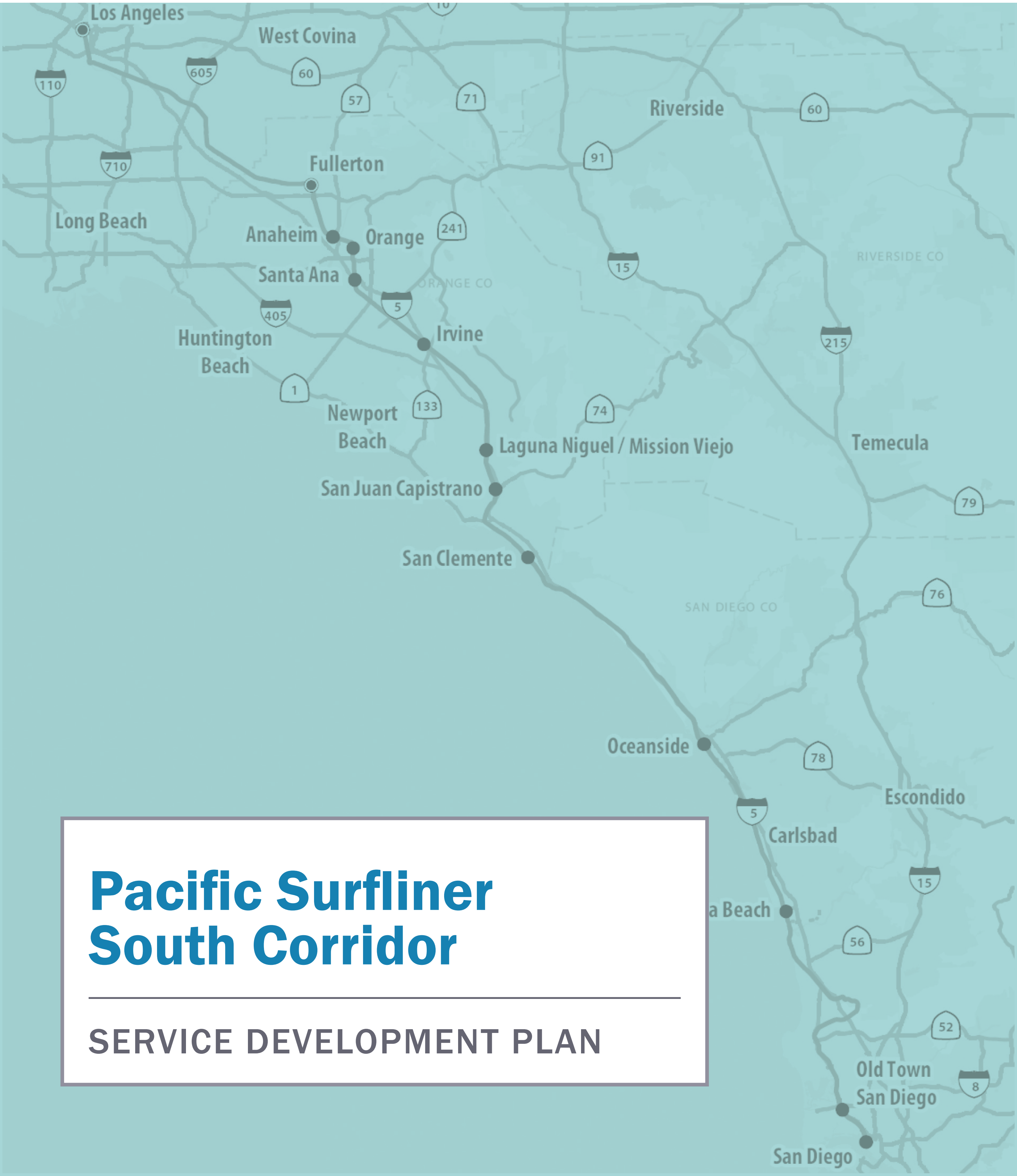
MAY 2013



Pacific Surfliner South Corridor

SERVICE DEVELOPMENT PLAN

FINAL SUBMITTAL

May 2013

SERVICE DEVELOPMENT PLAN

Pacific Surfliner South Corridor

Prepared for

California Department of Transportation

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List of Acronyms

ABS – Automatic Block System

ADA – Americans with Disabilities Act

Amtrak – National Railroad Passenger Corporation

Amtrak/Caltrans Model – Amtrak/California Intercity Passenger Rail Forecasting Model

ARB – Air Resources Board

ATLC – Active Transportation and Livable Communities

Authority – California High-Speed Rail Authority

BNSF – Burlington Northern Santa Fe Railway

BRT – Bus Rapid Transit

BT&H – State of California Business, Transportation and Housing Agency

Build Alternative – Build/Improved Passenger Services Alternative

CAD – computer-aided design

CALCOG – California Association of Councils of Governments

Caltrain – Peninsula Corridor Joint Powers Board

Caltrans – California Department of Transportation

CEC – California Energy Commission

CIB – California Interregional Blueprint

COFC – container-on-flat-car

COGs – Councils of Governments

Corridor – Pacific Surfliner South Corridor

CP – Control Point

CPUC – California Public Utilities Commission

CRCC – Coast Rail Coordinating Council

CSRP – California State Rail Plan

CTC – Centralized Traffic Control

CTI – commuter train interference

D.C. – District of Columbia

DOR – Division of Rail

EIR/EIS – Environmental Impact Report/Environmental Impact Statement

FAA – Federal Aviation Administration

FAF3 – Federal Highway Administration's Freight Analysis Framework

FAQ – frequently asked questions

FRA – Federal Railroad Administration

FTI – freight train interference

FY – fiscal year

GHG – greenhouse gas

GIS – Geographic Information Systems

GPS – Global Positioning System

HOV – high-occupancy vehicle

HEP – head-end power

HSIPR – High-Speed Intercity Passenger Rail

HSR – High-Speed Rail

HSR R&R Model – High-Speed Rail Ridership and Revenue Model

I-15 – Interstate 15

JPA – Joint Powers Authority

LA Metro – Los Angeles County Metropolitan Transportation Authority

LADOT – Los Angeles Department of Transportation

LAUS – Los Angeles Union Station

LAX – Los Angeles International Airport

LOSSAN – Los Angeles-San Diego-San Luis Obispo

LOSSAN North – Los Angeles–San Diego–San Luis Obispo Rail Corridor Agency – North Corridor

LOSSAN South – Los Angeles–San Diego–San Luis Obispo Rail Corridor Agency – South Corridor

LRTPs – long range transportation plans

MOW – maintenance-of-way

MP – Mile Post

MPO – metropolitan planning organization

NAAC – Native American Advisory Committee

NAICS – North American Industry Classification System

NCTD – North County Transit District

NGEC – Next Generation Equipment Committee

No-Build Alternative – No-Build/No-Action Alternative

NO_2 – Nitrogen Dioxide

NOI – Notice of Intent

NOP – Notice of Preparation

OCTA – Orange County Transportation Authority

O&M – operating and maintenance

OTP – on-time performance

PSRR – Pacific Sun Railroad

PIOs – Public Information Officers

PISOP – Public Involvement and Stakeholder Outreach Plan

PM_{10} – Respirable Particulate Matter

$PM_{2.5}$ – Fine Particulate Matter

PRIIA – Passenger Rail Investment and Improvement Act

PSDP – Preliminary Service Development Plan

PTC – Positive Train Control

PTI – passenger train interference

RCTC – Riverside County Transportation Commission

RCTF – Rural Counties Task Force

ROW – right-of-way

RTC – Rail Traffic Controller

RTE – routing

RTIPs – Regional Transportation Improvement Plans

RTPAs – Regional Transportation Planning Agencies

RTPs – Regional Transportation Plans

SANDAG – San Diego Association of Governments

SBCAG – Santa Barbara County Association of Governments

SBMTD – Santa Barbara Metropolitan Transit District

SCAG – Southern California Association of Governments

SCRRA – Southern California Regional Rail Authority

SCS – Sustainable Communities Strategies

SCTG – Standard Classification of Transported Goods

SDMTS – San Diego Metropolitan Transit System

SDP – Service Development Plan

SGC – Strategic Growth Council

SHA – State Highway Account

SJVRC – San Joaquin Valley Rail Committee

SPLC – Standard Point Location Code

SR – State Route

STB – Surface Transportation Board

STCC – Standard Transportation Commodity Code

STIP – Statewide Transportation Improvement Program

TAC – Technical Advisory Committee

TAZs – transportation analysis zones

TOD – Transit-Oriented Development

TOFC – trailer-on-flat-car

U.S. – United States

UPRR – Union Pacific Railroad

1.0 Introduction

The Service Development Plan (SDP) for the Pacific Surfliner South Corridor (Corridor) describes the corridor, identifies proposed service expansion and operational improvements, presents the rationale for such expanded and improved services, and identifies candidate rail infrastructure investments needed to support growth and deliver improved operations. The service expansion, operational and infrastructural improvements are consistent with the statewide vision and objectives established in the 2013 *California State Rail Plan (CSRP).* This SDP supports the vision of *a premier, customer-focused rail system that successfully moves people and products while enhancing economic growth and quality of life*.

1.1 Background

The Pacific Surfliner Corridor, which runs from San Luis Obispo to San Diego, is the second-most heavily traveled passenger rail corridor in the U.S., behind only the Boston-Washington D.C. Northeast Corridor. The 351-mile Pacific Surfliner Corridor carries approximately 2.8 million annual passengers on a variety of passenger rail services. The primary passenger markets are a mix of regional business travelers and intercity leisure travelers. A portion of the Pacific Surfliner South Corridor (Los Angeles – Anaheim) is also the future site of a proposed segment of the California High-Speed Rail (HSR).

The Pacific Surfliner Corridor consists of two segments, the northern segment (222 miles) runs from San Luis Obispo to Los Angeles, and the southern segment (129 miles) from Los Angeles to San Diego. This SDP will address the Los Angeles to San Diego portion, Pacific Surfliner South (refer to Exhibit 1.1).

Passenger rail services are operated on the Pacific Surfliner South Corridor by Amtrak and the Southern California Regional Rail Authority (Metrolink), and the North County Transit District (COASTER). Current services include:

- The *Pacific Surfliner* service between San Diego and Los Angeles is operated by Amtrak and jointly funded by Amtrak and Department of Transportation (Caltrans). Seventy percent of the service is funded by the State (Caltrans) and thirty percent of the service is funded by Amtrak, together they jointly administer the service. Starting in 2013-14 one hundred percent of the route will be funded and administered by the State;
- The *Southwest Chief* long distance service between Los Angeles and Chicago, running on the Los Angeles to Fullerton section of the Pacific Surfliner Corridor, is operated and funded by Amtrak;
- *Metrolink Orange County Line* commuter rail service between Los Angeles and Orange counties with connections to Oceanside in San Diego County; Metrolink service is operated by Amtrak and managed and funded by the SCRRA, a five-county joint powers authority;
- *Metrolink 91 Line* commuter rail service between Los Angeles and Riverside operates on the Los Angeles to Fullerton section of the Pacific Surfliner Corridor;
- *Metrolink Inland Empire-Orange County (IEOC) Line* commuter rail service connecting travelers from Riverside and San Bernardino counties to Orange County and Oceanside in San Diego County operates on the Orange to Oceanside section of the Pacific Surfliner South Corridor; and
- *NCTD's Coaster* commuter rail service between the cities of Oceanside and San Diego.

Exhibit 1.1: Pacific Surfliner South Corridor

There are three freight rail operators on the Pacific Surfliner South Corridor sharing tracks with passenger trains. The BNSF Railway (BNSF) serves freight customers between Los Angeles and San Diego, the Union Pacific Railroad (UPRR) serves freight customers between Fullerton and Irvine, and a short line railroad, the Pacific Sun Railroad (PSRR), serves local freight customers over an approximately 45-mile segment between the Stuart Mesa Rail Yard, near Oceanside, and San Onofre, near San Diego. The Pacific Surfliner South Corridor from Los Angeles to Fullerton is owned and operated by the BNSF Railway. In 2010, an estimated 32 daily BNSF freight trains operated on the BNSF San Bernardino Subdivision between Hobart Yard and Fullerton Junction[1].

A portion of the Pacific Surfliner South Corridor serves as one of the BNSF's primary freight rail segments (Redondo Junction to Fullerton), which is used to connect the Ports of Los Angeles and Long Beach and downtown Los Angeles rail yards to goods movement destinations throughout the western and central United States. Just east of Redondo Junction is BNSF's Hobart Yard, which handled over 966,000 cargo lifts in 2010, including about 400,000 marine containers from the ports. The remainder of the lifts constitutes transloaded containers that transfer international cargo from marine containers to domestic containers, domestic containers and trailers. All of this cargo uses the BNSF San Bernardino Subdivision, including the Hobart to Fullerton segment of the Pacific Surfliner South Corridor. In addition this segment is used by BNSF intermodal trains that are loaded at on-dock yards at the ports. Intermodal trains accounted for about 28 of the total 32 freight trains per day on this segment in 2010. The remainder trains were bulk and carload trains. These trains also use the segment of the San Bernardino Subdivision east of Fullerton and into Riverside County.

In the southern portion of the Pacific Surfliner Corridor, the tracks are owned by the Los Angeles County Metropolitan Transportation Authority (LA Metro), BNSF Railway, Orange County Transportation Authority (OCTA), the North County Transit District (NCTD), and the San Diego Metropolitan Transit System (SDMTS). Passenger service is operated by Amtrak, Metrolink, and NCTD's Coaster; freight service is provided by BNSF, UPRR, and Pacific Sun Railroad (PSRR). Preparation of the SDP will require coordination and review from these track owners and service operators, as well as the Federal Railroad Administration (FRA), Caltrans Division of Rail (DOR), SCRRA, Transportation Commission (RCTC), San Diego Association of Governments (SANDAG), and Southern California Association of Governments (SCAG).

Several segments of the Pacific Surfliner South Corridor are currently constrained by the lack of passing or second main tracks. In San Diego County, 46 percent of the Pacific Surfliner South Corridor is comprised of a single main line track. The segment of track between Hobart Yard and Fullerton Junction includes sections of both double and triple track and has the highest number of daily trains of any segment in the Pacific Surfliner Corridor.

The environmental conditions in the Pacific Surfliner South Corridor range from the highly urbanized areas in Los Angeles to suburban communities and highly sensitive environmental resources along the California coastline. The southern portion of the Pacific Surfliner South Corridor operates in highly sensitive coastline space, adjacent to restricted military reservations (Camp Pendleton) and agricultural land from the Orange-San Diego county line to the City of Oceanside, and through a coastal mountain canyon into downtown San Diego. Coastal bluffs along this segment are vulnerable to erosion from sea-level rise.

Passenger rail services through the Pacific Surfliner South Corridor are an integral element of plans to provide alternatives to reliance on private automobiles, to provide faster commuter service to key employment destinations, and to maintain linkages to other destinations in Southern California.

[1] Source: *Draft California State Rail Plan, in production.*

The Pacific Surfliner South Corridor has been the subject of numerous studies to understand, plan and develop passenger services in order to provide an attractive alternative to highway travel. The most recent study – the *LOSSAN Corridorwide Strategic Implementation Plan* – was completed in April 2012 by the Los Angeles – San Diego – San Luis Obispo (LOSSAN) Rail Corridor Agency. As a part of this plan, three scenarios were identified for ridership and service/operations modeling: No high speed rail service, high speed rail service on a blended system, and high speed rail on dedicated passenger track.

Development of the report's strategic recommendations was based on the following efforts:

- Evaluation of the policy and physical state of the Pacific Surfliner South Corridor;
- Assessment of operating conditions, including identification of capacity bottlenecks; and
- Identification of funded or programmed capital investments.

Passenger rail activity growth over the last 10 years has significantly impacted the Pacific Surfliner Corridor's physical capabilities as well as the line dispatchers' abilities to route traffic safely and efficiently. The following service policies and programs have been identified for improving system capacity and safety:

- **LAUS Run-Through Tracks Project** – Caltrans and the FRA have drafted a plan to create run through tracks that would extend four of the existing stub-end tracks and connecting them back to the mainline. This project would reduce trip times for the Pacific Surfliner and Metrolink trains to and from Orange and San Diego Counties, as well as increase the capacity of LAUS.

- **San Diego Double Track Improvement Projects** – SANDAG is constructing double track improvements in the 60-mile segment of the Pacific Surfliner South Corridor from Orange County to downtown San Diego. These improvements play a critical role in passenger and freight rail movements in San Diego County. Planned double track improvement projects include the San Dieguito, San Onofre, and Sorrento Valley double tracking.

- **BNSF Third Main Track and Grade Separation Project** – BNSF and Caltrans Division of Rail are currently designing and implementing a major improvement to a 14.7-mile section of the Pacific Surfliner South Corridor between Fullerton (Fullerton Junction) and Los Angeles (Redondo Junction). This section of the Pacific Surfliner South Corridor, which carries BNSF freight traffic heading to and from the Ports of Los Angeles and Long Beach as well as Amtrak and Metrolink passenger service, currently carries large volumes of rail traffic and is nearing its capacity. The project will complete a third main track for the entire section from Fullerton to Los Angeles, as well as grade separating or closing the remaining six at-grade road crossings in this stretch of the Pacific Surfliner South Corridor.

- **Positive Train Control** – The FRA mandated the installation of Positive Train Control (PTC) systems by December 2015 through passage of the Rail Safety Improvement Act of 2008. PTC is intended to keep trains under their maximum speed limit and within the limits of authorization to be on a specific track. In the Pacific Surfliner South Corridor, SCRRA and NCTD are the lead agencies for PTC design and implementation. These agencies will overlay a Global Positioning System (GPS)-based PTC technology on the existing wayside signal system. This system will be able to identify the positions of all trains on the line and automatically stop errant trains. Implementation of PTC could increase train speeds and track capacity without the associated capital investment in track improvements.

The SDP will represent a blueprint for meeting the transportation demand through the Pacific Surfliner South Corridor for the next twenty years by reducing travel times, increasing service reliability, and increasing the safety and accessibility of rail travel. Currently, intercity passenger service is heavily utilized with some over-capacity trains at peak times. Passenger demand is forecast to further increase over the next twenty years (See Chapter 4, Section 4.1.1 for more details), and minor service improvements are planned. Longer term plans include the introduction of HSR services on the segment of the Corridor between Los Angeles Union Station (LAUS) and Anaheim, and additional Metrolink services on the Orange County line.

1.1.1 Organization the Pacific Surfliner South SDP

As shown below, the SDP will include all chapters.

<u>Chapter</u>

1. Introduction
2. Purpose and Need
3. Rationale
4. Identification of Alternatives
5. Screening of Alternatives
6. Planning methodologies
7. Outreach Efforts
8. Ridership Demand and Revenue Forecast
9. Operations Modeling
10. Stations and Access Analysis
11. Conceptual Engineering and Capital Programming
12. Operating and Maintenance and Capital Replacement Forecast
13. Public Benefits and Impacts Analysis
14. Key Findings

1.2 Relationship of this SDP to Other Documents

1.2.1 SDP Support for State Rail Plan

The SDP includes planning analyses which will form the basis for the service concepts and improvements included in the California State Rail Plan. This SDP is prepared in coordination with, and is a subset of the CSRP. The Pacific Surfliner South Corridor SDP will be consistent with the SDPs for other State-supported rail services and will be consistent with planning by the California High Speed Rail Authority as documented in the *2012 Business Plan.*

1.2.2 Integration with other SDPs

The Pacific Surfliner South SDP will be coordinated with the SDPs for connecting corridors and services, including Pacific Surfliner North, and HSR. Integration and coordination of this planning effort with HSR is important as a portion of the Pacific Surfliner Corridor coincides with a proposed segment of the HSR program which will result in shared right-of-way between the Burbank LAUS and Anaheim. This planning effort will consider additional ridership from the connectivity between the Pacific Surfliner service and the HSR

1.2.3 Relationship to Corridor Environmental Analyses

In 2007, the State of California and FRA completed the LOSSAN Program Environmental Impact Report / Environmental Impact Statement (EIR/EIS) for the Pacific Surfliner South Corridor. This SDP is consistent with the purpose and need of that document, which called for additional rail improvements as a way to help meet the Southern California region’s transportation demands of today, as well as help to address the expected increase in intercity travel demand rising out of the growth in population over the next 20 years and beyond.

1.2.4 Relationship to the BNSF Third Main Track and Grade Separation Project

The most recent study – the *LOSSAN Corridorwide Strategic Implementation Plan* – identified BNSF third main track and grade separation project as in-progress. This project includes grade separation of six current at-grade crossings between Fullerton Junction and Redondo Junction. To date only two of the four crossings have been funded. Lacking funds to construct the remaining four grade separation the State has received permission to construct the third track through all but one the crossing of Rosecrans and Marquadt Avenues in the City of La Mirada. This SDP incorporates this updated information regarding the BNSF third main track and grade separation project.

2.0 Purpose and Need

This Purpose and Need Statement is intended to provide the basis for Pacific Surfliner South Corridor planning efforts, including the identification and evaluation of service development alternatives through the Alternatives Analysis (AA) process. The AA study effort will identify and evaluate the need for conventional rail improvements to help relieve the growing capacity and congestion constraints on intercity travel using existing air, highway and passenger rail infrastructure in the Corridor between Los Angeles and San Diego. It also will assess how incremental improvements would serve the purpose of improving the existing rail infrastructure, helping to relieve congestion and capacity constraints, while offering reliable, safe and time-efficient travel. The overall goal of the proposed improvements identified and evaluated in the AA effort will be to improve mobility and reliability in this part of the state's rail system by expanding service, decreasing trip times and improving rail infrastructure in a cost-effective and environmentally sensitive manner.

The Pacific Surfliner South Corridor refers to the 129-mile long corridor segment between LAUS and the City of San Diego's Santa Fe Depot, and operating through southern Los Angeles County, Orange County, and San Diego County as shown in Exhibit 2.1. The Pacific Surfliner service operates through a wide variety of physical settings from the flat, heavily-urbanized areas of Los Angeles and Orange Counties to a coastal alignment in southern Orange and northern San Diego counties. A majority of the northern portion of the Corridor runs through urban and suburban communities. The southern portion operates in highly-sensitive coastline space adjacent to military facilities in northern San Diego County, through sensitive coastal wetlands and developed communities, and through a coastal mountain canyon into downtown San Diego.

2.1 Purpose

The purpose of the proposed rail improvements to the Corridor is to enhance safety and develop a faster and more reliable passenger and freight rail system that provides added capacity in response to increased travel demand between Los Angeles and San Diego counties. The existing capacity of the Corridor's rail system is insufficient to meet future demand, and current and projected future rail system congestion will continue to result in slower travel speeds, increased travel times, and reduced reliability. Rail system improvements are required to address the following Corridor challenges:

- Increase in travel demand due to growing Corridor population and employment, as well as increased travelers connecting from the HSR.
- Constrained travel options due to the Corridor's physical setting.
- Constrained rail operations due to the condition of the existing rail system infrastructure.
- Need for improved travel time, reliability, and safety to serve projected rail passenger ridership and freight rail activity.
- Need to increase system capacity with minimal impacts to local communities, natural resources, and air quality.

Corridor rail system improvements would contribute to the viability of the Pacific Surfliner South Corridor, support operations of the future California High-Speed Rail (CHSR) system, and provide connectivity with local transit systems.

Exhibit 2.1: Pacific Surfliner South Corridor and Counties

The purpose of the Corridor planning efforts is to identify and evaluate possible rail improvements to relieve the growing capacity and congestion constraints on intercity travel using the Corridor's rail infrastructure operating near or at its design capacity. The project purpose for improved intercity rail improvements has been established and documented in Metropolitan Planning Organization's (MPOs) Regional Transportation Plans (RTPs), county transportation commission-developed Long Range Transportation Plans (LRTPs), the LOSSAN South PEIR/EIS (2007), the adopted *California State Rail Plan (2008)*, the *Pacific Surfliner Corridor Los Angeles to San Diego Service Development Plan (2010)*, and *LOSSAN Long-Term 2030 Operational Analysis (2011), and the LOSSAN Corridorwide Strategic Implementation Plan (2012)* . The Corridor improvements are required to: address the forecasted growth in population, employment, and resulting travel demand; improve the rail infrastructure to accommodate the projected increase in rail passenger ridership and freight rail activity; and provide additional capacity while minimizing impacts to communities, natural resources, and air quality in the Corridor.

Increase in Travel Demand

Between 2011 and 2040, the Pacific Surfliner South Corridor is projected to experience a 35.8 percent increase in population to a total of 22.1 million residents, along with a 30.3 percent increase in employment with a resulting total of 8.3 million jobs. The capacity of the Corridor's intercity transportation system is insufficient to meet future demand. Congestion of the system will continue to result in deteriorating air quality, reduced reliability, and increased travel times. The interstate highway system, commercial airports, and conventional passenger rail system serving the intercity travel market will require large public investments for expansion and maintenance in order to accommodate future growth over the next 20 years and beyond. The need for improvements to the Corridor relates to the following key issues:

- Passenger travel demand for trips between Los Angeles, Orange and San Diego Counties will continue to increase.
- If left unaddressed, rail capacity constraints will result in increased congestion and travel delays.
- The number of accidents on intercity highways may increase, and there is potential for more accidents at at-grade railroad crossings.
- Reduced reliability of travel stemming from congestion and delays, accidents and other factors will affect the quality of life and economic well-being of residents, businesses, and tourism in Southern California.

Protection of Communities, Natural Resources, and Air Quality

The Clean Air Act (CAA) makes "transportation conformity" the responsibility of the U.S. Department of Transportation and regional MPOs. Transportation conformity addresses air quality attainment and maintenance strategies contained in the State Implementation Plan (SIP), which are used to evaluate transportation alternatives, including the No Build alternative. Under both federal and State standards Los Angeles, Orange, and San Diego Counties are designated as "Ozone Non-Attainment Areas" where conformity requirements apply. The region must also reduce greenhouse gas (GHG) emissions, in response to Assembly Bill 32, the Global Warming Solutions Act.

Meeting federal and state air quality standards over the next 20 to 40 years will likely require reductions in the total distance traveled by vehicles. This can be accomplished by: integrating land use and transportation planning and development; implementing operational improvements; developing transportation demand strategies; using new technologies that improve transportation efficiencies: and providing an alternative to the single-occupant automobile. Moving passengers by rail produces significantly less pollution (including GHG) per passenger mile traveled compared to typical automobile use and would aid in reducing emissions throughout the region. The proposed Corridor rail improvements would help implement this strategy.

Implementing Corridor transportation system capacity improvements are required to accommodate the forecasted travel demand growth. This is especially true in the environmentally-sensitive setting of the coastal portion of the Corridor with its operational location adjacent to Pacific Ocean beaches, along ocean cliffs, and through undeveloped coastal canyons. In addition, the Corridor operates through the residential and downtown commercial areas of the cities and communities that it serves. Expanded highway construction, and increased motor vehicle use and congestion may lead to greater pressure on coastal natural resource and negatively impact the quality of life in coastal communities. Rail capacity improvements would minimize these impacts by taking advantage of existing rail right-of-way.

2.2 Need

The need for rail improvements to the Corridor was established based on: future Corridor population and employment growth, and a corresponding increase in travel demand; limited travel options; constrained existing rail system infrastructure; and the need for improved travel times, reliability, and safety.

2.2.1 Corridor Transportation Market Challenges

Corridor Population Growth

The Corridor's population is projected to increase by 35.8 percent with more than 5.8 million new residents for a total of 22.1 million residents by 2040 as shown in Table 2.1.

Table 2.1: Pacific Surfliner South Corridor Population Density Forecasts for 2011-2040

	2011	2015	2020	2025	2030	2035	2040
Population (Thousands)	16,273	16,989	18,000	19,020	19,998	21,026	22,096
Population Density (Pop/Sq. Mi.)	1,798	1,877	1,989	2,102	2,210	2,323	2,442

Source: Moody's Economy.com, 2011.

Along with the forecasted population growth, the Corridor's population density will increase by 35.8 percent between 2011 and 2040 from 1,798 residents per square mile to 2,442. It should be noted that the average population density reflects the Corridor-wide average, not the urbanized average. The urbanized Corridor population density, which would indicate strong support for passenger rail system usage, will in fact be much higher due to the significant level of rugged topography and protected coastal areas in all four Corridor counties.

The distribution of new Corridor residents is projected to be as follows, with a majority of the growth projected to occur in Los Angeles County as presented in Table 2.2:

- Los Angeles County – 3.3 million new residents, or 56 percent of the Corridor's future population;
- Orange County – 1.1 million new residents (19 percent); and
- San Diego County – 1.5 million new residents (25 percent).

Table 2.2: Pacific Surfliner South Corridor Population Forecasts by County (2011 to 2040)

County	2011	2040	Percent Growth
Los Angeles	10,048,450	13,317,360	32.5%
Orange	3,101,101	4,160,218	34.2%
San Diego	3,123,356	4,618,560	47.9%
Corridor Total	*16,272,907*	*22,096,138*	*35.8%*

Source: Moody's Economy.com, 2011.

While a majority of the future total population growth will occur in the Los Angeles County portion of the Corridor, San Diego County is projected to experience the highest percentage growth in population.

Corridor Employment Growth

Over the next 30 years, employment in the Corridor is expected to grow by 1.9 million jobs (30.3 percent) to a total of 8.3 million jobs as shown in Table 2.3. The distribution of new jobs is projected to be as follows with a majority of the employment growth occurring in Los Angeles County:

- Los Angeles County – 1.1 million new jobs, or 57 percent of the Corridor's future employment;
- Orange – 411,400 new jobs (21 percent).
- San Diego – 415,900 new jobs (21 percent);

Table 2.3: Pacific Surfliner South Corridor Employment Forecasts for 2011-2040

	2011	2015	2020	2025	2030	2035	2040
Employment (Thousands)	6,421	6,984	7,225	7,469	7,738	8,048	8,364

Source: Moody's Economy.com, 2011.

A majority of the Corridor's future total employment growth will occur in Los Angeles County as shown in Table 2.4.

Table 2.4: Pacific Surfliner South Corridor Employment Forecast by County (2011 to 2040)

County	2011	2040	Percent Change
Los Angeles	3,808,200	4,924,370	29.3%
Orange	1,368,994	1,780,376	30.0%
San Diego	1,243,455	1,659,369	33.4%
Corridor Total	6,420,649	8,364,115	30.3%

Source: Moody's Economy.com, 2011.

2.2.2 Corridor Transportation Market Opportunities

Cities served by the Pacific Surfliner South Corridor include Los Angeles, Fullerton, Anaheim, Santa Ana, Irvine, San Juan Capistrano, San Clemente, Oceanside, Solana Beach, and San Diego. Key land uses in the Corridor include employment centers, civic centers, public and private colleges, cultural and entertainment venues, agricultural sites, parks, and recreational resources. The Corridor's destinations and activity centers result in a diverse set of local and regional travel markets:

- Commuters traveling to employment centers located in downtown Los Angeles, Fullerton, Anaheim, Santa Ana, Irvine, and San Diego. Other key employment destinations include Camp Pendleton located near Oceanside, and Coronado Naval Base located near downtown San Diego.
- Agricultural workers traveling to and from work, and delivery trucks taking products to shipping locations.
- Students, teachers, and employees traveling to and from public and private educational institutions, such as the California State University at Fullerton, the University of California at Irvine, the University of California at San Diego, San Diego State University, and many specialized, regional, and local schools.
- Visitors traveling to the Corridor's many tourist destinations including: main street shopping and entertainment areas: in Fullerton and San Juan Capistrano; art and history museums, theaters, and special event generators such as the Angels Stadium and the Del Mar Racetrack; historic locations such as Old Town San Diego and several California missions.
- Residents and visitors traveling to the many state, regional, and local recreational facilities, including beaches.

Corridor Rail System Trip Purpose

Table 2.5 shows a comparison of the Corridor trip purpose from 2000 to 2030 with only minor changes projected to occur. In 2000, 70 percent of trips along the Corridor were made for recreational or other purposes, while 30 percent were business or commute trips. By 2030, the share of business trips is projected to increase to 31 percent reflecting more intercity commute trips, and a corresponding minor decrease in recreation and other travel. While this trip breakdown is similar to the Pacific Surfliner North Corridor, the percentage of recreation/other trips is well above statewide levels, reflecting the high number of tourist destinations located within the entire Pacific Surfliner Corridor.

Table 2.5: Existing and Forecast Pacific Surfliner South Trip Purpose (2000 to 2030)

Trip Purpose	Pacific Surfliner North		Pacific Surfliner South		Statewide(1)	
	2000	2030	2000	2030	2000	2030
Business/Commute	30%	32%	30%	31%	55%	55%
Recreation/Other	70%	68%	70%	69%	45%	45%

Notes:
The Amtrak/Caltrans Model's existing 22 state analysis zones were used as the basis for the Statewide travel data.

2.2.3 Current and Forecasted Demand

Table 2.6 presents a summary of the annual county-to-county two-way person trips for 2000 and the travel projected for 2030 and 2040 along the Pacific Surfliner South Corridor. Note that these trip tables selected a subcounty area in Los Angeles County and two subcounty areas in San Diego County in the Pacific Surfliner South Corridor – Los Angeles (South County), San Diego (North Coast) and San Diego (City).

Table 2.6: Current and Projected Pacific Surfliner South Annual Two-Way Person Trips (Millions)

Corridor County	Los Angeles (South County)	Orange	Total
2000			
Orange	690.0	--	**690.0**
San Diego (North Coast)	14.6	8.9	**23.5**
San Diego (City)	14.6	13.5	**28.1**
Total	*719.2*	*22.4*	*741.6*
2030			
Orange	707.3	--	**707.3**
San Diego (North Coast)	18.3	11.6	**29.9**
San Diego (City)	22.3	16.4	**38.7**
Total	*747.9*	*28*	*775.9*
2040			
Orange	713.1	--	**713.1**
San Diego (North Coast)	19.5	12.5	**32.0**
San Diego (City)	24.8	17.3	**42.1**
Total	*757.4*	*29.8*	*787.2*

Source: *California State Rail Plan Travel Market Analysis*, March 19, 2012.

Between 2000 and 2040, the results show a forecasted increase of 45.6 million annual trips (6.3 percent) in the Corridor. This growth is directly related to the increase of 23.1 million more annual trips (3.3 percent) between Orange County and Los Angeles (South County).

The following changes will occur between 2000 and 2040 in the county-to-county travel pairs:

- **Los Angeles (South County) to Orange County** – 23.1 million additional annual trips;
- **Los Angeles (South County) to San Diego (City)** – 10.2 million additional annual trips;
- **Los Angeles (South County) to San Diego (North Coast)** – 4.9 million additional annual trips;
- **Orange County to San Diego (City)** – 3.8 million additional annual trips;
- **Orange County to San Diego (North Coast)** – 3 million additional annual trips.

Table 2.7 presents the annual two-way person trips (all modes) in millions for 2000 and 2030 for the "extended" Pacific Surfliner South Corridor – those counties directly connected to the Corridor via Amtrak and Metrolink service – and the number of trips between the identified counties. The information below lists the top four counties that each Corridor county has existing and future travel connections with; the travel patterns show similar travel patterns for 2000 and 2030. The following summarizes the key connections for each Corridor county in 2030:

Table 2.7: Current and Projected Pacific Surfliner South Corridor Annual Two-Way Person Trips (All Modes)

Corridor County	**Top County Connections** (2000)	**Annual Trips** (Millions)	**Top County Connections** (2030)	**Annual Trips** (Millions)
Los Angeles (South County)	San Bernardino*	250.3	San Bernardino*	344.3
	Ventura *	181.8	Los Angeles (North)*	186.7
	Los Angeles (North)*	138.3	Ventura *	170
	Riverside (West)*	99.8	Riverside (West)*	146.6
Orange	Riverside (West)	98.4	Riverside (West)	125.3
	San Bernardino	92.8	San Bernardino	103.5
	Los Angeles(North)	5.0	Los Angeles(North)	7.5
	Ventura	4.6	Ventura	3.8
San Diego (North Coast)	San Bernardino	3.5	San Bernardino	4.6
	Riverside (West)	2.1	Riverside (West)	4.0
	Ventura	0.9	Ventura	1.5
	Los Angeles(North)	0.6	Los Angeles(North)	1.5
San Diego (City)	Riverside (West)	4.3	Riverside (West)	6.6
	San Bernardino	3.1	San Bernardino	5.2
	Ventura	1.0	Los Angeles(North)	1.7
	Los Angeles(North)	0.7	Ventura	1.6

- **Los Angeles (South County)** – has strong connections to San Bernardino County (344.3 million) and Los Angeles (North County) (186.7 million);
- **Orange** – has the strong travel connections to Riverside (West County) (125.3 million) and San Bernardino County (103.5 million);
- **San Diego (North Coast)** – has strong travel connections north to San Bernardino County (4.6 million) and Riverside (West County) (4.0 million); and
- **San Diego (City)** – has strong travel connections north to Riverside (West County) (6.6 million) and San Bernardino County (5.2 million).

Source: *California State Rail Plan Travel Market Analysis*, March 19, 2012.
*Trips from northern counties to Los Angeles (South County) are not able to directly connect to the Pacific Surfliner South Corridor since there is only one stop in this subcounty (Union Station) and passengers must travel at least one segment by rail in order to transfer from a dedicated bus. Thus, any traveler from these counties would necessarily be traveling to a more southerly destination.

2.2.4 Corridor Capacity Constraints

As discussed in section 2.2.3, between 2011 and 2040, the Pacific Surfliner South Corridor is projected to experience a 35.8 percent increase in population, and a 30.3 percent increase in employment. Travel activity between Los Angeles County (South County) and San Diego County (City) is projected to have the largest increase with a 69.8 percent trip growth translating to 10.2 million additional annual trips. While a majority of the future Pacific Surfliner South Corridor travel demand is still anticipated to be met by automobile travel, an increasing portion of the projected trip growth will be accommodated on Pacific Surfliner service as well as Metrolink service.

Constrained Travel Options

The three counties of the Corridor are served by a transportation system that includes air, highway, and rail services. The existing travel options are constrained by the Corridor's physical setting and limited opportunities for highway and air connections. South of Orange County, the Corridor operates in a narrow coastal plain with sensitive wetlands, developed urban and suburban communities. In this area, the Corridor is served by a single major highway – I-5. Current travel demand generated by residents and the area's growing tourism activities results in frequent Corridor highway congestion and travel delays. The resulting highway congestion has a negative impact on the Corridor's economy and efficiency and quality of life for residents. Due to the topographic setting and the urban development patterns along this segment of the Corridor, there is limited physical space available for expansion of the existing highway system or the construction of new highway alternatives.

Air travel access is available from San Diego Lindbergh Field at the southern end of the corridor and connection to the future CHSR system will be located in LAUS, Fullerton, Anaheim, and San Diego. Improved rail connection to air travel access and the future CHSR system could serve as an alternative to the congested highways in the Corridor. Rail system improvements are important to accommodating future travel growth in this constrained Corridor.

Constrained Rail System Infrastructure

Improvement and expansion of the Corridor's intercity rail system has not kept pace with the travel demand resulting from existing increases in population, employment, and travel demand. The rail system infrastructure serving the Corridor's intercity travel market is currently operating at or beyond its design capacity, and requires major improvements to meet existing demand and projected growth over the next 30 years. In San Diego County, 46 percent of the Corridor has single-track operations, and sidings are inadequate and infrequent. Without improvement, the existing Corridor rail capacity and operating constraints will result in increasing rail congestion and travel delays.

