or off-dock rail yards. Transloading today occurs primarily outside port property. As already noted, other West Coast ports, such as the Port of Tacoma and the Port of Oakland, are creating options for transloading on port property with access to on-dock or near-dock rail as a strategy to enhance port competitiveness. Given the demand for space for port operations at the Southern California ports, however, transloading is likely to continue to be an off-dock activity. Nonetheless, there is likely to be demand for as much as 11.7 million TEUs to be loaded on-dock by 2035 with the remainder to be accommodated at off-dock yards.

Given the demand for rail capacity for both domestic and passenger rail, there is not likely to be sufficient mainline capacity to handle all the demand for rail access to the SPB ports. While it is not clear how the railroads and ocean liners would handle potential shortfalls in rail capacity (see Chapter 7 for a further discussion of the benefits of continued investment in rail capacity), the impacts of access needs are an important consideration in planning for the growth in port cargo.

Highway access to the ports is also an issue. The number of truck trips entering and leaving the San Pedro Bay ports every day is expected to grow by 144 percent to 134,200 trips per day by 2035. The biggest impact this is likely to have is on the I-710 corridor but as warehouse demand begins to move farther to the Inland Empire over the next 20 years, port-related traffic on the east-west corridors is likely to increase. As these routes become more congested, port drayage drivers will make fewer turns per day. This will have the combined effect of reducing their incomes and/or increasing drayage costs.

---

[16] SCAG, Port Activity and Competiveness Tracker, February 2011.

All of these access problems will occur in a period when the SPB ports will be facing more competition from other West Coast ports (including Canadian and Mexican ports) and all water routing of traffic to the East and Gulf Coasts through an improved Panama Canal. The container forecast study completed in 2009 for the San Pedro Bay ports predicted a 5.9 percent reduction in imports and a 5.4 percent reduction in exports by 2030 due to the Panama Canal improvements.

The following sections describe in more detail the growth expected for Southern California ports and the implications for infrastructure investment.

4.3.1 Demand Forecasts for Containerized Cargo

In 2009, the San Pedro Bay Ports published a major update to their long range forecast of containerized cargo.[17] The previous forecast, which was prepared in 2007, was adjusted to account for the effects of the recent recession. The 2009 forecast predicted a slower growth rate than the 2007 forecast, but the results for 2035 were the same. The previous forecast predicted the ports would reach capacity by 2023, but the new forecast states it will take until 2035 to reach 39 million TEUs at which point further growth would be constrained by available terminal capacity. This was based on estimates of potential capacity, assuming that each port completed all of the terminal and access improvements identified in their respective master plans.

However, since the 2009 forecast was published, the San Pedro Bay Ports reduced their 2035 capacity estimate from 43.2 million TEUs to 39.4 million TEUs. As shown in Table 4.13, with current entitlements[18] the ports could reach 34.6 million TEUs per year by 2025. At full build out, the San Pedro Bay Ports could accommodate 39.4 million TEUs per year by 2035. To reach this full capacity, the San Pedro Bay Ports will need to invest in terminal expansion (see Table 4.13) and landside access improvements will be required.

---

[17] IHS Global Insight and the Tioga Group, San Pedro Bay Container Forecast Update, July 2009.

[18] Entitlements refer to developments that have received necessary approvals. The completion schedules for new developments varies but it is expected that they would all be completed by 2035.

Table 4.13 San Pedro Bay Ports Container Terminal Capacity (TEUs), At Full Build Out (and projected year of completion) and with Current Entitlements

	Full Build			Current Entitlements		
POLB	Acres	Capacity	Completion	Acres	Capacity	Completion
Pier A	230	1,785,000	2032	200	1,785,000	–
Pier C	70	582,000	–	70	582,000	–
Pier D/E/F	322	3,320,000	2019	322	3,320,000	2019
Pier G	295	3,229,000	2018	295	3,229,000	2018
Pier J	256	2,440,000	–	256	2,440,000	–
Pier S	150	1,800,000	2012	–	–	–
Pier T	380	4,422,000	–	380	4,422,000	–
Total POLB	1,703	17,578,000		1,523	15,778,000	
POLA	Acres	Capacity	Completion	Acres	Capacity	Completion
Pier 400	635	6,171,000	2030	484	6,171,000	–
Pier 300	428	3,206,000	2020	291	2,153,000	–
Berths 226-236	286	3,200,000	2025	230	2,382,000	–
Berths 212-225	192	2,459,000	–	192	2,459,000	–
Berths 206-209	84	1,111,000	2020	–	–	–
Berths 100-131	297	3,244,000	2015	297	3,244,000	2015
Berths 136-147	243	2,389,000	2025	243	2,389,000	2025
Total POLA	2,165	21,780,000		1,737	18,798,000	
Both Ports	3,868	39,358,000		3,260	34,576,000	

Source: Ports of Los Angeles and Long Beach.

