3 California Rail Network Vision

California's climate, natural and built environments, diverse population and economy, universities, and employment centers attract people from all over the world. Connecting these people, places, and goods in a cost-effective and efficient manner requires a sustainable, multimodal transportation system. A sustainable system must be accessible to all, provide for travel options to increasingly congested roads and highways, support development of vibrant and healthy communities, enhance the environment by reducing emissions and pollution, and support the state's economy by ensuring the fluid movement of goods and services to and from international, national, regional, and local markets.

An advantage of private automobile travel is the convenience of traveling from origin to destination in one vehicle without being reminded of the high cost of driving, other than the occasional visit to the gas pump. Rail transportation, however, can offer many advantages over the private car, including a lower cost per mile to operate; the ability to bypass congestion; potentially shorter end-to-end travel times between many origins and destinations; the

ability to be productive while moving (reading, working, or resting); and extraordinary safety benefits.[147] Public transit trips are also associated with increased physical activity, and further bicycle and pedestrian improvements at rail stations make that correlation stronger. Active travel helps to reduce chronic disease and is significantly beneficial for health and health-care costs, when coupled with safety improvements and VMT substitution.[148]

However, connecting between different rail systems is often a much more challenging experience. Schedules may result in substantial transfer delays, physical connections may be poor, and multiple payments may be needed. These and other issues (including limited frequencies of service and travel times) negatively affect the ability of the rail mode to compete with other modes. The Rail Plan presents a path toward eliminating as many of these barriers as possible, so that transferring across modes or across systems will feel to the rail passenger as simple as merging off of one road and onto another.

The Rail Plan defines a system that will help to fundamentally shift the way passengers view their travel choices. Imagine if you could reliably board a train at least every 30 minutes at a station in denser urban regions, or at least every 60 minutes at any station in the rest of the state, and travel seamlessly to any city in California? That is the vision for passenger rail in California.

The remainder of this chapter defines the 2040 Vision for passenger and freight rail, and how the 2040 Vision directly supports the State policy goals established in the CTP 2040. This chapter also describes the planning principles and policies underlying the 2040 Vision.

147 According to 2015 data from the U.S. DOT Bureau of Transportation Statistics, nearly 95 percent of national transportation fatalities occur on highways (35,092 versus 13 fatalities on trains).

148 Maizlish, Neil, Ph.D., MPH, California Department of Public Health Office of Health Equity. Increasing Walking, Cycling, and Transit: Improving Californians' Health, Saving Costs, and Reducing Greenhouse Gases (2016), accessed 2017.

3.1 California Transportation Plan 2040 Coordination

The Rail Plan is one of seven mode-specific plans that support the vision, goals, and policies of the CTP 2040. The CTP 2040 uses a "whole system" planning approach to evaluate the impact of plans system-wide—across modes and regions—on transportation and land use scenarios and policies.[149] Because the Rail Plan is mode-specific, it supports the CTP 2040 goals, but plans beyond the scope and provides many more rail details. The CTP 2040 acts as an umbrella plan and sets a policy framework to organize and guide the development of each subsequent modal plan. Each plan, in turn, provides service, delivery, and connectivity goals to identify how the State will invest in each specific mode to support statewide mobility goals.

The vision for CTP 2040 is to achieve a fully integrated, multimodal, and sustainable transportation system that supports the environment, the economy, and social equity. CTP 2040 offers a detailed overview of the existing transportation network, and assesses future transportation trends and challenges. It offers strategies to improve mobility and accessibility across all modes, contribute to system preservation, support a vibrant economy, improve public safety and security, promote livable communities and social equity, and support environmental stewardship.

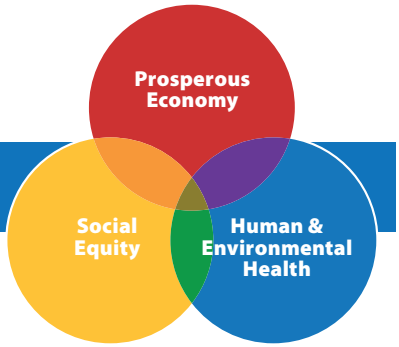
CTP 2040 identifies six broad goals, each with a series of policies and implementation recommendations (Exhibit 3.1). The policies aim to address recent transportation trends and challenges; meet federal and state regulatory obligations; and move toward a more efficient, competitive, multimodal transportation system.

CTP 2040 Vision: Sustainability

California's transportation system is safe, sustainable, universally accessible, and globally competitive. It provides reliable and efficient mobility for people, goods, and services, while meeting the state's GHG emission reduction goals and preserving the unique character of California's communities

149 CTP 2040 Fact Sheet (2016), accessed 2016.

CTP2040 Policy Framework



THE VISION
SUSTAINABILITY

California's transportation system is safe, sustainable, universally accessible, and globally competitive. It provides reliable and efficient mobility for people, goods, and services, while meeting the State's greenhouse gas emission reduction goals and preserving the unique character of California's communities.

THE GOALS

1	2	3	4	5	6
Improve Multimodal Mobility and Accessibility for All People	Preserve the Multimodal Transportation System	Support a Vibrant Economy	Improve Public Safety and Security	Foster Livable and Healthy Communities and Promote Social Equity	Practice Environmental Stewardship

THE POLICIES

1	2	3	4	5	6
POLICY 1 Manage and Operate an Efficient Integrated System	POLICY 1 Apply Sustainable Preventative Maintenance and Rehabilitation Strategies	POLICY 1 Support Transportation Choices to Enhance Economic Activity	POLICY 1 Reduce Fatalities, Serious Injuries, and Collisions	POLICY 1 Expand Engagement in Multimodal Transportation Planning and Decision Making	POLICY 1 Integrate Environmental Considerations in All Stages of Planning and Implementation
POLICY 2 Invest Strategically to Optimize System Performance	POLICY 2 Evaluate Multimodal Life Cycle Costs in Project Decision Making	POLICY 2 Enhance Freight Mobility, Reliability, and Global Competitiveness	POLICY 2 Provide for System Security, Emergency Preparedness, Response, and Recovery	POLICY 2 Integrate Multimodal Transportation and Land Use Development	POLICY 2 Conserve and Enhance Natural, Agricultural, and Cultural Resources
POLICY 3 Provide Viable and Equitable Multimodal Choices Including Active Transportation	POLICY 3 Adapt the Transportation System to Reduce Impacts from Climate Change	POLICY 3 Seek Sustainable and Flexible Funding to Maintain and Improve the System		POLICY 3 Integrate Health and Social Equity in Transportation Planning and Decision Making	POLICY 3 Reduce Greenhouse Gas Emissions and Other Air Pollutants
					POLICY 4 Transform to a Clean and Energy Efficient Transportation System

Exhibit 3.1: CTP 2040 Policy Framework

The CTP 2040 Policy Framework sets out specific goals and supporting policies to guide strategic planning across all modes of transportation in California.

