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California Freight Mobility Plan 2020

March 2020

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Secretary

Fellow Californians:

On behalf of the California State Transportation Agency, I am pleased to present the California Freight Mobility Plan 2020 (CFMP). The CFMP is a statewide plan that governs California's immediate and long-range freight planning activities and capital investments. The CFMP was developed to comply with the freight provisions of the Fixing America's Surface Transportation (FAST) Act, which requires each state that receives funding under the National Highway Freight Program to develop a freight plan. The CFMP was also developed to comply with California Government Code Section 13978.8 pertaining to the State freight plan.

Freight is a critical component of the global, national, and state economies. Californians depend on a goods movement system that provides communities with their most vital necessities including food, medicine, and inputs for manufacturing in a timely, efficient manner. The freight sector is rapidly changing due to technological advancements, economic fluctuations, increasing demand, and environmental concerns. In the face of these changes and challenges, the CFMP articulates a vision of California having "the world's most innovative, economically-competitive multimodal freight network that is efficient, reliable, modern, integrated, resilient, safe, and sustainable, where social and environmental impacts are considered equally." The CFMP reinforces California's leadership role in innovation and sustainability. The CFMP aligns with and supports many of the actions proposed within the California Sustainable Freight Action Plan including the State's transition to a zero- and near-zero emission freight fleet, supporting marine highways and short line rail, and proposing alternative modes for last mile deliveries.

I would like to thank the California Freight Advisory Committee, local, regional, State, and federal partners, stakeholders, the public, tribal governments, and private industries for the invaluable input they have provided. The California State Transportation Agency is a committed partner in creating a freight system that benefits all Californians. If you have any questions, please contact Jeanie Ward-Waller, Caltrans Deputy Director, Planning and Modal Programs, at (916) 654-5368 or by email to jeanie.ward-waller@dot.ca.gov.

Sincerely,

David S. Kim

DAVID S. KIM
Secretary

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Executive Summary

California's freight transportation system is the most advanced, environmentally friendly, and multimodal in the nation. This impressive goods movement system provides communities with their most vital necessities including food, medicine, and inputs for manufacturing in a timely, efficient manner. Improvements focusing on efficiency and reliability in the freight industry will continue to positively impact the economy and California's communities. In an effort to further strengthen these impressive ranks, and remain a national leader, California is working towards more efficiency, less-pollution, and higher-capacity in its freight facilities, equipment, and operations.

California Freight Mobility Plan 2020 Vision Statement

As the largest national gateway for international trade and domestic commerce, California exemplifies the world's most innovative, economically-competitive, multimodal freight network that is efficient, reliable, modern, integrated, resilient, safe, and sustainable, where social and environmental impacts are considered equally with economic growth and prosperity.

California Freight Mobility Plan 2020 Background

In alignment with the goals and principles of the California Transportation Plan (CTP) and the California Sustainable Freight Action Plan (CSFAP), the California Freight Mobility Plan (CFMP) 2020 is a complete update to California's first Freight Mobility Plan originally adopted in 2014. It is required by Assembly Bill (AB) 14 (Lowenthal, 2013) codified under California State Government Code (GC) Section 13978.8. The Federal Fixing America's Surface Transportation (FAST) Act (2015) requires states to develop FAST Act compliant state freight plans and update them every five years to be able to obligate National Highway Freight program funding.

Since the CFMP 2014 was adopted, there have been several significant achievements for California's freight industry. A detailed list of achievements is available in **Appendix A**. Examples of these achievements include:

- Adoption of the CSFAP in July 2016
- Passage of Senate Bill (SB) 1 (Beall and Frazier), the Road Repair and Accountability Act of 2017, including \$300 million annually for freight projects
- Adoption of the SB 1 Trade Corridor Enhancement Program (TCEP) Guidelines in October 2017

- Sixty to ninety-eight percent reduction of criteria pollutants and 13 percent reduction of carbon dioxide emitted at the San Pedro Ports from 2005 to 2017
- Awarded \$1.39 billion of SB 1 TCEP funding to multimodal freight projects throughout the state
- Ninety-eight percent reduction in truck emissions, and 76 percent reduction in vessel emissions at the Port of Oakland from 2009 to 2018
- Establishment of the Community Air Protection program (pursuant to AB 617) to reduce exposure in communities most impacted by air pollution

In June 2018, the State adopted the Addendum to the CFMP 2014 to address the new requirements under the Federal FAST Act and maintain eligibility for National Highway Freight Program (NHFP) funding. The Addendum recapped all the Moving Ahead for Progress in the 21st Century (MAP-21) elements addressed in the CFMP 2014, including, in detail, the three new FAST Act elements:

1. Designation of Critical Urban Freight Corridors (CUFC) and Critical Rural Freight Corridors (CRFC) [element #3],
2. Consideration of any significant congestion or delay caused by freight movements and any strategies to mitigate that congestion or delay [element #8], and
3. A freight investment plan [element #9].

The CFMP 2020 development was guided by the California Freight Advisory Committee (CFAC). The CFAC is a committee required by GC §13978.8 to advise the California State Transportation Agency (CalSTA) and Caltrans on all aspects of CFMP development. The CFAC is composed of diverse representatives from public and private sector freight stakeholders, including representatives of seaports, railroads, airports, trucking, shippers, carriers, freight-related associations, the freight industry workforce, regional and local governments, federal and state agencies, tribal governments, and environmental, safety, and community organizations.

CFMP 2020 Structure

- Chapter 1 - Provides a consistent vision across the state in relation to the CTP, CSFAP, the Caltrans Strategic Management Plan (SMP) 2020, and the Interregional Transportation Strategic Plan (ITSP). This section showcases overarching goals and objectives that enhance California's economy, protect the environment, and support a transportation system that can meet current and future freight demands.
- Chapter 2 - Establishes a framework for sound policy decisions in relation to the overall economy by developing competitiveness in the twenty-first century. A summary of findings based on an in-depth study (**Appendix C**) of the freight industry labor force, warehousing, logistics, key economic drivers, challenges to doing business in the state, and alternative avenues for thriving industry are all explored in detail.
- Chapter 3 – A review of the current performance and conditions of California freight infrastructure that are critical to making proper investments to enhance the movement of goods. This chapter highlights key freight performance measures.

- Chapter 4 - E-commerce, omni-channel distribution, first-and-last mile delivery, 3-D printing, and autonomous vehicles all pose opportunities for the State's aging infrastructure as technology advancements speed forward, placing excess burden on highway capacity and travel demand. A detailed look at the current state of trends, issues, and challenges facing the State's freight network and supply chain are explored in-depth.
- Chapter 5 – As one of the largest economies in the world, California is challenged with maintaining and preserving its environmental assets including air and water while reducing negative environmental impacts on communities due to land development and transportation practices specifically related to goods movement. A strategic public outreach and engagement effort was conducted and resulting feedback is reported in this chapter.
- Chapter 6 - Bringing it all together, the elements of each chapter including trends, opportunities, and outcomes of public outreach and engagement efforts are developed and refined into specific strategies that enact the plan's goals and objectives. This chapter also includes seven Regional Freight Investment Strategies that highlight the uniqueness of each region's freight needs.

Appendices:

- A. 2014 CFMP Goals, Objectives, Strategies, and Accomplishments - Goals, objectives, strategies from the 2014 CFMP, and accomplishments since the adoption of the 2014 CFMP.
- B. Freight System Policy Framework - Federal, state, regional and local policies and plans that have implications for freight in California.
- C. California's Competitive Position - Analysis of California's competitiveness in attracting and retaining businesses.
- D. National Highway Freight Network Mileage - Reports the routes and mileages associated with each component of the National Highway Freight Network within California.
- E. Critical Urban Freight Corridor CUFC/CRFC Designation Process - The process adopted by Caltrans and the CUFC/CRFC Technical Advisory Committee to designate CUFCs and CRFCs in California.
- F. Bi-national and Multistate Corridor Efforts - Descriptions of bi-national and multistate efforts that California participates in with other nations and states.
- G. Truck Technology Types - An assessment of available truck technologies with descriptions including zero-emission and near-zero emission technologies.
- H. Outreach Efforts Summary - A summary of outreach efforts that have been undertaken for the development of the CFMP, with locations, dates, and results.

- I. Safety, Security, and Resiliency - A discussion of the threats of terrorism, economic recession, and environmental disasters (amongst others) impacting the freight system, and current efforts that support resiliency to these threats.
- J. Smart Growth and Land Use – An analysis of the interactions between land use, real estate, and freight economics.
- K. Future Freight System Scenarios - Three distinct scenarios that can be tested through modeling to show how freight may change in the future with specific inputs and outputs.
- L. 2018 California Freight Investment Plan – A list of projects awarded TCEP funds including projects that utilize the federal formula funds.
- M. California Freight Mobility Plan 2020 Project List – A list of freight projects that are construction-ready by 2025.

CFMP 2020 GOALS

The guiding vision influencing freight sustainability in California is derived from three perspectives: economic vitality, environmental stewardship, and social equity. Building on the previous plan, the CFMP 2020 includes seven goals described below, which are further discussed in **Chapter 1B**. These goals were created through an extensive outreach and engagement process.

1. MULTIMODAL MOBILITY

Strategic investments to maintain, enhance, and modernize the multimodal freight transportation system to optimize integrated network efficiency, improve travel time reliability, and to achieve congestion reduction.

2. ECONOMIC PROSPERITY

Grow the economic competitiveness of California’s freight sector through increased system efficiency, productivity, and workforce preparation.

3. ENVIRONMENTAL STEWARDSHIP

Support strategies that reduce, avoid and/or mitigate adverse environmental impacts from the freight transportation system.

4. HEALTHY COMMUNITIES

Enhance community health and well-being by mitigating the negative impacts of the goods movement system across California’s communities

5. SAFETY & RESILIENCY

Reduce freight-related deaths/injuries and improve system resilience by addressing infrastructure vulnerabilities associated with security threats, effects of climate change, and natural disasters.

6. ASSET MANAGEMENT

Maintain and preserve infrastructure assets using cost-beneficial treatment as indicated in the State Highway System Management Plan (SHSMP), per the federal FAST Act, California Streets and Highway Code §164.6, Caltrans Director's Policy 35 Transportation Asset Management (DP-35), and other applicable state and federal statutes and regulations.

7. CONNECTIVITY & ACCESSIBILITY

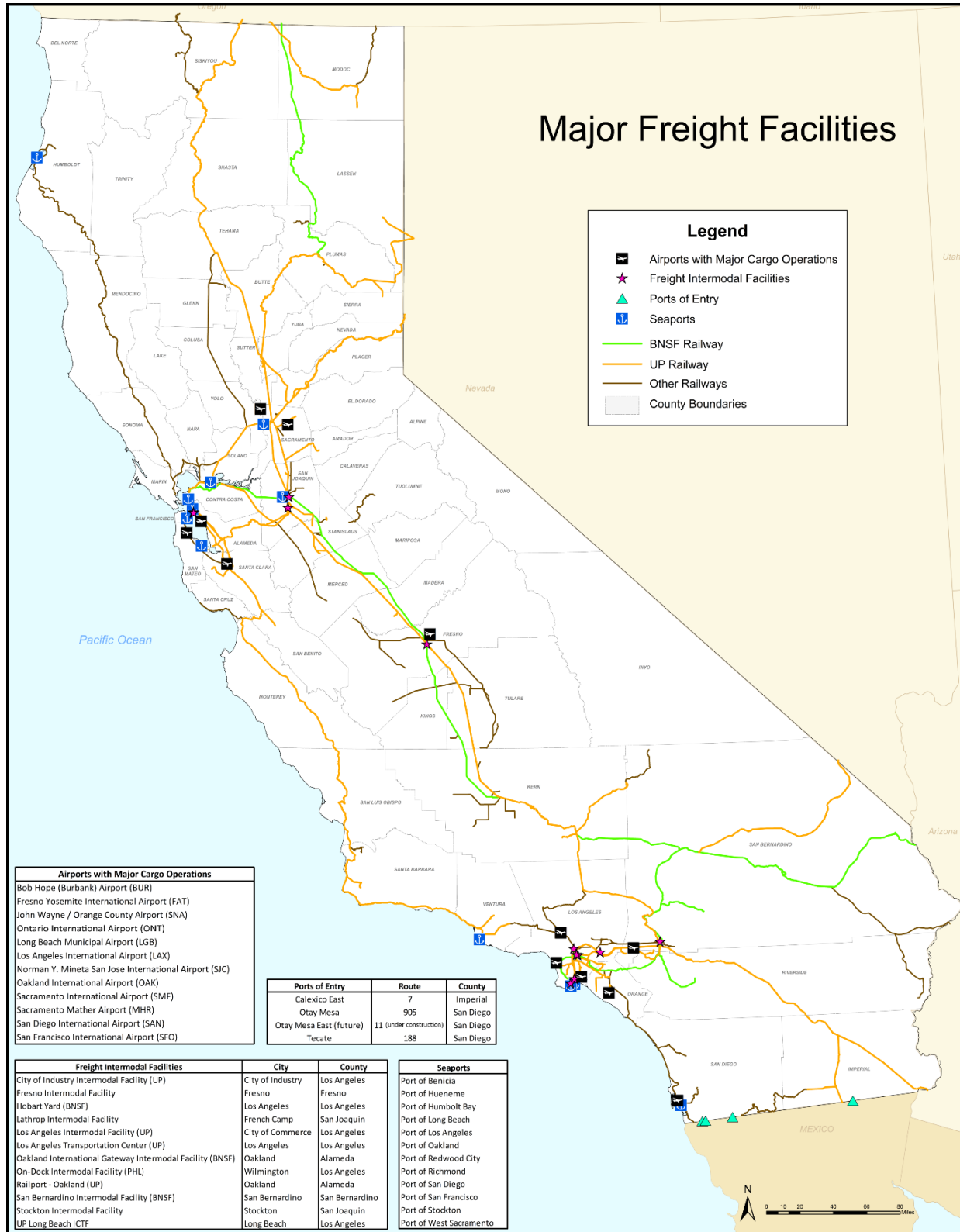
Provide transportation choices and improve system connectivity for all freight modes.

