West Coast Corridor Coalition Trade and Transportation Study

final

report

prepared for

West Coast Corridor Coalition

prepared by

Cambridge Systematics, Inc.

with

HDR, Inc.
Sarah Catz

April 2008

www.camsys.com

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Table of Contents

List of Figures

List of Figures
(continued)

List of Figures
(continued)

Executive Summary

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The West Coast freight transportation system – seaports, airports, border crossings, and the highways and rail corridors that connect them to the region's metropolitan areas – is a key element of the national and international supply and distribution chain, providing gateways for international freight shipments and connecting those gateways with major markets in the United States, Canada, and Mexico. However, this vital transportation network is being stressed by continued growth in freight volumes, driven by rapidly increasing Pacific Rim trade and the growing populations and economies of the Western region. This stress increasingly manifests itself in the form of capacity and congestion problems at key regional gateways, at important intermodal transfer facilities, and along critical highway and rail corridors. In addition, population growth is adding to the pressure on this already constrained infrastructure; it is becoming increasingly difficult to balance freight mobility needs with environmental, social, and financial concerns; there are rapidly rising infrastructure maintenance costs across all modes; and there is an increasing awareness that neither the public nor private sectors – acting independently – have the necessary resources to fully address rising transportation demands. Individually or collectively, these issues are eroding the efficiency and productivity of the region's transportation system, leading to economic implications that will reverberate locally, regionally, nationally, and internationally.

Although individual states, metropolitan planning organizations (MPO), ports, and railroads within the West Coast region have examined these issues – and have in many cases identified statewide, metropolitan, or facility-specific solutions – there has been no systemwide examination of the freight-related needs and deficiencies in the West Coast transportation system as an integrated whole. Through completion of this West Coast Trade and Transportation Study, the West Coast Corridor Coalition (WCCC), a partnership of state departments of transportation (DOT), regional and local transportation agencies, ports, and related transportation organizations (both public and private) from Alaska to California, has begun to identify regional, systemwide issues and develop a foundation to allow the Coalition and its members address issues and chokepoints that cross jurisdictional, interest (i.e., public/private), and financial boundaries. The key findings of this study should be used by the WCCC and its members to develop an approach to planning for and investing in the region's trade and transportation system that will help the West Coast stakeholders work collaboratively to ensure its continued efficiency, reliability, and sustainability.

Key Findings

The West Coast region incorporates a system of land, sea, and air trade gateways and transportation corridors of regional and national significance and is the gateway of choice for Trans-Pacific Trade.

The West Coast trade transportation system uniquely combines:

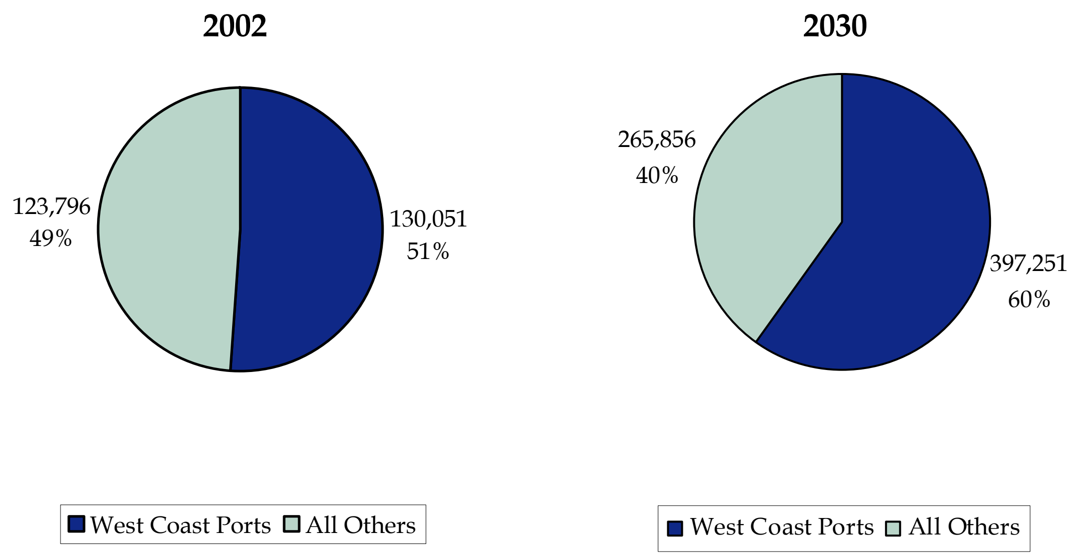
- The nation's largest international trade gateways (sea and air) supporting the fastest growing international trade lane (Trans-Pacific) and feeding the rest of the U.S. through major east-west highway, rail, and air corridors;
- A major north-south freight transportation system (border crossings, highway, and rail) connecting all three North American Free Trade Agreement (NAFTA) countries; and
- Megaregion trade flows supporting one of the fastest growing population and employment areas of the U.S.

This system converges in major metropolitan centers, with among the most severe congestion and air quality problems in the nation and traverses mountain passes and other topographic features that make it an extremely challenging system to manage.

Over the last decade, growth in demand for each of the major components of the West Coast trade transportation system underscores the national and regional significance of this system. West Coast seaports, led by Los Angeles, Long Beach, Seattle, Tacoma, and Oakland, handled over one-half of all containerized shipments entering and departing the United States in 2006. In the same year, the West Coast's airports handled nearly 8.4 million tons of overseas freight, accounting for 42 percent of the U.S. total. Since 1996, the West Coast has gained a larger share of both the nation's container and international air cargo shipments, further underlining the importance of the West Coast's port and air gateways to U.S. international trade. The West Coast's share of national container imports and exports grew from 47 to 52 percent from 1996 to 2006, an increase of 12.6 million containers. In the same time period, the West Coast's share of total international air cargo shipments grew from 34 to 42 percent, an increase of 2.0 million tons.

The West Coast is also the gateway of choice for rapidly growing Trans-Pacific Trade. Driven by rapid economic growth and industrialization in China, Malaysia, and other Asian nations, the volume and value of trade between Asia and the United States have been growing significantly. In addition, China is expected to have the largest economy in the world by 2050, which will further increase Trans-Pacific freight demand. Because of its geographic location, the West Coast handles the majority of this freight. As Figure ES.1 demonstrates, the West Coast ports handled just over one-half of all Asia-Pacific trade tonnage in 2002, or about 130 million tons. By 2030, this is expected to grow to approximately 397 million tons, representing 60 percent of all U.S. trade with Asia.

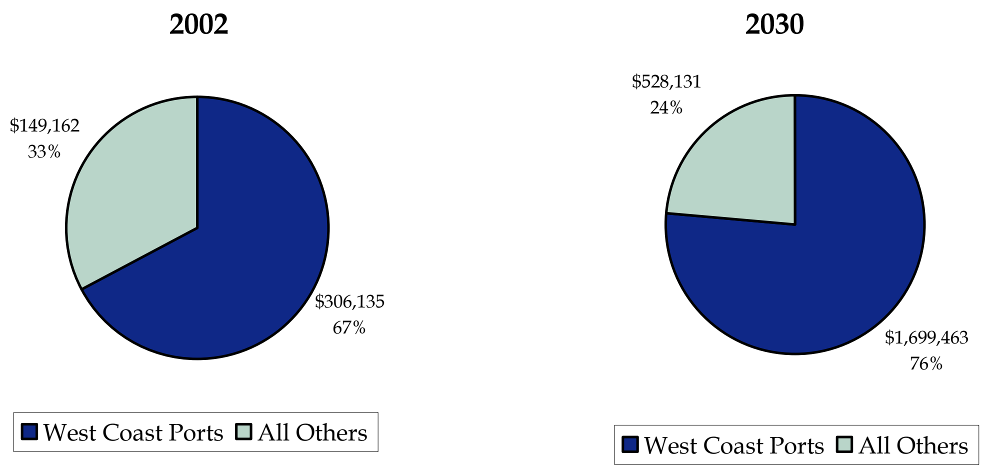
Figure ES.1 West Coast Share of United States-Asia Trade by Weight
2002 and 2030, In Thousands of Tons



Source: FHWA Freight Analysis Framework (FAF).

Figure ES.2 presents the West Coast share of United States Trans-Pacific trade by value. In 2002, the West Coast seaports handled just over two-thirds of the value of U.S.-Asia trade. This equates to $306 billion worth of goods. By 2030, the West Coast is expected to be processing 76 percent of the value of U.S. Trans-Pacific trade, representing nearly $1.7 trillion of freight value.

Figure ES.2 West Coast Share of United States-Asia Trade by Value
2002 and 2030, In Millions of Dollars

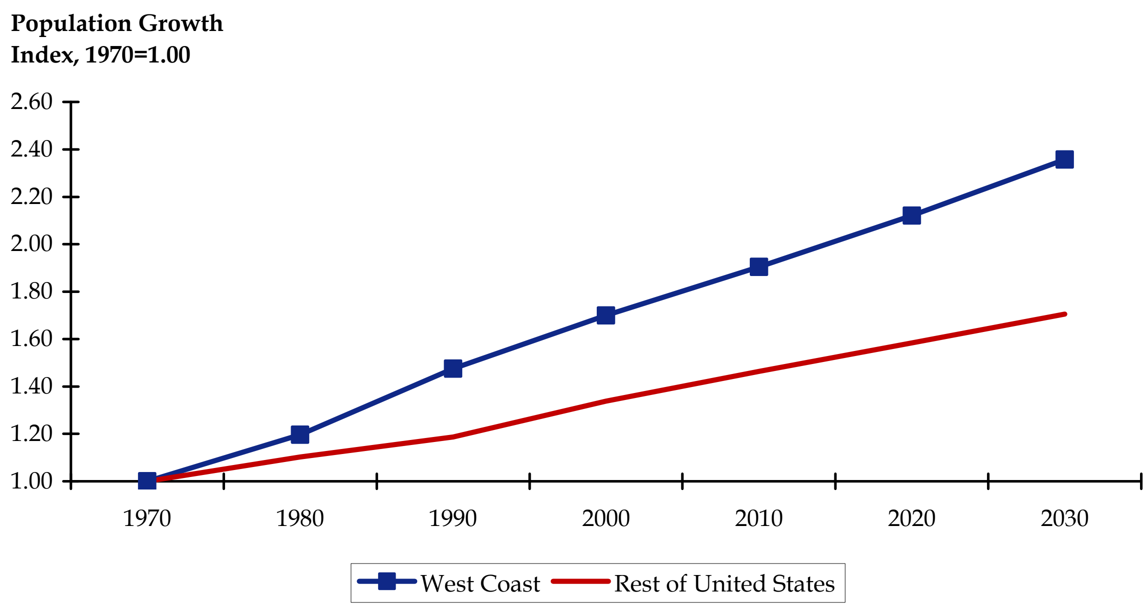


Source: FHWA Freight Analysis Framework (FAF).

Because the West Coast region is the gateway of choice for international shippers serving U.S. markets, the region's east-west transportation infrastructure handles the lion's share of overall freight shipments. However, in recent years, the region's north-south transportation infrastructure, with I-5 as its backbone, has emerged as a crucial trade corridor for both domestic commerce and international trade, connecting West Coast metropolitan areas and serving increasing volumes of NAFTA-related shipments.

These metropolitan areas are growing significantly. The West Coast, as a whole, absorbed about one-quarter of total U.S. population growth between 1970 and 2000, and this growth has been overwhelmingly concentrated in the region's urban areas. The region is expected to add over 13.5 million people during the next 24 years, and will reach a population of 60.8 million by 2030, as shown in Figure ES.3. Employment growth is expected to grow apace. Continuing growth at the region's international trade gateways, coupled with population and employment growth in the region's major metropolitan areas, is leading to concerns about the ability of the region's transportation system – east/west as well as north/south – to continue to provide safe, efficient, and reliable service for passenger and freight movements in the future.

Figure ES.3 West Coast and National Population Growth Index
1970 to 2030



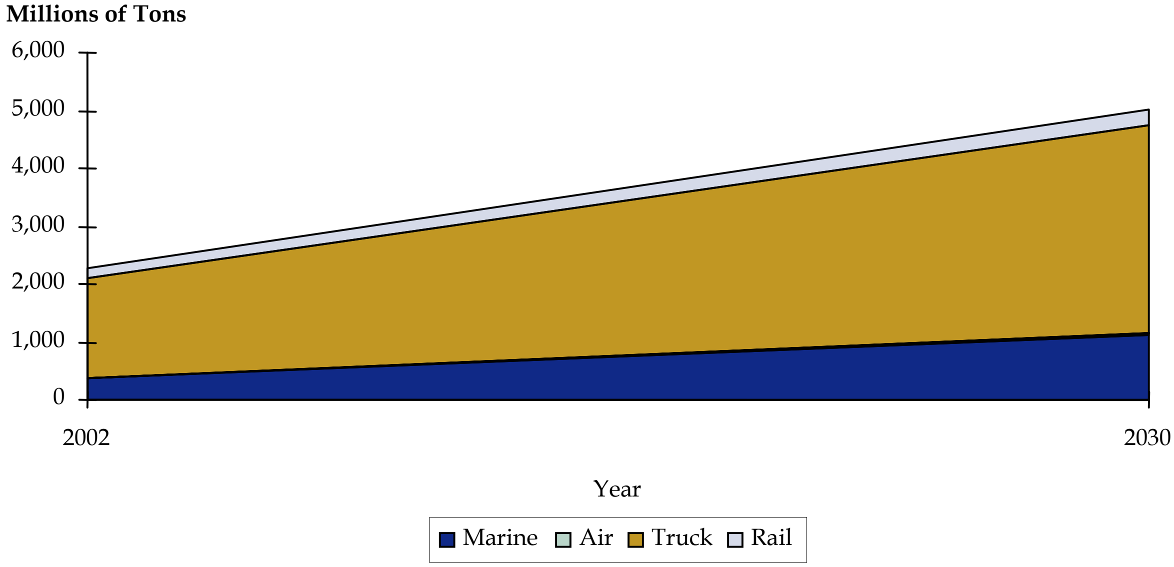
Source: U.S. Census Bureau.

Physical, operational, and institutional issues in the region will not allow the trade and transportation system to absorb anticipated growth in freight demand.

The overall freight demand to support the region's growing population and economy – both domestic and international – is expected to approximately double by 2030, as shown in Figure ES.4. By comparison, freight demand for the country as a whole is projected to grow by 71 percent.[1]

[1] FHWA Freight Analysis Framework (FAF).

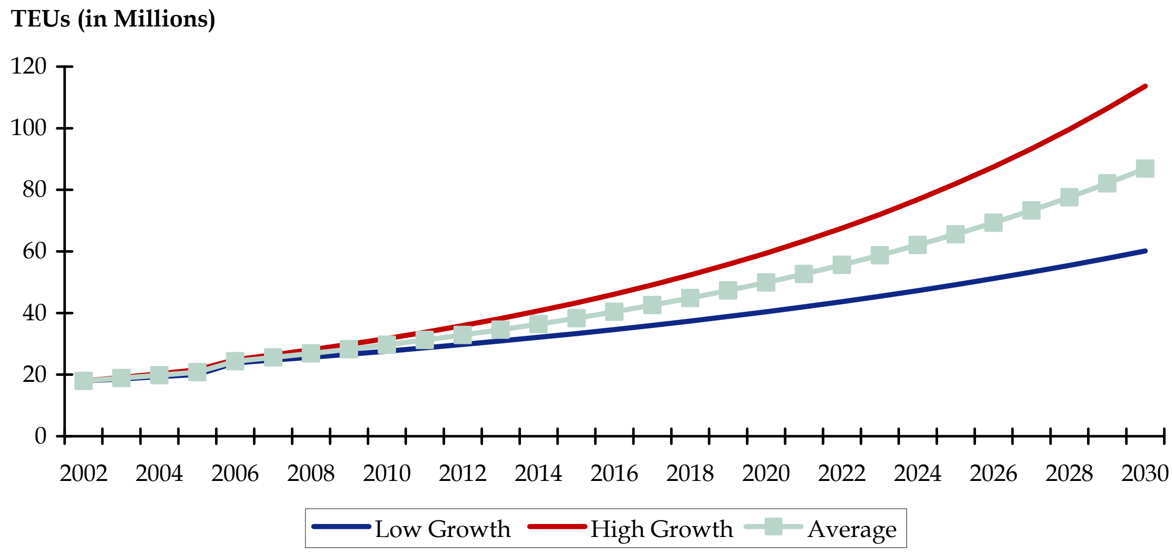
Figure ES.4 West Coast Freight Demand
All Modes, 2002 to 2030



Source: FHWA Freight Analysis Framework (FAF).

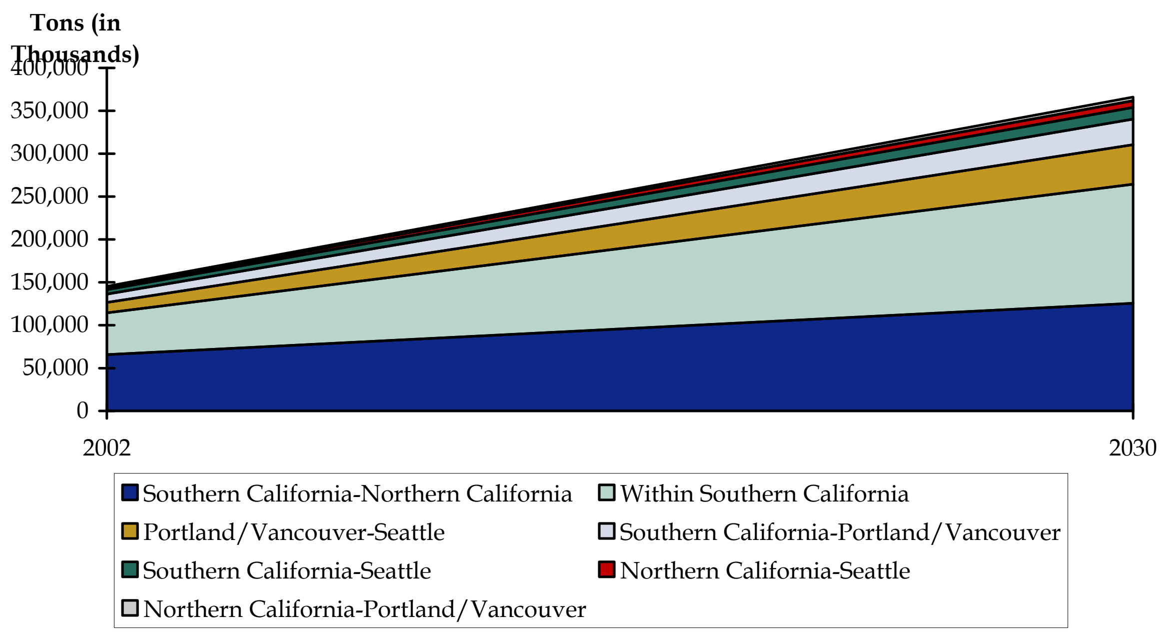
This growth will impact both east-west and north-south movements in the region. Overall, West Coast container volume (measured in 20-foot equivalent units (TEUs)) – many of which will move out of the region on the east-west network – will more than triple between now and 2030, as shown in Figure ES.5. Domestic freight shipments among the West Coast metropolitan areas (moving along the north-south network) are expected to grow from about 145 million tons to nearly 366 million in 2030, as shown in Figure ES.6.

Figure ES.5 Container Movements at West Coast Seaports
2002 to 2030



Sources: Cambridge Systematics, Inc., and HDR.

Figure ES.6 Domestic Trade Among West Coast Metropolitan Areas
2002 to 2030

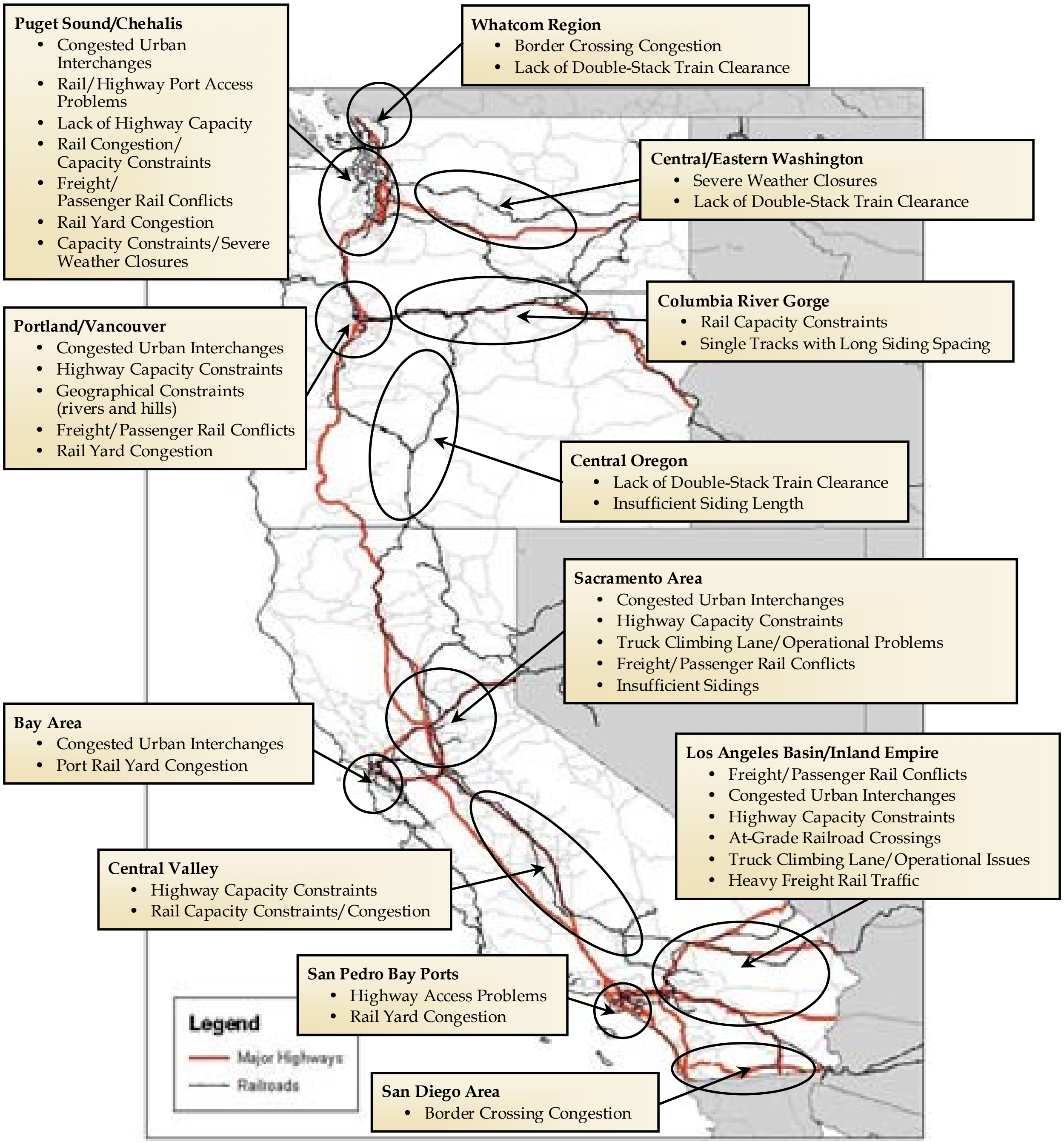


Source: FHWA Freight Analysis Framework (FAF).

Although the region's freight transportation system is managing existing demand, there are several physical, operational, and institutional issues that will, individually or collectively, hinder the ability of region's trade and transportation system from effectively serving this expected growth in freight traffic. The region's population and employment growth will be overwhelmingly concentrated in the region's urban areas; also home to many of the region's key international trade gateways. These growth patterns will make it difficult for the region to expand system capacity without significant environmental, social, and financial costs. Major chokepoints along the region's highway and rail systems – both east/west and north/south – already are impacting system reliability, constraining port growth and efficiency, and impacting international trade, as well as domestic trade among West Coast megaregions. And while operational and institutional strategies are being used effectively to mitigate the impacts of these physical chokepoints, this will become more difficult as freight demand continues to increase and as shippers continue to demand high-speed, high-quality, and highly reliable service. Figure ES.7 is a map of the region showing the locations and types of key freight system bottlenecks.

Continued growth in freight demand, coupled with the fact that the environmental, social, and financial costs of adding capacity to the system continues to rise, will require the physical, operational, and institutional issues affecting the West Coast region to be appropriately addressed. Not addressing regional chokepoints and issues will have significant impacts on the region's transportation system and economic competitiveness.

Figure ES.7 Key West Coast Regional Bottlenecks



Addressing These Challenges

Traditional approaches to planning and investing in the transportation system, which rely on states and metropolitan areas to identify and program improvements within their own jurisdictional boundaries, are not adequate to meet these challenges. Addressing these challenges will require a willingness to plan and fund freight system improvements across boundaries – the jurisdictional boundaries between West Coast states and MPOs, the interest boundaries between public agencies and the private-sector freight community, and the competitive boundaries among the region's seaports and airports.

This report highlights the need for West Coast freight stakeholders to take a different approach to planning and investing in the West Coast trade and transportation system as discussed below.

Working with Federal partners to invest in nationally significant trade and transportation resources.

It is clear that the West Coast trade and transportation system represents a nationally significant asset. The West Coast Corridor Coalition welcomes the emergence of a strong Federal role in partnering to protect and enhance this asset. Current Federal programs for gateway and corridor improvements have seen limited funding, and the range of Federal freight funding resources has been too diluted to tackle the costly problems facing the international gateway systems and trade corridors of the West Coast system. This report identifies a number of system chokepoints that would benefit from a strong partnership with the Federal government to invest in gateways and corridors of national significance.

Making targeted, system-level investments in the freight system across jurisdictional boundaries.

Although state and local planning and funding strategies can be useful for making localized improvements to the region's trade and transportation system, they are not well suited for identifying and funding improvements to the regional and national infrastructure issues facing the West Coast trade and transportation system, or placing state-level or facility-specific investment decisions in a regional or national context. Perhaps more so than many other regions, West Coast financing of transportation systems has become increasingly focused on local revenue sources, and freight investments reflect local priorities. While several states have taken bold steps to address multimodal freight system investment needs within their respective states (such as the California Trade Corridor Investment Fund and the Connect Oregon program), no such vehicles exist for multistate planning and programming.

Identifying, planning, and financing freight system improvements requires a regional or national approach; and investments must be made at the network level (i.e., capacity chokepoints along regionally significant trade corridors; at ports, airports, and intermodal terminals; and at urban rail or highway interchanges and connectors). Currently, there are limited opportunities for states to work together to identify funds for these sorts of multi-jurisdictional, system-level improvements. Developing and implementing multistate planning and funding mechanisms to facilitate new innovative funding and project delivery options will require a strong Federal and state role.

Promoting innovative approaches to congestion, both within and through major metropolitan areas.

Congestion within the West Coast region's metropolitan areas not only impacts urban mobility, it also hinders regional and national economic competitiveness. Chokepoints in the West Coast region, most of which are located at urban interchanges, at access points to international freight gateways, and along urban bypass facilities, not only impact the efficient flow of goods within and among major metropolitan areas along the West Coast, they also impact the overall efficiency of freight movements accessing national markets. While congestion at these urban chokepoints will not completely shut down the West Coast trade and transportation system, they will have significant safety, efficiency, and economic impacts.

Promoting innovative planning, funding, and project development strategies that relieve this congestion – both within and through the major metropolitan areas of the West Coast – will be critical to helping the region absorb growth in freight traffic and drive regional and national economic vitality. Strategies such as the PierPASS Off Peak program at the San Pedro Bay ports, increasing interest in corridor-level ITS strategies, and pricing and user fee programs (such as tolled truck lanes) are gaining growing interest among the West Coast states. A coordinated approach and sharing of best practices could benefit all stakeholders in the region, and facilitate continued growth in freight traffic in the growing megaregion centers.

Developing freight investment models that incorporate market and economic principles while ensuring environmental sustainability.

Many states and MPOs along the West Coast have been investing significantly in a variety of freight infrastructure projects that have local, regional, and national benefits. However, existing institutional arrangements and funding strategies make it difficult for states and MPOs to identify logical packages of potential freight improvement projects; quantify their costs and benefits; and determine how costs, risks, and benefits should be shared among public and private freight stakeholders.

The nation needs new freight system investment approaches that reflect both public- and private-sector benefits of freight projects, are supported by performance metrics to ensure accountability, and are consistent with environmental and community needs will improve the ability of states, MPOs, and private-sector freight stakeholders to make targeted, appropriate investments in the West Coast trade and transportation system, and improve mobility for people and goods regionwide. West Coast states, MPOs, and ports are actively engaged in developing new approaches and supporting data systems to evaluate freight system performance improvements and prioritize investments. Partnership opportunities with other multistate regions could benefit national efforts to gain greater adoption of these methods.

States, MPOs, ports, and special purpose authorities along the West Coast are experimenting with innovative financing, but there are obstacles. Public investment in private infrastructure is often prohibited by law, and approaches that blend public and private financing require clear delineation of public and private benefits and a nexus between cost responsibility and benefits. The analytical tools necessary to support these decisions and the appropriate public-private decision-making institutional arrangements should be funded and supported at the federal level to help ensure standardized adoption and implementation.

Developing new approaches to balancing environmental protection and community interests with system expansion needs.

Many gateway communities along the West Coast suffer the health and safety impacts of increasing trade volumes that serve national interests. While this trade activity also brings economic benefits to these communities, the appropriate balance between local and national benefits and these local impacts has been difficult to achieve. Community resistance to port and infrastructure expansion is increasingly the norm at West Coast gateways. Innovative approaches to environmental permitting, clean freight technology development, and new community participation models are all in the early stages of adoption along the West Coast. These efforts can serve as national models and should receive Federal support.

1.0 Introduction

The West Coast freight transportation system – seaports, airports, border crossings, and the highways and rail corridors that connect them to the region's metropolitan areas – is a key element of the national and international supply and distribution chain, providing gateways for international freight shipments and connecting those gateways with major markets in the United States, Canada, and Mexico. The West Coast seaports alone handle nearly half of all containerized shipments entering and departing the United States as well as significant volumes of bulk and break-bulk shipments, such as agricultural goods, lumber, petroleum products, and automobiles. The region's airports play a similar role, connecting far-flung markets for high-value, time-sensitive freight shipments. The West Coast states (Alaska, Washington, Oregon, and California) and their links to bordering Canadian provinces and Mexican states also represent a significant economic community within North America. Trade among megaregions along the West Coast was valued at more than $254 billion in 2002.

However, this vital transportation network is being stressed by continued growth in freight volumes, driven by rapidly increasing Pacific Rim trade and the growing populations and economies of the Western region. This stress increasingly manifests itself in the form of capacity and congestion problems at key regional gateways, at important intermodal transfer facilities, and along critical highway and rail corridors. Travel time and cost are increasing, service reliability is decreasing, and the ability of the system to recover from emergencies and service disruptions is becoming severely taxed. Layered on top of these concerns is continued population growth, which adds to the pressure on this already constrained infrastructure; the increasing challenge of balancing freight mobility needs with environmental, social, and financial concerns; rapidly rising infrastructure maintenance costs; and a recognition that neither the public nor private sectors – acting independently – have the necessary resources to fully address rising transportation demands. Individually or collectively, these issues are eroding the efficiency and productivity of the region's transportation system, leading to economic implications that will reverberate locally, regionally, nationally, and internationally.

Although individual states, metropolitan planning organizations (MPO), ports, and railroads within the West Coast region have examined these issues – and have in many cases identified statewide, metropolitan, or facility-specific solutions – there has been no systemwide examination of the freight-related needs and deficiencies in the West Coast transportation system as an integrated whole. From the perspective of international and national shippers, carriers, and logistics service providers, the West Coast freight transportation functions as a multistate system and system performance issues cross existing jurisdictional boundaries. A regional approach is critical, as without a clear understanding of how trade trends and transportation constraints are likely to affect the entire regional West Coast transportation system, individual West Coast states, ports, and other regional freight stakeholders cannot effectively meet future needs and ensure continued economic growth.

Through completion of this West Coast Trade and Transportation Study, the West Coast Corridor Coalition (WCCC), a partnership of state departments of transportation (DOT), regional and local transportation agencies, ports, and related transportation organizations (both public and private) from Alaska to California, has begun to identify and address these regional, systemwide issues. Through the identification of key trade, infrastructure, operational, and policy concerns affecting the West Coast region at the system level, this study provides a foundation and a process to allow WCCC members to work with national transportation policy makers, the private sector freight community, and local partners to begin addressing specific systemwide issues and chokepoints that cross jurisdictional, interest, and financial boundaries. More importantly, it encourages a system-level, regional approach to planning for and investing in the region's trade and transportation system that will help the West Coast stakeholders work collaboratively to ensure its continued efficiency, reliability, and sustainability.

2.0 The Setting

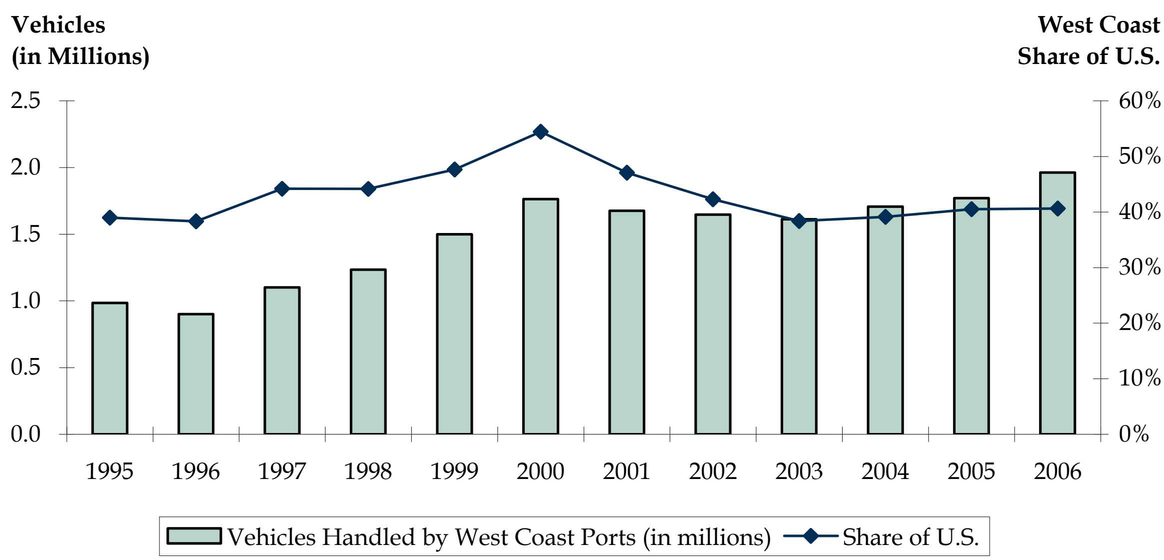
■ 2.1 The West Coast Incorporates a System of Trade Gateways and Transportation Corridors of Regional and National Significance

The West Coast trade and transportation system is of vital regional and national significance. The importance of the region's gateways in connecting consumer goods manufactured in Asia with U.S. markets has been well-documented and the system's importance in supporting the flows of containerized goods continues to grow. West Coast seaports, led by Los Angeles, Long Beach, Seattle, Tacoma, and Oakland, handled over half of all containerized shipments entering and departing the United States in 2006. In the same year, the West Coast's airports handled nearly 8.4 million tons of overseas freight, accounting for 42 percent of the U.S. total. Since 1996, the West Coast has gained a larger share of both the nation's container and international air cargo shipments, further underlining the importance of the West Coast's port and air gateways to U.S. international trade. The West Coast's share of national container imports and exports grew from 47 to 52 percent from 1996 to 2006, an increase of 12.6 million containers. In the same time period, the West Coast's share of total international air cargo shipments grew from 34 to 42 percent, an increase of 2.0 million tons.

The West Coast also is an important gateway for other commodities that play vital roles in ensuring the diversity and vitality of the national economy. As shown in Figure 2.1 below, the region's ports handle a significant volume of motor vehicles, processing two million vehicles in 2006 or 41 percent of the U.S. total. The Ports of Long Beach and Portland, respectively, rank as the third and fifth busiest auto ports in the country. In terms of energy, the West Coast's share of U.S. petroleum imports is rising dramatically; up from less than 5 percent in 1995 to about 11 percent of the U.S. total in 2006 (see Figure 2.2). Beyond large-scale imports from the Mid-East, the West Coast also imports significant volumes of petroleum from South America. The Trans-Alaska Pipeline System pumps about 722,000 barrels per day (approximately 30 million gallons) from Prudhoe Bay to Valdez for shipment. Overall, West Coast oil imports reached 542 million barrels in 2006 and supply Nevada and Arizona in addition to meeting the fuel demands of the West Coast region.

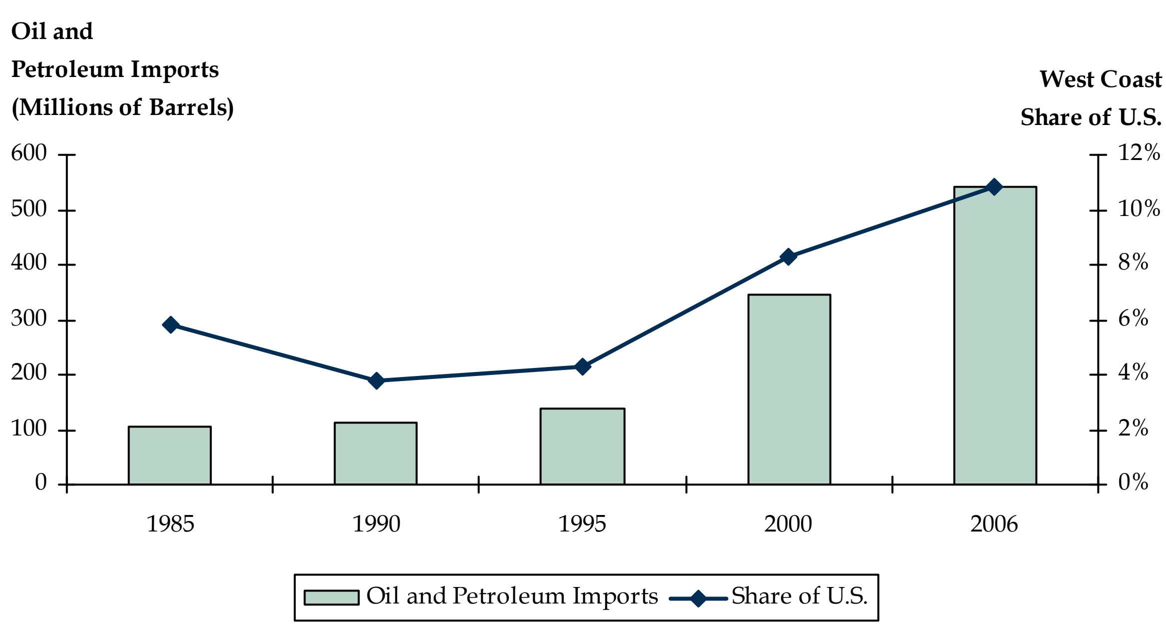
The West Coast and the Pacific Northwest, in particular, are the primary conduits for the nation's wheat exports. Arriving primarily at the Lower Columbia River ports by rail or barge, wheat grown in Eastern Washington, Montana, and the Upper Midwest is loaded onto ships and exported to large markets in Asia. In 2006, some 11.1 million tons of wheat was exported from West Coast ports, representing half of all overseas shipments of U.S.-grown wheat (see Figure 2.3). The West Coast region also accounts for significant percentages of other agricultural exports, particularly fruits, nuts, and vegetables, as shown in Figure 2.4.

Figure 2.1 Vehicles Handled by West Coast Ports
1995-2006



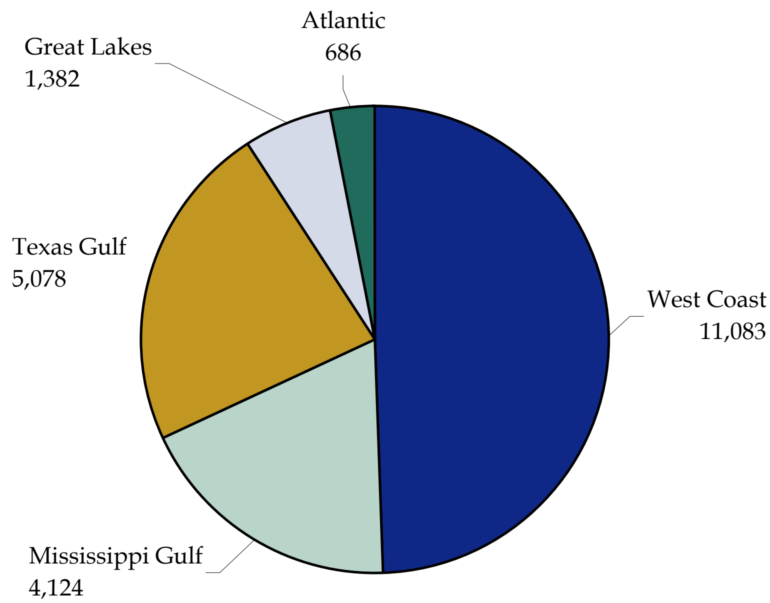
Source: American Association of Port Authorities.

Figure 2.2 West Coast Fuel Imports
1985-2006



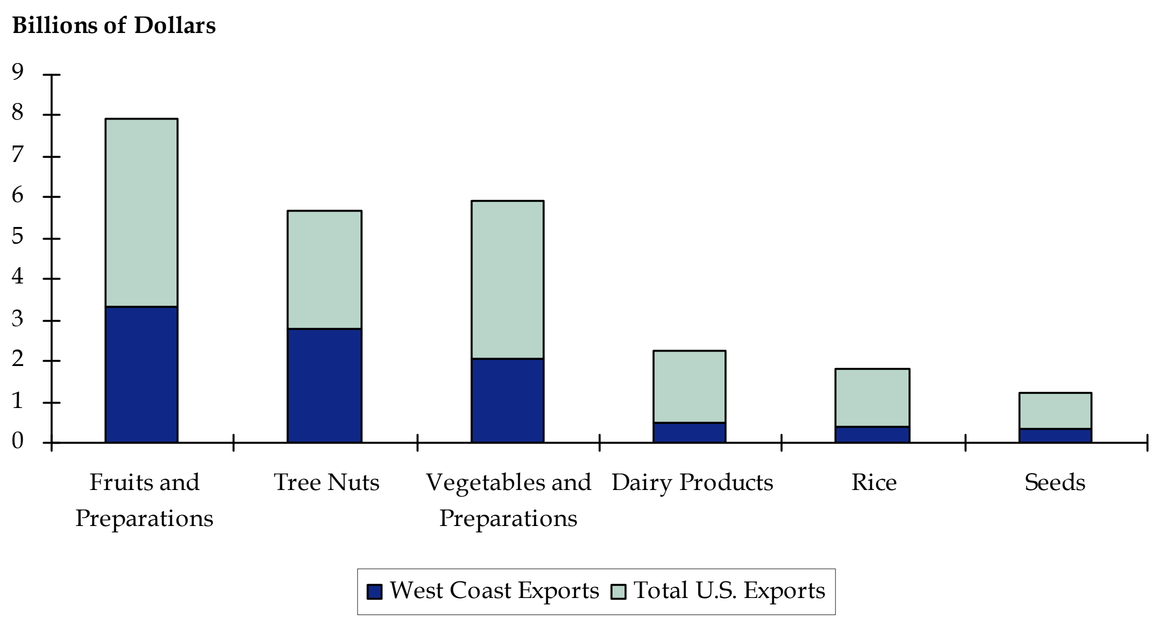
Source: Energy Information Administration, Petroleum Supply Annual.

Figure 2.3 U.S. Wheat Exports by Gateway Region
By Weight, 2006



Source: U.S. Department of Agriculture (in thousands of metric tons).

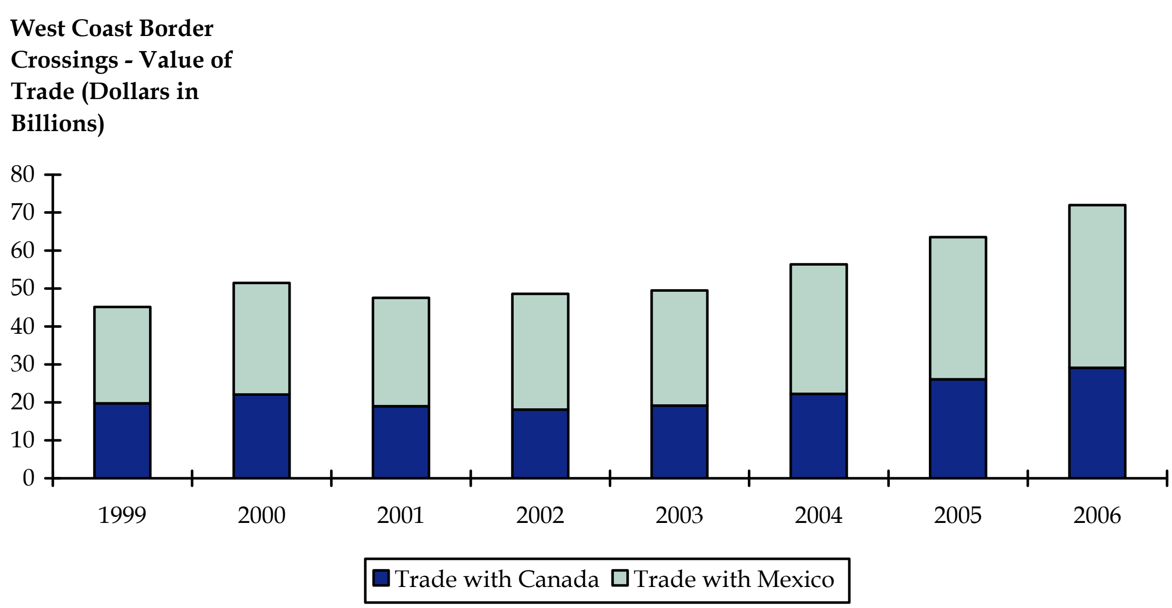
Figure 2.4 U.S. and West Coast Non-Wheat Agricultural Exports
By Value, 2005



Source: U.S. Department of Agriculture (in billions of dollars).

The West Coast's highway and rail networks provide critical connections between the region's overseas gateways and the rest of the country to support international trade. Historically, the primary focus has been on east-west infrastructure, which connects the region's seaport and airport gateways with major Midwestern and Eastern U.S. markets and handles the lion's share of international trade moving into and out of the region. In recent years, however, the region's north-south transportation infrastructure, with I-5 as its backbone, has emerged as a crucial trade corridor for both domestic commerce and international trade, with high-volume gateways located at the border crossings between Canada and Washington (Blaine), and Mexico and California (San Ysidro and Otay Mesa). North and southbound international shipments are being driven by growth in NAFTA-related trade and the closer economic ties developing between Canada, the United States, and Mexico. As shown in Figure 2.5, the value of land-based trade between the West Coast and NAFTA partners, Canada, and Mexico, rose from $45 billion in 1999 to $72 billion in 2006, an increase of 60 percent. By comparison, the total value of trade handled at U.S. border crossings to Canada and Mexico grew by 47 percent over the same period. The magnitude of trade carried out by the West Coast puts pressure on the U.S./Mexico and U.S./Canada border crossings in the region.

Figure 2.5 Value of Land-Based West Coast Trade with Canada and Mexico
1999-2006



Source: World Institute for Strategic Economic Research (WISER).

The West Coast absorbed about one-quarter of total U.S. population growth between 1970 and 2000, and this growth has been overwhelmingly concentrated in the region's urban areas. Growth in the region's major population centers is also contributing to overall freight demand and the West Coast's economic assets point to continued strong growth into the future. As shown in Figure 2.6, the West Coast is home to 3 of the 10 emerging megaregions described by the Regional Plan Association. The presence of 3 megaregions, Southern California (Greater Los Angeles-San Diego), Northern California (San Francisco Bay-Sacramento), and "Cascadia" (Portland-Seattle-Vancouver) is important, as these types of areas are the principal catalysts of national economic growth – generating the majority of its wealth, attracting highly educated people, and spawning the technological innovations that spur further economic growth.[1] Due to the economic capacity and robustness of the West Coast and other megaregions, U.S. jobs and population growth is expected to be concentrated in these areas in coming decades.

Continued employment and population growth in West Coast megaregions is a particular concern, given the important role the region plays in supporting national and international trade shipments. As shown in Figure 2.7, the emerging megaregions on the West Coast are also home to major gateways for international trade using the region's transportation system. Many of the region's largest gateways, including ports, airports, and border crossings, are located within these megaregions. Maintaining the efficiency, reliability, and sustainability of the West Coast trade and transportation system amidst population and employment growth in these megaregions is critical to continued regional and national mobility and economic vitality.