3.1.1 California State Rail Plan Vision Statement

The Vision Statement identifies rail's strategic role in advancing California's needs, using the transportation capacity that our rail corridors can provide through more intensive use, and largely within existing rail rights-of-way, to handle the equivalent volume of many additional lanes of freeway for cars and trucks. The 2040 Vision anticipates booming ridership on a truly integrated, statewide system that is a natural result of interconnecting so many more markets, and allowing the network to provide value not just for getting to work, but to travel for many purposes on clean, comfortable trains. The 2040 Vision also anticipates shared benefits and freight-specific investments that will allow significantly more freight capacity in the most important freight traffic corridors.

The 2040 Vision defines the State's interest in planning for the rail network, and policies for investing in passenger and freight rail to achieve the 2040 Vision. The Vision Statement describes how the State desires the rail system to function in 2040 (the horizon year for the Rail Plan), and how it will support the goals and policies of the CTP 2040.

California State Rail Plan Vision Statement

California will have a premier, customer-focused, integrated rail system that successfully moves people and products while enhancing economic growth and quality of life.

3.1.2 GOAL 1: Improve Multimodal Mobility and Accessibility for all People

Policy 1: Manage and Operate an Efficient Integrated System

The 2040 Vision foresees an efficient network of rail services that provide a statewide mobility solution, benefiting both regional and interregional travel needs. The vision will also build on and fully realize the benefits of California's investment in the HSR System by integrating intercity and local rail services with the HSR spine to expand the reach of the combined rail network to more Californians.

The 2040 Vision includes the following attributes:

Connectivity to Top Population and Employment Centers: The 2040 Vision establishes a State interest in connecting the most populous California cities and the communities between to the passenger rail network, to provide transportation options for the entire state, using existing or planned rail rights-of-way and corridors.

Competitive Travel Times and Service Frequencies: Existing intercity and regional rail service would be expanded in phases over time to provide more frequencies that both complement the HSR System, and significantly improve public transport for both long-distance and regional trips. The passenger rail network will be developed to provide travel times that are competitive with air travel times in the longest-distance trips between major urban areas, and automobile-competitive in regional markets. The 2040 Vision establishes service frequency goals for individual corridors on the state network that are tailored to market demand.

Rail Service Integration: The 2040 Vision foresees a statewide passenger rail network that physically integrates services at hub stations, allowing for seamless transfers between services, and convenient trips by rail across the state. These hubs provide connection points to local and regional transit systems, providing fast, frequent access to regional destinations and expanding the coverage of the state rail network. In addition to service goals, the Vision establishes state connectivity goals and key transfer hubs that tie corridors together.

Exhibit 3.2: California Service (2040 Vision)

Pulsed Schedules: A key component of the Vision is a pulsed system, a transportation network with trains[150] operating on coordinated schedules that repeat regularly—every hour or half hour, for example. The immediate advantage that a pulsed system affords the end user is that its repetitive pattern is intuitive and user-friendly, because services are usually offered at the same time every hour (or even half-hour) throughout the day. More importantly, the cyclical nature enables connecting services at hubs to be linked together easily and efficiently; connections between services can be designed to allow optimal onward travel consistently throughout the day, with minimal transfer times.

Efficient Infrastructure Design and Use: Another benefit of a repeating schedule is that it allows for optimal design of infrastructure requirements. Knowing the schedule and where trains meet allows engineers to design routes featuring more targeted and often less expensive infrastructure solutions. Additionally, track segments can be designed to meet pre-determined travel times. For example, if the pulsed schedule only requires trains to travel a segment in 60 minutes, expensive projects that would reduce that travel time but would create significant community impacts can be revisited; a wider range of solutions may be available to planners, that would be more acceptable to communities and the environment.

Multiple Service Types

Each mode and service in the transportation network, from streetcars to HSR, represents a tool designed for a certain kind of trip. When integrated effectively, these tools will form a seamless network that is both robust and flexible enough to meet diverse passenger transportation needs. For example, HSR trains can cover long distances, and passengers can transfer quickly to regional trains or local transit buses to get to their final destination in the most efficient manner.

The 2040 Vision identifies service types for different corridors based on travel time requirements for providing automobile- and air-competitive trips, as well as the State's interest in providing access to the rail network.

- **High-Speed Rail** provides air-competitive travel times between major urban centers of the state (when used for long-distance travel); and high capacity for longer distance regional and interregional trips between hubs (often used to link passengers to other services at one or both ends). HSR has numerous nonstop or limited-stop services tied to meeting long-distance market demand, but also offers trains that stop at all stations on a regular basis (every 30 or 60 minutes, based on market demand), allowing connectivity throughout the statewide rail network. Unlike the other categories, most sections of infrastructure used by HSR are designed for speeds over 125 mph (with long sections allowing speeds up to 220 mph).
- **Intercity** passenger rail services provide fast service between regions, with stops at major cities or at connectivity hubs in corridors that do not require HSR-level travel times to meet market demand.
- **Regional** services provide both express and local trips within a region, enabling access to the state rail network, with connections to intercity and high-speed services at hubs for longer-distance trips. Regional services operate with automobile-competitive travel times, which may be faster than automobile travel in rush-hour periods, but generally operate at slower speeds than intercity service.

150 Although trains account for the majority of this pulsed system, Integrated Express Buses are included in the coordination and pulsed schedule planning.

- **Amtrak Long-Distance Trains** provide connectivity to cross-border markets in Oregon, Nevada, and Arizona, in addition to providing service to rural communities. These trains service fewer stations and with lower frequencies, but increase network-wide connectivity and flexibility.
- **Integrated Express Bus** service is an important part of the statewide transportation system. Bus services can be used to extend the reach of the statewide passenger rail network, providing connections to parts of the state where rail services cannot be extended, including rural markets that are too small or remote to support rail service, where rail rights-of-way do not exist, or where it may be too expensive to upgrade track to meet state service and connectivity goals. Bus services can also fill low-ridership time slots in a regular rail schedule, where bus service is more time-competitive with automobile trips than rail, or where state and regional investments in managed or high-occupancy vehicle lanes in urban areas can be leveraged for express bus operations to bypass congestion.

