RAIL PLAN

California State Rail Plan

2023

Caltrans
CALIFORNIA DEPARTMENT OF TRANSPORTATION

2023 CALIFORNIA STATE RAIL PLAN

March 2023

Prepared for

California Department of Transportation

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INFORMATION HERE

TO BE UPDATED]

TO BE UPDATED

State and Federal Agency Partners

CalSTA
California Air Resources Board
California Freight Advisory Committee
California High Speed Rail Authority
California Public Utilities Commission
California Transportation Commission
Federal Railroad Administration
Governor's Office of Business and Economic Development (GoBiz)
National Railroad Passenger Corporation/ Amtrak
State of Arizona Department of Transportation
State of Nevada Department of Transportation

Intercity Passenger Rail and Rail Transit
Bay Area Rapid Transit/BART
Capitol Corridor Joint Powers Authority/ Northern California Rail Partners
Los Angeles – San Diego – San Luis Obispo Rail Corridor Agency Joint Powers Authority
Los Angeles County Metropolitan Transportation Authority
North County Transit District
Peninsula Corridor Joint Powers Board/Caltrain
Sacramento Regional Transit/SacRT
San Diego Metropolitan Transit System
San Francisco Municipal Transportation Agency/ MUNI
San Joaquin Joint Powers Authority/ Altamont Corridor Express
Sonoma Marin Area Regional Transit
Southern California Regional Rail Authority/ Metrolink
Valley Transportation Authority
XpressWest

Regional Planning Agencies
California Association of Councils of Governments
Metropolitan Transportation Commission
Placer County Transportation Planning Agency
San Benito Council of Governments
San Bernardino Association of Governments
San Diego Association of Governments
San Francisco County Transportation Authority
San Joaquin Valley Regional Policy Council
San Luis Obispo Council of Governments
Santa Barbara County Association of Governments
Santa Cruz County Regional Transportation Commission
Sacramento Area Council of Governments
Southern California Association of Governments
Riverside County Transportation Commission
Transportation Agency for Monterey County

Freight Rail
California Shortline Railroad Association
California Association of Port Authorities/ California Airports Council
BNSF Railway
Genesee & Wyoming Inc.
Pacific Merchants Shipping Association
Union Pacific Railroad

Advocates
California Transit Association
California Farm Bureau Federation
Local Government Commission
The Nature Conservancy

Tribal Representation
Native American Advisory Committee
Northern California Chairman's Association
Central California Chairman's Association
Southern California Chairman's Association

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Glossary

AB:Assembly Bill
ACE: Altamont Corridor Express
AC Transit: Alameda-Contra Costa Transit District
Amtrak: The National Rail Passenger Corporation
BART: San Francisco Bay Area Rapid Transit District
BNSF: BNSF Railway
BUILD: Better Utilizing Investments to Leverage Development
CalSTA: California State Transportation Agency
Caltrans: California Department of Transportation
CARB: California Air Resources Board
CARES: Coronavirus Aid, Relief, and Economic Security
Carloads of freight: Number of train cars carrying freight
CAPTI: Climate Action Plan for Transportation Infrastructure
CCJPA: Capitol Corridor Joint Powers Authority
CFR: Code of Federal Regulations
CHSRA: California High-Speed Rail Authority
CIBS: California Intercity Bus Study
CO: carbon monoxide
CO2: carbon dioxide
COPD: chronic obstructive pulmonary disease
CoSMoS: Coastal Storm Modeling System
CPUC: California Public Utilities Commission
CRISI: Consolidated Rail infrastructure and Safety Improvements Program
CTC: California Transportation Commission
CTP: California Transportation Plan
DMU: Diesel multiple unit
DRMT: Caltrans Division of Rail and Mass Transportation
EIR: Environmental Impact Report
EIS: Environmental Impact Statement
EMU: electric multiple unit
°F: degrees Fahrenheit
FAST: Fixing America's Surface Transportation
FFY: federal fiscal year
FHWA: Federal Highway Administration
FRA: Federal Railroad Administration
FTA: Federal Transit Administration
FY: fiscal year
GGRF: Greenhouse Gas Reduction Fund
GHG: greenhouse gas
HDC: High Desert Corridor
HRCSA: Highway-Railroad Crossing Safety Account
HSIP: Highway Safety Improvement Program
HSPTB: High-Speed Passenger Train Bond Program
HSR: High-Speed Rail
I: Interstate
ICTF: Intermodal Container Transfer Facility
INFRA Infrastructure for Rebuilding America grant program
IOS: Initial Operating Segment of HSR
ITA: interagency transfer agreement
ITIP: Interregional Transportation Improvement Program
ITSP: Interregional Transportation Strategic Plan
JPA: Joint Powers Authority
LA Metro: Los Angeles County Metropolitan Transportation Authority
LAUS: Los Angeles Union Station
LAX: Los Angeles International Airport
LCTOP: Low Carbon Transit Operations Program
LOS: Level of Service
LOSSAN: Los Angeles–San Diego–San Luis Obispo Rail Corridor Agency
MITC: Merced Intermodal Track Connector
mph: Mile(s) per hour
MPO: Metropolitan Planning Organization
MTC: Metropolitan Transportation Commission
Muni: San Francisco Municipal Railway
NCTD: North County Transit District
NOx: nitrogen oxide
O&M: Operation and Maintenance
OCTA: Orange County Transportation Authority
OTP: on-time performance
OTS: Office of Traffic Safety
PCJPB: Peninsula Corridor Joint Powers Board
PEMS: Portable Emissions Measurement System
PM: particulate matter
PM2.5: particulate matter less than 2.5 microns in diameter
PM10: particulate matter less than 10 microns in diameter
PMT: Passenger miles traveled
POLA: Port of Los Angeles
POLB: Port of Long Beach
PPP: Public-Private Partnerships
PTA: Public Transportation Account
PTC: Positive Train Control is designed to prevent train-to-train collisions, over-speed derailments, incursions into established work zones, and movements of trains through switches left in the wrong position.
Intermodal: is the movement of freight in an intermodal container, using multiple modes of transportation, without any handling of the freight itself
RD: Renewable diesel
ROW: Right of way
RRIF: Railroad Infrastructure Financing and Improvement Act
RSIA: Federal Rail Safety Improvement Act of 2008
RT: Sacramento Regional Transit
RTP: Regional Transportation Plan
RTPA: Regional Transportation Planning Agency
SAC: Stakeholder Advisory Committee
SANDAG: San Diego Association of Governments
SANDAG Tribal Working Group: San Diego Association of Governments, Interagency Technical Working Group on Tribal Transportation Issues
SB: Senate Bill
SCAG: Southern California Association of Governments
SCCRTC: Santa Cruz County Regional Transportation Commission
SCORE: Southern California Optimized Rail Expansion program
SCRRA: Southern California Regional Rail Authority
SCS: Sustainable Communities Strategies
SCVTA: Santa Clara Valley Transportation Authority
SDMTS: San Diego Metropolitan Transit System
SFAP: Sustainable Freight Action Plan
SFMTA: San Francisco Municipal Transportation Agency
SHA: State Highway Account
SJJPA: San Joaquin Joint Powers Authority
SJRRC: San Joaquin Regional Rail Commission
SLOCOG: San Luis Obispo Council of Governments
SLR: Sea level rise
SLRIP: Short-Line Infrastructure Improvement Program
SMART: Sonoma-Marin Area Regional Transit District
STA: State Transit Assistance
STA: Solano Transportation Authority
STB: Surface Transportation Board
STIP: State Transportation Improvement Program
STRACNET: Strategic Rail Corridor Network
TAMC: Transportation Agency for Monterey County
TCEA: Trade Corridor Enhancement Account
TCEP: Trade Corridor Enhancement Program
TIFIA: Transportation Infrastructure Finance and Innovation Act
TIGER: Transportation Investment Generating Economic Recovery
TIRCP: Transit and Intercity Rail Capital Program
TOD: Transit-Oriented Development
Tonnage: Tons of Freight
Tons of Freight: Weight in tons of goods moved on freight
TOS: Trip Optimizer Software
Transloading: the process of transferring a shipment from one mode of transportation to another
ULSD: Ultra-Low Sulfur Diesel
UPRR: Union Pacific Railroad
USC: United States Code
U.S. DOT: United States Department of Transportation
U.S. EPA: United States Environmental Protection Agency
USGS: United States Geological Survey
VMT: Vehicle miles traveled
Waybill: a document prepared by the carrier of a shipment of goods that contains details of the shipment, route, and charges.
ZE: Zero-Emissions
ZEHTRANS: Zero-Emission Heavy Transport Group
ZEMU: Zero Emissions Multiple Units
ZEV: Zero-Emissions Vehicle
2040 Vision: 2040 Passenger Rail Vision

Rail Plan Vision

The status quo is not an option.

California's economic, environmental, and equity goals demand a fully integrated, zero-emission, modern passenger and freight rail network that connects seamlessly with transit to safely and reliably delivers more service to more destinations more often and attracts significant demand away from highway and air travel.

Executive Summary

The California State Rail Plan (Rail Plan) reaffirms the State's Vision for an integrated, statewide rail and transit network that delivers on California's ambitious, yet vital, economic, environmental, and equity goals. In line with California Transportation Plan 2050 (CTP 2050) and the Climate Action Plan for Transportation Infrastructure (CAPTI), an integrated statewide rail network supports economic growth, improves environmental outcomes, and increases equity by providing the seamless mobility Californians need and shifts travel demand to zero-emission, high-capacity transport that supports efficient, sustainable land use. Regional implementation planning and project delivery build on the Rail Plan, as communities realize improved service, develop regional networks, and set land use recommendations that leverage enhanced connectivity.

The rail plan is the strategic funding and programming document for rail in California. In compliance with federal and state laws, the Rail Plan proposes a unified statewide network that aligns needs for passenger and freight service and connects passenger rail to other modes. The network will capture an increasing share of passenger and freight travel by rail to support economic, environmental, and equity goals.

Rail Plan Vision:

The status quo is not an option.

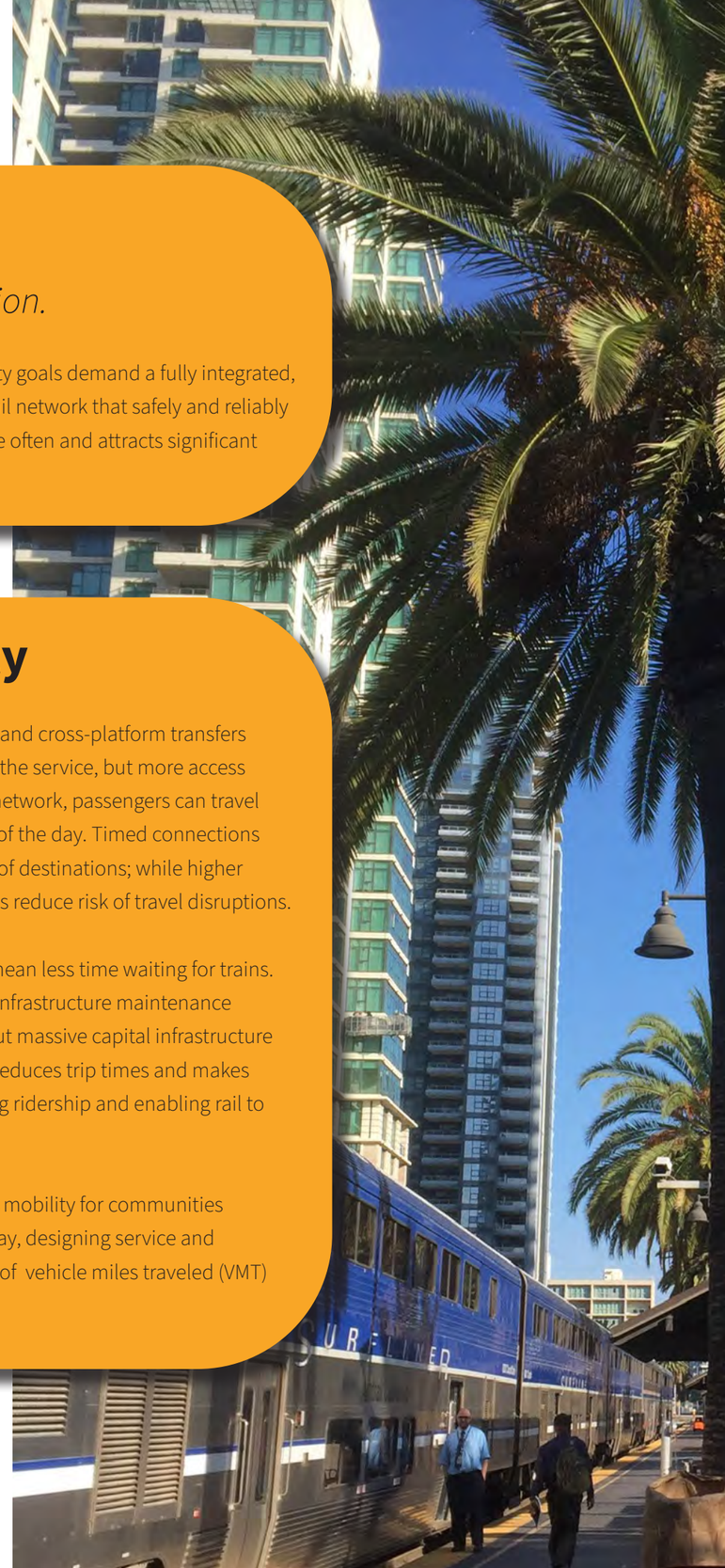
California's economic, environmental, and equity goals demand a fully integrated, zero-emission, modern passenger and freight rail network that safely and reliably delivers more service to more destinations more often and attracts significant demand away from highway and air travel.

Access and Mobility

Regularized service with connections by design and cross-platform transfers mean passengers not only have more access to the service, but more access to the whole network. Within a fully integrated network, passengers can travel between any origin and destination every hour of the day. Timed connections ensure short, seamless transfers to a multitude of destinations; while higher frequency, all-day, bi-directional service patterns reduce risk of travel disruptions.

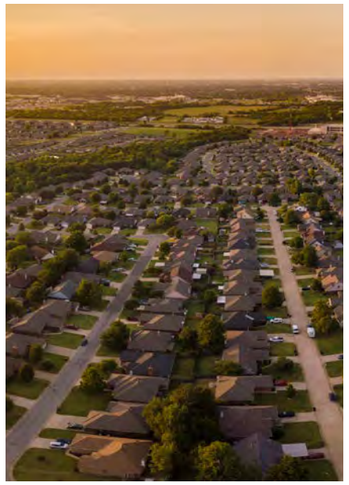
More frequency and shorter connection times mean less time waiting for trains. Modern, zero-emissions equipment and better infrastructure maintenance means faster trains. Taken together, even without massive capital infrastructure investments, the integrated statewide network reduces trip times and makes more trips competitive with car travel, increasing ridership and enabling rail to capture a larger share of trips.

Improved access and faster trip times enhances mobility for communities throughout the state. California is leading the way, designing service and identifying investments capable of shifting 20% of vehicle miles traveled (VMT) away from highways to the rail network.



California's Intersecting Crises

Climate change has rapidly evolved from a looming threat to a daily reality as drought, wild fire, and extreme weather endanger safety and strain resources. Transportation, including the extraction, refinement, and movement of fuels, is by far the leading source of California's GHG emissions[8] (over 50% of all emissions)



The housing crisis, racial inequity and income inequality drive sprawl and congestion. Transportation is the second highest household expenditure in California, only after housing[9]. Californians pay more for housing (both in real terms and as percentage of income) than almost any other state in the US[10]. In tandem, lack of effective transit and scarce affordable housing drives longer commutes, increased emissions, higher cost of living, wider housing insecurity, greater inequality, and sprawl[11].

COVID-19 brought disease and disruption not seen in a hundred years. While travel demand and car trips have already rebounded to pre-COVID levels in most markets, transit ridership continues to lag.

8 https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2019/ghg_inventory_trends_00-19.pdf

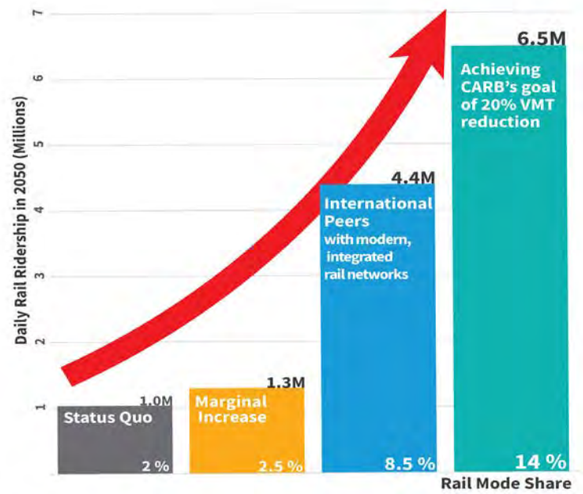
9 https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/ctp-2050-v3-a11y.pdf

10 https://www.jchs.harvard.edu/ARH_2017_cost_burdens_by_state_total

11 Caltrans Equity Statement, October 2020 Caltrans Equity Statement | Caltrans

California is Leading the Way

No other public investment is as capable of efficiently connecting large numbers of people across communities and between regions as modern, zero-emission rail networks. California's climate goals, namely reducing GHG and toxic pollutants, can only be achieved by reducing VMT, decarbonizing transport, and shifting travel from highways and air to the rail network. California's housing and economic development goals can only be achieved through broad increase in housing and jobs in transit-oriented communities, designed around fast, frequent, reliable transport services that take people where they want to go, when they want to go.



The state is reimagining the role of transit and how to equitably serve historically excluded populations. As new demand patterns are established, only a fully integrated network designed to provide robust all-day service with enhanced connectivity and a focus on customer satisfaction and cost-efficiency will be dynamic enough to effectively serve diverse spectrums of communities.

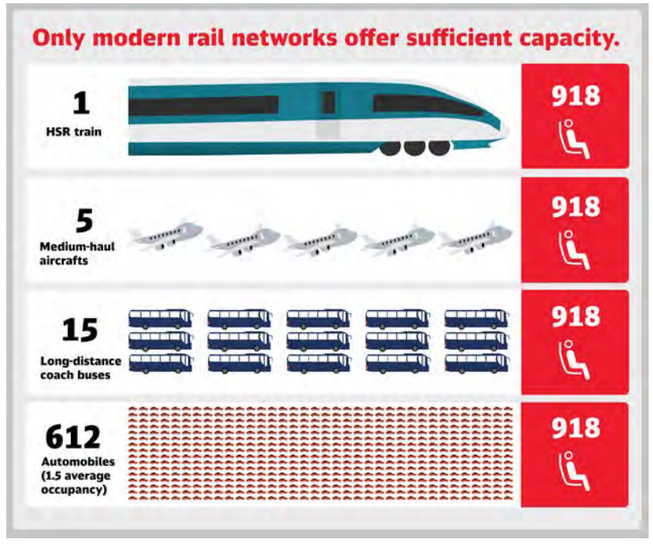
California, home to nearly 40 million people and the world's fourth-largest economy, supporting world-class cities, universities, and research centers, and the world's most valuable, innovative companies - will meet these challenges. California's agriculture feeds the world, and its ports are centers of international trade. Iconic natural landscapes are admired the world over. By connecting and improving the rail network, California can leverage existing assets and make efficient new investments in the zero-emission, modern transport network needed to serve the state's communities and their ambitions.

The Rail Plan identifies clear strategies to enhance the network, drive ridership growth, and achieve our equity, environmental, and economic goals.

California's Vision

The Vision answers the state's commitment to investing in people, programs and projects, partnerships, and the planet by delivering a vision for a modern, zero-emission rail network.

Passengers and communities
The Vision is passenger- and community focused, recognizing the value that high frequency, timed connections, integrated trip-planning, and simplified ticketing have in how (and how often) people utilize the network. The Vision addresses the role high-quality rail transit service plays in supporting dynamic community life, opportunities, and inclusive development.

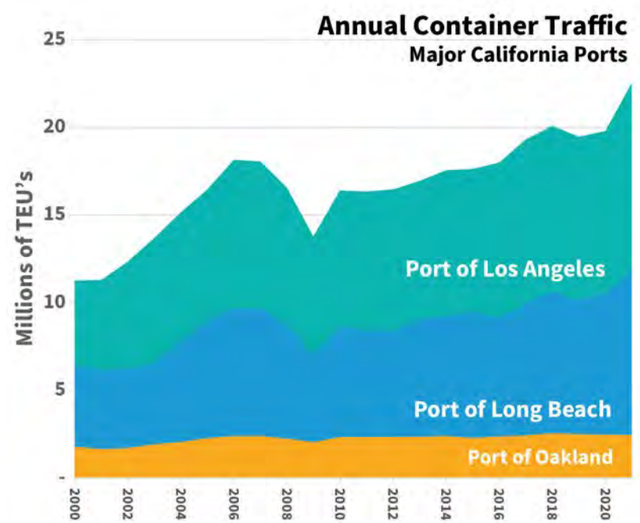


- More people will have more opportunities to access more destinations; the rail network will be more reliable for more trips than just peak-hour work-based travel or occasional regional trips.

- More communities will be served by more trains, more often, offering more connectivity to more destinations. Trains will operate on pulse schedules, with timed connections, in balanced, bi-directional patterns serving off-peak travel more equitably and utilizing investments more efficiently.

- Shifting travel from the highway network to a zero-emission rail network decreases need for roadway expansion and community displacement, improves air quality, and reduces noise pollution[8].

Freight railroads and customers
The Vision is holistic; a framework for partnerships between the freight railroads and the state, consistent with the 'California Sustainable Freight Action Plan'. Most of the rail network is privately owned by freight operators, representing a critical constituency for pursuing state policy goals for service improvements and network integration / expansion.



- The Rail Plan recognizes the importance of ports, intermodal facilities, Class 1 railroads, and regional short-lines in ensuring the viability of the freight network. Collaborative planning approaches with freight railroads, industry groups, port authorities, and public agencies that invest in freight access to the rail network builds constituencies for shared investments and helps divert goods movement from highways.

- The Rail Plan seeks to establish a common understanding capacity on the freight network. By collaboratively planning and investing in modern freight corridors, capacity on the rail network can be used more efficiently, allowing for increased frequencies within existing rights of way.

For partner agencies
While the Vision is articulated by the state, it will ultimately be implemented by planning, operating, and funding agencies. As such, Caltrans provides critical, on-going support and oversight to partners to empower decision-making, develop specific implementation plans, and follow through on project delivery.

This Vision sets clear strategic goals for policy, design principles, service frequencies, connectivity, and implementation. To fully integrate the statewide network, a broad constituency of stakeholders will plan, design, fund, and implement a dynamic, iterative set of service improvements, operating practices, and infrastructure investments. The state will work collaboratively with stakeholders to align implementation planning to the Vision and reflect progress through regional and local plans, capital grant applications, and awards.

- The Vision provides a documentable, reproducible set of technical assumptions for future service goals, operating plans, equipment parameters, and infrastructure interventions. Caltrans will provide technical resources, digital models, and technical expertise in interpreting, analyzing, and further iterating detailed technical work.

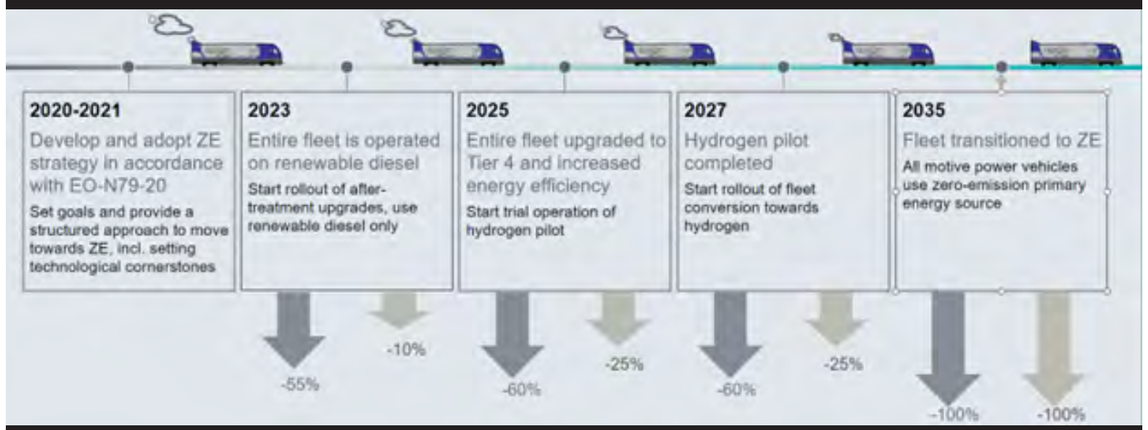
- More trains and regularized frequencies, which local transit agencies can plan around, elevate stations as gateways to the statewide network. Improved service at stations can support more successful station areas and shape more effective first/last mile connections, more robust community amenities, and more efficient land use.

8 Lercher, Peter. (2013). ROAD AND RAILWAY TRAFFIC NOISE EXPOSURE AND ITS EFFECTS ON HEALTH AND QUALITY OF LIFE. 10.13140/2.1.4897.8885.

Decarbonizing the Transportation Network

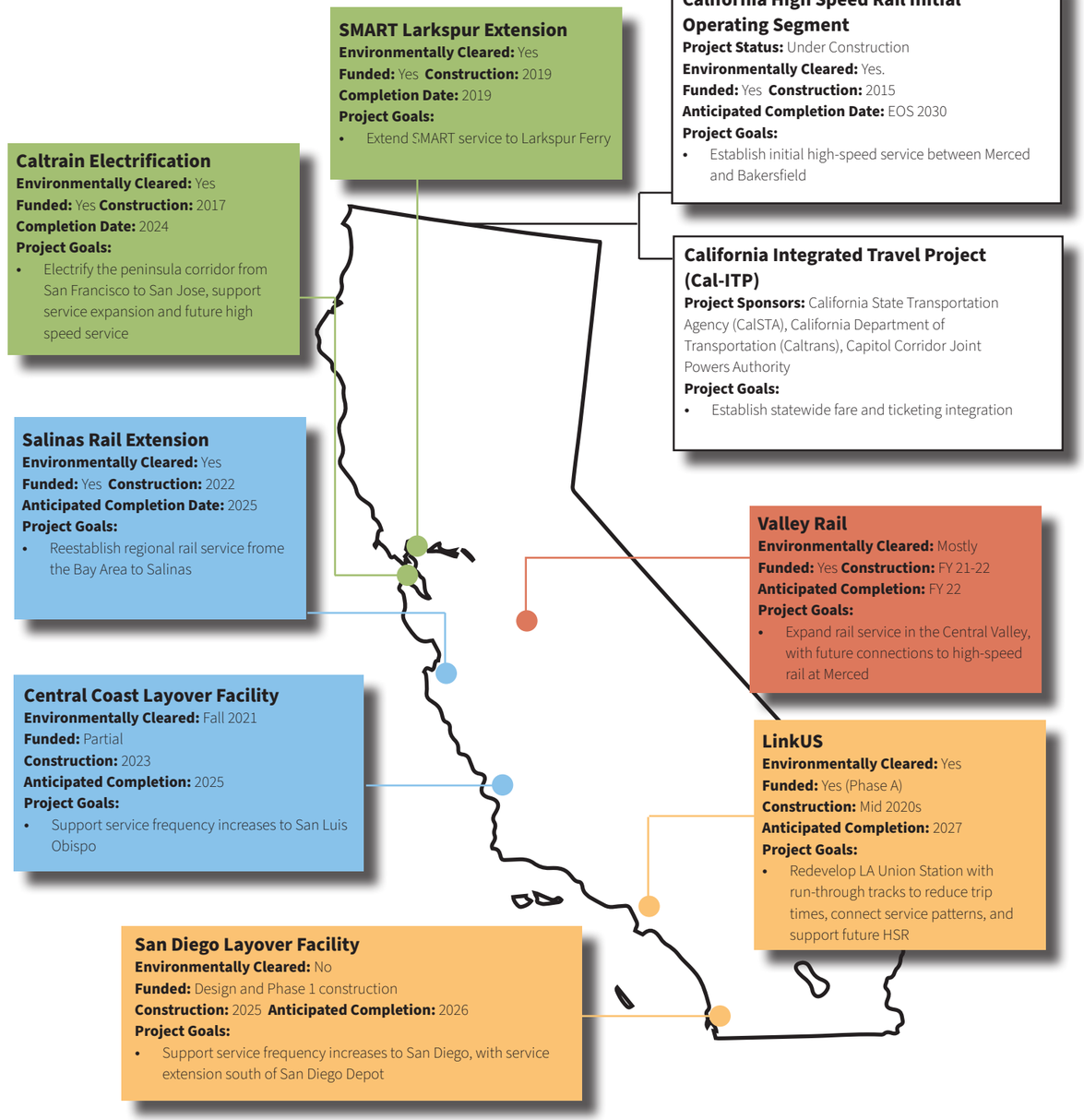
Governor Newsom has set ambitious goals for decarbonizing transport, including rail locomotives, by 2035. The California Air Resources Board (CARB) has set specific timelines for implementation and interim improvements to reduce harmful pollutants and GHG emissions.

Caltrans has developed a strategic implementation plan for rollout of zero-emission technologies ahead of CARB's deadlines. Hydrogen propulsion systems are in development for passenger rail and not expected to be commercially viable in the United States until 2026. Until that time, Caltrans can reduce emissions on its current locomotive fleet economically by implementing other low-emissions technology.



Progress Since the 2018 California State Rail Plan

Since the 2018 Rail Plan, Caltrans has been actively engaged in investments of the state's passenger network and supporting collaboration between passenger operators.



SMART Larkspur Extension
Environmentally Cleared: Yes
Funded: Yes **Construction:** 2019
Completion Date: 2019
Project Goals:
- Extend SMART service to Larkspur Ferry

California High Speed Rail Initial Operating Segment
Project Status: Under Construction
Environmentally Cleared: Yes.
Funded: Yes **Construction:** 2015
Anticipated Completion Date: EOS 2030
Project Goals:
- Establish initial high-speed service between Merced and Bakersfield

Caltrain Electrification
Environmentally Cleared: Yes
Funded: Yes **Construction:** 2017
Completion Date: 2024
Project Goals:
- Electrify the peninsula corridor from San Francisco to San Jose, support service expansion and future high speed service

California Integrated Travel Project (Cal-ITP)
Project Sponsors: California State Transportation Agency (CalSTA), California Department of Transportation (Caltrans), Capitol Corridor Joint Powers Authority
Project Goals:
- Establish statewide fare and ticketing integration

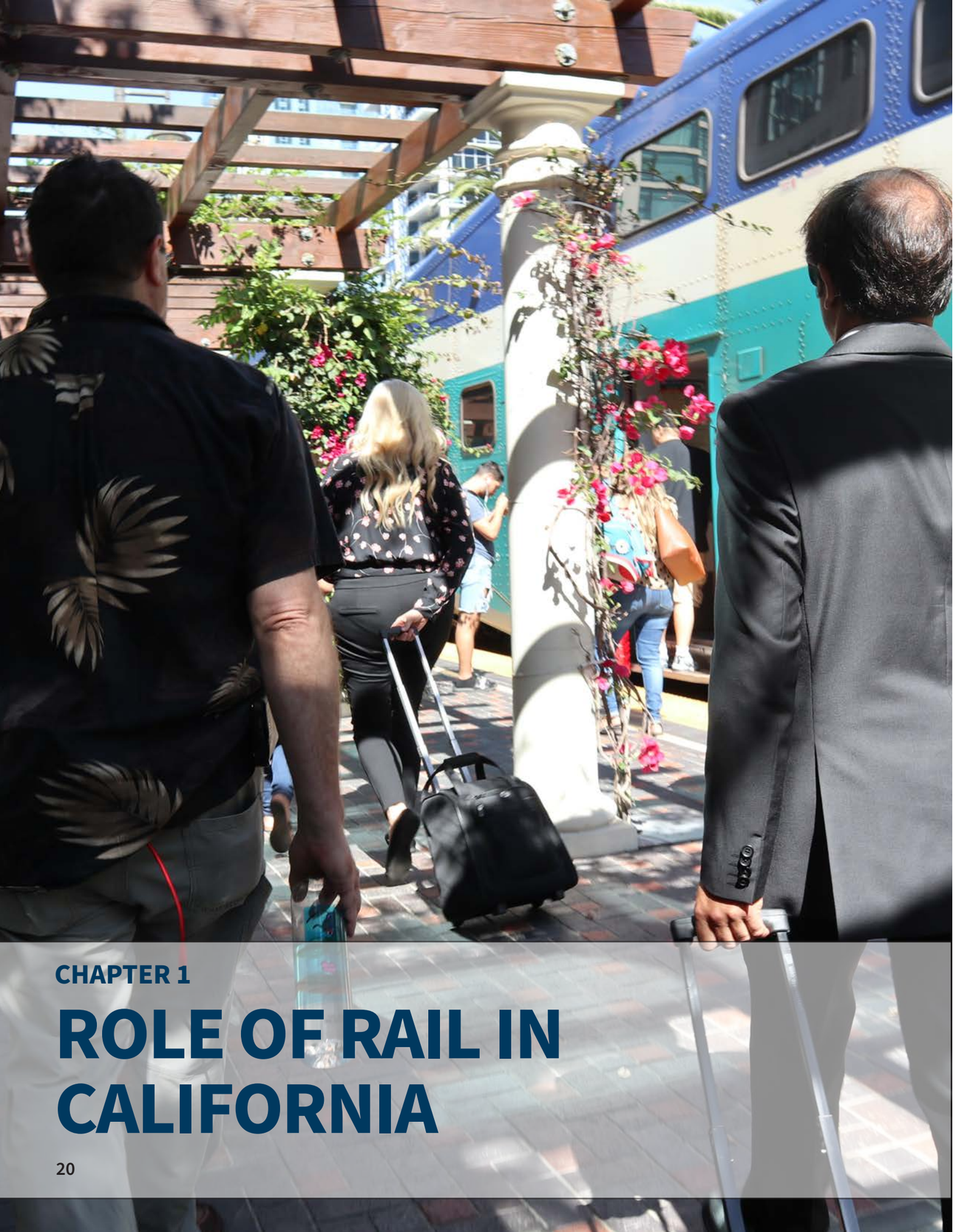
Salinas Rail Extension
Environmentally Cleared: Yes
Funded: Yes **Construction:** 2022
Anticipated Completion Date: 2025
Project Goals:
- Reestablish regional rail service frome the Bay Area to Salinas

Valley Rail
Environmentally Cleared: Mostly
Funded: Yes **Construction:** FY 21-22
Anticipated Completion: FY 22
Project Goals:
- Expand rail service in the Central Valley, with future connections to high-speed rail at Merced

Central Coast Layover Facility
Environmentally Cleared: Fall 2021
Funded: Partial
Construction: 2023
Anticipated Completion: 2025
Project Goals:
- Support service frequency increases to San Luis Obispo

LinkUS
Environmentally Cleared: Yes
Funded: Yes (Phase A)
Construction: Mid 2020s
Anticipated Completion: 2027
Project Goals:
- Redevelop LA Union Station with run-through tracks to reduce trip times, connect service patterns, and support future HSR

San Diego Layover Facility
Environmentally Cleared: No
Funded: Design and Phase 1 construction
Construction: 2025 **Anticipated Completion:** 2026
Project Goals:
- Support service frequency increases to San Diego, with service extension south of San Diego Depot



CHAPTER 1

ROLE OF RAIL IN CALIFORNIA

Rail Plan Vision

The status quo is not an option.

California's economic, environmental, and equity goals demand a fully integrated, zero-emission, modern passenger and freight rail network that safely and reliably delivers more service to more destinations more often and attracts significant demand away from highway and air travel.

1.1 State Rail Plan Purpose

The California State Rail Plan (Rail Plan) further articulates the course for developing an integrated, zero-emission statewide rail and transit network that helps California achieve its economic, environmental, and equity goals. The Rail Plan coordinates across stakeholders and communities to provide a strategic framework for delivering the state's Vision and to empower decision-making. The Rail Plan carries an ambitious agenda for the development of California's rail network.

As the agency responsible for developing the Rail Plan, Caltrans partners with stakeholders to define, refine, and deliver strategic policy and implementation planning. The strategic decisions, investments in technology, and delivery of capital infrastructure to realize that network are complex, dynamic, and implemented over decades. The Rail Plan articulates strategic and technical guidance to coordinate state resources and guide implementation planning in such a complex, dynamic environment.

1.1.1 California's Strategic Leadership

While the Rail Plan's Vision will ultimately be delivered by a coalition of federal, state, regional, local, and private partners, the state has a specific role to play in articulating the Vision and developing the technical framework for strategic implementation. Caltrans is uniquely positioned to take on strategic challenges that are bigger than any one agency or any one region to solve on their own.

Empowering Decision-Making

To achieve the Vision, projects need to move from planning to implementation in a timely manner, consistent with other projects in the network. Too often, proposals or potential improvements to the network are studied or planned over and over or in silos – with insufficient connection to decision-making and funding processes that establish commitments, accountability, and a clear path to delivery. While regulatory and permitting reforms will be crucial to delivering the Vision on a reasonable timeline for a reasonable cost, Caltrans has established clear technical parameters, network goals, and planning horizons, and investment strategies to support local and regional planning agencies so that projects can move from planning to implementation.

To this end, Caltrans has established the "Caltrans Service-Led Planning Methodology" with accompanying technical modelling and resource support for partner agencies to conduct reproducible, documentable technical analysis with shared assumptions and integration with regional and statewide planning.

More detail on this process is available in Section 2.2.2.

Leading the Zero-Emission Transition

California has long been recognized as a leader in setting environmental goals with specific targets, specific deadlines, and specific paths to implementation. In 2020, Governor Newsom challenged the status quo by setting a bold agenda to transition new vehicles, including heavy equipment like transit vehicles and locomotives, to be zero-emission.

Caltrans immediately stepped up to the challenge and delivered a strategy for meeting the zero-emission goal ahead of the Governor's deadline and ahead of CARB's implementation timeline. This strategy will support regional and intercity rail operators across the state to transition their existing fleets to zero emissions over the coming decade. More detail on this process is available in Section 2.2.2.

Planning for Success

Traditional ridership modeling starts with existing ridership and mode split data and projects forward with incremental growth. This approach works well for modest growth, but it doesn't capture the potential for transformational change that the State Rail Plan Vision calls for. Investing in fast, frequent, and connected rail and transit services across the state will provide competitive mobility options and unprecedented access for all kinds of trips across urban, suburban, and rural areas of the state.

Rather than using traditional forecasting, the State Rail Plan uses a "Market Viability Assessment" to assess the network's potential to reduce Vehicle Miles Traveled (VMT) by shifting a large share of existing trips from other modes and to capture the majority of new trips that will be taken by 2050.

More detail on this process is available in Section 5.

1.1.1 Federal Railroad Administration Compliance

The Federal Railroad Administration ('FRA') provides for each state to prepare and maintain a State rail plan[8] as a means for:

- Setting forth State policy involving freight and passenger rail transportation
- Presenting priorities and strategies to enhance rail service in the State that benefits the public
- Serving as the basis for Federal and State rail investments within the State

8 49 U.S. Code Chapter 227

1.1.3 State Law Compliance

California Government Code Section 14036 requires Caltrans to prepare a Rail Plan that aligns federal and State requirements[9].

1.2 The Future Statewide Rail Network

The Rail Plan establishes a long-term Vision for utilizing the rail network to deliver the goals of the California Transportation Plan 2050 (CTP 2050) and the Caltrans Strategic Plan 2020-2024. The Rail Plan identifies a network, composed of specific service goals, connection nodes, a conceptual operating plan, and a phased implementation strategy for achieving the Vision. The Rail Plan envisions a coordinated, statewide passenger network that gets Californians where they want to go, when they want to go, and enhances goods movement to support California's economy.

Rail is an essential element of California's multimodal transportation network; rail can be one of the most spatially, economically, and environmentally efficient modes to move people and goods. The statewide network will use the existing rail system more efficiently; expand the coverage and scope of service in key corridors; scale proposed services to meet anticipated market demand; and facilitate network-wide coordination through timed "pulse" transfers. For passengers, this integrated system means a faster, more convenient, and reliable door to-door travel experience. For freight movements, this network means better reliability and a public partner in expanding rail capacity, with economic benefits that reverberate locally, regionally, and nationally.

9 Compliance requires, among other things, an adequate plan for rail transportation in the State, and a suitable process for updating, revising, and modifying that plan. The Rail Plan and periodic updates fulfill this requirement.

1.2.1 Role of Rail and Intercity Bus in the State Transportation System

California's multimodal transportation system, consisting of highways, railroads, transit, seaports, and airports, provides the foundation for the state's economy. It provides businesses with access to markets and residents with access to jobs, education, healthcare, and other opportunities critical to quality of life.

Rail will continue to play a critical role in meeting California's challenges of accommodating a growing and changing population, expanding the economy, reducing GHG emissions, and protecting the environment. Immediate investment in increased rail capacity is a necessary strategy that California must pursue to meet its GHG reduction goals and accommodate the ever-increasing transportation demand. The Rail Plan provides the framework for helping the State rail system meet these goals.

This will offset capacity demand on roads and at airports—expansions that require significant investment and carry serious environmental externalities and equity impacts. The state cannot meet its climate goals or reduce congestion by further increasing road and airport capacity. Effective use of the rail network is central to pandemic recovery, while increasing quality of life for all Californians, particularly in disadvantaged communities.

With more efficient operating performance, the network can support additional service. With more frequent service, better connectivity, and greater ease of access, ridership will grow, reducing costs per passenger. More, faster trains, running more often with timed connections, will be competitive with car and in-state air travel.

As some areas are not feasible to reach with regular passenger rail service; Caltrans developed the California Intercity Bus Study (CIBS) in 2022. CIBS designs for a statewide bus network and high-level implementation plan.

1.2.2 Engaging Equity

Transportation benefits and burdens are unevenly distributed across communities, class, and racial groups. This is especially true of highway and rail corridors. Low-income, disadvantaged, and minority communities are pushed near highways and industrial areas, with poor air quality causing negative health effects, increased household expenses, and decreased household wealth. Communities of color often have poor transit access and service, despite rail corridors running nearby. Inadequate, and often unsafe, street infrastructure prevents people from using active transportation and transit. The COVID-19 pandemic further exacerbated theses disparities as people who depend on public transit continued to travel to work, providing essential services necessary to maintaining our communities.

Caltrans recognizes that transportation has often created barriers that decimate and separate communities. Going forward, the rail network must serve to connect communities. It is Caltrans' priority to partner with disadvantaged communities, communities of color, Native communities, and priority populations to plan strategically to partner on proactive investments that can ensure benefits are realized equitably.

Caltrans will continue to program recommendations on state funds with clear, documented benefits to disadvantaged communities and priority populations. The Rail Plan designs safe, reliable, and affordable transportation for those who need it most, and people negatively impacted by legacy transportation decisions.

This requires increased technical sophistication; where a project is physically located and where its benefits accrue are often not the same place. Caltrans has increased use of digital infrastructure and operations modelling, travel demand, and air quality analysis to better understand where benefits and burdens accrue across a range of potential improvements to the network. This is especially true in a rail network where a new siding for trains to pass, or new rolling stock equipment, or a new maintenance facility may create benefits (or impacts) elsewhere in the network, far from a specific project site.

Addressing equity also requires meaningful engagement with communities – in particular, underserved communities – to center their needs in the planning process. Caltrans

> ***CalSTA strongly condemns systemic racism and discrimination in all forms, including those historically entrenched in transportation.*** *Enhancing the lives of all Californians – particularly people of color and disadvantaged communities – by connecting individuals to jobs, healthcare, education, and other opportunities lie at the heart of what we do and why.*
>
> ***- California State Transportation Agency Statement on Racial Equity, Justice and Inclusion in Transportation***

conducted virtual equity engagement workshops across the state in 2021. These workshops focused on the needs of priority populations, relevant to the rail system. Caltrans engaged subject matter experts and advocates, able to speak to equity needs in context of the Rail Plan. A variety of stakeholders attended, focused on equity, environmental justice, social justice, alternative/multi-modal transportation, smart growth, environment, academia/ research, and regional agencies.

Input from the workshops included recommendations and strategies to support the Vision:

- Make service more accessible for underserved communities;
- provide affordable fares;
- plan efficient rail connections;
- improve safety to overburdened communities; and
- develop clean transit technology.

1.2.3 Implementation Strategy and Capital Funding

Phased implementation demands a strategic approach that prioritizes existing infrastructure and scales investment over time, ensuring the whole is greater than the sum of the parts. The Rail Plan designs toward a vision, on a long-term 2050-time horizon that is not financially constrained. The vision is a technical framework for realizing the potential of the existing rail network and using available capacity, covered in Chapter 5. In partnership with stakeholders, the vision will be delivered in phases, with different levels of integration activated as improvements are delivered over time. Phasing implementation prioritizes more intensive use of existing infrastructure, while minimizing duplicate or stranded investments and delivering interim benefits to the traveling public before every major infrastructure investment is completed.

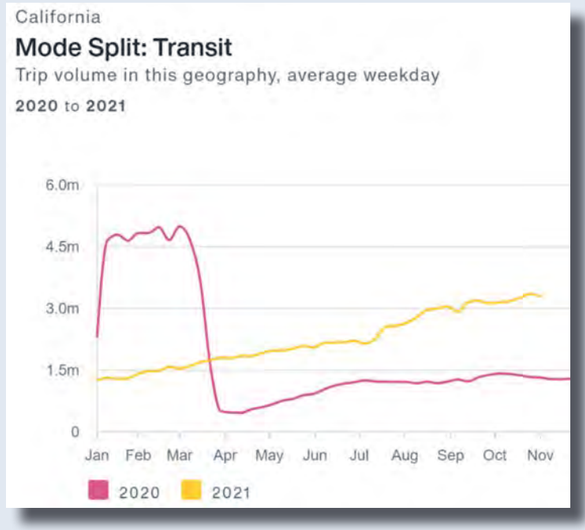
A mid-term 10-year capital program is derived from the long-term vision, building on programmed capital projects and represents what the state reasonably expects can be funded by 2032. This funding plan excludes the funding for California High-Speed Rail Authority (CHSRA) projects related to the high-speed rail system which has separate, dedicated funding. A 5-year near-term program documents committed, funded projects already in project delivery. Rather than set arbitrary deadlines, these phases are meant to establish horizon years and service thresholds that guide strategic planning and do not preclude projects from earlier delivery. The Rail Plan provides for incremental service planning and capital investment with a network vision established as a guide point.