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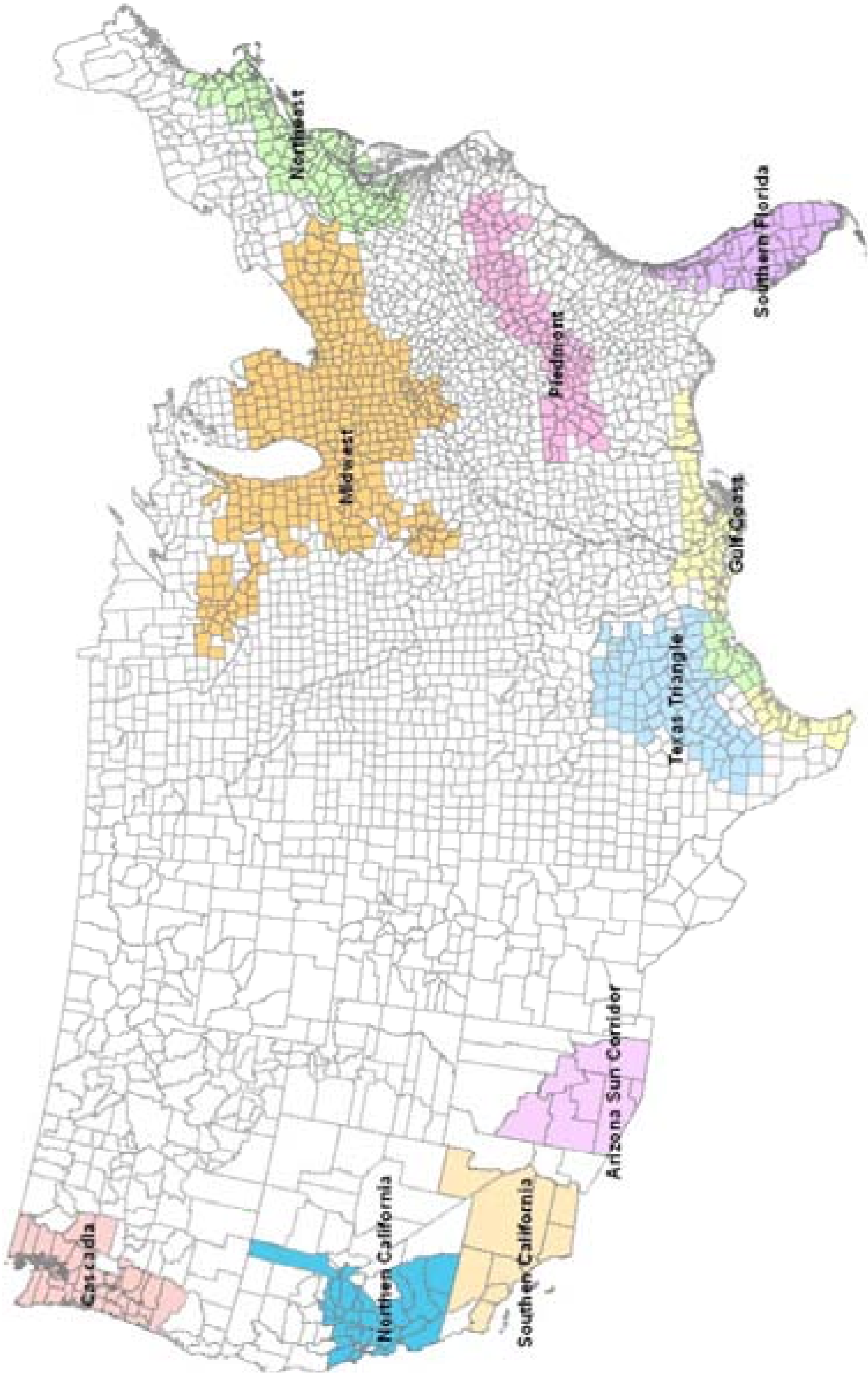
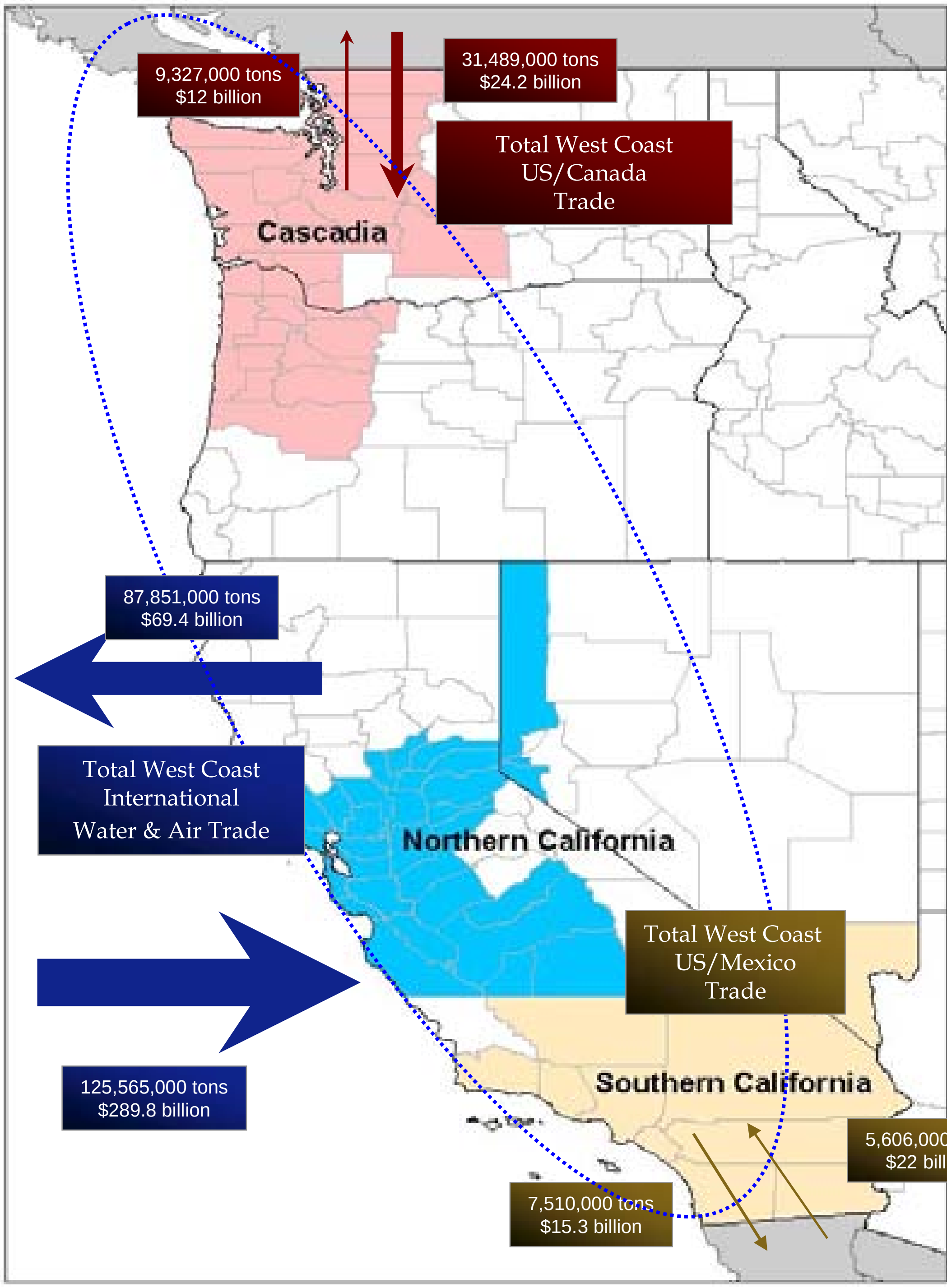
[1] Richard Florida, "The New Megalopolis," *Newsweek*, July 2006.

Figure 2.6 Emerging Megaregions



urce: Regional Plan Association, 2006

Figure 2.7 International Trade Flows
2002

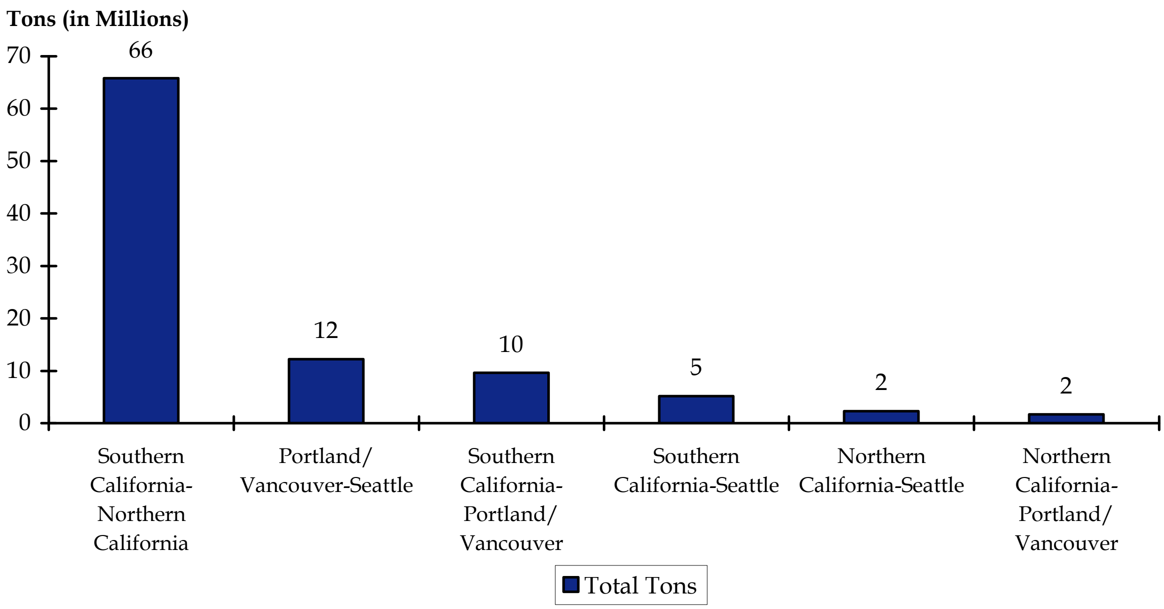


Source: Regional Plan Association, FHWA Freight Analysis Framework (FAF)

Trade among these megaregions, as well as between the major metropolitan areas they encompass, is also significant, as shown in Figures 2.8 and 2.9. Total domestic trade among these major West Coast metropolitan areas totaled over 145 million tons, valued at more than $254 billion in 2002. Approximately 21 percent (by weight) and 33 percent (by value) of this trade was interregional in nature (i.e., between metropolitan areas located in different West Coast states), and most of the remainder occurred within California – between Los Angeles, San Diego, and the San Francisco Bay Area. The majority of goods movement among the West Coast megaregions and their major metropolitan areas-approximately 75 percent- occurs by truck, primarily on the I-5 and SR-99 corridors.

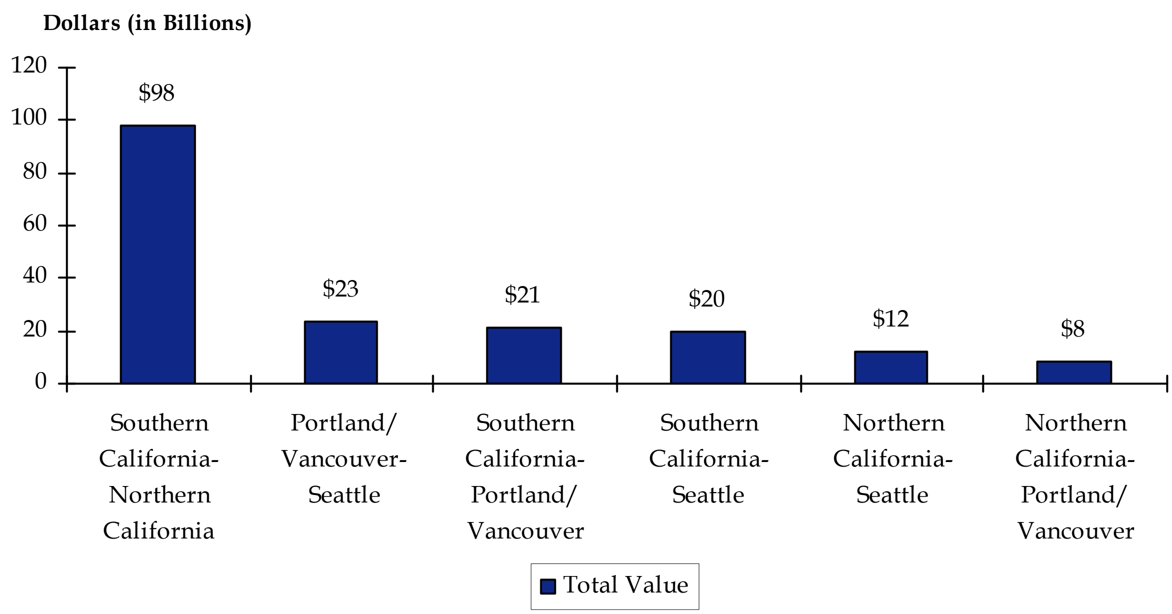
Figure 2.8 Total Volume (in Tons) of Trade Flows between Major West Coast Metropolitan Areas

2002



Source: FHWA Freight Analysis Framework (FAF).

Figure 2.9 Total Value of Trade Flows between Major West Coast Metropolitan Areas
2002



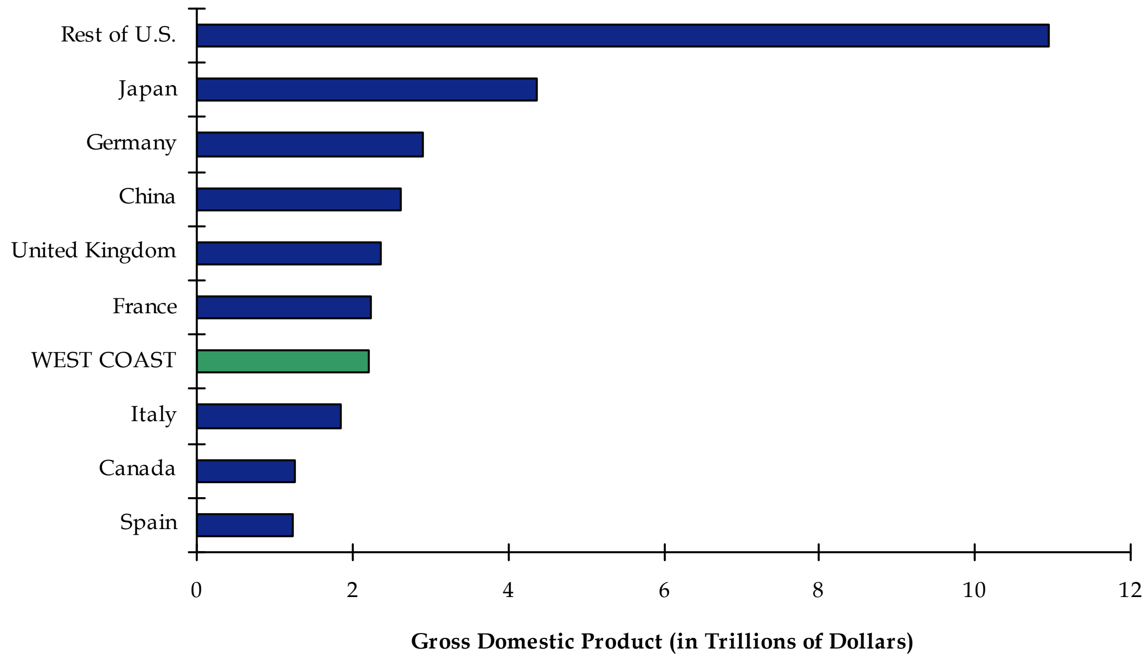
Source: FHWA Freight Analysis Framework (FAF).

■ 2.2 The West Coast Region is a Key Driver of National Economic Growth and World Innovation

The economic output of the West Coast region and its role within the national and world economies cannot be overstated. In terms of overall size, the combined economies of the four West Coast states (Alaska, California, Oregon, and Washington) make it the seventh largest economy in the world, with a gross domestic product (or "GDP," a measure of economic output) of $2.2 trillion in 2006. This makes the West Coast economy larger than Italy's and slightly smaller than both France's and the United Kingdom's (see Figure 2.10). Lately, as the West Coast has recovered from the 2001 to 2002 recession, it is accounting for a higher share of U.S. economic growth. As shown in Figure 2.11, the West Coast is a key driver of national economic growth, accounting for about one-fifth of the total increases in national GDP in recent years.

Figure 2.10 West Coast Economy is the Seventh Largest in the World

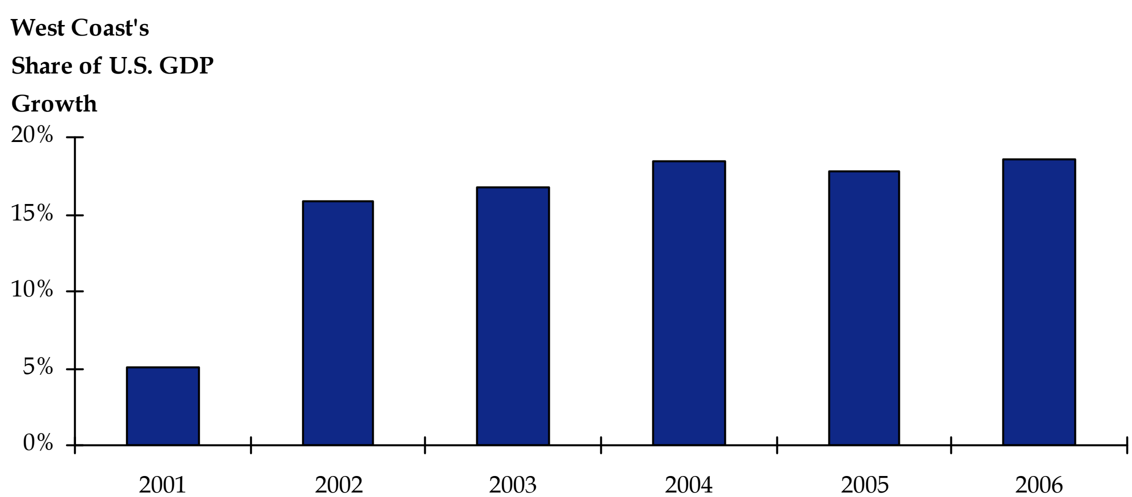
Nominal GDP, 2006



Source: Bureau of Economic Analysis and International Monetary Fund.

Figure 2.11 West Coast Accounting for Larger Share of Recent U.S. GDP Growth

2001-2006

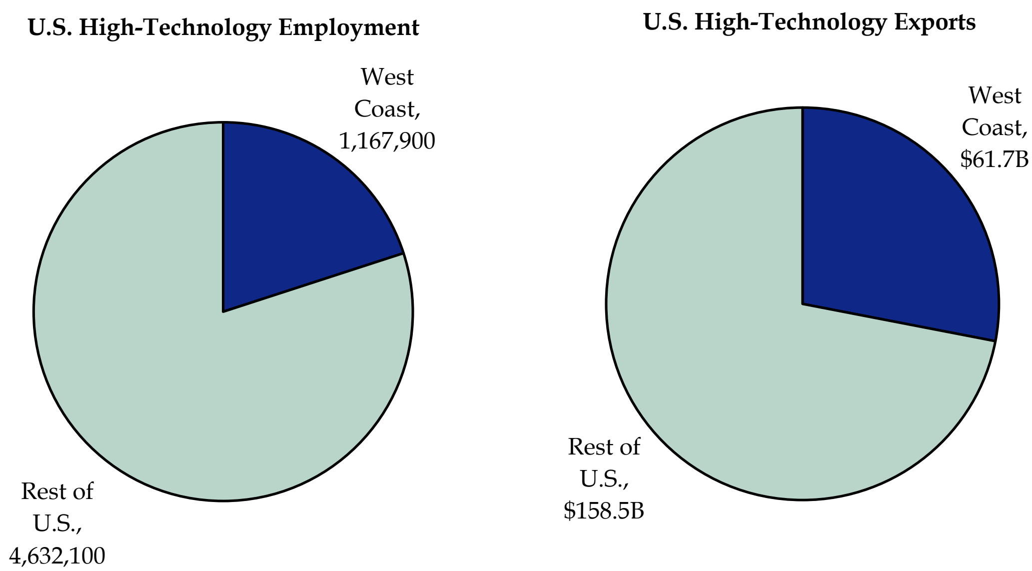


Source: Bureau of Economic Analysis.

Much of the West Coast's growth and economic influence can be attributed to the strength of its high-technology and research sectors which have helped propel the region's electronics, software, aerospace, medical, and entertainment industries to world leadership. Long home to NASA's Jet Propulsion Laboratory, Silicon Valley, Microsoft, Boeing,[2] Federal laboratories, and major research universities, the West Coast continues to be a leader in high-value added manufacturing, innovation, and research and development. The technological preeminence of the West Coast is critical to the nation's overall economic competitiveness as West Coast innovation sets the country apart in the world market. Examples of the West Coast's technological strengths can be seen in Figures 2.12 and 2.13 and include:

- Nearly 1.2 million high-technology jobs, accounting for one-fifth of the nation's total;
- $62 billion in high-technology exports, accounting for 28 percent of the U.S. total;
- Over one-half of U.S. venture capital disbursements, reaching $13.4 billion in 2006; and
- 27,700 patents issued in 2006, or nearly one-third of the U.S. total.

Figure 2.12 West Coast Accounts for Large Share of U.S. High-Technology Employment (left) and U.S. High-Technology Exports (right)
2006



Source: American Electronics Association; exports of manufactured high-tech goods.

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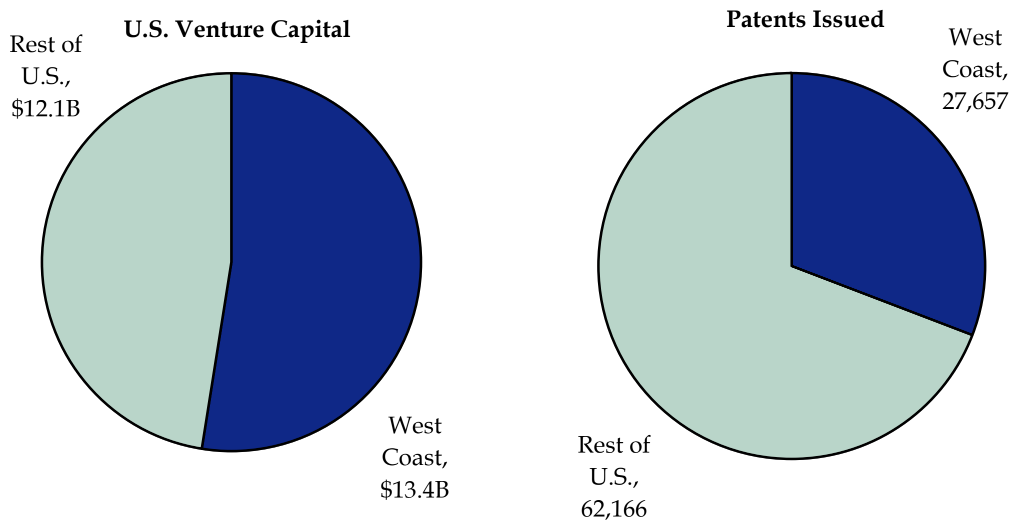
[2] Although headquartered in Chicago, the heart of Boeing's production and research is in the Puget Sound region.

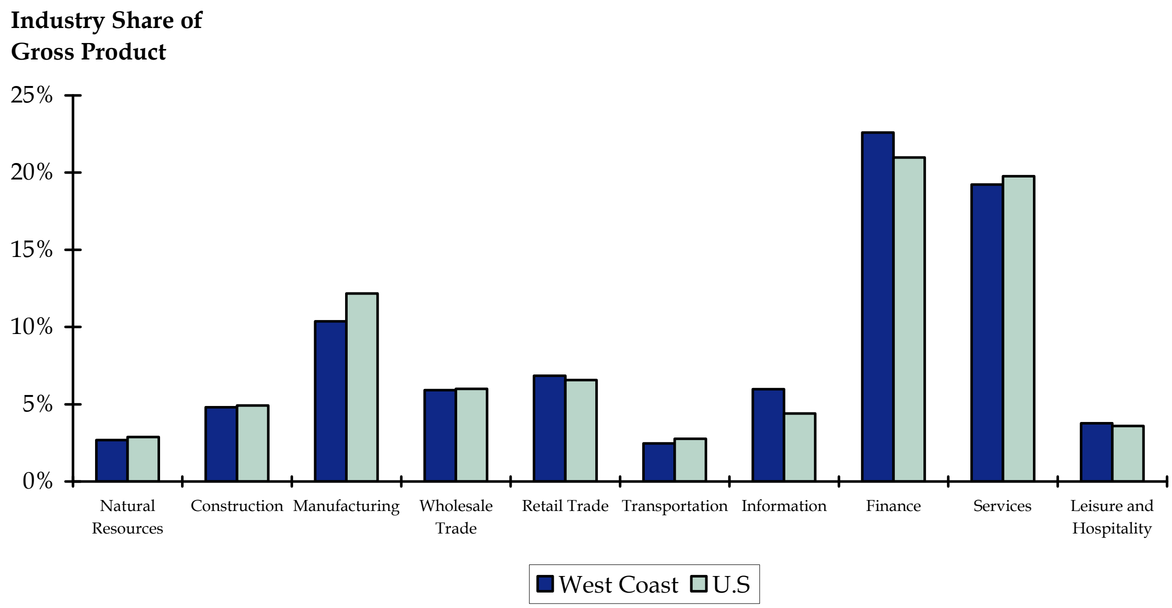
Figure 2.13 West Coast Share of U.S. Venture Capital (left) and Patents Issued (right)
2006



Sources: Venture Economics and U.S. Patent Office.

Mirroring trends in the United States as a whole, the economy of the West Coast region is shifting toward services and information industries, as can be seen in Figure 2.14, which shows the contribution to GDP of different industries in the region and in the U.S. as a whole. This shift impacts the composition of freight moved regionally as well as nationally and internationally, as service-related industries (e.g., engineering, law, architecture, finance, healthcare) have different transportation needs than traditional manufacturing industries. Shipments from service-related industries often consist of low-weight, high-value commodities that require a high degree of visibility and reliability – characteristics that are similar to the transportation needs of the West Coast's high-technology-based industries. In fact, many businesses in these types of industries employ just-in-time logistics practices, which involve lower inventory levels, more flexible freight services, time-definite delivery windows, and timely and accurate information to track market movements. In many cases, this results in a greater reliance on local truck shipments and air shipments, which are highly flexible and responsive.

Figure 2.14 West Coast Economic Structure Compared to U.S.
2006



Source: Bureau of Economic Analysis.

2.3 The West Coast Trade and Transportation System is Important to the Economic Vitality of the Region

The West Coast's ability to compete in the national and world economies goes beyond its natural resources and technological capacities, but also demands an efficient transportation system that can deliver products reliably and on time. The transportation service industries (e.g., trucking, rail, warehousing, wholesale trade, air, distribution, seaports) that serve the West Coast's businesses and consumers are a major contributor to the regional economy. These industries provide a significant number of jobs and income to West Coast residents working for the businesses that process, ship, and deliver goods bound for destinations within the region as well as to other locations within the United States and throughout the world. According the Bureau of Labor Statistics, transportation industries (including transportation services as well as transportation-related manufacturing [e.g., aircraft]) directly accounted for over 1.5 million jobs in 2006 accounting for 7.6 percent of all West Coast employment (or about 1 in 13 of the region's jobs).

The overall GDP of the West Coast has grown significantly over the past decade and this has included the region's transportation service and manufacturing industries. Between 1997 and 2006, the combined gross product (the value of goods and services produced) of the West Coast's transportation industries (again, including transportation services as well as transportation-related manufacturing [e.g., aircraft]) increased by 50 percent from $124 billion to nearly $186 billion. Despite this increase, transportation industries did not expand as fast as the overall regional economy which grew by some 68 percent during the period. Transportation industries accounted for over eight percent of the West Coast economy in 2006.

The West Coast trade and transportation system also plays a critical role in distributing fuel regionally and nationally, further contributing to the region's economic health. As described in the following case study, this system is highly interconnected among the WCCC states.

Case Study- West Coast Pipeline System

Although the region is home to three major refining centers, in Puget Sound, the San Francisco Bay area, and the Los Angeles Basin, the West Coast petroleum market is geographically isolated by the Pacific Ocean to the west and the Rocky Mountains to the east, making the WCCC states highly interdependent on each other – and on the region's multimodal transportation system – for their fuel supplies. Oregon has no refineries, and 70 percent of its fuel supply comes from Washington, with the remaining 30 percent from California. Over 90 percent of the crude petroleum entering Washington State does so by water from Alaska. In addition, the Olympic Pipeline in Washington is the sole source of jet fuel for Sea-Tac Airport, so any disruption in service would lead to significant problems for airport operations, as the airport only keeps a five to twelve day supply of jet fuel on site. The Columbia and Snake Rivers are also important routes for the shipment of petroleum products, sending fuel upriver to supply agricultural users in the interior of Oregon and Washington.

Although West Coast states do import petroleum products from the Gulf Coast region of the United States and from abroad, California's special requirements for fuel make this logistically difficult. This is due to the fact that gasoline marketed in California must meet the emissions requirements of the California Air Resources Board (CARB), which are the strictest in the world. These specifications require refiners to make expensive investments in their facilities to produce CARB-compliant gasoline. Consequently, most refineries outside of the West Coast region do not produce CARB gasoline. As a result, an interruption in the West Coast's internal supply and distribution system may take weeks to relieve via imports from other locations, resulting in significant economic consequences for the region.

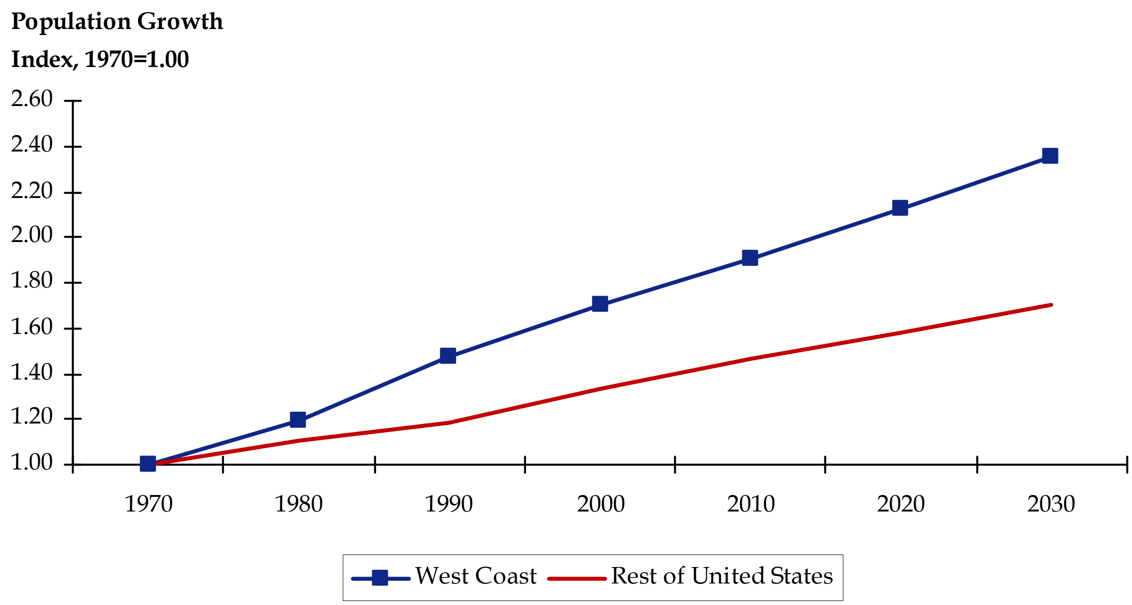
Sources: Washington Transportation Plan Freight Update; U.S. Department of Energy, Waterborne Commerce on the Columbia/Snake River Waterway: Commodity Movements Up/Down River 1995-2003.

■ 2.4 The West Coast Region's Population is Booming

The West Coast, historically, is one of the fastest growing regions in the United States and it is expected to continue to outpace the nation as a whole in population growth through 2030, as shown in Figure 2.15. In fact, one in five people added to the U.S. population through 2030 will live in one of the West Coast states, as shown in Figure 2.15. This increase in population, combined with rising employment levels, and a vigorous economic expansion, is making the West Coast region an even more important contributor to the economic vitality of the nation as a whole.

As of 2006, the West Coast was home to 47.2 million residents, representing just under 16 percent of the U.S. population. According to the U.S. Census Bureau, the region is expected to add over 13.5 million more people during the next 24 years and will reach a population of 60.8 million by 2030 (this would give the West Coast the same population in 2030 as present day France). The rate of the West Coast's population growth has exceeded the national average for decades and is expected to continue doing so through 2030.

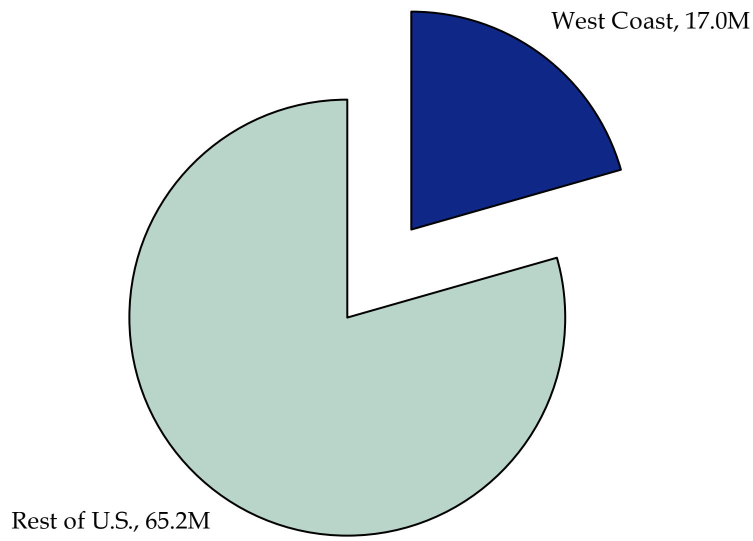
Figure 2.15 West Coast and National Population Growth Index[a]
1970-2030



Source: U.S. Census Bureau.

[a] 1970 = 1.00.

Figure 2.16 West Coast Share of U.S. Population Growth
2000-2030



Source: U.S. Census Bureau.

The West Coast ranks among the fastest growing regions in the nation, whether measured by its rising population or economic growth, and forecasts for continued growth will have several impacts on the West Coast's transportation system, including increased volumes of both freight and passengers along highways and rail lines, and at airports; increased congestion on the region's highway systems and intermodal access routes; increased residential, commercial, and industrial development in and around urbanized areas; and worsening air and water quality. As a result, there is increasing recognition that the public and private sectors in the region – acting independently – may not have the necessary resources to fully address rising passenger and freight demands related to these growth trends.

3.0 The Challenge

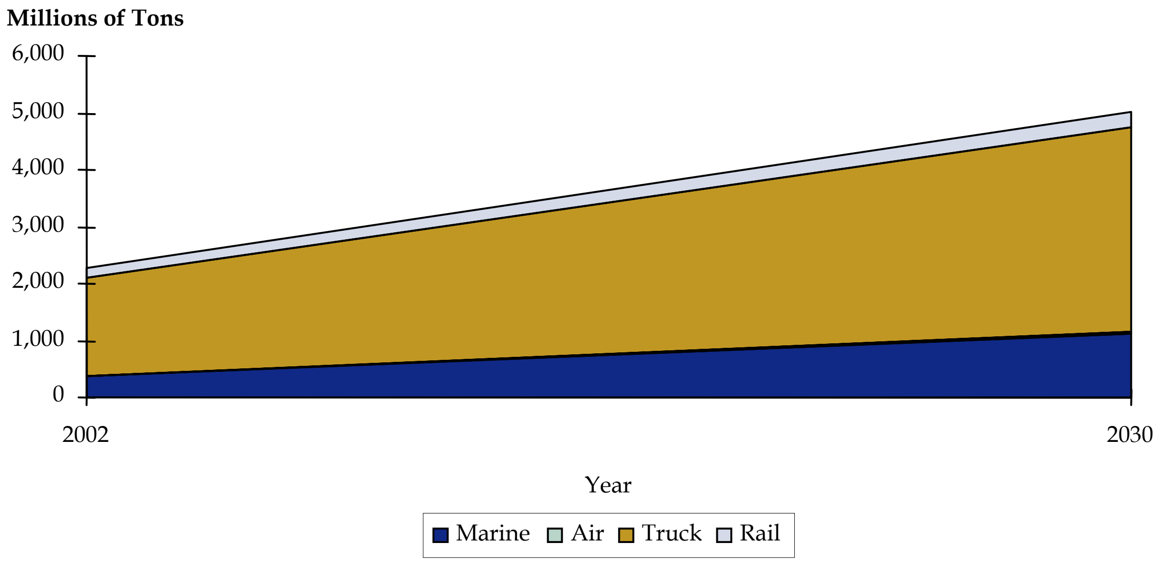
The West Coast trade and transportation system is a patchwork of transportation networks and freight facilities, some owned privately, some publicly; a number of operators, providing a wide-range of services to an array of local, national, and international customers; several complex access agreements and strategic partnerships among different stakeholders that impact how goods move within and through the region; and a variety of institutional relationships among states, ports, railroads, public authorities, and other entities. Together, this system provides a critical gateway for freight traffic entering/leaving the country and also supports significant volumes of domestic trade between megaregions on the West Coast and the rest of the U.S. Although the system is capable of serving current international and domestic trade volumes, it is increasingly fragile, prone to congestion and delays, and slower to recover from service disruptions at key freight facilities and along major trade corridors.

There are a number of transportation, domestic and international trade, financial, and demographic trends and issues that, individually or collectively, are contributing to the fragility of the system. In some cases, these trends and issues are resulting in physical or operational chokepoints in the system. In other cases, they are preventing states, MPOs, and private sector freight stakeholders from effectively managing existing or adding new transportation capacity to keep pace with rising demand. Regardless, these trends and issues will have important implications on the ability of the West Coast system to meet future regional and national freight mobility needs. Without a clear understanding of how these trends and system constraints are likely to affect the transportation system, West Coast states, regions, and ports cannot effectively meet future needs and assure continued economic growth. This section describes several key trends and describes their implications for the efficiency of the West Coast trade and transportation system.

■ 3.1 Freight Demand is Growing

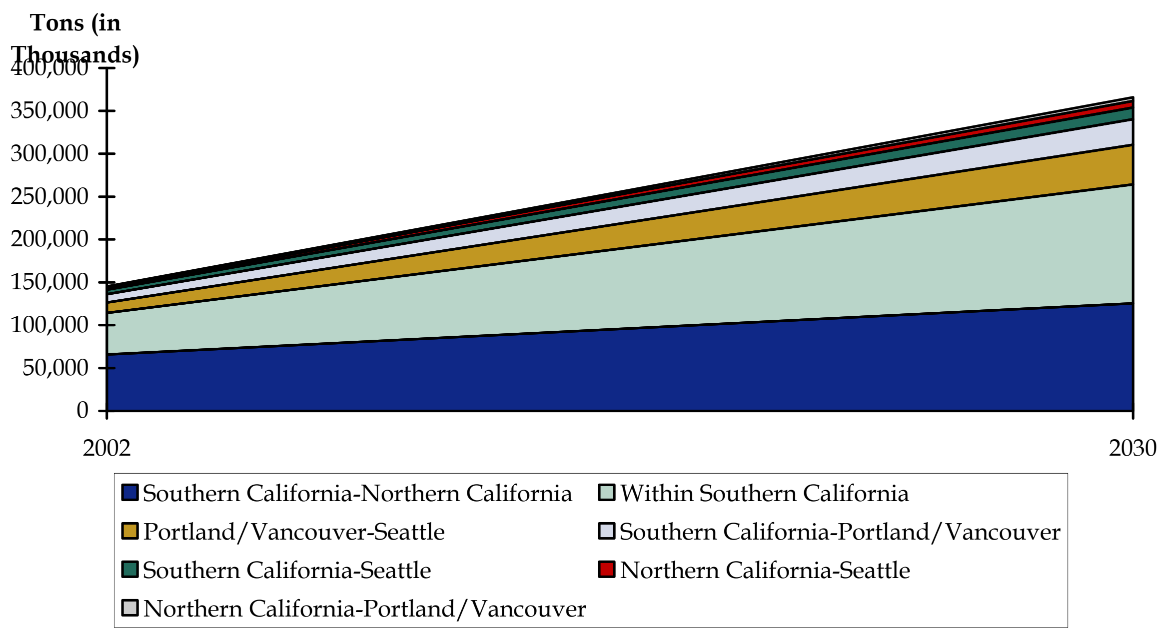
The overall freight demand to support the region's growing population and economy – both domestic and international – is expected to approximately double by 2030, as shown in Figure 3.1. Domestic freight shipments among the West Coast metropolitan areas are expected to grow even more rapidly in the same time period, from about 145 million tons to nearly 366 million in 2030, as shown in Figure 3.2.

Figure 3.1 West Coast Freight Demand (All Modes)
2002-2030



Source: FHWA Freight Analysis Framework (FAF) with marine and air cargo data and forecasts developed by CS/HDR.

Figure 3.2 Domestic Trade Among West Coast Megaregions
2002-2030



Source: FHWA Freight Analysis Framework (FAF).

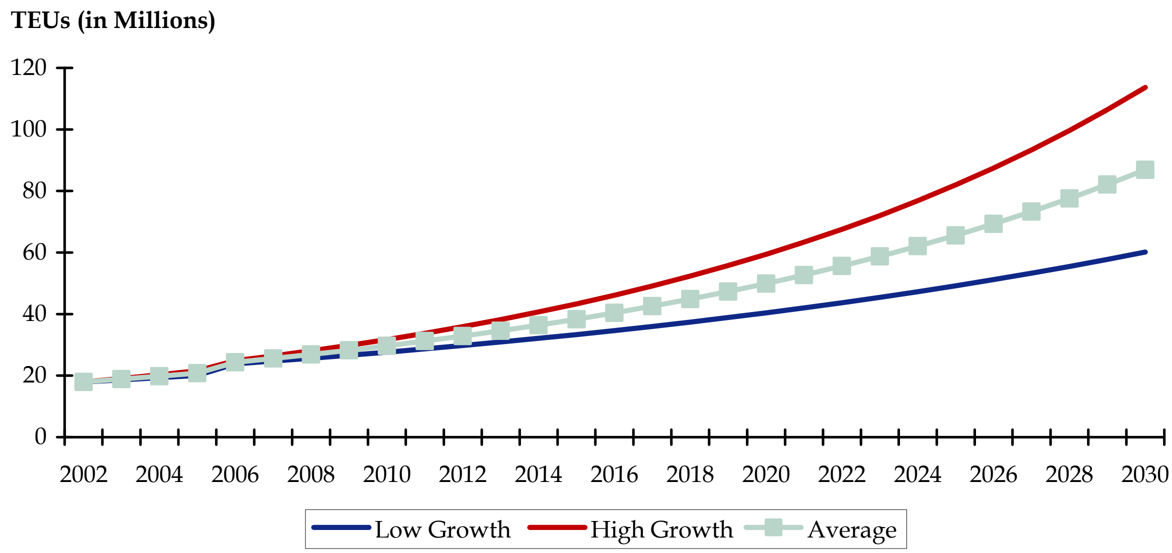
While this rate of growth is not extraordinary (it is about the same as we have seen in the last 20 years and roughly tracks growth in GDP), it does mean that freight movements will become a larger component of the traffic mix within the West Coast region and rapid growth in trade among West Coast metropolitan areas will place stress on the region's north-south infrastructure. Overall, this increase in freight will have a dramatic impact on the performance and capacity of the intermodal freight transportation system, as described in the following sections.

Seaport Demand

As described earlier, the West Coast ports are a critical trade gateway for the region and the rest of the U.S., and play an important role in regional, national, and international supply and distribution chains. Future demand at West Coast ports is being shaped by a number of factors, particularly economic growth among the region's key trading partners. China, for instance, is expected to have one of the world's largest economies by 2050, which will ensure that U.S. import and export trade with China will continue to dominate freight flows through West Coast ports. Available capacity at some U.S. Atlantic and Gulf Coast ports, freed up by the slowly growing economies of Western Europe, may be filled by the rapidly expanding economies of Russia and Brazil. However, the combined impact of China, India, and Japan, which will account for three of the top four economies in the world by 2050, will ensure that the West Coast ports will continue to play a critical role in supporting U.S. and world trade.

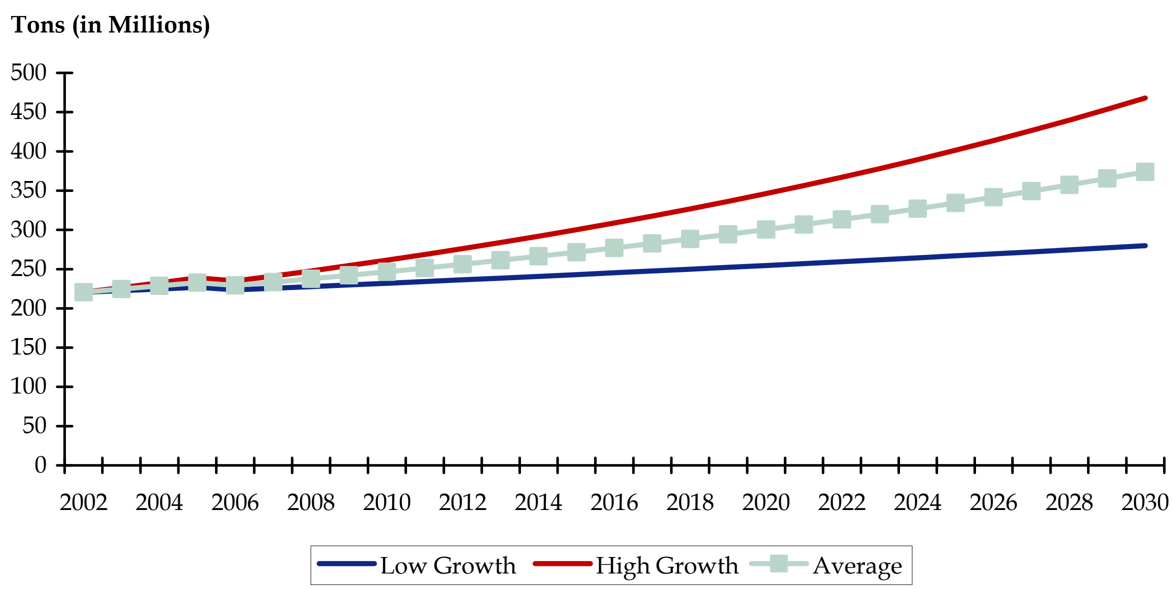
It is likely that overall West Coast container volume (measured in twenty-foot equivalent units [TEUs]) will more than triple and bulk/break-bulk shipments (measured in tons) will nearly double between now and 2030, as shown in Figures 3.3 and 3.4.

Figure 3.3 WCCC TEU Growth
2002-2030



Source: Cambridge Systematics, Inc., HDR.

Figure 3.4 WCCC Bulk and Break-Bulk Growth
2002-2030



Source: Cambridge Systematics, Inc., HDR.

Air Cargo Demand

The West Coast aviation system consists of nine principal international airports. Together, these airports handle approximately 8.1 million tons, approximately 23 percent of the U.S. total. Figure 3.5 shows the current (2006) and forecast (2030) air cargo volumes for these nine airports, with their compound annual growth rates (CAGR) shown on top. Total air cargo shipments are expected to nearly triple to approximately 24.2 million tons by 2030. Leading this growth will be Ted Stevens International (ANC), which will continue to handle more than half the air cargo in the region in 2030. Los Angeles International Airport (LAX) will remain a leader and Ontario International (ONT) is expected to pick up significant new regional growth in the Los Angeles market.

Figure 3.5 WCCC Air Cargo Forecast
2006-2030

Source: 2006 data from airport web sites or Airports Council International data; 2030 forecasts and growth rates derived from airport master plans and/or discussions with airport staff.

This growth will exacerbate existing capacity pressures at the region's airports, many of which are also seeing significant growth in passenger volumes. It will also worsen existing congestion on intermodal access routes, which are critical to support air cargo movements (all air cargo shipments originate or terminate via truck). Compounding this issue is the fact that airfield constraints (i.e., runway length, available land for capacity expansions) at most major West Coast airports are forcing them to redesign facilities in order to increase productivity per square foot. Without corresponding improvements in landside access (roadway) capacity or efficiency, many airports in the region (as well as the industries they serve) may actually see declines in overall productivity, which will impact the competitiveness of the region's high tech industries that rely on highly visible and reliable service.

In addition, changes in airplane capacity (smaller for passenger, larger for freight) are placing additional pressure on some facilities to improve their efficiency and connections to local and regional markets. However, larger air freighters (such as the Airbus A380 or Boeing's new 787) coming on line over the next several years may allow more direct connections between international markets and large consuming markets in the U.S., leading to a reduction in cargo traffic at some intermediate air hubs.

In addition to the larger international airports, it is important to recognize the growth in the air cargo market in smaller markets where the delivery of high-value, low-mass manufactured goods or medical/emergency supplies, is key to more distant local economies and populations. Investments at smaller airports is important to the regional trade and transportation system, because they help increase the resilience of the system as well as ensure that smaller markets also can be served by more than one mode. Growth in demand within these smaller markets, however, can strain operations at the larger, hub airports in the region, as the smaller aircraft that serve these markets often compete for space with other cargo and passenger operations. In addition, the smaller aircraft used to support these markets can have unique noise and operational characteristics (e.g., low-altitude departures/approaches) that may be exacerbated if this type of service expands in the region.

Highway Demand

The West Coast highway system consists of several primary freight corridors, shown in Figure 3.6, that connect the region's international freight gateways to the rest of the country as well as provide important connections among the West Coast megaregions. These corridors were defined through discussions with West Coast freight stakeholders and generally are recognized as those that handle the majority of truck movements into, out of, through, and within the region.