Freight and California's Economy

Freight transport is a vital component of California's regional and statewide economies. In 2018, California's economy was comparable to the fifth largest economy in the world, with the State's GDP at \$3.12 trillion.^{1,2} The State's freight sector is broadly defined to encompass industries that heavily rely on the transportation of their raw materials, intermediate goods and components, as well as their finished products. The sector includes businesses in the transportation, warehousing, utilities, trade, manufacturing, construction, agriculture, and mining industries. California's economy depends on an efficient, integrated, sustainable, and multimodal freight transport system. Understanding the relationship between freight transportation and the economy is critical for State and local agencies when they consider future freight transport system actions and how to optimize opportunities for growth in California. For more information on California's freight competitive position, refer to **Chapter 2** and **Appendix C**.

California's Freight Assets

California's freight system includes a vast inventory of infrastructure, which support the various freight dependent industries within the state. Currently, California has 12 seaports, 12 airports with major cargo operations, two Class I railroads and 27 Class III railroads, three existing and one future commercial land border ports of entry (POE) with Mexico, approximately 19,390 miles of hazardous liquid and natural gas pipelines, and a large warehousing and distribution sector. (**Chapter 3A** provides more information). Below, **Figure ES.1** shows California's major freight facilities mentioned above.

Figure ES.1. California's Major Freight Facilities

Trends and Issues

The CFMP 2020 covers several technological innovations and potentially disruptive trends such as e-commerce, autonomous trucks, and the greening of the freight industry. These innovations could potentially impact established supply chains, and the CFMP provides some insight into future implications these innovations may have for California's freight system.

Over the past 10 years California and the world have been experiencing the implications of shifting consumer behaviors from in-store (brick and mortar) to e-commerce (via the internet). The advent of e-commerce has not only altered how land is used in communities, but also how, when, and where goods are delivered. E-commerce is driving changes in warehouse construction and operations. New warehouses are 30 to 40-foot-high, 100,000 square-foot facilities operated through manual labor to high cube 60-foot high, 500,000+ square-foot, automated, fully electrified and employed with highly trained/ skilled workers.

The continued shift to home delivery means more brick and mortar businesses are closing, causing local governments and property owners to consider how land use and zoning codes may need to be adjusted. Therefore, businesses are rethinking site selection, while educators and skilled workers are seeking out opportunities to gain skills needed to compete in this new economic reality.

Similarly, automation in the form of autonomous vehicles, automated marine terminals and warehouses, and the increasing use of robotics in logistic facilities are improving supply chain efficiencies while improving workplace safety. On-going policy development around these new technologies is necessary for understanding and responding to how these technologies may impact the freight industry and its workforce. While technological advancements may result in significant changes to freight transportation, these advancements may also provide benefits to the transportation system through improvements in efficiency, reliability, and safety. These benefits and costs need to be considered when planning the future freight system in California. As California's freight industry evolves to be cleaner and more efficient, the State must continue to closely monitor and derive the necessary policies and activities to grow California's economy while protecting its most-valued resources, its environment and people.

CFMP 2020 Outreach

The CFMP 2020 tells the story of the freight industry in California. Stakeholders representing disadvantaged communities, freight-related industries, regulators, non-governmental organizations, and the CFAC were consulted extensively during various stages throughout the development of the plan. These stakeholders provided multifaceted perspectives on statewide freight issues, as well as potential solutions. Through engagement efforts including large public forums, industry specific workshops, telephone calls, in-person discussions, or online surveys, stakeholders identified critical concerns and issues from their perspectives.

The issues and concerns generally fell into one of the following six categories:

- Competitiveness
- Regulatory burdens
- Congestion
- Technology adaptation
- Workforce
- Sustainability

Based on this information, stakeholders and CFAC members were asked to identify and prioritize strategies to address the issues identified. Outreach efforts played an essential role when informing the development of the CFMP 2020 by testing new outreach approaches, incorporating lessons learned, and adopting new strategies when conducting public engagement efforts. A summary of activities and findings from stakeholder outreach and engagement are described in **Chapter 5** and **Appendix H**.

CFMP 2020 Implementation

Considering the many dimensions of the freight system and its impacts on the economy and environment, developing a freight strategy is an extensive process. The CFMP 2020 proposes specific objectives and strategies to support the accomplishment of the seven goals. The CFMP 2020 incorporates many of the strategies of the CFMP 2014, as well as the CSFAP. The CFMP 2020 also contains several new strategies, which are reflective of changes in legislation, department policy, private industry trends, public outreach and engagement efforts, and other changes since the 2014 CFMP was adopted.

Examples of these strategies are listed below:

- Strategy EP-3-A: Identify and actively advocate for workforce mobility, accessibility, and training needs and job training programs through collaboration with the freight industry and California's higher education system
- Strategy EP-4-A: Identify incentives for the retention, expansion, and new development of logistics industry facilities (warehouses)
- Strategy ES-2-D: Explore decarbonization of last mile delivery to decrease the freight system's impact on air quality in dense urban environments
- Strategy HC-2-B: Establish development standards to avoid and mitigate environmental and social impacts of freight on communities
- Strategy CA-1-A: Freight plan priority for projects implementing state-of-the-art and demonstration technologies
- Strategy CA-6-B: Support off-hour delivery/pick-up strategy development

In addition to these strategies, the State recognizes the need to develop more projects that reflect and align with California's climate change goals. **Chapter 6B** highlights a number of project types that the State is working towards to achieve better protection of its communities and environment while leading to further innovation within the freight industry.

Endnotes

¹ U.S. Bureau of Economic Analysis, “Table 2. Current-Dollar Gross Domestic Product (GDP) by State and Region, 2018: Q1 – 2019: Q2”

<https://www.bea.gov/system/files/2019-11/qgdpstate1119.pdf>

² U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Accounts, <http://www.bea.gov/regional/index.htm>

Chapter 1: Vision, Goals, and Objectives

A. Background

B. Vision, Goals, and Objectives

1.A. Background

Moving Ahead for Progress in the 21st Century Act (MAP-21)¹ was signed into law on July 6, 2012. The MAP-21 funded federal surface transportation programs at over \$105 billion for fiscal years (FY) 2013 and 2014 and was the first long-term highway authorization enacted since 2005. This authorization included several provisions to improve the condition of the national freight network (NFN) and to support investment in freight-related surface transportation projects. Section 1118 [State Freight Plans (SFP)] of MAP-21 directed the U.S. Secretary of Transportation (Secretary) to encourage states to develop comprehensive SFPs, specified certain minimum contents for SFPs, and declared that SFPs may be developed separate from, or incorporated into the statewide strategic long-range transportation plan required under 23 United States Code (U.S.C.) 135. Section 1117 [State Freight Advisory Committees] directed the Secretary to encourage states to establish a State Freight Advisory Committee (FAC) to help guide the aforementioned plans. Furthermore, Section 1116 [Prioritization of Projects to Improve Freight Movement] authorized the Secretary to increase the federal share payable for any project to 95 percent for projects on the Interstate Highway System and 90 percent for any other project if the Secretary certifies that the project meets certain criteria.

On December 4, 2015, the Fixing America's Surface Transportation (FAST) Act was signed into law, and it is the first federal authorization in over a decade to provide long-term funding certainty for surface transportation infrastructure planning and investment. The FAST Act authorizes \$305 billion over FY 2016 through 2020 for highway, highway and motor vehicle safety, public transportation, motor carrier safety, hazardous materials safety, rail, and research, technology, and statistics programs.² Section 1116 [National Highway Freight Program (NHFP)] of the FAST Act³ required the development of the National Highway Freight Network (NHFN), which replaced the National Freight Network and the Primary Freight Network established under MAP-21. FAST Act Section 1116 also requires the re-designation of the NHFP every five-years.

FAST Act Section 8001 added Section 70202 to Title 49 of the U.S.C. that requires state governments receiving NHFP (23 U.S.C. 167) funds to develop an SFP, in consultation with the State FAC (if applicable)⁴. The SFP must cover a five-year forecast period, be fiscally constrained, include a freight investment plan that includes a list of priority projects, and describe how the state will invest and match its NHFP funds.

FAST Act Section 1105 [Nationally Significant Freight and Highway Projects (NSFHP) program] established a discretionary competitive grant program, known formerly as Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies (FASTLANE), and presently known as Infrastructure for Rebuilding America (INFRA). This program includes \$4.5 billion over five years to provide financial assistance to nationally and regionally significant highway, rail, port, and intermodal freight and highway projects⁵.

On October 14, 2016, the Office of the Federal Register and the National Archives and Records Administration replaced the Department of Transportation Interim Guidance on SFPs (July 6,

2012) and State FACs (77 FR 62596, October 15, 2012) which were developed to address MAP-21 provisions with the guidance on SFPs and State Freight Advisory Committees (Federal Register Volume 81, Issue 199). The new guidance provides direction regarding the required elements of SFPs established under 49 U.S.C. 70202, as well as recommended approaches and information that state governments may include in their SFPs, including the establishment of State Freight Advisory Committees.

In September 2013, California passed Assembly Bill (AB) 14 (Lowenthal, 2013) requiring the California State Transportation Agency (CalSTA) to establish the FAC by the U.S. DOT, prepare an SFP consistent with federal law, and submit the plan to designated recipient State agencies by December 31, 2014 and every five years thereafter⁶.

The Secretary of CalSTA delegated their responsibility for developing the CFMP to the California Department of Transportation (Caltrans) in consultation with the CFAC formed in compliance with AB 14.

Table 1.A.1 shows the Federal Highway Administration (FHWA) requirements for freight plans and corresponding chapters in the CFMP⁷. Caltrans worked extensively with CalSTA, CFAC, and other freight stakeholders to develop the CFMP. The CFMP is structured so it can be readily updated by section in response to changes within the dynamic freight industry and public policy arena. As emerging federal and state freight-related policy and guidance is issued, the CFMP will be amended to align with those policies and guidance. Additionally, as regional freight plans receive approval from their respective boards or commissions, relevant sections of the CFMP may be updated to reflect the new information.

The State of California is looking beyond the CFMP development and is working through an integrated State agency effort that is committed to a broader freight vision that will guide California toward a future with a sustainable freight system.

Table 1A.1. FHWA Requirements and Chapter Contents

Element	Requirements	Descriptions
1	An identification of significant freight system trends, needs, and issues with respect to the state.	<p>Chapter 1 identifies background, vision, and goals for the freight plan.</p> <p>Chapter 2 outlines the State's needs and challenges in various sectors to increase economic growth and remain competitive.</p> <p>Chapter 3 outlines needs and issues under existing conditions.</p> <p>Chapter 4 identifies regional and global trends and what it means for California's Freight industry.</p> <p>Chapter 5 identifies environmental progress and opportunities for freight within California.</p> <p>Chapter 6 provides an overview of the Statewide Investment strategy and the regional freight investment strategies.</p> <p>Appendix E evaluates various alternative future scenarios with respect to long term trends and needs.</p>
2	A description of the freight policies, strategies, and performance measures that will guide the freight-related transportation investment decisions of the state.	<p>Appendix A outlines freight policies and strategies, grounded in the Freight Plan vision, goals, and objectives.</p> <p>Chapter 3A and Chapter 5 present the performance measures.</p> <p>Chapter 6B explains State and regional freight investment strategies.</p>
3	When applicable, listings of multimodal critical rural freight facilities and corridors designated within the state under section 70103 of Title 49: National Multimodal Freight Network (NMFN) and critical rural and urban freight corridors designated within the state under Section 167 of Title 23: National Highway Freight Program (NHFP).	<p>Chapter 3B contains a description of the critical rural freight corridors (CRFC) and critical urban freight corridors (CUFC) designated to date and National Multimodal Freight Network (it has yet to be finalized).</p>

4	A description of how the plan will improve the ability of the state to meet the national multimodal policy goals described in Section 70101(b) of Title 49, and U.S. Code and the NHFP goals described in Section 167 of Title 23 relating to intermodal goods movement.	Chapter 1B explains how CFMP enables the State to meet the national multimodal freight policy goals and NHFP goals.
5	A description of how innovative technologies and operational strategies, including freight intelligent transportation systems (ITS), that improve the safety and efficiency of the freight movement, were considered.	Chapter 1 proposes the use of ITS for solving freight issues outlined in the Freight Plan. Chapter 6 details operational strategies to resolve congestion, efficiency, and other issues affecting freight. Appendix E provides discussion of scenario planning, which considered technological advancements to define the potential future states affecting the State's freight transportation system.
6	In the case of roadways on which travel by heavy vehicles (including mining, agricultural, energy cargo or equipment, and timber vehicles) is projected to substantially deteriorate the condition of the roadways, a description of improvements that may be required to reduce or impede the deterioration.	Chapter 2 summarizes the share of each industry in overall goods movement flows on California multimodal freight System, specifically freight highway network. Chapter 3A summarizes the existing conditions on the freight highway network and maintenance efforts and operational improvements to preserve the infrastructure. Chapter 6 details strategies to improve freight mobility and efficiency affecting these industries.
7	An inventory of facilities with freight mobility issues, such as bottlenecks within the state, and for those facilities that are state-owned or operated, a description of the strategies the state is employing to address those freight mobility issues.	Chapter 3A and 3B identifies facilities with mobility issues, including bottlenecks. Chapter 4 identifies the needs and issues associated with mobility problems. Chapter 6 details improvements and strategies.

