Southwest Multi-State Rail Planning Study

Technical Background Report

September 2014

U.S. Department of Transportation
Federal Railroad Administration

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Acronyms and Abbreviations

ACE	Altamont Commuter Express
ADHS	Appalachian Development Highway System
ADOT	Arizona Department of Transportation
ARRA	American Recovery and Reinvestment Act
ARTIC	Anaheim Regional Transportation Intermodal Center
BART	Bay Area Rapid Transit
BNSF	Burlington Northern Santa Fe Railway
BUR	Bob Hope Airport
CHSR	California High-Speed Rail
CHSRA	California High-Speed Rail Authority
ConnDOT	Connecticut Department of Transportation
CONNECT	CONceptual NEtwork Connections Tool
CRT	commuter rail transit
DOT	department of transportation
EIS	environmental impact statement
FAA	Federal Aviation Administration
FACT 2	*Future Airport Capacity Needs in the National Airspace System 2007-2025*
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GDP	gross domestic product
HOT	high-occupancy toll
HOV	high-occupancy vehicle
HPR	high-performance rail
HRT	heavy rail transit
HSR	high speed rail
I-##	Interstate Route ##
IOS	initial operating segment
IWA	Williams Gateway Airport
LAS	McCarran International Airport
LAX	Los Angeles International Airport
LGB	Long Beach-Daugherty Field Airport
LRT	light rail transit
LRTP	long range transportation plan
maglev	magnetically levitated
MOU	memorandum of understanding
mph	miles per hour
MSA	Metropolitan Statistical Area
MSRP	multi-state rail plan
NDOT	Nevada Department of Transportation

NEPA	*National Environmental Protection Act*
NHS	National Highway System
NNEPRA	Northern New England Passenger Rail Authority
NTAD	*National Transportation Atlas Database*
O&M	operating and maintenance
OAK	Metropolitan Oakland International Airport
OIA	Oakland International Airport
ONT	Ontario International Airport
PHX	Phoenix Sky Harbor International Airport
PSP	Palm Springs International Airport
PTC	Positive Train Control
RITC	Regional Intermodal Transportation Center
RRIF	Railroad Rehabilitation and Improvement Financing
RTC	Regional Transportation Commission
SAFETEA-LU	*Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users*
SAN	San Diego International Airport
SCRRA	Southern California Regional Rail Authority
SDNR	San Diego Northern Railroad
SDP	service development plan
SFO	San Francisco International Airport
SJC	Mineta San Jose International Airport
SJRRC	San Joaquin Regional Rail Commission
SCRIP	Southern California Regional Interconnector Project
SNA	John Wayne-Orange County Airport
SR ##	State Route ##
SW Study	Southwest Multi-State Rail Planning Study
TBIT	Tom Bradley International Terminal
TIFIA	*Transportation Infrastructure Finance and Innovation Act*
TJPA	Transbay Joint Powers Authority
TOD	transit-oriented development
TTC/DTX	Transbay Transit Center/Caltrain Downtown Extension
TUS	Tucson International Airport
UP	Union Pacific Railroad
US ##	U.S. Highway ##
USRA	United States Railway Association
VMT	vehicle miles traveled
YOE $	year of expenditure dollars

Chapter 1. Introduction

1.1 Overview

The *Southwest Multi-State Rail Planning Study* (SW Study) is the first high-performance rail (HPR) network planning study led by the Federal Railroad Administration (FRA).[1] FRA initiated the SW Study concurrent with its national rail planning effort to develop a national toolkit for the conceptual planning of HPR networks at the multi-state and mega-regional level. The national toolkit includes a newly developed CONceptual NEtwork Connections Tool (CONNECT), which can help analyze the performance of HPR corridors and networks.

FRA NATIONAL PLANNING EFFORT

FRA's national planning effort is developing a toolkit to assist states with evaluating the potential of HPR corridors and networks. This national toolkit can help states identify the potential for HPR service between metropolitan areas.

The national planning effort has two components: (1) development of CONNECT, which is a CONceptual NEtwork Connections Tool to aid in development of conceptual cost, ridership, and performance information for HPR corridors and networks, and (2) development of an example approach for a multi-state (i.e., regional) rail planning study. The study will support FRA's efforts to assist states with corridor and HPR network planning.

The SW Study is a test case for the guidelines, tools, and performance standards developed in the national planning effort. Representatives from key transportation organizations worked through challenges of developing multi-state rail plans and outlined a common preliminary vision for HPR in the Southwest.

1.2 What is a Multi-State Rail Plan?

A multi-state rail plan (MSRP) is a visioning plan—it presents a long-term (30- to 40-year planning horizon) concept for an HPR network. It also summarizes information that would be helpful for identifying corridors in the vision and moving towards implementation. Sample information includes:

- Demographic trends
- Travel patterns and market analysis
- Transportation network conditions and connectivity
- Conceptual estimates of HPR costs, ridership, and financial performance
- Potential opportunities for shared improvements with commuter and freight railroads
- Institutional and governance issues

Public and private sector entities that currently are, and in the future could be, involved in the provision of passenger and freight rail investments should be involved in the development of a multi-state rail plan. Additional stakeholders, including the public, elected officials, and business leaders, should also be engaged in planning; this might occur at the multi-state network planning level and in subsequent phases of corridor planning.

An MSRP is complementary to individual state rail plans. Additionally, an MSRP does not reach the depth and breadth of analysis contained in a Tier 1 environmental impact statement (EIS) or service development plan (SDP), but can help prioritize corridors for these types of studies.

[1] While this is the FRA's first multi-state rail planning study, it is not the first FRA study to analyze network effects in passenger rail planning. For example, FRA's 1997 document, *High Speed Ground Transportation in America*, examines the economics of bringing high-speed ground transportation to well-populated groups of cities throughout the U.S. The report can be found at http://www.fra.dot.gov/eLib/details/L02519 (last accessed 04 Aug 2014).

In 2009, FRA established classifications of the services contemplated in a multi-state rail plan.[2] This framework describes the varying stages of development of HPR corridors across the country and provides clear and consistent definitions of HPR service levels. The framework classifies HPR corridors into three distinct service tiers—*Core Express, Regional,* and *Emerging/Feeder*. The three HPR service tiers encompass regular intercity passenger rail services as well as higher speed services. Defining features of the tiers include corridor length, top speeds, presence of dedicated track, population served, service frequency, and minimum reliability targets. FRA definitions of HPR service tiers are provided in Table 1. The long-term HPR network vision presented in a multi-state plan defines each corridor within the overarching network in terms of the service tiers.

Table 1 Definitions of high-performance rail (HPR) service tiers

	Top Speeds (mph)	Other Common Characteristics	Primary Markets Served	Minimum Reliability Target (On-time Performance)
Core Express corridors	over 125	Frequent service; dedicated tracks, except in terminal areas; electric-powered	Serving major metropolitan centers	99%
Regional corridors	90–125	Frequent service; dedicated and shared tracks; electric- and diesel-powered	Connecting mid-sized urban areas with each other or with larger metropolitan areas	95%
Emerging/ Feeder corridors	Up to 90	Shared tracks	Connecting mid-sized and smaller urban areas with each other or with larger metropolitan areas	85%*

**On-time performance target might increase in the future.*

1.2.1 The *Southwest Multi-State Rail Planning Study*

The SW Study is the first MSRP effort developed within FRA's conceptual HPR framework. Key tasks conducted to develop the plan included:

- Synthesizing existing state, local, and private plans and proposals and then identifying issues as related to multi-state rail network planning
- Generating conceptual planning information for intercity corridors that have not yet been studied or have not been studied recently
- Convening stakeholders to work through challenges related to an MSRP and move towards a common preliminary vision for HPR in the Southwest

This document summarizes the analysis and findings from the SW Study. Close to eighty percent of stakeholders provided feedback on the draft Technical Background Report. Comments included requests for clarification, updates on projects and references, and general expressions of support for the SW Study. In addition, there was great interest in advancing next steps to sustain the momentum for rail planning in the Southwest region.

1.3 Why the Southwest?

The Southwest region is an ideal place to have undertaken the first MSRP study. The region has collectively shown significant interest in the development of HPR services. The States of California, Arizona, and Nevada

[2] Federal Railroad Administration, High-Speed Rail in America, High-Speed Rail Strategic Plan, April 2009, http://www.fra.dot.gov/eLib/Details/L02833

have existing passenger rail services, and there are advanced plans for investment in discrete corridors in California and Nevada. This study built upon these endeavors and explored the performance of a multi-state network. Within these three states, extensive efforts are underway to advance passenger rail options, including the development of enhanced intercity passenger rail, commuter rail, and dedicated high-speed rail services. Studies range from corridor studies to FRA service development plans, long-range transportation plans, environmental documentation (including issued Records of Decision), and state rail plans.

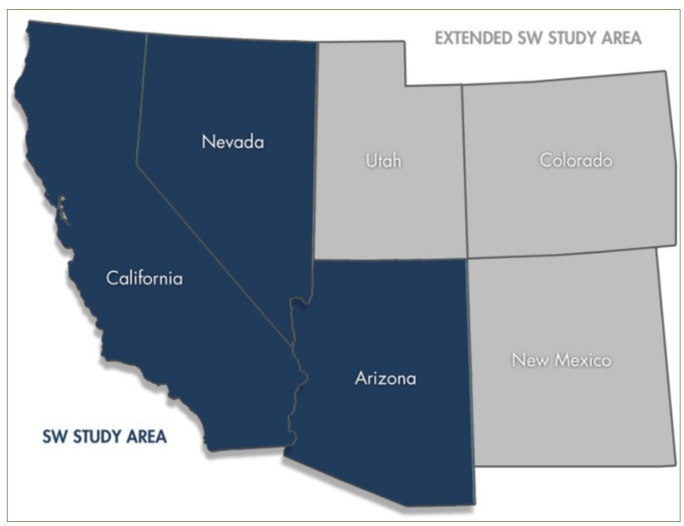
The region also has demonstrated a willingness to collaborate on projects that cross state lines. Ongoing multi-state planning efforts for the highway and rail transportation corridors include mobility improvements to the I-15 corridor that spans California, Nevada, and Arizona, as well as Utah, Idaho, and Montana, and a proposed interstate connecting Phoenix and Las Vegas. The private sector is leading an effort to implement high-speed rail service connecting Southern California and Las Vegas. In addition to the array of projects, the passenger rail operating environment in this region contains a large number of existing and proposed services with a variety of operating speeds, technologies, and operating environments. Thus, with plans in a variety of development stages for HPR funding and financing, the amalgamation of projects from these states represents a good cross-section of projects in planning and design.

Geographically and demographically, the three states contain several fast growing *megaregions*—large networks of metropolitan areas linked by overlapping commuting patterns and business travel, economic activity, urbanization, and cultural resources. The Southwest also has unique geographic features and land ownership that have shaped development patterns and a constrained transportation system. With a diverse group of stakeholders involved in these plans and projects, innovative policies and bold initiatives have been introduced, and the Southwest presents opportunities for enhanced coordination through an MSRP.

1.4 Geographic Scope of Study

In this Study, the *SW Study Area* is defined as Arizona, California, and Nevada. The *Extended SW Study Area* includes the three-state area as well as Utah, Colorado, and New Mexico (Figure 1). It is acknowledged that the Study's designation of the Southwestern U.S. differs from more widely understood definitions of the region.

Figure 1 Southwest Study Area and Extended Study Area



To perform a network planning study at this large of a scale, the study focused on analyzing conceptual connections between metropolitan statistical areas (MSA) within the Extended SW Study Area.[3] Defined by the Office of Management and Budget and used by the U.S. Census Bureau and other federal agencies, MSAs are populated areas identified by commuting patterns and economic linkages across county boundaries. The SW Study accounted for all MSAs in the study area, including all census-designated metropolitan and micropolitan areas.

- MSAs have at least one urbanized area of 50,000 or more population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties.

[3] Specific stations and alignments were not identified. The data limitations associated with the analytic tool used for this study, CONNECT Beta, do not provide the level of granularity desired for planning and decision-making on specific alignments and station locations.

- Micropolitan statistical areas have at least one urban cluster of at least 10,000 but less than 50,000 population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties.

This classification includes about 94 percent of the U.S. population—84 percent in MSAs and ten percent in micropolitan statistical areas.[4]

Because the official names of MSAs are often quite long, this study has adopted a shorthand name for each MSA that is generally the name of the largest city in the MSA (e.g., "Reno" for the Reno—Sparks, Nevada, MSA). Deviations from this approach were used for Los Angeles-Long Beach-Santa Ana, California; San Francisco-Oakland-Fremont, California; and Riverside-San Bernardino-Ontario, California, MSAs, which this study refers to as "Greater Los Angeles,""S.F./Oakland," and "Inland Empire." A complete list of all MSAs in the Extended SW Study Area and this study's shorthand name for them is included in Appendix A.

1.5 Study Stakeholders

The SW Study was molded by comprehensive stakeholder engagement. Participants represented the diverse array of entities with an interest in HPR services in the Southwest, including state departments of transportation, metropolitan planning organizations, councils of government, transit agencies, Amtrak, freight railroads, and private rail developers (Table 2). Their primary charge was to begin developing a long-range preliminary vision for an HPR network and identifying the needs for governance and multi-state coordination in the Southwest.

An important aim of the stakeholder engagement was to capture the information generated by recent and ongoing efforts. Early and active engagement of the study stakeholders was essential for the SW Study to reflect the lessons learned and information from these efforts.

Table 2 Stakeholder organizations

Stakeholder Organizations
Amtrak
Arizona Department of Transportation
BNSF Railway Company
California High-Speed Rail Authority
Caltrain
Caltrans
Capitol Corridor Joint Powers Authority
Denver Regional Council of Governments
Flagstaff Metropolitan Planning Organization
DesertXpress (a.k.a., XpressWest)
Los Angeles County Metropolitan Transportation Authority
Maricopa Association of Governments
Mid Region Council of Governments
Nevada Department of Transportation
Orange County Transportation Authority
Regional Transportation Commission of Southern Nevada
San Diego Association of Governments
Southern California Association of Governments
Union Pacific Railroad
Utah Transit Authority
Washoe County Regional Transportation Commission

[4] Office of Management and Budget (OMB) Bulletin No. 10-02 announcing updates to metropolitan and micropolitan statistical areas as of December 2009, based on the Census Bureau's July 1, 2007 and July 1, 2008 population estimates for cities and towns, and in specified circumstances, local opinion. Data can be found at http://www.whitehouse.gov/sites/default/files/omb/assets/bulletins/b10-02.pdf (last accessed 04 Aug 2014).

1.5.1 Stakeholder engagement process

The formal stakeholder engagement program commenced with a conference call, and stakeholders subsequently participated in five workshops. A summary of the major milestones is provided in Figure 2.

Figure 2 Stakeholder involvement milestones

Stakeholders provided input across three primary topic areas, each of which is described below.

- **Transportation network connectivity**—Stakeholders provided input on potential MSA connections and service plans, as well as appropriate assumptions to use in the CONNECT Beta analyses. Stakeholders also identified the Candidate Corridors for the Southwest HPR Preliminary Network Vision presented in Chapter 5 of this study.
- **Transportation capacity**—Stakeholders helped identify capacity bottlenecks and current plans to address them as well as corridors where right-of-way expansion opportunities should be explored. The input received informed the content of Chapter 3 of this Study.
- **Institutional and governance**—Stakeholders identified current challenges to and opportunities for multi-state coordination and potential alternative governance options to advance a multi-state vision and to ensure the success of HPR projects that cross state lines. They also outlined near-term action items that could promote multi-state coordination at the conclusion of the study effort. Institutional and governance efforts are summarized in Chapter 6 of this study.

1.6 Guiding Principles for Southwest Multi-State Rail Network Planning

A set of guiding principles for SW HPR network planning emerged through a series of stakeholder discussions. The first three principles represent the stakeholders' desired outcomes of the SW HPR network. The fourth principle emphasizes the need for stakeholders to collaborate on addressing challenging issues. Stakeholders should consider the principles outlined below when developing a mission statement and formal goals and objectives in a future phase of network planning.

- **Guiding Principle 1**—Support development of safe, reliable, efficient, and inter-connected multi-modal travel options.
- **Guiding Principle 2**—Balance providing a premier transportation system with the duty to be responsible stewards of public dollars. Consider factors such as return on investment, cost effectiveness, and modal alternatives when developing the network.
- **Guiding Principle 3**—Envision a multi-state rail network that supports environmental, social, and economic sustainability.
- **Guiding Principle 4**—Encourage cross-state coordination to achieve the most optimal outcomes in network planning.

Chapter 2. Planning Context

Population, travel demand, and economic activity all influence the success of HPR. Unlike airports that are often located at the fringe of metropolitan areas, rail has the ability to reach the city center and support activities in a dense central core. Land use policies of local municipalities, as well as local and regional transit systems, can also be a critical factor in a community's ability to attract density and leverage the investments in intercity rail.

This chapter explores the three key areas of population, travel demand, and economic activity for the Extended SW Study Area and focuses on data relevant to assessing the suitability of the SW Study Area for HPR. The information contained in this chapter is presented at a high level and helps to inform the identification of corridors that could be included in a multi-state network.

2.1 Overview of the Study Area

The SW Study Area—Arizona, California, and Nevada—encompasses over 379,000 square miles. The geographic landscape varies dramatically, from vast stretches of undeveloped desert, to major mountain ranges, to heavily-developed urban areas flanked by growing suburbs. The region's extreme climates have contributed to great diversity in land settlement patterns; the area contains vast swaths of uninhabited land and other areas of extremely large, dense population concentrations. Key features of the SW Study Area to be considered in identifying HPR corridors include varying topography as well as a high number of public lands, including 50 national parks, 80 American Indian reservations (reservations, colonies, and rancherias), some with multiple land holdings and some crossing state boundaries, and several military bases. The existing transportation system—highway, air, and rail—is well developed but facing capacity constraints and aging facilities (discussed in Chapter 3).

The SW Study Area also includes three of the nation's 11 *megaregions*—Northern California, Southern California, and the Arizona Sun Corridor. Megaregions are large networks of metropolitan areas linked by overlapping commuting patterns and business travel, economic activity, urbanization, and cultural resources. As defined by *America 2050*, a megaregion can stretch over hundreds of miles with populations of greater than ten million people.[5] With a concentration of multiple metropolitan areas and their central business districts within corridors or networks of 100 to 600 miles, these megaregions are representative of areas where HPR networks could be successful. Figure 3 depicts the 3 megaregions in the SW Study Area as well as the other 8 in the U.S.

Due to the very hot and dry climate, the history of development in the **Arizona Sun Corridor** is tied closely to major water infrastructure projects that provided a steady supply of water to the arid region, the advent of air conditioning that made it possible for people to live in the desert, and commercial air travel that enabled large numbers of people to more easily travel to Arizona. Between 1940 and 1960, development in the Arizona Sun Corridor began to boom in the areas surrounding Phoenix, Tucson, and Prescott. The opening of I-10 and I-17 was also a major impetus to the formation of the Arizona Sun Corridor. Most cities in the megaregion are located along these highways and they remain the strongest transportation connection between the cities today, allowing the people and economies of the megaregion to continue to grow more inter-connected.

In the **Northern California** megaregion, the mild climate, available water supply, and long growing season quickly made the Central Valley one of the most agriculturally productive regions in the world and have contributed to the development of the megaregion. Sacramento served as a key port for the Central Valley, enabling produce from the northern and middle portions of the Central Valley to ship to the San Francisco Bay

[5] *America 2050*, 2008

area. Railroads further served to tie the region closer together, including Reno and Carson City, Nevada, where produce shipped to the east coast via rail.

Over time, the economy of the region has diversified. San Jose became the center of Silicon Valley, home to many of the leading computer and technology companies in the world, and experienced explosive growth during the rapid suburbanization of the U.S. during the 1960s through the 2000s. Although geographically constrained by mountains and bodies of water, the development of much of the Bay area converted agricultural land and other developable land, creating a pattern of suburban sprawl during and after the 1950s. This has resulted in longer commutes and the growth of communities in traditionally agriculturally productive regions, such as the Central Valley, Napa Valley, and Sonoma. Transportation was a key factor in the formation of the Northern California megaregion and continues to enhance connectivity among its cities. The ties to the ports of the San Francisco Bay area, Richmond, Oakland, and Redwood City to the Central Valley are still vital connections that fuel the economy of the region. The public transportation rail systems of Bay Area Rapid Transit (BART), Caltrain, and Altamont Commuter Express (ACE) as well as the Capitol Corridor and the San Joaquin Amtrak services connect many residents to the core areas of the San Francisco Bay area, and I-80 provides a direct connection to Reno from Sacramento.

Similar to the Arizona Sun Corridor, major water infrastructure projects enabled population growth and agriculture across the very dry lands of the **Southern California** megaregion. In Los Angeles, the ability to film year-round in the mild climate spurred the growth of the film industry. For Las Vegas, Nevada's laws allowing gambling and related entertainment prohibited in other states led to the development of casinos and hotels that attracted workers and visitors. The region today is tied to the entertainment and film industries; Southern California and Las Vegas are popular tourist attractions, and tourism, entertainment, and the film industry continue to serve as critical economic drivers for the region.

Much of the region is connected by Metrolink, Amtrak's Pacific Surfliner and Thruway Bus routes, and direct highway connections to Los Angeles, Long Beach, and San Diego, including Bakersfield at the southern end of the Central Valley, which is connected to Los Angeles on an Amtrak Thruway Bus route. I-15 connects Las Vegas to Southern California. The proximity and existing tourism and travel connections between Los Angeles and Las Vegas have fueled the desire for a faster rail connection even before Amtrak's Desert Wind ceased operations between Salt Lake City, Las Vegas, and Los Angeles in 1997. Las Vegas-Los Angeles HPR train proposals would further tie Las Vegas to the Southern California megaregion.

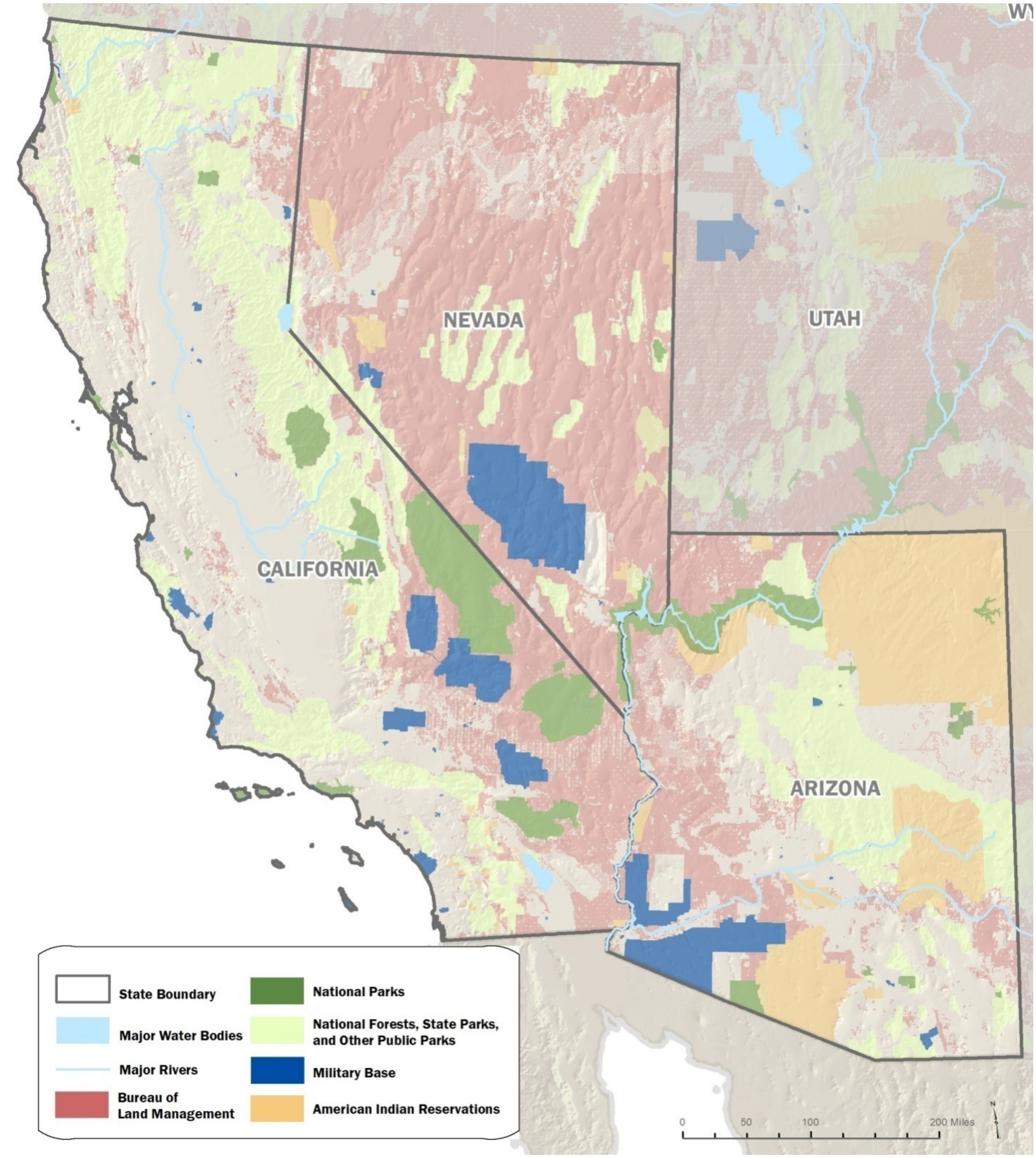
The Southern California megaregion also contains some of the busiest ports in North America, where the majority of U.S. goods from Asia enter the continent. This is critically important for the U.S. freight network, and some of the highest volume freight corridors emanate from Southern California for this reason.

Key factors that influence the formation of the megaregions include environmental characteristics and topography, infrastructure, economic linkages, settlement patterns and land use, and shared culture and history. HPR could strengthen connectivity within the megaregions, and a dramatic reduction in travel times could help improve the economies of each megaregion and foster linkages for one *super*megaregion. The analysis presented in the remainder of this chapter focuses on identifying key trends for the U.S. as a whole, the SW Study and Extended SW Study Areas, and the three Southwest megaregions.

2.1.1 Geographic features

Geographic features play a prominent role in the SW Study Area. In addition to topography such as mountain ranges, Figure 3 shows the water bodies, national and other parks, military bases, and American Indian reservations that comprise immense portions of these three states. These geographic features and land use designations represent potential constraints that can dictate the placement of transportation and other infrastructure investments.

Figure 3 Significant land uses in the SW Study Area



Source: Map prepared by Parsons Brinckerhoff. Data obtained from National Transportation Atlas Database (NTAD) 2010, NTAD, 2011; ESRI 2012; and the U.S. Department of Interior Bureau of Land Management, 2014.

2.2 Population and Travel Demand

2.2.1 Population

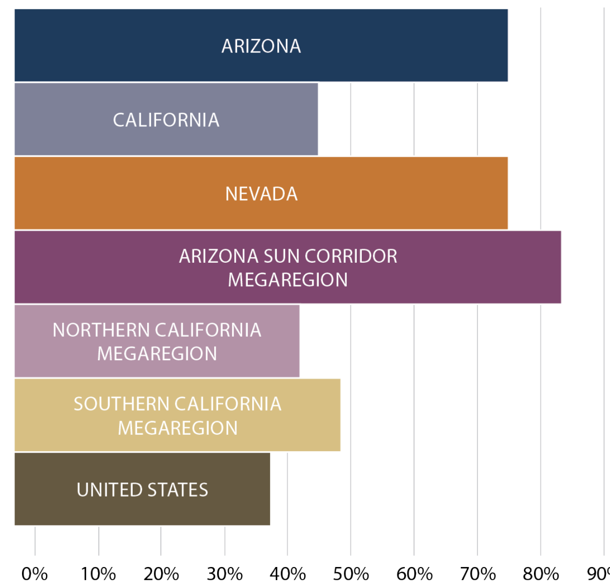
The SW Study Area contains some of the highest growth areas in the U.S.; Nevada and Arizona were the two fastest-growing states in the country between 2000 and 2010, with populations increasing 35.1 and 24.6 percent, respectively. Also of note, Utah was the third fastest-growing state, adding 23.8 percent more people between 2000 and 2010. These are significantly higher than the national growth rate of 9.7 percent during the same period.[6]

California remained the most populous state in the country and, while its total growth rate of 10.0 percent between 2000 and 2010 was on par with the U.S. as a whole, the total number of new residents in California (3.4 million) comprised 12.4 percent of the 27.3 million residents added to the U.S.[7]

As shown in Figure 4, significant growth is expected in the SW Study area by 2050.[8] Arizona and Nevada are each forecast to grow by 76 percent, nearly twice as fast as the national rate of 43 percent. In total, the SW Study Area is predicted to add 18 million people and expand from 15 percent to 16 percent of the U.S. population. Additional details on population growth can be found in Appendix B. Most of the Southwest's population lies within the three megaregions. As shown in Figure 5, the three megaregions contain roughly 95 percent of the population in the SW Study Area.

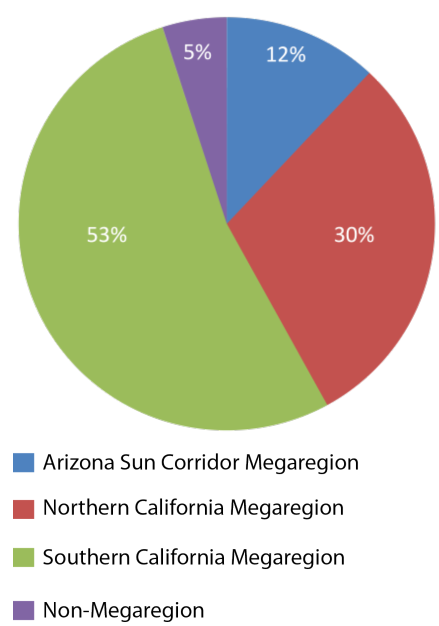
The Southwest contains the most populous state and the two fastest growing states over the last decade.

Figure 4 Forecast population growth between 2010 and 2050 in the SW Study Area



Source: 2010 data from 2010 Census, U.S. Census Bureau; 2050 figures extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010

Figure 5 Population distribution in the SW Study Area

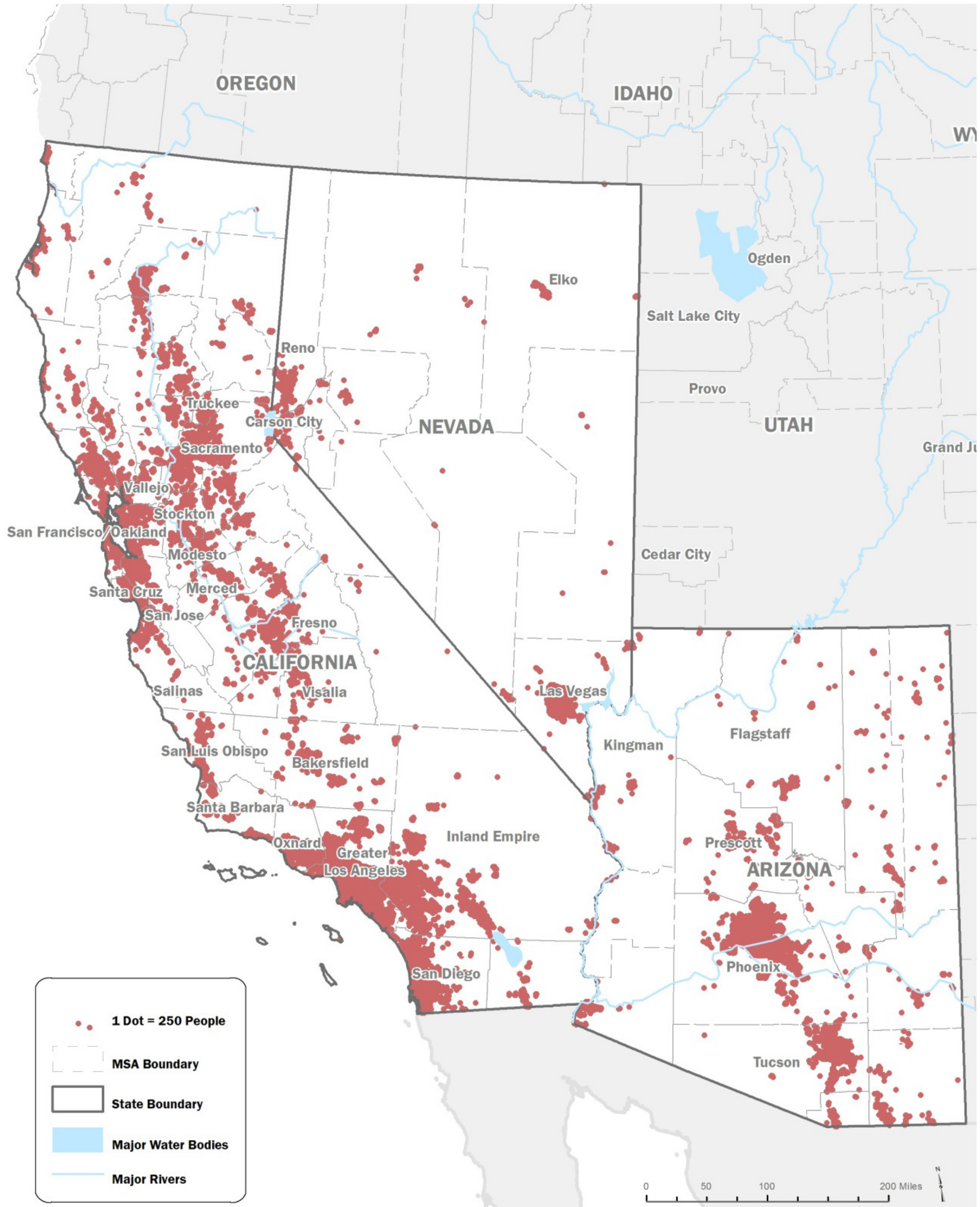


Source: 2010 Census data, U.S. Census Bureau

[6] U.S. Census Bureau, *Population Distribution and Change: 2000 to 2010,* March 2011
[7] U.S. Census Bureau, *Population Distribution and Change: 2000 to 2010*, March 2011
[8] 2040 is the latest year for which forecasts for all indicators in this chapter are available, thus data points were extrapolated to 2050 to reflect the planning horizon for the SW Study.

Population is distributed over a relatively small percentage of the land area in the Southwest. In 2010, roughly 94 percent of the SW Study Area's population was located in urban areas, as defined by the U.S. Census Bureau.[9] Urban areas account for just three percent of the total land area in the three states.[10] Population density is important, as rail is often most competitive when it is serving dense concentrations of population and economic activity. Figure 6 illustrates the relative concentration of population within the SW Study Area.

Figure 6 Population density



Source: Map prepared by Parsons Brinckerhoff. Data obtained from 2010 Census, U.S. Census Bureau and ESRI, 2012.

In many instances dots overlap in this map, which may give the appearance of a smaller than actual population.

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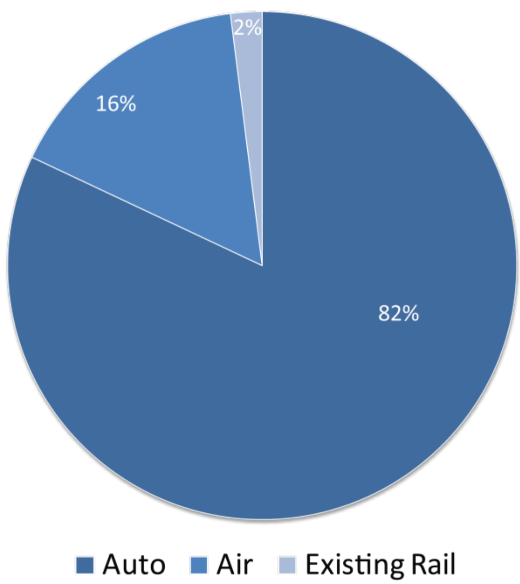
[9] For the 2010 Census, the Census Bureau defines urban areas as all urbanized areas and urban clusters. These are densely developed territory and encompass residential, commercial, and other nonresidential urban land uses. Urbanized areas have 50,000 or more people and urban clusters have at least 2,500 but less than 50,000 people.

[10] U.S. Census Bureau, *Lists of Population, Land Area, and Percent Urban and Rural in 2010, Percent Urban and Rural in 2010 by State*, www.census.gov/geo/www/ua/2010urbanruralclass.html (last accessed 04 Aug 2014)

2.2.2 Travel patterns

Auto is the predominant mode for intercity travel in the Southwest, as shown in Figure 7. Due to faster growth expected for air, air travel is expected to gain a larger share of the intercity market in the absence of new rail investments. Intercity travel within the region is forecast to increase nearly 70 percent between 2010 and 2050, from 162 million to 273 million trips per year. Annual trips via air are expected to increase more than 300 percent from 27 million in 2010 to 84 million by 2050. Trips via auto are projected to rise 42 percent.[11] Absent any new investment, annual trips by rail are anticipated to continue to comprise a relatively small share of intercity travel overall.

Figure 7 Current (2010) intercity mode shares between MSAs in the Southwest Network



Source: CONNECT Beta Version, 2012

In addition to regular intercity travel, there is one additional type of trip considered in this study—connect air trips. These are air trips between an MSA in the Extended SW Study Area and a location outside the Southwest, but where one leg of the trip could be replaced by a rail trip within the Southwest (which would then connect to a flight for travel to/from outside the Southwest). An example of a connect air trip is a passenger traveling from Las Vegas who may catch a regional jet to Salt Lake City, and then continue from Salt Lake City to his or her final destination in Washington, DC. In 2010, total connect air trips were estimated at 12.3 million, and by 2050 they are expected to more than double, reaching 35 million.[12]

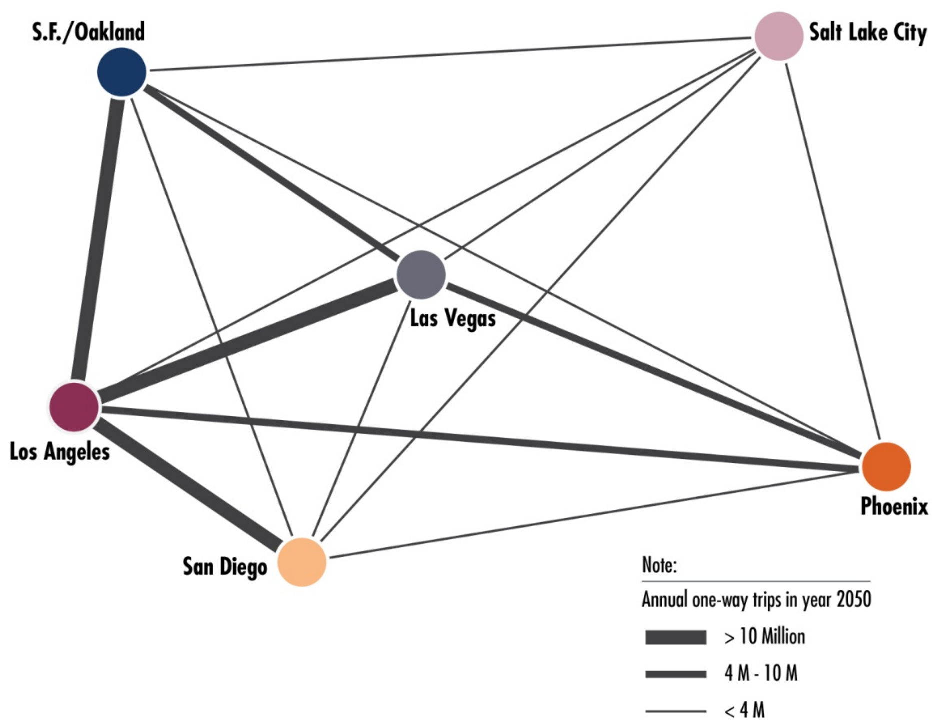
Considering intercity trips of 50 to 800 miles between MSAs in the Extended SW Study Area, trips between just six MSAs represent 44 percent of all intercity travel between MSAs considered in this Study.[13] Figure 8 illustrates the scale of travel between these large MSAs. Of note, travel to/from Greater Los Angeles is the largest intercity travel market for each MSA identified in this figure, even though Los Angeles is not always the closest MSA. The travel market data emphasizes the importance of markets to/from Greater Los Angeles.

[11] All travel demand figures presented in this report are for intercity trips between 50 and 800 miles. Trips less than 50 miles generally are not considered intercity travel and rail is typically not time-competitive with air on distances greater than 800 miles.

[12] CONNECT Beta Version, 2012

[13] CONNECT Beta Version, 2012

Figure 8 Total trips between selected MSAs



Source: CONNECT Beta Version, 2012
Only a small number of MSAs are presented in this graphic to enhance visual clarity. Other MSAs, such as the Inland Empire and Sacramento, also generate a large number of trips to other MSAs.

2.3 Economic Activity

With a combined gross domestic product (GDP) of $2.3 trillion, the economies of the SW Study Area represent 15.7 percent of the total U.S. economy.[14] If these three states were a country, they would be the sixth largest economy in the world, on par with the United Kingdom and 40 percent larger than Canada.[15] Viewed this way, the Southwest is the largest economy in the world that does not currently have dedicated high-speed rail.

The Southwest is the world's largest economy without high-speed rail.

2.3.1 HPR and Economic Growth

There is growing consensus among academic researchers—in fields such as economics, geography, business, and management—that high speed rail fosters increased economic productivity and contributes strongly to a region's competitive advantage. High speed rail uniquely facilitates increased face-to-face interactions for high value activities—for example, among scientific and technical research and universities, corporate headquarters, global finance and business services, and media and cultural centers.

The economic benefits of high speed rail and other major transportation improvements have been captured by recent research. Researchers, such as Daniel Graham at the University of London, a major contributor to new methods of economic evaluation of transportation investments in the United Kingdom, have documented the

[14] U.S. Bureau of Economic Analysis, *2010 Gross Domestic Product*
[15] Analysis based on 2010 GDP by country data from The World Bank, http://data.worldbank.org/indicator/NY.GDP.MKTP.CD/countries (last accessed 04 Aug 2014)

impact of high speed rail in achieving “agglomeration economies,” which arise because of the advantages that result to firms from the spatial concentration of economic activities.[16]

A growing body of literature suggests that agglomeration benefits are significant; one researcher found that traditional economic models underestimate the economic impact of high speed rail investment associated with agglomeration benefits by 10 to 80 percent.[17] Other studies from Europe, using sophisticated economic models, suggest that agglomeration-related economic benefits will account for up to 40 percent of total benefits, with most high speed rail investments falling between 10 and 20 percent of total benefits.[18] Studies of Japanese cities with high speed rail stations showed areas achieved average population growth rates of 1.6 percent while bypassed cities grew at 1 percent. Similarly, intermediate German cities connected via high speed rail to Frankfurt and Cologne experienced a 2.7 percent increase in GDP due to the increase in market accessibility to the larger cities.[19]

2.3.2 Business clusters, megaregions, and HPR

A key to understanding the benefits of HPR relates to how modern knowledge-based economies compete and grow: instead of individual industries, economic growth increasingly depends on the development of business clusters. These are characterized by complex networks and synergies among industries and institutions, involving a range of interrelated activities extending from research and innovation, financing, production, management, public policy, and infrastructure. Harvard Business School’s Michael Porter, a leading global academic expert in economic clusters, has consistently noted the importance of transportation linkage as one of the contributors to cluster growth and competitive advantage.[20]

While better accessibility contributes to an area’s productivity and to the strengthening of business clusters in general, HPR is uniquely suited to *linking* areas into megaregions and to strengthening the major economic clusters. Clusters are stronger, more productive, and more competitive when the *density* of interactions increases. Megaregions, anchored by one or more Global Cities,[21] provide the basis for competing at a global scale. U.S. megaregions, such as the Southwest, need to compete against existing as well as many more emerging global cities in Europe, Asia, Latin America, and elsewhere. The competition from these, many of which have or are developing advanced high speed rail networks, will be fierce.