The growth in freight demand will add truck traffic to the each of these corridors. Figure 3.7 compares truck traffic on primary West Coast highway corridors in 2002 with the anticipated density of truck traffic in 2030. Density is estimated in number of heavy-duty (i.e., five-axle tractor semitrailer) trucks per year. The blue lines indicate truck volumes in 2002; the red lines indicate truck volumes in 2030. The wider the red and blue lines, the greater the number of trucks using the road.

Figure 3.6 Primary West Coast Highway Freight Corridors
Connecting Gateways, Megaregions, and National Markets

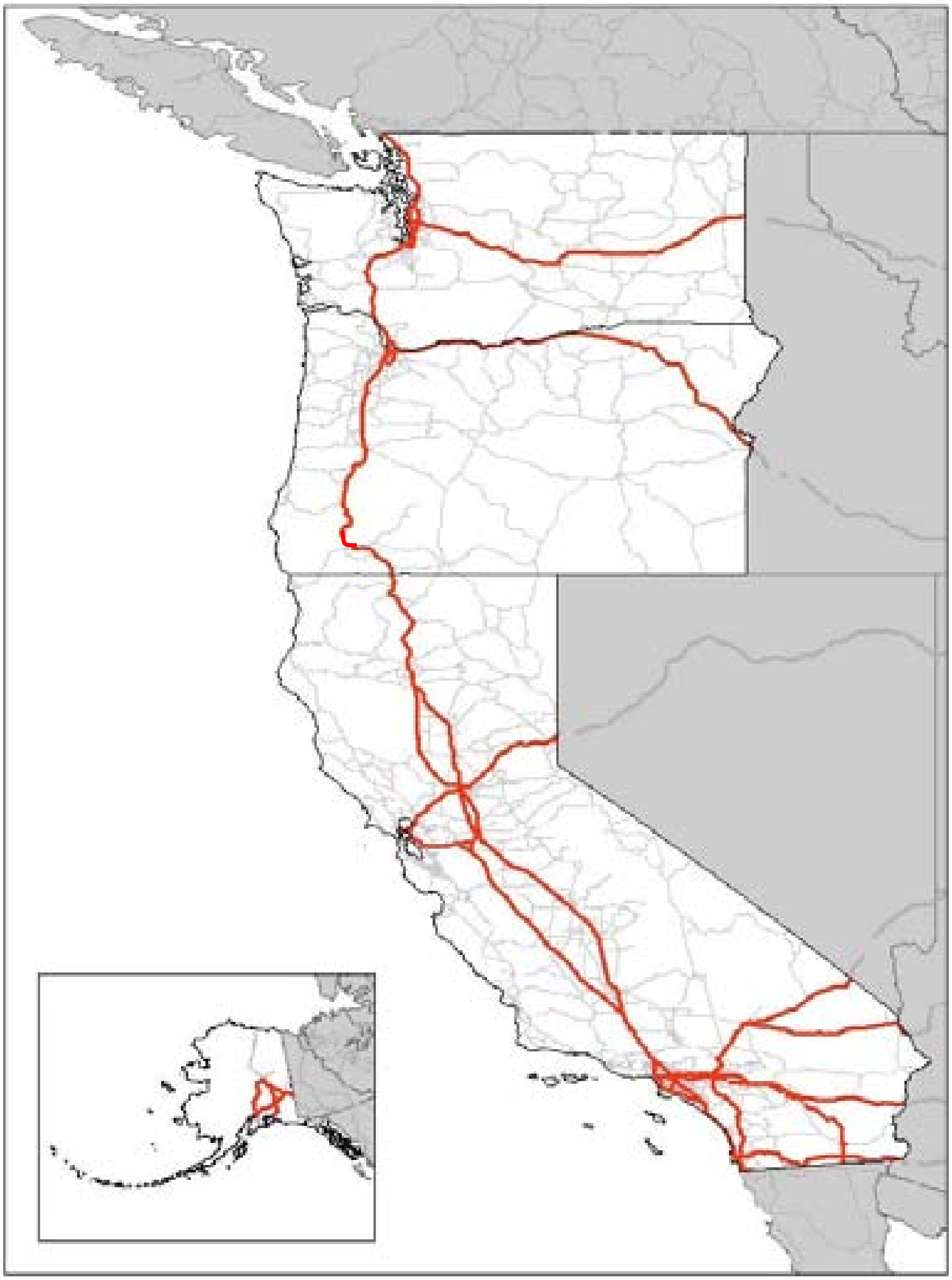
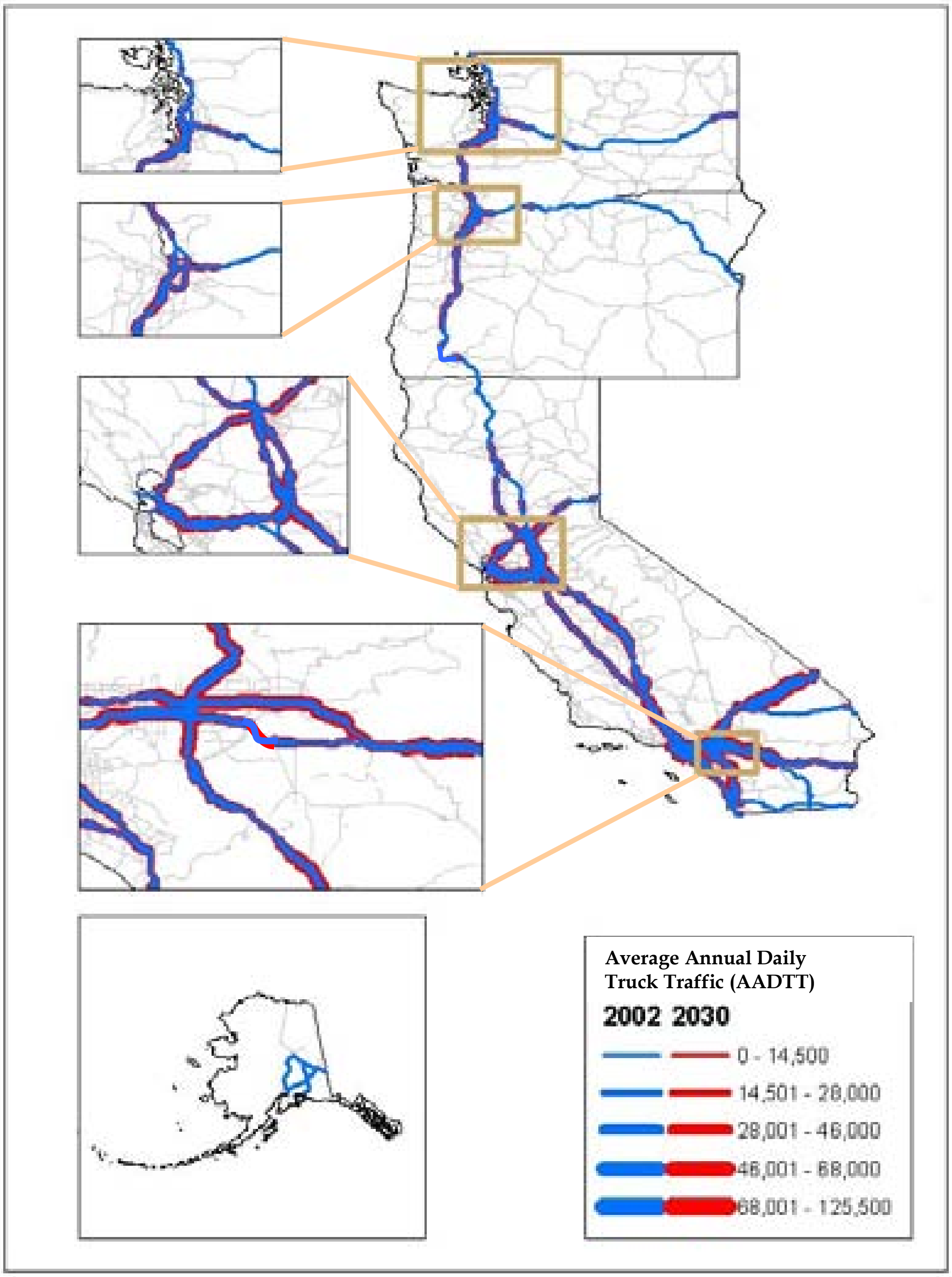


Figure 3.7 Growth in West Coast Truck Traffic
On Primary Highway Freight Corridors 2002-2030



Truck trips serving origins and destinations outside the region are expected to increase by 134 percent between 2002 and 2030, a CAGR of approximately 4.7 percent. Truck trips serving West Coast megaregions also are expected to increase significantly, nearly 94 percent (CAGR 3.3 percent) in the same time period. This increase in truck travel means that where today, on average, there are 10,500 trucks per day per mile along these corridors, in 2030 there will be more than 20,000 trucks. In addition, the most heavily used portions of the system, which are often located in urban areas or connect major freight facilities, will see upwards of 50,000 trucks per day per mile.

Without highway capacity or operational improvements, these additional freight trucks will exacerbate existing traffic congestion (already paralyzing in many parts of the region) and will have other national, regional, and local impacts. On the regional and national scale, this growth will result in more traffic and more traffic congestion at key points in the regional and national freight supply and distribution system, degrading the overall efficiency and reliability of freight movements entering and departing the region. On the local level, growth in truck traffic will result in increased noise, increased air quality concerns (particularly for existing nonattainment areas in the region), and increased community livability impacts (particularly for those areas adjacent to major freight facilities or situated along important trade corridors).

Rail Demand

The West Coast region is served by three key rail carriers: the BNSF Railway, the Union Pacific (UP) Railroad, and the Alaska Railroad. These railroads play a critical role in connecting the region's seaports to inland markets, and also handle significant volumes of domestic traffic. Figures 3.9 through 3.13 below show the current demand along the region's rail system as measured by capacity utilization. Those segments shown in red are those whose ratio of volume to capacity is 70 percent or greater; those in yellow range from 40 to 70 percent utilized; and green segments are those with capacity utilization less than 40 percent.[1]

Typically, a railroad's *practical* capacity is said to be approximately 70 percent of its *theoretical* capacity.[2] Utilization above 70 percent of capacity severely limits the ability of the rail system to recover from breakdown in service, extensive delays and system malfunction occurs. As can be seen below, large portions of the West Coast rail system are currently operating above their practical capacity, particularly those serving the region's seaports.

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[1] Note that, in order to highlight the most critical rail capacity issues, the region-level maps are shown at different scales, and are not contiguous. A Western U.S. Rail System map is provided (Figure 3.8) to illustrate the connectivity of the Class 1 rail network.

[2] Some railroads initiate decision-making processes concerning capacity investments when capacity of 80 percent is frequently reached in a given segment.

Figure 3.8 Western U.S. Rail System

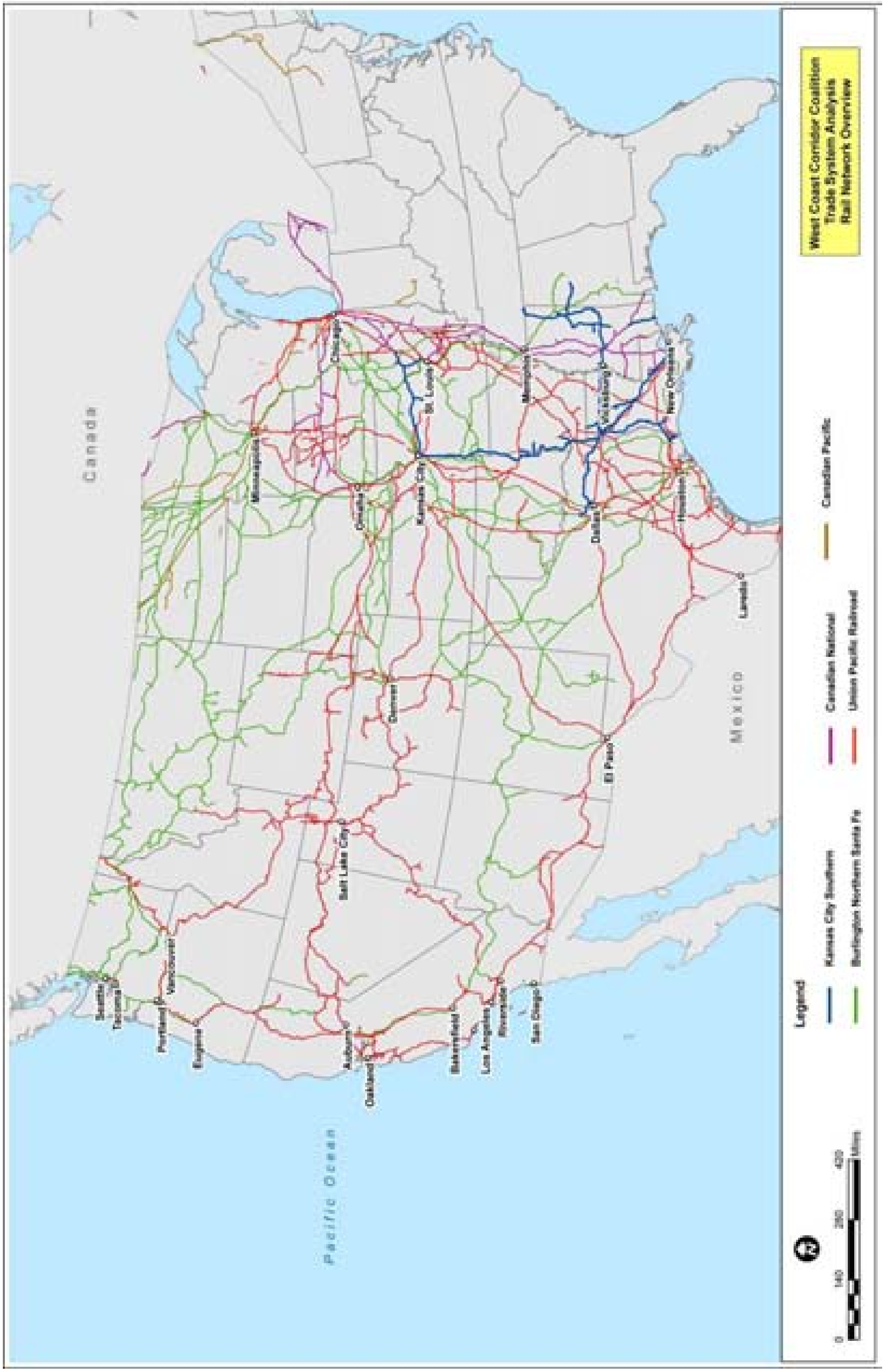


Figure 3.9 West Coast Rail Demand, 2007
Alaska

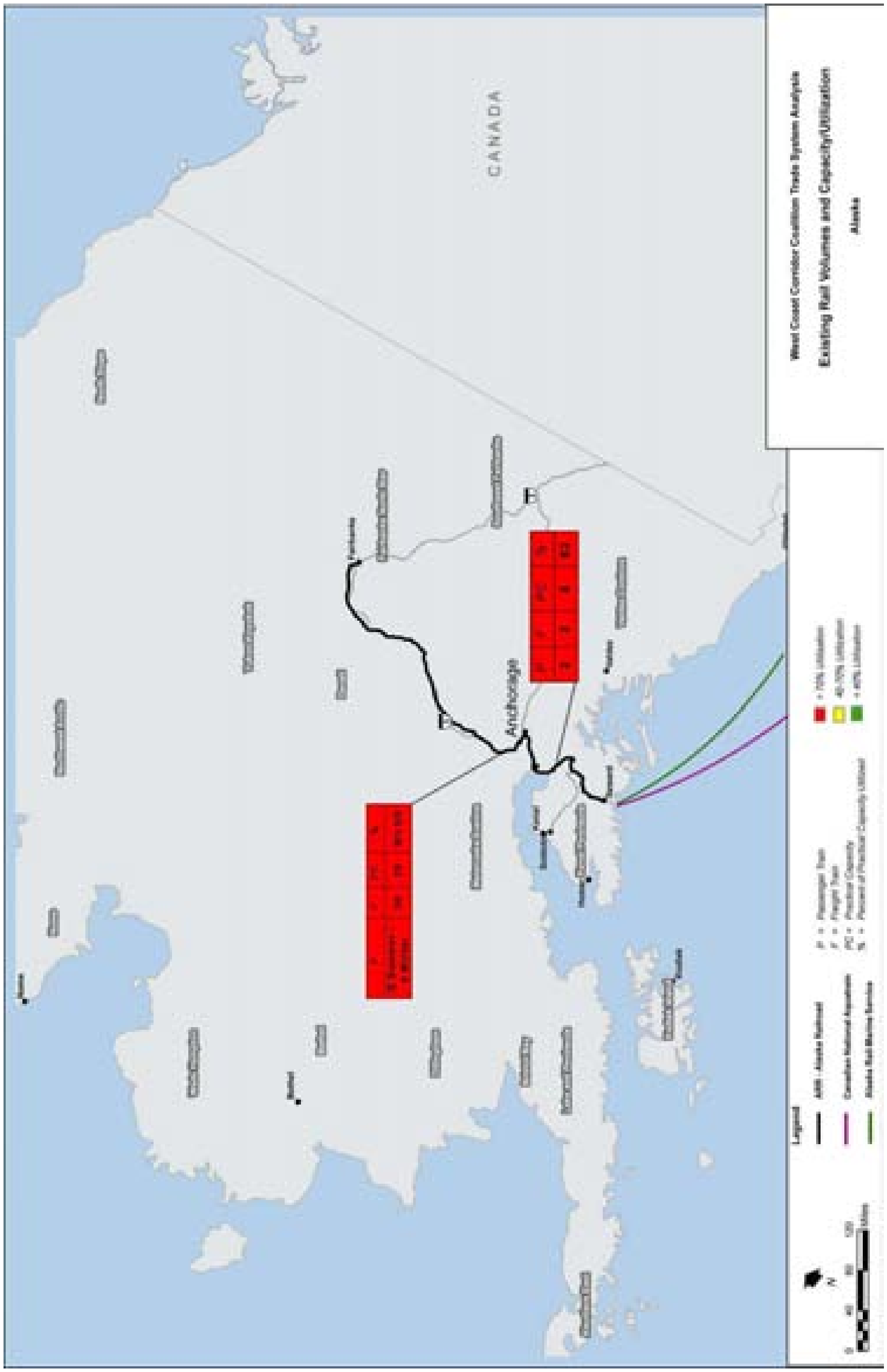


Figure 3.10 West Coast Rail Demand, 2007
Washington to Oregon

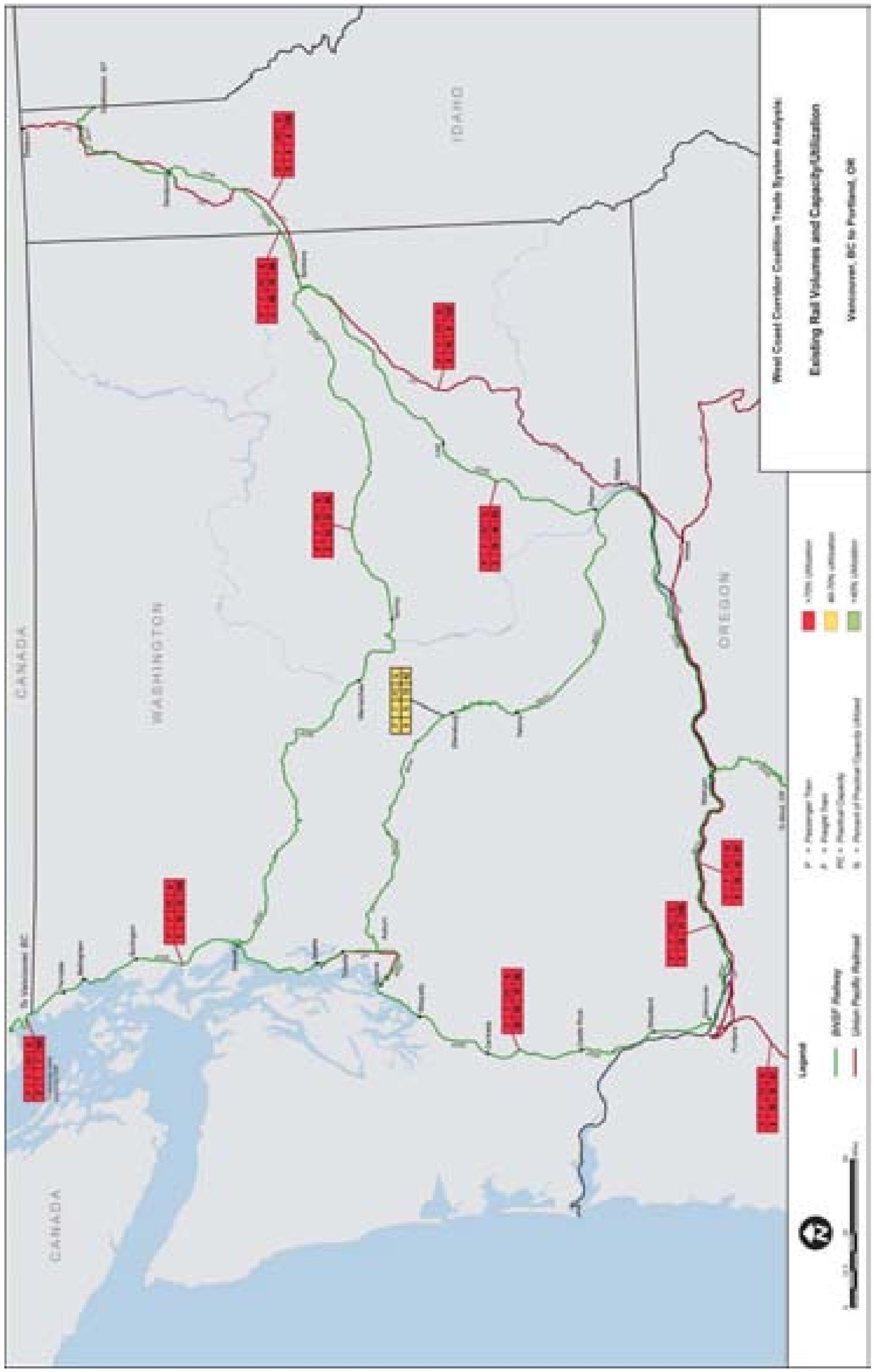


Figure 3.11 West Coast Rail Demand, 2007
Southern Oregon to Northern California

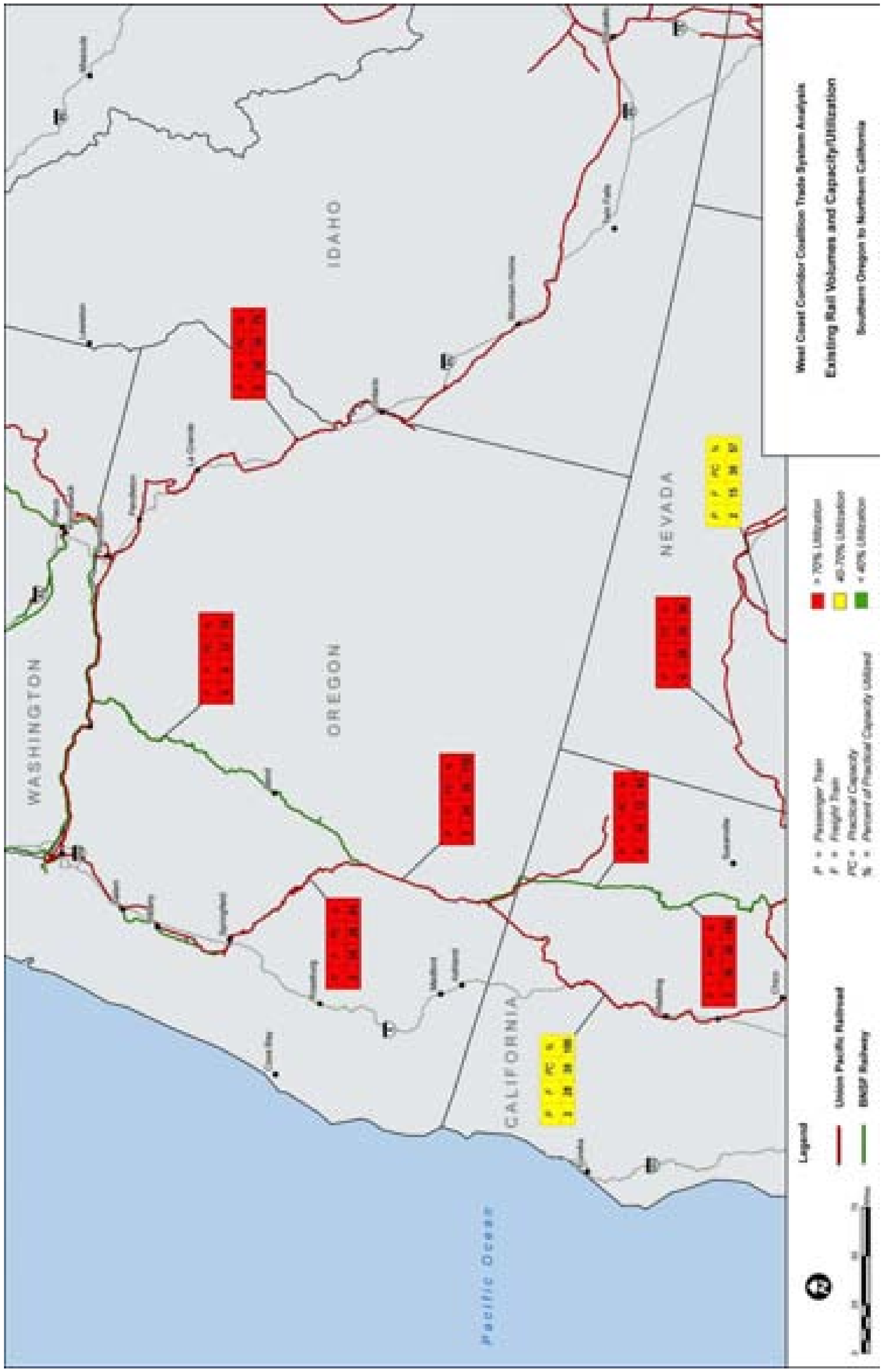


Figure 3.12 West Coast Rail Demand, 2007
Bay Area to Fresno, California

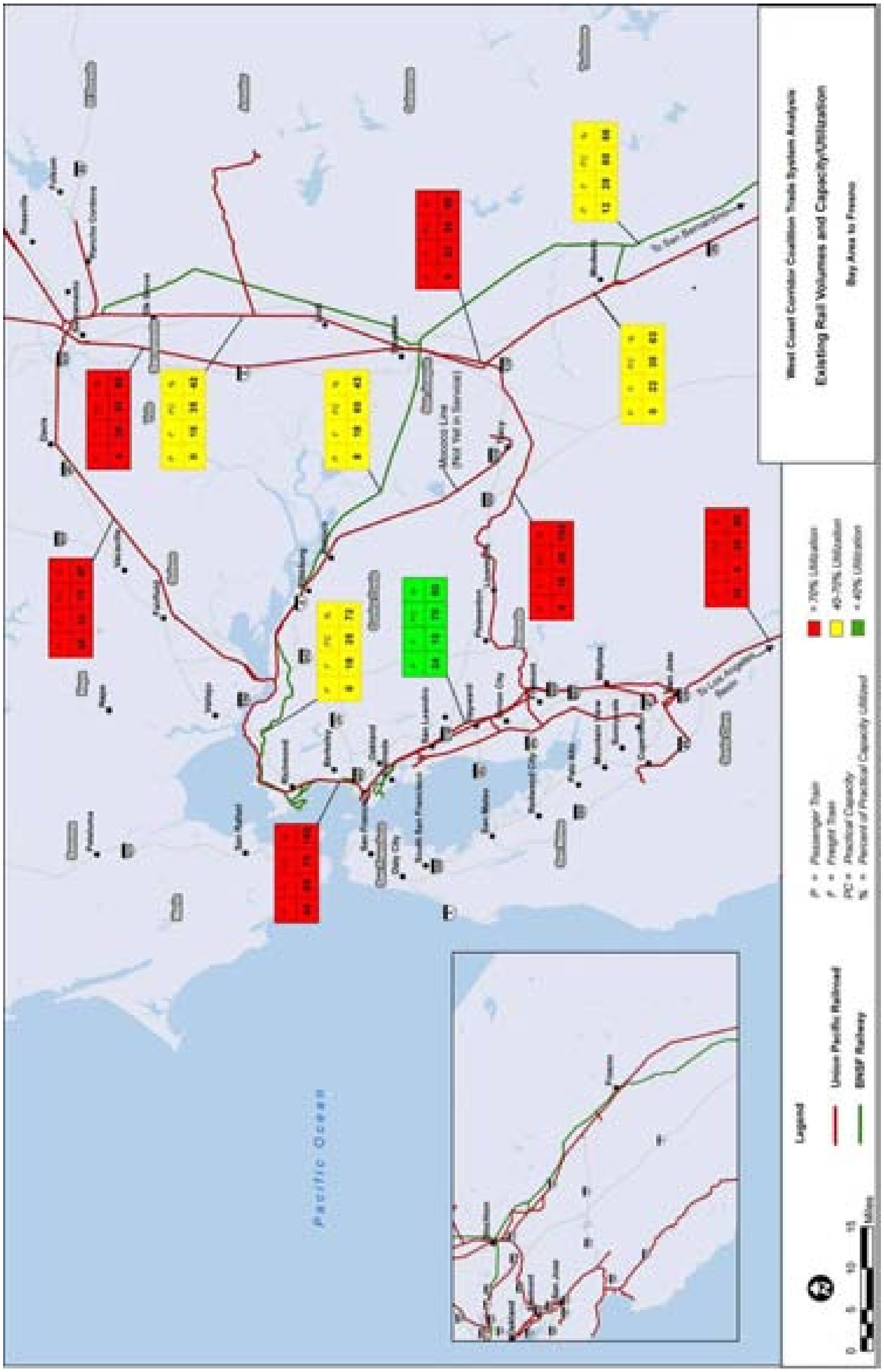
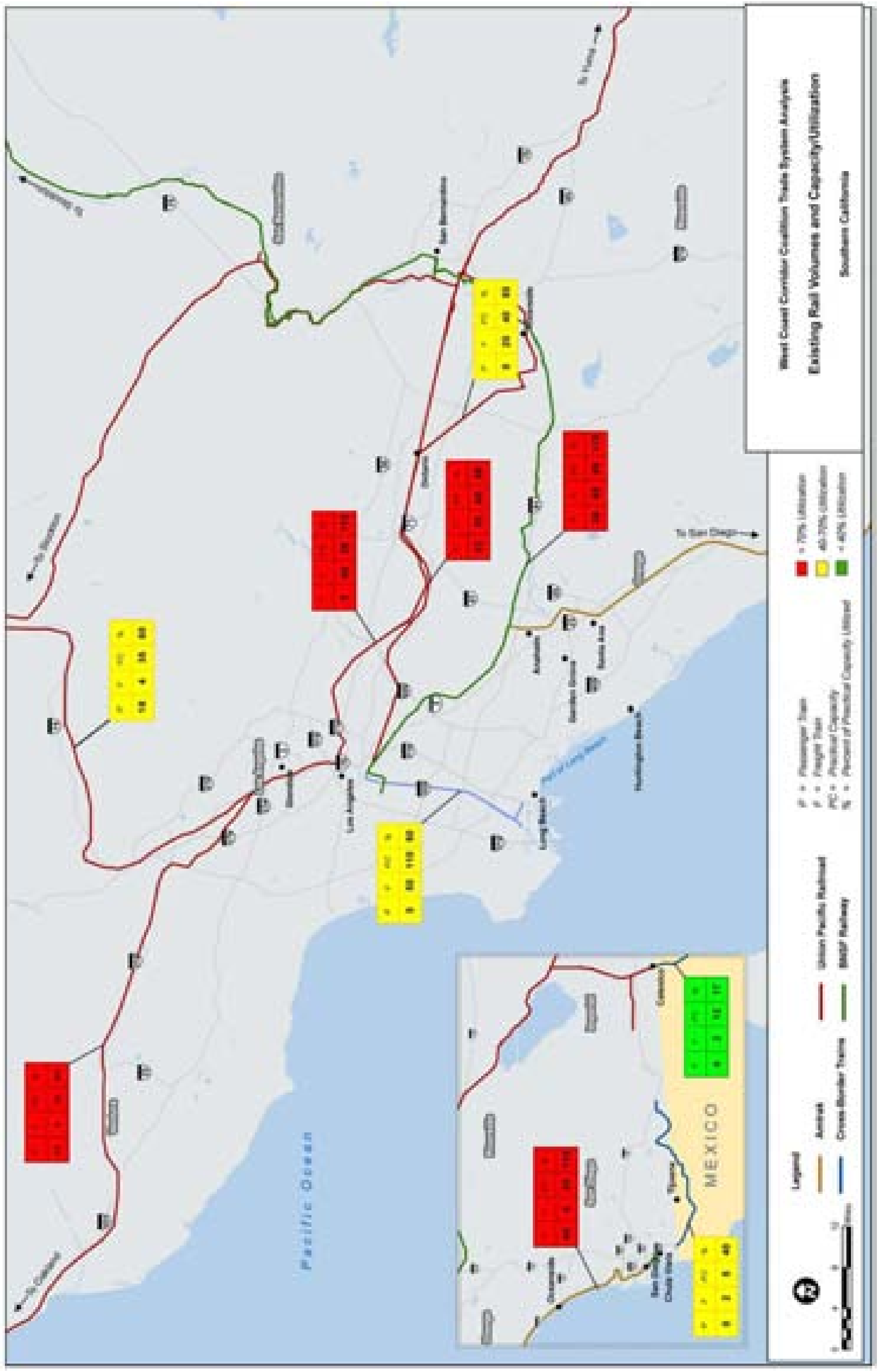


Figure 3.13 West Coast Rail Demand, 2007
Southern California



Demand on the region's rail system is expected to increase significantly between now and 2030. The AAR estimates that volume on key rail corridors in the region will increase from 50 to over 100 percent of practical capacity by 2035.[3] As shown in Figures 3.14 through 3.18, absent significant capacity increases or operational improvements, several of the region's already-congested corridors, most notably those serving the region's seaports and border crossings, are expected to be operating at or above capacity by 2035. The impacts of this growth will be felt most acutely by intermodal rail traffic, which demands high reliability. While the railroads in the West Coast region (and nationally) are utilizing technological and operational strategies to maximize the use of their existing capacity and have made (and continue to make) targeted capacity improvements along key corridors and facilities, the growth in freight rail demand in the region will make it difficult for rail to maintain efficiency and reliability.

[3] AAR, *National Rail Freight Infrastructure Capacity and Investment Study*, 2007.

Figure 3.14 Anticipated West Coast Rail Demand, 2035
Alaska

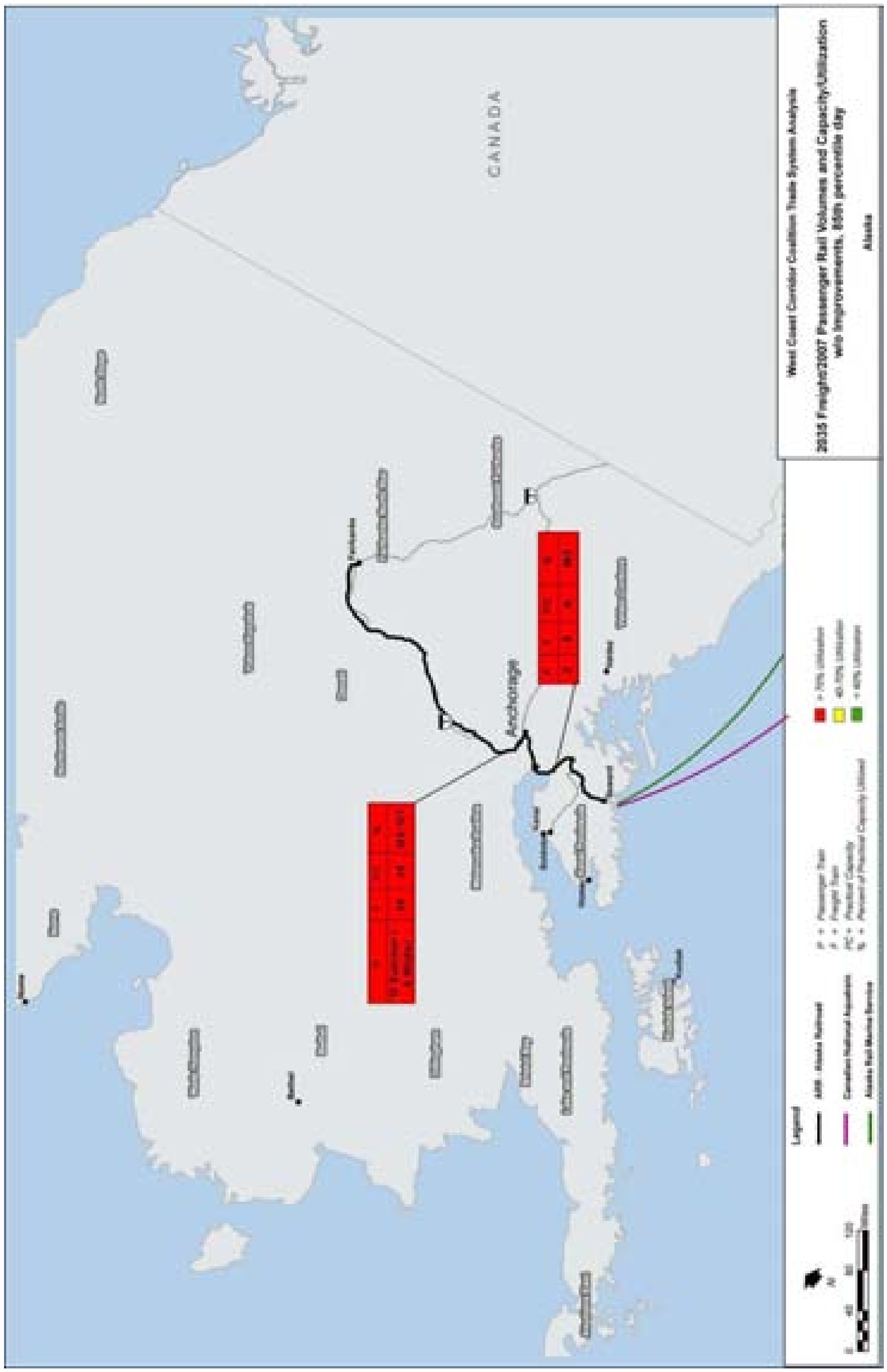


Figure 3.15 Anticipated West Coast Rail Demand, 2035
Washington to Oregon

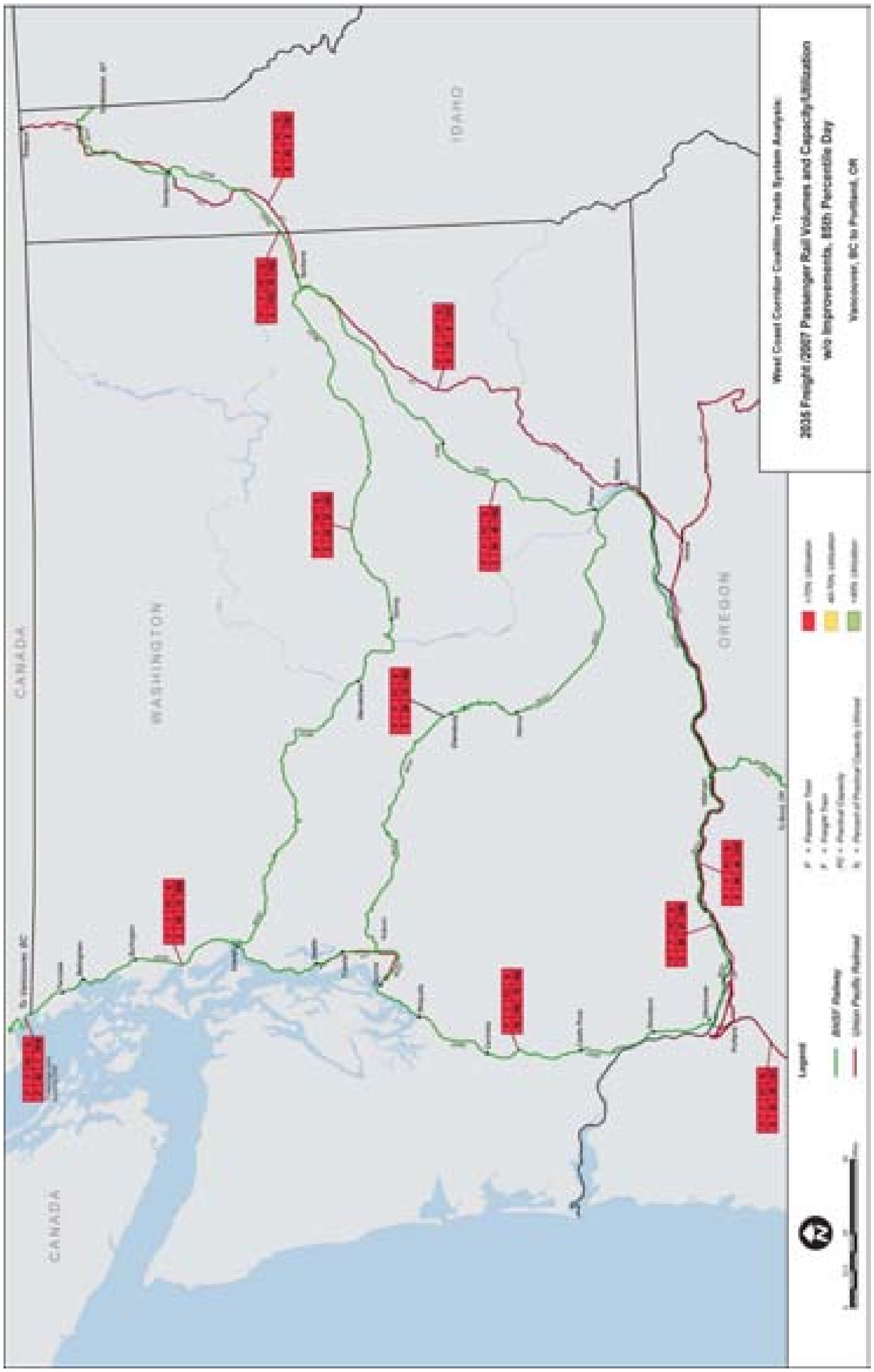


Figure 3.16 Anticipated West Coast Rail Demand, 2035
Southern Oregon to Northern California

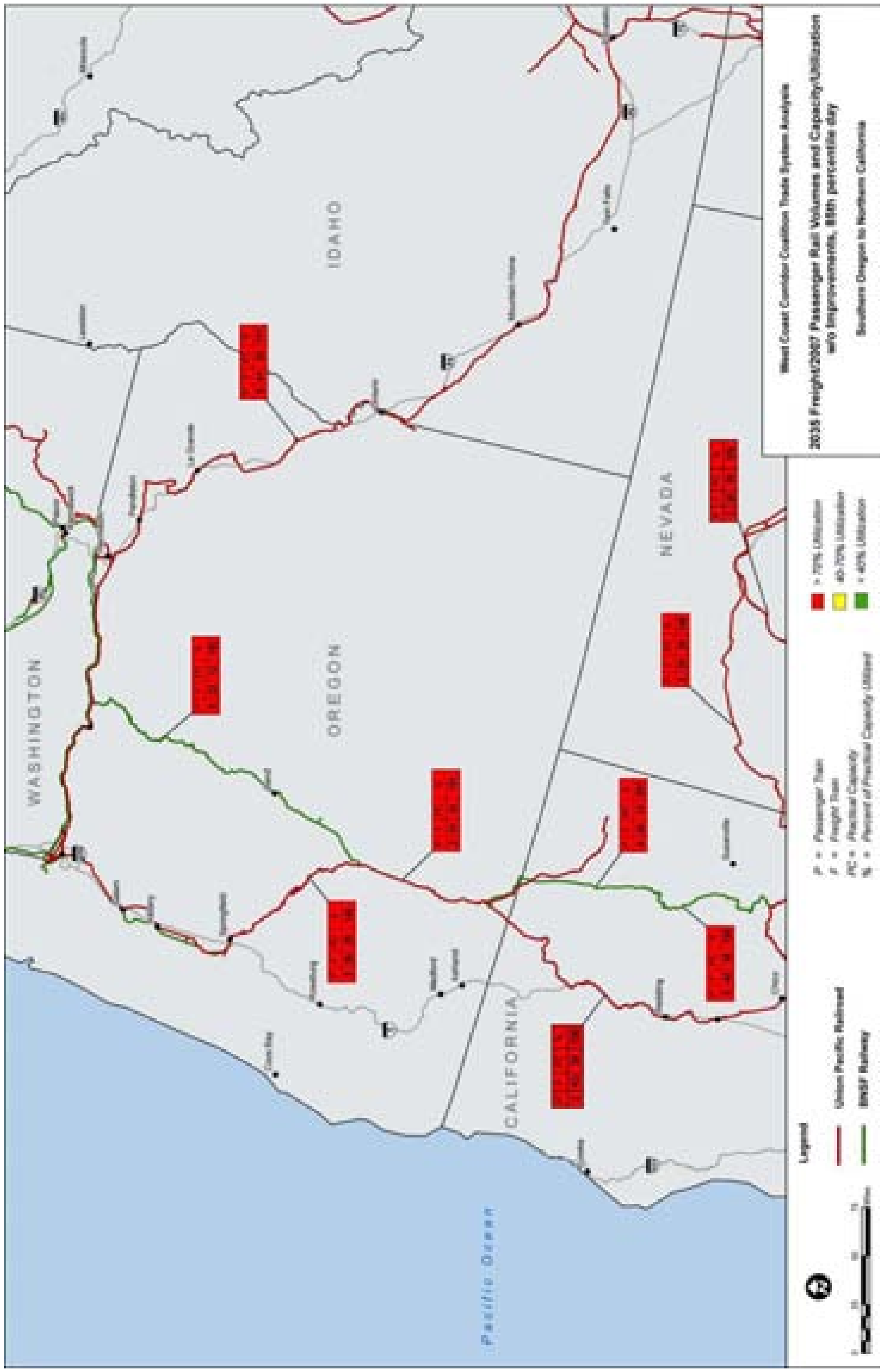


Figure 3.17 Anticipated West Coast Rail Demand, 2035
Bay Area to Fresno, California

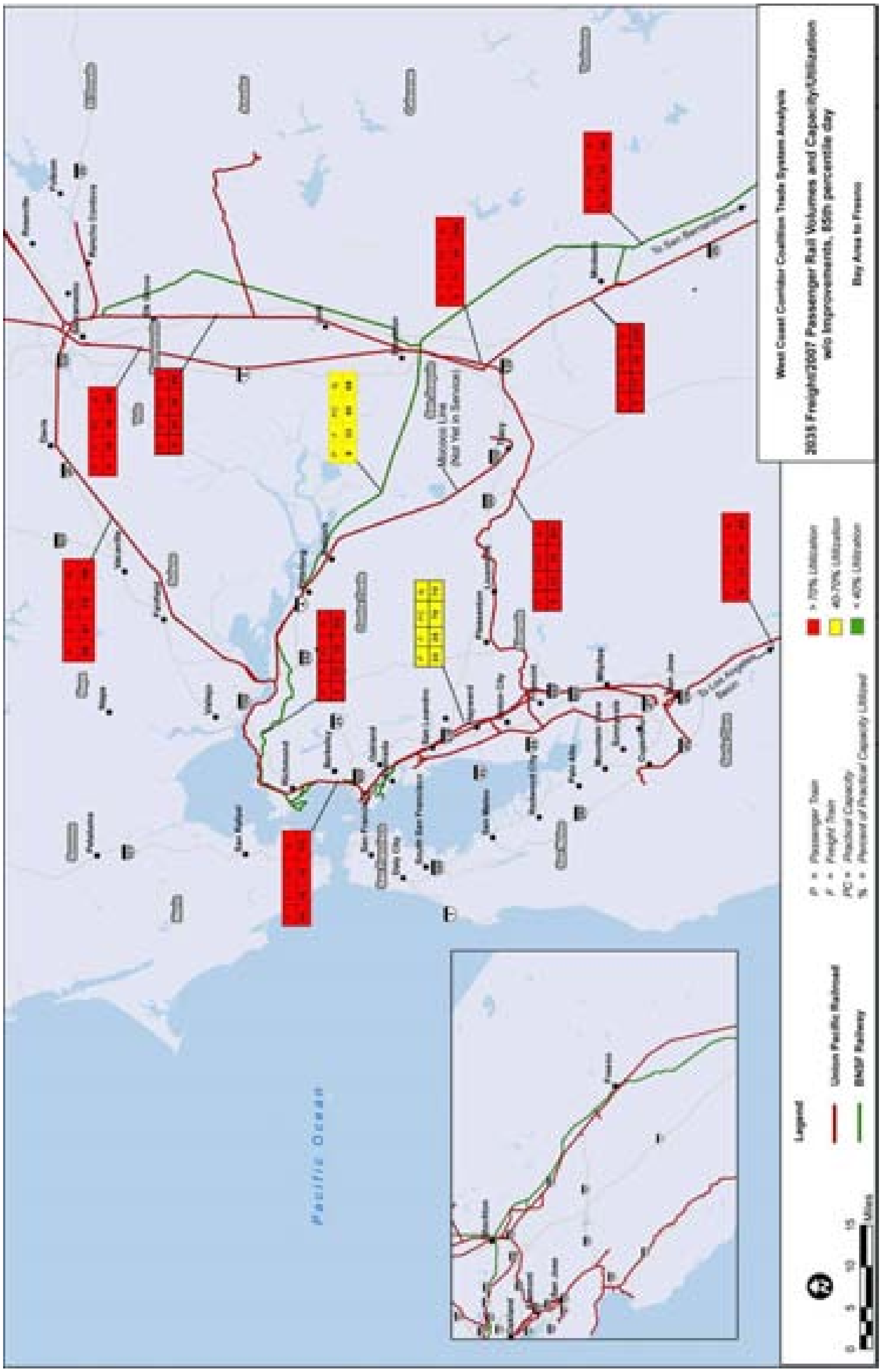
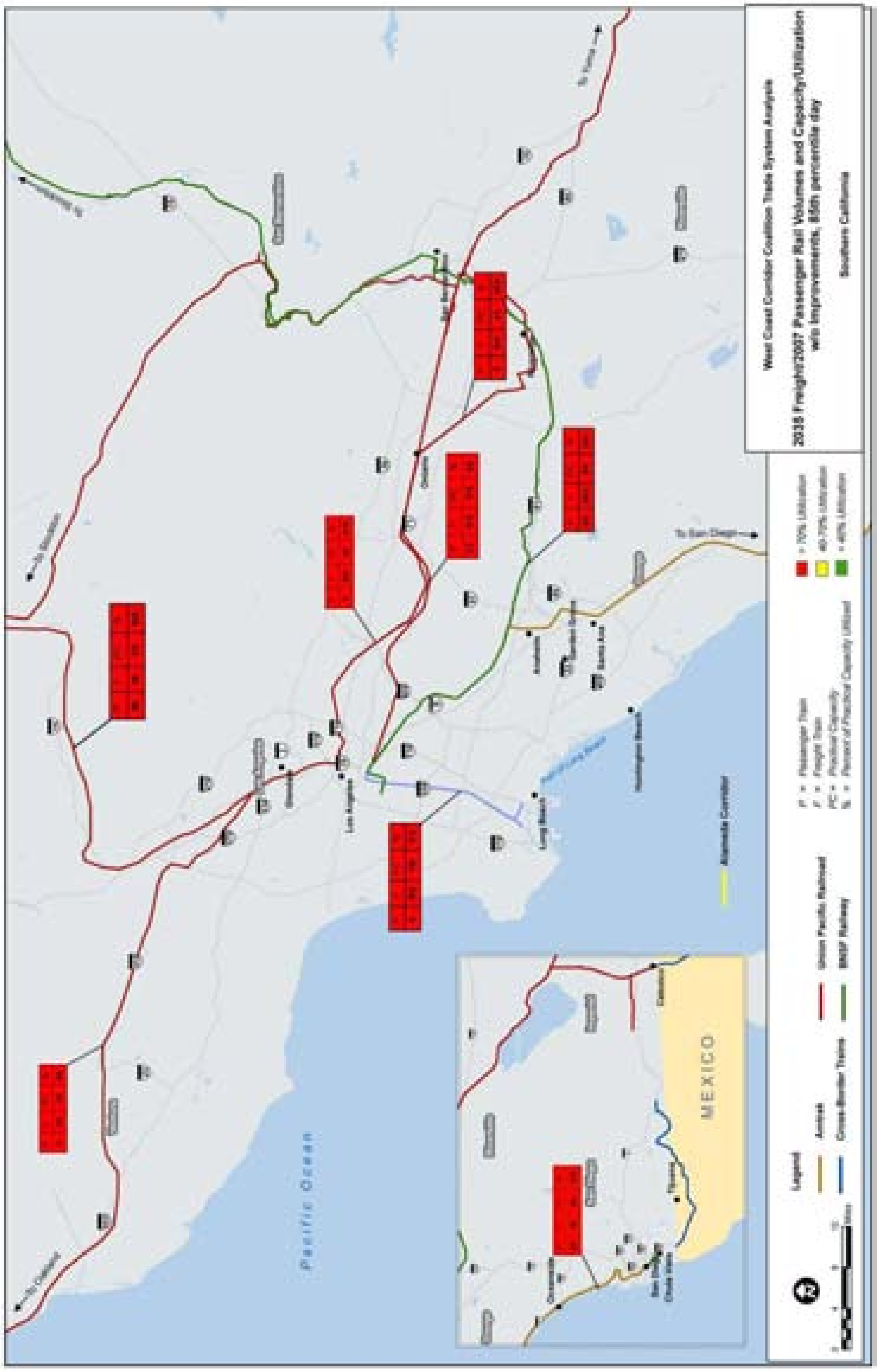


Figure 3.18 Anticipated West Coast Rail Demand, 2035
Southern California



■ 3.2 System Chokepoints are Affecting Performance

Chokepoints are physical points in the transportation system that have reduced capacity and/or operational capabilities in comparison to the rest of the system. Infrastructure and operational chokepoints in the West Coast region are affecting the overall performance and efficiency of the region's transportation system, limiting its ability to serve existing traffic and absorb anticipated increases in freight demand. In many cases, these chokepoints are impacting the efficiency and performance of the national freight supply and distribution chain, as well.