8	Consideration of any significant congestion or delay caused by freight movements and any strategies to mitigate that congestion or delay.	Chapter 3A identifies congestion issues. Chapter 6 details improvements and strategies.
9	A freight investment plan that, subject to 49 U.S.C. 70202(c), includes a list of priority projects and describes how funds made available to carry out 23 U.S.C. 167 would be invested and matched.	Chapter 6 is the Implementation Plan including improvement strategies, investment strategies, and short-term lists of projects for each region. Appendix L is the California Freight Investment Plan, which was adopted in 2018 through the Trade Corridor Enhancement Program (TCEP). The TCEP is composed of Trade Corridor Enhancement Account and National Highway Freight Program funds.
10	Consultation with the state FAC, if applicable.	All Freight Plan chapters were informed and reviewed by the CFAC as explained in Chapter 5 .
Source: Fixing America's Surface Transportation (FAST) Act, National Highway Freight Program, Section 1116, 23 U.S.C. 167		

Endnotes

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- ¹ “MAP-21- Moving Ahead for Progress in the 21st Century, FAST ACT Fact Sheet.” *U.S. Department of Transportation, Federal Highway Administration*. April 1, 2019. <https://www.fhwa.dot.gov/map21/factsheets/freight.cfm>.
- ² “Fixing America's Surface Transportation Act or "FAST Act" *U.S. Department of Transportation, Federal Highway Administration*. <https://www.fhwa.dot.gov/fastact/>
- ³ “National Highway Freight Program (NHFP), FAST Act Section 1116 Implementation Guidance.” *U.S. Department of Transportation, Federal Highway Administration*. February 29, 2016. https://ops.fhwa.dot.gov/freight/pol_plng_finance/policy/fastact/s1116nhfpguidance/.
- ⁴ “Guidance on State Freight Plans and State Freight Advisory Committees.” *Federal Register, The Daily Journal of the United States Government*. October 14, 2016. <https://www.federalregister.gov/documents/2016/10/14/2016-24862/guidance-on-state-freight-plans-and-state-freight-advisory-committees>.
- ⁵⁵ “U.S. Secretary of Transportation Elaine L. Chao Announces Major Infrastructure Investment in America.” *Infrastructure for Rebuilding America, United States Department of Transportation, Build American Bureau*. Wednesday, September 25, 2019. <https://www.transportation.gov/buildamerica/infragrants>.
- ⁶ “Bill Number: AB 14, Chaptered Bill Text, Chapter 223.” *Legislative Counsel's Digest*. December 2, 2012. http://leginfo.ca.gov/pub/13-14/bill/asm/ab_0001-0050/ab_14_bill_20130906_chaptered.html.
- ⁷ “Fixing America's Surface Transportation Act (FAST Act) Fact Sheet.” *Federal Highway Administration (FHWA)*. February 29, 2016. https://ops.fhwa.dot.gov/freight/pol_plng_finance/policy/fastact/s1116nhfpguidance/.

1.B. Vision, Goals, and Objectives

The California State Transportation Agency (CalSTA), Caltrans, regional and local partners, public and private sectors, and the members of the California Freight Advisory Committee (CFAC) began development of the California Freight Mobility Plan 2020 by creating a vision statement (see Executive Summary). Furthering this vision, a set of goals and objectives were developed to guide decision making and ensure consistency throughout the plan.

As the national gateway for international trade and domestic commerce, California exemplifies the world's most innovative, economically-competitive multimodal freight network that is efficient, reliable, modern, integrated, resilient, safe, and sustainable, where social and environmental impacts are considered equally.

California has a population of nearly 40 million, and it is one of the largest economies in the world. To support this diverse, vibrant, and intricate economy, the State must continue to cultivate and devote resources in a manner that promotes livability, equality, and economic and social prosperity. This includes protecting our natural and built environments, enhancing community livelihoods, and attracting greater investments to the State.

California's transportation system is the most extensive, least polluting, highest capacity, and most technically advanced multimodal freight transportation system in the United States. It handles the highest value of international commerce of any state in the nation and among the highest total freight volumes. This unparalleled system connects California's international gateways to the rest of the country, through several high-speed, high-capacity, multimodal gateways and corridors that provide access to every state in the nation. California is building upon these strengths to create an even more efficient, less-polluting, and higher-capacity freight sector that is competitive in the 21st century and also remains a national leader in freight.

The State's evolving freight system is focused on strengthening and preserving the existing system and making strategic improvements to increase mobility and safety with a focus on protecting communities and the environment. The freight industry will need to continue its leadership role by elevating sustainable practices including, reducing vehicle and equipment emissions and prioritizing environmental restoration adjacent to high volume truck corridors. The freight industry should also align with state policies that combat climate change, as well as addressing community and health impacts caused by freight. One example is the Governor's Regions Rise Together initiative which is supporting economic development strategies across California's diverse regions where inclusion, sustainability, and climate resilience are at the center of the table. The initiative is jointly led by the Governor's Office of Business and Economic Development (GOBiz) and Office of Planning and Research (OPR) and is encouraging an approach to regional economic development that brings all voices of the community to the table, including industry partners and social justice advocates. As noted in a November 2019 Fresno Bee op-ed and story map, "It's not enough to improve transportation mobility with new

highways or economic mobility with new education. We have to think about how these investments build better communities and respond to the dual dilemma of our climate and inequality crisis¹.”

Looking ahead to the year 2040, zero emission (ZE) or near-zero-emissions (NZE) vehicles and equipment are expected to dominate California’s freight system—powered by a modernized energy production and distribution system and a robust mix of renewable and clean energy sources (see **Chapter 6A**). Designated areas will have dedicated freight corridors and hubs – some of them automated – that separate passenger and freight movements and minimize impacts to surrounding communities. Local and regional agencies will be guided by detailed freight transportation plans that integrate land use and economic development. The transition to this mid-twenty-first century freight system will rely on both public and private investments in countless infrastructure projects, vehicle and equipment purchases, technology applications, and system management approaches. It will require incremental change as well as large-scale improvements, implemented by both public and private entities oriented toward achieving a shared freight vision for California.

Scope and Vision

The California Freight Mobility Plan 2020 (CFMP) Vision is consistent with, and built upon, the policies of the adopted California Transportation Plan 2040 (CTP). The CTP itself was developed in coordination with the framework established by the FAST Act. The CFMP Vision is also consistent with the Caltrans mission statement. The Vision recognizes that the CFMP must include all modes of freight transportation to achieve a truly integrated, intermodal freight network.

The Vision provides a common platform for informing and guiding the development of freight transportation policy, programs, and project prioritization across all sectors of State’s freight system. The Vision was crafted in collaboration with the CFAC, which was created to inform the development of the CFMP and serve as an ongoing freight advisory body to the State. From this Vision, seven overarching goals and a complementary set of more specific objectives were developed in correspondence with the goals included in federal statute. These goals, as well as additional attributes described later in this chapter, are correlated with strategies and projects identified in **Chapter 6**.

Goals and Objectives

Addressing the listed set of goals and objectives below can only be achieved through coordination, collaboration, and the combined efforts of State, regional, and local agencies, the freight industry, private freight stakeholders, special interest groups, and the public. The public sector plays a crucial role in constructing, operating, and maintaining many freight facilities, such as roadways and seaports. Regulatory activities implemented by the public sector, such as infrastructure investment and land use decisions, heavily influence the business operations of private-sector freight operators who are dependent on these public facilities and are

responsible for their own facilities and equipment. **Table 1B.1** includes the seven goals and description associated with each goal.

Table 1B.1. CFMP 2020 Goals

Goal	Goal Title	Goal Description
1	MULTIMODAL MOBILITY	Strategic investments to maintain, enhance, and modernize the multimodal freight transportation system to optimize integrated network efficiency, improve travel time reliability, and to achieve congestion reduction.
2	ECONOMIC PROSPERITY	Grow the economic competitiveness of California’s freight sector through increased system efficiency, productivity, and workforce preparation.
3	ENVIRONMENTAL STEWARDSHIP	Support strategies that reduce, avoid, and/or mitigate adverse environmental impacts from the freight transportation system.
4	HEALTHY COMMUNITIES	Enhance community health and well-being by mitigating the negative impacts of the goods movement system across California’s communities.
5	SAFETY AND RESILIENCY	Reduce freight-related deaths/injuries and improve system resilience by addressing infrastructure vulnerabilities associated with security threats, effects of climate change impacts, and natural disasters.
6	ASSET MANAGEMENT	Maintain and preserve infrastructure assets using cost-beneficial treatment as indicated in the State Highway System Management Plan (SHSMP), per the federal FAST Act, California Streets and Highway Code §164.6, Caltrans Director’s Policy 35 Transportation Asset Management (DP-35), and other applicable state and federal statutes and regulations.
7	CONNECTIVITY AND ACCESSIBILITY	Provide transportation choices and improve system connectivity for all freight modes.

Within each goal, a number of objectives are identified and intended to serve as means to move toward these goals. The goals are not prioritized; all are considered essential. The specific strategies for each goal and objective will be discussed in **Chapter 6**.

Individual strategies and projects support more than one goal, and therefore, more than one objective. Projects that most effectively address multiple goals and objectives will likely be the most competitive for future funding opportunities. The goals, objectives, and strategies (described in **Chapter 6**) are consistent with, federal, state, and local funding programs, including but not limited to the National Highway Freight Program administered by FHWA, and the Trade Corridors Enhancement Program administered by the California Transportation Commission.

GOAL 1: MULTIMODAL MOBILITY

Strategic investments to maintain, enhance, and modernize the multimodal freight transportation system to optimize integrated network efficiency, improve travel time reliability, and to achieve congestion reduction.

Objectives

- a) Identify causes and solutions to freight bottlenecks
- b) Invest strategically to optimize system performance
- c) Develop, manage, and operate an efficient, integrated freight system
- d) Identify causes and solutions to freight rail network improvements bottlenecks
- e) Identify freight rail network operational improvements and mode shift options

GOAL 2: ECONOMIC PROSPERITY

Grow the economic competitiveness of California's freight sector through increased system efficiency, productivity, and workforce preparation.

Objectives

- a) Promote economic development by investing in freight infrastructure projects and operational improvements
- b) Promote freight projects that enhance the economic activity, freight mobility, unique capabilities, reliability, system resiliency, and global competitiveness
- c) Increase workforce availability and training
- d) Promote the State's competitive logistics advantages

GOAL 3: ENVIRONMENTAL STEWARDSHIP

Support strategies that may reduce, avoid and/or mitigate adverse environmental impacts from the freight transportation system.

Objectives

- a) Continue to integrate environmental health considerations into freight planning, development, implementation, and operations of projects as feasible
- b) Minimize, and where possible, eliminate toxic air contaminants, criteria pollutants and GHGs emitted from freight vehicles, equipment, and operations
- c) Promote land use planning practices that prioritize mitigation of negative freight project impacts upon the environment

GOAL 4: HEALTHY COMMUNITIES

Enhance community health and well-being by mitigating the negative impacts of the goods movement system across California's communities.

Objectives

- a) Prioritize social equity for all freight-related projects by developing alternative methods that avoid negative impacts on, or near existing communities adjacent to high-volume freight routes and facilities
- b) Conduct meaningful outreach and coordination efforts with other agencies focused on environmental justice communities disproportionately burdened by the freight transportation system in urban areas and rural areas by identifying and documenting their needs
- c) Promote noise and other pollution abatement strategies associated with the movement of goods alongside residential areas and sensitive habitat near freight corridors

GOAL 5: SAFETY AND RESILIENCY

Reduce freight-related deaths/injuries and improve system resilience by addressing infrastructure vulnerabilities associated with security threats, effects of climate change impacts, and natural disasters.

Objectives

- a) Reduce rates of incidents, collisions, fatalities, and serious injuries associated with freight movements
- b) Utilize technology to provide for the resilience and security of the freight transportation system
- c) Develop a freight resiliency strategic plan

GOAL 6: ASSET MANAGEMENT

Maintain and preserve infrastructure assets using cost-beneficial treatment as indicated in the State Highway System Management Plan (SHSMP), per the federal FAST Act, California Streets and Highway Code §164.6, Caltrans Director's Policy 35 Transportation Asset Management (DP-35), and other applicable state and federal statutes and regulations

Objectives

- a) Apply preventative maintenance and rehabilitation strategies using sustainable best practices

GOAL 7: CONNECTIVITY AND ACCESSIBILITY

Provide transportation choices and improve system connectivity for all freight modes.

Objectives

- a) Support research, demonstration, development, and deployment of innovative technologies
- b) Promote innovative technologies and practices utilizing real time information to move freight on all modes more efficiently
- c) Coordinate with local and regional partners of freight facilities, siting, design, and operations
- d) Utilize inland port facility, short-haul rail shuttle, and inland seaports to lessen impacts on nearby communities
- e) Improve truck trip planning, coordination, operational, and management

Freight and Vehicle Miles Traveled

The State has passed several laws, issued Executive Orders (EO), and implemented several policies aimed to reduce vehicle miles traveled (VMT). See **Appendix B** for more details. The CFMP goals, objectives, and strategies are aligned with these statutes and EOs by encouraging sustainable, transformative, and innovative freight projects that increase freight competitiveness and reduce emissions. By taking into consideration compatible land uses, the CFMP also encourages more housing production near suitable freight jobs, thereby reducing transportation and housing costs for the freight workforce and reducing employee VMT per capita.

The State also recognizes that until additional freight modal shift occurs from motor vehicles to rail, waterways, cargo bikes, manned or unmanned aircraft systems (UAS), or other forms of transportation, motor vehicles will continue to be the predominant mode for freight deliveries. Efforts to specifically reduce freight VMT may be counter to California's other goals of increasing freight competitiveness and reducing GHG, as some modal shifts may have additional burdens on the supply chain, and as a shift of cargo away from California may result in a rise in GHG due to goods traveling greater distances to out-of-state warehousing and distribution centers from California ports.