There is a growing body of theory related to the economic and social interactions that characterize megaregions and the benefits of intercity passenger rail in strengthening them. The University of Chicago’s Saskia Sassen, a leading expert on global cities, has characterized the potential for competitive advantage arising from increased diversity of economic and social interactions:

> *“a megaregion can incorporate diversity into a single economic megazone. Indeed, in principle, it could create conditions for the return of particular (not all) activities now outsourced to other regions or to foreign locations. This would expand the project of optimizing growth beyond the usual preference for state of the art sectors (such as office and science parks) and include a greater diversity of economic sectors.”*[22]

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[16] Graham, D.J., “Agglomeration Economies and Transport Investment,” *Discussion Paper No. 2007-11*, International Transport Forum, Joint Transport Research Centre, OECD, December 2007

[17] Preston, J., A. Larbie, G. Wall, “The Impact of High Speed Trains on Socio-Economic Activity: The Case of Ashford (Kent),”4th Annual Conference on Railroad Industry Structure, Competition and Investment, Universidad Carlos III, Madrid, 2006

[18] de Rus, G. (ed.), *Economic Analysis of High Speed Rail in Europe*, Fundacion BBVA, Bilbao, Spain 2009

[19] Ahlfeldt, G.M. and A. Feddersen, *From Periphery to Core: Economic Adjustments to High Speed Rail LSE*, University of Hamburg, 2010

[20] Porter, M., “Location, Competition, and Economic Development: Local Clusters in a Global Economy,” *Economic Development Quarterly*, Vol. 14. No 1, February 2000

[21] Sassen, S., *The Global City: New York, London, Tokyo. 2000. Princeton; Sassen, Cities in a World Economy*, Thousand Oaks California, 2000

[22] Sassen, S., “Megaregions: Benefits Beyond Sharing Trains and Parking Lots?,” in *The Economic Geography of Megaregions*, published jointly by the Policy Research Institute for the Region, Woodrow Wilson School, Princeton and the Regional Plan Association as part of America 2050, 2007

Other researchers have focused also on megaregion growth and global city competitiveness: Peter Taylor's Globalization and World Cities Project has noted, among other things, the importance of expanded and more efficient international air service connections, something which the Southwest HPR network could greatly enhance if it provided fast, reliable, and direct connections to international airports. Presently, the Globalization and World Cities Project ranks Los Angeles as an *alpha* world city, with San Francisco a *beta* world city along with several up-and-coming locations, such as Sao Paolo, Madrid, Moscow, and Seoul.[23]

Case studies of specific industries confirm the potential for increased economic integration among areas served by high speed rail. For example, a study conducted on behalf of the orthopedics industry in Warsaw, Indiana (the largest concentration of orthopedics developers and manufacturers in the U.S.) found significant productivity benefits, as well as substantial potential for increasing critical face-to-face interactions among researchers, teaching hospitals, national surgeon leaders, equipment vendors and sales representatives, etc. In addition, the connectivity provided to Chicago and the rest of the Midwest high speed rail network was considered by industry executives to be critical to future recruitment and retention.[24]

In a global age, with an extensive communications and data processing infrastructure, seamless, reliable, low cost and safe travel are the new standards necessary for coordinating movements across the global network. An efficient HPR network in the study area would not only strengthen existing megaregion connections, but could help integrate the three megaregions to function as a single economically competitive unit. National benefits would also be created by strengthening the performance of this important region in the U.S.

2.3.3 SW Study Area economic interdependencies and the multi-state rail network

The southwest region includes three of the 11 emerging megaregions in the U.S.[25] One need only look at the economies of the metropolitan areas of the Southwest to see the potential for growth from linking the region together more closely. Cities of the Southwest and West have been particularly successful already in exploiting interdependencies—Silicon Valley, for example, would not exist as it does today without the historic and continuing relationships with Stanford University. These types of synergies have room to more completely expand beyond their respective metropolitan areas.

To help assess potential economic interdependencies within the SW Study Area, an analysis was conducted of selected economic characteristics of five major MSAs within the region—Greater Los Angeles, S.F./Oakland, San Diego, Phoenix, and Las Vegas. That analysis examined several knowledge-based economic clusters across the five MSAs and noted potential interdependencies. After identifying concentrations of knowledge, arts, financing, and technology manufacturing clusters, the density of potential synergies across MSAs was evaluated. That analysis indicated very strong economic potential for interdependencies among the region's metropolitan areas. Appendix D presents the analysis of the economic clusters along with the intensity and frequency of potential spatial interdependencies.

Taken together, these considerations suggest HPR could make an important contribution towards providing better connections among the three SW Study Area megaregions. This multi-state HPR network could help the SW be more productive, varied, efficient, and competitive on the national and global stage. The benefits for the region's citizens could include more employment, higher incomes, and increased consumer choice. The key findings outlined in Section 5.3.1 underscore these interdependencies and further demonstrate the benefits of market connections and network connectivity through HPR.

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[23] Globalization and World Cities Project; for list of Alpha and Beta cities, see www.lboro.ac.uk/gawc/citilist.html (last accessed 04 Aug 2014)
[24] Parsons Brinckerhoff, for Orthoworx, *Economic Impacts of Midwest High Speed Rail on the Orthopedics Industry in Warsaw, Indiana,* January 2011, http://orthoworxindiana.com/newsletters/Passenger-Rail-Study-1_11_2011.pdf (last accessed 04 Aug 2014)
[25] Regional Plan Association, *America 2050: A Prospectus,* New York, 2006

Chapter 3. The Multi-State Transportation System

The transportation system of the SW Study Area is diverse, in terms of the modes represented and the markets served. Increases in population and travel demand discussed in Chapter 2 have shaped the development of the transportation system, yet capacity constraints continue to be experienced on the region's rail, highway, and air networks. Increased congestion in the transportation network leads to a less reliable, more costly, and less safe transportation system that can threaten the economy, environment and social conditions. Particularly, as auto and air travel is projected to grow, the need for alternative mobility solutions for people and goods becomes more evident.

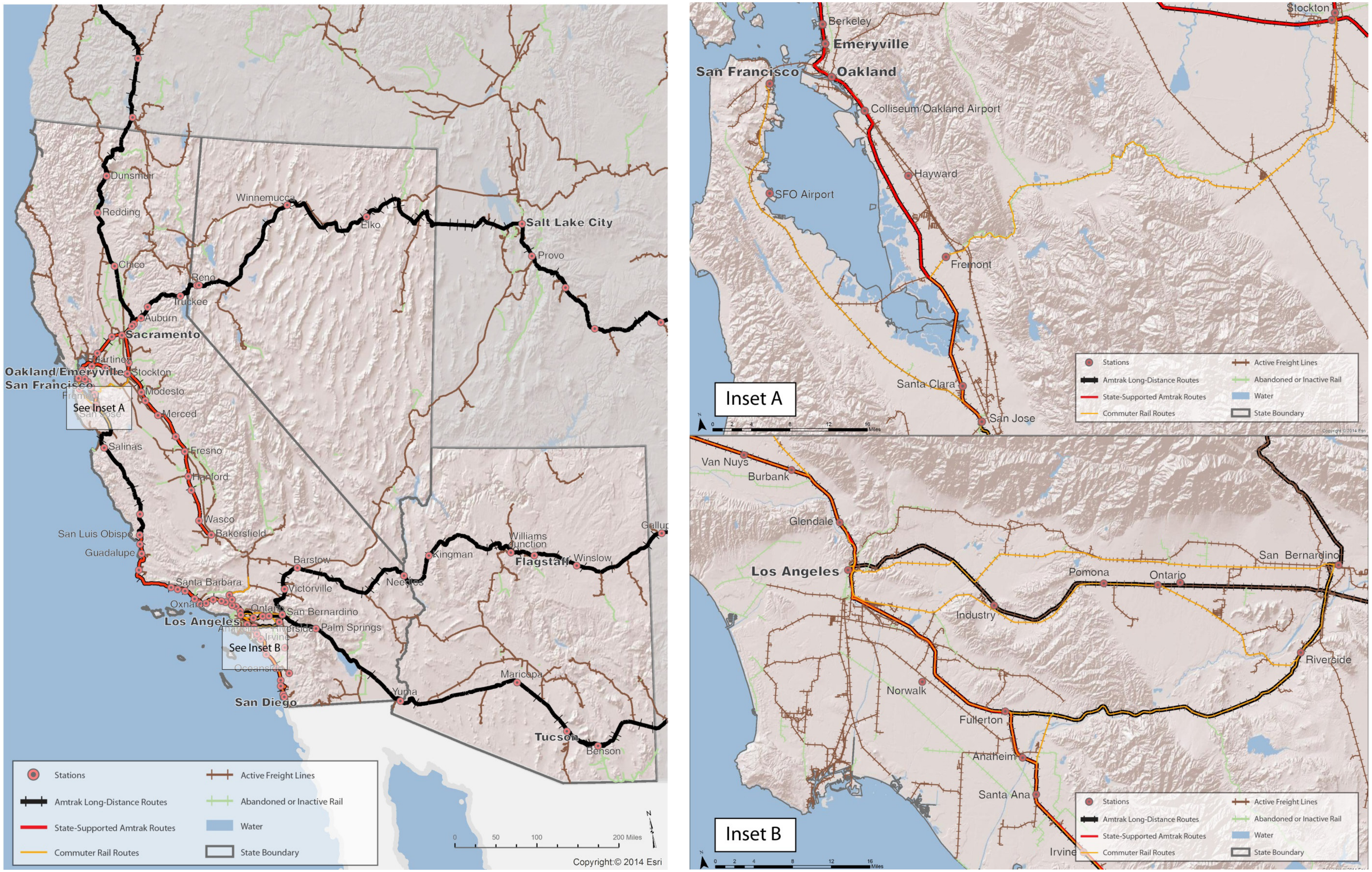
The long range transportation plan (LRTP) of each state reflects a long-term vision for a multimodal transportation system that provides a variety of modes as warranted, including highways, HPR, urban and rural transit (commuter rail, bus rapid transit, light rail, and buses), the air passenger system, and freight. In addition, with limited state funding, each state's LRTP is primarily focused on system preservation along with limited system expansion to accommodate growth in the movement of people and goods as population, employment, and economic activity increase. Common objectives include supporting mobility and economic development.

This chapter summarizes the SW Study Area's existing transportation system, including rail, highway, air, intercity bus, local transit service, and ports. It also provides an overview of the planned improvements that could affect the capacity of each mode and influence the viability of a multi-state HPR network.

3.1 Rail Network

The passenger rail network in the SW Study Area is deeply integrated with the Class I freight carriers. The region's two Class I railroads, Union Pacific (UP) and Burlington Northern Santa Fe (BNSF), host the majority of passenger rail service on their trackage, with some commuter operators owning their respective rights-of-way in California. Commuter rail serves metropolitan areas in several California cities, and Amtrak provides intercity rail service in all three states but with varying frequencies. Shortline railroads are located in all three states, providing connections to the Class I carriers, linking industries requiring rail freight, or operating as a tourist passenger train service. Figure 9 presents the SW Study Area's current passenger and freight rail network, along with Amtrak stations and abandoned or inactive rail lines

Figure 9 Rail network



Source: Map prepared by Parsons Brinckerhoff. Data obtained from Federal Railroad Administration, 2009 and ESRI, 2014.

3.1.1 Existing multi-state rail network

This section describes the freight, Amtrak, and commuter rail services that encompass the rail network in the SW Study Area.

Freight

The SW Study Area encompasses critical elements of the intercontinental freight network, including the CANAMEX trade corridor that traverses Arizona and Nevada and major corridors that connect west coast ports with the eastern U.S. Goods movement requires much of the region's rail network capacity and, consequently, there are limited opportunities to add passenger service on the existing freight rail network. Table 3 summarizes the freight network in the SW Study Area. In total, across the three states, there are 8,533 miles of Class I trackage, along with 31 distinct shortline carriers.

Table 3 Freight rail Class I miles and number of shortlines

	Class I Railroads	Class I Track Miles	Shortlines
Arizona	BNSF	595	7
	UP	1,237	
California	BNSF	2,125	23
	UP	3,384	
Nevada	UP	1,192	1

Source: Association of American Railroads, Freight Railroads in Arizona, Freight Railroads in California, Freight Railroads in Nevada, 2009

California's freight network is large (Figure 10), with 5,305 miles of track originating or terminating approximately 140 million tons in 2009.[26] Four major "port-to-border" transportation corridors have been established and serve as the state's goods movement backbone, built up over decades to encompass large complexes that facilitate ship-to-rail, rail-to-truck, and truck-to-rail exchanges to move containers to their ultimate destinations. These corridors are: Los Angeles-Long Beach/Inland Empire, San Diego/Border, San Francisco Bay Area, and Central Valley.[27] Maintaining and increasing capacity along these transportation arteries provides not only a basis for economic growth in the State, but also allows them to serve as an increasingly important network for freight throughout the entire U.S.[28]

All of Nevada's Class I track miles are owned by UP. BNSF has track usage rights to 805 of those miles. In 2009, the freight network in Nevada moved 191 million net tons and 96 percent of this was through traffic.[29]

The situation is similar in Arizona, which also serves primarily through traffic. Slightly more than 100 million tons are through traffic, compared to 28 million inbound tons and three million outbound tons.[30]

[26] Association of American Railroads, *Freight Railroads in California*, 2009
[27] State of California *Phase I Goods Movement Action Plan*, September, 2005
[28] California Department of Transportation, *California State Rail Plan,* March 2008
[29] Nevada Department of Transportation, *Nevada State Rail Plan*, Draft, March 2012
[30] Arizona Department of Transportation, *Arizona State Rail Plan*, Draft, March 2011

Figure 10 Freight density map

Source: Map prepared by Parsons Brinckerhoff. Data obtained from Federal Railroad Administration, 2009 and ESRI, 2014.

Intercity passenger rail

Amtrak operates long-distance routes across the SW Study Area and state-supported corridor routes in California. While there has been relative success and growth in California's corridor services, the states of Arizona and Nevada have not seen similar ridership growth due to the locations of some of the stations and reliance on the relatively infrequent Amtrak long-distance service in their metropolitan areas.[31] For example, Amtrak's intercity service in Arizona primarily serves long-distance overnight markets and does not serve the state during optimal times of the day. Similarly, the Amtrak station within close proximity of Phoenix is actually located in Maricopa—approximately 35 miles south of downtown Phoenix and without public transit access—likely limiting the attractiveness of the service to people who live in Phoenix.

Table 4 summarizes the four long-distance routes that Amtrak operates across the SW Study Area. The *Sunset Limited* is a good example of the challenges any new service between Los Angeles and Phoenix will face as a result of operating over an important freight corridor. Initially the Sunset Limited operated three times per week to directly serve Phoenix, but in 1996, due to UP's desire to downgrade its Phoenix to Yuma (Wellton Branch) line, the Sunset Limited was rerouted to a more southerly route bypassing Phoenix. Additionally, the Sunset Limited has operated only three days per week in both directions since 1971. This is a primary factor limiting its ridership and success as a route. Ultimately, a significant investment in infrastructure will be required for any new service between Los Angeles and Phoenix. As such, any vision for new service must also identify and address UP's capital needs.

Table 4 Amtrak long-distance routes

	Termini	Extended SW Study Area States Served	Selected MSAs Served	FY 2011 Ridership[1,3]	Host Railroads in SW Study Area States
Southwest Chief	Los Angeles, CA and Chicago, IL	AZ, CA, NM	Greater Los Angeles	354,912	BNSF
Sunset Limited	Los Angeles, CA and New Orleans, LA	AZ, CA, NM	Greater Los Angeles; Tucson	99,714	UP
California Zephyr	Emeryville, CA (San Francisco) and Chicago, IL	CA, NV, CO, UT	Sacramento; Reno	355,324	UP
Coast Starlight	Seattle, WA and Los Angeles, CA	CA	Sacramento; S.F./Oakland; Greater; Greater Los Angeles	426,584	UP, Metrolink/ SCRRA[2]

[1]*Source: Monthly Performance Report for September 2011, Amtrak, November 2011*
[2]*SCRRA is the Southern California Regional Rail Authority with its member agencies as the railroad owners.*
[3]*The Amtrak Sunset Limited has operated only thrice weekly service since 1971.*

Amtrak also operates state-supported corridor service within California, including the *Pacific Surfliner*, the *Capitol Corridor*, and the *San Joaquin*. These three routes are the second, third, and fifth busiest corridors in the country, respectively, and combined accounted for nearly 19 percent of Amtrak's total ridership in fiscal year 2011.[32] They are also among the fastest growing corridors, with Los Angeles to San Diego as the highest volume MSA-MSA pair in the Amtrak network outside of the Northeast Corridor. Amtrak previously operated a corridor route across southern Nevada, the *Desert Wind*, which served Los Angeles, Las Vegas and Salt Lake

[31] *U.S. High-Speed Rail System Summary: Arizona/Southwest*, HIGHSPEEDRAIL TEXASHSR.ORG: www.bqaz.gov/PDF/Rail_Framework_Final_Report_031610.pdf (last accessed 04 Aug 2014)
[32] *Monthly Performance Report for September 2011,* Amtrak, November 2011

City. The route operated three days per week (thrice weekly) in both directions and was discontinued in 1997.[33]

The State of California has heavily invested in intercity passenger rail, contributing to the overall success of these state-supported routes. Since Caltrans began funding the Pacific Surfliner service in 1976, nearly $1 billion in capital improvements has been made. Similarly, $460 million has been invested by the State in the San Joaquin corridor. The Amtrak state-supported routes in California are summarized in Table 5.

Combined, the seven Amtrak lines traversing the Southwest states, including the long distance routes and the California state-supported routes, carried 23 percent of Amtrak's total ridership in 2011.

Table 5 Amtrak state-supported corridor routes

	Termini	FY 2011 Ridership[1]	Host Railroads
Capitol Corridor	San Jose—Oakland—Sacramento—Auburn	1,708,618	UP, Caltrain
Pacific Surfliner*	San Luis Obispo—Santa Barbara—Los Angeles—San Diego	2,786,972	BNSF, Metrolink/ SCRRA, SDNR, UP[2]
San Joaquin*	Oakland or Sacramento—Bakersfield	1,067,441	BNSF, UP

[1]*Source: Monthly Performance Report for September 2011, Amtrak, November 2011*
[2]*SCRRA is the Southern California Regional Rail Authority; SDNR is the San Diego Northern Railroad.*
**Newly-created JPAs are currently negotiating with CALTRANS and the California Transportation Agency to assume responsibility for operations.*

Commuter rail service

California is the only state in the three-state SW Study Area with existing commuter rail service. Existing commuter rail services in California are summarized in Table 6.

Table 6 California commuter rail services

	Service Area	Current Operator	Average Weekday Ridership (000s)[1]	Host Railroads
San Diego Coast Express Rail—COASTER *(Owner: North County Transit District)*	San Diego to Oceanside	Transit America Services (Herzog Subsidiary)	5.0	San Diego Northern Railroad[2]
Metrolink *(Southern California Regional Rail Authority)*	Ventura, Los Angeles, Riverside, San Bernardino, Orange and San Diego Counties	Amtrak	39.6	Southern California Regional Rail Authority[2]
Caltrain *(Peninsula Corridor Joint Powers Board)*	San Francisco to Gilroy	Transit America Services (Herzog Subsidiary)	41.1	UP, Peninsula Corridor Joint Powers Board
Altamont Commuter Express *(San Joaquin Regional Rail Commission)*	Stockton to San Jose	Herzog Transit Services	3.0	UP

[1] *Public Transportation Ridership Report, Fourth Quarter 2011, American Public Transportation Association, February 2012*
[2]*With freight trackage rights.*

[33]*Las Vegas to Los Angeles Rail Corridor Improvement Feasibility Study*, 2007

3.1.2 Rail network constraints

Many of the rail capacity constraints in the SW Study Area are due to single track operations and competing demands for track between passenger and freight rail. Before a freight railroad grants a passenger operator use of its facilities, railroads generally require various capacity improvements to ensure the reliability of both freight and passenger services over time. It is also recognized that the topography in the Study Area presents serious constraints on the rail network. This section describes rail network constraints identified by the stakeholders within the SW Study Area.

California

Given its extensive intermodal network, California is facing significant capacity constraints that could potentially impact passenger service. The Class I railroads serve high levels of freight traffic along their corridors and are approaching maximum capacity. BNSF and UP have identified several chokepoints on their systems including:

- UP's Martinez Subdivision between Oakland and Martinez is also used by Amtrak and BNSF, provides connection to UP's Central Corridor and Feather River Canyon routes, and provides access to the Midwest and east along I-80.
- UP's Tehachapi Pass line between Bakersfield and Mojave, heavily used by BNSF, is a shared, single track route that connects Southern California to Northern California and the Northwest.
- BNSF's mainline through the Cajon Pass between the San Bernardino Mountains and the San Gabriel Mountains is a two to three track route. UP has rights to operate on a portion of this route segment between Daggett and West Riverside. UP also has its own single-tracked route with sidings parallel to BNSF's right of way through the Cajon Pass and has granted BNSF limited rights to operate on their tracks.
- Various places where the increase in intermodal freight traffic at the major California ports is placing heavy demands on existing railroad capacity, such as at the Port of Long Beach where rail capacity is reduced from three tracks to two at the intersection of Ocean Boulevard and I-710 on the existing mainline track. [34]

As ridership and train service have increased on commuter and intercity rail lines in California, in some cases capacity has proven insufficient to handle freight and passenger demands reliably. This is particularly common in metropolitan areas with substantial freight and passenger traffic. For example, freight interference causes major operating challenges for Metrolink, especially on UP's Los Angeles Subdivision between Riverside and Los Angeles. Heavy UP port rail traffic results in Metrolink trains operating behind schedule on nearly a daily basis.[35] Under development at the Los Angeles Union Station is the Southern California Regional Interconnector Project (SCRIP). This project will extend at least four of the existing platform tracks to form a "run through" track configuration. This will expand the capacity of Union Station by 50% and reduce greenhouse gas emissions from idling trains by 44%. This project will change the railroad operations in the southern California region and support the development of the California high speed rail project as well as any future HPR that could emerge from the SW Study.[36]

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[34] California Department of Transportation, *California State Rail Plan*, March 2008; The Port of Long Beach began construction March 26, 2013 on the Green Port Gateway project to add a third rail line, helping to remove bottlenecks on the existing mainline track (http://www.polb.com/news/displaynews.asp?NewsID=1142 - last accessed 04 Aug 2014)

[35] The Southern California Regional Interconnector Project, Los Angeles County Metropolitan Transportation Authority (Metro), retrieved from http://www.metro.net/projects/regionalrail/scrip (last accessed 04 Aug 2014)

[36] *The Southern California Regional Interconnection Project*, Los Angeles County Metropolitan Transportation Authority (Metro), retrieved from http://www.metro.net/projects/regionalrail/scrip

Arizona

Arizona is facing similar constraints on its freight network. Needs for Arizona's Class I railroads include the following:

- BNSF completed a triple double-tracking project through central New Mexico and will pursue triple-tracking through Northern Arizona as the economy recovers.[37] Additionally, facility access, elimination of grade crossings, and realignments of the rail bed were cited as potential needs for Flagstaff in the 2009 *Multimodal Freight Analysis Study*. These improvements would improve the operational efficiency and safety of rail operations.
- UP's primary asset in Arizona is its east-west Sunset Route. UP is planning to improve the Sunset Route into a high-capacity, double-tracked route throughout Arizona. The improvements are planned to serve increasing freight traffic, and double tracking the line could potentially triple its capacity, although it should be noted that these improvements are not guaranteed to support additional passenger service.[38]

Nevada

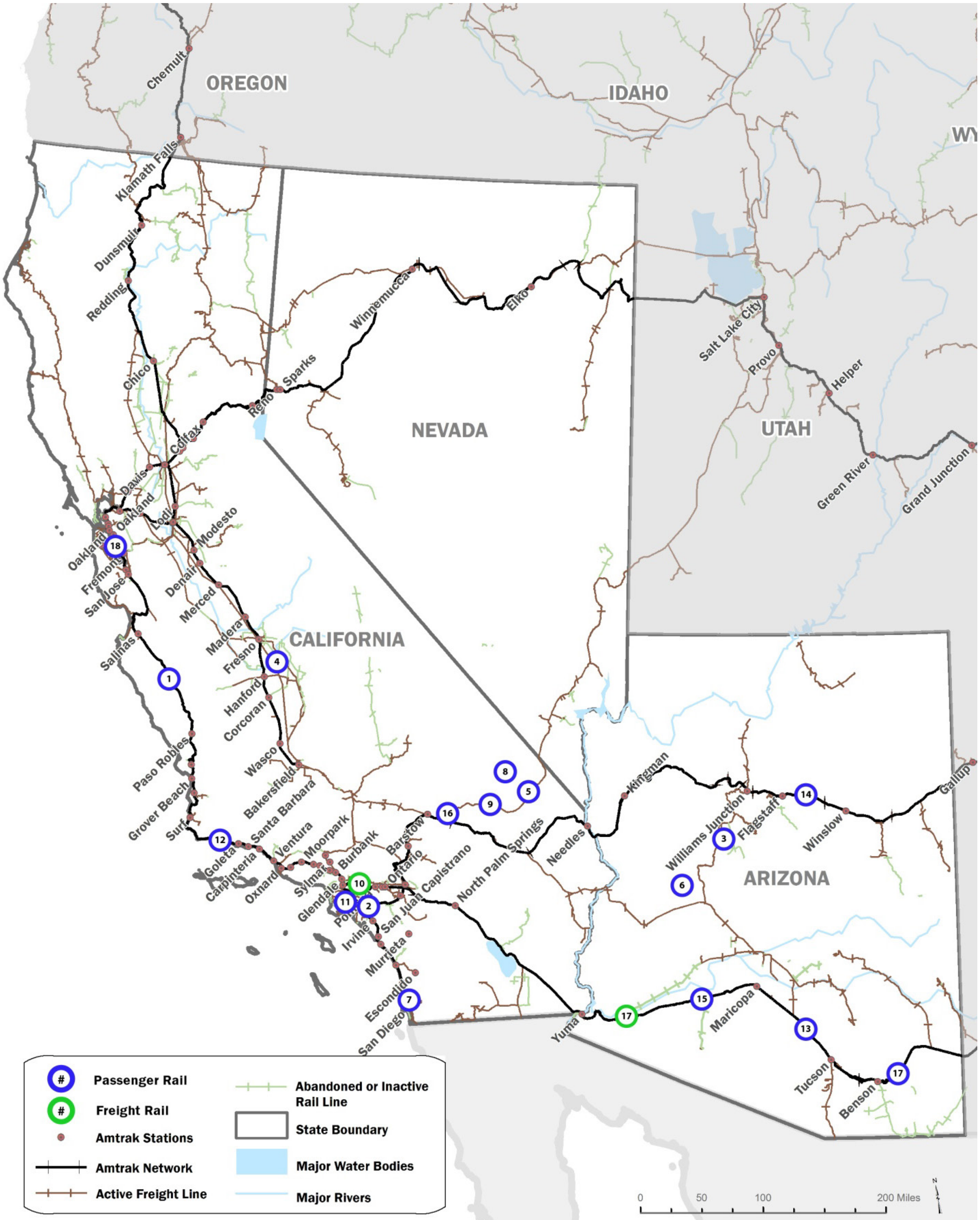
The ownership of the rail network in Nevada is concentrated with just one Class I carrier and one active shortline owner. The Nevada Department of Transportation (NDOT) does not own or control any rail lines. Grade crossing safety is a priority for the state, with projects in both the southern and northern portions of the state working to eliminate the grade crossings through the Las Vegas Valley and downtown Fernley.[39] An example of this, the ReTRAC project completed in 2005, eliminated two miles of at-grade freight track through Reno. Although through-rail tonnage has declined over the past four years, the volume of goods expected to originate in Nevada is expected to grow through 2040.[40] Recent legislation permitting design-build contract delivery and establishment of a pilot program for the use of the construction-management-at-risk model demonstrates the state's willingness to adopt new project delivery methods and practices.[41]

3.1.3 Planned rail improvements

Study stakeholders identified planned and potential improvements to alleviate these challenges or provide additional services in the SW Study Area. A number of these projects have capacity-improving elements within them but may not actually enhance capacity. These projects are also in various stages of development, with some programmed and others in the conceptual planning stages. These rail projects are shown in Figure 11 and Table 7; additional detail on these projects is provided in Appendix C.

[37] Arizona Department of Transportation Long-Range Transportation Plan, *What Moves You Arizona*, November 2011
[38] Arizona Department of Transportation, *Arizona State Rail Plan*, Draft, March 2011
[39] Nevada Department of Transportation, *Nevada State Rail Plan,* Draft, March 2012
[40] Nevada Department of Transportation, *Nevada State Rail Plan,* Draft, March 2012
[41] Nevada Department of Transportation, *Nevada State Rail Plan,* Draft, March 2012

Figure 11 Planned rail improvement projects



Source: Map prepared by Parsons Brinckerhoff. Data from Federal Railroad Administration, 2009, and ESRI, 2014.

Table 7 Planned rail improvement projects

	Project Name	Location(s)
1	Amtrak Coast Daylight Project	Between San Luis Obispo, San Jose, and San Francisco
2	Anaheim Regional Transportation Intermodal Center (ARTIC) Project	Anaheim
3	Arizona Spine Corridor Project (new rail service study)	Grand Canyon (north) to Nogales (south) using branches of BNSF Phoenix Subdivision, UP Phoenix Subdivision, UP Nogales Subdivision, Arizona Central Railroad, Grand Canyon Railway, Verde Canyon Railway, and Copper Basin Railway
4	California High-Speed Rail System (multiple project sections)	Between San Francisco, San Jose, and Sacramento in the North to Anaheim, Los Angeles, and San Diego in the South, via Merced, Fresno, Bakersfield and Palmdale.
5	California-Nevada Super Speed Train	Between Las Vegas and Anaheim following I-15 Corridor
6	CANAMEX Corridor Project (new service study)	State Portion: Las Vegas (north) to Nogales (south) using branches of BNSF Phoenix Subdivision, UP Phoenix Subdivision, UP Nogales Subdivision, and Arizona and California Railroad
7	Capacity, Bridge Replacements, and Other Rail Improvements	San Diego Subdivision, LOSSAN Rail Corridor, San Diego County
8	XpressWest (a.k.a., DesertXpress) Project	Between Victorville and Las Vegas following I-15 corridor
9	Los Angeles/Las Vegas Rail Study	Between Los Angeles and Las Vegas using one of a number of existing rail alternatives including Metrolink Subdivisions, UP Subdivisions, and BNSF Subdivisions
10	Los Angeles Port to Colton to Cajon Pass Rail Expansion Project	Los Angeles County
11	Los Angeles Union Station Rail Improvements	Los Angeles
12	LOSSAN Rail Corridor Rail Improvement Package	San Diego, Orange, Los Angeles, Ventura, Santa Barbara and San Luis Obispo Counties
13	Phoenix–Tucson Intercity Rail	Phoenix to Tucson Rail Corridor
14	Route 66 Corridor Project (passenger rail service improvement study)	East-west corridor between Lupton/New Mexico border (east) and Bullhead City/Lake Havasu City/California border (west) using branches of BNSF Transcon, Apache Railway, Grand Canyon Railway, and Black Mesa and Lake Powell Railroad
15	Sunset Route Corridor Project (passenger rail service improvement study)	East-west corridor between Willcox/New Mexico border (east) and Yuma/California border (west) using UP rail corridor
16	The X Train Project	Between Los Angeles Union Station and Las Vegas utilizing existing BNSF/ UP rail corridor
17	UP Sunset Route Double Track Project	Southern Arizona
18	Peninsula Corridor Electrification Project	San Francisco to San Jose

Source: Projects identified by Southwest MSRP Study stakeholders

Multi-state projects

Several multi-state HPR planning projects are currently being or have been studied between California and Nevada—all are described in this section.

XpressWest(a.k.a., DesertXpress)

The XpressWest project, formerly known as DesertXpress,[42] is a proposed new high-speed, steel wheel on rail double track interstate passenger rail line running 185 miles between Victorville (California) and Las Vegas. It would follow the I-15 freeway alignment. XpressWest is planned to utilize fully electric, next-generation trains that would operate at speeds of up to 160 miles per hour (mph) and can deliver passengers between Victorville and Las Vegas in under 80 minutes with non-stop service every 20 minutes during peak times and up to every 12 minutes based on demand. With an average round trip fare of $89 (in 2017 dollars), DesertXpress Enterprises, LLC (a private, for-profit corporation) anticipates it will generate enough revenue to pay for its own operating and capital costs.[43] Much of the route would use property along the I-15 alignment that is owned by the federal government and administered by the Bureau of Land Management. FRA issued a National Environmental Policy Act (NEPA) Record of Decision for the DesertXpress project in November 2011, and other federal agency approvals have also been granted. The estimated capital cost is $6.5 billion (year of expenditure dollars, or YOE $) and, at the time of this study, XpressWest was refining its financial plan.

California-Nevada Super Speed Train Project

Since 1988, the California-Nevada Super Speed Train Commission has been seeking support for magnetically levitated (maglev) ground transportation to connect Las Vegas to Anaheim via Primm, Barstow, Victorville, and Ontario. This project would follow the I-15 right-of-way and be separated completely from other traffic either at-grade or elevated. The project is envisioned to reach speeds over 300 mph, completing the 269-mile trip between Las Vegas and Anaheim in 86 minutes.[44] The priority is to build “The First Forty Miles®” in Nevada (between Las Vegas and the California state line at Primm/Ivanpah International Airport).[45]

The project was largely excluded from SCAG’s 2012-2035 Regional Transportation Plan/ Sustainable Communities Strategy, precluding the full project from receiving certain federal funds for additional study. In summer 2014, Congress repurposed SAFETEA-LU funds for the Nevada Maglev project and made them available for other railroad development programs administered by FRA.

X Train/Las Vegas Railway Express Train Project

The X Train/Las Vegas Railway Express (X Train) project was a proposed rail service that would connect Los Angeles Union Station and Las Vegas via the existing BNSF and UP rail corridors at speeds of up to 79 mph.

In its second quarter report for 2013, the Las Vegas Railway Express, the company developing the project, announced that it would no longer pursue approximately $100 million in new financing needed to launch the new service.[46] Since then, the company has been exploring opportunities to utilize the rail cars procured for the service on existing Amtrak routes.

Arizona

Both of Arizona’s Class I railroads, BNSF and UP, have plans to expand their transcontinental routes to achieve greater freight capacity. Expanding these corridors will accommodate increased freight volumes and provide capacity for improved efficiency. While additional intercity passenger routes between Arizona and other states might be more easily implemented along transcontinental corridors once additional capacity is available, such investments are not guaranteed to support additional passenger service.

For passenger rail, the Arizona Department of Transportation (ADOT) LRTP identifies needs for Amtrak, interregional commuter rail, and regional commuter rail, including opportunities for partnerships between the State and the Class I railroads for freight line improvements that would benefit passenger service:

[42] DesertXpress changed its name to XpressWest in 2012, in part to emphasize the role of the project in the Southwest HPR network.
[43] XpressWest, www.xpresswest.com/project.html (last accessed 04 Aug 2014)
[44] California-Nevada Super Speed Train Project, www.canv-maglev.com/pid10route.html (last accessed 04 Aug 2014)
[45] California-Nevada Super Speed Train Project, http://www.canv-maglev.com/pid7financing.html (last accessed 04 Aug 2014)
[46] Las Vegas Railway Express, Inc., Form 10-Q (Quarterly Report), filed 11/12/13 for the Period Ending 09/30/13

- The need for improved interregional rail service between Phoenix and Tucson has been documented by the 2008 *High Speed Passenger Rail Strategic Plan* and the 2010 *Statewide Rail Framework Study*. ADOT is currently performing the Arizona Passenger Rail Corridor Study: a Tier 1 EIS and Service Development Plan for the Phoenix—Tucson corridor. The benefits of the service would be increased mobility and travel options for Sun Corridor residents.
- Regional commuter rail options are under study in Arizona. The Maricopa Association of Governments' 2008 *Commuter Rail Strategic Plan* investigated the feasibility of and recommended the operation of commuter rail on the BNSF Peavine Line, on UP's Phoenix Subdivision from Queen Creek to Buckeye, and on UP's West Chandler-Tempe Industrial Lea branch line. The services would connect riders on a 110-mile network from suburban residential areas to downtown Phoenix and—in the case of the UP lines—to Mesa and Tempe work centers as well.[47]

ADOT's State Rail Plan includes a potential Arizona High-Speed Rail Corridor—an *opportunity* corridor for the Intermountain West advocated by the Western High Speed Rail Alliance. The conceptual HPR lines include service to New Mexico, Nevada, and California.[48]

California

In terms of freight improvements, the State Rail Plan identifies several planned and programmed freight rail projects throughout the state totaling nearly $8.4 billion that could help overcome the challenges facing California's goods movement system, accommodate international trade, and also benefit other areas of the U.S.[49] These projects include near dock facilities, port improvements, grade separations, intermodal terminals, double-tracking, and tunnel modifications. Since the 2008 plan, freight rail capacity constraints in the LA Basin have been alleviated primarily by triple-tracking in some sections, which benefits passenger train movements as well.

Additional projects identified in the State Rail Plan include an extension of the Capitol Corridor from Sacramento to Reno with up to two daily roundtrips. A coastal route (*Coast Daylight*) from San Francisco to Los Angeles via San Luis Obispo with one round trip train is proposed to start in 2020, however this project has not yet been studied or confirmed by Caltrain.[50] Potential intercity rail routes in planning include Los Angeles to Indio (Coachella Valley), San Francisco to Monterey, and Los Angeles to Las Vegas.

- Metrolink is currently in the process of upgrading its system to be Positive Train Control (PTC) compliant. This program was expected to cost the agency $230 million.[51]
- Caltrain has a list of capital projects that includes maintenance and safety work for track, stations, and rail cars.[52] The 2014 Peninsula Corridor Electrification Project aims to increase service from 92 to 114 trains per day, add one peak train in each direction, with the potential to increase service during off-peak hours.[53] The plan stresses state-of-good-repair upgrades but also includes PTC, electrification, and California High Speed Rail-Caltrain integration preparedness.

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[47] Maricopa Association of Governments (MAG), *Commuter Rail Strategic Plan Overview, Executive Summary,* 2008, Retrieved from http://www.azmag.gov/Documents/pdf/cms.resource/CRSG_2008_Draft-Commuter-Rail-Executive-Summary96339.pdf (last accessed 04 Aug 2014)
[48] Arizona Department of Transportation, *Arizona State Rail Plan,* March 2011, http://www.azdot.gov/docs/planning/state-rail-plan.pdf?sfvrsn=0 (last accessed 04 Aug 2014)
[49] California Department of Transportation, *California State Rail Plan*, 2013, Retrieved from http://californiastaterailplan.dot.ca.gov/docs/Final_Copy_2013_CSRP.pdf (last accessed 04 Aug 2014)
[50] California Department of Transportation, *California State Rail Plan*, 2013, Retrieved from http://californiastaterailplan.dot.ca.gov/docs/Final_Copy_2013_CSRP.pdf (last accessed 04 Aug 2014)
[51] Metrolink Quarterly Report, September 2011
[52] Peninsula Corridor Joint Powers Board, *Peninsula Corridor Joint Powers Board Comprehensive Annual Financial Report Fiscal Year Ended June 30, 2011,* December 2011
[53] Peninsula Corridor Electrification Project: Draft Environmental Impact Report, Caltrain, February 2014

- The SJRRC is currently working with the California High-Speed Rail Authority (CHSRA) and 12 other transportation-related entities, including the FRA and Caltrain, on the Altamont Corridor Express (ACE) project to develop a rail extension from the San Francisco Bay area into the Central Valley to connect with the proposed CHSR route. The goals for the project are to implement ACE service through the Altamont Pass on a dedicated passenger track, with the potential for the service to be fully grade-separated, electrified, and compatible with future CHSR.[54] The SJRRC is serving as the lead for the project under a 2013 amended MOU and will focus its resources to deliver near-term incremental improvements to the existing ACE service that can be achieved by 2018 when the IOS construction segment for CHSR is completed and by 2022 when the CHSR IOS is planned to be operational. In 2012, the California State Legislature appropriated $36.4 million for the project.[55]

California High-Speed Rail

California has been planning for high-speed rail since the 1990s, with the *California High-Speed Rail Act* established by the CHSRA to direct the development and implementation of intercity high-speed rail service in 1996. The April 2014 Business Plan calls out a phased implementation of three sections:

- Initial Operating Section (IOS) of 300 miles from Merced to San Fernando Valley
- Bay to Basin segment of 410 miles from San Jose and Merced to San Fernando Valle
- Phase One of 520 miles from San Francisco to Los Angeles/Anaheim

In addition, in 2012, the California State Legislature approved nearly $8 billion in federal and state funds for the construction of the first high-speed rail investment in the Central Valley and 15 bookend and connectivity projects throughout the State.[56] These early projects will have benefits as stand-alone projects and will help develop and mature regional HPR (less than 125 mph) culture and ridership that will be prepared to feed into core express service when it arrives.[57] This new plan estimates that the IOS will cost $31 billion (YOE $).[58] In the High, Medium, and Low ridership estimate scenarios, the revenue of this segment is enough to cover operating and maintenance costs. Both the High and Medium scenarios are projected to have a positive cash flow beginning in the first year of operations, and the Low scenario is projected to reach a positive cash flow by year two.[59]

Construction on the first portion of the Central Valley CHSR line began in 2012 and is planned to be completed by 2022. Closing the Bakersfield–Los Angeles Basin gap will help tie the Northern and Southern California megaregions together with rail service and allow those economic connections to begin to flourish. Future projects will focus on the remaining pieces—Los Angeles to San Diego, Fresno to San Francisco, Fresno to Sacramento, and improved ACE and high-speed rail service from San Jose into the northern Central Valley.

Nevada

With business growth in the Reno and Las Vegas MSAs, UP's intermodal business has grown considerably in Nevada, along with the development of super distribution warehouses. For example, the Tahoe Reno Industrial Center, located in Storey County approximately seven miles east of Reno-Sparks on the I-80 freeway, is proposed at build out to be the largest industrial park in the world. Rail services run through the middle of the park so businesses can utilize UP or BNSF or choose a private carrier. The City of Fernley, located on I-80

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[54] Altamont Commuter Express, www.Acerail.com (last accessed 04 Aug 2014); HPR Track 2 Corridor Programs" CA-Altamont Corridor Rail—NEPA/CEQA 10/01/09

[55] Altamont Commuter Express, http://www.cahighspeedrail.ca.gov/Altamont_Corridor.aspx (last accessed 04 Aug 2014); http://www.hsr.ca.gov/docs/brdmeetings/2013/060613/AI_3_Proposal_Amend_MOU.pdf (last accessed 04 Aug 2014)

[56] CHSRA, 2012 Business Plan, April 2012

[57] CHSRA, 2014 Business Plan, April 2014

[58] CHSRA, 2014 Business Plan, April 2014

[59] CHSRA, 2014 Business Plan, April 2014

approximately 32 miles east of Reno-Sparks at the intersection of U.S. Highways 50A and 95A, also established a business park with rail freight access.