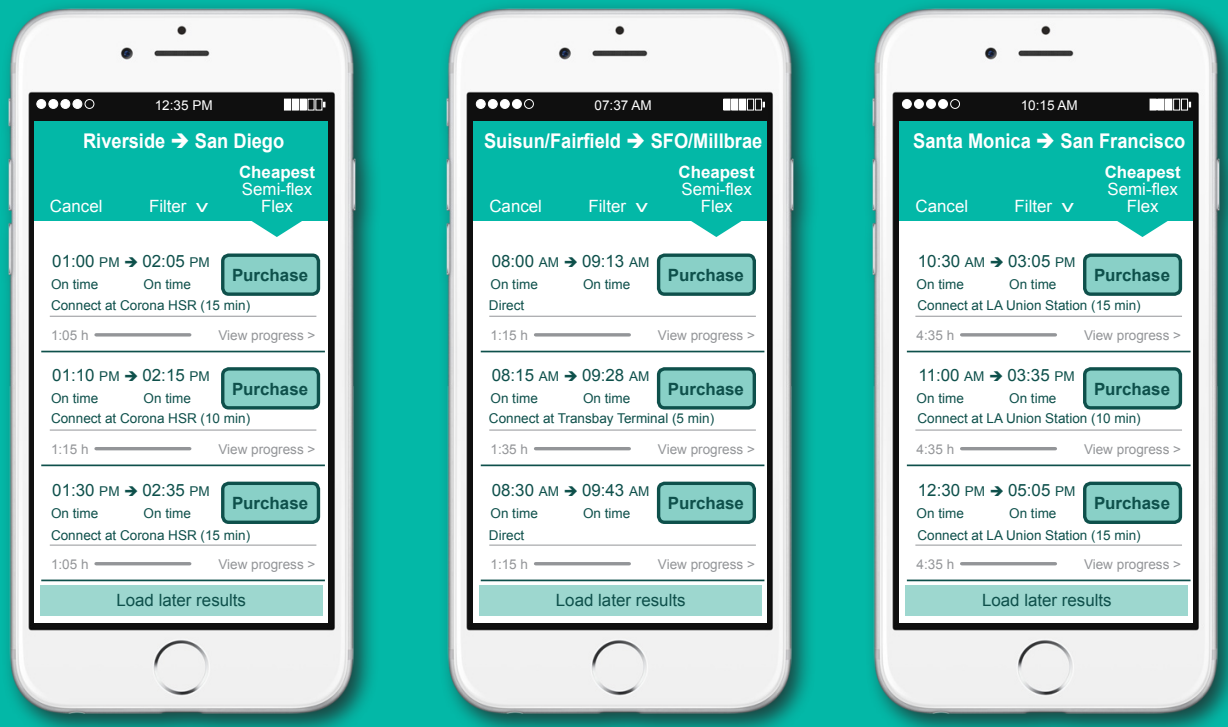
The 2040 Vision identifies corridors that could support more than one type of service, where there may be a market for providing local service in addition to express service, thereby providing access to the state network for local communities. Other, primarily rural corridors can include one type of service that serves all stops.

Integrated Ticketing and Fare Coordination: Successful implementation of the 2040 Vision requires coordinated fares and integrated ticketing options across service providers.

Coordinated fare collection streamlines the methods of payment across different services over the course of a journey. Some agencies already work together to provide free transfers between services, like the Los Angeles County Rail 2 Rail program that allows Metrolink monthly pass holders on the Orange and Ventura County corridors to travel on *Pacific Surfliner* trains. Metrolink also provides a free fare program, EZ Transit Pass, whereby a valid Metrolink ticket will grant you free transit on 15 different transit services, including Metro Rail, with the initiation of mobile ticket scanners at fare gates. Statewide integrated ticketing will go even further, allowing a passenger to use one ticket that works across all modes, rather than having multiple cards, mobile apps, and tickets. Additional features of an integrated fare collection system could include passes that work with combined ticket types, benefits to frequent travelers, and specialized fare packages for events and tourist attractions.

Integrated Passenger Service

The Rail Plan envisions integrated, door-to-door rail service. Rather than piecing together itineraries across different services and service providers, users will be able to plan a trip and buy a ticket for the entire integrated network in a seamless fashion. The graphic below represents both the possibility of schedule integration on different technological platforms and possible outcomes for rail travel in California with an integrated system.



One challenge going forward will be to scale these efforts to include more systems, and to achieve inter-operability of fare media across regions and the entire state, rather than just within metropolitan regions. Another challenge will be to leverage smartphone technology to streamline the purchase and use of integrated fare media. Amtrak and various commuter rail and transit operators in California currently support a smartphone application that can sell and save e-tickets to the phone, which can be scanned by train conductors. This app also provides on-time status and alerts. It will also be important to provide safety nets, like maintaining a cash payment or cash card option, for populations that may not have access to a bank account or smartphone.

Policy 2: Invest Strategically to Optimize System Performance

The CTP 2040 recommends investing to ensure that the transportation system is truly multimodal and integrated to serve all of the state's population and businesses, as well as to seek a broad suite of strategies to manage congestion in the state's most congested corridors. Investments in an integrated rail system strengthens one mode in the state's multimodal transportation system, while benefiting the entire system by providing viable alternatives to traveling on congested road and highway corridors.

The 2040 Vision incorporates a strategic framework to guide state and regional service planning and capital investment to support development of the ultimate 2040 Rail Plan Vision in phases over time. The integrated, scheduled network in the 2040 Vision is designed to optimize performance of the rail network to maximize use of existing infrastructure in shared passenger and freight corridors. This would be a first priority, with targeted investments made where necessary to connect the state network, and provide the capacity needed to grow freight and passenger services toward the 2040 network goals of the Rail Plan.

Electrification and Zero Emission Technology (ZET)

The 2040 Vision recognizes opportunities to electrify or deploy other zero-emission vehicle technologies on as much of the intercity passenger rail network as possible, which allows the system to be operated in a more efficient, cost-effective, and cleaner manner than is possible with existing diesel-powered locomotive technology.

Electrification for some parts of the statewide rail network will mean traditional catenary-based systems. For other services, this will mean other zero or near-zero emissions technologies.

This definition of electrification provides considerable opportunities to increase system efficiencies and performance, and improve air quality. This means that longer trains can be deployed and accelerated faster, and that the rail network supports the State's efforts to reach its GHG emissions

The State's investment strategy will include service development plans that identify individual elements (e.g., rail line and station infrastructure, vehicles, and other needs such as communications and systems) based on anticipated funding to develop the network. Key provisions of the investment strategy include:

- **Services scaled to market demand:** Integrated services will be scaled to market demand to maintain a reasonable balance between O&M costs in relation to fare revenues.
- **Providing for rail freight capacity:** Where passenger services are operating in corridors where track is shared with freight, sufficient capacity and other infrastructure will be provided to accommodate both freight and passenger traffic needs. The scheduling of trains will consider maintenance windows, as required. Taking freight owner/operator needs into account, slotted timetable planning methods will be used to identify specific capacity improvement projects that enhance timetable reliability and reduce overall infrastructure spending needs, creating a better operating environment for freight trains. Finally, the State's investment strategy recognizes the value to goods movement and the potential impact on the need for highway investments of supporting trade corridor investments that deliver benefits for freight rail.