Need for Improved Travel Times, Reliability, and Safety

Among the critical factors that impact the public's choice of transportation are travel time, reliability, and safety. Travel time and reliability are critical for all travelers, but particularly for work and business-related trips which require a more time-certain arrival. As highway congestion intensifies, travel delays increase and travel reliability worsens, non-automobile modes such as rail become more attractive options for travel. The Corridor's highway system currently experiences significant congestion during peak periods and has limited opportunities for expansion. With the projected annual trip growth, automobile travelers will experience increasing highway congestion and resulting travel delays. Corridor rail travel has the potential to serve future travel demand with faster and more reliable service if system improvements are made. Currently, the Corridor intercity and commuter rail travelers experience frequent delays and reduced reliability due to single-track operations, limited sidings and outdated communication systems.

The Corridor is also experiencing an increase in roadway congestion, particularly in travel chokepoints on the I-5 freeway. With more and more vehicles on the roadways and more frequent and faster trains, the potential for train/automobile collisions increase. The proposed rail improvements will address this need by reducing or eliminating the hazards of highway-rail crossings, as well as providing new or upgraded pedestrian crossings along the Corridor.

2.3 Scope and Objective of the Plan

2.3.1 Scope

The Corridor faces significant mobility challenges as continued growth in population, employment, and tourism activity is projected to generate increased travel demand straining the existing transportation network. Development of an effective rail system is necessary to meet the future mobility needs of residents, businesses, and visitors. The Corridor faces future transportation challenges as evidenced by the following:

- **Increasing Travel Demand** – By 2040, the Corridor's population is projected to grow by approximately 36 percent and employment by 30 percent with a corresponding increase in travel demand. While a majority of the future population (56 percent) and job (57 percent) growth will occur in the Los Angeles County portion of the Corridor, the forecasted growth represents a significant increase for the two less populated counties. For example, San Diego County will experience a 48 percent increase in population. Trips between Los Angeles, Orange, and San Diego counties will increase, with the highest absolute growth in travel occurring between Los Angeles (South County) and Orange County, and the highest percentage growth in travel occurring between Los Angeles (South County) and San Diego (City).
- **Constrained Travel Options** – While the Corridor is served by a transportation system that includes air, highway, and rail services, system capacity is insufficient to meet the future travel demands. South of Orange County, the Corridor is served by a single major highway – I-5 – which experiences frequent congestion and travel delays. Due to the Corridor's physical setting, there is limited space for the expansion of the highway system or the construction of new highway alternatives. While the Corridor has three passenger rail services providing intercity and business travel options, trains are frequently at-capacity during peak periods and system riders experience frequent travel delays due to rail infrastructure constraints.
- **Significant Highway Congestion** – Current travel demand generated by residents and visitors results in frequent highway congestion and travel delays, particularly at urban chokepoints along

I- 5. With the projected population and employment growth, a majority of the future travel demand is anticipated to be met by automobile travel, which will result in increased highway congestion. There is limited space and funding available for highway system improvements. As highway congestion intensifies, travel delays will increase and reliability decline. Rail travel could become an increasingly attractive option for personal, business, and goods-movement trips. The *2012 LOSSAN Corridorwide Strategic Implementation Plan* projects a doubling of corridor rail ridership between 2011 and 2030.

- **Constrained Rail System Capacity** – Corridor rail service could accommodate an increasing portion of the projected travel demand growth, but operational capacity is constrained by a track system that is undersized for the rail volumes it currently accommodates much less any future service increases. Many segments of the Corridor have single-track operations, and sidings are limited in number and length causing trains to stack at either end of the single-track section, resulting in delays and reducing the attractiveness of rail as a travel mode choice. The Corridor's rail system is currently operating beyond its design capacity and major infrastructure improvements are required to provide a more reliable, safe, competitive, and attractive intercity travel option.
- **Need for Increased Travel Capacity Without Impacting Air Quality, Communities, and Natural Resources** – Growing Corridor travel demand will require transportation system capacity and operating improvements, which could have negative impacts on regional and local air quality, local communities, and natural resources. Improvements in the Pacific Surfliner South Corridor are particularly sensitive in these impact areas. The Los Angeles, Orange, and San Diego counties are identified as either nonattainment or maintenance for carbon monoxide, ozone, particulate matter (PM10 and PM2.5), and nitrogen dioxide pollution under the 1990 Clean Air Act Amendments. Rail activity in the Corridor passes through residential neighborhoods and the commercial centers of many communities, and operates in the environmentally sensitive setting of the coastal portion of the Corridor. Meeting federal and state air quality standards over the next 20 to 40 years will likely require reductions in the total distance traveled by vehicles. Rail system capacity could be increased with air quality benefits (including GHG emissions) and minimal impacts to local communities and natural resources.

Expansion of the Pacific Surfliner South Corridor's intercity rail system has not kept pace with the significant increase in population, employment, travel, and tourism, and will require improvements to meet existing demand and future growth. These proposed Corridor rail infrastructure projects would provide for a reliable, safe, and attractive intercity travel option. Rail system improvements would provide additional capacity that would relieve some of the projected near-term and long-term demand on the highway system, potentially slowing the need to further expand highways and airports, or reduce the scale of those expansions, reducing their associated cost, community, and environmental impacts. The Corridor rail improvements would augment the highway system, thereby creating an interconnected, multimodal solution, allowing for better mobility throughout the Corridor. In addition, Corridor rail improvements would contribute to the viability of the entire Pacific Surfliner Corridor, support the successful implementation of the planned CHSR system, and provide connectivity with local transit systems.

2.3.2 Objectives

In the current *California State Rail Plan (2008)*, Caltrans has described the overall objectives and policies for intercity rail improvements as:

- Increase the cost-effectiveness of State-supported intercity passenger rail systems;
- Increase capacity on existing routes;
- Reduce running times to attract additional riders and to provide a more attractive service; and
- Improve the safety of State-supported intercity rail service.

The Corridor-specific objectives for this Service Development Plan (SDP) include:

- Develop a plan for the continued improvement of the southern segment of the Pacific Surfliner Corridor that complements and incorporates the recommendations of the SDP developed for the northern segment of the Pacific Surfliner Corridor;
- Clearly demonstrate the purpose and need for new or improved passenger rail service (i.e. improved on-time performance) ;
- Analyze alternatives for providing the new or improved service, and identify the alternative that best addresses the purpose and need;
- Demonstrate the financial and operational feasibility of the selected alternative, including identification of operational improvements (i.e. common ticketing and transfer structure) required to support new or improved service; and
- Describe how implementation of the selected alternative may be divided into discrete phases.

Within a multi-modal strategy, improving rail service in this Corridor would provide the following benefits:

- Address increasing travel needs;
- Alleviate demand on constrained highway system;
- Reduce travel times;
- Increase reliability and safety;
- Increase travel capacity with minimal impacts to the Corridor's communities and natural resources; and
- Provide potential benefits to air quality.

3.0 Rationale

The Pacific Surfliner Corridor is the second busiest intercity passenger rail corridor in the nation with a level of activity and ridership second only to that of the Northeast corridor. The Pacific Surfliner South portion of the Corridor provides intercity services for cities between San Diego and Los Angeles.

Improvements in the Corridor are required to develop a faster and more reliable passenger and freight rail system that enhances safety and provides added capacity in response to increasing travel demand due to Corridor population and employment growth. The existing rail system is experiencing increasing congestion constraints due to infrastructure that is operating near or at its design capacity. Corridor rail system improvements would provide the following benefits:

- Provide additional capacity to serve Corridor growth in a cost-effective manner with minimal impacts to local communities, natural resources, air quality and greenhouse gas emissions;
- Increase use of intercity passenger rail service as part of a multi-modal strategy identified in regional and county goals and plans; and
- Improve rail operations by reducing travel times and increasing reliability and safety.

Corridor rail system improvements would benefit other passenger transportation systems that interface with the Pacific Surfliner South Corridor. They would:

- *Support Pacific Surfliner North Corridor operations* – Many trips occur on both portions of the Pacific Surfliner Corridor, and improvements in the southern portion will ensure the successful utilization of both segments. Improvements in the Pacific Surfliner South Corridor would complement and support the improvements identified for the northern portion of the Corridor, which is experiencing similar travel demand growth and congestion and capacity constraints;
- *Support operations of the future California High Speed Rail (HSR) system* – Amtrak, Metrolink, and Coaster will provide important rail feeder services to the HSR system, connecting passengers from points in Los Angeles, Orange, and San Diego counties to HSR at LAUS, Anaheim, and San Diego; and,
- *Provide connectivity with local transit systems* – Corridor improvements would provide for a stronger interface with transit services operating to and from the Corridor's passenger rail stations. Corridor stations include the following: LAUS, Fullerton, Anaheim, Santa Ana, Irvine,, San Juan Capistrano, San Clemente, Oceanside, Solana Beach, San Diego – Old Town, and San Diego.

It should be noted that investments needed to expand passenger service and improve passenger service performance objectives in many cases will also benefit goods movement in the State. For example, improvements in the Pacific Surfliner South Corridor will benefit freight rail mobility by enhancing the capacity and reliability of the route as an alternative to the principal north-south freight corridors located in the Central Valley.

3.1 Capacity Benefits

Corridor rail service could serve an increasing portion of the Corridor's projected travel demand growth, but the operational capacity is constrained by a system that is inadequate for the rail volumes it currently serves. Corridor improvements would provide additional capacity, allowing more frequent service targeting Corridor growth in a cost-effective manner with minimal impacts to local communities, natural resources, and air quality.

Improvements identified for this SDP's Build/Improved Passenger Service Alternative would improve the cost-effectiveness of intercity passenger rail service by reducing travel time, increasing service frequency, improving on-time performance, enhancing safety, and increasing the maximum authorized speed for both passenger and freight trains. For example, improvements such as integrated fare collection along the Corridor would facilitate convenient, common ticketing between member agencies and associated transportation systems. The improvements have independent utility, are not dependent on the completion of other Corridor programs to be successful, and provide measurable benefits to intercity rail service.

Providing additional highway system capacity could have negative impacts on regional and local air quality, local communities, and natural resources. In the Pacific Surfliner South Corridor, Los Angeles, Orange, and San Diego counties are identified as either nonattainment or maintenance for carbon monoxide, ozone, particulate matter (PM10 and PM2.5), and nitrogen dioxide pollution under the 1990 Clean Air Act Amendments. Regional governments along the Corridor envision strategies that would allow the region to meet federal and state air quality standards over the next 20 to 40 years. . The South Coast Air Quality Management District's *2012 Air Quality Management Plan*[2] outlines transportation control measures designed to reduce vehicle miles travelled as included in SCAG's 2012 Regional Transportation Plan. Similarly, SANDAG's 2050 RTP outlines transportation control measures designed to reduced vehicle miles travelled. These strategies include high occupancy vehicle measures, transit and systems management measures, and information-based transportation strategies. The Corridor passes through residential neighborhoods and the commercial centers of many communities, and operates through environmentally sensitive coastal settings. Rail system capacity could be increased within existing rights-of-way with air quality benefits and minimal impacts to local communities and natural resources (See Chapter 5, Section 5.4 for more details).

3.2 Multi-Modal System Benefits

Increased intercity passenger rail service is a key component of multi-modal strategies identified in the Corridor's regional and county goals and plans. While the Corridor is served by a transportation system that includes air, highway, and rail services, existing system capacity is insufficient to meet the future travel demands. A single major highway, Interstate 5, serves the entire length of the Corridor and varies from six to twelve lanes. Due to the Corridor's constrained and environmentally sensitive physical setting, there is limited space for expansion of the highway system, and construction of new highway alternatives is less feasible. Regional and county multi-modal transportation plans have been developed in recognition of future growth and the Corridor's physical constraints and have adopted the rail mode as a key element.[3] Improved intercity rail service plans in the Corridor would support regional and county goals and plans related to growth, smart growth, economic development, air quality and greenhouse gas emissions, sustainability, and provision of a balanced transportation system. Improving passenger rail service would enhance rail travel as an increasingly viable and attractive option for personal and business trips, and would reduce pressure to expand the Corridor's highway system.

3.3 Operational Benefits

Improvements to the Corridor's intercity rail system have not kept pace with the growth in travel demand, and the rail system infrastructure is currently operating at or near its design capacity with travel time, reliability, and safety impacts for passenger service. The *2012 LOSSAN Corridorwide Strategic Implementation Plan* have predicted a more than doubling of yearly rail ridership in the entire Corridor from nearly 7 million in 2011 to 15.1 million in 2030 under the preferred operations plan. Freight service is

[2] South Coast Air Quality Management District *Revised Draft 2012 Air Quality Management District (September 2012)*

[3] e.g., San Diego Association of Governments *2050 Regional Transportation Plan (October 2011).*

also predicted to increase, especially in the LAUS to Fullerton segment of the Corridor (See Chapter 4, Section 4.1.1 for more details). Recent (2011) operational reliability generally ranged between 60 percent and 80 percent on-time performance (OTP) which is well below the goal of 90 percent. Improvements to the Corridor's rail system infrastructure, such as double or multi-tracking, improved signaling and critical sidings, would increase operational reliability and safety in the Pacific Surfliner South Corridor. Attracting more customers to both intercity and commuter rail through improved performance will offer a key mobility choice. Signalization and track improvements will improve the mixed passenger-freight operations in the Corridor and will allow for more freight services.

As presented in Chapter 8, the operations simulation modeling shows that the proposed capital program would produce capacity and operational benefits, including reductions in train travel times, improved on-time performance, speed increases, and the additional capacity required to increase train frequencies.

3.4 Safety Benefits

Improvements identified in the SDP's Build Alternative would improve safety for users of the Corridor and the surrounding communities. The Federal Railroad Administration (FRA) identified the Corridor as a priority area for Positive Train Control (PTC) implementation because of the numerous rail users. The primary and immediate benefit of implementing PTC along the Pacific Surfliner Corridor is safety. The collision-avoidance properties of PTC will only make the Pacific Surfliner Corridor a safer service for its passengers, employees, and surrounding communities. .

Other rail improvements identified in the Build Alternative will provide public safety benefits to intercity passenger rail, freight operations and commuter rail operations in the Corridor. Proposed projects in this alternative that will enhance safety include:

- New double track segments; powered switches at key locations;
- Bridge and turnout replacements;
- Sealed corridor projects that include additional protection at-grade crossings and barriers to vehicle incursions in the rail right-of-way; life cycle replacement of worn track components;
- Installation of fiber optics to improve speed and reliability of train communications; and
- Re-spacing of wayside signal components.

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4.0 Identification of Alternatives

This chapter describes the alternatives evaluated in this study effort: 1) the No Build Alternative, which provides a baseline discussion of the continued operation of the current Corridor system with only improvements that are already funded or under construction, and 2), and the Build Alternative which provides a set of improvement projects for the Pacific Surfliner South Corridor to accommodate increased passenger service levels. Consistent with the corridor-level planning and analysis of a Preliminary Service Development Plan (PSDP), which is intended to define the broad differences between the No Build and Build alternatives, the level of detail for any of the proposed improvement projects is conceptual in nature. Subsequent project-specific engineering and environmental analysis would be performed to provide more detailed information on implementation costs and environmental impacts for individual projects included in the Build Alternative as described in the Service Development Plan (SDP).

4.1 Previous Corridor Planning Studies

Starting with the Amtrak-sponsored California Passenger Rail System 20-Year Improvement Plan (Amtrak 20-Year Plan) completed in March 2001, a wide range of planning and feasibility studies have been prepared and proposed improvements identified for the Pacific Surfliner South Corridor. Recent plans identifying Corridor improvements include:

- *California State Rail Plan for 2007-08 to 2017-18* (2008);
- *San Diego - LOSSAN Corridor Project Prioritization Analysis* (2009);
- *Pacific Surfliner Corridor Operational Analysis* (2009);
- *LOSSAN Corridor Strategic Assessment* (2010);
- *Pacific Surfliner 2010 Development Plan* (2010); and
- *LOSSAN Corridorwide Strategic Implementation Plan* (2012).

As part of the LOSSAN strategic assessment efforts, 2030 passenger and freight rail operational plans were developed for the entire Pacific Surfliner Corridor from San Diego to San Luis Obispo. Previous plans have proposed the following types of Corridor infrastructure improvements:

- Track upgrades including second and third main tracks, crossovers, curve realignments, and crosstie replacement;
- Siding improvements including siding lengthening and rehabilitation;
- System improvements including bridge and overpass upgrades, grade separation projects, and grade crossing safety projects;
- Signal and communication system upgrades such as implementation of continuous centralized traffic control (CTC), upgrading the signal and wayside detector systems, and adding fiber and microwave systems; and
- Station projects such as pedestrian crossings and parking.

An improved rail system with additional capacity will address the forecasted population, employment, and travel demand growth in the Corridor (See Chapter 2, Section 2.2 for more details). Other plans related to the Pacific Surfliner South Corridor have included Metrolink commuter rail strategic plans prepared by the Southern California Regional Rail Authority (SCRRA) and Regional Transportation Plans (RTPs) prepared by Metropolitan Planning Organizations (MPOs).

4.1.1 SCRRA Strategic Assessment

The SCRRA completed a *Strategic Assessment (2007)* for its Metrolink commuter rail system through 2030. Approved by the SCRRA Board in January 2007, the plan developed future service scenarios for all of its rail lines, including the following lines in the Pacific Surfliner South Corridor:

- Orange County Line operating south from LAUS to Oceanside;
- Inland Empire-Orange County (IE-OC) Line operating south from San Bernardino to Oceanside via Orange; and
- 91 Line operating east from LAUS to Riverside via Fullerton.

The assessment identified future ridership forecasts and the service schedules and infrastructure improvements required to support the forecasts. In particular, future commuter rail service levels for the Orange County, IE-OC, and 91 Lines were used to determine the capacity constraints expected in the Corridor, and support the need for new sidings, double-tracking, and other rail capacity improvements to allow for reliable operations of all rail services. The resulting $1.1 billion long-range capital improvement plan was developed to support a doubling of Metrolink's passenger capacity. Two projects will have significant benefits for the Pacific Surfliner South Corridor:

- *Sealed Corridor Initiative* – This comprehensive strategy will enhance the safety of trains, passengers, motorists, and pedestrians along the Los Angeles-Orange county portions of the Corridor. Currently, the open nature of the right-of-way (with frequent at-grade crossings and pedestrian and vehicular trespassing) reduces service reliability. Safety measures will be implemented to reduce the opportunity for accidents at at-grade crossings, and other locations. Improvements may include: closure or grade separation of some crossings; and crossing-specific safety projects, such as four-quadrant gates, median separators, signal system improvements, and new signage and pavement striping. This program has been largely completed in Orange County, with improvements to more than 50 at-grade crossings.
- *Positive Train Control* – Implementation of a Positive Train Control (PTC) system will serve as an important step to improving operational reliability and safety, and increasing capacity and travel speed, and is scheduled for completion by early 2013 (See Chapter 1, Section 1.1 for more detail) .

4.1.2 MPO Regional Transportation Plans (RTPs)

Reflecting the forecasted growth in the Corridor population over the next 20 years, the corresponding increase in travel demand, and the projected significant deterioration in the freeway level of service, the RTPs and related studies prepared by Corridor MPOs have increasingly included alternative travel modes such as the increased use of intercity passenger rail services. In the Pacific Surfliner South Corridor, the MPOs include the San Diego Association of Governments (SANDAG), and the Southern California Association of Governments (SCAG) for Orange and Los Angeles counties. In developing their RTPs, the Corridor's MPOs have stated a desire for intercity rail service within their jurisdictions as part of a balanced, multimodal transportation system. Rail system improvements, such as those summarized in Table 4.1, have been included in the Corridor RTPs as integral components in improving rail service.

Table 4.1: RTP-Identified Rail System Improvement Projects

County/MPO	Proposed Improvements
San Diego/SANDAG	• Double tracking the rail between Orange County and downtown San Diego; • Building selected grade separations; • Improving grade crossings; Establishing quiet zones; • Implementing Positive Train Control (PTC); • Station improvements including parking structures at stations, as well as real time information for passengers and other amenities; and • Maintaining rail bridges in a state of good repair by replacing all aging single track trestle bridges made of timber with modern, double tracked structures.
Orange and Los Angeles/SCAG	• Mainline rail improvements and capacity expansion (such as double or triple tracking certain rail segments, implementing new signal systems, building universal crossovers, and constructing new sidings.); • Upgrades to existing railyards and construction of new yards; • Grade separations of streets from rail lines; and • Rail operation safety improvements such as Positive Train Control (PTC).

4.1.3 Corridor Rail Service Plans

Future corridor-wide service plans have been developed by the LOSSAN Rail Corridor Agency – an agency composed of rail owners and operators and regional planning agencies along the six-county Pacific Surfliner corridor (San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego counties). The resulting increases in service are designed to address the forecasted rail system demand through the provision of an increase in the number of weekday trains service and new services. Table 4.2 presents the proposed 2020 and 2040 train volumes in various segments of the Corridor between the cities of Los Angeles and San Diego. This SDP assumes 2014 and 2030 passenger levels from the *2012 LOSSAN Corridor-wide Strategic Implementation Plan* would be the same as the service levels for the plan horizon years 2020 and 2040, respectively. The train volumes represent more frequent Pacific Surfliner and Metrolink services. The rail improvements discussed in the following section will be required to accommodate the forecasted rail activity based on the operational analyses presented in Chapter 8.

Table 4.2: Daily Train Volumes by Corridor Segment (Round Trips)

Weekday Service	**LAUS - Fullerton**			**Fullerton - Orange**			**Orange - Laguna Niguel/Mission Viejo**			**Laguna Niguel/Mission Viejo-Oceanside**			**Oceanside - San Diego**		
	2012	**2020**	**2040**	**2012**	**2020**	**2040**	**2012**	**2020**	**2040**	**2012**	**2020**	**2040**	**2012**	**2020**	**2040**
Pacific Surfliner (All Stop)	10.5	11	14	10.5	11	14	10.5	11	14	10.5	11	14	10.5	11	14
Pacific Surfliner (Limited Stop)	0.5	1	4	0.5	1	4	0.5	1	4	0.5	1	4	0.5	1	4
Southwest Chief	1	1	1	--	--	--	--	--	--	--	--	--	--	--	--
Sunset Limited**	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--
Metrolink/Coaster LA-SD Commuter	--	1.5	5	--	1.5	5	--	1.5	5	--	1.5	5	--	1.5	5
Metrolink/Coaster IE-SD Commuter	--	--	--	--	--	--	--	--	2	--	--	2	--	--	2
Metrolink Orange County Line	9.5	8	9	9.5	8	9	9.5	8	9	5	3.5	2	--	--	--
Metrolink IE-OC Line	--	--	--	--	--	--	7	8	12	3	3	--	--	--	--
Metrolink 91 Line	4.5	6	16	--	--	--	--	--	--	--	--	--	--	--	--
Metrolink OC-Intra County Line	--	--	--	--	5	7	--	5	7	--	--	--	--	--	--
Metrolink Coast Line***	--	--	--	--	--	--	--	--	--	--	--	--	--	0.5	--
Coaster	--	--	--	--	--	--	--	--	--	--	--	--	11	14	20
Subtotal	26	28.5	50	20.5	26.5	39	27.5	34.5	53	19	20	27	22	28	45

Weekday Service	LAUS - Fullerton			Fullerton - Orange			Orange - Laguna Niguel/Mission Viejo			Laguna Niguel/Mission Viejo-Oceanside			Oceanside - San Diego		
	2012	**2020**	**2040**	**2012**	**2020**	**2040**	**2012**	**2020**	**2040**	**2012**	**2020**	**2040**	**2012**	**2020**	**2040**
UP Freight	--	--	--	1	1	1	1	1	1	--	--	--	--	--	--
BNSF Freight	41	41	59	2	2	2	3	3	4	2	2	3	3	3	4
Total	67	69.5	109	23.5	29.5	42	31.5	38.5	58	21	22	30	25	31	49

*Sunset Limited currently travels along the Union Pacific Railroad Los Angeles Division. It may be rerouted through Fullerton by 2030.
**This is a late night Metrolink train that operates between San Diego and Oceanside as the return to Train 608 that is extended to San Diego from Oceanside in 2014. This train is replaced by the increase in Metrolink/Coaster LA-SD Commuter service in 2030.

Source: *LOSSAN Corridorwide Strategic Implementation Plan: Final Report*, April 2012.

Future rail services being planned or proposed in the Pacific Surfliner Corridor include the following:

- The *2012 LOSSAN Corridor-wide Strategic Implementation Plan* completed by the LOSSAN Rail Corridor Agency; this effort evaluated both short and long-term service improvements including various schedule and route restructuring options, and developed ridership forecasts and a capital improvement program corridor-wide. Information from this on-going planning effort is utilized in the Surfliner South SDP.
- Future California High-Speed Rail (HSR) service will be operated on separate tracks within the segment of the Corridor between LAUS and the Anaheim Regional Transportation Intermodal Center (ARTIC) in Los Angeles and Orange Counties.

The 2020 forecasted freight operations indicate 82 one-way daily trains in the Corridor between LAUS and Fullerton, six one-way trains between Fullerton and Orange, eight one-way trains between Orange and Laguna Niguel/Mission Viejo, four one-way trains between Laguna Niguel/Mission Viejo and Oceanside, and six one-way trains between Oceanside and San Diego (these figures are shown as roundtrip in the Table 4.2). Future freight consists may increase in length, and when coupled with the passenger rail service increases, inadequate sidings and other rail capacity constraints will negatively impact freight and intercity passenger rail performance (See Section 4.1.2 for more details).

4.1.4 Corridor Rail Service Improvements

Pacific Surfliner South Corridor improvement projects have been identified and evaluated in order to improve mobility and reliability in this congested part of the state's rail system, while implementing the proposed rail infrastructure projects in a cost-effective and environmentally sensitive manner. Projects as shown in Table 4.3 were identified from the following prior studies:

- Caltrans - LOSSAN Corridor Strategic Plan (2003).
- Caltrans Pacific Surfliner Route FFY 2007-08 Business Plan (2007);
- Caltrans Final Program EIR/EIS, LOSSAN South (2007);
- LOSSAN Corridor Strategic Business Plan (2007);
- San Diego - LOSSAN Corridor Project Prioritization Analysis (2009);
- LOSSAN Corridor Strategic Assessment, Final Report (2010);
- Caltrans - Pacific Surfliner Corridor Los Angeles to San Diego Service Development Plan (2010);
- LOSSAN Rail Corridor Agency Joint Powers Board - Meeting Notice and Agenda (2012); and
- LOSSAN Corridorwide Strategic Implementation Plan (2012).

The identified rail improvement projects fall into six categories:

- **Track Upgrades** – The key to operating at maximum authorized speeds in mixed use (passenger and freight) operations is the condition of the infrastructure (rail, ties and sidings), track geometry, signal system and level of maintenance. Improvements such as additional and extended sidings, double tracking, curve realignments, and overpass/bridge improvements are necessary in order to maintain the track conditions of the Corridor. Track conditions range from FRA Class V in San Diego County and parts of Orange County to FRA Class IV in Orange County and Los Angeles County. Class V track permits maximum running speed limit of freight and passenger trains to 80 and 90 miles per hour (mph), respectively. Class IV track permits maximum running speed limit of freight and passenger trains to 60 and 80 mph, respectively. [4]

In addition to system infrastructure improvements, there are ongoing rail and ties replacement needs. While the UPRR and BNSF have made and continue to make infrastructure upgrades, portions of the Corridor in Orange County and north San Diego County are characterized by single-track operations, short sidings or lack of sidings and ten universal crossovers where trains can switch between two main tracks on the 42-mile Orange Subdivision between Fullerton Junction and the San Diego County line.

- **Siding and Siding Extensions** – A siding is a short section of track adjacent to a main track, used for meeting or passing trains. Sections of the Corridor need sidings extension or new sidings to make the most out of the existing track configuration. Extending and upgrading existing sidings wherever possible would provide additional capacity, reduce trip times, and improve operational reliability for both passenger and freight traffic. Constrained siding availability and length impact peak period passenger travel in south Orange County and north San Diego County. Market factors (labor costs, locomotive fleet utilization, etc.) are leading to longer freight trains. The operational result is that passenger trains are frequently forced into the siding when two trains meet because freight trains no longer fit. Where siding lengths of 5,000 feet were sufficient at one time, freight trains now operate at lengths approaching 9,000 feet. Corridor sidings, whether new or extensions of existing facilities, need to be a minimum length of 10,000 feet. As sidings are lengthened, they will also be upgraded to permit higher speeds.
- **Construction of Second or Third Main Tracks** – Providing additional segments of mainline tracks in areas of heavy rail traffic would allow trains to travel at their maximum allowed speed. The benefits of additional main tracks are increased train frequencies, improved operational reliability, increased capacity, and decreased train delays.
- **Curve Realignments** – Curve realignments allow for reduced trip times by increasing train speeds on the curves, and prolong the rail life, reducing the frequency of track repairs or maintenance.
- **Grade Separations** – These costly improvements eliminate dangerous at-grade crossings of rail and highway systems. Because cars and trucks are less sensitive to grades than trains, typically a grade separation is designed with the roadway relocated under or over the rail line. Grade separations reduce accidents and increase train performance, while providing community benefits, such as reducing noise (through the elimination of the need to sound the train’s horn) and improve local traffic flow by reducing vehicular delays at crossings.
- **Station Improvements** – Station improvements include providing new or improved station platforms, improved transit connectivity, and providing customer improvements such as additional parking, electronic signage with real-time arrival and departure information, and automated ticket vending machines. Benefits of station improvements include increased platform capacity and safety, improved customer service and information.

4.2 No Build Alternative

The No Build Alternative provides a baseline discussion of the continuation of the current Corridor system with only improvements that are currently programmed or have full funding from local, county, state, and federal sources. These projects are documented in the 2012 Draft California State Rail Plan and have been identified from county Long Range Transportation Plans (LRTPs), Regional Transportation

[4] FRA Track Safety Standards Compliance Manual (April 2007).

Improvement Programs (RTIPs), Caltrans's California Intercity Rail Capital Program, and the State Transportation Improvement Program (STIP), along with federally-funded projects under the High Speed Intercity Passenger Rail (HSIPR) Program. Rail projects included in the "No Build" Alternative are listed in Table 4.3.

Table 4.3: No Build Alternative Rail Improvement Projects

Project	Project Type	Cost (Millions)	Funding Status	County	Source(s)
Pico Rivera to Santa Fe Springs third main track (Los Angeles to Fullerton third main track, Segment 7)	Track & Signal	$37.50	Programmed	Los Angeles	HSIPR (ARRA) Proposition 1B (Intercity Rail Improvement)
La Mirada to Valley View third main track (Los Angeles to Fullerton third main track, Segment 8)	Track & Signal	$30.50	Programmed	Los Angeles	Proposition 1B (Intercity Rail Improvement)
State College Boulevard/Howell Street SCRRA crossing grade separation (Anaheim)	Grade separation	$92.00[a]	Programmed (1B TCIF)	Orange	Proposition 1B (Trade Corridors Improvement Fund) Southern California Potential Early Investment Projects
New passing siding between Laguna Niguel/Mission Viejo Station and San Juan Capistrano Station (La Zanja)	Track & Signal	$26.80	Programmed	Orange	SCAG RTP in the FTIP LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
San Clemente Beach Trail grade crossing improvements	Grade crossing	$4.50	Allocated	Orange	Proposition 1B (Highway-Railroad Crossing Safety Account) Proposition 116 Local funds CRIS
Positive Train Control (San Onofre to San Diego)	Track & Signal	$88.00	Allocated	San Diego	HSIPR (PRIIA) Proposition 1A
CP San Onofre to CP Pulgas second main track (Phase 1)	Track & Signal	$38.00	Allocated	San Diego	STIP Proposition 1B (Intercity Rail Improvement)
Oceanside through tracks	Track & Signal	$19.50	Allocated (HSIPR, local)	San Diego	HSIPR (ARRA) LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
Poinsettia Station improvements	Track & Signal	$13.00	Allocated (FTA, local)	San Diego	LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
CP Cardiff to CP Craven second main track (San Elijo Lagoon)	Track & Signal	$76.10	Allocated (FRA, local)	San Diego	LOSSAN Corridorwide Strategic Implementation Plan (Final Report)

Project	Project Type	Cost (Millions)	Funding Status	County	Source(s)
Sorrento Valley double track	Track & Signal	$33.00	Programmed	San Diego	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
Orangethorpe Avenue SCRRA crossing grade separation (Anaheim)	Grade separation	$99.00[a]	Allocated	Orange	Proposition 1B (Trade Corridors Improvement Fund) Southern California Potential Early Investment Projects

[a] Source document does not specify cost year. A review of available information concerning project scope concluded that no cost escalation or other adjustments are necessary.

4.3 Build Alternative

The Corridor's rail system is currently operating beyond its design capacity and major infrastructure improvements are required to enhance safety and provide a more reliable, competitive, and attractive intercity travel option as identified in the operational analysis presented in Section 8.0. The Build Alternative provides a set of county-designated and site-specific improvement projects for the Pacific Surfliner South Corridor to address infrastructure constraints. The proposed improvements are organized as: 1) near-term improvements (completed between 2013 and 2015); 2) mid-term improvements (completed between 2016 and 2020); and 3) long-term improvements (completed between 2021 and 2040). Projects were identified based on those identified in the 2012 Draft California State Rail Plan. Rail improvement projects are described in this document from north to south and are organized by county, beginning with projects in Los Angeles County and ending with San Diego County projects.

At this point in time, all of the near-term, mid-term, and long-term improvements that have been identified and validated through prior planning studies are being advanced as part of the Service Development Plan/Alternatives Analysis. After rail capacity modeling, ridership, and subsequent operational analyses are conducted as part of the service development planning process, the near-term improvement lists will be further stratified into: 1) high-priority near-term and mid-term improvements which would have a reasonable likelihood of being funded and implemented by 2020; and 2) other improvements which would remain in the long-term Corridor development plan and which would be implemented subject to funding.

Table 4.2: Daily Train Volumes by Corridor Segment (Round Trips)

Weekday Service	LAUS - Fullerton			Fullerton - Orange			Orange - Laguna Niguel/Mission Viejo			Laguna Niguel/Mission Viejo-Oceanside			Oceanside - San Diego		
	2012	**2020**	**2040**	**2012**	**2020**	**2040**	**2012**	**2020**	**2040**	**2012**	**2020**	**2040**	**2012**	**2020**	**2040**
Pacific Surfliner (All Stop)	10.5	11	14	10.5	11	14	10.5	11	14	10.5	11	14	10.5	11	14
Pacific Surfliner (Limited Stop)	0.5	1	4	0.5	1	4	0.5	1	4	0.5	1	4	0.5	1	4
Southwest Chief	1	1	1	--	--	--	--	--	--	--	--	--	--	--	--
Sunset Limited**	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--
Metrolink/Coaster LA-SD Commuter	--	1.5	5	--	1.5	5	--	1.5	5	--	1.5	5	--	1.5	5
Metrolink/Coaster IE-SD Commuter	--	--	--	--	--	--	--	--	2	--	--	2	--	--	2
Metrolink Orange County Line	9.5	8	9	9.5	8	9	9.5	8	9	5	3.5	2	--	--	--
Metrolink IE-OC Line	--	--	--	--	--	--	7	8	12	3	3	--	--	--	--
Metrolink 91 Line	4.5	6	16	--	--	--	--	--	--	--	--	--	--	--	--
Metrolink OC-Intra County Line	--	--	--	--	5	7	--	5	7	--	--	--	--	--	--
Metrolink Coast Line***	--	--	--	--	--	--	--	--	--	--	--	--	--	0.5	--
Coaster	--	--	--	--	--	--	--	--	--	--	--	--	11	14	20
Subtotal	26	28.5	50	20.5	26.5	39	27.5	34.5	53	19	20	27	22	28	45

Weekday Service	LAUS - Fullerton			Fullerton - Orange			Orange - Laguna Niguel/Mission Viejo			Laguna Niguel/Mission Viejo-Oceanside			Oceanside - San Diego		
	2012	2020	2040	2012	2020	2040	2012	2020	2040	2012	2020	2040	2012	2020	2040
UP Freight	--	--	--	1	1	1	1	1	1	--	--	--	--	--	--
BNSF Freight	41	41	59	2	2	2	3	3	4	2	2	3	3	3	4
Total	67	69.5	109	23.5	29.5	42	31.5	38.5	58	21	22	30	25	31	49

*Sunset Limited currently travels along the Union Pacific Railroad Los Angeles Division. It may be rerouted through Fullerton by 2030.
**This is a late night Metrolink train that operates between San Diego and Oceanside as the return to Train 608 that is extended to San Diego from Oceanside in 2014. This train is replaced by the increase in Metrolink/Coaster LA-SD Commuter service in 2030.

Source: *LOSSAN Corridorwide Strategic Implementation Plan: Final Report*, April 2012.

Table 4.3: No Build Alternative Rail Improvement Projects

Project	Project Type	Cost (Millions)	Funding Status	County	Source(s)
Pico Rivera to Santa Fe Springs third main track (Los Angeles to Fullerton third main track, Segment 7)	Track & Signal	$37.50	Programmed	Los Angeles	HSIPR (ARRA) Proposition 1B (Intercity Rail Improvement)
La Mirada to Valley View third main track (Los Angeles to Fullerton third main track, Segment 8)	Track & Signal	$30.50	Programmed	Los Angeles	Proposition 1B (Intercity Rail Improvement)
State College Boulevard/Howell Street SCRRA crossing grade separation (Anaheim)	Grade separation	$92.00[a]	Programmed (1B TCIF)	Orange	Proposition 1B (Trade Corridors Improvement Fund) Southern California Potential Early Investment Projects
New passing siding between Laguna Niguel/Mission Viejo Station and San Juan Capistrano Station (La Zanja)	Track & Signal	$26.80	Programmed	Orange	SCAG RTP in the FTIP LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
San Clemente Beach Trail grade crossing improvements	Grade crossing	$4.50	Allocated	Orange	Proposition 1B (Highway-Railroad Crossing Safety Account) Proposition 116 Local funds CRIS
Positive Train Control (San Onofre to San Diego)	Track & Signal	$88.00	Allocated	San Diego	HSIPR (PRIIA) Proposition 1A
CP San Onofre to CP Pulgas second main track (Phase 1)	Track & Signal	$38.00	Allocated	San Diego	STIP Proposition 1B (Intercity Rail Improvement)
Oceanside through tracks	Track & Signal	$19.50	Allocated (HSIPR, local)	San Diego	HSIPR (ARRA) LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
Poinsettia Station improvements	Track & Signal	$13.00	Allocated (FTA, local)	San Diego	LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
CP Cardiff to CP Craven second main track (San Elijo Lagoon)	Track & Signal	$76.10	Allocated (FRA, local)	San Diego	LOSSAN Corridorwide Strategic Implementation Plan (Final Report)

Project	Project Type	Cost (Millions)	Funding Status	County	Source(s)
Sorrento Valley double track	Track & Signal	$33.00	Programmed	San Diego	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
Orangethorpe Avenue SCRRA crossing grade separation (Anaheim)	Grade separation	$99.00[a]	Allocated	Orange	Proposition 1B (Trade Corridors Improvement Fund) Southern California Potential Early Investment Projects

[a] Source document does not specify cost year. A review of available information concerning project scope concluded that no cost escalation or other adjustments are necessary.

4.3.1 Near-Term (2013 - 2015) Improvements

Projects presented in Table 4.4 are those identified in previous studies and plans.