The state's FY ' 2022-23 Budget included more than $4 billion in funding for transit and active transportation. Combined with local and federal resources, California invests $10 billion a decade in capital upgrades for transit.

Caltrans is committed to continued funding of rail network improvements to achieve the vision. Caltrans has developed a methodology ('Service-Led Strategic Planning'), which coordinates network integration technical analysis and new service deployment and marshals the financial resources necessary to realize the vision. Caltrans will continue to support regional and local stakeholders with technical and financial resources in partnership toward delivering a fully integrated statewide rail network.

1.2.4 Impact of COVID-19

COVID-19 created unprecedented disruption to all aspects of society and the economy, particularly transportation. COVID-19 affected travel demand, altered supply chains and demand for goods, and further burdened California's most vulnerable communities, particularly frontline transit workers who risked their lives to keep California moving through the pandemic. The pandemic created a profound, shift in how frequently people travel, where they travel, and what modes they choose. Consequences will be felt for years, affecting how people use transportation.

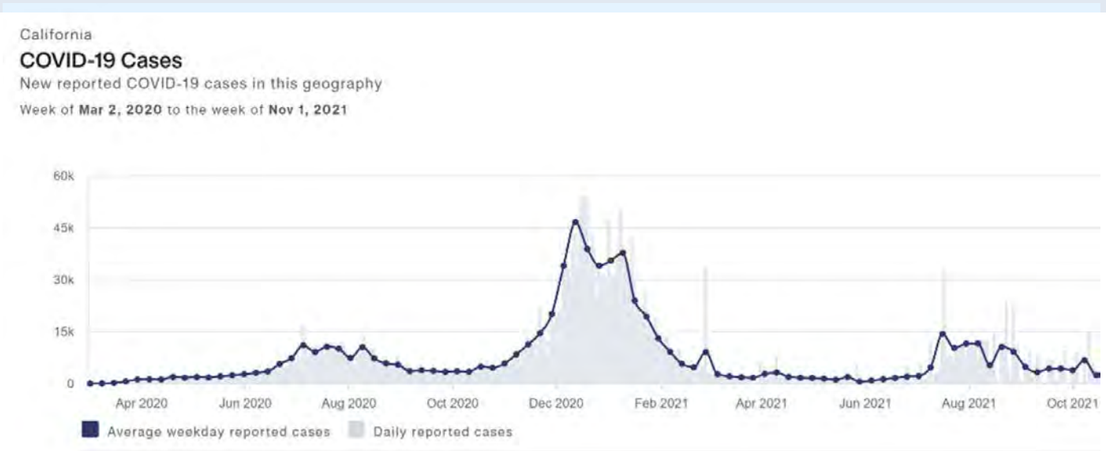


Throughout the pandemic, there was a steep reduction in ridership for public transportation, which has significantly impacted operating costs and farebox recovery. While roadway congestion was initially reduced as much as 40%[10], transit ridership was reduced as much as 90% or 95%. Since that time in early-2020, travel in single occupancy vehicles has rebounded, and now often exceeds, pre-pandemic levels. Meanwhile, rail and transit ridership continue to lag. Both the federal and state governments have responded vigorously to these challenges. Through the Coronavirus Aid, Relief, and Economic Security (CARES) Act, the federal government appropriated $25 billion to transit agencies across the country. This funding has been a crucial stopgap to make up for farebox shortfalls and disruptions to sales taxes and other sources of operating funds for public transit services[11]. For California, this meant an additional $3.7 billion for supporting essential transit service across the state.

Essential Service Planning

While Caltrans does not directly operate transit service, it does fund and provide equipment for intercity rail services. When the pandemic struck, Caltrans responded quickly by establishing 'Essential Service Planning' that provided critical guidance to preserving statewide travel corridors, right-sizing schedules, and fleet to manage reduced passenger demand and building collaboration between the state-supported intercity rail and thru-way bus services. As a result, Californians were able to maintain essential travel to jobs and healthcare and preserving the network for re-establishing service ramp-up in COVID-19 recovery.

10 ttps://www.transit.dot.gov/funding/apportionments/table-1-fy-2020-cares-act-appropriations-and-apportionments-grant-programs
11 https://www.transit.dot.gov/funding/apportionments/table-1-fy-2020-cares-act-appropriations-and-apportionments-grant-programs



1.3 California's Rail System

Much of the state rail network is owned by private freight railroad companies which operate freight rail service and 'host' passenger operations on their right-of-way through various funding and operational agreements. A portion of the network is in public ownership. Exhibit 1.1 shows the extent and ownership of California's rail network. Most passenger services operate over track owned by the Class I freight railroads. Private capital is the principal source of funding for upkeep and improvement of the freight network.

California supports a spectrum of passenger services ranging from longer-distance intercity service and future high-speed rail service to local urban rail transit. As travel demand patterns evolve and greater network integration is achieved, the lines between these categories will blur as passenger network positions itself as a unified platform for mobility rather than being a collection of individual services, with independent management, serving independent markets.

How well these passenger services integrate with each other and how well they utilize physical infrastructure is the core focus of the Rail Plan.

1.3.1 Freight Rail

Freight rail transports goods between producers, ports, and markets serving local customers, regional and national markets, and international trade.

California's freight railroad system links industries and consumers throughout the state with North American and overseas markets. Since its development in the 19th century, California's rail network has evolved in response to the changing needs of what is now the largest state economy in the U.S. The freight rail network operates on privately owned infrastructure that hosts freight and passenger service on the same tracks.

Freight services range from transcontinental operations of trains, sometimes over two miles in length, moving hundreds of containers from international ports in Los Angeles, Long Beach, and Oakland to markets across the United States to local 'short-line' operations moving small numbers of cars of industrial or agricultural products to logistics centers and the next leg in their journey.

1.3.2 Intercity Passenger Rail

Intercity rail provides passenger transportation between metro regions.

Intercity trains connect multiple metropolitan areas and rural communities. Caltrans-funded intercity services connect megaregional markets across Southern California, the Central Coast, the Central Valley, and the San Francisco Bay Area. California's current intercity rail services include Caltrans' state-supported routes (i.e., Capitol Corridor, San Joaquins, and Pacific Surfliner). Intercity trains stop less frequently than local or regional trains, offering faster trip times.

State law defines Caltrans's responsibilities for funding capital improvements and providing operating support for intercity passenger rail service. Regulatory law defines intercity rail service as conventional service capable of speeds up to 125 mph[12]. Caltrans is given the authority to plan and fund capital improvements for intercity routes[13]. In addition to essential intercity travel, they serve regional and traditional commuter markets. As service is further integrated into regional markets with coordinated scheduling and integrated ticketing, intercity services will play an expanding role in developing megaregional networks.

Several of Amtrak's long-distance routes also serve California markets. An overview of intercity rail and long-distance routes is provided in Appendix 4.2.

An overview of administrative roles between Caltrans and the Joint Powers Authorities (JPAs) is provided in Appendix 1.2 and 1.3.

1.3.3 Regional Rail

Regional rail provides passenger transportation across metro regions.

Regional rail is more frequent, stops more often, and serves shorter corridors than intercity rail. Regional rail often plays a role supporting daily commuter markets. Regional rail services are essential to supporting and connecting regional economies. Capital funding comes from federal, State, and local sources, while operating funding is the responsibility of local and regional entities

An overview of administrative entities is provided in Appendix 2.4.

1.3.4 Urban Rail Transit

Urban rail transit provides passenger transportation within metro regions.

Urban rail service exists in different forms for varying purposes, and includes high-capacity, heavy-rail transit service (i.e., subways or metros); lower-speed, lower-capacity streetcars and cable cars offering localized service (and often sharing roadways with cars); and light-rail systems, which offer capacities and speeds between those of heavy rail and streetcar systems.

Urban rail service provides critical local links to regional and intercity service in the broader integrated statewide network.

An overview of urban transit rail entities is provided in Appendix 2.4

1.4 Trends and Opportunities

The Rail Plan identifies trends in California's transport system and how the system may change or need to change in coming decades. This foundational analysis is critical to identifying responsive strategies, evaluating future transportation scenarios, and selecting plan recommendations.

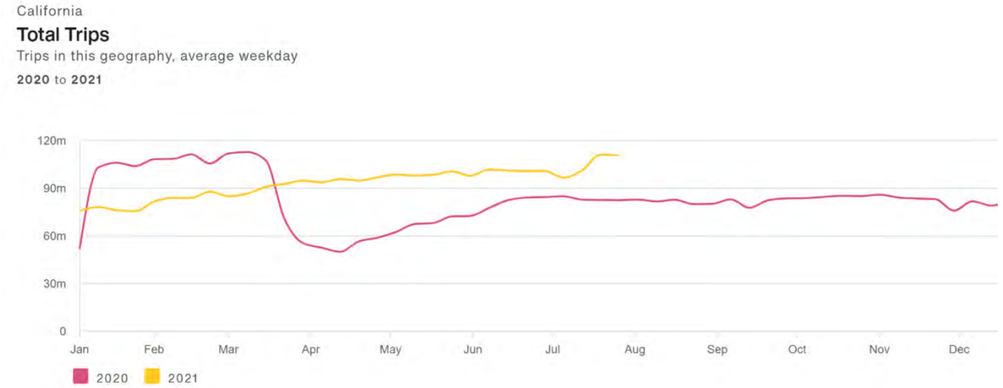
1.4.1 Recovery from COVID-19

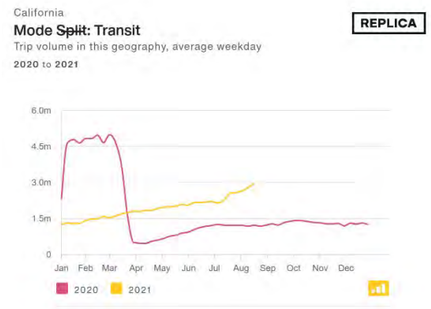
Travel demand effects of COVID-19 will reverberate for years to come, affecting how, when, and why people travel. COVID-19 depressed certain types of travel, namely peak-hour work-based trips to office markets that previously formed a core market for rail service. The pandemic also disrupted supply chains and shifted demand for goods.

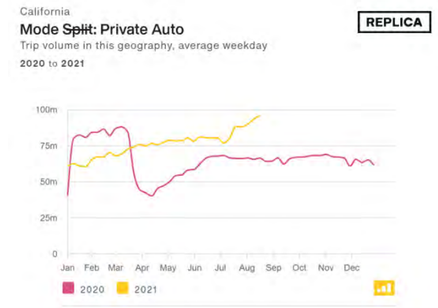
In addition to the demand shock to transit service, trip patterns have also changed, potentially significantly. Where traditionally regional travel demand was defined by an AM and PM peak, reflecting peak hour work travel, with significantly reduced spikes in peak hour trips.

The worst effects of COVID-19, from the loss of life, loss of employment, and loss of educational opportunities were concentrated in California's most vulnerable communities. Recovery and future resiliency demand designing future service patterns and future investments to prioritize accessibility and mobility for disadvantaged communities.

12 The California High Speed Rail Authority has jurisdiction on projects supporting service over that speed
13 Government Codes 14031.6, 14035, and 14038 (Attachment 2)







1.4.2 Passenger Rail Demand and Growth Trends

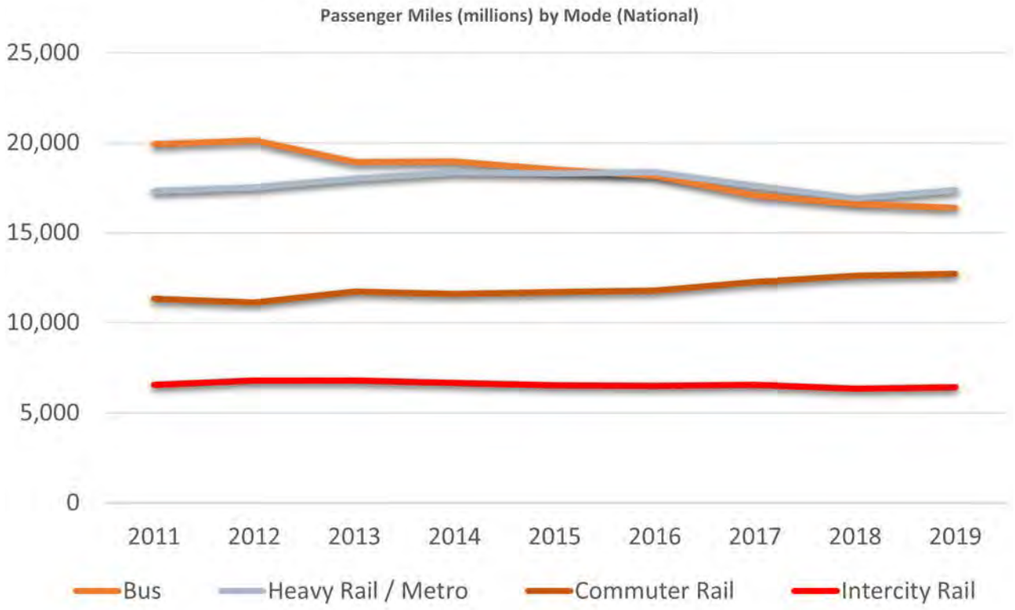
Over several decades, there has been a steady growth in long-distance travel in the U.S. Thirty percent of passenger miles traveled (PMT) in recent decades are attributable to long-distance travel[14]. Of all trips longer than 15 miles, only 5% were greater than 100 miles[15]. However, these 5% of trips accounted for 35% of passenger miles for all trips over 15 miles in length.

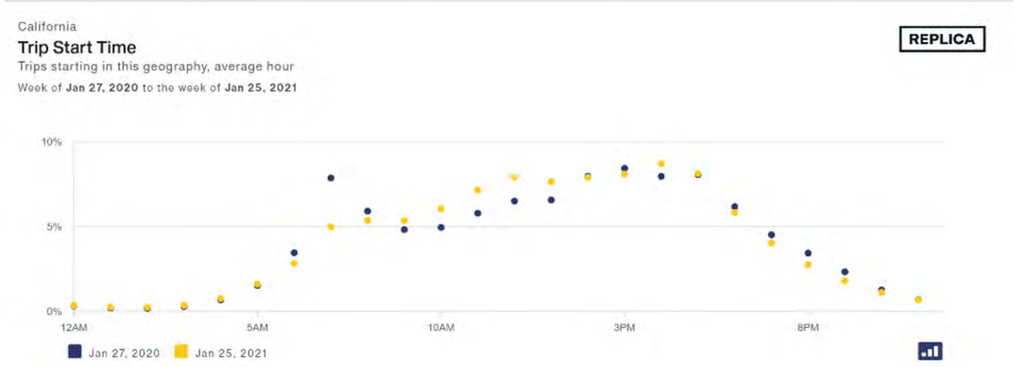
This means that, by investing in the state rail network to increase the rail mode share for these longer trips, a significant reduction in air and auto passenger miles could be realized, thus leading to significant GHG benefits. The 2010s saw overall declines in transit ridership nationally. Declines were largest in local bus services. Rail ridership was more consistent. Despite a 7% decline in trips across California agencies from 2011 to 2019, passenger miles traveled on transit were up 4%[16]. In the Bay Area, ridership rose 4% and passenger miles were up 18%.

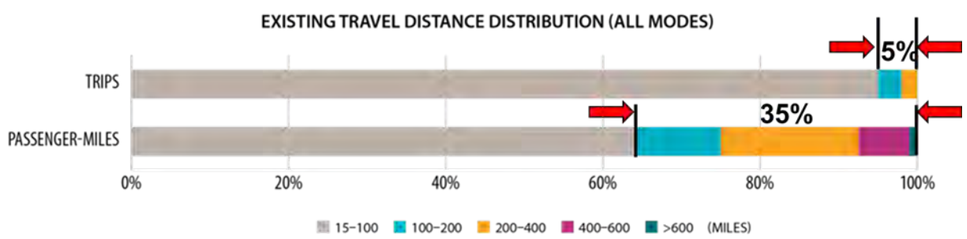
Intercity rail and bus modes are ideally suited to certain types of long-distance travel and can offer competition on routes dominated by personal vehicle or air travel. Expanding and integrating the rail network will make rail a more competitive mode of travel in California, especially for long-distance trips.

By investing in the state rail network to increase the rail mode share for these longer trips, a significant reduction in air and auto passenger miles could be realized.

14 https://escholarship.org/content/qt0ft8b3b5/qt0ft8b3b5.pdf?t=pkeepu
15 Analysis conducted using the California State Transportation Agency's (CalSTA) Rail Market Analysis Tool (RMAT)
16 US DOT, Bureau of Transportation Statistics







1.4.3 Population and Demographics

California is home to nearly 40 million residents[17]. The greater Southern California and the Bay Area megaregions are California's largest population centers, home to nearly half of the state's population. Inland areas in the Sacramento Valley, Central Valley, and Inland Empire are growing at the fastest rate. As population grows, so will demand for travel. Accommodating this growth in a way that supports environmental, economic, and equity priorities underpins the importance of delivering a fully integrated, zero-emission, modern statewide rail network.

California's population is also increasingly diverse, with no racial or ethnic group constituting a majority. California has the nation's largest immigrant population, with 27% of Californians foreign-born. Adults over 65 are expected to make up more than a quarter of California's population by 2050; and as people age, transportation patterns and needs change. Additionally, one in 10 Californians live with a disability, and many elements of the current transportation system are not designed to accommodate mobility of people with different needs. As the population ages, the share of Californians living with a disability is expected to increase.

A statewide rail network offers a competitive alternative to driving for both local and long-distance trips for all populations, including those who lack access to or cannot afford automobiles. Even when rail to rail connectivity is improved, there is often a gap at the start and end of a transit trip, called the first- and last-mile gap. Closing these gaps and investing in safe, multimodal first- and last-mile access to transit is critical, as well as constructing safe streets that incorporate universal design.

1.4.4 Land Use and Housing

Housing, transportation, and land use decisions are co-dependent; location and availability of housing determines how people travel, how much they spend on transportation, and what mode they use. California faces a critical housing shortage which creates compounding affordability issues. The housing shortage has caused a rapid increase in housing costs, which disproportionately impacts California's most vulnerable populations.

Homelessness in California is growing at an alarming rate, with nearly 150,000 unhoused people in 2019. Housing shortages, especially in urban regions, has also led to residents moving further from jobs, goods, and services, and relying more heavily on cars as the main form of travel.

The status quo is not enough to support this growing economy and meet its robust economic and environmental future needs. Residents and workers in California's growing megaregions face mounting vehicle congestion and long commute times due to pressures on the housing market and the aging transportation infrastructure. Rail has a unique effect among transport modes, in that its structure of networked nodes (organized around rail stations and connection points) and its spatial efficiency (moving more people and goods using less physical space) result in efficient land use. A connected network, specifically, the synergy between a modern, statewide rail network, will catalyze more compact land use patterns, the combined effect of which will be even greater reductions in GHG[18] emissions.

This effect has key benefits, both for the transportation system and the environment, because concentrated development around stations spares rural land and open space from the pressures of urban development. Less energy and travel time are needed to transport people and goods. Integrating rail systems with multimodal transportation and land use planning that minimizes sprawl offers residents, workers, and tourists more travel choices and better access to jobs, retail, entertainment, recreational facilities, and open spaces.

1.4.5 Climate Change

Climate change affects California with extreme heat, more frequent and intense wildfires, poor air quality, drought, sea-level rise, and flooding—all of which threaten public health, economic vitality, and transportation infrastructure. Fire and mudslide events have closed roads and highways, while rail service continued, providing critical links to regional and statewide travel. In 2017, the Sonoma–Marin Area Rail Transit (SMART) service offered free fares and

17 CTP 2050

18 Greenhouse gas

an emergency schedule to evacuees from North Bay wildfires[19]. In 2018, the U.S.101 was closed through coastal Santa Barbara County after a series of fires and mudslides. With highway travel to Los Angeles County impossible, the ***Pacific Surfliner*** added additional capacity and provided essential connectivity between Santa Barbara, Ventura, and LA Counties[20].

Today, virtually every community in California is regularly affected by fire, even indirectly through dangerous air quality. Drought ravages agricultural producers and endangers water access for residents. California's coastal communities experience early effects of sea level rise resulting in coastal flooding, periodic tidal flooding, and increased erosion. Beyond specific emergencies, the rail network faces the certainty that critical parts of the network are currently threated by high tides and will be underwater by mid-century without major intervention.

The transportation sector is the largest contributor to California GHG emissions, a leading cause of climate change. The state must prepare and adapt to these increasingly regular events. A modern, zero-emission rail network will reduce the transportation sector's substantial GHG emissions; add resiliency to the transportation system by providing connectivity complementary to road and air travel networks; mitigate climate change's adverse impacts; and contribute to California's ambitious GHG reduction requirements.

Sea Level Rise

While the pace and implications of sea level rise are dynamic, critical sections of the state's rail network, for both freight and passenger service, will need significant investment in coming decades simply to remain usable. At-risk sections include the UP-Martinez Subdivision, running on a trestle over a flood plain in Yolo County and immediately along the shore in San Pablo Bay and Carquinez Straight; the UP-Coast Subdivision running on trestle over the Alviso Wetlands north of San Jose and through a coastal wetland in Elkhorn Slough near Salinas. In Southern California, the UP-Santa Barbara Subdivision and publicly owned San Diego Subdivision run immediately along the Pacific coast and through coastal wetlands.

The Rail Plan, and other strategic work supported by Caltrans like freight pathing studies, the 2018 Sea Level Rise Policy Guidance, Critical Infrastructure at Risk Document and network integration analysis are identifying the risks faced, interventions required, and investments necessary to preserve the rail network in the face of climate change.

1.4.6 Governor Newsom's Leadership On Air Quality & GHG Emissions

In 2020, Governor Gavin Newsom issued Executive Orders focused on transportation:

- **EO N-19-19** empowers the state to leverage discretionary state transportation funds to help meet climate goals. This includes strategies for lowering vehicle miles traveled, supporting housing development near jobs, and supporting active transportation.
- **EO N-79-20** requires all new passenger cars and trucks sold in California to be zero-emission by 2035 and all medium and heavy duty vehicles to be zero-emission by 2045[21].

CalSTA and Caltrans Implementation

Collectively, these Executive Orders laid the groundwork for the Climate Action Plan for Transportation Infrastructure (CAPTI). The action plan, adopted in July 2021, details the state's recommendations for investing annual transportation dollars to aggressively combat and adapt to climate change while supporting California's public health, safety, and equity goals.

Caltrans had developed an ambitious plan to decarbonize its intercity passenger rail and using a combination of battery and/or hydrogen fuel cell propulsion technologies. The feasibility of these technologies is being investigated by manufacturers and researchers for short-line freight and long-haul freight operations.

CARB Policy Analysis & Regulation

Via the ***Innovative Clean Transit*** regulation, the California Air Resources Board (CARB) mandated California transit bus fleets must be zero emission by 2040, requiring that all bus purchases in 2029 and after must be battery electric or fuel cell electric.

CARB is developing a draft In-Use Locomotive Regulation consisting of four main components. The first component is the Spending Account. For the Spending Account locomotive operators will annually deposit funds into an account based on their emissions in California. The dirtier the locomotive, the more the operators place into the Spending Account. Spending Account funds may only be used to purchase a Tier 4 or cleaner locomotive or to repower to a Tier 4 or cleaner locomotive until 2030 and then zero-emission locomotives 2030 and beyond. At any time, the funds may be used for zero-emission infrastructure and demonstration and pilot projects.

The regulations include In-Use Operational Requirements. The In-Use Operational Requirements start in 2030 and allow only locomotives less than 23 years to operate in the state. Additionally starting in 2030, all switch, industrial and passenger locomotives with an engine build date of 2030 or later must be zero emission to operate in California. In 2035, freight locomotives with an original build date of 2035 or newer shall be zero-emission locomotives. The Idling Limit mandates that the main locomotive engine is shut off no more than 30 minutes after the locomotive becomes stationary. Reporting and recordkeeping which requires locomotive operators to track and report locomotive activity per Air District.

If the In-Use Locomotive Regulation is adopted, a state short-line program needs to be created to assist short-line railroads transition to zero emission in addition to infrastructure investment to upgrade short-line facilities and maintain the commercial viability of these railroads operations by 2030. We need to ensure that short-line contributions to achieving the broad benefits of rail freight to greenhouse gas emissions reductions and highway vehicle congestion are not lost.

19 https://www.sonomamarintrain.org/node/337
20 https://news.pacificsurfliner.com/2018-01-14-Amtrak-Pacific-Surfliner-Adds-Capacity-To-All-Trains-Serving-Santa-Barbara-County

21 Medium- and heavy-duty vehicle regulations requiring increasing volumes of new zero-emission trucks and buses sold and operated in the State towards the target of 100 percent of the fleet transitioning to zero-emission vehicles by 2045 everywhere feasible and for all drayage trucks to be zero-emission by 2035.

1.4.7 Freight Demand and Growth Trends

As identified in the 2018 Rail Plan, freight rail movements are projected to increase ~2-4% per year, generally in line with broader economic growth. Analysis of waybill[22] samples prior to 2020 have been in line with growth projections. This trend in growth in freight movements has three implications for the rail network:

- The freight rail network will continue to play a critical role in goods movement. This role has significant economic and infrastructure implications. Every freight train on the rail network means hundreds or thousands of trucks not on the highway network. Supporting the freight network is a key strategy for mitigating need for highway expansion.
- Capacity constraints and operating conflicts between passenger and freight service will continue to be a leading issue in modernizing passenger service. As passenger trains either share track with freight or operate on freight-owned corridors, the state must build stronger collaborative relationships to plan efficient use of capacity, invest effectively in expansion, and ensure a shared strategic approach to improving the network.
- Freight rail has a significant role to play in mitigating air quality impacts. Traditionally, freight rail is the most energy efficient mode for shipping goods over land. Uptake of zero-emissions technology is critical to maintaining that advantage.

With Caltrans' long-term network vision, ***Service-led Strategic Planning Methodology***, and digital infrastructure and technical operations models, Caltrans is establishing key strategic relationships to support collaborative planning processes and efficient capital investments.

1.4.8 Resiliency in the Transportation Network

Maintaining performance and condition of California's transportation system is vital; providing high-quality infrastructure means adapting service to accommodate changing demand and leveling the playing field for active transportation, rail, transit, and shared modes. California's service networks and infrastructure must be resilient to the impacts of earthquakes, extreme temperatures, fires, sea level rise, and flooding. Adapting to risks posed by climate change and natural disasters requires understanding the system's exposure and sensitivity to these threats, identifying likely consequences, and prioritizing investments to mitigate risks. This enables recovery from disruptions and ensures the system that can adapt to withstand sea-level rise and other severe weather events.

Projects should be scoped (planned and designed) to adapt to higher sea level rise projections. Design and planning efforts that include a trigger-based adaptation pathways approach should include a monitoring component to ensure timely implementation of adaptation or contingency measures once impact or risk thresholds are crossed[23].

Each Caltrans district has developed an adaptation priorities report to prepare the transportation system for climate change and to identify assets most at risk.[24] However, since the rail network is largely privately owned, rail infrastructure is not analyzed in the report. The state's general adaptation planning framework and prioritization methodology outlined in the report is indicative of climate change adaptation efforts more broadly, many of which are relevant to the state's rail network.

22 Waybill: a document prepared by the carrier of a shipment of goods that contains details of the shipment, route, and charges.

23 Sea-Level Rise Guidance, 2018: https://opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf

24 2020 Adaptation Priorities Reports: https://dot.ca.gov/programs/transportation-planning/2020-adapation-priorities-reports

CHAPTER 2

NETWORK VISION

Caltrans is leading development of the zero-emission, fully integrated, statewide rail network. The network will serve both passengers and freight, support local communities and business, and serve as a critical tool in achieving the State's economic, environmental, and equity goals.

This chapter articulates the Rail Plan's Vision, design principles, and direct support for policy goals established in the California Transportation Plan 2050 (CTP 2050), Smart Mobility Framework (SMF), and Climate Action Plan for Transportation Infrastructure (CAPTI).

The Vision is a strategy for meeting the State's transportation needs. The State will achieve the Vision through integrated service planning in partnership with local communities and other stakeholders.

2.1 Setting the Vision

Rail Plan Vision: California will have a ***customer-focused, fully integrated rail system*** serving as a ***preferred mode of choice for both passengers and shippers***. The rail system will e***nhance economic growth, improve quality of life, advance equity*** of the State's most vulnerable and impacted communities, while being a force in meeting California's ambitious climate goals.

To deliver on that Vision, the State commits to investing the following:

- **People** - Create a workforce at all levels that is representative of the communities we serve by improving our recruitment, hiring, contracting, and leadership development policies and practices.
- **Programs & Projects** - Meaningfully engage communities most impacted by structural racism in the creation and implementation of the programs and projects that impact their daily lives by creating more transparent, inclusive, and ongoing consultation and collaboration processes. We will achieve our equity commitments through an engagement process where everyone is treated with dignity and justice. We will reform programs, policies, and procedures based on this engagement to avoid harm to frontline and vulnerable communities. We will prioritize projects that improve access for and provide meaningful benefits to underserved communities.
- **Partnerships** - By leveraging transportation investments, we also commit to increasing pathways to opportunity for minority-owned and disadvantaged business enterprises, and for individuals who face systemic barriers to employment.
- **Planet** – We commit to combating the climate crisis and its disproportionate impact on frontline and vulnerable communities — such as Black and Indigenous peoples, communities of color, people experiencing homelessness, people with disabilities, and youth. We will change how we plan, design, build, and maintain our transportation investments to create a more resilient system that more equitably distributes the benefits and burdens to the current and future generations of Californians.

For Communities

The Vision is community-focused, recognizing the role high-quality transit service plays in supporting dynamic community life, economic and educational opportunities, and inclusive development.

Robust Service

More communities will be served by more trains, more often, offering more connectivity to more destinations. Trains will operate on pulse schedules, with timed connections, in balanced, bi-directional patterns serving off-peak travel more equitably and utilizing service investments more efficiently.

Dynamic Station Areas

Dynamic station areas enhance mobility and accessibility. Dynamic station areas provide opportunity through mixed uses, appropriate density, and a spectrum of housing, commercial, education, and recreation amenities. More trains and regularized frequencies, which local transit agencies can plan around, enhance stations as gateways to the statewide network. Improved service at stations can support more successful station areas and shape more effective first/last mile connections, more robust community amenities, and more efficient land use changes.

Sensitive Infrastructure

Highways require large amounts of land and right of way. In urbanized areas, this divides communities and is detrimental to safety, environmental justice, and equity. Shifting travel from the highway network to a zero-emission rail network decreases need for roadway expansion and community displacement, improves air quality (reducing particulate and NO2), and reduces noise[25] and light pollution.

25 Lercher, Peter. (2013). ROAD AND RAILWAY TRAFFIC NOISE EXPOSURE AND ITS EFFECTS ON HEALTH AND QUALITY OF LIFE. 10.13140/2.1.4897.8885.

For Passengers

The Vision is passenger-focused, recognizing the value that high frequency, timed connections, and integrated trip-planning and ticketing have in how (and how often) people utilize the network.

Access

Regularized service with connections by design and cross-platform transfers mean passengers not only have more access to the service, but more access to the whole network. Within a fully integrated network, passengers can travel between any origin and destination every hour of the day. Timed connections ensure short, seamless transfers; while higher frequency, all-day, bi-directional service patterns reduce risk of travel disruptions.

More people will have more opportunities to access more destinations; the rail network will be more reliable for more trips than just peak-hour work-based travel or occasional regional trips.

Mobility

More frequency and shorter connection times mean less time waiting for trains. Modern, zero-emissions equipment and better infrastructure maintenance means faster trains. Taken together, even without massive capital infrastructure investments, the integrated statewide network reduces trip times and makes more trips auto-competitive, increasing ridership and mode shift.

More people will be able to reach their destinations more quickly; the rail network will be more competitive for more trips than just peak-hour work-based travel or occasional regional trips.

For Freight Shippers and Customers

The Vision is holistic; a framework for partnerships between the freight railroads and the State, consistent with the 'California Sustainable Freight Action Plan'[26]. Most of the rail network is privately owned by freight operators, representing a critical constituency for pursuing State policy goals for service improvements and network integration / service expansion.

Access

The Vision recognizes the importance of ports, intermodal facilities, and regional short-lines in ensuring access to the freight network. Collaborative planning approaches with freight railroads, industry groups, port authorities, and local agencies that prioritize freight access to the rail network builds constituencies for shared investments and helps divert freight traffic away from highways and onto the rail network.

Capacity

The Vision seeks to establish a common understanding and marketplace for capacity on the freight network. By planning collaboratively and investing in modern signal and operating practices, capacity on the rail network can be used more efficiently, allowing for increased frequencies within existing rights of way.

For Partner Agencies

While the Vision is articulated by the State, it will be implemented by local and regional planning, operating, and funding agencies. As such, Caltrans will provide critical, on-going support to partners to empower decision making, develop specific implementation plans, and follow-through on project delivery.

Strategic Guidance

This Vision sets clear strategic planning goals for policy supports, design principles, service frequencies, connectivity, and implementation. To fully integrate the statewide rail network, a broad constituency of stakeholders will plan, design, fund, and implement a dynamic, iterative set of service improvements, operating supports, and infrastructure investments. The State will expect to work collaboratively with stakeholders to align implementation planning to the Vision and reflect progress through regional and local plans, capital grant applications, and awards.

Technical Support

The Vision provides a documentable, reproducible set of technical assumptions for future service goals, operating plans, equipment parameters, and infrastructure interventions. Caltrans will provide technical resources, digital models, and technical expertise in interpreting, analyzing, and further iterating detailed technical work.

26 https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/main-document-final-07272016v2.pdf

2.2 The Need for Strategic Planning

Decisions required to manage, enhance, and expand the public transport network are complex. Decision-making involves large groups of stakeholders, consequential social equity considerations, and is time- and resource- intensive. Public agencies must navigate a range of technical questions supporting service planning, environmental impacts analyses, civil engineering, project development, funding strategy, and, ultimately, project delivery and revenue service operations.

California has ambitious equity, environmental, and economic goals. Current project delivery timelines and capital costs, particularly when compared to international peers, are out of line with achieving the State's ambitions. Service network improvements take too long to implement and cost too much to deliver. While there are many challenges to reducing project costs and speeding implementation timelines, the planning phase is an opportunity to reduce complexity and drive better outcomes in public transportation service and infrastructure investment.

Effective strategic planning requires agency staff, executives, and boards to be empowered through transparent, reproducible analyses scaled to the level of detail and specificity appropriate to the decision in question. Given the interconnected nature of the State's transport network and the overlapping responsibilities of funding and operating agencies, clear documentation and coordination of process, parameters, and recommendations is critical to working across multiple stakeholder groups, jurisdictions, and planning horizon years.

Conversely, a lack of transparency or reproducibility creates opaque processes that are difficult to understand, scale, or ultimately deliver. Overinvestment in detail or unnecessary specificity delays timelines, creates confusion, and introduces false precision. Effective strategic planning empowers planners to clearly understand the question at hand, collect the data and analysis needed to answer that question, and ultimately articulate recommendations, coordinate with partners, and deliver on implementation.

2.2.1 Strategic Planning and Public Engagement

Engagement is most effective when it demonstrates respect for stakeholders. Effective engagement must respect stakeholders' values, their intelligence, and their time; providing meaningful opportunities to understand critical issues and provide actionable feedback.

That respect demands a robust technical process that provides a platform on which stakeholders can understand tradeoffs, develop informed opinions about options, and ask relevant critical questions. The methodology described for Service-led Strategic Planning is focused on the technical aspects of transportation operations required for delivering future service. Service-led Strategic Planning provides a platform for respectful, meaningful engagement.

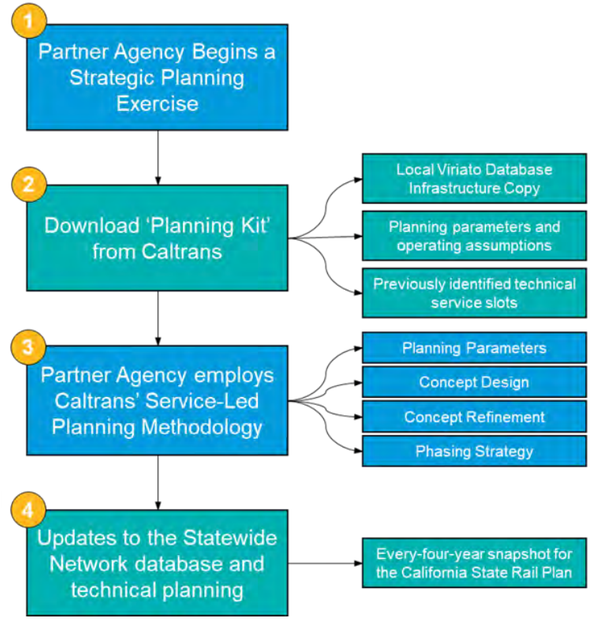
The planning process begins by identifying planning parameters and service goals as inputs to the process. Caltrans depends on its local and regional partners to bring a robust understanding of the needs of the communities they serve, particularly for priority populations and communities of color. Identified planning parameters and service goals reflect the policy aims of local agencies, informed by concerns, needs, and desires of their communities.

The outputs of the process (i.e., technical service plans, clear identification of infrastructure if necessary, and phased implementation strategies) then provide the local agencies with a wealth of resources to articulate the goals, implications, and tradeoffs involved in future planning decisions. As the methodology is inherently iterative by design, Caltrans expects a robust on-going conversation with stakeholders and communities as plans are developed, refined, and implemented over time.

2.2.2 Service Led Strategic Planning: Methodology & Process

Since 2015, Caltrans has been developing its 'Service-Led Planning Methodology', identifying the processes and technical resources required to support the methodology, and iterating refinement in practice with stakeholders. The result is a standardized process and set of expectations for Caltrans to structure planning exercises and technical analysis both internally and with stakeholders.

Going forward, Caltrans will expect stakeholders utilize ***Service-Led Strategic Planning*** to develop future service plans and identify capital investment needs. Grant awards, phased implementation priorities, and strategic recommendations will require articulation of a given service improvement or infrastructure investment utilizing the methodology. Caltrans' Division of Rail and Mass Transportation (DRMT) will provide resources, training, and ongoing engagement with stakeholders to implement the ***Service-led Strategic Planning*** methodology.



Service Led Planning

Service planning, as opposed to infrastructure planning or operations planning, is primarily concerned with provision of the transit service itself; what markets are served, how frequent that service is, what connections are provided, how much capacity is offered, and what trip times can be delivered. Service-led planning focuses on the customer, rather than on the operator or on the infrastructure developer. Only once a transit service concept is developed is it appropriate to design operations, analyze technology or equipment capable of delivering operations, or identify infrastructure necessary to support operations.

Service-led planning empowers planners to understand required operational changes and infrastructure investment and articulate tradeoffs in terms of their relative utility for customers. This process provides the necessary context to large scale projects and offers a clear, documentable, and reproducible reference for funding applications, stakeholder coordination, and project development progress.

The *Service-Led Planning Methodology* utilizes technical tools appropriate to the resources and timelines required to develop analysis, operating plans, and recommendations to further implementation planning and strategic decision making. Typical outputs include stringline diagrams, identifying technical service slots and corridor-level capacity constraints, customer timetables, identify customer-facing service offered with trip times, frequencies, and connection times, and netgraphs, demonstrating broader network connectivity and integration and operating plans.

Though Caltrans's Service-Led Planning methodology is a technical planning process that occurs between Caltrans and Agency partners, it is designed to be customer-centric, fully transparent, and reproducible. Caltrans documents and provides consistent inputs and a clear structure for partners to work through to develop meaningful results. The Coordinated process produces clear understanding of opportunities, constraints, trade-offs, and implications for improving service within a network. Caltrans documents outputs and coordinates strategic recommendations. This process is intended to empower decisions to advance strategic planning, enhance stakeholder coordination, and implement service improvements.

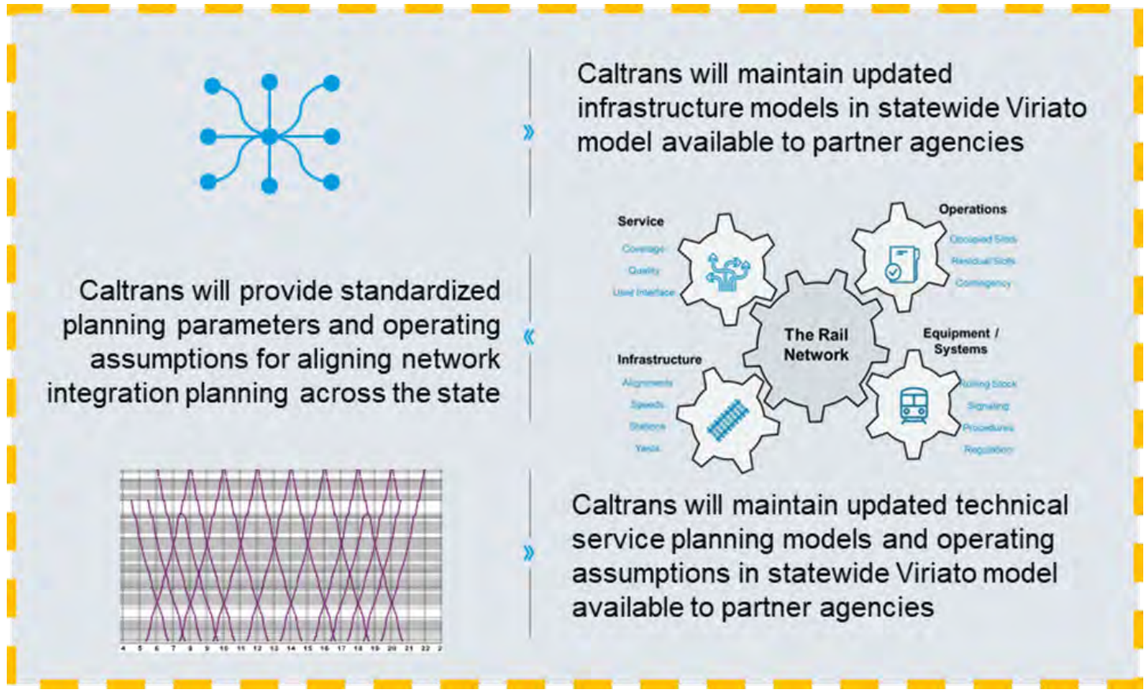
Step 1 Initiating Analysis

Planning exercises can be initiated either by Caltrans, an operating or funding agency, or other stakeholders. Relevant questions for analysis can be identified from goals in the Rail Plan for implementing service improvements through the phased implementation strategy or generated by local advocacy or service goals.

Once the decision to begin a planning exercise is taken, Caltrans and relevant stakeholder agencies will need to coordinate to confirm shared assumptions and technical parameters.

Step 2 A Foundation for Shared Assumptions

Caltrans has developed a statewide infrastructure model utilizing Viriato software. This model contains current and future infrastructure assumptions and technical service slots identified across various planning and service delivery scenarios. Caltrans will continue to refine and update this database over time such that it always represents the State's latest understanding of infrastructure availability, service and operating parameters, and technical service slots.



Caltrans will provide stakeholders with local, study area specific copy of the database and service slot assumptions from which to perform technical planning analysis. These resources will be provided as part of a 'Planning Kit' at the outset of an analysis exercise. Utilizing the Planning Kit is crucial to ensure multi-stakeholder planning work carries similar assumptions and constraints into analysis, as a shared foundation for recommendations.

Step 3 Deploying the Service Led Strategic Planning Methodology

The methodology itself works through four discrete phases of (1) identifying and confirming planning parameters for service goals, operations, and infrastructure considerations, (2) performing initial concept design to develop service concepts that achieve service goals in various ways, (3) concept refinement, where operational tradeoffs analyses, market analysis, and high-level feasibility are layered into an increasingly robust understanding and recommendations for service delivery, and (4) structuring those recommendations into a phased implementation strategy that aligns to expectations for market maturation, funding capacity, and project delivery.

Step 4 Capturing Recommendations

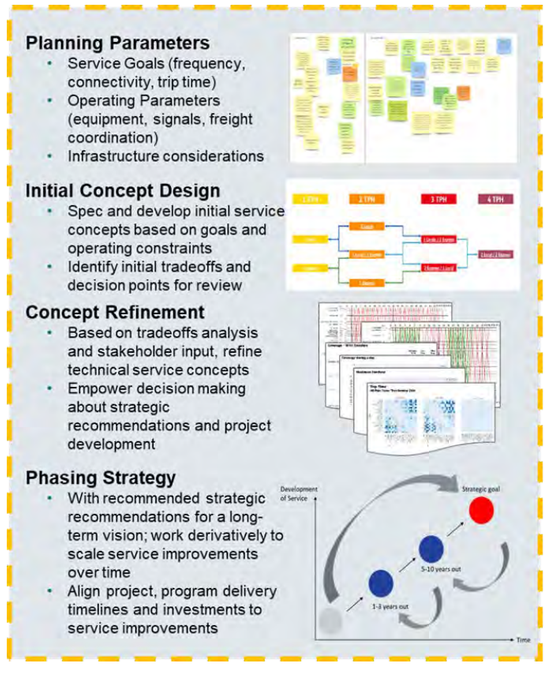
Crucially, resulting recommendations must be transparent, reproducible, and documented through the methodology. It must be clear how any given recommendations are the result of a given set of goals, parameters, assumptions, refinement, and phasing strategy. Those recommendations can then be documented and included in Caltrans' broader understanding of integrated service planning and technical analysis guiding State strategy and investments.