Hybrid power systems allow trains to run alternately on overhead electrical and battery power.
(Source: https://www.flickr.com/photos/camperdown/6308355515)

- **Avoiding duplicate investments:** The integrated network will not include duplicate or overlapping investments. Where multiple services operate in the same corridor, the mix of services (such as high-speed, express, and local) should address regional and statewide needs, and serve all markets, often using the same corridor.
- **Avoiding stranded investments:** To the greatest extent possible, interim investments will be incorporated into the long-range plan.
- **Phased delivery of integrated services:** As market conditions and ridership indicate, services can be integrated and expanded in phases over time. The 2040 Vision is divided into three time phases, representing building-blocks for achieving the Vision: . Specific dates are used for the building blocks, but some projects may get completed well in advance of these dates, and others may take a few years longer. The years for each phase have been chosen as markers that meet statutory planning requirements. They are as follows:
    - **Short-Term (by 2022):** The short-term capital plan in the 2040 Vision represents improvements already being planned, for which funding for construction and implementation is largely committed. These improvements serve as the near-term foundation for integrating the rail network. The short-term plan identifies the region-specific service planning studies required to implement the mid-term and long-term Vision. The short-term investment program is also intended to address the significant existing rail freight bottlenecks on trade corridors.
    - **Mid-Term (by 2027):** The mid-term capital plan is intended to represent a realistic phasing of the 2040 Vision, where the State coordinates with rail partners to grow passenger services to a level that maximizes use of the capacity available on existing rail infrastructure, with targeted infrastructure investments that tie services together and provide new access to different regions, including regions that now have only limited rail access. The mid-term capital plan begins growing rail freight capacity in significant rail freight corridors. This mid-term phase includes projects that the State expects will have a reasonable funding commitment, employing a range of funding strategies. Finally, during this phase, many of the detailed planning studies necessary to prioritize and advance long term improvements will be funded and completed.
    - **Long-Term (by 2040):** The long-term capital plan includes the infrastructure elements required to support the service and connectivity goals of the 2040 Vision, and to maximize the performance and market-capture potential of passenger rail within the 2040 time horizon of the plan. The plan provides for additional rail freight capacity as investments to expand the passenger rail system are made. The long-term plan represents the integration of services that is possible.

The 2040 Vision represents a strategy for meeting the state's transportation needs that takes advantage of rail's ability to develop in existing rights-of-way to add capacity. The first priority of the 2040 Vision is to make existing lines more efficient, making better uses of existing frequencies to improve productivity of passenger services. The State intends to achieve the Vision through service planning, in partnership with local communities.

Policy 3: Provide Viable and Equitable Multimodal Choices, Including Active Transportation

The 2040 Vision establishes the State's interest in developing a statewide passenger rail network that is time- and cost-competitive with other modes. Passenger rail and intercity bus services will be physically integrated with each other and with transit operations at mobility hubs, providing communities with statewide, door-to-door access via a seamless passenger rail network. The 2040 Vision allows for additional passenger rail frequencies to be physically connected, serving specific regional or corridor-level travel markets that are not necessary for statewide connectivity.

However, when poorly integrated, the first-mile/last-mile portions of a trip can present an insurmountable hurdle to rail passengers, because they cannot access stations or their destinations from a rail station. The expanded passenger rail access and connectivity that are part of the Vision provide opportunities to expand the use of bicycling, walking, and transit trips to provide first- and last-mile connections to a system that can be used for regional commute and interregional travel. When well integrated across agencies, urban mass transit and local land use policies can provide nearly seamless connections to rail stations in ways that reduce trip time, reduce trip cost, and ultimately reduce barriers to ridership. Some opportunities for reducing the first-mile/last-mile challenge include:

- State support for network and station planning will ensure that stations are pedestrian- and bicycle-friendly and accessible to public transit systems, providing connections to major centers of population and employment. This includes making transfers between rail and bus, transit, and active transportation as efficient and intuitive as possible. Reducing the time and difficulty of transfers is crucial to stimulating additional ridership, as is dramatically reducing the risk of delay due to missed connections.
- Bicycle- and car-sharing systems can be expanded, and stations can be designed for simple pick-up and drop-off.
- Secure and convenient bicycle parking can be provided at stations.
- Safe and complete pedestrian and bicycle networks can bring passengers as close to the platform as possible, with minimal interaction with road networks.
- Where transit connections are made that are less frequent (primarily those services that operate less frequently than every 15 minutes), the State has an interest in coordinating with local and regional transit partners to coordinate the schedules of bus trips that expand coverage.

Rail rights-of-way also present opportunities to develop walking and bicycling networks, connecting communities at the regional level. The 2040 Vision supports preserving rail corridor rights-of-way and assets for multimodal uses wherever feasible. Implementation will result from site-specific planning with every entity that owns infrastructure or operates on the right-of-way, with an emphasis on safety. Multi-use corridors support state and local mobility goals, and can safely enhance access for all modes coexisting in a corridor.[151]

SMART Rail corridor, pre-project build out, with future rail right-of-way and bicycle corridor

151 Rails-to-Trails Conservancy, *America's Rails with Trails* (2013), accessed 2016.

3.1.3 GOAL 2: Preserve the Multimodal Transportation System

Policy 1: Apply Sustainable Preventive Maintenance and Rehabilitation Strategies

By 2040, California's rail system will be a premier, national leader in its functionality, innovation, and effectiveness. The State will regularly benchmark the passenger and freight rail services in California against those of other states and international leaders as it supports development of the rail network to deliver a best-in-class system. To be premier, the system needs to be in a good state of repair, with investments made over time to maintain the system. The Rail Plan Vision supports state investment in capitalized maintenance costs to preserve the performance of the passenger and freight rail network.

Investment in an expanded and more efficient passenger and freight rail network in California is intended to enhance the state's ability to maintain and rehabilitate the entire transportation system by shifting car and truck trips, particularly long-distance interregional trips, from the state highway system to rail. This shift is expected to reduce vehicular wear and tear on the state's interregional roadways, and the substantial costs associated with bringing roadway infrastructure into a state of good repair. In addition, by improving the economics of the rail system, additional resources will become available in support of capitalized maintenance to ensure that railroads remain in a state of good repair throughout their life cycle, and that services achieve a high degree of reliability.

Policy 2: Evaluate Multimodal Life-Cycle Costs in Project Decision Making

The 2040 Vision is intended to provide a significant option for statewide travel and goods movement in interregional travel corridors. It can help evaluate ways to improve mobility on a corridor through various combinations of improvements to rail and transit, along with highway improvements. Life-cycle costs analysis could lead to efficient road use, parking, and fuel pricing; and to efficient road space allocation, leading to an overall reduction in the growth of VMT.

The network efficiencies and performance improvements associated with the 2040 Vision are expected to result in significant infrastructure savings that can be factored into corridor-level investment decisions, based on transportation demand management programs. This multimodal consideration of long-term corridor needs can maximize the effectiveness of asset management, and promote efficient use of limited resources for highway and bridge maintenance programs.

Investment decisions in the rail mode will focus on optimizing decisions across the life cycle, especially in the area of rolling stock replacement and maintenance. By considering the total cost of rolling stock across its life-cycle costs, new approaches will be considered to allow the fleet to be refreshed and replaced more regularly, based on commercial decisions and total expenditure across both capital and operating resources.