Table 4.4: Proposed Near-Term (2013 - 2015) Rail Improvement Projects

Project	Project Type	Cost (Millions)	Funding Status	County	Source(s)
Solana Beach Station parking expansion	Station	$27.00	Partially allocated	San Diego	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
Los Penasquitos Lagoon bridge replacements	Track & Signal	$24.00	Partially allocated	San Diego	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
CP Elvira to CP Morena double track	Track & Signal	$90.50	Partially allocated (FRA, FTA, TCRP, local)	San Diego	HSIPR (PRIIA) San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report) Southern California Potential Early Investment Projects

4.3.2 Mid-Term (2016 - 2020) Improvements

Projects presented in Table 4.5 are those identified in previous studies and plans.

Table 4.5: Proposed Mid-Term (2016 - 2020) Rail Improvement Projects

Project	Project Type	Cost (Millions)	Funding Status	County	Source(s)
Southern California Regional Interconnector Project (SCRIP) -- LAUS run-through tracks	Extension/ new route	$350.00		Los Angeles	Southern California Potential Early Investment Projects
Hobart Flyover (UPRR/BNSF San Pedro Junction)	Track & Signal	$95.00		Los Angeles	California Passenger Rail System: 20-Year Improvement Plan Technical Report
Hobart to Commerce fourth main track	Track & Signal	$25.00		Los Angeles	California Passenger Rail System: 20-Year Improvement Plan Technical Report
Basta to Fullerton Junction fourth main track	Track & Signal	$100.00		Orange	California Passenger Rail System: 20-Year Improvement Plan Technical Report

4.3.1 Near-Term (2013 - 2015) Improvements

Projects presented in Table 4.4 are those identified in previous studies and plans.

Table 4.4: Proposed Near-Term (2013 - 2015) Rail Improvement Projects

Project	Project Type	Cost (Millions)	Funding Status	County	Source(s)
Solana Beach Station parking expansion	Station	$27.00	Partially allocated	San Diego	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
Los Penasquitos Lagoon bridge replacements	Track & Signal	$24.00	Partially allocated	San Diego	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
CP Elvira to CP Morena double track	Track & Signal	$90.50	Partially allocated (FRA, FTA, TCRP, local)	San Diego	HSIPR (PRIIA) San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report) Southern California Potential Early Investment Projects

4.3.2 Mid-Term (2016 - 2020) Improvements

Projects presented in Table 4.5 are those identified in previous studies and plans.

Table 4.5: Proposed Mid-Term (2016 - 2020) Rail Improvement Projects

Project	Project Type	Cost (Millions)	Funding Status	County	Source(s)
Southern California Regional Interconnector Project (SCRIP) -- LAUS run-through tracks	Extension/ new route	$350.00		Los Angeles	Southern California Potential Early Investment Projects
Hobart Flyover (UPRR/BNSF San Pedro Junction)	Track & Signal	$95.00		Los Angeles	California Passenger Rail System: 20-Year Improvement Plan Technical Report
Hobart to Commerce fourth main track	Track & Signal	$25.00		Los Angeles	California Passenger Rail System: 20-Year Improvement Plan Technical Report
Basta to Fullerton Junction fourth main track	Track & Signal	$100.00		Orange	California Passenger Rail System: 20-Year Improvement Plan Technical Report

Project	Project Type	Cost (Millions)	Funding Status	County	Source(s)
Sycamore Street SCRRA crossing closure (Anaheim)	Grade crossing	$2.00[a]		Orange	Southern California Potential Early Investment Projects
Broadway SCRRA crossing improvements (Anaheim)	Grade crossing	$5.00[a]		Orange	Southern California Potential Early Investment Projects
Santa Ana Street SCRRA crossing closure (Anaheim)	Grade crossing	$2.00[a]		Orange	Southern California Potential Early Investment Projects
South Street SCRRA crossing improvements (Anaheim)	Grade crossing	$5.00[a]		Orange	Southern California Potential Early Investment Projects
Vermont Avenue SCRRA crossing improvements (Anaheim)	Grade crossing	$5.00[a]		Orange	Southern California Potential Early Investment Projects
Orange County supplemental signal system (maximum speed 110 mph)	Track & Signal	$15.00		Orange	California Passenger Rail System: 20-Year Improvement Plan Technical Report
Santa Ana Station expansion	Station			Orange	SCAG RTP in the FTIP
New CP on Metrolink Orange Subdivision at Fourth Street (MP 175.7), new powered No. 10 turnout to UPRR spur approximately 0.5 mile south of Santa Ana Station, and new powered derail on UPRR connecting track	Track & Signal	$4.00[a]		Orange	SCAG RTP in the FTIP
Irvine Station improvements (auxiliary siding and platform, new holding track, and new crossover)	Station	$17.00		Orange	California Passenger Rail System: 20-Year Improvement Plan Technical Report
San Diego County cab signal system (maximum speed 110 mph)	Track & Signal	$4.00		San Diego	California Passenger Rail System: 20-Year Improvement Plan Technical Report
San Diego County lagoon bridge replacements (tbd)	Track & Signal	$20.00[a]		San Diego	Southern California Potential Early Investment Projects
San Diego County grade crossing safety improvements and future quiet zones	Grade crossing	$66.00[a]		San Diego	Southern California Potential Early Investment Projects
CP San Onofre to CP Pulgas second main track (Phase 2)	Track & Signal	$36.00	Partially programmed	San Diego	STIP Southern California Potential Early Investment Projects

Project	Project Type	Cost (Millions)	Funding Status	County	Source(s)
CP Eastbrook to CP Shell double track (San Luis Rey River Bridge replacement)	Track & Signal	$53.00	Partially allocated (HSIPR, local)	San Diego	HSIPR San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report) Southern California Potential Early Investment Projects
Oceanside Station parking expansion	Station	$25.00		San Diego	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
Carlsbad Village double track (CP Longboard to CP Farr)	Track & Signal	$49.50	Partially allocated (HSIPR, local)	San Diego	HSIPR (PRIIA) LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
CP Ponto to CP Moonlight second main track and Batiquitos Lagoon Bridge replacement	Track & Signal	$48.50	Partially allocated (local)	San Diego	LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
CP Moonlight to CP Swami second main track	Track & Signal	$22.00		San Diego	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
New grade-separated pedestrian crossings in Encinitas (Hillcrest Drive, El Portal Street, and Montgomery Avenue)	Grade separation	$12.00	Partially allocated	San Diego	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
San Dieguito double track and bridge replacement (CP Valley to CP Crosby), and Del Mar Fairgrounds special events platform	Track & Signal	$110.00[a]	Partially allocated (HSIPR, local)	San Diego	HSIPR (PRIIA) LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
Del Mar Bluffs stabilization (Phase 4)	Track & Signal	$21.00		San Diego	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
Sorrento to Miramar (CP Pines to CP Cumbres (Miramar)) curve realignment and second main track (Phase 2)	Track & Signal	$98.00	Partially allocated (FRA, STIP, local)	San Diego	HSIPR (PRIIA) STIP LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
Airport Intermodal Transportation Center (ITC)	Station	$165.00[a]	Partially allocated (local)	San Diego	LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
San Diego Station (Santa Fe Depot) rehabilitation	Station	$20.00		San Diego	California Passenger Rail System: 20-Year Improvement Plan Technical Report

San Diego Station (Santa Fe Depot) parking expansion	Station	$8.00		San Diego	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
New San Diego layover facility	Maintenance facilities	$32.00		San Diego	California Passenger Rail System: 20-Year Improvement Plan Technical Report

[a] Source document does not specify cost year. A review of available information concerning project scope concluded that no cost escalation or other adjustments are necessary.

4.3.3 Long-Term (2021 - 2040) Improvements

Projects presented in Table 4.6 are those identified in previous studies and plans.

Table 4.6: Proposed Long-Term (2021 - 2040) Rail Improvement Projects

Project	Project Type	Cost (Millions)	Funding Status	County	Source(s)
DT Junction and Los Nietos Junction track realignment (diamond crossing elimination)	Track & Signal	$130.00		Los Angeles	California Passenger Rail System: 20-Year Improvement Plan Technical Report
Ball Road SCRRA crossing grade separation (Anaheim)	Grade separation	$95.00[a]		Orange	Southern California Potential Early Investment Projects
North Main Street SCRRA crossing grade separation (Orange)	Grade separation	$69.00[a]		Orange	SCAG RTP (financially-unconstrained) Rail and Facilities Program Update (Orange County Transportation Authority)
Orange Junction curve realignment	Track & Signal	$2.00		Orange	California Passenger Rail System: 20-Year Improvement Plan Technical Report
East 17th Street/Lincoln Avenue SCRRA crossing grade separation (Santa Ana)	Grade separation	$89.00[a]		Orange	Rail and Facilities Program Update (Orange County Transportation Authority)
East Santa Ana Boulevard SCRRA crossing grade separation (Santa Ana)	Grade separation	$74.00[a]		Orange	SCAG RTP in the FTIP Rail and Facilities Program Update (Orange County Transportation Authority)
South Grand Avenue/East Hunter Avenue SCRRA crossing grade separation (Santa Ana)	Grade separation	$72.00[a]		Orange	SCAG RTP (financially-unconstrained) Rail and Facilities Program Update (Orange County Transportation Authority)

Project	Project Type	Cost (Millions)	Funding Status	County	Source(s)
Red Hill Avenue/Edinger Avenue SCRRA crossing grade separation (Tustin)	Grade separation			Orange	SCAG RTP in the FTIP
Irvine third main track	Track & Signal	$75.00[a]		Orange	LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
Irvine Station enhancements to accommodate Amtrak, Metrolink, fixed-route bus service, and the Irvine Guideway	Station	$205.00		Orange	SCAG RTP (financially-unconstrained) 2011 CTC Needs Assessment
New double-track tunnel between San Juan Capistrano Station and San Diego County border	Track & Signal			Orange	SCAG RTP (financially-unconstrained)
Extension of Serra siding	Track & Signal	$15.00[a]		Orange	LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
MP 200 curve realignment (at Pacific Coast Highway)	Track & Signal	$4.00		Orange	California Passenger Rail System: 20-Year Improvement Plan Technical Report
CP "Trestles" to CP Songs second main track	Track & Signal	$38.00[a]		San Diego	LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
Leucadia Boulevard/Highway 101/North Vulcan Avenue grade separation (Encinitas)	Grade separation	$160.00		San Diego	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
New double-track Del Mar Tunnel (Camino del Mar option or I-5/Penasquitos option)	Track & Signal	$987.00		San Diego	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
Los Penasquitos Lagoon second main track (CP Sorrento to CP Torrey)	Track & Signal	$87.00		San Diego	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
New double-track UTC Tunnel (I-5 option or UTC option)	Track & Signal	$2,490.00		San Diego	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
Taylor Street grade separation (San Diego (Old Town) Station)	Grade separation	$90.00		San Diego	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
New Downtown San Diego rail trench and grade separations	Grade separation	$300.00		San Diego	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)

[a] Source document does not specify cost year. A review of available information concerning project scope concluded that no cost escalation or other adjustments are necessary.

4.4 Early Investment Projects for HSR

The California High-Speed Authority (CHSRA) envisions the HSR system as a phased investment that begins with an initial operating section that will be launched in 2022.[5] A 300-mile initial high speed rail operating section would connect Merced to the San Fernando Valley. A "blended system" would connect points south of the San Fernando Valley to the initial operating section with enhanced conventional intercity and commuter rail services for blended operations with common ticketing. As shown in Table 4.7, the Southern California Rail Partners Group has identified the following potential early investment projects in the Pacific Surfliner South Corridor.

Table 4.7: Early Investment Projects that Support Development of the HSR System

Code	Description	Status	Details
Ana-LA-C01	LAUS Run-Through Tracks – a layout that allows trains to run through without trains having to arrive and depart through the same set of tracks.*	Environmental	Needed for capacity impacts for HSR and rail growth in southern California
Ana-LA-S01	Alondra Boulevard - X-ing Improvements	Unknown	Crossing Improvements *(4 quad gates to improve speed & safety)* *Grade Separate for HSR Development*
Ana-LA-S02	Carmenita Road - X-ing Improvements	Unknown	Crossing Improvements *(4 quad gates to improve speed & safety)* *Grade Separate for HSR Development*
Ana-LA-S03	Pioneer Boulevard - X-ing Improvements	Unknown	Crossing Improvements *(4 quad gates to improve speed & safety)* *Grade Separate for HSR Development*
Ana-LA-S04	Vermont - X-ing Improvements	Unknown	Crossing Improvements *(4 quad gates to improve speed & safety)* *Grade Separate for HSR Development*
Ana-LA-S05	South St. - X-ing Improvements	Unknown	Crossing Improvements *(4 quad gates to improve speed & safety)* *Grade Separate for HSR Development*
Ana-LA-S06	Broadway - X-ing Improvements	Unknown	Crossing Improvements *(4 quad gates to improve speed & safety)* *Grade Separate for HSR Development*
Ana-LA-S07	Sycamore - Closure	Unknown	Road crossing closure

[5] California High-Speed Rail Authority, *Revised 2012 Business Plan*, April 2012.

Code	Description	Status	Details
Ana-LA-S08	Santa Ana – Closure*	Unknown	Road crossing closure
Ana-LA-S09	Rosecrans Ave / Marquardt Ave Grade Separation	Designed	PUC Rank #1 New Grade Separation
Ana-LA-S10	Norwalk Blvd / Los Nietos Rd - Grade Separation	Designed	PUC Rank #2 New Grade Separation
Ana-LA-S11	State College Blvd Grade Separation*	PSR Complete	PUC Rank # 48 Road Under
Ana-LA-S12	Ball Rd Grade Separation*	Planning/PSR	Road Over
Ana-LA-S13	Orangethorpe Ave Grade Separation*	Planning/PSR	Road Under
OC-C01	Laguna Niguel to San Juan Capistrano Passing Siding*	Environmental Underway	
OC-C02	Irvine 3rd Main Track Extension*	Planning/Env. Underway	
SD-C02	Eastbrook to Shell Double Track*	PE/Environ	0.6 miles in Oceanside (full amount shown, 16% funded)
SD-C03	Los Penasquitos Bridge Replacement	Final Design	3 Lagoon Railway Bridge replacements in City of San Diego.
SD-C04	Carlsbad Village Double Track*	PE/Environ	1.1 miles of double track, new bridge across Buena Vista Lagoon
SD-C05	San Elijo Lagoon Double Track*	PE/Environ	1.5 miles of double track, new bridge across San Elijo Lagoon
SD-C06	Elvira to Morena Double Track*	PE/Environ	2.0 miles of double track, curve realignments
SD-C07	San Dieguito Bridge Replacement/Double Track*	PE/Environ	1.1 miles of double track, new bridge across San Dieguito Lagoon
SD-C09	Sorrento to Miramar Ph 2*	PE/Environ/ Design	2.1 miles of double track, curve realignments
SD-C10	Batiquitos Lagoon Bridge Replacement	Planning	Lagoon Railway Bridge replacements in City of Carlsbad
SD-C11	Lagoon Bridge Replacements (tbd)*	Planning	Additional lagoon railway bridge replacements in San Diego County
SD-C12	Tecolote to Friar Double Track	Planning	0.9 miles of double track, second bridge across San Diego River
SD-C13	X-ing Improvements	Planning	Grade Crossing Safety Improvements/Future quiet zones

*In addition to having been identified by the Southern California Rail Partners Group, the projects identified with an asterick have been identified in prior studies and plans. These improvement projects are also shown in Tables 4.3 to 4.6.

5.0 Evaluation of Alternatives

The No-Build and Build Alternatives were evaluated using the criteria described in Chapter 6 *Planning Methodologies*. The purpose of the evaluation was to determine the reasonableness and feasibility of the alternatives, in order to identify those alternatives that would be carried forward into further analysis. The criteria assess how well each alternative meets the following:

- The Purpose and Need for the action;
- Technical feasibility based on right-of-way (ROW) and engineering constraints;
- Economic feasibility based on market potential and/or ridership, capital and operating costs; and
- Major environmental concerns.

5.1 Purpose and Need Criteria

The following criteria assess how each alternative meets the Pacific Surfliner South Corridor Purpose and Need, considering factors relating to the passenger's experience in using Corridor rail services, such as travel times, availability of connections, and service reliability and frequency.

Travel Time

Travel time between Los Angeles and San Diego is currently scheduled to take between 2 hours, 45 minutes to 3 hours. To improve Corridor travel time, previous studies have identified a comprehensive list of speed improvement projects as discussed in section 4.3, which could be incrementally pursued as funding permits. However, the total capital cost of the proposed improvements necessary to reduce travel time exceeds foreseeable funding levels.

Station Location

This criterion is not applicable because there are no new stations proposed in the Build Alternative.

Connections

Compared to the No-Build, the Build Alternative would provide improved intermodal connections and accessibility due to increased train frequency between Los Angeles and San Diego. In particular, increasing the number of trains between Los Angeles and San Diego would improve Corridor rail service, particularly during the off-peak hours. Currently, there are only five midday northbound and four southbound trains in the Corridor between the morning and afternoon peak hours. By 2030, the Build Alternative envisions hourly Pacific Surfliner South service between Los Angeles and San Diego. Increased train service would facilitate passenger travel in the Corridor during both the peak and off peak hours. Pacific Surfliner South will also be connected to the HSR by 2030, opening the market to the Central Valley and Northern California.

Connecting bus and circulator service is provided at all stations on the Corridor by local transit operators; and an extensive system of connecting bus and rail service is provided at LAUS and San Diego. These intermodal connections are discussed in Chapter 10 *Station and Access Analysis*. Higher train frequency in the Corridor would improve passengers' connections to local transit service throughout the day.

Reliability

With the Build/Improved Passenger Service Alternative, the reliability of all passenger trains operating in the Corridor will improve, including freight trains. Considering that portions of the Corridor are single track, extensions of selected sidings would reduce the time required for trains to pass one another when required and allow for improved schedule adherence. The No-Build Alternative would not provide these benefits and would continue the current constrained operational conditions with frequent travel delays.

Frequency

Under the Build Alternative, intercity passenger train frequencies would increase between San Diego and Los Angeles. The Corridor is currently served by eleven Pacific Surfliner trains in each direction each day. Under the Build Alternative, daily train service would increase to 24 and 36 one-way trips in 2020 and 2040, respectively.

Ridership

The current ridership in the Corridor is 1,646,200 annual riders. As market analysis for the State Rail Plan shows, the total Corridor ridership is forecasted to increase by 3.4 percent to 1,702,700 annual passengers by the year 2030.[6] Ridership between Los Angeles and San Diego is forecasted to increase by 53 percent during the same time period.

It is important to note that the previous forecast did not anticipate or account for the significant passenger rail improvements now envisioned in the California High-Speed Rail Authority's Revised 2012 Plan April 2012. The Business Plan calls for higher frequencies and faster running times between the San Francisco and Los Angeles markets via the San Joaquin Valley, as early as 2018. Access to the California High-Speed Rail (HSR) system for Pacific Surfliner passengers is currently planned to occur from San Fernando by 2022 and LAUS by 2029. It is expected that Pacific Surfliner Corridor ridership will increase as passengers from points south of LAUS use the Pacific Surfliner to access HSR. Eventually, high-speed rail service will operate in the portion of the Pacific Surfliner Corridor located between LAUS and the proposed Anaheim Regional Transportation Intermodal Center.

5.2 Technical Feasibility

The following criteria assess the technical feasibility of each alternative, identifying ROW requirements and possible disruptions to railroad operations, state highways, or adjacent property for each alternative.

ROW Requirements

A majority of the siding and track improvements identified in previous study efforts as presented in Chapter 4.0 can be constructed within the existing rail ROW. There are very few constraints in segments of the Corridor in San Diego County where the alignment runs adjacent to the I-5 freeway, sensitive coastal area, and some residential communities. While acquisition of residential property would not be required, these improvements may bring operational impacts closer to residents. Physical impacts to coastal resources may occur if new bridges or retaining walls are required, however the goal is first to avoid, then to minimize, and finally mitigate for these impacts. More detailed engineering work will identify if additional ROW and appropriate noise mitigation measures are required.

In summary, ROW requirements for the Build Alternative are minimal considering the length of the Corridor and will not displace residential uses.

Disruption to Railroads, Highways or Adjacent Property

Proposed rail system projects identified in the Build Alternative are primarily located within the existing rail ROW, and there would be no direct impacts to highways or adjacent property. Construction sites would be carefully selected to minimize temporary disruption of highway operations and property access. There would be potential temporary disruptions to railroad operations during construction of the proposed

[6] Source: *Draft California State Rail Plan, in production.*

system improvements, but implementation of the projects would result in a significant benefit for passenger and freight operations.

5.3 Economic Feasibility

The following criteria assess the economic feasibility of each alternative, identifying capital and operating costs, as well as independent utility and the potential for phasing.

Capital Cost

The capital cost estimates from prior studies, including the *LOSSAN Corridorwide Strategic Implementation Plan* completed in April 2012, provided a usable range of capital costs for evaluating the alternatives and provided support for the identification of the following general order of magnitude costs in 2012 dollars for the different types of improvement projects:

- LAUS run-through tracks: $350 million;
- Siding extensions: $10-30 million each;
- Second or third main track: $30-$125 million depending on length and topography;
- Station improvements – approximately $15 million; and
- New intermodal transportation center: $165 million.

These cost ranges indicate that providing siding extensions and additional tracks would provide significant operational improvements at a lower cost level than the other proposed projects. Project prioritization varies by local operational constraints. The San Diego County segment of the Corridor is 46 percent single track and the segment's primary goal is to increase rail capacity by double tracking.

Operating Cost

Operating cost evaluates alternatives with different daily train volumes. Based on an operating and maintenance cost rate of $67.30 per revenue-mile, the incremental additional daily operating and maintenance (O&M) costs of running one daily northbound train and one daily southbound train for 129 miles between Los Angeles and San Diego would be $18,000. Section 12.1 discusses the calculation of this operating and maintenance cost rate for the Pacific Surfliner Corridor in detail,

Independent Utility

The improvements identified in this SDP's Build Alternative are independent utilities and offer benefits to multiple agencies and stakeholders. Improvements such as double tracking and siding extensions would benefit all trains operating in the Corridor, both freight and passenger, improving their reliability and decreasing running time.

Phasing Potential

Projects to improve passenger and freight operations in the Pacific Surfliner South Corridor have been identified through previous state rail plans, regional transportation plans, passenger and freight operational plans, and corridor studies. It is recommended that the following outcomes should be prioritized when considering system improvements:

- Higher operational speeds and more efficient operations;
- Additional service for existing markets and to open new markets for rail;
- Increased track capacity and operational reliability;
- Increased safety for riders and local community; and

- Reduced environmental impacts.

5.4 Environmental Resources and Quality

The following criteria assess major environmental concerns with respect to the improvements identified in the Build Alternative. Findings are based on previous studies.

Geologic Constraints

The Pacific Surfliner South Corridor passes through an area with a significant number of active earthquake faults. According to the *Pacific Surfliner South Program EIR/EIS (2007)*, Southern California is primarily vulnerable to seismic activity generated by the north-northwest trending San Andreas fault system and the east-west trending Transverse Ranges fault system. In addition, the document identified five major active faults in the Corridor capable of generating significant groundshaking in areas along the existing Pacific Surfliner South Corridor and proposed alignment options. These major faults include Newport-Inglewood, Rose Canyon, Raymond, Whittier, and Elysian Park.

Possible liquefaction zones have also been identified in urban portions of the Corridor from LAUS to Irvine and along coastal segments in southern Orange and northern San Diego Counties. Coastal areas along the Corridor in San Clemente, Dana Point, and Del Mar have high slope instability due to the fragility of the coastal bluffs.

Wetlands / Nature Preserves / Environmentally Sensitive Areas

The preliminary environmental assessment provided in the *Pacific Surfliner South Program EIR/EIS (2007)* identified the major potentially environmentally sensitive areas along the Corridor in the coastal lagoons of northern San Diego County in Oceanside, Carlsbad, Encinitas, Solana Beach, and Del Mar. A sensitive community of coastal sagebrush exists in the Camp Pendleton segment of the Corridor and provides habitat for many endangered and threatened species. In many cases, the EIR/EIS identified goals to existing wetlands condition. For example, by lengthening lagoon bridges, projects will remove earthen fills and improve tidal flows.

Sea Level Rise

The *Pacific Surfliner South Program EIR/EIS (2007)* identified coastal regions that would be impacted by sea level rise and global warning. Rising water levels could expose the coastline to increased flooding and have direct impact on at-grade sections of the rail alignments near the shorelines in Encinitas, San Clemente, and Del Mar. Bridge structures across lagoons in northern San Diego County would be vulnerable to rising water level that could erode bridge footings.

Cultural / Parks / Section 4(f) / Farmland or Agricultural Zones

The *Pacific Surfliner South Program EIR/EIS(2007)* identified that operational impacts to historic structures, archeological and paleontological resources, parks and recreational resources, and farmland/agricultural zones would be not be significant as a majority of the improvements would be located within existing railroad ROW. As new work is undertaken, there is the high possibility of paleontological resources being potentially impacted during segment improvements, and would be addressed in project-specific environmental documentation. There would be the potential for construction-related impacts to all of the identified resources and mitigation measures would be identified to reduce potential impacts during the preparation of project-specific environmental documentation.

Sensitive Receptors

The environmental assessment in the *Pacific Surfliner South Program EIR/EIS (2007)* identified sensitive residential receptors or residential areas vulnerable to noise and vibration impacts related to the following alignment options for the Corridor:

- At-grade versus full grade separation between LAUS and Fullerton;
- At-grade versus trench option from Fullerton to Irvine;
- At-grade versus tunnel option in San Juan Capistrano;
- At-grade versus tunnel options through San Clemente;
- At-grade trench versus trench options in Carlsbad and Encinitas; and
- Tunnel concepts in Del Mar.

Some of these rail improvements would contribute to a higher cumulative noise source, and more detailed analysis are needed to assess the project-specific noise and vibration impacts.

A high-level review of visual and scenic impacts resulting from project implementation identified that rail system improvements would not significantly change visual and scenic resources, or affect built-up areas with institutional, medical, school and/or residential properties adjacent to the ROW.

5.5 Conclusions

The evaluation indicates that the Build Alternative of adding up to 51 one-way passenger train trips by 2040, operating at current speeds, is consistent with expected funding resources. Besides the increased frequency of trains in the Corridor, implementation of the proposed improvement projects would allow faster trips between the San Diego and the Los Angeles Metropolitan area, as well as improved access to future CHSRA service as identified in the *CHSRA Revised Business Plan*. Many of the proposed improvements discussed above would facilitate safer, more efficient operations for freight and passenger trains that operate along the same corridors.

The evaluation also indicates that ROW requirements for the Build Alternative are minimal, as are the expected impacts on railroads, state highways and adjacent properties. No significant environmental impacts are expected. There is high potential for phased implementation of the projects identified in the Build Alternative reflecting projected funding availability. The Corridor infrastructure provides many opportunities for the phasing of improvements, and projects could be grouped by type into packages and prioritized for implementation. As stated above, priority could be given to Corridor projects providing improved travel time and increased reliability and safety such as double tracking.

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6.0 Planning Methodologies

This chapter describes the basic elements of the methodology used in developing the Service Development Plan (SDP) for the Pacific Surfliner South Corridor. The chapter also addresses the planning horizons utilized and the major overall assumptions employed throughout the SDP.

Beginning early in the study process, technical memoranda were prepared describing the methodology to be followed when conducting various analyses necessary to preparing the SDP. These memoranda are listed in Table 6.1, and included as appendices to the SDP. The SDP contains summary discussions of these methodologies. As shown in Table 6.1, the methodologies for some of the more substantial disciplines (such as ridership and operations simulation) are summarized in the particular chapter that describes the results of that discipline's analysis. The other methodologies are summarized in this chapter.

Table 6.1: Methodology Descriptions

Technical Memorandum	Location of Summary Discussion in SDP
Socioeconomic Data for Planning and Forecasting – September 15, 2011	Section 6.2.1
Forecasting Assumptions – November 21, 2011	Section 6.2.2
Freight Rail Forecasting Methodology – October 17, 2011	Section 6.2.3
Passenger and Freight Market Analysis Methodology – October 17, 2011	Section 6.2.4
GIS Methodology – October 20, 2011	Section 6.2.5
Alternatives Analysis Methodology – March 8, 2012	Section 6.2.6
Passenger Rail Ridership and Revenue Forecasting Methodology – November 11, 2011	Chapter 8
Rail Operations Simulation and Capacity Analysis Methodology – January 3, 2012	Chapter 9
Capital Cost Methodology – October 17, 2011	Chapter 11

6.1 Planning Horizons

Two planning horizons are employed in the development of the SDP: a near-term horizon with service levels and improvements to be realized by 2020, and a long-term horizon with service levels and improvements to be realized by 2040.

6.1.1 Year 2020 (Near-Term)

The near-term horizon reflects an initial level of operation to provide additional train frequencies, faster running times and improved reliability between Los Angeles and San Diego, meeting ridership demand in the Corridor through 2020.

6.1.2 Year 2040 (Long-Term)

The long-term horizon reflects a vision of expanded Corridor service between Los Angeles and San Diego, meeting ridership demand in the Corridor expected by 2040. Improvements also include those needed to reduce running time and improve reliability.

The Year 2040 Long-Term ridership forecasts include the effects of the completion of the Phase 1 HSR system statewide. The Phase 1 HSR network includes HSR service from San Francisco to Anaheim, utilizing blended operations on the Caltrain segment between San Jose and San Francisco as well as on the Los Angeles to Anaheim segment, and dedicated HSR tracks between Los Angeles and San Jose.

6.2 Major Overall Assumptions

The major overall assumptions used in the SDP with regard to socioeconomic data, freight rail forecasting, market analysis, GIS, and screening of alternatives are presented in this section.

6.2.1 Socioeconomic Data

Passenger and freight demand forecasting, market analysis, and subsequent planning analysis rely upon a future year statewide socioeconomic forecast encompassing households, population, jobs, workers, household incomes, and other variables. Moody's 2011 Economy.Com socioeconomic data (SED) was selected for use in all planning and forecasting efforts on this SDP. These forecasts have a number of advantages, including:

- Economy.com SED forecasts are currently being used for both the Amtrak/California Intercity Passenger Rail Forecasting Model (Amtrak/Caltrans Model) and the High-Speed Rail Ridership and Revenue Model (HSR R&R Model)[7];
- Economy.com SED forecasts were developed in 2011 and represent the most up-to-date forecasts that best reflect the continued economic slowdown (prior SED forecasts anticipated a shorter recession and more robust upturn in the California economy); and
- Economy.com also produces a consistent set of economic output data used in the freight rail forecasts.

6.2.2 Forecasting Assumptions

Base values or methodologies are presented for the following planning assumption categories:

- Cost Assumptions, including automobile operating costs, airfares, intercity conventional rail fares, high-speed rail fares, and station parking costs;
- Travel Times for automobile and air;
- Headways for air;

[7] See Chapter 8 for a description of the two models.

- Wait Times for airports and rail stations; and
- Terminal Processing Times for airports and rail stations.

These values are derived in large part from assumptions supporting modeling activities for the California High-Speed Rail Authority (CHSRA); however, some assumptions such as conventional rail fares and parking costs are based on assumptions in the Amtrak/Caltrans Model. Travel times and headways for high-speed rail and conventional rail routes are not reported here as planning assumptions, since they were defined through the scenario development process.

Cost Assumptions

Cost assumptions are documented in the memorandum entitled “California State Rail Plan: Cost Assumptions – FINAL” dated November 21, 2011. In this document, base values or methodologies are presented for a number of assumptions, including cost assumptions. The cost assumptions described in this document include automobile operating costs, bridge tolls, airfares, intercity conventional rail fares, high-speed rail fares, and station parking costs. These values are derived in large part from assumptions supporting modeling activities for the California High-Speed Rail Authority, however, some assumptions such as conventional rail fares and parking costs are based on assumptions in the Amtrak/Caltrans model.

- Conventional Rail – Conventional rail station parking cost assumptions (per trip) are as follows:
  - $12 – Goleta, San Diego.
  - $6 – LAUS.
  - $3 – Anaheim, Bakersfield, Burbank, Commerce, Fresno, Fullerton, Irvine, Tustin[8].
  - $0 – All other stations.

  This pricing mechanism was adopted based on market cost assumptions developed by the program management team for high-speed rail analysis, and used for scenario runs conducted after 2007.
- High-Speed Rail – High-speed rail station parking cost assumptions currently assumed for modeling purposes range from $32 at Los Angeles, while costs at minor stations range from $21 at Burbank to $16 at San Fernando. Parking costs (in 2005 dollars) are assumed constant in real dollars for all analysis years. In the case of joint conventional rail and high-speed rail stations, the high-speed rail prices will be used.

Travel Times

Base travel time assumptions for auto and air travel between market pairs are fixed variables. Conventional and high-speed rail travel times are subject to level of service scenario assumptions. The following proposed levels are consistent with the most recent model run assumptions used by CHSRA.

Automobile – Peak-period region-to-region automobile travel time assumptions for year 2030 are based on the average auto speed and travel time assumptions used by the HSR R&R Model, which assumes a maximum annual decrease in automobile speeds of 0.5 miles per hour.

Air – Air travel times are based on existing HSR R&R Model assumptions, which utilize FAA data samples from years 2000 and 2005. Market-to-market air travel time assumptions are assumed constant for all analysis years.

[8] While the model assumed conventional parking cost to be $3 per trip at Fullerton, Irvine, and Tustin, these stations do not currently charge a parking fee and have not made a formal policy decision on parking fee in the future.

Headways

Air travel service headways are assumed constant for all analysis years. Service headways for conventional and high-speed passenger rail are established during scenario development.

Wait Times

Wait time refers to the average time spent between arriving at the airline gate or train platform and the closing of the airplane or train door after passengers have boarded. Air wait times are assumed to be held constant at 55 minutes based on a review of surveys conducted in support of the HSR R&R Model.

Rail travel wait times are lower than air travel wait times for a variety of reasons, including multiple train boarding points, proof-of-purchase ticketing, baggage-related delays, etc. The HSR R&R Model assumes wait times of 15 minutes on both high-speed and conventional rail modes.

Terminal Processing Times

Both airports and rail terminals are subject to terminal processing times, or the amount of time passengers must endure from the time they arrive at the terminal via their access mode to the point they reach the gate. This includes time spent walking between access points and the terminal, time spent receiving a ticket and checking baggage, security, and other factors. In the HSR R&R Model, terminal processing times are determined from a combination of peer review recommendations and subsequent refinements, and vary based on the characteristics of the airport or terminal.

Airports –

- At LAX – 24 minutes for non-business/commute trips and 22 minutes for business/ commute trips; and
- At other airports – 20 minutes for non-business/commute trips and 18 minutes for business/ commute trips.

High-Speed Rail –

- At downtown or terminal high-speed rail stations (e.g., Los Angeles) – 12 minutes; and,
- At other high-speed rail stations – 8 minutes.

Conventional Rail –

- At stations that serve only conventional rail – 3 minutes; and,
- At stations that serve high-speed rail and conventional rail – 10 minutes.

6.2.3 Freight Rail Forecasting Methodology

A key element in the SDP is an examination of the impact of future train volume changes on the rail system. Changes from present train traffic volumes will affect the performance of the system, its capital needs, and potential shifts in mode share between rail and other competing modes. Since train volume changes are not uniform across the entire network, some sections may be subject to substantial volume gains, others could face stable demand, while yet others could face declines.

Economists classify the movement of goods (i.e., transportation) as a “derived” demand, by providing the necessary linkage between locations where goods are produced and where they are consumed. The act of transporting a good between two locations has no value per se; it creates value when there is an economic need for that good at the destination, and the combined cost of production at origin and its transportation to the destination is less than that for any other geographic source or material substitute.

These linkages between production and consumption are indicated through an examination of freight flows moving between geographic origins and destinations.

Data Sources

Two different data sources were used for this effort:

1. The Federal Highway Administration's Freight Analysis Framework (FAF3) database – which contains aggregated annual volume summaries by origin-destination geography, mode, and commodity – provides this information on a historical basis, using a combination of actual data and modeled behavior; and
2. The Surface Transportation Board's (STB) Confidential Carload Waybill Sample also provides freight flow data for the rail mode only and is used as an input to the FAF.

These two data sources, used in combination, provide most of the information needed to produce a base year commodity flow database and forecast. The commodity flow database is then used to estimate daily train flows at the line level for base year and forecast years in addition to identifying flows by other modes that may represent potential markets for diversion to rail.

Approach

The freight forecasting process, which is a commonly accepted approach for freight forecasting, was structured in a series of five tasks discussed below. While the first four steps are fixed, the last step entails some adjustment, depending on the availability of actual train counts.

Step 1 – Aggregate STB Waybill data by commodity, shipment type (carload rail and mixed mode, e.g., intermodal), and FAF3 geographic zones.

Step 2 – Using FAF3, calculate multiplier (growth rate) for change in rail traffic volumes (tonnage and value) between 2007 and 2035 by commodity, shipment type, and FAF3 zones.

Step 3 – For the container traffic associated with the ports of Los Angeles and Long Beach, we acquire current long-range forecasts and use them to create growth rate tonnage multipliers for 2007 to 2035. Port-related traffic is segregated in the waybill by examining the container initials, equipment type, and service lanes in which it appears. A base year adjustment is made for transshipped traffic (i.e., containers that are unloaded in the port region and then reloaded into domestic containers and trailers for movement inland) by using available data.

Step 4 – Apply tonnage multiplier calculated in previous step against each row in the STB waybill data, using crosswalk between FAF3 zone and Standard Point Location Code (SPLC) used in the waybill data, FAF commodity (Standard Classification of Transported Goods (SCTG), and Waybill commodity (Standard Transportation Commodity Code (STCC). The net result is an STB waybill with a forecast showing tonnage, number of carloads, and value for each extant origin, destination, carrier (route), and commodity combination. As needed, the regional tonnage and carload totals are squared to avoid introducing distortions in volume growth.

Step 5 – Generate trains. Using the base case and forecast waybills from Step 3, estimate train volumes using the methodology that was developed in the Association of American Railroads' 2007 National Rail Freight Infrastructure Capacity and Investment Study. This methodology entailed the estimation of the number of carloads moving over the network on a representative day, with volumes allocated among four types of train service based on the commodity being carried and the type of operation:

- Auto – For assembled motor vehicles moving in multilevel cars;
- Unit Train – For grain, coal, and other bulk commodities usually moving as a single train between origin and destination;

- Intermodal – For commodities moving in containers or truck trailers; and
- General Merchandise – All other carload rail shipments, including commodities moved in box and tank cars.

The number of trains of each type needed to move the cars are estimated using information on the typical number of cars hauled by train service type, obtained from available industry and STB reports. The number of intermodal trains needed is based on the number of intermodal units (e.g., container-on-flat-car (COFC) units and trailer-on-flat-car (TOFC) units). Train counts are calibrated against existing train count data wherever possible.

The base year train count data developed from the freight forecasting methodology was compared against current train count data assembled from the Class 1 railroads, and other sources such as the LOSSAN service restructuring study underway in Southern California. Also, prior data on existing conditions and adjustments were made to minimize the disparities.

6.2.4 Market Analysis

This section outlines the methodology used to estimate current and future travel market trends in the passenger sector. For the purposes of corridor-level analysis, trip origin/destination pairs are aggregated at the county level. The three most-populous counties are separated into subcounty zones for more detail:

- Los Angeles is divided into Los Angeles (North County) and Los Angeles (South County);
- Riverside is divided into Riverside (West County) and Riverside (Coachella Valley); and
- San Diego is divided into San Diego (City), San Diego (North Coast), San Diego (Interstate 15 (I-15) Corridor), and San Diego (East County).