Several proposals have been prepared to establish or upgrade rail lines in the State to haul garbage from the San Francisco Bay Area to White Pine County, as well as transport power generating products, and as a possible route to Yucca Mountain. Approximately 100 miles northwest of Las Vegas, Yucca Mountain has been identified as a primary depository for U.S. nuclear waste. Rail transportation would be used throughout the U.S. to ship 70,000 metric tons of nuclear waste to Yucca Mountain, though the stated policy of Nevada and the federal government at this time is opposed to transporting high-level waste and spent nuclear fuel to a geological repository at Yucca Mountain.[60]

Recent focus has been on project development for the XpressWest Project, which would connect Las Vegas to California (discussed previously). The draft 2012 *Nevada State Rail Plan* notes the importance of the return of Amtrak's Desert Wind service, which formerly served the cities of Caliente and Las Vegas.[61] The plan also references the potential for high speed rail in the Southwest rail *Golden Triangle*, which includes Phoenix, Las Vegas, and Los Angeles.[62]

3.2 Air Network

While auto trips dominate travel *within* the three megaregions in the SW Study Area—between large neighboring MSAs, such as Los Angeles, Inland Empire, and San Diego in Southern California; San Francisco, San Jose, and Sacramento in Northern California; and Phoenix and Tucson in Arizona—air travel is the predominant mode of intercity passenger transportation *between* the three Megaregions.

More than 26 million origin-destination air trips were taken within the SW Study Area in 2010.[63]An additional 12 million air passengers flew between MSAs in the region to connect to another flight destined for a location outside the region.[64]These 38 million combined regional air trips accounted for 36 percent of all departures at the region's airports.[65] This volume includes many of the nation's top short-haul air markets.[66] In the study area there are four airports that rank in the top ten for overall enplanements for FY 2013: Los Angeles (2), San Francisco (7), Las Vegas (9), and Phoenix (10).[67]

Driven by strong underlying population and economic growth, this air volume is projected to grow by nearly 100 percent by 2050 to 52 million origin-destination trips and 75 million total trips include connecting passengers. These projections, however, are unconstrained. The region's airports may be unable to accommodate this growth as many of the airports in the SW Study Area already experience congestion and capacity constraints. Many will continue to experience capacity constraints by 2025 even with planned improvements.[68]

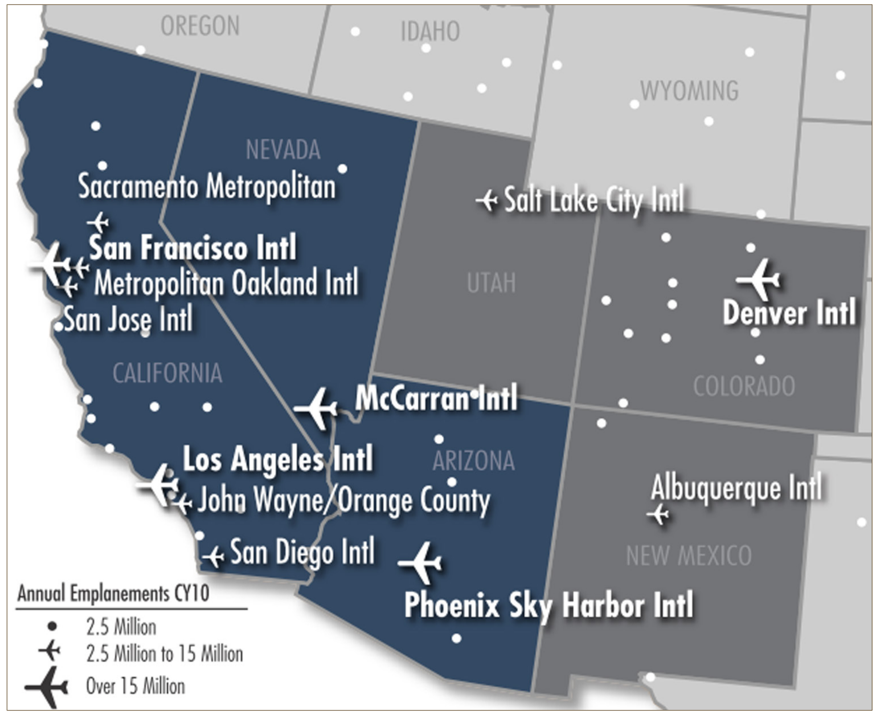
The Southwest contains the top seven short-haul air markets in the country.

[60] Nevada Department of Transportation, *Nevada State Rail Plan,* Draft, March 2012
[61] Nevada Department of Transportation, *Nevada State Rail Plan,* Draft, March 2012
[62] Nevada Department of Transportation, *Nevada State Rail Plan,* Draft, March 2012
[63] "Origin-Destination air trips" are counted when origin and final destination are both within the study area.
[64] BTS T-100 Market Data; BTS Office of Airline Information, Airline Origin and Destination Survey (DB1B), 2010
[65] RITA, BTS Airport Snapshots, 2010
[66] Short-haul air market defined as market of less than 600 miles.
[67] Federal Aviation Administration, *Preliminary CY 2013 Passenger Boarding and All-Cargo Data: Enplanements at All Commercial Service Airports (by Rank) Preliminary*
[68] FAA, FACT 2 Report, 2007

3.2.1 Existing multi-state air network

There are a number of commercial airports in the Southwest associated with the major metropolitan areas as shown in Figure 12. In 2010, total annual enplanements exceeded 15 million at five airports in the Extended SW Study Area: San Francisco International, McCarran International (Las Vegas), Los Angeles International, Phoenix Sky Harbor International, and Denver International.

Figure 12 Annual enplanements



Source: Calendar Year 2010 Revenue Passenger Enplanements at Primary Commercial Service Airports, Federal Aviation Administration, October 2011

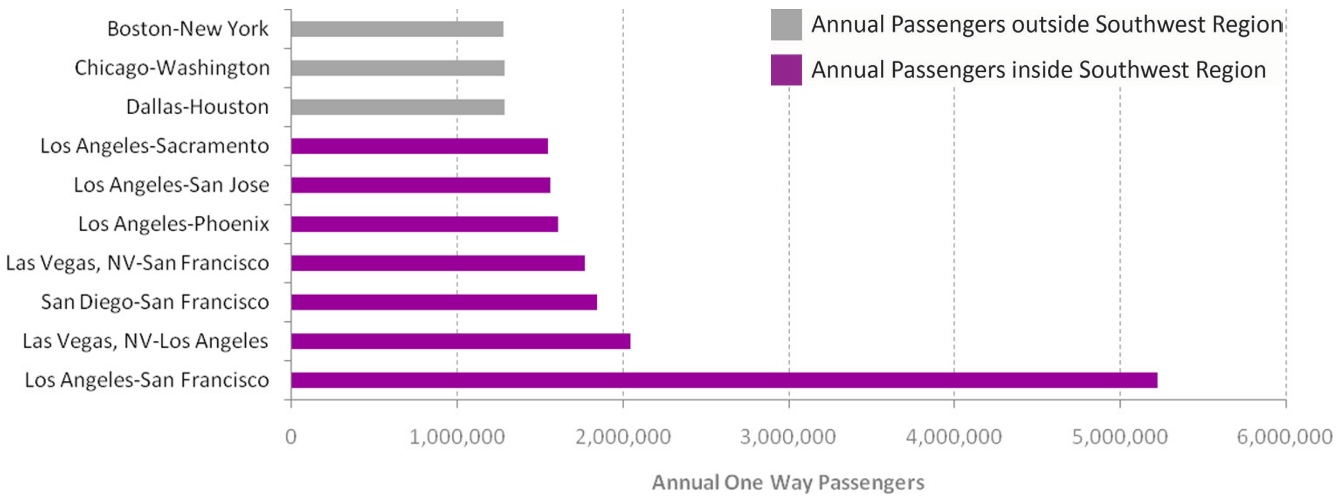
As shown in Figure 13, the top seven short-haul air markets in the country exist between MSAs in the SW Study Area.[69] These markets connect the major MSAs of San Francisco, Los Angeles, Las Vegas, Phoenix, and San Diego. With the exception of Los Angeles–Las Vegas, which is less than 300 miles, the other MSAs in the top seven are separated by 300 to 500 miles. The long distances between major markets and lack of competitive service for this distance offered by the existing rail network have led to a disproportionate reliance on short-haul flights for travel within the region. While the population of the SW Study Area represents 15 percent of the nation's population, it accounts for 24 percent of the short-haul air volume.

The Southwest has 15 percent of the nation's population yet accounts for 24 percent of the short-haul air

When considering the top ten air and/or rail travel markets less than 600 miles, the Southwest again ranks high. Seven of the country's top 10 air and/or rail travel markets less than 600 miles are within California, Arizona, and Nevada, as shown in Figure 14.

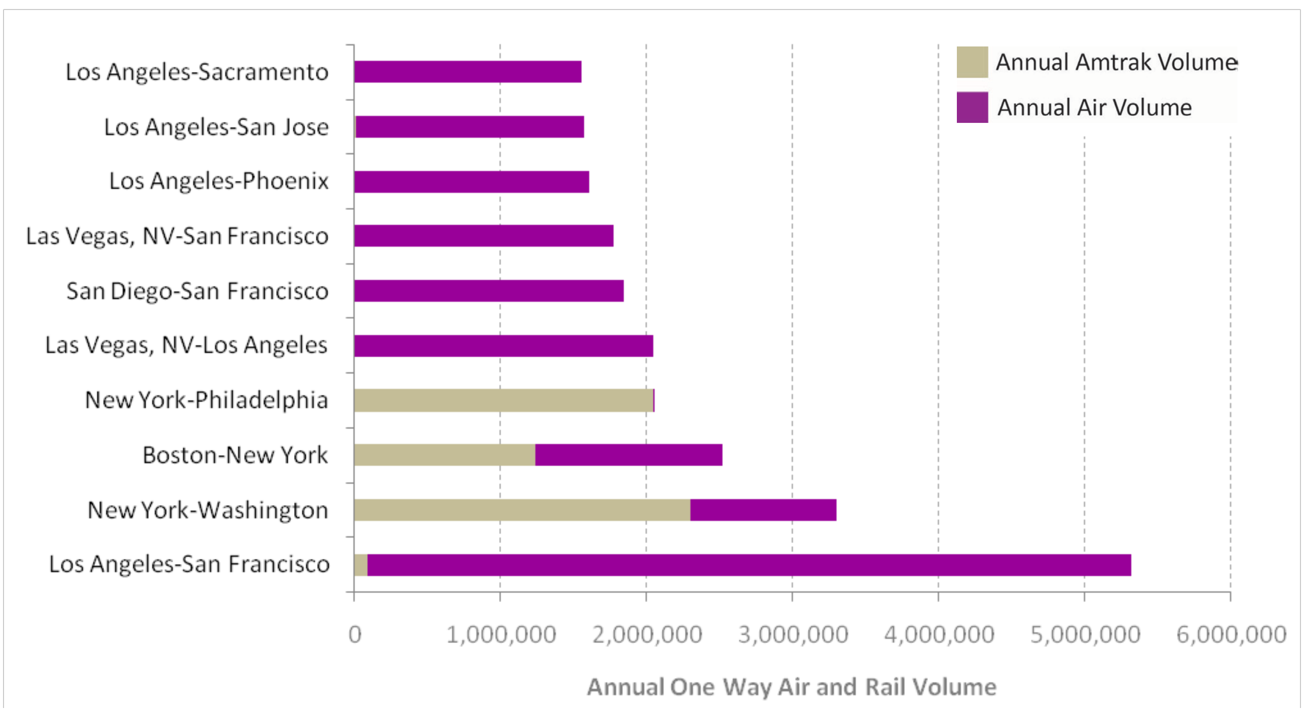
[69] BTS Office of Airline Information, Airline Origin and Destination Survey (DB1B), 2010

Figure 13 Top 10 air travel markets less than 600 miles



Source: Airline Origin and Destination Survey (DB1B), USDOT Bureau of Transportation Statistics Office of Airline Information, 2010

Figure 14 Top 10 air/rail travel markets less than 600 miles

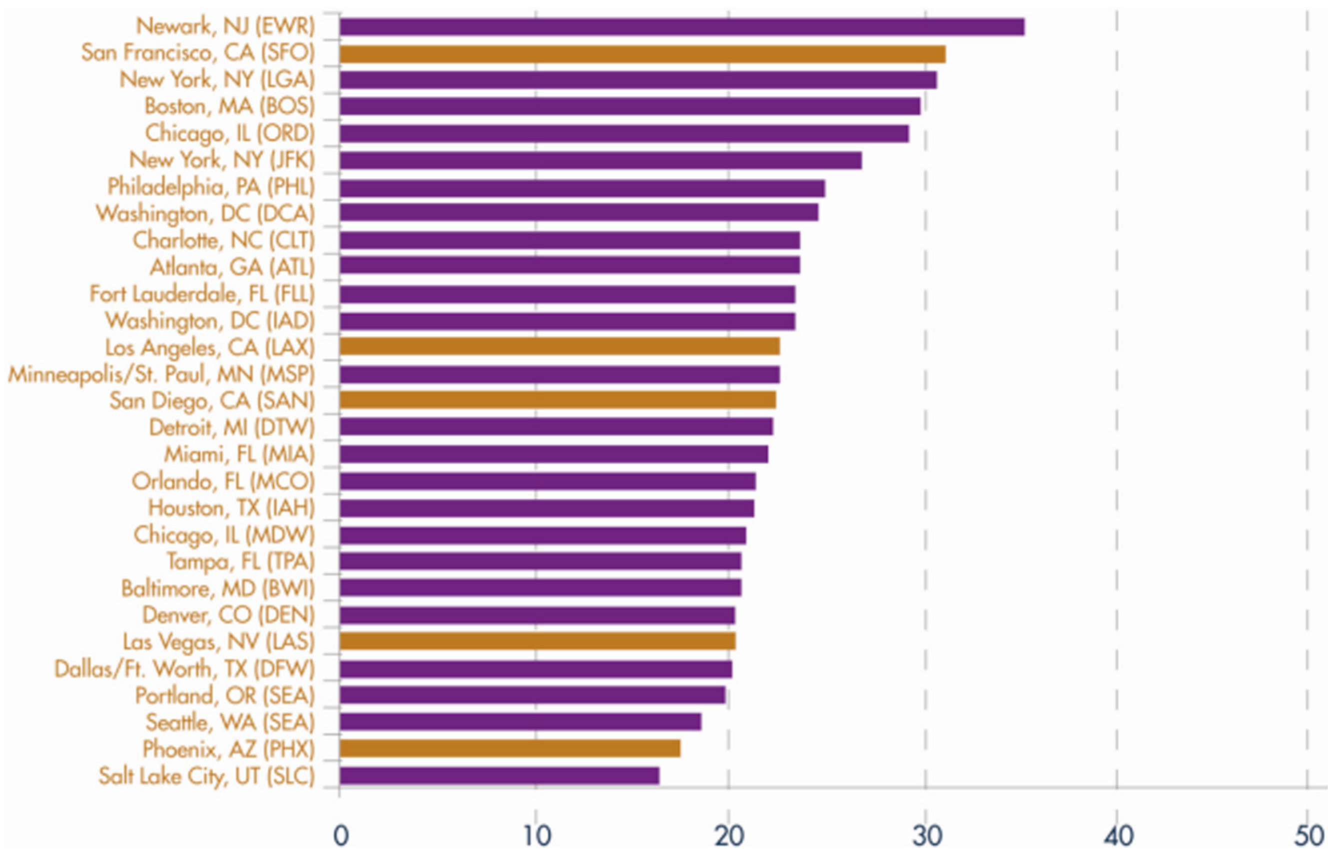


Source: Airline Origin and Destination Survey (DB1B), USDOT Bureau of Transportation Statistics Office of Airline Information, 2010; Fiscal Year 2010 Market Pair Ridership, Amtrak, 2010

3.2.2 Air network constraints

Constraints are prevalent and growing at airports in the SW Study Area. One indicator of the challenges faced by airports is on-time arrival performance. In this category, five major airports located in the SW Study Area (San Francisco, Los Angeles, San Diego, Las Vegas, and Phoenix) are plagued by delayed arrivals ranging from 18 percent in Phoenix to more than 30 percent in San Francisco.[70] Figure 15 shows how these five airports (represented by orange bars) compare with other major airports in the U.S. Although issues relating to delay are more severe at many of the major airports on the east coast, the physical constraints of the region's airports combined with the projected growth in air travel in the Southwest make this a notably acute issue in the study area. Additionally, the growing security demands of air travel may affect modal choice.

Figure 15 Percent of flights delayed at 29 major airports



Source: Ranking of Major Airport On-Time Arrival Performance Year-to-Date through July 2011, Bureau of Transportation Statistics, http://www.bts.gov/ programs/airline_information/airline_ontime_tables/2011_07/html/table_04.html (data retrieved October 2011)

[70] The three primary causes of late arrivals at the five largest airports in the Southwest (LAS, LAX, PHX, SAN, and SFO) are late arriving aircraft, national aviation system delays, and air carrier delays. These three causes combined account for 90-93 percent of all delays at these five airports.

3.2.3 Currently planned air improvements

The Federal Aviation Administration's (FAA) *Future Airport Capacity Needs in the National Airspace System 2007-2025* (FACT 2) report assessed the future capacity of 56 airports in the U.S., with a goal to determine which airports have the greatest need for additional capacity.[71] Within the SW Study Area, airports in the following metropolitan areas were included in the evaluation:

- **Los Angeles**—Bob Hope Airport (BUR), Long Beach-Daugherty Field Airport (LGB), Los Angeles International Airport (LAX), Ontario International Airport (ONT), Palm Springs International Airport (PSP), John Wayne-Orange County Airport (SNA)
- **San Diego**—San Diego International Airport (SAN)
- **San Francisco**—Metropolitan Oakland International (OAK), San Francisco International Airport (SFO), and Mineta San Jose International Airport (SJC)
- **Las Vegas**—McCarran International Airport (LAS)
- **Phoenix**—Phoenix Sky Harbor International Airport (PHX)
- **Tucson**—Tucson International Airport (TUS)

The FACT 2 analysis considered planned improvements affecting runway capacity for 2015 and 2025. The planned improvements include new or extended runways, new or revised air traffic control procedures, airspace redesign, and other assumptions.

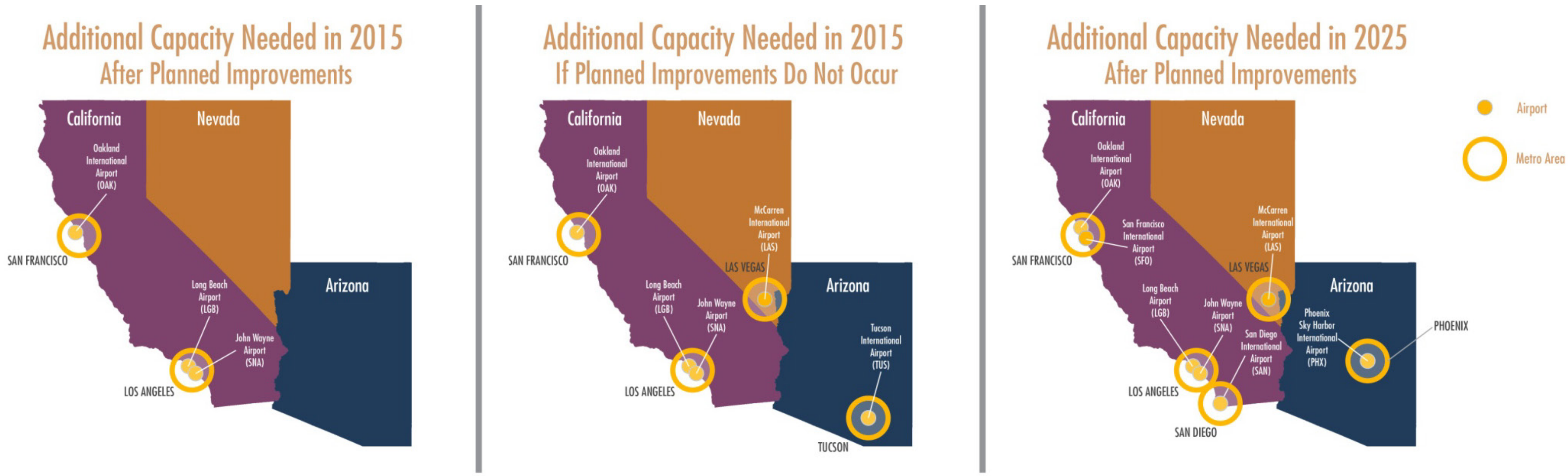
Based on the capacity improvement assumptions, the FACT 2 analysis identifies airports that will need additional capacity in three broad groupings: (1) airports that would need additional capacity in 2015 after planned improvements; (2) airports that would need additional capacity in 2015 if planned improvements do not occur; and (3) airports that would need additional capacity in 2025 after planned improvements. The results of the FACT 2 analysis for the states in the SW Study Area included in the analysis are shown in Figure 16.

The FACT 2 analysis indicates that airports in San Francisco and Los Angeles would need additional capacity by 2015 even after planned improvements are in place. In the San Francisco Bay Area, specifically OAK, the geography, terrain, and airspace issues will continue to constrain this airport. These issues limit the airport's ability to add runway capacity, and the FACT 2 analysis suggests that a regional solution in conjunction with other airports in the Bay Area may be needed. In Los Angeles, LGB and SNA both have operational and noise restrictions that limit the number of operations at these facilities. If these restrictions remain in place, the operational levels forecasted for these airports in 2015 will likely not be reached. Thus, the actual future delays will likely be less than the criteria established for the FACT 2 analysis. However, this may mean that significant demand will go unsatisfied.

If planned improvements in all three states do not occur by 2015, airports in Tucson and Las Vegas will similarly be in need of additional capacity. By 2025, San Diego and Phoenix airports will also need additional capacity. While geography, terrain, airfield, and airspace issues will continue to constrain airports like SAN and SFO, SAN is continuing to investigate capacity enhancements and estimates the airport will exceed its operational capacity before the 2025 planning period. SFO has similar constraints and is participating in a regional planning effort to address capacity needs within the Bay Area. In 2013, SAN also completed an expansion of Terminal 2 to include more gates and passenger facilities.

[71] FAA, *Future Airport Capacity Task (FACT 2) Capacity Needs in the National Airspace System 2007-2025*, May 2007

Figure 16 FACT 2 airport capacity needs



Source: Future Airport Capacity Task (FACT 2) Capacity Needs in the National Airspace System 2007-2025, Federal Aviation Administration, May 2007

In Phoenix, additional runway capacity will be needed if demand continues to grow as forecasted. The City of Phoenix Aviation Department is working with Williams Gateway Airport (IWA) in nearby Mesa to increase the use of this airport for scheduled commercial service. Local plans indicate that LAS will exceed its operational capacity before the 2025 planning period. However, plans are progressing for a new secondary commercial airport for the Las Vegas metropolitan area to supplement LAS. The new airport was not included in the FACT 2 analysis as many of the details are still being assessed in an ongoing EIS.

Since the FACT 2 report was published, several airports in the region have completed or initiated projects to address capacity constraints. Projects include both landside and airside improvements. A sample of the landside improvements in the region includes:

- **SFO: Renovation of Terminal 2**—The 640,000-square-foot Terminal 2 reopened to the public in April 2011 after a two-year, $383 million renovation designed to improve efficiency and customer experience.[72]
- **PHX: Airport people mover**— Stage 1 of PHX Sky Train opened in April of 2013. It connects the airport's Terminal 4 to parking and Metro light rail. The line carries approximately 70,000 riders per week. Stage 1A, an extension to Terminal 3, is due to open in 2015, with Stage 2, another further extension to the PHX Rental Car Center, by 2020. The total estimated project cost of $1.58 billion is paid for with airport revenues and passenger fees; $644 million for Stage 1, $240 million for Stage 1A, and remaining funds for Stage 2.[73]
- **LAX: New Bradley Terminal**—A $1.7-billion addition to the Tom Bradley International Terminal (TBIT) will provide 18 new gates. This is in addition to the $737-million renovation of the existing TBIT.[74]
- **BUR: Regional Intermodal Transportation Center (RITC)**—RITC will be a consolidated facility housing rental cars and a bus station and connecting to the airport passenger terminal via elevated moving walkway.[75] A second Metrolink commuter and Amtrak intercity passenger rail station is under development that will serve the airport with Metrolink service from another line.[76] In addition, the terminus of the Initial Operating Segment of the California High Speed Rail Project will be in the vicinity of the airport.
- **SAN: Master Plan implementation**—Projects recently completed include a ten-gate addition to Terminal 2 and an elevated dual level roadway to improve curbside check-in.[77] Advanced planning for the San Diego Airport Intermodal Transportation Center is underway by the San Diego Association of Governments (SANDAG).
- **LAS: Terminal 3**—Opened in 2012, Terminal 3 includes 14 gates.[78]
- **Salt Lake City International Airport**—Project to rebuild the Airport Terminal is currently in final design with construction slated to begin in the near future.

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[72] SFO's Community Newsletter, Winter 2012, http://www.flysfo.com/newsletter/sfo-community-newsletter-winter-2012 (last accessed 04 Aug 2014)
[73] http://skyharbor.com/PHXSkyTrain/QuickFacts.html (last accessed 7/30/2014)
[74] LAnext, Facts About Modernizing LAX, www.lawa.org/uploadedFiles/LAXDev/News_for_LAXDev/LAX%20Modernization.pdf (last accessed 04 Aug 2014)
[75] www.burbankairport.com/home/news/initiatives.html (last accessed 04 Aug 2014)
[76] The Burbank Leader, *Grand opening held for new transportation center at Bob hope Airport*, http://www.burbankleader.com/news/tn-gnp-grand-opening-held-for-new-transportation-center-at-bob-hope-airport-20140627,0,4592612.story (last accessed 04 Aug 2014)
[77] http://www.san.org/sdcraa/airport_initiatives/green_build/Default.aspx (last accessed 04 Aug 2014)
[78] "Pardon Our Dust: McCarran International Airport's Construction Update, Winter 2011-12 Edition" http://cms.mccarran.com/dsweb/View/Document-300211/PardonOurDust.pdf (last accessed 04 Aug 2014)

A sample of the airside capacity in the region includes:

- **LAX: Airfield improvements to include new taxiways, aprons, and runway improvements**—These include the Taxilane S project ($175 million) that reduces congestion and delays that occur at existing taxiways during peak periods, Taxiway R project ($138 million) to improve the safety and efficiency of the terminal, and the South Airfield Improvement Project ($333 million) that relocated a runway to improve safety and efficiency.[79]
- **SAN: Master Plan implementation**—Air side projects moving forward include new aircraft parking for overnight storage and new apron and taxilane.[80]

3.3 Highway Network

While there are several interstate highways that traverse the SW Study Area, only one (I-15) traverses all three states in the SW Study Area. Figure 17 shows the interstates as well as the other major roadways that provide connections between major MSAs in the Extended SW Study Area.

The U.S. Congress has designated 80 corridors nationally as *high-priority corridors* on the National Highway System (NHS). This designation indicates that the corridor is part of the 163,000-mile approved NHS and affords it federal funding through multi-year surface transportation authorizations (e.g., Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users [SAFETEA-LU]). High-priority corridors crossing at least two states in the SW Study Area include:[81]

- **Economic Lifeline Corridor**—running through California, Arizona, and Nevada along I-15 and I-40. This also includes I-215 South from near San Bernardino to Riverside and SR 91 from Riverside to the intersection with I-15 near Corona.
- **US 395 Corridor**—running from the U.S.-Canadian border in Washington through Oregon and California to Reno.
- **CANAMEX Corridor**—running north-south through Las Vegas to Salt Lake City to Idaho Falls to Montana to the Canadian Border. In Arizona, this corridor includes I-19 from Nogales to Tucson, I-10 from Tucson to Phoenix, and US 93 in the vicinity of Phoenix to the Nevada border. In Nevada, it follows US 93 from the Arizona border to Las Vegas and I-15 from Las Vegas to the Utah border.
- **East-West Transamerica Corridor**—running through the States of Virginia, West Virginia, Kentucky, Illinois, Missouri, Arkansas, Kansas, Oklahoma, Texas, Colorado, New Mexico, Utah, Arizona, Nevada, and California. In California, this corridor includes I-15 from San Diego to Barstow, joining I-40 through Arizona (and much of New Mexico).
- **High-Desert Corridor/E220**—from Los Angeles to Las Vegas via Palmdale and Victorville.

Two of these corridors—Economic Lifeline Corridor and CANAMEX Corridor—are truly multimodal, having both interstate highways and transcontinental rail routes. The Washoe County Corridor connecting Reno and Las Vegas is a high-priority corridor solely contained in Nevada. There are no high-priority corridors that exist solely within Arizona. Additional corridors designated as high-priority corridors within California include:

- **Alameda Transportation Corridor**—along Alameda Street from the entrance to the ports of Los Angeles and Long Beach to I-10, Los Angeles.

[79] LAnext, Facts About Modernizing LAX, http://www.lawa.org/uploadedFiles/LAXDev/News_for_LAXDev/LAX%20Modernization.pdf (last accessed 04 Aug 2014)
[80] http://www.san.org/sdcraa/airport_initiatives/green_build/Default.aspx (last accessed 04 Aug 2014)
[81] www.fhwa.dot.gov/planning/nhs/hipricorridors/hpcorqk.html (last accessed 04 Aug 2014)

- **I-5**—in California, Oregon, and Washington, including California SR 905 between I-5 and the Otay Mesa Port of Entry.
- **Alameda Corridor East and Southwest Passage**—generally described as the corridor from East Los Angeles (terminus of Alameda Corridor) through Los Angeles, Orange, San Bernardino, and Riverside Counties to termini at Barstow in San Bernardino County and Coachella in Riverside County. The Southwest Passage shall follow I-10 from San Bernardino to the Arizona state line.
- **I-710**—in California between the terminus at Long Beach to California SR 60.
- **California Farm-to-Market Corridor**—California SR 99 from south of Bakersfield to Sacramento.
- **Cross Valley Connector**—connecting I-5 and SR 14, Santa Clarita Valley.
- **High Desert Corridor/E-220**—from Los Angeles to Las Vegas via Palmdale and Victorville.

3.3.1 Highway network constraints

Highway network constraints are prevalent throughout the major metropolitan areas of the Southwest and can be attributed to a lack of capacity due to growing vehicle miles traveled (VMT) and increased goods movement by truck. From 1970 to 2007, VMT grew by 168 percent while population only grew by 48 percent.[82] The volume of truck transport in the SW Study Area is large and continued growth is expected. For example, in California, approximately 64 percent of freight moved across or within the state uses trucking as the principal mode of transportation.[83] Still, accommodating increased trucking goes beyond addressing highway congestion.

For drivers, non-work trips are increasing, leading to greater congestion during off-peak periods and more demand on local road networks. In Arizona, I-10 between SR 85 and US 191 is an example of a corridor where population growth in Phoenix, Tucson, and Pinal County has consumed much of the highway capacity between these two cities.

As one of the busiest truck-freight corridors in the nation, I-15 through California and Nevada and into Utah is also facing capacity constraints due to growing demand in freight and passenger traffic and the geography which dictated the original design of the road. Almost all segments of I-15 are at or approaching capacity with congestion delays projected at 3.2 hours per vehicle per day between Nevada and California.[84] Related, a lack of adequate ramp capacity connecting to the main highway, including connections to high occupancy vehicle (HOV)/high-occupancy toll (HOT) lanes, restricts operations in places such as the I-15/SR 78 Interchange near San Diego. A multimodal transportation master plan is being developed by the I-15 Mobility Alliance, which is a collaborative effort of the Departments of Transportation (DOTs) from California, Nevada, Arizona, and Utah. This plan is aimed at addressing current and future mobility needs along the I -15 corridor.[85]

Border crossing congestion due to population growth and freight movement is also a concern, with additional ports of entry needed to address this lack of capacity. An example of these types of improvements is the new SR 11 and Port of Entry at Otay Mesa East south of San Diego, scheduled to open in 2015.[86] In Southern California, the increase in demand due to freight movement causes backups at the border crossings, with an average processing time of two hours per truck.[87]

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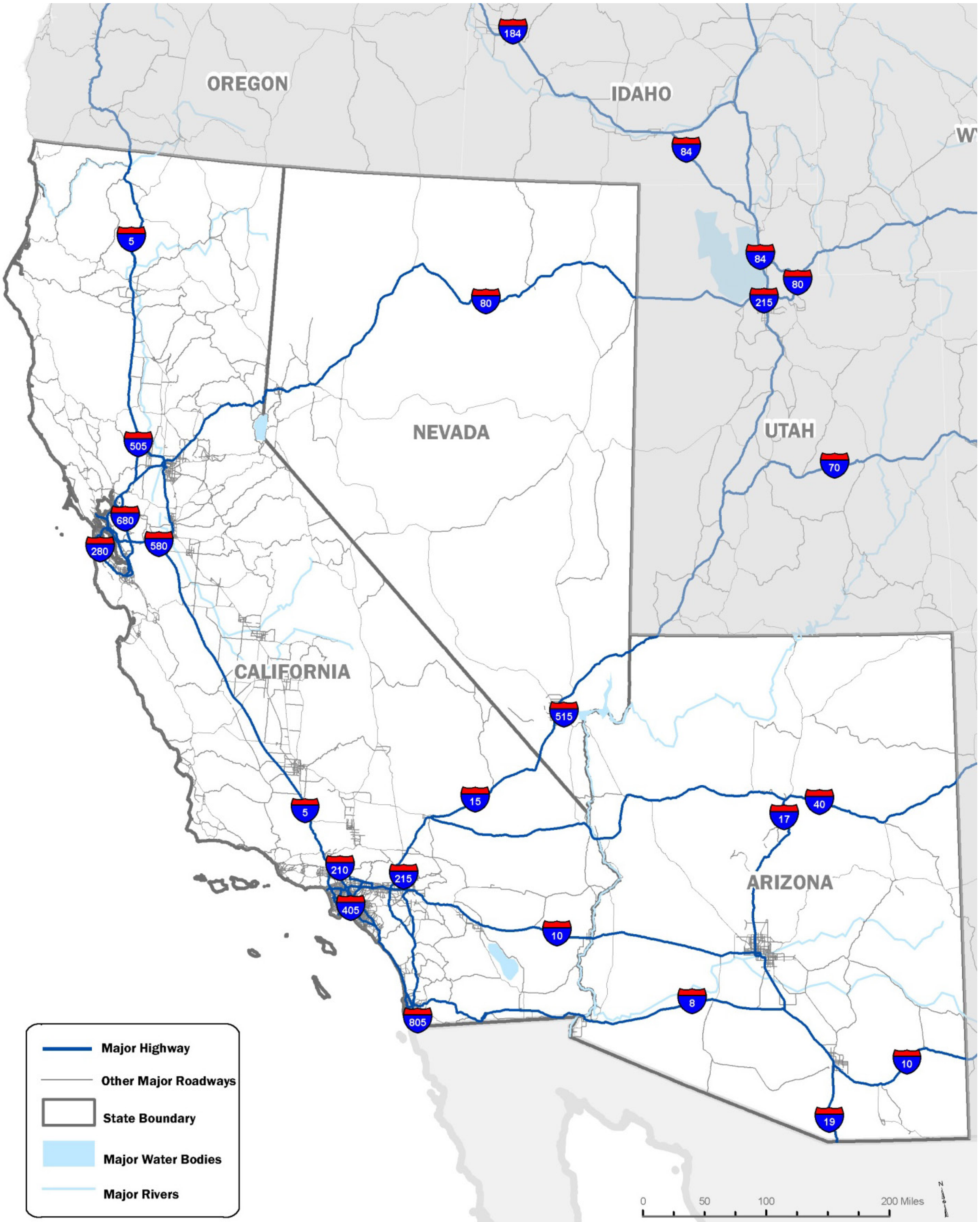
[82] APTA, *Changing the Way America Moves: Creating a More Robust Economy, a Smaller Carbon Footprint, and Energy Independence*, 2009
[83] FHWA FAF3 Summary Statistics by State for 2010, http://faf.ornl.gov/fafweb/FUT.aspx (last accessed 04 Aug 2014)
[84] I-15 Corridor System Master Plan, Corridor System Characteristics: Highways, I-15 Mobility Alliance, June 2011
[85] I-15 Mobility Alliance, http://www.i15alliance.org/ (last accessed 04 Aug 2014)
[86] http://www.sandag.org/index.asp?projectid=56&fuseaction=projects.detail (last accessed 04 Aug 2014)
[87] San Diego Association of Governments, *Economic Impacts of Border Wait Times at the San Diego-Baja California Border Region,* January 2006.

Figure 17 Highway network



Source: Map prepared by Parsons Brinckerhoff. Base map data from NTAD, 2010 and ESRI, 2014.

3.3.2 Currently planned highway improvements

The majority of highway expenditures are allocated to maintaining, rehabilitating, operating, and improving the highway system in each state. For example, in Arizona, highway preservation and modernization account for 63 percent of the total transportation funding under the State's Recommended Investment Choice, with highway expansion at 27 percent and the remaining ten percent dedicated to non-highway needs.[88] While planned improvements are in place for many of the region's highways, there is not always sufficient funding available to implement these improvements. There are also opportunities to move truck traffic to rail, e.g., I-15 between Los Angeles and Salt Lake City. Transporting freight by rail can mitigate highway congestion and may decrease the need for major new highway investments. A single intermodal train can take up to 280 trucks (equivalent to more than 1,100 automobiles) off a highway. However, for this to occur, continued development of inland container yards and intermodal facilities will be needed.[89]

Dedicated lanes with separate truck and bus facilities are being proposed in several locations to help reduce safety and operational conflicts. For example, in California, the Southern California Association of Governments is proposing a regional system of truck-only lanes along I-710, SR 60, and I-15 for a total of 142 miles.

Study stakeholders identified transportation projects that are planned or underway and could affect capacity. Of particular note to multi-state corridor planning, Arizona and Nevada are seeking to upgrade the highway linking Phoenix and Las Vegas and designate it as Interstate-11. If advanced, some of these projects may impact the need for rail investments in the corridor by increasing the competitiveness of highway travel alternatives. These projects are summarized in Table 8 and shown on Figure 18; additional detail on these projects is provided in Appendix C.

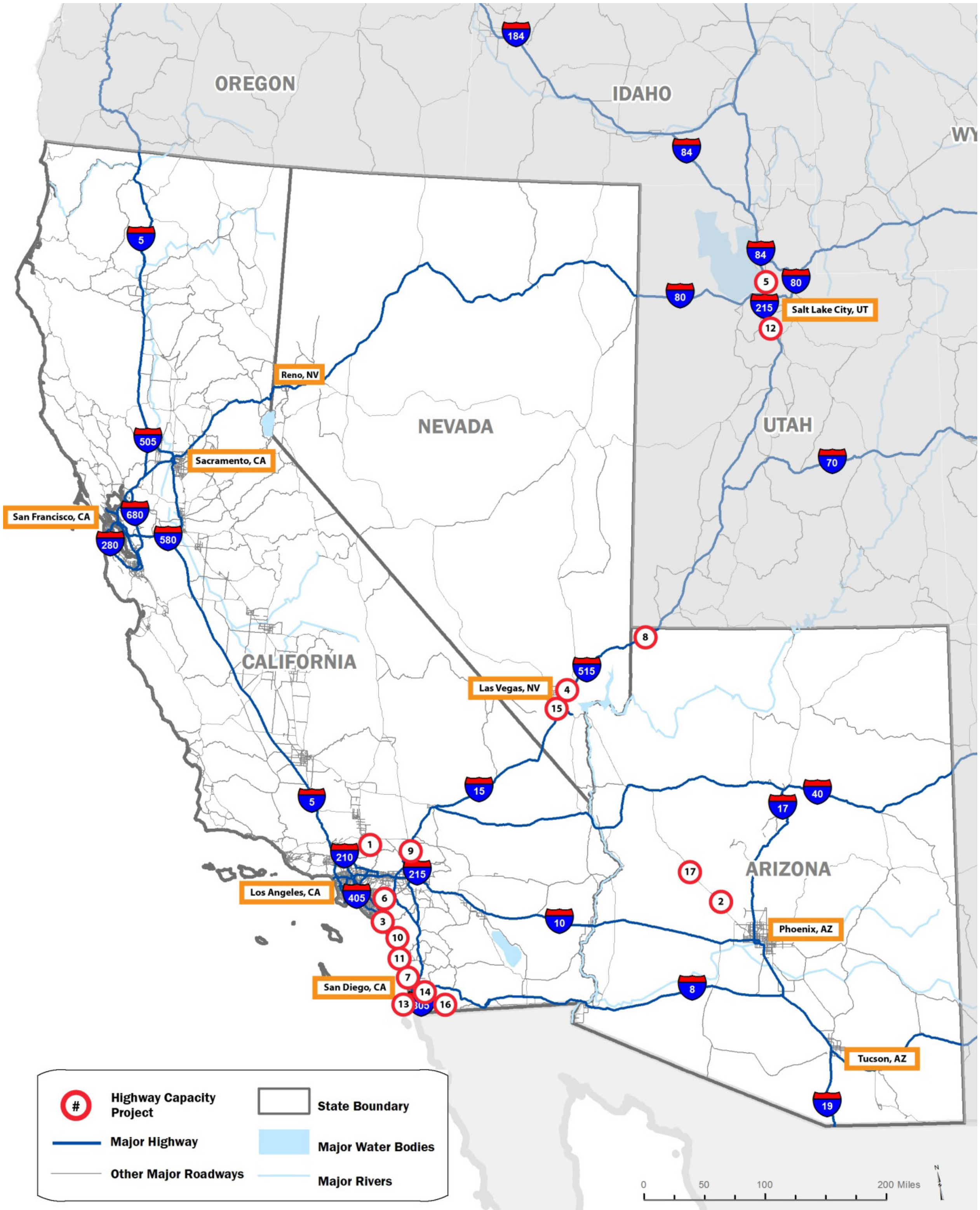
[88] Arizona Department of Transportation, *Long Range Transportation Plan*, 2011
[89] California Department of Transportation, *California Transportation Plan 2025*, April 2006, http://www.dot.ca.gov/hq/tpp/offices/osp/ctp2025_files/CTP_2006.pdf (last accessed 04 Aug 2014)

Table 8 Planned highway capacity projects

	Project Name	Location(s)
1	High Desert Corridor (SR 138) Project	Los Angeles and San Bernardino Counties
2	Interstate-11 and Intermountain West Corridor	Numerous corridors to improve linkages between Mexico and the Intermountain West, including mobility improvements around the Tucson and Phoenix Metro areas and the first segment of I-11 to be constructed north of the State Line in Nevada.
3	I-15/French Valley Parkway Interchange	I-15/French Valley Parkway Interchange, Temecula
4	I-15 from Speedway Boulevard to US 93 Widening and Interchange NEPA	I-15 between Speedway Boulevard and US 93, Las Vegas
5	I-15 HOV/HOT Lanes Interstate-215 to Riverdale Phase 1	I-15 to I-215 Interchange to Riverdale, Salt Lake County
6	I-15 HOV/HOT Lanes San Bernardino/ Riverside County	I-15 San Bernardino/Riverside County Line South to I-15/I-215 Interchange, Riverside County
7	I-15 Managed Lanes: I-8 to SR163	I-15 between I-8 to SR163, San Diego
8	I-15 Virgin River Gorge Bridges	Virgin River Gorge area bridges, Arizona
9	I-15/I-215 (Devore) Interchange Reconstruction	Devore Interchange, San Bernardino County
10	I-15/SR76 East	I-15/SR76 Interchange, San Diego
11	I-15/SR78 HOV/HOT Connectors	I-15/SR78 Interchange, San Diego
12	I-15: Lehi Main Street to 12300 South, Salt Lake County, UT Phase 1	SR92 to 12300 South, Salt Lake County
13	Port of San Diego Freeway Access Improvements—I	Civic Center Drive and I-5, 10th Avenue at Harbor Drive, San Diego
14	Port of San Diego Freeway Access Improvements—II	Bay Marina Drive at I-15, 32nd Street at Harbor Drive, San Diego
15	Project NEON, Phase 1	I-15, from Sahara Avenue to I-515/US95 Interchange (Spaghetti Bowl), Las Vegas
16	SR 11/Otay Mesa East Port of Entry Project	SR905 south to Otay Mesa East Port, San Diego
17	US 93 (Future I-11) Improvements	Wickenburg, Arizona to the Nevada State Line

Source: Projects identified by Southwest MSRP Study stakeholders

Figure 18 Planned highway capacity projects



Source: Map prepared by Parsons Brinckerhoff based on project list identified by Southwest Study stakeholders. Base map data obtained from NTAD, 2010 and ESRI, 2014.