Freight VMT within California has risen in recent years due several factors, including but not limited to, the robust economic growth of the freight sector and the shift to e-commerce (see **Chapter 4A**) and rapid shipping (one-hour or same day shipping). Many e-commerce deliveries are now made by contractors using their personal vehicles, rather than by commercial truck drivers which increase the number of VMT since more trips made by smaller vehicles are utilized.

Freight stakeholders and agencies should encourage increased freight efficiency and a shift from freight moved by motor vehicles to rail, waterways, and cargo bikes when feasible. When modal shift is not feasible, freight stakeholders and agencies should continue to implement projects that reduce the negative impacts of freight such as ZE or NZE vehicles, consolidation of goods, longer trailers, eco routing, fewer empty trailers, alternative fuel corridors, “clean” truck lanes, truck platooning, and other innovative methods. Some of these strategies and projects types are identified in **Chapter 6A** and **6B**.

Relationship to Freight National Goals

The FAST Act established a new National Highway Freight Program (NHFP) to improve the efficiency of goods movement on the National Highway Freight Network (NHFN). The FAST Act also implemented requirements of state freight plans to describe how they advance the National Multimodal Freight Policy (NMFP) and the NHFP goals and strategies intended to improve safety, security, and resiliency of the freight system.

The ten NHFP goals (23 U.S.C. §167), in alignment with the seven NMFP goals (49 U.S.C. §70101) directly pertain to the National Multimodal Freight Network (49 U.S.C. §70103) and have been outlined in **Table 1B.2** below. This table also shows the CFMP 2020 goals and objective that align with each NMFP and/or NHFP goal.

Table 1B.2. National Freight Goals and CFMP Goals Alignment

NHFP/NMFP Goals	CFMP Goals & Adjectives
<p align="center">NMFP/ NHFP Goal 1</p> <p>Invest in infrastructure improvements and implement operational improvements on the highways of the U.S. that:</p> <ul style="list-style-type: none"> a. Strengthen the contribution of the NHFN to the economic competitiveness of the United States b. Reduce congestion and bottlenecks on the NHFN c. Reduce the cost of freight transportation d. Improve the year-round reliability of freight transportation e. Increase productivity, particularly for domestic industries and businesses that create high-value jobs 	<p align="center">CFMP Goal 1 (Multimodal Mobility)</p> <ul style="list-style-type: none"> a. Identify causes and solutions to freight bottlenecks b. Invest strategically to optimize system performance c. Develop, manage, and operate an efficient integrated freight system d. Identify causes and solutions to Freight Rail Network Improvements bottlenecks e. Identify freight rail network operational improvements and mode shift options
<p align="center">NMFP Goal 2</p> <p>Improve the safety, security, efficiency, and resiliency of freight/multimodal transportation</p> <p align="center">NHFP Goal 2</p> <p>to improve the safety, security, efficiency, and resiliency of freight transportation in rural and urban areas</p>	<p align="center">CFMP Goal 5 (Safety & Resiliency)</p> <ul style="list-style-type: none"> a. Reduce rates of incidents, collisions, fatalities, and serious injuries associated with freight movements c. Develop a freight resiliency strategic plan
<p align="center">NMFP Goal 3</p> <p>Improve the state of good repair of the NMFN</p> <p align="center">NHFP Goal 3</p> <p>to improve the state of good repair of the NHFN</p>	<p align="center">CFMP Goal 6 (Asset Management)</p> <ul style="list-style-type: none"> a. Apply preventative maintenance and rehabilitation strategies using sustainable best practices <p align="center">CFMP Goal 7 (Connectivity & Accessibility)</p> <ul style="list-style-type: none"> c. Coordinate with local and regional partners of freight facilities, siting, design, and operations

<p>NMFP/NHFP Goal 4 Use innovation and advanced technology to improve the safety, efficiency, and reliability of the NMFN/NHFN</p>	<p>CFMP Goal 5 (Safety & Resiliency) b. Utilize technology to provide for the resilience and security of the freight transportation system</p> <p>CFMP Goal 7 (Connectivity and Accessibility) a. Support research, demonstration, development, and deployment of innovative technologies b. Promote innovative technologies and practices utilizing real-time information to move freight on all modes more efficiently</p>
<p>NMFP/NHFP Goal 5 Improve the efficiency and productivity of the NMFN/NHFN</p>	<p>CFMP Goal 2 (Economic Prosperity) a. Promote economic development by investing in freight infrastructure projects and operational improvements b. Promote freight projects that enhance economic activity, freight mobility, unique capabilities, reliability, system resiliency and global competitiveness c. Increase workforce availability and training d. Promote the State's competitive logistics advantages</p>
<p>NMFP Goal 6 to improve the reliability of freight transportation</p> <p>NHFP Goal 6 to improve the flexibility of States to support multi-State corridor planning and the creation of multi-State organizations to increase the ability of States to address highway freight connectivity</p>	<p>CFMP Goal 7 (Connectivity & Accessibility) a) Support research, demonstration, development, and deployment of innovative technologies b) Promote innovative technologies and practices utilizing real time information to move freight on all modes more efficiently c) Coordinate with local and regional partners of freight facilities, siting, design, and operations e) Truck trip planning, coordination, operational and management improvements</p>

<p>NMFP Goal 7</p> <p>to improve the short- and long-distance movement of goods that—</p> <ul style="list-style-type: none"> a) travel across rural areas between population centers; b) travel between rural areas and population centers; and c) travel from the Nation's ports, airports, and gateways to the NMFN 	<p>CFMP Goal 1 (Multimodal Mobility)</p> <ul style="list-style-type: none"> a. Identify causes and solutions to freight bottlenecks b. Invest strategically to optimize system performance c. Develop, manage, and operate an efficient integrated freight system <p>CFMP Goal 7 (Connectivity & Accessibility)</p> <ul style="list-style-type: none"> f. Improve truck trip planning, coordination, operational and management
<p>NHFP Goal 8</p> <p>Improve the flexibility of States to support multi-State corridor planning and the creation of multi-State organizations to increase the ability of States to address multimodal freight connectivity</p>	<p>CFMP Goal 7 (Connectivity and Accessibility)</p> <p>Provide transportation choices and improve system connectivity for all freight modes.</p> <ul style="list-style-type: none"> a) Support research, demonstration, development, and deployment of innovative technologies b) Promote innovative technologies and practices utilizing real time information to move freight on all modes more efficiently c) Coordinate with local and regional partners of freight facilities, siting, design, and operations d) Study the viability of utilizing inland port facility, short-haul rail shuttle, and inland seaports with less impact on nearby communities e) Improve truck trip planning, coordination, operational and management strategies

<p>NHFP Goal 9</p> <p>Reduce the adverse environmental impacts of freight movement on the National Multimodal Freight Network</p>	<p>CFMP Goal 3 (Environmental Stewardship)</p> <p>a) Continue to integrate environmental health considerations into freight planning, development, implementation, and operations of projects as feasible</p> <p>b) Minimize, and where possible, eliminate toxic air contaminants, criteria pollutants and GHGs emitted from freight vehicles, equipment, and operations.</p> <p>c) Promote land use planning practices that prioritize mitigation of negative freight project impacts upon the environment.</p>
<p>NHFP Goal 10</p> <p>to pursue the goals described in this subsection in a manner that is not burdensome to State and local governments</p>	<p>All CFMP Goals and Objectives</p>
<p>Source: National Highway Freight Program (NHFP) 23 U.S.C. §167</p>	

Endnotes

¹ California Office of Planning and Research, 2020, <https://arcg.is/nazrn>)

Chapter 2: California Freight Competitiveness

2. California Freight Competitiveness

Trade between the United States (U.S.) and other nations is worth approximately \$4.9 trillion per year. China, Canada, and Mexico are the country's largest trading partners and account for nearly \$1.9 trillion worth of imports and exports.¹ California's economy ranks fifth in the world, and the state is a leading competitor for trade. (See **Chapter 4B** for more information). In 2019, California's total value of exports was approximately \$1.7 trillion, nearly 10.5 percent share of the U.S. total.²

Increasing statewide competitiveness is a key priority for the State. California can achieve economic growth, environmental sustainability, and community development with a balanced and effective approach. California's competitiveness is vital to both public agencies and private stakeholders. Increasing competitiveness across the state will contribute to local, regional, and state economic development by making California a preferred choice for developers, businesses, and transportation providers. This chapter provides a summary of findings based on information found in **Appendix C**.

The State, its communities, its transportation providers, and its businesses compete in several ways:

- The State of California, and California municipalities, compete for business locations, including production facilities, distribution centers, and offices.
- California producers, manufacturers, distributors, and wholesalers compete for business and market share with their domestic and foreign counterparts elsewhere, and they may also compete for business within their own firms.
- California seaports, airports, and freight transportation providers compete with their counterparts in other states and nations for freight transportation business.

California's economy and the number of jobs continues to grow, especially in the State's well-publicized high-tech, biotechnology, and green technology sectors. However, the growth has not been uniform across the freight transportation and logistics sectors. Other states and regions have had successes in attracting businesses, especially businesses that do not need to locate in California.

Job losses in commerce, businesses, and jobs to other states or other nations are acutely felt throughout the state and across sectors. Losses of economic activity due to interstate and international competition vary in scope and effect. Losses are highly visible when businesses move away from California or when businesses that might have located in California choose a competing location instead. Other economic losses are less obvious, such as gradual shifts in business activity away from California. Yet, these less obvious losses can be equally important to California's aggregate economy and affect some communities disproportionately.

The role of freight transportation in economic competitiveness is usually assumed to be a function of freight system capacity, performance, and efficiency. In most discussions of competitiveness, quantitative or qualitative shortfalls in freight capacity, cost, service frequency, transit time, reliability, safety, and etc. are presumed to diminish economic competitiveness. The CFMP aims to support long-term competitiveness.

Competition for Business Locations

The focus of most regional and state competitiveness discussions is competition for locations of new production, distribution, or transportation facilities. These facilities generate jobs, tax revenue, and positive economic impacts within communities. Californians are concerned about the potential loss of businesses and facilities that close due to out-of-state competition or relocation to other states. Although there are many possible variations and combinations, most location decisions fall under the following categories:

- Choosing a location for a new production or distribution facility
- Choosing whether to expand, contract, or close an existing location
- Choosing how much production or distribution activity to allocate among locations

Location Decision Factors

Key factors commonly considered when deciding locations include:

- Access to target markets
- Workforce availability
- Proximity to suppliers, intellectual capital, and other inputs
- Availability of suitable sites, buildings, or other facilities, with appropriate zoning
- Fit within existing or planned production, supply chain, and distribution networks
- Development timeline (e.g. permitting, construction, environmental documents)
- Land cost and zoning
- Cost of doing business (other than transportation)
- Local regulations and other restrictions
- Freight transportation access, capacity, and reliability
- Freight transportation service and cost

California's consumer population, nearly 40 million in 2019, and direct access to international markets via ports on the Pacific Rim give the state a competitive edge on the first criterion, access to markets. Few businesses have a major presence in the California market without a physical location in California. California also has an advantage in attracting business in its strongest sectors, notably in the technology industries. Access to a skilled labor pool, technology suppliers, investment capital, and research institutions leads new tech businesses to locate in California and existing tech businesses to expand here. California also has strong rail access to markets in the U.S. Midwest and East Coast, which coupled with direct access to the Pacific Rim, makes it competitive for discretionary cargo. However, California's competitiveness declines when location decisions are more flexible and cost factors rise in importance.

Surface transportation infrastructure capacity, such as those on highways, ports, rail lines, or air cargo can be overlooked when businesses are making location decisions. Businesses ordinarily assume that their incremental shipments can be handled through existing infrastructure. Facilities that require or produce large volumes of marine bulk cargo (e.g. export grain elevators) or specialized cargo (e.g. import autos) need specialized terminals with sufficient capacity. Reliability can usually be achieved, but sometimes at a higher cost. If fleet operators must add drivers and equipment, and/or allow extra time to overcome local problems, then costs can increase significantly. Notably, some parts of rural California have limited Surface Transportation Assistance Act (STAA)³ truck route access, which can reduce the ability of those areas to compete for new facilities.

Freight transportation congestion and its impacts on productivity, cost, and reliability are serious concerns for industry stakeholders. While transportation cost differences may be relatively easy to quantify, reliability differences are not. Reduced reliability requires higher inventory levels, but in most cases the greater concern is the ability to meet corporate and customer requirements consistently. Recurrent congestion reduces productivity and can affect reliability. Non-recurrent delays and congestion are more serious reliability challenges. As California's transportation facilities – highways, arterials, ports, airports, railroads, pipelines operate closer to their capacity, the frequency and severity of non-recurrent congestion tends to rise. In some parts of California, geography and land uses restrict transportation corridors. Often, there are no practical alternatives to congested routes.

Manufacturing plants have flexibility when making location decisions, either within California, other states, or other countries (e.g., Mexico). For example, manufacturing plants that need access to high-tech suppliers or California agricultural products have strong reasons to locate in California. On the other hand, manufacturing plants that use easy-to-transport inputs (e.g. electrical components) or widely available inputs (e.g., paper or basic metals) may take the full list of location factors above into account and choose locations elsewhere. The ability of the facility to locate in a wide variety of locations implies that either goods movement differences are not likely to be critical, or that there are few significant goods movement differences between locations.

Where more generic inputs such as semi-skilled labor, space, or electrical power and its reliability, are a major part of production expenses, the costs of those inputs will have a greater impact on location decisions. In this case, California's higher labor, land, or power costs – or perceptions of higher costs – place the State at a competitive disadvantage.

Local Market Facilities

Many goods movement and freight-dependent industry facilities must be located close to the market that they serve or the sources on which they rely. California does not need to compete for these local market facilities, although there may be competition between cities and counties within California. In general, businesses shipping common commodities with high transportation costs relative to their value cannot outcompete nearby competition if they have to ship commodities far distances. Concrete batch plants, for example, are distributed throughout the state to serve local markets, and cannot serve California cities from other states. Food and beverage processors, such as wineries, need to be close to agricultural producers, and many are anchored in California.