The following data sources were used to develop of the passenger rail travel market analysis:

- Population and Employment figures are derived from the Moody's 2011 Economy.com dataset. Figures were obtained and aggregated at the county level for both statewide and corridor analysis. Employment North American Industry Classification System (NAICS) codes were grouped into four categories: wholesale, retail, professional services, and other employment.
- Population and Employment Density was estimated using land area information obtained via the 2000 U.S. Census.
- County-To-County Travel Market Trip Tables (all modes) for years 2000 and 2030 were derived from the HSR R&R Model9 , which consists of an interregional statewide model and intraregional models for the LA Basin and San Francisco Bay Area regions.
    - Underlying trip tables for travel within the LA Basin were provided by the Southern California Association of Governments (SCAG), while travel within San Francisco Bay Area zones was provided by MTC. These tables were adjusted based on Moody's Economy.com (2011) data. All trip tables reflect "no build" conditions, without high-speed rail service.

[9] The HSR R&R Model was chosen for this purpose over the Caltrans/Amtrak Model because the latter did not produce all-mode trip tables for future years. The HSR R&R Model was developed for High-Speed Rail Authority purposes and was only calibrated to produce trip tables for years 2000 and 2030.

- o The interregional model is based on trip frequency and destination choice models that utilize socioeconomic data directly and are influenced by accessibility between zones through logsums[10] reported under the CHSRA mode choice model.
- o Origin/destination information contained in HSR R&R Model transportation analysis zones (TAZs) was aggregated to the county (and subcounty) level.

Amtrak station Boardings and station-to-station Trips are observed station-to-station ticket sales figures reported by the Amtrak Data Warehouse (2011).

6.2.5 GIS Methodology

This section summarizes the methodology and approach taken to develop the GIS information used in developing the SDP. As a starting basis, Caltrans and CHSRA provided existing relevant data from CT Earth, the Caltrans Statewide Travel Demand Model, the Statewide Freight Model, and Caltrans and CHSRA GIS geospatial data and files for the statewide rail system. Building upon existing GIS information, a geospatial library for the existing and future rail system and rail services and facilities was developed in ArcGIS 9.3+.

A comparative analysis of the best available source of rail line data was conducted to determine which base layer provided the most efficient starting point for the GIS network update. To develop the data layers and attributes, an existing conditions inventory was constructed and built on the 2008 State Rail Plan. Features of the passenger rail inventory include intercity passenger rail lines (Amtrak California state and national lines), connecting bus service lines and station locations, intercity passenger rail station locations, proposed high-speed rail corridors and station locations, commuter rail systems and station locations, location of at-grade crossings, and passenger rail maintenance facilities.

A GIS database design was developed to store the data layers deemed feasible for data development. Data layers were reviewed against current orthoimage – photo image that has been adjusted for the topographic relief of the earth's surface – such as that available in Google Earth. Attributes and features were populated and verified, route-by-route, to ensure the physical characteristics of the existing passenger rail system were accurate and could be used for GIS-spatial and other analysis. This included characteristics such as shared corridor rail owner, rail operator, service frequency, condition, and station-level statistics. Corridors that are currently out of service were also noted.

6.2.6 Alternatives Analysis Methodology

This section presents the methodology developed for the Alternatives Analysis (AA) component of the SDP. The AA approach presented below includes the identification of AA criteria and the methodology for preliminary service development planning.

The AA evaluation was based on prior studies of the Pacific Surfliner South and related corridors, including:

- Amtrak California Passenger Rail System 20-Year Improvement Plan (March 2001)
- LOSSAN Corridor Strategic Assessment (January 2010)
- LOSSAN Corridor wide Strategic Implementation Plan (April 2012)
- Current service planning for Blended Service in Northern and Southern California (Draft California State Rail Plan, in production)

[10] In travel demand modeling, logsum is a composite measure of utility – or benefit – that is derived by making a specific trip. Logsum is used in choice-based models to predict the likelihood of a traveler selecting a particular option (such as destination, mode or route) given a set of socioeconomic and accessibility conditions.

- Current environmental planning work California (Draft California State Rail Plan, in production)

These studies identified a wide range of improvement projects including siding extensions, signaling upgrades, curve realignments, grade crossing improvements, and enhancements to existing stations. The efficacy of many of these improvements will be tested in the operations simulation analysis, which is a subsequent phase of the SDP. At this point in the development of the SDP, it was appropriate to provide an evaluation of candidate corridor-level improvements to focus further work and refine the concepts. Therefore, the AA methodology was designed to assemble and evaluate service plans and improvement lists that have been under development and/or implementation for some time, in order to create a foundation for further refinement.

There is tremendous variation in the nature of the built and natural environments along the Pacific Surfliner Corridor between San Diego and Los Angeles. The rail line traverses some of California's most scenic and environmentally-sensitive areas, including extended portions directly adjacent to the Pacific Ocean, thus opportunities for expansion are limited.

Expansion of rail right-of-way is constrained by topography along much of the Pacific Surfliner Corridor. The Pacific Surfliner runs along the coast between San Clemente to San Diego. Immediately to the east of the rails are steep cliffs and directly to the west is the Pacific Ocean. In addition, that area has numerous lagoons and sensitive wetlands that are crossed by the rail line. Impacts to wetlands and the corresponding protected species that inhabit the wetlands are extremely problematic.

The AA criteria address how alternatives are determined to be reasonable and feasible, in order to be carried forward into further analysis. The criteria assess how well each alternative meets the following:

- The Purpose and Need for the action;
- Technical feasibility (physical route characteristics, ROW (right-of-way) and engineering constraints, capacity-constrained existing facilities or infrastructure, and safety impacts);
- Economic feasibility (market potential and/or ridership, capital and operating costs); and
- Major environmental concerns.

The AA describes and evaluates two alternatives: 1) No-Build; and 2) Build. The analysis was primarily based on the following information from prior studies, program environmental documents prepared by Caltrans, and recent Corridor improvement projects:

- *Purpose and Need Statements*, which provide the basis for the AA studies, were identified from previous and on-going studies and Program Environmental Impact Report and Environmental Impact Statement (Program EIR/EIS) efforts.
- *Infrastructure improvements* and conceptual order-of-magnitude capital cost estimates were assembled based on conceptual planning and/or engineering from previous studies and similar recent projects.
- *Operating assumptions* were based on prior strategic improvement plans, service development plans, and operational analyses.
- *Operating and maintenance (O&M) cost estimates* for an initial operations period were estimated based on the train requirements identified as part of the operating assumptions analytical work and then on per train mile / hour operating and maintenance cost factors as provided in prior studies or similar recent projects.
- *Ridership forecasts and travel demand* for each alternative were identified from prior studies and clarified and updated to FY 2012 with new assessments of market potential.

7.0 Outreach Efforts

This section describes the public/agency involvement in developing the Pacific Surfliner South Corridor Service Development Plan (SDP), as well as the California State Rail Plan (CSRP) statewide outreach effort as described in Chapter 4 of the State Rail Plan.

As indicated in Chapter 1 of this SDP, a Program Environmental Impact Report (PEIR) was completed in 2007 for the LOSSAN Corridor including the legally required outreach providing information on the project alternatives, potential impacts and proposed mitigation. This SDP is consistent with the purpose and need of the document. Outreach efforts for the Pacific Surfliner South Corridor will be led by Caltrans Division of Rail and AECOM and will be coordinated with the efforts of the CSRP and Pacific Surfliner South Corridor outreach outlined here.

General outreach for the CSRP included the project website, advisory committee meetings, collateral materials and stakeholder outreach briefings. These outreach efforts also involved Pacific Surfliner Corridor South specific information as it relates to the overall SDP development process. The following outlines the specific outreach efforts and coordination for the Pacific Surfliner South SDP. The final Pacific Surfliner South SDP was vetted through Caltrans and other appropriate state agencies and other committees in early 2013.

7.1 Stakeholder Meetings

Presentations summarizing the goals, process, and schedule for the Pacific Surfliner South Corridor SDP were provided to Caltrans and various agencies, stakeholders, rail corridor committees and railroads during 2012 to ensure that key decision makers and executive staff were well informed and updated on the status of the SDP process and findings prior to submittal of the administrative draft.

7.1.1 California State Rail Plan Advisory Committee

A CSRP Advisory Committee was formed by Caltrans Division of Rail to provide input and expertise in the development of the CSRP and service development plans throughout the state including Pacific Surfliner South. Representatives from federal, state, and regional agencies and freight and passenger rail agencies comprised the committee to ensure a broad and diverse group of interests were represented. Participant groups included:

- National Railroad Passenger Corporation (Amtrak)
- BNSF Railway (BNSF)
- California High-Speed Rail Authority (CHSR)
- California Shortline Rail Association (CSLRA)
- California Transportation Commission (CTC)
- Capitol Corridor Joint Powers Authority (CCJPA)
- Coast Rail Coordinating Council (CRCC)
- Federal Railroad Administration (FRA)
- Los Angeles-San Diego-San Luis Obispo Rail Corridor Agency – North Corridor (LOSSAN North)
- Los Angeles-San Diego-San Luis Obispo Rail Corridor Agency – South Corridor (LOSSAN South)
- San Joaquin Valley Rail Committee (SJVRC)

- State of California Business, Transportation and Housing Agency (BT&H)
- Union Pacific Railroad (UPRR)

7.1.2 Caltrans Internal Coordination

Pacific Surfliner South information, as part of the overall SDP development effort was presented to Caltrans Management and related agency groups including: BT&H, CTC and others. Specific SDP information was also part of the five public CSRP meetings held throughout the state in early 2013.

A collaborative effort was also established with Caltrans District 7, 11 and 12 Public Information Officers (PIOs) and Planning Deputies to assist with reaching out to corridor district stakeholders. PIOs were provided an information packet (fact sheet, frequently asked questions (FAQ), and website links and other CSRP materials) including a “Meeting-in-a-Box” PowerPoint presentation containing information on the Pacific Surfliner South. They were also asked to help in getting the CSRP/SDP message out to stakeholders. Administrative Draft chapters of the Pacific Surfliner South were also sent to PIOs and Planning Deputies for their review and comments. The packet of information was used to educate the Districts on the CSRP and SDP process and to provide adequate reference materials should stakeholders inquire about the Pacific Surfliner South study and outreach process.

7.1.3 State Agencies/Regional Agencies

Status and updates were provided to state agencies and regional agencies (MPOs, RTPAs and Councils of Governments (COGs)) related to the Pacific Surfliner South Corridor including distribution of the same CSRP information packets discussed above. The agencies listed below were encouraged to review the materials and participate in the five public meetings held throughout the state in early 2013. The following agencies were provided a presentation on the status and process of developing the SDP’s including Pacific Surfliner South:

- **State Agencies**

  The following agencies received overview CSRP briefings including general SDP information only:
  - Native American Advisory Committee (NAAC)
  - California Association of Councils of Governments (CALCOG)
  - Active Transportation and Livable Communities (ATLC)
  - Rural Counties Task Force (RCTF)
  - Air Resources Board (ARB)

  The California Energy Commission (CEC) and Strategic Growth Council received an information packet but did not receive a briefing.

- **Metropolitan Planning Organizations (MPOs), Regional Transportation Planning Agencies (RTPAs) and Councils of Governments (COGs)**

  Representatives from the following agencies participated on the LOSSAN Rail Corridor Agency or CRCC rail committees where they received draft Pacific Surfliner documents:
  - Southern California Associations of Governments (SCAG)
  - Los Angeles County Metropolitan Transportation Authority (LACMTA)
  - San Diego Association of Governments (SANDAG)

7.1.4 SDP Rail Corridor Committees and Railroads

As part of the CSRP Advisory Committee the LOSSAN, CRCC, freight and passenger rail representatives received the draft Pacific Surfliner South SDP to review and provide comments. In addition, each member was tasked with coordinating the input needed to inform the SDP development process prior to the submittal of the Administrative Draft. Status reports and updates on the SDP and interim deliverables were also provided through specific presentations to the Advisory Committee. However, briefings were not scheduled to individual passenger and commuter rail owners and operators. Each of the agencies below received the draft Pacific Surfliner South Corridor SDP for review and comment.

- **Rail Corridor Board and Committees**
  - LOSSAN Joint Powers Authority (JPA) Board of Directors
  - LOSSAN Technical Advisory Committee (TAC)
  - Coast Rail Coordinating Council (CRCC)
- **Freight Railroads: Class 1/Shortline**
  - Union Pacific Railroad
  - BNSF Railway
  - California Shortline Railroad Association (CSLRA)
- **Passenger Railroads (Owners and Operators)**
  - Los Angeles County Metropolitan Transportation Authority (LACMTA)
  - Orange County Transportation Authority (OCTA)
  - Southern California Regional Rail Authority (SCRRA or Metrolink)
  - National Railroad Passenger Corporation (Amtrak)
  - California High-Speed Rail Authority (CHSRA)
  - North County Transit District (NCTD) – Coaster
  - San Diego Metropolitan Transit System (MTDB)

7.2 Public Meetings

One round of five public meetings was held throughout the state in early 2013 to discuss the CSRP and SDP areas including the Pacific Surfliner South Corridor. These public meetings garnered stakeholder input and supported the outreach efforts for the SDP. Meetings were held in the following cities/locations:

- Sacramento (February 12, 2013)
- Oakland (February 14, 2013)
- San Diego (February 19, 2013)
- Los Angeles (February 20, 2013)
- Fresno (February 21, 2013)

Stakeholder meetings involving the Pacific Surfliner North Corridor are summarized in Table 7.1.

Table 7.1: Stakeholder Meetings Involving Pacific Surfliner South Corridor

Date	Meeting	Location
February 15, 2012	CSRP Advisory Committee	Caltrans Headquarters, Sacramento
June 6, 2012	CSRP Advisory Committee	Caltrans Headquarters, Sacramento
September 19, 2012	CSRP Advisory Committee	Caltrans Headquarters, Sacramento
December 19, 2013	CSRP Advisory Committee	Caltrans Headquarters, Sacramento
September 14, 2012	BT&H	Caltrans Headquarters, Sacramento
September 14, 2012	CTC Staff	Caltrans Headquarters, Sacramento
November 2012	BT&H	Caltrans Headquarters, Sacramento
January 2013	BT&H	Caltrans Headquarters, Sacramento
October 30, 2012	CALCOG	SACOG Board Room, Sacramento
November 15, 2012	ATLC	Sacramento
November 16, 2012	RCTF	Caltrans Headquarters, Sacramento
April 20, 2012	CRCC	SBCAG, Santa Barbara
May 10, 2012	LOSSAN TAC	Metro, Los Angeles
June 29, 2012	LOSSAN TAC	San Diego
July 13, 2012	CRCC	Amtrak Office, Oakland
August 9, 2012	LOSSAN TAC	Metro, Los Angeles
August 30, 2012	LOSSAN/CRCC Joint Meeting	San Luis Obispo
September 6, 2012	LOSSAN TAC	San Diego
October 4, 2012	LOSSAN TAC	Metro, Los Angeles
November 8, 2012	LOSSAN TAC	San Diego
December 6, 2012	LOSSAN TAC	San Diego
January 2013	LOSSAN Board	San Diego
January 14, 2013	RCTF	Caltrans Headquarters, Sacramento

8.0 Ridership Demand and Revenue Forecast

This section of the Service Development Plan (SDP) addresses the methods, assumptions and outputs for travel demand forecasts, and the expected revenue from the proposed services.

8.1 Passenger Rail Forecast

Passenger Rail ridership (and revenue) forecasts were prepared for baseline and future conditions along the Pacific Surfliner South Corridor, using a 2020 and 2040 forecast year. An overview of the methodology and approach, study area, data sources and assumptions, travel demand model, and resulting ridership forecasts is provided below.

8.1.1 Methodology and Approach

The 2020 and 2040 ridership forecasts were prepared using the Amtrak/California Intercity Passenger Rail Forecasting Model (Amtrak/Caltrans Model), a forecasting model developed by AECOM for the California Department of Transportation (Caltrans) and Amtrak to provide consistent ridership and ticket revenue forecasts in support of short- and long-term rail passenger service planning in California. The Amtrak/Caltrans Model is based on extensive market and traveler behavior research throughout California (and nationwide), historical rail ridership and revenue data and trends, and demographic data. It provides coverage across the three existing California state-supported passenger rail corridors (including major thruway bus connections to/from rail) and addresses travel by intercity passenger rail, auto, and air (for trips between Northern and Southern California). This analysis assumes 2014 and 2030 passenger levels from the *2012 LOSSAN Corridorwide Strategic Implementation* Plan would be the same as the service levels for the plan horizon years 2020 and 2040, respectively.

A more detailed description of the Amtrak/Caltrans Model is provided in the *Passenger Rail Ridership and Revenue Forecasting Methodology* document prepared in October 2011.

8.1.2 Study Area Definition

The overall study area addressed by the Amtrak/Caltrans model is illustrated by Exhibit 8.1. The proposed Coast Daylight, the Pacific Surfliner North, Pacific Surfliner South and Amtrak's Coast Starlight are also shown in this Exhibit, since these services and their markets have important interactions. Specifically, the proposed Coast Daylight train service will operate as an extension of Pacific Surfliner North trains – providing a one-seat ride from San Francisco to Los Angeles, and most of the Pacific Surfliner North trains operate as through extensions of Pacific Surfliner South train service, providing a one-seat all the way to/from San Diego. Ridership/revenue on these shared trains will be accounted for as follows:

- Travel entirely south of Los Angeles (the northern end of the Pacific Surfliner South service area), such as a trip from Los Angeles to San Diego, is assigned to the Pacific Surfliner South.
- Travel south of San Luis Obispo and north of Los Angeles, such as a trip from San Luis Obispo to Los Angeles, is assigned to the Pacific Surfliner North.
- Travel completely north of and travel to/from points north of San Luis Obispo (the northern end of the Pacific Surfliner North service area), such as a trip from San Francisco to San Luis Obispo and a trip from San Francisco to Los Angeles is assigned to the Coast Daylight.

In addition, the proposed Coast Daylight and the Pacific Surfliner North trains serve some markets in common with Amtrak's Coast Starlight, which would continue to operate between Los Angeles, San Jose,

Exhibit 8.1: Pacific Surfliner South Corridor Study Area Map

Oakland and points north of Oakland. Regions of particular importance to the Pacific Surfliner South SDP forecasts are Los Angeles at the northern end, Orange County and San Diego at the southern end.

8.1.3 Data Sources and Assumptions

The Amtrak/Caltrans Model is based on extensive travel survey data collected between 2005 and 2008 from existing automobile and rail users at key locations within California. A more detailed description of these survey inputs is provided in the *Passenger Rail Ridership and Revenue Forecasting Methodology* document prepared in October 2011.

Modal service characteristics represent the key independent variables in forecasting the shares of travel captured by each mode of travel. These characteristics, often referred to as impedances, include:

- Travel time (minutes);

- Travel cost (dollars); and
- Frequency of service (departures per day).

Future growth estimates are based on socio-economic data and forecasts developed by Moody's Economy.com. Key measures include forecasts of population, employment and income.

8.1.4 Travel Demand Model

Structure

The Amtrak/California Model utilizes a two-stage model system. The first stage forecasts the growth in the total number of person trips in each market and the second stage predicts the market share captured by each available mode in each market. Both stages are dependent on the service characteristics of each mode and the characteristics of the Corrridor population. The key market segments addressed in the forecasting model system are defined and evaluated by origin-destination market pair and trip purpose (commute, business, recreation, and other).

The first stage of the Amtrak/California Model addresses the growth in the total intercity person travel volumes and includes "natural" growth and "induced" demand. The second stage of the Amtrak/California Model is the mode share component, which estimates the percentage of the total person travel by the following three different modes of intercity travel (auto, intercity rail, and air). The key variables in the mode share model include:

- Line-haul travel time for all modes;
- Access/egress time for intercity rail and air; and
- Travel cost or fare.

A more detailed description of the Amtrak/Caltrans Model is provided by the *Passenger Rail Ridership and Revenue Forecasting Methodology* document prepared in October 2011.

Network and Service Characteristics

The specific baseline assumptions that were used for competing (non-rail) modes of travel are detailed in the *Forecasting Assumptions Memorandum* prepared in September 2011. Detailed rail service inputs were developed for baseline conditions and four future service scenarios. The "Baseline" is defined by the current service levels, which include:

- 11 daily round trips on Pacific Surfliner trains between Los Angeles and San Diego; 10.5 all- stop round trips and one northbound limited stop trip.
- Metrolink weekday roundtrips:
    - Orange County line trains: Five roundtrips to/from Oceanside and Los Angeles; 9.5 round trips that operate as far south as Laguna Niguel.
    - 91 line trains: 4.5 roundtrips to/from Los Angeles and Riverside that operate over part of the Corridor between Los Angeles and Fullerton.
    - IE-OC line trains: Seven roundtrips to/from San Bernardino and Oceanside that operate over part of the Corridor between Orange and Oceanside.
- Eleven weekday Coaster round trips between Oceanside and San Diego
- One Amtrak Southwest Chief roundtrip between Los Angeles and Fullerton.

The future "Build" scenarios differ for forecast years 2020 and 2040, as follows:

- In 2020:

- Pacific Surfliner service increases to a total of 12 daily round trips between Los Angeles and San Diego; 11 all- stop round trips and one limited stop round trip.
- Metrolink weekday roundtrips:
  - Orange County line trains: 3.5 roundtrips to/from Oceanside and Los Angeles; Eight round trips that operate as far south as Laguna Niguel.
  - 91 line service increases to six roundtrips.
  - IE-OC line service increases to eight roundtrips.
  - Five Intra-Orange County roundtrips.
- Coaster service increases to 14 weekday round trips.
- 1.5 Metrolink/Coaster round trips operate through Oceanside, providing one-seat ride commuter service between Los Angeles and San Diego.

- In 2040:
  - Pacific Surfliner service increases to a total of 18 daily round trips between Los Angeles and San Diego; 14 all-stop round trips and four limited stop round trips.
  - Metrolink weekday roundtrips:
    - OC line trains: Two roundtrips to/from Oceanside and Los Angeles; Nine round trips that operate as far south as Laguna Niguel
    - 91 line service increases to 16 roundtrips.
    - IE-OC line service increases to 12 roundtrips.
    - Seven Intra-Orange County roundtrips.
  - Coaster service increases to 20 weekday round trips.
  - Five Metrolink/Coaster round trips operate through Oceanside, providing one-seat ride service between Los Angeles and San Diego.
  - Two Metrolink/Coaster round trips operate through Oceanside, providing one-seat ride service between Inland Empire and San Diego.
  - One Amtrak Sunset Limited roundtrip between Los Angeles and Fullerton.

In addition, Coast Daylight service is initiated north of San Luis Obispo in 2020 and 2040, but this does not result in any new frequencies south of San Luis Obispo not already accounted for above. Table 8.1 summarizes the train frequencies provided in the Baseline and 2020 and 2040 Build scenarios.

Table 8.1: Summary of Train Frequencies by Scenario

	Daily Train Frequencies (round-trips)		
	Baseline	**Build 2020**	**Build 2040**
Pacific Surfliner South			
Los Angeles-San Diego (All Stop)	10.5	11	14
Los Angeles-San Diego (Limited Stop)	0.5	1	4
Metrolink			
Los Angeles-Oceanside (OC line)	5	3.5	2
Los Angeles- Laguna Niguel (OC line)	9.5	8	9
Los Angeles- Fullerton (OC and 91 lines)	14	14	25
Orange - Oceanside (IE-OC line)	7	8	12
Fullerton- Laguna Niguel (Intra-OC line)	0	5	7
Coaster			
San Diego-Oceanside	11 weekday	14 weekday	20 weekday
Metrolink/Coaster			
Los Angeles-San Diego (LA-SD Commuter)	0	1.5	5
Orange – San Diego (IE-SD Commuter)	0	0	2
Amtrak			
Southwest Chief	1	1	1
Sunset Limited*	0	0	1

*Sunset Limited currently travels along the Union Pacific Railroad Los Angeles Division; it may be rerouted through Fullerton by 2030.

8.1.5 Baseline and Future Scenarios Forecasted Ridership

Using the Amtrak/California Model, ridership and ticket revenue forecasts were prepared for 2020 and 2040 baseline and future service scenarios. For Pacific Surfliner South, these forecasts were originally prepared to support the *LOSSAN Corridorwide Strategic Implementation Plan* and have been updated for this SDP to reflect the latest market data and growth forecasts for 2020 and 2040 forecast years. Table 8.2 summarizes these results by type of service for the Pacific Surfliner South Corridor market segment only, including state-supported Amtrak trains and parallel Metrolink and Coaster commuter services. Forecast results associated with Pacific Surfliner North markets, which are north of Los Angeles, are addressed in the Pacific Surfliner North SDP.

Table 8.2: 2020 and 2040 Annual Ridership and Revenue Forecasts for Pacific Surfliner South

	Forecast Year 2020		Forecast Year 2040	
	Baseline	**Build**	**Baseline**	**Build**
Annual Ridership				
Pacific Surfliner South Trains	2,149,300	2,156,000	3,031,000	3,321,600
Commuter Trains Metrolink	2,675,100	**	3,772,000	**
Coaster	1,849,700	**	2,608,400	**
Subtotal	*4,524,800*	*4,964,000*	*6,380,000*	*10,235,700*
Total	*6,674,100*	*7,120,000*	*9,411,400*	*13,557,300*
Ticket Revenue (2012$)				
Pacific Surfliner South Trains	$43,696,000	$44,072,000	$61,568,000	$72,911,000
Commuter Trains Metrolink	$17,683,000	**	$24,915,000	**
Coaster	$9,165,000	**	$12,913,000	**
Subtotal	*$26,848,000*	*$29,394,000*	*$37,828,000*	*$62,767,000*
Total	*$70,544,000*	*$73,466,000*	*$99,396,000*	*$135,678,000*

Notes:
** Allocation between Metrolink and Coaster dependent upon specific arrangement/agreement for new through service operations.

The results show generally expected growth in ridership/revenue as new Pacific Surfliner, Metrolink, and Coaster frequencies are implemented in 2020 and in 2040. In 2020, the relatively modest increases in service produce similarly modest increases in ridership and ticket revenue. In 2040, however, significant increases in service result in similarly significant increases in ridership (+44%) and ticket revenue (+36%) relative to the baseline. The relative ticket revenue increase is smaller than the relative ridership increase because the service increases are more significant among the commuter services, which have lower average fares and also serve shorter markets. The ridership differs from the ridership shown in the 2012 LOSSAN Corridorwide Strategic Implementation Plan because of different model structures and systems. Details on this analysis' Amtrak/Caltrans Model are provided by the *Passenger Rail Ridership and Revenue Forecasting Methodology* document prepared in October 2011.

8.2 Revenue Forecast

Revenue includes ticket revenue associated with fares paid by train rides and auxiliary revenue associated with on-board food and beverage service.

8.2.1 Ticket Revenue Forecast

Ticket revenue forecasts are simply the product of the ridership forecasts, described above, and the average fares by station pair market. The table above also summarizes the forecasted ticket revenue. All ticket revenue forecasts are expressed in 2012 dollars and are consistent with the latest near-term forecasts developed by Amtrak and Caltrans for current state-supported intercity passenger rail services within California.

8.2.2 Auxiliary Revenue Forecast

Typically, where detailed revenue sources are unavailable, the forecasting of auxiliary revenue is represented as a percentage of the total operation revenue. Auxiliary revenue is not substantial for the current network. Since there currently are no programs in place to increase auxiliary revenue sources in the future year scenarios, auxiliary revenue forecasts are not expected to be considerable.

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9.0 Operations Modeling

This section of the Service Development Plan describes the rail operation simulations for the southern portion of the Pacific Surfliner Corridor. For the purposes of this study, the Pacific Surfliner South Corridor is defined as operating between LAUS and San Diego. Railroad operation dynamic simulations were taken from the 2012 LOSSAN Corridorwide Strategic Implementation using the Berkeley Simulation Software Rail Traffic Controller (RTC) model (the model). The rail modeling results and the identified capital needs support the short-term (2014) and long-term (2030) business case agreed by the LOSSAN Corridor agencies. For the purpose of this SDP, the plan horizon years 2040 and 2020 assume passenger service levels and modeling results from the *2012 LOSSAN Corridorwide Strategic Implementation Plan* for the years 2014 and 2030, respectively.

The modeling includes all rail activity in the Corridor, including freight, intercity passenger and commuter rail. Though the discussion focuses on operations modeling of this specific Corridor, the methodology itself encompasses a statewide system approach. The simulation model includes the rail network for all of the SDP corridors and the rail activity loaded onto the model reflects movements from all potential sources that would be using a particular section of track.

The service network analysis models and methodologies used are described in detail, including the method through which potential infrastructure improvements were identified and incorporated into the modeling effort. This section specifically describes how stochastic operations were incorporated into the modeling effort, in terms of operational reliability of scheduled rail service, operational variability of non-scheduled rail service and equipment and infrastructure reliability. Base case and alternative specific schedules for existing and new services, and operating windows and schedules are provided. Equipment compositions (consists) for all services included in the operations modeling are described.

The origin of the rail infrastructure network employed in the operations modeling is described in this chapter as well as any major infrastructure-related assumptions employed in the operations modeling. The outputs and results from operations modeling of all base case and alternative scenarios are provided, including stringline diagrams. Stringline diagrams are graphs which show the time on the horizontal axis, and train stations on the vertical axis in order to show train positions over time. The background color on the stringline diagram indicates the number of main tracks available for each track segment. The following scenarios were modeled for the two planning horizon years:

- Year 2020 Preferred Build Alternative:
  - New through commuter trains between San Diego and Los Angeles making all stops.
  - An additional limited stop Pacific Surfliner train.
  - Additional mid-day Coaster and Metrolink service with timed connections in Oceanside.
  - Integration of Caltrans' goal for moving intercity service to a consistent 7-day per week schedule.
- Year 2040 Preferred Build Alternative:
  - Additional through commuter service between Los Angeles and San Diego.
  - New San Diego stops at Intermodal Transportation Center, Del Mar Fairgrounds, and Convention Center.
  - Peak period intercity trains converted to limited stop express services
  - This alternative did not include the high speed rail. At the time of the operational analysis, the LOSSAN project working group requested that the CHSRA take the lead of developing the proposed high-speed rail service plan for Southern California. Future modeling integration of high speed train service is pending on this development.

These two scenarios (2014 scenario version 3A and 2030 scenario version 1 in the *2012 LOSSAN Corridorwide Strategic Implementation Plan)* were agreed by LOSSAN project working group as the preferred alternatives for operational modeling.

9.1 Modeling Methodology

The Berkeley Simulation Software Rail Traffic Controller (RTC) model (Model) was selected as the platform on which to conduct the operations analysis for the LOSSAN Corridor Business Case. The Model was selected because it provides a variety of analytical and reporting capabilities encompassing the range of information required for this analysis and can realistically simulate higher-speed train operations in a mixed use operational environment (intercity, commuter and freight services). The advantage of the Model is that it is designed as a flexible tool that can be further modified, refined and upgraded as needed to evaluate different operational and infrastructure assumptions and configurations. The two scenarios were modeled using the ETC to determine the feasibility of the assumed infrastructure to support the desired future train volumes. Summary results for both planning horizons are provided below.

9.2 Input and Assumptions

The key input and assumptions for the two scenarios are described in the following sections:

- Train characteristics
- Infrastructure assumptions
- Operating assumptions and service plan

9.2.1 Train Characteristics

Train set performance characteristics and consist composition define the type of rail vehicle fleet that will be used in the services along the Corridor. These parameters were based on the existing consists and train set equipment, and have been agreed upon by the LOSSAN member agencies for each passenger and freight train classification:

- Commuter services: Trains are powered by General Motors F59PHI and Motive Power MP36PH locomotives capable of achieving maximum operating speeds of 110mph and 90mph, respectively.
- Intercity services: Trains are powered by General Motors F59PHI locomotives capable of achieving a maximum operating speed of 110mph.
- Freight services: Trains are powered by a range of motive power, typically the General Electric Dash 9-44CW and General Motors GP-38 locomotives capable of achieving maximum operating speeds that approach 70mph

9.2.2 Infrastructure Assumptions

The LOSSAN working group defined infrastructure improvements that could be funded and constructed by 2020 and 2040. These projects were incorporated into the model for purposes of simulating their effects on operations under the 2020 and 2040 service plans.

2020 Infrastructure Assumptions

Los Angeles Union Station Platform 7

Platform 7 was one of the station's original boarding platforms and was removed from service more than 35 years ago. The improvements assumed as part of this project include the restoration of tracks 13, 14, and 15, and passenger access/egress from these tracks to and from the main Station area. These enhancements are intended to allow for more efficient processing of the anticipated increase in passenger volumes into and out of Los Angeles as well as customer comfort and convenience.

Substantial Completion of BNSF Third Main Track

The LOSSAN working group agreed that the triple track project currently underway along the BNSF San

Bernardino Subdivision would be substantially complete by 2015. The only exception could be the segment located at the crossing of Rosecrans and Marquardt Avenues in the City of La Mirada. This segment currently lacks the funding necessary for grade separation of this crossing. The configuration as coded into the model, assumes a 200 to 300 foot section of double track along the 21 miles between Fullerton Junction and CP Soto.

CP Stadium Crossovers and Turnout

A new 40 miles per hour (mph) universal crossover was assumed immediately south (railroad timetable east) of the crossing of State College Boulevard. In addition to this universal crossover, the Union Pacific Railroad (UPRR) industry lead to the Santa Ana line would be powered, to eliminate the need for a freight train to stop on the State College Boulevard crossing while the train crew manually aligns the switch.

Santa Margarita River Bridge Replacement and Double Track

This project will replace the former single track steal truss bridge, located between the locations of existing CP Mesa and CP Westbrook, with two concrete viaducts, providing a two track operation across the Santa Margarita River. In addition, this project removes the existing CP Westbrook and makes modifications to the locations of CP Mesa and CP Stuart, which provide access and egress to the Stuart Mesa Maintenance Facility. This facility is the primary servicing facility for the COASTER commuter rail trains, and also provides overnight storage to Metrolink commuter trains.

Oceanside Thru-Track

This project will construct an additional station track at the Oceanside Transit Center (OTC) to allow both Metrolink and COASTER trains terminating at Oceanside to “turn” off of the mainline, minimizing conflicts with through Amtrak Pacific Surfliner intercity trains and “new” commuter trains. As currently being designed, the “thru-track” will be constructed on the east side of the railroad right-of-way, just south of the existing pedestrian underpass that connects Tracks 1 and 2. The southern end of the “thru-track” would rejoin the mainline at a modified CP Escondido Junction.

Carlsbad Second Track Extension

This project will extended the double track segment north of the Carlsbad Poinsettia COASTER station by an additional 1.8 miles to the location of the new CP Carl. The existing CP Farr will be relocated and retained as a new universal crossover.

Sorrento Valley Double Track and Sorrento to Miramar Phase 1

The Sorrento Valley Double Track project will extend the existing double track approximately 1.1 miles to the north from the existing CP Torrey to just south of the Los Penasquitos Lagoon crossing. The Sorrento to Miramar Phase 1 project is the first stage of a double tracking and curve realignment program for the Sorrento grade. Phase 1 of this project extends the double track (geographically) south from CP Pines approximately 1.1 miles, and will also provide for some curve straightening and speed improvements.

San Diego Crossovers

These two crossovers in the City of San Diego will enhance the overall capacity of the Corridor as it approaches the Santa Fe Depot terminal in downtown San Diego. The first is a universal crossover (CP Cudahy), to be located along the double track segment between CP Tecolote and CP Morena. The second will be CP Convair, a “left hand” crossover to be located south of the Old Town San Diego COASTER station, near the former Convair plant.

2040 Infrastructure Assumptions

Los Angeles Union Station (LAUS) Run-Thru Tracks

The Union Station Run-Thru Tracks project would construct a new approach to the station from the south (over US Route 101) and provide a connection to the existing platform tracks from 3 through 6. This would reduce the overall dwell time at the station for through trains (i.e. Pacific Surfliner trains or

through-routed Metrolink trains), making additional capacity available to service the projected increase in train volumes in 2040.

Laguna Niguel to San Juan Capistrano Passing Siding

This project would be the first step in addressing the capacity issue associated with the single track in Orange County by constructing a passing siding immediately south of the existing CP Avery. This siding would be about 1.8 miles in length and provide a location for trains to meet between the existing Serra Siding and the current southern termination point of double track at Laguna Niguel. The siding would end prior to reaching the developed area of the historic district in the City of San Juan Capistrano.

Irvine 3rd Main Track Extension

This project would provide an 8.5-mile long section of triple track located between the Red Hill Avenue crossing in the City of Tustin and CP Bake in the City of Lake Forest. The passenger platforms at Irvine and Tustin Stations also would be modified to provide access/egress to and from the new third main track. This length of triple track will be capable of supporting limited stop service, overtakes, and short-turning of trains off the mainline.

Anaheim Canyon Station Double Track

While not on the Pacific Surfliner South Corridor, the double tracking of the Anaheim Canyon Station provides significant benefit to the Corridor. Located along Metrolink's Olive Subdivision, this station improvement would provide a capacity improvement to the Olive subdivision, which connects Riverside with Orange and San Diego Counties. Currently, the Olive Subdivision is single track, which means that trains would need to wait on either end of the subdivision for opposing trains to clear. This configuration has the potential to cause delays on the Pacific Surfliner South Corridor, as trains are "held" in Orange. With the assumed increase in service of the Inland Empire – Orange County (IEOC) Line trains between Riverside, Orange and San Diego Counties, providing additional capacity to the Olive Subdivision will be important to maintaining the operational reliability of the Pacific Surfliner South Corridor.

CP San Onofre to CP Pulgas Double Track

This project envisions the construction of a second main track between CP San Onofre (MP 212.3) and CP Pulgas (MP 218.3) eliminating the single-track section between 2 existing sidings. As a part of the project, CP Pulgas is assumed to be relocated to the mid-point of this new double-track section near MP 216.4 and converted to a control point (CP) with a universal crossover.

CP Eastbrook to CP Shell Double Track

This double tracking project also includes the replacement of the aging single-track ballast-deck through-girder bridge over the San Luis Rey River near the Oceanside Station. In combination with the CP San Onofre to CP Pulgas Double Track Project, completion of this improvement would establish a fully double tracked railroad between CP Songs (MP 209.2) and the Oceanside Station, a distance of over 18 miles. As a part of this project, CP Shell is assumed to be upgraded to a control point (CP) with a universal crossover that allows trains to traverse between main tracks as they arrive at or depart from the Oceanside Station.

Carlsbad Village Double Track

This project assumes the completion of the second main track between CP Longboard (MP 228.4) and CP Carl (MP 229.5). This simulation assumed a second passenger platform would be constructed at the Carlsbad Village COASTER Station and that the CP Longboard would be "retired", with a new left-hand crossover to be located at CP Escondido Junction.

CP Ponto to CP Moonlight and CP Moonlight to CP Swami Double Track

These projects envision the completion of the second main track through the City of Encinitas between CP Ponto (MP 234.5) and CP Swami (MP 238.0). This simulation assumed a second passenger platform would be constructed at the Encinitas COASTER Station and A new control point (CP) with a universal crossover would be installed near Leucadia Boulevard in the City of Encinitas.

CP Cardiff to CP Craven Double Track

This project assumes the completion of the second main track between CP Cardiff (MP 239.6) and CP Craven (MP 241.1). Based on previous discussion with NCTD staff, this simulation assumed CP Craven would be “retired” and a single left-hand crossover would be constructed at the current location of CP Cardiff.