4.3.2 Ports Highway and Rail Network Needs

In order to accommodate the projected demand shown in the previous section, the Ports of Los Angeles and Long Beach are working to improve the highway and rail network within the port complex. Included are major investments for the Gerald Desmond Bridge, I-110/C Street interchange improvements, on-dock rail yards, and rail infrastructure outside of the terminals. The proposed projects are shown in more detail in Chapter 6.

4.4 Imperial County Border Crossings

4.4.1 Current and Projected Demand

As described in Chapter 3, the primary commercial border crossing in the SCAG region is the Calexico East-Mexicali II border crossing. According to traffic counts compiled for use with the SCAG HDT model, there were approximately 1,253 trucks on an average daily basis on SR 7 at the border crossing in 2008. A recent study of the San Diego/ Imperial freight gateways projected that truck flows at the Calexico East commercial crossing would increase at an average annual rate of 3.8 percent, meaning truck traffic at the border crossing would increase by almost 274 percent by 2035.[19] Rail traffic at the Imperial County border crossing represents much smaller traffic volumes (about 9,700 rail cars annually) but growth rates are expected to be similarly robust (3.3 percent average annual growth to 2050). While capacity constraints are not reported to be a primary concern today at the border crossing itself, there are truck related congestion issues as trucks move to/from the border through the cities of Brawley and Westmoreland.[20] If growth as projected is realized, there will likely be roadway capacity issues at the border crossing in the future.

4.4.2 Current Conditions and Identified Deficiencies

SCAG recently conducted a study of border crossing conditions at the regional international ports-of-entry in Imperial County.[21] The study provides one of the most up to date assessments of the performance and reliability of international border crossings in the SCAG region. The study collected data on border crossing times and compared the results with other U.S.-Mexico border crossings. The 2008 study "Improving Economic Outcomes by Reducing Border Delays" conducted by the U.S. Department of Commerce compared average border crossing times in the northbound direction for the five busiest truck crossing at the U.S.-Mexico border – Laredo, El Paso, Otay Mesa, Nogales, and Hidalgo. The SCAG effort compared the recent data collected in the northbound direction at the Calexico East – Mexicali II border crossing, the primary commercial port-of-entry in Imperial County, with the other five crossings analyzed in the U.S. Department of Commerce Study. The results are shown in Figure 4.8.