San Jose transit mall (Source: wikimedia commons, https://commons.wikimedia.org/wiki/File:VTA_Light_Rail_Santa_Clara_Street_Station.jpg)

Policy 3: Adapt the Multimodal Transportation System to Reduce Impacts from Climate Change

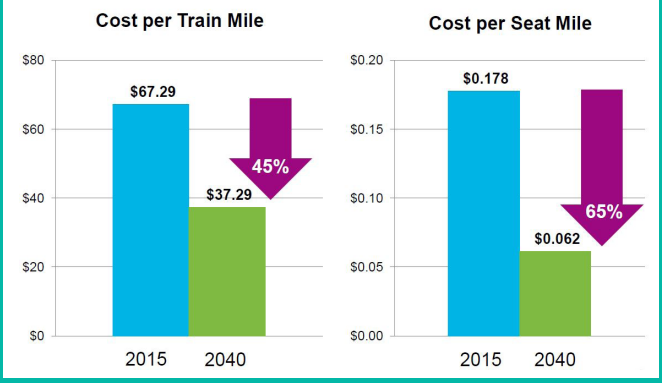
Infrastructure planning and investment in the state must facilitate meeting the state's climate goals, and must prioritize actions that both build climate preparedness and reduce GHG emissions. The Rail Plan is an important component of the State's strategy for reducing GHG emissions, and is one of many plans that leverage State support to reduce fuel dependency and serve disadvantaged communities in a changing climate.

The State will pursue and support technology and fuel-based solutions to reduce fuel consumption; and will work to increase the number of seats filled on each train operated (often referred to as the load factor), to reduce GHG emissions per passenger mile. In addition, because the Rail Plan includes significant core infrastructure, especially high-speed infrastructure, that is electrified, additional opportunities to expand electrification on adjoining corridors and on services that share HSR blended infrastructure will be pursued to operate a cleaner rail system. By 2040, Caltrans expects a majority of passenger miles on the rail system to be provided by electric trains.

Caltrans and CHSRA will take climate change into account in all planning and investment decisions that support implementation of the Rail Plan. Wherever possible, the Rail Plan supports flexible and adaptive approaches to prepare for uncertain climate impacts. The State supports and will use information from vulnerability assessments and other data to inform long-term life-cycle analysis in project selection, including anticipated climate impacts.[152]

Furthermore, current and future planning and requirements should reflect climate change adaptation in a more coordinated manner.[153] The 2040 Vision provides a common framework for coordinated planning between the State, rail operators, and stakeholder agencies to develop network infrastructure that takes known and projected climate change impacts into account.

The State expects that increased passenger rail revenues generated from increased use of the system will, in the ultimate 2040 Vision, allow the state network services to operate without a subsidy, and generate profits in some corridors that can be reinvested in maintaining and improving the system. Even for projects that will require large capital investments for infrastructure, the resulting service and connectivity enhancements cause an increase in ridership and overall efficiency that is sufficient to make the benefit-cost analysis positive. Because that is extrapolated out to the entire transportation system, the needed investments outlined in the Rail Plan are reasonable, considering the total future growth captured on the rail system. Efficient operations attract future private dollars in associated economic development and drive down the operating subsidies. These operating savings can be immediately returned to the system in the form of capital investments to continue implementation of the long-term vision and to increase efficiency. It becomes a self-fulfilling prophecy of sustainable funding that reinforces the need for detailed, collaborative service implementation planning to guide project prioritization as a way to organize projects that can help deliver network-wide efficiencies.



152 Natural Resources Agency, *Safeguarding California: Implementation Action Plans* (2016), accessed 2016.

153 Ibid

3.1.4 GOAL 3: Support a Vibrant Economy

Policy 1: Support Transportation Choices that Enhance Economic Activity

California's rail system will successfully move people and products by balancing the needs of freight rail and passenger rail customers. On the one hand, the freight rail system provides California's businesses, producers, and manufacturers with cost-effective transportation connections to national and international markets, making the state an effective place to conduct business. On the other hand, the passenger rail system provides access to essential and nonessential trips alike. Passenger rail also provides major safety and productivity benefits, further enhancing California's economy. Safety benefits translate into significant hospital and health care savings.[154]

Currently, many passenger rail operations share tracks owned by UPRR and BNSF. The infrastructure requirements for additional passenger rail service will be negotiated between public rail operators and private railroad companies. Requirements and negotiated terms for further shared use of freight railroad track may include major investments to enhance the capacity of these lines. These improvements and investments help to decrease bottlenecks and improve freight mobility and reliability, and support the shift of freight from trucks to rail where it is economically feasible to do so.

The passenger and freight rail systems support growth of California's existing businesses and communities, and the development of new businesses in the state. An integrated and coordinated passenger rail system connects workers to their jobs and travelers to recreation, and fosters sustainable development around rail stations. The rail system of the future will also be significantly less expensive on a unit basis than today's rail services, lowering the overall household and business expenditures on transportation, and further enhancing California's economy.[155] A robust passenger rail system is necessary to support the continued development and competitiveness of California's economy.

Port of Long Beach (Source: https://commons.wikimedia.org/wiki/File:Intermodal_ship-to-rail_transfer.JPG)

154 According to the Center for Disease Control's "State-Based Motor Vehicle Data & Information," in 2013, California lost $4.48 billion in medical expenses and work-loss due to collision fatalities. Short- and long-term hospital follow-up visits related to crash-related injuries translate into additional health care costs than can be mitigated or eliminated through safety improvements and decreased VMTs.

155 Fang, Kevin, and Jamey Volker, The National Center for Sustainable Transportation. Cutting Greenhouse Gas Emissions Is Only the Beginning: *A Literature Review of the Co-Benefits of Reducing Vehicle Miles Traveled* (2017), accessed 2017.

Policy 2: Enhance Freight Mobility, Reliability, and Global Competitiveness

California is committed to developing a world-class, sustainable freight rail system, and the Rail Plan addresses state policies and practices to enhance freight rail services. Those companies, subject to certain federal and state laws and regulations, are responsible for daily operational decisions and capital investments on the freight rail network. There is a need to strengthen partnerships that better align with the policies and action of the state and private freight rail companies. The 2040 Vision establishes a framework for partnerships between the freight railroads and the State—a framework that supports rail freight investment that is consistent with the State's sustainable freight goals.

The Rail Plan process identified five major areas of need and opportunity of statewide importance for freight rail services:

- **Trade corridor improvements:** California has several critical multimodal freight corridors that support both domestic and international trade. Given the importance of these corridors to the regional, state, and national economies, the Rail Plan has a significant interest in transforming these corridors into primary, high-capacity freight routes, shifting a share of freight loads from trucks to freight rail.
- **Economic development and short lines:** Traditional and emerging industries in the state can take advantage of freight rail services. The Rail Plan has an opportunity to support programs that provide grants and loans to short lines, to improve and upgrade their track to current standards; or to shippers, to provide or improve rail network access.
- **Statewide grade crossing improvements:** Grade-crossing projects, including grade separations, are extremely expensive, and federal and state program funds are limited. The Rail Plan will endeavor to expand funding for grade-crossing improvements, and continue advocacy for an expansion of the federal Section 130 program and the state Section 190 Grade Separation Program.
- **Terminal and yard capacity:** There is a need to expand intermodal terminal capacity in California. Many of these projects are in urban centers with access challenges on congested roadways. Roadway access improvements and congestion alleviation are critical in achieving the concepts of the California State Rail Plan Vision Statement.
- **Short-haul trains:** Short-haul trains can serve as efficient transportation between ports and distribution centers.