As described below, these chokepoints occur on all modes, but it is their cumulative effect at the system level that will most significantly impact the region's ability to effectively balance freight mobility, economic vitality, and community livability demands. The most critical chokepoints must be eliminated to allow the West Coast transportation system to absorb the expected growth in freight traffic and continue to play a vital role in the regional and national freight supply and distribution chain.

Highway Chokepoints

Highway chokepoints were identified by reviewing existing freight plans, studies, and policy documents developed by individual West Coast states. These chokepoints were then vetted by appropriate state DOT representatives for accuracy and validity. Critical highway chokepoints include:

- **Congested urban interchanges** (Figure 3.18). There are more than 14 highway interchanges in the region's urbanized areas that are insufficiently capable of handling current freight and passenger demand. These interchange bottlenecks are not necessarily freight-specific and many are the byproduct of rapidly growing population and passenger vehicle-miles-traveled (VMT) in major West Coast's urban areas. However, these interchange bottlenecks can represent a significant source of delay for trucks serving national and regional trade, as they often provide connections between major freight facilities (ports, airports, distribution/warehouse facilities) and important regional and national trade corridors. On average, these urban interchanges handle over 14,500 daily trucks, with several handling more than 18,000 and one handling more than 25,000. Total passenger and freight traffic at these interchanges, when coupled with poor geometrics and merging/weaving requirements, can result in safety concerns in many of these locations.

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Highway Chokepoints

Highway chokepoints were identified by reviewing existing freight plans, studies, and policy documents developed by individual West Coast states. These chokepoints were then vetted by appropriate state DOT representatives for accuracy and validity. Critical highway chokepoints on primary freight corridors include:

- **Congested urban interchanges** (Figure 3.19). There are more than 14 highway interchanges in the region's urbanized areas that are insufficiently capable of handling current freight and passenger demand. These interchange bottlenecks are not necessarily freight-specific and many are the byproduct of rapidly growing population and passenger vehicle-miles-traveled (VMT) in major West Coast's urban areas. However, these interchange bottlenecks can represent a significant source of delay for trucks serving national and regional trade, as they often provide connections between major freight facilities (ports, airports, distribution/warehouse facilities) and important regional and national trade corridors. On average, these urban interchanges handle over 14,500 daily trucks, with several handling more than 18,000 and one handling more than 25,000. Total passenger and freight traffic at these interchanges, when coupled with poor geometrics and merging/weaving requirements, can result in safety concerns in many of these locations.

- **Lack of capacity on critical port access routes** (Figure 3.20). Limited access to the region's major deepwater seaports is impacting the efficiency of freight movements regionally and nationally. In the Los Angeles/Long Beach region alone, there are two bridges (Schuyler Heim and Gerald Desmond Bridges) that require rehabilitation or replacement because of age, capacity, and weight restrictions. These bridges represent two of the three crossings into Terminal Island and also connect the Port of Long Beach to the I-710 Freeway, itself a congested facility. Combined, these port access facilities represent a significant chokepoint for international freight serving regional and national markets and serve more than 24,000 daily trucks.

- **Congested border crossings** (Figure 3.20). Border crossings at Otay Mesa (connecting Mexico and the U.S.) as well as those within the Cascade Gateway (connecting Canada and the U.S.) are increasingly congested. Even prior to the enhanced security requirements mandated in the wake of 9/11, these border crossings were not operating at peak efficiency. Longer processing times for inbound trucks, coupled with growth in freight traffic at these facilities, are exacerbating these congestion concerns.

- **Lack of capacity, recurring congestion, or incomplete segments along primary corridors or reliever facilities** (Figure 3.21). There are nearly 30 locations in the West Coast region where there are significant capacity constraints that are impacting truck movements. On average, these areas handle over 11,000 daily trucks, with some handling more than 25,000. Some of these constraints are caused by a general lack of capacity (such as along SR-99 in Fresno and Bakersfield, California), others by lane drops on key corridors (such as along I-5 in Lewis, Thurston, and Cowlitz Counties in Washington), still others by recurring congestion (often in urban areas). In other cases, there are incomplete segments on key trade corridors or reliever facilities. For example, completion of I-5/SR 509 corridor will provide a direct, alternative north-south route for air cargo, container, and other freight shipments in the region. Individually or collectively, these capacity "hot spots" are impacting the efficiency of freight shipments into, out of, and within the region.

- **Severe weather closures, lack of truck climbing lanes, and other operational issues on primary corridors** (Figure 3.22), particularly the Snoqualmie Pass (I-90) in Washington and the Altamont Pass (I-580) in California. The Snoqualmie Pass, for example, is routinely closed as a result of severe weather or avalanche danger. Limited truck climbing lanes over the Altamont Pass (which handles nearly 30,000 trucks per day [in both directions]), contribute to overall freight and auto delays for eastbound movements. In many cases, the truck movements in these areas are further delayed by the lack of regional, truck-focused traveler information systems in the region. The location and operation of truck scales around Cordelia also acts as a significant operational chokepoint to truck traffic in region.

Figure 3.19 Urban Interchange Chokepoints
On Primary Highway Freight Corridors, 2008

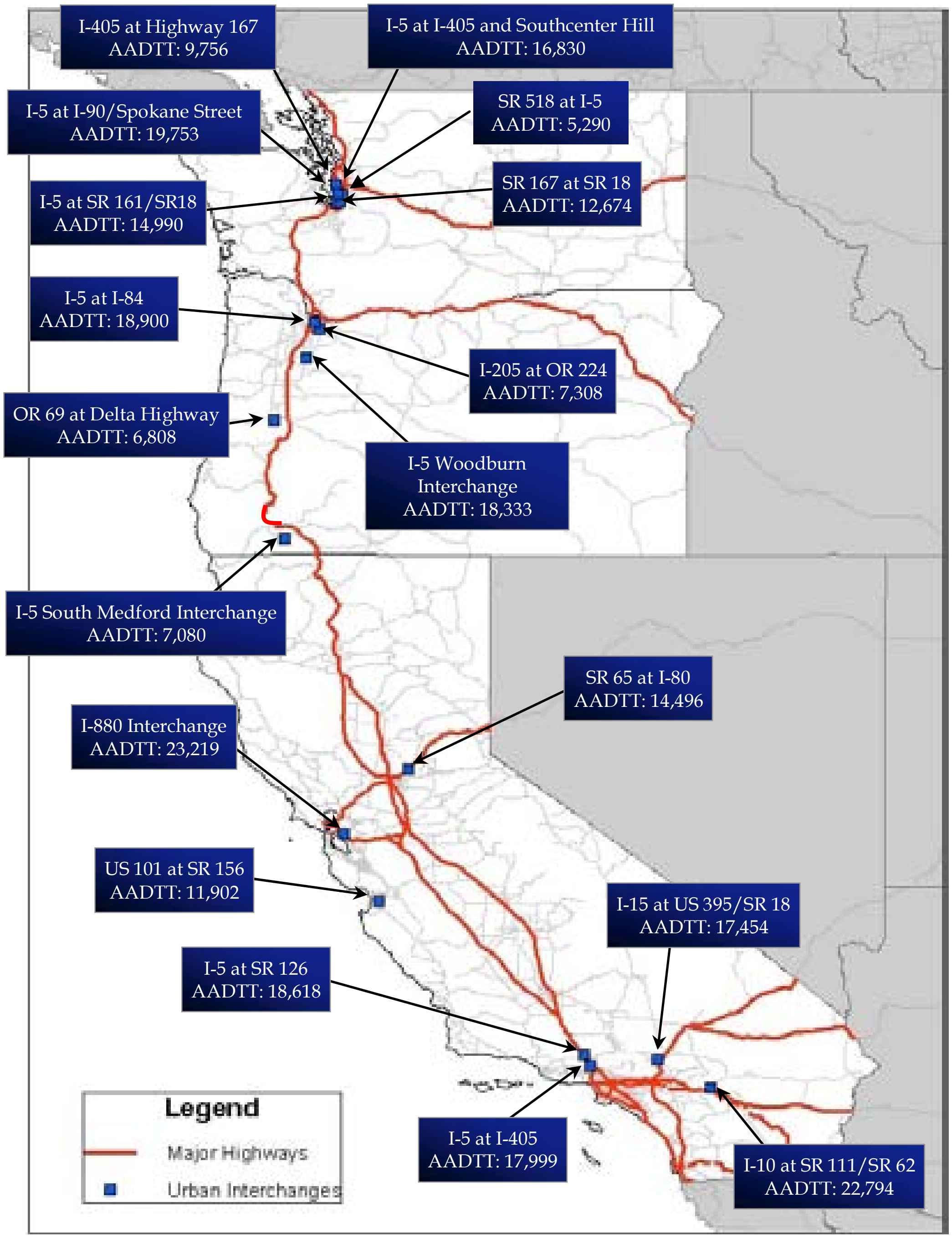


Figure 3.20 Port Access and Border Crossing Chokepoints
On Primary Highway Freight Corridors, 2008

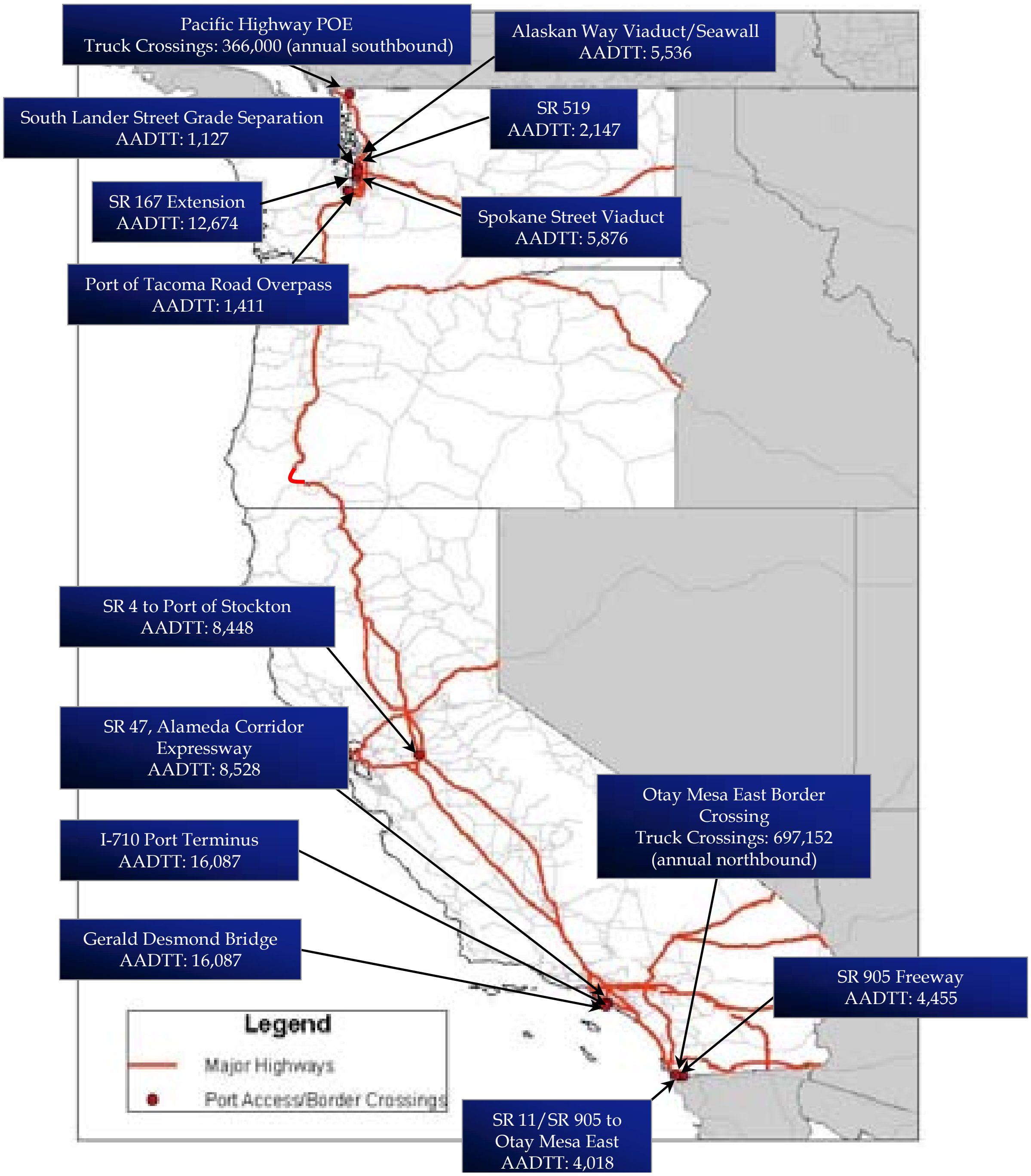


Figure 3.21 Capacity Chokepoints
On Primary Highway Freight Corridors, 2008

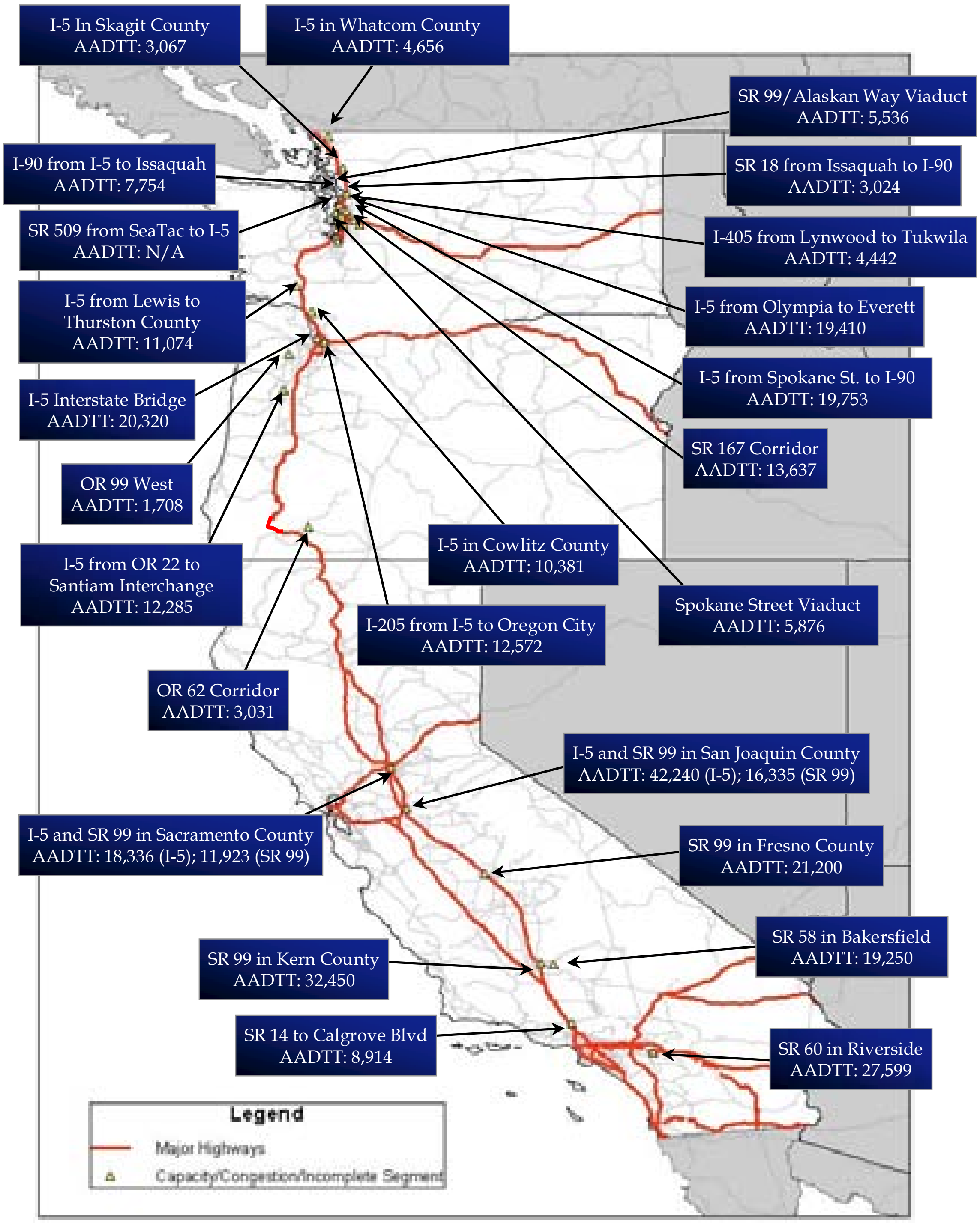
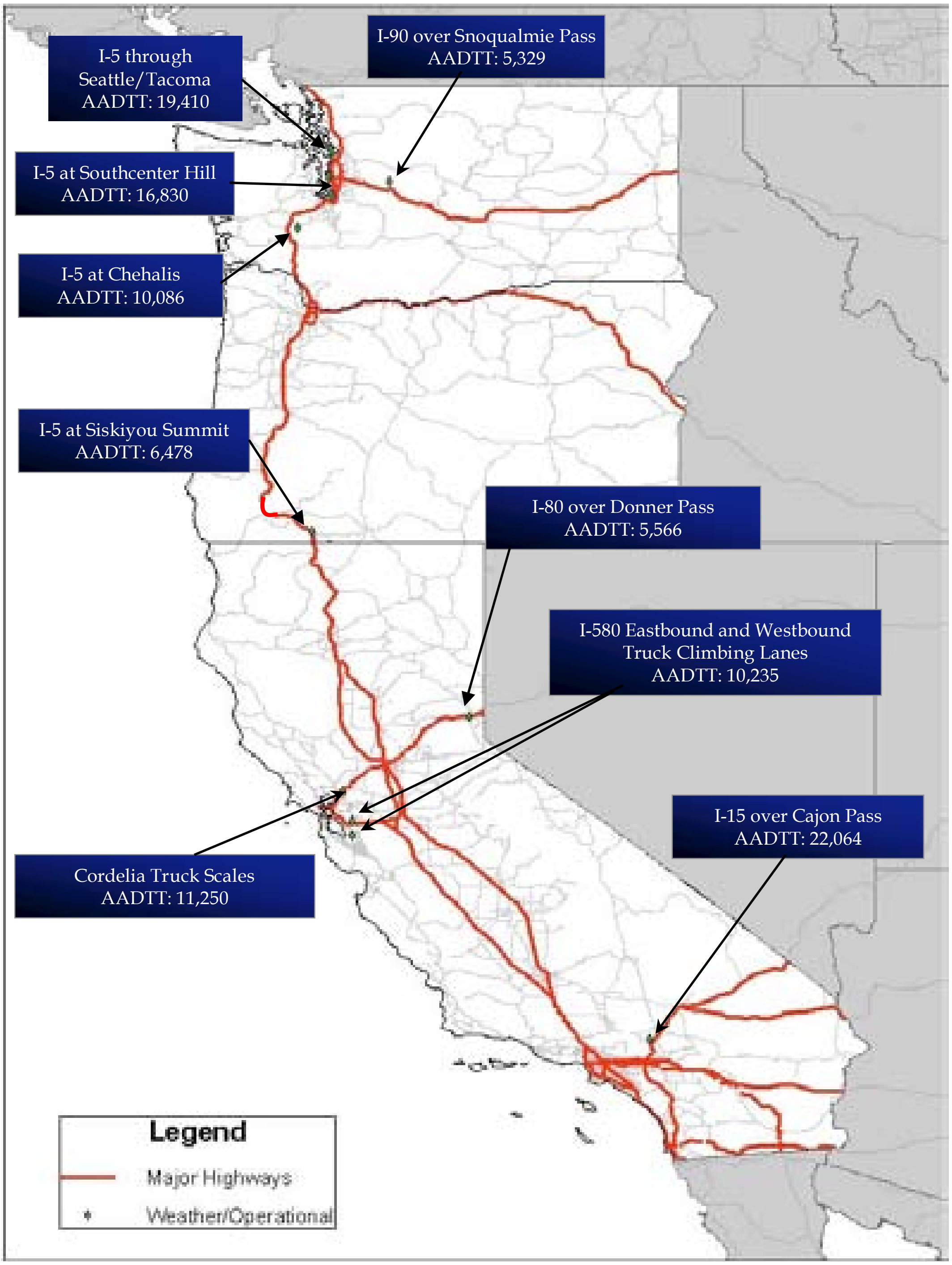


Figure 3.22 Severe Weather and Other Operational Chokepoints
On Primary Highway Freight Corridors, 2008



These highway chokepoints are already having significant impacts on the efficiency of the region's transportation system and are impacting the ability of the system to meet the needs of its customers, as described in the following case study.

Case Study – Columbia River Crossings

Oregon and Washington – along with the rest of the West Coast region – share a common transportation chokepoint, the Interstate 5 (I-5) Corridor highway and rail bridges that span the Columbia River. The crossings, shown below, are of strategic importance to freight transportation in the Portland-Vancouver area and the West Coast region, and provide critical connections to key regional and national markets.

The I-5/Columbia River bridge already handles more than 20,000 daily truck crossings, many of which are bound for destinations in California or the Midwest. The BNSF rail bridge is the only rail crossing connecting Portland and Vancouver and carries more than 60 freight trains across the river each day. A significant number of the containers processed for import and export by ports in Seattle and Tacoma, as well as by the Port of Portland, transit the Portland-Vancouver region by rail on their journeys to and from the Midwest and East Coast markets. Congestion on these crossings is impacting the safety and efficiency of freight shipments – as well as passenger movements – throughout the region.

Continued congestion at this crossing – particularly on the highway crossing – will have significant regional and national impacts. For instance, worsening congestion will continue to delay truck movements in the region, making it difficult for the region's ports to adequately serve regional and national markets and increasing costs for shippers and consumers. Rail congestion will delay shipments of grain, lumber, and minerals moving west by rail from Montana, Idaho, eastern Washington, and central and eastern Oregon for export through the ports.

Impacts of Freight Growth on Highway Chokepoints

Growth in freight traffic – particularly growth through the region's trade gateways and along critical trade corridors – will worsen performance and efficiency at these existing chokepoints. As described earlier, overall truck trips in the region are expected to increase between 94 and 134 percent between 2002 and 2030 (or between 3.3 and 4.7 percent per year). While these growth rates will impact travel time and reliability along entire corridors, those impacts will be felt most acutely at the chokepoints described above.

Figures 3.23 through 3.26 show how growth in truck traffic will impact the highway chokepoints identified by the WCCC states. Chokepoints shown in red are expected to have volume-to-capacity (v/c) ratios greater than 0.75 by 2035. These facilities essentially will be at or near capacity. Those chokepoints shown in yellow are expected to have v/c ratios between 0.50 and 0.75, and will be nearing capacity (particularly at peak-periods).

Those chokepoints shown in green are expected to have v/c ratios of less than 0.50 and will be best able to absorb anticipated growth in freight demand.

Figure 3.23 Growth Impacts on Urban Interchange Chokepoints
On Primary Highway Freight Corridors, 2030

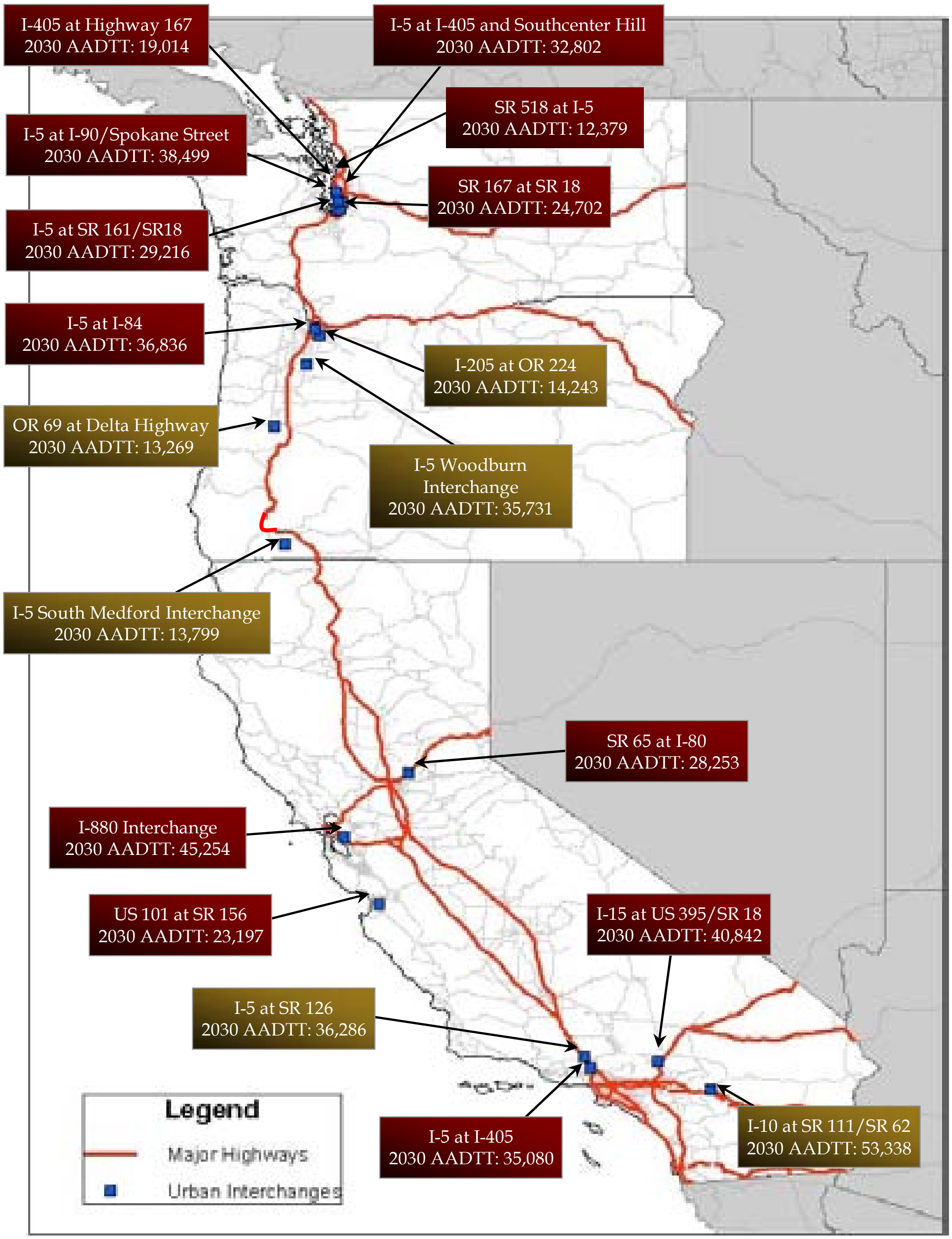


Figure 3.24 Growth Impacts on Port Access and Border Crossing Chokepoints

On Primary Highway Freight Corridors, 2030

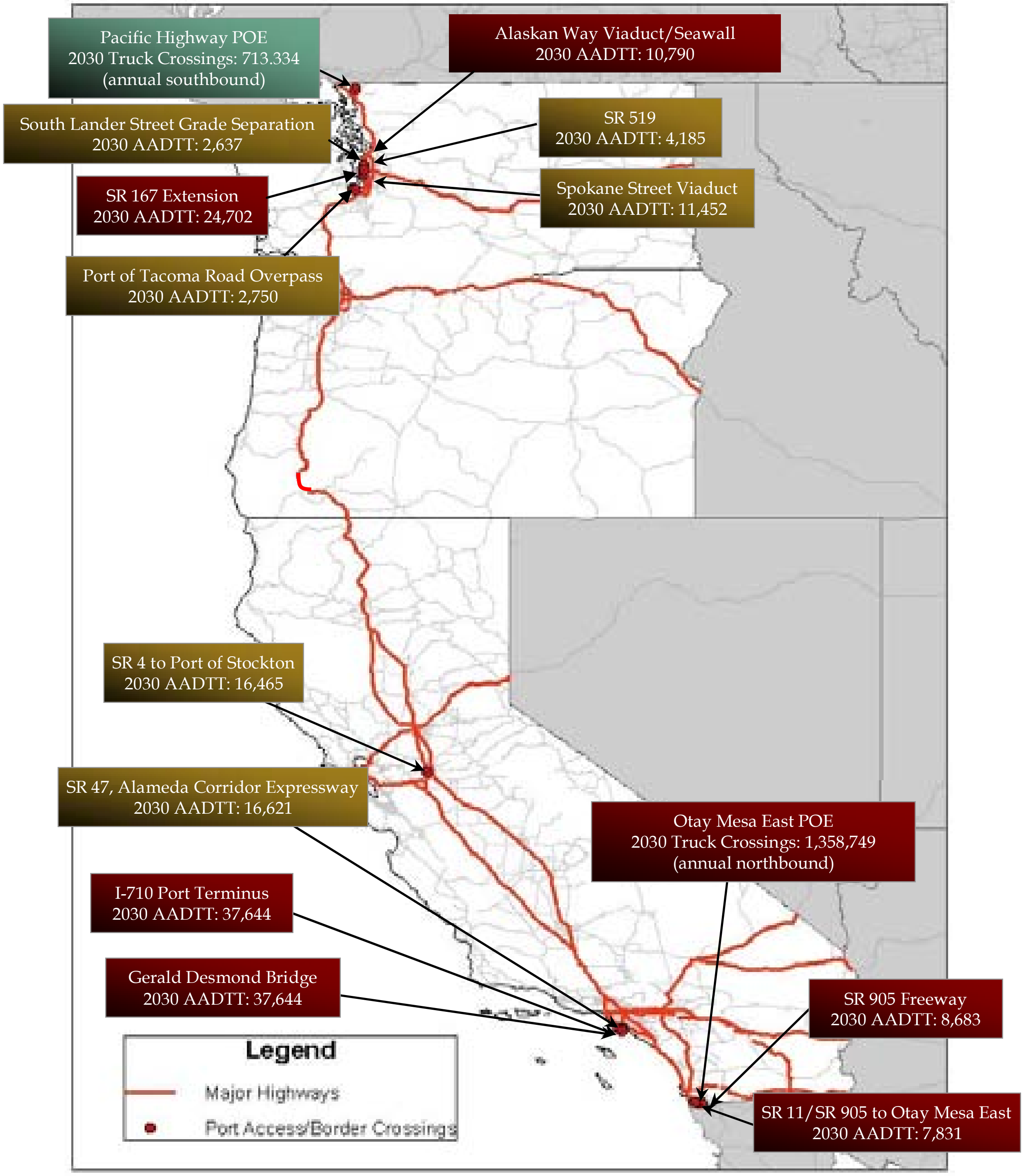


Figure 3.25 Growth Impacts on Capacity Chokepoints
On Primary Highway Freight Corridors, 2030

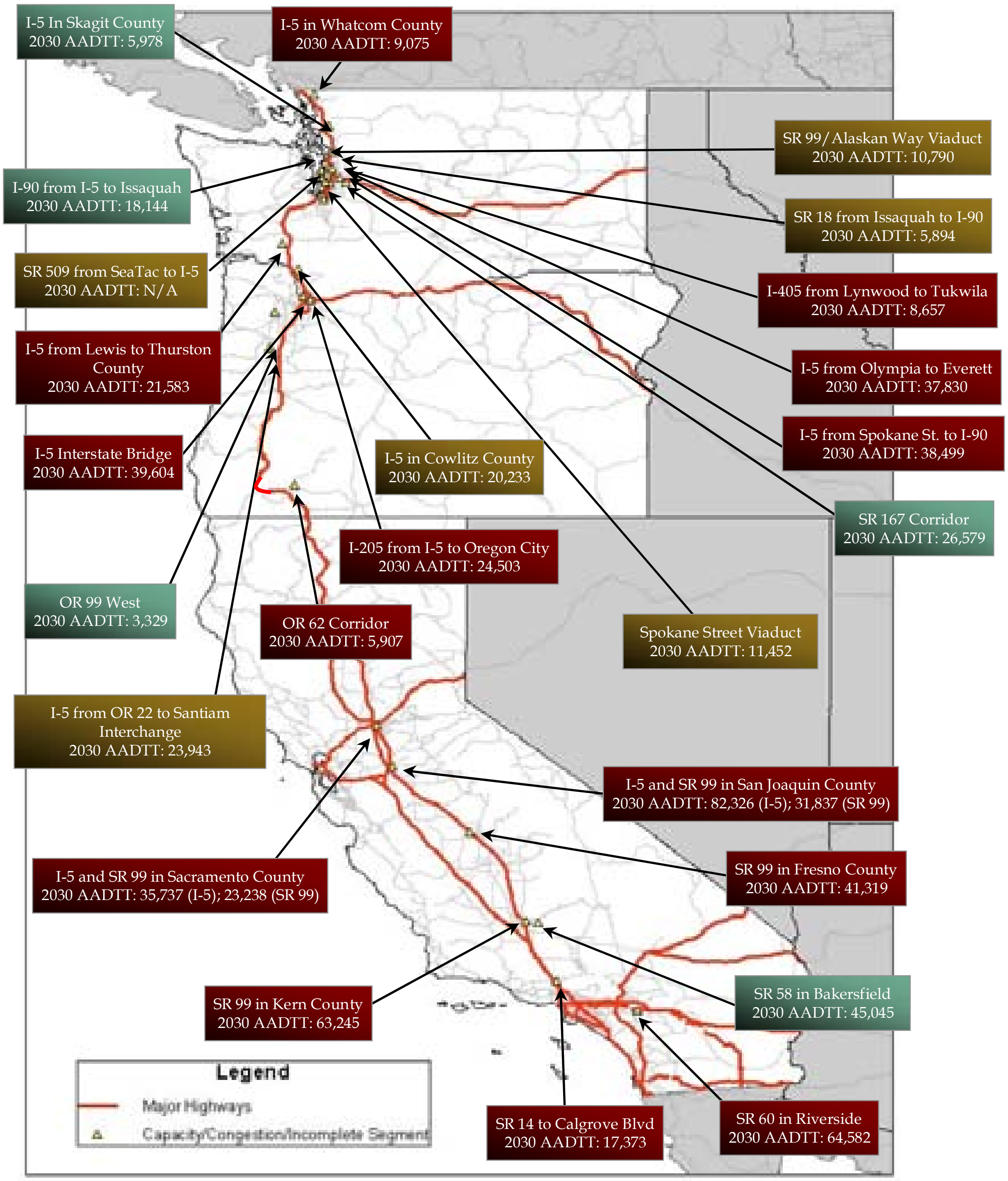
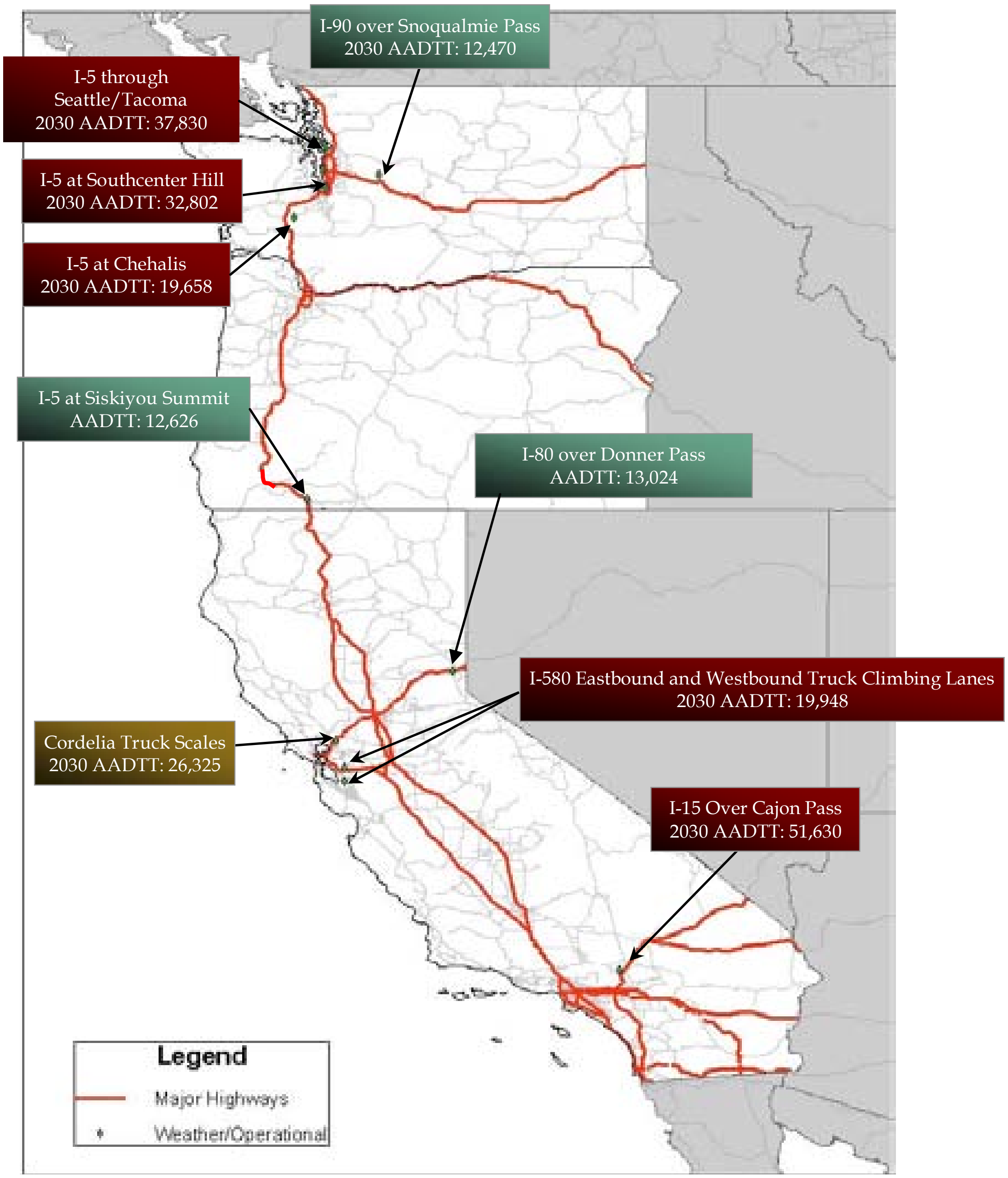


Figure 3.26 Growth Impacts on Severe Weather and Other Operational Chokepoints
On Primary Highway Freight Corridors, 2030



As can be seen in Figures 3.23 through 3.26, more than half (35) of the highway chokepoints identified by WCCC states will be at or above capacity by 2030. An additional 19 will be approaching capacity. And while congestion at these chokepoints will not completely shut down the West Coast trade and transportation system, they will have significant safety, efficiency, and economic impacts, as described in the following case study.

***Case Study – San Diego/Baja California Border Crossing Delays*[4]**

Nearly 730,000 trucks travel across the San Diego County/Baja California ports of entry from Mexico annually and a similar number is estimated to cross southbound. Today's level of processing time at the border (leading to over two hours on average of total wait time per truck crossing without U.S. secondary inspection), coupled with increasing truck volume using these facilities, is resulting in significant delay for these cross-border trips. In an increasingly just-in-time manufacturing economy, unpredictable wait times for trucks at the border act as a barrier to trade that slows and inhibits cross-border economic investment opportunities.

Because approximately one-third of these cross-border trucks (and more than two-thirds of the goods they carry) have destinations outside San Diego county, these delays also have economic impacts that reverberate regionally and nationally, as shown below:

	Economic Impacts of Border Delays[5]		
	Output Losses (Millions of Dollars)	**Labor Income Losses (Millions of Dollars)**	**Employment Losses (Jobs)**
Regional (San Diego County)	$455	$131	2,461
Statewide	$716	$204	3,654
National	$1,256	$351	7,646

The impacts of these delays are not only felt locally and regionally, through worsening congestion and air quality, and loss of employment and tax revenue; but also statewide and nationally, through increasing prices to shippers and consumers of cross-border goods

Rail Chokepoints

Critical rail chokepoints in the region include:

- **Insufficient mainline capacity and connections** (Figure 3.27). Rail capacity is not only a function of the number of tracks in a region, but also the number of sidings, the location and performance of signal and information systems, and the location and operations of yards and terminals. Overall, rail capacity in the region is tight, particularly in and around terminal areas and within heavy grade and curve territory (e.g., mountain crossings). New traffic patterns, increased traffic, and network connections are combining to overload mainline connections in many locations,

[4] San Diego Association of Governments/CalTrans District 11, *Economic Impacts of Wait Times at the San Diego–Baja California Border*, January 2006.

[5] For San Diego County and the State of California, the IMPLAN Input Output Model was used to quantify the incremental direct, indirect, and induced impacts of congestion. For Baja California and Mexico, multipliers developed by the Autonomous University of Baja California (Universidad Autónoma de Baja California - UABC) were used.

including Colton Crossing near San Bernardino, California, and the "Portland (Oregon) Triangle." Limited capacity and connections in the region means that there is little redundancy or flexibility in the system to allow for maintenance time, unforeseen events, and climate hazards.

- **Track clearance and alignment issues** (Figure 3.28). Some corridors in the region are not cleared for high-cube double-stack container cars and certain multilevel autorack cars, resulting in lower efficiency for the railroads operating in the region and higher transportation costs for shippers and consumers. Potential locations for provision of double-stack clearance include Stampede Pass (Washington), the Oregon Trunk (BNSF's I-5 corridor through Oregon), and Donner Pass (California). Track alignments also are an issue in the region. Railroads operate most efficiently on straight, level track, and must carefully (and slowly) navigate curves, particularly those with curvature sharper than eight degrees. Railroads utilizing networks with higher degrees of curvature must operate at slower speeds and must often run shorter trains, hindering their efficiency and often their overall reliability. The geography of the West Coast region has resulted in a rail system that is highly serpentine in some areas. These alignments make it difficult for rail operators to maintain speed between some key markets, affecting overall transit times and reliability.

- **Yard capacity and throughput** (Figure 3.29). Many rail yards in the region are approaching (or exceeding) capacity, making it difficult for the railroads to maintain efficient operations or attract additional market share in some areas. Many major rail yards were developed in close proximity to (or in some cases, in the middle of) urbanized areas. The growth in freight traffic has enhanced the pace of operations at these facilities, a trend that is not always consistent with surrounding land uses and can significantly impact community livability and accessibility. Many state DOTs and MPOs in the region are struggling with how to improve or relocate these facilities but making improvements to rail yards can be challenging, given the land use, population density, and environmental characteristics of the area.

- **Passenger/freight commingling** (Figure 3.30). There are some areas in the rail system that handle significant volumes of both freight and passenger service. Examples include the Seattle-Tacoma-Portland-Eugene Corridor, Capital Corridor (California), and Los Angeles Metro. Limited capacity along some of these corridors hinders the ability of passenger and freight trains to share infrastructure effectively. Efficient management of shared lines requires a delicate balance of effective communications and dispatching, adherence to curfews and delivery windows, and tight coordination among both passenger and freight railroads. When operational constraints or other issues disrupt this balance, the performance of all system users is affected.