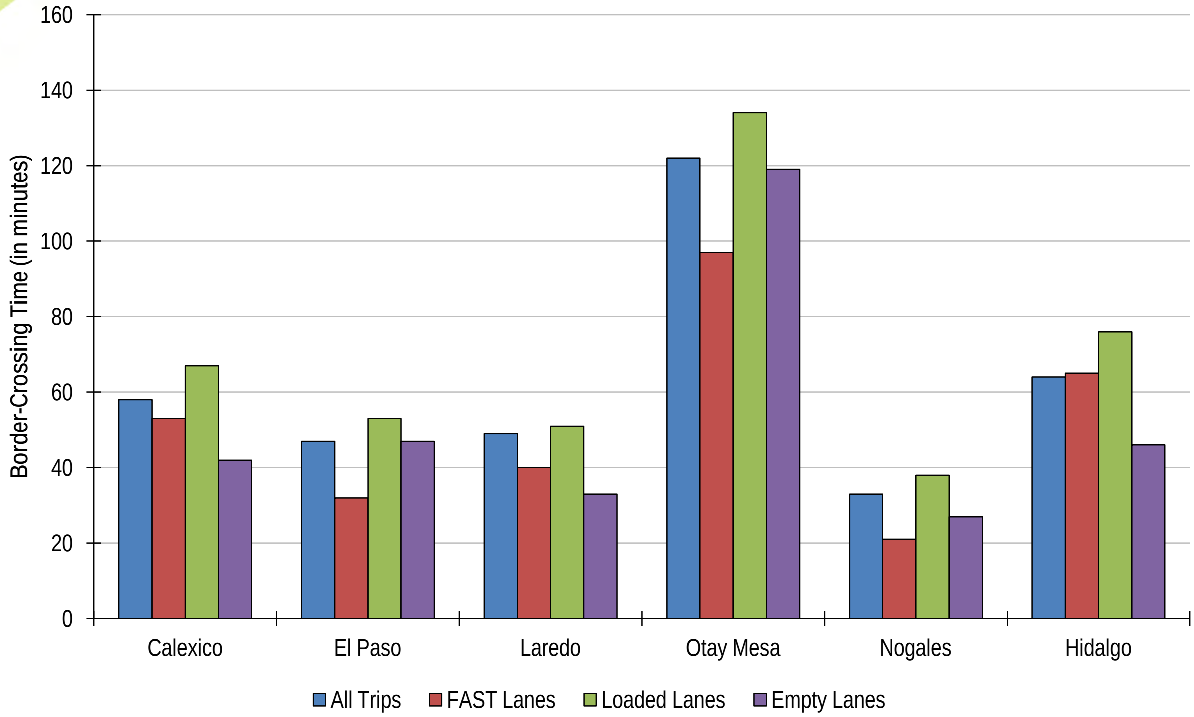
---

[19] *San Diego and Imperial Valley Gateway Study, Working Final Copy*, prepared for San Diego Association of Governments by HDR/Decision Economics in association with Cambridge Systematics IHS-Global Insight, SD Freight Rail Consulting, and Crossborder Group, March 2010.

[20] *Ibid.*

[21] *Goods Movement Border Crossing Study and Analysis,* HDR Decision Economics, prepared for SCAG, June 2012.

Figure 4.8 Northbound Average Border Crossing Times by Crossing Type and POE



Calexico ranks fourth (out of six) for aggregate trips, FAST lane crossing, and loaded general lane crossings and third in empty lane crossings. The five other crossings are the busiest at the U.S.-Mexico border and process a larger numbers of trucks than Calexico. When this is taken into account, Calexico's average performance does not compare favorably. Table 4.14 provides some additional information about performance and reliability for both the northbound and southbound truck crossings at Calexico.

Table 4.14 Adjusted Summary Statistics for Commercial Vehicles
by Trip Direction

Adjusted Statistic	Northbound	Southbound
Mean	0:48	0:55
Standard deviation	0:35	0:52
Minimum	0:06	0:02
Maximum	3:24	4:34
10th percentile	0:16	0:11
90th percentile	1:35	2:10
50th percentile	0:39	0:36

The data show that southbound crossings take longer and are generally less reliable than northbound crossings. However, these data may reflect some operational changes that were occurring on the Mexican side of the border when the data were collected and may have compromised performance and reliability. It is also unclear from the data the degree to which the issues that contribute to performance problems at Calexico are related to operations as opposed to infrastructure issues.

However, it is possible to gain some insight into this issue from a series of interviews that were conducted with manufacturers and logistics companies that operate at the Calexico border crossing. Manufacturing companies interviewed for the study overwhelmingly mentioned unreliability of the border crossing times as a major issue. They also often mentioned traffic congestion around the POEs. Approximately 44 percent of the respondents believed the cause of delay had to do with military checkpoints in Mexico. Logistics companies also identified unreliability of crossing times as a critical issue but they identified four factors that they felt were responsible for this unreliability: 1) infrastructure concerns (need for more lanes); 2) dispatch management practices by logistics firms (wait until close-of-business to dispatch); and 3) need for more personnel at inspection sites; and 4) hours of operations issues. There are a number of opportunities to address the infrastructure issues that are discussed later in the section of this report describing the Comprehensive Regional Goods Movement Plan.

Other findings from the study included:

- An overwhelming majority of the trade conducted through Imperial County's land POEs corresponds to goods moved between California and Baja California and includes a large amount of maquiladora movements. In fact, the study showed that industrial parks in Mexicali are an important generator of cross-border truck trips. These movements are important to both state's economies. The study validated the fact that currently most of the cross-border movements are local in nature and used economic models to measure the impacts of border crossing delays on the regional economy (which was high).
- With increasing interest in near-sourcing opportunities for products destined to the U.S. market, ensuring that goods movement flows are efficient and without delays will also become an increasingly important issue for the national economy.
- Given the significant delays that the study measured in both directions and the significance of these delays to the regional economy, efforts should continue to find solutions to this problem. The study measured truck drivers and logistics companies' willingness to pay tolls as a means to generate funds for improvements that

would lead to reductions to delay. It was determined that POE users are willing to pay tolls to improve border-crossing times and reliability in the northbound direction.

- In the northbound direction, the study found that there are a number of measures that could be taken to reduce queues based on analysis of the degree to which queues are related to queuing or inspection. These improvements could include adding more lanes in Mexicali both on the approach and within the POE. Improving signage could also help to reduce delays. However, the study also found that potential improvements resulting from these measures are likely to be limited to the amount of time spent in inspections.

Other long term policy, operational, and capacity options were suggested in the study and readers are referred to the study for more details.