Freight railroads are understandably concerned about the preservation of their existing operating flexibility and their future capacity to accommodate growing freight train traffic. Therefore, they are interested in minimizing impacts on existing and future freight rail operations. Caltrans will consider the potential impacts of the planned passenger rail service improvements on railroad capacity and access to industry spurs and yards. The infrastructure investments necessary for increased passenger train volumes will be planned so as to add capacity and flexibility to freight operations. The 2040 Vision enables market-responsive growth in goods movement by freight rail, while also providing for increased passenger capacity.

Richmond Pacific Railroad locomotive at work in Richmond, California
(Source: wikimedia commons, https://commons.wikimedia.org/wiki/File:Richmond_Pacific_Railroad_RPRC_Switcher_1268.JPG)

Policy 3: Seek Sustainable and Flexible Funding to Maintain and Improve the System

The integrated statewide mobility solution represented by the 2040 Vision encompasses a range of services that will require strategic investment and active partnerships to realize. The Vision therefore provides an operator-neutral framework for partnerships between the State, other public agencies, and private industry that can be used to leverage different sources of funding and different types of operating models to deliver cost-effective infrastructure and service improvements that implement the Rail Plan.

The intent of the 2040 Vision is to improve the efficiency and effectiveness of the intercity passenger rail network, to drive down costs and increase ridership and revenue. The integrated statewide network will realize infrastructure savings through more intensive use of existing infrastructure; scheduled operations will allow infrastructure capacity to be targeted where needed to grow the passenger and freight network over time. The 2040 Vision establishes a State interest in providing for higher frequencies on the integrated network to improve the convenience of passenger rail travel, which will dramatically increase ridership on the state's rail services. The State expects that increased passenger rail revenues generated from increased use of the system will, in the ultimate 2040 Vision, allow the state network services to operate without a subsidy, and generate profits in some corridors that can be reinvested in maintaining and improving the system.

The State supports public-public partnerships as well as public-private partnerships to deliver a variety of project types. Partnerships between service providers and local governments, especially in regard to land use and station development, will be mutually beneficial in terms of maximizing the value of the rail service, maximizing the value of local real estate, and maximizing return on investment of local dollars.

In addition to coordination among government entities, innovative partnerships will be needed to integrate rail services with private entities. Such partnerships would include both private operations of public rail services and coordination with private-sector providers of nonrail connecting services, such as airlines, rideshare operators, and private bus operators.

Beyond the provision of rail services, private-sector partnerships can also work to integrate wider sectors of the transportation industry to extend the reach of rail service to more customers. This can take a variety of forms, and many are already in place, including:

- **Intercity Bus:** Currently, Amtrak uses connecting bus services to extend and bridge rail services in the state. Beyond Amtrak, other long-distance and connecting bus services operate in California, and could be coordinated in a future integrated network to provide integrated fares and coordinated schedules to increase utility to customers.
- **Ride-Share and Ride-Hailing Apps:**[156] Ride-share service providers, especially ride-hailing apps, are already playing an increasing role in solving first-mile/last-mile challenges. By extending the local reach of urban transit networks and rail stations, on-demand ride hailing and ride sharing can provide key connections to origins and final destinations for passengers. Establishing partnerships between rail providers and these companies can elevate those services and provide better value for passengers. Some agencies are already pursuing these options, like OCTA's micro-transit pilot program, OCFlex, which seeks to solve first-mile/last mile challenges and increase ridership with on-demand ride hailing options.[157]

Metro bike share in Los Angeles
(Source: https://commons.wikimedia.org/wiki/File:Metro_Bike_Share_7th_and_Bixel_Los_Angeles.jpg)

156 Ride-sharing and ride-hailing apps are also referred to as Transportation Network Companies.

157 Orange County on the Move, On-Demand Shared Ride Service Coming to Orange County, 11 -1-2017.

- **Bicycle Share Providers** are playing an increasing role in improving first-mile/last-mile challenges. City-managed bicycle share (like The Metro Bike Share program), public-private bicycle share partnerships (like Capital Bikeshares in Washington, DC), dockless bicycle share systems (like Spin), and electric-assist bicycle share programs (like JUMP) are just some of the new and expanding bicycle share delivery options that have emerged in the past 4 years. Many of these bicycle share programs use regional fare cards (like Clipper Card) for payment; others use an app platform that is not geographically specific (like Social Bicycles) for bicycle reservations. Ease of access and ticketing and reservation integration allow bicycle share to provide another mobility option that can increase access and reduce first-mile/last mile and first-hour/last-hour restrictions.
- **Air-Rail Alliance Code-Sharing:** Common in Europe and occasionally in the northeastern United States, an air-rail alliance takes the concept of code-sharing between partnered airlines and extends it to the rail network. By allowing airlines to sell airline and rail services on a single ticket, the rail network can be used to extend the reach of airports, and better connect communities without an international or even regional airport.
- **Rail-Air Substitution:** Population growth is predicted to strain the multimodal transportation system, including airports. Coordination between rail and air can expand an airport's catchment zone (especially when connected with intercity or HSR services) and attract new markets. A rail system that is connected to both a local or regional market, as well as a statewide market, can help divert some of the airport demand and reduce capacity burdens. Although the result can be a reduction, or complete elimination, of inefficient air services, it actually benefits both air and rail partners. It does this by freeing capacity for more profitable and long-haul air travel, while increasing rail ridership, thereby providing customers flexibility on the same routes.[158][159]

It is anticipated that use of public-private partnerships and agreements will increase as California implements its network integration.

In the northeastern United States, United Airlines and Amtrak have an alliance connecting services to and from Newark Liberty International Airport and several regional cities served by Amtrak. Airline customers can buy a single ticket that includes their rail connection to and from the airport.

Similar arrangements are quite common in Europe, even involving American carriers. American Airlines has an air-rail alliance with Deutsche Bahn (the German national railroad) to provide rail connections at Frankfurt Airport. Germany has perhaps the most robust examples of connecting rail and air services, which occur in approximately 16 cities and involve dozens of domestic and international airlines. Through such agreements, rail services are integrated into the entire global transportation network, providing great value for passengers and rail service providers across the rail service spectrum.

158 Resource Systems Group, Inc., Airport Cooperative Research Program; Transportation Research Board; National Academies of Sciences, Engineering, and Medicine. *Integrating Aviation and Passenger Rail Planning* (2015).

159 Although there is a market (travel distances between 200 and 500 miles) for HSR or other intercity rail services to replace air travel (beyond the aforementioned inefficient routes), the research shows that this is unlikely to occur, especially in the context of the United States.

3.1.5 GOAL 4: Improve Public Safety and Security

Policy 1: Reduce Fatalities, Serious Injuries, and Collisions

The state rail system will offer high performance to customers, consistent with the emphasis on performance management metrics in the 2016 FAST Act Federal surface transportation legislation. Another measure of success for the state rail system will be the movement of people and products safely and without incident. The Rail Plan supports significant passenger and rail freight investments, including grade-crossing improvement projects to eliminate at-grade conflicts; and supports full implementation of PTC to reduce fatalities, serious injuries, and collisions on the rail system.