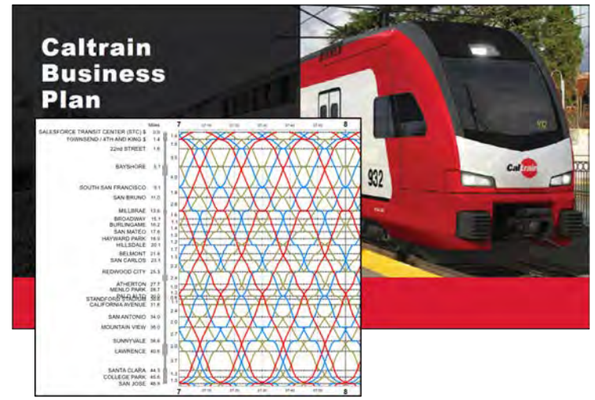
Recommendations are presented in a service-focused, operator-agnostic format. Customers, communities, and members of the public are engaged on these specific service planning outputs—as well as the rest of the Rail Plan, during the public outreach phase, detailed in Appendix 8.

Implementation Example: Caltrain Business Plan

In preparing the 2018 State Rail Plan, service and operations planning analysis across partner agencies including Caltrain and CHSRA identified minimum strategic service goals of at least half-hourly frequencies across a spectrum of high-speed, express, and local services on the peninsula. The 2018 Rail Plan did not specify specific operators, stopping patterns, detailed operating plans, or specific capital investments to deliver these strategic goals.

In the interim, Caltrain published the *Caltrain Business Plan* which developed technical service slots, conceptual operating plans, and phasing to guide investment and growth in the corridor up 12 trains per hour (4 high speed, 4 regional express, and 4 local services). This is also updated in the California High-Speed Rail Authority's 2020 Business Plan. Such analysis fed directly into Caltrans' statewide digital operations and infrastructure model – providing a blueprint for network operations in the megaregion and operating parameters for partner agencies to design connecting services. This technical analysis forms a basis of understanding for future state-funded planning studies and capital grants.





2.3 Host Railroad Coordination

In California, most passenger rail service is operated on infrastructure owned by freight railroads (or 'host railroads'). Freight railroad owners' incentive and duty to their shareholders is to preserve and grow their freight business. They do this by improving efficiency and preserving/building network capacity to accommodate growing freight traffic. Passenger rail service must not negatively impact the core freight business or infringe on future freight operations.

In technical service and operations planning, Caltrans considers the potential impacts of the planned passenger rail service improvements on railroad capacity, and access to yards and customers. Infrastructure investments necessary for increased passenger train volumes will also add capacity and flexibility to freight operations. Caltrans' articulation of future service goals and implementation strategy, paired with increased use of technical planning tools, provides a technical foundation and venue for strategic collaboration in implementation planning.

The State's goal is to enable continued, market responsive growth in goods movement by freight rail, while providing for increased passenger capacity. This will be achieved through early and continuous dialogue with the freight railroad partners, and progressive identification of shared opportunities. In some cases, ensuring capacity for passenger and freight rail operations will be realized through development of a shared track infrastructure used by both freight and passenger trains. In other cases, ensuring capacity for freight will involve the development of largely dedicated track for passenger and freight trains in a shared right of-way, while retaining the ability to share track under certain conditions; or the development of separate freight and passenger infrastructure.

Since 2018, the State has supported to several 'freight pathing studies', in collaboration with or led by host railroads, to optimize infrastructure and provide more freight and passenger slots with targeted improvements.

Where freight and passenger services share a corridor, opportunities exist to expand or reorganize agreements for additional capacity for passenger service. While the solutions will be context-specific, the State's strategic leadership in coordinating service planning and supporting detailed technical analyses will continue to facilitate increased dialogue with freight partners.

A detailed description of the proposed freight rail improvements and investments is included in Appendix 6.3 – 6.9, and host railroad coordination efforts are further discussed in Chapter 4.

2.3.1 Positive Train Control

On December 29, 2020, FRA announced that the Positive Train Control (PTC)[27] technology is in operation on all 57,536 required freight and passenger railroad route miles. Additionally, the railroads have achieved full interoperability between host and tenant railroads operating on PTC-governed main lines. Some passenger rail operators, like Metrolink, have led the way with PTC installation; Metrolink has become the first commuter rail operator in the nation to implement the advanced safety technologies. SMART became the first rail line in the United States to open with a fully outfitted PTC system.

2.4 State Policy Initiatives

To address California's intersecting equity, economic, and environmental challenges, the State is taking executive and legislative policy action to set clear requirements and empower decision making for local and regional partners. Caltrans recognizes the climate emergency and transportation's role in fighting that emergency; requiring massive mode shift away from highways and regional air travel to a modern, zero-emission rail network to serve statewide travel markets as well as investing in climate-resilient infrastructure and equipment.

Governor Gavin Newsom has signed two executive orders that set clear expectations for action the State will take to achieve policy goals through the transportation system:

- EO N-19-19 empowers CalSTA to leverage more than $5 billion in discretionary state transportation funds to reduce GHG emissions in the transportation sector and adapt to climate change.
- EO N-79-20 moves the transportation sector toward a zero-emission future by requiring all new cars sold in the state to be zero-emission by 2035 and all commercial trucks sold to be zero-emission by 2045. EO N-79-20 also reiterates the message of EO N-19-19 and emphasizes the urgency of CalSTA's implementation efforts.

The Rail Plan leverages an expanding funding landscape, including funding provided by Senate Bill (SB) 1 and California's Cap-and-Trade Program[28], extended to at least 2030. EO) N-19-19 empowers CalSTA to leverage more than $5 billion in annual state transportation spending for construction, operations, and maintenance to help reverse the trend of increased fuel consumption and reduce greenhouse gas emissions[29]

California's *Climate Change Scoping Plan*[30] is the State's strategy for achieving the 2030 greenhouse gas target and other long-term climate goals. CARB is responsible for developing and updating the Scoping Plan, in coordination with the Governor's Office, many state agencies, and stakeholders that include the public and the Environmental Justice Advisory Committee.

To reduce emissions from transportation, the 2017 Scoping Plan update calls for significant reductions in VMT among other key strategies. A recent report CARB completed, pursuant to SB 150, evaluated the state's primary measure to reduce VMT — the Sustainable Communities and Climate Protection Program (also known as SB 375) — revealed that VMT is increasing, not decreasing as expected. The report recommends multiple actions, including better aligning transportation funding programs to support implementation of projects consistent with the Sustainable Communities Strategies adopted pursuant to SB 375.

California will not meet its environmental goals relying solely on a shift in transportation technologies (e.g., electric cars). Further, changing motive power does nothing to address equity or economic development and may even exacerbate problems if zero-emissions cars lead to more single-occupancy vehicle driving, more demand for highway capacity, and more resulting sprawl and dispersed land uses.

As an implementation step of executive and legislative action, the Rail Plan is one of seven mode-specific plans that implement State policies. Further policy goals are identified in CTP 2050, the SMF, and CAPTI. The Rail Plan articulates how goals will be achieved through the rail network.

2.4.1 CTP 2050 Coordination

CTP 2050 is a statutorily required long-range policy plan that provides a collective vision and a set of goals, policies, and recommendations to help guide transportation decisions and investments[31]. CTP 2050 is an umbrella plan and sets a policy framework to organize and guide the development of each subsequent modal plan, including the Rail Plan. The CTP does not contain projects, but policies and strategies required to close the gap between what the regional transportation plans (RTP) aim to achieve and how much more is required to meet 2050 goals.

CTP 2050 provides a unifying and foundational policy framework for making effective, transparent, and transformational transportation decisions, addresses the varied transportation needs of urban, suburban, rural, and Tribal communities; and emphasizes implementation and identifies a timeline, roles, and responsibilities for each plan recommendation.

CTP 2050's Vision:

"California's safe, resilient, and universally accessible transportation system supports vibrant communities, advances racial and economic justice, and improves public and environmental health."

As the Rail Plan is mode-specific, it supports CTP 2050 goals, providing specificity as relates to the rail network. Each of the key Rail Plan Network Principles, discussed in more detail in this chapter, offer a pragmatic and reproducible planning approach that achieves the Rail Plan Vision as well as directly advances each of the eight CTP 2050 goals.

27 Positive Train Control (PTC) systems are designed to prevent train-to-train collisions, over-speed derailments, incursions into established work zones, and movements of trains through switches left in the wrong position. (FRA)

28 https://ww2.arb.ca.gov/our-work/programs/cap-and-trade-program/about

29 Executive Department State of California, September 2019 CAP14-20190920102028

30 https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan

31 Caltrans has prepared the CTP 2050 pursuant to California Government Code Title 7 Division 1 Chapter 2.3 and is submitting this report to the California State Legislature in accordance with California Government Code Section 9795

PLAN BENEFITS

ACCESSIBILITY

Total VMT
-27%

Non-Auto Mode Share
+10% pts.

IMPROVED ACCESSIBILITY

Compared to the 2050 baseline, the CTP would reduce total vehicle miles traveled (VMT) by up to 27 percent. The plan would also support ***a shift toward more convenient and healthier travel options***, from 13 percent to 23 percent of all trips occurring by walking, biking, transit, or other non-auto modes by 2050.

EMISSIONS

GHG Emissions
-76%

REDUCED EMISSIONS

A significant reduction in GHG emissions is expected to occur from the implementation of EO-N79-20, which requires 100 percent zero-emission vehicle sales in California by 2035. The shift to a predominantly zero-emission vehicle fleet would result in reductions that surpass the state's legislative target of reducing GHG emissions to 80% below 1990 levels by 2050, while also leading to ***improved air quality, public health outcomes, and quality of life.***

ECONOMY

Jobs
+1.7%

GSP
+1.1%

Income
+1.1%

ECONOMIC GROWTH

Transportation improvements stimulate economic growth by creating jobs, improving access to jobs, goods, and services, and ensuring goods can move efficiently between businesses, consumers, and the global marketplace. These benefits occur because of reduced roadway delay, shifting local travel toward transit, walking, and biking, and shifting interregional travel away from cars, trucks, and airlines and toward passenger and freight rail. If implemented, the CTP 2050 recommendations could generate a ***half-million new jobs statewide, an additional $1 billion in gross state product, and an additional $33.3 billion in new income*** for California employees.

2.4.2 CAPTI Coordination

CAPTI provides a framework for aligning state transportation infrastructure investments with climate, health, and social equity goals, built on the foundation of the "fix-it-first" approach established in SB1. Transportation is changing and California's investments in transportation need to shape those changes. CalSTA and its departments are leading analysis, policy, and funding to evolve the multimodal statewide transportation network toward a platform for clean mobility. To succeed, rail and transit must address service gaps that result in poor or non-existent travel options at many times of the day.

Although California's transportation funding programs have different statutory direction and invest in various types of infrastructure, collectively they advance toward a vision. Achieving the vision outlined in CTP 2050 requires a range of investment strategies. CAPTI identifies guiding principles for investment will work to reduce Californians' dependence on driving, increase multimodal options for all communities, and equitably meet the state's climate goals. These programs focus on prioritizing projects that align with the following guiding principles, as applicable within their existing structure.

- Building toward an integrated, statewide rail and transit network
- Investing in networks of safe and accessible bicycle and pedestrian infrastructure
- Including investments in light, medium, and heavy-duty zero-emission vehicle (ZEV) infrastructure
- Making safety improvements to reduce fatalities and severe injuries of all users towards zero
- Assessing physical climate risk
- Promoting projects that do not significantly increase passenger vehicle travel
- Promoting compact infill development while protecting residents and businesses from displacement
- Developing a zero-emission freight transportation system
- Protecting natural and working lands

The CAPTI Investment Framework includes ongoing and needed changes to state transportation planning, project scoping, programming, and mitigation activities. CAPTI is a living document that will adapt, pivot, and modify approaches and actions, as needed. It provides a structure to monitor and evaluate progress of the transportation sector's efforts to align with state climate, health, and equity goals. Responsive to CAPTI, the Rail Plan provides the strategic outline for leveraging State and federal resources to deliver an integrated rail and transit network.

Smart Mobility Principles

Health and Safety: Design, operate, and manage the transportation system to reduce serious injuries and fatalities, promote active living, and lessen exposure to pollution.

Reliable Mobility: Manage, reduce, and avoid congestion by emphasizing multimodal options and network management through operational improvements and other strategies. Provide predictability and capacity increases focused on travel that supports economic productivity.

Environmental Stewardship: Protect and enhance the state's transportation system and its built and natural environment. Act to reduce the transportation system's emission of GHGs that contribute to global climate change.

Social Equity: Provide mobility for people who are economically, socially, or physically disadvantaged in order to support their full participation in society.Design and manage the transportation system in order to equitably distribute its benefits and burdens.

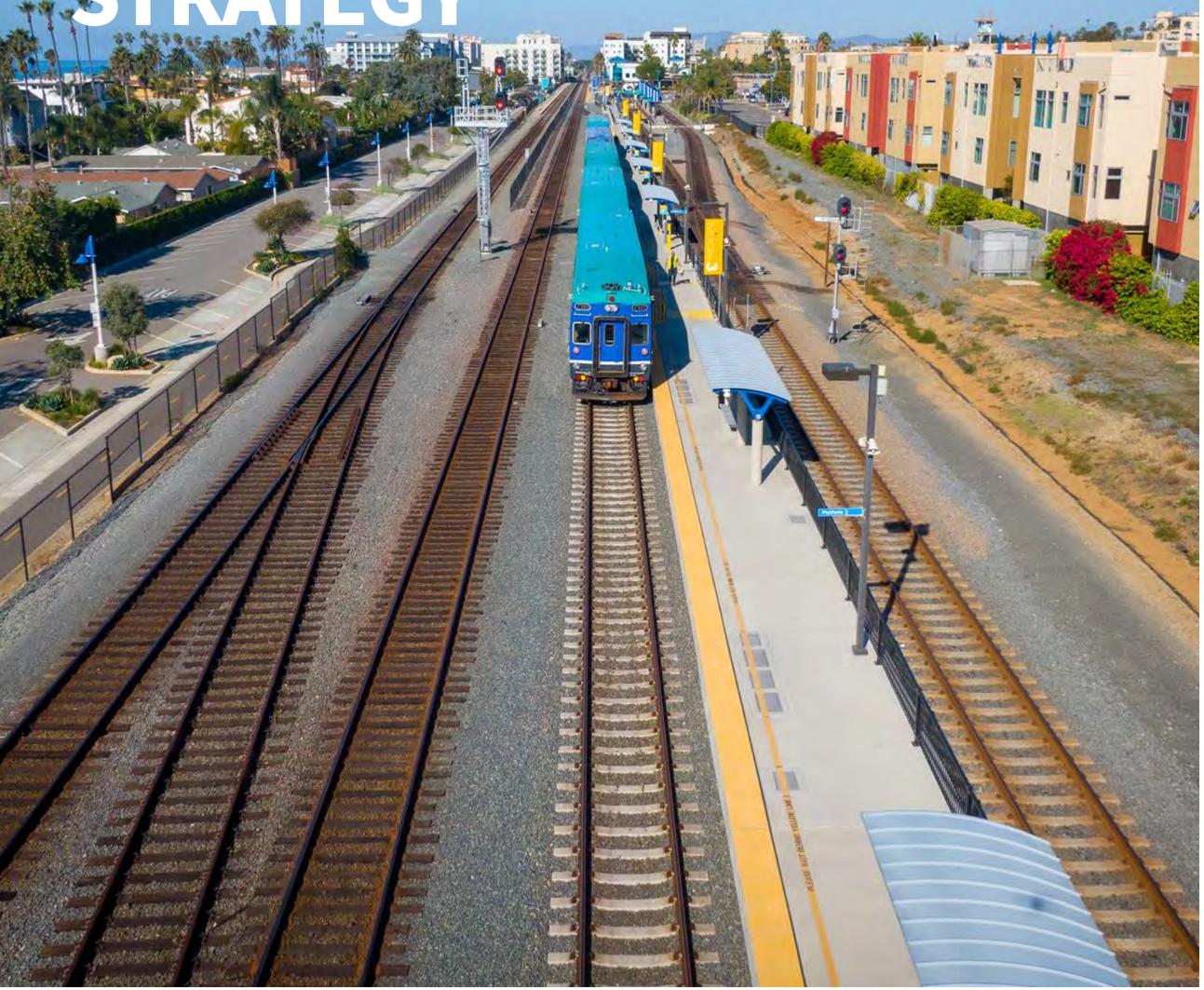
Robust Economy: Invest in transportation improvements – including operational improvements – that support the economic health of the state and local governments, the competitiveness of California's businesses, and the welfare of California residents.

Location Efficiency: Integrate transportation and land use in order to achieve high levels of non-motorized travel and transit use, reduced vehicle trip making, and shorter average trip length while providing a high level of accessibility.

Beneficial Technology: Use technology in the service of other smart mobility principles to increase transportation choices while respecting the other principles.

CHAPTER 3

PASSENGER NETWORK STRATEGY



The Passenger Network Strategy articulates service goals, phased implementation, and capital investments needed to achieve the Vision for a fully integrated statewide passenger network.

3.1 Evolving State Service and Connectivity Goals

Service goals describe planned frequencies, reflect trip times competitive with auto and air travel, and provide timed transfers by design at connection hubs. In some cases, but not all, connection hubs may require infrastructure investments to facilitate connectivity. Timed connections between services are critical to extending the reach of the statewide network, reducing trips times, increasing trip availability, and minimize operating and capital costs. All markets need not be served by direct service when timed connections can deliver similar trip times with higher frequency at a fraction of the cost.

Service goals are operator-neutral and strategic, rather than prescriptive—the Rail Plan does not determine specific operating and institutional responsibilities, which will be determined through implementation planning. Service goals can be achieved through a range of delivery options, with different types of services or capital investments.

3.1.1 Phasing and Planning Year Horizons

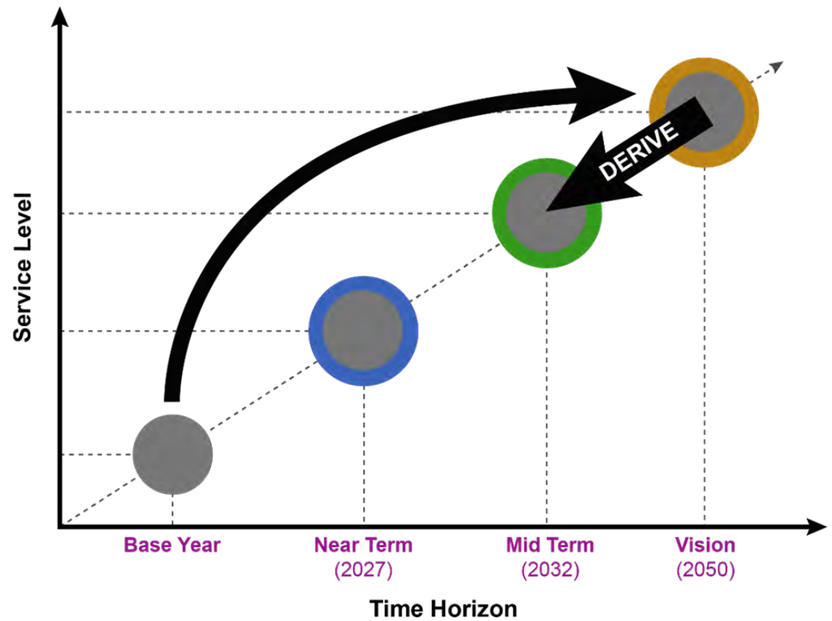
The Rail Plan's Vision for the future integrated statewide network is complex and resource intensive, delivered over decades by multiple agencies. The Rail Plan provides a strategic framework for service implementation planning, coordination between federal, State, and regional partners, and prioritization of capital improvements in phases tied to the near-, mid-, and long-term planning horizons.

Planning horizons described in the Rail Plan identify specific service planning and analysis needed to develop and integrate the network over time, responsive local and regional stakeholder needs. Planning horizons are not tied to a specific completion year of a given project. Some projects may be completed ahead of the horizon year; others may be near completed. Horizon years and corresponding plans serve as important markers and meet statutory planning requirements.

3.1.2 Local Transit Connectivity

Service goals assume local transit will continue operating, with planned improvements to provide necessary local connectivity. Where connection hubs have been identified on the network, the State will work with regional partners to co-locate all service types to enhance mobility and transfers.

For transit services not identified on the statewide network, connectivity to the rail network will be important for local mobility. Those decisions will be made by local agencies, with connectivity provided by an expanded statewide network. The State supports local connectivity as critical to providing a door-to-door platform for statewide mobility.



3.2 Passenger Network Design Principles

Policy goals for addressing equity, the environment, and the economy inform what the rail network aims to accomplish; network design principles inform the ***how*** as policy is translated to technical service planning and service operations.

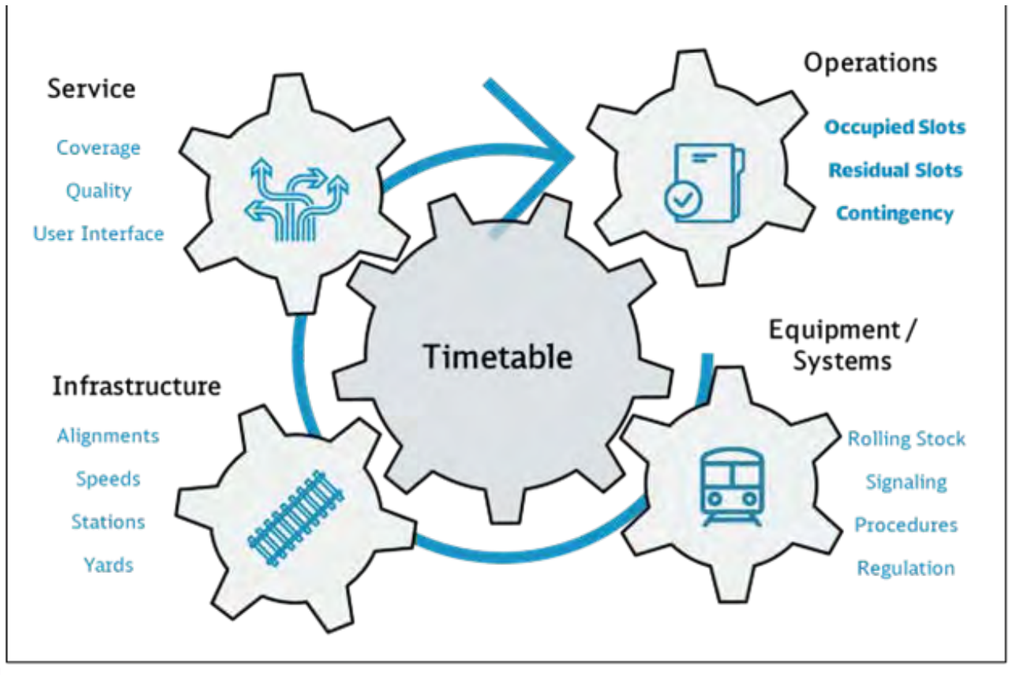
The State's Vision for a statewide integrated network begins its design process from the passenger's perspective. While the variables and components that make up a rail network are seemingly infinite, a passenger's perspective is framed through a customer timetable, or schedule. The timetable captures how often and when trains arrive at a station, how long journeys take, what connections are available between what services, and serves as a summary of what the network is, how it operates, and what value it offers passengers. The State's Vision is designed through a timetable for an integrated statewide network. By articulating goals and designing solutions through the timetable, it centers the passenger in every tradeoff analysis and recommendation.

The network covers corridors and regions across the State that are served by different agencies, different types of equipment, different infrastructure owners, different operating constraints, and different governance structures. Rather than tailor specific approaches to each, the Rail Plan identifies a standardized and simplified set of strategic design principles, based on international best practice in modern passenger rail operations and applicable statewide, to guide implementation planning from the outset.

These design principles include:

- Minimum standards for connectivity and frequency,
- coherence in fares and ticketing,
- a unifying approach to solve problems through better organization, better systems, and, when necessary, better infrastructure set an expectation for quality and utility for all users of the network.

Just as a user of the state highway system can expect consistent standards for highways throughout the state, a user of the rail network should be able to expect the same. The design principles allow a coherent, coordinated network to serve all Californians from San Ysidro to Redding. They will evolve in implementation planning and be refined by local priorities and stakeholder concerns; but ensure the whole of the network is greater than the sum of its parts.



Hour	Departures			
5				
6	01			
7	01	04	31	34
8	01	04	31	34
9	01	04	31	34
10	01	04		
11	01	04		
12	01	04		
13	01	04		
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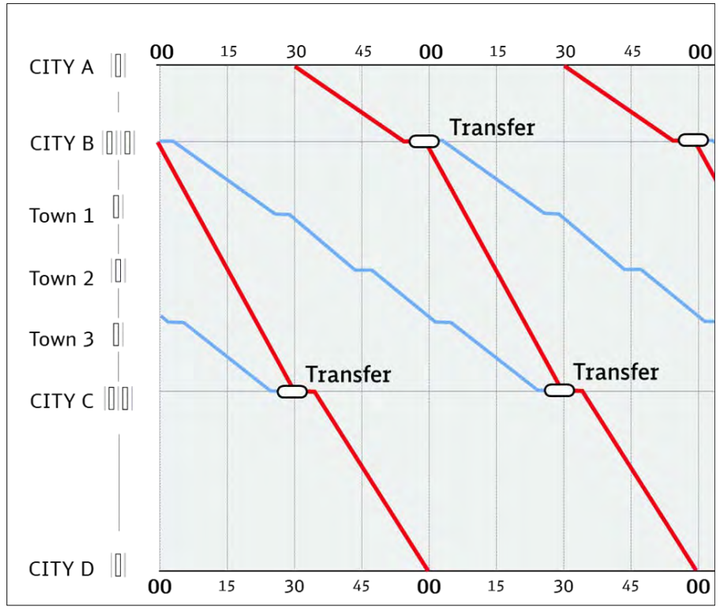
High Speed Service Reg Express Service



3.2.1 Pulse Scheduling

Network planning is based on pulse scheduling, which requires regular, uniform service patterns that repeat throughout the day on recurring time intervals. From the customer's perspective, it's simple and intuitive to understand when trains arrive without needing to constantly refer to a schedule because of irregular patterns. For operators, it standardizes the operating plan throughout the day, allowing for more efficient use of equipment, crew resources, and infrastructure.

Customer Schedules

In this example for a fictional station, high speed express trains depart at :01 after the hour and regional express trains depart at :04 after the hour. As market demands, additional service can be activated during peak hours, but aligning to the same pulse pattern, only offset by 30 minutes. A passenger can easily understand the schedule from the station and always know when trains are coming. The agency has a simplified operations plan to run throughout the day. Local transit agencies know when to time bus connections to and from the station.

If the policy goal were to provide up to hourly peak high speed and regional express service to this station, the timetable confirms the goal is achieved in this service concept with a pulse scheduling delivering regular service at the top of every hour throughout the service day.

Stringlines

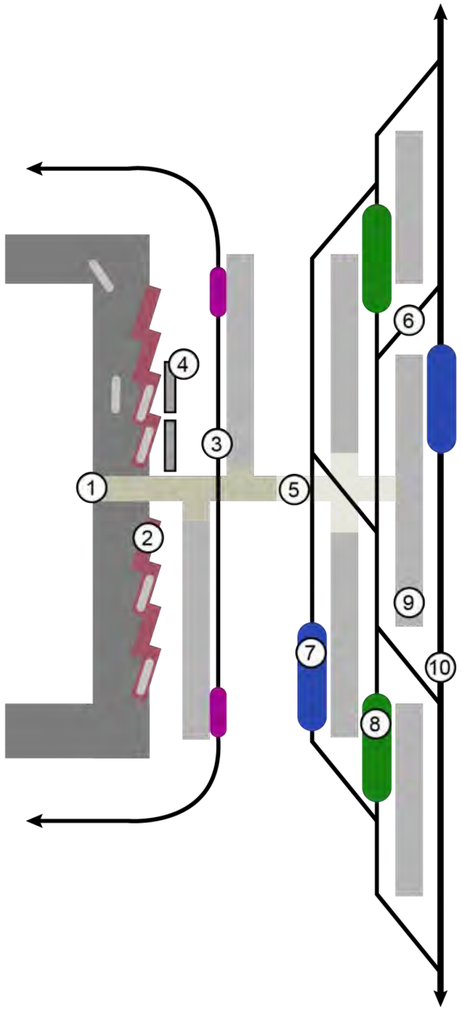
While a customer may understand the service a timetable, an operator utilizes an operating plan that visualizes service not just at station but how service moves through a network. For that, operators can use a visualize tool known as a 'stringline' diagram to chart how, when, and where trains move through the network.

Utilizing the stringline diagram, the operator can see how the red high-speed trains and the blue regional express trains move through the network. Distance is measured on the y-axis while time is measured on the x-axis. As the trains move through the network, the operator can ensure connections are being made at key nodes, the schedule is free of operating conflicts, and gain a high-level understanding of how well the infrastructure supports the operating plan.

3.2.2 Connections by Design

This timetable-based planning approach allows for timed transfers between services at hub stations where a transfer is required to complete a trip across the state, or to a location served by local transit. A repeating timetable allows for easy trip planning and seamless travel by ensuring that connections between trains can be made throughout the day, with minimal transfer times.

3.2.3 Connection Hubs



1. **Pedestrian Infrastructure:** Exclusive pedestrain crosswalks and walkways enable pedestrians to access stations and make multimodal connections.
2. **Bus Bays:** Bus bays provide easy bus-rail connections for local, regional, and intercity bus services. Bus and rail schedules must be integrated to ensure seamless connections.
3. **Local Rail:** Local rail transit connections extend the reach of intercity and regional rail and increase accessibility. Local rail transit should be ***high-frequency*** and be easy to reach from the rail platforms.
4. **Bicycle Parking:** Bike rack and locker spaces enable simple bicycle station access. Facilities must be protected and secure.
5. **Pedestrian Tunnels:** Pedestrian tunnels provide access to train platforms while maintaining grade separation and enhancing safety.
6. **Crossover Track:** Station crossover tracks offer greater operational flexibility and provide greater capacity.
7. **Intercity Rail:** Intercity rail provides statewide connections and runs on a regularized ***pulse frequency*** to seamlessly connect with regional rail, local rail, and bus services.
8. **Regional Rail:** Regional rail provides regional connections and runs on a regularized ***pulse frequency*** to seamlessly connect with intercity rail, local rail, and bus services.
9. **Platform:** Station platforms should be sheltered and offer amenities such as comfortable seating, real-time arrival information, and adequate lighting.
10. **Main Line:** The main line rail track connects the station to other stations on the network. It also allows freight rail to pass the station without interfering with passenger operations.

Exhibit 3.1: Diagram of “Pulsed” Service and Station Integration

3.2.4 Minimizing Infrastructure

By not requiring a unique train for every travel market, pulse scheduling allows the network to serve more destinations through connections, as airlines use hubs to allow smaller communities more frequent access to more destinations at a lower cost. A pulse schedule allows cost savings by reducing the set of infrastructure improvements needed to only those necessary to operate the repeating timetable. As such, the capacity of a single-track railroad can be maximized before additional track infrastructure is needed. The Rail Plan has identified a 30-minute or 60-minute service frequency (or headway) across most portions of the state by 2050.

3.3 Geographic Service Areas and Organizational Framework

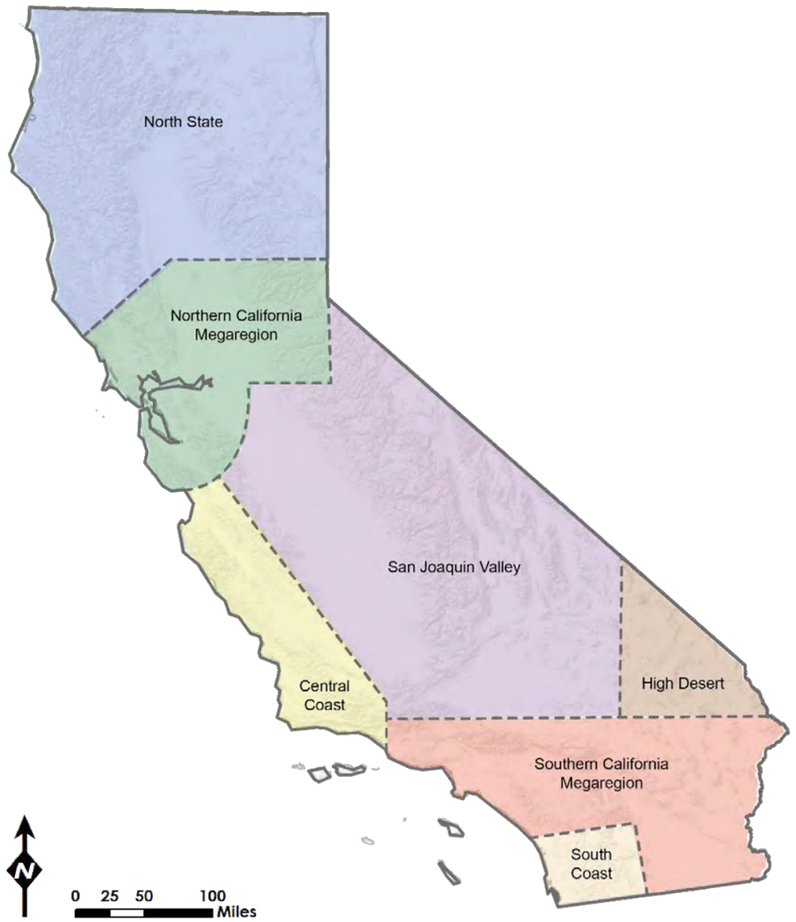
The Rail Plan defines seven geographic service areas. These service areas were developed to guide planning, based on market analysis, ridership forecasts, and corridor-based planning principles. These service areas do not represent political boundaries or specific constituencies, but were refined as a framework for understanding, discussing, and organizing future service.

HSR and intercity services, as well as several regional services, will operate across more than one service area and may be described in both where relevant. Since the 2018 Rail Plan, the service areas further refined with a greater focus on megaregions.

These areas are:

Region	Description
North State	This region includes all counties north of Sacramento including those along the coast as well as improvements between Sacramento and Redding.
Northern California Megaregion	This region includes the state rail network between Sacramento and Oakland/San Francisco, as well as the north San Francisco Bay Area rail network in Marin, Sonoma, Napa, and Solano Counties. The rail network connecting the Stockton area to the San Francisco Bay Area at Martinez is also included in this geographic region. Connections to points east of Sacramento, such as Reno and Carson City, as well as the Central Coast rail network between San Jose and Gilroy are also included.
Central Coast	This region includes the rail connection between Gilroy and San Luis Obispo, as well as between San Luis Obispo and Ventura
San Joaquin Valley	This region includes the state rail network in the San Joaquin Valley south of Stockton as well as improvements between Palmdale and Bakersfield.
High Desert	This region encompasses the HSR route being privately developed for service between Las Vegas and Apple Valley.
Southern California Megaregion	This region encompasses the high-capacity rail network being developed for different services between Burbank and Anaheim through the Los Angeles Area and Los Angeles Union Station (LAUS). It also includes regional rail connections from LAUS to Ventura, Laguna Niguel, Santa Clarita, and the Inland Empire.
South Coast	This region includes the rail corridor between Laguna Niguel and San Diego, as well as regional rail services in the County of San Diego.

Exhibit 3.3: Rail Plan Service Regions



3.4 Planning Year Horizons

The three planning horizons (Near-, Mid-, and Long-Term) provide a framework for service levels, project development timelines, and policy goals, as well as specific capital investments. While they are associated with given years, it is not the intent to say all services and capital projects identified for a given planning horizon become available precisely in that year and no sooner. Rather, the intent to frame the path in which services scale toward the long-term Vision

A comprehensive capital program for each horizon year can be found in **Appendix 6.3 – 6.5**.

3.4.1 Near-Term (~ +/- 5 year) Investments

Strategic Goal

Near-term goals are to deliver the committed, funded improvements planned across the state (mostly expected to be complete by ~2027), which leverage existing assets and prioritize maximizing use of existing infrastructure.

The 2027 services goals and Capital Program are focused on identifying the planned, committed, or otherwise under-construction projects that will ultimately serve the network identified in the 2050 Vision. Goals for the 2027 Capital Programs and projects list, which will potentially be achieved earlier than 2027, include relevant state-level projects that are already scoped, scheduled, and budgeted; and establish existing conditions for future capital cost analysis. Although capital projects identified for 2027 have specific operators and modes associated with the service, the subsequent time horizons are intended to be mode—and operator—neutral and assign costs to service types rather than any specific entity or jurisdiction. Intercity Rail improvements for 2027 include capacity expansion and speed improvements to existing intercity rail services; grade separations and other safety improvements; and shared freight corridor improvements, like new sidings and double-tracking sections and making key investments in regional networks to prepare for integration with HSR.

Tactical Goal

There are several passenger rail improvements identified in the 2027 Capital Program, primarily aimed at improving and integrating existing service. These include the completion of the Caltrain electrification project on the San Francisco Peninsula, the completion of the Valley Rail project in the Central Valley, the extension of SMART to Windsor, Healdsburg and Cloverdale, and the initial implementation of the Southern California Optimized Rail Expansion (SCORE) program.

3.4.2 Mid-Term (~2032 ~10 Years) Investments

Strategic Goal

The 2032 Capital Program and service goals are focused on maximizing the potential of existing infrastructure, making full use of available passenger rail capacity, and making key investments in regional networks to prepare for integration with HSR. In identifying service goals for 2032, every rail network in the state was carefully examined to identify latent capacity for additional service, while assessing it against the ridership potential of the corridor.

Tactical Goal

Goals for the 2032 Capital Program include identifying achievable mid-term improvements that affordably increase opportunities for additional long-distance passenger rail trips per day, while strengthening an integrated rail network that leverages HSR investments and enables rapid statewide travel by rail, creating more options for automobile dependent communities.

3.4.3 Long-Term (~2050) Investments

Strategic Goal

The long- term capital program is focused on completion of the full build-out of regional networks to integrate the statewide system and HSR with unified service throughout the state. The program represents the long-term investments needed to achieve the 2050 passenger rail service goals described in this chapter. These include incremental projects built to expand and connect previously described services in the near- and mid-term programs; wider-scale investments to modernize services through electrification and connectivity improvements at station hubs; and large infrastructure projects like HSR expansion, intermodal hubs, a new Transbay tube, and urban rail transit investments.

Tactical Goal

HSR expansion is of key importance to the long-term capital program and includes electrified blended service from Sacramento to Merced and through the Inland Empire, as well as HSR service to San Diego. Intercity rail improvements include electrification of express services in both Northern and Southern California, complementing HSR in network hubs with pulsed service schedules to achieve the Vision.

Future service goals are often dependent on significant infrastructure investments, including new mega projects:

- Future rail service in the Bay Area is highly dependent on a second Transbay crossing managed and led through the Link21 Program. The zero emission and integrated rail corridor between the San Francisco Peninsula and Sacramento identified in the Vision would not be possible without a second bay crossing. Beyond the crossing infrastructure itself, the Link21 Program is working to modernize and transform the Northern California megaregion through an integrated, safe, equitable passenger rail system that improves access and mobility and allows for new and expanded economic opportunities.

- Major service goals in Southern California are dependent on the construction of new run-through tracks at Los Angeles Union Station (LAUS), which are expected to be completed in the near term. LAUS's current track configuration does not have the capacity to handle the levels of service planned for in the 2050 vision.

3.5 2027 Near-Term Plan Goals

In the short-term, the Rail Plan's primary statewide goal is to integrate the state rail and intercity bus systems to run on a consistent pulse schedule by 2027. This will enable more connections to be made leading to a more seamless travel experience. Furthermore, integrated ticketing and fare coordination will be implemented across the statewide network by 2027.

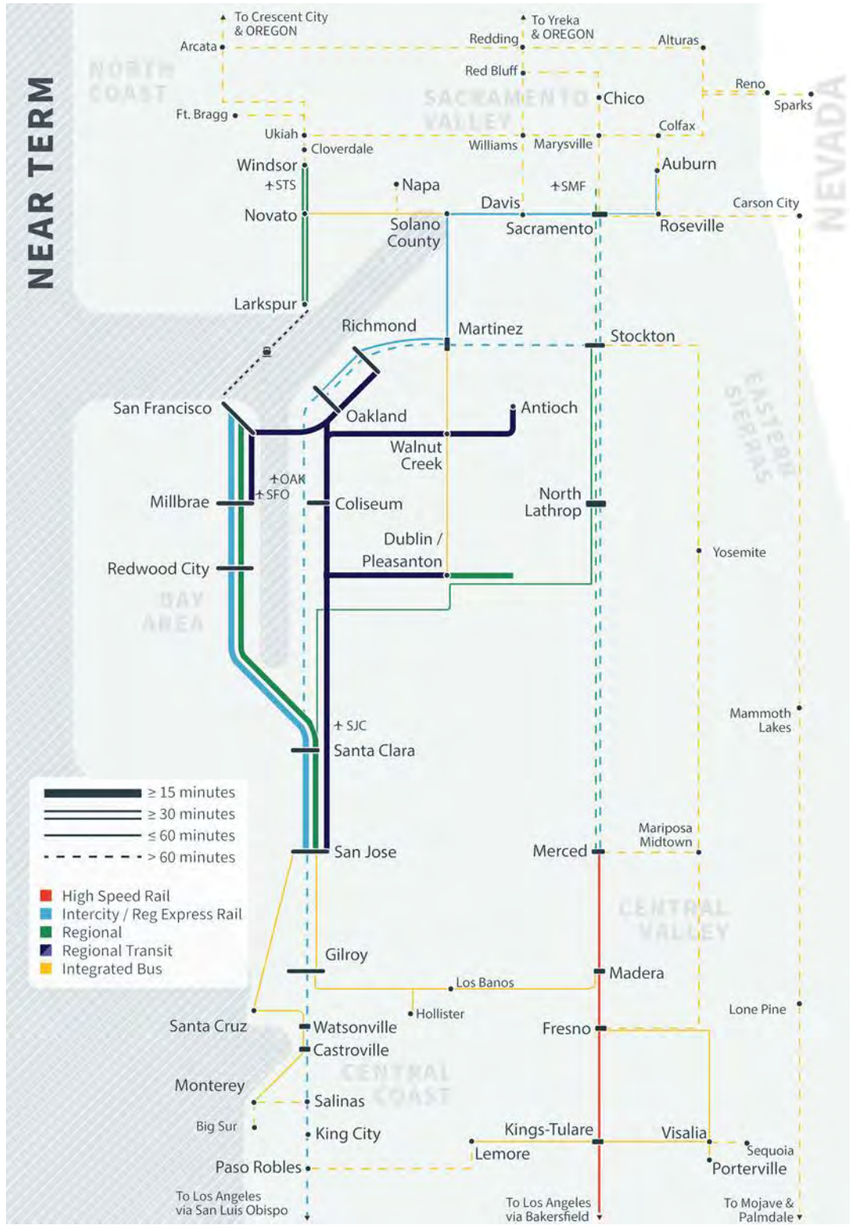


Exhibit X.X: Near-Term Northern California Service Map

3.5.1 North Coast Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
North State	Arcata	Cloverdale	Every-four-hours	Integrated Bus	San Jose/San Francisco Bay Area-North Coast

3.5.2 North Bay Rail Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Northern California Megaregion	Cloverdale	Larkspur	Half-hourly	Regional Rail / Integrated Bus	San Jose/San Francisco Bay Area-North Coast
	Napa	Vallejo	-	-	
	Napa	Suisun-Fairfield	Hourly	Integrated Bus	
	Novato	Suisun-Fairfield	Hourly	Integrated Bus	

3.5.3 Sacramento Valley Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Northern California Megaregion	Redding	Sacramento	Every-two-hours	Integrated Bus	Sacramento Valley-Oregon Border
	Chico	Sacramento	Every-two-hours	Integrated Bus	

3.5.4 East Sierra Corridor (*Seasonal)

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Northern California Megaregion	Reno, NV*	Roseville*	Every-two-hours	Integrated Bus	Sacramento Valley-Oregon Border
	Carson City, NV	Sacramento	Every-two-hours	Integrated Bus	

3.5.5 Sacramento to San Francisco Bay Area Corridor

Region	Sub-Corridor/Segment		Service	Service Mode	Associated ITSP Corridor
	Node	Node			
Northern California Megaregion	Sacramento	Richmond	Hourly	Intercity/Regional Express	San Jose/ San Francisco Bay Area-Sacramento-Northern Nevada
	Roseville	Sacramento	Every-two-hours	Intercity/Regional Express	
	Suisun-Fairfield	Richmond	Hourly	Intercity/Regional Express	
	Richmond	San Jose (via SF)	-	-	
	Richmond	San Jose (via East Bay)	Every-two-hours	Intercity/Regional Express	
	Tri-Valley Hub	Martinez	Hourly	Integrated Bus	

3.5.6 San Francisco Peninsula Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Northern California Megaregion	San Francisco	San Jose	Every-15-min.	Intercity/Regional Express Regional Rail	Central Coast-San Jose/San Francisco Bay Area
	Union City	Redwood City	Every-15-min.	Regional Transit	

Key Connections:

- Connections to local and regional transit in Sacramento, Chico, and Redding
- Connection to state network at San Jose Diridon to/from the San Francisco Peninsula
- Ferry connection between regional rail service in Larkspur and San Francisco
- Transit connection between the East Bay and San Francisco Peninsula via the Dumbarton Corridor
- SMART rail service extension to Windsor

Project Development Goals

- Initiate Valley Rail service to Natomas to establish regular passenger rail connections north of Sacramento
- SMART extensions to Healdsburg and Cloverdale
- Sacramento to Roseville Third Main Track Project
- Completion of the South Bay Connect Project
- Sacramento Midtown Station is planned to open for service by 2023/2024
- Development of the Martinez station connectivity project to turn Stockton-Martinez trains
- Development of new right-of-way to support a high-frequency regional rail connection between the Dublin/Pleasanton BART Station in the Tri-Valley and the Stockton area
- Completion of the Caltrain modernization project, including full corridor electrification and grade crossing improvements
- Development of HSR Valley-to-Valley projects, including the downtown extension project to Salesforce Transit Center
- Finalize service planning, design and operational analysis for Union City Hub
- Solano County hub Phase 2 - complete project study report

Planning Goals

- Assist communities throughout the North State in better connecting transit systems to rail and enhancing station area functions Complete LINK-21 Study, with recommendations for East Bay corridor development and potential transbay main-line operations
- Based on recommendations from coordinated megaregional planning, develop the ***Sacramento Corridor Strategic Service Development Plan***
- Based on recommendations from coordinated megaregional planning, plan alignment between Richmond and a Solano County hub, including selection of an alignment, motive power needs, and determination of express and local service needs on the corridor
- Based on recommendations from coordinated megaregional planning, develop ***East Bay Strategic Service Development Plan*** to determine future service frequencies between Oakland and San Jose on the East Bay, considering BART extension to San Jose Diridon and potential for future through service onto the peninsula for intercity or high-speed trains via a second Transbay tube
- Plan for Alviso corridor preservation and enhancement as necessary to support passenger service goals
- Develop the ***Sacramento Hub Study*** to identify potential and strategic service tradeoffs for a Sacramento Subdivision/Martinez Subdivision connection and/or potential transfer station at CP Haggin
- Study expansion of intercity rail service east of Roseville
- Plan for Dumbarton corridor preservation and enhancement as necessary to support passenger service goals

- Perform implementation planning for new rail connections between Marin and Napa counties and the state network at a Solano County hub
- Plan for hourly regional east-west rail service between a Solano County hub and Novato
- Assist communities throughout the Northern California Megaregion in better connecting transit systems to rail and enhancing station area functions
- Decision for location and design of a South Bay Area Shared Maintenance Facility
- Studying the feasibility of different alignments across the Carquinez Strait for a new crossing needed to accommodate futuer service increases

3.5.7 Coast Route Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Central Coast	San Jose	Salinas	Two Round Trips	Intercity/Regional Express Regional Rail	Central Coast-San Jose/San Francisco Bay Area
	Gilroy	Hollister	Every-four-hours	Integrated Bus	
	Santa Cruz	Monterey	Hourly	Integrated Bus	
	Santa Cruz	Pajaro/Watsonville	Hourly	Integrated Bus	
	Castroville	Monterey	Hourly	Integrated Bus	
	Salinas	San Luis Obispo	Every-four-hours	Integrated Bus	

Key Connections:

- Connections to the state rail network in San Jose and Los Angeles
- Integrated bus service for regional connections will support the regional network, improving transit connectivity and reliability of routes that service existing rail connections.