San Dieguito Bridge Double Track

This project envisions the replacement of an existing single-track trestle over San Dieguito Bridge with a new double-track bridge. When complete, this improvement would extend the second main track from CP Valley (MP 242.2) south (railroad east) to CP Crosby (MP 243.3). This simulation assumed that the existing Del Mar Siding would remain as a controlled siding at its current location. A seasonal Del Mar Fairgrounds platform was not assumed as part of this infrastructure assumption since only year-round stops were included.

Sorrento to Miramar Phase 2 Double Track

This improvement would be Phase 2 of the project to complete the double-tracking along the Sorrento grade between CP Pines (MP 249.8) and CP Miramar (MP 252.9).

CP Tecolote to CP Friar Double Track

This project would close the existing double-track “gap” between CP Tecolote (MP 263.2) and CP Friar (MP 264.1) near the Old Town Station.

San Diego Airport Intermodal Transportation Center

A proposed intermodal station presented by the San Diego Association of Governments would have a new station constructed approximately 1.8 miles north of the Santa Fe Depot in downtown San Diego to service travelers arriving or departing from the San Diego Airport. This station would be serviced by both commuter and intercity rail operations.

San Diego Convention Center Station

A proposed extension of limited commuter service presented by the San Diego Association of Governments (SANDAG) and NCTD would have some trains extending south of the Santa Fe Depot in downtown San Diego (the current terminus of passenger rail service) to a new San Diego Convention Center station located approximately 0.70 miles south of the Santa Fe Depot along Harbor Boulevard.

9.2.3 Operating Assumptions

The following basic operations operational assumptions were identified to help form the foundation from which the two scenarios were developed:

- Trainset equipment cycles based on existing rotations provided by Metrolink, Amtrak and NCTD (COASTER).
- Maximum length of “work day” for one crew cannot exceed 11 hours and 59 minutes.
- Crews report “on duty” 30 minutes before the initial departure from the lay-up yard.
- Minimum terminal turnaround time between two revenue-service trips is 15 minutes.
- Timetables represent weekday operations.

- UPRR freight train movements are based on discussions and data obtained from observations made at the Metrolink Operations Center (MOC) in Pomona, California on June 30, 2011 and increased at an assumed rate of 2% per year until 2030.
- BNSF freight train movements are based on data obtained from observations made over a 24-hour /seven day week period in May 2007, and increased at an assumed rate of 2% per year until 2030. This assumed rate increase is consistent with previous studies conducted along the Corridor.

Table 9.1 shows the passenger service increases that were assumed in the 2020 and 2040 Preferred Build Alternatives, and simulated in the operations modeling.

Table 9.1: Weekday Service Assumptions

Weekday Service	No. of One-way Trips / Day	
	2020	2040
Pacific Surfliner (All Stop)	22	28
Pacific Surfliner (Limited Stop)	2	8
Southwest Chief	2	2
Sunset Limited	0	2
Metrolink/Coaster LA-SD Commuter	3	10
Metrolink/Coaster IE-SD Commuter	-	4
Metrolink Orange County Line	16	18
Metrolink IE-OC Line	16	24
Metrolink 91 Line	12	32
Metrolink OC-Intra County Line	10	14
Metrolink Coast Line*	1	0
Coaster	28	40
Total	**112**	**182**

Sources: 2012 LOSSAN Corridorwide Strategic Implementation Plan

**Represents a late night Metrolink train operating from San Diego to Oceanside for overnight storage at Stuart Mesa Yard.*

9.3 Model Output Results

9.3.1 2020 Output Results

Los Angeles Union Station to Fullerton

Table 9.2: 2020 Los Angeles Union Station to Fullerton Total Train Trips

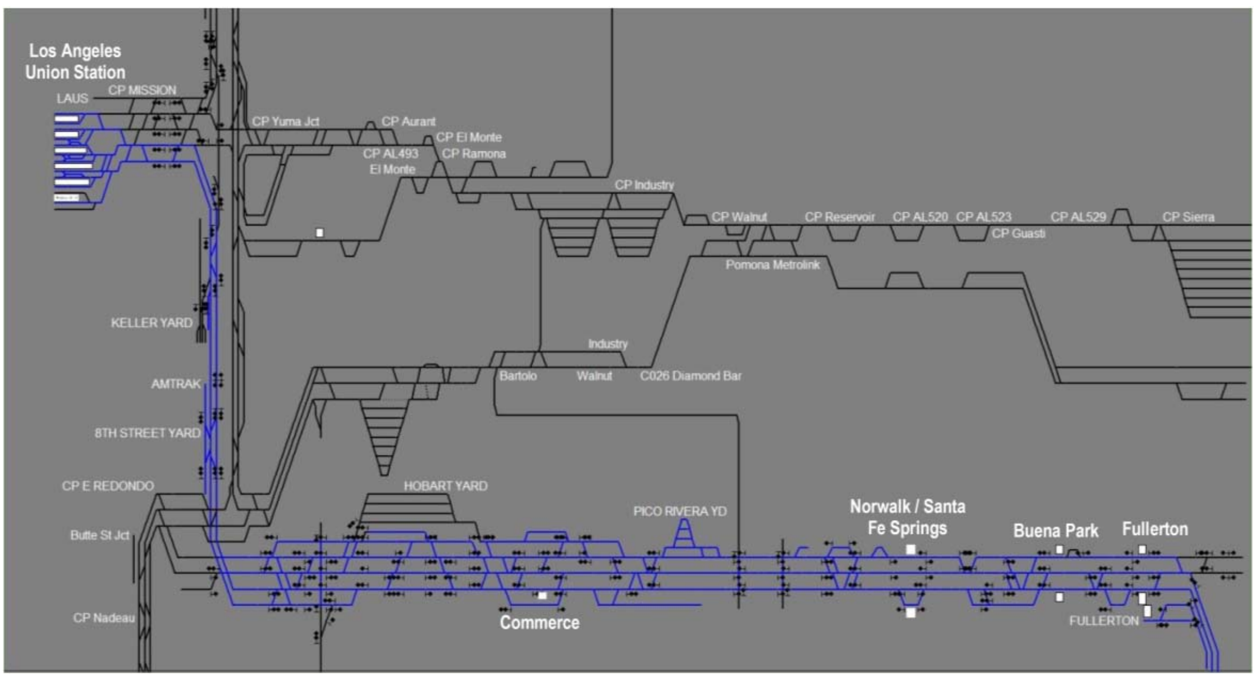
Weekday Service	No. of One-way Trips / Day
	2020
Pacific Surfliner (All Stop)	22
Pacific Surfliner (Limited Stop)	2
Southwest Chief	2
Metrolink/Coaster LA-SD Commuter	3

Weekday Service	No. of One-way Trips / Day
	2020
Metrolink Orange County Line	16
Metrolink 91 Line	12
BNSF Freight	92
Total	**149**

The results of the simulation indicate that the assumed infrastructure for 2020 in this segment can feasibly support the operations of the Preferred Build Alternative while maintaining or improving operational flexibility, reliability, performance, and capacity for rail operations along the Corridor.

Approximately 80-percent, or 20 miles (of the 25 miles) of this portion of the Corridor is assumed to be triple track by 2014. Some conflicts were observed along this segment each day and were primarily associated with the remaining double track section of the BNSF San Bernardino Subdivision in La Mirada. At this location, the majority of the delays were incurred by freight trains holding for other freight trains at this location, not for passenger trains. These conflicts were observed to have the potential to be mitigated through adjustments in the simulation, and did not appear to be a "fatal flaw" in the capacity of the infrastructure.

Exhibit 9.1: 2020 Los Angeles Union Station to Fullerton Track Diagram



Fullerton to Orange

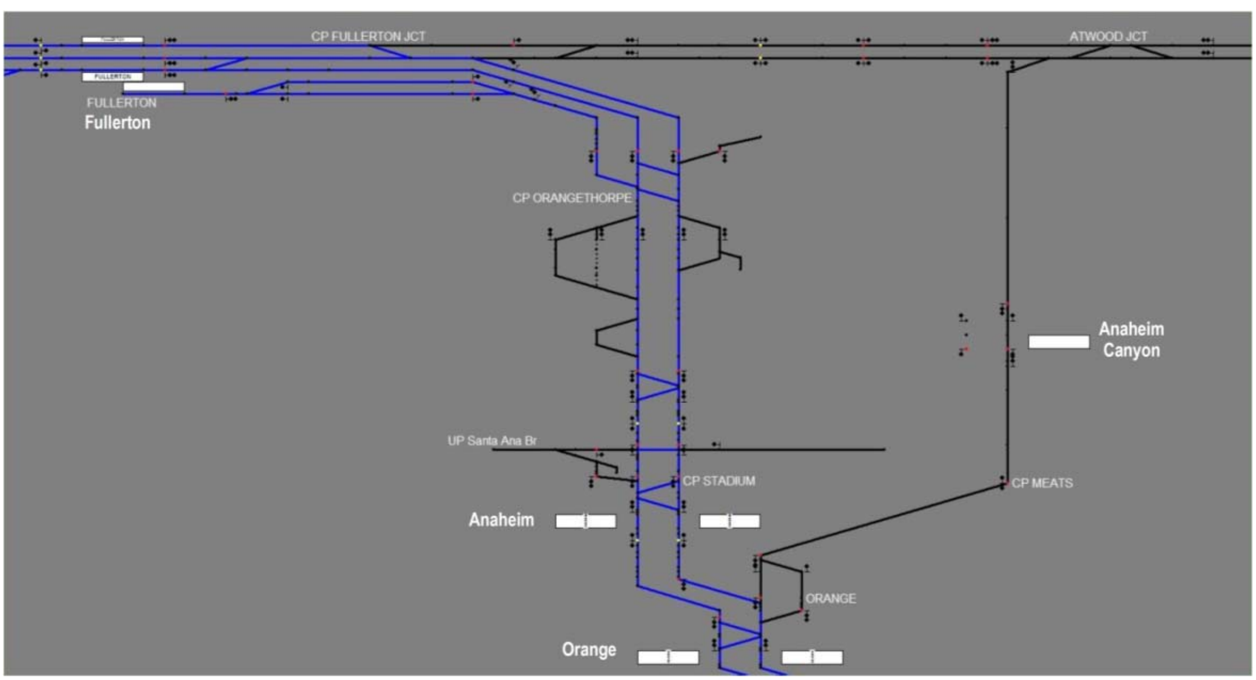
Table 9.3: 2020 Fullerton to Orange Total Train Trips

Weekday Service	No. of One-way Trips / Day 2020
Pacific Surfliner (All Stop)	22
Pacific Surfliner (Limited Stop)	2
Metrolink/Coaster LA-SD Commuter	3
Metrolink Orange County Line	16
Metrolink OC Intra-County Line	10
BNSF Freight	4
UPRR Freight	2
Total	**59**

The results of the simulation indicate that the assumed infrastructure for 2020 in this segment can feasibly support the operations of the Preferred Build Alternative while maintaining or improving operational flexibility, reliability, performance, and capacity for rail operations along the Corridor.

The construction of the CP Stadium crossovers and powered turnout helped to maintain reliable operations while incorporating the UPRR Costa Mesa local into the increasing volume of passenger trains along this section of the Corridor. The CP Stadium crossover mitigates the need for reverse running the five mile distance from Santa Ana to Anaheim, which has the potential to cause delays to the new mid-day Metrolink and modified Amtrak services

Exhibit 9.2: 2020 Fullerton to Orange Track Diagram



Orange to Laguna Niguel/Mission Viejo

Table 9.4: 2020 Orange to Laguna Niguel/Mission Viejo Total Train Trips

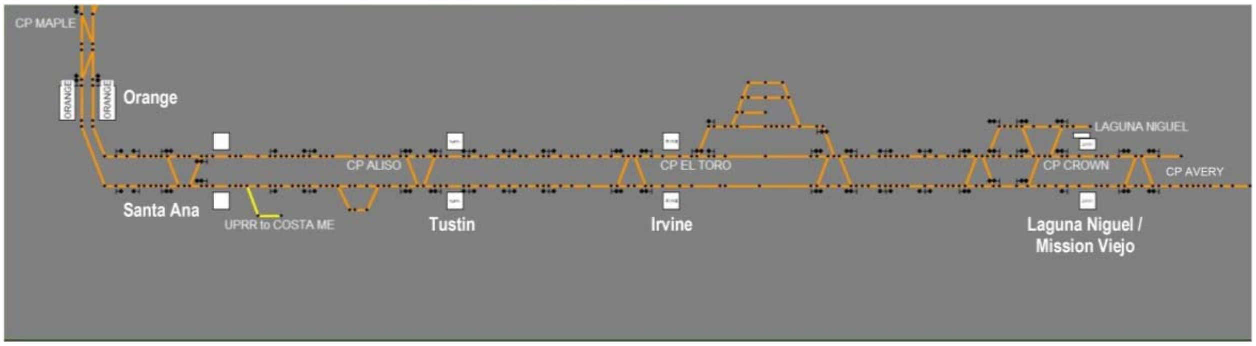
Weekday Service	No. of One-way Trips / Day
	2020
Pacific Surfliner (All Stop)	22
Pacific Surfliner (Limited Stop)	2
Metrolink/Coaster LA-SD Commuter	3
Metrolink Orange County Line	16
Metrolink OC Intra-County Line	10
Metrolink IEOC Line	16
BNSF Freight	4
UPRR Freight	2
Total	**77**

The results of the simulation indicate that the assumed infrastructure for 2020 in this segment can feasibly support the operations of the Preferred Build Alternative while maintaining or improving operational flexibility, reliability, performance, and capacity for rail operations along the Corridor.

The simulation provided a dynamic illustration of the delays cascading at CP Avery that are associated with trains traveling north from the single track segments in south Orange County and north San Diego County. The increase in the number of trains originating and terminating at the Laguna Niguel / Mission Viejo Metrolink station also created the necessity, at times, to operate trains left side (left handed) running through the station (standard Metrolink operating practice is to operate right side). These “reverse” movements were associated with Pacific Surfliner trains, and were necessary to pass Metrolink trains “turning” on main track 1. During these occurrences, those Metrolink trains that were required to turn on main track one did so because the train did not have sufficient schedule time to “turnaround” on the pocket track adjacent to CP Avery while another train occupied the turnback track 1A.

Further conflicts were identified for those Metrolink trains that continued to turnaround at the Irvine station. With the goal of this analysis to provide implementable improvements within the next two to three years along the Corridor, the extension of service for existing trains from Irvine to Laguna Niguel / Mission Viejo would add approximately 40 minutes to the schedule and cycle for any given trainset. This adjustment would significantly alter the commute schedule for both the Orange County and IEOC Line trains, which currently operate at about 30 minute headways in the peak directions. Service extensions to Laguna Niguel / Mission Viejo should be reviewed as service on these lines is added to ensure the 30 minute frequencies are not impacted. It is important to note that as more trains are added to this segment of the Corridor, the practice of turning trains on the main track at the Irvine Station during peak periods will become increasingly problematic.

Exhibit 9.3: 2020 Orange to Laguna Niguel/Mission Viejo Track Diagram



Laguna Niguel to Oceanside

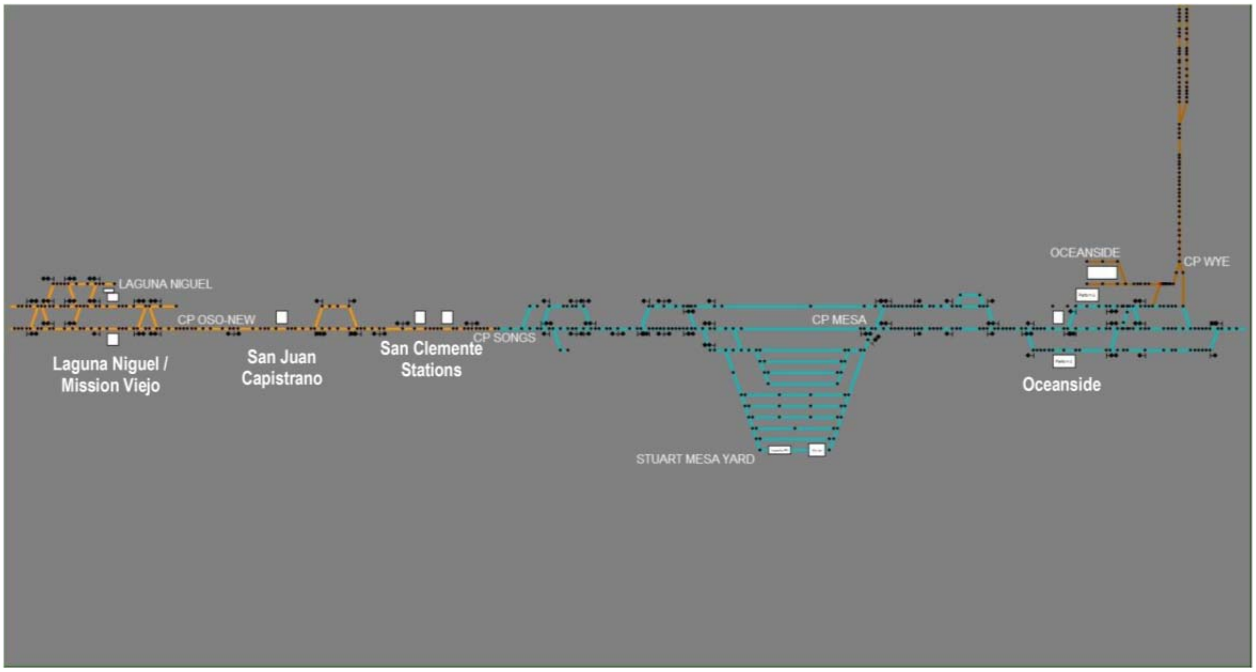
Table 9.5: Laguna Niguel to Oceanside Total Train Trips

Weekday Service	**No. of One-way Trips / Day**
	2020
Pacific Surfliner (All Stop)	22
Pacific Surfliner (Limited Stop)	2
Metrolink/Coaster LA-SD Commuter	3
Metrolink Orange County Line	7
Metrolink IEOC Line	6
BNSF Freight	4
Total	**44**

The results of the simulation indicate that the assumed infrastructure for 2020 in this segment can feasibly support the operations of the Preferred Build Alternative while maintaining or improving operational flexibility, reliability, performance, and capacity for rail operations along the Corridor.

The long sections of single track in south Orange County and through Camp Pendleton were observed as continuing to contribute to delays for both Amtrak and Metrolink trains operating “out of slot”. Unless additional capacity can be provided, any new trains that begin service in this segment may require additional “pad” or “recovery” time to accommodate the additional time that will be necessary for trains to “hold” for meets with other trains operating “out of slot”, thereby lengthening travel times rather than reducing them.

Exhibit 9.4: 2020 Laguna Niguel to Oceanside Track Diagram



Oceanside to San Diego

Table 9.6: 2020 Laguna Niguel to Oceanside Total Train Trips

Weekday Service	**No. of One-way Trips / Day**
	2020
Pacific Surfliner (All Stop)	22
Pacific Surfliner (Limited Stop)	2
Metrolink/Coaster LA-SD Commuter	3
Metrolink Coast Line	1*
Coaster	28
BNSF Freight	6
Total	**44**

** This is a late night Metrolink train that operates between San Diego and Oceanside as the return to Train 608 that is extended to San Diego from Oceanside.*

The results of the simulation indicate that the assumed infrastructure for 2020 in this segment can feasibly support the operations of the Preferred Build Alternative while maintaining or improving operational flexibility, reliability, performance, and capacity for rail operations along the corridor.

The analysis of the simulation shows that, while additional capacity to the Oceanside Transit Center is necessary to support the 2020 service plan, the proposed track configuration represented has the potential to cause "new" conflicts associated with passenger operations on main track one (platform 1). Metrolink trains using the new "thru" track must travel through the passenger platform area on main track one to enter or exit from the new track, constraining the potential capacity provided by the additional station track for Metrolink trains arriving from and departing to the north. During peak periods, this conflict was observed when Metrolink trains operating to or from the "stub" track were required to "hold" until COASTER trains operating to or from the Stuart Mesa Maintenance Facility departed platform 1. To mitigate this conflict, most Metrolink trains were “turned” on track 2, which is the same operating methodology that currently exists. Exceptions to this were when the assumed timetable has four trains serving the OTC at one time. During these instances, Metrolink and COASTER trainsets are both positioned on the “thru-track”, while Amtrak trains service the station platforms on both main tracks 1 and 2.

Exhibit 9.5: 2020 Oceanside to San Diego Track Diagram

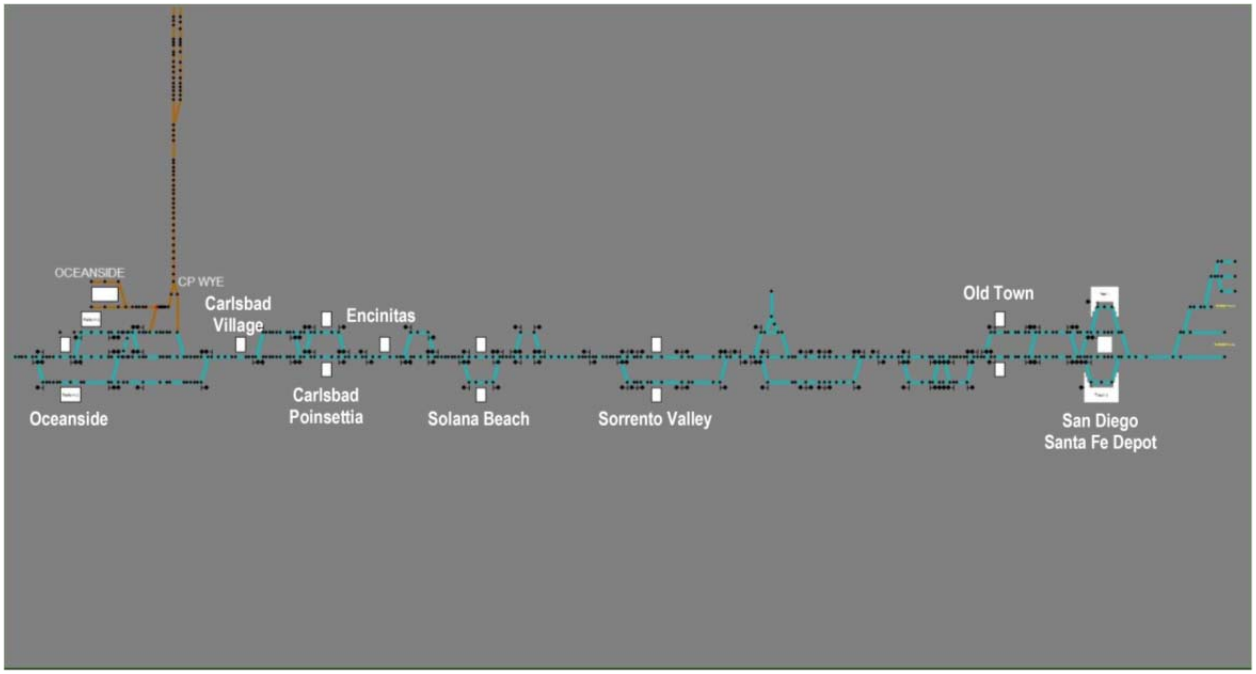


Exhibit 9.6: Stringline 2020 Los Angeles to San Diego AM

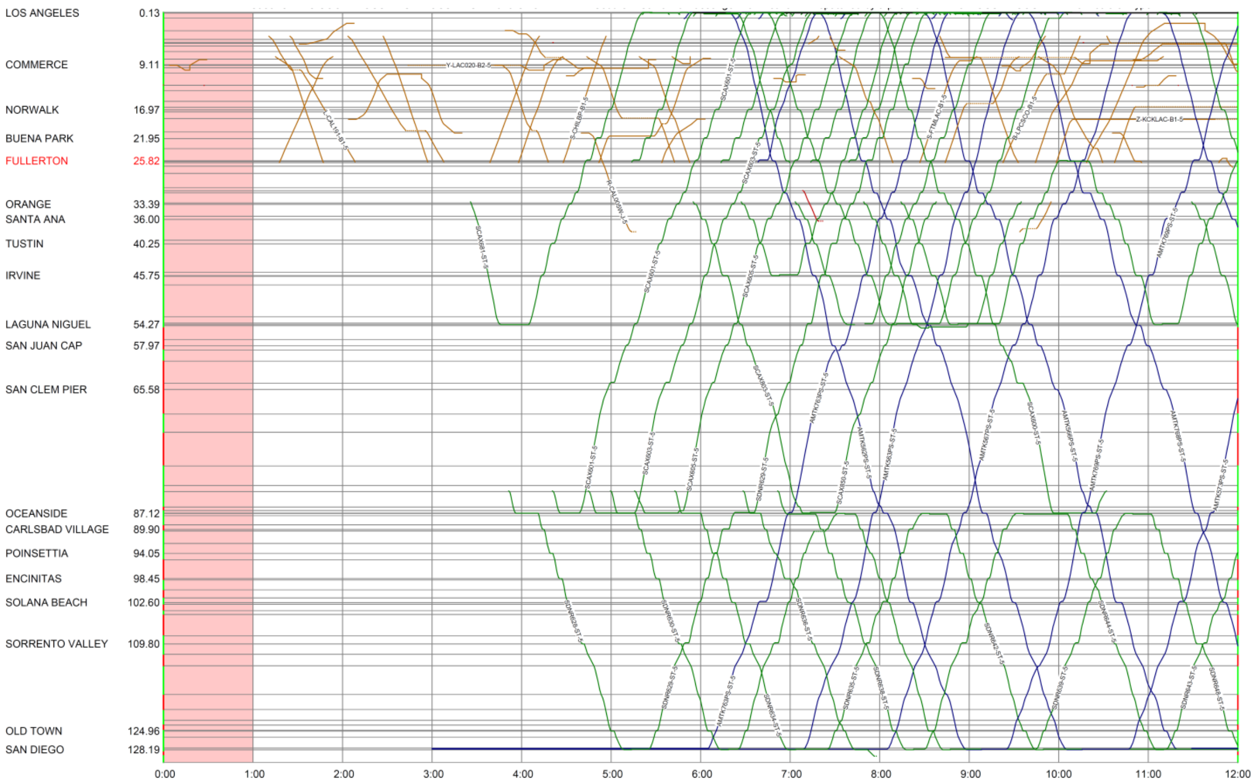
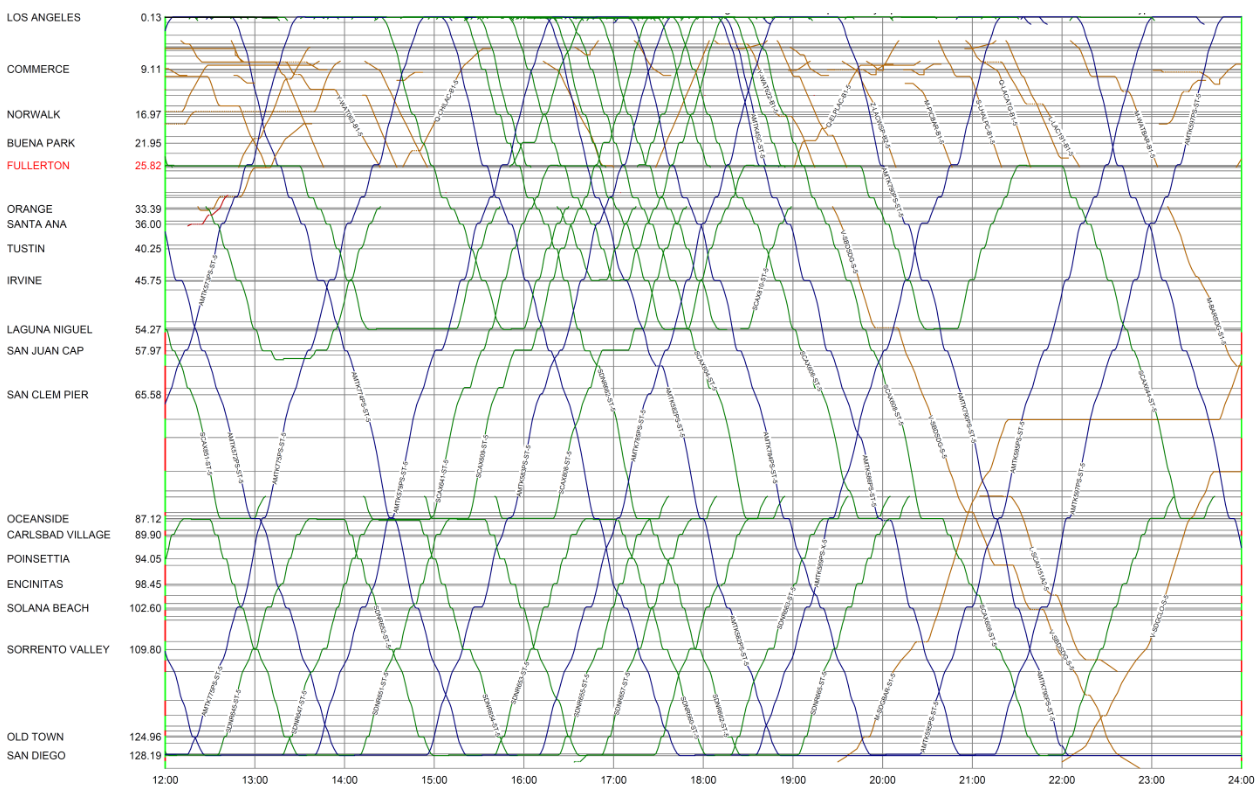


Exhibit 9.7: Stringline 2020 Los Angeles to San Diego PM



9.3.2 2040 Output Results

Los Angeles Union Station to Fullerton

Table 9.7: 2040 Los Angeles Union Station to Fullerton Total Train Trips

Weekday Service	No. of One-way Trips / Day 2040
Pacific Surfliner (All Stop)	28
Pacific Surfliner (Limited Stop)	8
Southwest Chief	2
Sunset Limited	2
Metrolink/Coaster LA-SD Commuter	10
Metrolink Orange County Line	18
Metrolink 91 Line	32
BNSF Freight	118
Total	**218**

Operations in this Corridor are currently dominated by freight traffic and it is anticipated that this pattern will continue in the future. While the proposed service plan was identified as being feasible, due to the volume of freight operations along this segment, delays to passenger trains will continue to be a risk to reliability along this segment as BNSF balances their freight operations with the peak period passenger commute needs. While assumptions were made for increased service along the BNSF by 2040, actual economic conditions determine freight volumes and will ultimately drive the need for additional infrastructure projects along this segment.

Based on the assumptions made in this analysis, no additional infrastructure projects were identified as being necessary to support passenger operations along this segment.

Fullerton to Orange

Table 9.8: 2040 Fullerton to Orange Total Train Trips

Weekday Service	No. of One-way Trips / Day 2040
Pacific Surfliner (All Stop)	28
Pacific Surfliner (Limited Stop)	8
Metrolink/Coaster LA-SD Commuter	10
Metrolink Orange County Line	18
Metrolink OC Intra-County Line	14
BNSF Freight	4
UPRR Freight	2
Total	**84**

As part of the 2040 service plan, the Fullerton to Orange segment is anticipated to have 78 passenger trains serving this portion of the Corridor. This segment is owned by the OCTA and is dispatched by

Metrolink. The BNSF and UPRR both maintain trackage rights along this section and it was assumed that they would continue to operate limited freight service.

The results of the simulation indicate that the assumed infrastructure for 2040 in this segment can feasibly support the rail operations while maintaining or improving operational flexibility, reliability, performance, and capacity for rail operations along the Corridor. No additional infrastructure improvements were identified as necessary or recommended for this segment.

Orange to Laguna Niguel/Mission Viejo

Table 9.9: 2040 Orange to Laguna Niguel/Mission Viejo Total Train Trips

Weekday Service	**No. of One-way Trips / Day**
	2040
Pacific Surfliner (All Stop)	28
Pacific Surfliner (Limited Stop)	8
Metrolink/Coaster LA-SD Commuter	10
Metrolink/Coaster IE-SD Commuter	4
Metrolink Orange County Line	18
Metrolink OC Intra-County Line	14
Metrolink IEOC Line	24
BNSF Freight	8
UPRR Freight	2
Total	**116**

The results of the simulation indicate that the assumed infrastructure for 2040 in this segment can feasibly support the rail operations while maintaining or improving operational flexibility, reliability, performance, and capacity for rail operations along the Corridor. However, with passenger operations in this segment increasing, the ability to slot freight traffic into the Corridor becomes more difficult. In order to facilitate freight operations, freight trains were routinely “pocketed” where possible to allow passenger trains to pass or overtake the freight train.

In addition, no capacity issues were identified with the Laguna Niguel / Mission Viejo (LNMV) Station Turnback Facility, despite relocating the existing CP Avery pocket track approximately 0.5 miles further south (railroad east) as part of the Laguna Niguel to San Juan Capistrano passing siding project. The equipment cycles assumed for the LNMV station, presented sufficient turnaround time to mitigate the increased time necessary to travel the additional distance to turn in this relocated “pocket” track. No additional infrastructure improvements were identified as necessary or recommended for this segment.

Laguna Niguel/Mission Viejo to Oceanside

Table 9.10: 2040 Laguna Niguel/Mission Viejo to Oceanside Total Train Trips

Weekday Service	No. of One-way Trips / Day
	2040
Pacific Surfliner (All Stop)	28
Pacific Surfliner (Limited Stop)	8
Metrolink/Coaster LA-SD Commuter	10
Metrolink/Coaster IE-SD Commuter	4
Metrolink Orange County Line	4
BNSF Freight	6
Total	**60**

The results of the simulation indicate that the assumed infrastructure for 2040 in this segment can feasibly support the rail operations while maintaining or improving operational flexibility, reliability, performance, and capacity for rail operations along the Corridor.

However, despite the investment assumed in double tracking the Corridor in 2040, the Laguna Niguel to Oceanside segment continues to have the majority of the single track within the South Corridor. The long sections of single track in south Orange County and through north Camp Pendleton were observed as continuing to have the potential to exacerbate delays for trains already operating “out of slot” as well as cause additional trains to run late due to the “domino effect”. This was assumed to remain one of two single track segments in the 2040 scenario. A schedule was required that focused not on clock faced departures, but on making the “meets” that would be necessary around the remaining single track segments.

To assist in mitigating the potential delays, it is recommended that the Serra siding be lengthened south by approximately one mile, to the Beach Road crossing in Dana Point and for double track to continue north of CP Songs in San Diego County by one to 1.5 miles. These capacity improvements will help in allowing trains more opportunities for “moving meets” in south Orange County and north San Diego County, rather than holding for the opposing train.

Unless additional capacity can be provided, any new trains that begin service in this segment may require additional “pad” or “recovery” time to accommodate the additional time that will be necessary for trains to “hold” for meets with other trains operating “out of slot”, thereby lengthening travel times rather than reducing them.

Oceanside to San Diego

Table 9.11: 2040 Oceanside to San Diego Total Train Trips

Weekday Service	No. of One-way Trips / Day 2040
Pacific Surfliner (All Stop)	28
Pacific Surfliner (Limited Stop)	8
Metrolink/Coaster LA-SD Commuter	10
Metrolink/Coaster IE-SD Commuter	4
Coaster	40
BNSF Freight	8
Total	**98**

The simulation results indicate that this segment's 2040 assumed infrastructure can feasibly support the rail operations while maintaining or improving operational flexibility, reliability, performance, and capacity for rail operations along the Corridor, with one exception. The dense passenger operations that are projected to operate in this segment in 2040 precluded the ability to operate "express" COASTER commuter trains between Oceanside and San Diego. These trains were originally identified in the service planning goals established for the Corridor by the LOSSAN working group. The travel time differences between the local (all stop) commuter trains and the express (limited stop) trains created conflicts associated with the remaining single track in Del Mar. To avoid meets near this single track segment, the timetable was initially laid out with the intention of using repetitive departures each hour so that meets between trains were predictable and occurred at approximately the same location throughout the day.

As the service plan was refined to reflect the desired stopping pattern variations requested for both commuter and intercity trains, it was quickly identified that the number of different stopping patterns being included in the timetable prevented a repeatable pattern from being identified and subsequently created conflicts that were associated with the single track in Del Mar. A number of iterations were run in the model in an attempt to identify a repetitive timetable capable of supporting express COASTER trains however, it was concluded that in order to preserve the ability of the Corridor to support reliable operations, express COASTER trains would need to be removed from the 2040service plan.

With increased passenger operations by 2040, the ability to slot freight traffic into the Corridor becomes more difficult. In order to facilitate freight operations, freight trains were routinely "pocketed" where possible to allow passenger trains to pass or overtake the freight train.

Despite the investment assumed in double tracking the Corridor in 2040, the Oceanside to San Diego segment continues to have single track through the City of Del Mar. This section of single track was observed as continuing to have the potential to contribute to delays for both intercity and commuter trains operating "out of slot". No mitigation was identified for this capacity need beyond the "tunnel" alternative identified in the Los Angeles to San Diego (LOSSAN) Proposed Rail Corridor Improvements Final Program Environmental Impact Report / Environmental Impact Statement (Finalized in 2007) and the LOSSAN Corridor Strategic Plan. Two tunnel alternatives have been identified in these past studies, one traveling under Camino Del Mar within the City of Del Mar (Milepost 243.6 to 246.0) and the other traveling under Interstate 5 (Milepost 243.3 to 247.9). Regional funding for any tunnel option is not anticipated before the 2041 – 2050 timeframe.

No additional capacity was identified as necessary for this segment, beyond the completion of double track through the City of Del Mar. Operations were identified as feasible in downtown San Diego, both at the Santa Fe Depot and the new convention center station. Sufficient capacity for the 90 passenger trains was provided on Tracks 1, 2 and 3 of the Santa Fe Depot to continue to allow BNSF to operate trains through the depot on Track 4 during mid-day periods. In addition, no additional storage tracks were identified as necessary in the SDMTS yard, where Coaster trains currently layover during the mid-day.

10.0 Station and Access Analysis

This chapter addresses the location of the stations to be served by the proposed expanded Pacific Surfliner services, how stations will accommodate the proposed services, how passengers will access stations, and how intermodal connections will be integrated at the stations.

The chapter identifies existing stations along the Pacific Surfliner South Corridor, characterizing existing and planned service integration and coordination. Current intermodal connectivity is analyzed and key capital projects that would improve multimodal connectivity are presented. A typology of station types is developed, reflecting that stations sharing certain key characteristics would ideally be developed with common features.

The analysis is focused on identifying necessary safety, capacity and operational improvements in the stations themselves or in connecting bus and rail transit service. Key land use considerations such as Transit-Oriented Development (TOD) potential, Complete Streets and Smart Communities Strategies (SCS) are evaluated.

10.1 Station Location Analysis

10.1.1 Methodology

The methodology employed to evaluate the station locations includes a review of the existing stations along the Corridor to determine potential locations for station improvements. Available station services (i.e., staffing and ticketing machines) and multimodal access (i.e., transit connections, parking, taxi service, rental car services, bicycle facilities) were studied to identify which stations require improvements under the proposed expanded service in the Corridor.

Criteria addressing station location include:

- the extent to which the station location capitalizes on and serves existing jobs and residential neighborhoods;
- the level of convenience provided to the passenger in accessing important destinations in the station area or nearby; and,
- the potential for the station to complement and enhance the building fabric and streetscape in the station area.

Recent policy has been adopted to ensure that federally-planned facilities, such as Corridor rail stations, include consideration of sites that are pedestrian friendly, near existing employment centers, accessible to public transit, and emphasize existing central cities.[11] Such policy aligns with California state law SB375, which requires the linking of transportation and land use in SCSs.