Even without these necessary safety improvements to the system, the FRA reports that fatalities per mile are 17 times more likely in an automobile than in an intercity passenger train.[160]

Between 2000 and 2009, California had 7.28 fatalities per billion miles traveled in a car, versus 0.43 fatality per billion miles traveled on Amtrak, commuter and urban rail systems, buses, and commercial aviation. This supports the need to reduce VMTs, because VMTs are strongly correlated with fatalities per capita.[161] Safety improvements to the rail network will only continue to reduce injury and death on the transportation system.

Policy 2: Provide for System Security, Emergency Preparedness, Response, and Recovery

Inherent in a multimodal transportation system are network redundancies that can offer system security and emergency preparedness. An integrated, statewide rail network is crucial to the state's emergency preparedness, because it provides a viable evacuation option, particularly for the 10 million Californians who do not drive. Developing the rail network to be reliable, safe, and efficient for daily uses will ensure that the system can respond and recover during an emergency.

160 FRA, Office of Safety Analysis, accessed 2016, The rate for intercity passenger rail = 0.43 per billion; for car passengers/drivers = 7.3 per billion.

161 Fang, Kevin, and Jamey Volker, The National Center for Sustainable Transportation. *Cutting Greenhouse Gas Emissions Is Only the Beginning: A Literature Review of the Co-Benefits of Reducing Vehicle Miles Traveled* (2017), accessed 2017.

Extreme Weather Events and Transportation Resiliency

In 1994, 10 seconds of shaking during the Northridge Earthquake created havoc in Los Angeles County. Many commuters lost access to freeways—especially from Santa Clarita to either Los Angeles or the San Fernando Valley. Nine days after the earthquake, Metrolink reached 22,000 daily boardings along the Santa Clarita line at a time when normal ridership was 1,000 daily riders. The catastrophe of the 1994 earthquake illustrates the importance of a resilient, multimodal system and how rail can offer evacuation and alternative travel options if roads and highways are compromised.

Metrolink riders using commuter rail in Santa Clarita, after the Northridge Earthquake[162]

In late 2017 and early 2018 alone, California experienced extreme weather incidents across the state. In October 2017, a series of more than 200 wildfires in Northern California ravaged entire communities, especially in the Sonoma and Santa Rosa areas. More than 40 people lost their lives in the fires; 8,400 buildings were destroyed, with some estimating that property damage could reach $65 billion[1]. SMART rail services commenced operations in August 2017 and quickly sprang into action, providing free evacuation transportation for Sonoma and Marin county fire victims. They were able to transport emergency personnel where needed, as well as victims fleeing to safer areas. They ran free services for 2 weeks and, as a way to help start the rebuilding process, offered free services to anyone with a receipt from a local business for some time after that. SMART accredits some of their success in responding to the fires and maintaining flexibility to assist in evacuations to their newness. Because they had just opened, all employees were up to date with emergency preparedness training and knew exactly the steps needed to prepare the trains for their own evacuation.

In January 2018, mudslides in Santa Barbara and Ventura counties took the lives of 19 people and closed Highway 101 for over a week. During the closure, the *Pacific Surfliner* increased services to provide additional round-trip service to Santa Barbara, and borrowed an additional 15 railcars from northern California to accommodate the increased demand. During the Highway 101 closure, the *Pacific Surfliner* was the only north-south transportation route for anyone needing to travel or evacuate along the coast. Their ability to react quickly, increase service, and coordinate with partners to acquire more capacity allowed a continued throughput of people while workers expedited Highway 101 clearances.

162 Photo Credit: Dana Peters (http://trn.trains.com/bonus/TL1990#twelve)

3.1.6 GOAL 5: Foster Livable and Healthy Communities and Promote Social Equity

Policy 1: Expand Collaboration and Community Engagement in Multimodal Transportation Planning and Decision-Making

The Rail Plan has implemented many of the recommendations for this policy, including early collaboration with stakeholders and partner agencies to implement transparent decision-making for all investment options, as well to include economic, health, equity, and sustainability considerations in the planning process. The long-range planning process undertaken by the State as part of the Rail Plan includes local, regional, and tribal outreach to improve collaboration and engagement. The 2040 Vision also provides a framework for ongoing collaboration and engagement with partners and stakeholders, tied to implementation actions that support development of the Vision, including specific planning studies needed to facilitate conversations with communities regarding the ways the rail network can be improved to meet local needs. The State will develop the Vision through this engagement process.

Transbay Joint Powers Authority (TJPA), 2017.

The Salesforce Transit Center in San Francisco, now under construction, will serve as a key hub station for California High Speed Rail connections to other local and intercity rail and bus services.

Policy 2: Integrate Multimodal Transportation and Land Use Development

Passenger rail is a safe, clean, and efficient mode of transportation, with stations that support efficient and transit-oriented land use development. RTPs now include SCSs, which link land use planning and transportation investments to meet regional targets for GHG emissions reductions. The 2040 Vision of an integrated state network tying the state's population centers together will enhance regional SCSs and will provide for expanded access to a statewide network that supports sustainable, efficient land use development. This 2040 Vision for passenger rail is an important state tool for working with regional agencies and stakeholders to address the mega-regional nature of transportation needs in California. California's two mega-regions account for nearly 95 percent of the population, and therefore must be taken into consideration when planning transportation[163] —especially transportation well-suited for inter- and intra-regional passenger travel and goods movement, like rail. In the Northern California mega-region, for example, building a second Transbay tube to accommodate conventional rail will expand the mega-regional travel options, while further decreasing congestion on parallel corridors.

The 2040 Vision provides for attractive opportunities in more communities for station area planning that supports walkable, TOD near-station sites with access to a statewide rail network—a network providing for local, regional, interregional, and out-of-state travel. The 2040 Vision is focused on providing transportation improvements using existing rights-of-way that generally serve existing city centers, or that provide for future growth around sites that can be designed around rail, transit, and active transportation. The 2040 Vision supports California's Vibrant Communities and Landscapes component of the State's climate strategy.[164]

163 Bay Area Council: Economic Institute, *The Northern California Megaregion: Innovative, Connected, Growing* (2016).

164 CARB, *Vibrant Communities and Landscapes: A Vision for California in 2050* (2016).

Policy 3: Integrate Health and Social Equity in Transportation Planning and Decision-Making

This policy recognizes the need for a comprehensive multimodal system that increases access to education, employment opportunities, amenities, and health care; and preserves California's competitive edge as a highly desirable place to live and work. The Rail Plan will build on this vision of quality of life for all Californians, especially by providing viable access to destinations across the state without a car. Rail network investments and station stops can be well integrated with local transit, bicycle, and pedestrian improvements to provide for a healthy transportation system with a statewide reach.

The State supports integrating social equity in the rail planning process. The 2040 Vision plans for many more access points to a transportation network than exist today, or that were envisioned previously, providing economic benefits and opportunities to disadvantaged communities in the state. Implementation actions and investment supported by the 2040 Vision are also associated with discussion and evaluation of improvements to possible community impacts of rail service, including establishment of quiet zones and implementation of grade-crossing improvements to make rail corridors good neighbors.