4.5 Airports[22]

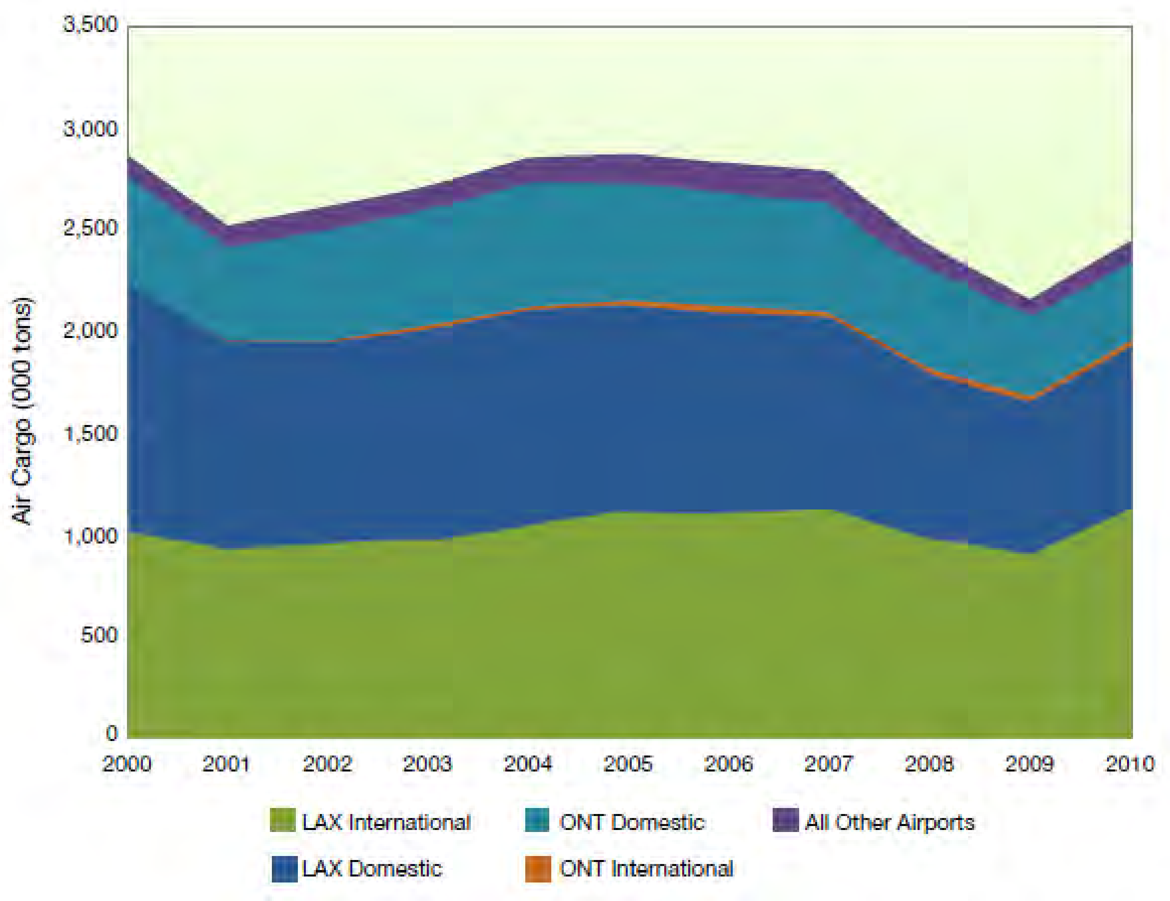
4.5.1 Air Cargo Forecast

Air cargo forecasts estimate 5.6 million tons of air cargo moving through SCAG regional airports by 2035 (an average annual growth rate of 2.4 percent). A significant portion of this growth is anticipated to come from exports, which have been growing much more rapidly than imports. In fact, between 2006 and 2010, Southern California international air cargo exports grew 8.1 percent, while imports dropped by 9.3 percent. Chapter 3 describes the types of export products that are shipped through LAX and this information coupled with information about the local manufacturing sector in the region presented in Chapter 2 provides a good picture of the importance of air cargo to the regional economy.

Air cargo in the SCAG region grew quickly in the previous two decades, increasing from 921,800 tons in 1979 to 2.87 million tons in 2000. However (and also shown in Figure 4.9), there has been a downward trend since then for various reasons including the events of September 11, 2001, the steep economic recession beginning in 2007, and the increased diversion of domestic air cargo to ground transport modes (many express packages that can be delivered overnight by truck our now shipped by truck instead of air cargo).

[22] Information in this section is from SCAG's 2012-2035 Regional Transportation Plan "Aviation and Airport Ground Access Appendix."

Figure 4.9 Historical Air Cargo
2000-2010



Source: 2012-2035 RTP/SCS, Aviation and Airport Ground Access Appendix, Southern California Association of Governments, April 2012.