Figure 3.27 Rail Capacity Chokepoints
On Primary Freight Rail Corridors

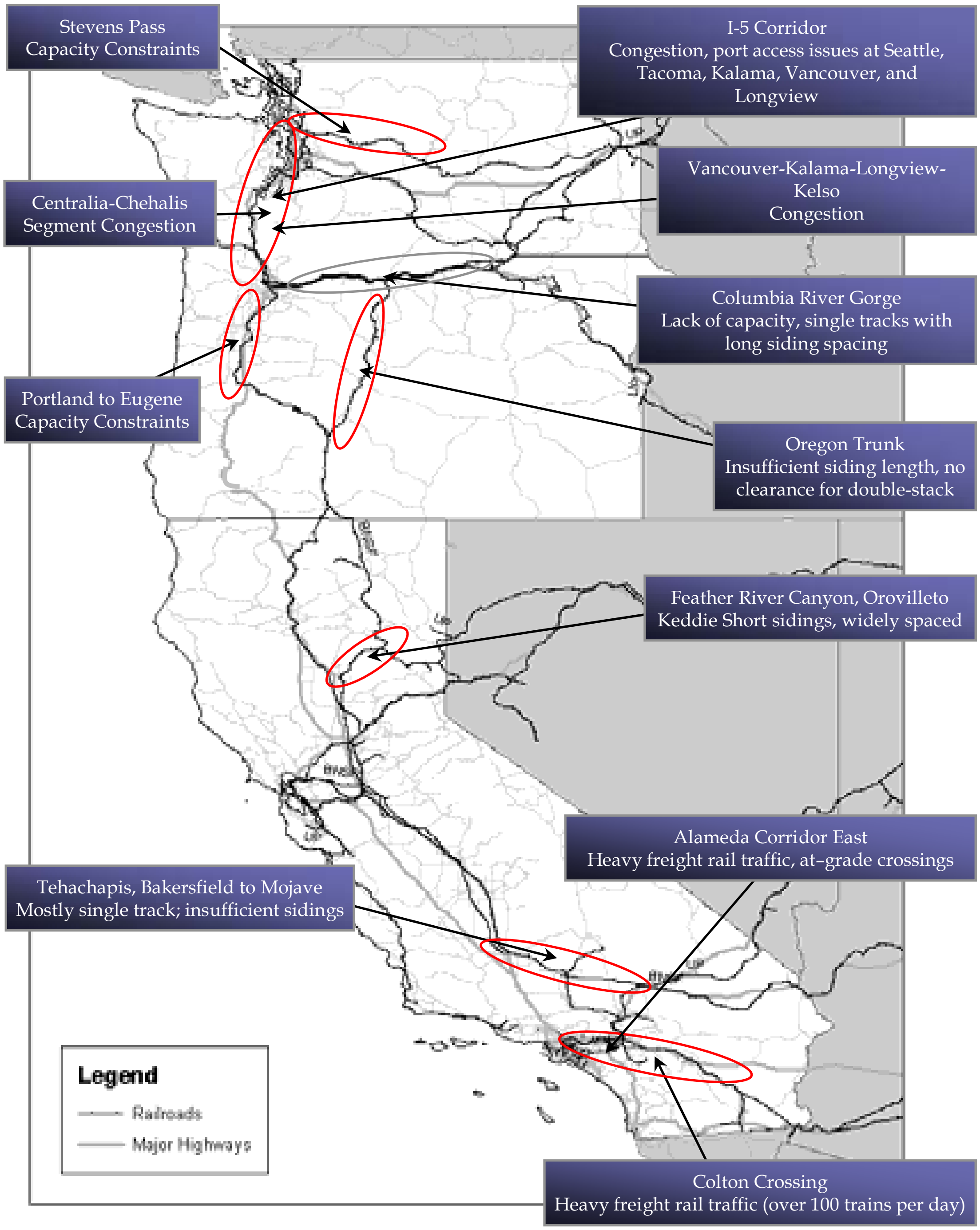


Figure 3.28 Track Clearance and Alignment Chokepoints
On Primary Freight Rail Corridors

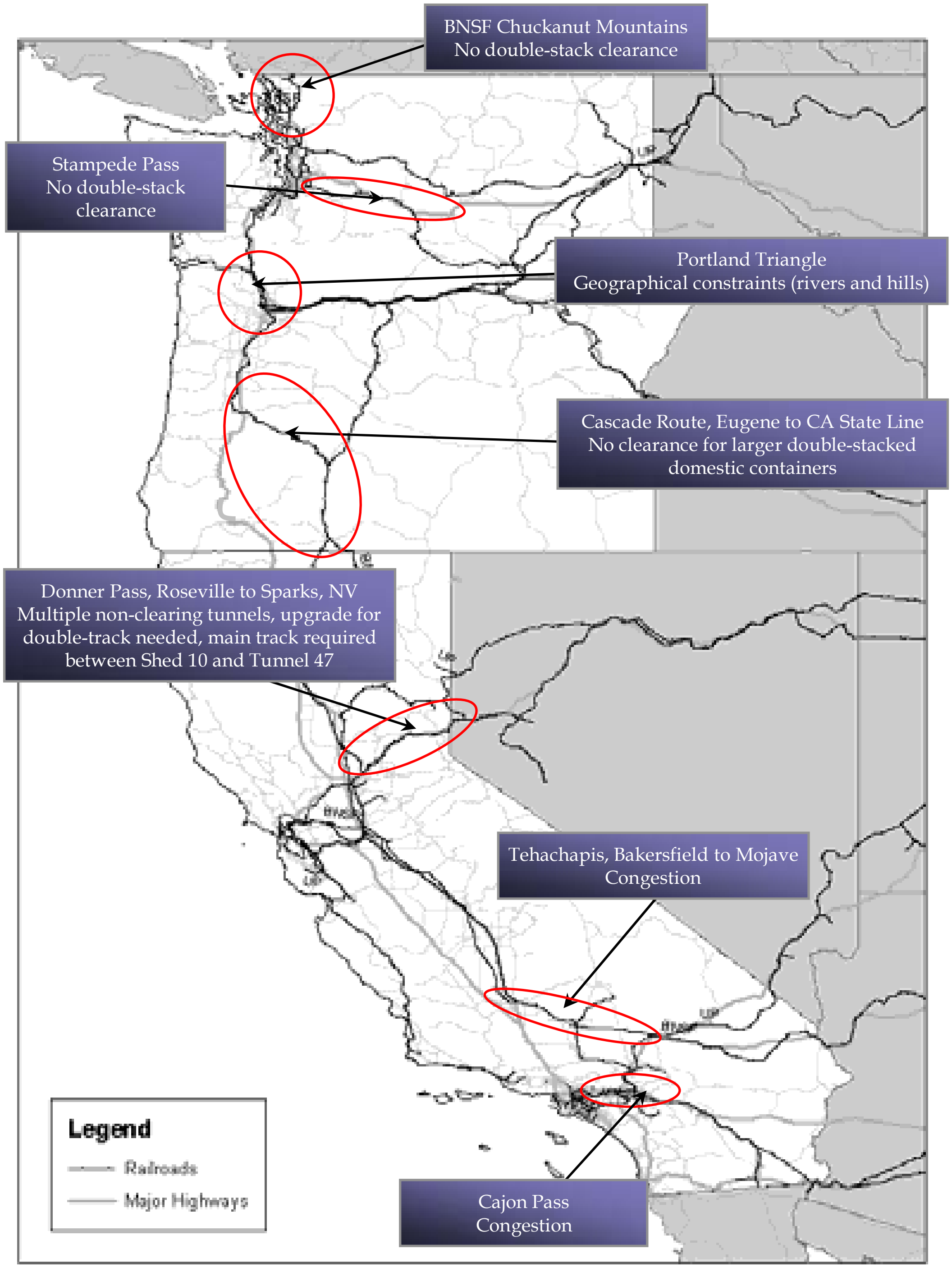


Figure 3.29 Yard Capacity Chokepoints
On Primary Freight Rail Corridors

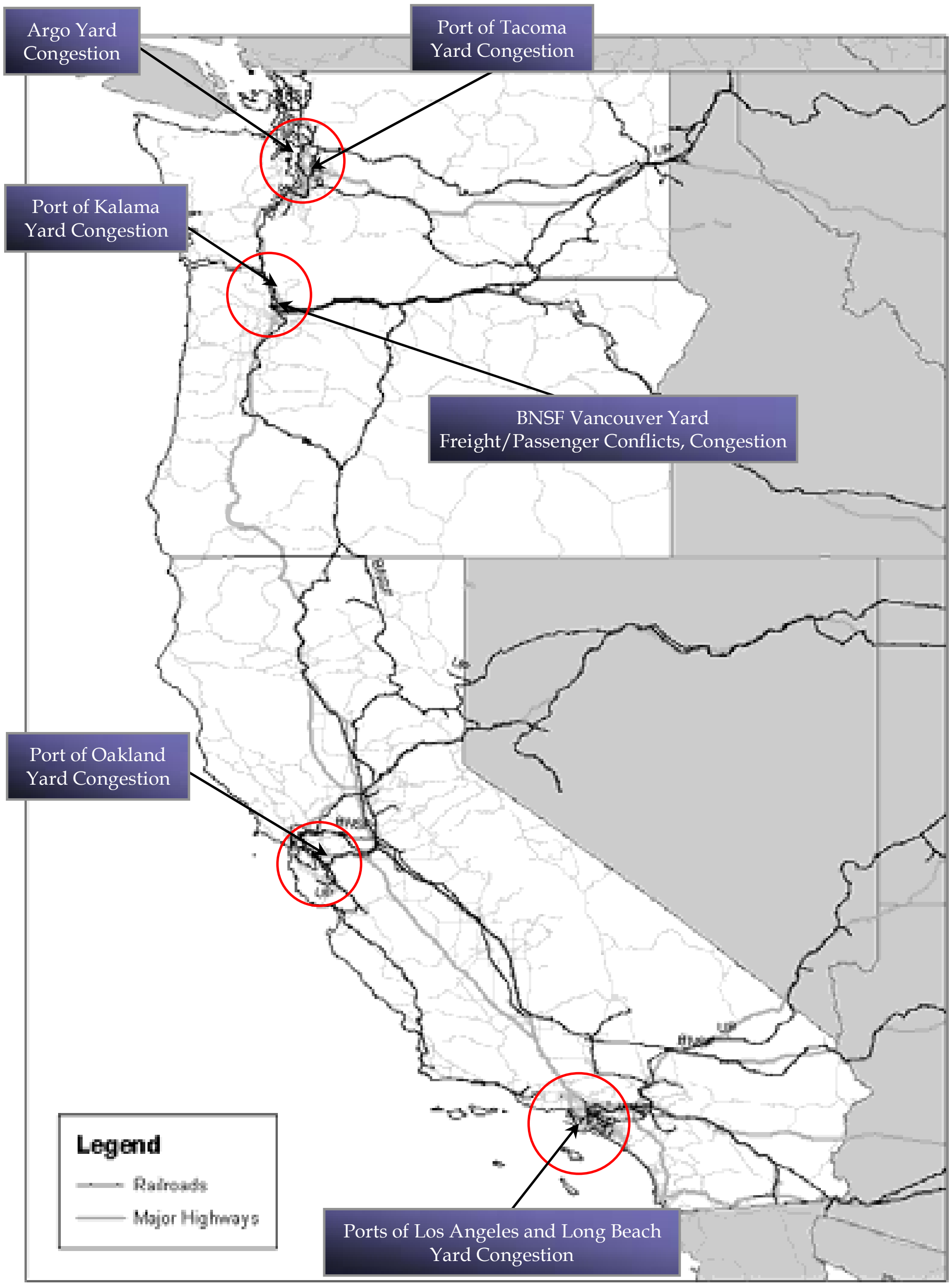
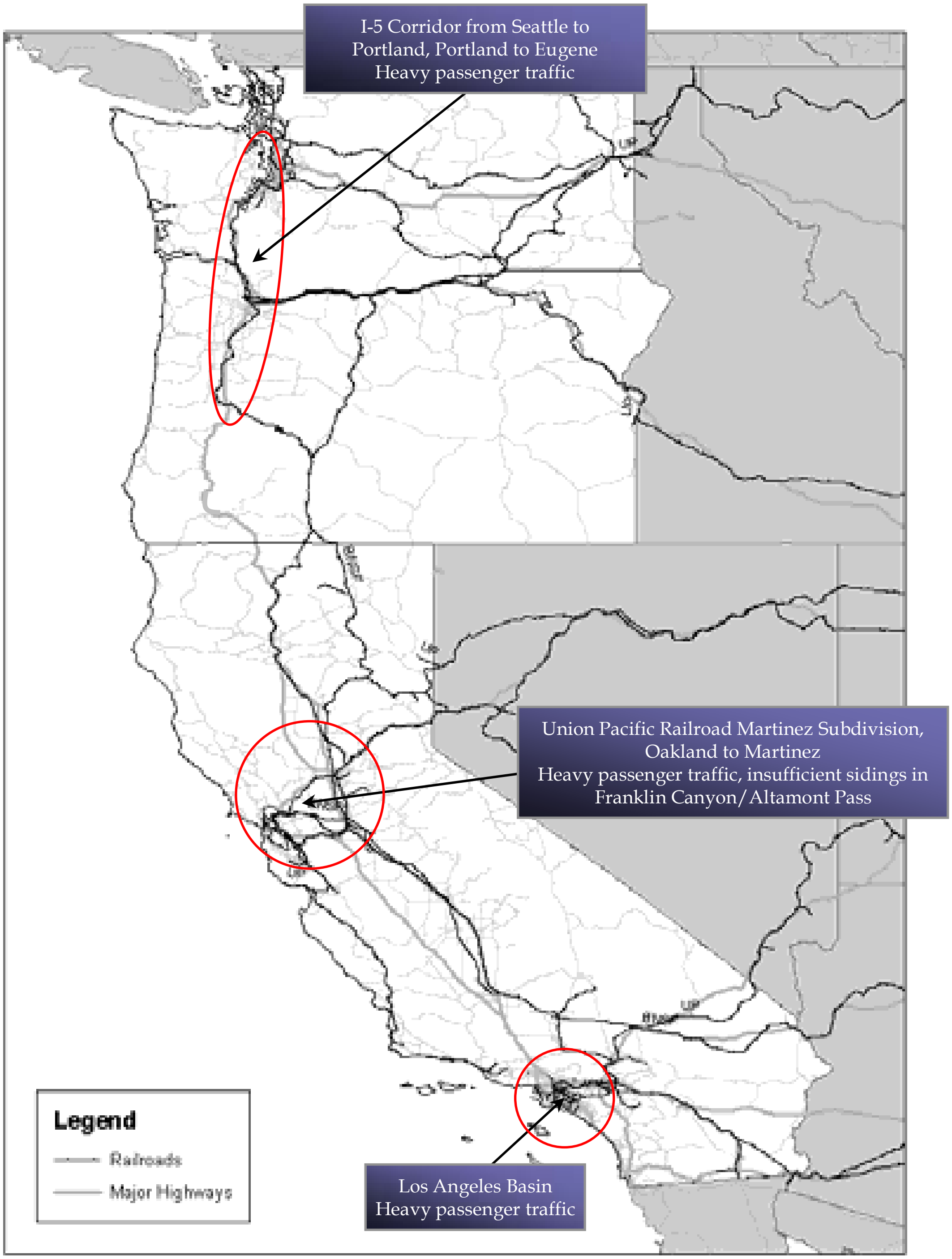


Figure 3.30 Passenger/Freight Commingling Areas
On Primary Freight Rail Corridors



These rail chokepoints can have significant local, regional, and national impacts, as described in the case study below.

Case Study – Bay Area Central Corridor

The Central Corridor, shown below, connects the Port of Oakland (and the rest of the San Francisco Bay Area) with points east. I-80 is the primary east-west highway connector, extending northeast through Sacramento and over Donner Summit, where it crosses into the State of Nevada. Rail service along the corridor is provided by the Union Pacific Railroad (UP). This rail line extends from the UP Oakland Yard and the Port of Oakland's Oakland International Gateway (OIG) intermodal yard, east to the UP J.R. Davis Yard in Roseville, the UP's major car-load classification yard in Northern California. This yard receives daily trains from Los Angeles, Oakland, the Central Valley, Chicago, Kansas City, and the Pacific Northwest. After leaving the Davis Yard, the line branches into two lines: East-west movements continue along the UP line along I-80 over Donner Summit and points east, and north-south movements connect with the UP's north-south line between Seattle and Los Angeles along I-5. Burlington Northern Santa Fe (BNSF) Railway also runs trains along this same infrastructure between Stockton and Keddie under a trackage rights agreement with UP.

Several spots on this corridor are already serving significant rail volumes, some of which are contributing to chokepoints at the Port of Oakland. The UP Mainline Between Oakland and Martinez, for instance, is used by AMTRAK, UP, the Capitol Corridor commuter rail, and BNSF. In many cases, the conflict between passenger and freight trains limits the capacity to move freight trains away from the Port. In addition, there is very limited capacity to store trains prior to departure or after arrival. The ability to move freight capacity away from the Port of Oakland is further limited by the fact that tunnels over Donner Summit do not provide sufficient clearance for double-stack container trains, forcing single-stack operations along this key east-west corridor. Exacerbating these chokepoints is the fact that capacity improvements are hampered by limited availability of additional right-of-way along the existing mainlines. As a result, the rail system must rely primarily on operational efficiency gains to accommodate growth in freight traffic.

Together, these rail chokepoints have two important implications for the Bay Area and the West Coast region as a whole. First, limited capacity on the rail system may result in an increase in truck volumes into and out of the Port, exacerbating existing congestion in the Bay Area and at other points along the I-80 corridor. Just as important, these chokepoints may prevent the ability of the Port of Oakland to absorb expected growth in demand and threaten its expansion capabilities (as well as the jobs and revenue that follow). As a result, regional, national, and international shippers may be forced utilize other port facilities within or outside the region.

■ 3.3 Capacity Improvements and Operational Strategies Will Not Keep Pace with Demand

There are a number of improvement projects in the region, shown in Figures 3.31 through 3.33, that currently are under consideration by West Coast states, MPOs, ports, railroads, and other stakeholders. Although the full slate of proposed improvements described below may not be implemented by 2030, many of these projects do appear in statewide, regional, or facility transportation or master plans and some (but not all) have identified funding sources. Taken together, these capacity improvements are expected to allow the system to absorb approximately 75 million TEUs of freight demand, well short of anticipated demand in both the "likely" (83 million TEU) and "high growth" (112 million TEU) scenarios.

Figure 3.31 Representative Seaport Improvements
Under Consideration by West Coast Freight Stakeholders

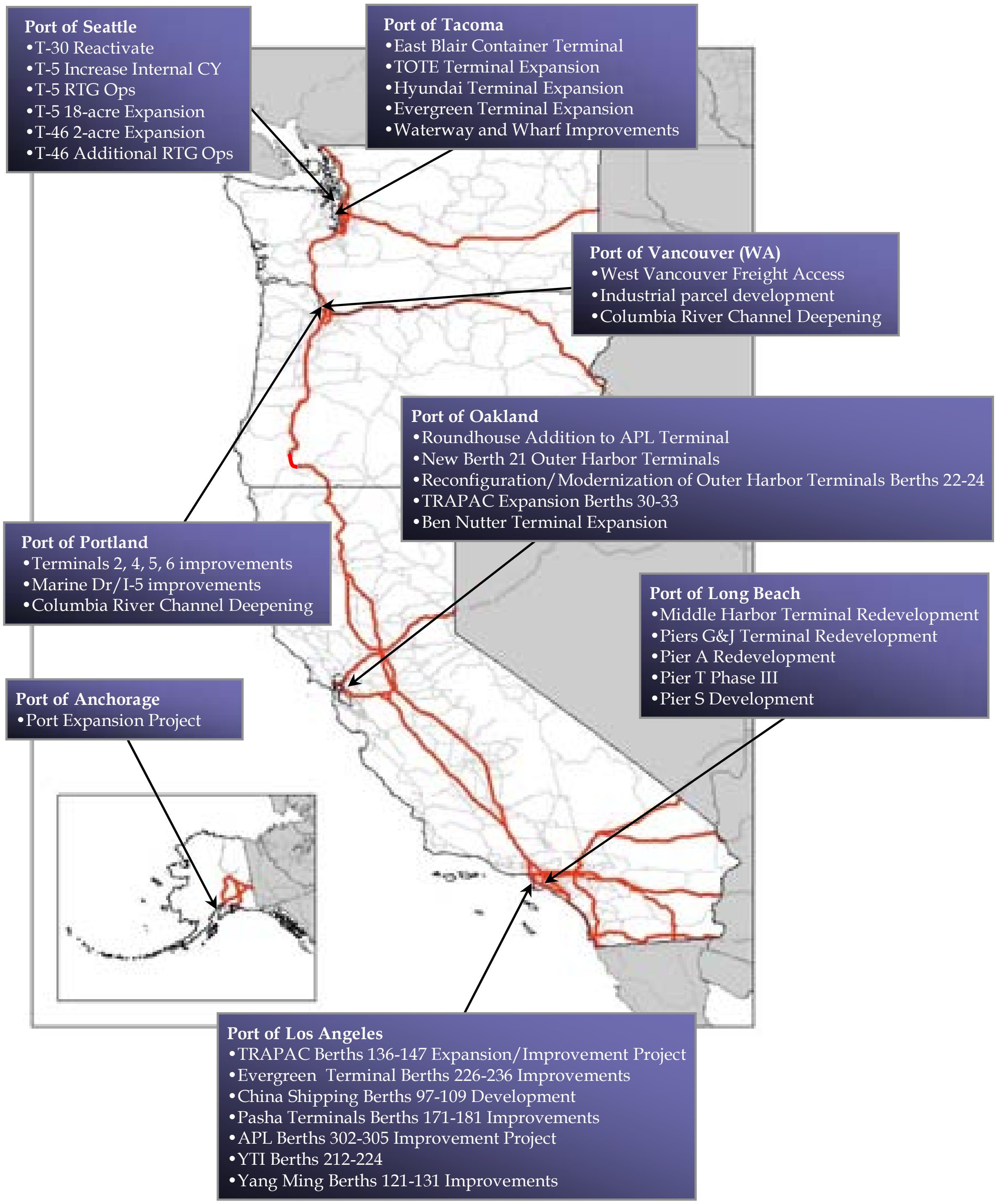
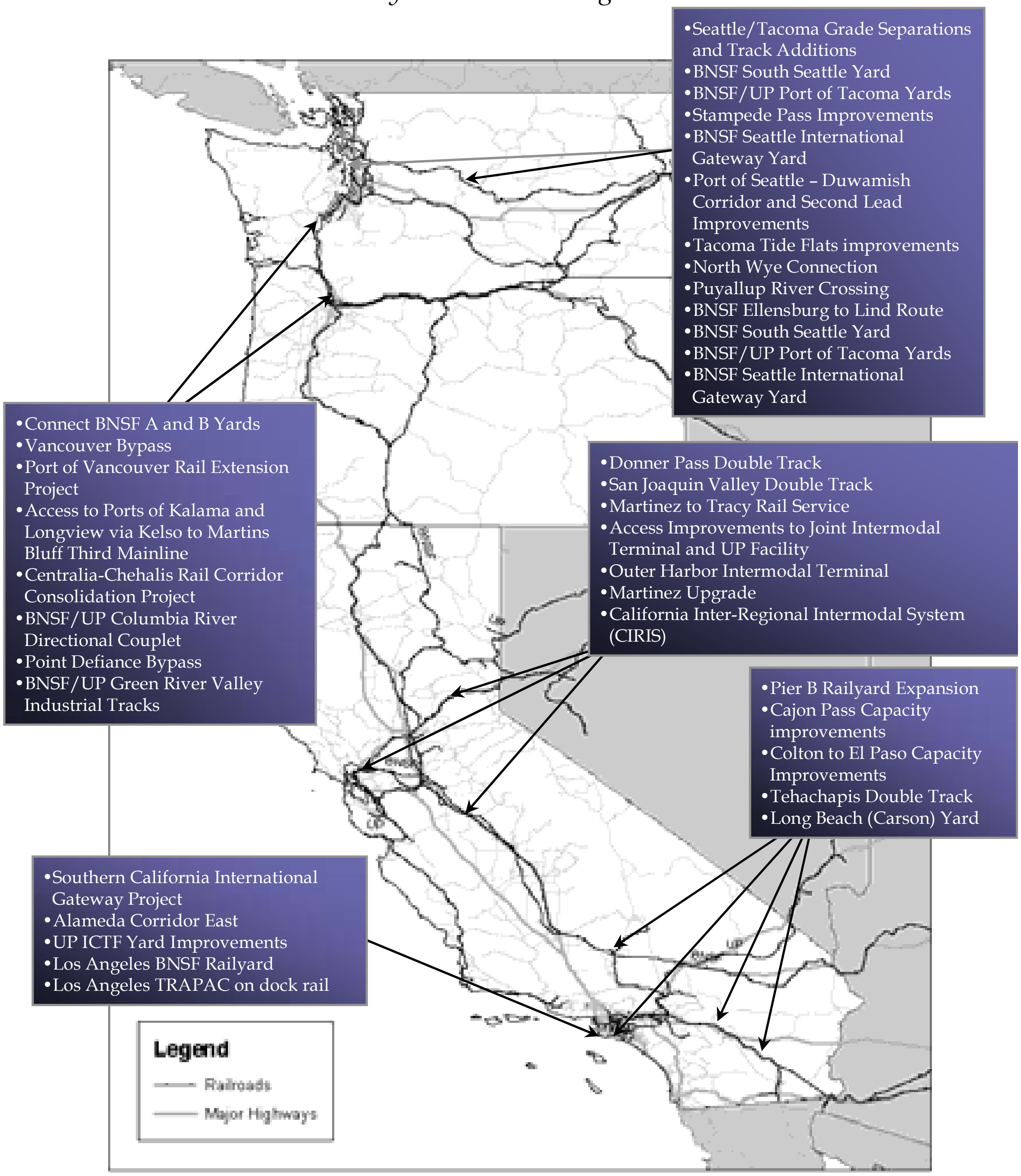


Figure 3.32 Representative Port Access and Highway Corridor Improvements
Under Consideration by West Coast Freight Stakeholders

Figure 3.33 Representative Rail Yard and Corridor Improvements
Under Consideration by West Coast Freight Stakeholders



In addition to these infrastructure investments, there is increasing interest in using innovative operational strategies to maximize existing system capacity. Examples of operational strategies include:

- **PierPass Off-Peak Program**, implemented at the Ports of Los Angeles and Long Beach. This program uses pricing techniques as part of a congestion mitigation and air quality improvement strategy. All international container terminals at the Los Angeles and Long Beach ports implemented five new shifts per week – Monday through Thursday nights, and during the daytime on Saturdays. In addition, a Traffic Mitigation Fee was created, and is required for cargo movement through the ports during peak hours (Monday through Friday, 3:00 a.m. to 6:00 p.m.). This fee is used as a congestion pricing mechanism providing an incentive to use the off-peak shifts. Similar strategies may not be appropriate for all the region's ports, but PierPass has shown promise at the Ports of Los Angeles and Long Beach.

- **Railroad operational strategies.** Railroads, both nationally and within the West Coast region, are utilizing "hook-'n-haul" strategies, moving connections off of main lines, and running longer and heavier trains:

  - Hook and haul strategies involve the railroads picking-up and dropping-off large blocks of railcars, leaving the assembly and disassembly of these blocks to the industries or to short line railroads. This strategy, which increases train velocity by reducing the number of stops the railroads make for individual railcars, is generally performed off of the main lines, on track owned by shippers/industries or short lines, thus freeing the main lines for through trains.

  - Longer and heavier trains also are being used by the railroads to maximize existing capacity and improve efficiency. For example, the BNSF prefers that all their international intermodal shipments be handled in 40-foot well cars and all their intermodal trains are 8,000 feet in length. These changes will allow the BNSF to increase the amount of freight that can be handled over its mainlines without increasing the number of trains. However, the longer trains cannot be handled without lengthening sidings to permit trains to meet and pass; and without providing the corresponding yard capacity to assemble and hold the longer trains. Adding sidings and expanding terminals is a major challenge in densely developed urban areas. Railcar weights also are increasing, with many Class I main lines now capable of handling 315,000-pound railcars.

- **Port operational improvements**. Ports in the region have taken a variety of operational and technological approaches to improving cargo throughput efficiency. Operational improvements tend to focus on how to better utilize existing infrastructure, such as extending truck gate hours of operation at The Port of Vancouver. These strategies encourage trucks to operate on port access routes during less-congested hours, and increase truck trip turnover time. Another operational improvement is the reorganization of Backlands (container storage) space at the Port of Los Angeles, which will allow for higher density of containers and an increased utilization of port land. Technology enhancements largely deal with using information to more efficiently manage port operations. An example of this is the on-line truck wait monitoring systems at the Ports of Seattle and Vancouver (WA). These programs are attempting to increase the efficiency of the ports by sharing real-time information about truck wait times and thereby reducing the amount of truck time spent waiting at the port gates. The Port of Seattle has also developed a Radio Frequency Identification (RFID) Pilot program at its Terminal 18 facility, through which more than 1,500 trucks have been outfitted with RFID tags. Through August 2007, nearly two-thirds of truckers indicated that these tags saved time at the gates by streamlining the egress process.

Taken together, the combination of infrastructure investments and operational strategies will enhance system capacity, but will not keep pace with overall freight demand on the system.

In addition to these and other improvements being made within the West Coast region, there are significant investments being made in freight infrastructure outside the region in an attempt to capture some portion of rising freight demand. The Panama Canal Authority, for instance, is undertaking an expansion project in order to boost trade – particularly containerized trade from Asia – through the Canal. More than $700 million has been invested in Mexican ports since the late 1990s, particularly at the Ports of Manzanillo and Lazaro Cardenas along the Pacific coast. In addition, Mexico plans to begin taking bids to construct a new port at Punta Colonet in the State of Baja California Norte as well as a 350-kilometer (217-mile) railroad to connect with the U.S.-Mexico border. Construction may begin in 2008. Finally, Canadian National Railway (CN) has made significant mainline and access infrastructure and operational investments to handle the container traffic between Prince Rupert Sound and major Canadian and Midwest U.S. markets.

These investments, coupled with aggressive marketing to Asia-based shippers, may allow these ports to capture market share from West Coast competitors. However, their overall impact is likely to be minimal for three key reasons. First, even if these facilities are on line and operating at full capacity within the next 15 to 20 years, overall freight demand may still outstrip system capacity, particularly in the high-growth scenario described earlier.

Second, to make a meaningful impact on West Coast freight demand, these and other facilities will need to make significant investments in highway and rail connections in order to offer competitive service to major U.S. markets. In many cases, the planning, funding, and development of these intermodal connections lags behind the investments being made at the waterside.

Finally, there is a significant local market for goods among the megaregions of the West Coast and many of these megaregions represent major industry hubs for manufacturing, distribution and warehousing, and other industries. Many shippers will continue to use existing gateways to serve these industries, regardless of trade and transportation investments being made elsewhere.

■ 3.4 There are Policy and Institutional Constraints to Enhancing Capacity at the System Level

The West Coast states understand the importance of investing in the regional trade and transportation system. But while there are a number of planned freight improvement projects that would increase the overall capacity and efficiency of the system, only a handful have progressed beyond the discussion stage. This lack of action can be traced in large part to a number of policy and institutional issues, i.e., key social, financial, legal, and environmental matters, that combine to limit the ability of the West Coast states to add or enhance the transportation system capacity in a meaningful way.

There are several characteristics of the West Coast region that play a considerable role in how some of these institutional issues have developed. First, three of the regions states are contiguous and have transportation systems that are highly interconnected. Although their transportation systems are intertwined, these states consist of a mosaic of counties, cities, and towns, which have a wide array of government, oversight, and administrative functions. When coupled with the variety of freight stakeholders and facilities in the region, which include ports and port authorities, airports and airport authorities, railroads, and others, this structure can make it challenging to coordinate infrastructure improvements, operational strategies, and transportation and economic development policies across jurisdictional boundaries. Second, individual states in the region are dependent upon each other for a significant amount of trade. Alaska, for example, is heavily dependent on goods shipped through ports in Washington State. Washington State has long been a gateway to Alaska, which is the Puget Sound region's fifth largest trading partner. There are similarly close economic and trade connections among many of the other states in the region. Finally, the region is the primary gateway for international trade entering the country, though its seaports, airports, and border crossings. Consequently, freight movements into, out of, and through the region can be affected by the policies, procedures, and practices of other agencies and stakeholders, such as customs and law enforcement, shippers, or logistics providers, well outside the region. Existing and emerging institutional issues that are impacting the ability of the region to enhance system capacity and absorb anticipated growth in freight traffic are described in the following sections.

Policy and Investment Decisions are Not Made at the System Level

As discussed earlier, the West Coast region's trade and transportation system is highly interconnected. International and domestic freight shipments in the region often involve more than one mode, travel through several jurisdictions in the region, and serve far-flung national and international markets. However, operations, management, and investment decisions affecting this system are often made at the state and local levels (for highways and intermodal connectors), at the facility level (for ports and airports), or at the national corridor level (for railroads).

Although there are many instances where policy, infrastructure, or operations decisions in one jurisdiction (or mode) would impact key bottlenecks in another, no effective institutional arrangement exists to discuss or coordinate these system-level decisions that cross jurisdictional or modal boundaries. This is complicated by the fact that there is no guiding national policy that spells out appropriate public and private sector roles and or that provides financial and decision-making mechanisms for planning and investing in the transportation system. When coupled with the nearly complete earmarking of available freight funding programs at the Federal level, states and MPOs are finding it increasingly difficult to make system-level investment decisions. This issue is described in the following case study.

Case Study – Coordinating Rail Capacity Improvements

As described earlier, there are several rail corridors in the West Coast region that are at or near capacity. In Washington, these include two key east-west routes: the Stevens Pass tunnel and the mainline from Stampede Pass, through Spokane and into Sandpoint, Idaho. These facilities, shown in the figure at left, provide a critical link between the state's seaports and inland regional and national markets. However, increasing congestion along these routes is impacting the efficiency of the freight railroads, the region's seaports, and even passenger rail service between Washington and Oregon, as limited service on the east-west network often results in congestion on the north-south network.

A number of different east-west capacity building projects have been discussed within Washington to alleviate these chokepoints. These include improving Stampede pass to allow for double-stack trains, restoring the Old Milwaukee line from Ellensburg to Lind, and incorporating "Bridging the Valley" improvements for the Spokane to Sandpoint section. But while these improvements may improve rail movements within Washington, it is unclear how costs and benefits should be shared, as the largest benefits of these projects may be to the railroads and national shippers, rather than the state itself. More importantly, it is unclear what implications any of these improvements might have on the West Coast trade and transportation system, particularly how these improvements would impact the viability of other proposed rail improvements in the region (such as improvements at Donner Pass or Tehachapi Pass in California) or how they would influence other rail or port operational strategies or investment decisions. Because there are limited modeling tools, institutional arrangements, and funding strategies that states and MPOs can use to guide these sorts of decisions, it is difficult to identify packages of potential solutions, quantify their costs and benefits, and determine how costs, risks, and benefits should be shared among freight stakeholders.

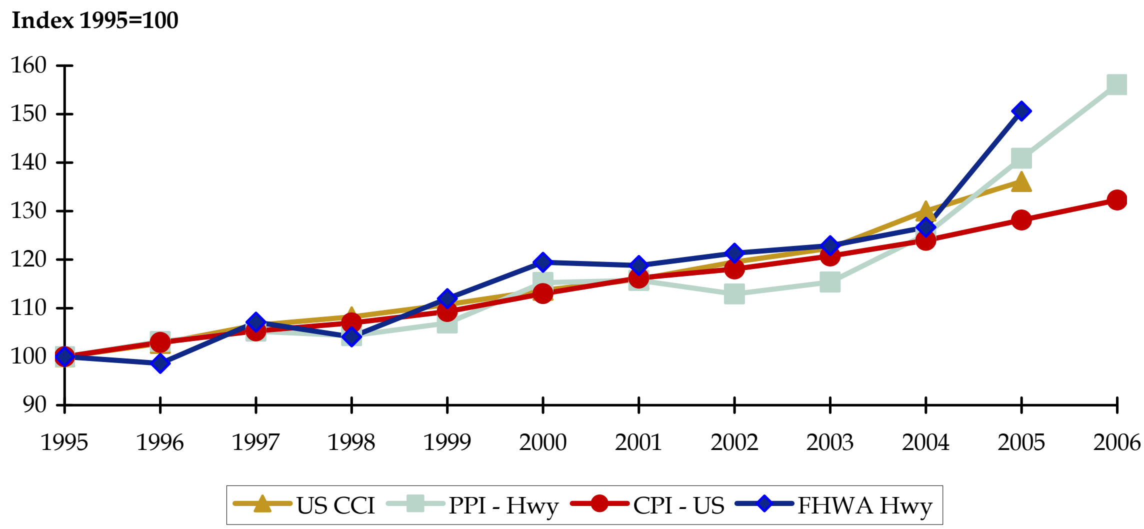
There is Insufficient Funding at the State Level to Address System Chokepoints

Another key institutional issue is the availability of funding resources with which to make system improvements. The West Coast states have not been idly waiting for Federal assistance. In fact, all states and MPOs in the region already commit a large portion of their budgets to the maintenance and preservation of their current highway systems, and (as described earlier) many have been investing significantly in a variety of freight infrastructure projects that have local, regional, and national benefits. The California Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006 (Proposition 1B), for instance, authorized the sale of $20 billion of general obligation bonds to fund transportation projects to relieve congestion, improve the movement of goods, improve air quality, and enhance the safety and security of the transportation system. In addition, since 1998 the Freight Action Strategy Team (FAST), a coalition of public and private partners in the Puget Sound maritime freight gateway, has leveraged $568 million of public and private funding for strategic freight mobility infrastructure improvements. Finally, the Washington State Legislature has enacted two revenue packages to support investment highway, rail, ferry, transit, freight, and local transportation projects across the state. The "Nickel" package, enacted in 2003, provides $4.2 billion (thru 2013) funded by a five-cent per gallon fuel tax, a 15 percent increase in gross weight fees on heavy trucks, and a 0.3 percent increase to the state motor vehicles sales tax. The Transportation Partnership Act (TPA) package (enacted 2005) provides $8.5 billion (thru 2021) funded by a 9.5 cent per gallon fuel tax increase (to be phased in over 4 years) and other fee increases.

However, construction (e.g., concrete, steel, labor) and maintenance (e.g., highway crack and joint repairs) costs have been increasing faster than the general rate of inflation (six to eight percent versus five percent) over the last several years (see Figures 3.34 and 3.35, which show growth in various construction costs indices and maintenance costs, respectively). These increases have caused the purchasing power of transportation dollars to decline, particularly in the last several years. Compounding this issue is the fact that the region's vehicle fleet, in aggregate, is becoming more fuel efficient and these efficiency gains are outpacing growth in vehicle-miles traveled on the system. Improvements in fuel efficiency will continue to decrease overall gas tax revenues, particularly at the Federal level; and there is little appetite among many statewide and national transportation decision-makers in modifying existing gasoline or diesel tax rates. All of this is exacerbated by the fact that the West Coast states are "donor" states – paying more in Federal gas tax than they receive back in Federal transportation aid – leaving less for the states to invest in the system.

Figure 3.34 Construction Costs Indices (1995 to 2006)[6]

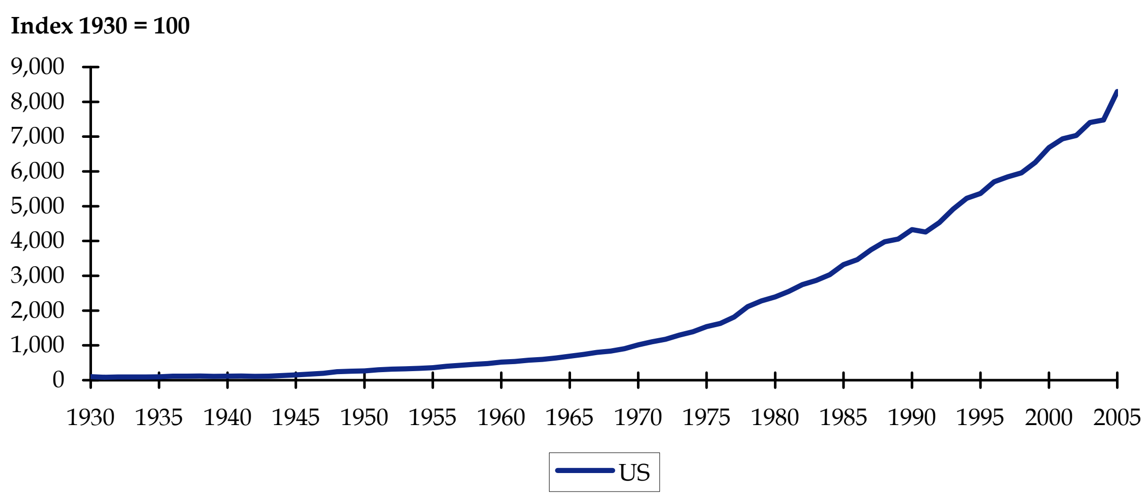
1995=100



Source: FHWA, U.S. Bureau of Economic Analysis

Figure 3.35 Maintenance Cost Increases (1930 to 2005)

1930=100



Source: FHWA Highway Statistics, 2005

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[6] Shows increases in Consumer Price Index (CPI), Building Cost Index (BCI), Highway Construction Cost, Construction Cost Index (CCI), Producer Price Index (PPI), and FHWA Estimates of Highway Construction costs.

There are Significant Environmental and Community Constraints to Adding System Capacity

The growth in international trade and the corresponding increase of inland highway freight and rail traffic is exacerbating congestion along trade corridors and at seaports, airports, and intermodal terminals. Though system capacity expansion is a logical solution to manage the increases in freight volumes expected over the next several decades, many ports and railroads within the West Coast region and the rest of the United States are facing an acute shortage of land suitable for development for a variety of reasons, including burgeoning cargo volumes at existing facilities, as well as the ecological, historical, or cultural sensitivity in and around the areas where many of these improvements are necessary. The problem of meeting system needs is further complicated by pressures to "reclaim waterfronts" with competing non-marine development, such as housing and high-value commercial/industrial land uses that may generate higher revenues for local governments.

Additionally, there are a variety of state, federal, and local agencies involved in the planning and approval of freight systems improvements. Interlocking requirements for coordination among federal, state, and local agencies, along with permit and environmental approvals, can significantly expand the time required to plan and implement projects, often driving up the cost of a project significantly. Although these reviews and approvals serve an essential function, the costs of the reviews themselves, in dollars, time to complete, and uncertainty, are substantial. Changes in practices and policies that engage affected stakeholders and communities earlier and more consistently in the process and encourage collaboration and consensus building may ultimately shorten delivery time and reduce the difficulty of efficiently matching capacity to demand.[7]

Expansion of freight facilities in existing locations also can create other serious environmental and environmental justice concerns, as these facilities are usually located in environmentally sensitive waterfront or urban areas and access improvements may generate additional truck or rail trips in air quality nonattainment regions. Freight-related pollutants, and in particular NO_x, and particulates ($PM_{2.5}$), make it harder to attain health-based national, state, and regional air quality goals, and many goods movement sources are regulated Federally, not at the state level. Southern California is facing Federal attainment dates of 2014 and 2019 for annual and 24-hour $PM_{2.5}$ standards and 2023 for attainment of the eight-hour ozone standard. The Ports of Seattle, Tacoma, and Vancouver (BC), through the Northwest Ports Clean Air Strategy, are also undertaking a voluntary systemwide program to reduce maritime, port-related emissions that affect air quality and climate change in the Pacific Northwest.

In addition, neighborhoods adjacent to ports and those that are located along major highway and rail trade corridors are often those that house the poorest citizens in the community. Many ports are under pressure to resolve their access problems while

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[7] Transportation Research Board, *Freight Capacity for the 21st Century.*

minimizing additional community impacts. Cleaner engines are the primary strategy being used to meet air quality goals. But other strategies, such as improving wait tines at port gates, truck-only toll lanes, extensive rail grade separation projects, and freight rail electrification may also be needed to help the region meet its long-term ozone air quality targets. Growing concern at the state and regional level about carbon footprints and greenhouse gas emissions associated with global trade only adds to potential constraints on freight capacity.

4.0 Conclusions

This section presents the conclusions of the study, which were developed from the analysis of freight, trade, and transportation trends in the West Coast, and from the identification and description of key chokepoints, constraints, and issues in the region. These conclusions are meant to provide a foundation to allow the West Coast Corridor Coalition and its member states to begin addressing specific systemwide issues and chokepoints that cross jurisdictional, interest (i.e., public/private), and financial boundaries.

The West Coast trade and transportation system plays a vital role in the national supply chain and distribution system and the region is a critical driver of national and regional economic vitality.

The West Coast trade and transportation system is a critical gateway for freight traffic entering and leaving the country while also serving the domestic trade traffic between megaregions on the West Coast and the rest of the U.S. Goods moving through this system serve local, regional, national, and international markets. The region's ports, airports, and border crossings serve commodities that play vital roles in ensuring the diversity and vitality of the national economy, including wheat, agricultural products, automobiles, and other goods. While the region's east-west transportation infrastructure still handles the lion's share of international freight shipments moving through the region's gateways into national markets, in recent years the region's north-south transportation infrastructure, with I-5 as its backbone, has emerged as a crucial trade corridor for both domestic commerce and international trade, connecting West Coast metropolitan areas and serving increasing volumes of NAFTA-related shipments.

The West Coast is also a key driver of the national economy, particularly its high-technology and research sectors, which have helped propel the region's electronics, software, aerospace, medical, and entertainment industries to world leadership. In each of the last five years, the West Coast has accounted for more than 15 percent of total U.S. economic growth since 2001. Industries in the region rely on a safe, reliable, and efficient freight transportation system to ship raw materials, components, and finished products to markets within the region as well as to other locations within the United States and throughout the world. These industries also provide a significant number of jobs and income to West Coast residents working for the businesses that process, ship, and deliver goods. Overall, these and other industries have helped drive the overall gross domestic product (GDP) of the West Coast to $2.2 trillion in 2006, making it the seventh largest economy in the world.

Physical, operational, and institutional issues in the region will not allow the trade and transportation system to absorb anticipated growth in freight demand.

The West Coast's population and employment, economy, employment, and trade levels are growing significantly. The region is expected to add over 13.5 million people during the next 24 years and will reach a population of 60.8 million by 2030, the same population in 2030 as present day France. Employment growth is expected to grow apace. The freight demand to support this growing population and economy – both domestic and international – is expected to approximately double by 2030. Trade among the West Coast megaregions is expected to grow even more rapidly in the same time period, from about 145 million tons to nearly 366 million in 2030.

Although the region's freight transportation system is managing this existing demand, there are several physical, operational, and institutional issues that will, individually or collectively, hinder the ability of region's trade and transportation from effectively serving expected growth in freight traffic. The region's population and employment growth will be overwhelmingly concentrated in the region's urban areas, also home to many of the region's key international trade gateways. These growth patterns will make it difficult for the region to expand system capacity without significant environmental, social, and financial costs. Major chokepoints along the region's highway and rail systems – both east/west and north/south – already are impacting system reliability, constraining port growth and efficiency, and impacting international trade as well as domestic trade among West Coast megaregions. And while operational and institutional strategies are being used effectively to mitigate the impacts of these chokepoints, this will become more difficult as freight demand continues to increase and as shippers continue to demand high-speed, high-quality, and highly reliable service.

Continued growth in freight demand, coupled with the fact that the environmental, social, and financial costs of adding capacity to the system continues to rise, will require the physical, operational, and institutional issues affecting the West Coast region to be appropriately addressed. Not addressing regional chokepoints and issues will have significant impacts on the region's transportation system and economic competitiveness.

A systemwide, regional approach is required to address these challenges.

Traditional approaches to planning and investing in the transportation system, which relies on states and metropolitan areas to identify and program improvements within their own jurisdictional boundaries, are not adequate to meet these challenges. Although state and local planning and funding strategies can be useful for making localized improvements to the region's trade and transportation system, they are not well suited for identifying and funding improvements to the regional and national infrastructure issues West Coast trade and transportation system, or placing state or facility-specific investment decisions in a regional or national context.

Financing these system capacity improvements requires a regional or national approach and investments must be made at the network level, i.e., those key elements at the top of the system: capacity chokepoints along regionally significant corridors; at ports, airports, and intermodal terminals; and at urban rail or highway interchanges and connectors. Currently, there are limited opportunities for states to work together to fund multijurisdictional, system-level improvements. Developing and implementing specific funding solutions and mechanisms to facilitate new innovative funding and project delivery options will require a strong Federal and state role. Most importantly, though, addressing these challenges will require a willingness to plan and fund freight system improvements across boundaries – the jurisdictional boundaries between West Coast states and MPOs; the interest boundaries between public agencies and the private sector freight community; and the competitive boundaries among the region's seaports and airports.

■ 4.1 Addressing these Challenges

Traditional approaches to planning and investing in the transportation system, which rely on states and metropolitan areas to identify and program improvements within their own jurisdictional boundaries, are not adequate to meet these challenges. Addressing these challenges will require a willingness to plan and fund freight system improvements across boundaries – the jurisdictional boundaries between West Coast states and MPOs, the interest boundaries between public agencies and the private-sector freight community, and the competitive boundaries among the region's seaports and airports.

This report highlights the need for West Coast freight stakeholders to take a different approach to planning and investing in the West Coast trade and transportation system as discussed below.

Working with Federal partners to invest in nationally significant trade and transportation resources.

It is clear that the West Coast trade and transportation system represents a nationally significant asset. The West Coast Corridor Coalition welcomes the emergence of a strong Federal role in partnering to protect and enhance this asset. Current Federal programs for gateway and corridor improvements have seen limited funding, and the range of Federal freight funding resources has been too diluted to tackle the costly problems facing the international gateway systems and trade corridors of the West Coast system. This report identifies a number of system chokepoints that would benefit from a strong partnership with the Federal government to invest in gateways and corridors of national significance.

Making targeted, system-level investments in the freight system across jurisdictional boundaries.

Although state and local planning and funding strategies can be useful for making localized improvements to the region's trade and transportation system, they are not well suited for identifying and funding improvements to the regional and national infrastructure issues facing the West Coast trade and transportation system, or placing state-level or facility-specific investment decisions in a regional or national context. Perhaps more so than many other regions, West Coast financing of transportation systems has become increasingly focused on local revenue sources, and freight investments reflect local priorities. While several states have taken bold steps to address multimodal freight system investment needs within their respective states (such as the California Trade Corridor Investment Fund and the Connect Oregon program), no such vehicles exist for multistate planning and programming.

Identifying, planning, and financing freight system improvements requires a regional or national approach; and investments must be made at the network level (i.e., capacity chokepoints along regionally significant trade corridors; at ports, airports, and intermodal terminals; and at urban rail or highway interchanges and connectors). Currently, there are limited opportunities for states to work together to identify funds for these sorts of multi-jurisdictional, system-level improvements. Developing and implementing multistate planning and funding mechanisms to facilitate new innovative funding and project delivery options will require a strong Federal and state role.