Project Development Goals:

- Develop Pajaro, Watsonville, and King City stations
- Siding and signal work to prepare corridor for increased intercity rail frequencies on the Coast Subdivision
- Complete layover facilities in Goleta and SLO
- Plan for preservation of the Coast Subdivision, particularly through Elkhorn Slough

Planning Goals:

- Implementation planning for connecting Monterey and Santa Cruz to the statewide rail network with regional rail services as recommended by the TAMC Monterey Bay Network Integration Study
- Determination of an appropriate mix of rail and bus services, based on infrastructure capabilities, market study, and the business case for investments; with an initial goal of planning for rail service every 4 hours between San Luis Obispo and Salinas, and bi-hourly rail service between Salinas and Gilroy
- Implementation planning for rail services, including determination of maintenance facility and equipment needs, and opportunities for through-running trains north of Gilroy and south of Goleta
- Assist communities throughout the Central Coast in better connecting transit systems to rail and enhancing station area functions

3.5.8 Altamont Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
San Joaquin Valley	Stockton	San Jose	Hourly	Regional Rail	San Jose/San Francisco Bay Area-Central Valley-Los Angeles
	Stockton	Union City	-	-	
	Stockton	Tri-Valley Hub	-	-	
	Tracy	Tri-Valley Hub	-	-	
	Livermore	Tri-Valley Hub	Every-15-min.	Regional Rail	
	Merced	San Jose	Every-two-hours	Regional Rail	

3.5.9 Northern San Joaquin Valley Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
San Joaquin Valley	Sacramento	Stockton	Every-two-hours	Intercity/Regional Express Regional Rail	San Jose/San Francisco Bay Arear-North Coast
	Oakland	Merced	Every-two-hours	Intercity/Regional Express	
	Stockton	Merced	Every-two-hours	Regional Rail	

3.5.10 Cross Valley Rail Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
San Joaquin Valley	Porterviile	Lemoore	Hourly	Integrated Bus	San Jose/San Francisco Bay Area-Central Valley-Los Angeles
	Lemoore	Paso Robles	Every-four-hours	Integrated Bus	

3.5.11 CA High Speed Rail Phase 1 Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Northern California Megaregion	San Francisco	San Jose	Every-15-min.	Intercity/Regional Express Regional Rail	San Jose/San Francisco Bay Area-Central Valley-Los Angeles
San Joaquin Valley	San Jose	Merced/Madera	Every-two-hours	Integrated Bus	
	Yosemite	Merced	Every-four-hours	Integrated Bus	
	Yosemite	Fresno	Every-four-hours	Integrated Bus	
	Merced	Bakersfield	Hourly	High Speed	
	Bakersfield	Palmdale	Hourly	Integrated Bus	
Southern California Megaregion	Palmdale	Burbank	Hourly	Regional Rail	
	Burbank	Los Angeles	Every-two-hours Every-15-min.	Intercity/Regional Express Regional Rail	
	Los Angeles	Anaheim	Every-two-hours Half-hourly	Intercity/Regional Express Regional Rail	
	Rancho Cucamonga	Los Angeles	Hourly	High Speed	

- Timed rail connections to initial high-speed service in Merced
- Timed high-speed rail-bus connections in Bakersfield to West Los Angeles, LA Union Station and Pasadena
- Timed rail connections to Central Valley service in North Lathrop and Stockton
- SacRT light rail and/or local bus shuttles will serve connections between Midtown and Sacramento Valley Stations
- Integrated express bus connections at Kings-Tulare to Visalia, Porterville, Lemoore, and the Central Coast, with at least a bi-hourly frequency

Project Development Goals:

- Completion of the California High-Speed Rail Initial Operating Segment (IOS)
- Merced Intermodal Track Connector (MITC)
- Develop Valley-to-Valley service infrastructure for delivery in the Mid-Term

Planning Goals:

- Plan for future service south of Merced, including the following:
- Cross valley corridor connecting Visalia, Hanford, and Porterville. The Cross Valley is a vital to the existing east-west rail corridor between the cities of Huron and Porterville in the Central San Joaquin Valley. With a proposed California High-Speed Rail Station located in the middle of the Corridor, there is an opportunity to improve connectivity and mobility throughout the communities and cities in Tulare, Kings, and southwest Fresno Counties.
- An east-west transit corridor that connects the westside valley to the eastside valley through the City of Fresno
- Assist communities throughout the Central Valley in better connecting transit systems to rail, and enhancing station area functions, as well as in identifying any additional integrated express bus corridors
- A connection between the proposed Kings/Tulare Regional High-Speed Rail Station and the CVC could benefit the region by potentially linking the communities to each other. These cities and communities include Huron, Naval Air Station (NAS) Lemoore, Lemoore, Hanford, Goshen, Visalia, Farmersville, Exeter, Lindsay, and Porterville
- Plan for future expansion of Valley Rail service to provide enhanced connectivity to HSR EOS

3.5.12 Las Vegas Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
High Desert	Las Vegas	Apple Valley	Hourly	High Speed	Southern California – Southern Nevada/ Arizona
	Apple Valley	Rancho Cucamonga	Hourly	High Speed	
	Apple Valley	Palmdale	-	-	

Key Connections:

- Integrated express bus services connecting to the statewide rail system in Bakersfield, Palmdale, San Bernardino
- Integrated bus service to connect Las Vegas HSR service between Victorville and Las Vegas with the statewide rail network, based on frequency improvements to the corridors serving Bakersfield, Palmdale, San Bernardino, and Riverside

Project Development Goals:

- Begin construction of the High Desert Corridor (HDC) connection, based on the results of HDC environmental clearance, subject to available financing, between Victorville and Palmdale, to connect with Phase 1 HSR service.

Planning Goals:

- Conduct a long-term, 2050-focused service integration study, addressing Las Vegas HSR and HDC in the context of the statewide network, including the potential for through train operations

3.5.13 Antelope Valley Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Southern California Megaregion	Lancaster	Los Angeles	-	-	San Jose/San Francisco Bay Area – Central Valley-Los Angeles
	Lancaster	Palmdale	Hourly	Regional Rail	
	Palmdale	Santa Clarita	Hourly	Regional Rail	
	Santa Clarita	Burbank	Half-hourly	Regional Rail	

3.5.14 Central Coast to Los Angeles Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Southern California Megaregion	San Luis Obispo	Goleta	Every-four-hours	Intercity/Regional Express	South Coast – Central Coast
	Goleta	Moorpark/Chatsworth	Every-two-hours	Intercity/Regional Express	
	Moorpark/Chatsworth	Burbank	Half-hourly	Regional Rail	
	Burbank	Los Angeles	Half-hourly	Regional Rail	

3.5.15 Los Angeles to San Diego Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
South Coast	Los Angeles	Fullerton	Hourly	Intercity/Regional Express	South Coast – Central Coast
	Fullerton	Oceanside	Hourly	Intercity/Regional Express	
	Oceanside	San Diego	Hourly	Intercity/Regional Express	
	Oceanside	Escondido	Half-hourly	Regional Rail	
	San Diego	San Ysidro/Tijuana	Every-15-min.	Regional Transit	

3.5.16 Inland Empire Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Southern California Megaregion	San Bernardino	Los Angeles	Half-hourly	Regional Rail	South Coast – Central Coast
	Redlands	San Bernardino	Half-hourly	Regional Rail	
	Riverside/San Bernardino	Fullerton	Hourly	Regional Rail	
	Riverside	Hemet	Every-two-hours	Regional Rail	

3.5.17 Coachella/Arizona Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Southern California Megaregion	Arizona	Indio	-	-	Southern California – Southern Nevada/ Arizona
	Indio	Riverside/San Bernardino	Every-two-hours	Integrated Bus	
	Riverside/San Bernardino	Los Angeles	Half-hourly	Regional Rail	

3.5.18 Inland Empire to San Diego Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Southern California Megaregion	Rancho Cucamonga/ Corona	San Diego	-	-	San Jose/San Francisco Bay Arear-North Coast

Key Connections:

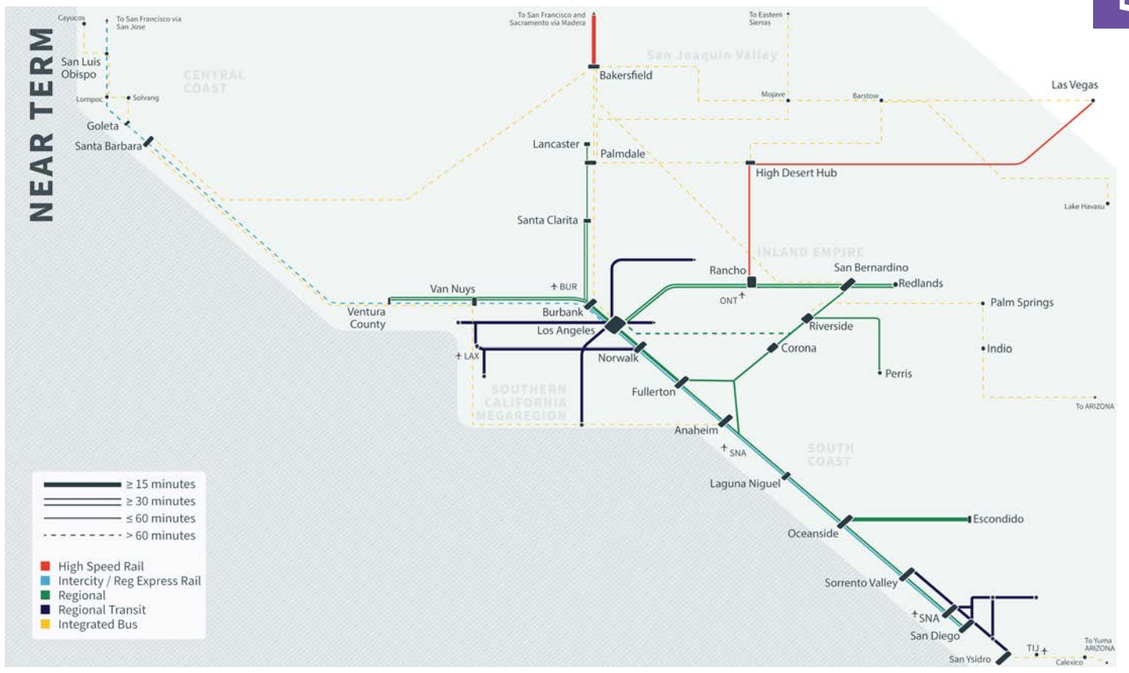
- Organize state rail network connections in the megaregion around pulse connections at Los Angeles Union Station, San Bernardino, Riverside, and an emerging Inland Empire connection hub at Rancho Cucamonga
- Oceanside
- Old Town San Diego

Project Development Goals:

- Initial run-through tracks at LAUS
- Begin construction of HSR-supporting infrastructure between Bakersfield and LAUS
- Begin construction of HSR-supporting infrastructure between LAUS and Anaheim including HSR run-through tracks at LAUS
- Make early rail investments with stakeholder engagement and coordination to deliver connecting services between LAUS and Indio in the Coachella Valley
- Complete maintenance and layover facility investments for integrated services
- Continue service improvements to solidify half-hourly service to all local stations, with increased reach of half-hourly network due to capacity improvements between Fullerton and Los Angeles, as well as between Fullerton and Riverside
- LOSSAN corridor capacity enhancements

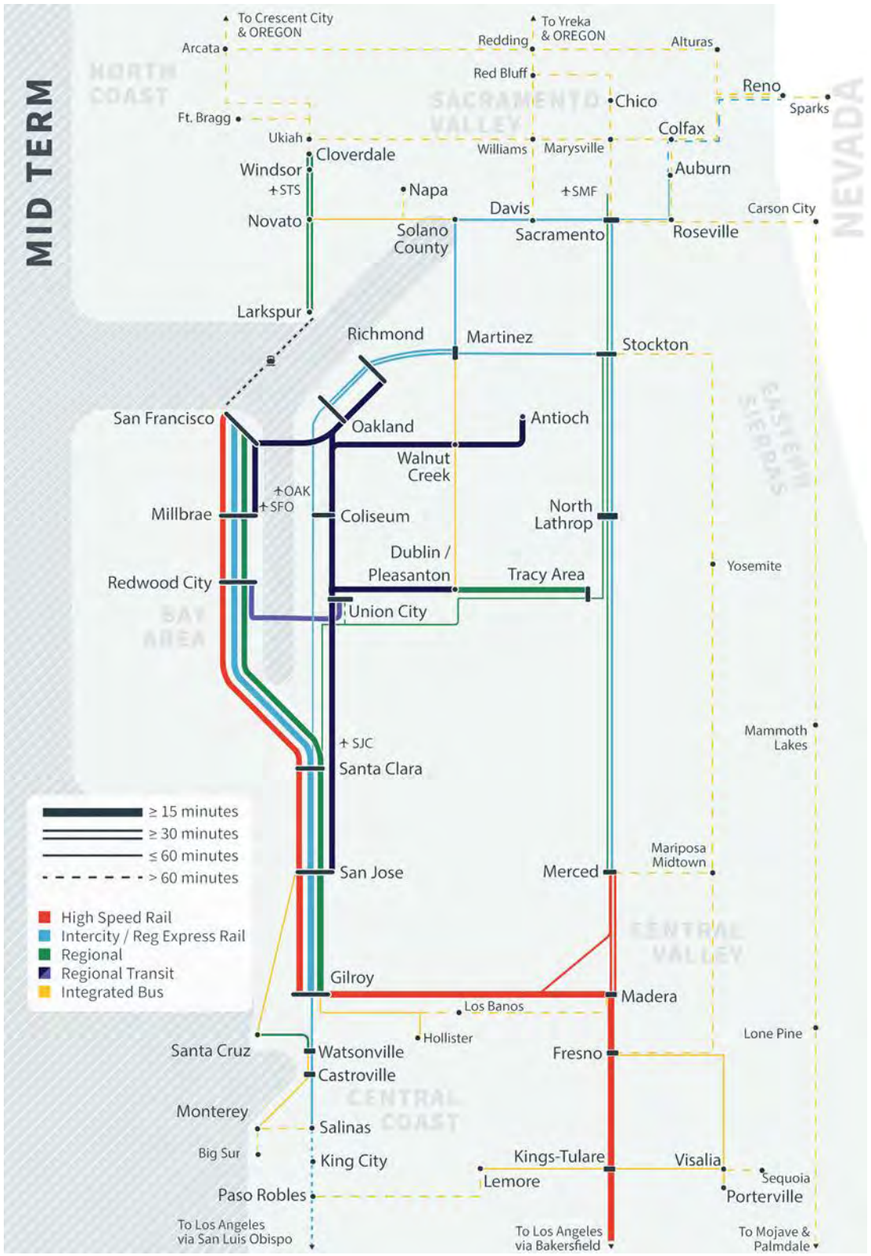
Planning Goals:

- Conduct a study to determine the long-term mix of express and local services that can be supported on the Ventura County Line corridor and the end point for half-hourly services (i.e., Chatsworth, Moorpark, or Ventura).
- Plan for half-hourly all-day local service between Los Angeles and Riverside via Fullerton, and between Riverside and Orange County
- Plan for 2050 LOSSAN South network, including increase in express train service to half-hourly, and integration of mid-term HSR services to Anaheim
- Work with SANDAG to implement the SD RTP and network integration between intercity and high-speed rail
- Plan for long-term realignment and or tunneling of the LOSSAN corridor at Del Mar



3.6 2032 Mid-Term Plan Regional Goals

The mid-term builds on the short-term with phased service expansion, increased frequencies across markets on the statewide pulse, and new connections to the expanding HSR network. By 2032, state rail fleet procurement will consist entirely of zero emission vehicles.



3.6.1 North Coast Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
North State	Arcata	Cloverdale	Every-four-hours	Integrated Bus	San Jose/San Francisco Bay Arear-North Coast

3.6.2 North Bay Rail Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Northern California Megaregion	Cloverdale	Larkspur	Half-hourly	Regional Rail	San Jose/San Francisco Bay Arear-North Coast
	Napa	Vallejo	-	-	
	Napa	Suisun-Fairfield	Every-two-hours	Integrated Bus	
	Novato	Suisun-Fairfield	Every-two-hours	Integrated Bus	

3.6.3 Sacramento Valley Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Northern California Megaregion	Redding	Sacramento	Every-two-hours	Integrated Bus	Sacramento Valley-Oregon Border
	Chico	Sacramento	Every-two-hours	Integrated Bus	

3.6.4 East Sierra Corridor (*Seasonal)

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Northern California Megaregion	Reno, NV*	Roseville*	Every-two-hours	Integrated Bus	Sacramento Valley-Oregon Border
	Carson City, NV	Sacramento	Every-two-hours	Integrated Bus	

3.6.5 Sacramento to San Francisco Bay Area Corridor

Region	Sub-Corridor/Segment		Service	Service Mode	Associated ITSP Corridor
	Node	Node			
Northern California Megaregion	Sacramento	Richmond	Hourly	Intercity/Regional Express	San Jose/ San Francisco Bay Area-Sacramento-Northern Nevada
	Roseville	Sacramento	Every-two-hours	Intercity/Regional Express	
	Suisun-Fairfield	Richmond	Hourly	Intercity/Regional Express	
	Richmond	San Jose (via San Francisco)	-	-	
	Richmond	San Jose (via East Bay)	Every-15-min.	Regional Transit	
	Tri-Valley Hub	Martinez	Hourly	Integrated Bus	

3.6.6 San Francisco Peninsula Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Northern California Megaregion	San Francisco	San Jose	Every-15-min.	Intercity/Regional Express Regional Rail	Central Coast-San Jose/San Francisco Bay Area
	Union City	Redwood City	Every-15-min.	Regional Transit	

Key Connections:

- Connections to local and regional transit in Sacramento, Chico, and Redding SacRT light rail and/or local bus shuttles to serve connections between Midtown and Sacramento Valley stations
- Ferry connection between regional rail service in Larkspur and San Francisco
- Timed transfers in Tracy and North Lathrop
- BART connection to Altamont trains at Union City enhancing connectivity to Oakland/San Francisco and San Jose
- Local transit connection between the East Bay and San Francisco Peninsula via the Dumbarton Corridor
- Connection to state network at San Jose Diridon from regional service on the San Francisco Peninsula and the BART network

Project Development Goals:

- Advance San Francisco to Sacramento corridor expansion based on based on recommendations from coordinated megaregional planning and ***Sacramento Corridor Strategic Service Development Plan***
- Advance project planning for the preservation/expansion of the Alviso Corridor, subject to recommendations of the ***East Bay Strategic Service Development Plan***
- Depending on recommendations of the ***Sacramento Hub Study***, advance project development for potential Almond Cross Station and/or connection between Martinez Subdivision and Sacramento Subdivision
- Advance potential high-capacity fixed guideway service between Union City and Redwood City, not to preclude future through-running main-line trains based on recommendations from ***East Bay Strategic Service Development Plan***
- Complete San Francisco to San Jose corridor capacity improvements, including grade separations, level boarding, and platform lengthening as identified in the ***Caltrain Business Plan***
- Extend hourly regional rail service north of Natomas to Butte County based on recommendations from the ***North State Rail Network Integration Study***

3.6.7 Coast Route Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Central Coast	San Jose	Salinas	Hourly	Intercity/Regional Express	Central Coast-San Jose/San Francisco Bay Area
	Gilroy	Hollister	Hourly	Integrated Bus	
	Santa Cruz	Monterey	Hourly	Integrated Bus	
	Santa Cruz	Pajaro/Watsonville	Hourly	Regional Rail	
	Castroville	Monterey	Hourly	Integrated Bus	
	Salinas	San Luis Obispo	Every-four-hours	Intercity/Regional Express	

Key Connections:

- Connections to the broader statewide network in Gilroy and Santa Barbara

Project Development Goals:

- Siding and signal work on the Coast subdivision to prepare for additional intercity frequency
- Develop regional rail corridor between Monterey and Santa Cruz based on recommendations from the TAMC Monterey Bay Regional Network Integration Study
- Plan for HSR service extension to Sacramento

Planning Goals:

- Lead Central Coast Service Integration Study to develop specific implementation planning for delivering long-term service goals on the coast

3.6.8 Altamont Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
San Joaquin Valley	Stockton	San Jose	Every-two-hours	Regional Rail	San Jose/San Francisco Bay Area-Central Valley-Los Angeles
	Stockton	Union City	Every-two-hours	Regional Rail	
	Stockton	Tri-Valley Hub	-	-	
	Tracy	Tri-Valley Hub	Every-15-min.	Regional Rail	
	Livermore	Tri-Valley Hub	Every-15-min.	Regional Rail	
	Merced	San Jose	Every-two-hours	Regional Rail	

3.6.9 Northern San Joaquin Valley Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
San Joaquin Valley	Sacramento	Stockton	Every-two-hours	Intercity/Regional Express Regional Rail	San Jose/San Francisco Bay Arear-North Coast
	Oakland	Merced	Every-two-hours	Intercity/Regional Express	
	Martinez	Stockton	Every-two-hours	Intercity/Regional Express	
	Stockton	Merced	Hourly	Regional Rail	

3.6.10 CA High Speed Rail Phase 1 Corridor

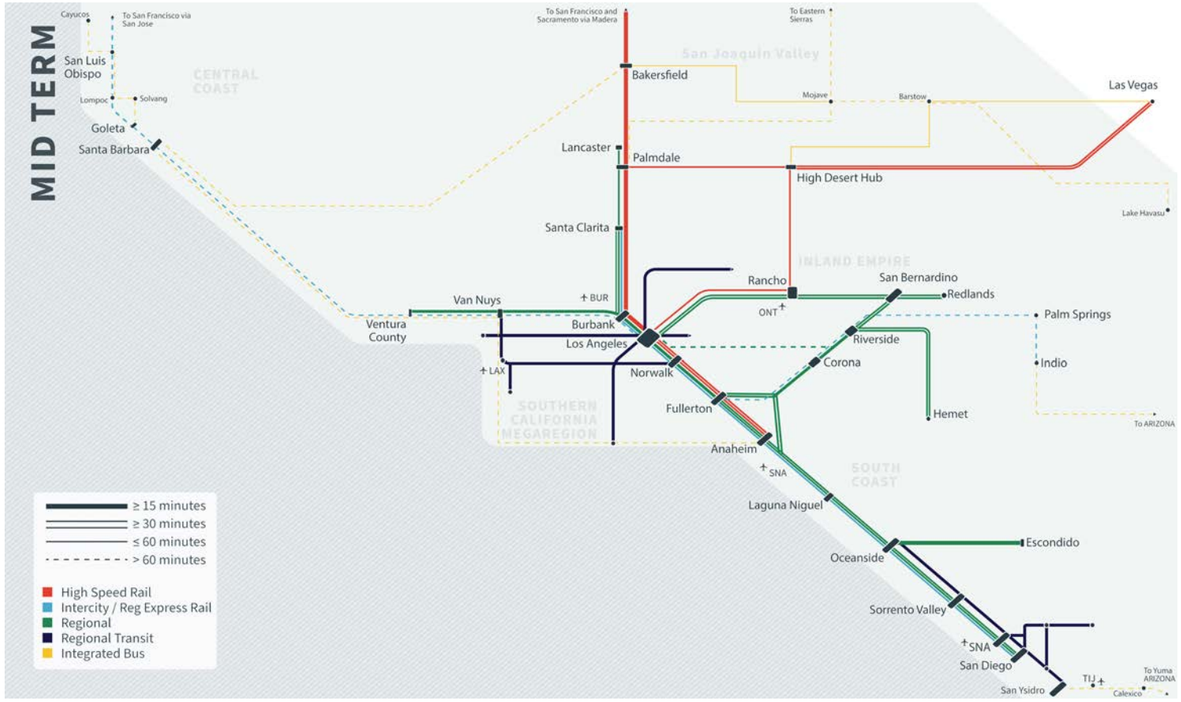
Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Northern California Megaregion	San Francisco	San Jose	Every-15-min.	Intercity/Regional Express Regional Rail High Speed	San Jose/San Francisco Bay Area-Central Valley-Los Angeles
San Joaquin Valley	San Jose	Merced/Madera	Every-15-min.	High Speed	
	Yosemite	Merced	Every-four-hours	Integrated Bus	
	Yosemite	Fresno	Every-four-hours	Integrated Bus	
	Merced	Bakersfield	Hourly	High Speed	
	Bakersfield	Palmdale	Hourly	High Speed	
Southern California Megaregion	Palmdale	Burbank	Hourly	High Speed	
	Burbank	Los Angeles	Hourly	High Speed	
	Los Angeles	Anaheim	Half-hourly Half-hourly Hourly	Intercity/Regional Express Regional Rail High Speed	
	Rancho Cucamonga	Los Angeles	Half-hourly	Regional Rail	

3.6.11 Cross Valley Rail Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
San Joaquin Valley	Porterviile	Lemoore	Hourly	Integrated Bus	San Jose/San Francisco Bay Area-Central Valley-Los Angeles
	Lemoore	Paso Robles	Every-two-hours	Integrated Bus	

Key Connections:

- High-speed connection to intercity bus at the Kings-Tulare station
- Enhance integrated bus service to national parks from Kings-Tulare, Fresno, and Merced
- Timed connections in Merced, North Lathrop, and Stockton
- Regional Service in Santa Cruz with connections to the statewide network at Pajaro/Watsonville



3.6.12 Las Vegas Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
High Desert	Las Vegas	Apple Valley	Half-hourly	High Speed	Southern California – Southern Nevada/ Arizona
	Apple Valley	Rancho Cucamonga	Hourly	High Speed	
	Apple Valley	Palmdale	Hourly	High Speed	

Key Connections:

- Integrated bus connections to the Las Vegas High-Speed rail at a High Desert Hub

3.6.13 Antelope Valley Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Southern California Megaregion	Lancaster	Los Angeles	-	-	San Jose/San Francisco Bay Area – Central Valley-Los Angeles
	Lancaster	Palmdale	Hourly	Regional Rail	
	Palmdale	Santa Clarita	Hourly	Regional Rail	
	Santa Clarita	Burbank	Half-hourly	Regional Rail	

3.6.14 Central Coast to Los Angeles Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Southern California Megaregion	San Luis Obispo	Goleta	Every-two-hours	Intercity/Regional Express	South Coast – Central Coast
	Goleta	Moorpark/Chatsworth	Every-two-hours	Intercity/Regional Express Regional Rail	
	Moorpark/Chatsworth	Burbank	Half-hourly	Intercity/Regional Express	
	Burbank	Los Angeles	Half-hourly	Regional Rail	

3.6.15 Los Angeles to San Diego Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
South Coast	Los Angeles	Fullerton	Half-hourly	Intercity/Regional Express	South Coast – Central Coast
	Fullerton	Oceanside	Half-hourly	Intercity/Regional Express	
	Oceanside	San Diego	Half-hourly	Intercity/Regional Express	
	Oceanside	Escondido	Every-15-min.	Regional Rail	
	San Diego	San Ysidro/Tijuana	Every-15-min.	Regional Transit	

3.6.16 Inland Empire Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Southern California Megaregion	San Bernardino	Los Angeles	Half-hourly	Regional Rail	South Coast – Central Coast
	Redlands	San Bernardino	Half-hourly	Regional Rail	
	Riverside/San Bernardino	Fullerton	Half-hourly	Regional Rail	
	Riverside	Hemet	Hourly	Regional Rail	

3.6.17 Coachella/Arizona Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Southern California Megaregion	Arizona	Indio	-	-	Southern California – Southern Nevada/ Arizona
	Indio	Riverside/San Bernardino	Every-four-hours	Intercity/Regional Express	
	Riverside/San Bernardino	Los Angeles	Every-four-hours	Intercity/Regional Express	

3.6.18 Inland Empire to San Diego Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Southern California Megaregion	Rancho Cucamonga/ Corona	San Diego	-	-	San Jose/San Francisco Bay Arear-North Coast

Key Connections:

- Organize state rail network connections in the megaregion around pulse connections at Los Angeles Union Station, San Bernardino, Riverside, and an emerging Inland Empire connection hub at Rancho Cucamonga
- San Diego transit connections to services at San Ysidro, and integrated bus connections to Otay Mesa and the Tijuana Airport
- Integrated bus connection from the San Diego hub to El Centro/Calexico via El Cajon

Project Development Goals:

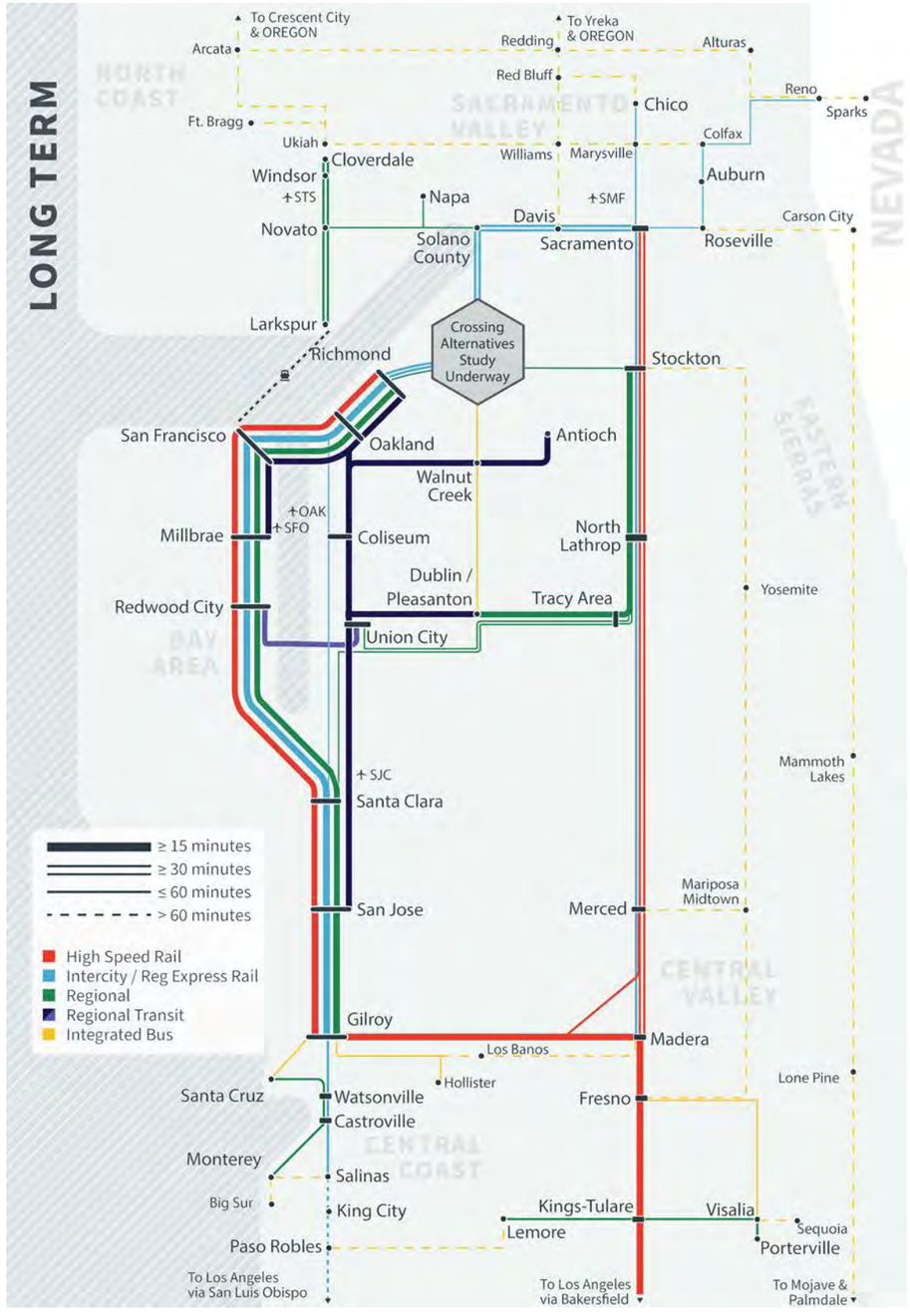
- Develop Burbank/Bob Hope Airport as a connection hub, connecting services extending west to Santa Barbara/Goleta, as well as north to Palmdale
- Complete HSR planning for post-2050 investments, including additional upgrades to east-west infrastructure, planning for HSR to the Coachella Valley and Arizona, and potential connectivity via San Bernardino to Victorville and Las Vegas
- Create a San Diego hub for HSR, intercity rail, regional rail, and high-capacity transit at San Diego Airport / Old Town
- Project implementation planning for San Diego Subdivision Corridor tunnel projects
- Project implementation planning for high-frequency regional service
- Initial development of high frequency, all-day, bi-directional regional service corridors identified by SANDAG

Planning Goals:

- Implementation planning for main line service expansion south to San Ysidro

3.7 Long-Term Regional Goals

By 2050, the state rail network will be fully integrated with the completed statewide network, allowing seamless air- and auto- competitive rail travel throughout the state.



3.7.1 North Coast Corridor

Region	Sub-Corridor/Segment Node	Node	Service Frequency	Service Mode	Associated ITSP Corridor
North State	Arcata	Cloverdale	Every-two-hours	Integrated Bus	San Jose/San Francisco Bay Arear-North Coast

3.7.2 North Bay Rail Corridor

Region	Sub-Corridor/Segment Node	Node	Service Frequency	Service Mode	Associated ITSP Corridor
Northern California Megaregion	Cloverdale	Larkspur	Half-hourly	Regional Rail	San Jose/San Francisco Bay Arear-North Coast
	Napa	Vallejo	Every-two-hours	Integrated Bus	
	Napa	Suisun-Fairfield	Hourly	Regional Rail	
	Novato	Suisun-Fairfield	Hourly	Regional Rail	

3.7.3 Sacramento Valley Corridor

Region	Sub-Corridor/Segment Node	Node	Service Frequency	Service Mode	Associated ITSP Corridor
Northern California Megaregion	Redding	Sacramento	Hourly	Intercity/Regional Express	Sacramento Valley-Oregon Border
	Chico	Sacramento	Hourly	Intercity/Regional Express	

3.7.4 East Sierra Corridor (*Seasonal)

Region	Sub-Corridor/Segment Node	Node	Service Frequency	Service Mode	Associated ITSP Corridor
Northern California Megaregion	Reno, NV*	Roseville*	Every-four-hours	Integrated Bus	Sacramento Valley-Oregon Border
	Carson City, NV	Sacramento	Every-two-hours	Integrated Bus	

3.7.5 Sacramento to San Francisco Bay Area Corridor

Region	Sub-Corridor/Segment Node	Node	Service Frequency	Service Mode	Associated ITSP Corridor
Northern California Megaregion	Sacramento	Richmond	Half-hourly	Intercity/Regional Express	
	Roseville	Sacramento	Hourly	Intercity/Regional Express	
	Suisun-Fairfield	Richmond	Hourly	Intercity/Regional Express	
	Richmond	San Jose (via San Francisco)	Every-15-min.	Intercity/Regional Express Regional Rail High Speed	
	Richmond	San Jose (via East Bay)	Hourly Every-15-min.	Intercity/Regional Express Regional Transit	
	Tri-Valley Hub	Martinez	Hourly	Integrated Bus	

3.7.6 San Francisco Peninsula Corridor

Region	Sub-Corridor/Segment Node	Node	Service Frequency	Service Mode	Associated ITSP Corridor
Northern California Megaregion	San Francisco	San Jose	Every-15-min.	Intercity/Regional Express Regional Rail High Speed	Central Coast-San Jose/San Francisco Bay Area
	Union City	Redwood City	Every-15-min.	Regional Transit	

Key Connections:

- Connections to local and regional transit in Sacramento, Chico, and Redding
- Timed bi-directional connections at Sacramento Valley Station via a new Sacramento Subdivision to Martinez Subdivision track connection based on recommendations from the ***Sacramento Hub Study***
- Timed connections in Novato from South/North regional rail service to East/West regional service
- Timed connections to Sacramento, San Joaquin Valley, and Southern California bound trains in Stockton and North Lathrop
- San Francisco to Oakland improved connectivity based on the recommendations of the ***Link21 Study***

Project Development Goals:

- Expand and preserve the Alviso Corridor based on the recommendations from the ***East Bay Strategic Service Development Plan***

3.7.7 Coast Route Corridor

Region	Sub-Corridor/Segment Node	Node	Service Frequency	Service Mode	Associated ITSP Corridor
Central Coast	San Jose	Salinas	Hourly	Intercity/Regional Express	Central Coast-San Jose/San Francisco Bay Area
	Gilroy	Hollister	Hourly	Integrated Bus	
	Santa Cruz	Monterey	Hourly	Regional Rail	
	Santa Cruz	Pajaro/Watsonville	Hourly	Regional Rail	
	Castroville	Monterey	Hourly	Regional Rail	
	Salinas	San Luis Obispo	Every-two-hours	Intercity/Regional Express	

Key Connections:

- Timed connections between intercity and regional rail service at hub stations in Castroville and Pajaro / Watsonville

3.7.8 Altamont Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
San Joaquin Valley	Stockton	San Jose	Hourly	Regional Rail	San Jose/San Francisco Bay Area-Central Valley-Los Angeles
	Stockton	Union City	Hourly	Regional Rail	
	Stockton	Tri-Valley Hub	Every-15-min.	Regional Rail	
	Tracy	Tri-Valley Hub	Every-15-min.	Regional Rail	
	Livermore	Tri-Valley Hub	Every-15-min.	Regional Rail	
	Merced	San Jose	Hourly	High Speed	

3.7.9 Northern San Joaquin Valley Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
San Joaquin Valley	Sacramento	Stockton	Hourly Half-hourly	Intercity/Regional Express High Speed	San Jose/San Francisco Bay Arear-North Coast
	Oakland	Merced	-	-	
	Martinez	Stockton	Hourly	Regional Rail	
	Stockton	Merced	Hourly Half-hourly	Intercity/Regional Express High Speed	

3.7.10 CA High Speed Rail Phase 1 Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Northern California Megaregion	San Francisco	San Jose	Every-15-min.	Intercity/Regional Express Regional Rail High Speed	San Jose/San Francisco Bay Area-Central Valley-Los Angeles
San Joaquin Valley	San Jose	Merced/Madera	Hourly	High Speed	
	Yosemite	Merced	Every-four-hours	Integrated Bus	
	Yosemite	Fresno	Every-four-hours	Integrated Bus	
	Merced	Bakersfield	Half-hourly	High Speed	
	Bakersfield	Palmdale	Every-15-min.	High Speed	
Southern California Megaregion	Palmdale	Burbank	Every-15-min.	High Speed	
	Burbank	Los Angeles	Every-15-min.	High Speed	
	Los Angeles	Anaheim	Half-hourly	High Speed	
	Rancho Cucamonga	Los Angeles	Half-Hourly	High Speed	

3.7.11 Cross Valley Rail Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
San Joaquin Valley	Porterviile	Lemoore	Hourly	Regional Rail	San Jose/San Francisco Bay Area-Central Valley-Los Angeles
	Lemoore	Paso Robles	-	-	

Key Connections:

- Cross-Valley regional rail service and integrated bus connection to the Central Coast at Tulare-Kings station

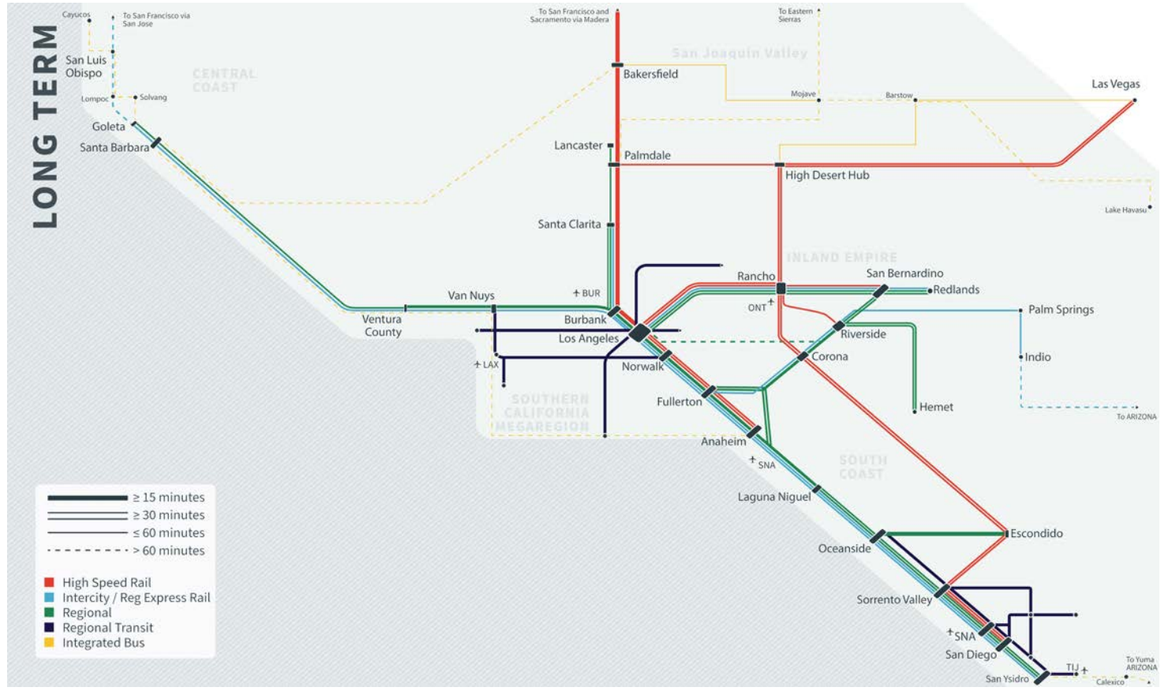


Exhibit X.X: Long-Term Southern California Service Map

3.7.12 Las Vegas Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
High Desert	Las Vegas	Apple Valley	Half-hourly	High Speed	Southern California – Southern Nevada/ Arizona
	Apple Valley	Rancho Cucamonga	Half-hourly	High Speed	
	Apple Valley	Palmdale	Hourly	High Speed	

Key Connections:

- Connections to the Las Vegas High-Speed rail at a High Desert hub

3.7.13 Antelope Valley Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Southern California Megaregion	Lancaster	Los Angeles	Hourly	Regional Rail	San Jose/San Francisco Bay Area – Central Valley-Los Angeles
	Lancaster	Palmdale	Hourly	Regional Rail	
	Palmdale	Santa Clarita	Hourly	Regional Rail	
	Santa Clarita	Burbank	Hourly Half-hourly	Intercity/Regional Express Regional Rail	

3.7.14 Central Coast to Los Angeles Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Southern California Megaregion	San Luis Obispo	Goleta	Hourly	Intercity/Regional Express Integrated Bus	South Coast – Central Coast
	Goleta	Moorpark/Chatsworth	Hourly	Intercity/Regional Express Regional Rail	
	Moorpark/Chatsworth	Burbank	Hourly Half-hourly	Intercity/Regional Express Regional Rail	
	Burbank	Los Angeles	Half-hourly Every-15-min. Every-15-min.	Intercity/Regional Express Regional Rail High SPeed	

3.7.15 Los Angeles to San Diego Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
South Coast	Los Angeles	Fullerton	Half-hourly Every-15-min. Half-hourly	Intercity/Regional Express Regional Rail High Speed	South Coast – Central Coast
	Fullerton	Oceanside	Half-hourly	Intercity/Regional Express Regional Rail	
	Oceanside	San Diego	Half-hourly Every-15-min.	Intercity/Regional Express Regional Rail	
	Oceanside	Escondido	Every-15-min.	Regional Rail	
	San Diego	San Yisdro/ Tijuana	Hourly Half-hourly Every-four-hours	Intercity/Regional Express Regional Transit Integrated Bus	

3.7.16 Coachella/Arizona Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Southern California Megaregion	Arizona	Indio	Every-two-hours	High Speed	Southern California – Southern Nevada/ Arizona
	Indio	Riverside/San Bernardino	Hourly	Intercity/Regional Express	
	Riverside/San Bernardino	Los Angeles	Half-hourly	Intercity/Regional Express	

3.7.17 Inland Empire Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Southern California Megaregion	San Bernardino	Los Angeles	Hourly Half-hourly	Intercity/Regional Express Regional Rail	South Coast – Central Coast
	Redlands	San Bernardino	Hourly Half-hourly	Intercity/Regional Express Regional Rail	
	Riverside/San Bernardino	Fullerton	Every-two-hours Half-hourly	Intercity/Regional Express Regional Rail	
	Riverside	Hemet	Half-hourly	Regional Rail	

3.7.18 Inland Empire to San Diego Corridor

Region	Sub-Corridor/Segment		Service Frequency	Service Mode	Associated ITSP Corridor
	Node	Node			
Southern California Megaregion	Rancho Cucamonga/ Corona	San Diego	Half-hourly	High Speed	San Jose/San Francisco Bay Arear-North Coast

Key Connections:

- High speed connections in LAUS, Anaheim, and San Diego
- High speed connection in Escondido

Project Development Goals:

- New corridors and service increases identified by SANDAG in San Diego Forward
- Buildout of the regional rail network with enhanced light rail and commuter services with hubs near SAN, University Heights, and UTC
- Phase II High Speed Rail connects into the corridor at least to the Inland Empire via Escondido

3.8 Integrated Bus Connections

While the State Rail Plan focuses on development of the passenger and freight rail network, service planning goals include integrated bus service along key corridors—often as an interim solution before future rail service is implemented. The State is leading integrated bus planning efforts, specifically to integrate the existing rural bus network, the Amtrak Thruway bus network, and intercity bus service operated by public and private operators. Although this network primarily serves less-populated areas of the State, the intercity bus network serves strategic connections to the rail network.