[11] Executive Order 13514 – Federal Leadership in Environmental, Energy, and Economic Performance

Exhibit 10.1: Map of Existing Stations

10.1.2 Potential Station Locations

The Pacific Surfliner South route stretches between Los Angeles and San Diego, roughly following I-5, as shown in Exhibit 10.1. Of the 17 existing stations, one is also served by both Metrolink and Coaster trains (Oceanside), seven are also served by Metrolink trains (stations north of Oceanside), and three are also served by Coaster trains (stations south of Oceanside). Access to Pacific Surfliner service is considered appropriate with the current station spacing, and no plans in conjunction with the proposed service improvements call for adding stops at intermediate Metrolink or Coaster stations, such as Norwalk / Santa Fe Springs or Encinitas. An additional station, however, is proposed at San Diego International Airport that would be served by both Pacific Surfliner and Coaster trains.

10.1.3 Transit-Oriented Development, Joint Use and Joint Development Opportunities

Ideally, stations are located in proximity to complementary land uses. Locations near existing commercial and residential areas maximize ridership potential and function as a gateway to a city's major activity centers. Appropriate to the scale of the community, TOD and SCS initiatives also factor into station area planning. Smaller communities may not support the density typically associated with TOD, nor may the ridership at their stations justify such investment. However, most of the stations in the Corridor are potential candidates for station-oriented infill development.

Table 10.1 provides a preliminary assessment of TOD potential at Corridor stations. Stations in the core urban areas of Los Angeles, Orange, and San Diego Counties have the highest potential, as these stations host multiple transit services and have a greater market for higher-density, mixed-use development. An exception is the proposed station at San Diego International Airport, which is expected to focus on intermodal connections and would likely be surrounded by a limited number of developable parcels. Stations in the periphery of the Los Angeles / Orange County and San Diego metropolitan region offer medium potential, reflecting their moderate levels of transit service and a more limited market for TOD-style residences, offices and retail. San Clemente exhibits low TOD potential, with a constrained oceanfront location and lack of frequent connecting services.

TOD at stations furthers Caltrans policy to promote integrated land use and transportation. Such policy depends on, as well as supports, the efforts of local jurisdictions to maintain and redevelop their station-area districts and increase housing and employment opportunities for their residents. Caltrans and corridor committees can build upon initiatives such as the transit village plan for Simi Valley station, as they engage local planners in TOD-related efforts.

While TOD brings development to station environs, joint use and joint development add value to stations by placing additional uses and activity in station buildings and properties themselves. Businesses and offices can profit from close proximity to rail service, and passengers can benefit from convenient access to these uses. Typical examples appropriate to the Corridor include cafés, newsstands, car wash/detailing services, and other vendors that cater to rail passengers. Complementary retail uses can draw upon the non-passenger market of the surrounding area, enlivening the station and addressing security issues. Retailers can also fill the role of providing basic information about train services and local transportation options at unstaffed stations or outside of staffed hours.

Due to lack of available property surrounding Corridor stations, joint development may not be possible. Potential for joint use around stations in the core urban areas of Los Angeles, Orange and San Diego Counties is greater, but may be constrained by existing development adjacent to the station and limited room for expansion. More frequent Metrolink and Coaster commuter rail services represent a greater driver of joint development than Pacific Surfliner service.

At stations along the Corridor in the metropolitan periphery, sufficient property may be available for joint development, but lower ridership levels may not be sufficient to spur joint use and joint development alone. However, provided the location would support the business with or without the presence of rail service, joint development may still be viable. Neighboring parcels may provide better opportunities for integrating complementary businesses, as is the case for a car rental agency at Emeryville station in the San Francisco Bay Area.

Table 10.1 presents the existing amenities and staffing at Corridor stations, as well as a preliminary assessment of their joint use / joint development potential. Opportunities for joint use and joint development are on par with TOD potential at most stations, but are lower in cases where the station's function as an origin or destination is less important than the station's location in the surrounding region. Joint development opportunities are also considered low at platform-only stations. While site constrains are likely to limit TOD potential at the proposed San Diego International Airport Station, moderate joint development opportunities would be anticipated, catering to passengers connecting between air and rail travel.

Table 10.1: Station Joint Development and TOD Potential

Station	Existing Amenities / Staffing	Existing TOD?	Joint Use / Development Potential	TOD Potential
LAUS	Staffed, ticket office, ticket machine, restrooms, payphone, vending machines, ATM, baggage check, baggage storage	Yes	High	High
Fullerton	Staffed, ticket office, ticket machine, restrooms, payphone, vending machines, ATM, baggage check, baggage storage	Yes	High	High
Anaheim	Staffed, ticket office, ticket machine, restrooms, payphone, vending machines, ATM, baggage check, baggage storage	Yes	High	High
Santa Ana	Staffed, ticket office, ticket machine, restrooms, payphone, ATM, baggage check, baggage storage	Yes	High	High
Irvine	Staffed, ticket office, ticket machine, restrooms, payphone, vending machines, ATM	No	Medium	Medium
San Juan Capistrano	Staffed, ticket office, ticket machine, payphone	No	Medium	Medium

Station	Existing Amenities / Staffing	Existing TOD?	Joint Use / Development Potential	TOD Potential
San Clemente	Unstaffed, platform only, restrooms, payphone	No	Low	Low
Oceanside	Staffed, ticket office, ticket machine, restrooms, payphone, vending machines, ATM, baggage check, baggage storage	No	Medium	Medium
Solana Beach	Staffed, ticket office, ticket machine, restrooms, payphone, ATM	No	Medium	Medium
San Diego – Old Town	Unstaffed, platform only, ATM	No	Low	High
San Diego International Airport	N/A	No	Medium	Low
San Diego	Staffed, ticket office, ticket machine, restrooms, payphone, ATM, checked baggage, baggage storage	No	High	High

10.2 Station Operations Analysis

Station operations include a number of considerations related to the needs of Corridor passengers (ticketing, baggage handling, and information provision) and other supporting functions. Station operations also facilitate access by various modes and promote intermodal connections. Operational analysis of Corridor stations includes the identification of existing services and amenities provided at the stations, their track and platform configuration, and surrounding land uses. Stations are classified based on their relative importance: statewide, regional or local.

Table 10.2 differentiates stations still further, defining five station categories based on the physical characteristics of stations: the density and type of urban form of the station area; auto access, as indicated by parking cost; and intermodal access, as represented by connecting rail and passenger services. These five station prototypes capture the wide range of station contexts and connectivity functions found throughout the state in an easily-applied framework.

- Statewide Significance. The “Urban Activity Center” station prototype has statewide significance. These stations are located in the high-density, mixed-use primary downtowns of major metropolitan areas. Auto access, while important, is not dominant and parking costs are high. All types of connecting passenger services are typically represented at these stations. Long-distance as well as Corridor services stop at these stations, and by virtue of the fact that these stations are located in major cities, a broad range of regional and local transit services are also represented. Trains serve the station throughout the day, often at regular intervals. The number of daily passengers and trains warrants a broad spectrum of amenities, including staffed ticketing offices, restrooms, phones, and vendors.

  LAUS and San Diego represent “Urban Activity Center” stations in the Corridor.

Table 10.2: Station Prototypes

Station Category	Density and Urban	Auto Access	Typical Intermodal
Statewide Significance			
"Urban Activity Center" • LAUS • San Diego	High density; mixed-use, grid-based primary downtown in major metropolitan area	High parking cost Taxi	• Amtrak long-distance service • Amtrak Corridor service • Amtrak Thruway bus • Commuter rail • Rail transit • Local transit • Shuttles (e.g., hotels)
Regional Significance			
"Developed Urban Area" • Fullerton • Santa Ana • San Diego - Old Town • San Diego International Airport (proposed)	Middle density; mixed-use, grid-based secondary downtown in major metropolitan area	Moderate parking cost Taxi	• Amtrak long-distance service • Amtrak Corridor service • Amtrak Thruway bus • Commuter rail • Rail transit • Local transit • Shuttles
"Outlying Downtown or Activity Center" • Anaheim • Irvine • Oceanside	Middle to low density; grid-based downtown in low-density suburban area or outside major metropolitan area	Moderate to low parking cost Taxi	• Amtrak Corridor service • Amtrak Thruway bus • Commuter rail • Local transit • Shuttles
Local Significance			
"Exurban or Outlying Area with Moderate Transit Connectivity" • San Juan Capistrano • Solana Beach	Low density; exurban or outlying	Low parking cost / free parking	• Amtrak Corridor service • Amtrak Thruway bus and/or commuter rail • Local transit • Shuttles
"Exurban or Outlying Area with Limited Transit Connectivity" • San Clemente	Low density; exurban or outlying	Free parking	• Amtrak Corridor service • Commuter rail • Local transit • Shuttles

- Regional Significance. Stations with regional significance may be "Developed Urban Area" prototypes if in an area of middle density in a major metropolitan area; or "Outlying Downtown or Activity Center" prototypes if in a lower-density suburban area, or outside of a major metropolitan area. The areas around these stations feature middle to lower-density development in grid-based downtowns, with moderate to low parking costs. Stations with regional importance typically host Corridor trains, commuter rail, or rail transit options. Several trains may serve the station throughout the day, but not necessarily at regular intervals. Regionally-significant stations may feature amenities such as staffed ticketing offices, restrooms, phones, and vendors, especially if outside the major metropolitan areas.

  Fullerton, Santa Ana, and San Diego-Old Town represent "Developed Urban Area" stations in the Corridor. The proposed station at San Diego International Airport is also expected to be of this prototype. "Outlying Downtown or Activity Center" stations in the Corridor include Anaheim, Irvine, and Oceanside.

- Local significance. Stations with local significance are "Exurban or Outlying Area" prototypes, with moderate or limited transit connectivity. A station with moderate transit connectivity is a connection point for Amtrak Thruway buses or commuter rail. A station with limited transit connectivity is served primarily by local buses; if also served by commuter rail, such stations are intermediate stops and are not primary transfer points. The areas around these stations are outlying or exurban in character, with a dominant focus on auto access and low cost or free parking. Stations with local significance typically will not serve long-distance trains, only Corridor trains. Locally-important stations within metropolitan regions may in some cases have commuter rail or rail transit options, but most will have only local bus service. Trains may be limited to only a few services in each direction throughout the day. Amenities are typically limited at locally-significant stations, and most are unstaffed.

  "Exurban or Outlying Area" stations with moderate transit connectivity include San Juan Capistrano and Solana Beach. "Exurban or Outlying Area" stations with limited transit connectivity include San Clemente.

10.3 Intermodal Connectivity

10.3.1 Integration of Non-Program Operations and Services

Expanding passenger rail service between Los Angeles and San Diego would open up new travel markets in the intermediate regions, requiring integration with existing and future transportation modes. These other modes are crucial to the effectiveness of Corridor rail service, and include Amtrak long-distance services, Amtrak Thruway buses, commuter rail (Metrolink and Coaster), scheduled airline service (at San Diego International Airport), and taxi/car rental services.

The particular mode or modes that would be used in combination with a Corridor rail trip depends on trip purpose and length, among other factors. The available intermodal connections available at each station are presented in Table 10.4 at the end of the chapter.

LAUS offers connections to long-distance services, which include the Coast Starlight, Southwest Chief, Sunset Limited, and Texas Eagle. The Southwest Chief also stops at Fullerton. Unlike the northern portion of the Pacific Surfliner route, no long-distance service operates in the Pacific Surfliner South Corridor.

LAUS is also an Amtrak Thruway Bus connection point. Thruway buses extend origin and destinations to off-Corridor points such as Bakersfield and Palm Springs, and connect to the San Joaquin rail service in the Central Valley. Thruway Bus Route 1a operates late night and early morning trips in the Corridor between Los Angeles and San Diego when train service is not offered.

The Corridor is shared with two regional rail services that cater to commuter travel, but also play a “feeder” role for Pacific Surfliner service. The Metrolink Orange County Line operates between LAUS and Oceanside, and the Coaster operates between Oceanside and San Diego. Passengers originating at or destined to commuter stations where Corridor service does not stop, such as the Norwalk / Santa Fe Springs Metrolink station or Encinitas Coaster station, transfer at common stations such as Fullerton or Oceanside, respectively.

Expanded Corridor service will also create connections to national and international origins and destinations, as frequent “Airport Flyer” (Route 992) bus service connects San Diego station to San Diego International Airport. In addition, a new station serving the airport directly is proposed. A dedicated bus service (“FlyAway”) also connects LAUS to Los Angeles International Airport (LAX).

To facilitate access between other off-Corridor points, taxi service is available at Corridor stations and many are also in proximity of rental car agencies, as indicated in Table 10.4.

Local rail transit, as operated by Los Angeles County Metropolitan Transportation Authority (Metro) and the San Diego Metropolitan Transit System, also provides intermodal connections. Throughout the Corridor, local bus systems, vans and shuttles round out local transit options. The particular services available at each station are presented in Table 10.4.

10.3.2 Intermodal Integration Measures

Intermodal integration consists of measures and improvements to coordinate the modes outlined in the previous section with Corridor service and with each other. Intermodal connections are facilitated by two major types of considerations: operational characteristics and physical characteristics.

Operational Characteristics

Operational characteristics of stations contribute to their function and value as intermodal connections. Passenger connections are preferably “cross platform”, or at a minimum a common concourse connection, for direct rail to rail connections. Equally important as the physical layout of the station and platforms is the scheduling required to provide the necessary connectivity, as discussed further below.

Schedule Coordination

Schedule coordination refers to efforts to minimize delay for passengers transferring between modes. Each service operates according to a schedule reflecting travel speed, stops and service frequency, which differ from service to service. In general, schedule coordination is organized by hierarchy of service; for example, faster trains serving intercity and regional destinations arrive last at a connectivity station and are the first to leave. Slower trains serving local destinations arrive first and wait for passengers to transfer from all of the faster/intercity trains that they are scheduled to meet.

The same principle applies for the local transportation system, whether consisting of light rail, buses, shuttles or vans. Local transit services would arrive early enough to transfer their passengers to the Corridor rail service, then wait for the arriving passengers from these higher-speed systems to continue to their local destination.

Schedule coordination requires a high level of reliability and on-time performance. Existing rail services often do not operate at their full potential of speed and reliability, largely due to the shared infrastructure of the passenger/ freight network. As passenger rail service increases, a larger volume of passenger trains have to stop at each station, which may affect freight rail service. The improvements described in

Chapter 4 are designed to address these issues, and will contribute to the opportunity to implement schedule coordination among services in the Corridor.

Schedule coordination is most important when a connection is being made to a less frequent service, during off-peak periods, or to the last trip offered during the service day. Conversely, schedule coordination is relatively unimportant for major origin and destination stations that have very frequent service.

Three schedule coordination strategies can be implemented, depending on the services involved: pulse schedules, directional schedule coordination, and dependent linked schedules.

- Pulse Schedules – At a station with a pulse schedule, services converge at regular intervals at a hub and depart after a short interval during which transfers can be made. Pulse schedules would be implemented at rail stations that serve as hubs of Amtrak Thruway buses or local transit services. Lines would either terminate at these stations, or observe a period of several minutes to allow transfers to be completed.
- Directional Schedule Coordination – In this variation of a pulsed schedule, Thruway or local transit services operating forward in the peak direction of travel would “pulse” directly following train arrivals. This type of schedule coordination has the advantage of not requiring the services involved to be held for each other, as in the case of pulse schedules. However, it affords convenient transfers only in one direction of travel – transferring passengers in the opposite direction of the coordinated schedule would face longer waits.
- Dependent Linked Schedules – Transfer times can be reduced to an absolute minimum with dependent linked schedules. When a train arrives, a Thruway bus or vehicle of another feeder service can be scheduled to be having a layover and can immediately receive transferring passengers. However, this requires high reliability on the part of both services, as delays on one line would affect service along the other line in the forward direction of travel.

Fare Integration

Fare integration addresses the cost and inconvenience of paying a second fare when transferring between services. Caltrans has implemented fare integration with its “Free Transit Transfer Program” and its cross ticketing “Rail 2 Rail Program”. The Free Transit Transfer Program offers passengers of Corridor services free transfer passes to the services of local transit authorities. The “Rail 2 Rail Program” allows Metrolink and Amtrak monthly ticket holders to have access to both systems’ trains within the geographical extents of their tickets, and, for the price of an upgrade, a similar arrangement is available for Coaster pass holders. Furthermore, fares between Burbank-Bob Hope Airport and LAUS have been equalized, and tickets issued by the two operators are interchangeable along this segment of the Corridor. These successful programs can be enhanced and improved in conjunction with expanded Corridor service.

Other opportunities for fare integration include providing free transfers to the “Airport Flyer” connecting San Diego station with San Diego International Airport, and through ticketing for the “Flyaway” buses connecting LAUS and LAX.

Physical Characteristics

Just as operational characteristics contribute to a station’s function and value as an intermodal connection, so do physical characteristics. They involve the station’s location within the urban fabric of the communities it serves, as well as the functional layout of station facilities.

Station Configurations

Depending on their size and importance in the statewide network, as well as particular site characteristics and constraints, stations may have a broad range of configurations, with implications for intermodal connectivity.

The simplest station configuration is an at-grade platform alongside a single track. With a second passenger track, two side platforms or a central platform may be used. With additional tracks, combinations of center and side platforms may be employed. As long as tracks are at ground level, passengers may typically cross tracks at-grade to reach the outer platform. Various design considerations can improve the safety of such crossings. With more than two platforms and/or greater levels of train traffic, underground or overhead concourses may be implemented to convey passengers to platforms, avoiding at-grade crossings. As space allows, ramps can be used to facilitate movement from ground level to the concourses and avoid the cost of escalators and elevators.

The simplest stations have only a shelter next to the platform, but many have a station building offering an indoor waiting environment and amenities as warranted by the level of station activity. The station building itself will typically be located on one side of the tracks, with intermodal connections facilitated within or through the facility.

Locally-significant stations, as defined in Section 10.2, will typically have a single platform serving both directions, while regionally-significant stations may have a second platform, one for each direction. Multiple-track stations with additional platforms, and above- or below-grade track crossings, are typically limited to stations of statewide importance.

Particularly where the services of different operators converge, the infrastructure may not have been designed with transferring passengers in mind. Thus, transfers may range from a cross-platform situation to those that require changes in level and a substantial walk between platforms and stops. The elderly and passengers with disabilities in particular may face considerable obstacles in transferring from one mode to another.

Regardless of station size or configuration, safety concerns must be addressed as intermodal integration measures are considered. At new stations, UPRR now requires “station tracks” (sidings for passenger trains at stations) along with outside platforms connected by pedestrian bridges. The inclusion of “station tracks” at rail stations will improve the efficiency of freight operations by allowing freight trains to bypass passenger trains that are stopped at stations. Although costly, the pedestrian bridges greatly reduce the potential for train/pedestrian accidents.

Where pedestrians are permitted to cross tracks, safety can be improved by a number of measures, such as gates that restrict pedestrian flows, devices that provide visual and acoustic warnings of approaching trains, and barriers arranged to slow pedestrians down and face them in the direction of oncoming trains. These measures are especially warranted where passengers may be rushing to make connections between trains and buses.

Key capital projects to improve the safety and capacity of Corridor stations are presented in Table 10.3.

Table 10.3: Key Capital Projects for Intermodal Integration

Station	Project	Source
LAUS	Union Station Run-Through Tracks	*LOSSAN North Draft Program EIR/EIS*, Caltrans, August 2011
Oceanside	Parking garage	*San Diego - LOSSAN Corridor Project Prioritization Analysis – Final Project Report*, Caltrans, May 2009

Station	Project	Source
Solana Beach	Parking structure	*San Diego - LOSSAN Corridor Project Prioritization Analysis – Final Project Report*, Caltrans, May 2009
San Diego International Airport	New station (Airport Intermodal Transportation Center)	*LOSSAN Corridorwide Strategic Implementation Plan - Final Report*, LOSSAN Rail Corridor Agency, April 2012
San Diego	Parking facility	*San Diego - LOSSAN Corridor Project Prioritization Analysis – Final Project Report*, Caltrans, May 2009

Station Access and Wayfinding

Connections between a station and the surrounding land uses are typically provided by the local street system. The grid-based street system of the original settlement area of many California cities and towns often coincides with station locations, and fosters a fine grain of connectivity and multiple routes of access. Stations in more suburban contexts that developed after widespread adoption of automobile travel may offer fewer routes and points of access. In either case, the railroad itself may act as a barrier, resulting in circuitous routes of access that may be particularly discouraging to pedestrian and bicycle access.

Pedestrian and bicycle access may be enhanced with new grade crossings or overcrossings and undercrossings, as appropriate to the surrounding context. Table 10.4 presents the “Bicycle Facilities” currently available at each station. Three classes of bicycle facilities are defined; Class I (bike path or bike trail separate from motorized traffic), Class II (designated bike lane on a roadway), and Class III (roadway signed or marked for bicycle travel but shared with motor vehicles). Some stations may warrant bicycle lockers, bike share services and other amenities for cyclists.

Consistent and clear signage and wayfinding systems should be integrated into the station property and buildings, orienting transferring passengers. While stations themselves may integrate multiple modes, and facilitate intermodal connections within a single building or property, some connections may depend on the local street system. In such cases, it is important that high standards of sidewalk and streetscape conditions are maintained, and that appropriate wayfinding elements guide passengers to and from the station as they transfer between modes.

As considerations are made for accommodating various modes of access, the following hierarchy should be observed, in order of increasing distance from the immediate station entrance or platform access:

- Passenger pick-up / drop-off and taxi stands and bicycle parking;
- Shuttle bus stops and car share parking;
- Fixed route bus stops and rental auto parking and facilities; and
- Auto parking.

Amtrak Thruway bus or local transit access may be provided with a simple stop along the street outside a station, or facilitated with an off-street terminal with multiple bays for different buses, shuttle and van services. Such facilities provide an opportunity for vehicles to lay over at the end of their routes and to organize services for passenger convenience. This is particularly useful for Amtrak Thruway coaches, which require staging areas for luggage loading and unloading.

Auto access is facilitated with designated areas for passenger pick-up and drop-off and taxi stands, as well as parking and rental car facilities. Table 10.4 presents the “Taxi/Rental Car” opportunities currently available at each station. Appropriate signage along major routes, such as interstate and state highways, is important in guiding motorists to stations and to the various functional components of the station. In addition, the local road system may need to be reviewed to determine if station-area streets are adequate for station-related traffic, particularly in association with service expansion.

Parking facilities serving a station may be publicly or privately operated; provided free or subject to hourly or daily fees; dedicated or shared with adjacent uses; and provided on surface lots or in structures. Parking availability may have a major influence in ridership, while parking provisions may limit the land use potential of the station area. Table 10.4 indicates the amount and distribution of parking at Corridor stations.

10.4 Station Access

This section provides a detailed summary of station access at each station along the Corridor. While all stations have pedestrian access and are ADA-accessible, other modes of access to the existing and proposed stations are described, as presented in Table 10.4.

Los Angeles Union Station

LAUS functions as Los Angeles' main intermodal hub and provides connections between auto, several rail lines, buses, shuttles, and Class II bikeways. Metrolink operates a network of seven commuter rail lines, six of which terminate at Union Station. The Metro Red and Purple (heavy rail subway) and Gold (light rail) lines converge at this station, and will be augmented by the future Regional Connector, allowing through light rail service on the Blue and Expo Lines. A large bus terminal hosts Amtrak Thruway buses and services operated by Metro, LADOT, Foothill Transit, Santa Clarita Transit, Santa Monica Big Blue Bus, as well as a LAX Flyaway shuttle service providing direct service to LAX. Long- and short-term parking for 1,600 vehicles is also provided at the station.

Fullerton

The station at Fullerton Transportation Center is also served by Amtrak's Southwest Chief and Thruway Bus Routes 1a and 39. Multimodal connections with Metrolink (Orange County and 91 Lines) and regional and local buses are also provided, including five Orange County Transportation Authority (OCTA) bus routes. A surface parking lot with 100 short-term spaces and 158 long-term spaces is provided, and car rentals are also available within one mile of the station. In addition, Class II and III bikeways serve the immediate vicinity.

Anaheim

This station facilitates connections between Metrolink's Orange County commuter rail line, OCTA buses, and Anaheim Resort Transit. Dedicated parking with 150 spaces is available at the station; in addition, parking is also available in the adjacent Angel Stadium lots outside of events. A taxi zone is located adjacent to the platform and within the parking lot, and car rental services are located one mile away. Secure bicycle lockers are provided at the station. Bicycle facilities in the vicinity include the Santa Ana River Trail, which is a Class I bikeway within a quarter-mile of the station, and a Class II bikeway on Sunkist Street, located a half-mile away.

Table 10.4: Station Access Summary

Station	Parking	Taxi/Rental Car	Transit Connections				Bicycle Facilities	Other Communities Served
			Local & Regional Rail	Local & Regional Bus	Amtrak Services	Airports		
LAUS	600 short-term spaces, 1,000 long-term spaces	Taxi within parking lot, car rental adjacent to station	Heavy Rail (Metro Red Line, Purple Line), Commuter Rail (Metrolink), Light Rail (Metro Gold Line and future Regional Connector)	BRT (Metro Silver Line, Silver Streak), Bus (Metro, LADOT, Foothill Transit, Santa Clarita Transit, Santa Monica Big Blue Bus)	Coast Starlight, Southwest Chief, Sunset Limited, Texas Eagle; Thruway Bus Route 1a (Bakersfield – San Diego), Route 1b (Bakersfield – Los Angeles – San Pedro), Route 4 (Los Angeles – Santa Barbara)	LAX Flyaway (LAWA)	Class II bikeways within 1 mile	N/A
Fullerton	100 short-term spaces, 158 long-term spaces	Car rental within 1 mile	Commuter Rail (Metrolink)	Bus (OCTA)	Southwest Chief; Thruway Bus Route 1a (Bakersfield – San Diego), Route 39 (Fullerton – Palm Springs – Indio)	N/A	Class II & III bikeways within immediate vicinity	Buena Park, Placentia
Anaheim	100 short-term spaces, 50 long-term spaces	Taxi within parking lot, car rental 1 mile away	Commuter Rail (Metrolink)	Bus (OCTA), Anaheim Resort Transit	N/A	N/A	Minimal Class II bikeways within 0.5 mile; Class I bikeway (Santa Ana River Trail) within 0.25 mile	N/A
Santa Ana	600 short-term spaces, 600 long-term spaces	Car rental within 1 mile, taxi zone within parking lot	Commuter Rail (Metrolink)	Bus (OCTA, Greyhound, Intercalifornias)	Thruway Bus Route 1a	N/A	Class I (Santa Ana River Trail) within 1.5 miles	Tustin
Irvine	1,500 spaces	Taxi zone, Spectrumotion Ride Share, car rental 1 mile away	Commuter Rail (Metrolink)	Bus (OCTA, iShuttle)	Thruway Bus Route 1a	iShuttle to John Wayne Airport	54 bike lockers; Class I, II, & III bikeways within 1 mile	Lake Forest
San Juan Capistrano	73 short-term spaces, 32 long-term spaces	Car rental within 2 miles, taxi on-call	Commuter Rail (Metrolink)	Bus (OCTA)	Thruway Bus Route 1a	N/A	Class I recreation trails (horse, bike, hike) within immediate vicinity	Dana Point
San Clemente	150 spaces	Car rental 1 mile away	Commuter Rail (Metrolink)	Bus (OCTA)	N/A	N/A	Class III bikeways within immediate vicinity	N/A
Oceanside	180 short-term spaces, 80 long-term spaces	Car rental 1.5 miles away, taxi zone	Commuter Rail (Metrolink, Sprinter, Coaster)	Bus (NCTD Breeze, Riverside Transit Agency, Greyhound)	Thruway Bus Route 1a	N/A	Class III bikeway within immediate vicinity that connects to Class I & II bikeways throughout Oceanside	N/A
Solana Beach	250 spaces	Car rental 0.5 mile away, taxi on-call	Commuter Rail (Coaster)	Bus (NCTD Breeze)	Thruway Bus Route 1a	N/A	Class I & II bikeways within immediate vicinity	Del Mar
San Diego – Old Town	787+ spaces	Car rental within 0.5 mile, taxi on-call	Commuter Rail (Coaster), Light Rail (San Diego Trolley)	Bus (MTS, USD Tram, UCSD Shuttle)	N/A	N/A	Class I, II, & III bikeways within immediate vicinity	Mission Valley
San Diego	150 spaces with numerous lots in immediate vicinity	Car rental 0.5 miles away, taxi zone on Kettner Boulevard	Commuter Rail (Coaster), Light Rail (San Diego Trolley)	Bus (MTS)	Thruway Bus Route 1a	"Airport Flyer" (MTS Route 992) to San Diego International Airport	Class I & III bikeways within immediate vicinity; Class II bikeway 1 mile away	N/A
San Diego International Airport (proposed)	N/A	Potential car rental and taxi access	Commuter Rail (Coaster) proposed	Potential Bus (MTS) and Light Rail (San Diego Trolley)	N/A	Direct connection to San Diego International Airport proposed	Potential bikeway access	N/A

Santa Ana

The station at Santa Ana Regional Transportation Center is also served by Metrolink commuter rail (Orange County and Inland Empire-Orange County Lines). The station offers intercity bus connections via Amtrak Thruway Bus Route 1a, Greyhound, and Intercalifornias, as well as local OCTA buses. A total of 1,200 parking spaces (600 short-term and 600 long-term) are provided in an adjacent structure, and a taxi zone is located at street level. Car rental services are available approximately one mile from the station. The Santa Ana River Trail, a Class I bikeway, is located within 1.5 miles of Santa Ana station.

Irvine

The station at Irvine Transportation Center is a staffed, multimodal facility facilitating connections between Metrolink commuter rail (Orange County and Inland Empire-Orange County Lines), Amtrak Thruway Route 1a, five OCTA bus routes, and two shuttle services (Irvine iShuttle Routes C and D). A total of 1,500 parking spaces are provided, complemented by a taxi zone. Spectrumotion car sharing services are available at the station, with car rentals available approximately one mile away. Several Class I, II, and III bikeways are provided within a one-mile radius, and 54 bike lockers are provided at the station.

San Juan Capistrano

This station is served by Metrolink commuter rail (Orange County and Inland Empire-Orange County Lines), Amtrak Thruway Bus Route 1a, and OCTA buses. A total of 105 parking spaces (73 short-term and 32 long-term) are provided adjacent to the station, and on-call taxi service is offered. Car rental service is available within two miles of the station. A Class I bicycle facility, the Trabuco Creek Trail, is located within the immediate vicinity of the station.

San Clemente

The San Clemente Pier station is served by the Orange County and Inland Empire-Orange County Metrolink lines on weekends only in addition to a limited number of Pacific Surfliner trains. Local bus connections are operated by OCTA. A total of 150 parking spaces are offered, and car rentals are available approximately one mile from the station. Class III bikeways are located within the immediate vicinity.

Oceanside

The multimodal Oceanside station is served by Metrolink (Orange County and Inland Empire-Orange County Lines), Sprinter, and Coaster commuter rail services. Intercity bus connections are provided by Amtrak Thruway Route 1a and Greyhound, and local buses are operated by North County Transit District (NCTD) and Riverside Transit Agency. Parking facilities consist of 180 short-term and 80 long-term spaces, and a taxi zone is provided at the station. Car rental services are available 1.5 miles away. The surrounding bike network consists of Class III facilities within the immediate vicinity that connect to Class I and II bikeways throughout Oceanside.

Solana Beach

The Solana Beach station is also served by Coaster commuter rail, Amtrak Thruway Route 1a, and three NCTD Breeze bus routes. The station offers 250 parking spaces, and car rentals are available within one-half mile. Class I and II bikeways within the immediate vicinity can be accessed directly from the station.

San Diego-Old Town

Coaster commuter rail and the San Diego Trolley Green Line also stop at this station. Local connections are provided by buses and shuttles operated by San Diego Metropolitan Transit System (MTS) and the University of San Diego. Parking facilities accommodate 787 vehicles, and on-call taxi service is offered. Car rental is available approximately one-half mile from the station. An extensive bike network consisting of Class I, II, and III bikeways connects to the station.

San Diego

The San Diego station (Santa Fe Depot) serves as the southern terminus of the Pacific Surfliner, as well as Coaster commuter rail and Amtrak Thruway Bus Route 1a. Local transit services are provided by San Diego Trolley and San Diego MTS buses; Route 992 provides frequent service to San Diego International Airport. Station parking is supplied by a 150-space lot adjacent to the station; additionally, numerous private lots in close proximity provide ample parking opportunities. A taxi zone is located across the street on Kettner Boulevard. Class I and III bikeways within the immediate vicinity connect to Class II facilities approximately one mile from the station.

San Diego International Airport

The San Diego Association of Governments has proposed an Airport Intermodal Transportation Center approximately 1.8 miles north of the San Diego station (Santa Fe Depot) to serve travelers arriving or departing from San Diego International Airport. This facility would be served by Coaster commuter rail as well as Pacific Surfliner trains, in addition to potential San Diego Trolley and local bus connections.

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11.0 Conceptual Engineering and Capital Programming

11.1 Rail Equipment and Infrastructure Improvements Identification

Improvements for the Pacific Surfliner South Corridor were identified based on projects described in previous studies and plans. The majority of the improvements identified for the Pacific Surfliner South Corridor include the following types of projects:

- Extension of existing sidings (or construction of new sidings),
- Grade separations,
- Station Improvements
- Construction of second or third main tracks, and
- Realignment of tracks / curves.

In addition to these projects, other identified improvements include two new crossovers at Tecolote and Washington streets in San Diego, new control points and signal re-spacing in Orange County, Del Mar Bluffs Stabilization, new stations at the San Diego Convention Center and the San Diego Airport Intermodal Transportation Center, and new run-through tracks at LAUS.

11.2 Project Cost Estimates

11.2.1 Methodology and Assumptions

Planning-level project cost estimates for many of the identified improvement projects have already been developed in the Amtrak 20-year Plan (2001) and the other sources consulted in developing the list of proposed improvements. A systematic review of the projects indicated that these cost estimates were generally reasonable and acceptable for planning purposes, and contained sufficient detail to permit their use in the SDP. However, many of the cost estimates were developed in previous years and are no longer current. As a result, a cost escalation factor was applied to bring these specific estimates to Year 2012 dollars. The escalation factor was based upon the increase in the Engineering News Record Construction Cost Index evaluated between the time of prior estimate compared to current year (2012) values. This methodology reflects actual cost experience for similar projects over the intervening period of time. New cost estimates were developed for project cost estimates that did not appear reasonable based on the information available regarding project scope.

11.2.2 Cost Estimates and Documentation

As part of validating the cost estimates from the various sources, typical Year 2012 unit cost ranges were developed for common improvement projects. These unit cost ranges are summarized in Table 11.1. The cost factors for the most typical improvement category – siding extensions and double-tracking have been validated against current cost estimates reflecting higher levels of engineering (either preliminary engineering or final design) received from the railroads for work on California lines and the evaluation has determined that these factors will provide a substantial contingency to address current and/or near term implementation.

Table 11.1: Typical Unit Cost Ranges for Improvement Projects

Project Type	Unit Costs (Year 2012 dollars)			
	Unit	Low	Medium	High
Siding extension and island CTC	track-foot	$1,300	$1,900	$2,500
Second main track	track-foot	$3,000	$5,500	$8,000
Curve realignments	track-foot	$1,000	$2,500	$4,000

The development of “low”, “medium”, and “high” estimates of typical project costs allows for flexibility in the cost estimation process to account for project- or location-specific features which may suggest actual costs that are lower or higher than the medium (i.e., “average”) cost for that type of project. For example, construction of retaining walls, bridges, or other civil / structural elements may result in higher total costs for some double track projects such as Santa Margarita Bridge and Sorrento to Miramar.

The resulting total costs for each of the identified improvements are summarized in Table 11.2.

Table 11.2: Total Costs for Improvement Projects

Project Description	Cost (Millions, Year 2012 dollars)
Near-Term Projects (2013-2015)	
Pico Rivera to Santa Fe Springs third main track (Los Angeles to Fullerton third main track, Segment 7)	$37.50
La Mirada to Valley View third main track (Los Angeles to Fullerton third main track, Segment 8)	$30.50
State College Boulevard/Howell Street SCRRA crossing grade separation (Anaheim)	$92.00
New passing siding between Laguna Niguel/Mission Viejo Station and San Juan Capistrano Station (La Zanja)	$26.80
San Clemente Beach Trail grade crossing improvements	$4.50
Positive Train Control (San Onofre to San Diego)	$88.00
CP San Onofre to CP Pulgas second main track (Phase 1)	$38.00
Oceanside through tracks	$19.50
Poinsettia Station improvements	$13.00
CP Cardiff to CP Craven second main track (San Elijo Lagoon)	$76.10
Solana Beach Station parking expansion	$27.00
Los Penasquitos Lagoon bridge replacements	$24.00
Sorrento Valley double track	$33.00
CP Elvira to CP Morena double track	$90.50

Project Description	**Cost** (Millions, Year 2012 dollars)
Mid-Term Projects (2016-2020)	
Southern California Regional Interconnector Project (SCRIP) -- LAUS run-through tracks	$350.00
Hobart Flyover (UPRR/BNSF San Pedro Junction)	$95.00
Hobart to Commerce fourth main track	$25.00
Basta to Fullerton Junction fourth main track	$100.00
Orangethorpe Avenue SCRRA crossing grade separation (Anaheim)	$99.00
Sycamore Street SCRRA crossing closure (Anaheim)	$2.00
Broadway SCRRA crossing improvements (Anaheim)	$5.00
Santa Ana Street SCRRA crossing closure (Anaheim)	$2.00
South Street SCRRA crossing improvements (Anaheim)	$5.00
Vermont Avenue SCRRA crossing improvements (Anaheim)	$5.00
Orange County supplemental signal system (maximum speed 110 mph)	$15.00
Santa Ana Station expansion	N/A
New CP on Metrolink Orange Subdivision at Fourth Street (MP 175.7), new powered No. 10 turnout to UPRR spur approximately 0.5 mile south of Santa Ana Station, and new powered derail on UPRR connecting track	$4.00
Irvine Station improvements (auxiliary siding and platform, new holding track, and new crossover)	$17.00
San Diego County cab signal system (maximum speed 110 mph)	$4.00
San Diego County lagoon bridge replacements (tbd)	$20.00
San Diego County grade crossing safety improvements and future quiet zones	$66.00
CP San Onofre to CP Pulgas second main track (Phase 2)	$36.00
CP Eastbrook to CP Shell double track (San Luis Rey River Bridge replacement)	$53.00
Oceanside Station parking expansion	$25.00
Carlsbad Village double track (CP Longboard to CP Farr)	$49.50
CP Ponto to CP Moonlight second main track and Batiquitos Lagoon Bridge replacement	$48.50
CP Moonlight to CP Swami second main track	$22.00
New grade-separated pedestrian crossings in Encinitas (Hillcrest Drive, El Portal Street, and Montgomery Avenue)	$12.00

Project Description	Cost (Millions, Year 2012 dollars)
San Dieguito double track and bridge replacement (CP Valley to CP Crosby), and Del Mar Fairgrounds special events platform	$110.00
Del Mar Bluffs stabilization (Phase 4)	$21.00
Sorrento to Miramar (CP Pines to CP Cumbres (Miramar)) curve realignment and second main track (Phase 2)	$98.00
Airport Intermodal Transportation Center (ITC)	$165.00
San Diego Station (Santa Fe Depot) rehabilitation	$20.00
San Diego Station (Santa Fe Depot) parking expansion	$8.00
New San Diego layover facility	$32.00
Long-Term Projects (2021-2040)	
DT Junction and Los Nietos Junction track realignment (diamond crossing elimination)	$130.00
Ball Road SCRRA crossing grade separation (Anaheim)	$95.00
North Main Street SCRRA crossing grade separation (Orange)	$69.00
Orange Junction curve realignment	$2.00
East 17th Street/Lincoln Avenue SCRRA crossing grade separation (Santa Ana)	$89.00
East Santa Ana Boulevard SCRRA crossing grade separation (Santa Ana)	$74.00
South Grand Avenue/East Hunter Avenue SCRRA crossing grade separation (Santa Ana)	$72.00
Red Hill Avenue/Edinger Avenue SCRRA crossing grade separation (Tustin)	N/A
Irvine third main track	$75.00
Irvine Station enhancements to accommodate Amtrak, Metrolink, fixed-route bus service, and the Irvine Guideway	$205.00
New double-track tunnel between San Juan Capistrano Station and San Diego County border	N/A
Extension of Serra siding	$15.00
MP 200 curve realignment (at Pacific Coast Highway)	$4.00
CP “Trestles” to CP Songs second main track	$38.00
Leucadia Boulevard/Highway 101/North Vulcan Avenue grade separation (Encinitas)	$160.00

Project Description	**Cost** (Millions, Year 2012 dollars)
New double-track Del Mar Tunnel (Camino del Mar option or I-5/Penasquitos option)	$987.00
Los Penasquitos Lagoon second main track (CP Sorrento to CP Torrey)	$87.00
New double-track UTC Tunnel (I-5 option or UTC option)	$2,490.00
Taylor Street grade separation (San Diego (Old Town) Station)	$90.00
New Downtown San Diego rail trench and grade separations	$300.00

11.3 Project Schedule and Prioritization

Previous studies provide details on the prioritization and recommended timeline of improvements in the Pacific Surfliner South Corridor. This prioritization scheme and timeline are reflected in the grouping of proposed improvements into the near-term (2013–2015), mid-term (2015–2020), and long-term (2021-2040) timeframes in Table 11.2.