International versus Domestic Air Cargo

The overall downward trend since 2000 has been entirely due to declining domestic air cargo. Much of the domestic air cargo is handled by integrated carriers including FedEx, ABX Air, and UPS, with the remainder carried in the belly of commercial air carriers:

- At LAX, FedEx handled 46 percent of the domestic air cargo in 2010, ABX Air (which provides air service for DHL) handled 7 percent, and UPS handled 4 percent, meaning that 57 percent of the air cargo market share is captured by integrated carriers.
- At ONT, UPS handled 60 percent of the domestic air cargo in 2010[23] and FedEx handled 32 percent, meaning that 92 percent of the air cargo market share is captured by integrated carriers.

[23] Market share data is only for January through October.

- Of the domestic air cargo at LAX not handled by the integrated carriers, the majority (27 percent of all domestic air cargo in 2010) was handled by five scheduled airlines: American, Continental, Delta, United, and US Airways. A relatively small amount of the remainder was handled by other scheduled airlines (Alaska, Southwest, etc.).

International air cargo, on the other hand, reached a peak in 2007, declined in 2008 and 2009 with the recession, then recovered in 2010 to slightly below the 2007 peak. It seems likely that international air cargo will continue to grow in the future, although the traffic for the first seven months of 2011 was about 3 percent below the level for the corresponding period in 2010.

- Almost all international air cargo moves through Los Angeles International Airport (LAX). Over 82 percent of the international air cargo at LAX is handled by scheduled passenger airlines or their cargo divisions that operate freighter aircraft.
- Ontario International Airport (ONT) handles a very small proportion (about 3 percent in 2010) and the other airports essentially none.

It should be noted that the distinction between domestic and international cargo relates to the destination of the flight carrying that cargo, not the final destination of the shipment. For example, if FedEx put an international shipment on a flight from LAX to its hub at Oakland International Airport, where it was put on an international flight, that shipment would be counted as domestic cargo at LAX.

The air cargo forecasts presented in this chapter anticipate continued dominance of the Southern California air cargo market by LAX and ONT. While substantial growth is forecast for LAX than 2009 conditions (the base year for forecasting), growth compared to 2005 peak volumes is relatively modest by 2035. Existing air cargo facilities (described in Chapter 3) appear to be sufficient for the foreseeable future. Also as described in Chapter 3, ONT does have plans for expansion with a new air cargo facility on a 94-acre site in the northwest corner of the airport.

Warehousing

In 2008, the SCAG region had about 837 million square feet of warehousing space, of which about 694 million were occupied and about 143 million were "available" (vacant or about to become vacant). In addition, it was estimated that another 186 million square feet could be added on suitably zoned vacant land (mostly in the High Desert areas of the SCAG region). The characteristics and locations of this warehouse space were described in Chapter 3.

Forecasts of warehousing space were made through 2035. These forecasts differentiated between warehouse space need to serve port-related cargo versus purely domestic cargo. A detailed description of the methodology used to estimate port and non-port relate warehouse space is presented in a technical memorandum prepared for the Comprehensive Regional Goods Movement Plan and Implementation Strategy.[24] Some of the key assumptions included:

- Warehousing space is only needed for local imports or transloaded imports and the percentages of total cargo that falls into this category is all non-IPI loaded import containers as provided by the ports in their forecasts of cargo growth.
- The volume of containerized goods is calculated based on the dimensions of a TEU and it is assumed that on average, 90 percent of the space within a container.
- Approximately 10 percent of the cargo needing warehousing is moved from warehouse to warehouse within the region before being shipped to customers or out of the region.

[24] SCAG, *Industrial Space in Southern California: Future Supply and Demand for Warehousing and Intermodal Facilities,* Final Task 5 Report, September 2010. These forecasts were made based on assumed port growth to 43.158 million TEUs by 2035. In 2012 the ports reduced their forecast of 2035 throughput to 39.358 million TEUs.

- Based on interviews with major warehouse developers and operators in the region, it was estimated that approximately 23 percent of the floor area in a warehouse is devoted to storage and the remainder is devoted to moving goods, providing value-added services and administration.
- It is assumed that on average, warehouses operate at 75 percent of full capacity.
- It is assumed that the average ceiling height of warehouses in the region is 27 feet (based on interviews with warehouse operators).
- While the turnaround time for warehouse inventory varies widely depending on the function of the warehouse, it was estimated that on average there is complete turnaround of the cargo in warehouses every month (i.e., 12 times per year).

Once these assumptions were used to estimate the total current demand for space for port-related cargo, this demand was subtracted from the currently occupied warehouse space to determine the space needed for domestic goods. This demand was assumed to grow at the same rate as projected domestic commodity movements for the region as provided by HIS Global Insight in their Transearch database. The rate of growth commodity flows varied by time period but was generally between 2.1 and 3.0 percent per year.