CHAPTER 4

FREIGHT NETWORK STRATEGY

4.1 California's Freight Network

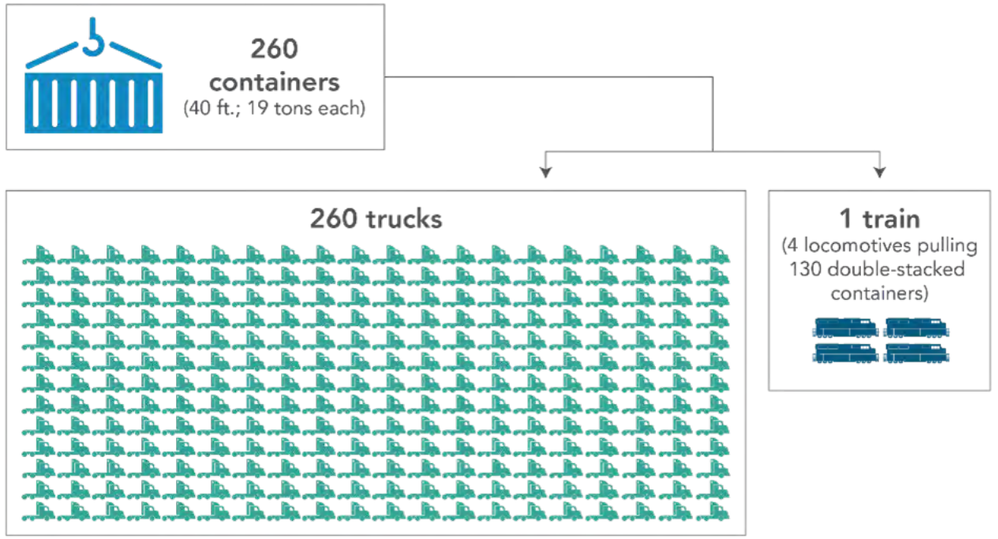
Freight rail connects industries and markets in California to national and global economies. Since development in the 19th century, the network has evolved to the changing needs of what is now the US's largest state economy. Responsible for goods movement and the State's economic competitiveness, the network largely operates on privately owned infrastructure with passenger service sharing the same tracks.

Ground transportation, shipping, and logistics contributes more than $50b/year to California's state economy[32]. Caltrans's strategic goal is to leverage legacy investments and ongoing public sector support for the freight network to deliver economic, equity, and environmental benefits. This requires active partnership between funding and regulatory agencies, like Caltrans and CARB, with local government, and private railroads. This partnership manages freight and passenger needs under a shared understanding of existing infrastructure, technical service planning, capacity constraints, and future demand. Aggregating current operations and future capacity needs enables a technical understanding of improvements through pinpoint, coordinated investments.

The 5,295-mile network supports California's international trade and industrial competitiveness. In 2019, that network handled an estimated 14.3 million tons of freight[33].

32 Bureau of Economic Analysis, US Department of Commerce

33 2019 Public Use Waybill Sample



California ranks[34]:

- 5th in total rail miles
- 5th in originating freight tons
- 2nd in originating carloads
- 3rd in terminating freight tons
- 2nd in terminating carloads 4th in freight employment (8,270 employees)

4.1.1 Freight Network Goals

The overwhelmingly private freight rail industry provides public benefits to the State. The State's responsibility is to work with freight railroads to enhance those public benefits and regulate the industry in line with policy goals while also fostering attainment of economic, equity, and environmental goals .

Economic:

The freight network is owned by private industry and market driven. California's rail infrastructure, especially the transcontinental routes, must effectively serve international ports, industries throughout the state, and markets throughout the country. Freight flows are determined by network reliability and competitiveness against other modes (i.e., highways and trucking).

California's ports, logistics industry, manufacturers, and agricultural industry's ability to compete depends on rail connections to/from the rest of North America. Caltrans will continue to collaborate with freight railroads and support public/private freight projects to maintain this competitiveness.

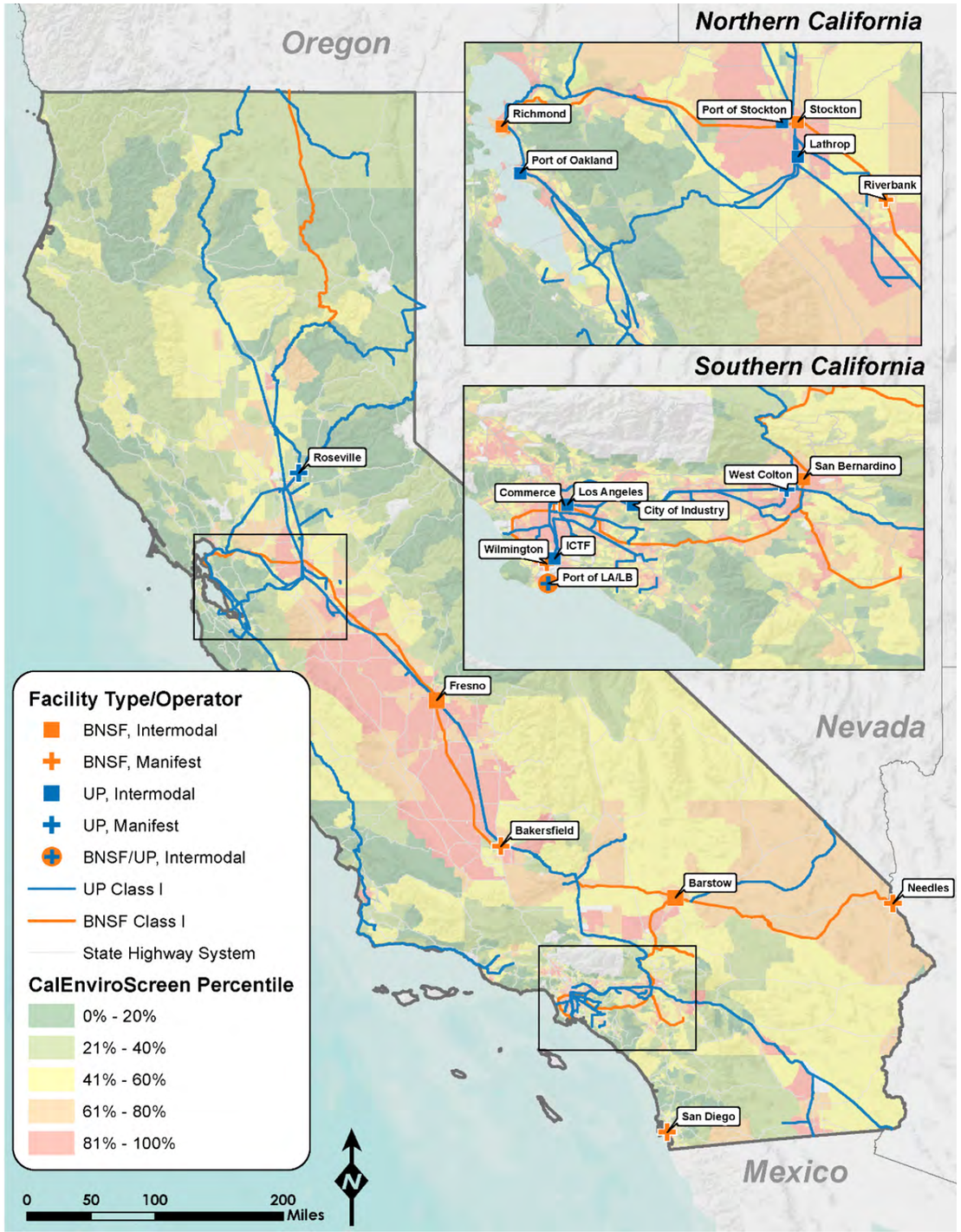
Environmental:

Railroads are traditionally four times more fuel efficient than trucks, with one ton of freight on a train moving an average of 470 miles on one gallon of diesel fuel, a 75% decrease in greenhouse gas emissions. However, that historic advantage is being challenged by rapid evolution of cleaner diesel engines and ZE technology in long-haul trucking. As California's current truck regulations are implemented through 2023, trucks will produce less PM2.5 and NOx emissions by 2023. Beyond 2023, future CARB Regulations will further reduce truck emissions, eventually bringing them to zero. The freight railroads need to transition to zero emission locomotives following the other freight source categories.

Equity:

Freight rail is inherently infrastructure focused; too often that infrastructure is co-located with disadvantaged communities and priority populations burdened with air quality, noise pollution, grade-crossing safety, and physical barriers. While directly providing good paying jobs and supporting manufacturing and agricultural industries,

34 Association of American Railroads (AAR)



those benefits must be balanced against challenges rail operations and rail infrastructure can create in communities.

Freight rail is also an outlet for highway traffic and highway expansion. Without effective rail connections to ports in places like Los Angeles, Long Beach, Oakland, and Richmond, state highway networks would require significant expansion to handle increased truck traffic. The State can reduce the need for highway expansion by supporting and improving rail infrastructure to attract freight traffic and growth away from highways, enhancing trade corridors by lowering transportation costs for businesses.

Caltrans is committed to taking the broader, network-focused approach to considering and supporting future growth of the freight network and the transition to ZE operations.

Support for Passenger Services

Lastly, the freight network supports economic, environmental, and equity goals via its support and facilitation of passenger services. Regional and intercity rail has and will continue to largely utilize freight railroad owned and dispatched right of way. To deliver the passenger service goals identified in the long-term Vision, Caltrans and host railroads will need to work increasingly collaboratively to identify, plan, and deliver improvements with shared benefits.

4.1.2 Class I Freight Railroads

Freight railroads are characterized by revenues, with Class I being the largest,and Class III being the smallest. Most of California's route-miles (3,871 miles) are owned by two Class I railroads, BNSF and UP, followed by short-lines (1,296 route-miles). BNSF and UPRR, two Class I railroads, provide service throughout the western United States. Public ownership accounts for ~ 700 route miles, most of which are concentrated around major metropolitan areas in Southern California and the Bay Area. In instances of public ownership, legacy carriers (BNSF & UP) retain trackage rights and access to the publicly owned ROW.

BNSF

BNSF is North America's largest intermodal carrier, operating more than 32,000 route-miles of track across 28 states and handled over 10.1 million carloads in 2021. California serves as the western anchor of BNSF's transcontinental corridor, linking Southern and Northern California with Chicago. In addition to its own routes, BNSF holds trackage rights between Denver and the San Francisco Bay Area, Tehachapi Pass between Bakersfield and Mojave, and in the Central Valley. Consumer products represent BNSF's most transported commodities.

BNSF operates more than 2,114 route-miles in California, with a workforce of almost 3,500 employees. Major BNSF facilities include the major system yard at Barstow and shared on-dockrail facilities at POLA and POLB. There are a total of 11 carload yards located in Bakersfield, Barstow, Commerce, Needles, Riverbank, San Bernardino, San Diego, Stockton, and Wilmington. Five dedicated intermodal facilities are in Fresno, Richmond,San Bernardino, Stockton, and Los Angeles.

Union Pacific

UP operates 32,000 route-miles of track across 23 states, and is California's largest railroad in termsof volume, employees, and mileage. In 2020, with a workforce of about 5,000 employees, UP's California operations handled more than 3 millioncarloads on a state network of almost 3,300 miles. Industrial cargo represents UP's highest revenue commodity.

UP serves the San Joaquin Valley, the Port of Oakland, the San Francisco Bay Area, and the Los Angeles area. UP operates major carload yards at West Colton in Southern California and Roseville in Northern California; and three regionalyards in Lathrop, Commerce,and Yermo. Intermodal services are available at six dedicated terminals, in Oakland, Stockton, and Los Angeles / Long Beach. UP also hasshared use of the on-dock rail terminals at POLA and POLB. UP holds trackage rights between San Bernardino and Yermo over Cajon Pass. UP also owns the tracking rights through the Tehachapi Pass in Northern California.

4.1.3 Class III Short-line Railroads

Short-line railroads play an important role in the shipping network. Short-line railroads handle the "first mile" and "last mile" of the freight rail, serving as a distribution and feeder system for the overall freight network. Short-lines play an important role in supply chains, providing shippers a connection allowing them to ship by rail, rather than by truck. Short-lines handle one in every four rail cars moving through the nationwide network.

As of 2021, a total of 26 short-lines, including seven terminal and switching railroads, operated in the state. These local, switching, and terminal railroads vary widely in mileage, ownership, traffic volumes, and markets. Although some have been longstanding fixtures, many more came into existence during industry restructuring of the 1980s and 1990s, whenClass I railroads streamlined their networks, selling off or abandoning lines. Since then, short-lines consolidated under the control of a handful of holding companies, such as Genesee & Wyoming.

Most of the State's short-lines focus on carload traffic.By providing "first mile, last mile" service to many smaller shippers in rural communities, they ensure access to rail service and facilitateeconomic development. Tourist service is part of several short-lines; for a few, such as the Napa Valley Railroad and the Fillmore and Western, it is their primary business.

Collectively, short-lines operate 47,500 miles of track (29% of the national network). In California the short-lines operate 1,296 route miles (nearly 1/3 of the California rail network).

Economic Development

Short-lines help maintain freight rail service in places that might not otherwise have it. Short-lines are integral to a shipper's operations and smaller markets that have been left without rail service following previous rounds of abandonments and/or consolidations by larger railroads. Because short-lines connect to Class I Railroads, these companies often work hand in hand to provide rail service to customers located in areas that are not directly served by the larger railroads. Most short-lines connect to at least one, if not multiple, Class I railroads and nearly all freight that ships on a short-line ends up on a Class I.

Operational Benefits

Short-line railroads provide shippers a critical "first mile, last mile" connection to the nation's rail network and allow them to ship by rail. This gives local manufacturers and farmers access to distant markets. Short-lines reduce transportation costs on bulk commodities, like timber, aggregate, and fertilizer. Over half of short-line locomotives in California are originally built pre-1973 and they emit 13 to 29 times more NOx and PM than the cleanest Tier 4 locomotives. Short-lines can be a more economical shipping solution than truck as well as a net benefit to the public only if short-lines transition to zero emission locomotives. However, many short-lines are near disadvantaged communities and contribute a negative socioeconomic dynamic. Conversion of these locomotives to ZE propulsion will have large-scale positive quality of life impacts.

Like many small businesses, short-lines pride themselves on providing a high level of customer service. The short-line will be eager to partner with a customer and make rail service work for them. With smaller staffs and employees accustomed to working on a wider variety of tasks as well as more flexible and nimble scheduling and service options, short-lines are often willing to tailor the service to move customer goods and products in a way that helps their business.

Issues and Limits to Growth

Following a survey of 15 California short-line railroads[35], the issue the railroads almost universally prioritized as a top issue was identification of new business opportunities. In subsequent interviews, numerous short-line railroads expanded on this topic, noting the environmental efficiency of moving more freight traffic from trucking to rail, which includes the increasing importance of intermodal and transload shipping as part of California's overall freight network. Transloading is process of transferring a shipment from one mode of transportation to another and intermodal is the movement of freight in an intermodal container, using multiple modes of transportation, without any handling of the freight itself.

Increasing transload shipments are seen as a business growth opportunity for short-line railroads to expand to customers where building or rebuilding spurs are cost prohibitive.

35 Caltrans Short-Line Study, 2021

Track conditions are also a top priority. Trespassing and grade crossing issues were also considered high- or moderate-importance. While track conditions and state-of-good-repair issues are critical issues for all railroads, short-lines are uniquely impacted considering more limited resources to address these issues: a trio of funding issues in the survey – funding to properly maintain rail lines, funding for state/federal programs for construction or rail line rehabilitation, and funding to maintain rail/highway crossings – were similarly ranked highly by survey respondents. (Funding for emergency repairs was also rated as a high-importance issue by most respondents.) In addition, several railroads mentioned track condition on privately-owned spurs for current and potential customers as another significant issue, considering customer-side track conditions can affect a client's mode choice decision for moving freight and whether to choose rail or trucking.

Transloading

By working with Class I railroads, short-lines have growth opportunity for transloading, where goods are moved between shipping modes (e.g., truck to train) as part of the overall journey. While transloading is like intermodal – where goods remain in the same container and the container itself is moved between modes – transloading allows railroads to unload and reload goods into different containers, trailers, or train cars to increase efficiency. Transloading expands the reach of a short-line, as customers without a dedicated spur track can still utilize the service.

4.2 Freight Rail Governance

Class I Freight railroads cross state lines and national borders as part of international networks and are broadly regulated and governed at the federal level. Specific local issues, particularly related to grade crossings, utilities, safety, and air quality are also governed at the state level within California.

4.2.1 Federal Railroad Administration (FRA)

The FRA is one of ten agencies within the U.S. Department of Transportation concerned with intermodal transportation. Its mission is to enable a safe, reliable, and efficient movement of people and goods for a strong America, now and in the future. The FRA's Office of Railroad Safety promotes and regulates safety throughout the Nation's railroad industry. Railroad safety regulation is reserved for the Federal government through the FRA. However, states can opt-in to a State Rail Safety Participation program. This program consists of States employing safety inspectors in the five rail safety inspection disciplines, Grade Crossings, Hazardous Materials, Motive Power and Equipment, Operating Practices, Signal and Train Control, and Track. The is FRA is also responsible for regulating the safety of California and the nation's railroad system, including freight railroads and development of intercity passenger rail through, Legislative Rules, Non-legislative Rules (Interpretive Rules and Policy Statements), and Management and Procedural Rules.

4.2.2 Surface Transportation Board (STB)

The STB is a federal agency overseeing economic regulation of freight rail carriers. The STB provides a venue for dispute resolution between railroads. The STB oversees shipping rates, commercial practices, and service issues. The STB also governs rail restructuring transactions (mergers, line sales, line construction, and line abandonments)[36].

Freight Corridor Abandonments

Rail lines are classified as abandoned when the STB has granted permission to remove a line fromservice, with no potential for operation in the foreseeable future. Subsequently, track materials can bescrapped, and right-of-way is sold off, or "rail banked", for use as a future transportation corridor.

Route miles proposed for abandonment can change from year to year. In California between 2005 and 2015, short-line railroad abandonment requests affected almost 201 miles, compared to 105 miles attributed to Class I's. Many Class I abandonments were industrial leads or connectors to specific facilities.

Since 2015, the following railroads abandonment exemptions have been requested in[37]:

Railroad	County	Route miles	Exemption	Status
Sierra Northern Railway	Yolo County	0.7	Abandonment	Approved
North Coast Railroad Authority	Humboldt, Trinity, Mendocino	160.36	Abandonment	Proceeding
BNSF	Los Angeles	5.93	Abandonment	Reopened
Northwestern Pacific Railroad	Mendocino	53.5	Abandonment	Accepted (TRAC's objection rejected)
Northwestern Pacific Railroad	Marin, Napa, Sonoma	87.65	Discontinue Service	Approved
Union Pacific	Riverside, San Bernardino	0.54	Abandonment	Reopened
Union Pacific	Alameda	4.3	Abandonment	Reopened
City of Los Angeles	Los Angeles	2.6	Abandonment	Reopened

36 https://www.stb.gov/about-stb/
37 Surface Transportation Board proceedings records: https://www.stb.gov/proceedings-actions/search-stb-records/

4.2.3 California Public Utilities Commission (CPUC)

The CPUC regulates privately owned electric, natural gas, telecommunications, water, railroad, rail transit, and passenger transportation companies. CPUC's railroad safety program ensures the safe operation of freight and passenger rail[38]. The CPUC reports annually on results of investigations of runaway trains, railroad lines it finds to be hazardous, and all derailment sites in which accidents have occurred. The CPUC employs federally certified inspectors to ensure railroads comply with federal and state railroad-safety regulations.

Grade Crossings

Within California, rail grade crossings are under the regulatory authority of the CPUC. The CPUC sets rail crossing rules and regulations to provide minimum design and construction requirements to ensure consistent safety standards throughout the state; additionally, the CPUC also provides railroads and highway departments with guidance documents for additional best practices with grade crossings. By taking a more proactive approach with grade crossings and grade separations, Caltrans could provide for additional efficiencies and improved outcomes for all travelers regardless of mode. The benefits of grade separations can generally be identified in one of three ways, with most projects satisfying several of these categories:

- **Safety Improvement:** The grade separation would improve safety for all users by discouraging trespassing on railroad rights-of-way and eliminating conflicts between trains and roadway users.
- **Operational Enhancement:** The grade separation would provide a strategic advantage for the railroad by allowing for higher speed operations or improved operational flexibilities while reducing disruptions to local communities. These grade separations can also be used to help establish quiet zones to benefit residents.
- **Motorist Benefits:** The grade separation would provide a major benefit to road users, reducing idling and improving travel time reliability for road users.

38 California Public Utilities Code (PUC) 916 requires the CPUC to report to the State Legislature on its rail safety activities on or by November 30 of each year.

CPUC Rail Crossing Safety Action Plan

Whereas California is required to complete a Safety Action Plan[39]; CPUC is responsible for developing the Rail Crossing Safety Action Plan. The plan outlines the current state of rail crossing safety in California, investments to separate or eliminate existing grade crossings and to eliminate hazards at existing crossings.

CPUC Section 190 Funding Program

The CPUC manages the Section 190 Grade Separation Program, which allocates approximately $15 million in financing to three or four high-priority road/rail grade separation projects each year; Section 190 funding is limited to a maximum of $5 million per project per year, with a 20% required match.

CPUC Section 130 Funding Program

The purpose of the Railroad/Highway At-Grade Crossing Program is to reduce the number and severity of highway accidents by eliminating hazards to vehicles

39 Section 202 of the Rail Safety Improvement Act of 2008 (RSIA) required USDOT to identify the ten states with the most grade crossing collisions in the prior three years and require those States to develop action plans to identify specific solutions for improving safety at crossings.

and pedestrians at existing railroad crossings.[40] Section 130 funds are targeted exclusively to freight railroads and cannot be used for existing or planned passenger rail lines[41]. To assist railroads, Caltrans and the CPUC have instituted the Grade Crossing Hazard Elimination Program to provide local match funds[42]. The federal government covers 90% of costs, with the State funding a 10% local match. The State's program funding is approximately $16 million per year.

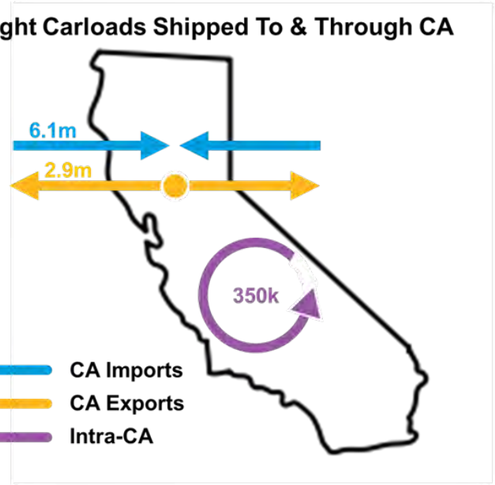
CPUC identifies and prioritizes project locations in coordination with local agencies, railroads, and Caltrans. The local agency, railroad, and Caltrans (if project is on a state route) provide concurrence and sign an agreement regarding scope of work and commitment to proceeding once funding is approved.

Section 130 projects include, but are not limited to, the following safety enhancements at at-grade crossings:

- Approach improvements (channelization, traffic signals, guardrails, pedestrian/bicycle path improvements, illumination)
- Signage and pavement marking improvements
- Active warning equipment installation/upgrades (flashing lights and gates, track circuitry, signal interconnection and preemption, wayside horns)
- Visibility improvements (sight distance improvements, vegetation clearance)
- Roadway geometry improvements (horizontal and vertical alignment)
- Grade crossing elimination (roadway closure)

The CPUC submits a Section 130 Priority List annually. Caltrans provides project estimates, ROW, and environmental certifications for federal funding. Caltrans then submits contracts for local agencies and railroads. Caltrans is responsible for conducting and documenting environmental reviews[43]. The CPUC is

40 For more information on Section 130 Program: https://dot.ca.gov/programs/rail-and-mass-transportation/railroad-highway-at-grade-crossings-section-130-guidelines
41 These projects must also be included in a Transportation Improvement Plan (TIP), developed by the local MPO, and the STIP, approved by the FHWA.
42 provided the affected grade crossings have already been identified as priority sites by CPUC
43 most Section 130 projects by their nature generally do not involve significant environmental impacts and qualify as Categorical Exclusions



responsible for the development and administration of the Section 130 priority list, development and updates to the final scope of work, preliminary plan drawings, project cost estimates and approval of the GO-88B request.

Caltrans is responsible for conducting and documenting environmental reviews. CPUC and Caltrans also provide before-and-after safety evaluations three years following the completion of each project, which is included in the state's annual Highway Safety Improvement Plan report submitted to FHWA.

Grade Crossing Inventory

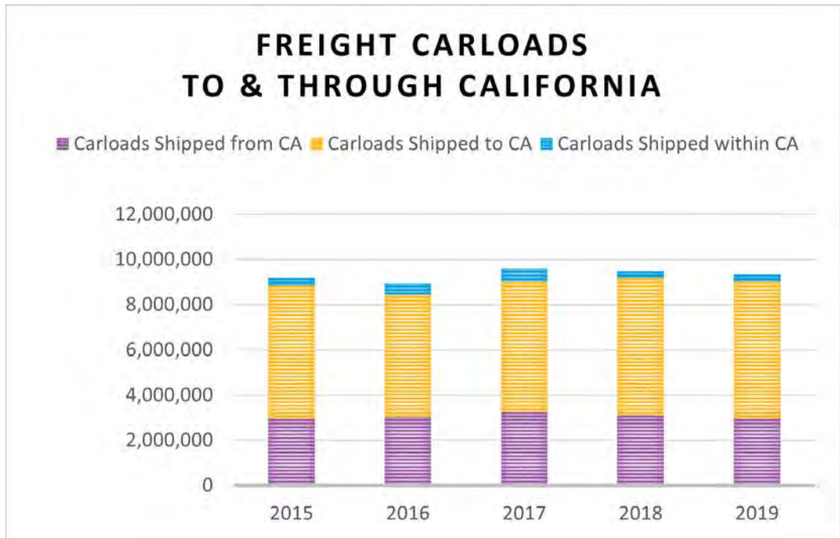
The CPUC maintains a documentation database of all grade crossings that includes the operating railroad, location, warning devices, passenger use, and more[44].

For a complete listing of grade crossings in the state, please refer to ***Appendix (X)***.

4.2.4 California Air Resource Board (CARB)

CARB is responsible for protecting the public from the harmful effects of air pollution and developing regulations and actions to fight climate change. Its mission is to promote and protect public health, welfare, and ecological resources through effective reduction of air pollutants while recognizing and considering effects on the economy. These regulations work to protect public health by improving and protecting air quality.

44 The database is separate from the FRA's national crossing inventory.



4.3 Freight Demand and Growth Trends

4.3.1 Freight Flows

California is a major logistics hub for the global economy. In 2019, the last reporting year prior to disruptions from COVID, over 9 million carloads of freight traveled to or through the state[45]. California ports handle over 200m tons of freight a year. Taken in aggregate, Los Angeles Area[46] and Bay Area[47] ports would represent the 4th and 16th largest ports in the United States by tonnage[48].

How freight gets to and from those ports, how California's agricultural and manufacturing industries obtain raw materials and ship to markets, and how the state manages growth of truck traffic on state highways and plans the transition to zero-emission require a detailed, technical understanding of how freight railroads operate both as transportation networks and as businesses.

45 Caltrans analysis of STB Public Waybill Sample
46 Combined tonnage of Port of LA and Port of Long Beach
47 Combined tonnage at Port of Oakland and Port of Richmond
48 Tonnage of Top 50 U.S. Water Ports, Ranked by Total Tons, Bureau of Transportation

Macro Trends and Micro Impacts

Freight traffic in any year-over-year period is dynamic as only just one link in a global supply chain connecting factories, farmers, and consumers throughout the world. Economic factors in different markets, trade policy, and even the weather can drive surges or slowdowns in freight shipments. Overall, freight traffic is expected to grow in line with the economy as global trade and population increase over coming decades.

Freight operations are dynamic; a 5% increase the economy doesn't equate to a 5% increase in freight shipping volume or weight. An increase in freight volume doesn't equate to an equal increase in number of carloads or number of trains.

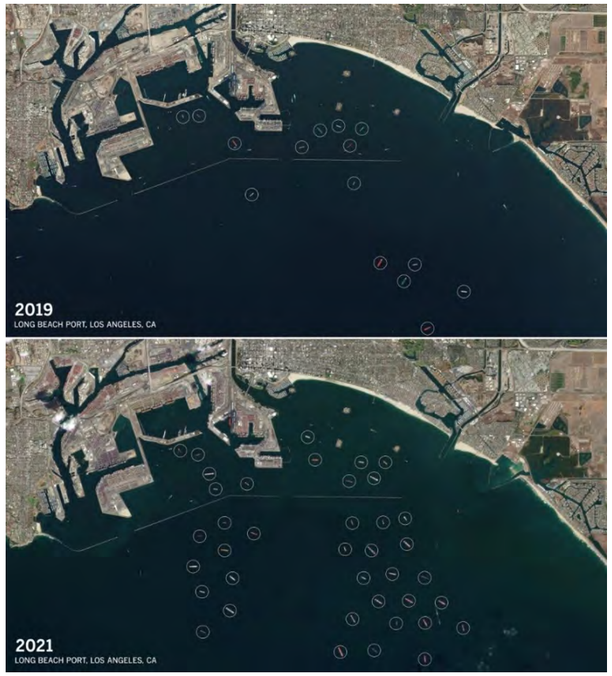
Freight operators can create longer or shorter trains depending on markets served, timing of shipments through ports, equipment availability, and other factors. Maintenance projects or customer needs may push dispatchers to route trains via one rail corridor vs another. Changes in fuel costs or port capacity may push shippers to redirect traffic from rail to long-haul trucks or vice-versa. All to say, understanding and predicting freight demands and freight rail traffic flows demands a technical, nuanced understanding of freight operations, market factors, and future forecasts.

When Caltrans needs to make specific decisions about where to support and fund improvements to freight networks, the need for and benefits of those investments demand both a macro understanding of the economy ***and*** a micro understanding of how shippers and freight rail operators make specific operational decisions about what types of trains (manifest, mixed, intermodal, etc.), in what operating patterns, on what routes, at what times.

As such, Caltrans will continue to scale up efforts to engage freight operators directly in freight pathing studies to develop a technical understanding of operational needs on the railroad, beyond the higher-level macro understanding of freight demand growth and year-over-year changes in train counts. Caltrans expanded passenger service performance monitoring connects changes in freight operations to passenger operating partners.

Covid Impacts & Supply Chain Disruptions

No industry was untouched by the COVID-19 pandemic. For transportation generally, and global shipping



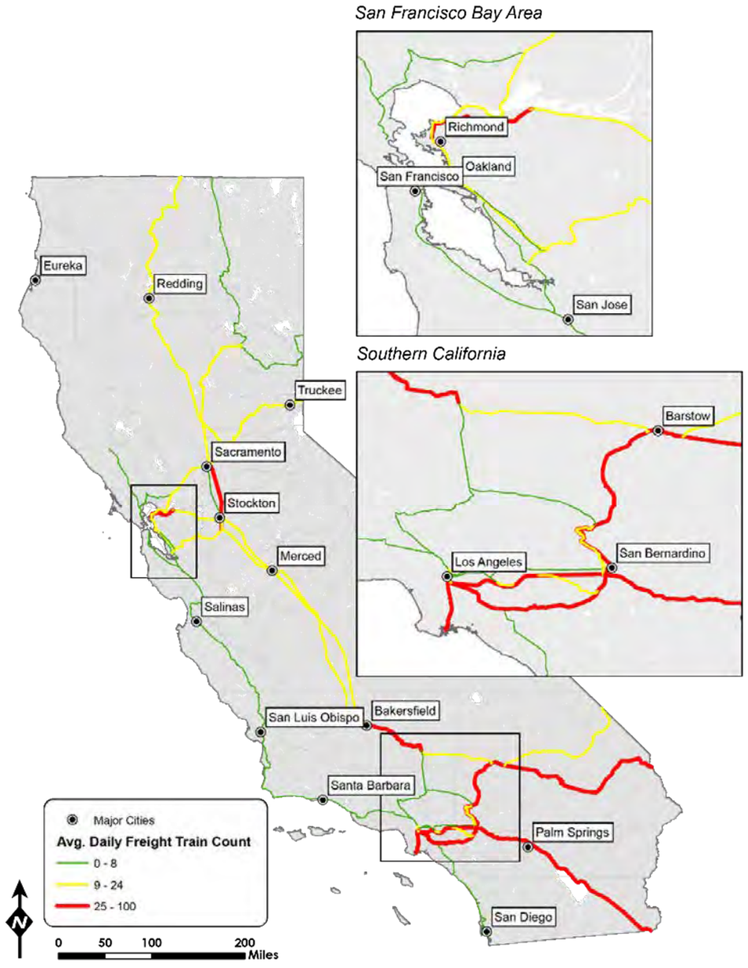
specifically, lock-downs, international borders, quarantine rules, and disruptions elsewhere in the network have caused huge backups at the Port of LA and Port of Long Beach[49]. Whereas in 2019, a dozen container ships may have been waiting to dock, in 2021 those number as much as quadrupled as containers stacked up on docks and storage areas. Queues to load/unload freight extended by weeks.

Operational changes at the ports (longer hours, potential fees for container storage) may help alleviate back-ups in the short-term. The long-term, ongoing challenges to freight traffic because of COVID-19 specifically and changes to global supply chains generally will reverberate in the years to come. With joint efforts of public and private planning collaboration, through freight rail pathing and passenger service performance monitoring, is critical to making effective investments in managing the freight network.

4.3.2 Freight Rail Train Counts

Freight train counts are estimated through FRA grade crossing data. Such analysis is useful for understanding traffic volumes on various segments of the network. When combined with other inputs related to current and future passenger service frequencies, sea-level rise, and economic development goals, this informs the State's prioritization of capacity improvements and other capital projects.

49 LA Times



Example: UP Alhambra Subdivision: Los Angeles to Colton/San Bernardino

The UP Alhambra Subdivision runs between LA and Colton (near San Bernardino) through Alhambra, Pomona, and Ontario. Daily train movements vary, with 8 average daily trains between Los Angeles and La Puenta, 14 between La Puenta and Pomona, and 40 between Pomona and Colton[50]. Though the corridor is primarily single-track, there are multiple freight yards, sidings, and crossovers with other major subdivisions. Passenger service is limited, consisting of three Amtrak long-distance trains each way per week. Metrolink also uses subsets of the corridor for the San Bernardino line (east of El Monte) and the Riverside line (west of Downtown Pomona).

Currently, four rail lines serve this general East/West route, albeit with different service areas; the SCRRA San Gabriel Subdivision, the UP Alhambra Subdivision, the UP Los Angeles Subdivision, and the BNSF San Bernardino Subdivision. Given current traffic volumes, it is possible that rebalancing traffic across the different routes will accommodate growth. The Alhambra Subdivision is an important component of UP's transcontinental network and serves as a key connection to the Ports of LA and Long Beach. The route serves national security interests as part of the Strategic Rail Corridor Network (STRACNET). Given needs for future rail traffic, both UP and the State share interests in coordinated capacity investments.

50 CPUC Grade Crossing Train Count Data

4.4 Freight Rail Vision

The Rail Plan supports a robust freight industry that serves the State's economic, environmental, and equity goals while providing a platform for integrated passenger service.

Two main strategies have been identified to fulfill that Vision;

- transitioning the freight network to zero-emission operations, and
- scaling technical analysis to corridor- and network- wide programs for understanding capacity needs, benefits, impacts, and aggregate effects of public sector capital investments.

Transitioning to ZE operations is required for achieving environmental goals, reducing air quality burdens on disadvantaged communities, and maintaining an emissions advantage over trucking.

Capital investments will be critical to maintain the network; the key is identifying the right investments with demonstrated benefits to achieve the State's goals. Caltrans must continue to scale technical expertise and strategic leadership in coordinated analysis to ask and answer those questions effectively.

Expanding freight facilities can provide an alternative for highway expansion and can provide for increased/improved passenger service. Short-lines can connect new industries and markets to the network. At ports, increased terminal capacity can decrease turn times and improve reliability. While a location for the Inland Port Facility has not yet been selected, it is anticipated an Inland Port in the Central Valley will improve the efficiency of goods movement while laying the foundation for a new intermodal spine connecting seaports in Oakland, Los Angeles, and Long Beach. By shifting cargo truck traffic to the railroad spurs, the Inland Port is expected not only to help establish a world-class efficient and competitive logistics system, but also significantly reduce greenhouse gas emissions. Such investments require an equity analysis to understand safety, right-of-way, noise, emissions, and other implications. Any investment requires technical analysis, not just at a project site, but at a corridor- and network-wide level to demonstrate and document clear benefits that support State policy goals, thus justifying public investment.

Key tenets in delivering the Vision:

Organization

- Support additional technical freight pathing studies for trade corridors
- Support ongoing state-sponsored performance monitoring of passenger services in collaboration with host railroads
- Support grade crossing improvements and advocacy for expansion of the federal Section 130 program and the state Section 190 Grade Separation Program

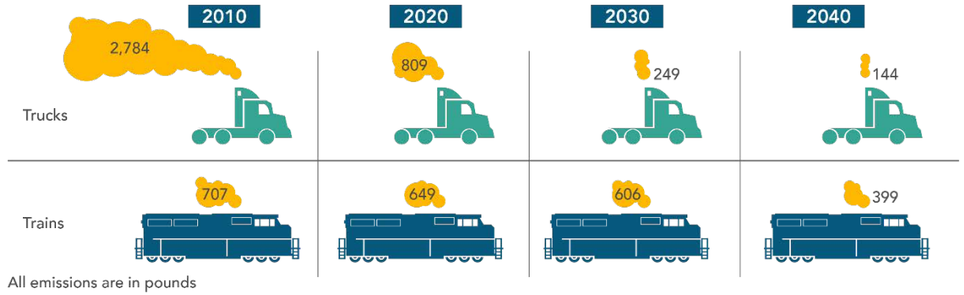
Systems

- Support transition of main-line haul, short-line, yard, and port operations to zero-emission
- Support economic development of short-lines to provide or improve rail network access

Infrastructure

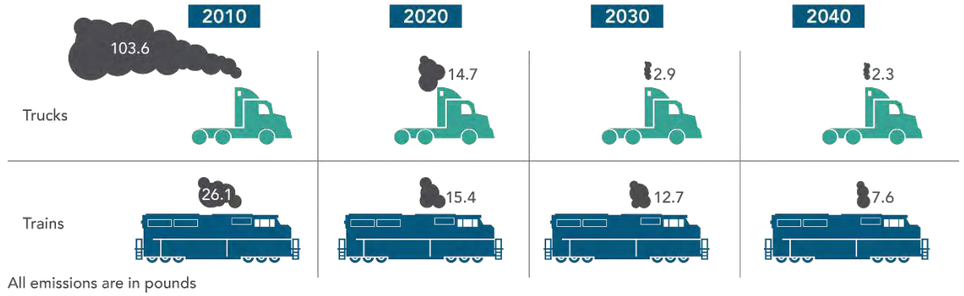
- Support trade corridor improvements, avoiding highway expansion, shifting freight loads from trucks to rail
- Support investments in shared passenger/freight corridors
- Support terminal and yard capacity improvements

Total NO_x Emissions in Communities 20-300 Miles from the Ports



All emissions are in pounds

Total $PM_{2.5}$ Emissions in Communities 20-300 Miles from the Ports



All emissions are in pounds

4.4.1 ZE Transition

California's goal is to transition the freight network to ZE operations. Caltrans is coordinating with public[51] and private[52] partners such as CARB and federal and state to identify and implement standards, regulations, and financing to facilitate the transition. The transition will be complex, capital intensive, and technically challenging. Nevertheless, it is essential to the State's environmental, economic, and equity goals[53].

Typical locomotives are powered by a diesel engine and are large contributors to diesel particulate matter (PM), nitrogen oxide (NOx), and greenhouse gas (GHG) emissions. Other sources of NOx and PM2.5 emissions in railyards include railcar movers, yard trucks, drayage trucks, and other cargo handling equipment.

Locomotives and railyards are a harmful source of NOx emissions, PM 2.5 emissions, and GHG emissions. Trucks in California have become cleaner and are moving towards ZE[54]. As California's current regulations are implemented, trucks are producing less particulate matter and oxides of nitrogen (NOX) emissions. As soon as 2023, trucks may be the cleaner mode to transport freight in certain circumstances.

This development is a significant benefit to California's air quality, particularly for disadvantaged communities and priority populations often co-located proximate to industrial sites and ports with high freight traffic. It's also a significant change in the traditional contrast between over-the-road trucking and freight rail; where rail has been more fuel efficient and

51 Federal EPA, California EPA, CARB, CPUC
52 freight railroads, equipment manufacturers
53 California has placed additional emphasis on protecting local communities from air pollution through AB 617; C. Garcia, Chapter 136, Statutes of 2017
54 CARB analysis

with fewer emissions by volume. Without aggressively transitioning to zero-emissions technology, the freight network risks losing a core advantage over trucking, with potential implications for how the public-sector prioritizes capital support for freight network capacity projects.

ZE and Equity

Beyond economic value of the freight network, ZE transition is a central pillar of environmental justice and supporting equity through transportation investments. Disadvantaged communities and priority populations are more likely to be exposed to higher emissions of diesel exhaust, particulate, and other harmful emissions.

Exposure to diesel exhaust/PM2.5 can lead to:

- Acute respiratory symptoms;
- Asthma exacerbations;
- emergency room visits for asthma Bronchitis;
- chronic obstructive pulmonary disease (COPD)
- Heart attacks
- Nervous system effects (e.g., cognitive deficits)
- Lost workdays
- Premature death
- Increased risk for cancer[55]

Reducing those emissions to zero as quickly as possible is tangible and provides immediate, quantifiable benefit to disadvantaged communities.

Technology

Major locomotive OEMs have developed s that are either currently going through demonstrations or have plans for future demonstrations. ZE Line haul locomotive developments have been announced by major OEMs and railroads. Multiple manufacturers offer small ZE switchers suitable for low usage freight applications. ZE implementation also necessitates capital intensive infrastructure to support hydrogen and/or battery fueling/charging. Advanced locomotive technologies, such as batteries and fuel cells, are being developed.

55 https://ww2.arb.ca.gov/sites/default/files/2021-03/Railyard%20Listening%20Session%203-2-21_1.pdf

Possibilities include the use of a current hybrid diesel (or natural gas)-electric locomotive engine modified to switch from the diesel engine to another source of electricity. This source may be a bank of batteries or fuel cells located on the subsequent rail car or an external power supply (like overhead electric catenary or in-ground wayside power). While running in zero-emission mode, the diesel engine would not be operating. Aftertreatment-equipped locomotives could be augmented with on-board batteries to provide an additional 10-25 percent reduction in diesel fuel consumption and greenhouse gas (GHG) emissions. With battery technology improvements, a locomotive equipped with on-board batteries could realize fuel savings of about 15 percent by 2025, and 25 percent by 2030.

Class 1 railroads operating in California reported over 10 billion dollars in net income combined in 2020, and short-lines have potential support from their parent company as well as access to public grants to transition to zero emission. Battery locomotives are expected to cost ~$3 million or more and hydrogen fuel-cell locomotives are expected to cost ~$4 million or more. Meanwhile, used diesel locomotives can be purchased for less than $500,000 and overhauled diesel locomotives cost ~$2 million or more; while neither option meets the mandated ZE requirements. In California, UP and BNSF operated Tier 1+ and dirtier locomotives in the South Coast for 38 percent of the activities, while less than 7 percent of the activities were done with Tier 4 locomotives. Under the federal definition, the useful life for a freight interstate line haul locomotive can be between 30,000 and 40,000 megawatt-hours (MWh), which typically translates to about seven to ten years of operation.

BNSF Battery Electric Pilot

BNSF recently completed testing of a diesel-battery hybrid train from Barstow to Stockton with an experimental battery locomotive coupled with two diesel locomotives, and achieved “an 11% reduction in fuel consumption, along with similar reductions in emissions of nitrogen oxides, small particles (particulate matter), and greenhouse gases”. A future operational version is expected to improve fuel efficiency.[30]

The indicated diesel-battery hybrid locomotive continues to rely significantly on traditional diesel combustion as a means of propulsion. Additional research, development, and scaling in battery technology are required to achieve full zero emission to comply with the Executive Order N-79-20.