Promoting innovative approaches to congestion, both within and through major metropolitan areas.

Congestion within the West Coast region's metropolitan areas not only impacts urban mobility, it also hinders regional and national economic competitiveness. Chokepoints in the West Coast region, most of which are located at urban interchanges, at access points to international freight gateways, and along urban bypass facilities, not only impact the efficient flow of goods within and among major metropolitan areas along the West Coast, they also impact the overall efficiency of freight movements accessing national markets. While congestion at these urban chokepoints will not completely shut down the West Coast trade and transportation system, they will have significant safety, efficiency, and economic impacts.

Promoting innovative planning, funding, and project development strategies that relieve this congestion – both within and through the major metropolitan areas of the West Coast – will be critical to helping the region absorb growth in freight traffic and drive regional and national economic vitality. Strategies such as the PierPASS Off Peak program at the San Pedro Bay ports, increasing interest in corridor-level ITS strategies, and pricing and user fee programs (such as tolled truck lanes) are gaining growing interest among the West Coast states. A coordinated approach and sharing of best practices could benefit all stakeholders in the region, and facilitate continued growth in freight traffic in the growing megaregion centers.

Developing freight investment models that incorporate market and economic principles while ensuring environmental sustainability.

Many states and MPOs along the West Coast have been investing significantly in a variety of freight infrastructure projects that have local, regional, and national benefits. However, existing institutional arrangements and funding strategies make it difficult for states and MPOs to identify logical packages of potential freight improvement projects; quantify their costs and benefits; and determine how costs, risks, and benefits should be shared among public and private freight stakeholders.

The nation needs new freight system investment approaches that reflect both public- and private-sector benefits of freight projects, are supported by performance metrics to ensure accountability, and are consistent with environmental and community needs will improve the ability of states, MPOs, and private-sector freight stakeholders to make targeted, appropriate investments in the West Coast trade and transportation system, and improve mobility for people and goods regionwide. West Coast states, MPOs, and ports are actively engaged in developing new approaches and supporting data systems to evaluate freight system performance improvements and prioritize investments. Partnership opportunities with other multistate regions could benefit national efforts to gain greater adoption of these methods.

States, MPOs, ports, and special purpose authorities along the West Coast are experimenting with innovative financing, but there are obstacles. Public investment in private infrastructure is often prohibited by law, and approaches that blend public and private financing require clear delineation of public and private benefits and a nexus between cost responsibility and benefits. The analytical tools necessary to support these decisions and the appropriate public-private decision-making institutional arrangements should be funded and supported at the federal level to help ensure standardized adoption and implementation.

Developing new approaches to balancing environmental protection and community interests with system expansion needs.

Many gateway communities along the West Coast suffer the health and safety impacts of increasing trade volumes that serve national interests. While this trade activity also brings economic benefits to these communities, the appropriate balance between local and national benefits and these local impacts has been difficult to achieve. Community resistance to port and infrastructure expansion is increasingly the norm at West Coast gateways. Innovative approaches to environmental permitting, clean freight technology development, and new community participation models are all in the early stages of adoption along the West Coast. These efforts can serve as national models and should receive Federal support.

Appendix A

List of Steering Committee Members

A. List of Steering Committee Members

Sean Ardussi, Puget Sound Regional Council

Jeannie Beckett, Port of Tacoma

Katy Brooks, Port of Vancouver (Washington)

Michael Bufalino, Oregon Department of Transportation

Christina Casgar, San Diego Council of Governments

Carolyn Clevenger, Metropolitan Transportation Commission

Hugh Conroy, Whatcom Council of Governments

Linda Culp, San Diego Association of Governments

Scott Drumm, Port of Portland

Michelle Fell-Casale, California Department of Transportation

Gary Gallegos, San Diego Association of Governments

Elissa Hicks, Washington Department of Transportation

Barbara Ivanov, Washington Department of Transportation

Therese McMillan, Metropolitan Transportation Commission

Richard Nordahl, California Department of Transportation

Jeff Ottesen, Alaska Department of Transportation

Deena Platman, Portland Metro

Geraldine Poor, Port of Seattle

Larry Pursley, Washington Trucking Association

Bob Russell, Oregon Trucking Association

Jeff Spencer, California Department of Transportation

Elizabeth Stratton, Washington Department of Transportation

Jim Tutton, Washington Trucking Association

Scott Witt, Washington Department of Transportation

Christine Wolf, Port of Seattle

Andrew Wood, Washington Department of Transportation

Appendix B

Demand and Supply Analysis Framework

B. Demand and Supply Analysis Framework

This technical appendix presents the framework used by the consulting team for the freight demand and supply analysis as part of the WCCC West Coast Trade System Analysis task. The framework, which was developed based on a comprehensive literature review of available freight studies and data sources, allowed the project team to utilize existing materials to develop a comprehensive and consistent picture of the West Coast trade and transportation system. The framework presented in the subsequent sections describes the two types of analyses that were used to complete the study:

- **Freight Demand**, which involves the analysis of base year and forecast international (marine, air cargo and NAFTA) and domestic (megaregion interregional) freight demand in the study area; and
- **Freight System Characteristics**, which involves the analysis of base year and future conditions of the freight transportation system in the study area by highlighting key capacity (supply) constraints and bottlenecks.

B.1 Freight Demand

This section describes the project team's approach to analyzing base year and forecast freight demand in four key areas:

- International shipments to and from the region's seaports;
- Inland movements of international shipments to and from the region's seaports;
- NAFTA-related commodity movements; and
- Domestic flows between West Coast Megaregions and between the West Coast and other regions.

International Shipments To and From the Region's Seaports (Base Year and Forecasts)

For the estimation of base year and forecast international commodity flow demand through west-coast seaports, the FAF2 commodity origin-destination (O-D) database was used as the initial source for the data compilation. FAF2, developed by the FHWA, estimates tonnage and value of goods shipped by type of commodity and mode of transportation among and within 114 areas, to and from 7 international trading regions though the 114 areas, and through 17 additional international gateways. The 2002 estimate is primarily based on the Commodity Flow Survey and other components of the Economic Census. Forecasts derived from robust economic forecasting methods as well as assumptions on relative market shares of international trade are included for 2010 to 2035 in five-year increments.

Although FAF2 represents the most comprehensive and geographically consistent commodity flow dataset, it is critical to compare the FAF2 base-year estimate and forecasts with individual port-specific data sources to ensure consistency. The project team compared the FAF2 base-year estimates with existing port demand estimates. If inconsistencies were found between FAF2 data and individual port demand estimates, further analysis and discussions with the affected ports guided the determination of the final set of base-year demand estimates.

A similar process was used to develop a forecast up to 2030. Again, the project team compared FAF2 forecasts with those available from individual west-coast ports to arrive at high and low ranges of forecasts. For cases where there were major discrepancies between FAF2 estimates and the individual port forecasts, the team conducted further analysis and worked directly with the ports to arrive at a consensus on the final set of port cargo forecasts.

There were several key work steps that guided the development of the base year and forecast demand analysis using the FAF2 database:

- **Develop consensus among the west-coast seaports on use of the FAF2 database**. Although few seaports in the region actively utilize the FAF2 to guide their own planning activities, it will be important to develop consensus on its use at a regional, multiport level to ensure consistency. The project team made contacts with the ports not represented at initial project meetings (Oakland, Los Angeles, and Long Beach) and received feedback on their thoughts about using the FAF2 database;

- **Estimate base-year containerized, bulk, and break-bulk cargo demand through the west-coast seaports**. The FAF2 database only provides cargo throughput for the seaports in terms of flows by commodity type. However, it is important to understand how these commodity flows translate into containerized, bulk, and break-bulk shipments, as these types of movements have different impacts on the transportation system and are impacted differently by capacity constraints and bottlenecks. The project team therefore gathered information for each port on base-year shares of throughput for each commodity by containerized, bulk, and break-bulk cargo from individual port statistics/data sources as well as from discussions with the ports. These shares were then applied to the FAF2 estimates to arrive at equivalent base year and forecast demand estimates in terms of containerized, bulk, and break-bulk cargo;

- **Estimate mode splits (truck and rail) for containerized, bulk, and break-bulk cargo flows**. Using the international cargo flows by commodity type from the FAF2 database by mode (truck and rail), and the information on the shares of flows by commodity type for each port by containerized, bulk, and break-bulk cargo, estimates of mode splits (truck and rail) for each port for containerized, bulk, and break-bulk cargo were derived from the FAF2 database. However, in order to ensure the accuracy of these estimates, they were compared and vetted against mode split data available from individual ports for containerized, bulk, and break-bulk cargo;

- **Estimation of empty container flows:** Since FAF2 provides international freight flow demand through the seaports in terms of commodity flows, it does not provide the capability to analyze base-year empty container movements through the seaports. Therefore, the estimation of base year and forecast empty container flows was made using information available from individual port data sources, as well as through discussions with the seaports. A key issue that was considered particularly for the forecasts is whether the estimates of empty container movements account for the implementation of future operational strategies by the seaports (for example, the application of empty container management (ECM)/virtual container yard (VCY) strategies for reduction of port empty container truck trips);

- **Assess freight demand through Canadian seaports.** Since the FAF2 database does not provide commodity flow data through Canadian west-coast seaports, the base year and forecast commodity flow data from the Canadian seaports was used directly for the demand estimation. The project team worked directly with Canadian seaports to collect, analyze, and vet this information. As part of this analysis, the project team paid particular attention to expected market shares of Lower Mainland (British Columbia) seaports of Asian trade and the potential impacts of new marine terminal developments on the Canadian west-coast (e.g., Prince Rupert in British Columbia) being appropriately accounted for in future-year market share assumptions for seaports in the U.S.

Inland Movements of International Shipments (Base Year and Forecasts)

The FAF2 commodity O-D database also was used for the estimation of inland origins and destinations of base year and forecast international cargo flows through the U.S. west-coast seaports, and to arrive at international trade flows through major trade lanes (for example, north-south and east-west). Again, FAF2 provides the most geographically consistent source of commodity flow data, allowing the project team to understand the ultimate origins and destinations of international commodity shipments impacting the region's transportation system.

There were two key work steps that guided the development of the base year and forecast demand analysis using the FAF2 database:

- **Validate FAF2 inland O-D estimates with data available from the individual west-coast ports, to the maximum extent possible:** Many ports in the region have conducted their own O-D studies. Where these studies are available, the project team ensured that port-specific O-D flows were consistent with FAF2 estimates. The project team made contacts with these ports to obtain information on the availability of inland O-D flows from the ports; and

- **Validate FAF2 inland O-D estimates with traffic flow data:** In addition, there are a wide range of modal traffic flows available within the region. The project team therefore conducted a high-level comparative analysis along major trade corridors between the freight flow estimates by mode from the FAF2 database with available modal traffic flows. For example, freight flows by truck from the FAF2 database along a corridor were converted to equivalent truck flows using payload factors. These flows were then compared to truck counts and/or model outputs to ensure consistency.

NAFTA-Related Commodity Movements (Base Year and Forecasts)

The FAF2 commodity O-D database also was used for the estimation of base year and forecast NAFTA freight demand between U.S. and Canada/Mexico through border-crossing locations in the study area (which include Washington-Canada and California-Mexico border crossings), and by mode (truck and rail). As described earlier, FAF2 provides commodity flow information at 24 international border crossings.

In order to ensure the accuracy of modal NAFTA freight flow demand estimates from FAF2 for the base year, these estimates were compared against existing modal border crossing traffic flow data available from the Bureau of Transportation Statistics, U.S. Customs and Border Protection, the Canada Customs and Revenue Agency, and Aduana México, Mexico's customs agency. The project team compared NAFTA-related truck freight demand estimates available from FAF2 with these border-crossing truck counts to ensure consistency.

Domestic (Megaregion Interregional) Freight Demand (Base Year and Forecasts)

The FAF2 commodity O-D database was used to estimate base year and forecast domestic freight demand in the study area related to megaregion domestic interregional trade. This analysis focused on domestic flows between West Coast Megaregions (Puget Sound metropolitan area, Portland-Vancouver metropolitan area, San Francisco bay area, and Los Angeles metropolitan area) and between the West Coast and other regions.

Air Cargo Demand

For base-year air cargo demand through major airports in the study area, cargo data reported by airlines to individual airports was be used as the initial baseline data source. The airports require airlines to report air freight and air mail tonnage, typically on a monthly basis, which served as an initial robust data source for the base-year air cargo demand analysis. The airline-reported data was then compared and vetted against the following data sources, to the extent possible, to ensure consistency in the demand estimates.

- **U.S. DOT T-100 database:** This is available for all airports, showing air cargo total, or mail/freight separately, for both international and domestic trade; and

- **U.S. Commerce database:** This database was used mainly for the comparison of international air cargo imports/exports.

Forecast air cargo demand data was derived from the airport master plans available from major airports in the study area. As part of the forecast air cargo demand estimation, the following issues were addressed:

- **Establishment of forecast year:** Due to the differences in the forecasting periods across airport master plans, a consistent normalized horizon year was established for the air cargo forecasts; and

- **Validation of air cargo forecasting assumptions:** Since the air cargo forecasts were derived using data available from individual airports (master plans and discussions with planning/forecast staff), the issue of the potential existence of mutually exclusive air cargo forecasts without internally consistent market share assumptions across airports was addressed as part of the estimation of air cargo demand forecasts. This was done by analyzing the underlying air cargo forecasting assumptions available to the extent possible from individual airports related to growth in trade, airport market shares, etc. to identify any glaring aberrations. These assumptions also were compared against other available data sources (for example, data sources on air cargo trade forecasts by region) to perform reality checks on related forecasting assumptions. As part of this process, the consultant team also conducted discussions with airport planning and operations staff to arrive at internally consistent and consensus-based air cargo forecasts across major airports in the study area.

■ B.2 Freight System Characteristics

An assessment of the characteristics of the region's freight transportation system helped the project team identify key physical chokepoints that currently are hindering transportation system efficiency and/or are expected to impact the ability of the system to absorb future growth. The study team's approach to assessing the region's highway, rail, air, and port system characteristics is described below.

Highway Network Characteristics

The FAF2 highway network was used for the analysis of base year and forecast highway system characteristics in the study area pertaining to highway network capacity constraints and bottlenecks along major highway freight corridors (for example, key segments of the I-5 north-south corridor), freight access routes (for example, access routes to major freight facilities like seaports and rail intermodal terminals), and truck border crossing locations. The results from the initial assessment of highway capacity constraints and bottlenecks using the FAF2 highway network was then compared and vetted at a high level against data available from local, regional, and statewide freight/goods movement studies to ensure consistency. Also, as part of the consistency check, the team worked with each of the states to do a reality check on the results obtained from the FAF2 network analysis.

The consultant team used HPMS truck counts as a comprehensive and internally consistent data source of truck counts for the validation of FAF truck flows on the study area highway network. Where discrepancies were found between HPMS counts and available state-level counts, the states were consulted to arrive at a consensus for accurate truck volume data. As part of the analysis of highway system characteristics using the FAF2 network, the consultant team also used the HPMS highway traffic flow data in conjunction with network flow data available from FAF2 to identify FAF and non-FAF trucks on the highway network. This allowed the project team to assess major long-haul truck freight movements, as well as urban area nonfreight truck movements (for example, those associated with service trucking activity), along key corridors.

Rail Network Characteristics

Analysis of the rail network system characteristics involved looking at base year and forecast rail network flows in terms of number of trains along major corridors, as well as identifying key existing and forecast rail network capacity constraints and bottlenecks in the study area. Initial assessment of rail network flows in terms of number of trains along major corridors in the base and future (2030) years was made using data/information available from regional/statewide rail studies in the study area. Some of the key studies that provided base year and forecast rail network flow data include the Washington Statewide Rail Capacity and System Needs study (December 2006), the Freight Rail and the Oregon Economy study (March 2004), and the Inland Empire Railroad Mainline Study (June 2005). The consultant team also assessed the availability of rail network flow data for the San Francisco bay area from current and past rail studies conducted in the region. In order to perform a reality check on the rail network flows estimated from available studies, these results were vetted to the extent possible based on discussions with the railroads as well as regional planners and steering committee members to ensure consistency in the estimates.

Similar to the rail network flow estimation, initial assessment of existing- and forecast-year rail terminal and network capacity constraints and bottlenecks were identified using information available from existing regional and statewide rail studies conducted in the study area. Again, the Washington Statewide Rail Capacity and System Needs study, the Freight Rail and the Oregon Economy study, and the Inland Empire Railroad Mainline Study were key sources for compiling this information for the base and future years. Information available from these studies were vetted to the extent possible based on discussions on rail network capacity constraints and bottlenecks with the railroads as well as regional planners and steering committee members in order to ensure consistency in the estimates.

Air Cargo System Characteristics

Analysis of the air cargo system characteristics in the study area involved looking at existing and forecast capacity constraints and bottlenecks in the air cargo system. The particular focus areas in this analysis included air cargo terminal capacity and airport runway capacity constraints and bottlenecks for major airports in the study area. Current and past master plans available from major airports were the primary data sources used for compiling information on air cargo system characteristics. The initial assessment of air cargo system characteristics for the base and future years from the master plans was vetted based on discussions with regional aviation and airport planners to ensure consensus, as well as identification of all the critical air cargo system capacity issues in the study area.

Port System Characteristics

The analysis of port system characteristics involved looking at existing and forecast capacity constraints and bottlenecks in the west-coast marine terminal infrastructure in the study area. Focus areas in this analysis included capacity of marine terminals to handle base and projected cargo throughputs (and associated bottlenecks), capacity constraints associated with channel depths, on-dock rail yard capacity constraints, and marine terminal gate throughput capacity constraints, among others. Information on existing and forecast marine terminal capacity constraints and bottlenecks in the study area was compiled using data available from port planning studies (to the extent these are available for major west-coast seaports), which were then supplemented with information obtained from direct discussions with the ports.

Appendix C

Port Demand Forecast

C. Port Demand Forecast

This technical appendix discusses the approach and results of the port forecast, using the methodology outlined in Appendix B. The appendix is organized as follows:

- **Identification of Key West Coast Region Trends and Issues.** There are several trends both within and outside the West Coast region in terms of economic growth, trading patterns and partners, and infrastructure investments that may impact freight demand on the West Coast. This section discusses these trends and assesses how they might affect overall freight demand in the region;
- **Determination of Initial Base-Year Data.** This section discusses the derivation of base-year (2002) FAF2 port demand estimates and compares it to those obtained from the individual seaports in order to arrive at an initial estimate of base-year port demand, and shipment type splits;
- **Development of Growth Factors based on FAF2 and Other Sources.** This section presents the methodology for developing cargo growth factors from the FAF2 data and existing plans and studies. Compound annual growth rates (CAGR) are presented for high- and low-growth scenarios, taking into account the various port trends and issues discussed previously; and
- **Development of the forecasts.** The growth factors are applied to the base-year data to arrive at high- and low-growth forecasts for each port.

C.1 Key Regional Trends and Issues

An important component of the West Coast Trade and Transportation Study is the identification of key areas of uncertainty regarding future system demands and how these areas of uncertainty relate to overall freight demand. Many of these uncertainties revolve around:

- **Economic growth**, i.e., how will the region's economy (and the economies of key trading partners) evolve and how will these patterns impact trade and transportation in the region;
- **Trade patterns and partners,** i.e., how will the region's trading partners evolve and what impact will that have on key trade lanes and gateways; and
- **Infrastructure investments of the other states and countries,** i.e., what port, rail, and roadway infrastructure investments are planned or underway and how will they impact trade flows?

This section describes several trends and issues in these categories that, individually or collectively, may impact future freight demand at ports in the region. Both the probability and potential implications of this initial set of port-related issues was discussed in more detail with the WCCC Goods Movement Committee. The feedback gathered from the committee was used to further fine-tune the port demand forecast.

Trend 1 – Infrastructure Investments

There are several current or planned infrastructure investments, described below, that will impact freight demand in the region.

- **Panama Canal Expansion**. The Panama Canal Authority is undertaking a $5.25 billion expansion project that would involve the construction of two lock facilities (one on each side of the Canal); the excavation of new access channels to the new locks and widening of existing channels; and the deepening of the existing navigation channels. Construction is expected to begin in 2007 and the new set of locks would begin operation by 2015.[1] In addition to these significant infrastructure investments, the Panama Canal Authority has developed strategic partnerships with key United States ports, including the Port of Houston, to boost trade through the Canal.

- **Prince Rupert Container Terminal Development.** When fully completed, the Prince Rupert Container Terminal will have total container capacity of two million TEUs. Phase I of the project, on track to open in 2007, will have a 500,000 TEU capacity; Phase II, which will add an additional 1.5 million TEUs of capacity, is expected to be completed in 2010. In addition, Canadian National Railway (CN) is planning to upgrade its northern mainline serving the new facility by making tunnel and bridge improvements to accommodate double-stack trains.

- **Mexican Port Development**. More than $700 million has been invested in Mexican ports since the late 1990s, particularly at the Ports of Manzanillo and Lazaro Cardenas along the Pacific coast. Manzanillo already is Mexico's busiest seaport, connecting Asian manufacturers with Eastern U.S. markets through the Panama Canal and handling approximately one million TEUs annually. Manzanillo currently is the only port in Mexico offering double-stack service to the U.S. (via the FerroMex railway). Manzanillo currently is planning to invest $150 million to double its docking capacity, container storage, and transfer space through the development of a new terminal at Laguna de Cuyutlan. Completion of this container terminal will increase its overall footprint to approximately 8,378 acres. The Port of Lazaro Cardenas currently is investing $290 million to expand its capacity to 2.5 million TEUs (up from 180,000 today).

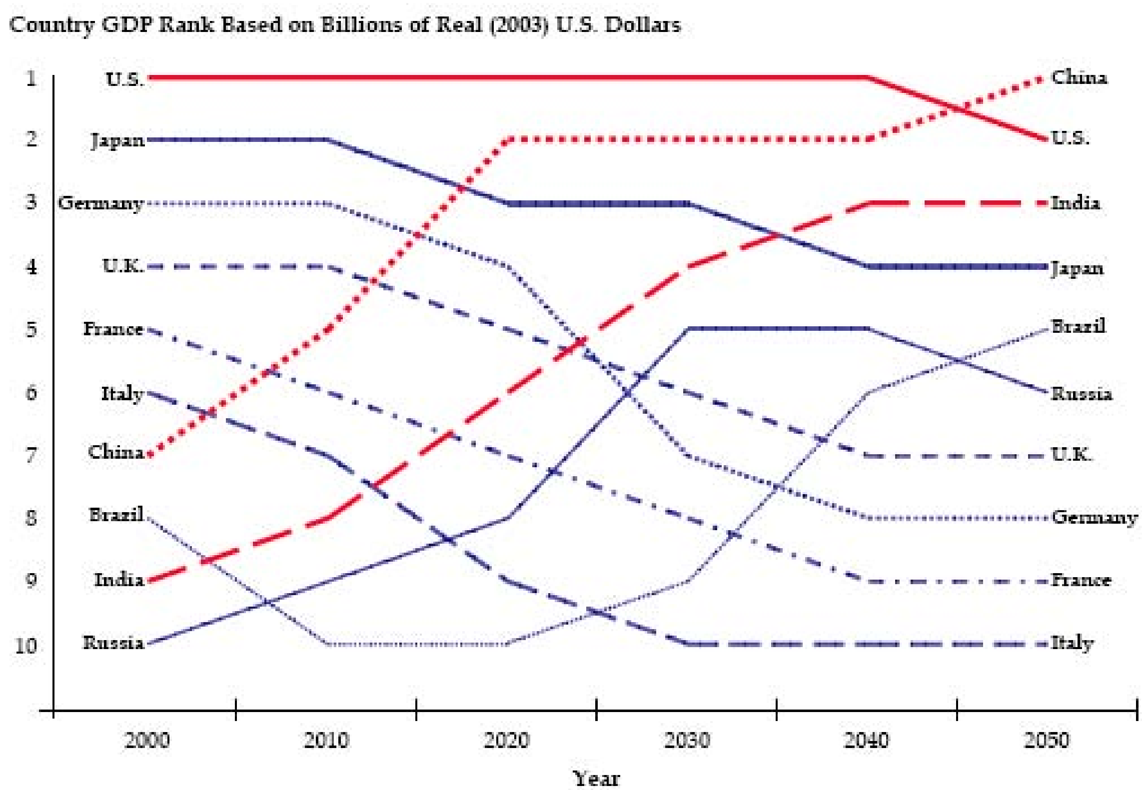
[1] Panama Canal Authority (ACP) – Proposal for the Expansion of the Panama Canal. April, 2006.

The combination of wider navigation channels and locks (to allow post-Panamax ships to navigate through the Canal), coupled with strategic marketing partnerships with key United States ports, will increase demand through the Canal itself and for ports along the Gulf and East Coasts. Some Asia-based shippers may begin to use the expanded Canal to serve Midwestern and Southeastern U.S. markets (via the Port of Houston, Charleston, or Savannah). In addition, the Prince Rupert Container Terminal, along with the Ports of Manzanillo and Lazaro Cardenas, will provide alternative connections to major Midwestern markets, Northeastern markets, and east-west highway and rail corridors. These connections, coupled with significant capacity increases and aggressive marketing to Asia-based shippers, may allow these ports to capture market share from West Coast competitors.

Trend 2 – Shifting Trade Lanes

Changes in trading partners and trade routes will alter the volume of freight moving though West Coast ports and along the highway and rail systems. Figure C.1 ranks the top 10 world economies by the projected size of their real GDP for each decade between 2000 and 2050.

Figure C.1 GDP Growth Rates for Top 10 Global Economies



As can be seen, China is expected to have the world's largest economy by 2050. U.S. import and export trade with China will continue to dominate freight flows through West Coast ports. Also evident in Figure C.1, however, is the slowly growing economies of Western Europe, particularly Italy, France, and Germany. Demand for freight transportation between the U.S. and these countries will grow slowly, too, freeing capacity at some U.S. Atlantic and Gulf Coast ports. Some of this capacity will be absorbed by trade with the rapidly expanding economies of India, Russia, and Brazil, which will displace some freight that now moves from the Pacific Rim through West Coast ports and overland by rail to East Coast markets.

Trend 3 – Changes in Supply Chain Strategies

As has been documented in many reports and studies, there has been a broad shift in business logistics practices from manufacture-to-supply or inventory-based "push" supply chains to manufacture-to-order or replenishment-based "pull" supply chains. These "pull" supply chains have proven effective. Inventory turns, a common measure of the speed with which material moves through a company's supply chain, increased from an average of eight turns per year in 1995 to an average of 21 in 2005. The constant pressure to improve the speed and efficiency of these supply chains has led to nearly continuous experimentation and innovation, some of which will impact freight flows through West Coast ports. Current trends include:

- **Landside infrastructure investments**. Shippers are investing in infrastructure to handle "pull" supply chains by investing in additional warehousing, deconsolidation, and transfer facilities in and around port areas;

- **Empty container repositioning**. Although both imports and exports are growing at West Coast ports, imports continue to outpace exports, leading to a demand for empty containers to be filled with finished products and ultimately returned to the U.S. Shipments of empty containers grew by 6.4 percent to 2.3 million TEU in 2006. To reduce costs associated with repositioning and shipping empty containers, some shippers are considering investing in disposable containers; and

- **Changes in the maquiladora industry**. Maquila manufacturers have begun to take advantage of their proximity to major U.S. markets by encouraging North American customers to custom order with short turnaround times (24 to 48 hours), allowing them to compete more effectively with lower-cost Asia-based manufacturers. This strategy has increased shipments of raw materials from Asia to Mexican ports, and has encouraged some shippers to pack containers in Asia for direct delivery to U.S. stores, eliminating the cost of repacking for final delivery.

These and other changes in supply chain and logistics strategies may have implications on West Coast ports. Load center ports may experience shifts in shipments of raw materials to ports in Canada or Mexico; smaller ports may experience increased volumes, if shippers continue to distribute directly to U.S.-based stores. In addition, changes in empty container repositioning and deployment strategies will impact volumes and truck/rail activity at West Coast ports.

Trend 4 – Labor Uncertainty

A dispute between the Pacific Maritime Association, which represents West Coast shipping companies and port terminal operators, and the International Longshore and Warehouse Union (ILWU) effectively closed 29 West Coast ports for 11 days in 2002 and had significant regional, national, and international economic and transportation impacts, estimated by some at $147 million per day. In the spring and summer of 2008, several master contracts in the transportation, warehousing, and distribution industries are set to expire, including:

- **National Master Freight Agreement** of the Teamsters union (which now includes both rail workers in addition to truckers and warehouse employees) expires on March 31, 2008. This agreement covers economic issues, such as wages, pensions, health care benefits, and certain working conditions, while local supplements (which are negotiated concurrently with the master agreement) cover work rules, local wage rates, and operating conditions;

- **National Master Auto Transportation Agreement**, which covers the economic issues of car haulers, expires on May 31, 2008;

- **ILWU/Pacific Maritime Association coast-wide agreement**, which ended the 2002 West Coast Ports lockout, expires on July 1, 2008; and

- Any labor disruptions associated with the renegotiations of these contracts could have significant impacts on West Coast freight volumes.

Trend 5 – Fluctuating Energy Costs

Finally, fluctuating energy costs also may impact overall freight volumes through West Coast ports. Energy is a larger part of the total cost of air and truck transportation than it is of rail or water transport costs. Dramatic increases in energy costs can make rail and water more cost-effective for shippers than truck or air. These energy costs also can impact the mode-split of shipments entering and departing port facilities. In addition, if transportation costs increase significantly, locally produced goods could gain a cost advantage over distant goods. Buyers may cut back on overseas suppliers and purchase more materials and parts from local sources.

■ C.2 Determination of Initial Base-Year Data

This section outlines the approach used by the project team to develop a base-year international commodity flow demand through WCCC seaports. This initial review of the data focused on the following key tasks:

- Determine an appropriate base-year data set by:
  - Identifying FAF2 flows through WCCC seaports; and
  - Comparing FAF2 flows with available data from individual West Coast ports to determine a recommended base-year dataset.
- Applying shipment type (bulk, breakbulk, container) splits to the base-year data.

Identifying Freight Flows Through the Ports

The geographic structure of the FAF2 data set includes 114 domestic regions, which correspond to Metropolitan Statistical Areas (MSA), Consolidated Statistical Areas (CSA), and states or balances of states used in the 2002 Commodity Flow Survey. West coast regions include:

- Alaska;
- Los Angeles/Long Beach/Riverside, California;
- San Diego/Carlsbad/San Marcos, California;
- Sacramento/Arden-Arcade/Truckee, California;
- San Jose/San Francisco/Oakland, California;
- Remainder of California;
- Portland/Vancouver/Beaverton, Oregon;
- Remainder of Oregon;
- Seattle/Tacoma/Olympia, Washington; and
- Remainder of Washington.

The FAF2 data set also provides data for 17 additional international gateways, two of which are in the WCCC study area:

- Anchorage, AK; and
- Blaine, WA.

There also are seven foreign trade regions:

- Canada;
- Mexico;
- Latin and South America;
- Asia;
- Europe;
- Middle East; and
- Rest of World.

To identify international freight demand through the WCCC seaports, the FAF2 data were queried to identify records where the "Port" field was one of the West Coast regions or international gateways. Base-year total tonnage through the west coast regions (in thousands of tons) was calculated based on the results of this query (Table C.1). This data was further subdivided into imports and exports by identifying the records originating in or destined for any of the seven international regions used in the FAF2 data set.

Table C.1 West Coast Total Tonnage, Imports, and Exports by Region
FAF2 Data, 2002

	Base		
Region/Gateway	**2002**	**Imports**	**Exports**
Anchorage	664	251	413
Alaska	7,650	524	7,126
Los Angeles/Long Beach/Riverside	95,689	67,974	27,715
San Jose/San Francisco/Oakland	10,481	5,029	5,453
San Diego/Carlsbad/San Marcos	1,861	1,730	131
Sacramento/Arden-Arcade/Truckee	601	316	284
Remainder of CA	33,076	27,759	5,316
Portland/Vancouver/Beaverton	15,249	4,048	11,202
Remainder of OR	1,950	160	1,790
Seattle/Tacoma/Olympia	26,482	12,176	14,306
Remainder of Washington	19,714	5,598	14,115
West Coast Total	**213,416**	**125,565**	**87,851**

Compare FAF2 to Available Port Statistics

It is critical to compare the freight demand volumes estimated by FAF2 with other published sources, particularly base-year volumes that will be used to develop forecasts. Table C.2 below compares total West Coast tonnage from the FAF2 data set with total tonnage derived from published port statistics. Where possible, 2002 data from individual ports were used, to ensure an apples-to-apples comparison with the FAF2 data (2002 base year). When port-specific or non-2002 data were not available, we used historical data identified as part of the literature review, such as SCAG's Port and Modal Elasticity Study, data available from the American Association of Port Authorities (AAPA), and other sources.

Table C.2 Comparison of Published Port Statistics to FAF2 Outputs
Thousands of Tons

	Ports	FAF2	Percent Difference
West Coast Total Tonnage	**268,321**	**213,416**	**20%**

As Table C.2 demonstrates, the FAF2 underestimates total West coast cargo volumes by approximately 20 percent (for 2002). As such, the project team determined that it was more appropriate to use published West Coast port statistics as the base year (2002).

In addition, FAF2 does not account for movements into and out of Canadian ports. Consistent with the use of port-specific data for the West Coast Ports base-year data, 2002 import/export data were obtained for three Canadian seaports: Vancouver, Prince Rupert Sound, and Fraser River. These data were added to the existing U.S. ports to develop an aggregate West Coast port base-year summary, shown in Table C.3.

Table C.3 Base-Year (2002) Tonnage for and TEUs for WCCC Ports

	Base Year (2002)		
United States Ports	**Bulk (tons)**	**Breakbulk (tons)**	**TEUs**
Anchorage	1,284,584	1,056,113	472,406
Nikishka	3,299,011	881,909	0
Los Angeles	29,101,019	790,538	6,105,863
Long Beach	42,609,551	3,173,154	4,526,465
San Diego	1,211,823	1,043,111	107,239
Oakland	2,568,266	2,568,266	1,707,827
Richmond	11,736,453	1,173,645	0
Portland	6,660,855	1,463,824	255,745
Vancouver, Washington	3,800,000	587,264	45
Seattle	3,117,911	192,662	1,438,872
Tacoma	3,971,534	366,968	1,470,834
Anacortes	1,584,787	1,584,787	0
Longview	2,020,187	2,020,187	0
Kalama	9,228,769	0	0
Rest of Alaska	0	0	0
Rest of Washington	1,202,660	1,202,660	0
Rest of Oregon	1,761,643	127,517	0
Rest of California	8,579,349	2,721,842	310,177
Total	**133,738,402**	**20,954,446**	**16,395,473**
Canadian Ports			
Vancouver	52,447,000	3,517,000	1,458,280
Prince Rupert	4,932,000	0	0
Fraser River	3,256,000	1,757,623	100,544
Total	**60,635,000**	**5,274,623**	**1,558,824**
Grand Total	**194,373,402**	**26,229,069**	**17,954,297**

C.3 Development of Growth Factors based on FAF2 and Other Sources

A number of different data sources were consulted to arrive at acceptable growth rates to be used in the forecast. These included port-specific forecasts (such as Anchorage and Oakland), FAF2 growth rates, and national growth rates derived from the AASHTO Water Bottom Line Reports. A set of compound annual growth rates (CAGR) was developed for application to the base-year data presented above to arrive at a forecast for 2030. In order to "bracket" the forecast based on the trends and issues described above, a high-growth and low-growth scenario was developed for each port. These growth rates were derived using the following methodology:

- **Port-Specific High-Low Scenarios –** If the port already had a high-low growth forecast, the CAGR for those respective scenarios was used;

- **Port-Specific Forecasts –** If there was a port-specific forecast but no high-low scenario, the FAF2 growth rate was used as the low-growth scenario while the port's own forecast was used for the high-growth CAGR;

- **No Port-Specific Forecasts –** If no forecast was available from the port itself, national averages from the AASHTO Water Bottom Line Reports were used for the low-growth scenario and FAF2 rates were used for the high-growth scenario; and

- **Adjust as Necessary to Eliminate Outliers –** In consultation with the individual ports, high- and low-growth rates were adjusted to eliminate outliers.

The high- and low-growth rates that were used for the forecast and their sources are presented in Tables C.4 and C.5.

Table C.4 Growth Rates for High-Growth Scenario

United States Ports	CAGR (High Growth) Bulk (tons)	Breakbulk (tons)	TEUs
Anchorage	2.40%[a]	1.00%[a]	3.40%[a]
Nikishka	3.09%[b]	1.00%[c]	8.00%[c]
Los Angeles	3.34%[b]	6.17%[d]	6.50%[d]
Long Beach	3.34%[b]	6.17%[d]	6.50%[d]
San Diego	2.02%[b]	2.22%[b]	8.00%[c]
Oakland	3.40%[b]	6.17%[d]	7.22%[a]
Richmond	3.40%[b]	6.17%[d]	8.00%[c]
Portland	2.00%[a]	5.32%[a]	6.75%[a]
Vancouver, Washington	1.20%[a]	2.90%[a]	8.00%[c]
Seattle	1.20%[a]	2.90%[a]	4.00%[a]
Tacoma	1.20%[a]	2.90%[a]	9.63%[d]
Anacortes	1.20%[a]	2.90%[a]	8.00%[c]
Longview	2.00%[a]	1.00%[c]	8.00%[c]
Kalama	2.00%[a]	1.00%[c]	8.00%[c]
Rest of Alaska	3.09%[b]	1.00%[c]	8.00%[c]
Rest of Washington	1.20%[a]	2.90%[a]	8.00%[c]
Rest of Oregon	1.00%[c]	1.00%[c]	8.00%[c]
Rest of California	5.42%[b]	6.17%[d]	8.00%[c]
Canadian Ports			
Vancouver	1.40%[a]	1.70%[a]	6.50%[c]
Prince Rupert	1.40%[a]	1.70%[a]	15.00%[d]
Fraser River	1.40%[a]	1.70%[a]	8.00%[c]

[a] Port-specific forecast.
[b] FAF growth rate.
[c] National average.
[d] Adjusted.

Table C.5 Growth Rates for Low-Growth Scenario

	CAGR (Low Growth)		
United States Ports	**Bulk (tons)**	**Breakbulk (tons)**	**TEUs**
Anchorage	0.50%[a]	0.00%[a]	0.50%[a]
Nikishka	1.00%[c]	0.06%[b]	0.00%[d]
Los Angeles	1.00%[c]	1.00%[c]	3.43%[b]
Long Beach	1.00%[c]	1.00%[c]	3.43%[b]
San Diego	1.00%[c]	1.00%[c]	3.37%[d]
Oakland	1.00%[c]	1.00%[c]	4.37%[d]
Richmond	1.00%[c]	1.00%[c]	4.42%[b]
Portland	-0.60%[a]	1.05%[a]	0.14%[a]
Vancouver, Washington	1.00%[c]	1.00%[c]	4.00%[a]
Seattle	1.00%[c]	1.00%[c]	2.93%[d]
Tacoma	1.00%[c]	1.00%[c]	4.00%[a]
Anacortes	1.00%[c]	1.00%[c]	4.00%[a]
Longview	1.00%[c]	0.80%[a]	1.50%[a]
Kalama	1.00%[c]	0.80%[a]	1.50%[a]
Rest of Alaska	1.00%[c]	0.06%[b]	0.00%[d]
Rest of Washington	1.00%[c]	1.00%[c]	1.50%[a]
Rest of Oregon	-0.30%[b]	-0.11%[b]	0.37%[b]
Rest of California	1.00%[c]	1.00%[c]	3.04%[b]
Canadian Ports			
Vancouver	1.00%[c]	1.00%[c]	3.50%[a]
Prince Rupert	1.00%[c]	1.00%[c]	7.20%[a]
Fraser River	1.00%[c]	1.00%[c]	7.20%[a]

[a] Port-specific forecast.
[b] FAF growth rate.
[c] National average.
[d] Adjusted.

■ C.4 Development of Forecasts

The above growth rates were then applied to the base-year (2002) data for each port to arrive at low- and high-growth forecasts for 2030. The results are presented in Tables C.6 through C.8.

Table C.6 Bulk Cargo Port Demand Forecast

United States Ports	Base Year (2002)	Low Growth (2030)	High Growth (2030)
Anchorage	1,284,584	1,477,108	2,495,521
Nikishka	3,299,011	4,358,953	7,734,761
Los Angeles	29,101,019	38,450,914	73,017,170
Long Beach	42,609,551	50,091,032	86,794,055
San Diego	1,211,823	1,601,171	2,121,427
Oakland	2,568,266	3,393,427	6,549,606
Richmond	11,736,453	15,507,269	29,930,361
Portland	6,660,855	5,627,931	11,596,710
Vancouver, Washington	3,800,000	5,588,310	5,860,030
Seattle	3,117,911	4,119,667	4,354,297
Tacoma	3,971,534	5,247,552	5,546,418
Anacortes	1,584,787	2,093,965	2,213,223
Longview	2,020,187	2,669,254	3,517,194
Kalama	9,228,769	12,193,889	16,067,510
Rest of Alaska	0	0	0
Rest of Washington	1,202,660	1,589,064	1,679,567
Rest of Oregon	1,761,643	1,619,505	2,327,643
Rest of California	8,579,349	11,335,816	37,609,596
Total	**133,738,402**	**166,964,828**	**299,415,089**
Canadian Ports			
Vancouver	52,447,000	69,297,747	77,407,562
Prince Rupert	4,932,000	6,516,607	7,279,236
Fraser River	3,256,000	4,302,123	4,805,595
Total	**60,635,000**	**80,116,478**	**89,492,393**
Grand Total	**194,373,402**	**247,081,306**	**388,907,482**

Table C.7 Breakbulk Cargo Port Demand Forecast

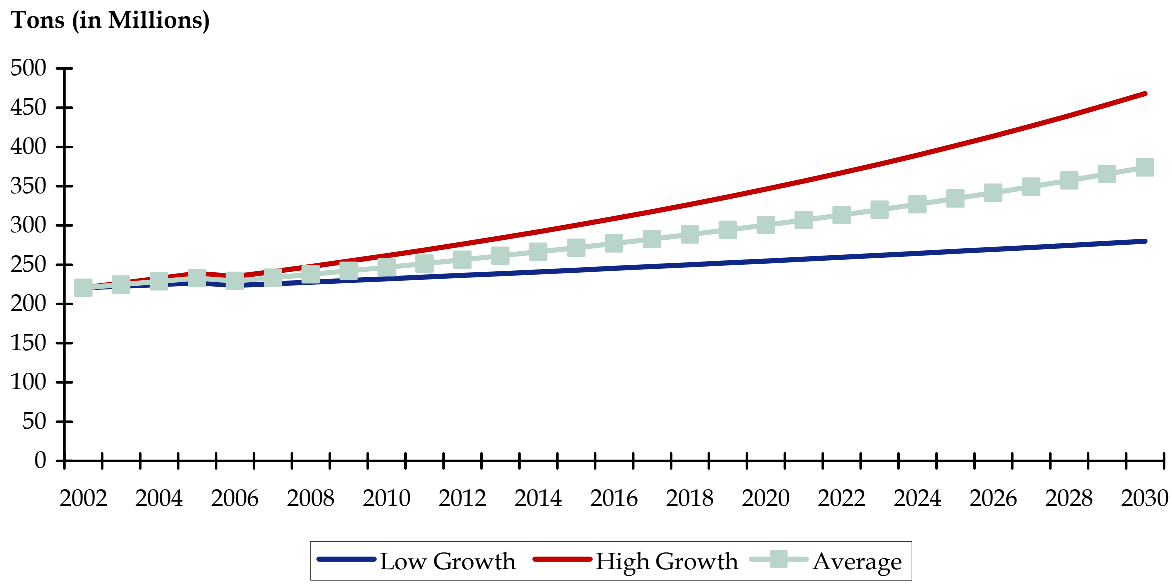
United States Ports	Base Year (2002)	Low Growth (2030)	High Growth (2030)
Anchorage	1,056,113	1,056,113	1,395,433
Nikishka	881,909	896,845	1,165,258
Los Angeles	790,538	1,044,530	4,226,428
Long Beach	3,173,154	2,793,416	9,256,915
San Diego	1,043,111	1,378,253	1,929,013
Oakland	2,568,266	3,393,427	13,730,646
Richmond	1,173,645	1,550,727	6,274,625
Portland	1,463,824	1,961,127	6,248,743
Vancouver, Washington	587,264	1,003,955	1,570,255
Seattle	192,662	254,563	428,970
Tacoma	366,968	484,872	817,069
Anacortes	1,584,787	2,093,965	3,528,592
Longview	2,020,187	2,525,145	2,669,254
Kalama	0	0	0
Rest of Alaska	0	0	0
Rest of Washington	1,202,660	1,589,064	2,677,771
Rest of Oregon	127,517	123,647	168,487
Rest of California	2,721,842	3,596,345	14,551,700
Total	**20,954,446**	**25,745,994**	**70,639,158**
Canadian Ports			
Vancouver	3,517,000	4,646,980	5,638,441
Prince Rupert	0	0	0
Fraser River	1,757,623	4,302,123	2,817,815
Total	**5,274,623**	**8,949,104**	**8,456,256**
Grand Total	**26,229,069**	**34,695,098**	**79,095,413**

Table C.8 Containerized Cargo Port Demand Forecast

United States Ports	Base Year (2002)	Low Growth (2030)	High Growth (2030)
Anchorage	472,406	543,207	1,204,732
Nikishka	0	0	0
Los Angeles	6,105,863	17,972,421	30,606,877
Long Beach	4,526,465	16,175,179	27,546,189
San Diego	107,239	271,268	925,162
Oakland	1,707,827	5,656,698	12,027,250
Richmond	0	0	0
Portland	255,745	265,962	1,592,604
Vancouver, Washington	45	328	812
Seattle	1,438,872	3,229,962	4,314,750
Tacoma	1,470,834	4,410,595	19,301,331
Anacortes	0	0	0
Longview	0	0	0
Kalama	0	0	0
Rest of Alaska	0	0	0
Rest of Washington	0	0	0
Rest of Oregon	0	0	0
Rest of California	310,177	717,420	2,675,930
Total	**16,395,473**	**49,243,040**	**100,195,637**
Canadian Ports			
Vancouver	1,458,280	3,820,944	8,504,131
Prince Rupert	0	530,487	2,862,518
Fraser River	100,544	704,385	867,404
Total	**1,558,824**	**5,055,817**	**12,234,052**
Grand Total	**17,954,297**	**54,298,856**	**112,429,690**

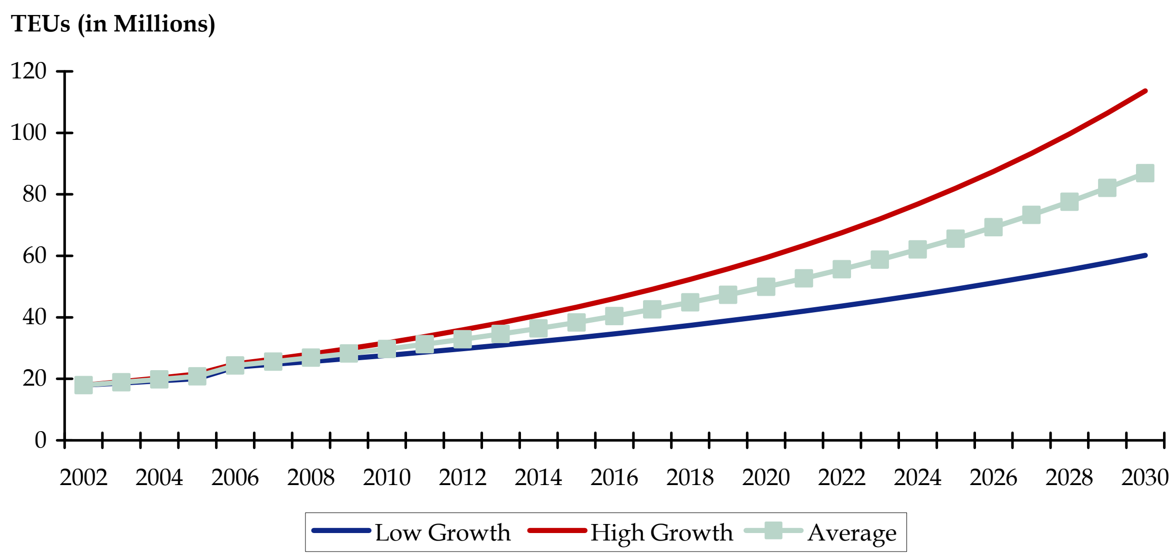
The averages of the high and low forecasts were then calculated to arrive at a "most likely" scenario for bulk/breakbulk and containerized cargo, as shown in Figures C.2 and C.3.

Figure C.2 WCCC Bulk and Breakbulk Growth
2002 to 2030



Source: Cambridge Systematics, HDR.

Figure C.3 WCCC TEU Growth
2002 to 2030



Source: Cambridge Systematics, HDR.

Appendix D

Air Cargo Forecast

D. Air Cargo Forecast

D.1 Introduction

This technical appendix describes the air cargo component of the study. The appendix provides 2030 forecasts for air cargo for nine West Coast Airports: Alaska's Ted Stevens International Airport (ANC); British Columbia's Vancouver International Airport (YVR); Washington's Sea-Tac (SEA) and King County International Airport, also known as Boeing Field (BFI); Oregon's Portland International Airport (PDX); the Bay Area's San Francisco International Airport (SFO) and Oakland International Airport (OAK) and Southern California's Los Angeles International Airport (LAX) and Ontario International Airport (ONT).