Port-related warehouse square footage in 2008 was estimated at 102 million square feet. It was estimated that 307 million square feet of port-related warehousing space would be needed in the year 2035.

Nonport-related warehouse square footage in 2008 was estimated at 591 million square feet. By 2035, the demand for nonport-related warehousing is projected to reach 943 million square feet based on domestic cargo shipments in the SCAG region.

This amounts to 1,250 million square feet of port and nonport-related warehouse square footage demanded in 2035. Given the assumed growth rates in cargo, the region would run out of suitably zoned vacant land in about the year 2028. At that time, forecasts show that the demand for warehousing space will be approximately 1,023 million square feet.

The aggregate 2035 forecast of warehouse space for port- and nonport-related cargo was developed as part of the Comprehensive Regional Goods Movement Plan and Implementation Strategy. Expected aggregate growth in regional cargo was then determined and allocated to subregions. It was assumed that growth would occur in a logical sequence (i.e., as subregions closer to the urban core become saturated, future development would jump to the next logical subregions until the supply of vacant industrial-zoned land runs out). The aggregate forecasts are shown in Table 4.15.

Table 4.15 Estimates of Warehouse Supply and Demand
2008–2035 (Square Feet)

Year	TEUs/Year	TEUs/Yr Using Warehouse Space in Region[a]	Total Port-Related Warehouse Square Feet Required	Percent Port-Related	Non-port Occupied Square Feet	Total Occupied Port and Non-Port Square Feet
2008 actual	14,337,801	4,565,873	102,082,701	15%	591,760,159	693,842,860
2009 actual	11,816,592	3,762,994	84,132,118	13%	578,615,852	662,747,971
2010	12,814,000	4,080,618	91,233,496	14%	565,763,510	656,997,007
2011	13,550,015	4,315,002	96,473,797	15%	553,196,647	649,670,444
2012	14,329,677	4,563,286	102,024,858	16%	540,908,922	642,933,780
2013	15,155,647	4,826,316	107,905,626	16%	557,214,315	665,119,941
2014	16,030,754	5,104,993	114,136,234	17%	574,011,224	688,147,458
2015	16,958,000	5,400,275	120,738,070	17%	591,314,468	712,052,538
2016	17,829,867	5,677,921	126,945,612	17%	609,139,307	736,084,919
2017	18,749,827	5,970,882	133,495,571	18%	627,501,466	760,997,037
2018	19,720,669	6,280,047	140,407,800	18%	643,520,270	783,928,070
2019	20,745,348	6,606,356	147,703,346	18%	659,948,000	807,651,346
2020	21,827,000	6,950,808	155,404,521	19%	676,795,096	832,199,616
2021	22,883,394	7,287,217	162,925,869	19%	694,072,263	856,998,132
2022	23,994,893	7,641,174	170,839,546	19%	711,790,479	882,630,026
2023	25,164,507	8,013,637	179,167,005	20%	729,961,006	909,128,011
2024	26,395,422	8,405,622	187,930,909	20%	745,471,649	933,402,558
2025	27,691,000	8,818,199	197,155,201	21%	761,311,872	958,467,073
2026	28,937,941	9,215,287	206,033,208	21%	777,488,677	983,521,885
2027	30,245,459	9,631,667	215,342,517	21%	794,009,216	1,009,351,733
2028	31,616,627	10,068,315	225,104,994	22%	810,880,794	1,035,985,788
2029	33,054,674	10,526,261	235,343,644	22%	828,110,869	1,063,454,513
2030	34,563,000	11,006,587	246,082,670	23%	845,707,058	1,091,789,729
2031	36,145,182	11,510,433	257,347,537	23%	864,320,511	1,121,668,047
2032	37,804,983	12,038,997	269,165,037	23%	883,343,633	1,152,508,669
2033	39,546,363	12,593,539	281,563,363	24%	902,785,441	1,184,348,804
2034	41,373,488	13,175,387	294,572,183	24%	922,655,150	1,217,227,333
2035	43,158,000	13,743,665	307,277,606	25%	942,962,179	1,250,239,785
Growth 08-35	28,820,199	9,177,792	205,194,904		351,202,020	556,396,925
Ratio: 2035/2008	3.0	3.0	3.0		1.6	1.8
Growth 20-35	20,274,606	6,456,448	144,351,737		248,889,916	393,241,653

[a] *Including TEUs moving twice; i.e., a container that is sent from the ports to a warehouse and then is later sent to another warehouse in the region.*

Over time, warehousing space directly or indirectly impacted by activities at the San Pedro Bay Ports will affect twenty-five Southern California submarkets identified as part of this effort (Table 4.16). These are shown in priority order together with the amount of occupied space, vacant existing space and developable space. Priority order refers to the rough sequence in which increases or decreases in port and off-port activity will impact each of these submarkets. Thus, the South Bay market will likely be impacted before the I-710 corridor market, while the Imperial County market would be the last place to feel any activity. The term “rough” is used because the market does not always work in a smooth geographic fashion with the excess demand for space in one area overflowing exactly into the next priority subregion.