Short-Lines

Short-line railroads often purchase second-hand used locomotives and operate them for as long as possible. This increases the difficulties for short-line railroads to meet stricter emission standards without costly upgrades or replacements. As of 2020, the average age of short-line locomotives in California was 43 years old, with two-thirds of locomotives operating with unregulated engine technology (pre-Tier 0 units), responsible for a combined estimated 1.4 tons of NOx emissions annually.[56] The two-thirds unregulated must be zero emission by 2035.

While all short-lines contribute to air pollution, many short-lines are near disadvantaged communities and contribute a negative socioeconomic dynamic. Conversion of these locomotives to ZE propulsion will have large-scale positive quality of life impacts. Over half of short-line locomotives are originally built pre-1973 and they emit 13 to 29 times more NOx and PM than the cleanest Tier 4 locomotives. Short-lines can have emission reductions only if short-lines transition to zero emission locomotives.

56 CARB: https://ww2.arb.ca.gov/sites/default/files/2020-09/CARBlocoinvwebinar2020.pdf

4.4.2 Partnering with CARB

Given its regulatory authority over air quality and emissions, CARB is a critical partner and lead agency in freight ZE transition. CARB has developed and implemented measures to reduce locomotive and railyard emissions, including studies, regulations, enforceable agreements, funding clean technology, and has established enforceable agreements with railroads. Additional emission reductions are critical to meet the criteria pollutant standards.

CARB Heavy-Duty Low NOx (Nitrogen Oxides) Truck and Omnibus Regulation will require tougher emissions standards, overhaul engine testing procedures, and further extend engine warranties to reduce NOx emissions. For short-lines, this includes Spending Account to purchase or repower to a Tier 4 or cleaner locomotives, and the In-Use Operational Requirements that allow only locomotives less than 23 years or older to operate in the State.

CARB is engaged in a wide array of innovative programs to reduce the air quality impact of moving freight throughout the state:

- Introduce new regulatory legislation to facilitate transition to ZE locomotives
- Decrease locomotive emissions by increasing turnover to EPA Tier 4 and cleaner locomotives
- Prioritize emission reductions in communities disproportionately impacted by locomotive emissions
- CARB has also petitioned U.S. EPA to create a new, cleaner Tier 5 emissions standard for locomotives.

It is critical that both Caltrans and CARB work with the freight railroads to pursue ZE technology in a manner that allows California's freight railroads to remain operational. CARB is complying with the Governor's EO N-79-20 to move towards zero emission technologies. The Class 1 railroads that operate in California generate over 10 billion dollars in net-profit every year, and short-lines are often part of larger parent companies with hundreds of million dollars in annual net profit. With various additional public funding available to the railroads, transition to ZE rail is financially feasible.

Federal Regulation

CARB has petitioned the US EPA to adopt more stringent locomotive emission standards. The petition asks the EPA to update its standards to take effect for remanufactured locomotives in 2023 and newly built locomotives in 2025. The new emission standards would provide critical NOx and PM reductions especially in disadvantaged communities near railyards.

State Regulation

In the absence of federal action to address harmful emissions from locomotives, CARB is developing regulatory concepts to reduce criteria pollutants, toxic air contaminants, and greenhouse gas emissions for locomotives in-use. These concepts are intended to be implemented statewide and provide an opportunity for the railroads to better address regional pollution and long-standing environmental justice concerns with communities near railyards.

The goal of the regulatory concepts is to accelerate immediate adoption of advanced cleaner technologies for all locomotive operations. CARB is working with industry to create and test zero-emission locomotive technologies. As discussed in CARB's draft Mobile Source Strategy, such technologies are critical to the State's ability to protect public health, address climate change, and meet both State and federal air quality standards.

CARB anticipates bringing an In-Use Locomotive Regulation for Board consideration in Fall 2022 to address emissions from passenger and freight locomotives (Class I, Class III, and industrial locomotives). The in-use locomotive regulatory concept encourages a more rapid transition to zero emission technologies in accordance with the Governors Executive Order N-79-20.

***Sierra Northern Railway,** a shortline railroad operating in the central regions of the state, has debuted a newly designed **ZE hydrogen-powered switching locomotive**[8]. The $4M project was funded through a California Energy Commission award in 2021 and will allow the expedited replacement of older Tier-zero diesel switching locomotives for ZE vehicles.*

8 https://www.trains.com/trn/news-reviews/news-wire/sierra-northern-provides-look-at-design-for-hydrogen-switcher/

4.4.3 Network Capacity Analyses

Intermodal traffic and international trade growth are expected to grow along with the economy, likely beyond the capacity of the existing network. Understanding the capacity of a railroad or a rail network is a complex question that demands more technical analysis than simply dividing the available track space by the number of potential trains, as might be represented in highway planning.

A railroad does not have a simple set limit of how many trains per hour it can accommodate. Any question of current or future capacity depends on many administrative and technical variables.

Administrative Agreements

Freight service often utilizes infrastructure owned by more than one railroad. When a given freight operator uses another company's infrastructure, it's done through 'trackage rights,' or a legal agreement between the two entities that allows for certain numbers of certain types of trains to use a corridor at certain times and in certain ways, all for a certain fee.

Train	Length	Weight	Power		
Infrastructure	Tracks	Grade	Junctions	Signals	Yards
Operations	Number of train movements	Terminal operations			
	Freight cars transported per time period	Average speed of service			
	Tons of freight transported per time period	Stability of the operations			

Trackage rights spell out specific allowances for using a corridor (determined by a maximum number of trains, maximum length of trains, type of trains, times of day / week / year the infrastructure is available), the rules under which the corridor can be used (dispatching responsibilities, operating rules and parameters, insurance, and maintenance responsibilities), and the consideration given for that use (a one-time fee, an ongoing fee, a swap for trackage rights elsewhere, etc.).

Such rights agreements also pertain to passenger operators utilizing freight corridors, as much of California's passenger network does. These agreements typically spell out how many and what type of trains are allowed to use the corridor, along with any operating parameters (track used, direction of travel, time of day). The agreements are typically the starting point for negotiation between passenger service operators and host railroads for increased service frequency, changes in service patterns, and service expansion.

When it comes to increasing 'corridor capacity,' particularly for passenger service, administrative agreements should be the first topic analyzed as capacity constraints can be addressed through a negotiation process with partner stakeholders before any infrastructure need be designed or built.

Technical Parameters

From a technical operating perspective, while often colloquially expressed as 'trains per hour', several variables determine the 'capacity' of a railroad or a given corridor. Those variables break down into three buckets:

- The specific characteristics of the train or trains themselves that utilize a corridor;
- The specific characteristics of the infrastructure; and
- The specific characteristics of how the corridor is operated.

Only when understood in combination, is it possible to understand what the current technical capacity of a corridor is – or – what it would need to be to serve future traffic volumes. The number and complexity of variables and assumptions demand detailed documentation of assumptions and rigorous technical analysis to effectively understand capacity constraints and future capacity needs.

Mitigating Capacity Constraints

Since the 2018 State Rail Plan, Caltrans has engaged in several strategic efforts to understand, prioritize, and articulate future capacity needs. These efforts scale Caltrans' ability to understand current capacity constraints, implications of future freight or passenger traffic increases, and effectively prioritize future investments.

There are four components to Caltrans' strategic management of understanding capacity and relevant investments to mitigate constraints:

1. Documentation / monitoring: Caltrans is collecting and cataloging actual operations performance data of state-sponsored intercity passenger service
2. Technical analysis: Caltrans is developing and updating digital infrastructure and operations models for current and planned traffic volumes in the Rail Plan ***Vision***
3. Strategic planning: Caltrans' analysis is then refined and updated iteratively through implementation planning exercises (utilizing the Service-Led Planning Methodology) to deliver the integrated statewide passenger network detailed in the Rail Plan ***Vision***
4. Prioritized investments: Components 1-3 provide a technical foundation for Caltrans to understand what improvements should be prioritized under what set of assumptions/conditions for future traffic volumes and operating parameters – and – the relative utility that should be expected to accrue to passenger services. this understanding is a basis for funding commitments and negotiations over administrative agreements with host railroads.

Since 2018, Caltrans has begun a series of two ongoing efforts to scale (1) documentation / monitoring efforts and (2) technical analysis to complement (3) strategic planning conducted in the Rail Plan, network integration studies, and other efforts:

4.4.4 Freight Pathing Studies

Corridor-based freight path planning allows for an open, cross-jurisdictional process that weighs corridor- and network-wide impacts to rail operations. Analyzing rail operations at a corridor level facilitates collaboration among transportation agencies at the local, regional, and state levels as they identify approaches to solving problems and prioritizing funding. A corridor-based approach is necessary to examine trade-offs, trade corridor impacts, and joint passenger and freight effects. These trade-offs and decision points can include land use planning, zoning, and environmental regulations to maximize public benefit and efficiency.

For example, a proposed grade separation on a lightly used line to serve a future intermodal terminal may not be justifiable, absent construction of the terminal. In that case, corridor-level planning bundles the projects together, allowing for funding, sequencing of construction, and impact. This type of corridor-level project delivery results in coordinated, enhancing system- wide mobility and efficiency.

Although Caltrans and the CPUC put out an annual lists of prioritized grade-separation projects, an additional study or criteria is needed to consider grade separations not as stand-alone safety or traffic relief projects, but rather as rail-corridor-based projects. When organized and pursued strategically as part of an identified corridor, grade-separation projects can dramatically improve rail capacity and passenger service.

Methodology and Application

By treating track operations as a marketplace based on supply (track capacity) and demand (train frequency), railroads can operate more efficiently and move more trains – which means moving more freight and more passengers.

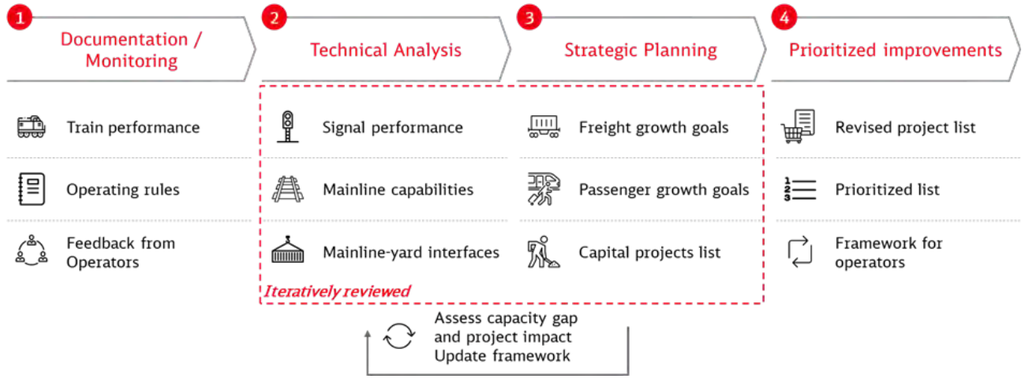
The overall approach uses schedule "slots" – pre-planned windows of time that it takes a train to operate along a corridor – as a "currency" of sorts, establishing a theoretical maximum throughput for a track using only existing infrastructure and then identifying operational issues that "cost" slots.

For example, if a track can theoretically support one train every 15 minutes, a train that stages on the main line for 45 minutes before entering a yard costs five "slots": the original slot the train operated in, three slots behind it representing the time waiting on the track, and a final fifth slot to accelerate and pull into the yard. Adding a siding in this location – even if the train still incurs a 45-minute delay waiting for clearance into the yard – would free up three slots by not occupying the main line, increasing theoretical throughput. An extended yard lead, rather than a siding, would save a fourth slot by allowing the train to pull off the main line entirely.

This approach improves passenger operations as well, helping to identify infrastructure constraints such as stations where platforms only exist on a single track, costing additional slots on other tracks to accommodate passenger trains changing tracks to serve a station.

Example: San Diego Pathing Study

The San Diego Pathing Study draws on previous optimization studies completed by North County Transit District (NCTD) and other Los Angeles-San Diego-San Luis Obispo (LOSSAN) stakeholders and supports efforts to holistically consolidate freight and passenger rail service needs into one executable operating plan, which also aligns with the goals of the 2018 California State Rail Plan. Additionally, the Pathing Study identifies and prioritizes specific infrastructure improvements that would increase service capacity in the near-, mid-, and long-term future.



4.5 Progress Toward Implementation

Since the 2018 Rail Plan, Caltrans has been actively engaged in investments of the State's freight network and supporting collaboration between passenger and freight operators.

Example: San Bernardino Rosecrans – Marquardt Triple-Track

Project Goal[57]*:*

- Improve safety by separating pedestrian and vehicular traffic from trains at the railroad crossing
- Enhance the efficiency of the existing and future rail system needs of the BNSF, Amtrak and Metrolink services.
- Accommodate potential future high-speed rail

Project Sponsors

- LA Metro
- Caltrans
- BNSF
- CAHSRA
- City of La Mirada
- City of Santa Fe Springs

Project Status

- Environmentally Cleared: Yes
- Funded:
- Construction: Underway – site clearance and utility relocation complete, roadway overpass bridge anticipated in 2023
- Anticipated Completion Date: 2023

Relevance to the State Rail Network

The BNSF San Bernardino Rosecrans-Marquardt Triple Track project is designed to construct an overpass at the intersection of Rosecrans Marquardt Avenues in Santa Fe Springs. This will allow for enhanced safety and a more efficient traffic flow, eliminating wait times for a passing train. In addition, the installation of a third main track will increase capacity for passenger and freight service.

Example: Stockton Diamond[58]

Project Goal

- Provide for an uninterrupted flow of rail through the crossing, which will improve freight movements and lead to lower costs for freight shipping, reduced delays, and a decrease in fuel consumption.

Project Sponsors

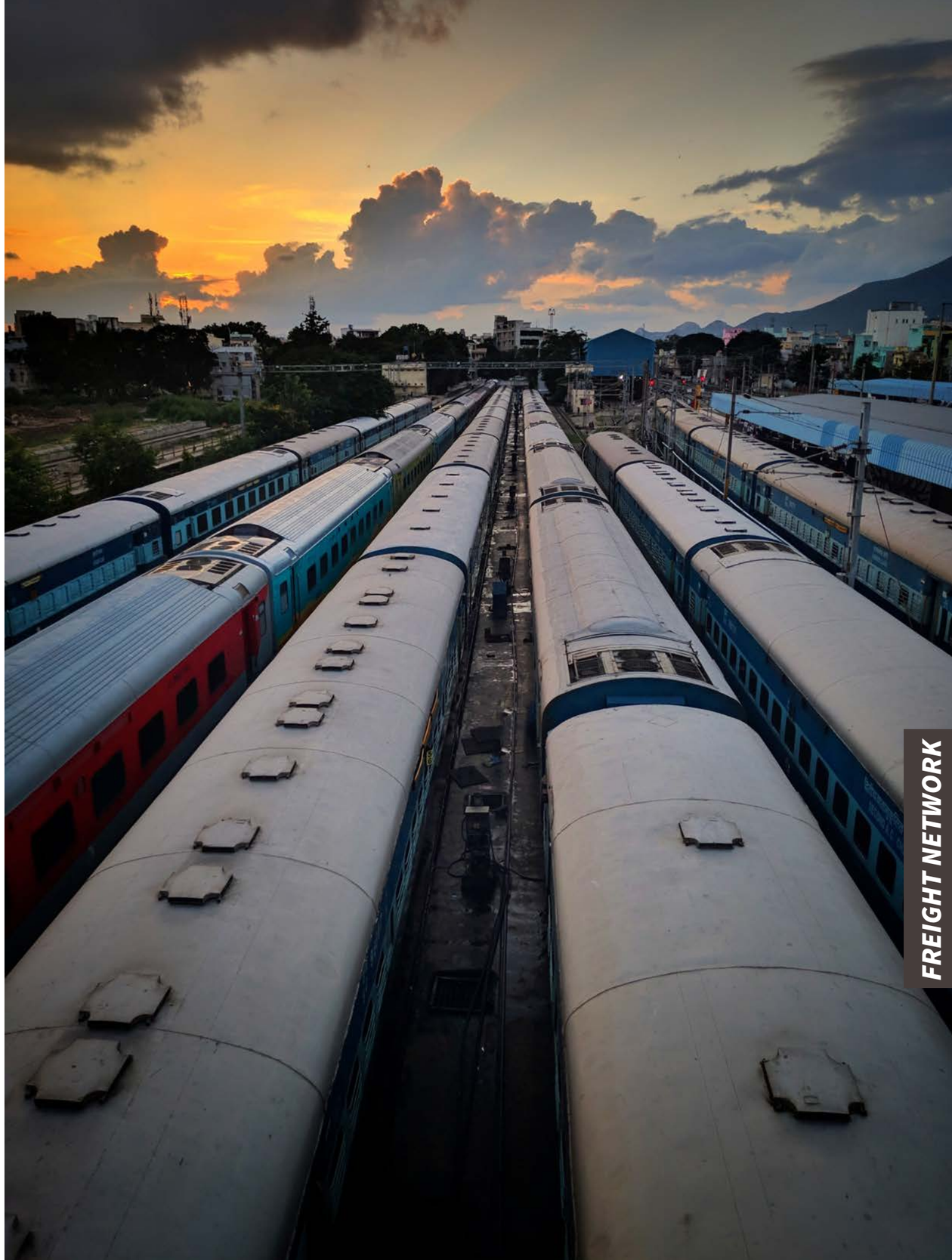
- SJRRC
- SJJPA
- ACE
- UP
- BNSF
- City of Stockton

Project Status

- Environmentally Cleared: Yes
- Funded: ITIP
- Construction: Underway
- Anticipated Completion Date: 2025

Relevance to the State Rail Network

Construction of a grade separation will provide for an uninterrupted flow of rail through the crossing, which will reduce delays and lower costs for freight operations. The decrease in locomotive idling time will result in less fuel consumption and improved air quality. The cost savings resulting from increased freight throughput and velocity will allow for continued growth and improved efficiency.



57 https://media.metro.net/projects_studies/regionalrail/factsheet_Rosecrans%3AMarquardt_2018_04.pdf

58 https://acerail.com/wp-content/uploads/SJRRC_SJJPA_Stk-Diamnd-Grade-Sep_Fact-Sheet_May2020.pdf

CHAPTER 5

DECARBONIZATION & MITIGATING CLIMATE CHANGE

Climate change is a real phenomoneon, threatening all aspects of the transportation network.

California is focused on both decarbonizing the the state's rail system by planning and transition to zero-emission fleets, as well preparing for sea level rise through increasing resiliency in the network.

5.1 Decarbonizing Transport

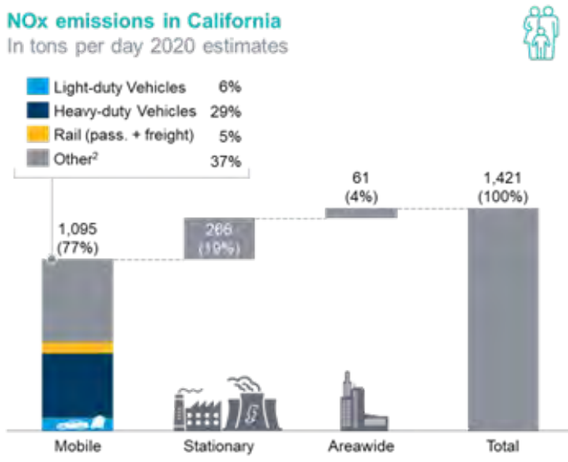
5.1.1 Regulatory Background

At the State level, EO N-79-20 requires that all off-road vehicles, including trains and other rail vehicles be ZE by 2035. Achieving this goal eliminates use of traditional diesel locomotive engines; thus requires a significant technological and logistical shift. Developments in propulsion technology including batteries and hydrogen fuel cell hybrid propulsion systems, which produce no pollutants, have been demonstrated as feasible mechanisms of propulsion for passenger rail.

Air Quality

Efforts to federally regulate air pollution from diesel engines, found in a wide variety of vehicles including locomotives, have been underway since the Clean Air Act of 1963. Specific pollutants of concern, known as criteria pollutants, are nitrogen oxides (NOx), hydrocarbons (HC), carbon monoxide (CO), and particulate matter (PM / PM2.5)[59]. These pollutants result from internal combustion engines and have negative effects on the environment (smog, ozone depletion, etc.) and human health (chronic respiratory diseases, etc.).

The EPA has passed progressively more stringent regulations on vehicle emissions, including locomotives, in the form of CFR-defined emissions tiers. There are five defined levels, with Tier 0 being the most polluting, up to Tier 4 being the least polluting. All locomotives constructed after 2015 must meet EPA Tier 4 emissions levels. However, advancements in non-polluting technologies have enabled complete separation from diesel propulsion and negative pollution effects for the passenger rail industry.



59 Identified in 40CFR1033

Global Warming

In addition to criteria pollutant reduction, efforts must be pursued to ensure that the production of low- and zero-emissions fuel sources, such as renewable diesel and hydrogen, does not add to macroscopic emissions levels between the point of production and the point of delivery onto the locomotive, for both criteria pollutants and greenhouse gases (GHGs). This "well-to-wheel" (WTW) environmental impact is being assessed as part of the strategic implementation of low- and zero-emissions technologies to ensure a net positive impact during and after implementation.

Executive Order S–3–05, signed in 2005, established state GHG emission reduction targets. The Global Warming Solutions Act, AB 32, signed into law in 2006, created a comprehensive, multi-year program to reduce greenhouse gas emissions in California. AB 32 required CARB to develop a Scoping Plan that describes the approach California will take to reduce GHGs to achieve the goal of reducing emissions to 1990 levels by 2020. Since 2008, there have been two updates to the Scoping Plan. Each of the Scoping Plans have included a suite of policies to help the State achieve its GHG targets, in large part leveraging existing programs whose primary goal is to reduce harmful air pollution. This included the high-speed rail project, which is expected to reduce GHG emissions by 1 million metric tons annually in CO2 equivalent.

It is important to note that the implementation of low- and zero-emissions technologies, in particular the short-term plans for low-emissions technology implementation, will have a direct and immediate impact on disadvantaged communities that are near rail corridors. These technologies will have significant impact in reducing criteria pollutants which will reduce human health issues such as premature deaths due to cardiopulmonary illnesses, hospitalizations for cardiovascular and respiratory illnesses, cancer, and emergency room visits for conditions like asthma and related pulmonary conditions, and thus should increase the quality of life for many of the citizens of California.

- **5.1.2 Near-Term ZE Transition**

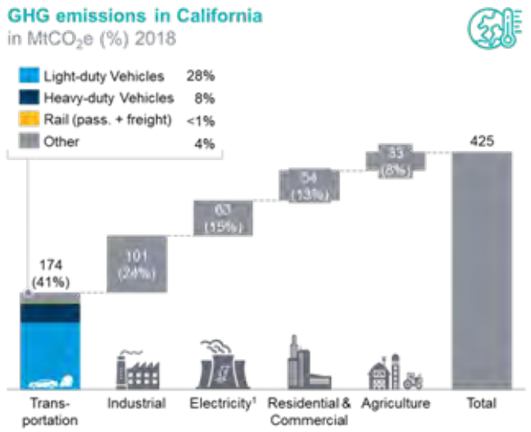
Caltrans's intercity locomotive fleet consists of 13 F59PHI

locomotives (EPA Tier 2) and 24 Siemens SC-44 Charger locomotives (EPA Tier 4). Caltrain is in the process of electrifying its corridor for conversion to all-electric operations via overhead catenary. California High-Speed Rail project will be powered by overhead catenary. Local rail transit[60] (either heavy-rail metro service or light-rail service) is already electrified throughout the State.

Caltrans has developed a strategic implementation plan for rollout of ZE technologies and is engaged in developmentary activities to support commencement, with anticipated completion by 2025. Hydrogen propulsion systems are in development for passenger rail and not expected to be commercially viable in the United States until 2026. Until that time, Caltrans can reduce emissions on its current locomotive fleet economically by implementation of low-emissions technology.

Caltrans's short-term plans for its intercity passenger rail fleet include efforts to bring locomotives up to or near EPA Tier 4 emissions levels. This will be accomplished through two objectives: 1) implementation of renewable diesel (RD) fuel fleetwide as an alternative to standard Ultra-Low Sulfur Diesel (ULSD) locomotive fuel, and 2) implementation of after-treatment technology onto its F59PHI locomotives, which are currently EPA Tier 2.

Auxiliary efforts, including implementation of trip optimizer software (TOS) to reduce excessive diesel emissions due to engineer performance and wayside power stations to minimize locomotive idling will be implemented. These low-emissions technologies and associated efforts can be implemented by ~2027.



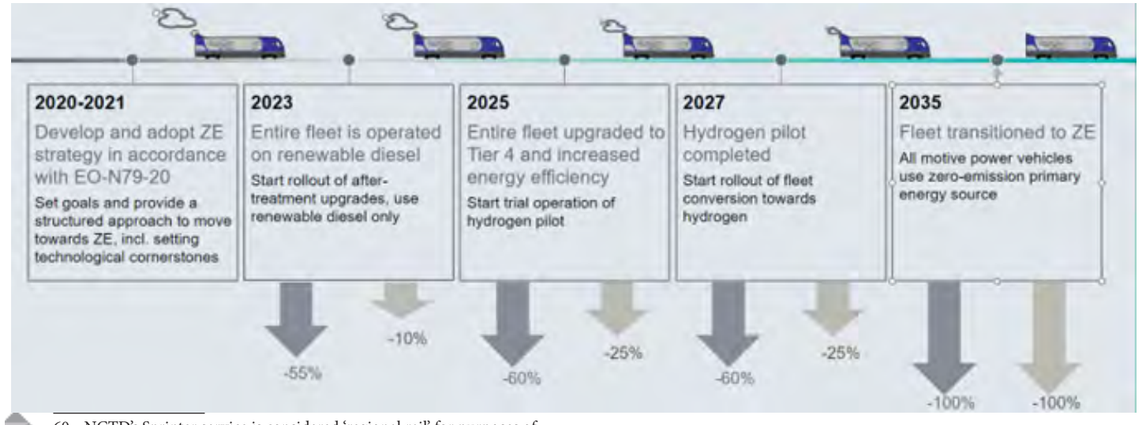
emissions technology:

Renewable Diesel

Specifically, RD implementation involves the transition of Caltrans's intercity passenger locomotives from operating on ULSD fuel to operating on RD fuel. There is established precedent for F59PHI locomotives to operate on alternative fuels[61] with no negative operational impacts, e.g., engine degradation, maintenance issues, loss of fuel economy, etc., and the Caltrans F59PHI fleet can similarly be transitioned to RD with no expected risks to performance. RD fuel will initially be implemented onto a few F59PHI locomotives in Caltrans's fleet, and the locomotives will operate in normal revenue service for several weeks to confirm expected operational status. Once confirmed, RD can be rolled out as the fuel source for the remaining F59PHI locomotives. RD implementation as a standalone effort is expected to improve the F59PHI locomotive emissions levels to approximately EPA Tier 3 in addition to improved WTW emissions numbers. The cost difference between RD and ULSD has historically been marginal, so Caltrans is not expecting to incur any significant additional capital expense during the conversion to RD.

61 Evaluation of Locomotive Emissions Reduction Strategies, Frey & Rastogi, 2018

Caltrans's timeline of implementation for low- and zero-



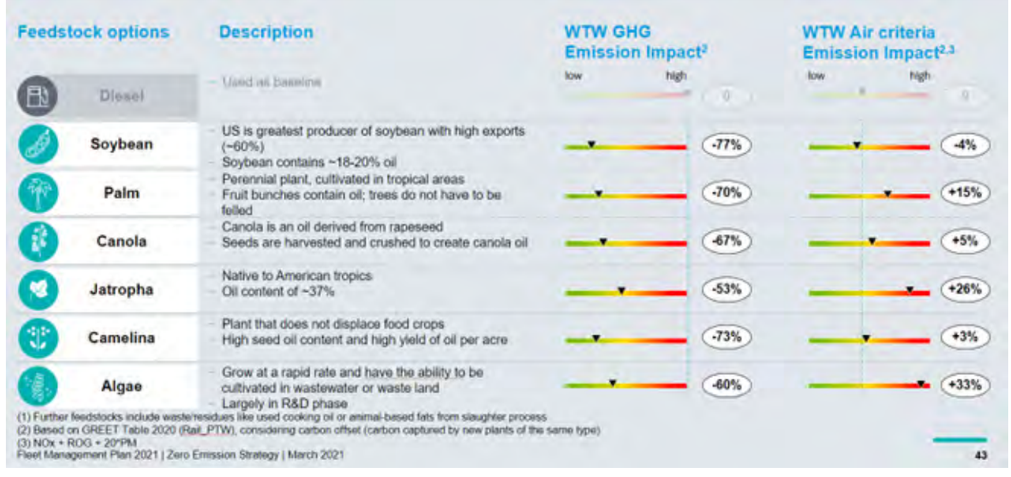
60 NCTD's Sprinter service is considered 'regional rail' for purposes of the Rail Plan

Conversion of Caltrans's Siemens SC-44 Charger locomotives involves additional steps, as these units are newer, still under warranty, and there is less information currently available regarding how alternative fuels affect engine performance. Caltrans is currently testing one Siemens Charger on RD fuel to confirm acceptable operational performance; testing is expected to be completed in early 2022 and Caltrans will subsequently ask Cummins (the QSK59 engine manufacturer) to add RD to the list of approved engine fuels. After approval by Cummins, Caltrans will develop a rollout plan to the other Charger locomotives in the fleet, similar to what is indicated for the F59PHI locomotives. As the Charger locomotives are already EPA Tier 4 emissions levels, there will be some localized criteria pollutant reductions but the emissions improvements and associated public health benefits will be primarily realized in WTW emissions impacts.

The implementation of RD fuel offers the opportunity for emissions testing to precisely quantify criteria pollutant reduction. Caltrans is currently in contract negotiations with the University of California, Riverside (UCR) to perform Portable Emissions Measurement System (PEMS) testing on Caltrans's locomotives. PEMS is an established emissions testing methodology for criteria pollutant reduction quantification in multiple aspects of the transportation industry, including the passenger rail sector for quantification of emissions reduction due to introduction of alternative fuels. PEMS testing will first be performed on Caltrans's F59PHI locomotives, as these are the units that are expected to realize the most significant emissions reduction, then subsequently on the Charger locomotives. Testing will be performed in both static operation and revenue service and is expected to start in 2022 and is expected to be completed in 1-2 years.

The pursuit of RD as a permanent solution to ULSD offers the opportunity to evaluate multiple feedstock sources for RD, to ensure maximum WTW emissions reduction. The figure below provides a summary of Caltrans's efforts to date regarding potential plant-based RD feedstock options, and associated WTW emissions reduction levels:

Similarly, after-treatment system implementation offers a financially viable opportunity to further improve criteria pollutant emissions levels on Caltrans's F59PHIs. The after-treatment system is an EPA approved, retrofit assembly kit that reduces emissions via selective catalytic reduction. The after-treatment system fits onto the locomotive superstructure without functionally affecting its existing clearance envelope. The system captures locomotive exhaust prior to release to the environment and chemically reacts the extant criteria pollutants to at or near EPA Tier 4 levels. The after-treatment system will be applied only to the F59PHI locomotives, which are EPA Tier 2, and not to the Charger locomotives which are already



equipped with an OEM after-treatment system. Caltrans is currently establishing pre-contractual activities associated with after-treatment system implementation and expects fleetwide retrofit within the next 3-4 years. Implementation is expected to require collaboration with a third-party installer to physically implement the after-treatment system onto the locomotives, followed by operational validation to confirm proper system functionality. It is expected that a pilot system will initially be installed on one F59PHI by the after-treatment OEM and then tested to confirm emissions reduction levels, then after acceptance by Caltrans similar implementations will be performed on the remaining F59PHI locomotive fleet. Note that this will be the first installation of an after-treatment on an F5PHI locomotive, however an equivalent system was previously installed on a North Carolina DOT owned F59PH locomotive with an equivalent engine configuration; based on this previous installation, no implementation issues are anticipated on Caltrans's F59PHI fleet.

5.1.3 Mid-Term ZE Transition

Caltrans's ZE compliance strategy replaces its current fleet of diesel locomotives with ZE propulsion locomotives. It is expected that hydrail propulsion will be the primary powertrain configuration for intercity passenger service. Battery propulsion is expected to have situational use for regional rail services and switchers – circumstances that enable short travel times and/or frequent charging opportunities.

Hydrail implementation on Caltrans's intercity service will be accomplished through a combination of retrofitting existing locomotives and replacing other existing units with new (OEM) ZE locomotives, although foregoing retrofitting existing locomotives and purchasing all new ZE equipment remains a possibility. The procurement of new OEM ZE locomotives will require coordination between Caltrans and one or more locomotive manufacturers.

In addition, Caltrans plans to pursue implementation of related ZE infrastructure, such as battery recharging stations, hydrogen refueling facilities, and opportunities for collaboration on hydrogen production facilities. These infrastructure technologies are critical to ensure that future ZE trains remain operational for service needs. Caltrans is developing strategies to determine appropriate application of ZE infrastructure; expected to be route specific.

- Battery charging could be facilitated by endpoint charging for certain operations but may require in-route charging for longer corridors

- Efforts are underway to determine the preferred sources for hydrogen generation to meet California's upcoming supply demands at a competitive price point while maximizing WTW emissions

Caltrans is assessing rail agencies across the State to determine the next round of ZE technology deployments once intercity passenger rail is operational.

Application Examples:

- The San Bernardino County Transit Authority (SBCTA) has partnered with Stadler to acquire hydrail-powered ZEMU for its Redlands corridor. Upon completion this will be the first hydrail powered passenger service in the US. Caltrans is similarly pursuing hydrail ZEMU units for several of its corridors and can look to SBCTA's efforts regarding implementation.

5.1.4 ZE Fleet Expansion

Since 2020 Caltrans DRMT has pursued the acquisition of Zero Emissions Multiple Units (ZEMUs) from Stadler, Inc. In September 2022 a major milestone was realized as Caltrans and Stadler signed a memorandum of understanding (MOU) for delivery of four ZEMUs, with the option for Caltrans to acquire up to 25 ZEMUs total. These trainsets will support Caltrans's passenger rail fleet expansion efforts and significantly contribute to Caltrans's strategic efforts to eventually eliminate diesel air pollution on its inter-city rail service.

The ZEMU is designed on the Stadler FLIRT platform and thus is like existing diesel multiple units (DMUs) in terms of size and passenger capacity; the primary difference is that it is powered by hydrogen fuel cells and batteries ("hydrail") rather than a traditional diesel engine. This hydrail propulsion system allows the ZEMUs to be deployed for inter-city use while producing no harmful air pollutants. Initially the ZEMUs will be deployed on the new Valley Rail service between Sacramento and Stockton, with planned future expansion to other intercity lines statewide including the Antelope Valley and Central Coast corridors.

Caltrans will provide strategic oversight and technical expertise on hydrail propulsion; this will include ongoing oversight of the vehicle procurement process, and implementation of hydrail infrastructure along the Valley Rail corridor to support operational demands. Caltrans will advise on and support regulatory compliance / safety testing activities associated with ZEMU implementation; currently there is little federal regulation on hydrogen safety requirements for passenger rail. Caltrans is in ongoing conversation with the FRA to develop a safety integration plan for the ZEMUs.

The Stadler ZEMUs the first hydrail powered, zero emissions inter-city passenger vehicles in the US, and their planned deployment via the MOU represents an important step toward wide-scale air pollution reduction efforts. ZEMUs will eventually provide a significant portion of Caltrans's statewide rail service as their zero emissions strategy is realized and reinforces Caltrans DRMT's position as a leader in clean rail propulsion technology efforts.

5.1.5 Caltrans Coordination

Caltrans is currently pursuing efforts to develop ZE implementation activities among transportation agencies within California. Two of the mechanisms that support this effort include the ZE Working Group and the Zero-Emission Heavy Transport (ZEHTRANS) Group. The ZE Working Group is a Caltrans-led effort of multiple transportation agencies within (and a few external to) California. Caltrans has taken the lead on determining each group's interest in and readiness level toward ZE implementation and is helping develop strategies for each agency to go forward. Similarly, the ZEHTRANS group consists of regular meetings between Caltrans, the California Energy Commission, GO-Biz, CARB, and Caltrans's consultant subject matter experts (SMEs) to ensure that larger-scale ZE efforts are progressing as expected. Caltrans is also pursuing R&D funding, primarily in the form of TIRCP funding, to pursue ZE implementation efforts. The current TIRCP funding efforts are twofold – 1) ZE vehicles (ZEMUs or retrofit diesel locomotives) to agencies that have already expressed interest in ZE technology and would immediately benefit from implementation; Metrolink and the Altamont Corridor Express (ACE) have been identified as good candidates for this effort. 2) R&D efforts toward development of ZE trains for the intercity JPA corridors, with focus on the hydrail locomotive prototype.

California Air Resources Board

CARB is the designated agency responsible for overseeing implementation of EO N-79-20 and ensuring compliance by affected transportation agencies. CARB is monitoring Caltrans's low- and zero-emissions strategic implementation plan. CARB and Caltrans maintain a positive synergy regarding ZE strategy and are in regular ongoing discussion regarding implementation efforts. CARB

has indicated support of Caltrans's short-term plan for achieving low emissions on its existing intercity passenger fleet and plan for conversion to ZE propulsion equipment. Caltrans will continue its regular discussions with CARB to ensure that compliance with the EO is being achieved.

As part of the In-Use Locomotive Regulation, CARB is proposing a Spending Account. For the Spending Account locomotive operators annually deposit funds into an account held and controlled by the locomotive operator. The amount of funds deposited each year is based on locomotive emissions in California. The funds held in the Spending Account are to be used to purchase a Tier 4 or cleaner locomotives or repower to a Tier 4 or cleaner locomotives until 2030. In 2030, the Spending Account Funds must be used on zero emission locomotives. At any point the spending account funds can be used for zero emission infrastructure and demonstration and pilot projects. If an operator is utilizing a complete zero emission fleet in California, they would no longer be subject to the Spending Account.

CARB is in contact with other transportation agencies regarding development of strategies for compliance with the EO. The requirements for these agencies include a range of activities from ZE propulsion equipment implementation strategies and schedules for regional railroads, to determining optimal compliance strategies for long-distance freight and passenger rail. It is expected that Caltrans's intercity passenger rail ZE strategy will significantly inform the optimal approach needed for many of these agencies.

5.1.6 Application to Freight

Current intercity passenger rail ZE efforts will serve as the template for how ZE technology can be applied to a large section of the freight rail industry. For example, freight yard switcher locomotives can be converted from diesel propulsion to battery propulsion, similar to ongoing applications for regional passenger service; furthermore there are many similarities between intercity passenger service and short-line freight service – locomotive operating profiles, route length, etc. – and with hydrail technology functionally proven to be viable for intercity passenger rail, it is anticipated that there will be a straightforward transition to application of equivalent technology for short-line freight.

Similar ZE efforts for long range freight rail is in development. Current ZE technology is suboptimal for longer distance travel. With continued development, these advancing technologies will support prototyping and eventual conversion of long-distance trains by the 2035 EO compliance deadline.

Application Examples:

- BNSF and Wabtec have partnered to develop a battery hybrid locomotive – a battery powered B Unit that is operated with traditional diesel locomotives, which operates between Stockton and Barstow. The implementation of this unit has reduced emissions and resulted in fuel savings. This battery locomotive represents significant technological progress but is ultimately not a ZE solution and likely has short-term application. However, the battery configuration could likely inform a similar configuration for intercity hydrail propulsion.
- The Sierra Northern Railway is a freight rail service in Northern California. Sierra is one of the most progressive rail agencies in California and is actively working to develop a hydrail switcher locomotive and a hydrogen production facility and related infrastructure. Caltrans envisions opportunities to collaborate with Sierra during the ZE, and specifically hydrail, implementation process on Caltrans locomotives. California.

Freight

Executive Order S-32-15, signed in 2015, directs State agencies to develop an integrated freight plan that will increase efficiencies and reduce air and GHG pollutants. The executive order called for the completion of a Sustainable Freight Action Plan by July 2016 and includes the following participating agencies: CARB, Caltrans, California Energy Commission, and the Governor's Office of Business and Economics. The Action Plan is a comprehensive planning effort to integrate investments, policies, and programs across agencies to help realize a sustainable freight vision. The executive order mandates that "to ensure progress toward a sustainable freight system, these entities initiate work [beginning 2015] on corridor-level freight pilot projects within the State's primary trade corridors that integrate advanced technologies, alternative fuels, freight and fuel infrastructure, and local economic development opportunities." The cross- agency and corridor-level planning focus presents an opportunity for the Rail Plan to strengthen the policies and help deliver the actions needed for realizing the sustainable freight vision. Caltrans DRMT has begun attending the Sustainable Freight Interagency partners meetings to coordinate implementation between the Rail Plan and the Sustainable Freight Action Plan to maximize the efficiency of the state rail system, while reducing emissions from the freight sector.

5.2 Coastal Sea Level Rise Guidance

To assist state agencies and local governments incorporate sea level rise into their planning, permitting, and investment decisions, the California Coastal Commission adopted the Sea Level Rise Policy Guidance in 2015. The original guidance provides an overview of the best available science on sea level rise for California and recommended methodology for addressing sea level rise in Coastal Commission planning and regulatory actions. The 2018 update to the SLR Policy Guidance and the 2021 updates to the State of California Sea-Level Rise Guidance provides higher level recommendations for how local governments, asset managers, and other stakeholders can plan for and address sea level rise impacts, notably including a set of projections recommended for use in planning, permitting, investment, and other decisions. Every local jurisdiction has unique characteristics and circumstances that influence it's planning for sea level rise. The guidance presents six key considerations and recommendations for successful infrastructure adaptation planning:

- Coordinated Planning: Planning for sea level rise is a complex process where much of California's critical infrastructure such as highways, railways, pipelines, and Tribal areas. Thus, planning requires coordination among state agencies, local governments, regional planning bodies, asset managers, coastal communities, stakeholders, and other interested parties.
- Environmental Justice: Planning for infrastructure adaptation must include robust public involvement and consideration of environmental justice communities because these communities often experience disproportionate environmental burdens, are more vulnerable to related adverse impacts, and often lack access to the decision-making process.
- Phased Adaptation: Phasing allows asset managers to undertake adaptation incrementally, which can allow time for long-term planning and identification of funding sources.
- Cost and Funding: The costs associated with damage to infrastructure from sea level rise – and the costs of conducting adaptation planning – are both significant; however, planning and avoiding hazards may reduce long-term costs and providing funding now is important for long-term infrastructure resilience.
- Nature-Based Adaptation Strategies: Unlike hard shoreline protective devices that can exacerbate erosion and contribute to the loss of coastal resources, nature-based adaptation strategies improve ecological systems while reducing the impacts of coastal flooding and erosion.
- Tribal Consultation: Consistent with the Commission's adopted Tribal Consultation Policy, this Guidance recommends early outreach and continued consultation and coordination with tribes who have ancestral ties to the lands and waters of California and are engaged in critical infrastructure decision-making. Additionally, the High-Speed Rail Authority (HSR) seeks to identify areas of shared concern and work toward the development of partnerships and consensus with California Indian tribes. The Authority's Tribal Relations webpage was created to share foster tribal awareness about high-speed rail projects, encourage tribal participation in the project planning process and establish connections between the High-Speed Rail Authority and California Indian Tribes.

California's highways, railways, local roads and freight support commerce, travel, emergency response, and economic development state-and nation-wide. Impacts to these assets from sea level rise and other climate hazards pose the risk to disrupt transportation, commerce, public safety, and economies at many scales. Sea level rise, flooding, and erosion have the potential to damage roads and rail lines which can impede the ability to use them for emergency response or other essential purposes. Therefore, the funding, planning, designing, and implementing adaptation strategies for the short- and long-term horizon is critical.

The Caltrans climate change Vulnerability Assessments and the Coastal Commission's Vulnerability Synthesis, and the Coastal Commissions SLR Policy Guidance reports the highway vulnerabilities in each coastal county8. The Caltrans' District Climate Change Vulnerability Assessments and Adaptation Priority Reports serve as an initial starting place for a general understanding of risk and priority for the state highway system, they are also unsuitable to use when applying them to characterize the exposure of the rail network sea level rise.

The ownership, jurisdiction, and management over California's railroad system is complex because the infrastructure crosses land owned by or under the jurisdiction of multiple cities, counties, and state and federal agencies. Vulnerable coastal zones include Santa

8 County Vulnerability Assessments (ca.gov)

Barbara, Orange, and San Diego counties; as well as Humboldt Bay and Elkhorn Slough. Many local jurisdictions that have conducted vulnerability analyses showing risks to rail infrastructure have begun asking how they can best engage rail owners, operators, and managers, and otherwise coordinate planning and permitting related to the vulnerable rail lines that traverse their jurisdictional limits.

5.2.1 Sea Level Rise Impact Analysis

Table 5.2 shows the high-level impact that sea level rise, storm surges, cliff retreat, and groundwater are expected to have on the state's rail network. The analysis is broken down by railroad subdivision and shows how many miles of each subdivision's route will be impacted for each CoSMoS sea level rise scenario. In certain cases, subdivision have already been impacted under current conditions (with zero additional feet of sea level rise) and have already implemented adaptation measures (such as raised trestles0. This analysis does not define a specific cutoff point determining where investments should or should not be made. It is intended to provide a high-level overview of where the greatest vulnerabilities lie so that further analysis can be done considering other factors such as track ownership, future service plans, and adaptation options. Table 5.2 shows sea level rise projections for the San Francisco bay for 2030, 2050, and beyond. Using the Ocean Protection Council's H++ extreme risk aversion scenario, this analysis assumes 1 foot of sea level rise by 2030, and 2.7 feet by 2050, and approximately 10 feet by 2100, requiring proactive planning and adaptation approaches. For the 2030 mid-term horizon year in the rail plan, .25m SLR CoSMoS projections were used. For the 2050 long-term scenario, the 1m SLR CoSMoS scenario was used. As a policy, the State Rail Plan supports the development of a state operations and protection funding program for rail, which would establish an ongoing source of emergency repair and capitalized maintenance funding, as well as funding for longer-term proactive approaches associated with adaption pathways to improve the reliability and resiliency of the rail network to sea level rise and natural hazards. The level of funding available to this program should be tied to the service goals identified for each corridor in the rail plan, ensuring that planned future service is resilient to the impacts of climate change and other natural hazards.