3.4 Intercity Bus

Much of the intercity bus service in the Southwest connects major cities and Amtrak rail services. The region is served by a number of intercity bus carriers, some of which serve seasonal interests. Greyhound serves 125 cities in California, 21 in Arizona, and ten in Nevada.[90] Amtrak's Thruway Connecting Service reaches 107 cities in California, seven in Arizona, and eight in Nevada.[91] There are approximately 120 other companies in California, 20 in Arizona, and ten in Nevada that offer routes for commuters, travelers, and visitors.[92]

In California, Caltrans funds the Amtrak Thruway services, which provide direct/train bus transfers at train stations serving the Pacific Surfliner, Capitol Corridor, and San Joaquin routes. Under California state law, Thruway bus travel is permitted only in conjunction with a rail ticket. Figure 19 shows the existing Amtrak and other rail services as well as the Amtrak Thruway services in the Extended SW Study Area.

Figure 19 Amtrak Thruway service in the Southwest

Map provided courtesy of Amtrak®, 2012

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[90] https://www.greyhound.com/ (data retrieved May 22, 2012)
[91] http://www.amtrak.com/train-routes (data retrieved May 22, 2012)
[92] www.business.highbeam.com (data retrieved May 22, 2012)

3.5 Local Transit Systems

The SW Study Area contains a large number of transit providers, with services ranging from extensive subway systems in large metropolitan areas to buses serving smaller communities. Because riders need good access to and from HPR stations in order to reach their final destinations, transit service can plan an important rail in the attractiveness of HPR with many cities developing local circulation systems to support HPR investments. To illustrate the extent to which current transit systems are relied upon as a means of travel within urban areas, Table 9 presents transit ridership per capita for selected metropolitan areas in the Extended SW Study Area. Further details on the transit systems, including the total number of riders by mode for each of these MSAs, can be found in Appendix E.

Table 9 Transit ridership per capita in selected metropolitan areas

	Annual Ridership per Capita (2011)
Albuquerque	15.4
Denver	38.1
Greater Los Angeles	50.9
Las Vegas	29.6
Phoenix	16.7
Reno	18.5
Sacramento	14.3
Salt Lake City	35.2
San Diego	31.9
San Francisco/Oakland	98.0
Tucson	20.4

Sources: Public Transportation Ridership Report, Fourth Quarter 2011, APTA, February 2012; 2010 Census data, U.S. Census Bureau. Excludes demand response (paratransit) ridership

3.5.1 Local transit connections to airports

The majority of the transit systems in the SW Study Area provide service to the region's airports, and several rail transit connections are in place or under construction. Some of the key transit connections to airports in the SW Study Area include:

- SFO is served directly by BART with connections to downtown San Francisco and various destinations in the metropolitan area. The Caltrain commuter rail service offers a transfer to BART for airport passengers. The airport is also served directly by SamTrans buses with service throughout the region.[93]
- At Oakland International Airport (OIA), BART provides a shuttle bus connecting to its rail system with connections to downtown San Francisco and the region.[94] A rail connection to BART is under construction. AC Transit serves OIA via frequent bus service.[95]
- SJC has a shuttle bus connection to the Metro Light Rail Station and the Santa Clara Caltrain Station.[96]
- LAX is served by shuttles that provide connections to area public transportation or park-and-ride lots. A shuttle connects riders from the Metro Green Line Aviation Station to terminals.[97] Shuttles also connect passengers to parking lot C, where transfers can be made to the bus service to Los Angeles and three other local bus services.[98] Four Flyaway shuttle routes operate daily and offer connections to Los Angeles Union Station or park-and-ride locations around the region.[99]

[93] www.flysfo.com (data retrieved May 22, 2012)
[94] www.flyoakland.com (data retrieved May 22, 2012)
[95] www.flyoakland.com (data retrieved May 22, 2012)
[96] www.flysanjose.com (data retrieved May 22, 2012)
[97] www.lawa.org (data retrieved May 22, 2012)
[98] www.lawa.org (data retrieved May 22, 2012)
[99] www.lawa.org (data retrieved May 22, 2012)

- SAN is served directly by the Metropolitan Transit System.[100] The Route 992 bus makes trips every 15 minutes and connects to Amtrak, COASTER commuter rail, and the light rail system.[101]
- Stage 1 of the PHX Sky Train opened in April of 2013. The automated train connects the airport's Terminal 4 to parking and Metro light rail. The line carries approximately 70,000 riders per week. Stage 1A, an extension to Terminal 3, is due to open in 2015, with Stage 2, another further extension to the PHX Rental Car Center, by 2020. The total estimated project cost of $1.58 Billion is paid for with airport revenues and passenger fees (no local tax dollars); $644 million for Stage 1, $240 million for Stage 1A, and remaining funds for Stage 2.[102]
- LAS is served directly by the Regional Transportation Commission (RTC) through multiple bus routes.[103] Nine private bus and shuttle companies also serve the airport.[104]
- TUS is served by Sun Tran City Bus Service with service to and from Tucson every 30 minutes.[105]

Other airports in the SW Study Area, including SNA, SAC, and Reno-Tahoe International, provide local transit bus service connections as well as multiple private shuttle services.

3.5.2 Planned intermodal passenger facility projects

In California, there are three major multimodal transit facility projects in planning or under construction:

- In Southern California, Union Station in Los Angeles is undertaking development of a master plan to prepare for future high speed rail as well as commuter rail improvements to further enhance the multimodal transportation center. Union Station is the transportation hub for the region, providing connectivity between Metrolink, Amtrak, and local transit. Along with increased frequencies of Metro service, additional buses are anticipated to serve the station, and passenger circulation at the station will be critical.[106] The Southern California Regional Interconnection Project (SCRIP) involves the reconfiguration of the tracks at Union Station and will increase capacity by 40% to 50% as well as improve operational flexibility.[107]
- The Transbay Transit Center/Caltrain Downtown Extension (TTC/DTX) project is replacing San Francisco's Transbay Terminal. The project, which is under construction and led by the

Figure 20 Transbay Transit Center rendering

Source: Transbay Transit Center Image Gallery, Cross Section View of the New Transbay Transit Center, http://transbaycenter.org/media-gallery/image-gallery/transit-center-architecture, retrieved June 5, 2012

[100] www.san.org (data retrieved May 22, 2012).
[101] www.san.org (data retrieved May 22, 2012)
[102] http://skyharbor.com/PHXSkyTrain/QuickFacts.html (last accessed 04 Aug 2014)
[103] www.rtcsnv.com (data retrieved May 22, 2012)
[104] www.rtcsnv.com (data retrieved May 22, 2012)
[105] www.flytucsonairport.com (data retrieved May 22, 2012)
[106] www.metro.net/projects_studies/union_station/images/Union_Station_July_2011_Master_Plan_Presentation.pdf (last accessed 04 Aug 2012)
[107] http://media.metro.net/projects_studies/connector/images/regional_rail_scrip_fact_sheet.pdf (last accessed 04 Aug 2012)

Transbay Joint Powers Authority, will link 11 transportation systems in the downtown and construct a large transit oriented development at the new transit center (Figure 20).[108] This will involve a 1.3-mile extension of Caltrain to Mission Street to meet the new TTC and connect riders with AC Transit, BART, Golden Gate Transit, Greyhound, Muni, SamTrans, WestCAT Lynx, Amtrak Thruway service, paratransit, and the proposed CHSR line. The combined cost of the TTC/DTX is estimated at $4.2 billion (YOE $); the first phase includes construction of the TTC, the second includes the extension of the rail line on the infrastructure that was readied in Phase I.[109] As of 2012, $2.2 billion in funding has been identified for Phases I and II.[110]

- The ARTIC Intermodal Center in Anaheim is another Southern California project located in Orange County. Serving as a multimodal transit hub, the TOD site is poised to accommodate development of an HPR station, implementation of the Anaheim Rapid Connection (providing a fixed-guideway transit connection to the resorts and convention center), and the planned California-Nevada Super-Speed Maglev train as well as hotel and office development adjacent to the station. Construction began in 2012 and is expected to be completed in 2014 (Figure 21).

Figure 21 ARTIC Intermodal Center rendering

Source: ARTIC Image & Video Gallery, http://www.articinfo.com/Default.aspx (retrieved June 5, 2012)

3.6 Ports

All the ports in the SW Study Area are located within California. There are 12 ports in California, including five in the San Francisco Bay area. Ten of these ports are coastal, and the remaining two are located inland. The Port of West Sacramento is located 79 nautical miles up the Sacramento River and deep water channel from San Francisco Bay, and the Port of Stockton is located on the San Joaquin River 80 miles inland. Approximately 45 percent of intermodal traffic entering or leaving the U.S. passes through California ports, principally the port complexes of Los Angeles/Long Beach in the Los Angeles area and Oakland in Northern California. When considering the container volume, the ports of Los Angeles and Long Beach are the two busiest container ports in North America; on a global level, their combined container volume would rank sixth in the world.[111] In terms of overall tonnage, the Port of Long Beach is the fifth largest in the country, with a cargo volume (2010) of over 75 million tons; the Port of Los Angeles ranked ninth in the country with 62 million tons. Combined, this port complex ranks fourth in the country on a tonnage basis.[112]

The top ten ports based on import/export value are shown in Figure 22. Together, the nine major coastal ports of California exchanged nearly 187 million tons of goods in 2010.[113] The recession hit the ports of California hard, causing a decrease in trade volume. Collectively, the California coastal ports have recovered to their 2006 high, though among international ports, the rankings of the ports of Long Beach and Los Angeles have slipped from 10th and 12th to 16th and 18th.[114]

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108 www.Transbaycenter.org (last accessed 04 Aug 2012)
109 Transbaycenter.org (last accessed 04 Aug 2012)
110 Transbaycenter.org (last accessed 04 Aug 2012)
111 American Association of Port Authorities, World Port Rankings, 2010
112 American Association of Port Authorities, U.S. Port Rankings by Cargo Tonnage, 2010
113 American Association of Port Authorities, U.S. Port Rankings by Cargo Tonnage, 2010
114 American Association of Port Authorities, World Port Rankings, 2010

Figure 22 Top ten ports in the SW Study Area by import/export value

Source: Map prepared by Parsons Brinckerhoff. Data obtained from U.S. Import and Export Merchandise Trade Statistics, U.S. Census Bureau Foreign Trade Division, 2011 and ESRI, 2012.

Expansion of the Panama Canal has potential to divert some traffic bound for the U.S. interior from West Coast to East Coast ports. This could relieve pressure on rail capacity as cargo volumes continue to recover or allow it to be managed by railroad pricing, but it is less likely to create underutilized capacity of the transcontinental freight rail lines.

One of the principal constraints at any port is the movement of goods on land to and from the piers. Major freight corridors extend by rail and road both east-west and north-south from California through the SW Study Area for the movement of both imports and exports serving local, regional, and national needs. The system of service is complex, involving interrelated distribution, staging, transfer, and consolidation facilities and interdependent movements by truck and rail. Port-based rail service can run from locations on or near the docks or further inland from points like San Bernardino. The capacity and reliability of this system is vital to the ports, their states, and the nation, but it is the product of many components. Its sensitivity is evidenced by the shift to East Coast ports that began in the middle of the last decade, when West Coast capacity questions and other risks became apparent to supply chain managers. Its importance to private railroads is evidenced by the ongoing and huge capital investments they have made, partly in response—one example of which is the double-tracking of the UP Sunset Corridor that parallels I-10.

Nevada does not currently have any inland ports, but the *Inland Port Authority Act*, which took effect July 1, 2011, allowed for the creation of inland ports and authorities.[115] The state is considering opening inland ports in Northern and Southern Nevada.[116] There are no ports in Arizona.

[115] Nevada Department of Transportation, *Nevada State Rail Plan*, March 2012, https://www.nevadadot.com/uploadedFiles/NDOT/About_NDOT/NDOT_Divisions/Planning/Rail/2012_09_10_NVStateRailPlan.pdf (last accessed 04 Aug 2012)

[116] Nevada Department of Transportation, *Nevada State Rail Plan*, March 2012, https://www.nevadadot.com/uploadedFiles/NDOT/About_NDOT/NDOT_Divisions/Planning/Rail/2012_09_10_NVStateRailPlan.pdf (last accessed 04 Aug 2012)

Chapter 4. Corridor Profiles

4.1 Corridor Identification Process

The identification of potential corridors for a long-term SW preliminary HPR vision was a multi-step process, informed by travel demand trends and economic activity (described in Chapter 2). The first stakeholder workshop, held in November 2011, began the process with the initial identification of potential HPR market connections. In addition to the initial corridors identified by the study stakeholders, promising corridors identified in other previous studies were also considered in the SW Study. Subsequently, a secondary stakeholder workshop in January 2012 focused on identifying the corridor alternatives to be tested with CONNECT, the network planning tool developed for this project and described in more detail in Chapter 5. Initial results of the CONNECT corridor analyses were presented at the March workshop and the analyses were then refined based on one-on-one stakeholder discussions. In April 2012, the refined network analysis results were presented to the study stakeholders to inform a discussion on the SW HPR network performance and vision, leading to the final workshop in May. A schedule of stakeholder involvement milestones is illustrated in Figure 2.

4.2 Corridors Analyzed

Based on the corridor identification process described above, the following corridors were identified for analysis within the Southwest multi-state network:

- San Diego–S.F./Oakland[117]
- Greater Los Angeles–Las Vegas
- Greater Los Angeles–Phoenix
- San Diego–Phoenix
- Las Vegas–Tucson via Phoenix
- S.F./Oakland–Reno
- Las Vegas–Salt Lake City
- Phoenix–Tucson
- Las Vegas–Reno
- Phoenix–Albuquerque
- Reno–Salt Lake City

Brief descriptions of each corridor are provided in this section, including growth trends and current infrastructure characteristics.

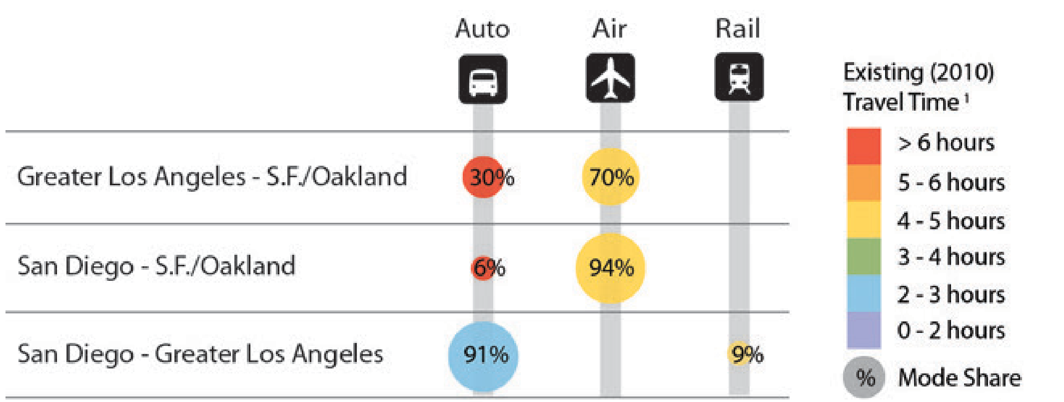
[117] This corridor is a subset of the larger CHSR project (i.e., this corridor does not include the Merced-Sacramento extension). For this reason and others, the numbers presented in this report are not directly comparable with CHSR plans.

4.2.1 San Diego–S.F./Oakland Corridor

The San Diego to S.F./Oakland Corridor (via Los Angeles) spans almost 575 miles and includes the intermediate MSAs of the Inland Empire, Greater Los Angeles, Bakersfield, Visalia, Fresno, Madera-Chowchilla, Merced, and San Jose.[118] Some of its distinguishing characteristics include:

- **Demographics**—Population levels along the corridor are projected to grow in line with the national average of 43 percent between 2010 and 2050.[119]
- **Mode share**—Due to the long distances, air is currently the primary modal choice for end-to-end corridor travel.[120]
- **Capacity-constrained airports**—San Diego International Airport (SAN), Long Beach Airport (LGB), John Wayne Airport (SNA), San Francisco International Airport (SFO), and Oakland International Airport (OAK) will all require additional capacity by 2025 after planned runway capacity improvements.[121]
- **Annual trips**—Annual trips within the San Diego-S.F./Oakland corridor are high and are projected to grow between 2010 and 2050 from 84 million to 119 million trips, respectively.[122,123]
- **Existing rail service**—Two of Amtrak's current routes, Pacific Surfliner and San Joaquin, connect cities between these markets and are Amtrak's second and fifth busiest routes in terms of 2011 ridership.[124] The Coast Starlight operates long distance train service between Los Angeles and the Bay area. While there are currently multiple Amtrak services in California, there is no existing corridor passenger rail service connecting these Northern and Southern California markets with direct service. Scheduled Amtrak travel time from S.F./Oakland to San Diego (including connecting Amtrak Thruway service) is over 11 hours.

Figure 23 San Diego–S.F./Oakland existing mode share and travel times



[1] Auto travel time estimates from GoogleMaps. Air travel time estimates from FAA T-100 Data Bank (Bureau of Transporation Statistics). Rail travel time estimates from existing Amtrak schedule (www.amtrak.com). Auto travel times include base drive time and congestion effects (calculated per the CONNECT methodology). Air and rail travel times include access time, terminal time and in-vehicle time. See Appendix G, CONNECT SW Study Advanced Settings, for access and terminal time assumptions.

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[118] The corridor length presented here is the straight-line distance between MSAs as estimated by CONNECT. The actual driving or rail distance would be higher.

[119] 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.

[120] CONNECT Beta Version, 2012.

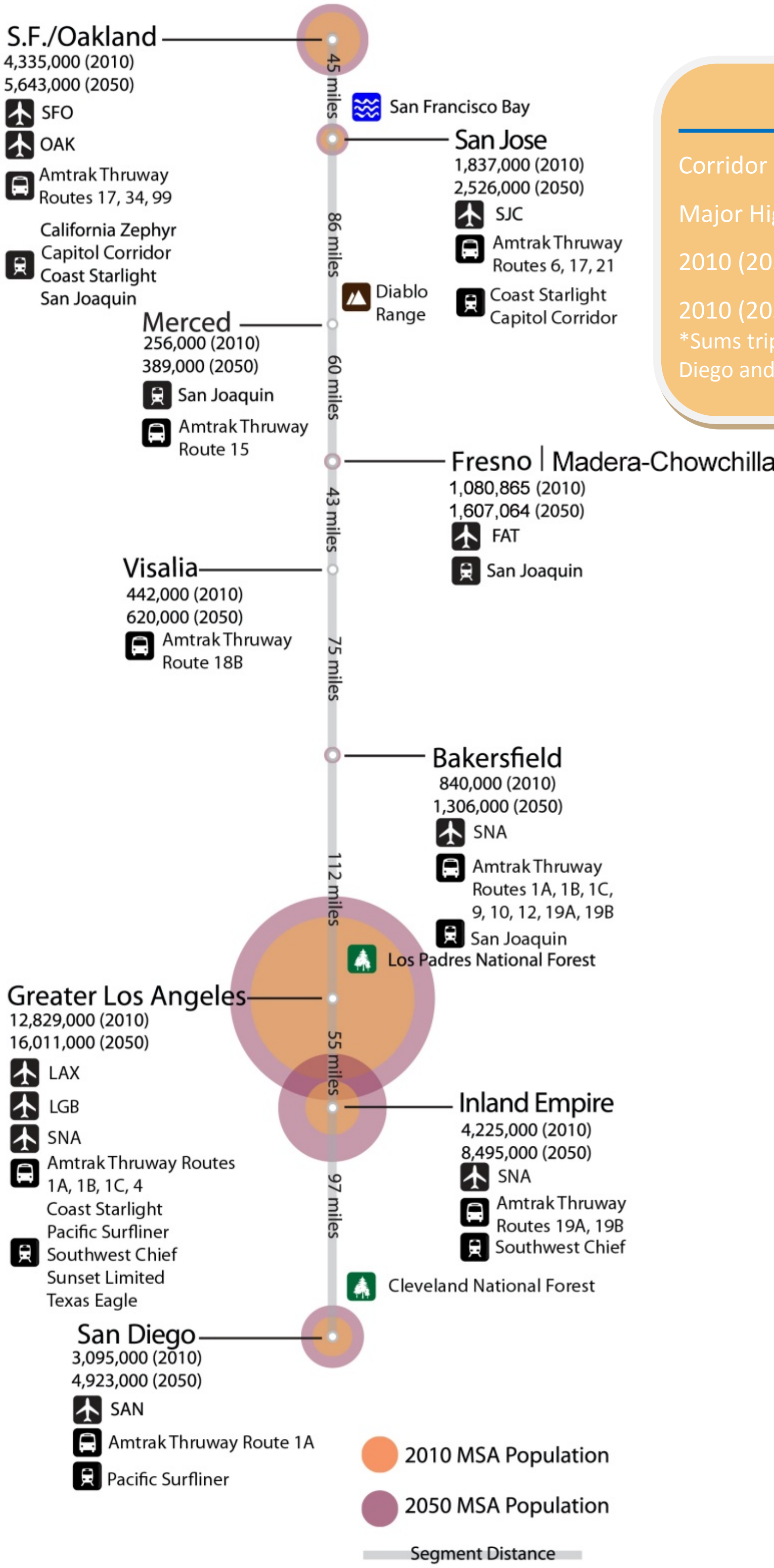
[121] FAA Future Airport Capacity Task (FACT 2) Capacity Needs in the National Airspace System 2007-2025, May 2007.

[122] CONNECT Beta Version, 2012.

[123] The number of trips estimated here may differ from project-specific forecasts for this corridor. These figures only consider intercity trips longer than 50 miles, do not include trips that have an origin or destination outside the corridor, only consider trips between MSAs, and are based on national-level data rather than data collected within the specific corridor.

[124] Monthly Performance Report for September 2011, Amtrak, November 2011

Figure 24 San Diego–S.F./Oakland corridor characteristics



Corridor Summary

Corridor Length--573 miles

Major Highways --------------------------I-5, I-10, I-15, CA-99

2010 (2050) Corridor Population ------------ 29 (41) million

2010 (2050) Corridor Annual Trips* ------ 84 (119) million

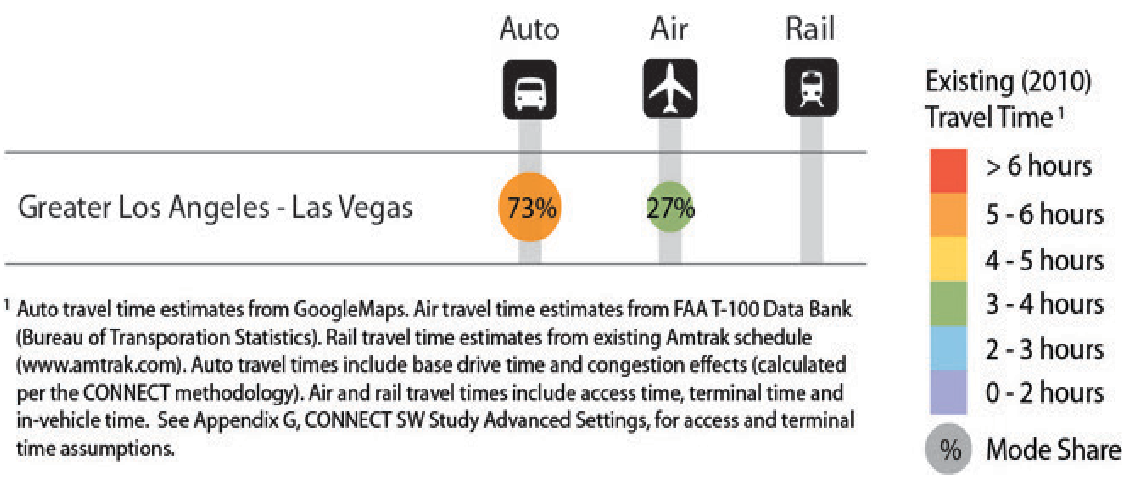
*Sums trips across all modes on all segments between San Diego and San Francisco/Oakland

4.2.2 Greater Los Angeles–Las Vegas Corridor

The Greater Los Angeles to Las Vegas Corridor spans almost 275 miles and includes the intermediate MSA of the Inland Empire.[125] Some of its distinguishing characteristics include:

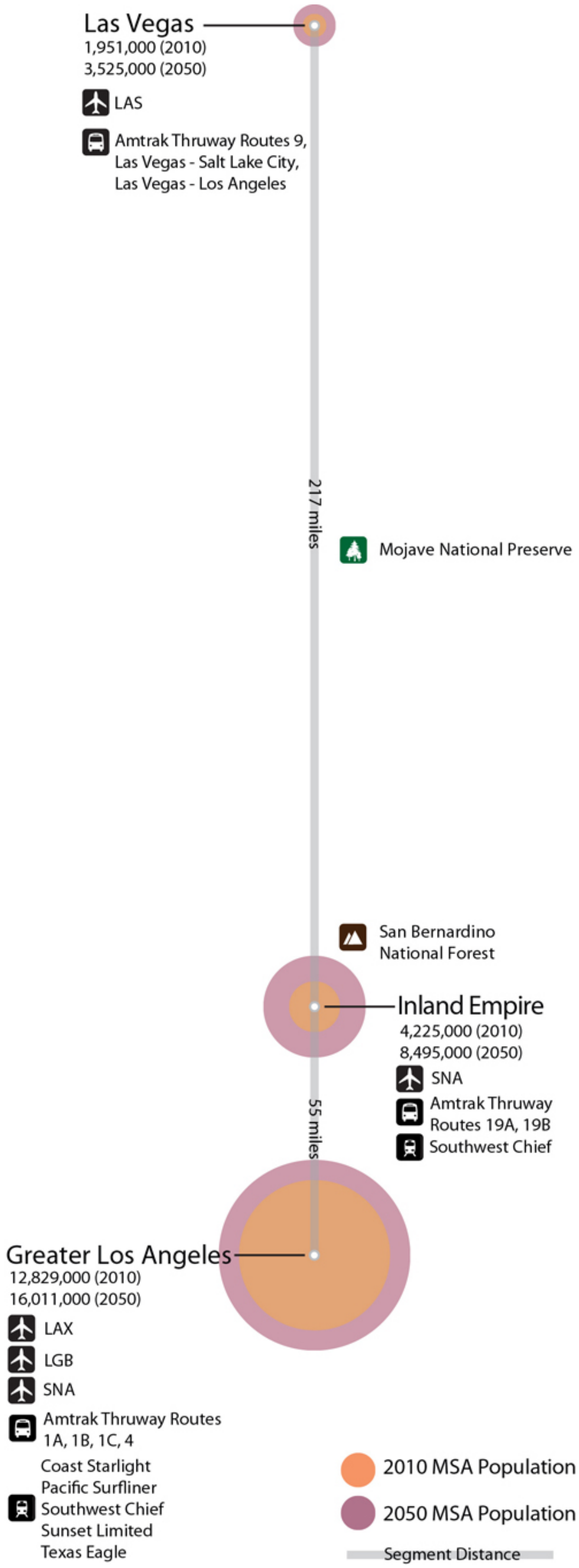
- **Demographics**—Population levels along the corridor are projected to grow 47 percent between 2010 and 2050, compared to a projected 43 percent growth for the entire U.S.[126]
- **Mode share**—The primary modal choice along the corridor is the automobile, representing 73 percent of travel. Air travel also represents a sizeable share, 27 percent, of current (2010) travel.[127]
- **Capacity-constrained airports**—Long Beach Airport (LGB), John Wayne Airport (SNA), and McCarran International Airport (LAS) will require additional capacity in 2025 after planned runway capacity improvements.[128] A new Metrolink station is in development, connecting an additional line to the Bob Hope Airport.[129]
- **Annual trips**—Annual trips within the Greater Los Angeles – Las Vegas corridor are projected to grow between 2010 and 2050 from 45 million to 60 million trips, respectively.[130]
- **Existing rail service**—Currently, no rail options exist between Greater Los Angeles and Las Vegas. The XpressWest project has federal authority granted by the Surface Transportation Board to construct and operate high-speed rail service from Victorville (part of the Inland Empire) to Las Vegas.

Figure 25 Greater Los Angeles–Las Vegas existing mode share and travel times



[125] The corridor length presented here is the straight-line distance between MSAs as estimated by CONNECT. The actual driving or rail distance would be higher.
[126] 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.
[127] CONNECT Beta Version, 2012.
[128] FAA Future Airport Capacity Task (FACT 2) Capacity Needs in the National Airspace System 2007-2025, May 2007.
[129] The Burbank Leader, *Grand opening held for new transportation center at Bob hope Airport*, http://www.burbankleader.com/news/tn-gnp-grand-opening-held-for-new-transportation-center-at-bob-hope-airport-20140627,0,4592612.story (last accessed 04 Aug 2014)
[130] CONNECT Beta Version, 2012.

Figure 26 Greater Los Angeles–Las Vegas corridor characteristics



Corridor Summary

Corridor Length--272 miles

Major Highways --I-10, I-15

2010 (2050) Corridor Population ------------ 19 (28) million

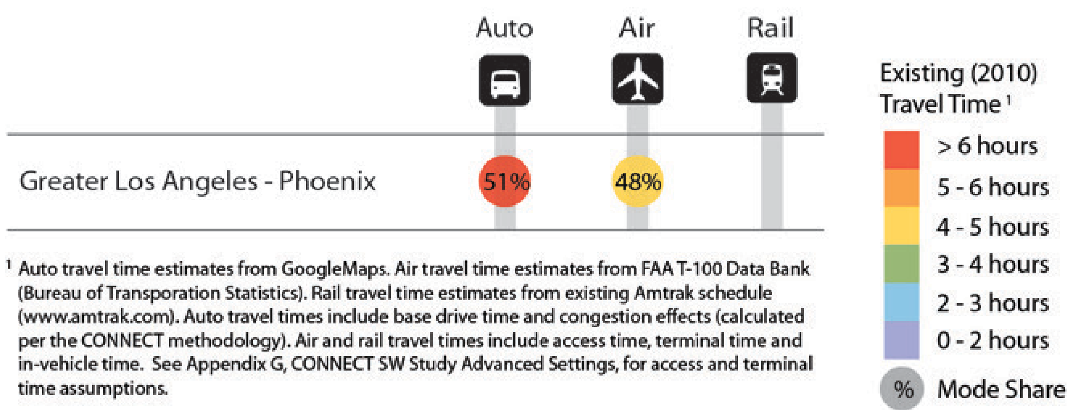
2010 (2050) Corridor Annual Trips* -------- 45 (60) million
*Sums trips across all modes on all segments between Greater Los Angeles and Las Vegas.

4.2.3 Greater Los Angeles–Phoenix Corridor

The Greater Los Angeles to Phoenix Corridor spans almost 400 miles and includes the intermediate MSA of the Inland Empire.[131] Some of its distinguishing characteristics include:

- **Demographics**—Population levels along the corridor are projected to grow 52 percent between 2010 and 2050, compared to a projected 43 percent growth for the entire U.S.[132]
- **Mode share**—Modal share on the corridor is roughly split between auto and air travel with auto mode share representing 51% and air mode share representing 48% of corridor travel.[133]
- **Capacity-constrained airports**—Long Beach Airport (LGB), John Wayne Airport (SNA), and Phoenix Sky Harbor International Airport (PHX) will all require additional capacity in 2025 after planned runway capacity improvements.[134]
- **Annual trips**—Annual trips within the Greater Los Angeles – Phoenix corridor are high, and are projected to grow between 2010 and 2050 from 38 million to 48 million trips, respectively.[135]
- **Existing Rail Service** —Amtrak's Sunset Limited operates three days per week in both directions between Maricopa and Tucson. Maricopa is located 35 miles south of Phoenix.

Figure 27 Greater Los Angeles-Phoenix existing modes share and travel times



[131] The corridor length presented here is the straight-line distance between MSAs as estimated by CONNECT. The actual driving or rail distance would be higher.
[132] 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.
[133] CONNECT Beta Version, 2012.
[134] FAA Future Airport Capacity Task (FACT 2) Capacity Needs in the National Airspace System 2007-2025, May 2007.
[135] CONNECT Beta Version, 2012.

Figure 28 Greater Los Angeles-Phoenix corridor characteristics

Corridor Summary

Corridor Length -- 398 miles

Major Highways --- I-10

2010 (2050) Corridor Population ------------ 21 (32) million

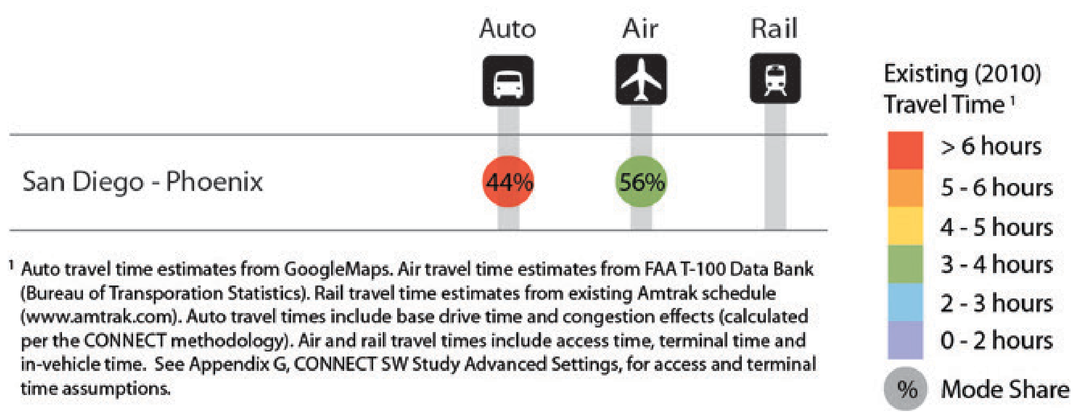
2010 (2050) Corridor Annual Trips* -------- 38 (48) million
*Sums trips across all modes on all segments between Greater Los Angeles and Phoenix

4.2.4 San Diego–Phoenix Corridor

The San Diego to Phoenix Corridor spans 440 miles and includes the intermediate MSA of the Inland Empire.[136] Some of its distinguishing characteristics include:

- **Demographics**—Population levels along the corridor are projected to grow dramatically by 84 percent between 2010 and 2050, significantly higher than the projected nationwide growth of 43 percent.[137]
- **Mode share**—Modal share for 2010 indicates air as the primary mode of travel, while auto mode share represents roughly 44% of corridor travel.[138]
- **Capacity-constrained airports**—San Diego International Airport (SAN), John Wayne Airport (SNA), and Phoenix Sky Harbor International Airport (PHX) will require additional capacity in 2025 after planned runway capacity improvements.[139]
- **Annual trips**—Annual trips within the San Diego – Phoenix corridor are projected to double between 2010 and 2050 from 6 million to 12 million trips, respectively.[140]
- **No existing rail service**.

Figure 29 San Diego–Phoenix existing mode share and travel times



[136] The corridor length presented here is the straight-line distance between MSAs as estimated by CONNECT. The actual driving or rail distance would be higher.
[137] 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.
[138] CONNECT Beta Version, 2012.
[139] FAA Future Airport Capacity Task (FACT 2) Capacity Needs in the National Airspace System 2007-2025, May 2007.
[140] CONNECT Beta Version, 2012.

Figure 30 San Diego–Phoenix corridor characteristics

Corridor Summary

Corridor Length -- 440 miles

Major Highways--------------------------------------I-5, I-8, I-10

2010 (2050) Corridor Population-------------12 (21) million

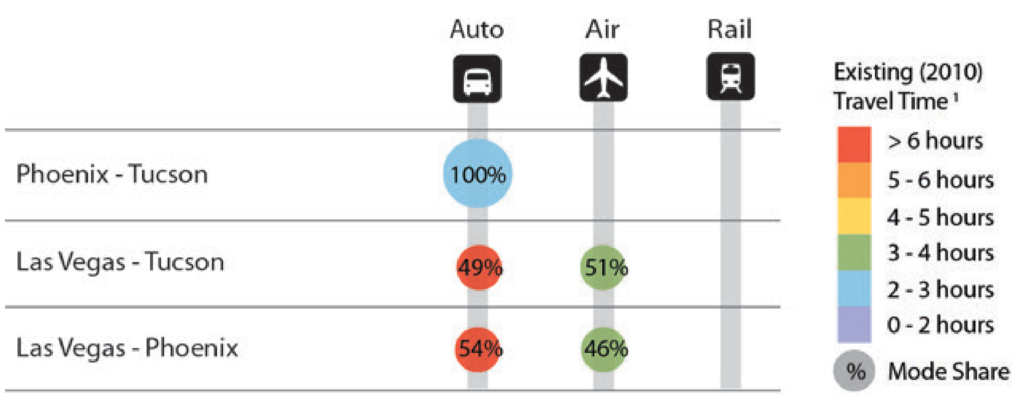
2010 (2050) Corridor Annual Trips* ---------- 6 (12) million
*Sums trips across all modes on all segments between San Diego and Phoenix

4.2.5 Las Vegas–Tucson via Phoenix Corridor

The Las Vegas to Tucson Corridor spans 400 miles and includes the intermediate MSAs of Kingman and Phoenix.[141] Some of its distinguishing characteristics include:

- **Demographics**—Population levels along the corridor are projected to grow dramatically by 85 percent between 2010 and 2050, significantly higher than the projected nationwide growth of 43 percent.[142]
- **Mode share**—Auto is the primary modal choice for travel between Phoenix and Tucson, due to the relatively short distance between these markets. Mode share for travel between Las Vegas and Tucson and Las Vegas and Phoenix is roughly split between auto and air.[143]
- **Capacity-constrained airports**—McCarran International Airport (LAS) and Phoenix Sky Harbor International Airport (PHX) will require additional capacity in 2025 after planned runway capacity improvements.[144]
- **Annual trips**—Annual trips within the Las Vegas – Tucson corridor are projected to more than double between 2010 and 2050 from 4 million to 11 million trips, respectively.[145]

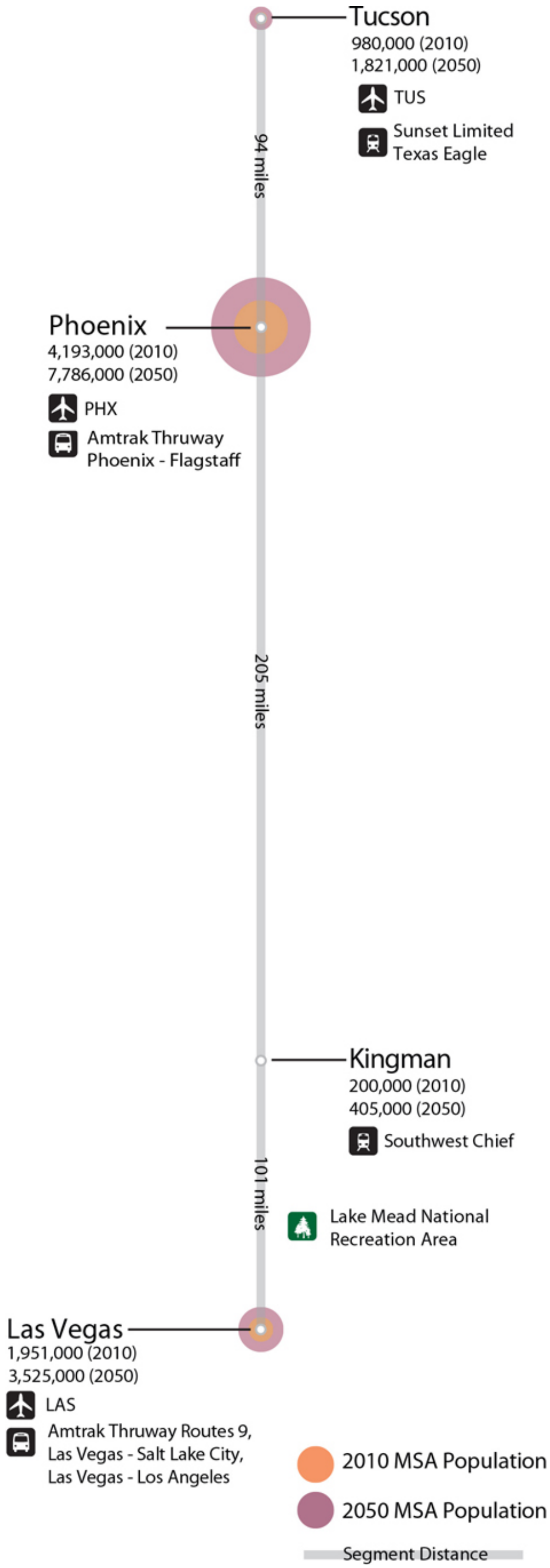
Figure 31 Las Vegas–Tucson via Phoenix existing mode share and travel times



¹ Auto travel time estimates from GoogleMaps. Air travel time estimates from FAA T-100 Data Bank (Bureau of Transporation Statistics). Rail travel time estimates from existing Amtrak schedule (www.amtrak.com). Auto travel times include base drive time and congestion effects (calculated per the CONNECT methodology). Air and rail travel times include access time, terminal time and in-vehicle time. See Appendix G, CONNECT SW Study Advanced Settings, for access and terminal time assumptions.

[141] The corridor length presented here is the straight-line distance between MSAs as estimated by CONNECT. The actual driving or rail distance would be higher.
[142] 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.
[143] CONNECT Beta Version, 2012.
[144] FAA Future Airport Capacity Task (FACT 2) Capacity Needs in the National Airspace System 2007-2025, May 2007.
[145] CONNECT Beta Version, 2012.