- **Corroborating air cargo forecasts.** Review and discussion of both the forecasts and trend factors with airport planning staff added greatly to the value of this technical appendix.[1] The project team reviewed master plan data with each airport, and determined the latest best forecasts for the respective facility. When 2030 data was unavailable, forecasts for that year were either interpolated, or airport-approved growth rates were applied to historic or projected volumes to arrive at a 2030 forecast year that is consistent across all airports.

- **Identifying growth factors from the airport master plans and other airport sources**. The Project Team reviewed airport planning documents and incorporated general and airport-specific trend factors into a discussion of how a wide range of infrastructure, industry/logistics, and institutional factors would influence projected growth in air cargo volumes.

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[1] This technical memorandum is based in large part on information and insights generously shared by the following airport management and staff experts: Rich Wilson, Master Plan Project Manager and Eric Miyashiro, Project Manager/Contract Manager, ASCG Inc.,(ANC); Alix Yi, Manager, Cargo Marketing, Cargo and Business Development (VYR); Geri Poor, Port of Seattle, and Tom Green, Business Development Analyst (Port of Seattle/SEA); Gary Molyneaux, Manager of Planning and Program Development (BFI); Ivar Satero, Deputy Airport Director, Design and Construction, Danielle Rinsler, Associate Deputy Airport Director, Planning, and Vishal Tivedi (SFO); Kristi McKenney, Port of Oakland Aviation Planning Manager, and Hugh Johnson, Aviation Project Manager, (OAK); and Paula McHargue, Manager, Forecasting and Regional Plans, Los Angeles World Airports (LAX and ONT.) Thanks also to Mike Armstrong (Aviation Specialist, Southern California Association of Governments) and members of the WCCC Technical Committee.

D.2 Key Findings

- "Aircraft carry around 2 percent of international trade by volume, but around 40 percent by value"- FedEx chief operating officer Michael Ducker
- Globally, air cargo volumes are expected to triple over the next 20 years; [2]
- West Coast airports typically project a doubling of volumes in the 20 years ending in 2025. Anchorage and Los Angeles are and will remain the West Coast leaders in air cargo.
- West Coast airports include 5 of the top 50 air cargo airports in the world (2006): Anchorage (3rd); Los Angeles (10th); Oakland (31st); San Francisco (33rd); and Ontario (38th).
- Unlike passenger travel forecasts, air cargo is more closely related to trends in the general economy than to population.
- Key factors influencing future air cargo growth are U.S. Transportation Security Administration (TSA) guidelines and restrictions; equipment changes; fuel costs; land-side constraints; community opposition to expansion. Less predictable factors such as wars and outbreaks of airborne diseases can quickly and drastically impact passenger (and, thus, belly cargo) operations.
- With respect to which specific airports grow, freight forwarders – the "travel agents for cargo" – hold a lot of sway in determining freight pathways, logistical decisions, and business relationships.
- There has been a shift from belly cargo to freighter and integrator cargo shipments since 9/11, for a variety of reasons. Additional screening requirements associated with "known shipper rule" could continue the trend from belly cargo to freighter cargo, as could proposed and popular legislation requiring belly cargo screening.

[2] PSRC Regional Air Cargo Strategy, Final Report, October 2006, p. II-1; Asia-North America trade will grow 7.1 percent per year (Boeing World Air Cargo Forecast, 2004/05). Global forecasts for the next two decades, according to experts such as Boeing, Airbus Industrie, and the International Air Transport Association (IATA), are fairly consistent, and range from five to seven percent per year. The regional average of forecasts from the West Coast air cargo airports (Table 1) is within that range.

D.3 An Overview of General Trends

- FAA projects domestic air cargo will grow 3.2% annually; international at 6.3% annually (Bay Area memo; July 2007) FAA projects only to 2016; forecast for domestic reported at 3.7% for freighter, 1.7% for belly cargo by Puget Sound Regional Council;[3] internal freighter growth 6.9%, belly 5.4%.
- In some markets, domestic cargo that is not moving to trucks is moving to freighter aircraft (80%).
- More than half of international air cargo is still carried in belly of scheduled passenger flights—this strategy works especially well for foreign carriers.
- FedEx assumption of mail service and its lack of reporting mail vs. other freight have obscured data and create problems for planners in this area.
- Unreported truck-to-truck component requiring both warehousing and landside requirements could add 20% to cargo volumes (SeaTac)

D.4 Air Cargo Forecasting Considerations

Typically, both constrained and unconstrained forecasts are determined during the airport master planning process. When driven by macroeconomic factors, air cargo forecasts are expressed in annual tons of cargo, and are factored together with measures such as tons of cargo per departure, based on equipment type, and considered together with airfield and other constraints on the cargo system.

Among the myriad of subtasks involved in air cargo analysis, any forecasting effort must attempt to:

- Distinguish between inter-airport and intermodal competition, though this is difficult because data is notoriously absent on truck-to-truck transshipments at airports.
- Distinguish between local and regional demand
- Determine attraction and expansion of throughput and transfer activity
- Consider size and scope of service market hinterland relative to competing gateway airports

[3] PSRC Regional Air Cargo Strategy, Final Report, P. II-9 Note that FAA uses RTMs (Revenue Ton Miles) for domestic fleet cargo forecasting, while others use tons.

- Examine integrated carriers wanting to bypass their primary hubs using coastal gateway airports where international traffic is sorted typically to serve a single region (e.g., Fed-Ex's network gateway for the U.S. Northeast).

Some factors are currently impossible to quantify. For example, as referenced above, though typically unreported, truck-to-truck arrivals and departures that take place within airport cargo complexes also require infrastructure investment and operational planning consideration.

Table D.1 shows the 2030 air cargo forecasts (total, inbound/outbound, domestic and international, belly, freighter and integrator) for the nine airports that are the focus of the West Coast Corridor Trade Analysis. From today's 8.087 million annual U.S. tons (MAT) to a West Coast aggregate forecast of nearly 24.2 MAT in 23 years (2030) the region as a whole is forecasting a tripling of freight tonnage. At the top of the forecast growth, in terms of percent, are ANC and ONT. SFO and LAX show low growth over the planning horizon, while the rest anticipate moderate growth in the 3-5 percent range.

Table D.1. West Coast Air Cargo Forecasts
Airport Data, Published and Unpublished, 2030

Region/Gateway	Million U.S. Tons (MAT)	Million Metric Tons	CAGR	Data Source	Notes
Ted Stevens International(ANC)[a]	12.412	11.147	6.1%	Master Plan Update (2/07)	2006 Airport data projected at 6.1% to 2030.
Vancouver, British Columbia (YVR)	0.615	0.558	3.72 %	Airport Forecast; unpublished data from YVR staff	"Most likely" base case; increase from international and freighter.
Sea-Tac International Airport (SEA)	0.927	0.841	3.5% (2004-2025)	PSRC Regional Air Cargo Strategy (10/06)	2025 forecast at 3.5% growth from 2025-2030.
King County International Airport (BFI)	0.309	0.280	3.07% (2005-2030)	PSRC Regional Air Cargo Strategy (10/06)	2025 forecast at 2.9% growth from 2025-2030.

[a] Using the higher baseline from ANC T-100 historical data at 6.1 percent CAGR yields 2030 forecast of 21.126 MAT (U.S.). Ramp space, runway, and air fueling facilities are implicated by Anchorages unique cargo profile. This would seem to unnecessarily confound the discrepancy stemming from enplaning and deplaning cargo, and provide a misleading result. If these figures were included in the table, the overall West Coast increase from 2006 to 2030 would be approximately 385 percent – more than the global average projected by Boeing.

Table D.1. West Coast Air Cargo Forecasts
Airport Data, Published and Unpublished, 2030

Region/Gateway	Million U.S. Tons (MAT)	Million Metric Tons	CAGR	Data Source	Notes
Portland International Airport (PDX)	1.257	1.140	4.1%	Task 1, Portland/ Vancouver Trade and Transportation Study, Task 1	Verified by PDX staff, pending results of master plan update.
Oakland International Airport (OAK)	1.79	1.623	4.27% (2006-2030) 3.5% (2025-2030)	Port of Oakland presentation September 2007	Extended 1.5 MAT (2025) by 3.5% CAGR to 2030.
San Francisco International Airport (SFO)	0.556	0.613	0.3%	Extrapolated historic data, per SFO staff	Severely land constrained.
Los Angeles International Airport (LAX)	3.1	2.812	1.58%	LAWA Staff	Master Plan 2015 forecast is projected to remain static due to facility constraints.
Ontario International Airport (ONT)	3.260	2.957	7.74%	LAWA Staff	May be modified by master plan update (2008).
West Coast 2006 Airport Data Totals	**8.037**	**7.364**		Airport Web Site Data	Previously vetted with airports.
West Coast 2030 Forecast Total	**24.226 (U.S. Tons)**	**21.971 (Metric)**			

D.5 Trends Impacting Forecasts

According to Boeing, air cargo volumes worldwide will triple over the next twenty years. The nine West Coast study airports accounted for approximately 8.037 million U.S. tons in 2006.[4] Airport forecasts indicate more than 24 U.S. tons in 2030, a volume three times the 2006 tonnage. For these forecasts to occur, there are a number of factors that must come into play and remain in force over the life of the forecast. Some of the major factors are listed below.[5]

The need to ship quickly, frequently, and securely are key drivers for air cargo demand. A SeaTac Air briefing on the subject (September 6, 2007) identifies the following "value and perishability" factors: physical and economic perishability, business process impairment and shipment security. These and other factors discussed below are considered as airports and regions try to forecast the very volatile air cargo demand.

Infrastructure Trends

Land side constraints at most established West Coast airports are forcing airports to redesign facilities to increase productivity per square foot. Changes in airplane capacity (smaller for passenger, larger for freight) hold further implications for air cargo operations, as indicated in Table D.2.

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[4] Airport-reported figures verified through WCCC study tasks.

[5] Note that some key factors, such as skyrocketing fuel costs, are not well accounted for in existing forecasts: no forecasts include oil costs of more than $100 per barrel; in fact some explicitly cap oil prices as low as $30 per barrel. Such exogenous factors as airborne epidemics, rising seas that can flood many coastal airports, terrorism and wars, have likewise remained at the fringes of, or even beyond, the typical master planning processes.

Table D.2. West Coast Air Cargo Influences
Infrastructure

Low/Neutral (Factors Tending to Reduce or Maintain 2030 Forecast)	High (Factors Tending to Increase 2030 Forecast)
• Though a minor problem and being phased out, the older freight fleet (e.g., old 727s) is often the target of noise and emission regulations. • Stagnant airport infrastructure capacity relative to changing industry requirements. • Ground element of integrators market is increasing, meaning less air-only volumes, and more on-airport truck queuing space required. • If (or when) there are new screening requirements, this will impact space-constrained airports for screening areas, security holds, and possibly shift to more freighter traffic, which would require more freighter parking positions. • Need for greater cargo lift capacity – i.e., number of flights going to a wide range of destinations – impacted by lower wide-body passenger flights (SeaTac). • Need for greater freighter parking (SeaTac). • As runway capacity is constrained, cargo and passenger flights may compete for capacity. There has always been the assumption that cargo operates at night or can move to nighttime operations but that may not be true for small package/on time delivery companies. Outlying airports may be too far out for small package carrier due to traffic congestion and time constraints. • Highway congestion may limit how far out from the metro area carriers are willing to land their planes. Time and cost of ground transport has to enter into their profitability equation and the ability to meet customers' delivery expectations. Ground access infrastructure needs to be considered as well as on-airport facilities. • Downsizing of passenger aircraft reduces available belly cargo space available on desirable passenger schedule basis.	• Adequate runway length/redundancy. • Adequate aircraft parking. • Adequate landside facilities/services. • Good interstate highway access. • Good local surface access to local markets. • Well-trained, available labor force. • New aircraft such as B787 make more second tier cities economical to serve nonstop. • Technological improvements increase ease of booking/tracking. • Ability to use off-airfield property for facility expansion (e.g., SeaTac). • Solutions considered "optimal" for air cargo (e.g., hub and spoke system of remote cargo airports supported by truck system) would dislocate local economies, so probably will not occur. • Air to High Speed Rail connections are being discussed in California, for cargo as well as passenger.

Industry/Logistics

Recently, air cargo has faced competition from integrator services that are making use of truck delivery for 2-day and 3-day service. However, new air cargo niches continue to be discovered and developed by both shippers and the airports. Table D.3 shows some of the key industry and logistics trends influencing current and future air freight demand.

Table D.3 West Coast Air Cargo Influences
Industry/Logistics

Low/Neutral (Factors Tending to Reduce or Maintain 2030 Forecast)	High (Factors Tending to Increase 2030 Forecast)
• Less demand for small, light, high value, time-sensitive service would reduce air cargo demand. • Greater weight, size (in some, not all cases). • Smaller local market. • Expanded use of trucks for small package 2-3 day delivery service (up to 700 miles). • Greater reliability and predictability in sea shipping and intermodal transfer to rail might reduce demand for air cargo. A lot of work is being done on the truck and rail end to get shipments from the port to intermodal transfer facilities and out of the region. The faster and more reliable the sea and rail legs become, the less attractive is air cargo. • Higher fuel costs could shift less time-sensitive, lower value cargo to rail/marine/highway modes.	• More demand for small, light, high value, time-sensitive service. • Greater perishability, value (e.g., donor organs, seafood, produce). • Items, regardless of value, which are high value to a production cycle (i.e., keep people working by flying in a critical part). • More outsourcing to remote locations within the global economy. • 3PLs who act as shippers' agent to handle an entire distribution chain. • Higher volume of all direct air traffic in O/D pairs. • Ability to attract and expand hinterland service market. • Larger local market. • Higher congestion and delay (capacity of the ground and intermodal systems). • Closer to high density markets or customers. • Alignment with freight forwarder preferences. • Good connectivity, interlining; adequate supply of distribution services. • Lower congestion and delay (capacity of the ground and intermodal systems).

Institutional

Institutional interventions can have massive impacts—intended and unintended—on both shipping costs and on the ability of air cargo to compete with other modes, and to continue to provide customers with expected levels of service. Table D.4 shows institutional trends that may have an impact on future air cargo levels.

Table D.4. West Coast Air Cargo Influences
Institutional

Low/Neutral (Factors Tending to Reduce or Maintain 2030 Forecast)	High (Factors Tending to Increase 2030 Forecast)
• 9/11 security restricts cargo on passenger flights, increases costs from greater screening and security review processes; this could decrease competitiveness of air cargo versus other freight modes, but could advantage secondary gateways with less congestion. • Problem of noise and emissions impacts on communities. • FAA projections assume no change in security requirements; assume also that the resultant shift from air to truck has stabilized. • Bilateral agreements that limit carrier entry and routes concentrate services at a limited number of gateways. • Community impact of truck traffic. The areas around airports are often residential. • Airlines have institutional obstacles as well. Many do not want to split up operations among airports in the same region and have to duplicate facilities and services. Some carriers that operate freighter and passenger services want to keep them at the same airport to optimize use of belly capacity. • Limited availability Federal sources of funding for air cargo facilities.	• Open Skies agreements will provide opportunity for more point to point service. • Secondary gateways could benefit from Open Skies provisions that would allow foreign carriers to serve U.S. domestic and international markets not involving their home market. • Foreign trade zones.

D.6 Operational Strategies to Enhance Capacity Utilization (Productivity)

Operational strategies that have been discussed in Southern California include the following:[6]

- Moving toward common use cargo terminals run by cargo handlers rather than single carrier terminals, where appropriate.
- Planning airfield and terminal facilities to handle A380 and other large freighter aircraft.
- Land use planning to make the most out of limited cargo land area.
- Working with local and regional transportation agencies to accommodate trucks on arterial and highway systems.
- Regional planning to support the use of outlying airports for cargo. (This is being discussed in the Bay Area, as well).
- Encouraging logistics industry growth (trucking, intermodal facilities, and distribution) around outlying airports to generate future air cargo demand in those locations.

Operational strategies considered elsewhere include:

- Increasing frequency of large wide-body freighter aircraft
- Implementing the appropriate amount of aircraft parking space
- Focused planning for the truck side of air cargo operations, to ensure correct sizing (generally this means an increase in truck parking and staging space).
- Sea-Tac is exploring use of the Transportation Worker Identity Card (TWIC) to facilitate secure and efficient movement of air cargo handling personnel throughout the cargo facilities areas.
- A significant amount of land at YVR is committed to processing relatively small volumes of freight. The Airport Authority will collaborate with its business partners over the life of the current master plan to increase the productivity of cargo facilities.

[6] Similar strategies may be under consideration in other areas; however Southern California's Paula McHargue explicitly identified these operational and planning strategies.

Operational strategies that some airports might wish to use—such as 24/7 scheduling of truck delivery—are unviable due to opposition from neighboring residents.

D.7 Airport-Specific Constraints and Cargo Forecast Issues

Air cargo capacity is constrained by the physical characteristics of the airport, in combination with operational features that limit or expand capacity. It is also important to determine the limiting physical and operational features of each airport to determine its current and future capacity for handling air cargo. The discussion below is drawn from the review of airport master plans, and conversations with airport planning staff.

Alaska

Ted Stevens International Airport (ANC)

Anchorage's Ted Stevens International Airport is the closest to Asian export points and provides excellent access to much of the Eastern portion of the United States. It is third globally (after Memphis, Tennessee and Hong Kong), up 5.9% since 2005.[7]

Data for ANC is somewhat misleading because, unlike other airports, much of the air cargo does not simply land and take off in the same plane; the large majority (approximately 80 percent) of it is unloaded and passed to other planes or airlines. This "in transit" number is counted twice (as it is in all airport data) and because of that, Anchorage appears to handle more freight than it does in terms of landed weight.

The question of ANC's future, now that "technical stops" for refueling are no longer strictly necessary with longer distance air freighters, is still up in the air. However, rumors of Anchorage's impending decline in stature may be premature and erroneous for several reasons. First, Anchorage continues to provide a convenient, congestion-free staging area for air cargo sorting from one airline to another. Second, crew changes remain desirable after long flights. And third, though the new Boeing and Airbus cargo freighters can easily overshoot Alaska, they pay a price for carrying fuel rather than revenue-generating cargo. A business choice to reduce the weight of fuel and substitute it for cargo, and continue the refueling stop at Anchorage may make sense for a number of carriers and shippers.

[7] http://www.aircargoworld.com/Graphics/month/Top50ACWD0707.pdf.

Canada

Vancouver International Airport, British Columbia, Canada (YVR)

Although YVR is primarily a passenger facility, cargo is a major business at Vancouver International Airport; YVR handles belly cargo, freighter, and integrator cargo (UPS, FedEx, and Purolator). The Master Plan document forecast for 2027 contains a Low Case (400,000 metric tons); Base Case, considered the most likely (500,000 metric tons); and a High Case (600,000 metric tons).

In line with many other airports, and with the global forecasts in general, YVR's Base Case projects a doubling of air cargo from 2005 to 2025. The bulk of the increase in volume of cargo is from international markets and, in terms of composition, shows a larger percentage of cargo carried by freighters.

Potential factors constraining capacity (or at least adding to air shipping costs) at YVR include mandatory pre-board screening of belly cargo and the possibility that inbound cargo will need to undergo security and health inspections. The airport's implementation of the North-South Taxiway and any future South East terminal expansion will affect future cargo operations at YVR. Like major U.S. airports, YVR is considering regionalizing (i.e., moving away from centralized cargo facilities) as well as preserving on-site or nearby land for future facility expansion.

Washington

Sea-Tac International Airport (SEA)

Sea-Tac, the Pacific Northwest's largest airport, ranks sixth on the west coast and 20th nationally. It serves regional commercial aerospace, high-tech manufacturing, fresh seafood, and specialty agriculture industries. Sea-Tac expects to grow its air cargo volumes by about 3.5 percent per year—a projection constrained not by demand, but by facility limitations. Growth will be seen primarily in international cargo, forecast at 4.8 percent per year (to 2025) with Asia trade estimated at 6.3 percent for that period. Domestic cargo—primarily FedEx or belly cargo, grows slightly through 2015 and then evens off; Airmail stays at or below 2006 levels through 2030.

The primary limiting factor is land, and a component of that land constraint relates to the passenger "remain over night (RON)" demand, as well as warehouse utilization. Plans to relocate belly cargo operations and to accommodate freight and cargo distribution center needs are part of the constrained forecast.

Other constraints include the limited supply of usable large-aircraft parking hardstand positions, and limitations on space to stage cargo and ground service equipment. Inefficient cargo terminal building layout also constrains capacity. Off-airport developable land is only a third of the national average, according to a 2004 study (New Economic Strategy Triangle or NEST), forcing airport planning staff to "right-size" facilities precisely.

King County International Airport (BFI, Boeing Field)

Air cargo forecasts here are driven by expected increases in domestic cargo, and will be influenced by the U.S. economy, rather than global economic factors. Though UPS is considering building a new and expanded sort and distribution center on site, land constraints are holding BFI to 3.2 percent annual growth from 2004 to 2025. Regional airspace constrains operations, but that will be resolved in five years with new air traffic control systems slated for implementation nationwide.

Portland International Airport (PDX)

Port of Portland staff is in the initial stages of a master plan and forecast update, which should be available in early 2008. Air cargo growth at PDX is constrained in part by land-side congestion at the interchange of Airport Way and I-205—a problem now under review by the Port of Portland and Oregon Department of Transportation. PDX air freight is overwhelmingly domestic (92% in 2005); however it does have all-cargo service to China and some passenger service to Japan and Germany.[8] Integrators UPS, DHL/ABX operate out of PDX. In May 2006, PDX lost direct freighter service to South Korea to Sea-Tac International Airport in Seattle.

■ California

California air cargo saw steady increases from the 1980s to the late 1990s, up until September 11, 2001. California's airports increased in value of trade in the latter half of the 1990s, but their share of U.S. trade dropped from 38 percent to 21 percent during the period between 1995 and 2002.[9] Congestion around airports is a key reason for this decline, though increased range of cargo freighters is also a factor. This section discusses northern and southern California's experience and forecasts, based on available documents and input from airport staff.

[8] Portland and Vancouver International and Domestic Trade Capacity Analysis, 2006, Task 3, page 6.

[9] California's Global Gateways: Trends and Issues, 2004.

Bay Area Airports

Bay Area air cargo facilities at Oakland and San Francisco are severely land constrained. Of the cargo coming in from overseas, more than two thirds of it travels by truck for West Coast locations outside the Bay Area.[10]

Oakland International Airport (OAK)

Oakland was 31st among the top 50 global air cargo airports in 2006. The airport is home to air cargo sort facilities for the major integrators FedEx, DHL and UPS. UPS is looking to relocate from the heart of the terminal to a better layout.

In 2004, daily cargo operations (take-offs plus landings) numbered 156; 2010 projections show a marginal increase to 164 daily cargo operations. Operationally, night cargo flights might relieve congestion, but are strongly resisted by the neighboring residential community.

Million annual tons of cargo handled at the airport is projected to rise during that same period from 0.7 (2004) to 0.9 MAT (2010.) 2030 MAT is projected at 1.79 U.S. tons. With this modest increase, relative to a global and regional tripling of demand, Oakland air cargo growth has basically leveled off, according to planning staff—a trend that began with the locally hard-hitting dotcom bust. Contributing to that relatively lower upward trend is the fact that the air market matured and some growth has been siphoned to truck service to Salt Lake City, where it is then air shipped. Thus the overall trend for Oakland is no big growth; staff is not trying to add hubs or accommodate significant new growth.

San Francisco International Airport (SFO)

Just behind Oakland is San Francisco International Airport, ranking 33rd among the top 50 global air cargo airports in 2006, notable for its United Airlines hub and Carolux service. The bulk of SFO's freight is international belly cargo.

Severely land constrained, air cargo is projected to be flat through the 2030 horizon year. Airport staff roughly estimated a 0.3% growth rate for use in this study, giving a 2030 total cargo of 613,155 metric tons. Future growth is expected in the international segment, not domestic freight. Cargo forecasts are being updated, and will be ready late December 2007 or early January 2008.

[10] July 13, 2007 SFBCDC Summary of Findings and Recommendations from Phase 1 Expert Panels.

Southern California Airports

Currently, the international airports at Los Angeles (LAX) and Ontario (ONT) handle more than 95% of the air cargo in Southern California.[11] From a 2003 total of 2.7 million annual tons (MAT), SCAG forecasts a tripling of regional air cargo to 8.7224 MAT by 2030.

Los Angeles International Airport (LAX)

Ranked 10th globally in 2006 with 1.9 million tons (up 1.1 percent from 2005), LAX will achieve its likely maximum capacity of 3.1 million annual tons in 2015.

The preferred and approved Alternative D in the LAX Master Plan includes a "cargo activity level that is determined by the ability of facilities in that alternative to serve the unconstrained market demand." (LAX Master Plan, April 2004, p. 3-4) "Alternative D cargo activity is determined by the amount of cargo sort space available to process cargo tonnage. This sort space would be measured in square feet of cargo building space. The Alternative D cargo facilities would be sized to accommodate 3.1 million annual (U.S.) tons, or MAT, which is the total cargo volume forecast in the constrained No Action/No Project Alternative." Due to air cargo sorting constraints, the 2015 forecast (3.1 MAT) would likely remain constant through 2030.

Ontario International Airport (ONT)

Ontario ranked 38th among the top global air cargo airports in 2006. Los Angeles World Airports (LAWA) staff has just begun Ontario's master planning process. Recently, however, UPS has accounted for approximately 73 percent of Ontario's freight volume.[12] This will change as Ontario increasingly expands its air cargo business. It has already begun to see the migration of air cargo from LAX, due to congestion at the latter. Contributing to the 7.74 percent growth rate through 2030 is the expected cargo from the million square foot Pacific Gateway Air Cargo Center (PGCC) which breaks ground for its first facility in 2008.[13]

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[11] Southern California Association of Governments, Mike Armstrong memo 2004.

[12] Ontario International Airport Forecast of Aviation Demand, Keiser Phillips Associates, June 23, 2005, page 6-4.

[13] A recent report on the major California air cargo airports can be accessed at http:// www.aircargoworld.com/features/1107_1.htm.

Appendix E

Truck Forecast

E. Truck Forecast

This appendix documents and describes the project team's approach to developing base and forecast truck flows for the WCCC region.

E.1 Introduction

The truck forecasting approach involved four key steps:

- **Define megaregions and corridors**. Truck forecasts were developed at the 'megaregion' level. The first step was to define these 'megaregions' within the WCCC region as well as the key corridors serving them. The initial list of megaregions and corridors was vetted then with WCCC members for accuracy.
- **Collect truck counts on key corridors**. The project team worked with individual WCCC states to collect truck volume information on these key corridors, adjusting individual volumes, as appropriate, to ensure a consistent base year for the entire region.
- **Develop truck growth rates using FAF2 data**. The consultant team then developed truck growth rates for the region by first converting base year and forecast FAF2 data to truck volumes using payload factors. Truck growth rates were calculated for east-west corridors serving regions external to the WCCC and north-south corridors serving trade between the West Coast megaregions and NAFTA trading partners.
- **Apply truck growth rates to base year truck data**. We will then apply truck rates (developed in step 3) to the base year truck counts (developed in step 2). We will apply the most appropriate growth rate (regional, state, or metropolitan area) to each megaregion/corridor defined in step 1. The end result of this step is a forecast database of truck movements between WCCC megaregions.

E.2 Define MegaRegions and Corridors

The consultant team defined an initial list of West Coast megaregions and their associated major freight corridors in the WCCC region and then gathered feedback from the Steering Committee members to ensure that all relevant highway corridors were included in the final list. The megaregions and corridors were defined as follows:

- Alaska: SR 1, SR 2, SR 4
- Seattle/Tacoma: I-5, I-90, I-405, SR 99 (Alaskan Way Viaduct), SR 167
- Portland/Vancouver: I-5, I-84, I-205
- San Jose/San Francisco/Oakland: I-5, I-80, I-580, I-205, SR 99
- Los Angeles/Long Beach: I-5, I-10, I-15, I-40, I-405, I-710, SR 99, SR 60
- San Diego: I-5, I-8, I-15, SR 111 (Calexico border crossing), SR 905 (Otay Mesa border crossing)

E.3 Collect Truck Counts on Key Corridors

The primary data source for truck volume information was the Highway Performance Monitoring System (HPMS), which is produced by the states for the FHWA. The HPMS contains information on certain road characteristics for the entire universe of public roads, as well as more detailed data for a random sample of highway segments. Annual average daily truck traffic (AADTT) is one of the sample data items.

Truck traffic data for highway links that were not included in the sample were interpolated by taking the midpoint between two links that had sample data. While this method can miss truck traffic caused by large trip generators or attractors that are located along a highway segment with no sample data, it was judged to be adequate for a high-level planning study since the goal is to identify regionwide problem areas, not specific links as would be the case in a more geographically specific capacity needs study.

The truck volume data gathered through this method was then vetted by the WCCC Steering Committee members. In cases where truck counts varied significantly from similar state-level counts, the state's counts governed.

E.4 Develop Truck Growth Rates Using FAF2 Data

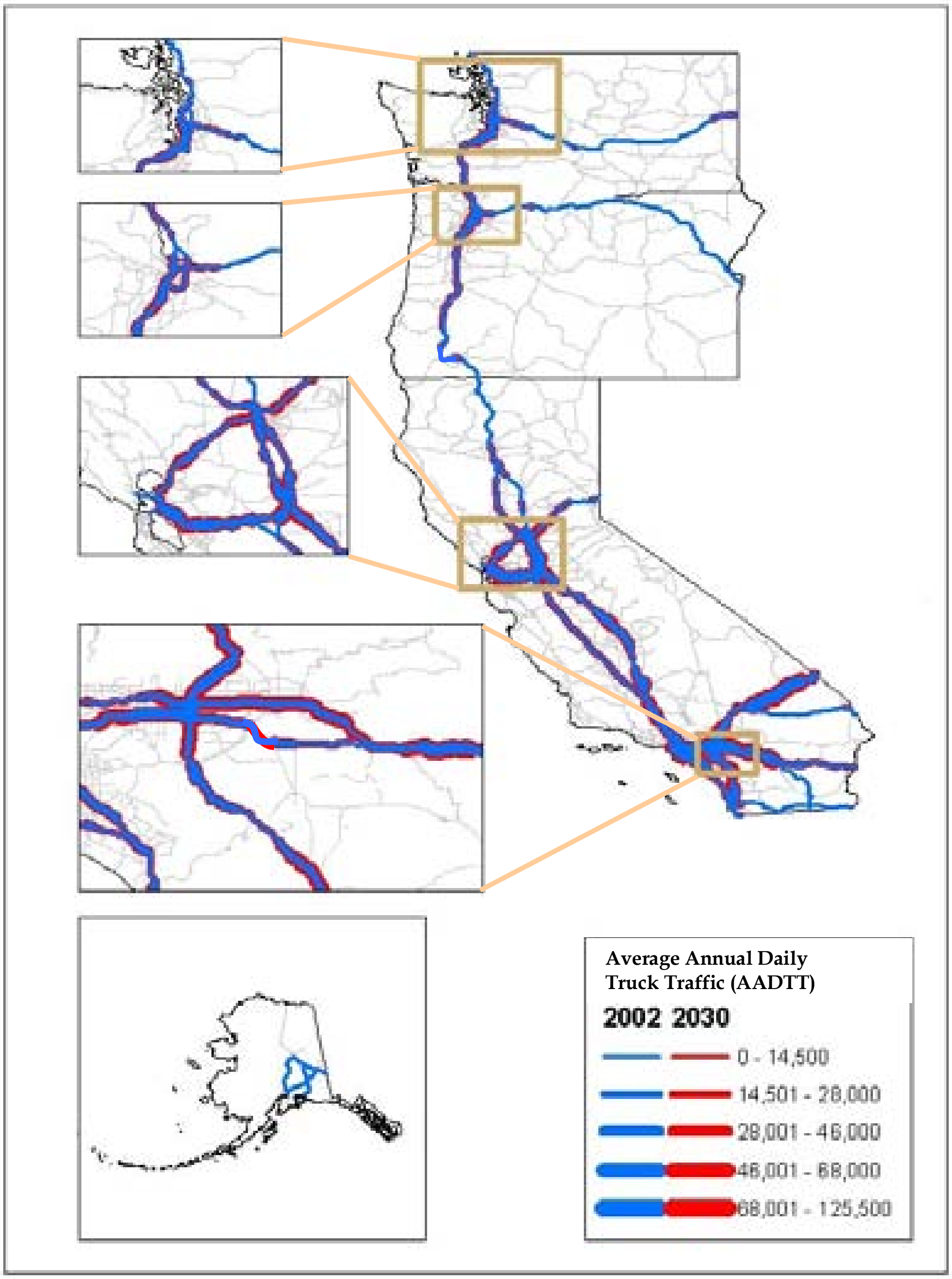
The project team used FAF2 data describing truck tonnage in the WCCC region to develop internal and external truck growth rates. Tonnage from FAF2 was converted to truck trips using Vehicle Inventory and Use Survey (VIUS) data from the U.S. Census. The VIUS provides data on the physical and operational characteristics of the nation's private and commercial trucks. Its purpose is to produce national and state-level estimates of the total number of trucks. VIUS includes private and commercial trucks that were registered in the U.S. as of July 1 of the survey year. It excludes government-owned vehicles, ambulances, buses, farm tractors, motor homes, unpowered trailers, and any trucks reported sold, junked, or wrecked prior to January 1 of the survey year. The survey was conducted every 5 years up to 2002 in conjunction with the economic census. It has since been discontinued, but the more recent data is appropriate to use with FAF2 data since the base year is the same (2002).

Tonnage was converted to truck trips for both the base year (2002) and the forecast year (2030). Using origin-destination data also contained in FAF2, the project team then identified those trucks that would be using the key corridors described above. Growth rates were derived by dividing 2002 volumes by 2030 volumes for both north-south and east-west movements. This yielded unique growth rates depending on whether the corridor primarily serves trucks moving to and from areas external to the WCCC region (east-west) and those that are moving within the region (north-south). The calculated truck growth rates using this method were 94.9 percent (3.3 percent annually) for north-south traffic and 134 percent (4.8 percent annually) for east-west traffic.

■ E.5 Apply Truck Growth Rates to Base Year Truck Data

The growth rates described above were then applied to each critical freight corridor to arrive at forecast AADTT for each highway. The results are mapped in Figure E.1, which shows projected 2030 volumes superimposed on existing 2002 truck volumes.

Figure E.1 Growth in West Coast Truck Traffic
On Primary Highway Freight Corridors 2002 to 2030



Appendix F

Literature Review

F. Literature Review

Source	Description/Attributes	Agency/Organization	Availability
Freight Impact Analysis of Potential Alaska Peninsula Roadway Segments and Regional Freight Movement Summary	Baseline demand for freight in SW AK, gross breakdowns by commodity type, and mode split by volume; demand forecast for petroleum, fish, and "other" products; uses imputed freight movement value data for communities for which complete data is not available; demand forecast to 2020; describes constraints to freight movement in SW AK.	AK DOT	http://www.dced.state.ak.us/dca/aeis/PDF_Files/Statewide_Transportation_SWATFreight.pdf
Ted Stevens Anchorage International Airport Master Plan Update (draft chapters in process) esp. Chapter 2, February 27, 2007	Historical and projected passenger and cargo activity; forecast comparisons; discussion of freight operations; discussion of critical air cargo assumptions, including socioeconomic, political/trade environment, air freight industry and technological.	Anchorage International Airport (ANC)	http://projects.ascg.com/anc-apmp/Documents.htm
Greater Vancouver (British Columbia) Goods Movement Study – Phase I	Port of Vancouver bulk, breakbulk and containerized cargo volumes (TEU) (historical data); Port of Vancouver containerized cargo tonnages (2004), with commodity information; Greater Vancouver marine gateway cargo forecasts (up to 2020) for bulk/break-bulk, and containerized cargo; VPA Port containerized cargo traffic (2002) with modal distributions; British Columbia domestic and international imports and exports by region (2002 and 1997); Hourly truck volume data at key highway locations, truck volumes at external gateways, and truck share of total volumes on the highway network in the peak hour; Commodity movements in tons to/from BC by rail (2004); Lower Mainland baseline and forecast freight train movements by terminal nodes; YVR historical and forecast air cargo tonnages (with air cargo type information for forecasts – domestic, transborder, other international, etc.); Discussion on highway network congestion (am peak); Discussion of railroad operational strategies (co-production agreements and running scheduled trains); Discussion of upcoming rail system capacity upgrades; Detailed discussion of planned infrastructure projects (with proposed timelines) under the Gateway Strategy; Impact of Goods-related industries on Greater Vancouver economy (shares of employment and GDP).	Consultant (Cambridge Systematics, Inc.)	Not yet available; study is ongoing
Port of Vancouver Economic Impact Study (May 2005)	Analysis based on 2004 maritime cargo traffic volumes; Economic impacts of maritime goods movement in the region, including direct employment, multipliers, tax impacts. Compares 2000 and 2004 impacts.	Port of Vancouver	http://www.portvancouver.com/the_port/economic_impact.html
Port of Vancouver Cargo and Container Traffic Statistics	2006 statistical summary of total tonnage, bulk, breakbulk, TEUs, vessels, imports and exports (by country of origin); containerized commodities-inbound/outbound, key commodity totals (foreign and domestic).	Port of Vancouver, British Columbia	http://www.portvancouver.com/statistics/2006_statistical.html http://www.pacificgatewayportal.com/irpt/

Source	Description/Attributes	Agency/Organization	Availability
WSDOT Truck Parking Study: Final Report	Strategies and recommended capital improvements to cope with truck parking shortages on I-5, I-90, and I-82 corridors; Discusses policy issues related to truck parking and institutional reasons for increased truck parking demand.	WSDOT	www.wsdot.wa.gov/freight/Truck%20Study-Final.pdf
2006 Annual Traffic Report	Traffic data; includes AADT, AWDT, truck counts, and AVMT.	WSDOT	http://www.wsdot.wa.gov/mapsdata/tdo/annualtrafficreport.htm
Washington Transportation Plan – Freight Element	International seaborne imports and exports by Washington State ports and by commodity type (2002) in terms of tonnage; Base year (2004) and projected (2025) rail traffic estimates across mainline segments in Washington State with capacity information as well; Barge traffic on the Columbia River system by commodity type, direction (upstream/downstream, and tons; Truck AADT on Washington State Highways for base year (1998) and future (2020); Air Cargo Statistics through Sea-Tac Airport (1980 – 2002), and current air cargo tonnage distribution by trade (domestic versus international); Detailed discussion of port terminal capacity constraints; Discussion of key highway bottleneck locations in the state (also provides a map of specific highway features at locations that impede truck traffic); Information on average daily vehicle hours of delay across segments of the highway network; Some discussion of rail bottlenecks (for example, the BNSF Columbia River bridge); Discussion of current and planned capital infrastructure projects at the Ports of Tacoma and Seattle; Discussion of current and planned rail projects implemented/considered by BNSF for rail capacity enhancements and operational efficiencies; Discussion of the impacts of trade and goods movement on the Washington State Economy.	WSDOT	http://www.wsdot.wa.gov/freight/images/WTP_FreightUpdate.pdf
Washington Transportation Plan Freight Report: Executive Summary	Overview of freight demand on all modes.	WSDOT	http://www.wsdot.wa.gov/freight/WTP/WTPExecutiveSummaryFolio.pdf
Washington Transportation Plan Update Phase 2 Workshop: Demand Capacity Imbalance/Moving Freight	Identifies bottlenecks, incl. all-weather road deficiencies on I-5 corridor, feeder routes, mainline and shortline rail, Columbia River/Snake barge system; Identifies projects to relieve freight constraints on all modes; Discusses economic benefits and impacts of investment, by mode and within regions.	WSDOT	http://www.wsdot.wa.gov/NR/rdonlyres/FC5F28FA-F3F7-4B7E-BCFC-62807C64C71B/0/MovingFreight.PDF
Washington State 2007-2026 Highway System Plan (Draft)	Defines and identifies chokepoints and bottlenecks in highway system and on core freight system grid. Distinguishes between bottlenecks (physical constraints) and chokepoints (congestion related to operations). Listed bottlenecks/chokepoints must meet defined criteria for current or projected congestion; Identifies major needs for the Global Gateways Highway Freight System, the Made in Washington system and the local/regional highway freight delivery system; Discusses impact of freight system on global and regional economies.	WSDOT	http://www.wsdot.wa.gov/planning/HSP.htm

Source	Description/Attributes	Agency/Organization	Availability
Washington Commerce Corridor Feasibility Study	Examines demand for a western alternative to I-5; Report recommends I-90 to Chehalis freight corridor; Discusses community impacts likely along a 5-mile n/s corridor west of I-5, including growth management and environmental issues, quality of life, ROW losses; Discusses regulatory, statutory, institutional (governance) issues related to infrastructure finance.	WSDOT	http://www.wsdot.wa.gov/freight/images/WACommerceCorridorFS/Final%20Report/WCC%20Final%20Report.pdf
Washington Strategic Freight Transportation Analysis (SFTA) Origin-Destination Database	Base year (2002-2003) commodity O-D flows by truck at the city level of detail, along with highway routing information (mainly for internal, inbound, and outbound flows with respect to Washington) (can also get seasonality information based on the underlying survey database).	Washington State University	http://www.sfta.wsu.edu/
FMSIB 2006 Activities and Recommendations Report	Discussion of railroad capital infrastructure projects implemented and/or planned in the state by BNSF and UP; Discussion of seaport capital, operational, and environmental strategies for efficient goods movement; Discussion of three key projects selected for consideration (from a list developed from a Call for Projects process) for funding and implementation based on maximum impact on goods movement; Discussion of key freight projects completed in 2006, new projects seeking funding, and projects slated for construction during the 2007-2009 time period; Discussion of funding issues and strategies being considered or implemented for improved goods movement; Discussion of clean air efforts by the ports, railroads, and the trucking industry.	Freight Mobility Strategic Investment Board	http://www.fmsib.wa.gov/report/AnnualReports/FMSIB2006report.pdf
SFTA Profile of Washington Rail Shipments (1985 – 2002)	Historical rail tonnage originating and terminating in Washington (1985 to 2002), with information for Eastern and Western Washington as well; Washington inbound and outbound rail tonnage by commodity and origin/destination location information; Seasonal (monthly) distribution of total rail commodity tonnage originating and terminating in Washington (2002); Historical rail tonnage of major commodities originating and terminating in Washington (1985 – 2002), with data provided separately for Eastern and Western Washington; Historical tonnage data by commodity and region for intrastate Washington rail shipments.	Washington State University	http://www.sfta.wsu.edu/
SFTA Washington Statewide Transportation Input-Output Study	Inter-relationships between transportation service usage and industry outputs; Impacts of transportation related industries on Washington's economy; Discussion of economic impacts of goods related industries based on Input-Output multipliers.	Washington State University	http://www.sfta.wsu.edu/
SFTA Washington – British Columbia Trade Traffic Projections	Base year (2002) and future (up to 2015) daily truck border crossings by direction at each of the major border crossing locations between Washington and British Columbia. Also has discussion on commodity distributions (with empty trucks) for truck border crossings, with historic data; Data on route usage by trucks for each border crossing.	Washington State University	http://www.trforum.org/forum/viewabstract.php?id=241&PHPSESSID=055cdd6413e699ebf765a4ddfae89f30 http://www.sfta.wsu.edu/research/reports/pdf/Report22_ProjectionsTrade-Traffic.pdf

Source	Description/Attributes	Agency/Organization	Availability
SFTA Freight Movements on Washington State Highways – Comparison of Results 1993 – 2003	Historical trends (1993 and 2003) in average daily truck trips by region in Washington; Historical trends (1993 and 2003) in average daily cargo truck shipment tonnages by region and commodity class; Historical trends in corridor truck traffic profile based on type of commodity.	Washington State University	http://www.sfta.wsu.edu/research/reports/pdf/Rpt20_SFTA-EWITScomparison.pdf
Freight Projection Memo 5-07	POV current truck counts; build-out trip generation rates, 2013, 2018 and 2025 truck percentages and peak trips. Includes railcar counts for 2004, plus 2014 projections; Discusses importance of Columbia River Crossing project and five interchanges on I-5, as well as local port access issues.	WSDOT	Not publicly available
Statewide Rail Capacity and System Needs Study	2004, 2015, 2025 rail tonnage (top 10 commodities); 2004 carload/intermodal breakouts; Details of mainline, short line and passenger rail system infrastructure and 2006 mainline capacity. Detailed discussions of rail bottlenecks and chokepoints based on 2015 and 2025 peak day train volumes; operational issues; Lists capacity-enhancing rail operational strategies, including differential impacts on intermodal versus carload freight. Lists current and proposed freight investments; Discusses governance structure, state powers, authorities and interests in freight and passenger rail, including roles and responsibilities and possible freight investment programs.	Washington State Transportation Commission	http://www.wstc.wa.gov/Rail/RailFinalReport.pdf
Freight and Goods Transportation System (FGTS) 2005 Update	Provides updated information for T-1 to T-5 roadways at the state, county and city levels. Based on truck gross tonnage, identifying most heavily used commercial trucking routes.	WSDOT	http://www.wsdot.wa.gov/freight/FGTS/FGTS%202005%20Final%20report.pdf
2006 Congestion Monitoring Report Draft (published June 2007)	AM & PM peak delay, capacity, speed as % of speed limit, % trucks on I-5, I-205, etc. for PM Peak; Lists of 2000-2006 roadway capacity projects.	SW Washington RTC	http://www.rtc.wa.gov/
IMTC Pacific Highway Port-of-Entry Commercial Vehicle Operations Survey	Average daily truck crossings (northbound and southbound) during survey period for the pacific highway border crossing; Time of day distribution of southbound truck arrivals at border crossing; Truck demand/usage by lane (especially FAST versus non-FAST lanes); Booth processing time and queuing information from the survey can be used to analyze congestion/bottlenecks associated with border crossing operations.	Whatcom Council of Governments	http://www.wcog.org/library/imtc/2007cvo_finalreport.pdf
Destination 2030	Summarizes Freight Action Strategy (FAST) Phase 1 and 2 projects; unclear if funded; Summarizes the regional context, including population/economic growth, local planning, transportation investment strategy, and funding sources.	Puget Sound Regional Council	http://www.psrc.org/projects/mtp/
Puget Sound Freight Efficiency and Competitiveness Study	Pinpoints freight bottlenecks/chokepoints for three industries: aerospace, processed foods, and construction; Operational/capital improvement recommendations for WSDOT (some funded, some not); Policy recommendations to enhance competitiveness.	WSDOT	http://www.wsdot.wa.gov/Research/Reports/600/646.1.htm

Source	Description/Attributes	Agency/Organization	Availability
Freight Mobility Strategic Action Plan	Baseline TEUs for 2005 (not disaggregated by product); Lists projects (unclear if funded); Employment/economic impacts of freight movement; Broad policy initiatives to improve freight mobility in Seattle.	Seattle DOT	http://www.seattle.gov/transportation/docs/2005FreightPlan_FINAL2.pdf
SR 167 Corridor Study Truck Mobility Design Concepts	Truck traffic counts for one link on SR 167 (current and 2030 projected).	WSDOT	http://www.wsdot.wa.gov/NR/rdonlyres/98865179-3D4D-4C4F-AB4C-5C4BF8CA1F61/0/TruckMobilityDesignOptions020107Draft.pdf
SR 167 Corridor Extension Study	Truck traffic counts for one link on SR 167 (current and 2030 projected); Identifies truck-friendly improvements on SR 167 corridor.	WSDOT (website does not contain the study, but is a link to the project's page)	http://www.wsdot.wa.gov/Projects/SR167/ValleyFreewayCorridorPlan/default.htm#background
Transportation Technology at the Washington-British Columbia International Border	Discussion of current and planned capital (highway improvements) and operational (ITS) improvement projects impacting cross-border commercial travel through the Cascade Gateway; Recommendations for additional operational (ITS) strategies for efficient shipment tracking and border crossing operations; Discussion of public sector jurisdictional and regulatory framework along the Washington – BC border; Discussion of trade and security programs/regulations impacting cross-border travel.	WSDOT	http://www.wcog.org/library/imtc/its-cvo3.pdf
Washington State-British Columbia International Mobility and Trade Corridor ITS-CVO Border Crossing Deployment Evaluation Final Report	Discussion of past and ongoing operational strategies related to commercial vehicle border crossings (mainly ITS related strategies like WIM sensors, AVI readers, transponder tags, Trade Corridor Operating System (TCOS), etc.); Introductory discussion on U.S. Canada collaborative solutions related to trade (for example, IMTC, ITS initiatives, etc.); Discussion of trade related regulatory issues impacting border crossing movements, and comparisons with the ITS-enabled regulatory scenarios.	U.S. DOT	http://www.wcog.org/library/imtc/itsreport.pdf
Port of Vancouver USA Freight, Development and State Surface Transportation System Projections	Includes truck trip projections for Port of Vancouver for 2013, 2018, and 2025 and LOS at key intersections around the port; Identifies issues related to I-5 Columbia River Crossing project.	Port of Vancouver	Not publicly available