Protecting the rail network in the near term will preserve the infrastructure from climate threats. For example, sea level rise can lead to flooding which can stop trains from running. Flash floods can lead to washout of tracks and cause derailment, this can cause track segments to be impassable. As sea level rises, flooding will be more frequent and proper drainage systems become less effective. Additionally, increased rainfall intensity will further the severity of flooding. In the past year, California reached record high temperatures and each successive year will be hotter than the last. This can cause warping of tracks due to uneven thermal expansion in the summer which causes decreased speeds and derailment. High-speed crosswinds can also influence locomotive stability. These climate risks all represent the potential impacts the rail network faces in the coming years if California does not act now outlined in the Sea Level Rise Guidance and other plans to mitigate these threats. This can lead to serious delays on the railroads which will result in loss of economic efficiency and safety while moving people, goods, and services.

Currently, the Del Mar Bluffs in San Diego has statewide eyes on this issue as two emergency bluff stabilization measures were undertaken in 2019 in order to protect the track bed and resume safe rail operations. Drainage inlets were blocked with sediment and vegetation, and storm water runoff overflowed the railroad track bed causing significant erosion immediately west of the track bed at the two locations. Eventually this railroad will be relocated.

Similarly, The Delta Adapts Vulnerability Assessment by the Delta Stewardship Council was completed in 2021. The Delta contains a network of infrastructure that is critical to the functioning of the Delta and the State such as energy and utilities, transportation, solid and hazardous waste and water supply. The Delta is a critical, important omission with currently 18 miles of mainline rail track that is exposed to flooding by levee overtopping, by 2085 this amount is expected to be 48 miles of railroad exposed.

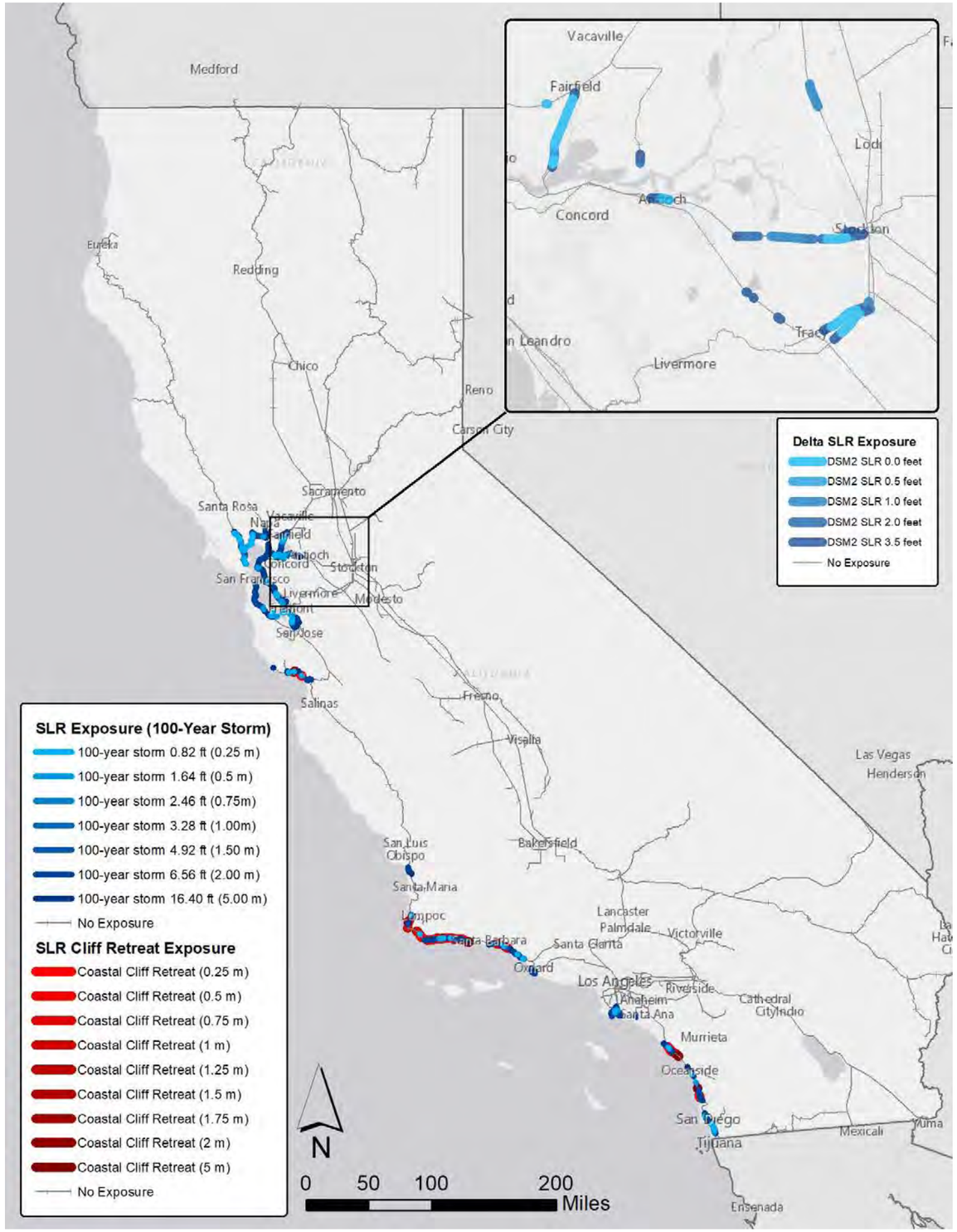
The current analysis provides a baseline regional assessment that provides a lower bound of potential vulnerability related to sea level rise and does not include erosion risk or storm flood damage potential that will result from climate change induced weather extremes in addition to acceleration of rising seas.

Table 5.1: Cumulative Miles of Rail Exposure

SLR Exposure Scenario	Avg SLR	20 Year Storm	100 Year Storm	Cliff Retreat
0.8 ft (0.25 m)	2.8	3.2	7.1	7.3
1.6 ft (0.50 m)	8.9	16.6	19.3	12
2.5 ft (0.75 m)	22.6	33.3	32.8	15.7
3.3 ft (1.00 m)	40.5	52.4	54.7	18.5
4.1 ft (1.25 m)	40.5	52.4	54.7	19.8
4.9 ft (1.50 m)	83.7	101.4	108.3	21.5
5.7 ft (1.75 m)	83.7	101.4	108.3	22.9
6.6 ft (2.00 m)	133.5	155.8	173	24.6
16.4 ft (5.00 m)	319.8	338.2	336.5	35.3

	Cumulative Miles of Rail Exposure
Exposure Scenario	Delta SLR
0 Feet	23.1
0.5 Feet	25.6
1 Foot	50.3
2 Feet	57.2
3.5 Feet	63.0

Data source: Coastal Storm Modeling System (CoSMos) Sea Level Rise Data



Statewide Railroad Sea Level Rise (SLR) Exposure. Exposure conducted using USGS CoSMoS projections of SLR for 100-year Storm and Cliff Retreat, as well as SLR projections for the Delta and Suisun Marsh from the 2021 Delta Adapts Vulnerability Assessment

Table 5.2: Sea-Level Rise Projections (in Feet) for the San Francisco Bay

		Probabilistic Projections (in feet) (based on Kopp et al. 2014)					H++ scenario (Sweet et al. 2017) *Single scenario
		MEDIAN	LIKELY RANGE		1-IN-20 CHANCE	1-IN-200 CHANCE	
		50% probability sea-level rise meets or exceeds...	66% probability sea-level rise is between...		5% probability sea-level rise meets or exceeds...	0.5% probability sea-level rise meets or exceeds...	
				Low Risk Aversion		Medium - High Risk Aversion	Extreme Risk Aversion
High emissions	2030	0.4	0.3 -	0.5	0.6	0.8	1.0
	2040	0.6	0.5 -	0.8	1.0	1.3	1.8
	2050	0.9	0.6 -	1.1	1.4	1.9	2.7
Low emissions	2060	1.0	0.6 -	1.3	1.6	2.4	
High emissions	2060	1.1	0.8 -	1.5	1.8	2.6	3.9
Low emissions	2070	1.1	0.8 -	1.5	1.9	3.1	
High emissions	2070	1.4	1.0 -	1.9	2.4	3.5	5.2
Low emissions	2080	1.3	0.9 -	1.8	2.3	3.9	
High emissions	2080	1.7	1.2 -	2.4	3.0	4.5	6.6
Low emissions	2090	1.4	1.0 -	2.1	2.8	4.7	
High emissions	2090	2.1	1.4 -	2.9	3.6	5.6	8.3
Low emissions	2100	1.6	1.0 -	2.4	3.2	5.7	
High emissions	2100	2.5	1.6 -	3.4	4.4	6.9	10.2
Low emissions	2110*	1.7	1.2 -	2.5	3.4	6.3	
High emissions	2110*	2.6	1.9 -	3.5	4.5	7.3	11.9
Low emissions	2120	1.9	1.2 -	2.8	3.9	7.4	
High emissions	2120	3	2.2 -	4.1	5.2	8.6	14.2
Low emissions	2130	2.1	1.3 -	3.1	4.4	8.5	
High emissions	2130	3.3	2.4 -	4.6	6.0	10.0	16.6
Low emissions	2140	2.2	1.3 -	3.4	4.9	9.7	
High emissions	2140	3.7	2.6 -	5.2	6.8	11.4	19.1
Low emissions	2150	2.4	1.3 -	3.8	5.5	11.0	
High emissions	2150	4.1	2.8 -	5.8	5.7	13.0	21.9

Most of the available climate model experiments do not extend beyond 2100. The resulting reduction in model availability causes a small dip in projections between 2100 and 2110, as well as a shift in uncertainty estimates (see Kopp et al. 2014). Use of 2110 projections should be done with caution and with acknowledgement of increased uncertainty around these projections. Recommended projections for use in low, medium-high and extreme risk aversion decisions are outlined in blue boxes in the above table.

5.2.2 Responding to Sea-Level Rise UP Martinez and Coast Sub

The Orange County Transportation Authority (OCTA) conducted a study assessing how future climate change affects the Orange County rail corridor. The study focused on the approximately 25-mile section of railway The purpose of the study was both to characterize and understand future climate-related risk to the rail system and passengers and to identify strategies to help mitigate these risks and preserve the continuity of rail service into the future.[9]

Included system wide exposure scan: coastal floating, island flooding , slope failure and erosion, high heat, wildfire, drought. The second tier looked ad facility to better understand climate risks on coastal alignment,

9 https://www.octa.net/Projects-and-Programs/Plans-and-Studies/Completed-Studies/Rail-Infrastructure-Plan/

mission Viejo trench and extended Oso creek

Two of Union Pacific's subdivisions in Northern California—the Martinez and Coast Subdivisions—are particularly vulnerable to Sea Level Rise (SLR). This vulnerability has implications on UP's national freight network, the state passenger rail network, and future capital investments along the subdivisions.

Southern California Coastal Inundation

Two publicly-owned railroad subdivisions in Southern California—the SCRRA Orange Subdivision and the NCTD San Diego Subdivision—have already begun experiencing the impacts of Climate Change and Sea Level Rise. Both subdivisions are located directly alongside the coastline in certain places and are under immediate threat from erosion.

In September of 2021, a landslide South of San Clemente shut down the rail line for nineteen days while emergency repairs were done. This closure prevented both passenger and freight rail trips between the Los Angeles and San Diego regions. As sea level rise continues, coastal erosion will continue to impact vulnerable rail infrastructure unless serious mitigation work is done.

The State Rail Plan identifies the rail corridor between the Los Angeles and San Diego regions as a critical piece of the 2050 vision. By 2050, both intercity and regional/ commuter rail service frequencies will be greatly increased from their current levels to run on a half-hourly pulse frequency. In addition to the phased investments that will be necessary to develop additional capacity, significant sea level rise mitigation will also be necessary, requiring large investments. In some cases, smaller-scale interventions such as more robust sea walls may be effective. However, it is also in the state's interest to study possible realignments of the corridor, moving the most vulnerable parts of the

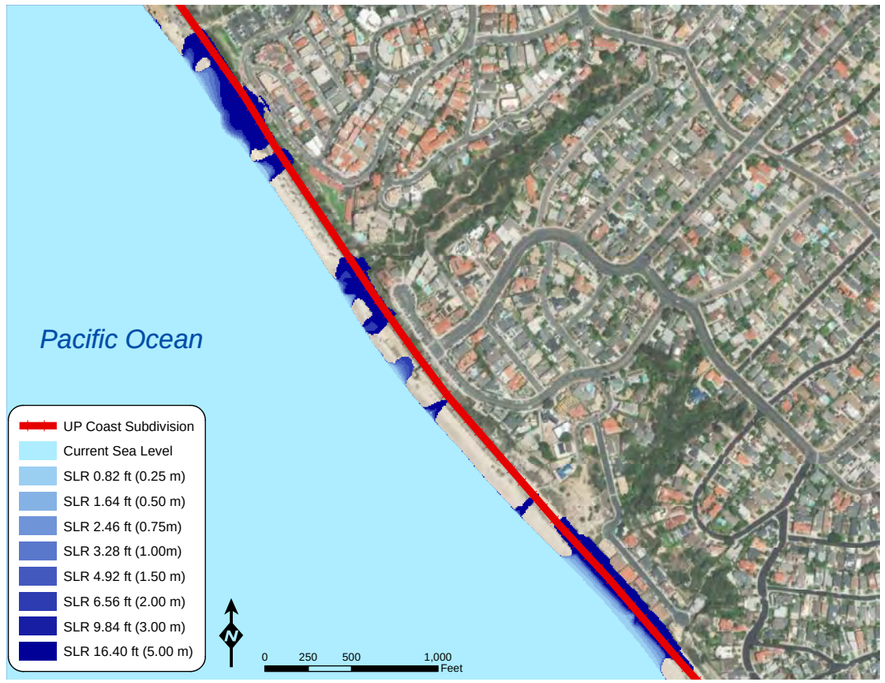


Figure X.X: Inundation of the SCRRA Orange Subdivision at San Clemente
Data Source: *USGS CoSMos Sea Level Rise Data*

route inland to avoid damage and disruption from coastal inundation.

UP-Martinez Subdivision

The UP Martinez Subdivision is the backbone of UP's freight rail network in Northern California, connecting the Port of Oakland to the rest of the state and country. Furthermore, it is part of the Strategic Rail Corridor Network (STRACNET) and serves a role in national defense. The subdivision is entirely double tracked, with numerous sidings and crossovers to other subdivisions. Freight train volumes along the corridor vary but are at their greatest between Oakland and Richmond with an average of 24 trains daily. Segments further East between Richmond and Roseville see between 12 and 14 average daily freight trains. The subdivision currently is, and will continue to be, UP's most important East/West route in Northern California and provides a vital link between the Port of Oakland and the rest of California and the United States.

The UP Martinez Subdivision is also a key part of the state's passenger rail network, with the busiest sections carrying approximately 36 passenger trains a day. While the subdivision will continue to play an important role in the state's passenger rail network in future time-horizons, the state is also interested in developing new alignments to serve the Oakland/Sacramento corridor, which would separate passenger and freight rail where possible, adding additional capacity for both.

As the effects of climate change become greater, the UP Martinez Subdivision will be among the most impacted pieces of infrastructure by Sea Level Rise (SLR). Potential solutions to address this problem include the construction on new sea walls, raising tracks along their current alignment, and rerouting existing alignments to avoid changing coastlines. All these interventions would require significant capital investments. The Rail Plan also supports investments in capital projects designed to mitigate the impact of climate change and sea level rise on parts of the rail network that are the most vulnerable. Planning for and implementing these adaptation projects early is crucial in ensuring that future rail service is not impaired.

The State must be careful when investing in corridors guaranteed to be impacted by sea-level rise. The state typically invests in private railroad infrastructure to increase capacity and run more passenger service. The UP Martinez Subdivision is already double-tracked and additional investments would mostly be focused on climate change adaptation. Given the importance of the subdivision to their national network, UP will eventually need to make these investments regardless of the State's position.

UP-Coast Subdivision

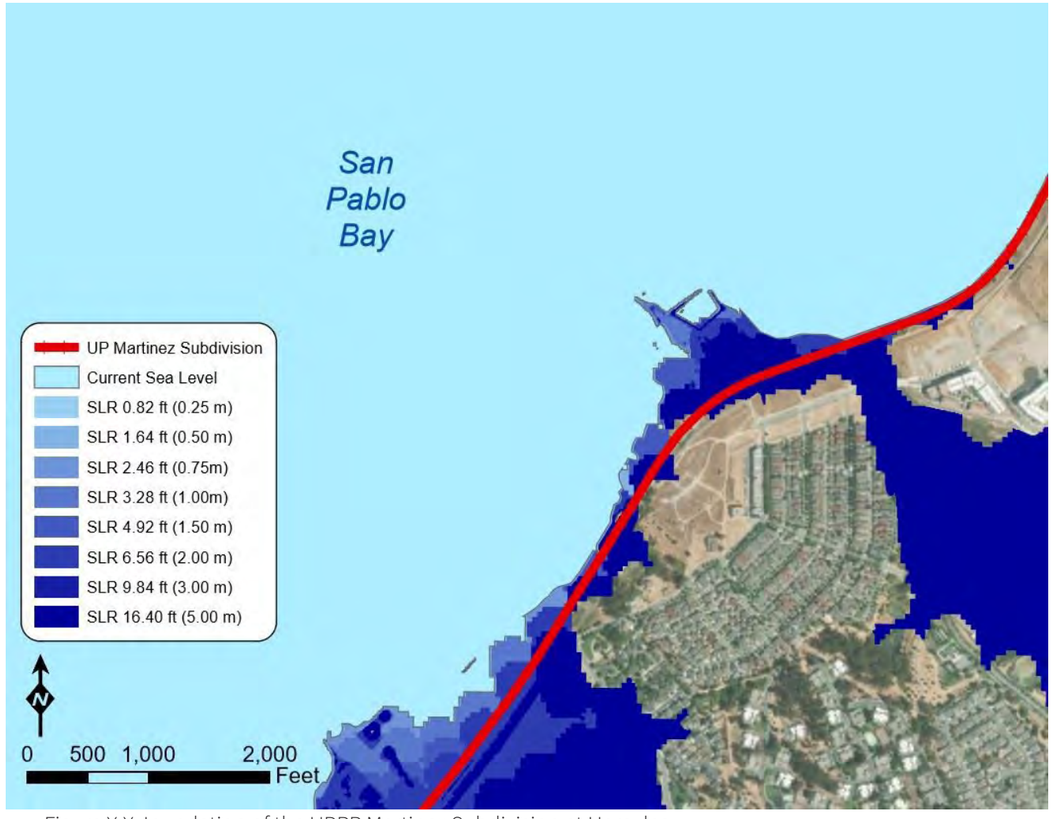


Figure X.X: Inundation of the UPRR Martinez Subdivision at Hercules

Data Source: USGS CoSMos Sea Level Rise Data

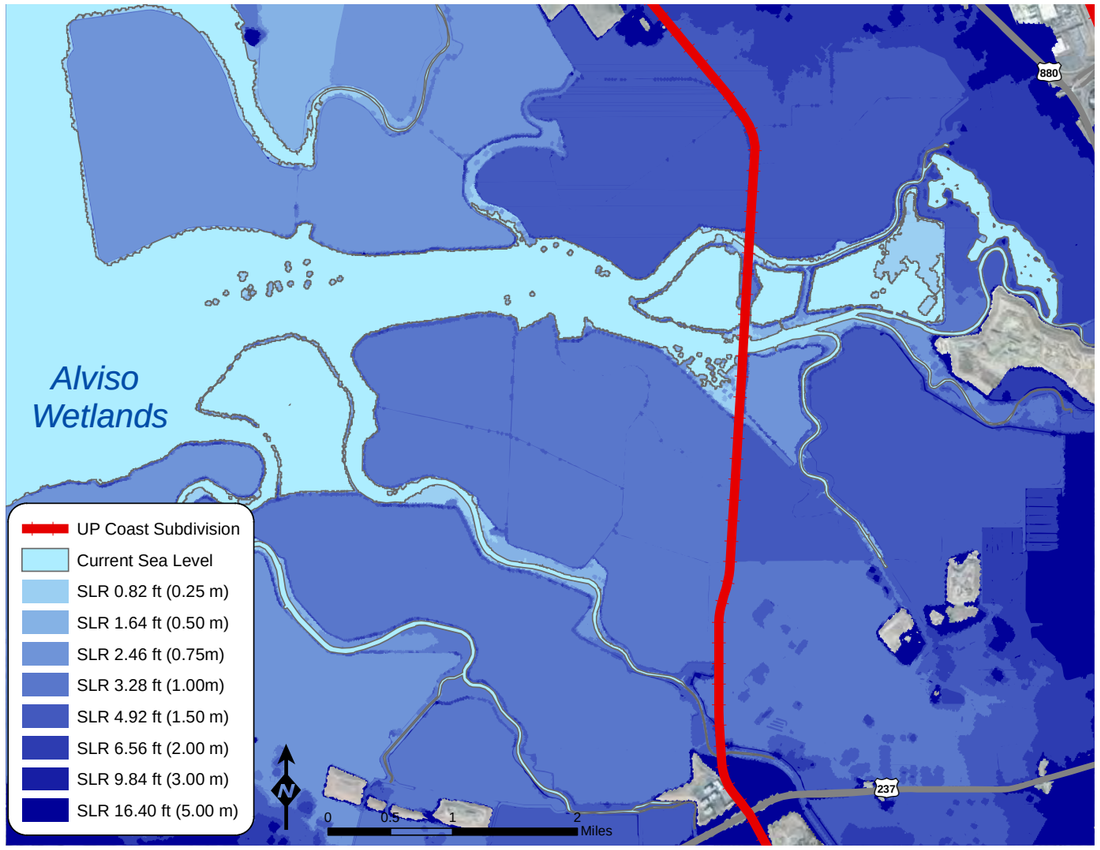


Figure X.X: Inundation of the UPRR Coast Subdivision at Alviso

Data Source: USGS CoSMos Sea Level Rise Data

The Union Pacific Coast Subdivision runs between San Leandro and San Luis Obispo and serves both passenger and freight trains. Currently, the subdivision is primarily used for passenger rail service, with higher frequency intercity and regional rail operating to the north of San Jose and less-frequent long-distance service continuing to the South. Though the subdivision does see regular freight train movements, freight activity is fairly limited with only an average of six trains per day in the busiest sections.

The California State Rail Plan identifies increased passenger rail service frequencies along the subdivision by the long-term (~2050) time-horizon. Though freight rail service could also increase in future years, the subdivision is of less importance to UP's network and is not a part of the Strategic Rail Corridor Network (STRACNET), although it is designated as a Connector line connecting military installations to STRACNET lines.

The UP-Coast Subdivision is highly vulnerable to sea level rise (SLR), especially at its highest-volume passenger rail section in the South Bay through the Alviso Wetlands. To prepare the subdivision for future passenger rail service, significant SLR adaptation work will need to be completed in addition to more common capacity-building capital investments. Given the importance of the corridor to future rail passenger rail service, it is in the State's interest to support these capital investments. The California State Rail Plan identifies specific climate change adaptation projects in the Alviso Wetlands.

CHAPTER 6

VISION IMPLEMENTATION

The long-term Vision implementation strategy includes program effects, funding sources, and a strategy for phased implementation over planning horizons.

The Rail Plan is ultimately an iterative strategic document. It will be updated every 4 years, adjusted as the state rail network is built out, and as market factors and other key indicators— such as climate change—dictate. Undoubtedly, the scope and detail of specific services and projects will continue to be refined in future revisions to this document.

6.1 Network Phasing

The service and connectivity goals, along with corridor-level improvements required to achieve the long-term Vision, are described in a phased plan with capital projects identified for the next 5 years (~2027); mid-range needs identified for the next decade (2032); and long-range improvements and investments for long-range (2050) planning toward the envisioned future.

- 2027 catalogs the Capital Plan of ongoing and committed projects as part of an enhanced existing conditions assessment of present and near-term rail services across the state.
- 2032 captures new and established projects and planning studies intended to maximize capacity and utility of the existing passenger rail network, and to begin using high-speed rail while connecting it to the statewide integrated network.
- 2050 identifies additional corridor-level investments and service goals needed to fully realize the Vision, connecting regional networks into a statewide, integrated system.
- To achieve the Vision, the Rail Plan identifies a robust, strategic capital investment program that catalogs near-term projects, maximizes returns from existing investments, and builds out and connects regional networks into an integrated statewide system. The full spectrum of passenger rail modes is included in the capital investment program, from local transit projects to potential future high-speed rail extensions.

6.1.1 Future Planning Studies

Ongoing planning studies are important to ensure the right investments are being made in the right markets at the right time. Consistent planning will empower policymakers and regional stakeholders through the iterative process of optimizing current investments and scaling toward an effective and integrated regional and statewide network.

Planning studies such as the Sea Level Rise Guidance and the Critical Infrastructure Guidance provide local governments, asset managers and other stakeholders with policies and planning information to help inform sea level adaptation decisions that are consistent with the California Coastal Act. Other plans included in policy and planning decision making include the Climate Action Plan for Transportation Infrastructure (CAPTI), the Interregional Transportation Strategic Plan (ITIP) and more.

While capital rail improvements and studies across the state are ongoing, Caltrans intends to conduct planning studies with the help of local and regional partners in the rail planning regions. These studies are to be completed in the near-term (~2027) time horizon for possible project implementation, either in the mid- or long-term time horizons.

6.1.2 Near-Term Investments

The near-term project list and service goals were developed by reviewing recent and ongoing strategic, vision, and service plans published by stakeholder passenger rail agencies and service providers around the state.

The near-term capital program carries approximately ~$40B of statewide infrastructure investments. Major projects include the California High Speed Rail initial operating segment between Bakersfield and Merced, Link Union Station initial run-through tracks, initial SCORE program investments, and completing the Peninsula Corridor electrification. These represent major ongoing investments in establishing the statewide passenger network.

In addition to passenger rail projects, the Rail Plan supports several freight-focused projects ranging from more traditional grade separations, track work, and yard expansions to facilitate freight movement to major investments in port capacity and container handling at the Ports of LA and Long Beach, Port of Hueneme, and the Otay Mesa port of entry. California's coast faces a crucial risk of experiencing SLR of up to 1.0 feet by 2030 and 7.6 feet by 2100.

Near-term investments also include significant ramp-up in the State's ZE transition to decarbonize the intercity fleet.

The 2027 Near-Term Capital Program is available in Appendix X.X.

6.1.3 Mid-Term Investments

The mid-term project list and service goals were developed by reviewing recent and ongoing strategic, vision, and service plans published by stakeholder passenger rail agencies and service providers around the state.

- The mid-term capital program carries approximately ~$46B of statewide infrastructure investments. Major projects include Valley-to-Valley high-speed rail connecting Bakersfield to San Francisco, the DTX downtown extension to Salesforce Transit Center, completion of Link-US, and major capacity investments in Los Angeles County rail capacity in preparation of Full Phase 1 high-speed rail service.

The 2032 Mid-Term Capital Program is available in Appendix X.X.

6.1.4 Long-Term Investments

The long-term project list and service goals were developed by reviewing recent and ongoing strategic, vision, and service plans published by stakeholder passenger rail agencies and service providers around the state.

- The long-term capital program carries over ~$100B of statewide infrastructure investments. Major investments include high-speed rail Phase II extensions to San Diego, the Inland Empire, and Sacramento. Concurrently, the Rail Plan supports major projects to develop a second transbay tube connecting San Francisco and Oakland, allowing main-line service for regional and intercity trains, major tunnel projects in San Diego County along the coast, and full build-out of regional transit networks and connections to the fully integrated statewide network.

The 2050 Long-Term Capital Program is available in Appendix X.X.

6.1.5 Operating Costs

Capital costs are only part of the equation to establish a financially sustainable passenger rail service. While operating passenger rail service is capital intensive, there are massive efficiencies and economies of scale to be captured through well-planned, fast, and frequent service. The more frequently and faster the trains run, the more people ride, and the more cost-effective it is to provide the service per passenger mile traveled.

Key factors to lowering costs include:

- more efficient train rolling stock, largely through electrification and modern DMU trains that are cleaner and lighter than traditional diesel locomotive-hauled trains;
- faster train speeds, allowing for shorter trips and more hours of revenue service, with more efficient train crew service;
- faster turn-arounds, reducing the amount of time trains are idling at station or in rail yards; and
- changes in travel distances, largely through integrating regional and statewide services to ensure market sensitivity in route and service planning.

Taken together, these changes reduce unit costs for train operations, crews, and other overhead, resulting in more service available for far lower unit prices. Based on high-level estimates of train hours and operating efficiencies to run fully integrated statewide service in the long-term, it would cost $2.4b/yr. This figure is before any fare or other operating revenue is realized and before any federal formula operating funds are realized. The Vision network has a 45% lower cost per train mile, and a 65% lower cost per seat mile than today's service.

Although the O&M costs for the Vision are higher in real terms than existing (i.e., today's) rail services, increased train speeds and frequencies, newer equipment, longer consists (i.e., higher capacity), longer travel distances, and increased operating efficiencies all contribute to driving down the average cost per train mile and cost per seat mile.

6.1.6 Economic Benefits

Benefits include employment (measured as person-years of full-time employment), income (wages and salaries) associated with this employment, and firm output (essentially the same as expenditures).

Improvements in California's rail system are investments will pay off in terms of greater economic activity: new construction, more jobs, and growing tax revenues.

- The roughly $80 billion of direct expenditures identified in the Rail Plan will result in a total output for the economy of over $150 billion by 2050—a payout of nearly 2 dollars for every dollar invested.
- The expenditures will result in a total employment impact across affected industries of over 900,000 full time jobs, and labor income of nearly $55 billion.
- By 2050, state and local tax revenues anticipated from the expenditures will be close to $4 billion, and federal tax revenues will be $10.5 billion. The tax impacts pertain to taxes for which revenues can be directly inferred from economic expenditures, such as sales or income taxes
- The fiscal impact is broadly by jurisdictions all across the state, it is not limited to growing just state revenues.

6.2 Market Viability Assessment

The Vision identifies ~300 station areas throughout California. They range from major urban terminals, to regional transit centers, to rural intercity bus stops. Each station serves a local market in and around the station (its 'catchment area') and a statewide market by facilitating connections. Catchment areas vary in size by the value of the service on offer. To better understand these markets and the network, Caltrans assigned flat assumptions to station catchment areas ranging from 1.75-mile radius for a local transit or bus station to up to a 10-mile radius for a high-speed station. While these catchment areas certainly do not capture all trips that might utilize a station, they are intended to conservatively capture the majority of the relevant local market to a given station.

6.2.1 Travel Demand in California

In pre-Covid 2019, when filtering out trips within station areas, there were just over 35 million trips taken every day between station areas. Over 98% of those trips were taken by car. To achieve the State's economic, environmental, and equity goals – a significant portion of those trips will need to be captured by rail and bus in future. The Rail Plan's Vision specifically designs for market capture rates to shift auto VMT to the statewide rail and bus network.

Within this station area to station area market within the statewide network, trips range in distances from just a few miles across town to up to 1000 miles across the state. However, the median travel distance is approximately 15 miles with the middle 50% of all trips ranging between 8 and 33 miles in length.

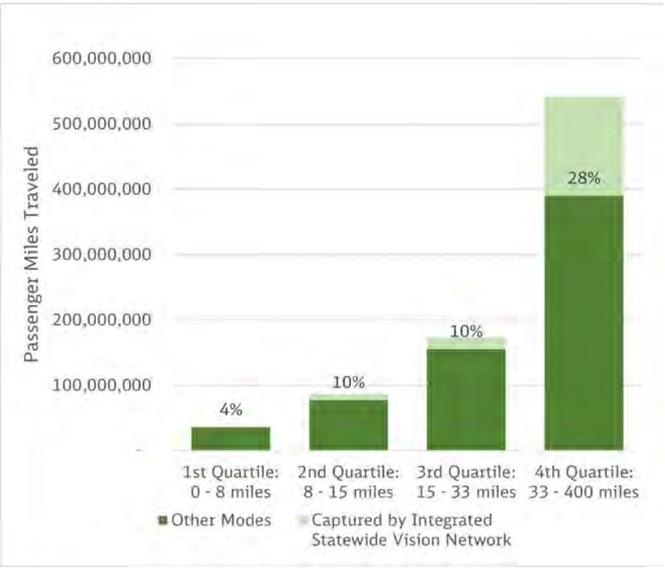
- That market, ~17.5 million daily trips between station areas, represents the largest potential to shift a high volume of trips from highway travel to public transport. These trips represent the core market for frequent, all-day, bi-directional regional rail services.

- There are an additional ~7.5 million daily trips ranging from 33 miles to 400 miles. While lower in volume, this market represents the core market for intercity and high-speed rail service, supported by integrated long-distance bus services

- ### 6.2.2 Benchmarking Peers

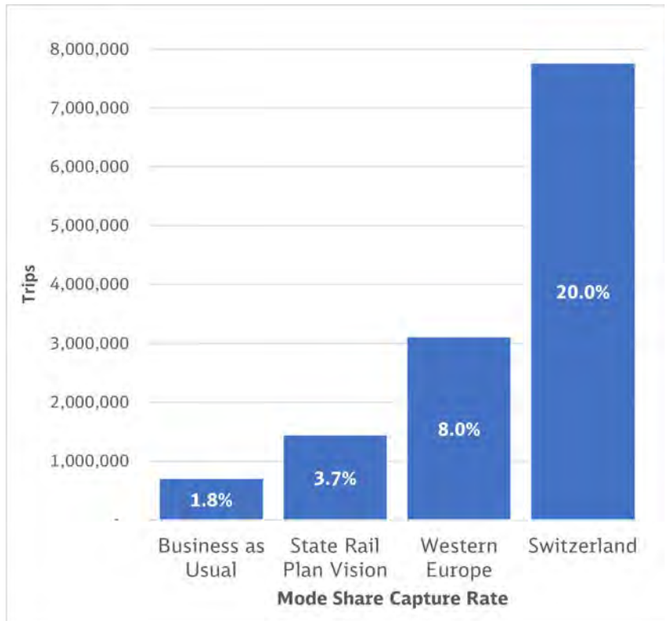
While California's current rail and transit mode share capture lags at less than 2% statewide, international peers of comparable size, investment, and network development often see rail mode share approaching 8% of all trips. Highly integrated networks, like that of Switzerland, capture up to 20% of all trips. The 2018 California State Rail Plan forecast ~1.3 million daily trips on the fully built out statewide transport network, a ten-fold increase over pre-covid trip volumes. This would represent a doubling of market capture from the pre-Covid ~1.8% to ~3.7%. While a marked improvement, this still assumes business-as-usual in terms of concurrent highway expansion, high transfer penalties, and legacy cost structures. It also would leave the State short of CARB's goals for shifting 20% of VMT from highway to public transit.

Extrapolating by the latest statewide growth projections from the California Department of Finance (~+0.3% year-over-year) gives an estimated 2050 trip volume of ~38.8 million daily trips between station areas.



- ### 6.2.3 Achieving State Goals for VMT Shift

Pre-Covid, California's daily VMT statewide was ~892 million miles. CARB's environmental goals call for shifting 20% of that daily vehicle mileage away from the highway network and onto statewide public transport network. That would mean delivering ~178 million daily passenger miles through the statewide network. While the median trip length is ~15 miles, the majority of VMT is driven by trips longer than 33 miles. By targeting market share in longer trip distances, leveraging bus, transit, and regional rail as a feeder network to the state's high-speed service, VMT shift goals can be met by achieving Western European peers in intercity market capture rates. The network connectivity and capacity of the future statewide integrated network is specifically designed to compete for, capture, and serve just these types of trips at the necessary high volumes. In addition to the service itself, it will be critical for the state to continue removing barriers (in cost, complication, proximate land use, and travel time) on par with Western European counterparts to achieve these capture rate goals.



As example, capturing 4% of local trips, 10% of regional trips, and 28% of long-distance trips (greater than 33 miles) between station areas in the network delivers a 20% VMT shift with just under 4 million daily trips.

6.3 Coordinating Rail Policies and Plans

The 2050 Vision describes in detail the types and intensities of services to be provided in various corridors around the state. However, more study is needed to make recommendations on rail governance and service integration to ensure that the various rail providers can proactively align and scale their services as the statewide network comes online. This research will evaluate what existing institutions are already in place and how best various partner agencies can use their established expertise to collaborate and establish project prioritization. The State supports collaborative efforts to move forward with implementing the Rail Plan vision without reinventing organizational structures and creating cumbersome

institutions. Future inter- agency service integration planning will inform how the state can continue to work to be a better partner in implementation.

Existing plans were used to identify near-term goals, and to begin the implementation planning toward the Long-Term Vision. Those plans include, but are not limited to:

Rail/Transit Planning Inputs	Release Year
ACE*forward*	2018
Association of Monterey Bay Area Governments – 2040 Metropolitan Transportation Plan & Sustainable Communities Strategy	2018
Amtrak Five-Year Plans - FY 2021-2026	2021
Amtrak Strategic Plan - FY 2019-2023	2019
Bay Area Rapid Transit Sustainability Action Plan	2017
Bay Area Council Economic Institute – The Northern California Megaregion	2016
Caltrain Strategic Plan - FY 2015-2024	2014
Capitol Corridor Business Plan - FY 2020-2022	2020
Capital Corridor Joint Power Authority Vision Implementation Plan	2016
California High Speed Rail Authority 2020 Business Plan	2020
California High Speed Rail Authority 2022 Business Plan	2022
California Transportation Commission Annual Report to the California Legislature	2020
Federal Rail Administration Southwest Multi-State Rail Planning Study	2014
LA Metro Long-Range Transportation Plan	2020
LOSSAN Business Plan – FY 2019-2021	2019
Metrolink Strategic Business Plan	2021
Monterey Plan – 2040 Metropolitan Transportation Plan/Sustainable Communities Strategy	2018
MTC Plan Bay Area 2050	2021
NCTD Comprehensive Strategic Operating and Capital Plan – FY 2017-2026	2016
SacRT – Strategic Plan FY 2021-2025	2021
SCAG Regional Transportation Plan/Sustainable Communities Strategy, FY 2020-2050	2021
SFMTA Strategic Plan	2018
San Joaquin Joint Power Authority 2021 Business Plan	2021
San Joaquin Council of Governments – The 2018 Regional Transportation Plan/ and Sustainable Communities Strategy	2018
Santa Barbara County Association of Governments – Fast Forward 2040 Regional Transportation Plan and Sustainable Communities Strategies	2017
Santa Clara Valley Strategic Plan 2017-2022	2016
San Diego Association of Governments – San Diego FORWARD the 2021 Regional Plan	2021
Transportation Agency for Monterey County 2018 Business Plan	2018

6.3.1 Collaboration with Regional Partner Agencies to Pursue Planning Grants

Working with regional and local partners on planning grants is an opportunity to deliver multimodal connectivity hubs. This includes plans and studies for connectivity, multimodal transportation, transit hubs and station areas, corridors, and active transportation. Planning grants help to improve station area access and user experience. The Sustainable Communities grants identify mobility deficiencies, including the needs of disadvantaged riders, often in transit-dependent communities. Strategic Partnership grants encourage collaboration between regional partners and the State to address statewide and interregional transportation deficiencies. Grant opportunities better coordinate funding and planning to deliver a sustainable transportation system and help implement elements of the Rail Plan that require nuanced regional collaboration.

6.3.2 Land Use Coordination

Land use and transportation coordination seeks to provide more housing for the housing-strapped state, while locating the housing close to transit access. This is intended to decrease congestion and increase mobility options for mixed-income level residents. This commitment by local and state leaders to better connect land use and transportation to create more housing supports successful transit and rail systems. This type of legislation will maximize livability, affordability, equity, and mobility.

Collaboration to Improve Station Functionality

Delivering attractive, multifunctional, and easy-to-use stations requires ongoing work with local and regional partners. At the station itself, the State is pursuing various actions to improve station functionality, including coordinating implementation of Toward an Active California and the Rail Plan to provide guidance for bike parking at stations; co-locating hubs to improve bus connections; and planning for up to a mile radius around stations to improve safety and access for active transportation. The State supports the Smart Mobility Framework and working with entities who own stations and the land around stations to provide sustainable, equitable, multimodal connectivity hubs.

Where HSR is co-located with other rail and transit services, the work the CHSRA is doing to develop a vision for station communities will help guide implementation. The state supports their vision that HSR stations will be about more than connecting transportation modes. These stations can become station communities and provide enhanced connectivity and economic opportunities for travelers and communities alike. Specific guidelines for all stations and station areas in the statewide rail network will be included in forthcoming implementation planning documents and will be location- and context-specific. Decisions will be based on local community input during the project development process.

Collaboration to Improve Station Area Planning

Station area planning is a specific type of land use planning that integrates different modes of transportation and mobility needs with transit-supportive land use. Stations are the first point of contact for users exiting the rail system and a potential hurdle for entry for new users if the station and the surrounding areas are not designed to attract and accommodate all travelers. Station areas themselves have the potential to accommodate uses that allow efficient, non-motorized station access, increasing use of the rail system and reducing environmental impacts of reaching the station.

SB 375—the Sustainable Communities and Climate Protection Act of 2008—promotes integrated transportation and land use planning to reduce GHG emissions from passenger vehicle travel, and help California meet AB 32 goals. SB 375 requires CARB to develop regional GHG emissions reduction targets for passenger vehicle travel, setting benchmarks in 2020 and 2035 for each of the state's 18 MPOs. SB 375 requires that California's MPOs draft an SCS as part of their RTP, which describes the transportation and land use strategies the MPO regions will use to meet the regional GHG emissions reduction targets established by CARB.

Although SB 375 has a regional focus, SB 391 highlights the critical roles that Caltrans and other State agencies play in addressing interregional travel issues, including the reduction of GHG emissions associated with interregional travel. The California Interregional Blueprint defines strategies to address interregional travel needs, while ensuring that CTP 2050 identifies statewide policies and investment priorities needed to support the State's GHG emission reduction goals. These goals include reducing GHG emissions to 80 percent below 1990 levels by 2050, as called for in Executive Order S-3-05.

6.4 Funding the Rail Plan Vision

California's rail system is funded by several sources and programs, including state fuel taxes and fees, federal fuel taxes, federal grant programs, state bonds, the Cap-and-Trade program, and local sales tax measures. Currently, the largest sources of funding include the state's Public Transportation Account (PTA) (funded by the diesel fuel tax and other state accounts), the Greenhouse Gas Reduction Fund (GGRF) from the Cap-and-Trade program, and federal fixed guideway capital investment grants. Detailed descriptions of these funding sources are provided later in the chapter and **Appendix 6.1**. Further opportunities to incorporate sea level rise mitigation into state funding programs should be explored.

Passenger rail capital projects draw funding from several sources at the federal, state, and local levels. Funding sources are more likely to have committed to near-term projects than to long-term projects, which are more open-ended. Due to the private-sector nature of freight rail, less detail is known regarding freight capital spending. However, public funding sources for shared corridor improvements are identified in the next section and delineated in the 2027 projects list in **Appendix 6.3**. This section describes the full breadth of funding options available at the federal, state, and local levels.

6.4.1 Funding Opportunities

Caltrans is at a precipice for making pivotal decisions and setting course for the mobility of the state and the rest of the country for several years to come. State and local spending has outpaced federal spending over the past few decades. Exhibit 5.1 shows the amount of spending by year on mass transit and rail by federal, state, and local sources across the United States. Exhibit 5.2 shows the state annual rail and transit investment funding for the fiscal year 2020-2021 is about $2.37 billion.

All the coordination functions would not be realized without available funding. A Governance and Revenue Study documented funding opportunities Rail Plan Vision. Caltrans is taking a leadership role to help organize decision-making. This provides information regarding funding level, intended use, funding category, and eligibility.

With the passage of SB 1, the Road Repair and Accountability Act of 2017, California has increased its transportation investment to rebuild by fixing neighborhood streets, freeways, and bridges in communities across California, and by targeting funds toward transit and congested trade and commute corridor improvements. SB 1 invests an average of $5.2 billion annually over the next decade to fix California's transportation system—and invests at an even higher level beyond the first decade. It will address a backlog of repairs and upgrades, while ensuring a cleaner and more sustainable travel network for the future.

California's state-maintained transportation infrastructure will receive $26 billion, roughly half of SB 1 revenue. The other half will go to local roads, transit agencies, and an expansion of the state's growing network of pedestrian and cycle routes. Each year, this new funding will be used to tackle deferred maintenance needs both on the state highway system and the local road system.

6.4.2 Federal Funding

The Infrastructure Investment and Jobs Act (Bipartisan Infrastructure Law)[10] of 2021 authorized $66 billion nationally for passenger and freight rail (equivalent to about $13.2 billion annually over 5 years).

Consolidated Rail Infrastructure and Safety Improvements (Sec. 11301).

Since 2017, the Federal Railroad Administration has administered the Consolidated Rail infrastructure and Safety Improvements (CRISI) Program. The purpose of this grant program is to improve the safety, efficiency, and reliability of passenger and freight rail systems. Eligible activities include a wide range of capital, regional, and corridor planning; environmental analyses; research; workforce development; and training projects. Unlike some other state and federal grant programs, Class III railroads are eligible to apply for and receive CRISI funds without a local partner agency. In Fiscal year 2020, 50 projects in 29 states were selected to receive over $320 million in funding.

Federal-State Partnership for State of Good Repair (Sec. 11302).