3.1.7 GOAL 6: Practice Environmental Stewardship

Policy 1: Integrate Environmental Considerations in All Stages of Planning and Implementation

The 2040 Vision represents a significant state strategy for meeting California's future mobility needs and environmental goals by developing and investing-in a clean, efficient state rail network for the movement of people and goods. The Rail Plan provides a program-level platform from which more detailed service and environmental analysis must be conducted by the State and rail operators as the 2040 Vision is implemented.

Policy 2: Conserve and Enhance Natural, Agricultural, and Cultural Resources

The 2040 Vision supports development of existing rail corridors and rights-of-way as a priority for adding transportation capacity that serves the needs of future population growth and avoids sprawl-inducing impacts of new roadway construction or expansion of state highways. The 2040 Vision outlines a state strategy for planning and investment in transportation infrastructure that supports local and regional planning and efficient growth around rail stations, thereby reducing development pressures on natural and agricultural resources. Planning for services that are part of the 2040 Vision will be sensitive to the preservation of natural resources, and mitigation strategies will be deployed at the landscape level, with superior ecological outcomes wherever possible. The state rail planning process includes early outreach and consultation with Native American tribes to identify and disclose concerns about cultural resource disturbance, which will be addressed throughout the planning and project-development process.

Policy 3: Reduce GHG Emissions and Other Air Pollutants

As the state's passenger rail system grows, the resulting reduction in VMTs and reduced rate of highway expansion will result in air quality benefits. As described in Chapter 2, emissions from transportation account for 38 percent of California's total GHG emissions, the vast majority of which come from on-road sources. Limiting the growth of VMTs through mode-shift will reduce on-road sources of pollution. Rail is also a relatively energy-efficient way to move freight. According to federal statistics, an average freight rail car moves 10.6 miles per gallon of fuel consumed, while an average combination truck moves 5.9 miles per gallon.[165] A 2009 FRA study reported that a double-stack container-trailer-freight rail car moves freight three to five times more fuel-efficiently than a truck.[166] Each freight train carries much more total weight than a single combination truck, so each train movement reduces truck traffic on highways and reduces GHG emissions.

Policy 4: Transform to a Clean and Energy Efficient Transportation System

An accessible, connected, integrated, state-of-the-art passenger rail system offers travelers a wealth of mobility choices, reducing reliance on the automobile. Reducing the number of automobile trips will reduce pressure on—and improve the performance of—the state's highway network, while decreasing VMTs and GHG emissions.

Rail's ability to transport more people with fewer emissions supports a clean and energy-efficient transportation system. The intent of the 2040 Vision is to accommodate additional demand for trips, and grow the rail network in a manner that incorporates substantial electrification of the state network, with improvements possible on additional corridors where there is support to do so. The statewide HSR network included in the 2040 Vision will be powered entirely from renewable energy sources, providing a growing market for clean energy providers.

To support transformation of the technology used in the rail system, CARB has petitioned the United States Environmental Protection Agency (U.S. EPA) to adopt more stringent national locomotive emissions standards. These include more stringent standards for remanufactured locomotives; and a Tier 5 standard for new locomotives that would require capability for zero-emission operation in designated areas, such as disadvantaged and high-traffic regions, to better protect the health of those residents. Under the proposed standard, with capability for zero-emission operation, newly manufactured locomotives could achieve 99 percent control of oxides of nitrogen (NO_x) and diesel particulate matter; 98 percent control of hydrocarbons, and 10 to 25 percent control of GHGs.

165 Bureau of Transportation Statistics, *National Transportation Statistics* (2011), Tables 4 14 (2012) and 4 17.

166 FRA, *Comparative Evaluation of Rail and Truck Fuel Efficiency on Competitive Corridors* (2009), page 5.

3.2 Program Effects

The state's passenger and freight rail vision and investment program has been carefully developed to provide benefits to California residents and businesses, while minimizing adverse impacts. To evaluate the performance of the vision and investment program toward meeting the stated goals and objectives, Chapter 6 considers program effects across many measures, including the following:

- **Access and mobility:** Effects are measured through forecast changes in travel times; passenger rail ridership and revenue; number of travelers using air versus passenger rail and automobiles; roadway travel by trucks and automobiles; and elimination of rail congestion locations and choke points. As passenger rail service frequencies are increased, the system can carry more passengers to more destinations in less time. This is achieved through reduced wait times at destinations and transfer points, improved connections, and expanded travel time flexibility—all providing travelers with more seamless mobility.
- **Environmental stewardship:** Effects are measured through projected changes in GHG and criteria and toxic air pollutant emissions; consideration of actions taken to address rail-related noise; the extent to which projects and programs can support the State's climate change policies; and the extent to which sea-level rise and extreme weather may affect rail corridors and investment needs.
- **Livable and healthy communities:** Effects are considered by evaluating impacts on grade crossings, quiet zones, and other neighborhoods near rail lines, yards, and passenger stations; the extent to which projects and programs support local land use visions in RTPs and sustainable communities strategies; and the extent to which expanded passenger rail service integrates with local transportation options.
- **Safety and security:** Effects are considered by summarizing research results regarding the demonstrated safety benefits of passenger and freight rail travel versus highway travel; and by including and prioritizing programs that directly fund rail safety improvements.
- **Economic benefits:** The potential job creation and economic growth effects are addressed quantitatively through synthesis of recently completed economic and benefit-cost analyses, which are used to characterize enhanced real estate values near passenger rail stations. This plan also considers potential highway and bridge maintenance cost reductions from reduced truck and automobile travel. It decreases direct and indirect health care costs for the State and individuals as a result of improved safety associated with reduced VMTs (from mode shift). Additionally, households spend nearly 20 percent of their income on transportation, largely from the associated costs of car ownership.[167] Increasing access to alternatives, as is the goal of the 2040 Vision, will help to lower VMTs, thereby reducing total household transportation costs and increasing disposable income.

167 Fang, Kevin, and Jamey Volker, The National Center for Sustainable Transportation. *Cutting Greenhouse Gas Emissions Is Only the Beginning: A Literature Review of the Co-Benefits of Reducing Vehicle Miles Traveled* (2017), accessed 2017.

3.3 Conclusion

California's diversity is one of the state's strongest assets; however, the diversity of people and places poses great challenges to safeguarding against climate impacts and preparing for future vulnerabilities. To sustainably and equitably prepare for the future and expand mobility choices for California's residents, visitors, and businesses, the state needs a robust, multimodal transportation system—and an integrated passenger and freight rail network. An integrated rail system that is developed in coordination with land use planning strengthens the benefits of both by increasing access, and dispersing mobility and equity benefits. Furthermore, almost every city or region in the state is vulnerable to at least one effect of climate change, and planning and being equipped to handle all of them is a daunting task. The Rail Plan can help by guiding rail planning and corresponding investments to incorporate State policies that aim to reduce GHG emissions, reflect climate change adaptation strategies, and provide a seamless travel experience for all populations.

The 2040 Vision and planning framework details how a pulsed system incorporates integrated and complementary services, and can be sustainably executed through a phased investment strategy. Chapter 4 will elaborate on these planning principles, and explain geographically specific connectivity and service delivery goals and options.

This page intentionally left blank.