Competition for California Products and Producers

California producers and their products compete with producers and products from other states and nations. The extent and nature of that competition depends on commodity type. Some California products are differentiated by source or brand, such as Napa Valley wines, California raisins, or Tesla autos. Since customers may not see wines, raisins, or autos from elsewhere as perfect substitutes, differentiated products can often command a somewhat higher price and have a greater ability to absorb transportation and distribution cost differences without losing market share. Market demand and production volume help some California products dominate their industry and shield them from competition (such as almonds). California products that are not differentiated by source or brand must compete on delivered price and reliability of supply and are more vulnerable to lower-cost production elsewhere. See **Appendix C** for an example case study.

Competition for Distribution Centers

Distribution centers (DCs) can be national (NDCs, serving the entire nation), regional (RDCs, serving a region within the nation), or local in scope. There may also be separate import distribution centers (IDCs) handling imported goods separately from domestic goods. A state or a sub-region may compete as a potential location for a national, regional, or import DC.

RDCs in the state may also “compete” for coverage with RDCs in other states. Due to the large size of California, it is unlikely that a major retail business would serve the state without at least one RDC in the state. However, the activity level of California’s DCs may be subject to “competition” within the supply chain of various types:

- Competition for existing territory – how much of California, or the Western states, will be served from California DCs, as opposed to DCs elsewhere?
- Competition for expansion – will the firm choose to expand stores or sales in California, thus increasing volume at the California DC, or expand elsewhere?
- Competition for new territory – as a producer, importer, or retail chain expands into new markets, will California DCs serve those markets?

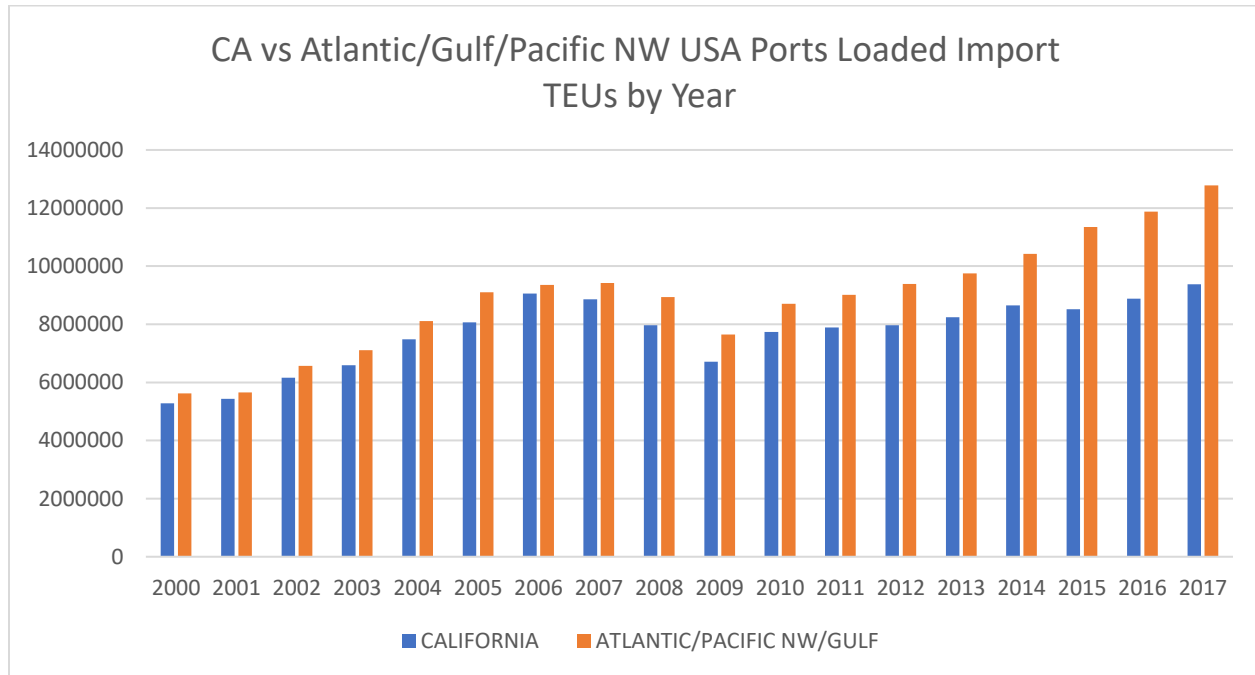
Competition for California Seaport Business

California has 12 deep water port complexes that each specialize in a different mix of major cargo types, commodities, and service territories. California also has numerous private terminals that handle liquid and dry bulk commodities. California container ports compete with other U.S. and North American ports in two ways:

- California ports compete for discretionary container traffic that moves by rail to inland U.S. destination or truck to other regions through any of its ports. For example, Los Angeles and Long Beach compete with various U.S. and Canadian ports for Asian imports to Midwestern consumer markets.⁴
- California port cities compete with other regions for the location of import DCs and their inbound trade flows. For example, Riverside County might compete with Georgia for a new import DC that would bring in goods through either Los Angeles/Long Beach or Savannah.

If businesses choose to send discretionary cargo to other ports, economic activity and employment at California ports and in the transportation sector would be at risk. If import DCs locate or expand outside of California, economic activity and employment at California DCs are also at risk, due to competition with other regions.

From 2000 through 2010, California ports combined had a 46.7 to 49.2 percent share of the loaded U.S. import container trade. From 2010 to 2017, the Atlantic, Gulf, and Pacific Northwest port share rose from 52.9 to 57.7 percent. California's market share declined within those seven years despite an increase in loaded containers (TEUs or twenty-foot equivalent units). This apparent loss of market share, shown graphically in **Figure 2.1**, has prompted concerns over the competitiveness of California's container ports⁵.

Figure 2.1. Shift in Coastal Import Shares

Source: U.S. Maritime Administration 2000-2017 U.S. Waterborne Container Trade by U.S. Customs Ports (series)

Since 2006 the total inland point intermodal (IPI) (inbound and outbound) containers through the POLA/POLB peaked at 43 percent of total POLA/POLB volume, the IPI share has declined significantly, by 31 percent (to 30 percent in 2018). In absolute terms, although total POLA/POLB volumes have increased from 15.76 million TEU to 17.5 million TEU between 2006 and 2018, the IPI volume have actually decreased by 1.6 million TEU.

The faster growth on the Atlantic and Gulf Coasts may be explained by the following:

- Strong growth in the Transatlantic/ European and Caribbean/South American trades
- Increased use of Suez Canal routings from Southeast Asia, driven in part by a shift of manufacturing and sourcing from China to countries in Southeast Asia and the Indian subcontinent (China tariff implications)
- Increased adoption of "three corner"⁶ and "four corner"⁷ logistics strategies by large importers
- A reduction in Southern California import transloading
- Rate increases on rail intermodal service, leading ocean carriers to replace some rail movements from Southern California with truck or rail movements from other ports
- Rising costs of locating and operating distribution and manufacturing facilities in California versus aggressive economic development efforts from other states
- New Panama Canal locks permitting larger, more efficient vessels on route to the Gulf and Atlantic Coasts

- Increased cost at Southern California ports due to "clean truck" requirements, PierPass/Off-Peak fees, and drayage costs increases from port and highway congestion
- Concerns over West Coast labor relations stability after the lengthy 2014-2015 dispute and accompanying shipping disruption

Of these factors, only the last two are specific to California ports; the other factors are shifts in trade patterns in the economic context in which California ports must compete. There is no publicly available information on relative costs at different container ports. The fees that marine terminal operators charge their ocean carrier customers are negotiated and embodied in confidential contracts. The rents that port authorities charge marine terminal operators are also negotiated and confidential.

Table 2.1 provides a key perspective on the relative growth of California's container port volumes. In the rapid growth era of 1990-2007, Southern California ports outperformed the nation. Much of the cargo and share growth in that period was attributable to the rapid expansion of rail intermodal container movements through San Pedro Bay in response to the introduction of double-stack rail cars. This period also saw an increase in the practice of import transloading: bringing in international containers of imported merchandise and transferring the goods to domestic containers or trailers in Southern California. Finally, this period also saw dramatic growth in U.S. imports from China, with Southern California as the leading gateway. The Port of Oakland did not benefit as much from the expansion of intermodal traffic or transloading, and Northern California TEU totals did not grow as fast.

The U.S. container ports were hit hard by the recession, with Southern California losing 24 percent of its 2007 peak volume by 2009. Following the recession, the Southern California ports rebounded slightly faster than the nation. Oakland's volume dropped by 14 percent during the recession but did not grow as quickly after partial recovery in 2010. The labor-management issues in late 2014 and early 2015 hampered recovery for all U.S. West Coast ports.

Table 2.1. Container Port Cargo Growth Rates by Volume, 1990-2017

Compound Average Growth Rate (CAGR)	1990-2007	2007-2009	2009-2017
United States	6.4%	-6.1%	4.4%
California	7.9%	-8.4%	4.3%
Northern California	8.9%	-8.9%	4.6%
Southern California	3.8%	-5.0%	2.1%
Pacific Northwest	3.6%	-8.1%	1.4%
British Columbia	11.7%	-1.3%	7.1%
Source: American Association of Port Authorities			

Competition for California Air Cargo Business

As with the State's seaports, the competitive position of California's cargo airports is largely determined by their geographic position relative to major markets. Because both domestic and international air cargo tend to be time-sensitive, shippers commonly choose airports based on the combination of ground and air transit time. Direct competition for air cargo business is largely regional:

- Oakland (OAK) and San Francisco (SFO) compete for Bay Area air cargo, with OAK prevalent in domestic and SFO in international. FedEx has major capacity at OAK. San Jose (SJC) has a smaller air cargo business.
- Sacramento (SMF) and Mather (MHR) compete for air cargo business in the Sacramento area. UPS and FedEx serve SMF while DHL and UPS serve MHR. Amazon has a fulfillment center near SMF.
- LAX and Ontario (ONT) compete for air cargo in Southern California with LAX having the dominant share. UPS has a major facility at ONT. San Diego (SAN) competes for the southern portion of the market.
- The numerous other California airports (Stockton, Merced, Fresno, etc.) are served by feeder connections to the major airports. Stockton (SCK) has recently added service by Amazon.

California airports compete with other states for hub status and for transfer/interchange freight. Hub airports host a larger number of feeder flights to and from regional airports, as well as a full schedule of flights serving other major airports and markets. The competition for West Coast hub status is primarily within California; the nearest alternatives are Portland and Las Vegas. The size of the Northern and Southern California markets, however, will keep major air cargo hub locations within the state. Major hubs may also compete for air cargo transfer/transshipment business between foreign and domestic carriers.

Air cargo is increasingly dominated by the integrated carriers such as FedEx, UPS, and DHL. To use these carriers, the customer tenders the shipment locally, and the carrier chooses the routing and the airports. California airports therefore compete mostly for the business of the integrated carriers rather than for the underlying customer choices.

With the exception of the air cargo transloading segment, which stays on the airport footprint, California's airports are not in close competition with those in other states. Goods movement mobility within the state is unlikely to affect the competitive position of California airports either nationally or internationally.

California's Cost Difference

Trucking Costs

U.S. marginal trucking costs per mile are computed by the American Transportation Research Institute (ATRI)⁸. As of 2017, ATRI estimates that the average U.S. marginal trucking cost per mile is \$1.691. The average marginal cost percentage data in **Table 2.2** indicates that fuel accounts

for 22 percent of motor carrier costs, while driver wages and benefits are 43 percent. The average semi-truck's fuel economy is about 6.8 mpg. California has relatively high diesel fuel prices, and the recent State diesel fuel tax increase of \$0.12 per gallon adds approximately \$0.02 per mile to trucking costs.

Table 2.2. Cost Comparison Chart

Motor Carrier Costs	2009	2010	2011	2012	2013	2014	2015	2016	2017
Vehicle-Based (Percentages)									
Fuel costs	28	31	35	39	38	34	26	21	22
Truck/Trailer Lease or Purchase	18	12	11	11	10	13	15	16	16
Repair & Maintenance	8	8	9	8	9	9	10	10	10
Truck Insurance Premiums	4	4	4	4	4	4	5	5	4
Tires	2	2	2	3	2	3	3	2	2
Tolls	2	1	1	1	1	1	1	2	2
Driver-Based (Percentages)									
Driver Wages	28	29	27	26	26	27	32	33	33
Driver Benefits	9	10	9	7	8	8	8	10	10
TOTAL	100	100	100	100	100	100	100	100	100
Source: ATRI, 2018									

Motor carriers within California are concerned about highway and facility congestion that reduces driver productivity, vehicle productivity, and effective capacity. This issue has received the most attention in connection with port container drayage, where longer times spent at terminals and on congested highways to-and-from terminals reduce the number and length of the trips a driver can make within Hours of Service (HOS) limits. These issues are not unique to California or to port drayage. Busy Pacific Northwest and East Coast ports have similar problems, and urban congestion affects all trucks. When in competition with less congested regions and ports such as Savannah or Charleston, however, these higher costs place California at a disadvantage. The higher cost of port drayage in California is likely to be a significant factor when choosing the location for import distribution facilities or export- oriented businesses, partially offsetting the State's advantage with close access to Asian markets.

Reducing congestion and increasing reliability is a long-term effort. The State is investing in freight transportation improvements through implementation of the Road Repair and Accountability Act of 2017, also known as Senate Bill (SB) 1. SB 1 provides stable, long-term funding for both state and local transportation infrastructure. SB 1 projects an estimated average of \$5.4 billion per year over the next ten years for a strategic mix of state and local transportation projects, depending on tax and fee revenue. The current budget provides \$4.8 billion in new SB 1 funding, of which \$300 million per year is available to improve trade corridors, and \$250 million per year is available to increase throughput on congested corridors.