Table 4.16 Submarkets in Priority Order of Occupied, Vacant, and Developable Space

Priority	County	Submarket	Occupied	Vacant	Developable	Total Available
1	Los Angeles	South Bay	55,222,927	5,730,730	1,723,183	62,676,840
2	Los Angeles	Mid I-710	21,339,348	3,145,870	500,273	24,985,491
3	Los Angeles	Central Los Angeles	78,121,132	10,064,154	503,966	88,689,252
4	Los Angeles	605	55,174,480	8,571,933	100,298	63,847,316
5	Los Angeles	San Gabriel	74,710,961	9,570,002	3,641,972	87,922,935
6	San Bernadino	Westend SB	83,553,302	21,204,109	3,480,113	108,165,524
7	Orange	West Orange	6,844,239	2,664,637	414,432	9,923,308
8	Los Angeles	I-5	20,674,648	2,231,773	5,783,759	28,690,180
9	Ventura	Port Hueneme	18,362,615	976,845	2,169,614	21,509,074
10	Riverside	West Riverside	77,666,478	10,408,022	9,528,375	97,602,875
11	San Bernadino	East SB Valley	66,182,417	28,816,656	13,879,760	108,878,833
12	Riverside	March JPA	27,412,126	20,007,359	21,649,981	69,069,466
13	Orange	Orange Airport	13,976,430	4,846,335	1,516,831	20,339,596
14	Orange	North Orange	12,018,265	5,349,334	373,668	17,741,267
15	Ventura	118	8,934,654	1,027,942	932,849	10,895,563
16	Ventura	101	10,540,581	1,004,704	702,738	12,248,124
17	Orange	South Orange	1,649,100	256,264	800,951	2,706,315
18	Riverside	SW Riv. County	15,457,595	446,294	6,270,262	22,174,151
19	Riverside	Pass	3,543,654	2,025,336	2,870,080	8,439,070
20	San Bernadino	High Desert	14,961,152	3,295,661	40,154,546	58,411,359
21	Los Angeles	North Los Angeles	5,453,221	974,647	38,516,107	44,943,975
22	Ventura	126	2,409,068	82,141	157,585	2,648,920
23	Riverside	Coachella	12,341,197	71,000	19,748,090	32,160,287
24	Imperial	South Imperial	6,789,246	925,245	10,303,800	18,018,291
25	Imperial	North Imperial	484,024	149,915	551,565	1,185,504
	Total		*693,822,860*	*143,846,908*	*186,274,798*	*1,023,873,516*

The last year in which there is sufficient space available to fully allow the distribution of the demand for space in the various submarkets is 2027. In 2028, there is space to barely distribute the demand but it requires unrealistically low vacancy rates and heavy dependence on Imperial County locations.

It is important to acknowledge that the existence and timing of future shortages in warehouse space in Southern California are dependent on a number of key assumptions. Some reflect current practices in warehouse operations that are already changing. Some of these trends could significantly reduce demand for space. At this time, these changes in warehouse operations practices have only been documented anecdotally and further study and monitoring of trends will be important if the region is to ensure that the warehouse sector has sufficient land supply to meet future demand in the logistics sector. Some of the observed changes that could reduce demand for warehouse space would include:

- Modern warehouses have much higher building height and thus contain more storage space.
- Warehouses are more highly automated and may be using space more efficiently.
- Order fulfillment rates and modern information technology used for inventory controls are leading to ever short cycle time for inventory. The assumption that warehouse cargo turns every month may be too conservative in the future.
- Domestic cargo growth rates may be overly optimistic given the slow pace of economic recovery and changing consumption patterns. This would not eliminate the longer term demand for warehouse space. However, it might push shortages out into the future.

On the other hand, there are also assumptions that may lead to even greater demand for space. Most analysis of global supply chains makes it very difficult to track the flows of imported products once they enter the domestic supply chain. It is very likely that a higher percentage of goods move from warehouse to warehouse within the region (from Original Equipment Manufacturers (OEM) warehouses to retailers' warehouses) than is assumed in the forecasts for future warehouse demand. As, already noted, periodic updating of these forecasts based on monitoring trends will be important for determining impacts on industrial land supply needs.