Figure 32 Las Vegas–Tucson via Phoenix corridor characteristics



Corridor Summary

Corridor Length---400 miles

Major Highways -------------------------------------I-10, US-93

2010 (2050) Corridor Population --------------7 (14) million

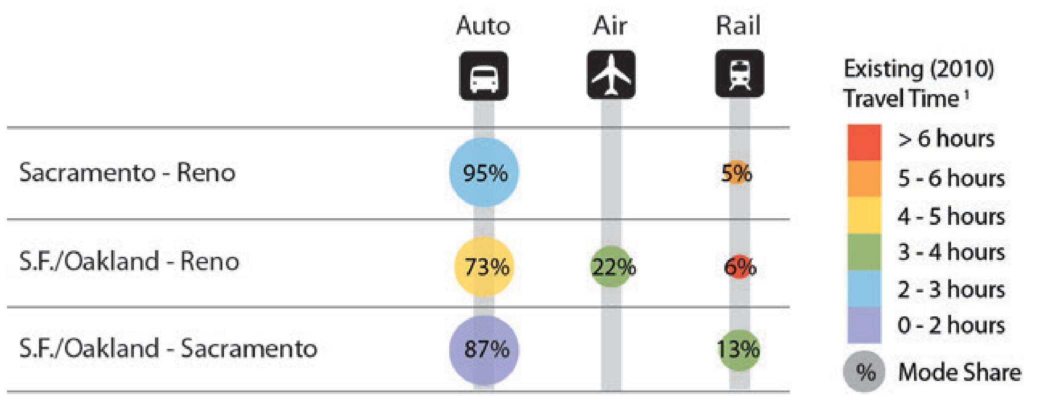
2010 (2050) Corridor Annual Trips* ----------4 (11) million
*Sums trips across all modes on all segments between Las Vegas and Tucson via Phoenix

4.2.6 S.F./Oakland–Reno Corridor

The S.F./Oakland to Reno Corridor spans 180 miles and includes the intermediate MSAs of Vallejo, Sacramento, and Truckee.[146] Some of its distinguishing characteristics include:

- **Demographics**—Population levels along the corridor are projected to grow 46 percent between 2010 and 2050, compared to a projected 43 percent growth for the entire U.S.[147]
- **Mode share**—The automobile is the primary mode choice for travel between the markets along the corridor, attributable to the short distances between the market pairs. For travel between S.F./Oakland and Reno, air travel represents a sizeable 22 percent of mode share. Rail ridership is significant between S.F./Oakland and Sacramento, representing 13 percent of mode share.[148]
- **Capacity-constrained airports**—San Francisco International Airport (SFO) and Oakland International Airport (OAK) will require additional capacity in 2025 after planned runway capacity improvements.[149]
- **Annual trips**—Annual trips within the S.F./Oakland – Reno corridor are projected to almost double between 2010 and 2050 from 8 million to 16 million trips, respectively.[150]
- **Existing rail service**—Amtrak's Capitol Corridor, which already provides service between Oakland and Sacramento, is Amtrak's third busiest route in terms of 2011 ridership.[151] The California Zephyr also serves San Francisco and Reno running to and from Chicago daily.

Figure 33 S.F./Oakland–Reno existing mode share and travel times



[1] Auto travel time estimates from GoogleMaps. Air travel time estimates from FAA T-100 Data Bank (Bureau of Transporation Statistics). Rail travel time estimates from existing Amtrak schedule (www.amtrak.com). Auto travel times include base drive time and congestion effects (calculated per the CONNECT methodology). Air and rail travel times include access time, terminal time and in-vehicle time. See Appendix G, CONNECT SW Study Advanced Settings, for access and terminal time assumptions.

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[146] The corridor length presented here is the straight-line distance between MSAs as estimated by CONNECT. The actual driving or rail distance would be higher.
[147] 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.
[148] CONNECT Beta Version, 2012.
[149] FAA Future Airport Capacity Task (FACT 2) Capacity Needs in the National Airspace System 2007-2025, May 2007.
[150] CONNECT Beta Version, 2012.
[151] Monthly Performance Report for September 2011, Amtrak, November 2011.

Figure 34 S.F./Oakland–Reno corridor characteristics

Corridor Summary

Corridor Length -- 180 miles

Major Highways --- I-80

2010 (2050) Corridor Population --------------7 (11) million

2010 (2050) Corridor Annual Trips* ----------8 (16) million

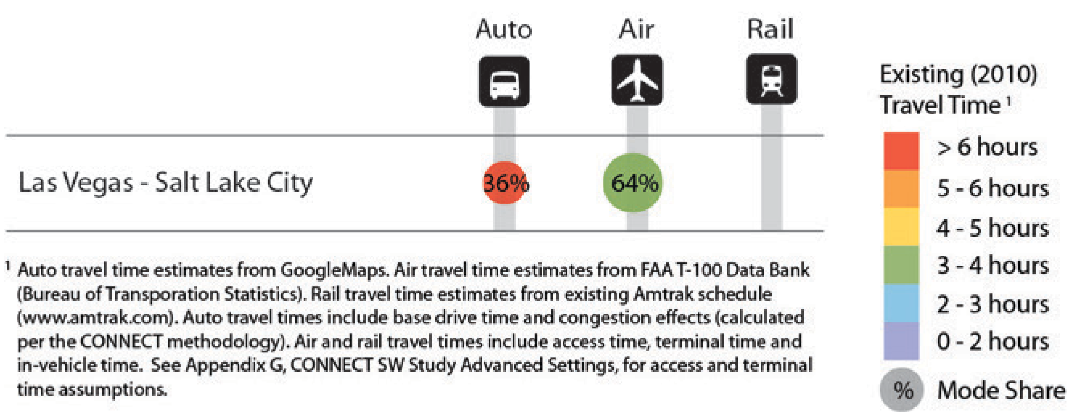
*Sums trips across all modes on all segments between San Francisco/Oakland and Reno

4.2.7 Las Vegas–Salt Lake City Corridor

The Las Vegas to Salt Lake City Corridor spans over 460 miles and includes the intermediate MSAs of Cedar City and Provo.[152] Some of its distinguishing characteristics include:

- **Demographics**—Population levels along the corridor are projected to grow dramatically at 84 percent between 2010 and 2050, significantly higher than the projected nationwide growth of 43 percent. Provo is projected to more than double its population from 2010 to 2050.[153]
- **Mode share**—Air is the primary modal choice, approaching almost 65 percent of the share, partly attributable to the long distance of the corridor.[154]
- **Capacity-constrained airports**—McCarran International Airport (LAS) will require additional capacity in 2025 after planned runway capacity improvements.[155]
- **Annual trips**—Annual trips within the Las Vegas – Salt Lake City corridor are projected to more than double between 2010 and 2050 from 0.7 million to 2 million trips, respectively.[156]
- **No existing rail service.**

Figure 35 Las Vegas–Salt Lake City existing mode share and travel times



[152] The corridor length presented here is the straight-line distance between MSAs as estimated by CONNECT. The actual driving or rail distance would be higher.
[153] 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.
[154] CONNECT Beta Version, 2012.
[155] FAA Future Airport Capacity Task (FACT 2) Capacity Needs in the National Airspace System 2007-2025, May 2007.
[156] CONNECT Beta Version, 2012.

Figure 36 Las Vegas–Salt Lake City corridor characteristics

Corridor Summary

Corridor Length---463 miles

Major Highways --- I-15

2010 (2050) Corridor Population --------------- 4 (7) million

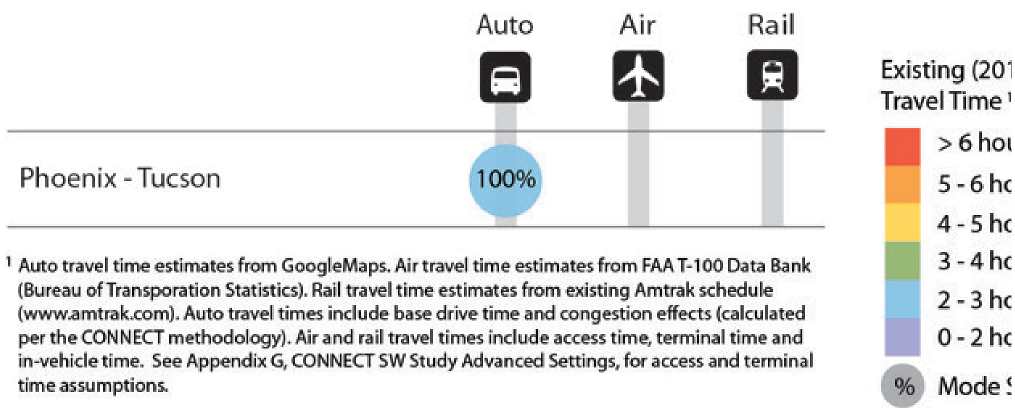
2010 (2050) Corridor Annual Trips* ---------0.7 (2) million
*Sums trips across all modes on all segments between Las Vegas and Salt Lake City

4.2.8 Phoenix–Tucson Corridor

The Phoenix to Tucson Corridor spans less than 100 miles and is the shortest corridor in the SW Study Area.[157] Some of its distinguishing characteristics include:

- **Demographics**—Population levels along the corridor are projected to grow dramatically by 86 percent between 2010 and 2050, significantly higher than the projected nationwide growth of 43 percent.[158] Much of this growth is projected in Pinal County, located between Phoenix and Tucson.
- **Mode share**—The automobile is the primary mode of travel within the corridor, attributable to the short distance between the two markets. Negligible rail share is attributable to a lack of exisiting rail options.[159]
- **Capacity-constrained airports**—Phoenix Sky Harbor International Airport (PHX) will require additional capacity in 2025 after planned runway capacity improvements.[160]
- **Annual trips**—Annual trips within the Phoenix – Tucson corridor are projected to double between 2010 and 2050 from two million to four million trips, respectively.[161]
- **Existing Rail Service** —Amtrak's Sunset Limited operates three days per week in both directions between Maricopa and Tucson. Maricopa is located 35 miles south of Phoenix.

Figure 37 Phoenix–Tucson existing mode share and travel times



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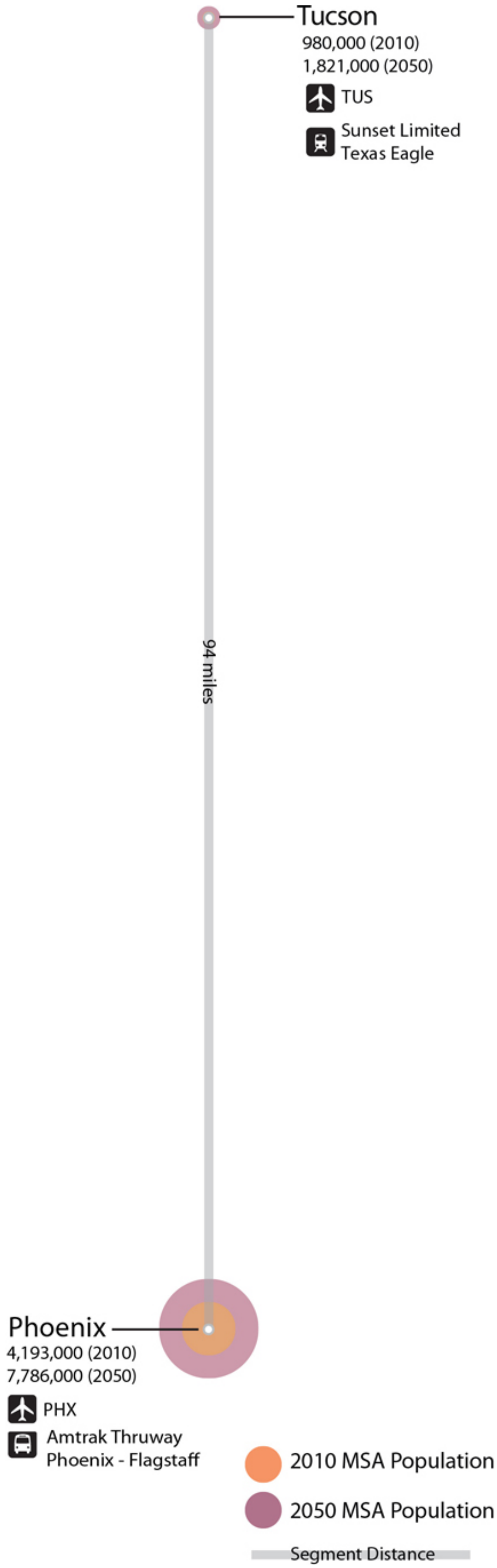
[157] The corridor length presented here is the straight-line distance between MSAs as estimated by CONNECT. The actual driving or rail distance would be higher.
[158] 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.
[159] CONNECT Beta Version, 2012.
[160] FAA Future Airport Capacity Task (FACT 2) Capacity Needs in the National Airspace System 2007-2025, May 2007.
[161] CONNECT Beta Version, 2012.

Figure 38 Phoenix–Tucson corridor characteristics



Corridor Summary

Corridor Length --94 miles

Major Highways---I-10

2010 (2050) Corridor Population --------------5 (10) million

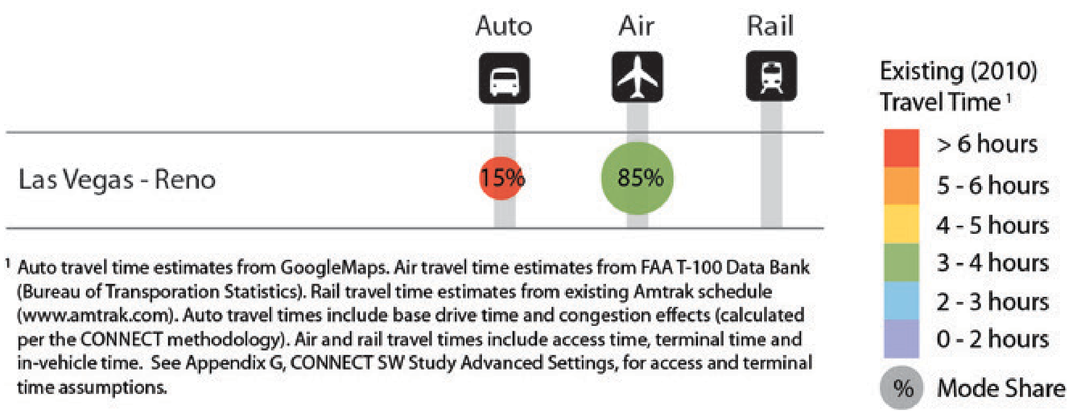
2010 (2050) Corridor Annual Trips* ------------2 (4) million
*Sums trips across all modes on all segments between Phoenix and Tucson

4.2.9 Las Vegas–Reno Corridor

The Las Vegas to Reno Corridor spans almost 390 miles and includes the intermediate MSA of Carson City.[162] Some of its distinguishing characteristics include:

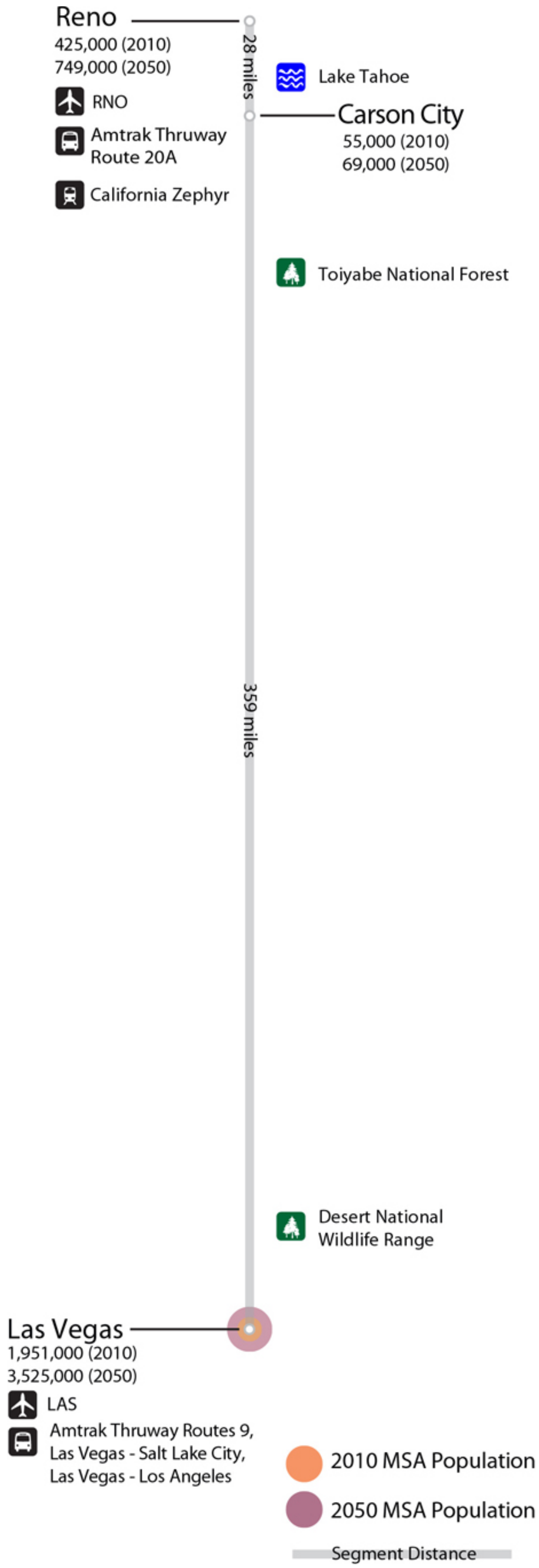
- **Demographics**—Population levels along the corridor are projected to grow 79 percent between 2010 and 2050, significantly higher than the projected nationwide growth of 43 percent.[163]
- **Mode share**—Air is the primary mode choice for travel along the corridor, at 85%, with auto travel representing 15% of corridor mode share.[164]
- **Capacity-constrained airports**—McCarran International Airport (LAS) will require additional capacity in 2025 after planned runway capacity improvements.[165]
- **Annual trips**—Annual trips within the Las Vegas – Reno corridor are projected to see considerable growth between 2010 and 2050 from 0.5 million to 1 million trips, respectively.[166]
- **No existing rail service.**

Figure 39 Las Vegas–Reno existing mode share and travel times



[162] The corridor length presented here is the straight-line distance between MSAs as estimated by CONNECT. The actual driving or rail distance would be higher.
[163] 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.
[164] CONNECT Beta Version, 2012.
[165] FAA Future Airport Capacity Task (FACT 2) Capacity Needs in the National Airspace System 2007-2025, May 2007.
[166] CONNECT Beta Version, 2012.

Figure 40 Las Vegas–Reno corridor characteristics



Corridor Summary

Corridor Length---387 miles

Major Highways --- US-95

2010 (2050) Corridor Population -------------- 2 (4) million

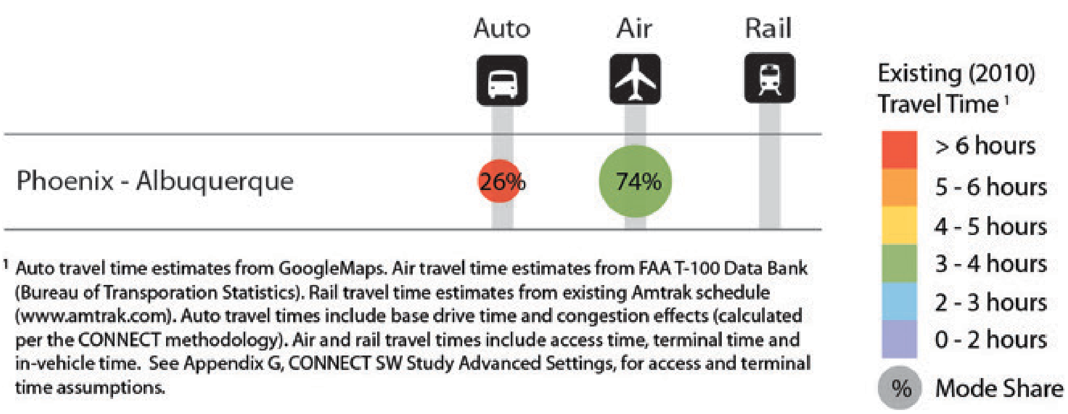
2010 (2050) Corridor Annual Trips* ---------0.5 (1) million
*Sums trips across all modes on all segments between Las Vegas and Reno

4.2.10 Phoenix–Albuquerque Corridor

The Phoenix to Albuquerque Corridor spans 460 miles and includes the intermediate MSAs of Prescott, Flagstaff, Gallup, and Grants.[167] Some of its distinguishing characteristics include:

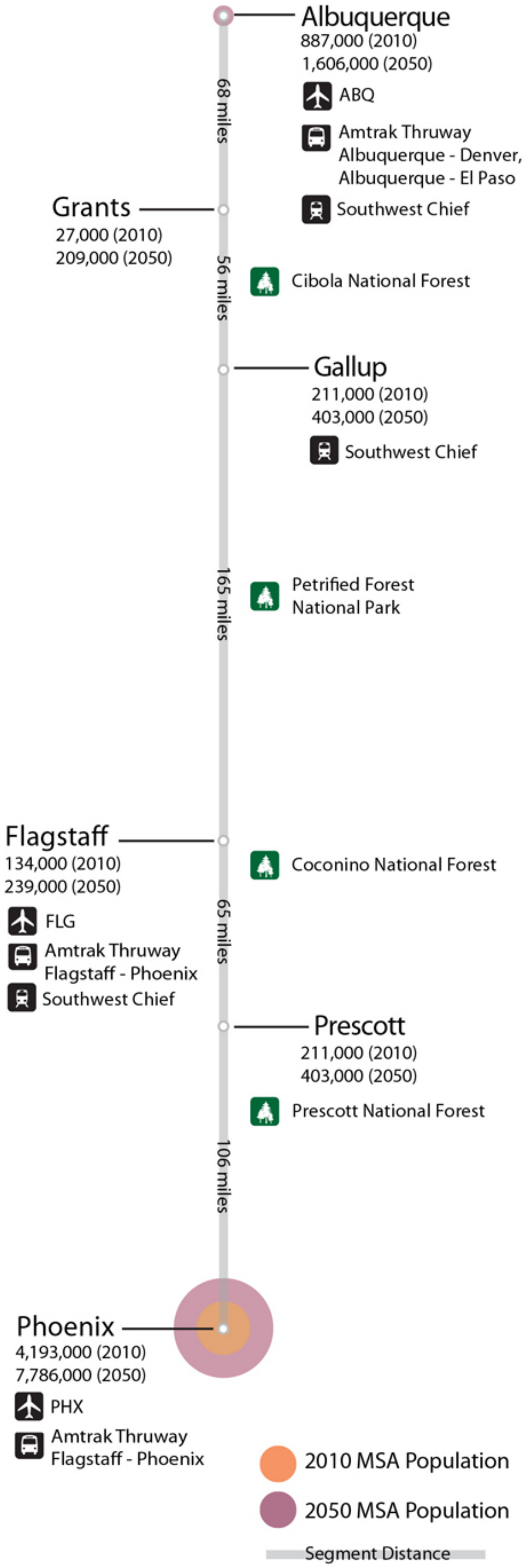
- **Demographics**—Population levels along the corridor are projected to grow dramatically by 87 percent between 2010 and 2050, significantly higher than the projected nationwide growth of 43 percent. Grants is expected to see its population grow nearly ten-fold from 27,000 in 2010 to over 200,000 in 2050.[168]
- **Mode share**—Air is the primary modal choice along the corridor, approaching almost 75 percent of the share, while auto represents just over 25% of mode share.[169]
- **Capacity-constrained airports**—Phoenix Sky Harbor International Airport (PHX) will require additional capacity in 2025 after planned runway capacity improvements.[170]
- **Annual trips**—Annual trips within the Phoenix – Albuquerque corridor are projected to grow significantly between 2010 and 2050 from 1 million to 3 million trips, respectively.[171]
- **No existing rail service.**

Figure 41 Phoenix–Albuquerque existing mode share and travel times



[167] The corridor length presented here is the straight-line distance between MSAs as estimated by CONNECT. The actual driving or rail distance would be higher.
[168] 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.
[169] CONNECT Beta Version, 2012.
[170] FAA Future Airport Capacity Task (FACT 2) Capacity Needs in the National Airspace System 2007-2025, May 2007.
[171] CONNECT Beta Version, 2012.

Figure 42 Phoenix–Albuquerque corridor characteristics



Corridor Summary

Corridor Length---460 miles

Major Highways -- I-40

2010 (2050) Corridor Population -------------6 (10) million

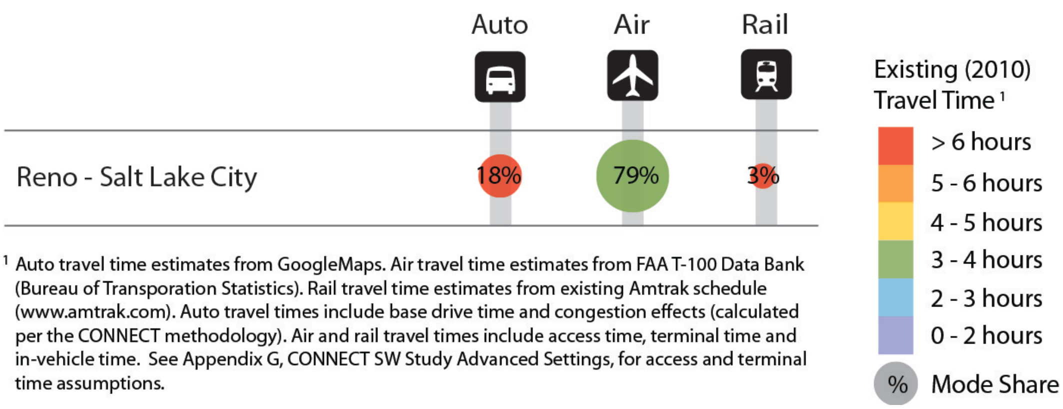
2010 (2050) Corridor Annual Trips* ----------- 1 (3) million
*Sums trips across all modes on all segments between Phoenix and Albuquerque

4.2.11 Reno–Salt Lake City Corridor

The Reno to Salt Lake City Corridor spans almost 500 miles and includes the intermediate MSA of Elko.[172] Some of its distinguishing characteristics include:

- **Demographics**—Population levels along the corridor are projected to grow by 62 percent between 2010 and 2050, compared to the projected nationwide growth of 43 percent.[173]
- **Mode share**—Air is currently the primary mode of travel (79 percent of mode share in 2010). Auto mode share is equal to 18 percent and rail mode share, with rail service available on the California Zephyr, only represents about three percent of the overall mode share.[174]
- **Annual trips**—Annual trips within the Reno – Salt Lake City corridor are projected to grow significantly between 2010 and 2050 from 0.1 million to 0.3 million trips, respectively.[175]
- **Existing rail service**—Amtrak's California Zephyr, which provides service from Chicago to Emeryville with stops in Salt Lake City and Reno, is Amtrak's sixth busiest national (long distance) route in terms of 2011 ridership.[176]

Figure 43 Reno–Salt Lake City existing mode share and travel times



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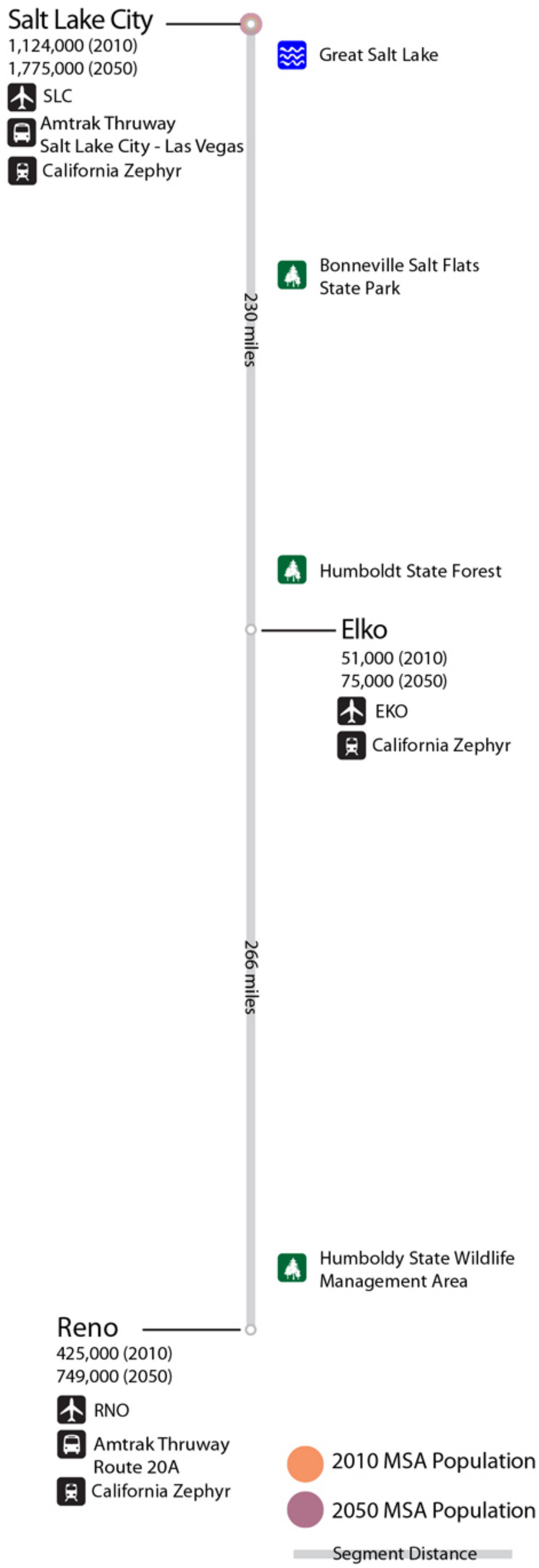
[172] The corridor length presented here is the straight-line distance between MSAs as estimated by CONNECT. The actual driving or rail distance would be higher.
[173] 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.
[174] CONNECT Beta Version, 2012.
[175] CONNECT Beta Version, 2012.
[176] Monthly Performance Report for September 2011, Amtrak, November 2011.

Figure 44 Reno–Salt Lake City corridor characteristics



Corridor Summary

Corridor Length --- 496 miles

Major Highways--- I-80

2010 (2050) Corridor Population---------------- 2 (3) million

2010 (2050) Corridor Annual Trips* ------- 0.1 (0.3) million
*Sums trips across all modes on all segments between Reno and Salt Lake City

Chapter 5. The Multi-State Preliminary Network Vision

The preliminary network vision for HPR in the Southwest was developed through a comprehensive stakeholder engagement process and a performance analysis informed by outputs from CONNECT. As discussed in Sections 1.5 and 4.1, FRA convened representatives from a diverse range of entities in the Southwest with an interest in HPR to develop the preliminary vision. Over the course of multiple workshops, stakeholders collaborated to identify potential network connections through an analysis of the existing and forecast demographic trends and travel patterns, economic activity, and noted capacity constraints in the current and planned transportation network largely presented in Chapters 2 and 3 of this report. CONNECT facilitated the analysis of potential performance of candidate corridors and the potential network vision. This chapter provides an overview of CONNECT, the metrics considered in the analysis, and the final network vision that emerged from the analysis and stakeholder engagement process.

5.1 Analysis Methods and the Network Planning Tool

5.1.1 Introduction to the network planning tool

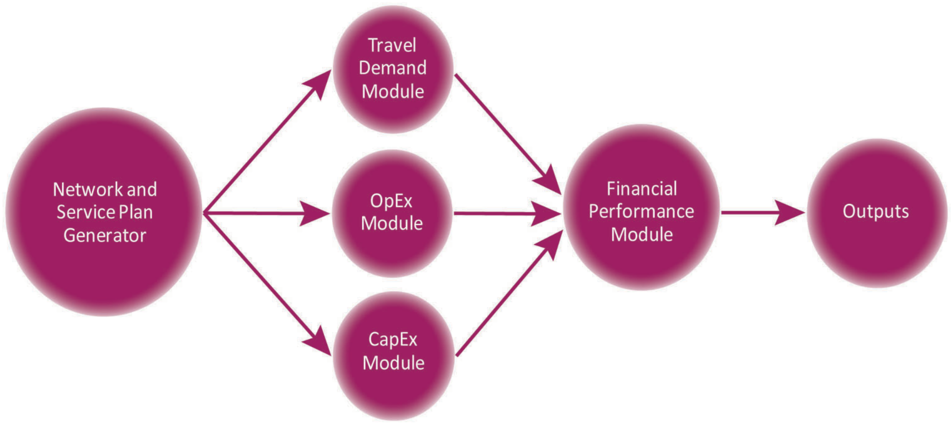
Developed as part of the FRA's national planning effort, CONNECT is designed to help analyze the performance of HPR corridors in the context of an HPR network. Specifically, the outputs of the tool provide a comparison of the relative differences on ridership, revenue, and costs for various network configurations, allowing the user to assess the tradeoffs of higher or lower investment levels. The tool is intended for use at the very outset of the planning process before decisions on alignments, service plans, and exact station locations are made. In this way, the tool can be used to narrow down a wide range of potential network configurations to a smaller subset of configurations for more advanced stages of planning. As an early stage planning tool, CONNECT does not replace detailed corridor planning nor is it intended to provide results necessary for investment decisions. Its usefulness is primarily in making high-level order-of-magnitude comparisons and in seeing the relative impact of broad scenarios.

CONNECT consists of several interrelated modules that build networks and service plans and estimate the ridership, revenue, capital, and operating and maintenance costs as well as the financial performance of the network. Figure 45 illustrates the tool's structure. The travel demand, operating expenditure, capital expenditure, and financial performance modules are fully automated but rely upon certain assumptions and information provided on the network to be tested. Outputs generated by the tool include summary level statistics on capital costs, O&M costs, ridership, and revenue for the individual corridor and the full network. The tool's outputs also provide a series of charts developed from the summary level data that can be used for performance analysis and the evaluation of alternatives.

CONNECT is intended to be an intercity rail planning tool that estimates intercity ridership for markets separated by at least 50 miles.[177] It does not attempt to capture commuter markets that may exist between neighboring MSAs, even if those MSAs are more than 50 miles apart. In markets less than 50 miles where ridership is not estimated, there is potential to utilize infrastructure to serve a primarily commuter/intraregional market. For markets in the 50- to 100-mile range, full potential of the rail market may be under-represented as the tool only estimates the intercity portion of the combined intercity and commuter markets.

[177] CONNECT estimates distance between MSAs based on the straight line distance between primary rail stations in the largest city within each MSA. In MSAs where no major rail station exists, distance is measured from a central point within the central business district of the largest city within the MSA.

Figure 45 CONNECT structure



5.1.2 CONNECT inputs

Two general sets of inputs are associated with CONNECT. The first is the assumed physical and operational characteristics for each corridor of the network. These characteristics include:

- Service tier assumed (Core Express, Regional, or Emerging/Feeder)
- Frequency of service
- Markets served
- Number of stations per segment
- Whether or not there are airport connections
- Percentage of existing versus new alignment

For corridor segments on new alignment, the general level of investment that can be expected in the corridor, ranging from low to high for rural and urban locations, must be assumed. For corridor segments on existing alignment, the defined freight density and existing track quality (Class 0 to 2, Class 3, or Class 4) inputs will drive the requirements for capacity and speed upgrades implied by the new service.

Significant input from stakeholders was provided for this set of inputs including the assumed infrastructure, development types, and appropriate service tiers. These corridor-specific inputs used in the Southwest multi-state network analysis are detailed for each corridor in Appendix F.[178]

The second set of inputs required to run CONNECT includes the other drivers of ridership and cost that are not unique to the specific corridors in the network, such as operational assumptions, unit costs, access times, and exogenous factors (e.g. auto congestion, value of time, and population growth projections). Values for these global network variables were developed for the SW HPR network analysis through research of domestic and international rail systems and with input from the stakeholders involved in the process. Table 10 provides an overview of the key input assumptions used in the development of the Southwest HPR network analysis. Refer to Appendix G for a comprehensive list of the global variables and values assumed for the network.

It should be noted that performance presented in this report is based on many assumptions, and *the results implied by this set of assumptions used in this analysis only represent one potential scenario*. Some project sponsors might decide to focus on maximizing financial performance, in which case they might make a different fare policy assumption and yield a higher operating recovery ratio, while others might choose fare

[178] For a thorough discussion of all inputs and assumptions incorporated into the network planning tool, refer to the CONNECT User Manual.

policies that yield lower operating recovery ratios yet attract more riders and maximize public benefits. In addition, CONNECT's cost estimates are only intended to represent a potential range. Other studies might validly take other factors into consideration and make different assumptions, yielding different estimates of costs, ridership, and financial performance.

Table 10 Key assumptions for the Southwest HPR network analysis

Train speeds	CONNECT uses two inputs to derive average speeds between markets—Average Operating Speed and Station Penalty. For Emerging/Feeder, Regional, and Core Express, the Southwest network uses 60, 90, and 186 mph, respectively, for Average Operating Speed. These average operating speeds do not indicate maximum authorized speeds, but rather speeds at the high end of the estimated operating speeds that account for curves and other speed restrictions. For the Station Penalty input, 5 minutes was used per station. The five minutes account for the additional time it takes on average to decelerate, stop at a station to load and unload passengers, and accelerate back to top speed above the time it would take to cover that same distance at top speed. These settings yield trip times between markets in the Southwest generally in line with those on existing California corridor service and the planned CHSR system.
Transfer times	Two inputs are used to drive total transfer time for origin and destination pairs on the network that require a transfer—Transfer Time and Transfer Penalty. Transfer Time is the scheduled time it takes to transfer between trains. Transfer Penalty is an additional allowance above the transfer time added to the scheduled run time to account for the inconvenience and schedule uncertainty associated with transfers. For the Southwest network these are set at 15 and 30 minutes, respectively.
Auto travel times	Estimated auto travel time has two components—Base Travel Time and Congested Travel Time. These two components are added together to yield a total auto travel time between any two MSAs on the network. The base travel time is 95 percent of the Google Maps travel time. For the base year, the congested travel time is 5 percent of the Google maps travel time plus five minutes per one million of population at each end of the trip up to a cap of 30 minutes per MSA. For future years, the base travel time is held constant; the congested travel time is grown at 2 percent per year.
Rail access and terminal times	Access times to rail stations, the time it takes on average to travel between an origin point within an MSA to a rail station, vary by size of metropolitan area with longer access times in larger MSAs. For the Southwest network, access times were set at 10 minutes for MSAs with a population fewer than 1 million, 20 minutes for MSAs 1 million to 3 million, 30 minutes for MSAs 3 million to 6 million, and 40 minutes for MSAs with a population greater than 6 million. Rail terminal times, the time on average a passenger spends in the train station prior to boarding a train, was set at 25 minutes. For each origin and destination pair, an access time on each end of the trip and a single terminal time was added to the estimated run time of the train to arrive at total trip time.
Air access and terminal times	Access times to airports, the time it takes on average to travel between an origin point within an MSA to an airport, vary by size of metropolitan area, with longer access times in larger MSAs. Access times were set at 15 minutes for MSAs with population fewer than 1 million, 30 minutes for MSAs 1 million to 3 million, 45 minutes for MSAs 3 million to 6 million, and 60 minutes for MSAs with population greater than 6 million. Air terminal times, the time on average a passenger spends in the airport prior to boarding a flight, was set at 75 minutes. For each origin and destination pair, access time on each end of the trip and a single terminal time was added to the in-flight time to arrive at total trip time.
Rail on-time performance	In accordance with published FRA goals, minimum on-time performance for the Southwest network was set at 85 percent for Emerging/Feeder, 95 percent for Regional, and 99 percent for Core Express.
Rail fare	Rail fare assumptions are based on existing Amtrak business fares. Business Fares are a function of service tier and distance with Core Express fares based on existing Acela service, Regional fares based on existing Northeast Regional service, and Emerging fares based on existing state-supported and long distance service. Non-business fares were set at 65 percent of business fares.

5.1.3 Performance metrics

The network planning tool provides an array of metrics that help to describe the performance of any particular corridor. The following five key performance metrics were considered in the SW Study decision making process:

- Ridership
- O&M recovery ratio
- Initial capital investment
- O&M profit/(subsidy)
- Rail share of total intercity travel market

RECOVERY RATIO

Recovery Ratio is the fraction of expenses met by revenues. The O&M Recovery Ratio and Total Cost Recovery Ratio performance metrics are calculated as follows:

O&M Recovery Ratio = $\dfrac{\textit{Annual Fare Revenue}}{\textit{Annual O\&M Cost}}$

The SW Study corridor performance analysis did not define discrete thresholds for each of the key performance metrics. Instead, it is acknowledged that the stakeholders must decide what is most appropriate in their region, taking into consideration the costs and benefits of other available alternatives for providing intercity passenger transportation. In addition, full benefit-cost analysis relies on more detailed modeling and data than is available at this early stage of planning. As a result, it is not a primary performance metric recommended for high-level network analysis.

For the purposes of assisting the stakeholders in defining the appropriate service goals for corridors in the network, a set of four criteria were used to help classify the performance of a corridor.

CONNECT only considers intercity markets and passenger rail corridors. The potential utility of all of these corridors is enhanced by integrated commuter and intercity rail services. Additionally, connections to other modes, e.g., transit, walking, and biking can have positive effects on rail ridership.

CORRIDOR PERFORMANCE ANALYSIS CRITERIA

Stand-alone performance—*Performance of the corridor without consideration of other service in the network*

Network performance—*Performance of the corridor considering other service in the network*

Enabling corridor—*Extent to which the corridor enables improved performance on other corridors**

Dependent corridor—*Extent to which the corridor is dependent on other corridors for improved performance*

The first criterion, *stand-alone performance*, evaluates the performance of the corridor without consideration of other service on the network. In general, corridors with an operating recovery ratio greater than 1.0 were ranked top performing stand-alone corridors, corridors with operating recovery ratios between 0.5 and 1.0 were ranked strong performing stand-alone corridors, and corridors with operating recovery ratios well below 0.5 were ranked low performing corridors. The specific breakpoints between performance categories are open to revision in the context of future planning efforts.

The second criterion, *network performance*, evaluates the performance of the corridor within the context of the entire network. Corridors were ranked as either top performing corridors in the network context, showing improved performance in the network context, or showing little to no performance improvement in the network context.

To further distinguish performance levels on the corridor, the third criterion, *enabling corridor*, identifies the extent to which each corridor enhances the performance of other corridors or the network as a whole.

Corridors were ranked from best to worst in enabling significant improvement in the performance of other corridors, enabling some improvement in the performance of other corridors, or not enabling performance improvements in other corridors.

The fourth criterion, *dependent corridor*, identifies the extent to which a corridor relies on other corridors for improved performance. Corridors were assigned a three-tier rank of not dependent, somewhat dependent, or very dependent on other corridors for improved performance.

5.2 Preliminary Multi-State Network

This section describes the resulting long-term preliminary vision for a multi-state HPR network of corridors identified by the Southwest stakeholders. The stakeholders identified the long-term preliminary vision based on the conceptual performance estimated by CONNECT for the year 2050. It also provides a summary of potential network-level performance for the year 2050. The three rail service tiers of Core Express, Regional, and Emerging/Feeder Corridors (Table 1) reflect the long-term HPR overarching network and the varying stages of progression that could be expected for HPR corridors across the country.