Railroad Costs

California is served by two Class 1 railroads: BNSF and UPRR. The two railroads have extensive networks across Western states, with connection to other railroads at Midwestern gateways and Canada and Mexico. Their rates and services would not ordinarily effect competitiveness with other states. For California's short line railroads, these predominately operate within the state. Similar to Class 1 railroads, short line rates are under confidential, negotiated contracts rather than under published tariffs. It is important for the State to continue to support short line rail operations, as their operations reduces the number of trucks on the roadway. Caltrans efforts to support multi-modal freight mobility include the development of the California Sustainable Action Plan, the State Rail Plan, and the CFMP 2020. Caltrans is also leading the development of a Short line Rail Plan to develop a vision of this system.

Railroad operating costs may be slightly higher in California than in other states. There has been a series of CARB actions designed to reduce emissions from both line-haul and yard operations driven by federal requirements. These include increased use of low-sulphur fuel; low-emission, high-efficiency road locomotives; and hybrid and other low-emission switching locomotives. Some of these costs have been offset by grants, such as those under the Carl Moyer program. Recently, the railroads have been acquiring low-emission locomotives for use across their systems. Over time, higher capital costs will likely be offset by lower operating costs.

Ocean Shipping Costs

The ocean shipping rates paid by customers include the cost of vessel operations, the cost of terminal operations, fees assessed by ports, canal tolls, and ocean carrier overhead. All West Coast port terminals in North America are covered by the same basic labor contract, and many are operated by the same firms. The ports' own charges tend to be highly competitive. Vessels calling California ports do incur higher costs for low-sulphur fuel and cold-ironing. Almost all relevant rates and fees are contained in confidential, negotiated contracts. Assembling a quantitative comparison from available data is currently not possible.

Air Cargo Costs

The air cargo industry is dominated by the integrated carriers, FedEx, DHL, and UPS, and trailed by smaller air freight forwarders and airlines offering belly cargo space on passenger flights. Air cargo operations in California have similar costs as in other states, and California customers likely face similar rates for air cargo service.

Land Costs

As **Figure 2.2** shows, California median earnings for transportation and material moving occupations and for production occupations, are comparable or even lower than other regions. California ranks first in a national study⁹ of total land valuation according to the U.S. Bureau of Economic Analysis. The study estimated the combined value of all land in the country and found that California accounts for 17 percent of the total value of the land in the 48 contiguous states. High land values can be attractive for investors but can discourage development of facilities which could locate less expensively elsewhere. Commercial and industrial land prices are driven up by the value of land in residential development. In California, residential land

values as a percentage of total property values have increased substantially over the last 40 years.

Energy and Utility Costs

The price of petroleum gas, water, diesel, natural gas, and electricity affect California’s competitiveness for business locations and freight movement. Energy and utility costs including electricity and water, can be prominent factors in facility operating costs and impacts the decision-making processes for facility locations. These factors become more important for facilities that use electric power for lighting, climate control, and production equipment, and water for processing. These costs also affect the cost of living for employees.

Figure 2.2. Median Earnings Comparison, 2016



Source: Massachusetts Institute of Technology Living Wage Calculator

California
Competing Regions Median

California’s average commercial, industrial, and residential electric power rates are high compared with most other states. According to the U.S. Energy Information Agency (EIA), in 2018, California had the fifth highest average commercial electricity rates, the sixth highest average industrial electricity rates, and the seventh highest average residential electricity rates. California's average commercial electricity rates over the course of a year study were 59 percent higher, average industrial electricity rates were 100

percent higher, and average residential electricity rates were 49 percent higher than the average of all other states in the nation for this period¹⁰.

The higher industrial electric power rates combined with near-zero emissions equipment mandates at port terminals may lead to higher costs for terminal operators. Diesel fuel prices are an especially important factor in freight transportation, as the freight industry still heavily depends on diesel-powered trucks and rail locomotives. Compared with other states, California's average diesel fuel prices are usually second-highest, behind only Hawaii. In September 2018, for example, the average diesel fuel price in California was \$0.86 higher than the average for the other states, a 27 percent difference¹¹.

Average natural gas prices for transportation, building heating, and industrial process use are also higher in California than in other states. The U.S. EIA reports that for the 12 months ending in July 2018, California's average residential natural gas rates were 16 percent higher than the average for other states. In the same period, California's average natural gas rates for commercial customers were seven percent higher than the average for the rest of the U.S., while industrial natural gas customers in California paid an average natural gas rate 77 percent higher than the average for the rest of the country.

Comparative Distribution Center Costs

The combined impact of these various cost factors is evident in total operating costs for distribution centers or other industrial facilities. **Table 2.3** compares the cost factors for potential distribution center locations. Warehouse operating costs were scaled to a hypothetical 500,000 sq. ft. facility employing 150 nonexempt workers and shipping over-the-road to the nearest intermodal and port city¹². As **Table 2.3** indicates, California locations had the highest annual combined costs except for a few locations in the Northeast and Idaho. The estimate for Tracy, for example, was 16 percent higher than in Cordele, GA, and the company would save \$1.85 million annually by choosing Cordele over Tracy. More detailed analysis and information is provided in the **Appendix C**.

Table 2.3. Distribution Center Operating Cost Ranking, 2015

Rank	Distribution Warehouse Location	Total Annual Operation Costs
1	Stoughton, MA	\$15,018,230
2	Meadowlands, NJ	\$14,631,975
3	Idaho Falls, ID	\$14,576,733
4	Bordentown, NJ	\$14,273,497
5	Newburgh, NY	\$13,660,758
6	Tracy, CA	\$13,302,372
7	Patterson, CA	\$13,104,947
8	Hesperia, CA	\$12,937,809
9	Apple Valley, CA	\$12,923,646
10	Victorville, CA	\$12,913,886
11	Mira Loma, CA	\$12,912,925
12	Bethlehem, PA	\$12,894,630
13	Casa Grande, AZ	\$12,694,040
14	Miramar, FL	\$12,573,879
15	Kent, WA	\$12,490,728
16	Mesquite, NV	\$12,490,074
17	York, PA	\$12,120,409
18	Kingman, AZ	\$11,936,644
19	Springfield, OR	\$11,935,905
20	Fernley, NV	\$11,899,135
21	Columbia, SC	\$11,728,259
22	Humble, TX	\$11,661,803
23	Cordele, GA	\$11,450,594
24	Ritzville, WA	\$11,351,481
25	Chesterfield, VA	\$11,238,491
Source: Comparative Distribution Warehousing Costs in Port and Intermodal-Proximate Cities, 2015 Boyd Company, Inc.		

Perceptions of California's Business Climate

As a part of the CFMP 2020 outreach and engagement efforts (**Appendix H**), many of the freight industry stakeholders contacted perceive an “anti- business” attitude in California, and see that attitude manifest in environmental regulations, high taxes and fees, and opposition to facility development. Opinions and concerns over California’s friendliness to business are evident in state rankings on the ease of doing business, or as places to start a business.

Examples include the following:

- WalletHub, a personal finance company used a variety of statistics to rank states as places to start a business. Although California ranked 8th overall, it lagged behind states such as Texas and Georgia, which are making strong efforts to attract firms. California ranked 46th in business costs¹³.
- USA Today placed California 15th among the best states in which to do business¹⁴.
- A 2018 CNBC poll placed California 25th among “America’s Top States for Business.”¹⁵ California was ranked: 12th on workforce, 24th on infrastructure, 48th on cost of doing business, 11th on the economy, 21st on quality of life, and 1st on technology.
- A 2018 ranking by Area Development did not list California among the Top 20 States for Doing Business¹⁶.
- A 2009 study by the Public Policy Institute of California¹⁷ found that California typically ranks highly on productivity, but poorly in terms of taxes and costs.

California may be viewed as a magnet for high-tech research and product development, with superlative access to venture capital and expertise, however, for wholesaler seeking to build distribution center and warehousing developments, access to markets, cost, and reliability are key factors for these types of investments.

Competitive Economic Development

Industry outreach efforts have revealed opportunities for California’s economic development efforts and the linkage of those efforts to goods movement, logistics, and freight transportation infrastructure. In fiscal year 2016, California ranked forty-eighth among the 50 states for state spending on economic development and related functions, as compiled by the Council for Community and Economic Research. Higher spending by the Southeast states is noteworthy and paralleled with strong economic development in that region.

Examples of aggressive economic development initiatives are described in **Appendix C** and include such examples as Georgia’s economic development efforts with the Port of Savannah and Canada’s Asia Pacific Gateway initiative. These initiatives attract cargo flows, manufacturing plants, distribution centers, and jobs away from California.

Implications for Competitiveness and Potential Improvements

Competitiveness is a matter of degree rather than a dichotomy. California’s competitiveness varies depending on the type of decision being made, the industry sector and products involved, and the location within California.

- California is highly competitive in sectors where its resources, products, markets, and capabilities are difficult to match elsewhere. Examples include unique agricultural products and high-technology research and development. While freight mobility is a minor factor in some of these sectors, mobility needs must also be considered due to the time-sensitivity or high-volume movement of these goods
- California is much less competitive for businesses or functions that can be readily located elsewhere and that are vulnerable to high transportation, labor, land, or utility costs. Distribution is one such sector, and distribution centers that do not need to be

near California markets or ports are increasingly likely to locate elsewhere. Freight mobility can be a significant factor in such sectors.

California is currently attracting and will continue to attract business activity tied to specific state industry clusters, such as the high-tech or green energy sectors. California is in a unique or advantageous competitive position in those cases. The State is also experiencing and will continue to experience "organic" growth in businesses and establishments serving the population. For the most part, businesses seeking to serve California customers will continue to have a physical presence in the State.

Some of the perceived losses of economic activity and market share are resultant of exogenous logistics developments and strategies. Wider Panama Canal locks have reduced the cost of shipping from Asia to the East Coast compared to the West Coast, and port market shares have shifted in response. As import volumes grow and import supply chains mature, importers have established multiple import routes and facilities, again reducing California's market share.

The measures and initiatives that can improve California's competitiveness through increased capacity efficiency, reliability, and efficiency are the same as those that can improve performance for California's own needs. For example, public agencies might improve the state's competitiveness on trucking costs by:

- Increasing capacity efficiency on state highways and local roads to reduce congestion
- Deploying ITS technologies to reduce congestion and trucking costs
- Providing greater financial assistance to ease emissions limits, clean truck requirements, and clean fuel taxes (alignment to State objectives)
- Reducing truck driver time spent at marine terminals and other freight facilities
- Improving truck driver training to increase the supply of drivers
- Increasing the supply of truck parking in public locations

The State's competitiveness is effected by several non-transportation factors identified through the CFMP industry focus groups. These factors include the following:

- Workforce availability and cost of living
- Land and development costs and uncertainty
- Environmental regulations
- Lack of linkage between goods movement and economic development efforts

Increased competitiveness in these areas will require policy initiatives and actions outside of the freight transportation sphere.

Freight Carrier Industry Workforce

Workforce

America's workforce is experiencing significant changes as "baby boomers", people born between 1944 and 1964, continue to retire, and with many retiring early. Seventy million people are estimated to retire in the U.S. within the next decade, which will have massive

impacts on industries and economy throughout the country. As companies address the issue of an aging workforce, some companies are implementing retention and succession planning, as well as additional incentive strategies, such as job-sharing, flextime, telecommuting, and part-time work. All levels of employment are undergoing constant change and face great challenges and opportunities as new technologies are developed and are applied throughout the freight industry. Freight modal, supply chain, and logistics industries will need to implement more transitional training to reskill displaced workers.

Trucking

Truck driver employment falls into following categories: Delivery Driver, Driver, Line Haul Driver, Log Truck Driver, Over the Road Driver (OTR Driver), Production Truck Driver, Road Driver, Semi Truck Driver, and Tractor Trailer Operator. In 2017, the California workforce consisted of 136,920 Heavy and Tractor-Trailer truck drivers. The majority of those drivers work in the Los Angeles-Long Beach-Glendale Metropolitan Division and the Riverside-San Bernardino-Ontario Metropolitan Statistical Area (MSA), with 34,800 and 25,290 employed respectively. Between the years of 2016 and 2026, the U.S. Department of Labor projects 18,200 annual job openings for Heavy and Tractor-Trailer truck drivers. With stricter enforcement of HOS regulation, the industry will need more drivers and trucks to do the same amount of work due to the need for breaks and limited HOS flexibility.

Drivers are either paid a salary, paid hourly, or paid by the mile. Drivers specializing in heavy hauling or hauling low boys (low deck semi-trailers with a drop-in deck height), household moving services, cattle, hazardous materials, or refrigerated units are often paid more. For trucking companies that are unionized, employees are typically represented by the International Brotherhood of Teamsters Union. As of May 2017, California's median yearly wage for a Heavy and Tractor-Trailer truck driver was \$45,560¹⁸. Variability and differences in local minimum wage laws creates monitoring and compliance challenges since drivers may be subjected to multiple minimum wages during a single trip.

According to a March 2019 Journal of Commerce (JOC) article¹⁹, the average driver turnover rate at large truckload carriers (those with more than \$30 million in annual revenue) was 98 percent in the second quarter, 87 percent in the third quarter, and 78 percent in the fourth quarter. A carrier with 100 drivers and an 87 percent turnover rate could spend nearly \$500,000 on recruitment and replacement annually. Carriers are focusing on truck driver development, not just recruitment, to gain greater control over the stability and quality of their workforce and capacity, while reducing driver turnover rates.