The purpose of this grant program is to reduce the state of good repair backlog on publicly owned or Amtrak-owned infrastructure, equipment, and facilities. Eligible activities include capital projects to (1) replace existing assets in-kind or with assets that increase capacity or service levels; (2) ensure that service can be maintained while existing assets are brought into a state of good repair; and (3) bring existing assets into a state of good repair.

Restoration and Enhancement Grants (Sec. 11303).

The purpose of this grant program is to provide operating assistance to initiate, restore, or enhance intercity passenger rail transportation. Grants are limited to 3 years of operating assistance per route and may not be renewed.

Federal Transit Administration Formula Grants

The Bipartisan Infrastructure Law reauthorized funding of FTA formula grants through 2026, providing more stability and predictability in funding for transit agencies. There are also competitive grant programs, but the FTA formula funds that support Rail Plan service and delivery goals are:

Rural Areas – 5311

- Tribal Transit Formula Grants – 5311(c)(2)(B)
- Urbanized Area Formula Grants – 5307
- State of Good Repair – 5337
- Rural Transportation Assistance Program – 5311(b)(3)

National Highway Freight Program

The National Highway Freight Program, which funds projects that support the movement of goods on the National Highway Freight Network, including rail crossings, with $1.2 billion annually in funding. California is expected to receive $600 million over the next 5 years, or an average of $117 million per year, from the National Highway Freight Program. As much as 10 percent of these funds may be put toward improvements to freight rail or ports.

National Surface Transportation and Innovative Finance Bureau

Federal loan and discretionary programs are organized under the Surface Transportation and Innovative Finance Bureau.[11]

The Bureau houses the following programs:

- **Transportation Infrastructure Finance and Innovation Act** (1998) (TIFIA). The act provides federal credit and financing assistance with flexible repayment terms to projects of national and regional significance, including rail transit programs. To date, California has received roughly $6.1 billion in TIFIA assistance, $1.7 billion of which has gone to rail transit programs, primarily intercity rail in Los Angeles.
- **Railroad Infrastructure Financing and Improvement Act (RRIF)** (2015). The Bipartisan Infrastructure Law reauthorized eligible projects for railroad rehabilitation and improvement financing to include transit-oriented and station development. As of 2020, the program has executed 40 loans for approximately $7.13 billion nationally. Some California projects have received loans through RRIF.[12]
- **Nationally Significant Freight and Highway Program** (2015). The program is planning to allocate $4.5 billion in grants in fiscal years 2016 through 2021. The minimum grant awarded is $25million.

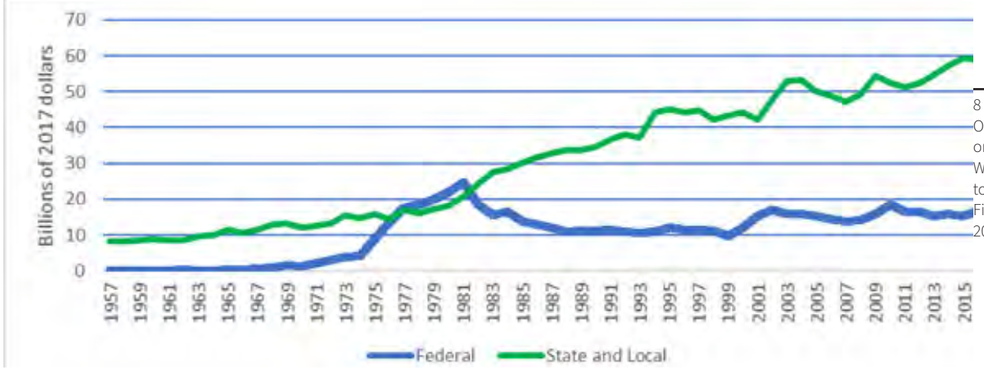
FASTLANE/INFRA Grants Program

The Bipartisan Infrastructure Law reauthorized the FASTLANE/INFRA grant program, which provides competitive grants to nationally and regionally significant

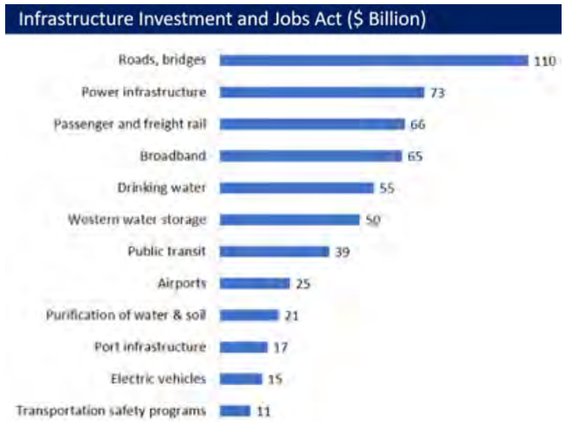
10 https://www.congress.gov/bill/117th-congress/house-bill/3684

11 FRA, FAST ACT Overview, 2021.
12 U.S. DOT, ***RRIF Overview***, accessed 2021.

Exhibit XX: Federal Government and State and Local Government Spending on Mass Transit and Rail across the U.S., 1957 to 2017 (billions of 2017 dollars) [8]



8 Congressional Budget Office, Public Spending on Transportation and Water Infrastructure, 1956 to 2017 (Data Underlying Figures) (2017), accessed 2021.



freight and highway projects that demonstrate cost-effectiveness and the ability to generate national or regional economic, mobility, or safety benefits. Eligible projects include freight rail and freight intermodal facility improvements and improvements within the border of freight rail and intermodal facilities.[13] INFRA awards grant projects to two project tiers: small projects with a minimum cost of $5 million, and large projects with a minimum cost of $25 million. The program is required to allocate at least 10% of funds to small projects and at least 25% to rural projects. The FFY 2020 FASTLANE/INFRA grants awarded $906 million to 20 projects nationally.[14] California received none of the grants. FASTLANE/ INFRA grants were authorized $5.5 billion from FFY 2016 to FFY 2021.[15] The funding available for the FFY 2021's grants total approximately $889 million.

- **Fixed Guideway Capital Investment Grants (Section 5309)** The Fixed Guideway Capital Investment Grants Program is a discretionary program that provides funding for new or expanded commuter rail, ferry, or bus rapid transit projects. It includes four categories: New Starts, Small Starts, Core Capacity, and Programs of Interrelated Projects. It is programmed to fund $2.3 billion of projects nationally each year from FFY 2016 through FFY 2020.[16] The FFY 2022 funding recommendations for the program included five California projects and these California projects were allocated over $2 billion.

13 FRA, FAST ACT Overview, 2021
14 U.S. DOT, Fiscal Year 2020 FASTLANE Awards Annual Report (2020), accessed 2021.
15 U.S. DOT, ***FASTLANE Grants FAQs*** (2021), accessed 2021.
16 FTA, Fixed Guideway Capital Investment Grants, accessed 2021.

Federal Short-line Tax credit (Section 45G)

Since its enactment in 2004, the railroad track maintenance tax credit (Internal Revenue Code section 45G) has provided an important financial incentive to maintain and improve short-line infrastructure. The result has been a marked increase in industry investment, as evidenced, for example, by industry purchases of railway ties, which have grown at an annual rate of 6.3 percent since enactment of the credit, compared to 0.1 percent before the credit. In addition, safety on short-line railroads has improved since enactment of the credit.

The Section 45G credit is a business tax credit that allows for 50 percent of qualified railroad track maintenance expenditures paid or incurred in a taxable year by an eligible short-line railroad. Qualified railroad track maintenance expenditures are gross expenditures for maintaining railroad track (including rail, ties, bridges, signals, crossings, tunnels, roadbed, etc.) owned or leased as of 2015, by a Class II or Class III railroad. The credit is limited to the product of $3,500 times the number of miles of railroad track owned, leased, or assigned to the eligible taxpayer as of the close of its taxable year. The credit is assignable to any eligible taxpayer who makes qualified expenditures. An eligible taxpayer is (1) any Class II or Class III railroad and (2) any person that transports property using the rail facilities of a Class II or Class III railroad or that furnishes railroad-related property or services to such person. The Section 45G credit was reauthorized in 2019 (retroactive to 2018) and will remain in effect through 2022 barring any additional extensions of the program.

RAISE – Rebuilding American Infrastructure with Sustainability and Equity, or RAISE Discretionary Grant program

RAISE, previously known as the BUILD (Build Utilizing Investments to Leverage Development) and TIGER (Transportation Investment Generating Economic Recovery) discretionary grant programs, provides a unique opportunity for the DOT to invest in road, rail, transit and port projects that promise to achieve national objectives. The Consolidated Appropriations Act, 2021 appropriated $1 billion, available for obligation through September 30, 2024, for National Infrastructure Investments. As with previous rounds, funds for FY 2021 RAISE grants are to be awarded on a competitive basis for projects that have a significant local or regional impact.[17]

Congress has awarded over $8.935 billion for twelve rounds of National Infrastructure Investments to fund projects that have a significant local or regional impact in all 50 states, the District of Columbia and Puerto Rico since 2009. While RAISE grants are available to fund private railroad improvements, applications need a public sponsor. Each state is capped at $100 million per year, with a national 50/50 split on funds geared towards urban and rural areas. BUILD grants focus on capital projects that generate economic development and improve access to reliable, safe, and affordable transportation. Both rail and port projects are eligible. In FFY 2020, the third round of former BUILD grants awarded nearly $1 billion to 70 transportation infrastructure projects including rail in 44 states. Two California projects received $36 million from this round, and one of them is rail project. BUILD had previously awarded nearly $4 billion of grants nationally from 2017 to 2020. TIGER had previously funded $5.5 billion of grants nationally from 2009 to 2017.[18]

Railway-Highway Crossings (Section 130)

The Railway-Highway Crossings (Section 130) Program provides funds to reduce the number and severity of highway accidents by eliminating hazards to vehicles and pedestrians at existing railroad crossings. The Section 130 Program has been correlated with a significant decrease in fatalities at railway-highway grade crossings since the Program's inception in 1987

The funds are set-aside from the Highway Safety Improvement Program (HSIP) apportionment. As provided by Title 23, United States Code, Section 130, the Railroad-Highway Grade Crossing Program, also known as Section 130 Program is funded at a 90% Federal contribution and 10% local matching contribution.

CARES ACT

The Coronavirus Aid, Relief, and Economic Security (CARES) Act was signed into act on March 27, 2020. It responds to the COVID-19 (i.e., coronavirus disease 2019) outbreak and its impact on the economy, public health, state and local governments, individuals, and businesses. FTA is allocating $25 billion to recipients of urbanized area and rural area formula funds to transit agencies to help to prevent, prepare for and respond to the COVID-19 pandemic, with $22.7 billion to large and small urban areas and $2.2 billion to rural areas. Funding will be provided at a 100-percent federal share, with no local match required, and will be available to support capital, operating, and other expenses generally eligible under those programs to prevent, prepare for, and respond to COVID-19. CARES Act passed by Congress includes $3.7 billion in federal funding for transit systems in cities and on Indian reservations throughout California.[19]

17 U.S DOT, ***RAISE Discretionary Grants***, accessed 2021.

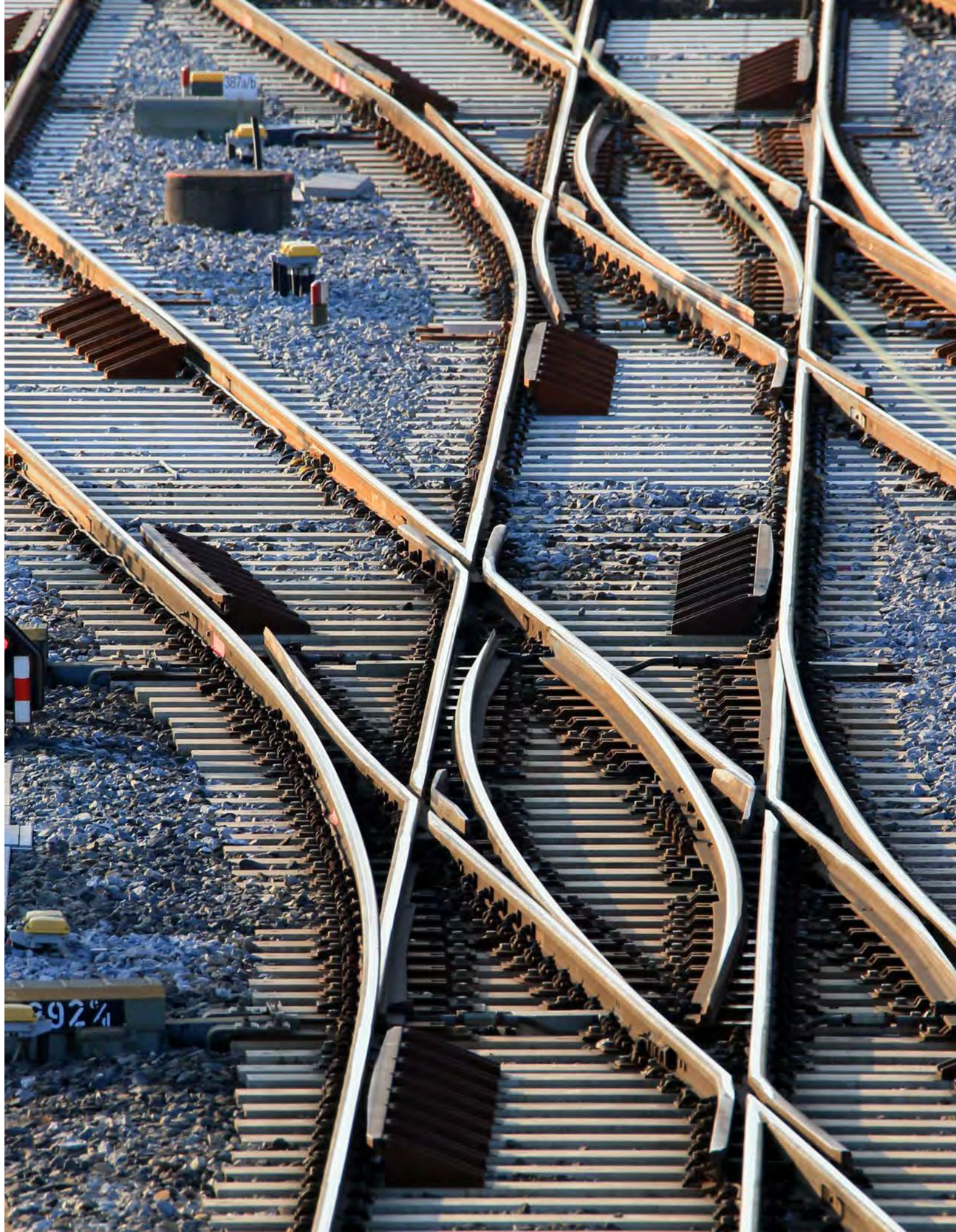
18 U.S DOT, ***RAISE Discretionary Grants***, accessed 2021

19 FTA, ***CARES Act***, accessed 2021.

Table 6.4: Federal Rail and Intercity Bus Funding Programs

Funding Programs	Funding Amount	Intended Use	Funding Category	Eligibility
Amtrak Grants	Amounts determined by US DOT	Amtrak uses these federal funds for its operating and capital activities.	Capital/Operating	N/A
Rebuilding American Infrastructure with Sustainability and Equity (RAISE, previously known as BUILD / TIGER)	$1 Billion (FY 2021)	Passenger and freight rail transportation projects, and rail extensions	Capital/Planning	1. Equity: at least $10 million is for projects located in or directly benefitting Areas of Persistent Poverty 2. Local Match: 20%
Infrastructure for Rebuilding America (INFRA)	$889 Million (FY 2021)	Railway-highway grade crossing or grade separation project; or a freight project that is an intermodal or rail project, or within the boundaries of a public or private freight rail.	Capital	1. Environmental Requirement: The Department encourages applicants to 1) consider climate change and environmental justice in project planning efforts, and 2) to incorporate project components dedicated to mitigating or reducing impacts of climate change. 2. Local Match: 40%
Capital Investment Grants Program (CIG)	$2.5 Billion (FY 2022)	Funds light rail, heavy rail, commuter rail, streetcar, and bus rapid transit projects.	Capital	1.Ridership Forecasts & VMT Reduction: Project sponsor is required to calculate trips for the mobility, congestion relief, and cost effectiveness measures using its local travel model, the sponsor is expected to also use its local travel model to calculate the change in VMT used in the environmental benefits measure. 2. Local Match: 20%
Federal-State Partnership for State of Good Repair Grant Program	$291.4 Million (FY 2020)	The purpose of this grant program is to reduce the state of good repair backlog on publicly owned or Amtrak-owned infrastructure, equipment, and facilities	Capital	Local Match: 20%
Consolidated Rail Infrastructure and Safety Improvements (CRISI)	$321 Million (FY 2020)	This program funds projects that improve the safety, efficiency, and reliability of intercity passenger and freight rail.	Capital	Local Match: 20%
Restoration and Enhancement Grants	$24 Million (FY 2018-20)	The purpose of this grant program is to provide operating assistance to initiate, restore, or enhance intercity passenger rail transportation.	Operating	1. Equity Requirement: FRA will give priority to proposed projects in applications that 1) Provide service to regions and communities that are underserved or not served by other intercity public transportation; 2) Foster economic development, particularly in rural communities and for disadvantaged populations 2. Local Match: 20%
Commuter Rail Positive Train Control (PTC) Grants	$197 Million in total	Offers funding to the deployment of PTC system technology for intercity passenger rail transportation, freight rail transportation, and/or commuter rail passenger transportation.	Capital	Local Match: 20%
National Highway Freight Program	$1.6 Billion annually; CA is expected to receive $117 million per year	This program is to support the movement of goods on the National Highway Freight Network, including rail crossings.	Capital	Local Match: 40%

Transportation Infrastructure Finance and Innovation Act (TIFIA)	$300 Million (FY 2020)	Rail projects involving the design and construction of intercity passenger rail facilities, or the procurement of intercity passenger rail vehicles are eligible for TIFIA credit assistance.	Capital	Local Match: 67%
Rail Infrastructure Financing and Improvement Act (RRIF)	$35 Billion in total	The RRIF Program dedicates funding to providing vital access to financing for short-line and regional railroads.	Capital	Local Match: N/A
Railroad/ Highway Grade Crossing Program (Section 130)	$245 million (FY 2020) (CA gets $16 Million each year)	This program provides funds for the elimination of hazards at railway-highway crossings.	Capital	Local Match: 10%
FTA's State Safety Oversight Program (SSO)	$3.25 Million (FY 2020)	The purpose of the State Safety Oversight program is to oversee safety at rail transit systems. FTA provides federal funds through the SSO Formula Grant Program for eligible states to develop or carry out their SSO programs.	Capital/ Operating	N/A
Coronavirus Aid, Relief, and Economic Security (CARES) Act	$25 Billion in total	COVID-19 relief Bill. CARES Act passed by Congress for transit systems in cities and on Indian reservations throughout California.	Capital/ Operating/ Planning	100% federal share



6.4.3 State Funding

The California State Legislature passed SB 1 and the Road Repair and Accountability Act of 2017 to reform the transportation program and increase transportation revenue. In the 2016-2017 budget documentation, the Governor presented a transportation funding and reform package that included a new road improvement charge; stabilization of the gasoline excise tax to 18 cents, with an adjustment annually of the broader gasoline tax to inflation; an increase in the diesel excise tax; additional money provided by the cap-and-trade program; and costs savings from increasing Caltrans' efficiency.[20] This funding package will generate $5.4 billion annually, and establishes new funding sources like a new annual vehicle fee, amongst other things. The Transportation Improvement Fee and Road Improvement Fee generate $16.35 billion and $191 million, respectively, over the next 10 years. This section describes all the opportunities to pursue state funding.

State Transportation Accounts

- State Highway Account

20 Legislative Analyst's Office, Governor's Budget Summary 2016-17 – Transportation Summary (2016), accessed 2021.

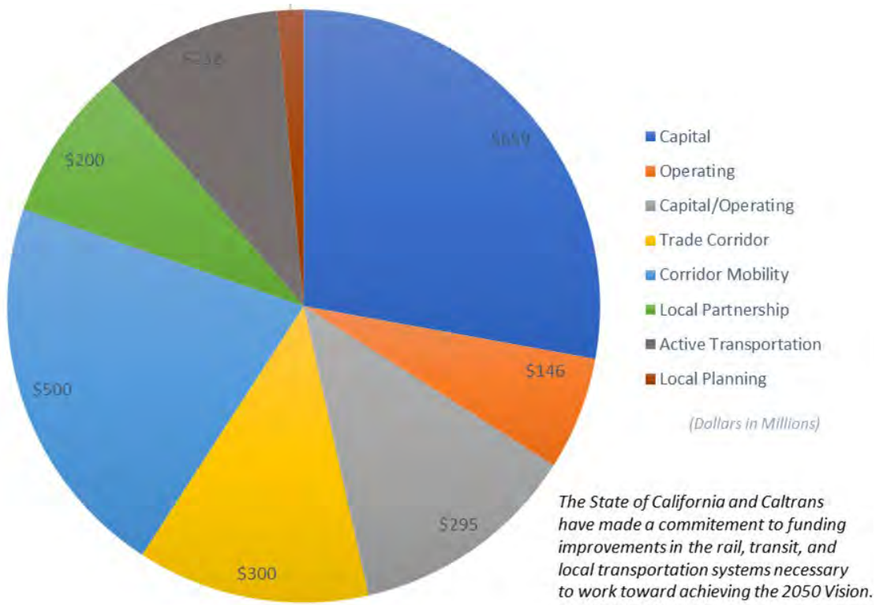
The bulk of State Highway Account (SHA) funding goes to the State highway system. The SHA receives its funds from state gasoline fuel taxes, state vehicle weight fees, and reimbursements from the Federal Trust Fund for Federal Aid projects and other smallersources of funds.

The SHA had an estimated $13.6 billion available for distribution in FY 2020-2021.[21] The SHA is funded 60 percent from state sources and 40 percent from federal sources. It does not fund passenger rail directly, but rather flows into the PTA and STIP.

- Public Transportation Account

The PTA is a trust fund to be used "only for transportation planning and mass transportation purposes." The PTA is now almost exclusively fundedthrough the sales tax on diesel fuel, and there is a transfer of $25 million from the SHA. The 2020-2021State Budget includes $2.94 billion in PTA resources.

21 CalSTA, 2020-21 California State Transportation Financing Package (2020), accessed 2021.



The State of California and Caltrans have made a commitement to funding improvements in the rail, transit, and local transportation systems necessary to work toward achieving the 2050 Vision. The 2020-2021 Budget proposed more than 2 billion dollars annually in funding for transit, congested and trade corridors, active transportation.

Exhibit 6.2: Caltrans-Anticipated Annual Rail and Transit Investment Funding

PTA funds are apportioned between state and local programs in accordance with Proposition 22, passed by the voters in 2010.[22] Approximately 60 percent of the funds go to the local State Transit Assistance (STA) program, through which funds are apportionedon a formula basis to local transit agencies. The state portion goes to intercity rail operations ($130.8 million in the 2016-2017 state budget), state-owned equipment rehabilitation, staff support to Caltrans and other state agencies that support mass transportation, and rail projects in the STIP. The PTA is the only state funding source for state-supported intercity rail service operations.

SB 1 significantly increased the amount of funding in the PTA, but low fuel prices, along with greater fuel-efficient vehicles may erode the future revenuein this account.

- State Transportation Improvement Program

The STIP is a program and not a funding source; it is funded through the SHA, the Federal Trust Fund,and a small amount from the PTA. The STIP devotes25 percent of its expenditures to the Caltrans ITIP, which includes intercity rail improvements; and 75 percent of its expenditures to the Regional Agencies' Regional Transportation Improvement Program, which funds local projects, including regional rail transit.[23]

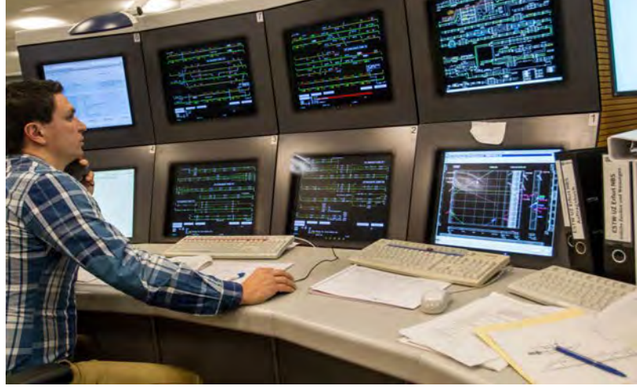
The adopted 2020 STIP Capacity for 2020-21 through 2024-25 is $2.57 billion, and estimated total statewide new programming capacity of $408 million, including positive capacity in the SHA ($911 million) offset by a negative capacity in the PTA (-$593 million).[24] With limited PTA funding available for the STIP on an ongoing basis, most transit projects programmed in the STIP will have to be delivered with other STIP fund types (SHA and Federal funds), to remain in the STIP.

SB 1 stabilized and increased funding in the STIP program, which will be reflected in forthcomingyears.

State Transit Assistance Program

The STA funds day-to-day transit operations and capital infrastructure. The revenue for the STA comes from diesel fuel sales taxes and distributesfunds to MPOs/RTPAs based on population, or totransit agencies based on revenue. SB

22 Per Proposition 22, passed by voters in 2010.
23 California Streets and Highways Code Section 164.
24 CTC, Adoption of 2020 State Transportation Improvement Program (STIP) Resolution G-20-29 (2020), accessed 2021.



1 provides $250 million annual to the STA. SB 1 also creates an STA Capital Program of $105 million annually to fund transit, with a specific focus on state of good repair.

The Section 190 Grade Separation Program

This is a State-funded safety program that supports projects that replace and upgrade existing at-graderailroad crossings, primarily with grade separations.The CPUC establishes a project list, and the CaltransDRMT administers the program.

Section 190 of the California Streets and HighwaysCode requires the State's annual budget to include $15 million for funding these projects.[25] The maximum funding per project is $5 million annually.

Trade Corridors Improvement Fund

The Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006 (Proposition 1B) created the Trade Corridors Improvement Fund; and provided for allocation by the CTC of $2 billion in bond funds for infrastructure improvements on highway and rail corridors that have a high volume of freight movement, and for specified categories ofprojects eligible to receive these funds.

Automatic Grade-Crossing Warning DeviceMaintenance Fund

Caltrans sets aside a minimum allocation of $1 million per year for this fund, which is administered by CPUC. The CTC approved an amount of $3.75 million to be set aside for the CPUC's Railroad Grade Crossing Maintenance Program for the Fiscal Year 2019-20 State Budget, as the CPUC requested in Resolution SX-128.[26]

25 Caltrans DRMT, Grade Separation Program Section 190 Guidelines (2021), accessed 2021.
26 CPUC, Rail Crossing Engineering Section, "Grade Crossing Maintenance Fund Program," February 2019.

State Bonds

State bonds used to fund California's rail systeminclude the following.

- *Proposition 1B – Highway Safety, Traffic Reduction,Air Quality, and Port Security Bond Act (2006)*

In 2006, California voters approved Proposition 1B, the "Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006," to authorize the State of California to issue up to $19.925 billion in bonds for transportation projects "aimed at relieving congestion, improving movement of goods, improving air quality, and enhancing safety and security of the transportation system". Of the Proposition 1B funds, $3.2 billion was specifically budgeted for projects to improve the movement of goods through ports, state highways and rail systems, and between California and Mexico and to improve air quality by reducing emissions from transporting goods.

As part of Proposition 1B, the California Air Resources Board (CARB) organized the Goods Movement Emissions Reduction Program, which has utilized $1 billion in Proposition 1B funding to date to provide dollar-for-dollar matching funds to local agencies, which can then be used to assist freight operators to buy cleaner, more modernized vehicles to reduce overall emissions. Of the larger $1 billion project budget, $85.4 million was used to help upgrade or replace 67 locomotives for California railroads, which reduced emissions by an estimated 680,000 pounds (340 tons) of PM 2.5 and 12,578,000 pounds (6,289 tons) of NOx.

The CTC was authorized to manage $12 billion[27] of this money, including the following programs that impactrail funding:

- *Public Transportation Modernization, Improvement, and Service Enhancement Account*

Proposition 1B authorized the Public Transportation Modernization, Improvement, and Service Enhancement Account with $3.6 billion, $3.49 billion of which has been committed.[28] The account had anestimated $11.42 million available for distribution in FY 2020-2021.[29]

- *Highway Railroad Crossing Safety Account (Freight)*

Proposition 1B authorized the Highway Railroad Crossing Safety Account with $250 million for high- priority grade separation and railroad crossing safetyimprovements.

The account was split into two sections: Part 1 included $150 million to be matched dollar-for-dollar with non-state funds for improvements to grade crossings on CPUC's priority list; Part 2 included the remaining $100 million, which would be used for "high-priority" railroad crossing improvements (or grade separations) at other crossings that satisfy at least one of the following five criteria:

27 CTC, Proposition 1B: Promises Made, Promises Kept (2015), accessed 2021.
28 State of California, Strategic Growth Plan Bond Accountability – Proposition 1B (2016), accessed 2021.
29 CalSTA, 2020-21 California State Transportation Financing Package (2020), accessed 2021.

- Crossings where freight and passenger rail share the affected line;
- Crossings with a high incidence of motor vehicle-rail or pedestrian-rail collisions;
- Crossings with a high potential for savings in rail and roadway traffic delay;
- Crossings where an improvement will result in quantifiable emission benefits; or
- Crossings where the improvement will improve the flow of rail freight to or from a port facility.

Part 2 funds had no required match, although the amount of declared matching funds would be considered as part of the project selection process.

As of June 30, 2020, the California Transportation Commission reported that it had allocated $242 million from the HRCSA to 38 projects throughout the state.

Cap-and-Trade Program California Greenhouse Gas Reduction Fund

In 2006, the California State Legislature passed AB 32,with the ambitious goal of reducing GHG in the state. AB 32 created the Cap-and-Trade Program, and authorized CARB to establish a carbon permit auction.A series of subsequent bills allocated the revenue from the Cap-and-Trade Program to the newly createdCalifornia GGRF, which is used to fund projects through the California Climate Investments Program. [30] These funds will contribute to CHSR.

Transit and Intercity Rail Capital Program

GGRF continuously appropriates 25 percent of revenue to HSR, and 10 percent to the TIRCP. One program under GGRF allocates 25 percent of revenues to HSR, and 10 percent to the TIRCP. The TIRCP is a competitive grant program that receives annual appropriations equivalent to 10 percent of theState's Cap-and-Trade auction revenues. This programis dedicated to transformative transit and rail projectsthat will have a significant impact on increasing ridership and reducing GHGs. TIRCP will receive an average of $300 million annually from SB 1; a minimum of 25 percent of that will fund projects thatbenefit disadvantaged communities. This program has also received funds from sources other than Cap-and-Trade auction revenues, including early debt repayment appropriated to the TIRCP.

Low Carbon Transit Operations Program

Another transportation program now available through the GGRF includes the Low Carbon TransitOperations Program (LCTOP), under which funds are awarded to local transit agencies to support new facilities, and to prioritize projects that support disadvantaged communities. The LCTOP receives a continuous appropriation of 5 percent of the Cap-and- Trade revenues via GGRF.

To date (FY 2015-16 through FY 2020-2021), GGRF funding has included $3,564 million to HSR, $1,325 million to TIRCP, and $607 million to LCTOP For FY 2020-2021. GGRF allocated 25 percent of funds to the HSR program, 10 percent of funds to the TIRCP, and 5 percent of funds to the LCTOP.

Road Repair and Accountability Act (SB 1)

In addition to enhancing and stabilizing existing funding sources such as the TIRCP, the STA, and the STIP, SB 1 created new funding programs that will help fund rail and transit projects and deliver the RailPlan.

State Rail Assistance Program

The State Rail Assistance Program is specifically designed as a revenue source for intercity and commuter rail. The revenue comes from 0.5 percentof a new diesel sales tax revenue, as defined in SB 1. Half of the revenue will be evenly distributed between the five commuter rail operators, and half is allocated to intercity rail corridors. In total, the SRA Program has awarded funds to 11 agencies with a total of $96.3 million awarded since 2018.

30 CARB, California Climate Investments from the Greenhouse Gas Reduction Fund (2021), accessed 2021.

Solutions for Congested Corridors Program

The Solutions for Congested Corridors Program (SCCP) is a statewide, competitive program that provides funding to achieve a balanced set of transportation, environmental, and community access improvements to reduce congestion throughout the state.

The SCCP makes $250 million available annually to fund projects that implement specific transportation performance improvements and are part of a comprehensive multimodal corridor plan, by providing more transportation choices while preserving the character of local communities and creating opportunities for neighborhood enhancement.

Trade Corridor Enhancement Program

The Trade Corridor Enhancement Program (TCEP) provides funding for infrastructure improvements on federally designated Trade Corridors of National and Regional Significance, on California's portion of the National Highway Freight Network, as identified in California Freight Mobility Plan, and along other corridors that have a high volume of freight movement.

The TCEP funds projects designed to move freight more efficiently on corridors with high volumes of freight. These projects increase the use of on-dock rail, improve safety by eliminating at-grade crossings, reduce impacts to surrounding communities, reduce border wait times, and increase rail capacity with double tracking. This statewide, competitive program will provide approximately $300 million per year in state funding and approximately $515 million in National Highway Freight Program funds if the federal program continues under the next federal transportation act.

Projects eligible for funding under the program include, but are not limited to, the following as Rail components;

- Highway improvements to accommodate the movement of freight more efficiently, particularly for ingress and egress to and from the state's land ports of entry, rail terminals, and seaports, to relieve traffic congestion, along major trade or goods movement corridors.
- Freight rail system improvements to enhance the ability to move goods from seaports, land ports of entry, and airports to warehousing and distribution centers, including grade separations and at-grade crossing improvements.
- Port and/or rail projects to facilitate intermodal interchange, transfer, and access into or out of the facility (limited to 10% of federal yearly apportionments).

Short-Line Railroad Improvement Program

On June 27, 2019, the Governor signed Senate Bill (SB)87, creating the Short-Line Infrastructure Improvement Act of 2019, which directs the California Transportation Commission to establish a competitive funding program to allocate funds for short-line railroad projects. The primary objective of the Short-Line Infrastructure Improvement Program (SLRIP) is to fund infrastructure improvement projects designed to enable Class III/short-line railroads to improve freight mobility, efficiency, reliability, sustainability, safety, and load capacity. The SLRIP provides a one-time appropriation of $7.2 million. See CTC Short Line Railroad Improvement Program webpage for detailed SLRIP project information (https://catc.ca.gov/programs/short-line-railroad-improvement-program).

The projects to be funded under this program are intended to allow for Class III Rail to become more compatible in supporting modern rail freight traffic and the communities and industries they serve throughout California. All projects nominated for the Short-Line Railroad Improvement Program must be consistent with the goals and objectives of the 2018 California State Rail Plan regarding short-line railroad infrastructure investment. The Short-Line Railroad Improvement Program is a reimbursement program for eligible costs incurred. Projects funded from the Short-Line Railroad Improvement Program require at least a 30% match of private funds.

Carl Moyer Program

The Carl Moyer Program was implemented in 1998 through a partnership between CARB and California's 35 local air pollution control and air quality management districts. California 's Carl Moyer Memorial Air Quality Standards Attainment Program, which provides for cleaner-than-required engines and equipment, has helped finance purchases of low-emission locomotives at many freight railroads. The Carl Moyer Program also provides grant funding for drayage trucks that transport containers and bulk to and from the ports and intermodal railyards.

Table 6.5: State Rail Funding Programs

Funding Program	Funding Amount	Intended Use	Funding Category	Eligibility
Transit and Intercity Rail Capital Program (TIRCP)	$500 Million (FY 2020)	This program provides funding for transformative capital improvements that will modernize and transform California's intercity, commuter, and urban rail systems, bus transit, and ferry transit systems. Further goals are expanding and improving rail service to increase ridership, rail service integration, and safety improvements.	Capital	1.Environmental Requirement: All projects must demonstrate that they will achieve a reduction in GHG emissions. 2.Ridership: Grant recipient must show benefits such as improved transit ridership, integration with other rail and transit systems, including HSR, and improved rail safety. 3.Equity Requirement: The program has a goal of providing at least 25% of benefits to disadvantaged communities.
Short-Line Railroad Improvement Program (SLRIP)	$7.2 Million in total	Offers funding to short-line railroad infrastructure projects intended to improve freight mobility, volume thresholds, and support modern rail freight traffic and the communities and industries they serve throughout California.	Capital	1.Environmental Requirement: Projects need to demonstrate how they would reduce GHG emissions and criteria pollutants, as well as how the project would help advance California's air quality and climate goals. 2.Project Support: Projects would need to demonstrate meaningful public outreach and engagement for the proposed project. 3.Local Match: At least 30% match of private funds.
State Rail Assistance Program	$41 Million (FY 2019)	This program provides funding directly to intercity passenger rail Joint Power Authorities (JPAs) and commuter rail agencies for operations and capital investments.	Capital/ Operating	Request Cap: For intercity rail, statute directs a minimum of 25 percent of funding to each of the State's three intercity rail corridors with regularly scheduled service. CalSTA will determine the allocation of the remaining 25 percent.

Solutions for Congested Corridors Program (SCCP)	$250 Million	The primary objective of this program is to fund projects designed to reduce congestion in highly traveled and highly congested corridors through performance improvements that balance transportation improvements, community impacts, and that provide environmental benefits.	Capital	Eligible Applicants: Regional transportation planning agencies, county transportation commissions, and the California Department of Transportation (Caltrans) are all eligible to apply for program funds. Eligible Project Elements (include but not limited to): Improvements to state highways, local streets and roads, rail facilities, public transit facilities, bicycle and pedestrian facilities, and restoration or preservation work that protects critical local habitat or open space. Program funds cannot be used to construct general-purpose lanes on a state highway.Other Eligibility Requirements: All nominated projects must be included in a Comprehensive Multimodal Corridor Plan.
Sustainable Transportation Planning Grant Program	$34 Million (FY 2021)	The Grant Program also supports related State sustainability initiatives including California State Rail Plan.	Planning/ Operating	1.Equity Requirement: Sustainable Communities Grants only- the project area or portions of the project area is defined as a disadvantaged community. 2. Environmental Requirement: Sustainable Communities Grants- Projects contributes to the State's GHG reduction targets and advances transportation related GHG emission reduction project types/strategies. 3. Community Engagement: Sustainable Communities Grants- Project would engage disadvantaged communities. 4. Strategic Partnership: Strategic Partnership Grant- Projects should strengthens government-to-government relationships. 5.Local Match: 11.47% for Sustainable Communities Grant and 20% for Strategic Partnership Grant.

Local Partnership Program (LPP)	Total annual funding is $200 million: $20 million is set aside for incentive funding awards, and $180 million is distributed. The funding distribution is 40% via a ompetitive program and 60% via a formulaic program.	The Local Partnership Program provides funds for transportation improvements to local and regional transportation agencies that have enacted taxes, tolls, and fees dedicated to transportation improvements.	Capital / Operating	Eligible applicants are local or regional transportation agencies that meet the following requirements: Formulaic Program: taxing authorities with voter-approved taxes, tolls, or fees dedicated solely to transportation improvements. Competitive Program: taxing authorities eligible for the formulaic program or agencies with imposed fees, including uniform developer fees, dedicated solely to transportation improvements.
Trade Corridors Enhancement Program (TCEP)	$ 430 Million	Federally designated Trade Corridors of National and Regional Significance & California's portion of the National Highway Freight Network.	Capital	1.Congestion Relief: Project provides for increased volume of freight traffic through capacity expansion or operational efficiency to improve the interregional transportation network and move goods to, through, and from ports. 2.Environmental Requirement: Project contributes to corridor or air basin emission reduction of greenhouse gases, diesel particulates (PM 10 and PM 2.5), carbon monoxide, nitrogen oxides, and other pollutants. 3. Local Match: Require 30% matching funds.
High Speed Passenger Train Bond Program (HSPTB)	$950 million in total	This program provides funds for capital improvements to intercity rail lines, commuter rail lines, and urban rail systems that provide direct connectivity to the high-speed train system and its facilities, or that are part of the construction of the high-speed train system.	Capital	1.Ridership: Intercity Rail Program- Projects that promotes increased ridership, increases On Time Performance and decreases running times. 2.Connectivity: Commuter and Urban Rail Program- projects that provide direct connectivity to the high-speed train system.

The Grade Separation Program (Section 190)	$15 Million (FY 2020)	This program funds the construction of grade separation projects.	Capital	1.Project Priority: A statement of the applicant's position on the annual priority list established by the Public Utilities Commission. 2. Local Match: An allocation of 80 percent of the estimated cost of the project shall be made.
Low Carbon Transit Operations Program (LCTOP)	$146 Million (FY 2020)	Supports new or expanded rail service, expand intermodal transit facilities, and may include equipment acquisition, fueling, maintenance and other costs to operate those services or facilities, with each project reducing greenhouse gas emissions.	Capital/ Operating	1. Equity Requirement: Meeting all statutory DAC, low-income community, and/or low-income household requirements, where applicable. 2. Environmental Requirement: Quantifying greenhouse gas (GHG) emission reductions per project for the Allocation Request.
Regional Transportation Improvement Program (RTIP)	$1875 Million (FY 2020)	The RTIP funds a variety of local or regional projects for transit, from buses to bus stations to light rail.	Capital	Funding Distribution: The RTIP receives 75% of the STIP and is subject to a split of 60% to Southern California and 40% to Northern California.
Interregional Transportation Improvement Program (ITIP)	$625 Million (FY 2020)	The ITIP funds for intercity rail projects and to improvements outside the urbanized areas on interregional road routes.	Capital/ Operating	1. Environmental Requirement: Demonstrate the project help to achieve reductions of GHG emissions to meet the 2030 and 2050 GHG reduction targets. 2. Equity Requirement: Demonstrate the project directly benefit disadvantaged communities. 3.Local Match: At least 60 percent of the program shall be programmed to projects outside urbanized areas on the Interregional Road System (IRRS) and for intercity passenger rail. Of this amount, at least 15 percent (9 percent of the ITIP) must be programmed for intercity passenger rail projects, including grade separation projects.

TDA - Local Transportation Fund	$1.14 Billion (FY 2019)	Rail passenger service operations & capital improvements	Capital/ Operating	1. Eligible Applicant: TPAs, Cities, Counties, Transit Districts, MPOs. 2. Request Cap: A transit claimant must either claim no more than 50% of their operating budget from TDA or maintain a ratio of fare revenues to operating cost at least equal to 20 percent if the claimant is in an urbanized area, or 10 percent if the claimant is in a non-urbanized area, whichever is greater.
Public Transportation Modernization, Improvement, and Service Enhancement Account (PTMISEA)	$11.42 Million (FY 2020)	Funding could be used for rolling stock (buses and rail cars) procurement.	Capital	Eligible Applicant: 1) A transit operator including a rail transit, commuter rail, bus, or waterborne transit operator eligible for an allocation of PTMISEA funds under State Transit Assistance; 2) A local agency including a transportation planning agency, county transportation commission.
Active Transportation Program	$232 Million (FY 2020)	Bicycle parking facilities at transit stops, rail and transit terminals, ferry docks and landings, park and ride lots, and provisions for transporting bicyclists and bicycles on transit or rail vehicles or ferry vessels.	Capital/ Planning	1. Equity: More than 400 of the funded projects are Safe Routes to Schools projects and programs that encourage a healthy and active lifestyle throughout students' lives. In addition, every cycle has seen more than 85% of funds going towards projects that will benefit disadvantaged communities throughout the State. 2. Local Match: The Commission does not require a funding match for ATP. Large MPOs, in administering a competitive selection process, may require a funding match for projects selected through their competitive process.

6.4.4 Local Funding

Article XIIIB of the State Constitution allows for local sales tax measures subject to voter approval. Most county sales tax measures are used to fund urban transit, but also support commuter rail services and intercityrail stations. There are already many local sales tax measuresthroughout the State. In November 2018 and 2020, votersapproved many new local sales tax measures, including Caltrain Measure RR, Caltrain's rail service tax measure. This measure will provide Caltrain an estimated $100 million annually for the next 30 years to help fund operations, including expansion of service and capacity, as well as major capital projects. With the passage of Measure RR, Caltrain now has for the first time in its nearly 30-year history a reliable and dedicated funding source. Table 5.4 outlines other local tax measures that have been approved as of November 2020 that support the network and connectivity goals.

Table XX. New Sales Tax Measures since November 2020

Location	Funding Source	Amount	Description of Proposed Improvements
Marin County (Measure AA)	0.5% sales tax for 30 years	$27 million/year	Maintain, improve, and manage local roads and other infrastructure; maintain and expand efficient and effective local transit services; reduce school-related congestion and provide safer access to schools; reduce congestion on Highway 101.
San Benito County (Measure G)	1% sales tax for 30 years	$16 million/year	Maintain local roads, repair potholes, and improve traffic; Route 25 4-lane expressway project.
City of Monterey (Measure S)	1% sales tax for 8 years	$9 million/year	Fix streets, sidewalks, storm drains, and install ADA ramps and signals at intersections.
San Mateo County (Measure W)	0.5% sales tax for 30 years	$80 million/year	Funding used for highway projects, local street repair, grade separations for Caltrain tracks that intersect local streets, expanded bicycle and pedestrian facilities, and improved transit connections.
Caltrain (Measure RR)	0.125% sales tax for 30 years	$100 million/year	Support the operation of Caltrain service levels throughout the corridor from San Francisco to Gilroy, and the expansion of Caltrain peak hour service from six trains per hour per direction to eight trains per hour per direction, as well as the expansion of the Gilroy service to a minimum of five morning and five afternoon trains.
Sonoma County (Measure DD)	¼-cent sales tax for 20 years	$26 million/year	Increased bus frequencies and extended hours of operations should be prioritized where routes make first and last mile connections to major bus transit hubs, schools, and rail stations, or serve major transit corridors or commute routes between communities.

6.4.5 Public-Private Partnerships

Rail services that approach or exceed self-funding for operating specific services are attractive for private operators. With government to take on some of the operating risk of providing passenger rail service, the opportunity exists to earn a return on investment through fare revenues.