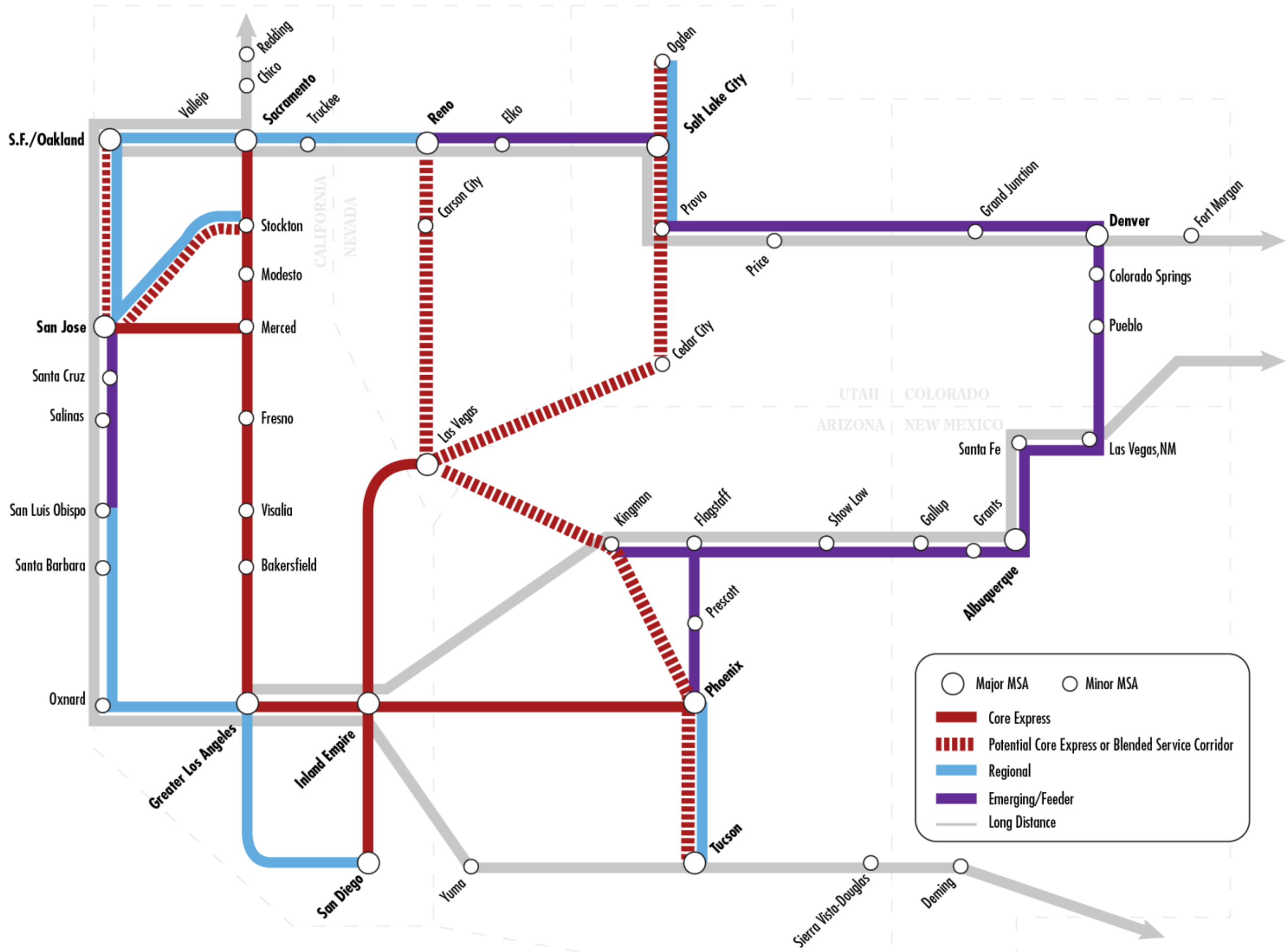
Each of the individual corridors introduced in Chapter 4 have distinguishing characteristics associated with their advancement as part of a multi-state network, and the needs, attributes, opportunities, and challenges of each played a part in the development of the long-term preliminary vision for HPR in the Southwest. The development of the preliminary vision for the multi-state rail network also takes into account the performance analysis informed by outputs from CONNECT. CONNECT considered both the stand-alone investment of an individual corridor as well as the performance of the full series of corridors and resulting benefits from linkages across multiple states.

5.2.1 Identification of corridor type/service tier

The result of this network planning analysis is the stakeholders' identification of candidate corridors that might be included in a Southwest HPR network vision. All 11 of these corridors and their potential long-term planning service tiers are listed below and shown in Figure 46:

- Potential Core Express candidate corridors
  - San Diego–S.F./Oakland
  - Greater Los Angeles–Las Vegas
  - Las Vegas–Salt Lake City
  - Las Vegas–Reno
  - Las Vegas–Tucson via Phoenix
  - Greater Los Angeles–Phoenix
  - San Diego–Phoenix
- Potential Regional candidate corridors
  - S.F./Oakland–Reno
  - Phoenix–Tucson
- Potential Emerging/Feeder candidate corridors
  - Phoenix–Albuquerque
  - Reno–Salt Lake City

Figure 46 Candidate corridors for potential SW HPR network*



Source: CONNECT Beta Version, 2012
**Figure identifies desired connections between metropolitan areas. It does not identify alignment or station locations and does not preclude multiple alignments within a corridor segment.*

The solid red line represents Core Express service in the CHSR network and the key connections from Southern California to Las Vegas and Phoenix. The S.F./Oakland to Reno corridor in blue is shown as Regional service, representing an upgrade and extension of the Capitol Corridor as well as plans for the existing Pacific Surfliner corridor. The corridors shown with a dashed red line represent corridors that might be considered for Core Express service over the long-term once the core network was developed.

Several corridors are depicted as Regional with a red dashed line, indicating that these might start as regional corridors and could potentially grow into Core Express based on other investments in the network. Alternatively, these could exist as hybrid corridors with Core Express equipment operating through service at reduced speeds mixed with commuter or traditional intercity service (some might classify this approach as 'blended service'). Emerging/Feeder services are shown in purple.

One of the key metrics estimated by CONNECT is the operating recovery ratio. This metric is calculated for each corridor in isolation, with no connections to other corridors on the network (defined as the "stand-alone" context), as well as in the network context. The network context accounts for connections to other corridors as well as potential shared infrastructure with overlapping services. While operating recovery ratio is certainly not the only metric to be considered when judging the value of a corridor, and there are numerous other metrics coming out of CONNECT that help evaluate the performance and value of any particular corridor, it can be used to help compare the relative performance of the corridors.

Table 11 shows the operating performance level as a stand-alone corridor and as part of a network. A green dot indicates an operating recovery ratio of greater than 2; a yellow dot indicates an operating recovery ratio greater than 1 but less than 2; and a gray dot indicates an operating recovery ratio of less than 1. For all the key metrics, CONNECT calculates low, medium, and high values. For the sake of simplicity, the values presented here represent the medium values in this range. These values represent scenarios tested with CONNECT based on stakeholder input and generalized estimates of unit costs and construction methods. These results do not reflect detailed planning or cost estimating based on specific rights of way, alignment, station, technology, or phasing decisions; rather, they are conceptual in nature and are most useful for identifying whether additional study of a corridor may be warranted, the relative impacts of alternatives, and the relative importance of the network context. Different policy assumptions would yield different results.

As stand-alone corridors, only the San Diego to San Francisco, Las Vegas to Los Angeles, Los Angeles to Phoenix, and San Diego to Phoenix corridors had operating recovery ratios greater than one with the assumptions used in this analysis. In the network context, however, nearly every corridor in the network showed potential for the ticket revenue to exceed operating costs; however the private sector could have a role in the development of a HPR system. From a multi-state planning perspective, it should be noted that eight of these 11 corridors are interstate markets.

Table 11 Operating recovery ratio performance

			Stand-alone[1]	Network[1]	Multi-state Corridor
San Diego–San Francisco (C.E.)			● (green)	● (green)	
Las Vegas–Los Angeles (C.E.)			● (green)	● (green)	✓
Los Angeles–Phoenix (C.E.)			● (yellow)	● (green)	✓
San Diego–Phoenix (C.E.)			● (yellow)	● (yellow)	✓
Las Vegas–Phoenix–Tucson (C.E.)			● (gray)	● (yellow)	✓
San Francisco–Reno (Regional)			● (gray)	● (green)	✓
Las Vegas–Salt Lake City (C.E.)			● (gray)	● (yellow)	✓
Phoenix–Tucson (Regional)			● (gray)	● (yellow)	
Las Vegas–Reno (C.E.)			● (gray)	● (yellow)	
Phoenix–Albuquerque (Emerging/Feeder)			● (gray)	● (gray)	✓
Reno–Salt Lake City (Emerging/Feeder)			● (gray)	● (gray)	✓

[1]Operating recovery ratio: X = <1; 1 < X < 2; X > 2;

It is not suggested that operating recovery ratio is the only metric that should be considered when judging the value of a corridor. Rather, there are many benefits that may accrue to the larger network and to the public that this single metric does not account for. For example, while existing services that have O&M recovery ratios greater than 1.0, such as Amtrak's Acela, are considered successful by many, there are other corridors with recovery ratios in the 0.35 to 0.45 range that many consider fill a critical need in the transportation network, such as the Pacific Surfliner, Capitol Corridor, and San Joaquin in California.[179] These corridors can also generate positive externalities, such as congestion relief, environmental benefits, safety benefits, etc. The operating recovery ratios also reflect many states choosing to pursue ticket pricing policies that place more emphasis on generating public benefits and ridership than maximizing operating recovery ratios. For this reason, it is important to consider alternative policy assumptions, other performance metrics, the local context, and the availability of other intercity travel alternatives when assessing the value of investing in passenger rail to serve a corridor.

5.2.2 Benefits of connectivity

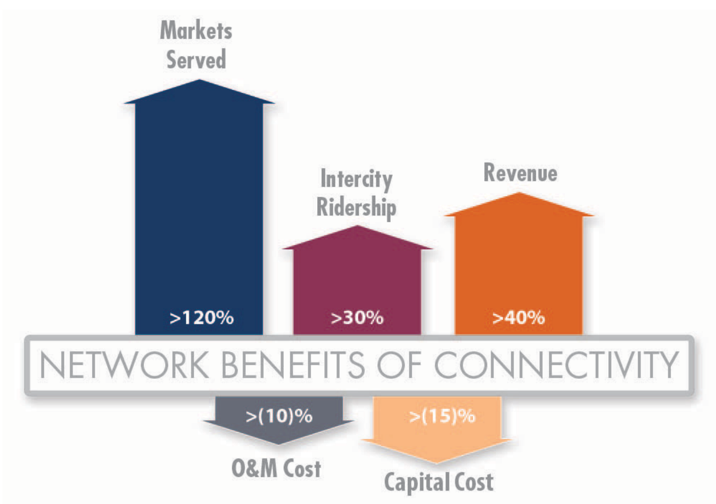
The impacts of connectivity can also be assessed on a network-wide basis. Figure 47 compares the performance of all 11 corridors as stand-alone corridors and as a full network.[180] It shows that the connectivity associated with the full network yields higher ridership and revenues and with lower capital and O&M costs.

These network benefits are a result of two primary factors. First, by allowing transfers between the corridors the number of market pairs connected by the rail network increases substantially. Allowing a single transfer between corridors more than doubles the market pairs served by the rail network.[181] This increases the ridership and revenue on every corridor in the network. For the full network, these connections increase ridership by 30 to 38 percent and revenue by 42-55 percent.

The other primary factor driving the benefits of connectivity is the more efficient use of infrastructure. Multiple services on the network are able to take advantage of shared stations and track segments increasing the infrastructure utilization and driving down costs.

Additional benefits of connectivity through the region are demonstrated from the efficiencies of multi-state rail network performance, presented as key findings in Section 5.3.1.

Figure 47 Southwest network results: benefits of connectivity



[179] The O&M recovery ratio performance as described in this report is defined as the net ticket revenues divided by the sum of direct and shared O&M costs (excluding OPEBs, capital charges, and other costs as defined by Amtrak). This approach differs from the performance reported by Amtrak.
[180] The role of long-distance Amtrak service has not been considered in this analysis.
[181] It is important to note that the number of unique markets served, representing number of origin and destination pairs, also more than doubles with the full network. With no transfers between corridors, 87 unique markets are served by this collection of corridors. In contrast, when the corridors are connected, and one transfer is allowed, the number of markets served increases to 197. Because CONNECT currently only allows for one transfer, this scenario likely understates the actual number of markets served and underscores the importance of accounting for network impacts from the very outset of the planning process.

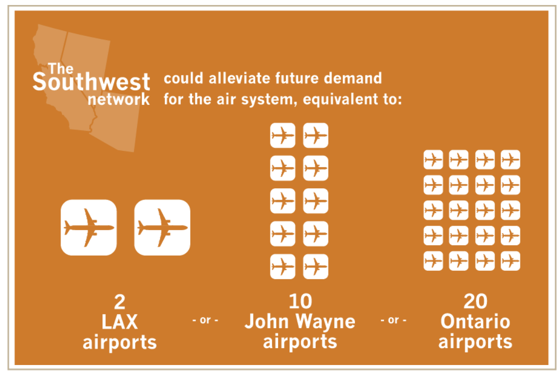
5.3 Preliminary Multi-State Network Performance

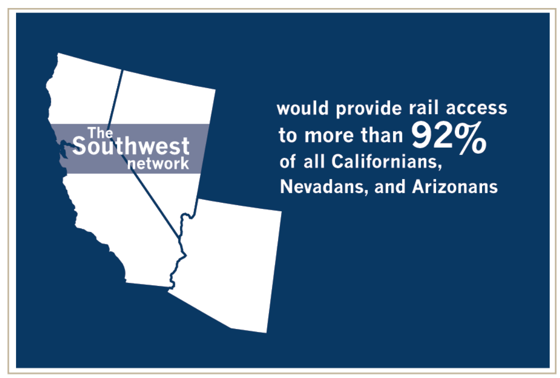
5.3.1 Key findings

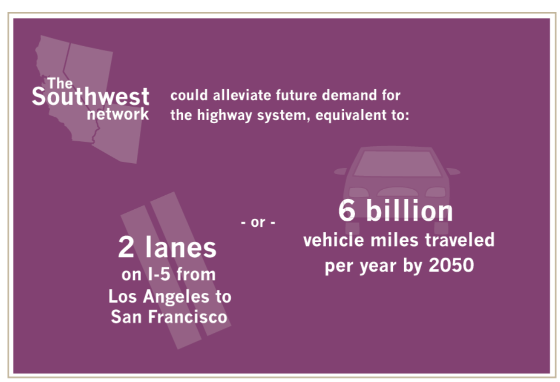
The CONNECT tool clearly illustrates the benefits and efficiencies of network connectivity. More specific findings from the analysis include identification of key market connections, strengths of alternative configurations, and potential to alleviate future demand on the regional aviation and highway system.

More specifically, the key findings are as follows:[182]

- **Finding #1**—The Southwest network would provide rail access[183] to more than 92 percent of all Californians, Nevadans, and Arizonans. Existing long-distance trains provide service to additional markets.
- **Finding #2**—Connections to Los Angeles enable significantly improved performance for many corridors. The Southwest network would allow more than 85 percent of Californians, Nevadans, and Arizonans to reach Los Angeles in less than four hours on rail.
- **Finding #3**—More than 60 percent of the travel markets within 800 miles would use CHSR or Los Angeles–Las Vegas infrastructure.
- **Finding #4**—The performance of every corridor included in the Southwest network improves in the network context.[184]
- **Finding #5**—The Southwest network is far greater than the sum of its parts. Connections open up new markets, resulting in up to 50 percent higher network ridership. Efficiencies also lead to capital and O&M cost savings.
- **Finding #6**—The Inland Empire is potentially a large interstate rail hub, connecting the major markets of Phoenix, Las Vegas, San Diego, Los Angeles, the Central Valley, and Northern California.
- **Finding #7**—There is a strong case to connect Phoenix with Los Angeles and San Diego via the Inland Empire. There are economies of scale to be







[182] The role of long-distance Amtrak service has not been considered in this analysis.
[183] Rail access is defined as people living within an MSA with at least one station stop.
[184] This statement does not imply every potential corridor would always improve in the network context, but rather that the performance improved for each of the SW corridors tested.

gained by a unified connection between Phoenix and these two major markets in Southern California.

- **Finding #8**—The case for the San Diego–Inland Empire segment is considerably strengthened in the context of the multi-state network. Planning for this segment should account for future service to Las Vegas and Phoenix in addition to California destinations. Connections to Las Vegas may also provide the opportunity for direct service to Las Vegas and Northern California without the added distance of traveling through downtown Los Angeles.
- **Finding #9**—Most of the Phoenix–Las Vegas market could be captured with air competitive travel time (3 ½ hours on Core Express) and more frequent service on a route through the Inland Empire.
- **Finding #10**—Las Vegas–Reno and Las Vegas–Salt Lake City have potential to develop into Core Express corridors after other key parts of the Southwest network are in place. A direct Core Express link between Las Vegas–Phoenix might also be considered in the future if there is a compelling capacity or market justification in the context of the full Southwest network.
- **Finding #11**—The SW network could alleviate future demand for the air system by 2050, equivalent to the amount of traffic currently served by two LAX airports, 10 John Wayne airports, or 20 Ontario airports.[185]
- **Finding #12**—While demand for the air system is expected to grow 74 percent by 2050 even with the SW HPR network, future air demand is estimated to grow 111 percent by 2050 without the SW HPR network.[186]
- **Finding #13**—The SW network could alleviate demand for the highway system, avoiding up to 6 billion vehicle miles traveled per year by 2050. This amount of traffic, spread across the Southwest, might equate to two lanes on I-5 from Los Angeles to San Francisco.[187]

[185] Based on CONNECT Beta estimate that 38 to 48 million passengers per year would choose rail instead of air in 2050 if the rail network were implemented, equating to approximately 1,200 flights/day assuming 100 passengers/fight.
[186] Based on analysis of current and future demand for the total number of departures at the largest 15 airports in the Southwest (LAX, PHX, LAS, SFO, SLC, SAN, OAK, SMF, SNA, SJC, ONT, BUR, RNO, TUS, LGB).
[187] Based on CONNECT Beta estimate that 29 to 33 million auto passengers per year would choose rail instead of auto in 2050 if the rail network were implemented. Assumes average vehicle occupancy of 1.25 for auto passengers diverted to rail, a 10% peak hour factor, and 2,400 vehicles per hour per lane. This estimate should not be compared to project-specific estimates of highway congestion relief. The figures presented here only consider intercity trips longer than 50 miles that are between MSAs on the HPR network, and the methodology used here for estimating highway demand relief here is based on crude sketch-planning factors rather than corridor-specific analysis.

Chapter 6. Governance

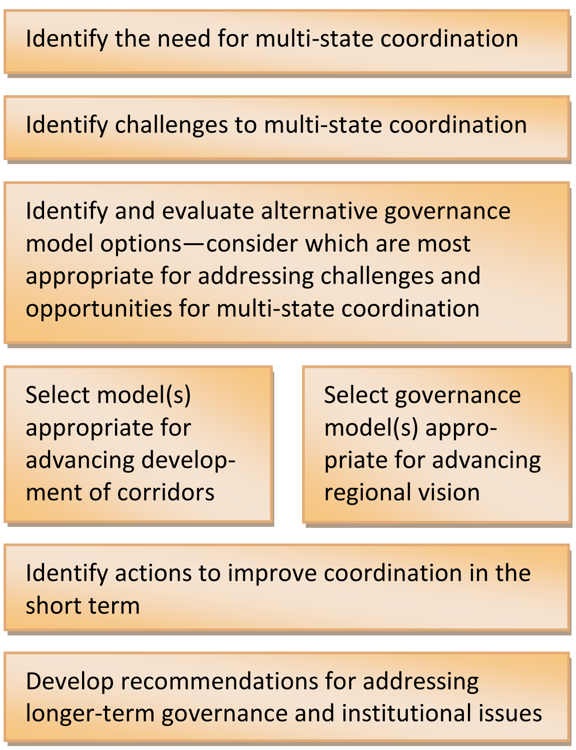
Institutional constraints—often more than technical issues—are frequently a major impediment to the implementation of transportation projects. Rail projects in particular are complicated by the unique mix of private and public owners and operators of infrastructure and rolling stock and the legacy of federal law. For the SW Study Area, the need to identify a mechanism for coordinating across state lines adds complexity to an already challenging concept. This chapter summarizes the study approach to working through the governance and institutional issues, input received from stakeholders, alternative governance models considered for the Southwest, and governance findings and recommendations.

6.1 Study Approach to Governance and Institutional Considerations

The objective of the governance and institutional portion of the Study was to identify the key issues and potential governance structures needed for advancing a broad, multi-state vision and ensuring the success of HPR projects that cross state lines. These objectives reflect two foundational principles: (1) no single, perfect governance model exists and (2) it is not critical to settle every detail regarding future stages of vision development at this early stage of planning, but rather to lay out a flexible framework for making these decisions as projects are further developed.

The study process engaged stakeholders in a series of governance-related roundtable exercises and large group discussions (Section 1.5). A summary of the process is shown on Figure 48.

Figure 48 Governance process

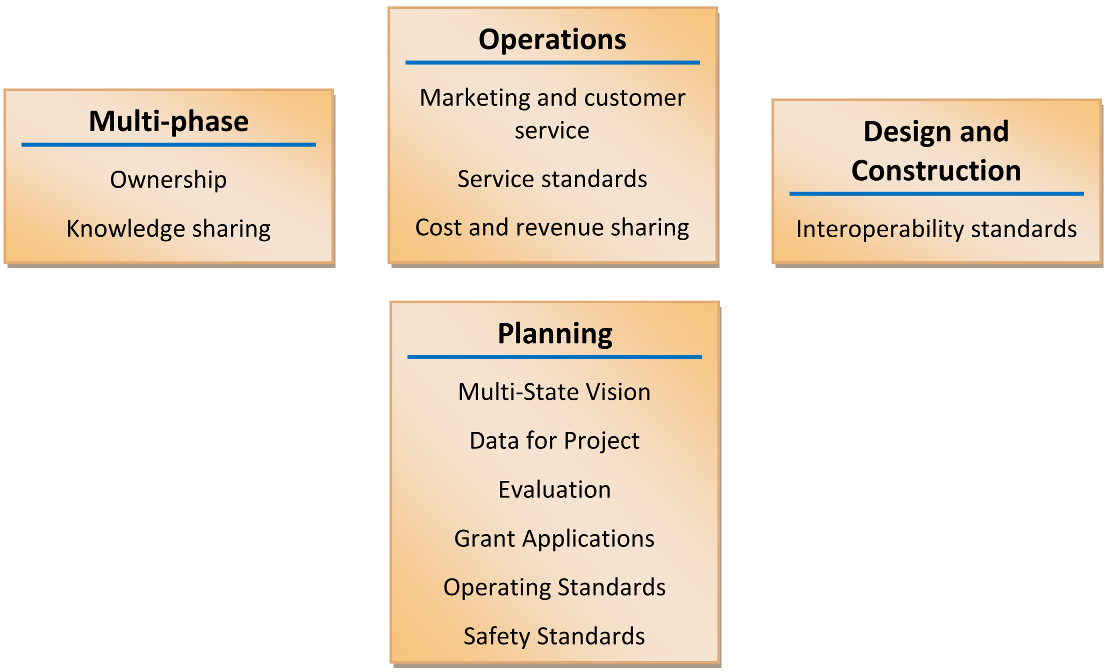


6.2 Areas of Need for Multi-State Coordination

Stakeholders identified several areas of need for multi-state coordination in HPR planning and development. These areas address a range of financial, legal, business, project development, and operational issues. Multi-state coordination is necessary in these areas because without it there are likely to be sub-optimal outcomes in customer service, the seamlessness of the system, or the efficient use of scarce financial resources. The areas collectively represent the need for stakeholders to establish a multi-state governance framework.

The areas identified by stakeholders were categorized into three stages of transportation project development: *planning, design and construction,* and *operations*. Those areas that cross multiple stages of project development were organized into a fourth, *multi-phase*, category. Figure 49 shows the areas where stakeholders identified a compelling need for multi-state coordination.

Figure 49 Needs for multi-state coordination



6.3 Challenges to Multi-State Coordination

Stakeholders also considered challenges to coordinating across the network or on an individual corridor that crosses state lines. Identified challenges covered eight categories: funding, travel, regulatory/legal requirements, developing buy-in to the common vision, different goals, role of cities in the decision-making process, overlap in responsibility among different agencies, and powers of stakeholders:

- **Funding**—Study stakeholders cited funding issues as the primary impediment to coordinating across state lines. Specific concerns included cost sharing and individual state restrictions on spending money in other states. In addition, the role of the federal government in providing HPR funding was also raised, in particular the potential for a dedicated, long-term funding source.
- **Travel**—Stakeholders noted that out-of-state agency travel and budget restrictions make it difficult to work with other states.
- **Regulatory/legal requirements**—The stakeholders acknowledged that each state is subject to distinct, and sometimes conflicting, regulatory and legal requirements that could present a

challenge to multi-state transportation project planning and implementation. Examples of where requirements might differ include procurement, contracting, permitted uses for state funds, jurisdiction, and environmental reviews and permitting. Stakeholders discussed the need to address differing legal requirements and seek regulatory consistency in areas most critical for delivering projects.

- **Developing buy-in to common vision that lasts**—Stakeholders asserted that building and sustaining support for a common vision across the study area states is critical. Stakeholders acknowledged the need to garner support from elected officials and find champions who will buy into the vision and support it for the entire life of the project. They also cited the need for a strong public outreach program to build the initial vision.
- **Different goals**—Stakeholders identified sometimes conflicting goals between the private railroads and states as another challenge. States noted that improving existing rail facilities to support passenger rail service can also enhance freight services, while freight railroads noted they must preserve capacity to accommodate their future long-term growth. Finding synergies and opportunities for *win-wins* could help to facilitate shared use of freight right-of-way for long-term passenger rail initiatives.
- **Role of cities in decision-making process**—Stakeholders noted the importance of including cities in the decision-making process but also noted the challenge of balancing local politics in a multi-state context. If cities are involved appropriately early in the planning process, and their issues are addressed, then subsequent phases of project design and construction may proceed more successfully. Stakeholders agreed that implementing a vision will require local political support, but determining the appropriate timing and role is critical for ensuring that multi-state projects reflect a constructive and balanced level of local political concerns.
- **Overlap in responsibilities among different agencies**—Stakeholders noted that several agencies have overlapping responsibilities in the region, and that new entities are often created to respond to local needs rather than addressing the needs within existing frameworks. As a result, stakeholders noted that it can be difficult to determine which agencies to consult during visioning and project development and also noted the importance of creating multi-state frameworks that limit the potential for establishing entities with duplicative responsibilities.
- **Powers of stakeholders**—Stakeholders noted that identifying decision-makers and allocating authority among them in a multi-state context is a key challenge to multi-state coordination. Specific roles and responsibilities to be considered include adopting a vision for the plan, setting policy direction, engaging local levels of government, finding champions, and creating partnerships/coalitions for advancing projects. At a fundamental level, answering questions of “who to work with” and “who has authority” within the states often must be addressed before stakeholders can begin to consider “who is in charge” for a multi-state effort.

6.4 Alternative Governance Structures Considered

Stakeholders considered seven alternative governance models to address the needs for multi-state coordination. This section presents a brief description of each model and then notes potential roles for some of the models in multi-state HPR network and corridor governance in the Southwest.

6.4.1 Description of governance structures

The general types of governance models considered by the stakeholders are described below. Additional detail on each model, as well as the referenced example entities, is provided in Appendix I.

Lessons Learned from Other Regions:

The Northeast Corridor (NEC)

- *There is merit in establishing a working group to advance rail planning at a regional level. A working group developed the NEC Infrastructure Master Plan, which—for the first time—identified a comprehensive set of needs from all states and Amtrak in a single, unified plan for the corridor.*
- *There is a need for a more formal governance model—beyond a voluntary partnership/coalition—to address the most challenging multi-state issues, such as cost allocation. PRIIA created the NEC Infrastructure and Operations Advisory Commission and made it responsible for facilitating cooperation and planning amongst states as well as establishing a standardized cost allocation method for the corridor.*

The Midwest

- *Input from both elected officials and technical staff is needed to gain buy-in for a single vision of the network.*
- *Midwest stakeholders believe there is a need for a formal governance mechanism to ensure continuity and compliance with the single, unified vision of the network.*
- *With the lack of a formal governance mechanism in the Midwest, each state tends to focus on investments that primarily benefit the home state; corridors with benefits more broadly dispersed have been slower to develop.*

- **Single state agency contracting with and on behalf of other states**—This governance model features an existing or newly created state agency that addresses multi-state interests through agreements with the other state(s). Powers can vary depending on the type of entity established (i.e., authority, agency, corporation) and the degree to which other states can enter into contracts. Oversight generally includes multi-state participation, but ultimate accountability rests with the single state agency. Examples include MTA Metro-North Services in Connecticut and New Jersey Transit, the New Woodrow Wilson Bridge construction approach, and the Northern New England Passenger Rail Authority.
- **Voluntary coalition/partnership**—Under this model, stakeholders convene in a forum for a common interest on a voluntary basis. A voluntary coalition can be established without any formal agreement or mechanism, but in some instances may use a multi-state agreement. The voluntary coalition generally makes decisions based on consensus of member agency representatives with rotating leadership and generally does not possess legal powers. This entity can also work with or through a non-profit corporation that is often tax-exempt and eligible to receive government funds and private contributions. Examples include the Midwest High Speed Rail Steering Group, the NEC Master Plan Working Group, the I-95 Corridor Coalition, and the Coalition of Northeastern Governors (CONEG).
- **Special authority**—A special authority is an independent entity, often a distinct governmental body, that delivers a limited number of public services within defined boundaries and can exercise a broad range of typical governmental powers. Following limits set in state legislation or an interstate compact, some can also exercise specified fiscal powers, such as issuance of bonds, imposition of special taxes, levying benefit assessments, and charging service fees. Special authorities are often governed by a board of directors appointed by elected officials. Examples of special authorities include the Louisville and Southern Indiana Bridges Authority (and Bi-State Management Team), the Port Authority of New York and New Jersey, the Transbay Joint Powers Authority, and the California High-Speed Rail Authority.

- **For-profit corporation**—In this model, a privately held company develops infrastructure or operates services on a for-profit, limited liability basis. The corporation is formed and managed by for-profit investors and is generally only limited by contracts, laws, and regulations. The corporation may be a recipient of a franchise or concession from government to allow it to operate under certain constraints. This entity is generally governed through a board of directors that represents shareholders and is accountable for proper oversight and compliance with laws and regulations. Examples of for-profit corporations in transportation include London-Paris-Brussels High Speed Rail Network (Eurostar and Eurotunnel) and DesertXpress.
- **Federally chartered corporation**—A federally charted corporation is a corporation established by Congress to provide a public service. These entities are similar to for-profit corporations and their missions and constraints are specified in federal legislation. Federally chartered corporations are generally established with federal subsidies at the outset but are often intended to become financially self-sustaining over time. They are typically governed through a federally structured board of directors whose members are often appointed by the President. Oversight is provided by Congress with limited opportunity for state participation. Examples include the Tennessee Valley Authority, Amtrak, the U.S. Railway Association (1973-1982), and Conrail (1976-1987).
- **Federal-state commission**—A federal-state commission is a body of federal, state, and, sometimes, local leaders organized to address a critical need, which often includes the distribution of federal funds among multiple states or coordination of multi-state investments. They are generally authorized through federal legislation and can carry a broad range of governmental powers. The commission can often issue funds in the form of grants to participating states. The commission is the governing body, with members appointed by state governors and at least one member appointed by the President. Oversight is provided by Congress, and the entity is often structured with veto power for the federal member. Examples include the Appalachian Regional Commission and the Northeast Corridor Infrastructure Operations and Advisory Commission.
- **Federal government project office**—A federal government project office is created within an existing federal agency to carry out a specific purpose. Authorized through federal legislation, this entity generally has a limited range of powers related to the purpose the office was established to address and within the scope of the federal agency's powers. It can be governed by the federal agency in which the entity is housed; if the office is designed to support a federal/state/local partnership, decision-making might also include state and local stakeholders. Oversight is provided by Congress within the context of overall agency oversight. An example is the Chesapeake Bay Program Office within the Environmental Protection Agency.

6.4.2 Potential models for the Southwest

While some governance models are more appropriate than others for different purposes, stakeholders found that there could be a role in the Southwest for all of the governance models considered. Below are some of the reasons why the stakeholders thought different models might be a good choice for different circumstances. In addition to the options below, stakeholders also noted that hybrids might also be used for governance of network- and corridor-level efforts.

Voluntary coalition/partnership

A key advantage of this model, relative to the other governance structures considered, is that it is easy to create. It can be established without any formal agreement mechanism and thus more easily engages a broad range of stakeholders, including local entities that may not be represented in other decision-making bodies. The model might also serve as a stepping point for establishing a model with more formal powers. It is a structure that is relatively common in the Southwest and has demonstrated success as a cross-state model for transportation planning. A noteworthy example is the I-15 Mobility Alliance, a voluntary partnership led by the leadership of Arizona, California, Nevada, and Utah Departments of Transportation to provide direction for the I-15 Corridor System Master Plan and lead implementation of the corridor planning efforts.

Stakeholders determined that this highly flexible governance structure might be appropriate for addressing the needs for multi-state coordination identified during planning, as shown in Figure 49. It was deemed generally not the most appropriate governance model for subsequent phases of project development (design, construction, and operations) because its effectiveness is generally limited to planning and policy issues that can reach consensus. In addition, the absence of a formal agreement makes it difficult to ensure plans or policies are enacted, and it also has relatively limited leverage with state and federal decision-makers. Stakeholders noted that this model can be appropriate for network planning as well as corridor planning.

Special authority

One of the most attractive attributes of special authorities is that they can have a clearly defined purpose, designed to address a common interest among different stakeholders. Depending on what authorities are granted in their charter, they can also have decision-making authority, the ability to implement projects, and the responsibility for operating services. This model has been applied within single states in the Southwest, particularly in California with examples such as the Transbay Joint Powers Authority and the California High-Speed Rail Authority in California. No bi-state special authorities exist in the Southwest today for addressing transportation corridors, but the stakeholders identified special authorities as a governance model that may be needed and might be effective for advancing a multi-state corridor project through planning and the project development process.

Although they have some attractive elements, multi-state special authorities are challenging to establish; legislation in each state and an interstate compact would likely be needed. In addition, this model can be viewed as too autonomous with insufficient accountability to stakeholders. Stakeholders noted this model should be particularly applicable to network planning or planning and operating a multi-state corridor.

Federal-state commission

Due in part to the unique role of the federal government in the Southwest, stakeholders identified federal involvement as a desirable characteristic of governance models in the Southwest. A federal-state commission is one model that could facilitate this involvement, and it could be one of the more effective models for performing multi-state network planning. Other benefits of this model are that it might help the Southwest develop a stronger partnership with the federal government. Federal-state commissions can also be easier to establish than special authorities; while they still require federal legislation, they do not necessarily require the extra step of an interstate compact.

While this model has demonstrated success in other regions of the U.S., such as in Appalachia, there are no examples of federal-state commissions being used for similar purposes yet in the Southwest. While an attractive aspect of federal-state commissions is that they enhance the chances of receiving federal financial support for multi-state planning and coordination efforts, federal funding traditionally relies on the annual appropriations process and is therefore not guaranteed.

Federal government project office

Building on the desire for federal partnership, stakeholders also identified a federal project office as an attractive option for the Southwest. This model has direct access to the federal government and can be a strong candidate for attracting federal financial support. Relative to the Federal-State Commission, this model is potentially easier to establish, as it uses an existing overhead agency and established management processes; it does not require an interstate compact or creation of a new agency.

While there are no existing examples in the Southwest of federal project offices being used for a network development, federal project offices have been used in other regions for different yet similar purposes (e.g., the U.S. Environmental Protection Agency's Chesapeake Bay Program Office). In practice, this model has generally been limited to planning and knowledge-sharing functions, and the stakeholders identified these areas as the most likely application if a federal project office were implemented. There are less attractive aspects of this option, however, such as it could be challenging to implement if there is tension about the perception of expanding the federal government. Another drawback is potential for less state and local engagement than other models.

Federally chartered corporation

This model might be considered for a range of needs. Similar to the federal-state commission and the federal government project office, federally-chartered corporations can be a strong candidate for attracting federal funds because of the direct relationship with the federal government. The corporation can also undertake a broad range of functions across all phases of project development. There are currently no examples of a similar federally-chartered corporation operating exclusively in the Southwest, but Amtrak and the Tennessee Valley Authority are examples of this model.

Stakeholders determined that this model might be considered for addressing multi-state coordination needs in the design and operations phases of project development (as identified Figure 49). Similar to the federal government project office, a challenge to establishing a new corporation in the Southwest might be overcoming potential concerns about expanding the federal government and creating an entity that might be viewed as too autonomous (i.e., lacking sufficient accountability and responsiveness to state and local concerns).

For-profit corporation

Stakeholders identified a role for for-profit corporations in the design, construction, and operations of corridor projects. The use of corporations can provides financial incentives for cost effective investment decisions, as well as leverage of limited taxpayer dollars. DesertXpress Enterprises, LLC is an example of this model being applied in the Southwest for rail development.

A for-profit corporation was not recommended as model for leading multi-state network planning, as it is more appropriate to have public agencies promote public goals and lead planning if public funds will be used to support the implementation of corridors. Stakeholders also noted that it can be difficult for a for-profit corporation to foster a collective vision or overarching planning for a multi-state network.

6.5 Governance Findings and Recommendations

6.5.1 Governance findings

The SW Study developed eight key findings related to institutional and governance issues. Those findings are as follows:

- **Finding #1**—To achieve optimal outcomes, multi-state coordination and network planning is necessary during HPR network development. A common Southwest network vision and a unified strategic plan, built on coordination and planning for an integrated system, will lead to better network performance, a more efficient use of scarce financial resources, and improved outcomes for customers.
- **Finding #2**—During planning, multi-state coordination is needed on the following areas: corridor connectivity, multi-modal connections, capacity planning, grant applications, data used for project evaluation, operating standards, safety standards, regulatory/legal/statutory issues, and knowledge sharing. In the design and construction phases, coordination is also needed to address

interoperability, branding, procurement, and project delivery. When planning for operations occurs, coordination is needed to address service delivery, service standards, marketing and customer service, and cost and revenue sharing.

- **Finding #3**—The desirable characteristics of governance models include provisions for changing structures at different phases while maintaining continuity in the vision, roles for elected officials, a role for the federal government, potential for expanding beyond a focus on rail, and goodwill among participants.
- **Finding #4**—To facilitate network planning, multi-state coordination, and advancing a common vision, the Southwest needs a voluntary policy forum, a federal project office, a federal-state commission, a special authority (e.g., a regional rail development authority), or a hybrid of these.
- **Finding #5**—Federal leadership and partnership is helpful to assist with Southwest network planning. With limited resources and many demands, states are often pressured to focus on planning and developing corridors within their state boundaries. Federal technical assistance, such as performing multi-state network analysis and convening stakeholders, could help the Southwest identify key issues and advance a more coordinated network of corridors.
- **Finding #6**—Continued funding for passenger rail network planning and coordination is needed. Multi-state coordination and network planning is essential, yet it is challenging for states to fund planning activities for investments that might significantly benefit another state.
- **Finding #7**—Challenges and constraints to multi-state coordination include funding and cost sharing, out-of-state travel restrictions, different regulatory and legal requirements, different goals, overlapping responsibilities, the allocation of decision-making authority, the development of a common vision that lasts, and the appropriate role of cities, counties, and regional entities in the decision-making process.
- **Finding #8**—Numerous governance structures, including some already established in the Southwest, represent potential models for developing a multi-state corridor. During planning, these might include a voluntary partnership, a special authority, a federal-state commission, or hybrids of these. For-profit corporations or federally chartered corporations might also be needed during development and operations.

6.5.2 Governance recommendations

Two key governance recommendations emerged from the SW MSRP Study. These recommendations, which are focused on the relatively near term, are as follows:

Stakeholder Recommendation #1

Stakeholders proposed, for the most immediate future, convening a voluntary California-Arizona-Nevada Passenger Rail Policy and Planning Group. Initial membership of the Policy and Planning Group might include stakeholders who participated in the SW Study. The group would be responsible for:

- Implementing next steps emerging out of the SW Study
- Developing, and potentially implementing, a broader strategy to engage elected officials, the business community, and the public in refining the vision
- Coordinating among corridor planning efforts in the Southwest until a different governance model is needed

- Recommending a long-term governance model to facilitate Southwest network planning, multi-state coordination, and advancing the common vision
- Establishing a charter (focusing on mission, roles, authorities, and membership) and identifying a reliable funding source for network planning and coordination

Stakeholder Recommendation #2

Stakeholders also supported formation of a Blue Ribbon Commission to guide a Phoenix–Southern California Corridor study over an 18-month schedule. The Blue Ribbon Commission might include leaders such as local elected officials and gubernatorial appointees and be supported by a planning/technical committee including MPO and state department of transportation (DOT) staff for evaluation and analysis. The Blue Ribbon Commission should seek input from railroads, the California High-Speed Rail Authority, FRA, transportation agencies, local jurisdictions, business groups, and the general public as an integrated element of its work plan. The Blue Ribbon Commission would be responsible for the following actions:

- Reviewing the SW Study findings that pertain to the Phoenix–Southern California corridor
- Developing a scope of work and budget needed to analyze multi-modal alternatives and produce a service development plan.
- Identifying and securing funding for the study
- Facilitating participation and input from stakeholders in the corridor
- Identifying what governance may be needed to develop the corridor successfully

Chapter 7. Next Steps

The SW Study identified the importance of conducting long-range planning for high performance passenger rail corridors within the context of an integrated multi-state network. Strong growth in population, travel demand, and economic activity through 2050 will place additional pressure on an increasingly congested transportation network, and conceptual planning analysis performed in this study indicates there are several multi-state corridors in the Southwest that warrant further study in advance of possible new rail investments.

Chapters 5 and 6 of this report presented long-term recommendations for coordinating transportation issues across state lines. Following are possible strategies sustaining momentum in Southwest regional rail planning.

Recommendation #1

Integrate the Southwest Multi-State Rail Planning Study into Existing and Ongoing Transportation Planning Efforts. In the near term, findings and recommendations from this study could be considered in individual State Rail Plans as well as other ongoing state and regional planning efforts. In addition, while this study performed an initial assessment of rail corridor potential against a set of performance metrics, further study is needed to analyze whether other modes could present more cost-effective investment solutions, as well as the implications of not making new infrastructure investments. While this is a recommendation for subsequent phases of planning, it may also be incorporated into ongoing corridor planning studies.

Recommendation #2

Establish A Southwest Rail Working Group to Initiate Implementation of the Study's Governance Recommendations. This working group's charge might include:

- Developing a strategic implementation plan for advancing the study recommendations. This would include laying the groundwork for the California-Arizona-Nevada Passenger Rail Policy & Planning Group, identifying participants, determining the need for a formal agreement mechanism (e.g., MOU), and refining roles and responsibilities;
- Crafting a mission statement and distinct goals & objectives for the Southwest rail network;
- Initiating development of a compelling business case for the Southwest rail network. This should include near-term "wins" that demonstrate the benefits of multi-state coordination;
- Exploring potential state and local funding sources to fund future multi-state planning efforts; and
- Initiating a broad-based outreach program that engages stakeholders such as elected officials, the private sector, and the public in future rail network development efforts. Aspects of the stakeholder engagement program could be reserved for the California-Arizona-Nevada Passenger Rail Policy & Planning Group.
- Championing the creation of the Blue Ribbon Commission for the Phoenix-Southern California corridor study.