At the same time, trucking firms are raising driver pay--sometimes multiple times in a year. In the U.S., the average age of a commercial truck driver is 55. Currently, there are roughly 30,000 unfilled truck driving jobs, and these numbers will continue to climb. The current long-haul driver shortage is due to an 18-year low U.S. employment rate of 3.7 percent (as of October 2018), as well as higher-paying employment alternatives to truck driving form a barrier to recruitment. According to the U.S. Bureau of Labor and Statistics (BLS), the economy added on average 213,000 non-farm jobs a month in 2018. However, employment in transportation and

warehousing only increased by 184,000. Driver shortage and turnover is a function of California's high cost of living, insurance costs, regulations, lack of experienced drivers, and interested but unqualified persons. Many trucking companies are actively recruiting military veterans, and many truck driving schools are also actively recruiting veterans to get training for their commercial driver's license using the Servicemen's Readjustment Act of 1944 (also known informally as the GI Bill) or other veteran's educational benefits. Formal education is not a requirement for seeking and obtaining a truck driver position. However, important skills and knowledge are necessary.

Lastly, truck parking availability also contribute to truck driver demand. Due to state and federal HOS regulations, truck drivers spend a significant amount of time searching for authorized parking, thereby reducing the productivity of the trip. By increasing truck parking availability, there will be greater truck driver efficiency that may reduce the demand for truck drivers.

Rail

The railroad industry's response to the aging workforce is to actively recruit military veterans for both Class I and short line railroads. Veterans transition favorably to rail positions because they respond well to a chain of command, have experience working in teams, can either bring a unique skill set or modify their skill sets to meet rail industry needs, and importantly, have been well-trained for safety. According to the American Association of Railroads (AAR), nearly 20 percent of current U.S. railroad employees are veterans²⁰. Sacramento City College and San Diego City College (SDCC) offer Railroad Operations associate degrees and certificate programs, SDCC offers an apprenticeship program in Railroad and Light Rail Operations, and apprenticeship programs and web-based training are offered by various organizations, such as the International Union of Operating Engineers and the Teamsters Apprenticeship Fund for Southern California.

The Class I and short line railroads provide railroad careers that tend to be relatively stable. Railroad employees are also among the best-paid workers in American industry. However, some short line railroads find it difficult to recruit employees due to the requirement for multiple skills and lower wages than Class I railroads. America's major freight railroads supports 1.5 million jobs, nearly \$274 billion in output, and \$88 billion in wages across the U.S. economy²¹.

Currently, California is home to 8,153 freight railroad employees, with an average wage and benefits package of \$123,400 per employee²². According to AAR, in 2017, there were approximately 165,000 freight railroad employees in the U.S., and the average U.S. Class I freight railroad employee earned \$125,400 (including fringe benefits). Approximately 82 percent of Class I rail employees and more than half of non-Class I rail employees are unionized under one of more than a dozen labor unions. Labor relations in the rail industry are subject to the Railway Labor Act (RLA). Under the RLA, labor contracts do not expire. Rather, they remain in effect until modified by the parties involved through a complex negotiation process which can take years to conclude.

Maritime

Maritime careers include shipping and transportation, navigation, engineers, offshore operations, technology, shipbuilding and repair, port and marine terminal operations, clerical, and others. In the ocean shipping industry, two primary organizations represent labor and cargo carriers on the West Coast ports. Labor is represented by the International Longshore and Warehouse Union (ILWU). Domestic carriers, international carriers, and stevedores that operate in California, Oregon, and Washington are represented by the Pacific Maritime Association (PMA). Members of the PMA hire workers represented by the ILWU. PMA members employ longshore, clerk, and foreman workers along with thousands of “casual” workers, who typically work part-time.

The terms of employment are governed by labor contracts that are periodically negotiated between the two organizations, and the results are applied to all U.S. West Coast ports. Similar processes and organizations are found in the country’s other maritime regions. When agreements cannot be reached, as happened in 2002 on the West Coast, strikes or lockouts can occur, which may severely disrupt the entire freight movement system and sometimes have lasting impacts as shippers permanently redirect their products to ports in other regions or countries. Tens of thousands of trucking, railroad, warehouse, and support workers may be temporarily out of work because strikes and lockouts stop the flow of goods that other sectors handle. The 2002 dispute was estimated to cost the U.S. economy \$1 billion per day.

As of December 2017, PMA members employed 13,985 registered union workers at 29 West Coast ports in California, Oregon, and Washington, and thousands more workers who typically worked part-time. Since the signing of the 2002 agreement that brought the widespread use of technology to the West Coast, the registered workforce has increased by 36 percent.

A major issue that promises to become more prevalent and complex over time is the implementation of cargo handling automation. Much of this technology is already in place in other countries, particularly in Asia and Europe, where, in some locations, highly automated terminal operations already handle cargo and require fewer people to operate. Some ports in California already have, or are planning to implement, various degrees of automation. The automation trend is likely to accelerate.

The Maritime Administration nationally provides limited funding to six state maritime academies. One such academy, the California Maritime Academy (Academy), is part of the California State University System and is the only Maritime Academy on the West Coast. The Academy prepares students for careers in international business and logistics, marine engineering technology, global studies and maritime affairs, marine transportation, mechanical engineering, and facilities engineering technology. The nation’s maritime academies educate young men and women for service in the American merchant marine, the U.S. Armed Forces, and in the nation’s intermodal transportation system. Located in Vallejo, the Academy’s enrollment is currently at approximately 1,017 students (as of Fall 2018).

Air Cargo

In the aeronautics industry, the Federal Aviation Administration (FAA) increased the retirement age from the previous mandatory retirement at 55 years old to 65 years old for scheduled pilots. The FAA also instituted a new rule requiring scheduled pilots to get a minimum amount of uninterrupted rest – at least 10 hours between shifts. This will impact the movement of belly cargo, but the rule does not apply to cargo pilots. Many cargo pilots are pushing to be included in this regulation; however, the FAA has not yet applied this to the cargo industry and is still considering the matter. Consensus across the industry (pilots, air traffic controllers, airport managers, etc.) appears to be that the rate of retirement may hinder the development and operations of aviation activity. The FAA uses the Veterans Recruitment Appointment (VRA) program, which acts as a hiring authority to expedite the hires of veterans.

The air cargo pilot employment falls into at least three different categories: Airline Pilots, Copilots, and Flight Engineers. The definition includes, “Pilot and navigate the flight of fixed-wing, multi-engine aircraft, usually on scheduled air carrier routes, for the transport of passengers and cargo. Requires Federal Air Transport Pilot certificate and rating for specific aircraft type used. Includes regional, national, and international airline pilots and flight instructors of airline pilots.” In 2018, the annual mean wage for California airline pilots, copilots, and flight engineers was \$205,520. The mean wage across the U.S. was \$169,560.²³ The projected annual job openings between 2016 and 2026 is 940 jobs within California, and 8,100 jobs across the U.S. As of 2016, there were 8,600 airline pilots in California and 84,000 in the U.S.

California’s freight industry needs to increase efficiency to remain economically competitive, and to improve environmental sustainability while retaining high paying jobs and educating/increasing training for the freight industry workforce so that the industry can successfully transition for continued success going forward.

Freight Dependent and Support Industry Workforce

Freight plays a significant role in supporting California’s \$2.75 trillion economy. Technology and the use of artificial intelligence (AI) can increase productivity, cut operation costs, and increase a customer’s experience and satisfaction. All industries rely on safe and efficient movement of goods, whether by road, sea, rail, or air. There are some industries, however, where this movement is essential to the sector’s competitiveness and ability to operate. According to the Southern California Association of Governments (SCAG), “goods movement-dependent industries are defined as industries that operate frequent inbound and outbound freight vehicle trips and costs associated with goods movement, and the also have sizable impact on their business expenses. Key industries include construction, manufacturing, wholesale trade, retail trade, and transportation and warehousing.”²⁴ Altogether, these industries employed roughly 5.2 million Californians in 2018, which grew compared to 2017 employment figures. The California agriculture industry is also heavily reliant on efficient and dependable freight transportation. These industries rely upon agriculture products, raw materials, semi-finished

and finished products to warehouse, and processing distribution centers before they are moved to final locations to be consumed.

Construction

The construction industry was hardest hit during the Great Recession. The industry has rebounded in recent years as the economy continues to grow. In 2017, the California construction industry employed 893,094 people and its GDP was valued at \$65 billion.

The passage of SB 1 in 2018 helped secure additional funding for local and regional transportation projects, which in turn helps the construction industry. The State will need to ensure that funding continues to keep pace with the level of maintenance required and that the freight transportation system continues to operate.

Transportation and Warehousing

The transportation and warehousing sectors currently employ 600,618 Californians. The warehousing jobs that make up this sector rely on freight movement to receive and ship goods to and from the warehouses and storage facilities. Warehousing is meant to act as a storage facility and intermediary between the various links in a supply chain. Warehousing incorporates diverse purposes, such as storage, bulk storage, and transloading. Warehouses can also be distribution centers, where functions such as sorting, palletizing, pick and packing, labelling, assembly, and wrapping of goods occur before shipment to retailers or consumers directly. Warehousing relies on efficient, reliable, and resilient transportation to ensure prompt delivery and pick-up of goods. Efficient goods movement ensures that warehouse capacity is neither over-filled nor empty, otherwise it will result in monetary losses by the warehouse operators and it will negatively disrupt downstream operations.

Endnotes

- ¹ America's Top Trading Partners
<https://money.cnn.com/interactive/news/economy/how-us-trade-stacks-up/index.html?iid=EL>
- ² State Exports from California
<https://www.census.gov/foreign-trade/statistics/state/data/ca.html>
- ³ Note: Surface Transportation Assistance Act (STAA), 1982. Allows large trucks to operate on the Interstate and certain primary routes called collectively the National Network. These trucks, referred to as STAA trucks, are longer than California legal trucks. As a result, STAA trucks have a larger turning radius than most local roads can accommodate. Other states allow STAA vehicles on all roads where they are not expressly prohibited. California allows STAA vehicles only on roads where they are expressly permitted.
- ⁴ Note: Discretionary cargo is maritime cargo for which the United States port of unloading is different than the United States port of entry. This means that shippers have the discretion to bring the cargo through almost any port in the United States because the cargo is not bound to any particular location. Cargo can be moved to final destinations across the country using the intermodal transportation system.
- ⁵ "U.S. Waterborne Foreign Container Trade by U.S. Customs Ports 2000 – 2017." *United States Department of Transportation, MARAD (Maritime Administration)*.
<https://maritime.dot.gov/data-reports/data-statistics/us-waterborne-foreign-container-trade-us-customs-ports-2000-%E2%80%93-2017>.
- ⁶ Note: Using three import ports, such as Los Angeles, Savannah, and New York-New Jersey
- ⁷ Note: Using four import ports, such as Los Angeles, Seattle, Savannah, and New York-New Jersey
- ⁸ "An Analysis of the Operational Costs of Trucking: 2018 Update". *American Transportation Research Institute*. October 2018. Print.
- ⁹ Larson, William, "New Estimates of Value of Land of the United States," U.S. Bureau of Economic Analysis, 2015. The estimated values were aggregated from valuation of different property types, including agricultural areas, federal land, and developed suburban and urban areas.
- ¹⁰ "Electric Power Monthly Average Price of Electricity to Ultimate Customers by End-User Sector Report". *U.S. Energy Information Administration Independent Statistics and Analysis*. <https://eia.gov>.
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- ¹³ McCann, Adam. "Best and Worst States to Start a Business." *WalletHub*. July 8, 2019.
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- ¹⁵ "America's Top States for Business 2018." *CNBC*. July 10, 2018.
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- ¹⁶ Gambale, Geraldine. “2018 Top States for Doing Business: Georgia Ranks #1 Fifth Year in a Row.” *Area Development*. <https://www.areadevelopment.com/Top-States-for-Doing-Business/Q3-2018/overall-results-georgia-ranked-top-state-by-site-selection-consultants.shtml>.
- ¹⁷ Kolko, Jed, David Neumark, and Marisol Cuellar Mejia. “Business Climate Rankings and the California Economy”. *PPIC*. 2009. Print.
- ¹⁸ “Occupational Employment and Wages, May 2017.” *United States Department of Labor, Bureau of Labor Statistics*. March 30, 2018. <https://www.bls.gov/oes/2017/may/oes533032.htm#nat>.
- ¹⁹ Cassidy, William, B. “Pay hikes cut US driver turnover at big truck fleets.” *Journal of Commerce*. October 30, 2019. https://www.joc.com/trucking-logistics/labor/pay-hikes-cut-truckload-driver-turnover-big-fleets_20190314.html.
- ²⁰ “Railroad Jobs: A Highly Skilled & Compensated Workforce.” *Association of American Railroads*. <https://www.aar.org/wp-content/uploads/2019/10/AAR-Railroad-Jobs-Issue.pdf>.
- ²¹ “Overview of America’s Freight Railroads.” *Association of American Railroads*. October 2018. <https://www.aar.org/wp-content/uploads/2018/05/AAR-Overview-Americas-Freight-Railroads.pdf>.
- ²² “U.S. Freight & International Trade Stats.” *Association of American Railroads*. February 2019. https://img1.wsimg.com/blobby/go/29e544b6-eb7c-4706-9d4f-78d8700070f6/downloads/Notes%20on%20Freight_Intl%20Trade%206-19.pdf?ver=1561742750285.
- ²³ U.S. Bureau of Labor Statistic <https://www.bls.gov/ooh/transportation-and-material-moving/airline-and-commercial-pilots.htm#tab-1>
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Chapter 3: Existing Freight Assets & System Performance Needs Assessment