Source	Description/Attributes	Agency/Organization	Availability
IMTC Cascade Gateway Rail Study	Base year (2002) and forecast (2012) train traffic (number of trains per day) and tonnage (by direction) through the Cascade Gateway; Base year and forecast train traffic between Everett and Seattle (BNSF) and some traffic information for intra-BC freight rail operations; Some port related rail traffic demand estimates for Vancouver, Fraser river, Seattle and Tacoma; Discussion of key bottlenecks and associated capacity improvements needs along the Cascade Gateway rail corridor; Presentation of key WSDOT planned capital projects along the Cascade Gateway rail corridor between Everett and Blaine, with associated costs; Discussion of planned and/or completed roadway and rail corridor infrastructure projects for handling increased cargo traffic through the seaports; Discussion of impacts of modal diversion (truck to rail) along the Cascade Gateway rail corridor on highway accidents, air quality, and energy consumption.	Whatcom Council of Governments	http://www.wcog.org/DesktopDefault.aspx?tabid=50
IMTC Short Sea Shipping on the Canada-United States West Coast Phase I summary	Discussion on potential markets/demand for cross-border SSS (however, no quantitative data on demand provided); Detailed discussion of existing cross-border short-sea shipping system characteristics related to Port infrastructure (U.S. – Washington and Canadian west coast ports), and existing services; Detailed discussion of regulatory (trade, security, etc.) and institutional (labor, cross-modal collaboration, costs, etc.) issues impacting cross-border SSS.	Whatcom Council of Governments	http://www.wcog.org/DesktopDefault.aspx?tabid=152#ph1
IMTC Short Sea Shipping on the Canada-United States West Coast Phase II Final Report	Base and Forecast truck and rail commodity tonnage flows between potential cross-border SSS service markets; Analysis of trucking industry and shipper perspectives and interest towards cross-border SSS (based on surveys); Assessment of public sector financing (subsidy) contributions for SSS for a particular market pair using a spreadsheet model analysis, with demand and service schedule/cost inputs; Summary of institutional and regulatory issues impacting the future implementation of cross-border SSS (regulations related to labor, tax, security, trade, etc.).	Whatcom Council of Governments	http://www.wcog.org/DesktopDefault.aspx?tabid=152#ph2
IMTC Cross-Border Trade and Travel Study	Cross-border (northbound and southbound) commodity O-D tonnage flows by truck and by border crossing location based on comprehensive truck intercept surveys; Data collected from the surveys provides the capability to analyze commodity O-D flows by season (fall versus summer), time of week (weekend versus weekday), and time of day.	Whatcom Council of Governments	http://www.wcog.org/DesktopDefault.aspx?tabid=55
Port of Seattle Economic Impact Studies (2003 and previous)	Measures economic impact of marine cargo, fishing activity, waterborne passenger activity, marina, and nonmarine cargo/nonaviation Port of Seattle real estate. Highly detailed (1,150 company-level interviews).	Port of Seattle (Consultant)	http://www.portseattle.org/business/economicdevelopment/economicimpact.shtml
Port of Tacoma Economic Impacts	Measures economic impacts of marine cargo and vessel activity at Port of Tacoma and private marine terminals in Commencement Bay, comparing 2000 and 2004 data. Based on interviews of 681 firms in six economic sectors.	Port of Tacoma	http://www.portoftacoma.com/files/Econ_Impact_2004.pdf

Source	Description/Attributes	Agency/Organization	Availability
Port of Tacoma Cargo Statistics	Cargo volumes by commodity for 2002-2007 (YTD) in short tons plus total TEUs.	Port of Tacoma	http://www.portoftacoma.com/tonnage.cfm
Port of Tacoma Container Volumes	Historical monthly TEUs from 2004 to present.	Port of Tacoma	http://www.portoftacoma.com/tonnage.cfm
SFTA Waterborne Commerce on the Columbia/Snake Waterway	Historical trends (1995-2003) in upstream and downstream total commodity tonnages; Historical trends (1995-2003) in upstream and downstream commodity tonnages by commodity type (including empty barges); Average monthly tonnages for upstream and downstream flows by commodity type.	Washington State University	http://www.sfta.wsu.edu/
Washington Public Ports Association (WPPA) Marine Cargo Forecasts	2004 Marine Cargo forecasts in total tonnage and TEUs, by cargo segment. Forecasts are unconstrained by inland highway or rail capacity. Includes cargo trends and 2010, 2015, 2020, and 2025 imports/exports, domestic receipts and shipments, showing container, breakbulk, general cargo, auto, timber, agriculture for WA and Columbia River Oregon. Discusses truck trip generation on major highway corridors serving ports. Uses Global Insight and PIERS 2003 data to identify PNW market shares.	Washington Public Ports Association	http://www.washingtonports.org/downloads/default.asp
Washington Public Ports Association Rail Capacity Needs Study	Current average daily train volumes by segment, and commodity type. Projected 2025 operations (average trains/day and peak trains/day) by segment; Unconstrained, high-level analysis of freight rail system, from perspective of marine terminal ports of Everett/Cherry Point, Seattle, Tacoma, Longview/Kalama and Vancouver, WA, with some consideration to growth and rail initiatives in Vancouver, BC. Identifies chokepoints and constraints by segment; Identifies most important infrastructure investments and terminal and mainline operational changes needed to improve port-serving rail freight system; Includes growth assumptions.	Washington Public Ports Association	http://www.washingtonports.org/downloads/default.asp
Economic Impacts of Sea-Tac International Airport (2003)	Economic impacts of Seattle airport and marine cargo activity, including direct jobs, income and revenue impacts, induced, indirect and related impacts, tax impacts.	Port of Seattle	http://www.portseattle.org/downloads/business/POS2003EIS_Final.pdf
Port of Seattle Cargo and Container Statistics	Monthly TEUs, international full/empty inbound/outbound; domestic; comparison with previous year/month.	Port of Seattle	http://www.portseattle.org/seaport/statistics/
Oregon Commodity Flow Forecast (April 2005)	Baseline (1997) and forecasts (up to 2030) of inbound, outbound, internal and through commodity flows by mode (truck, rail, marine, air, pipeline) in Oregon; Also discusses economic, industry logistics, and other trends and assumptions used in developing the forecasts.	ODOT	http://www.oregon.gov/ODOT/TD/FREIGHT/docs/publications/odot/CommodityFlow/ CFForecastRep_Final4-2005.pdf
Freight Moves the Oregon Economy (1999)	1997/98 data for all freight modes; Though dated, this document provides detail on freight corridors, intermodal facilities and generators; Provides background on Oregon policy issues.	ODOT	http://www.oregon.gov/ODOT/TD/TP/FME.shtml
Regional Freight and Goods Movement Action Plan: Transportation Management Strategies for Regional Freight Mobility (June 2007)	Reviews transportation options for industrial areas, focusing on transportation system management and operations that benefit freight mobility, as well as management of employee commute trips.	METRO (Document is not yet posted)	http://www.metro-region.org/article.cfm?articleid=20884

Source	Description/Attributes	Agency/Organization	Availability
Regional Freight and Goods Movement Action Plan: Community Impacts and Mitigation Strategies (May 2007)	Refers to 2000 and 2035 commodity flows from Portland/Vancouver International and Domestic Trade Capacity Analysis (Port of Portland, 2006); Identifies traffic and neighborhood impacts, as well as impacts to freight mobility from surrounding development; Lists impact reduction strategies and projects, including qualitative benefits to community/carriers; mitigation employed by ports of Vancouver and Portland, and measures used to resolve conflicts between freight operations and residential/commercial neighborhoods.	METRO (Document is not yet posted)	http://www.metro-region.org/article.cfm?articleid=20884
Freight Rail and the Oregon Economy (March 2004)	FHWA FAF2002 data, Cambridge Systematics (2002) study, used for demand analysis; Rail capacity problems in five corridors: Portland-Seattle; Willamette Valley; Klamath/West Coast "I-5" corridor; Columbia Gorge and Portland Triangle; Lists top Oregon industries dependent on affordable freight rail, incl. lumber, wood, paper, trans equipment, wholesale trade and Port of Portland's marine terminal business; report measures rail's role in Oregon economy and job creation; Public sector investment in "top" of the system (major corridors, intermodal terminals and connectors, and urban rail interchanges like PDX Triangle) can be market-based or policy-driven. Policy approach requires a new public-private partnership with the railroads.	Port of Portland	http://www.flypdx.com/PDFPOP/Trade_Trans_Studies_Freight_Rail_OR_Econ.pdf
The Cost of Highway Limitations and Traffic Delay to Oregon's Economy (March 20, 2007)	Identifies infrastructure limitations for east-west truck routes, notes capacity constraints due to increase in size of ships, trucks, railcars; discusses limited and unreliable intermodal options. Statewide shipper interviews provides detail on freight system problems; Discusses decreasing window for deliverables due to peak spreading and other non-freight issues; Identifies statewide economic impacts and benefits, market access and competitiveness impacts.	Oregon Business Council and Portland Business Alliance	http://www.portofportland.com/PDFPOP/Trade_Trans_Studies_CostHwy_Lmtns.pdf
Columbia River Crossing Project Documents	Freight improvements are being analyzed for five alternatives within an upcoming (spring 2008) DEIS.	Columbia River Crossing Task Force	http://www.columbiarivercrossing.org/
The Cost of Congestion to the Economy of the Portland Region	Identifies highway and non-highway constraints. Inventories local transportation-dependent industries. Background on Portland area freight-related economic impacts of congestion, including retail/wholesale and distribution. Provides background on local transportation and warehousing practices, business patterns.	Portland Business Alliance, Metro, Port of Portland	http://www.portofportland.com/PDFPOP/Trade_Trans_Studies_CoCReport1128Final.pdf
Portland/Vancouver International and Domestic Trade Capacity Analysis (2006)	Baseline and projections of freight volumes through 2035 by commodity/mode; Task 3: Growth opportunities and challenges for maritime trade, rail, and air cargo; looks at chokepoints in rail system; Identifies rail projects in pipeline; Task 2 examines trade and economic dynamics; Task 4 looks at projected freight growth and assesses industrial land supply/key projects needed to meet it.	Metro, ODOT, Portland Development Commission, Port of Portland, Port of Vancouver	http://www.flypdx.com/PDFPOP/Trade_Trans_Studies_TrdCap_DetailRpt.pdf

Source	Description/Attributes	Agency/Organization	Availability
Commodity Flow Forecast Update and Lower Columbia River Cargo Forecast (2002)	2030 import and export demand driven and supply constrained forecasts under low and high growth scenarios, with separate analyses for log, breakbulk, dry and liquid bulk, grains and containers; Identifies market share trends and assumption related to Columbia River cargo forecasts.	Port of Portland	http://www.flypdx.com/PDFPOP/Trade_Trans_Studies_LCR_Cmdty_Flw_Rpt.pdf
2007 Port Transportation Improvement Plan	Cites Commodity Flow Forecast Update by DRI/WEFA predicting doubling of freight volumes in the region in 30 years; Project Lists, with project description, purpose, timeframe, costs and project status for Port priorities for marine terminals, rail, road, aviation, bike/pedestrian, channel improvements, ITS.	Port of Portland	http://www.flypdx.com/PDFPOP/Trade_Trans_Studies_PTIP_2007_Final.pdf
Trade Capacity Study: Growth Opportunities and Challenges Assessment Related to Maritime Trade (August 2006)	Compares 2002 and 2006 trends and forecasts for 2010, 2020, 2030, and 2035 for general, breakbulk, container, grain and auto, dry/liquid bulk cargo in Port of Portland. Includes barge forecasts, inbound/outbound in short tons.	Port of Portland; Metro; ODOT; Port of Vancouver; Regional Transportation Council; Portland Development Commission	http://www.portofportland.com/PDFPOP/Trade_Trans_Studies_TrdCap_DetailRpt.pdf
The Local and Regional Economic Impacts of the Port of Portland, 2006	Data on economic impacts of Port of Portland air and sea cargo operations on employment, personal earnings, business revenue and state, county, and local taxes.	Port of Portland	http://www.flypdx.com/PDFPOP/Trade_Trans_Studies_Ecnmc_Impact_2006.pdf
The Working Harbor Reinvestment Strategy Business Interview Results (December 2006)	Overcommitted rail system identified as competitive limiting factor. Identifies I-5 as bottleneck, plus district bottlenecks, rail and roadway deficiencies; Identifies demand for rail access, land use type (e.g., warehouse and truck distribution); Interviews identify conflicts between freight growth in the working harbor and community issues. Conflicts between transit and freight mobility noted. Land use policy, industrial preservation policy, transit versus freight goals are discussed.	City of Portland, Portland Development Commission, Port of Portland	http://www.portofportland.com/PDFPOP/Trade_Trans_Studies_WrkHrbr.pdf
Regional Economic Effects of the I-5 Corridor/Columbia River Crossing Transportation Choke Points (April 2003) and related presentations Columbia River Crossing Choke Points (PPT Presentation January 23, 2007)	Shows 2000/2020 peak spreading; trucks & autos; O&D map of trucked commodities, hi-tech mfg., and truck route volumes (Based on Reebie Associates TRANSEARCH data, 1998); Portland area concentration of traded industries (EDRLEAP database; IMPLAN/U.S. Dept of Commerce REI). Identifies major national chokepoints (from 2003 Freight-Rail Bottom Line report research) and cites $175-$195 B of needed investment over next 20 years. Graphic illustration of economic interrelationships of freight traffic flow, infrastructure, logistics patterns, economic context, and investment policy. Assessment of region's labor costs, worker skills and region's research and funding base. Noted regional scarcity of new industrial development land; regional strength in mfg. and transportation support industries.	ODOT and Columbia River Crossing Task Force	www.i-5partnership.com/reports/RegionalEffects_r1.pdf
Expert Panel for the Oregon Transportation Commission Freight Workshop, Supply Chain 101, March 21, 2007	Shows infrastructure, delivery networks, shipper dynamics, trends and issues, and implications for Oregon.	ODOT	http://www.oregon.gov/ODOT/TD/FREIGHT/Expert_Freight_Panel/isbell.pdf

Source	Description/Attributes	Agency/Organization	Availability
City of Portland Freight Master Plan (May 10, 2006)	Shows local multimodal freight system bottlenecks. Identifies local freight system infrastructure improvements for highway, rail, and marine terminal. Provides list of comprehensive plan policy that support freight mobility. Identifies policy metrics used to rate proposed highway and street-level freight improvements.	City of Portland Office of Transportation	http://www.portlandonline.com/transportation/index.cfm?c=diieg
Rogue Valley Freight Study (Final Report and related docs, 2004)	Demand data is from 1997; update was not available for this document. Regional shipper interviews provides good background into existing operations. Ranks RVMPO 2004 projects by importance to freight, ability to create and sustain jobs and remove barriers. Interviews with five area city representatives and three major trucking firms identifies freight mobility issues within communities in Rogue Valley.	Rogue Valley Metropolitan Planning Organization	http://www.rvmpo.org/Page.asp?NavID=24
Portland Freight Data Collection Project – Phase I	Discussion more related to data needs related to freight demand; Discussion related to data needs related to freight system characteristics; Discussion related to data needs related to policy and institutional issues in the region.	Consultant (Cambridge Systematics, Inc.)	No
Portland Freight Data Collection Project – Phase II	Truck AADT by truck class on key highways in the Portland metropolitan region; Commodity origin-destination flows into and out of the region; Time of day distribution of truck traffic at key freight corridor locations.	Consultant (Cambridge Systematics, Inc.)	No
Port of Portland Cargo and Container Traffic Volumes	Air cargo volumes as reported by airlines to the Port.	Port of Portland	http://www.portofportland.com/MTMP_Facts_Figrs.aspx
California Goods Movement Action Plan (Phase I) September 2005	Projected California & U.S. Growth through 2020 ($ and tonnage) from PPIC, April 2004; discusses distinction between demand and actual throughput capability. System characteristics for four major corridors (Bay Area, Central Valley, LA/Inland Empire, San Diego); Report notes that capacity of each corridor is limited by the most constrained segment, and that currently, it is not port capacity that is limiting throughput, but constraints outside the ports. California Port-to-Border Project Inventory for major projects (more than $10M); characterizes operations for each subregion. Discusses larger national and international factors affecting California goods movement; Reviews environmental, community, security and safety issues, and their relationship with the communities surrounding freight facilities; Discusses Port, ARB and local actions to reduce emissions.	California Business, Transportation and Housing Agency and California EPA	http://www.arb.ca.gov/gmp/docs/finalgmpplan090205.pdf
California Goods Movement Action Plan (Phase II) Jan 2007	Identifies multimodal operational improvements (immediate action) + Short-, intermediate- and long-term (10+ years) infrastructure projects; Identifies immediate to long term environmental and public health mitigations, community and workforce dev. + safety/security.	California Business, Transportation and Housing Agency and California EPA	http://www.arb.ca.gov/gmp/docs/gmap-1-11-07.pdf

Source	Description/Attributes	Agency/Organization	Availability
Proposed Emissions Reduction Plan for Ports and Goods Movement in California (2006) (plus April 2007 update PowerPoint presentation)	Capital projects and operational strategies identifies for air quality conformity constitute an enforceable list of potential investments. Proposes $1B bond to fund needed projects. Highlights issues and progress toward resolving constraints related to community resistance, public health, livability and environmental limitations. Provides background on California-specific air quality/freight mobility linkages. Includes discussion of truck inspection/AQ issues, NAFTA policy, and Mexican border delays.	California EPA and Air Resources Board	http://www.arb.ca.gov/planning/gmerp/gmerp.htm
Implementing a Statewide Goods Movement Strategy and Performance Measurement of Goods Movement in California	Performance indicators include average truck wait times; throughput per acre; dwell time; ratio of wheeled to grounded operations; lifts per hour; average time a container is handled in a port complex. Reliability, Sustainability and Environmental Quality indicators also included. Wait times come from three trucking firms' records, for imports, exports, and empties. (Data from c.1999); Priority ranking for "Causes of Delay" from trucker survey; makes recommendations for improvements. Discusses institutional, legal barriers to productivity (e.g., interchange agreement between marine carriers over movement of empty containers over the highway within the LA basin); adjustment of union work rules; demurrage and terminal leases; hours of operation.	METRANS	http://www.metrans.org/research/final/99-10_Final.pdf
California Marine Transportation System Infrastructure Needs (2003)	Identifies high-priority waterside, terminal and landside marine infrastructure projects for northern ($7.2 b) and southern ($16.5 b) California. Identifies desired Federal funding policies and commitments to freight in general and marine infrastructure in particular. Discusses need for national investment in national assets, and problems of local priority versus port needs in investment commitments on the political level.	California Marine and Intermodal Transportation System Advisory Council (CALMITSAC)	http://www.slc.ca.gov/Reports/MTS_Infrastructure_Needs_Report/ MTS_Infrastructure_Needs_Report_102203_Entire_Document.pdf
Regional Goods Movement Study for the San Francisco Bay Area	International and domestic trade flows for the bay area by commodity type, mode, tons and value; Truck Traffic (ADT) on major regional highways; Freight train counts on the rail network for key O-Ds (for example, between Oakland and Stockton); Commodity type and tonnage information for inbound and outbound rail carload and intermodal shipments; Port of Oakland historical cargo tonnage and TEU data (1998 to 2002), and comparisons with west coast totals, and bay area maritime tonnage forecasts (up to 2020) by cargo type (containerized, breakbulk, bulk, etc.); Air Cargo tonnage historical information for San Francisco, Oakland, and San Jose, and bay area air cargo forecasts (up to 2020) by type of cargo (domestic, international, and mail). Highway bottleneck (V/C > 1) location information in the region; No comprehensive discussion on rail network capacity and bottlenecks. Discussion of key goods movement issues by corridor, and capital and operational projects/strategies to address them Northern California Trade and Mobility Corridor combines two regional corridors (I-80 and Altamont Corridor) and is focus for new investment. Impact of goods movement related industries on the bay area economy in terms of employment and economic output; Expenditures of goods producing industries on transportation. Discussion of goods movement reauthorization issues/implications for the bay area, with particular focus on funding issues/strategies; Impacts of land use policies, the real estate market, and community attitudes on goods movement in the region	Metropolitan Transportation Commission	http://www.mtc.ca.gov/planning/rgm/

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SACOG Regional Goods Movement Study Phase 1	Truck AADT and share of total traffic on major highways; Historical data on air cargo tonnage through major airports in the region. Also has discussion on Air Cargo forecasts in the region. Also has discussion on truck traffic generated by the airports; Port of Sacramento historical tonnage data, with major commodities; Total commodity O-D flow tonnage (inbound, outbound, local, and through); Inbound, Outbound and Through Rail Carload Tonnage (baseline and forecasts). Discussion of congestion/bottlenecks on key corridors in the region (For example, I-80); Discussion of rail network bottlenecks (particularly related to Donner Pass double-stacking constraints, and how that impacts rail traffic routing in the region, and bottlenecks created due to passenger rail demand). Also discussion on key rail capacity expansion constraints. Discussion of capital projects at the Port of Sacramento (for example, new industrial plant developments); Discussion of port related operational strategies (For example, strategic alliance with the Port of Oakland). Economic impacts of goods movement in the region (base and forecast employment by goods related industries, and shares of total); Land use impacts of goods movement in the region. Discussion of trucking industry structure (fleet/truck types, commodity types, types of operations, costs, etc.) in the region; Policy and institutional issues impacting the growth of the Port of Sacramento (for example, land use constraints, channel depth, etc.); Discussion on multijurisdictional size weight regulations impacting trucking activity; Discussion of land use policy issues and their impacts on goods movement (for example, smart growth impacts, etc.)	Sacramento Area COG	http://www.sacog.org/goodsmovement/
SACOG Regional Goods Movement Study Phase 2	Discussion of base and forecast freight demand in terms of demand for warehousing/distribution space. Prioritization of MTP projects based on goods movement significance. More detailed discussion (compared to Phase I) on economic impacts of transportation and logistics activity in the region in terms of employment and value added multipliers; Discussion of long term economic potential of logistics industry/activity development in the region; Truck involved collision information; Brief discussion on air quality impacts. More detailed discussion (compared to Phase I) on economic impacts of transportation and logistics activity in the region in terms of employment and value added multipliers; Discussion of long term economic potential of logistics industry/activity development in the region; Truck involved collision information; Brief discussion on air quality impacts. Land use policy implications on goods movement; Discussion of trucking regulatory issues (for example, parking, environmental issues such as anti-idling regulations, etc.); Discussion of funding issues and opportunities for the region, with focus on Corridor Mobility Improvement Account funding, Trade Corridor funding, and funding for Highway 99 improvements, and how they relate to the MTP projects identified earlier	Sacramento Area COG	http://www.sacog.org/goodsmovement/
Bay Area Regional Rail Plan (Multiple documents, 2006-2007)	Tech memo 4a shows rail traffic on existing system. Tech Memo 4a shows tracks and sidings, conditions, configurations, and capacity expansion challenges. Tech Memo 4h discusses approaches to handling regional rail freight, esp. short-haul freight.	MTC, BART, Caltrain, California High-Speed Rail Authority (Final plan will be posted on the website when it is available)	http://mtc.ca.gov/planning/rail/

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San Joaquin Valley Goods Movement Study – Phase I	Base year (1992) commodity flows (total, by truck, and tonnage distributions by mode) to and from the San Joaquin valley, with aggregate O-D information as well (for truck mode); Truck classification counts (AADTT) by number of axles on major highways (1997); Base year (1997) cargo tonnage by major commodities through the Port of Stockton; Air cargo tonnage (1997) for Fresno International Airport; Some useful information based on carrier and shipper surveys on major Os and Ds for inbound and outbound shipments, demand by modes, and major routes used by trucks. Highway congestion and LOS analysis based on counts; Highway congestion and bottleneck analysis based on trucking survey responses. Also covers bottlenecks occurring due to railroad crossings; Highway geometry and pavement (potholes, etc.) issues impacting trucking operations. Truck routing designation issues in the region, particularly associated with STAA truck routing.		http://www.fresnocog.org/document.php?pid=33
San Joaquin Valley Goods Movement Study – Phases II and III	Truck AADT (base and forecast) on key corridors and freight access roads from the truck model developed as part of these studies. Highway LOS and congestion/bottleneck locations on the highway network from the truck model		http://www.fresnocog.org/document.php?pid=42
Economic Impacts of Wait Times at the San Diego Baja California Border	Truck crossings by Port of Entry, 1994-2003; Estimates regional and national economic losses due to wait times at border crossings on both passenger and freight traffic	San Diego Association of Governments	http://www.sandag.org/programs/borders/binational/projects/2006_border_wait_impacts_report.pdf
Survey and Analysis of Trade and Goods Movement Between California and Baja California, Mexico	Most commonly imported commodities at Otay Mesa by value and metric ton; # of inbound/outbound shipments for sampled businesses by business type. Suggests a number of policies/projects to shorten wait times. A number of 'customer satisfaction' questions regarding the POEs on border (e.g., hours of operation, factors influencing shipping times).	San Diego Association of Governments	http://www.sandag.org/uploads/publicationid/publicationid_901_2267.pdf
2007 Regional Plan Update/Freight Component (in progress)	Report was not available during study preparation timeframe.	Southern California Association of Governments	http://www.scag.ca.gov/rtp2004/2004/FinalPlan.htm
Goods Movement Truck Count Study (September 25, 2002)	Numerous problems with existing Caltrans classification counts (AADT on all state highways taken on a 6-year rotation); Caltrans 2000 Statewide Truck Survey (weigh stations and agricultural inspection stations); This study surveyed 10 locations at or near external cordon lines for the SCAG region study area. Survey was supplemented by Caltrans Heavy-Duty Truck Travel Model Survey (statewide, 1999) that added 9 more So Cal locations.	Southern California Association of Governments	http://www.scag.ca.gov/goodsmove/knowledgebase/reports/002%20-%20Truck%20Count%20Study.pdf
Southern California Consensus Priority Goods Movement Projects (May 2005)	Lists 5 rail projects ($2.425 Billion), 5 highway projects ($1.321 Billion) and ITS Enhancements (Cost TBD) total cost: (w/o ITS) + $3.75 B. This one-page summary document also notes that the Multi-County Goods Movement Action Plan will study an east-west truck way linking proposed I-710 truck lanes with potential truck lanes on I-15.	Southern California Association of Governments	http://www.scag.ca.gov/goodsmove/pdf/Summary_GM_Priorities.pdf

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Port and Modal Elasticity Study, Final Report, September 8, 2005	West Coast port volumes 1994-2004 (TEUs, loaded and empty, inbound and outbound) from port websites. Cites U.S. DOT's projection that demand for freight transportation will double by 2020. Local container traffic is 23% of SPB total. Study establishes distribution of values of goods, using c.2003 data from World Trade Atlas-total declared value to U.S. customs for 99 commodities. Also, from POLB the 2003 PIERS data on TEU volumes imported from Asia, by commodity type. Data sets combined with Pacific Maritime Ass. marine container type data, to estimate average declared value per cubic foot for each commodity type. $9 per cubic foot was most common value (Max $72/cf). Capacity: Container-Handling Facilities (from Port websites) & Rail Intermodal Facilities at West Coast Ports (from POLB/POLA Trans. Study, June 2001). Discussion of more positive local economic impacts of transloaded shipments, versus direct pass-through shipments. Looks at what level of fees would induce traffic diversion to other ports, or mode shift (rail versus truck). Says container fees should be collected at the dock as a wharfage charge; regardless of landside mode or destination, on imports only.	Southern California Association of Governments	http://www.scag.ca.gov/goodsmove/pdf/FinalElasticityReport0905.pdf
Goods Movement in Southern California: The Challenge, The Opportunity, and The Solution (September 2005)	Shows "original" and "revised" SPB Port container growth projections; revised 2030 is 44.7 M TEUs, or 44% of U.S. Import Market Share; 25% of exports. Based on several assumptions, a 2030 travel time/planning time model compares travel minutes and planning minutes saved (necessary buffer time to account for travel time unreliability) to generate value of time saved, at $73/hr. for trips from/to harbors to downtown LA, Ontario and Victorville. These run as high as $490 per trip in 2030. This is a benefit that could be captured to fund truck lanes. Document identifies potential goods movement system financing options for scenarios that improve truck, rail, combined, and w/environmental. Regional dilemma to find mitigations for freight impacts, and funding to implement them, in order to harness economic opportunity from trade. Discusses economic and logistical advantages of So Cal ports, and reasons that transloading to truck/rail is preferred to shipping to other, nearer ports (inventory costs for retailers are reduced due to several weeks' time savings). This means the time advantage must be preserved. PierPass (off-peak program) began July 2005; other suggestions to reduce community and environmental impacts are increased investment in Tier III (lower diesel-emitting) railroad and truck engines; require low-sulfur fuel, require slow ship speeds in harbor, or use of electrical grid for in-harbor power. Additional suggestions included. SCAG suggests it's possible to fund an additional $10B for environmental mitigation for goods movement impacts. Suggestion for creation of a So Cal institution to execute infrastructure construction; need for political leadership identified; noted role for Federal government.	Southern California Association of Governments	http://www.scag.ca.gov/goodsmove/pdf/GoodsmovePaper0905.pdf

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Subregional Freight Movement Truck Access Study (July 2004)	Heavy-duty truck volumes and percentages, truck-related accidents (Statewide Integrated Traffic Reporting System of CHP) and freeway interchange historic traffic counts from local and regional data sources-compiled and summarized. High concentrations of industrial/warehousing in Ontario and Fontana also have high HDT volumes and percentages on arterials. Also, detailed new vehicle counts conducted at 3 major interchanges on SR-210, I-10 and SR-60, showed highest truck peaks at mid-day-67 % > PM peak. Includes survey results of 37 trucking companies as well as shipper/carrier surveys. W. Riverside Co. shows double the 2030 truck trips compared to SCAG region. Study incorporates air cargo facility trip generation data for autos and trucks (Draft Ontario Master Plan). Documents that locally designated truck routes are contiguous and provide good cross-jurisdiction connectivity. Very few truck restrictions. Nine arterial streets expected to have high 2030 truck volumes were identified for future roadway improvements. Generic improvements are listed.	Southern California Association of Governments and San Bernardino Association of Governments	http://www.scag.ca.gov/goodsmove/pdf/SFM_Truck_Access_Study_0704.pdf
Multi-County Goods Movement Action Plan	Draft (May 9, 2007) freight demand tech memo provides detailed warehouse (2020 and 2030), marine cargo (2005,2010,2020,2030 port data), rail (2025), port carload/intermodal rail volumes (2010, 2020, 2030); truck (SCAG HDR model) and air cargo (FAA and Boeing forecasts, 2004-2024) forecasts. Four forecast scenarios and key assumptions identified. Uses SCAG HDT model for highway; unique methodology for warehouse forecasting; most recent BNSF/UP/Amtrak and Metrolink data for RR volumes. Highlights high-volume rail segments; identifies port-related trucks on highways. Identifies highway, rail, economic and environmental performance measures under different scenarios.	Metro (with partners Caltrans, SCAG, OCTA, RCTC, SANBAG, VCTC)	http://www.metro.net/projects_programs/mcgmap/
Inland Goods Movement Corridor Study	Rail crossing mitigations for Alameda Corridor East Trade Plan are identified.	San Bernardino Association of Governments	http://www.sanbag.ca.gov/planning/regional_goodsmvmt_corridor-study.html
SCAG Emission Reduction Strategies (Goods Movement Task Force, July 2007 presentation)	Identifies rail emission reduction strategies needed to meet 2014 deadlines. Strategies range in cost from $2-6 B; elected officials aware of 5,400 annual deaths in So Cal from continued non-attainment status.	Southern California Association of Governments	http://www.scag.ca.gov/goodsmove/pdf/2007/workshop/GMCM080207_FreightRail.pdf
SCAG Heavy Duty Truck Model	Base year (2003) and forecast (2010, 2020, and 2030) truck AADT volume data on the SCAG regional highway network by truck class	Southern California Association of Governments	http://www.scag.ca.gov/goodsmove/pdf/HDTM_Update_Fischer0506.pdf http://scag.ca.gov/modeling/mtf/presentations/012407/mtf012407_5_4_Truck.ppt
Inland Port Feasibility Study (2007 presentation; report due in 2007)	Evaluates different inland port facility types, locations, and operational models, for potential use in Southern California. Discusses needed negotiated rail operational cooperation. Strategy can result in VMT and emissions reductions, but will require public investment in rail and institution of permanent $100/container fee. Uses "cost effectiveness per diverted (avoided) VMT" comparison to evaluate competing public investment options.	Southern California Association of Governments	http://www.scag.ca.gov/goodsmove/pdf/SCAG-InlandPortCaseStudies063006.pdf http://www.scag.ca.gov/goodsmove/pdf/2007/presentations/gmtf011707_INLANDportfeasibilitystudy.pdf

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Southern California Regional Strategy for Goods Movement (Consensus paper, existing and needed infrastructure maps, 2005)	Provides 2005 list of regional freight projects (to be refined over time.) Consensus document showing regional commitment to both freight and environmental/health standards.	Southern California Association of Governments	http://www.scag.ca.gov/goodsmove/#current
Southern California Regional Corridor Studies (I-710, SR-60, I-15)	Results of individual corridor studies that are then incorporated into regional data and analysis.	SCAG and Subregions	http://www.scag.ca.gov/corridor/
Assembling and Processing Freight Shipment Data: Developing a GIS-Based Origin-Destination Matrix for Southern California Freight Flows (June 2001)	SCAG Region 1996 Int'l trade value and tonnage, by TAZ, by mode (imports and exports) from 1996 Waterborne Commerce of the U.S.; Also Air Cargo (including mail) for 1991, 1996, 1998, by Airport TAZ; Rail tonnage at 8 regional entry points (ITMS 1996 data). Looks at a network with 2 seaports (POLB, POLA)	METRANS	http://www.metrans.org/research/final/99-25_Final.pdf
West Coast National Freight Gateway: A Trade Congestion Reduction Program	Reviews economic impacts of "doing nothing" about trade-related project investments in Southern California. Discusses policy basis for funding framework; bond finance program; investment in freight rail and highway freight projects. Discusses state and local partnership issues.	Los Angeles Economic Development Corporation (LAEDC)	http://www.laedc.org/consulting/projects/2005_WCNFGProgram-FullReport.pdf
An Integrated Approach to Managing the Local Container Traffic Growth in the Long Beach-Los Angeles Port Complex, Phase II (December 2001)	POLA/POLB growth, market share 1990-2000 (1998 SPB Ports Long Term Cargo Forecast, Mercer). Refers to POLA/LB 2001 Trans Study for modal distribution of freight; truck distribution on road network; includes monthly aggregate daily truck trips for 14 container terminals, showing daily and weekly patterns. Diminishing port land area requires maximum terminal throughput-from 2,000 TEU per acre in 1990 to 5,500 TEUS in 2000. (is a rough measure of efficiency of land usage, though not necessarily other resources) Study notes disconnect between vessel operations (24/7) and traditional terminal gate operations (8 am to 5 p.m.)-though that is changing.	METRANS	http://www.metrans.org/research/final/00-17_Final.pdf
The Logistics of Empty Cargo Containers in the Southern California Region: Are Current International Logistics Practices a Barrier to Rationalizing the Regional Movement of Empty Containers (March 2003)	Shows 2000-2020 container growth forecasts for 3 scenarios (Asia Crisis, High Growth, 2001 POLB-POLA study). East-West container trade imbalance, 1998-2002; Shows cycle of container handling; current SCAG reality is that exporters in U.S. have too many empty containers; China has too few. There aren't really any regional solutions that can address the basic problem. And as big as it is, SCAG is merely a sub-region in global logistics-carriers will not tolerate optimizing SCAG's transportation system (i.e., reducing empty container trips) if it impacts the global situation negatively. However, a chassis-pooling system could be beneficial, as could adoption of collapsible containers. Report says that public sector support for regional solutions like depot-direct return and direct off-hire do not produce enough benefit for carriers to be used. So no point in investing in them. Nor is the time right for IT solutions like virtual info sharing about container location and need.	METRANS	http://www.metrans.org/research/final/01-05_Final.pdf

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Evaluation of the Terminal Gate Appointment System at the Los Angeles/Long Beach Ports (March 2006)	International Top Container Ports, 2004, plus percent change, 2003-2004 (Journal of Commerce figures) (Jan-May 2005, LA-LB accounted for 75% of west coast imports); West Coast Container Traffic 1995-2004 (American Association of Port Authorities); combined POLA/POLB container volumes, TEUs, 1999-2004 (port statistics) LA Region HDDT miles more than doubled since 1982 (REIS data). Discusses PierPass (off-peak operations); gate moves, scheduling practices; measures or estimates of turn times (data disparities noted and discussed). CARB and SCAQMD attempts to regulate port pollution fail to reach ocean vessels and locomotives. The 16 daily ships at POLA/POLB = pollution of 1 M cars. (NRDC 2004) AB2650 regulated truck queuing at terminal gates to reduce vehicle emissions; offered ports options of extended hours or appointments; fines of $250 for idling >30 min.-targeted port terminal ops for AQ objectives, rather than emissions directly. Labor benefits are noted-550K jobs; $1.4 B from POLA state/local taxes alone (2004 POLA).	METRANS	http://www.metrans.org/research/final/04-06_Final.pdf
Development of Methods for Handling Empty Containers with Application in the Los Angeles/Long Beach Port Area (March 2006)	Addresses operational issues regarding empty container reuse, to reduce double handling.	METRANS	http://www.metrans.org/research/final/04-05_Final.pdf
Implementing a Statewide Goods Movement Strategy and Performance Measurement of Goods Movement in California	Performance indicators include average truck wait times; throughput per acre; dwell time; ratio of wheeled to grounded operations; lifts per hour; average time a container is handled in a port complex. Reliability, Sustainability and Environmental Quality indicators also included. Wait times come from three trucking firms' records, for imports, exports, and empties. (Data from c.1999). Priority ranking for "Causes of Delay" from trucker survey; makes recommendations for improvements. Discusses institutional, legal barriers to productivity (e.g., interchange agreement between marine carriers over movement of empty containers over the highway within the LA basin); adjustment of union work rules; demurrage and terminal leases; hours of operation.	METRANS	http://www.metrans.org/research/final/99-10_Final.pdf
Port of Oakland Economic Impact Study (March 4, 2006)	Economic impacts of Maritime goods movement in the region, including direct employment, multipliers, tax impacts. 2005. Compares 2001 and 2005 impacts.	Port of Oakland	http://www.portofoakland.com/pdf/mari_impact_2006.pdf
Port of Oakland Maritime Development Alternatives Study	1.8 M TEUs in 2003; growth rates have varied between 3 and 6% per year. Facing land constraints on future demand/capacity. Discusses growth scenarios for a variety of development strategies. Discusses issues of upcoming land constraint on growth. Identifies development sequencing for rail, road, and maritime developments based on a range of growth assumptions and development strategies. Discusses a range of possible futures.	Port of Oakland	http://www.trb.org/Conferences/MTS/1C%20Osantowski.WardPaper.pdf

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Port of Los Angeles/Long Beach and ACTA Trade Impact Study Final Report (2007)	Shows value of trade, exports/imports; compares impacts from international containerized trade via POLA/POLB in 1994, 2000 and 2005; summarizes impacts by congressional districts	Port of Los Angeles, Port of Long Beach, Alameda Corridor Transportation Authority	http://www.portoflosangeles.org/DOC/REPORT_ACTA_Trade_Impact_Study.pdf
Alameda Corridor East Project Reports	Lists needed grade separation projects. Updated cost estimates show $4 B total cost for grade separations; $3 B unfunded.	Alameda Corridor East Construction Authority	http://www.theaceproject.org/
San Pedro Bay Ports Clean Air Action Plan (April 2007)	This study and all air quality studies in Southern California are critical to addressing freight impacts on health, and ability to meet 2014-15, 2019-20, and 2023-24 State and Federal Air Quality standards.	Ports of Long Beach/Los Angeles	http://www.portoflosangeles.org/News/news_041207ctp_qa.pdf
San Pedro Bay Ports Rail Study Update (December 2006)	Establishes 2005 baseline; examines 2030 rail capacity based on 2030 cargo forecasts. Identifies crossing blockages. Documents recent operational changes; Identifies rail system deficiencies and proposes improvements based on rail yard capacity modeling and train simulation results. Examines benefits of on-dock rail, esp. considering rail yard capacity shortfall by 2010-2015. Discusses non-traditional rail concepts including inland shuttle train to "inland port" and inland block-swap (inland rail yard to sort trains.) These solutions require collaboration between ports and railroads, with government agency facilitation.	Ports of Long Beach/Los Angeles	http://www.portoflosangeles.org/DOC/REPORT_SPB_Rail_Study_ES.pdf
Port of Long Beach Economic Impact Study (2005)	Uses Rutgers I-O MARAD-updated economic impact model to quantify direct, indirect, and induced impacts for employment, wages and salaries, business sales.	Port of Long Beach	http://www.polb.com/civica/filebank/blobdload.asp?BlobID=2103
Port of Los Angeles Transportation Baseline (2004)	2010, 2025 trip generation and traffic projections, cargo growth forecasts and deficiency analysis. Baseline is from 2001 truck counts on port area roadways. Includes conceptual transportation improvement recommendations. Model assumptions include discussion of local truck operations.	Port of Los Angeles	http://www.portoflosangeles.org/DOC/REPORT_Draft_Traffic_Baseline.pdf
Port Truck Trip Reduction Strategies (presentation March 1, 2006)	Infrastructure and operational initiatives to reduce truck traffic from POLA/POLB. Identifies institutional and operational issues associated with specific truck-trip reduction strategies (e.g., warehouse and trucker acceptance of extended gate policy)	Port of Harbor Commissioners	http://www.portoflosangeles.org/Board/Presentations/030106_Truck_Traffic.pdf
Container Movement Technology Forum and Roundtable Discussion (Proceedings of January 26, 2007 meeting)	Examines new technologies and systems to reduce emissions and congestion impacts of cargo handling. E.g., CargoRail trams for line-haul and "last-mile" service; numerous Maglev, linear induction, and cleaner fuel systems are discussed, as is reducing idling, repairing or replacing engines, etc. Notes need to reduce emissions and congestion "almost at any cost." However, ROW is needed for the Maglev solutions; demo projects are costly.	SCAQMD	http://www.aqmd.gov/tao/conferencesworkshops/Container_Forum-01-26-07/ContainerForumReport.pdf http://www.aqmd.gov/tao/conferencesworkshops/Container_Forum-01-26-07/Container_Forum_Agenda.htm

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Ports of Long Beach/Los Angeles Transportation Study (June 2001)	Marine terminal trip generation and distribution; container and non-container terminal trip generation. Trip distribution based on 3300 valid O-D truck driver surveys from 13 terminals. Future year 2010/2020 trip generation traffic projections using a focus model of the SCAG regional model, with peaks, daily volumes for roads, intersections, and terminal gates. Plus arterials and freeways serving the ports. Study incorporates HDT trips and future on-dock/off-dock rail mode splits. Cargo forecasts come from 1998 San Pedro Bay Ports Long-Term Cargo Forecast-the "High Growth" scenario. Existing Rail and Highway operations and capacity analysis. Intermodal facility capacity analysis feeds into trip generation model. Includes recommendations for Port Area Transportation Improvements. Discusses funding sources and processes, but too old now.	Ports of Long Beach/Los Angeles	Not publicly available
A Survey of Drayage Drivers Serving the San Pedro Bay Ports (2007)	Identifies issues related to drayage operations and trucker opinions; includes 54 respondents to Licensed Motor Carriers survey and 209 respondents to Independent Owner Operator. Identifies needs and concerns and correlates these to income, working hours; shows IOOs with average net income of $12.13 per hour; Fuel costs noted as significant issue.	Gateway Cities Council of Governments	http://www.polb.com/civica/filebank/blobdload.asp?BlobID=3724
Southern California's Freight Movement Challenge (presentation 2005)	Identifies bottlenecks in Southern California. Discusses economic, congestion, air quality and health impacts of trade moving through So. Cal	Southern California Association of Governments, San Bernardino Association of Governments	http://www.sanbag.ca.gov/planning/05-05_SC-freight-challenge.pdf
Critical Goods Movement Issues Scan for Riverside County (PPT Presentation, September 15, 2006)	RC trade balance (2003) (Caltrans ITMS data); truck/rail freight split in tons; 300K sf + distribution centers built since; major highways w/ truck volumes >15K/Day (2004, Caltrans Traffic and Vehicle Data Systems Unit); truck % on major highways; I-10/San Gorgonia Pass EB/WB and I-15 at RC/SDC line NB/SB O&D results (Caltrans Truck Survey); 2001 volumes, truck splits on I-10, SR-60, SR-91 (POLA Baseline Transportation Study, April 2004); peak spreading on I-15 and I-215; midday peak in Indio; 2004 injury data; rail tons (2003 Caltrans ITMS); air cargo 2002/2030 (SCAG 2030 Regional Aviation Plan). At-grade rail crossing delay is severe; average crossings now blocked nearly 2 hours/day-10 are blocked 3 hours/day-growing to nearly 4 and 6 hours blocked in 2030. Identifies interrelationships between logistics trends: globalization, intermodal containers, transloading, regional distribution centers. Severe environmental and health impacts on Riverside County related to goods movement industry, much of which is pass-through traffic. (SCAQMD Multiple Air Toxics Exposure Study II, Mar 2000; CARB diesel emission data).	RCTC	http://www.rctc.org/projects/pdf/GoodsMovement06-09-15.Presentation.pdf

Source	Description/Attributes	Agency/Organization	Availability
RCTC Alameda Corridor East Trade Corridor Grade Crossing Separation Needs List (April 2006)	Update of 2001 list; includes 61 identified grade separation projects in Riverside County; includes weighting and priority ranking. Weighting factors include safety, delay (2005 and 2030), and to lesser extent, emissions and noise, local priority and proximity to other grade separations. Note that only one project was completed between 2001 and 2006 update.	RCTC	http://www.rctc.org/projects/pdf/ACElist.pdf
Inland Empire Railroad Main Line Study Final Report (June 2005)	Passenger and Freight rail volumes, current and future (2010/2025). Forecasts were validated, and found reasonably close for train counts, but at variation with freight train mix (from 2000-2004). Describes existing RR mainline infrastructure from downtown LA to Barstow and Indio; presents alternative routing scenarios for evaluation; Summary of required track capacity for BNSF and UP lines under different scenarios for 2010/2025; cost estimates provided. Includes emissions analysis for each routing alternative. Alternative ranking considers population exposure to heavy freight train operations (2025 population within 0.5 miles of trackside X forecast peak-day freight train throughput); also considers total population access to passenger trains.	SCAG	http://www.scag.ca.gov/goodsmove/pdf/InlandEmpireRailStudyFinalReport.pdf
Alameda Corridor Transportation Authority Reports	Corridor train counts from 2002-2007. ACTA (under Expanded Mission) identified improvements to SR 47 to construct 4-lane expressway to replace Schuyler Heim Bridge, eliminate signal lights, 5 at-grade crossings, facilitate I-710 future improvements	ACTA	http://www.acta.org/projects_planning_SR47.htm
SCAG Regional Transportation Improvement Program (2006)	Programmed projects by county, for state and local highway and transit projects. (2006)	Southern California Association of Governments	http://www.scag.ca.gov/rtip/
Port of Los Angeles and Long Beach Cargo and Container Statistics	Current and historic cargo and container statistics	Ports of Los Angeles and Long Beach	http://www.portoflosangeles.org/factsfigures_Portataglance.htm
Port of Oakland Cargo and Container Statistics	Current and historic cargo and container statistics	Port of Oakland	http://www.portofoakland.com/maritime/factsfig.asp
National Rail Freight Infrastructure Capacity and Investment Study (September 2007)	Uses U.S. DOT's 2035 projected growth for rail freight of 88% over 2007 levels. Shows 30% of U.S. primary freight rail system as congested by 2035 without investment (based on 88% increase in demand and no change in mode share.)	Association of American Railroads	http://www.aar.org/PubCommon/Documents/natl_freight_capacity_study.pdf
Transborder Surface Freight Database	NAFTA Trade Flows between U.S. and Canada, and U.S. and Mexico by O-D (States in the U.S. and Mexico, and Provinces in Canada), commodity type, mode, value and tonnage, and border crossing location	BTS	http://www.bts.gov/transborder/

Source	Description/Attributes	Agency/Organization	Availability
FHWA Freight Analysis Framework Commodity O-D Database	Base year (2002) and forecast (from 2010 to 2035 by 5 year increments) U.S. domestic flows at the MSA level of detail by commodity, mode, and value/tonnage; Base year (2002) and forecast (2010 to 2035 with 5 year increments) NAFTA trade flows between U.S. and Canada, and U.S. and Mexico, at the MSA level of detail in the U.S., by commodity, mode, port of entry/exportation, and values/tons; Base year (2002) and forecast (2010 to 2035 by 5 year increments) U.S. international marine trade flows at the MSA level of detail in the U.S. with information on mode used for inland leg of shipment, as well as seaport of entry/exit, by commodity, and values/tons	FHWA	http://ops.fhwa.dot.gov/freight/freight_analysis/faf/index.htm
TRANSEARCH Freight Database	Base year (2005) domestic and NAFTA commodity O-D flows at the county/city level in the U.S, CMA/province level in Canada, and State level in Mexico, by modes, and by tons (with port and airport information as well); Future year data is not built-in into the database. However, custom made forecast data can be purchased from Global Insight.	Global Insight	http://www.globalinsight.com/TradeTransportation
ACE Waterborne Trade statistics/Port Statistics	U.S. Custom Ports 2003-2006 trade statistics; also by trade partners. Total metric tons, import/export, total value, import/export.	AAPA	http://www.marad.dot.gov/MARAD_statistics/