Appendix A. List of MSAs in the Extended SW Study Area

MSA Full Name[1]	SW Study Shorthand Name
Arizona	
Flagstaff	Flagstaff
Lake Havasu City–Kingman	Kingman
Nogales	Nogales
Payson	Payson
Phoenix–Mesa–Glendale	Phoenix
Prescott	Prescott
Safford	Safford
Show Low	Show Low
Sierra Vista–Douglas	Sierra Vista
Tucson	Tucson
Yuma	Yuma
California	
Bakersfield–Delano	Bakersfield
Bishop	Bishop
Chico	Chico
Clearlake	Clearlake
Crescent City	Crescent City
El Centro	El Centro
Eureka–Arcata–Fortuna	Eureka
Fresno	Fresno
Hanford–Corcoran	Hanford
Los Angeles–Long Beach–Santa Ana	Greater Los Angeles
Madera–Chowchilla	Madera
Merced	Merced
Modesto	Modesto
Napa	Napa
Oxnard–Thousand Oaks–Ventura	Oxnard
Phoenix Lake–Cedar Ridge	Phoenix Lake
Red Bluff	Red Bluff
Redding	Redding
Riverside–San Bernardino–Ontario	Inland Empire
Sacramento–Arden–Arcade–Roseville	Sacramento
Salinas	Salinas
San Diego–Carlsbad–San Marcos	San Diego
San Francisco–Oakland–Fremont	S.F./Oakland
San Jose–Sunnyvale–Santa Clara	San Jose
San Luis Obispo–Paso Robles	San Luis Obispo
Santa Barbara–Santa Maria–Goleta	Santa Barbara
Santa Cruz–Watsonville	Santa Cruz

MSA Full Name[1]	SW Study Shorthand Name
Santa Rosa–Petaluma	Santa Rosa
Stockton	Stockton
Susanville	Susanville
Truckee–Grass Valley	Truckee
Ukiah	Ukiah
Vallejo–Fairfield	Vallejo
Visalia–Porterville	Visalia
Yuba City	Yuba City
Colorado	
Boulder	Boulder
Cañon City	Cañon City
Colorado Springs	Colorado Springs
Denver–Aurora–Broomfield	Denver
Durango	Durango
Edwards	Edwards
Fort Collins–Loveland	Fort Collins
Fort Morgan	Fort Morgan
Grand Junction	Grand Junction
Greeley	Greeley
Montrose	Montrose
Pueblo	Pueblo
Silverthorne	Silverthorne
Sterling	Sterling
Nevada	
Carson City	Carson City
Elko	Elko
Fallon	Fallon
Fernley	Fernley
Gardnerville Ranchos	Gardnerville Ranchos
Las Vegas–Paradise	Las Vegas
Pahrump	Pahrump
Reno–Sparks	Reno
New Mexico	
Alamogordo	Alamogordo
Albuquerque	Albuquerque
Carlsbad–Artesia	Carlsbad
Clovis	Clovis
Deming	Deming
Espanola	Espanola
Farmington	Farmington
Gallup	Gallup
Grants	Grants

	MSA Full Name[1]	SW Study Shorthand Name
	Hobbs	Hobbs
	Las Cruces	Las Cruces
	Las Vegas	Las Vegas, NM
	Los Alamos	Los Alamos
	Portales	Portales
	Roswell	Roswell
	Ruidoso	Ruidoso
	Santa Fe	Santa Fe
	Silver City	Silver City
	Taos	Taos
Utah		
	Brigham City	Brigham City
	Cedar City	Cedar City
	Heber	Heber
	Logan	Logan
	Ogden–Clearfield	Ogden
	Price	Price
	Provo–Orem	Provo
	Salt Lake City	Salt Lake City
	St. George	St. George
	Vernal	Vernal

[1] *Includes Metropolitan Statistical Areas and Micropolitan Statistical Areas as defined by the Office of Management and Budget, December 2009*

Appendix B. SW Study Area Population

	2010 (thousands)	2050 (thousands)	% Change 2010–2050
State of Arizona	6,392	11,815	76.0%
State of California	37,254	54,143	45.0%
State of Nevada	2,701	4,755	76.7%
SW MSRP Primary Study Area (AZ, CA, NV)	46,347	70,713	52.6%
United States	308,746	442,214	42.7%
Arizona Sun Corridor Megaregion	5,654	10,437	84.6%
Northern California Megaregion	14,038	20,135	43.4%
Southern California Megaregion	24,362	36,212	48.6%
Three Megaregions	44,054	66,784	51.6%

Source: 2010 Census, U.S. Census Bureau; 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010

Appendix C. Rail and Highway Projects List

Table C-1 Planned rail improvement projects

	Project Name	Project Sponsor	Location(s)	Project Description
1	Amtrak Coast Daylight (Extension) Project	Amtrak, California DOT	Between San Luis Obispo, San Jose, and San Francisco	Extension of Amtrak's Pacific Surfliner Line to northern California from San Luis Obispo
2	Anaheim Regional Transportation Intermodal Center (ARTIC) Project	Southern California Association of Governments	Anaheim	New multi-modal station for Anaheim and Orange County to include services provided by new CHSR, Amtrak, and Metrolink. Would assume service from current Amtrak/Anaheim station
3	Arizona Spine Corridor (New Rail Service Study) Project	Arizona DOT	Grand Canyon (north) to Nogales (south) using branches of BNSF Phoenix Subdivision, UP Phoenix Subdivision, UP Nogales Subdivision, Arizona Central Railroad, Grand Canyon Railway, Verde Canyon Railway, and Copper Basin Railway	Include a north-south spine of intercity rail serving the emerging Sun Corridor megaregion, coupled with a regional HPR network Plan for an efficient rail connection between Northern Arizona, the Sun Corridor, and Mexico while supporting commuter rail within the urban cores of Phoenix and Tucson
4	California High Speed Rail Corridor Projects	CHSRA	Phase 1: Between Anaheim, Los Angeles, and Merced/San Francisco following San Joaquin Amtrak line in the Central Valley; Phase 2:Between Irvine and Anaheim, Los Angeles, San Diego via San Bernardino following portions of Sunset Limited Line; Phase 3: Between Stockton and San Jose	First phase of CHSR with connections to Metrolink and Amtrak services Second phase of CHSR with connections to Metrolink and Amtrak services Third phase of CHSR with connections to Amtrak services
5	California-Nevada Super Speed Train (New Service Project)	California-Nevada Super Speed Train Commission	Between Las Vegas and Anaheim following I-15 Corridor	Concept to connect Las Vegas with Anaheim through the following cities: Primm, Barstow, Victorville, and Ontario

	Project Name	Project Sponsor	Location(s)	Project Description
6	CANAMEX Corridor (New Service Study) Project	Arizona DOT	State Portion: Las Vegas (north) to Nogales (south) using branches of BNSF Phoenix Subdivision, UP Phoenix Subdivision, UP Nogales Subdivision, and Arizona and California Railroad	Include a north-south spine of intercity rail serving the emerging Sun Corridor megaregion, coupled with a regional HPR network Plan for an efficient rail connection between Arizona and Las Vegas while supporting implementation of intercity and commuter rail within the Sun Corridor Includes plan for intercity rail connecting Phoenix and Tucson Part of larger plan to connect Mexico and Canada via the western U.S. by rail
7	Del Mar Tunnel	San Diego Association of Governments	LOSSAN Rail Corridor, Del Mar, San Diego County	Construction of tunnel along LOSSAN corridor running through Del Mar to improve capacity
8	XpressWest(a.k.a. DesertXpress) Project	DesertXpress Enterprises, LLC.	Between Victorville and Las Vegas following I-15 corridor	Final Environmental Impact Statement completed March 2011 Records of Decision issued by the lead and cooperating federal agencies in 2011. Certificate of Public Convenience and Necessity issued by the Surface Transportation Board in October, 2011. 200-mile corridor to connect Las Vegas and Victorville.
9	Los Angeles/Las Vegas (New Service) Rail Study	Regional Transportation Commission of Southern Nevada	Between Los Angeles and Las Vegas using one of a number of existing rail alternatives including Metrolink Subdivisions, UP Subdivisions, and BNSF Subdivisions	Study to determine feasibility of rail link between Southern California and Las Vegas using existing rail lines Provides a number of alternative alignments along with infrastructure improvements, costs, and ridership figures
10	Los Angeles Port to Colton to Cajon Pass Rail Expansion Project	Southern California Association of Governments	Los Angeles County	Construction of additional rail track to increase capacity along this corridor
11	Los Angeles Union Station Rail Improvements	Southern California Association of Governments	Los Angeles	Construction of through tracks for trains scheduled to bypass Union Station
12	LOSSAN Rail Corridor Rail Improvement Package	LOSSAN Joint Powers Authority	Los Angeles County	Multiple projects including technology improvements, additional trackage, station improvements, and grade separations

	Project Name	Project Sponsor	Location(s)	Project Description
13	Phoenix–Tucson Intercity Rail (New Service Project)	Federal Rail Administration, Federal Transit Administration, Arizona Department of Transportation	Phoenix to Tucson Rail Corridor	Construction of intercity passenger rail between metropolitan areas of Phoenix and Tucson
14	Route 66 Corridor (Passenger Rail Service Improvement Study) Project	Arizona DOT	East-west corridor between Lupton/New Mexico border (east) and Bullhead City/Lake Havasu City/California border (west) using branches of BNSF Transcon, Apache Railway, Grand Canyon Railway, and Black Mesa and Lake Powell Railroad	Enhance intercity passenger service which supports tourism industry and plan for seamless connection to future intercity service that would serve the emerging Sun Corridor and improved connections with Amtrak service Planning for this corridor should be coordinated with planning of ICR within Sun Corridor
15	Sunset Route Corridor (Passenger Rail Service Improvement Study) Project	Arizona DOT	East-west corridor between Willcox/New Mexico border (east) and Yuma/California border (west) using Union Pacific Railroad	Enhance intercity passenger service which can be incremental step to intercity service that would serve the emerging Sun Corridor and a southwestern HPR network Passenger service within this corridor should be coordinated with ICR service within the Sun Corridor
16	The X Train Project	Las Vegas Railway Express, Inc.	Between Los Angeles Union Station and Las Vegas utilizing existing BNSF/UP rail corridor	High-speed rail scheduled to run between Los Angeles and Las Vegas four days a week Still in planning stages
17	UP Sunset Route Double Track (Rail Expansion) Project	Union Pacific Railroad	Southern Arizona	Double-tracking of Sunset Route along entire length of route in Arizona
18	Peninsula Corridor Electrification Project	Caltrain	San Francisco to San Jose	Electrify the Caltrain Corridor from San Francisco’s 4th and King Caltrain Station to approximately the Tamien Caltrain Station, convert diesel-hauled to Electric Multiple Unit (EMU) trains

Table C-2 Planned highway capacity projects

	Project Name	Project Sponsor	Location(s)	Project Description
1	High Desert Corridor Project	High Desert Corridor Joint Powers Authority	Los Angeles and San Bernardino Counties	Construction of new state highway to provide additional access and capacity to I-15 from Los Angeles County. EIS alternatives include high speed rail connectivity Victorville and Palmdale.
2	I-10 Phoenix/ Tucson Bypass West Segment (New Highway Project)	Arizona DOT	Numerous corridors using bisecting highways away and towards I-10 to avoid metro-politan areas of Phoenix and Tucson	Bypasses studied in order to improve congestion on I-10 in and around metro areas of Phoenix and Tucson Additional corridors in addition to I-10 due to large increase in population along emerging Sun Corridor
3	I-15 /French Valley Parkway Interchange	City of Temecula, California Transportation Commission	I-15/French Valley Parkway Interchange, Temecula	Provide new interchange between I-15 and French Valley Parkway and I-15 and Winchester Road in Temecula
4	I-15 from Speedway Boulevard to US 93 Widening and Interchange NEPA	Nevada DOT	I-15 between Speedway Boulevard and US 93, Las Vegas	Proposed widening of I-15 to six lanes and reconstruction of I-15/US 94 interchange Relieve significant congestion impacting the movement of goods through southern Nevada
5	I-15 HOV/HOT Lanes I-215 to Riverdale Phase 1	Utah DOT	I-15 to I-215 Interchange to Riverdale, Salt Lake County	Construction of HOV/HOT lanes would alleviate congestion and better serve existing and future travel demand along this section of I-15
6	I-15 HOV/HOT Lanes San Bernardino/ Riverside County	California Transportation Commission	I-15 San Bernardino/Riverside County Line South to I-15/I-215 Interchange, Riverside County	Construction of HOV/HOT lanes to add additional capacity to efficiently move goods and people Construction of two HOT lanes from San Bernardino County line to Hidden Valley Parkway and from Cajalco Road to SR74; construction of one multifunction lane between San Bernardino County line to SR74; construction of one HOT lane between Hidden Valley Parkway to Cajalco Road; construction of one HOV lane between SR74 and I-15/I-215 Junction

	Project Name	Project Sponsor	Location(s)	Project Description
7	I-15 Managed Lanes: I-8 to SR 163	Caltrans	I-15 between I-8 to SR 163, San Diego	Project would add four managed lanes along I-15, improving freeway capacity for HOV and transit in peak direction Result in improved utilization of roadway and reduced congestion and travel delays, and improved travel time reliability
8	I-15 Virgin River Gorge Bridges (Rehabilitation Project)	Arizona DOT	Virgin River Gorge area bridges	Rehabilitate or replace the decks of seven bridges to prevent interruption to the movement of people and goods Highest maintenance priority for ADOT
9	I-15/I-215 (Devore) Interchange Reconstruction	San Bernardino Associated Governments, Caltrans, Southern California Association of Governments	Devore Interchange, San Bernardino County	Reconstruct interchange to allow I-15 to be the main movement for vehicles between Las Vegas, Laughlin and Southern California Truck bypass lanes being considered to improve traffic flow
10	I-15/SR76 East (Interchange Improvement Project)	Caltrans	I-15/SR 76 Interchange, San Diego	Bring SR 76 to minimum design standards of 2006 Highway Design Manual Capacity improvements on interchange to accommodate increased traffic demand and alleviate congestion
11	I-15/SR 78 HOV/HOT Connectors	Caltrans	I-15/SR 78 Interchange, San Diego	Project to connect existing/ future HOV/HOT lanes on mainline roadways and interchange Project will reduce congestion and travel time and improve safety and operations by reducing weaving movements
12	I-15: Lehi Main Street to 12300 South, Salt Lake County, UT Phase 1	Utah DOT	SR 92 to 12300 South, Salt Lake County	Add two travel lanes to I-15 in each direction and reconstruct three interchanges to meet existing and projected 2030 travel demand Project would improve traffic operation, alleviate congestion, and improve safety
13	Port of San Diego Freeway Access Improvements—I	Port of San Diego	Civic Center Drive and I-5, 10th Avenue at Harbor Drive, San Diego, CA	Project would separate Port truck traffic from local communities, improving goods movement and local traffic circulation and reducing travel time for freight accessing I-15

	Project Name	Project Sponsor	Location(s)	Project Description
14	Port of San Diego Freeway Access Improvements—II	Port of San Diego	Bay Marina Drive at I-15, 32nd Street at Harbor Drive, San Diego	Project would separate port truck traffic from local communities, improving goods movement and local traffic circulation and reducing travel time for freight accessing I-15
15	Project NEON, Phase 1	Nevada DOT	I-15, from Sahara Avenue to I-515/US 95 Interchange (Spaghetti Bowl), Las Vegas	Improve traffic operations, improve safety by addressing congestion-related incidents, provide better access to area neighborhoods and businesses, and provide connection between proposed HOV lanes on I-15 and HOV lanes on US 95 Phase 1 would widen I-15 to ten lanes and include HOV lanes
16	SR 11/Otay Mesa East Port of Entry Project	San Diego Association of Governments, California DOT	SR 905 south to Otay Mesa East Port, San Diego	Construction of new SR 11 (four lane freeway) and new US CBP Port of Entry in East Otay Mesa SR 11 will extend 2 miles south of SR 905 to Otay Mesa East Port and improve traffic congestion and border wait times for commercial vehicles
17	US 93 (Future I-11) Improvements	Arizona DOT	Wickenburg, Arizona to the Nevada State Line	Designation of I-11 Corridor in the US 93 alignment from Las Vegas to metropolitan Phoenix.

Appendix D. Economic Characteristics of Major MSAs in the Study Region

Table D-1 Major economic cluster concentrations—five major SW MSAs (2010)

	Greater Los Angeles		S.F./Oakland		San Diego		Phoenix		Las Vegas	
	Emp. (000s) (% of MSA)	Location Quotient	Emp. (000s) (% of MSA)	Location Quotient	Emp. (000s) (% of MSA)	Location Quotient	Emp. (000s) (% of MSA)	Location Quotient	Emp. (000s) (% of MSA)	Location Quotient
Investment Banking	4.2 (0.1%)	0.65	4.1 (0.3%)	**1.76**	1.1 (0.1%)	0.76	ND	ND	0.1 (0%)	0.1
Computer and Electronics Manufacturing	82.7 (1.8%)	**1.78**	24.9 (1.5%)	**1.49**	26.2 (2.6%)	**2.51**	ND	**4.31**	0.5 (0.1%)	0.07
Telecommunications	36.3 (0.8%)	0.95	15.8 (1.0%)	1.14	8.3 (0.8%)	0.96	11.7 (0.8%)	0.97	3.3 (0.5%)	0.55
Scientific Research	23.6 (0.5%)	0.90	30.6 (1.9%)	**3.23**	30.6 (3.0%)	**5.18**	1.7 (0.1%)	0.21	1.6 (0.2%)	0.39
Hospitals	133.5(3.0 %)	0.73	ND	ND	20.9 (2.1%)	0.51	ND	ND	13.6 (1.9%)	0.47
Colleges and Universities	49.6 (1.1%)	1.04	ND	ND	11.2 (1.1%)	1.04	17.4 (1.2%)	1.14	1.0 (0.1%)	0.13
Amusement and Recreation	66.0 (1.5%)	**1.13**	20.7 (1.3%)	0.98	16.2 (1.6%)	**1.23**	16.6 (1.2%)	0.89	11.4 (1.6%)	**1.25**
Motion Picture, Recording, and Broadcasting	141.7 (3.1%)	**7.60**	14.5 (0.9%)	**1.45**	6.4 (0.6%)	1.05	ND	ND	3.2 (0.9%)	0.75
Retailing	527.4 (11.7%)	0.86	186.6 (11.5%)	0.84	130.6 (12.9%)	0.95	205.7 (14.4%)	1.06	92.4 (13.1%)	0.96

1. *Numbers in parenthesis are percentages of MSA employment for that sector.*
2. *Numbers in **blue** indicate that the industry is highly concentrated in the MSA.*
3. *The U.S. Bureau of Economic Analysis does not report total employment in the Phoenix MSA for Computer and Electronic Manufacturing (NAICS 334) but does report 21,400 employees in semiconductor and electronic component manufacturing (NAICS 3344). The location quotient reported for Phoenix is NAICS 3344.*
4. *Amusement and Recreation (NAICS 713) includes gambling/gaming. Las Vegas's location quotient just for gambling/gaming (NAICS was 5.86 in 2010; this is down from 7.41 in 2001). Gaming employment in Las Vegas has been relatively constant, but other amusement and recreation activity employment has declined.*

5. Retailing included, as a control, to indicate range of location quotients about 1.0, for a primarily non-basic sector.

Table D-2 Cluster interdependencies

	Investment Banking	Computer and Electronics Manufacturing	Telecom-munications	Scientific Research	Hospitals	Colleges and Universities	Amusement and Recreation	Motion Picture, Recording, and Broadcasting
Investment Banking	Moderate	Strong	Moderate	Weak	Weak	Weak	Moderate	Strong
Computer and Electronics Manufacturing		Moderate	Strong	Strong	Weak	Strong	Weak	Moderate
Telecommunications			Weak	Strong	Weak	Moderate	Weak	Strong
Scientific Research				Strong	Strong	Strong	Weak	Weak
Hospitals					Strong	Strong	Weak	Weak
Colleges and Universities						Strong	Weak	Weak
Amusement and Recreation							Moderate	Moderate
Motion Picture, Recording, and Broadcasting								Strong

Table D-3 Frequency of potential spatial interdependencies—within sector network effects

	Greater Los Angeles	S.F./ Oakland	San Diego	Phoenix	Las Vegas	Total
Greater Los Angeles		2	3	1	1	7
San Francisco/Oakland			3	1	0	6
San Diego				1	1	8
Phoenix					0	3
Las Vegas						*2*

The column "Total" equals the total number of interdependencies for the row MSA.

Table D-4 Frequency of potential spatial interdependencies—between sector network effects

	Greater Los Angeles	S.F./ Oakland	San Diego	Phoenix	Las Vegas	Total
Greater Los Angeles		9	2	0	0	11
San Francisco/Oakland			8	5	1	23
San Diego				0	0	10
Phoenix					0	5
Las Vegas						1

The column "Total" equals the total number of interdependencies for the row MSA.

Appendix E. Summary of Transit Services in Selected MSAs

	Mode*	Agency	2011 Ridership (thousands)
Albuquerque	CRT	Rio Metro Regional Transit District	1,242
	Bus	City of Albuquerque Transit Department, Rio Metro Regional Transit District	12,375
Denver	LRT	Denver Regional Transportation District	20,694
	Bus	Denver Regional Transportation District	76,129
Las Vegas	Bus	Regional Transportation Commission of Southern Nevada	57,777
Los Angeles	CRT	Southern California Regional Rail Authority (Metrolink)	11,745
	HRT	Los Angeles County Metropolitan Transportation Authority	46,964
	LRT	Los Angeles County Metropolitan Transportation Authority	50,798
	Bus	15+ operators	543,800
Phoenix	LRT	Valley Metro Rail, Inc.	13,162
	Bus	5 operators	56,654
Reno	Bus	Regional Transportation Commission of Washoe County	7,876
Sacramento	LRT	Sacramento Regional Transit District	12,816
	Bus	5 operators	17,913
Salt Lake City	CRT	Utah Transit Authority	1,641
	LRT	Utah Transit Authority	15,298
	Bus	Utah Transit Authority	22,611
San Diego	CRT	North County Transit District	1,547
	LRT	North County Transit District, San Diego Metropolitan Transit System	35,147
	Bus	3 operators	62,056
San Francisco	Cable Car	San Francisco Municipal Railway	7,684.40
	CRT	Peninsula Corridor Joint Powers Board (Caltrain)	12,324
	Ferryboat	City of Alameda Ferry Services, Golden Gate Bridge, Highway and Transportation District	2,554
	HRT	San Francisco Bay Area Rapid Transit District	114,325
	LRT	San Francisco Municipal Railway	50,794
	Bus	8 operators	170,212
	Trolleybus	San Francisco Municipal Railway	67,153
Tucson	Bus	City of Tucson	20,036
	Streetcar	City of Tucson	Opening Summer of 2014

Source: Public Transportation Ridership Report, Fourth Quarter 2011, American Public Transportation Association, February 2012

**CRT = Commuter Rail Transit; LRT = Light Rail Transit; HRT = Heavy Rail Transit*

Appendix F. Corridor Projected Growth Trends and Network Analysis Assumptions

Table F-1 San Diego–S.F./Oakland corridor: MSA projected growth trends

	Population		
	2010	2050	Percent Change (2010 to 2050)
San Diego	3,095,000	4,923,000	59%
Inland Empire	4,225,000	8,495,000	101%
Greater Los Angeles	12,829,000	16,011,000	25%
Bakersfield	840,000	1,306,000	55%
Visalia	442,000	620,000	40%
Fresno	930,000	1,312,000	41%
Madera-Chowchilla	150,865	295,064	96%
Merced	256,000	389,000	52%
San Jose	1,837,000	2,526,000	38%
S.F./Oakland	4,335,000	5,643,000	30%
Total	*28,789,000*	*41,225,000*	*43%*

Source: 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.

Table F-2 San Diego–S.F./Oakland corridor: network analysis assumptions

		Alignment Type		Right of Way Availability for New Alignment			Development Type by Investment Level for New Alignment						Freight Density for Existing Alignment			Existing Track Quality		
	Number of Stations	New	Existing	Public ROW	New Acquisition—Urban	New Acquisition—Rural	Rural—Low	Rural—Medium	Rural—high	Urban—Low	Urban—Medium	Urban—High	High	Medium	Low	Class 0-2[1]	Class 3[2]	Class 4[3]
Core Express Service																		
San Diego–Inland Empire	5	100%	0%	0%	78%	22%	0%	10%	30%	25%	20%	15%	—	—	—	—	—	—
Inland Empire–Greater Los Angeles	5	100%	0%	0%	100%	0%	0%	5%	0%	0%	80%	15%	—	—	—	—	—	—
Greater Los Angeles–Bakersfield	4	100%	0%	0%	30%	70%	15%	30%	20%	10%	15%	10%	—	—	—	—	—	—
Bakersfield–Visalia	2	100%	0%	0%	12%	88%	40%	35%	0%	15%	10%	0%	—	—	—	—	—	—
Visalia–Fresno	2	100%	0%	0%	21%	79%	30%	45%	0%	10%	15%	0%	—	—	—	—	—	—
Fresno–Merced	2	100%	0%	0%	30%	70%	65%	5%	15%	0%	15%	0%	—	—	—	—	—	—
Merced–San Jose	3	100%	0%	0%	17%	83%	45%	0%	20%	10%	20%	5%	—	—	—	—	—	—
San Jose–S.F./Oakland	4	100%	0%	100%	0%	0%	0%	0%	0%	90%	5%	5%	—	—	—	—	—	—

[1] Maximum passenger operating speed of 0-30 mph
[2] Maximum passenger operating speed of 30-60 mph
[3] Maximum passenger operating speed of 60-80 mph

Table F-3 Greater Los Angeles–Las Vegas Corridor: MSA projected growth trends

	Population		
	2010	2050	Percent Change (2010 to 2050)
Greater Los Angeles	12,829,000	16,011,000	25%
Inland Empire	4,225,000	8,495,000	101%
Las Vegas	1,951,000	3,525,000	81%
Total	*19,005,000*	*28,031,000*	*47%*

Source: 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.

Table F-4 Greater Los Angeles–Las Vegas Corridor: network analysis assumptions

	Number of Stations	Alignment Type		Right of Way Availability for New Alignment			Development Type by Investment Level for New Alignment						Freight Density for Existing Alignment			Existing Track Quality		
		New	Existing	Public ROW	New Acquisition—Urban	New Acquisition—Rural	Rural—Low	Rural—Medium	Rural—high	Urban—Low	Urban—Medium	Urban—High	High	Medium	Low	Class 0-2[1]	Class 3[2]	Class 4[3]
Core Express Service																		
Greater Los Angeles–Inland Empire	5	100%	0%	0%	100%	0%	0%	5%	0%	0%	80%	15%	—	—	—	—	—	—
Inland Empire–Las Vegas	2	100%	0%	80%	15%	5%	60%	30%	0%	0%	5%	5%	—	—	—	—	—	—

[1] Maximum passenger operating speed of 0-30 mph
[2]Maximum passenger operating speed of 30-60 mph
[3]Maximum passenger operating speed of 60-80 mph

Table F-5 Greater Los Angeles–Phoenix Corridor: MSA projected growth trends

	Population		
	2010	2050	Percent Change (2010 to 2050)
Greater Los Angeles	12,829,000	16,011,000	25%
Inland Empire	4,225,000	8,495,000	101%
Phoenix	4,193,000	7,786,000	86%
Total	*21,247,000*	*32,292,000*	*52%*

Source: 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.

Table F-6 Greater Los Angeles–Phoenix Corridor: network analysis assumptions

	Number of Stations	Alignment Type		Right of Way Availability for New Alignment			Development Type by Investment Level for New Alignment						Freight Density for Existing Alignment			Existing Track Quality		
		New	Existing	Public ROW	New Acquisition—Urban	New Acquisition—Rural	Rural—Low	Rural—Medium	Rural—high	Urban—Low	Urban—Medium	Urban—High	High	Medium	Low	Class 0-2[1]	Class 3[2]	Class 4[3]
Core Express Service																		
Greater Los Angeles–Inland Empire	5	100%	0%	0%	100%	0%	0%	5%	0%	0%	80%	15%	—	—	—	—	—	—
Inland Empire–Phoenix	4	100%	0%	0%	15%	85%	35%	30%	20%	10%	5%	0%	0%	0%	100%	—	—	—

[1] Maximum passenger operating speed of 0-30 mph
[2] Maximum passenger operating speed of 30-60 mph
[3] Maximum passenger operating speed of 60-80 mph

Table F-7 San Diego–Phoenix Corridor: MSA projected growth trends

	Population		
	2010	2050	Percent Change (2010 to 2050)
San Diego	3,095,000	4,923,000	59%
Inland Empire	4,225,000	8,495,000	101%
Phoenix	4,193,000	7,786,000	86%
Total	*11,513,000*	*21,204,000*	*84%*

Source: 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.

Table F-8 San Diego–Phoenix Corridor: network analysis assumptions

	Number of Stations	Alignment Type		Right of Way Availability for New Alignment			Development Type by Investment Level for New Alignment						Freight Density for Existing Alignment			Existing Track Quality		
		New	Existing	Public ROW	New Acquisition—Urban	New Acquisition—Rural	Rural—Low	Rural—Medium	Rural—high	Urban—Low	Urban—Medium	Urban—High	High	Medium	Low	Class 0-2[1]	Class 3[2]	Class 4[3]
Core Express Service																		
San Diego–Inland Empire	5	100%	0%	0%	78%	22%	0%	10%	30%	25%	20%	15%	—	—	—	—	—	—
Inland Empire–Phoenix	4	100%	0%	0%	15%	85%	35%	30%	20%	10%	5%	0%	0%	0%	100%	—	—	—
Regional Service																		
Inland Empire–Phoenix	4	90%	10%	0%	15%	85%	35%	30%	20%	10%	5%	0%	0%	0%	100%	0%	100%	0%

[1] Maximum passenger operating speed of 0-30 mph
[2] Maximum passenger operating speed of 30-60 mph
[3] Maximum passenger operating speed of 60-80 mph

Table F-9 Las Vegas–Tucson Corridor: MSA projected growth trends

	Population		
	2010	2050	Percent Change (2010 to 2050)
Las Vegas	1,951,000	3,525,000	81%
Kingman	200,000	405,000	103%
Phoenix	4,193,000	7,786,000	86%
Tucson	980,000	1,821,000	86%
Total	*7,324,000*	*13,537,000*	*85%*

Source: 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.

Table F-10 Las Vegas–Tucson Corridor: network analysis assumptions

	Number of Stations	Alignment Type		Right of Way Availability for New Alignment			Development Type by Investment Level for New Alignment						Freight Density for Existing Alignment			Existing Track Quality		
		New	Existing	Public ROW	New Acquisition—Urban	New Acquisition—Rural	Rural—Low	Rural—Medium	Rural—high	Urban—Low	Urban—Medium	Urban—High	High	Medium	Low	Class 0-2[1]	Class 3[2]	Class 4[3]
Regional Service																		
Las Vegas–Kingman	2	85%	15%	0%	10%	90%	0%	20%	70%	10%	0%	0%	15%	0%	85%	0%	100%	0%
Kingman–Phoenix	3	67%	33%	0%	5%	95%	25%	10%	60%	0%	5%	0%	0%	0%	100%	0%	0%	100%
Phoenix–Tucson	6	40%	60%	0%	35%	65%	50%	15%	0%	20%	10%	5%	80%	20%	0%	80%	20%	0%

[1] Maximum passenger operating speed of 0-30 mph
[2] Maximum passenger operating speed of 30-60 mph
[3] Maximum passenger operating speed of 60-80 mph

Table F-11 S.F./Oakland–Reno Corridor: MSA projected growth trends

	Population		
	2010	2050	Percent Change (2010 to 2050)
S.F./Oakland	4,335,000	5,643,000	30%
Vallejo	413,000	621,000	50%
Sacramento	2,149,000	3,656,000	70%
Truckee	99,000	171,000	73%
Reno	425,000	749,000	76%
Total	*7,421,000*	*10,840,000*	*46%*

Source: 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.

Table F-12 S.F./Oakland–Reno Corridor: network analysis assumptions

	Number of Stations	Alignment Type		Right of Way Availability for New Alignment			Development Type by Investment Level for New Alignment						Freight Density for Existing Alignment			Existing Track Quality		
		New	Existing	Public ROW	New Acquisition—Urban	New Acquisition—Rural	Rural—Low	Rural—Medium	Rural—high	Urban—Low	Urban—Medium	Urban—High	High	Medium	Low	Class 0-2[1]	Class 3[2]	Class 4[3]
Core Express Service																		
S.F./Oakland–Vallejo	3	100%	0%	0%	100%	0%	0%	0%	0%	10%	50%	40%	0%	50%	50%	100%	0%	0%
Vallejo–Sacramento	2	100%	0%	0%	75%	25%	10%	15%	0%	40%	25%	10%	0%	50%	50%	100%	0%	0%
Sacramento–Truckee	2	100%	0%	0%	45%	55%	0%	25%	30%	0%	25%	20%	0%	100%	0%	50%	50%	0%
Truckee–Reno	2	100%	0%	50%	0%	50%	0%	20%	80%	0%	0%	0%	0%	100%	0%	50%	50%	0%
Regional Service																		
S.F./Oakland–Vallejo	3	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	50%	50%	100%	0%	0%
Vallejo–Sacramento	2	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	50%	50%	100%	0%	0%
Sacramento–Truckee	2	20%	80%	0%	45%	55%	0%	25%	30%	0%	25%	20%	50%	50%	0%	50%	50%	0%
Truckee–Reno	2	20%	80%	50%	0%	50%	0%	20%	80%	0%	0%	0%	80%	20%	0%	50%	50%	0%
Emerging/Feeder Service																		
S.F./Oakland–Vallejo	3	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	50%	50%	100%	0%	0%
Vallejo–Sacramento	2	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	50%	50%	100%	0%	0%
Sacramento–Truckee	2	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	50%	50%	0%	50%	50%	0%
Truckee–Reno	2	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	80%	20%	0%	50%	50%	0%

[1] Maximum passenger operating speed of 0-30 mph
[2] Maximum passenger operating speed of 30-60 mph
[3] Maximum passenger operating speed of 60-80 mph

Table F-13 Las Vegas–Salt Lake City Corridor: MSA projected growth trends

	Population		
	2010	2050	Percent Change (2010 to 2050)
Las Vegas	1,951,000	3,525,000	81%
Cedar City	46,000	78,000	70%
Provo	527,000	1,333,000	153%
Salt Lake City	1,124,000	1,775,000	58%
Total	*3,648,000*	*6,711,000*	*84%*

Source: 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.

Table F-14 Las Vegas–Salt Lake City Corridor: network analysis assumptions

	Number of Stations	Alignment Type		Right of Way Availability for New Alignment			Development Type by Investment Level for New Alignment						Freight Density for Existing Alignment			Existing Track Quality		
		New	Existing	Public ROW	New Acquisition—Urban	New Acquisition—Rural	Rural—Low	Rural—Medium	Rural—high	Urban—Low	Urban—Medium	Urban—High	High	Medium	Low	Class 0-2[1]	Class 3[2]	Class 4[3]
Core Express Service																		
Las Vegas–Cedar City	4	100%	0%	70%	15%	15%	45%	25%	15%	5%	5%	5%	—	—	—	—	—	—
Cedar City–Provo	2	100%	0%	—	—	—	55%	30%	10%	5%	0%	0%	—	—	—	—	—	—
Provo–Salt Lake City	3	100%	0%	—	—	—	0%	5%	10%	55%	25%	5%	—	—	—	—	—	—

[1] Maximum passenger operating speed of 0-30 mph
[2] Maximum passenger operating speed of 30-60 mph
[3] Maximum passenger operating speed of 60-80 mph

Table F-15 Phoenix–Tucson Corridor: MSA projected growth trends

	Population 2010	Population 2050	Percent Change (2010 to 2050)
Phoenix	4,193,000	7,786,000	86%
Tucson	980,000	1,821,000	86%
Total	*5,173,000*	*9,607,000*	*86%*

Source: 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.

Table F-16 Phoenix–Tucson Corridor: network analysis assumptions

	Number of Stations	Alignment Type		Right of Way Availability for New Alignment			Development Type by Investment Level for New Alignment						Freight Density for Existing Alignment			Existing Track Quality		
		New	Existing	Public ROW	New Acquisition—Urban	New Acquisition—Rural	Rural—Low	Rural—Medium	Rural—high	Urban—Low	Urban—Medium	Urban—High	High	Medium	Low	Class 0-2[1]	Class 3[2]	Class 4[3]
Core Express Service																		
Phoenix–Tucson	6	100%	0%	50%	20%	30%	50%	15%	0%	20%	10%	5%	—	—	—	—	—	—
Regional Service																		
Phoenix–Tucson	6	40%	60%	0%	35%	65%	50%	15%	0%	20%	10%	5%	80%	20%	0%	80%	20%	0%
Emerging/Feeder Service																		
Phoenix–Tucson	6	40%	60%	0%	35%	65%	50%	15%	0%	20%	10%	5%	80%	20%	0%	80%	20%	0%

[1] Maximum passenger operating speed of 0-30 mph
[2] Maximum passenger operating speed of 30-60 mph
[3] Maximum passenger operating speed of 60-80 mph

Table F-17 Las Vegas–Reno Corridor: MSA projected growth trends

	Population		
	2010	2050	Percent Change (2010 to 2050)
Las Vegas	1,951,000	3,525,000	81%
Carson City	55,000	69,000	25%
Reno	425,000	749,000	76%
Total	*2,431,000*	*4,343,000*	*79%*

Source: 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.

Table F-18 Las Vegas–Reno Corridor: network analysis assumptions

	Number of Stations	Alignment Type		Right of Way Availability for New Alignment			Development Type by Investment Level for New Alignment						Freight Density for Existing Alignment			Existing Track Quality		
		New	Existing	Public ROW	New Acquisition—Urban	New Acquisition—Rural	Rural—Low	Rural—Medium	Rural—high	Urban—Low	Urban—Medium	Urban—High	High	Medium	Low	Class 0-2[1]	Class 3[2]	Class 4[3]
Core Express Service																		
Las Vegas–Carson City	4	100%	0%	0%	22%	78%	30%	35%	20%	5%	5%	5%	—	—	—	—	—	—
Carson City–Reno	2	100%	0%	25%	20%	55%	15%	30%	25%	15%	15%	0%	—	—	—	—	—	—

[1] Maximum passenger operating speed of 0-30 mph
[2]Maximum passenger operating speed of 30-60 mph
[3]Maximum passenger operating speed of 60-80 mph

Table F-19 Phoenix–Albuquerque Corridor: MSA projected growth trends

	Population		
	2010	2050	Percent Change (2010 to 2050)
Phoenix	4,193,000	7,786,000	86%
Prescott	211,000	403,000	91%
Flagstaff	134,000	239,000	78%
Gallup	71,000	97,000	37%
Grants	27,000	209,000	674%
Albuquerque	887,000	1,606,000	81%
Total	*5,523,000*	*10,340,000*	*87%*

Source: 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.

Table F-20 Phoenix–Albuquerque Corridor: network analysis assumptions

	Number of Stations	Alignment Type		Right of Way Availability for New Alignment			Development Type by Investment Level for New Alignment						Freight Density for Existing Alignment			Existing Track Quality		
		New	Existing	Public ROW	New Acquisition—Urban	New Acquisition—Rural	Rural—Low	Rural—Medium	Rural—high	Urban—Low	Urban—Medium	Urban—High	High	Medium	Low	Class 0-2[1]	Class 3[2]	Class 4[3]
Core Express Service																		
Phoenix–Prescott	3	100%	0%	0%	25%	75%	40%	25%	10%	10%	10%	5%	—	—	—	—	—	—
Prescott–Flagstaff	2	100%	0%	0%	5%	95%	35%	35%	25%	0%	5%	0%	—	—	—	—	—	—
Flagstaff–Gallup	2	100%	0%	0%	5%	95%	45%	35%	15%	0%	5%	0%	—	—	—	—	—	—
Gallup–Grants	2	100%	0%	0%	5%	95%	45%	35%	15%	5%	0%	0%	—	—	—	—	—	—
Grants–Albuquerque	3	100%	0%	0%	15%	85%	45%	25%	15%	5%	5%	5%	—	—	—	—	—	—
Regional Service																		
Phoenix–Prescott	3	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%	0%	0%
Prescott–Flagstaff	2	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	100%	0%	0%
Flagstaff–Gallup	2	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	100%	0%	0%
Gallup–Grants	2	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	100%	0%	0%
Grants–Albuquerque	3	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	100%	0%	0%
Emerging/Feeder Service																		
Phoenix–Prescott	3	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%	0%	0%
Prescott–Flagstaff	2	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	100%	0%	0%
Flagstaff–Gallup	2	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	100%	0%	0%
Gallup–Grants	2	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	100%	0%	0%
Grants–Albuquerque	3	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	100%	0%	0%

[1] Maximum passenger operating speed of 0-30 mph
[2] Maximum passenger operating speed of 30-60 mph
[3] Maximum passenger operating speed of 60-80 mph

Table F-21 Reno–Salt Lake City Corridor: MSA projected growth trends

	Population 2010	Population 2050	Percent Change (2010 to 2050)
Reno	425,000	749,000	76%
Elko	51,000	75,000	47%
Salt Lake City	1,124,000	1,775,000	58%
Total	*1,600,000*	*2,599,000*	*62%*

Source: 2050 data extrapolated from 2040 population forecasts by Woods & Poole Economics, Inc., Washington, D.C., copyright 2010; 2010 Population Data, US Census, 2010.