Calculations were made of the share of each submarket's internal space usage that went to port and non-port activities. This shows the degree of specialization in each area:

- In 2008, only 14.7 percent of regional warehouse demand is related to handling port cargo whereas this increases to 21.9 percent of regional warehouse demand by 2027. This is due to the faster rate of growth in international cargo relative to domestic cargo. This change in the mix of overall demand for warehousing space is likely to be reflected in the degree to which particular submarkets can specialize in the type of cargo that they handle. Nonetheless, there is a high degree of specialization in certain submarkets that remains throughout the forecast period. This is important because this specialization already does and may continue to affect the origin-destination patterns of truck traffic moving to and from these submarkets (and where highway access routes will be needed). For example, extreme specialization is shown in South Bay. There, the share of total space that is devoted to port-related uses remains above 95 percent throughout the forecast period indicating the importance of good roadway connections between the port and these concentrations of warehouse. The reverse is true in the outlying deserts which largely remain at 0 percent port and 100 percent nonport. Warehouses in these locations are much more likely to serve as national and regional distribution centers and will need good connections to the interstate system.
- The share of port-related cargo increases in areas nearest to the San Pedro Bay ports between 2008 and 2027. Examples of the increase in port-related cargo handled in these areas include an increase from 22.1 percent to 29.7 percent in the Mid-I-710 submarket and an increase from 11.1 percent to 19.1 percent in the Central Los Angeles submarket.
- Farther from the ports, but not in the desert areas, the increases in the share of port-related cargo handled tends to grow even faster as more land is available. For example, the port-related share of cargo is expected to grow from 7.1 percent to 23.2 percent in the San Bernardino County West end submarket, from 7.1 percent to 29.2 percent in the East San Bernardino Valley submarket, and from 6 percent to 28.6 percent in the March JPA submarket.

Here again, we see the current tendency of the market to move outward to build space where land is available and port and nonport users following as their need for space grows.

4.7 Summary of Deficiencies and Needs

All of the modal elements that comprise the goods movement system in the region are expected to experience significant growth over the next 25 years. As noted in Chapter 2, this growth is linked to the expansion of the regional population and its demand for goods and services, continuation of the region's role as a major manufacturing center, increasing international trade, and the benefits to global supply chains of using the region's ports, airports, and logistics services. Ultimately, this growth is the result of a growing and healthy economy. But without addressing the need to expand the system, ensure modal options and connectivity, and address safety concerns, this growth and its benefits cannot be achieved.

The highway system will require investments and improvements to meet the growing demands placed on it by trucking. Trucking serves all goods movement markets and truck VMT is expected to grow much more rapidly than auto VMT. The highest concentrations of truck traffic and the highest rates of growth in truck traffic are seen in the region's industrial core and gateway regions. Links between the San Pedro Bay ports and industrial warehouses, between industrial enclaves and warehousing in the San Gabriel Valley, San Bernardino County and Riverside County need accessibility to the region's population centers as well as inter-regional connectivity. Truck safety is also a critical concern in these corridors. As will be discussed in Chapter 6, the system of truck lanes that has been incorporated in the plan has the potential to make a major contribution to addressing these concerns. But a truck lane system alone cannot address all of the congestion-related trucking needs in the region. Addressing congestion hot spots along key truck corridors is another strategy that needs to be considered.

Growth in rail traffic will require expansion of intermodal terminal capacity and additional mainline track capacity. The greatest driver in rail traffic growth will be increased international trade but there will also be substantial growth in domestic rail freight. The region also has plans to significantly expand commuter rail, often in the same corridors as the freight system is expanding. In order to make maximum use of the rail system where it can complement the regional trucking system, a series of investments have been identified. The private Class I railroads will make some of these investments on their own but there are other cases, particularly where there is sharing of track between passenger and freight railroads, where there will also be a need to share the expense between public and private sectors. Accommodating this increase in train traffic will also require grade-separations at many crossings where delays and safety issues will become more severe in the future.

Forecasts of international trade suggest that there will be significant growth in demand for cargo movements through the San Pedro Bay ports and that even with increased investments in marine terminals, the ports will reach capacity by 2035. To realize the benefits of this demand, the region will need to invest in supporting infrastructure – access improvements to the port, rail terminal and mainline capacity investments, and warehouse and distribution centers. While SCAG, the county transportation commissions, and other transportation facility owners and operators will have a major role to play in ensuring that investments are made in the transportation infrastructure, local land use decisions will largely dictate how warehouse and distribution center supply will evolve. Given the strong connections that are needed between transportation infrastructure and industrial/warehouse land supply, regional transportation stakeholders should continue to emphasize this linkage in transportation plans and should use tools such as project prioritization incentives, potential application of sustainable communities strategies, and development of land use guidance documents focusing on industrial land supply issues.

Chapter 6 presents a visionary system plan to address many of these goods movement needs while helping the region meeting its economic, environmental, and livability goals.