The *LOSSAN Corridorwide Strategic Implementation Plan* also includes some existing Corridor bottleneck segments, although it evaluates both the Pacific Surfliner North and Pacific Surfliner South Corridors in the same context as a single corridor ("LOSSAN"). However, this information can also be useful in determining the relative importance of specific segments along the Pacific Surfliner South Corridor to overall train delay and level of service. Proposed Service Development Plan improvements in more critical segments of the Corridor should be considered higher priorities than improvements in less critical segments of the Corridor. The ranking of Corridor bottleneck segments as provided in the *LOSSAN Corridorwide Strategic Implementation Plan* is summarized in Table 11.3.

Table 11.3: LOSSAN Corridorwide Strategic Implementation Plan Bottleneck Segment Rankings – Pacific Surfliner South Corridor

Segment	**Rank**	
	Within LOSSAN Corridor	**Within Pacific Surfliner South Corridor**
LAUS to Fullerton	8	2
Fullerton to Orange	NA	NA
Orange to Laguna Niguel	8	2
Laguna Niguel to Oceanside (Orange County)	13	4
Laguna Niguel to Oceanside (San Diego County)	12	3
Oceanside to San Diego	3	1

*Source: *LOSSAN Corridorwide Strategic Implementation Plan*, April 2012.

Notes: "NA" indicates not applicable or not available.

11.4 Conceptual Engineering Design Documentation

The *California Passenger Rail System: 20-Year Improvement Plan Technical Report (2001)* and other sources provide details on most of the proposed improvements at a conceptual planning level. Those details are summarized below for common improvement types.

- Siding extension: Siding extensions generally involve increasing siding length to 10,000 ft to better accommodate passing movements (either between freight and passenger trains or between trains in opposing directions). Switches would be powered and the extended siding designed with Number 24 turnouts (40 mph through switch) to streamline passing movements. All track and ties on the siding would be replaced. A conceptual siding extension is illustrated in Exhibit 11.1.
- Curve realignment: Curve realignments would involve redesigning and reconstructing track curves to eliminate slowdowns and reduce travel times by permitting higher speeds. Track curves would either be removed completely or reduced to a two- or three-degree maximum curvature, increasing maximum train speeds to 90 mph (and possibly increasing the number of 90 mph trackage miles). Auxiliary measures such as right-of-way acquisition and construction of retaining walls or new structures may be required to facilitate the realignment. A conceptual curve realignment is illustrated in Exhibit 11.2.
- Second main track: A second main track involves construction of an additional track to increase operational reliability and capacity at strategic locations along the mainline, reducing conflicts between freight and passenger trains and / or permitting operation of more passenger train services. Similar to siding extensions, the second track would feature Number 24 turnouts, and be designed with the requisite signaling and infrastructure (e.g., new bridges). A conceptual second main track is illustrated in Exhibit 11.3.

Exhibit 11.1: Conceptual Siding Extension

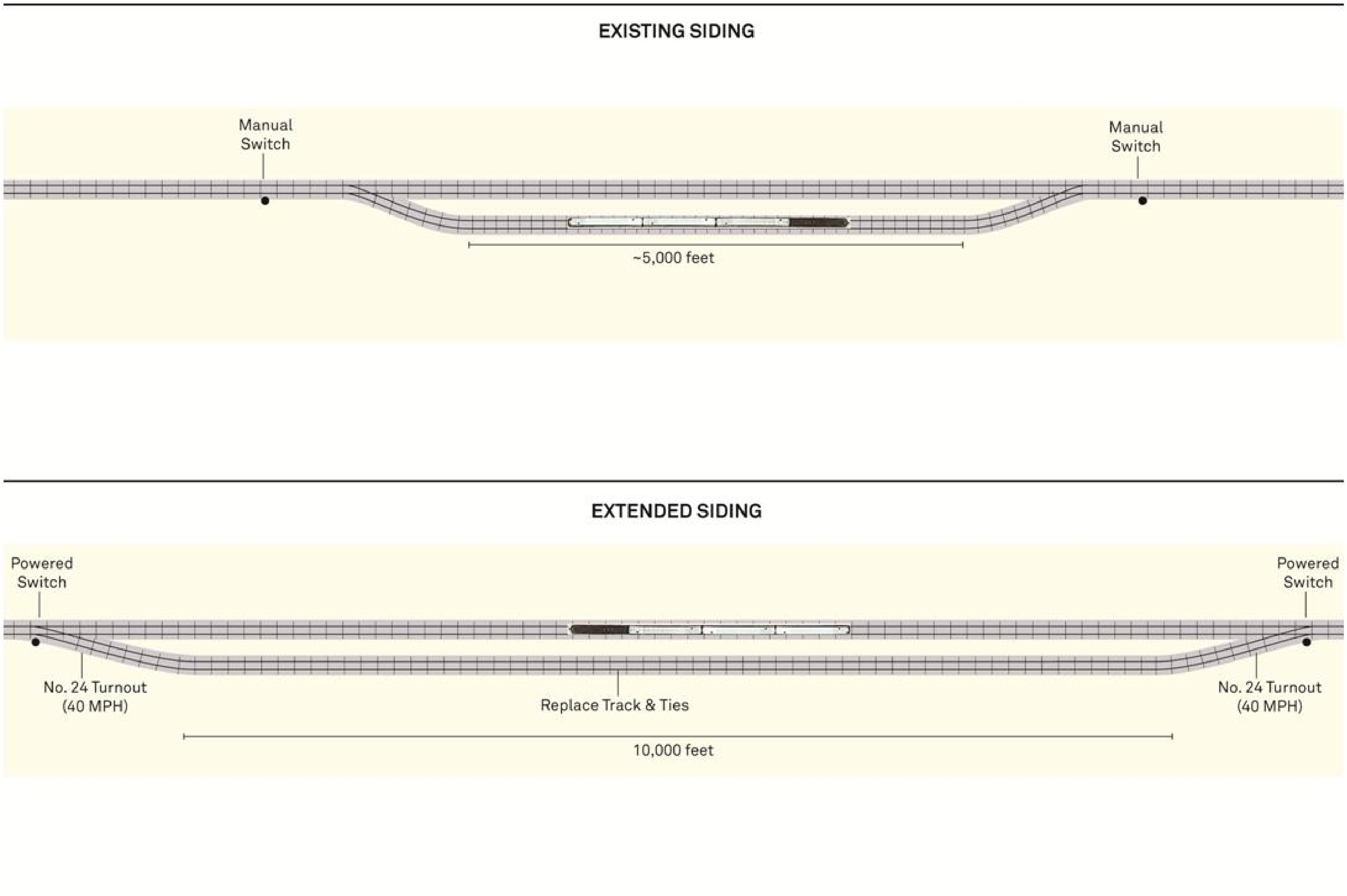


Exhibit 11.2: Conceptual Curve Realignment

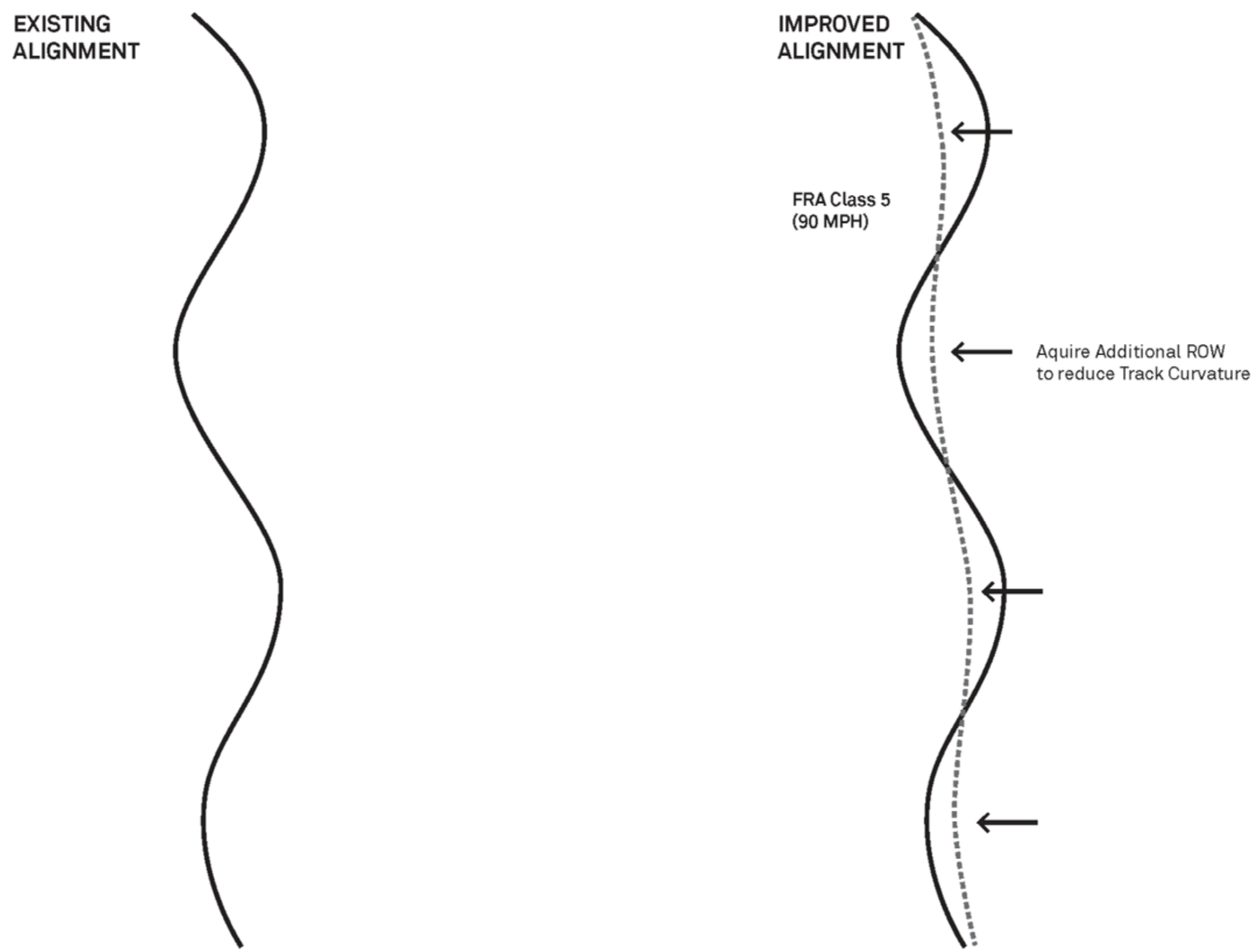
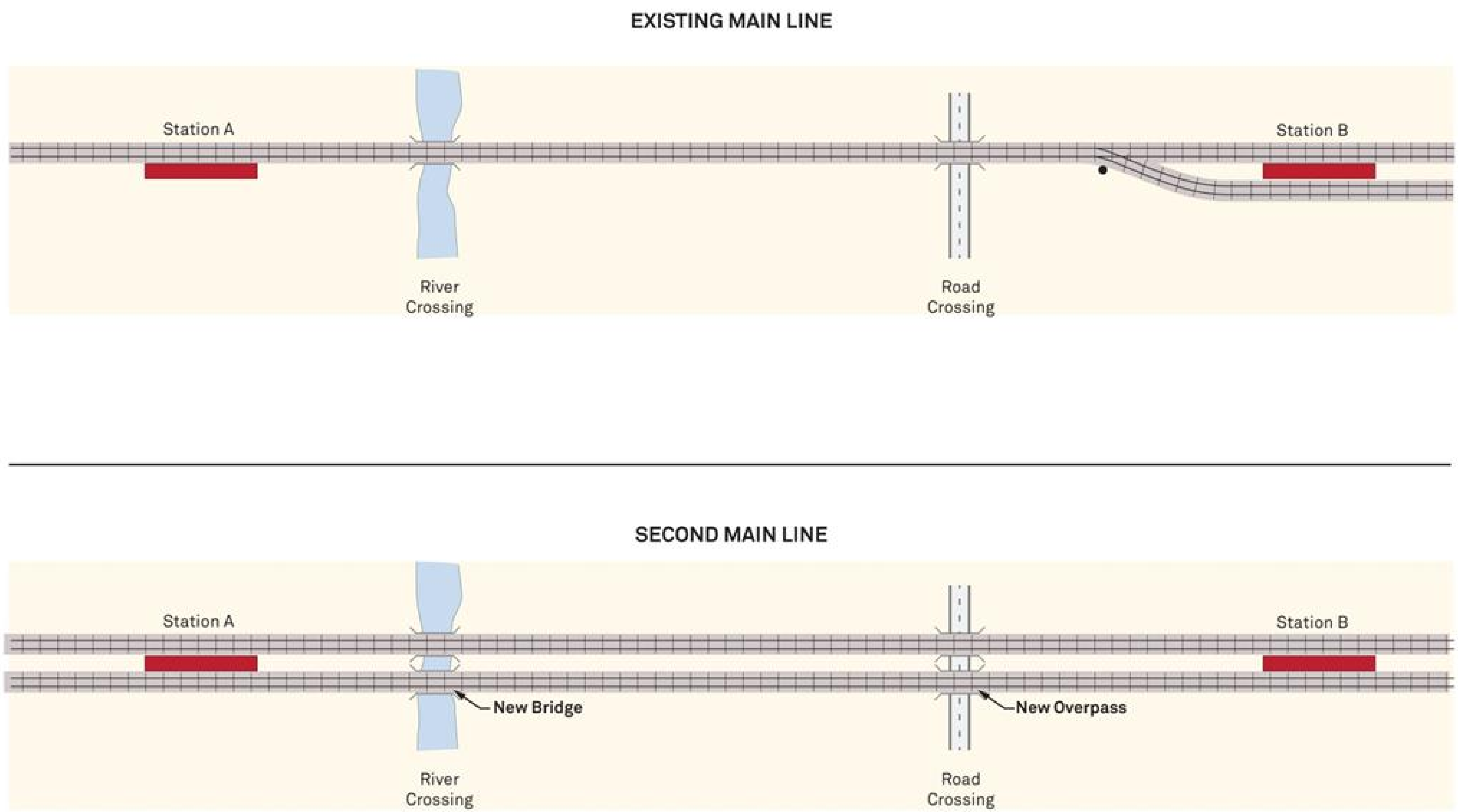


Exhibit 11.3: Conceptual Second Main Track



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12.0 Operating and Maintenance Costs and Capital Replacement Forecast

This chapter of the SDP presents operating and financial projections for each forecast year of the intercity passenger rail service in the Pacific Surfliner South Corridor. The methods, assumptions and outputs for operating expenses for the train services are addressed. Documentation of key assumptions is included, along with a description of how unit costs and quantities are derived.

An estimate of the Profit and Loss Statement for the route is also presented, as well as details of capital replacement costs.

12.1 Costing Methodologies and Assumptions

The Operating and Maintenance (O&M) cost estimates are developed by deriving the cost per train mile and applying this unit cost to the number of train miles operated by forecast year. The unit cost per train mile is calculated based on recent operating experience of the Pacific Surfliner service.

The total operating expenses for the proposed train services include rail operations – maintenance of way, maintenance of equipment, transportation (train movement), station and on-board services – as well as administration and marketing costs. Expenses covering heavy overhaul of equipment are considered capital costs and are not included. The unit cost per train mile is the quotient of the total annual O&M expenses divided by the annual train miles. The expenses, which are presented in Table 12.1, are averaged over the past two state fiscal years (FY 2010-11 and 2011-12) to determine the unit cost of $67.30.

Table 12.1: Operational Expenses – Pacific Surfliner Route

	State Fiscal Year 2010–11	**State Fiscal Year 2011–12**
Rail Operations • Maintenance of Way • Maintenance of Equipment • Transportation (Train Movement) • Station • On-board Services	$98,826,221	$106,401,372
Administration	$1,500,000	$1,500,000
Marketing	$2,300,000	$2,300,000
Total Annual Operating and Maintenance Costs	*$102,626,221*	*$110,201,372*
Annual Train Miles	1,600,001	1,563,915
Unit Cost per Train Mile	$64.14	$70.47
Average Unit Cost per Train Mile	*$67.30*	

Source: "Statistical History 2004-2011 – Pacific Surfliner, San Joaquin, Capitol Corridor", Caltrans, 2012

The factors (or driving variables) influencing the operating cost are based on the physical characteristics of the lines supporting the service and the operating plan, which in turn is based on operational and capacity analysis and significant operations decisions. Such decisions include the location of crew bases and maintenance facilities, as well as basic schedule concepts, which are developed in a manner consistent with achieving efficient operations and favorable O&M costs.

12.2 Summary of Operating Costs

The total operating costs are developed for the forecast years in base year dollars, based on a unit cost per train mile of $67.30. Daily roundtrips in the forecast years are the same for both weekdays and weekend days.

Total annual O&M costs for intercity passenger rail service in the Pacific Surfliner South Corridor currently amount to nearly $69.2 million. With an additional roundtrip between LAUS and San Diego planned by 2020, total O&M costs are estimated to increase to approximately $75.4 million (base year dollars). With the increase of seven additional roundtrips by 2040, annual O&M costs are estimated to again amount to nearly $113.2 million (base year dollars).

Table 12.2: Operating Costs by Service Year

Pacific Surfliner South Corridor		**Base Year (Existing)**	**Forecast Year 2020**	**Forecast Year 2040**
Route Miles (one way)	LAUS – San Diego	128	128	128
Daily Roundtrips	LAUS – San Diego	11	12	18
Annual Train Miles		1,027,840	1,121,280	1,681,920
Annual Operating and Maintenance Costs (Base Year Dollars)		**$69,173,600**	**$75,462,100**	**$113,193,200**

Source of Number of Daily Roundtrips: LOSSAN Corridorwide Strategic Implementation Plan, April 2012

12.3 Route Profit and Loss Statement

An estimate of the Profit and Loss Statement for the route is provided, based on revenue and operating cost forecasts.

Table 12.3: Estimated Profit and Loss

	Forecast Year 2020	**Forecast Year 2040**
Annual Ridership	1,095,000	1,717,000
Route Profit / Loss		
Ticket revenue (2012 dollars)	$31,100,000	$49,000,000
O&M Costs	$33,112,900	$38,468,000
Subsidy Required	($2,012,900)	NA
Subsidy per Rider	($1.84)	NA

Notes:

- “NA” indicates not applicable.

12.4 Capital Replacement Costs

Capital replacement or economic depreciation is the portion of the value of physical plant and equipment that is used up in the production of passenger train service. These additional capital costs beyond those incurred in the initial implementation of the Service Development Program are anticipated to be required due to economic depreciation, obsolescence and lifecycle replacement and other factors. This would include track renewal, bridge replacement or rehabilitation, station renovation or replacement, signal system upgrades and rolling stock rehabilitation and replacement. Capital replacement costs exceed routine maintenance and ordinary repairs, which are included in O&M costs categorized in Section 12.2 above.

Capital replacement is usually treated as a discretionary expense in any particular year. It may be deferred when funds are unavailable but ultimately must be allocated to maintain the infrastructure, plant and rolling stock so the operation remains safe and reliable over the long term. Many of these capital replacement expenditures are incurred and paid for by the host railroads or local communities.

Track renewal and bridge maintenance and replacement is paid for and scheduled by the host railroads. Trackage rights fees paid by Amtrak and Caltrans includes an apportioned cost allocated for capital replacement in addition to routine and ordinary maintenance of infrastructure. Station renovation and/or replacement costs are usually paid for by local communities often with funding support from Caltrans. However, rolling stock is a critical capital replacement cost item and a major annual budget consideration.

Funding for the rolling stock overhaul program varies by budget year based on the specific overhauls planned for that particular budget year. The overhaul program has been funded through PTA funds appropriated each year by the Budget Act. Article XIX of the State Constitution prohibits the use of State Highway Account (SHA) funds for mass transit vehicle acquisition or maintenance. Thus, SHA funds cannot be used for the overhaul program, nor is there any dedicated funding source for the overhaul work needed in the future as the equipment ages.

Railcar Overhaul and Replacement

California owns its own fleet of 88 railcars and 17 locomotives and has spent over $300 million on the design and acquisition of railcars and locomotives since the early 1990's. The Northern California fleet, which is used on both the *San Joaquin* and *Capitol Corridor*, is entirely State-owned. It includes 78 cars – 66 California Cars and 12 new *Pacific Surfliner* fleet cars, and 17 locomotives – 15 Electro Motive Division F59PHI and two General Electric Dash-8 units.

California acquired the original 66 bi-level "California Cars" between 1995 and 1997. The "California Car" fleet is comprised of four distinctive car types –- cab, trailer, coach, and food service cars. In 2001, California purchased and placed into service an additional 22 cars. The cars were acquired as an option to Amtrak's 40 car *Pacific Surfliner* fleet order for Southern California. Twelve of the State-owned cars were assigned to Northern California operations, and ten cars were assigned to *Pacific Surfliner* operations. In 2012, 14 Comet I coaches were purchased from New Jersey Transit. Passenger railcars have an economic useful life of approximately 30 years. On-going routine maintenance keeps the railcars reliable and attractive to customers.

Caltrans received $245 million in ARRA funds for equipment acquisition to replace some of the existing railcars and locomotives and to add capacity to the existing fleet. Caltrans and several Midwest states initiated a joint procurement of new railcars that will be compatible with existing equipment and recently awarded a contract to Sumitomo for railcars produced by Nippon Sharyo in Rochelle, Illinois. The equipment to be purchased will be designed and built using specifications approved by the Passenger Rail Investment and Improvement Act of 2008 (PRIIA) Section 305 Next-Generation Equipment Committee (NGEC). California will receive a total of 42 NGEC railcars. The railcars will include 29 allocated for capacity increases while the remaining 13 will be used to replace older or damaged equipment, with a total of 21 to be allotted to the *Pacific Surfliner* fleet.

In 2003-04, Caltrans contracted for the midlife (eight-year) overhaul of the original 66 "California Cars." Design, engineering and the completion of the overhaul and testing of the four pilot (prototype) cars (cab, coach, foodservice, and baggage) was completed in 2004-05, and midlife overhauls of the remainder of the fleet were completed in 2008.

However, additional work was still required to bring the cars up to current industry standards. Caltrans awarded a $13.1 million to Alstom for the complete replacement of the door systems and upgrade of the wheelchair lifts, as well as heavy cleaning of vehicle interior including upholstery and carpets; rebuilding and new flooring in toilet rooms; 110 volt convenience outlets at every seat; as well as other additions and improvements to the cars. In future years, the newer 22 cars (12 in the Northern California fleet and ten in the Southern California fleet) will need their midlife overhaul. Table 12.4 provides information on the overhaul program.

Table 12.4: Intercity Railcar Overhaul Program

State Fiscal Year	Projected Overhaul Funding Needs (Million Dollars)
2011-12	$ 16.1
2012-13	$ 18.4
2013-14	$ 14.4
2014-15	$ 11.9
2015-16	$ 11.9
2016-17	$ 21.0
2017-18	$ 25.5
2018-19	$ 24.5
2019-20	$ 23.5

Source: Caltrans, Division of Rail

Locomotive Overhaul and Replacement

Although Caltrans has its own fleet of locomotives, these are used exclusively for Northern California services—locomotives used on the *Pacific Surfliner* are owned by Amtrak, and this is expected to continue into the future. Although Caltrans is working to purchase six new State-owned locomotives together with the previously-mentioned 42 railcars, these locomotives would be allocated to the *San Joaquin* and *Capitol Corridor* fleets.

Locomotives have a projected economic life of approximately 20 years, but overhauls can extend the life of units beyond this timeframe, delaying the need for replacement. In particular, a program is currently underway to re-power Caltrans' fleet of locomotives with new Tier 4 EPA standard head-end power (HEP) units, which supply electrical power to the train. Three locomotives have already had this upgrade. Caltrans currently has a contract to re-power five more locomotives beginning in February 2013. These repowering processes typically take approximately six weeks to complete at a cost of $260,000 per HEP unit. The schedule of specific locomotives to be retrofitted is still to be determined. This program is anticipated to give two more overhaul cycles to the equipment. Repowered locomotives will be overhauled again in eight years and then at year 16 will be replaced. Although this program is for State-owned locomotives in the Northern California fleet, Amtrak would be required to carry out similar overhaul programs or purchase new locomotives to achieve compliance with Tier 4 emissions standards.

13.0 Public Benefits and Impacts Analysis

This chapter describes the public benefits and impacts associated with passenger and freight rail improvements for the *Pacific Surfliner* route south of LAUS. This analysis encompasses potential transportation, environmental, and economic effects for rail system users and non-users.

13.1 Operational and Transportation Output Benefits

The ridership and revenue forecasting process described in Chapter 8 provides a mechanism for calculating vehicle miles traveled (VMT), vehicle hours traveled (VHT), and travel mode changes as passenger rail service is expanded.

13.1.1 Travel Mode Changes

Passenger rail ridership increases arise from travelers diverting from air or personal vehicles or from taking entirely new trips ("induced travel"). These travel mode changes occur due to improved passenger rail travel times, reliability, and service frequencies that can be obtained with capital projects and service expansion. The ridership forecasting tools project that expanded service for the *Pacific Surfliner* route south of LAUS will reduce statewide personal vehicle travel by about 0.21 million annual person trips in 2020 and 0.50 million annual person trips in 2040.

13.1.2 Personal Vehicle Travel

Table 13.1 summarizes the projected 2020 VMT and VHT changes by subregion. Table 13.2 provides similar information for year 2040. These results reflect the illustrative service plan assumptions for the *Pacific Surfliner* route.

Table 13.1: Year 2020 Changes in Daily Vehicle Miles Traveled (VMT) and Vehicle Hours Traveled (VHT)

	VMT		VHT	
Region	**Change**	**Percent Change**	**Change**	**Percent Change**
Sacramento	~0	~0%	~0	~0%
Bay Area	~0	~0%	~0	~0%
San Joaquin Valley	~0	~0%	~0	~0%
Central Coast	~0	~0%	~0	~0%
Los Angeles	(18,000)	~0%	(600)	~0%
San Diego	(21,000)	-0.02%	(800)	-0.02%
Rest of California	~0	~0%	~0	~0%
Statewide Total	**(39,000)**	**~0%**	**(1,400)**	**~0%**

Notes: Value reflect the illustrative service plan assumptions for the *Pacific Surfliner* route. Negative values indicate reductions from "baseline" or "no project" assumptions.

Table 13.2: Year 2040 Changes in Daily Vehicle Miles Traveled (VMT) and Vehicle Hours Traveled (VHT)

	VMT		VHT	
Region	**Change**	**Percent Change**	**Change**	**Percent Change**
Sacramento	~0	~0%	~0	~0%
Bay Area	~0	~0%	~0	~0%
San Joaquin Valley	(8,000)	-0.01%	(300)	-0.01%
Central Coast	~0	~0%	-	~0%
Los Angeles	(141,000)	-0.03%	(4,900)	-0.03%
San Diego	(144,000)	-0.09%	(5,100)	-0.09%
Rest of California	~0	~0%	~0	~0%
Statewide Total	**(293,000)**	**-0.03%**	**(10,300)**	**-0.03%**

Notes: Value reflect the illustrative service plan assumptions for the *Pacific Surfliner* route. Negative values indicate reductions from "baseline" or "no project" assumptions.

The forecasts show a daily VMT reduction in most regions. At the statewide level, daily VMT is projected to drop by about 39,000 miles in 2020 and 293,000 miles in 2040. The forecast shows a slight reduction in daily VHT (or hours spent driving) in southern California with daily statewide VHT falling about 1,400 hours in 2020 and 10,300 hours in 2040.

13.1.3 Air Travel

Diversion of air trips to conventional and high-speed intercity passenger rail may lead to reduced aircraft operations for intra-California air travel. The most recent analysis, which was conducted for the 2008 *Bay Area to Central Valley High-Speed Train (HST) Program Environmental Impact Report/Environmental Impact Statement (EIR/EIS)* estimated that the full statewide high-speed rail (HSR) system (Phases I and II) could result in approximately 280,000 fewer annual commercial aircraft operations at California airports (a five percent reduction). This magnitude of aircraft operation reduction was projected to reduce air travel delay each year by about 13.9 million passenger hours.

13.2 User and Non-User Economic Benefits

Passenger and freight rail improvements will benefit the State in a number of ways, and many of these benefits are quantifiable. For example, improved passenger rail service directly benefits travelers who shift from autos to trains for travel within the State. As more people use rail, those who remain on California's highways enjoy the benefits of reduced congestion levels, saving themselves time on their trips. Finally, more passenger rail trips will also translate to crash reductions and lower air pollution emissions. These benefits are measurable by monetizing values generated from the ridership and revenue forecasting tools described in Chapter 8.

The benefits quantified in this analysis divide into "user benefit" and "non-user benefit" categories.

13.2.1 User Benefits Analysis and Results

User benefits accrue to individuals as they shift from airplanes or personal vehicle to passenger rail. These travelers place a monetary value on riding comfortable, reliable, and safe trains. Passengers also value the dependability provided by rail in almost all weather conditions, allowing travel even as flights are canceled and driving is treacherous. The user benefits for rail passengers are a reflection of these advantages.

User benefits in this analysis include intercity rail passengers who shift to rail for their trips, plus induced travel (i.e., new trips that would not have taken place otherwise if the rail improvements had not been made). The passenger rail user benefits reflect these advantages and are measured by consumer surplus, which is the difference between how much passengers are willing to pay and the actual train fare that is paid. User benefits were estimated through a process known as log-sum calculation[12], which is derived from “values of time” and other mathematical equations in the ridership forecasting models.

Annual user benefits are projected to total $8.4 million (2012 dollars) for the illustrative year 2020 service plan assumptions, and $28.3 million for the year 2040 service plan assumptions. The 2020 user benefit total includes an $8.2 million benefit for intercity travelers and a $0.2 million benefit for urban area travelers. The 2040 user benefit total includes a $27.9 million benefit for intercity travelers and a $0.4 million benefit for urban area travelers.

13.2.2 Non-User Benefits Analysis and Results

Non-user benefits include highway delay reductions, safety improvements, and lower pollution emissions that result from a less intensive use of motor vehicles on California’s roadways. These benefits are measured by monetizing the VMT and VHT changes shown in Table 13.1.

Vehicle Crash and Air Pollution Reduction Benefits

Expanded passenger rail service will reduce VMT and, by extension air pollution and crashes. For this analysis, VMT reductions were converted to monetary benefits using rates of 14.7 cents per mile for crash reduction[13] and 2.1 cents per mile for air pollution reduction[14] (both are in 2012 dollars). The monetized accident and pollution reduction benefits are shown by region in Tables 13.3 and 13.4 for years 2020 and 2040, respectively.

Highway Delay Benefits

Traffic congestion is a perennial problem in California and it imposes costs on the State’s people in the form of lost time. Hours not spent at work, with family, or other activities such as exercising or entertainment translate to economic and social losses for the State. Improved rail service will reduce traffic delays by diverting personal vehicle travel to intercity passenger rail.

For this analysis, VHT reductions were monetized using values of time (in 2012 dollars per hour) for intercity business and non-work trips of $72.36 and $20.97, respectively. Tables 13.3 and 13.4 summarize these results by subregion.

[12] An explanation of the log-sum process and its application to this analysis is available in “Economic Growth Effects Analysis for the Bay Area to Central Valley Program-Level Environmental Impact Report and Tier 1 Environmental Impact Statement”, Appendix A, California High-Speed Rail Authority, July 2007.

[13] Federal Highway Administration, *Highway Economic Requirements System*.

[14] National Research Council, *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use*, Committee on Health, Environmental, and Other External Costs and Benefits of Energy Production and Consumption, 2009.

Table 13.3: Year 2020 Non-User Benefits by Subregion

Region	Annual Benefits (in millions in 2012 dollars)		
	Highway Crash Reduction	**Air Pollution Reduction**	**Highway Delay Reduction**
Sacramento Region	~$0	~$0	~$0
Bay Area	~$0	~$0	~$0
San Joaquin Valley	~$0	~$0	~$0
Central Coast & Monterey Bay	~$0	~$0	~$0
Greater Los Angeles Region	$0.9	$0.1	$16.6
San Diego	$1.2	$0.2	$20.8
Rest of California	~$0	~$0	~$0
Statewide Total	**$2.1**	**$0.3**	**$37.4**

Table 13.4: Year 2040 Non-User Benefits by Subregion

Region	Annual Benefits (in millions in 2012 dollars)		
	Highway Crash Reduction	**Air Pollution Reduction**	**Highway Delay Reduction**
Sacramento Region	~$0	~$0	$0.1
Bay Area	~$0	~$0	$0.1
San Joaquin Valley	$0.4	$0.1	$4.5
Central Coast & Monterey Bay	~$0	~$0	~$0
Greater Los Angeles Region	$7.6	$1.1	$88.3
San Diego	$7.7	$1.1	$91.7
Rest of California	~$0	~$0	~$0
Statewide Total	**$15.7**	**$2.3**	**$184.7**

13.2.3 Summary of User and Non-User Benefits

Table 13.5 summarizes the total benefits of the expanded passenger rail service levels. The benefits are closely divided between the intercity passenger rail travelers and the personal vehicle operators who continue to use California's roadways.

While this analysis forecast major benefit components for California's economy, data and analysis methods were not readily available to capture all potential benefits. Some examples are as follows:

- Increased rail usage may reduce highway maintenance.
- Reduced in-state air travel may lead to fewer in-state flights at California's congested. This situation might reduce delays for remaining flights or free up capacity for transcontinental and international flights.

- New highway-rail grade separations might reduce the projected number of train-vehicle crashes, further increasing the benefits shown in Tables 13.3 and 13.4.

Table 13.5: Summary of Annual User and Non-User Benefits

Benefits Summary	**2020**	**2040**
User Benefits		
Intercity Passenger	\$8.2	\$27.9
Urban Passenger	\$0.2	\$0.4
Non-User Benefits		
Accident Reduction	\$2.1	15.7
Pollution Reduction	\$0.3	2.3
Highway Delay Reduction	\$37.4	184.7
Total Benefits	**\$48.2**	**\$231.0**

Note: Table values are in millions in year 2012 dollars.

- Improved rail operations might reduce fuel-related costs for freight and passenger rail operators.
- Potential economic development benefits from HSR that are expected to strengthen the competitiveness of California's industries, major metropolitan areas, and intermediate cities by more effectively connecting markets and encouraging business interactions that further stimulate growth.

13.3 Environmental Effects

This section describes the potential environmental effects of the proposed capital and service improvements for the *Pacific Surfliner* route south of LAUS.

13.3.1 Air Quality Emissions

Table 13.1 illustrates that improved *Pacific Surfliner* rail services are projected to reduce automobile and truck VMT throughout California. VMT reductions lead directly to reduced emissions of carbon dioxide (CO_2) and key mobile source pollutants[15]. Air quality emissions were forecast using the California Air Resources Board Emissions Factor (EMFAC) model[16] coupled with the VMT forecasts[17].

Tables 13.6 through 13.11 summarize the reduction in emissions due to reduced VMT for key pollutants by region within California. The column titled "'No Action' EMFAC Emissions" shows total statewide mobile source emissions by pollutant. "No Action" assumes continuation (but no expansion) of current

[15] This analysis addressed reactive organic gases (ROG), oxides of nitrogen (NO_x), carbon monoxide (CO), large particles (PM_{10}), and small particles ($PM_{2.5}$).

[16] The analysis used the EMFAC 2011 model.

[17] This emissions analysis reflects vehicle travel reduction due to mode shifts from personal vehicles to passenger rail and residual congestion reduction from this mode shift. Additional emission reduction might arise from: a) improved rail system efficiency through reduced locomotive idling and improved locomotive fuel economy; b) reduced aircraft operations from air to rail modal shifts; c) reduced vehicle acceleration and deceleration from highway bottleneck elimination; and d) shifting of freight from trucks to rail .Emission increases might arise from: a) additional locomotive operation due to expanded service levels; and b) passenger travel to/from intercity passenger rail stations.

passenger rail routes and service levels. The “Emissions Reduction from ‘No Action’” column indicates each pollutants projected emission reduction arising from the illustrative service plan assumptions. The emission reduction projections are organized by pollutant in the following tables:

- Table 13.6 shows the reduction in carbon dioxide (CO_2) emissions to quantify GHG emission reduction benefits.
- Table 13.7 and 13.8 show the reduction in reactive organic gases (ROG) and oxides of nitrogen (NO_x) respectively; these are precursor emissions that contribute to the formation of ground level ozone and secondary aerosols.
- Table 13.9 shows the reduction in carbon monoxide (CO) emissions.
- Table 13.10 shows the reduction in particulate matter between 2.5 and 10 microns (PM_{10})
- Table 13.11 shows the reduction in particulate matter smaller than 2.5 microns ($PM_{2.5}$)

Table 13.6: Carbon Dioxide Emission Reduction

Region	2020		2040	
	Emission Reduction from “No Action”	“No Action” EMFAC Emissions	Emission Reduction from “No Action”	“No Action” EMFAC Emissions
Sacramento Region	-	7,286,000	20	8,274,000
Bay Area	<1	30,941,000	40	33,194,000
San Joaquin Valley	10	25,218,000	1,400	34,123,000
Central Coast & Monterey Bay	-	6,069,000	-	6,507,000
Greater Los Angeles Region	2,800	81,412,000	21,700	94,233,000
San Diego	3,300	13,947,000	20,200	16,365,000
Rest of California	-	11,191,000	-	13,360,000
Statewide Total	6,100	176,064,000	43,300	206,056,000

Note: Table values are in tons per year.