Table F-22 Reno–Salt Lake City Corridor: network analysis assumptions

	Number of Stations	Alignment Type		Right of Way Availability for New Alignment			Development Type by Investment Level for New Alignment						Freight Density for Existing Alignment			Existing Track Quality		
		New	Existing	Public ROW	New Acquisition—Urban	New Acquisition—Rural	Rural—Low	Rural—Medium	Rural—high	Urban—Low	Urban—Medium	Urban—High	High	Medium	Low	Class 0-2[1]	Class 3[2]	Class 4[3]
Core Express Service																		
Reno–Elko	2	100%	0%	75%	20%	5%	25%	30%	25%	5%	10%	5%	0%	100%	0%	50%	50%	0%
Elko–Salt Lake City	2	100%	0%	0%	30%	70%	25%	20%	25%	10%	15%	5%	0%	0%	100%	50%	50%	0%
Regional Service																		
Reno–Elko	2	20%	80%	75%	20%	5%	25%	30%	25%	5%	10%	5%	50%	50%	0%	50%	50%	0%
Elko–Salt Lake City	2	20%	80%	0%	30%	70%	25%	20%	25%	10%	15%	5%	0%	0%	100%	50%	50%	0%
Emerging/Feeder Service																		
Reno–Elko	2	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	50%	50%	0%	50%	50%	0%
Elko–Salt Lake City	2	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	50%	50%	0%

[1] Maximum passenger operating speed of 0-30 mph
[2]Maximum passenger operating speed of 30-60 mph
[3]Maximum passenger operating speed of 60-80 mph

Appendix G. CONNECT SW Global Variable Inputs

Operating Characteristics	
Circuitry Factor	
Emerging/Feeder	1.2
Regional	1.15
Core Express	1.1
Operating Speed before Station Penalty (mph)	
Emerging/Feeder	60
Regional	90
Core Express	186
Station Penalty	5
Transfer (minutes)	
Transfer Time	15
Transfer Penalty	30
Miscellaneous Operating Characteristics (minutes)	
Daily Operating Time	16
Layover Time	40
Physical Network/Fleet Characteristics	
Network Data	
Network Wide Maintenance Facility	Y
Corridor Data	
Electrification—Emerging/Feeder	N
Electrification—Regional	Y
Electrification—Core Express	Y
Number of terminal layover yards	2
Number of intermediate maintenance facilities	2
Fleet Characteristics	
Consist size	8
Seats—Emerging/Feeder	300
Seats—Regional	400
Seats—Core Express	600
Fleet spare ratio	20%
Max Network Load Factor	70%
Factors on Ridership	
Forecast Year	2050

Global Adjustment Factors	
Value of Time	1
Auto Congestion	1
Population	1
Rail Speed	1
Rail Fare	1
Air Travel Time	1
Air Fare	1
Auto Cost	1
Auto Travel Time	1
Transit Ridership	1
Air Effective Daily Service Hours	16
Induced Trips (as a % of Diverted Trips)	
Emerging/Feeder—Minimum	0%
Emerging/Feeder—Maximum	6%
Regional—Minimum	0%
Regional—Maximum	12%
Core Express—Minimum	0%
Core Express—Maximum	18%
Air Business Share	25%
Connect Air Business Captive Share	75%
Connect Air Non-business Captive Share	75%
Auto Business Share	12%
Auto Business Captive Share	35%
Auto Non-business Captive Share	40%
Auto Business Chooser Share (non-choosers are less likely to divert)	5%
Auto Non-business Chooser Share (non-choosers are less likely to divert)	10%
Existing Rail Business Share	50%
Rail Non-business/Business Fare Ratio	65%
Air/Rail Access Cost (dollars per minute)	0.2
Average Access Speed (mph)	30
Rail Access Time by MSA Population (minutes)	
< 1,000,000	10
1,000,000—2,999,999	20
3,000,000—5,999,999	30
> 6,000,000	40
Air Terminal Time	75
Rail Terminal Time	25
Air Connect Time	60
Elasticity of Air Trips With Respect to Population Growth	30%
Elasticity of Auto Trips With Respect to Population Growth	30%
Elasticity of Rail Trips With Respect to Population Growth	30%

Rail On-time Performance	
Emerging/Feeder	85%
Regional	95%
Core Express	99%
Population Growth Factor Values	
Low	80%
Medium	100%
High	120%
Auto Congestion Factor Values	
Low	80%
Medium	100%
High	120%
Rail Speed Factor Values	
Low	80%
Medium	100%
High	120%
Auto Cost Factor Values	
Low	80%
Medium	100%
High	120%
Rail Fare Sensitivity Factors	
Low	80%
High	120%
Range Boundary Percentiles	
Low Percentile	25%
Medium Percentile	50%
High Percentile	75%
Emerging/Feeder / Regional Average Speed Threshold (mph)	60
Regional/Core Express Average Speed Threshold (mph)	90
Capital Cost Inputs	
Unit Costs (2010 $)	
New Construction	
Average Cost per Acre—Urban	$-
Average Cost per Acre—Rural	$-
Cost per route Mile—At Grade (low)	$15,000,000
Cost per route Mile—At Grade (high)	$35,000,000
Cost per route Mile —Tunnel (220mph)	$325,000,000
Cost per route Mile—Tunnel (180mph)	$275,000,000
Cost per route Mile—Tunnel (150mph)	$250,000,000
Cost per route Mile—Tunnel (120mph)	$200,000,000
Cost per route Mile—Tunnel (90mph)	$150,000,000
Cost per route Mile—Tunnel (60mph)	$125,000,000
Cost per route Mile—Aerial (low)	$60,000,000

Cost per route Mile—Aerial (high)	$100,000,000
Major Station—Core	$200,000,000
Major Station—Regional	$100,000,000
Major Station—Emerging/Feeder	$50,000,000
Minor Station—Core	$40,000,000
Minor Station—Regional	$20,000,000
Minor Station—Emerging/Feeder	$10,000,000
Train set	$35,000,000
Emerging/Feeder Adjustment from Core for new track	60%
Regional Adjustment from Core for new track	80%
For All Corridors	
Heavy Maintenance Facility	$225,000,000
Intermediate Maintenance Facility	$100,000,000
Storage Yard	$30,000,000
Extraordinary Items	
Miscellaneous	
Contingency	20%
Operating and Maintenance Costs	
Unit Costs (2010 $)	
Fixed Costs	$5,000,000
Major Stations—Core (cost per station)	$10,000,000
Minor Station—Core (cost per station)	$2,500,000
Major Stations—Regional (cost per station)	$4,000,000
Minor Station—Regional (cost per station)	$1,000,000
Major Stations—Emerging/Feeder (cost per station)	$1,000,000
Minor Station—Emerging/Feeder (cost per station)	$500,000
Annual Seat Miles—Low (cost per seat mile)	$0.040
Annual Seat Miles—High (cost per seat mile)	$0.060
Route Miles—Low (cost per route mile)	$200,000
Route Miles—High (cost per route mile)	$300,000

Appendix H. Corridor Performance

Performance characteristics and definitions

Four corridor performance analysis criteria (introduced in Section 5.1.3) were used to classify the general performance levels of the corridors in the network in the year 2050. The first two criteria assess the performance of a corridor in isolation (i.e., on a stand-alone basis, with no connections to other corridors on the network), and in the network context. The network context accounts for connections to other corridors as well as potential shared infrastructure with overlapping services. The second two criteria are relative measures that assess the extent to which a corridor affects and is affected by other corridors in the network. Figure H-1 provides definitions of the four corridor performance analysis criteria and presents a guide for the icons used to indicate the meanings of each.

Figure H-1 Corridor performance definitions

Stand Alone Performance: Performance of corridor without consideration of other service on network.

Network Performance: Performance of corridor considering other service on network.

Enabling Corridor: Extent to which it enables improved performance on other corridors.

Dependent Corridor: Extent to which it is dependent on other corridors for improved performance.

Guide:

Stand Alone Performance	***Top performing*** corridor. Operating Recovery Ratio of > 1.0
Network Performance	***Top performing*** corridor.
Enabling Corridor	Enables ***significant improvement*** in the performance of other corridors.
Dependent Corridor	Is ***not dependent*** on other corridors for best performance.

Stand Alone Performance	***Strong performing*** corridor. Operating Recovery Ratio of 0.5 - 1.0
Network Performance	Shows ***improved performance*** in network context.
Enabling Corridor	Enables ***some improvement*** in the performance of other corridors.
Dependent Corridor	Is ***somewhat dependent*** on other corridors for improved performance.

Stand Alone Performance	***Lowest performing*** corridor. Operating Recovery Ratio of < 0.5
Network Performance	Shows ***little to no improvement*** in performance in network context.
Enabling Corridor	***Does not enable*** improvement in the performance of other corridors.
Dependent Corridor	Is ***very dependent*** on other corridors for improved performance.

A solid black circle indicates that a corridor is a top performing corridor for stand-alone and network performance categories. A solid black circle also indicates that the corridor enables significant improvement in the performance of other corridors, and it is not dependent on other corridors for its best performance.

A half-filled circle indicates the next group of corridors. These are still strong performing corridors, enabling some improvement in other corridors but are somewhat dependent on other corridors for improved performance.

A hollow circle indicates the lowest performing corridors tested, as well as corridors that do not enable better performance in other corridors. These corridors are very dependent on other corridors for improved performance.

It should be noted that although these criteria focus on operating performance for the purpose of this classification, the stakeholders also considered capital investment requirements in their assessment. Also important, *the operating recovery ratios presented here only represent one potential scenario*. Some project sponsors might decide to focus on maximizing financial performance, in which case they might set higher ticket fares than assumed in this analysis and yield a higher operating recovery ratio, while others might choose fare policies that yield lower operating recovery ratios yet attract more riders and maximize public benefits.

When interpreting the analysis, readers should be careful not treat the results as a definitive screen, or as "the number" associated with a corridor. The performance presented in this report is based on a wide range of assumptions, limited in part by the constraints of the conceptual analysis tool, and other studies might validly take other factors into consideration. To highlight one example, the analysis did not consider short trips (those less than 50 miles) or commuter trips, yet these might be key markets for some corridors. Another caveat is that the presented costs are based on a potential range of unit costs, developed with limited data;[188] project-specific cost estimates might be valid yet outside this range due to project-specific conditions.

Given the limitations of the analysis, it was developed for the purposes of assisting the stakeholders with setting appropriate long-term service goals for corridors in the network. Many of the corridors were tested with multiple service tiers. The results presented in this chapter reflect a single service tier for each corridor based on CONNECT analysis for the year 2050 and stakeholder input. Table H-1 below presents the long-range service tier target for each corridor identified by the stakeholders.

Table H-1 Candidate corridor service tier targets

	Service Tier
San Diego–S.F./Oakland	Core Express
Las Vegas–Greater Los Angeles	Core Express
Greater Los Angeles–Phoenix	Core Express
San Diego–Phoenix	Core Express
S.F./Oakland–Reno	Regional
Las Vegas–Phoenix	Core Express
Las Vegas–Salt Lake City	Core Express
Las Vegas–Reno	Core Express
Phoenix–Tucson	Regional
Phoenix–Albuquerque	Emerging/Feeder
Reno–Salt Lake City	Emerging/Feeder

There are several segments in the SW network map presented in Chapter 5 that are depicted with a red dashed line, indicating potential core express or blended service. These include:

- S.F./Oakland–San Jose
- Phoenix–Tucson
- San Jose–Stockton
- Provo–Ogden

[188] There are many limitations to the use of unit costs. One example is that the range used in this analysis will likely underestimate capital costs for creating new access to the core of some highly developed urban areas that present particularly challenging construction conditions. Another example is that, due to limited experience in the United States, much of the data considered in developing the O&M unit costs used in this analysis is based on planned or international systems, which have lower O&M unit costs than realized in many U.S. corridors today because of generally better operating conditions. Accordingly, all costs presented in this report should be considered conceptual, and more detailed analysis of corridor-specific conditions is needed to develop cost estimates appropriate for making investment decisions.

The San Jose–S.F./Oakland segment is included in the San Diego–S.F./Oakland corridor for which Core Express results are presented. Regional service is presented for the Phoenix–Tucson corridor, however, multiple scenarios were tested in which this segment was included in the larger Greater Los Angeles–Phoenix–Tucson and Las Vegas–Phoenix–Tucson corridors. The remaining two segments indicated with a dashed red line on the map (San Jose–Stockton and Provo–Ogden) were not explicitly tested with CONNECT, but rather reflect either current plans in the region or stakeholder input on the potential future plans. The southern half of the Provo-Ogden corridor (Provo–Salt Lake City) is included in the Las Vegas-Salt Lake City corridor.

Identification of corridor type/service tier

The 11 corridors in the network that were tested are listed in Table H-2, generally listed by performance level. The prevalence of solid and half-filled circles among the first half of corridors indicates that the San Diego to San Francisco as well as the Los Angeles to Las Vegas Corridors serve not only as top performing corridors as stand-alone and in the network context, but also strong enabling corridors. In addition, all corridors tested show at least marginally improved performance in the context of a multi-state network.

Table H-2 Candidate corridor performance summary

	Stand-alone Performance	Network Performance	Enabling Corridor	Dependent Corridor
San Diego–S.F./Oakland (Core Express)	●	●	●	◐
Las Vegas–Greater Los Angeles (Core Express)	●	●	●	◐
Greater Los Angeles–Phoenix (Core Express)	●	●	◐	◐
San Diego–Phoenix (Core Express)	◐	●	○	○
S.F./Oakland–Reno (Regional)	◐	●	◐	◐
Las Vegas–Phoenix–Tucson (Core Express)	◐	◐	◐	◐
Las Vegas–Salt Lake City (Core Express)	○	◐	◐	○
Las Vegas–Reno (Core Express)	○	◐	○	○
Phoenix–Tucson (Regional)	○	◐	○	○
Phoenix–Albuquerque (Emerging/Feeder)	○	○	○	◐
Reno–Salt Lake City (Emerging/Feeder)	○	○	○	◐

For the year 2050.

Top Performing Corridors

The top performing corridors in the network show the strongest demand as stand-alone corridors and enable significant increases in ridership on the other corridors in the network. These three Core Express corridors form the backbone of the Southwest network analyzed. The three top performing corridors are:

- San Diego–S.F./Oakland
- Las Vegas-Greater Los Angeles
- Greater Los Angeles–Phoenix

Core Express service on these three corridors allow for competitive trip times to the primary population centers throughout the entire Southwest network including San Francisco, Los Angeles, Las Vegas, Phoenix, the Inland Empire, and San Diego. They show strong demand as stand-alone corridors with O&M recovery ratios greater than 1.0 even under conservative scenarios and provide large network impacts with connecting corridors throughout the Southwest region.

Second Tier Corridors

Second tier corridors perform well in a stand-alone context however their performance is greatly improved in the network context with connections to the three top performing corridors. Second tier corridors do not enable other network effects to the same extent as the three primary corridors do.

The three second tier corridors are:

- San Diego–Phoenix
- Las Vegas–Phoenix–Tucson
- S.F./Oakland–Reno

Service between these markets is more likely to be affected than the top performers by other investment decisions elsewhere on the network. For example, the benefits of the San Diego-Phoenix Core Express Corridor are maximized under network conditions with the Greater Los Angeles–Phoenix Core Express line via the Inland Empire also in operation. A potentially cheaper Regional alternative to the corridor via El Centro and Yuma may be possible but attracts fewer passengers and does not take advantage of the greater network. Similarly, Core Express service in the Las Vegas-Tucson via Phoenix corridor may be negated with investments in Core Express service between Los Angeles and Phoenix with good connections in the Inland Empire to Core Express Service to Las Vegas.

The S.F./Oakland-Reno Regional Corridor allows competitive trip times for destinations throughout the entire Southwest network, including Los Angeles, San Diego, and Las Vegas. The recovery ratio exceeds 1.0 when the corridor is part of the greater network.

Third Tier Corridors

The third tier corridors in the network rely heavily on network connections to drive ridership, serve smaller markets on the periphery of the network, and are generally more appropriately served with Regional or Emerging/Feeder service. The five third tier corridors are:

- Las Vegas–Salt Lake City
- Las Vegas–Reno
- Phoenix–Tucson
- Phoenix–Albuquerque
- Reno–Salt Lake City

The Las Vegas–Salt Lake City and the Las Vegas–Reno corridors were modeled with Core Exress service. Lack of existing infrastructure on the route between Las Vegas and Reno results in marginal difference between Emerging/Feeder / Regional and Core Express service investment. In addition, the long distances between the cities on this corridor make Core Express service the most competitive option. Neither corridor generates sufficient ridership to achieve high cost recovery ratios between these markets, but both see some network benefits when modelled with the three top perfroming corridors in the network. Ridership on the Las Vegas–Salt Lake City corridor was three times greater than the ridership on this corridor without network connections. For the Las Vegas-Reno corridor, benefits were maximized under network conditions with the S.F./Oakland – Reno Regional line also in operation.

The Phoenix-Tucson Regional Corridor results in a marginal decrease in rail modal share (16 percent vs. 17 percent) versus Core Express service. The corridor sees significant increase in ridership when connected to the larger network via a Core Express line between Phoenix and Tucson. Core Express service may be viable in this corridor when the entire proposed network is in operation. It should be noted that CONNECT only accounts for a portion of the potential ridership on this corridor; it does not account for daily commuter or short intercity trips. Including these trips in the analysis could boost the corridor’s performance and make it a more viable connection.

The Phoenix–Albuquerque Emerging/Feeder Corridor attracts a marginal increase in rail modal share (0 percent vs. 3 to 4 percent) compared to 2010 share. The corridor can be built in phases with an extension towards Albuquerque as ridership and the network grows. Approximately one-third of the ridership on this corridor is between Phoenix, Flagstaff, and Prescott, suggesting this portion of the corridor might have stronger performance than the corridor’s average performance.

The Reno to Salt Lake City Emerging/Feeder Corridor attracts a marginal increase in ridership compared to California Zephyr statistics. Operation on this corridor is highly dependent on subsidies. Service other than Emerging/Feeder rail would require heavy investment in infrastructure due to topographical challenges along the corridor.

Appendix I. Multi-State Governance Models

Table I-1Multi-state governance model definitions

Governance Models	Definition	Mechanism for Implementation	Powers
Single state agency contracting with and on behalf of other states	Where an existing or newly created state agency addresses multi-state interests through agreements with the other state(s).	Multi-state agreements	Range of powers can vary depending on type of entity established within state (i.e., authority, agency, corporation) and the degree to which other states can enter into contracts.
Voluntary coalition/ partnership Voluntary coalition/ partnership with non-profit entity	Where stakeholders convene in a forum to collaborate for a common interest on a voluntary basis. Can work with/through establishment of a non-profit corporation, often tax exempt and eligible to receive government funds and private contributions.	Can be established without any formal agreement or mechanism but in some instances may use a multi-state Memorandum of Understanding or other type of agreement	Generally has no legal standing and possesses no powers. Largely advocacy or advisory body. *With Non-Profit Entity:* Generally organized as a distinct corporation; often tax-exempt and can often be a direct recipient of certain government grants and tax-deductible contributions from private sector.
Special authority	Where an independent entity, often a distinct governmental body, delivers a limited number of public services within defined boundaries. Services are generally provided within a single state or two to three states.	State legislation Interstate compact	Can carry a broad range of typical governmental powers, including entering into contracts and employing workers, acquiring real property through purchase or eminent domain, and suing or being sued. Following limits set in state legislation or an interstate compact, some can also exercise specified fiscal powers such as issuance of bonds, imposition of special taxes, levying benefit assessments, and charging service fees.
For-profit corporations	Where a privately held company develops infrastructure or operates services on a for-profit, limited liability basis.	Formed and managed by for-profit investors	Generally only limited by contracts, laws, and regulations. May be recipients of a franchise from government to allow them to operate under certain constraints.
Federally chartered corporations	Where a corporation is established by Congress to provide a public service. Generally set-up with federal subsidies at the outset but often intended to become financially self-sustaining over time.	Federal legislation	Similar to for-profit corporations but the mission and constraints of the organization are specified in the federal legislation.
Federal-state commission	Body of federal, state, and, sometimes, local leaders organized to address a critical need, which often includes the distribution of federal funds among multiple states or coordination of multi-state investments.	Federal legislation	Can carry a broad range of powers, including entering contracts and employing workers. Typically does not have authority to issue debt. Can issue funds in the form of grants to participating states.
Federal government project office	Where an office is created within an existing federal agency to carry out a specific purpose.	Federal legislation	Generally has a limited range of powers related to the purpose the office was established to address and within the scope of the federal agency's powers.

Table I-1Multi-state governance model definitions (continued)

Governance Models	Governance Approach	Examples
Single state agency contracting with and on behalf of other states	Governance body can vary depending on type of entity established. Oversight generally includes multi-state participation but ultimate accountability rests with single state agency.	MTA Metro-North Services in CT and by NJT New Woodrow Wilson Bridge Construction Northern New England Passenger Rail Authority
Voluntary coalition/ partnership Voluntary coalition/ partnership with non-profit entity	Rarely establishes a chartered board of directors. Generally makes decisions based on consensus of member agency representatives with rotating leadership. *With Non-Profit Entity:* Generally organized as corporation and governed by a board of directors. Board of directors may be appointed by members of the voluntary coalition/partnership.	Midwest High Speed Rail Steering Group Northeast Corridor Master Plan Working Group I-95 Corridor Coalition Coalition of Northeastern Governors*(CONEG Policy Research Center, Inc., is non-profit arm)*
Special authority	Generally governed by a board of directors appointed by elected officials. Executive Director appointed by board of directors and other staff carry out day-to-day operations. Precedent exists for designation of federal members on such agencies.	Louisville and Southern Indiana Bridges Authority (and Bi-State Management Team) Port Authority of NY &NJ Transbay Joint Powers Authority (single-state) California High Speed Rail Authority (single-state)
For-profit corporations	Governed through a board of directors that represents shareholders and is accountable for proper oversight and compliance with laws and regulations.	London-Paris-Brussels High-Speed Rail Network (Eurostar and Eurotunnel) DesertXpress
Federally chartered corporations	Governed through a federally structured board of directors whose members are generally appointed by the President. Oversight provided by Congress. Limited opportunity for state participation.	Tennessee Valley Authority Amtrak United States Railway Association (1973-1982) Conrail (1976-1987)
Federal-state commission	Governance model established in federal legislation. The commission is the governing body, with members appointed by state governors and at least one member appointed by the President. Oversight provided by Congress. Often structured with veto power for the federal member.	Appalachian Regional Commission Northeast Corridor Infrastructure Operations and Advisory Commission
Federal government project office	Can be governed by the federal agency in which the entity is housed; if the office is designed to support a federal/state/local partnership, decision-making might also include state and local stakeholders. Oversight provided by Congress within context of overall agency oversight.	EPA Chesapeake Bay Program Office

Multi-State Governance Model Case Study Summaries

Single state agency contracting with and on behalf of other states

MTA Metro-North Railroad

Metro-North Commuter Railroad operates commuter rail service in the New York metropolitan area as a subsidiary of New York State's Metropolitan Transportation Authority, a public benefit corporation responsible for public transportation in the New York metropolitan area. Metro-North serves 120 stations distributed in seven counties in New York State as well as two counties in the state of Connecticut. Service to New Haven, CT and points west of the Hudson River are provided through agreements with Connecticut DOT (ConnDOT) and New Jersey Transit, the public transportation provider for the State of New Jersey, respectively.

The New Haven Line is operated through a partnership between Metro-North and the State of Connecticut. Under the arrangement, ConnDOT owns the tracks and stations within Connecticut. ConnDOT also finances and performs capital improvements within Connecticut. Metro-North owns the tracks and stations, and handles capital improvements for such within New York State. Metro-North also performs routine maintenance and provides police services for the entire New Haven Line, its branches and stations. New cars and locomotives are typically purchased in a joint agreement between Metro-North and ConnDOT, with the agencies paying for 33.3% and 66.7% of costs, respectively. The contract between ConnDOT and Metro-North self-renews every five years.

As part of the creation of Metro-North upon the divestiture of passenger rail service by Conrail after 1981, Metro-North assumed responsibility for operating the former Erie Lackawanna services west of the Hudson and north of the New Jersey state line. However, since those lines are physically connected to New Jersey Transit lines, their operations were contracted to NJ Transit, with Metro-North subsidizing the service and supplying equipment. Two lines west of the Hudson River - the Port Jervis and the Pascack Valley - operate out of NJ Transit's terminal in Hoboken, N.J., and connect with service out of Penn Station, NY via the Secaucus Transfer.

New Woodrow Wilson Bridge Construction

The Woodrow Wilson Memorial Bridge is part of the I-95/I-495 Capital Beltway that connects Maryland and Virginia over the Potomac River; it also crosses the southern tip of the District of Columbia. In 1988 the FHWA initiated a cooperative study with several agencies to address the operational and structural deficiencies of the original six-lane Woodrow Wilson Memorial Bridge. A new alternative was chosen to replace the original bridge, which consists of a new Potomac River crossing and complete reconstruction and reconfiguration of the four interchanges on the Capital Beltway (I-95/I-495), two each in Maryland and Virginia.

In September 2001 the four partners – the FHWA, Maryland, Virginia, and DC—signed an agreement that assigned roles and responsibilities for the ownership, operation, inspection, maintenance, and rehabilitation of the Woodrow Wilson Memorial Bridge. The agreement stipulated that, while the FHWA owned the original Bridge, Maryland and Virginia would accept joint ownership and title to the completed work upon completion and final acceptance for maintenance of each bridge construction contract.

According to the Agreement, Maryland is responsible for the design, engineering, and preparations of plans, specifications, and estimates for the Bridge, as well as the supervision of its construction. But the operations and maintenance of the bridge will be split between Virginia and Maryland. A standing committee consisting of the chief bridge engineers in Maryland and Virginia (or their designees) will meet annually to evaluate the needs for periodic inspections and determine what work is necessary to maintain and rehabilitate the bridge. This committee must agree to all work performed on the bridge, whether it is entirely within one jurisdiction or in multiple jurisdictions. All costs for the work to operate, maintain, inspect, repair, and rehabilitate the bridge will be split equally between Maryland and Virginia.

Northern New England Passenger Rail Authority

Maine's State Legislature established the Northern New England Passenger Rail Authority (NNEPRA) in 1995 to oversee the operation of passenger rail service in Maine. After an almost 30-year hiatus, passenger rail service restarted in Maine in December 2001 following the completion of a $60 million track rehabilitation project. Since that time, NNEPRA has managed the budget, contracts, promotion, and customer services associated with the Downeaster passenger rail service, the Amtrak line which operates five round-trips daily between Portland and Boston, linking ten communities in three states. While both Massachusetts and New Hampshire contribute to station development within their respective jurisdictions, they do not contribute to the Downeaster's operational budget. NNEPRA is governed by a seven-member Board of Directors; all members are appointed by the Governor of Maine.

NNEPRA, Amtrak, MBTA, and Pan Am Railways have entered into cooperative agreements relative to the execution of specific work orders (such as track improvements in Massachusetts and signal work in New Hampshire). The agreements vary depending on the type of project (operating or construction) since there is no formal Memorandum of Understanding in place among the states.

As outlined in a 1996 service agreement between Amtrak and NNEPRA, Amtrak is responsible for providing and maintaining equipment for, and operating, five daily round trips between Portland and Boston. The Service Agreement also requires that NNEPRA pay Amtrak an annual service fee for the operation of the Downeaster and reimburses Amtrak for fuel costs and for payments made to host railroads. Downeaster ticket revenues are retained by Amtrak and are credited against amounts NNEPRA owes Amtrak. In instances where the state or a local municipality owns part or all of the land around stations, the states/municipality maintains agreements with Amtrak that permits the construction, operation, and maintenance of the stations. In some instances, NNEPRA and Amtrak have entered into three-way agreements with municipalities where the municipalities themselves have paid to develop and build stations.

Voluntary coalition/partnership

Midwest High Speed Rail Steering Group

In 2009, the Governors of eight Midwestern states-- Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio and Wisconsin—and the City of Chicago signed a Memorandum of Understanding (MOU) to work cooperatively to secure a portion of the $8 billion included in the American Recovery and Reinvestment Act (ARRA) for development of HPR. The MOU supported implementation of the region's vision of a Chicago Hub that would connect trains traveling up to 110 miles per hour serving cities across the region, along with connections to adjoining regional corridors. The MOU also created the Midwest High-Speed Rail Steering Group, to which each MOU signatory appointed one senior-level official as a voting representative to the group. The Steering Group coordinates and advocates on behalf of the region's collective HPR interests and serves as the single point of contact for the region. Priorities of the Steering Group include: promoting regional coordination in individual applications for ARRA funding and other federal funding opportunities; communicating a Midwest strategy to the federal government; and creating economic development in the Midwest region. The Steering Group submitted a coordinated application for ARRA funds in 2009 and was awarded $2.6 billion of the $8 billion available to states across the country.

NEC Master Plan Working Group

In 2010 Amtrak published an Infrastructure Master Plan for the Northeast Corridor (NEC) that, for the first time, brought individual state plans together in a collaborative way. The plan identifies an initial baseline of infrastructure investment needed to maintain the current NEC system in a state of good repair; integrate intercity, commuter and freight service plans; and move the NEC forward to meet the expanded service, reliability, frequency, and trip-time improvements envisioned by the NEC states.

The Master Plan Working Group that authored the document consisted of representatives from 28 entities: Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, Delaware, Pennsylvania, Maryland, Virginia, and District of Columbia DOTs, the Massachusetts Bay Transportation Authority, the Northern New England Passenger Rail Authority, the New York Metropolitan Transportation Authority (including Metro-North Railroad and LIRR), NJ TRANSIT, the Southeastern Pennsylvania Transportation Authority, the Maryland Transit Administration, Virginia Railway Express, the Coalition of Northeastern Governors (CONEG), FRA, Norfolk Southern, Providence and Worcester Railroad, CSXT, the Port Authority of New York & New Jersey, and Amtrak.

The Working Group was not governed by any formal processes; rather, the states, stakeholders, and agencies were invited to contribute their own priorities and projects. Discussions of routes and operations eventually led to the final plan. The ability to address mobility needs through such a planning process underscores the importance of partnership among the states, Amtrak, and other stakeholders.

I-95 Corridor Coalition

The I-95 Corridor Coalition is a volunteer partnership of transportation agencies, toll authorities, and related organizations, established in 1993. The Coalition provides a forum for key decision and policy makers to address programmatic transportation improvement across multiple jurisdictions and all modes, including travel information, coordinated incident management, commercial vehicle operation, electronic payment services, and the efficient transfer of people and goods between modes. No formal agreement exists among Coalition members and, similar to other voluntary coalitions, it has no legal status. An Executive Board, Steering Committee, and Program Track Committees, in addition to full-time professional staff, carry out Coalition objectives. Each year, a program of projects is developed by the Coalition, with a project budget, responsibility, and accountability assigned to the committees within the defined program areas. With its Priority Corridor designation by the USDOT, the Coalition receives federal funding (through its state department of transportation members) for support of its projects and programs, with local match provided by the member agencies.

Coalition of Northeastern Governors (CONEG)

CONEG is a non-partisan regional intergovernmental organization established in 1976 by the Governors of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont to address regional issues and provide a forum for inter-governmental cooperation. CONEG programs, policies, and initiatives address regional issues in transportation, energy, environment, and economic development. Through CONEG programs, member states cooperate on issues of shared concern to monitor regional developments, assess the regional implication of national policies, identify opportunities for action by member states, adopt policy positions, and advocate the region's interests. Policies adopted by CONEG are issued as public statements and communications to policy-relevant members of congress.

CONEG's governing body is responsible for its strategic direction. The governing body is composed of seven member state Governors who serve throughout their gubernatorial term. CONEG management is directed by the Advisory Committee who acts on behalf of member Governors. Each Governor names a representative to serve on the Advisory Committee. Specific programs are administered by CONEG program committees headed by Program Directors. Program committee members are selected by the state Governors as needed. Program coordination is administered by the CONEG Policy Research Center, Inc, the non-profit staff arm of CONEG.

Program activities are conducted by the CONEG Policy Research Center, Inc, a non-profit organization which functions as the staffing arm for CONEG. The center's fiscal and management affairs are directed by a Board of Governors.

Special authority

Louisville and Southern Indiana Bridges Authority (and Bi-State Management Team)

The Louisville and Southern Indiana Bridges Authority is a bi-state governmental agency organized by the Commonwealth of Kentucky and the State of Indiana for the purpose of financing and constructing the Ohio River Bridges Project. Kentucky adopted legislation authorizing the creation of the Authority and the Governor of Indiana issued an Executive Order that authorized Indiana's participation. The Authority's primary task has been to develop a financial plan for the project. The authority operates in consultation with, but separately from, the project's bi-state management team, under the direction of the Indiana and Kentucky departments of transportation, which has managed the environmental and engineering aspects of the project.

The Bi-State Management Team has recently explored cost-saving ideas in the face of decreasing federal transportation dollars and increasing construction costs, and is developing a Supplemental Environmental Impact Statement to examine the proposed changes.

In December 2011 the Authority reached a consensus on a plan to finance and build the project. Under this agreement, which is supported by both state governors, Kentucky will be responsible for financing and constructing the downtown portion of the project - a new I-65 bridge, a re-decked Kennedy Bridge, modernization of the Kennedy Interchange, and expansion of the I-65 approach in Indiana. Indiana will be responsible for financing and constructing the East End portion of the project - a new bridge near Utica, IN and Prospect, KY; a new highway linking the Lee Hamilton Expressway and Gene Snyder Freeway, and a tunnel in Eastern Jefferson County. The role of the Authority is to help coordinate, monitor and ensure an interface between the two procurements, which would continue to be carried out as one project under a single financial plan.

Port Authority of New York & New Jersey

The Port Authority was established in 1921 through an interstate compact between the states of New York and New Jersey. The Port Authority's initial task was to overcome the high costs of having most of the port's docking facilities in New York with most of the rail terminals in New Jersey and to thereby increase the port's competitive position among East Coast ports. Later, the Authority's scope was expanded to include the planning, design, construction, and operation of bridges and tunnels, two bus terminals in Manhattan, a containerized marine terminal, arterial highways, rail transit, the region's airports, and the World Trade Center. The Port Authority is governed by a six-member Board of Commissioners. It is a self-supporting entity, funded primarily by tolls, fees, rent, and investment income. It does not receive tax revenues from any state or local jurisdiction and issues bonds for capital projects.

Transbay Joint Powers Authority

The Transbay Joint Powers Authority (TJPA) was created in 2001 through a joint powers agreement among its three member entities: the City and County of San Francisco, Alameda-Contra Costa Transit District (AC District) and the Peninsula Corridor Joint Powers Board. The primary responsibility of the TJPA is to design, build, operate and maintain the Transbay Transit Center (TTC) project serving multiple bus and train operators, and including the extension of the Caltrain commuter rail 1.3 miles into the new TTC and accommodation for future California High Speed Rail. The TJPA is governed by a Board of Directors appointed by the three members of the Authority, with the City and County of San Francisco having the authority to appoint more members than the other entities. Staff to the TJPA manages the project as well as the Caltrain extension. The TJPA currently is a direct recipient of federal funding, with local match requirements covered by contributions from member entities through land sales, a local sales tax, regional bridge tolls, and state investment. All funds received have been used to cover project costs and the cost of contracting staff services. It is anticipated that all or a significant portion of the costs will be recovered through income from sale and development of adjacent land and air rights and, later, through user fees and charges.

California High Speed Rail Authority

The California High-Speed Rail Authority is an example of a state-legislated authority. It was established in 1996 to plan, construct, and operate high-speed passenger rail service connecting all the state's major metropolitan areas. It has a nine-member policy board (five appointed by the governor, two by the State Senate Rules Committee, and two by the Speaker of the State Assembly). The state's voters approved a 2008 ballot proposal that provides $9 billion in bond funding to get the system started, and the system will also receive federal aid. Once in full operation, the Authority expects the system to require no operating subsidies.

For-profit corporations

London-Paris-Brussels HSR Network—Eurostar and Eurotunnel

The London-Paris-Brussels high-speed rail network spans three countries in Western Europe. The infrastructure consists of four distinct geographic segments, the ownership and operation of which are specific to each segment and include a variety of public and private entities. The Channel Tunnel, the 31.4-mile undersea rail tunnel linking the United Kingdom (UK) and France beneath the English Channel, is essential to the existence of the network and was created through a multi-national public-private partnership infrastructure project between France and the UK. The tunnel hosts passenger and freight services between the countries, and is currently operated and maintained by the private Eurotunnel Corporation under a 99-year concession agreement.

Initially conceived as a joint operation among French (SNCF), British (LCR), and Belgian (SNCB) rail service providers, high-speed rail passenger service is now provided by the private Eurostar operator through the tunnel and over the rail infrastructure of the three-country high-speed rail network. Two of these companies are Eurostar, a corporate international entity that operates high-speed rail service, and Groupe Eurotunnel S.A., a Franco-British publicly-traded joint venture that manages and operates the Tunnel infrastructure.

*Eurostar International Limited E*urostar owns and operates high-speed rail service through the Channel Tunnel and on the London-Paris-Brussels high-speed rail network. It was until 2009 operated jointly by the national railway companies of France and Belgium, SNCF and SNCB, and Eurostar (UK) Ltd (EUKL), a subsidiary of London and Continental Railways (LCR), which also owns the high-speed infrastructure and stations on the British side. In 2010, Eurostar was incorporated as a single corporate entity called Eurostar International, a single, stand-alone business owned by three shareholders: SNCF (55%), LCR (40%) and SNCB (5%). Eurostar is governed by a board of directors.

Groupe Eurotunnel S.A. Groupe Eurotunnel S.A. (Eurotunnel), a French public limited company listed in Paris and in London, operates and maintains the Channel Tunnel under a 99-year concession with France and Great Britain. Eurotunnel also operates and directly markets a Shuttle Service through the Tunnel. Eurotunnel's concession to maintain the tunnel requires it to pay dividends to its shareholders and repay loans that financed the tunnel construction. Eurotunnel is governed by its shareholder-elected, 11-member Board of Directors. Eurotunnel is self-sustaining, funded primarily through revenues from fees charged for Eurostar, freight service providers who use the tunnel, and Eurotunnel truck and passenger vehicle shuttle services.

DesertXpress

DesertXpress is an interstate high-speed rail project planned to provide non-stop service for the approximate 190 miles between Victorville, California and Las Vegas, Nevada. The project is proposed to be wholly constructed, owned, operated, and maintained by a private entity, DesertXpress Enterprises, LLC. DesertXpress was required to obtain environmental clearance under NEPA and obtain requisite approval and permits from the FRA, the Bureau of Land Management, Surface Transportation Board, Federal Highway Administration, and the National Park Service (NPS).The California Department of Transportation (Caltrans) and the Nevada DOT participated in reviewing the environmental documentation. Desert Xpress has applied for a $6 billion loan through the federal Railroad Rehabilitation & Improvement Financing Program.

Federally chartered corporations

Tennessee Valley Authority (TVA)

TVA is a government-owned corporation created by a congressional charter in May 1933 to plan, construct and operate navigation, flood control, and electricity generation infrastructure, and promote economic development in the Tennessee Valley, a region particularly affected by the Great Depression. Today, the TVA is the nation's largest public power company and provides electricity for 9 million people in parts of seven southeastern states (Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, Virginia) at prices below the national average.TVA is governed by a nine-member Board of Directors appointed by the President and subject to Senate confirmation. At its inception, TVA received direct congressional appropriations to fund its activities in navigation, flood control, and land management. Since 1999, TVA has funded all of its operations almost entirely from the sale of electricity.

Amtrak

The National Railroad Passenger Corporation (Amtrak) was created in 1971 as a for-profit corporate entity to respond to the sustained decline of private passenger rail in the U.S. from 1920 through 1971. Amtrak operates passenger service on 21,200 miles of track connecting 500 destinations in 46 contiguous U.S. states and three Canadian provinces, and has succeeded in branding US passenger rail service nationally, with specialized premium service brands in the Northeast corridor. While much of the trackage on which it operates is owned by private freight rail companies, Amtrak owns and maintains its own rail infrastructure in some corridors. Amtrak also serves as a contractor in various capacities for several commuter rail agencies. Amtrak is governed by a Board of Directors, appointed for five-year terms by the U.S. President and subject to Senate confirmation. Amtrak receives annual federal subsidies requested by the FRA through the annual USDOT budget request and directly by Amtrak through its federal grant and legislative request to Congress. In conjunction with operating revenues and funds from state and local governments, which are used to subsidize state-supported routes and contracted commuter rail services, Amtrak uses federal appropriations to cover its operating expenses and to maintain and improve capital assets.

United States Railway Association (1973-1987)

Congress created the United States Railway Association (USRA), a government-owned non-profit corporation in 1973, to reorganize the railroads in the Northeast and Midwest into an economically viable system. USRA was tasked with settling suits involving seven bankrupt rail carriers that were to be consolidated into the Consolidated Rail Corporation (Conrail). USRA also created the Final System Plan for Conrail that encompassed the consolidation of the seven bankrupt railroads. USRA was governed by a Board of Directors comprised of five members appointed by the President, and the federal government maintained oversight and involvement throughout USRA's existence. During the reorganization, USRA controlled the flow of federal rail appropriations, as well as USRA bond issues and loans. USRA received appropriations from the federal government to cover administrative expenses and operational activities. Revenues generated through operation were appropriated to Conrail and to implement the Final System Plan. Upon completion of USRA's objectives, the corporation was dismantled by Congress and all powers, duties, rights, and obligations transferred to the Secretary of Transportation on January 1, 1987.

Conrail (1973-1998)

Congress created Conrail in 1973, with amendments in 1976, to reorganize the railroads in the Northeast and Midwest into an economically viable system. The governance model of Conrail from 1976 to 1987 was that of a private corporation with heavy oversight from the federal government. In return for the federal subsidies that would be required, federal taxpayers acquired near complete ownership of the company. The original model gave the federal government an 85 percent stake in the company, with employees holding the remainder. Conrail's Board of Directors included 11 members selected by stockholders, in addition to the chief executive officer and the chief operating officer. In its early years the company received heavy federal subsidies to compensate the estates of the bankrupt rail operators, rehabilitate rail infrastructure that had deteriorated under the bankrupt operators, and cover operating losses during the rebuilding period. To increase the general economic viability of railroads, and to improve the long term prospects for Conrail, Congress passed legislation, including the 1976 4R Act, Staggers Rail Act of 1980 and the Northeast Rail Service Act of 1981 (NERSA), that relieved many of the constraints that precluded Conrail and its predecessor private operators from being profitable. Conrail subsequently became a profitable corporation, and in 1986, the Conrail Privatization Act was signed, authorizing a public stock offering to return Conrail to the private sector. In 1987 the federal government sold all of its shares, with an initial public offering of $1.6 billion. With the $300 million in funds that Conrail had already returned to the government, the sale generated nearly $1.9 billion. Subsequently, Norfolk Southern Corporation (NS) and CSX Transportation (CSX) jointly purchased Conrail in 1998 and restructured the corporation.

Federal-state commission

Appalachian Regional Commission

ARC is a regional economic development agency established by Congress as a partnership of federal, state, and local governments to address the poverty and economic and social distress of Appalachia, the primarily rural areas linked by the Appalachian Mountains, including all of West Virginia and parts Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, and Virginia. The largest ARC program is the planning and construction of the Appalachian Development Highway System (ADHS), a network of highways and access roads to generate economic development in previously isolated areas of Appalachia and to supplement the interstate system. The Commission itself is comprised of 14 members: the Governor of each of the 13 Appalachian states (one of whom is elected as a State Co-chairman by the governors for a term of at least one year) and one Federal Co-chairman, appointed by the President and subject to Senate confirmation. Funding for the ADHS is apportioned to states annually based on each state’s proportional share of the cost to complete the ADHS. States are required to contribute the requisite 20 percent local match, and highways require approval by ARC prior to the states receiving federal funds.

NEC Infrastructure and Operations Advisory Commission

Among its many other provisions, the Passenger Rail Investment and Improvement Act of 2008created the NEC Infrastructure and Operations Advisory Commission. The Commission consists of 18 representatives from the USDOT, Amtrak, the District of Columbia and the eight states served by Amtrak along the NEC spine. Another five states, four freight railroads, and one commuter agency are represented on the Commission as non-voting representatives.

The primary role of the Commission is to facilitate cooperation and planning among NEC stakeholders for intercity, passenger, and freight rail. The Commission has extensive responsibilities to set corridor-wide policy goals and recommendations that encompass passenger rail mobility, intermodal connections to highways and airports, energy consumption, air quality improvements, and local and regional economic development of the entire Northeast region. The Commission is required to create a statement of goals concerning the future of NEC rail infrastructure and operations; develop recommendations for the NEC for short-term and long-term capital investment needs; and develop and implement standardized formula for determining and allocating costs across states.

The Commission is still in its infancy and is in the process of internally organizing to begin working on these directives. In its early months, the Commission has provided a forum for state members, most of whom are state DOT directors or deputy directors, to understand the dynamics of the corridor so that states will able to adopt greater ownership over the corridor’s future.

Federal government project office

EPA Chesapeake Bay Program Office

EPA Chesapeake Bay Program Office (CBPO) was established by Congress in 1987 under the Clean Water Act. The CBPO is located in Annapolis, Maryland and serves as the staff of the Chesapeake Executive Council, a collaborative body established by an agreement between the partners of the Chesapeake Bay Program: the states of Maryland, Pennsylvania, and Virginia; the District of Columbia, the Chesapeake Bay Commission (a tri-state legislative body with representatives from Maryland, Virginia, and Pennsylvania), and the U.S. EPA. The CBPO is made up of approximately 120 staff members from various federal, state, non-profit, and academic entities (with Executive Leadership consisting of EPA members). The CBPO conducts the day-to-day operations of the Chesapeake Bay Program by implementing and coordinating science, research, modeling, support services, monitoring, data collections and other activities. It also administers EPA grants/cooperative agreements to state agencies, interstate agencies, other public and or non-profit agencies, institutions, organizations, and individuals to achieve the goals of the program. Since the early 1980s, the EPA has provided approximately $20 million in annual funding to the CBPO through an annual Congressional appropriation to support the partnership and its programs. Approximately $3 million of these funds go towards running the Office, including staff salaries and other administrative expenses.