Table 13.7: Reactive Organic Gas Emission Reduction

Region	2020		2040	
	Emission Reduction from “No Action”	“No Action” EMFAC Emissions	Emission Reduction from “No Action”	“No Action” EMFAC Emissions
Sacramento Region	-	3,700	<1	3,100
Bay Area	<1	19,000	<1	15,400
San Joaquin Valley	<1	11,000	<1	10,900
Central Coast & Monterey Bay	-	3,000	-	2,400
Greater Los Angeles Region	1	39,000	7	32,000
San Diego	2	7,000	8	6,500

Region	2020		2040	
	Emission Reduction from "No Action"	"No Action" EMFAC Emissions	Emission Reduction from "No Action"	"No Action" EMFAC Emissions
Rest of California	-	7,100	-	5,300
Statewide Total	3	90,800	16	75,600

Note: Table values are in tons per year.

Table 13.8. Oxides of Nitrogen Emission Reduction

Region	2020		2040	
	Emission Reduction from "No Action"	"No Action" EMFAC Emissions	Emission Reduction from "No Action"	"No Action" EMFAC Emissions
Sacramento Region	-	7,600	<1	5,300
Bay Area	<1	34,800	<1	23,000
San Joaquin Valley	<1	36,300	1	30,400
Central Coast & Monterey Bay	-	7,900	-	4,900
Greater Los Angeles Region	3	93,100	16	69,300
San Diego	3	13,900	13	10,300
Rest of California	-	18,000	-	12,100
Statewide Total	7	211,700	30	155,300

Note: Table values are in tons per year.

Table 13.9: Carbon Monoxide Emission Reduction

Region	2020		2040	
	Emission Reduction from "No Action"	"No Action" EMFAC Emissions	Emission Reduction from "No Action"	"No Action" EMFAC Emissions
Sacramento Region	-	33,800	<1	26,100
Bay Area	<1	151,300	<1	109,800
San Joaquin Valley	<1	93,300	4	84,700
Central Coast & Monterey Bay	-	31,600	-	20,800
Greater Los Angeles Region	12	347,500	62	271,500
San Diego	15	63,100	66	53,100
Rest of California	-	56,200	-	38,300
Statewide Total	27	776,800	132	604,400

Note: Table values are in tons per year.

Table 13.10: Large Particle (PM10) Emission Reduction

Region	2020		2040	
	Emission Reduction from "No Action"	"No Action" EMFAC Emissions	Emission Reduction from "No Action"	"No Action" EMFAC Emissions
Sacramento Region	-	1,100	<1	1,300
Bay Area	<1	4,700	<1	5,400
San Joaquin Valley	<1	3,400	<1	4,800
Central Coast & Monterey Bay	-	900	-	1,000
Greater Los Angeles Region	<1	11,900	3	14,600
San Diego	<1	2,000	3	2,600
Rest of California	-	1,600	-	1,900
Statewide Total	1	25,500	7	31,700

Note: Table values are in tons per year.

Table 13.11. Small Particle (PM2.5) Emission Reduction

Region	2020		2040	
	Emission Reduction from "No Action"	"No Action" EMFAC Emissions	Emission Reduction from "No Action"	"No Action" EMFAC Emissions
Sacramento Region	-	500	<1	600
Bay Area	<1	2,100	<1	2,500
San Joaquin Valley	<1	1,700	<1	2,300
Central Coast & Monterey Bay	-	410	-	500
Greater Los Angeles Region	<1	5,500	2	6,800
San Diego	<1	900	1	1,200
Rest of California	-	700	-	900
Statewide Total	<1	11,892	3	14,700

Note: Table values are in tons per year.

13.3.2 Climate Change Assessment

In 2008, through the Governor's Executive Order S-13-08, Caltrans was charged with examining a preliminary assessment of the State's transportation system vulnerability to sea-level rise.[18] Caltrans also developed guidance on incorporating sea-level rise in Project Initiation Documents in May 2011.[19]

[18] Caltrans, *Vulnerability of Transportation Systems to Sea Level Rise: Preliminary Assessment*, submitted by Business, Transportation, and Housing Agency, February 2009.

In 2012, the National Research Council confirmed that tide gages show that global sea level has risen about 7 inches during the 20th century, and recent satellite data shows that the rate of sea-level rise is accelerating.[20] Scientists have continued to narrow predictions of climate change and scenarios that include sea-level rise, temperature rise, as well as the variability of precipitation. Both passenger and freight rail systems in California are susceptible to the impacts of a changing climate.

This section outlines the potential effects of changes in storm activity, sea levels, temperature, and precipitation patterns could be on the rail network, paying specific attention to coastal tracks and bridges. California is climactically diverse, with bioregions that span from the coastal marine to the Sonoran desert, and associated infrastructure are found statewide. Accordingly adaptation strategies may take on a very local approach.

Projected Climate Change Consequences and Possible Rail System Effects

Future projections of climate change for California have been synthesized by the 2009 California Climate Change Scenarios Assessment and the 2012 Reports on the Third Assessment from the California Climate Change Center, which examined changes in average temperatures, precipitation patterns, sea-level rise, and extreme events.[21] In California, the physical impacts on railroads from these changes include inundation, landslides, flooding, high winds, intense waves, storm surge, accelerated coastal erosion, and change in construction material durability.[22] The following sections provide a summary of the potential consequences of climate change and the affiliated impacts to the state rail system.

Temperature

Current emissions model scenarios all project hotter conditions by the end of the century, with business as usual projecting a 1°C increase by 2100. Temperature levels are expected to rise more quickly and be higher by the end of the century under higher emissions scenarios.

Rail tracks are laid on top of and within a range of land surfaces, including cleared pavement right-of-way (ROW), solid earth and a network of bridges and tunnels. Expected increases in temperature and temperature extremes may produce a range of new effects, including the following:

- More freeze-thaw conditions may occur, creating frost heaves and potholes on road and bridge surfaces and compromising rail beds.
- Longer periods of extreme heat can cause deformation of rail lines and derailments, or at a minimum, speed restrictions.[23] Buckled rails and heat kinks result from overheated rails that expand and cannot be contained by the material supporting the track.

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[19] Caltrans, *Guidance on Incorporating Sea Level Rise for Use in the Planning and Development of Project Initiation Documents*, May 16, 2011.

[20] National Research Council. *Sea-Level Rise for the Coasts of California, Oregon and Washington: Past, Present, and Future*. National Academies Press, 2012.

[21] Cayan, D., M. Tyree, M. Dettinger, H. Hidalgo, T. Das, E. Maurer, P. Peter Bromirski, N. Graham, and R. Flick, *Climate Change Scenarios and Sea Level Rise Estimates for the California 2008 Climate Change Scenarios Assessment*, PIER Research Report, CEC-500-2009-014, Sacramento, California: California Energy Commission. 2009 and Reports on the Third Assessment from the California Climate Change Center, http://www.climatechange.ca.gov/adaptation/third_assessment/.

[22] Kahrl, F., and D. Roland-Holst, *Climate Change in California: Risk and Response*, University of California Press, 2012.

[23] National Research Council of the National Academies (NRC), *Potential Impacts of Climate Change on U.S. Transportation*, Transportation Research Board Special Report 290, Washington, D.C., 2008.

- Higher heat can increase cost to cool equipment, and equipment may even have to be redesigned if inadequate for increased temperature. Many urban rail systems are controlled by a system of complex electrical train control and communications systems that are sensitive to overheating with substations, signal rooms, and electrical boxes designed with ventilation and air conditioning.[24]
- Increased extreme heat can also strain overhead catenary wires, cause overheating of vehicles, and lead to failed air conditioning systems within the vehicle itself.[25]

An overall extension of extreme heat days can cause challenges for customer service and worker safety; passengers waiting on platforms in hot weather, or construction and maintenance crews working in cramped spaces in indoor vehicle maintenance facilities.[26]

Precipitation

Projected changes in precipitation are less clear-cut than for temperature. The seasonal pattern of cool, wet winters and hot, dry summers, typical of a Mediterranean climate, is likely to continue. However, the amount of precipitation is likely to change; and, where and how much rain and snow fall differs with emission scenarios.

Expected changes in precipitation, both for averages as well as extremes, will produce a range of new impacts, including:

- The frequency, intensity, and duration of intense precipitation events contribute to design specifications for transportation infrastructure; and projected changes may necessitate design specification updates for rail beds and storm water drainage around rail tracks.[27]
- More intense precipitation may cause flooding of coastal rail lines. Low-lying bridge and tunnel entrances for rail and rail transit will be more susceptible to flooding, and thousands of culverts could be undersized for flows.[28] In urban rail systems, during heavy rain storms, the volume of water can exceed the capacity of street storm water drains and systems, leaving no capacity to accommodate water pumped out of subway tunnels.[29]
- Changing precipitation may result in erosion and subsidence of rail beds, causing interruption or disruption of rail traffic. As a result, commuter and freight trains could experience extensive delays due to damaged or inundated tracks.[30]
- The changing precipitation (for instance, changes from frozen to liquid precipitation) may change runoff patterns, increasing the risk of floods, landslides, slope failures, and consequent damage to rail beds, especially rural rail beds in the winter and spring months.[31]

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[24] Federal Transit Administration Office of Budget and Policy, *Flooded Bus Barns and Buckled Rails: Public Transportation and Climate Change Adaptation*, FTA Report No. 0001, August 2011.

[25] Ibid.

[26] Ibid.

[27] National Research Council of the National Academies (NRC), *Potential Impacts of Climate Change on U.S. Transportation*, Transportation Research Board Special Report 290, Washington, D.C., 2008.

[28] Ibid.

[29] Federal Transit Administration Office of Budget and Policy, *Flooded Bus Barns and Buckled Rails: Public Transportation and Climate Change Adaptation*, FTA Report No. 0001, August 2011.

[30] National Research Council of the National Academies (NRC), *Potential Impacts of Climate Change on U.S. Transportation*, Transportation Research Board Special Report 290, Washington, D.C., 2008.

Sea-Level Rise

Sea levels have risen by about seven inches on the California coast in the past century.[32] Present sea-level rise projections suggest that global sea levels in the 21st century can be expected to be much higher. These projections are summarized in the State of California Sea-Level Rise Interim Guidance Document[33,34] and shown in Table 13.12.

Higher water levels may also increase coastal bluff erosion rates; change environmental characteristics that affect material durability (e.g., pH and chloride concentrations); lead to increased groundwater levels; and change sediment movement both along the shore and at estuaries and river mouths. These issues for existing and planned rail ROWs at the planning and project level will need to be addressed. Caltrans recently developed a project screening process to plan for the impact of different potential sea levels based on a facility's importance for statewide travel, community safety, and other factors.[35]

Table 13.12: Sea-Level Rise Projections

Mean Sea-Level Rise (Meters)	Year to Reach Projected Sea-Level Rise in High (A2) Scenario	Year to Reach Projected Sea-Level Rise in Low (B1) Scenario
0.0	2000	2000
0.5	2054	2057
1.0	2083	2098
1.4	2100	2125

Note: The State has agreed on two emissions scenarios (A2 and B1) from the Special Report on Emissions Scenarios from the Intergovernmental Panel on Climate Change (IPCC) representing a range of possible futures.[36]

Source: OPC, 2011.

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[31] Ibid.

[32] National Research Council. Sea-Level Rise for the Coasts of California, Oregon and Washington: Past, Present, and Future. National Academies Press, 2012.

[33] Ocean Protection Council (OPC), *State of California Sea-Level Rise Interim Guidance Document*, Ocean Protection Council. 2011.

[34] The recent sea-level rise publication from the NRC *titled Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future* (NRC 2012) revises some of the projections included in the OPC report and Caltrans guidance. Caltrans is working with other State agencies to determine specific sea-level rise values to incorporate into future planning and design documents. As new state guidance becomes available it will be important to incorporate that information into future planning assessments and update Caltrans guidance, as appropriate.

[35] California Department of Transportation, Climate Change Working Group, Guidance on Incorporating Sea Level Rise, May 19, 2011.

[36] These are both scenarios evaluated by California for statewide climate assessments. Each scenario leads to a projection of possible emissions levels based on population growth rate, economic development, and other factors. Ultimately, the effect on climate change depends on the amount and the rate of accumulation of heat-trapping gases in the atmosphere that these scenarios suggest. Of the two options provided, the A2 scenario is the more realistic choice for decision-makers to use for climate adaptation planning. Generally, the B1 scenario might be most appropriately viewed as a version of a "best case" or "policy" scenario for emissions, while A2 is more of a status quo scenario incorporating incremental improvements. These two scenarios are represented above.

Extreme Events

Gradual changes in average temperature, precipitation and sea level have been described. However, it is likely that the State will face a growing number of additional climate change-related extreme events, such as heat waves, wildfires, droughts, and floods.[37]

Region-Specific Impacts to the State Rail Network

The Central and South Coast will be susceptible to changes in temperature and precipitation, but the biggest threat will be sea-level rise on the coastal railways, including Amtrak *Coast Starlight* and the state-supported *Pacific Surfliner*. Numerous other local and regional rail lines, such as Los Angeles County Metro Rail, Metrolink, COASTER, and SPRINTER also span segments of the coastal areas at risk.

The South Coast is a particularly dense and urbanized region, and the rail system there is a critical asset for both passenger and goods movement. Sea-level rise and storm surges, along with weather-related landslides, could disrupt parallel, roadway transportation infrastructure, such as U.S. 101 and the Pacific Coast Highway, leaving railroads the potential alternative mode in the area. Railroads also supported the tourism industry in the Central and South Coast by bringing tourists to coastal attractions. With passenger rail lines contributing to the high-value tourist industry for the State, the economic effects are substantial.[38]

Potential Adaptation Options for the California State Rail Network

Of the various climate stressors, sea-level rise and inland flooding pose the biggest climate impact to the California state rail network. Adaptation strategies should be coordinated with a wide range of stakeholders, including other state agencies (e.g., California Emergency Management Agency, California Natural Resources Agency); federal agencies [e.g., U.S. Army Corps of Engineers and regional and local partners metropolitan planning organizations (MPO), counties, and cities], potential strategies may include:

- Improving the drainage around rail stations and rail facilities, and increasing the capacity for storm water drainage.
- Retrofitting entrances to stations to minimize volume of floodwater that might inundate the station, and placing water-sensitive elements above a flood elevation.
- Elevating railroad tracks, rail beds, and/or station sites, but still maintaining adequate clearances.
- Conducting partial or temporary closures in extreme events, and providing alternative routes for goods movement.
- Constructing a permanent or temporary floodwall/barrier to manage tidal flows.
- Building levees and strengthening coastal armoring around key high-risk locations.
- Providing supportive hazard mitigation and emergency evacuation plans.
- In the most extreme cases, abandoning the asset or finding alternate routes for the coastal rail lines and at-risk stations under consideration.

[37] Mastrandrea, M. D., C. Tebaldi, C. P. Snyder, S. H. Schneider, *Current and Future Impacts of Extreme Events in California*, PIER Research Report, CEC-500-2009-026-D, Sacramento, California: California Energy Commission, 2009.

[38] Ibid.

13.3.3 Land Use and Community Benefits

Intercity passenger rail, commuter rail, and freight rail services are important components of California's transportation system, providing benefits to the State that extend beyond the mobility of people and goods. Safe and efficient rail systems contribute to community, land use, safety, and public health benefits. This section describes the community and greening benefits further by safe and efficient passenger and freight rail services enjoyed by rail users, as well as the greater public.

Proposed capital and operational improvements can be broken down into the following categories:

- Rail line improvements improve the speed, capacity, reliability, and safety of a railroad corridor. Rail line improvements may include double-tracking, siding improvements, curve realignments, and panelized turnouts to increase capacity and improve safety and travel times. Community and greening benefits resulting from rail line improvements include reduced braking and acceleration noise, reduced idling on sidings, and enhanced safety.
- Grade separations may be considered a subset of rail line improvements, but these improvements are so prevalent and such an important part of the rail improvement plan that they are noted separately. Grade separations improve the safety, speed, capacity, and reliability of rail service by eliminating dangerous at-grade crossings of rail and highway systems. More specifically, greening and community benefits of grade separation improvements include reduced braking and acceleration noise, less traffic disruption, reduced idling at crossing, enhanced safety, and removal of barriers and walls dividing the community.
- Bridges are planned along some corridors. Existing bridges require widening to accommodate expected passenger rail and freight rail activity, and new bridge construction is planned to accommodate proposed track extensions. Community and greening benefits resulting from these improvements include providing enhanced supporting wildlife corridors/crossings, providing agriculture access, and may reduce barriers dividing communities.
- New rail corridor construction and line extensions provide service to new areas. Examples include the Coachella Valley, and XpressWest corridors. Community and greening benefits resulting from rail line extensions include reduced emissions, encouraging non-motorized transportation modes, and land use benefits supporting vibrant transit-oriented development (TOD).
- Signal and train control improvements provide integrated command, control, communications, and information systems for controlling train movements with safety, security, precision, and efficiency. Community and greening benefits resulting from these improvements include reduced braking and acceleration noise, reduced idling on sidings, enhanced safety, and less traffic disruption.
- Rolling stock improvements include purchasing new railcars/locomotives, and upgrading existing railcars/locomotives. In addition to improving the passenger experience (e.g., amenities, ride comfort), new rolling stock can offer tangible travel time benefits – for example, trains with tilting capabilities can reduce or eliminate the need for trains to reduce speed on low-radius curves, allowing trains to maintain higher average speeds. Community and greening benefits resulting from these improvements include reduced braking and acceleration noise expanded system capacity, and emission reductions from cleaner locomotives.
- Electrification converts a railroad corridor to be fully powered by electricity. Community and greening benefits resulting from electrification include reduced pollution and noise, which may have the further effect of encouraging TOD along the rail line.
- Station and station access improvements may include providing new or improved station platforms; enhanced pedestrian and bike facilities; and customer amenities, such as additional

parking, shuttle service to enhance access to the station, electronic signage with real-time arrival and departure information, and enhanced lighting. Community and greening benefits resulting from station improvements include enhanced safety, mitigation of issues related to noise and emissions from locomotives, land use benefits supporting vibrant TOD communities, and promotion of multimodal transportation options such as bicycling or pedestrian activity, which may help reduce obesity and improve broader measures of health throughout the community.

- Freight terminal improvements include new and expanded freight rail yards and intermodal facilities. Greening benefits of these projects include the mitigation of noise and pollution concerns and diversion of trucks from the highway system, as well as improved efficiency and safety.

The way these benefits accrue to users and non-users of the rail system differs somewhat by rail service type. The accrued benefits are described in more detail for passenger rail (both intercity and commuter) and the freight rail system in the following section.

Intercity and Commuter Passenger Rail

Passenger rail includes a complex system of intercity and commuter rail to connect cities across the state. Intercity passenger rail in California serves metropolitan and rural areas, and provides service between regions in the State. Commuter rail service is a key component of the State's integrated rail system serving local travel and providing regional connections to and from intercity Amtrak service. Safe and efficient intercity and commuter passenger rail services that are well-integrated with local transportation options can contribute to community and greening benefits to users and non-users of the system in regards to community livability, land use, safety, and public health.

As with the intercity passenger rail system, community and greening benefits of commuter rail service improvements may be valued differently for users and non-users of the system. Benefits that result from improvements to California's commuter rail system also extend beyond better transportation service provided to users of the system. Generally, the capital and operation improvements to the State's commuter rail systems have the potential to impact local road congestion; alternate transportation options (i.e., nonmotorized transportation, transit, etc.); land use patterns; community livability; the environment; and public health.

For users, improved passenger rail service that operates more safely, comfortably, and efficiently will enhance personal mobility and offer travelers greater diversity of transportation options. Capital and operational improvements, such as grade separation projects, double-track projects, station improvements, and service frequency improvements, are examples of projects that will improve the attractiveness and viability of rail travel as the preferred mode for many intercity and commuter trips. Rail station improvements that enhance pedestrian and bike facilities and amenities and increase TOD around station areas will be important factors encouraging users to utilize active transportation modes to access stations. Users of passenger rail may enjoy economic benefits associated with a reduced travel cost compared to automobile ownership/travel. Providing more varied and affordable travel modes also mitigates transportation equity and environmental justice issues for users of the passenger rail system.

Passenger rail improvements may bring about community and greening benefits for non-users in several ways. Shifting the rail system to a cleaner energy source through projects like electrification will reduce greenhouse gas (GHG) emissions and diesel-generated criteria air pollutants from system operations. Increasing the appeal of rail travel through grade separation projects, double-track projects, station improvements, and service frequency improvements will encourage people to shift from driving single-occupancy vehicles (SOV) to comparatively cleaner and safer rail travel. Non-users will also enjoy reduced congestion on roadways as drivers shift to train travel. That mode shift will translate to congestion relief for the non-users along parallel highway corridors. TODs supported by the commuter rail services facilitate concentrations of homes, shops, and jobs nearby rail stations. Thus, users and non-users may enjoy access to vibrant TOD communities with diverse and accessible recreational and employment opportunities. Benefits may also be enjoyed by non-users as more compact development presents more opportunities to integrate walking and biking for mobility purposes.

One of the most important roles that improved passenger rail service plays is that of supporting the development of livable communities. The *Vision California* scenario modeling project[39] undertaken by the state of California found significant economic, fiscal, health, water and environmental co-benefits from the state, regions, and localities choosing to grow through TOD and infill near existing and future local and intercity rail service. Households could save over $7,250 per year in auto costs and utility bills. Local governments could save more than $47 billion in infrastructure costs (water pipes, sewers, roads, and utility lines) while gaining over $120 billion in new revenue. Reduced health incidences would save approximately $1.9 billion a year by 2035. By 2050 water saving would total 19 million acre-feet. Over 3,700 square miles less farmland, open space, and recreation areas would be lost to development, and 75 million metric tons of less GHG would be created by 2050. These enormous indirect benefits from smarter growth and development choices would be above and beyond the direct user and non-user benefits discussed above.

Freight Rail

Freight rail operations in California help link the State to both domestic and international markets. The freight railroad system in California consists of an expansive network of Class I railroads, short line railroads, and switching yards/terminals stretching more than 5,000 miles across the State. Safe and efficient freight rail services that are well-integrated with the State's transportation system can contribute to community and greening benefits to users and non-users of the system in the areas of safety, job creation, noise reduction, the environment, and public health.

For planning analysis, benefits to users and non-users of the freight rail system will depend on the varying perspectives and freight knowledge of stakeholders and whether they are more focused on the impacts on track, the rolling stock, or the freight facilities, for example. For users of the freight rail system (i.e., shippers), service and infrastructure improvements that allow the system to operate more safely and efficiently will reduce freight transportation costs. Rail grade separation projects, double-track projects, and freight facility improvements are examples of projects that will improve the reliability and economic competitiveness of freight rail travel as a preferred mode for freight trips.

Freight rail improvements may also bring about community and greening benefits for non-users in several ways. For example, the GenSet technology (short for "Generator Set" or sets of engines turning a generator) replaces the large diesel engine and generator found in almost all existing freight locomotives with two or three much smaller diesel engines and generators providing fuel consumption reduction and improved air quality benefits. Shifting the rail system to a cleaner energy source through projects that expand the use of GenSet Locomotives at switching yards, implement idling limit devices, and facilitate eventually electrification will reduce GHG emissions and benefit public health in communities located near rail lines terminals. However, for the electrification of passenger and freight rail to occur, enough electricity must be available in the California power grid. Enhancing freight rail movement through grade separation projects will improve safety and reduce congestion and the associated emissions from vehicle idling, reduce conflicts between trains traffic within neighboring communities, and improve community connectivity by removing divisive at-grade tracks. Rail line improvements may reduce noise along freight corridors, and new freight intermodal terminals will create jobs.

[39] California High Speed Rail Authority and Strategic Growth Council funded project. http://www.visioncalifornia.org/

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14.0 Key Findings

This chapter presents the key findings of the Service Development Plan (SDP) prepared for the Pacific Surfliner South Corridor. The purpose of the Corridor planning effort was to identify and evaluate possible rail improvements to relieve the growing capacity and congestion constraints. Passenger and freight travel using the Corridor's rail infrastructure is operating near or at its design capacity. The Corridor faces significant mobility challenges as continued growth in population, employment, and tourism activity is projected to generate increased travel demand straining the existing rail network. The Corridor needs infrastructure improvements to improve mobility, reliability, and safety in this part of the state's rail system by expanding service, decreasing trip times, and improving rail capacity in a cost-effective and environmentally sensitive manner.

Two alternatives were evaluated for the SDP: 1) the No Build Alternative, which provides a baseline discussion of the continued operation of the existing Corridor system with no improvements beyond those identified in current programming and funding plans through 2040; and, 2) the Build Alternative, which provides a set of improvement projects to accommodate increased passenger service levels. They were evaluated to determine their reasonableness and feasibility in addressing the identified Corridor purpose and need for action. As part of the evaluation process, Chapter 9 documented the operational system modeling conducted as a part of the *2012 LOSSAN Corridorwide Strategic Implementation Plan*. The operational analysis concluded that the Corridor's existing rail network was not capable of accommodating the Corridor's future travel needs and that service and capital improvements were necessary to serve future travel needs.

The Build Alternative, and the improvement projects it provides, best meets the project goals and purpose and need. Implementation of this alternative would result in a faster, safer, and more reliable passenger and freight rail system. It would remove existing operational constraints and provide additional capacity in response to increased travel demand between Los Angeles and San Diego counties. The viability of the proposed projects included in the Build Alternative was assessed based on the following criteria:

- Environmental impacts;
- Technical feasibility based on right-of-way (ROW) and engineering constraints; and
- Economic feasibility based on a comparison of capital and operating costs to anticipated levels of capital funding and the revenue generated by market potential and/or ridership.

The SDP analytical efforts identified that the proposed improvement projects included in the Build Alternative would have minimal environmental impacts to local communities and natural resources while resulting in air quality benefits. The Build alternative is technically and economically feasible.

The Build Alternative would provide additional capacity to serve improved intercity rail service plans in the Corridor that would support regional and county goals and plans related to growth, smart growth, economic development, air quality and greenhouse gas emissions, sustainability, and provision of a balanced transportation system.

The identified infrastructure projects could be accommodated within the existing railroad right-of-way and system improvements are technically feasible. The Corridor improvements would provide additional capacity to serve forecast growth in a cost-effective manner. The improvements would have independent utility, are not dependent on the completion of other Corridor programs to be successful, and provide measurable benefits to intercity rail service. The projects planned to be completed by 2015 are consistent with expected funding resources, and would provide faster, more reliable service that would be more attractive to potential riders, thereby increasing the service revenue potential.

14.1 Operational Initiative Priority

Future Pacific Surfliner South Corridor service plans have been developed by the Los Angeles-San Luis Obispo-San Diego (LOSSAN) Rail Corridor Agency building upon the *2012 LOSSAN Corridorwide Strategic Implementation Plan*. The resulting service increases are designed to address the forecasted rail system demand through the provision of increased weekday service along with new services. Operational plans have been developed for proposed 2020 and 2040 train volumes in various segments of the Corridor between the cities of Los Angeles and San Diego. The train volumes represent more frequent Pacific Surfliner and Metrolink intercity services. By 2020, the following operational revisions are planned to be made in the Pacific Surfliner South Corridor:

- Pacific Surfliner service increases to a total of 12 daily round trips between Los Angeles and San Diego; 11 all- stop round trips and one limited stop round trip.
- Metrolink weekday roundtrips:
  - Orange County line trains: 3.5 roundtrips to/from Oceanside and Los Angeles; Eight round trips that operate as far south as Laguna Niguel.
  - 91 line service increases to six roundtrips.
  - IE-OC line service increases to eight roundtrips.
  - Five Intra-Orange County roundtrips.
- Coaster service increases to 14 weekday round trips.
- 1.5 Metrolink/Coaster round trips operate through Oceanside, providing one-seat ride commuter service between Los Angeles and San Diego.
- Daily California High-Speed Rail (HSR) service would be operated to an interim terminal station in the San Fernando Valley prior to extension of the HSR system south to LAUS. Increased “feeder” train service would provide a one-seat interim connection south to LAUS.
- Corridor freight activity is expected to remain the same.

Operational priorities to support the planned increase in rail activity would include implementation of the following improvements:

- Passenger safety initiatives such as the Federal Railroad Administration (FRA)-mandated installation of Positive Train Control (PTC) between LAUS and San Diego. The San Diego County segment is fully funded and anticipated to be completed and in operation by the end of 2015.[40]
- Passenger service improvements at the Corridor’s existing stations, such as the provision of new and/or improved station platforms, electronic signage with real-time arrival and departure information, automated ticket vending machines, and improved transit connectivity.
- System infrastructure improvements required to improve rail system capacity and speed constraints that currently negatively impact intercity passenger and freight rail performance are provided by the Build Alternative and are discussed below.

14.2 Capital Funding Project Priority

The Corridor’s rail system infrastructure is currently operating at its design capacity, and the Build Alternative provides improvement projects that are required to accommodate the forecasted rail activity and improve mobility and reliability in this congested part of the state’s rail system. Projects were identified from prior studies, including the current *State Rail Plan*, the *LOSSAN Corridorwide Strategic*

[40] NTCD – PTC Fact Sheet (2012). http://www.gonctd.com/ptc/ptc.pdf

Implementation Plan, the *Pacific Surfliner 2010 Development Plan*, and the *LOSSAN Corridor Strategic Assessment.* Reflecting system operational needs and projected funding availability, the identified Corridor improvement projects are organized into three phasing categories: 1) near-term improvements (completed between 2013 and 2015); and 2) mid-term improvements (completed between 2016 and 2020).

Priority would be given to Corridor capital projects providing improved travel time and increased reliability and safety, such as siding improvements and signal upgrades. As increased funding became available, the more costly curve realignment projects and provision of additional tracks could be accomplished.

In order to support the forecasted 2020 service levels, priority would be given to:

- Completion of Corridor infrastructure projects already fully funded or under construction as listed below in Table 14.1.
- Projects identified, first, in the near-term improvement list, and second, in the mid-term improvement list as presented in Table 14.2.
- Infrastructure projects that would also support implementation of the HSR system for which HSR funding may be available.

These projects are all joint-use because they benefit more than one passenger rail service. A systematic review of the projects indicated that these cost estimates were generally reasonable and acceptable for planning purposes, and contained sufficient detail to permit their use in the Service Development Plan. Many of the cost estimates were developed in previous years and are no longer current. LOSSAN corridor staff reviewed these cost estimates and updated them to Year 2012 dollars. Many of the improvements do not have a cost estimate and would require additional engineering and design analyses.

Table 14.2 presents the near-term and mid-term improvements that have been identified in previous studies and plans. Consistent with the corridor-level planning and SDP analysis, the level of detail for any of the proposed improvement projects is conceptual in nature. Subsequent project-specific engineering and environmental analysis would be performed to provide more detailed information on implementation costs and environmental impacts for the individual projects presented below.

Table 14.1: Identified Rail Improvement Projects

Project	Cost (Millions)	Source(s)
Pico Rivera to Santa Fe Springs third main track (Los Angeles to Fullerton third main track, Segment 7)	$37.50	HSIPR (ARRA) Proposition 1B (Intercity Rail Improvement)
La Mirada to Valley View third main track (Los Angeles to Fullerton third main track, Segment 8)	$30.50	Proposition 1B (Intercity Rail Improvement)
State College Boulevard/Howell Street SCRRA crossing grade separation (Anaheim)	$92.00	Proposition 1B (Trade Corridors Improvement Fund) Southern California Potential Early Investment Projects
New passing siding between Laguna Niguel/Mission Viejo Station and San Juan Capistrano Station (La Zanja)	$26.80	SCAG RTP in the FTIP LOSSAN Corridorwide Strategic Implementation Plan (Final Report)

Project	**Cost (Millions)**	**Source(s)**
San Clemente Beach Trail grade crossing improvements	\$4.50	Proposition 1B (Highway-Railroad Crossing Safety Account) Proposition 116 Local funds CRIS
Positive Train Control (San Onofre to San Diego)	\$88.00	HSIPR (PRIIA) Proposition 1A
CP San Onofre to CP Pulgas second main track (Phase 1)	\$38.00	STIP Proposition 1B (Intercity Rail Improvement)
Oceanside through tracks	\$19.50	HSIPR (ARRA) LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
Poinsettia Station improvements	\$13.00	LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
CP Cardiff to CP Craven second main track (San Elijo Lagoon)	\$76.10	LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
Sorrento Valley double track	\$33.00	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
Orangethorpe Avenue SCRRA crossing grade separation (Anaheim)	\$99.00[a]	Proposition 1B (Trade Corridors Improvement Fund) Southern California Potential Early Investment Projects

Table 14.2: Proposed Near-Term (2013 to 2015) and Mid-Term (2016 to 2020) Rail Improvement Projects

Project	Cost (Millions)	Source(s)
Near-Term (2013 to 2015)		
Pico Rivera to Santa Fe Springs third main track (Los Angeles to Fullerton third main track, Segment 7)	$37.50	HSIPR (ARRA) Proposition 1B (Intercity Rail Improvement)
La Mirada to Valley View third main track (Los Angeles to Fullerton third main track, Segment 8)	$30.50	Proposition 1B (Intercity Rail Improvement)
State College Boulevard/Howell Street SCRRA crossing grade separation (Anaheim)	$92.00	Proposition 1B (Trade Corridors Improvement Fund) Southern California Potential Early Investment Projects
New passing siding between Laguna Niguel/Mission Viejo Station and San Juan Capistrano Station (La Zanja)	$26.80	SCAG RTP in the FTIP LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
San Clemente Beach Trail grade crossing improvements	$4.50	Proposition 1B (Highway-Railroad Crossing Safety Account) Proposition 116 Local funds CRIS
Positive Train Control (San Onofre to San Diego)	$88.00	HSIPR (PRIIA) Proposition 1A
CP San Onofre to CP Pulgas second main track (Phase 1)	$38.00	STIP Proposition 1B (Intercity Rail Improvement)
Oceanside through tracks	$19.50	HSIPR (ARRA) LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
Poinsettia Station improvements	$13.00	LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
CP Cardiff to CP Craven second main track (San Elijo Lagoon)	$76.10	LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
Solana Beach Station parking expansion	$27.00	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
Los Penasquitos Lagoon bridge replacements	$24.00	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
Sorrento Valley double track	$33.00	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
CP Elvira to CP Morena double track	$90.50	HSIPR (PRIIA) San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report) Southern California Potential Early Investment Projects

Project	Cost (Millions)	Source(s)
Mid-Term (2016 to 2020)		
Southern California Regional Interconnector Project (SCRIP) -- LAUS run-through tracks	$350.00	Southern California Potential Early Investment Projects
Hobart Flyover (UPRR/BNSF San Pedro Junction)	$95.00	California Passenger Rail System: 20-Year Improvement Plan Technical Report
Hobart to Commerce fourth main track	$25.00	California Passenger Rail System: 20-Year Improvement Plan Technical Report
Basta to Fullerton Junction fourth main track	$100.00	California Passenger Rail System: 20-Year Improvement Plan Technical Report
Orangethorpe Avenue SCRRA crossing grade separation (Anaheim)	$99.00	Proposition 1B (Trade Corridors Improvement Fund) Southern California Potential Early Investment Projects
Sycamore Street SCRRA crossing closure (Anaheim)	$2.00	Southern California Potential Early Investment Projects
Broadway SCRRA crossing improvements (Anaheim)	$5.00	Southern California Potential Early Investment Projects
Santa Ana Street SCRRA crossing closure (Anaheim)	$2.00	Southern California Potential Early Investment Projects
South Street SCRRA crossing improvements (Anaheim)	$5.00	Southern California Potential Early Investment Projects
Vermont Avenue SCRRA crossing improvements (Anaheim)	$5.00	Southern California Potential Early Investment Projects
Orange County supplemental signal system (maximum speed 110 mph)	$15.00	California Passenger Rail System: 20-Year Improvement Plan Technical Report
Santa Ana Station expansion		SCAG RTP in the FTIP
New CP on Metrolink Orange Subdivision at Fourth Street (MP 175.7), new powered No. 10 turnout to UPRR spur approximately 0.5 mile south of Santa Ana Station, and new powered derail on UPRR connecting track	$4.00	SCAG RTP in the FTIP
Irvine Station improvements (auxiliary siding and platform, new holding track, and new crossover)	$17.00	California Passenger Rail System: 20-Year Improvement Plan Technical Report
San Diego County cab signal system (maximum speed 110 mph)	$4.00	California Passenger Rail System: 20-Year Improvement Plan Technical Report
San Diego County lagoon bridge replacements (tbd)	$20.00	Southern California Potential Early Investment Projects
San Diego County grade crossing safety improvements and future quiet zones	$66.00	Southern California Potential Early Investment Projects
CP San Onofre to CP Pulgas second main track (Phase 2)	$36.00	STIP Southern California Potential Early Investment Projects

Project	Cost (Millions)	Source(s)
CP Eastbrook to CP Shell double track (San Luis Rey River Bridge replacement)	$53.00	HSIPR San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report) Southern California Potential Early Investment Projects
Oceanside Station parking expansion	$25.00	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
Carlsbad Village double track (CP Longboard to CP Farr)	$49.50	HSIPR (PRIIA) LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
CP Ponto to CP Moonlight second main track and Batiquitos Lagoon Bridge replacement	$48.50	LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
CP Moonlight to CP Swami second main track	$22.00	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
New grade-separated pedestrian crossings in Encinitas (Hillcrest Drive, El Portal Street, and Montgomery Avenue)	$12.00	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
San Dieguito double track and bridge replacement (CP Valley to CP Crosby), and Del Mar Fairgrounds special events platform	$110.00	HSIPR (PRIIA) LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
Del Mar Bluffs stabilization (Phase 4)	$21.00	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
Sorrento to Miramar (CP Pines to CP Cumbres (Miramar)) curve realignment and second main track (Phase 2)	$98.00	HSIPR (PRIIA) STIP LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
Airport Intermodal Transportation Center (ITC)	$165.00	LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
San Diego Station (Santa Fe Depot) rehabilitation	$20.00	California Passenger Rail System: 20-Year Improvement Plan Technical Report
San Diego Station (Santa Fe Depot) parking expansion	$8.00	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
New San Diego layover facility	$32.00	California Passenger Rail System: 20-Year Improvement Plan Technical Report

Project	Cost (Millions)	Source(s)
Mid-Term (2016 to 2020)		
Southern California Regional Interconnector Project (SCRIP) -- LAUS run-through tracks	$350.00	Southern California Potential Early Investment Projects
Hobart Flyover (UPRR/BNSF San Pedro Junction)	$95.00	California Passenger Rail System: 20-Year Improvement Plan Technical Report
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Santa Ana Street SCRRA crossing closure (Anaheim)	$2.00	Southern California Potential Early Investment Projects
South Street SCRRA crossing improvements (Anaheim)	$5.00	Southern California Potential Early Investment Projects
Vermont Avenue SCRRA crossing improvements (Anaheim)	$5.00	Southern California Potential Early Investment Projects
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CP San Onofre to CP Pulgas second main track (Phase 2)	$36.00	STIP Southern California Potential Early Investment Projects

Project	Cost (Millions)	Source(s)
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CP Moonlight to CP Swami second main track	$22.00	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
New grade-separated pedestrian crossings in Encinitas (Hillcrest Drive, El Portal Street, and Montgomery Avenue)	$12.00	San Diego-LOSSAN Corridor Project Prioritization Analysis (Final Project Report)
San Dieguito double track and bridge replacement (CP Valley to CP Crosby), and Del Mar Fairgrounds special events platform	$110.00	HSIPR (PRIIA) LOSSAN Corridorwide Strategic Implementation Plan (Final Report)
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