- A. Existing Freight System Assets
- B. Freight System Performance Assessment

3.A. Existing Freight System Assets

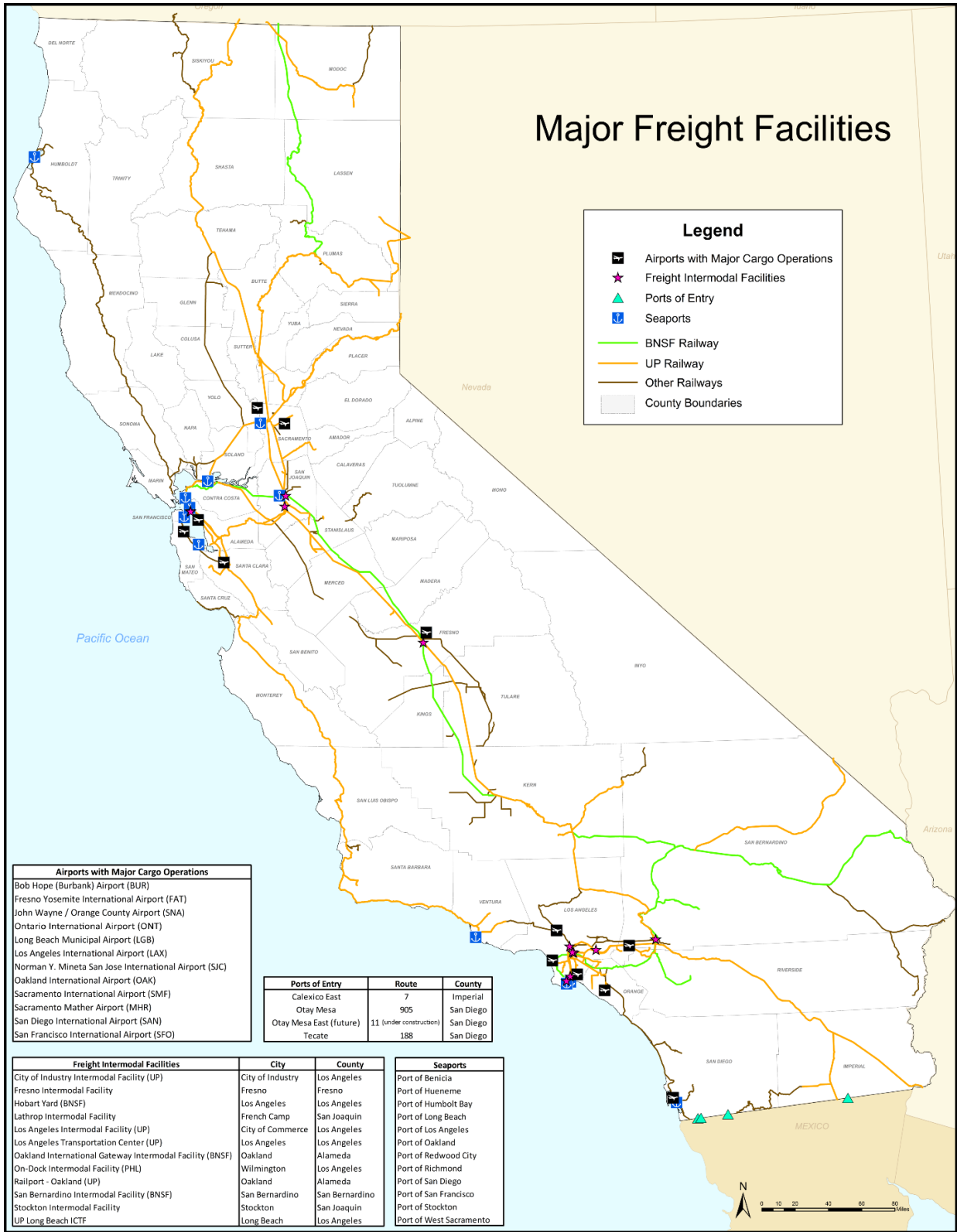
California has one of the most extensive, complex, and interconnected freight systems in the nation. With a rich history of freight infrastructure development dating to the opening of the first transcontinental railroad in 1869, California's freight network has become a vital economic force that connects the state to the rest of the country and the world. According to the California Chamber of Commerce, California's economy is the 5th largest in the world, and the State's freight network plays a major role in securing its global economic position.¹

In 2018, California exported to 230 foreign markets, valued at approximately \$178 billion,² up from \$172 billion in 2017 and \$163.5 billion in 2016.³ The freight system also facilitates commerce internally. The State's current core freight system is comprised of 1 private and 11 public and deep-water seaports, numerous private port and terminal facilities, 12 airports with major cargo operations, 2 Class I railroads and 27 short line railroads operating over approximately 6,500 miles of railroad track, approximately 5,800 miles of high traffic volume Interstate and State highways, seven existing and one future commercial land border ports of entry (POE) with Mexico, intermodal transfer facilities, approximately 19,390 miles of hazardous liquid (includes crude oil, refined petroleum products, and other highly volatile liquids) and natural gas pipelines, a vast warehousing and distribution sector, and numerous local connector roads that complete the "last mile."

Maintaining and modernizing this extensive freight system requires continuous investment. Ports and their navigation channels must be dredged for ever larger ships; railroad track must be upgraded to handle heavier loads and faster trains; highway pavement must be strengthened to handle more trucks with more cargo; airports must balance passenger and air-freight demands; and innovative technologies must be developed and applied across the entire industry to improve efficiency and reduce costs. California must meet these daunting needs while also ensuring community and environmental impacts are avoided, minimized, or mitigated. At the same time, California must also meet the challenge of maintaining international competitiveness and retaining millions of freight related jobs.

California's freight assets include an extensive inventory of infrastructure that is essential for supporting the multitude and diversity of freight dependent industries within the state. The smooth functioning of California's complex freight system depends on a series of interconnected facilities working in concert with one another. Each system component is typically owned and operated by a different public or private organization, often in competition with other organizations that have similar facilities. Seaports compete against each other for domestic and international business. The Class I railroads that serve California are the nation's two largest railroads and are competitors, yet they also often coordinate their operations to safely share the same track. And like the railroads, each trucking company is in competition with many other trucking and logistics firms and owner/operators. Still, the whole system works remarkably well due to a web of cooperative relationships and partnerships. **Figure 3A.1** highlights California's major freight facilities.

Figure 3A.1. California's Major Freight Facilities



Source: Caltrans 2020

National Highway System (NHS)

According to the FHWA, the National Highway System⁴ consists of roadways important to the nation's economy, defense, and mobility. The NHS includes the following subsystems of roadways (note, a specific highway route may be on more than one subsystem):

- Interstate: The Eisenhower Interstate System of highways retains its separate identity within the NHS.
- Other Principal Arterials: These are highways in rural and urban areas which provide access between an arterial and a major port, airport, public transportation facility, or other intermodal transportation facility.
- Strategic Highway Network (STRAHNET): This is a network of highways which are important to the United States' strategic defense policy and which provide defense access, continuity and emergency capabilities for defense purposes.
- Major Strategic Highway Network Connectors: These are highways which provide access between major military installations and highways which are part of the Strategic Highway Network.
- Intermodal Connectors: These highways provide access between major intermodal facilities and the other four subsystems making up the National Highway System. Within California, there are currently 122 miles.⁵

National Highway Freight Network in California

The National Highway Freight Network (NHFN) consists of the following subcategories: The Primary Highway Freight System (PHFS) including routes and connectors, portions of the Interstate System not part of the PHFS (non-PHFS), Critical Rural Freight Corridors (CRFC), and Critical Urban Freight Corridors (CUFC). The CRFCs and CUFCs are important freight corridors that provide critical connectivity to the NHFN. **Table 3A.1** shows the four California freight systems and their respective total lengths in miles. The full list of routes and facilities that comprise the various systems is presented in **Appendix D**.

One of the more dynamic components advised through the FAST Act is the process of designating the critical corridors initiated by Metropolitan Planning Organizations (MPO) for CUFCs and initiated by Caltrans for CRFCs. Designating CUFCs and CRFCs is a collaborative effort and all miles must be certified by the FHWA. For the CUFC/CRFC Designation Process, refer to **Appendix E**.

Table 3A.1. National Highway Freight Network in California⁶

Freight System	Total Length (Miles)
California Primary Highway Freight System (PHFS)	3117.72
<i>California PHFS Routes</i>	<i>3053.71</i>
<i>California PHFS Intermodal Connectors</i>	<i>64.01</i>
California Non-PHFS Interstate Highway	362.64
Critical Urban Freight Corridors	162.08
Critical Rural Freight Corridors	44.5

As stated above, California has a vast inventory of freight assets, allowing the State to support various freight dependent industries and making it a top competitor with neighboring states such as, Oregon, Nevada, and Arizona. **Table 3A.2** compares California’s PHFS miles, Truck VMT, and Rail Miles with its neighboring states.

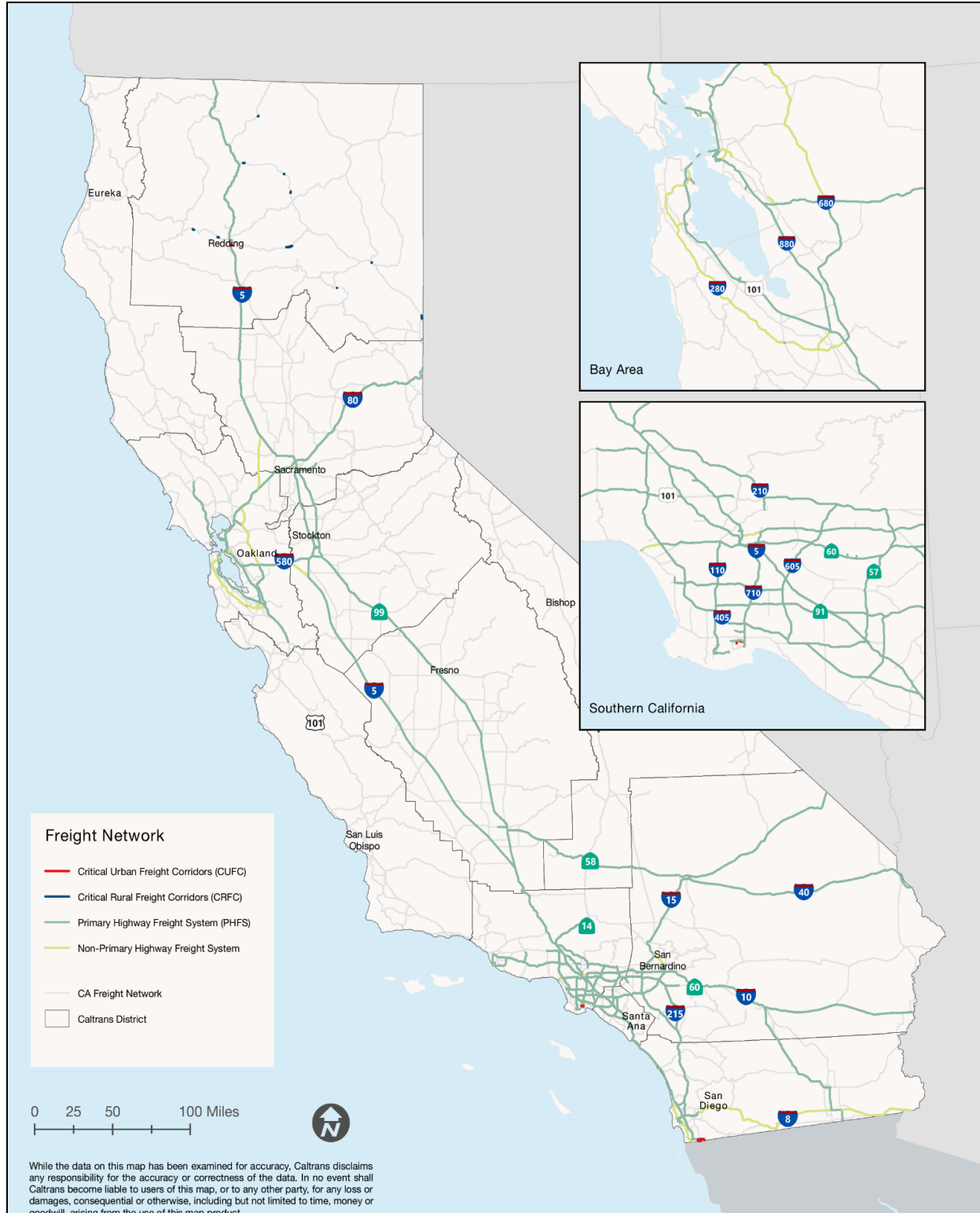
Table 3A.2. California’s Freight Movement Compared to Neighboring States

State	PHFS (Miles) ⁷	Truck VMT* (% of State’s total VMT) ⁸	Rail Miles ⁹
California	3117.72	20.9%	4,828
Oregon	775.32	32.1%	2,382
Nevada	572.79	21.4%	1,193
Arizona	1025.62	24.9%	1,820
*Truck VMT are listed as a percentage of the respective State’s total VMT			

Intermodal connections are an essential consideration in the discussion of freight movement within California. These connections provide access to intermodal facilities where transloading of freight occurs between multiple modes, allowing for the least amount of handling and overall delay. Intermodal connectors are generally associated with airports, seaports, rail yards, and warehousing facilities where the transfer of freight is completed on-site. The access to and from these intermodal facilities is typically located along local roadways which connect to Interstate and State Highway freight corridors and serve as the “last mile” for freight movement.

Often these local arterials and roadways have not been designed to accommodate the largest combination vehicles and are not designated Surface Transportation Assistance Act (STAA) routes. The STAA directs US DOT to create the National Network (NN) where States would be required to allow the operation of tractors with single and double trailers; it covers about 150,000 miles.¹⁰ Additionally, they are not engineered to accommodate the amount of Average Annual Daily Truck Traffic (AADTT) that exists on the roadway either. Despite this, some of the roadways have among the highest AADTTs in the state. Many of the environmental and community impacts from freight can be most prevalent along these local intermodal connectors shown in **Table D.2** in **Appendix D**. In addition, **Table D.4** in **Appendix D** lists California’s freight intermodal connectors organized by type (truck/rail, truck/pipeline, port terminal, and airport) designated on the NHS.

Figure 3A.2. National Highway Freight Network in California



Source: Map produced using data from FHWA Freight Management and Operations, 2018

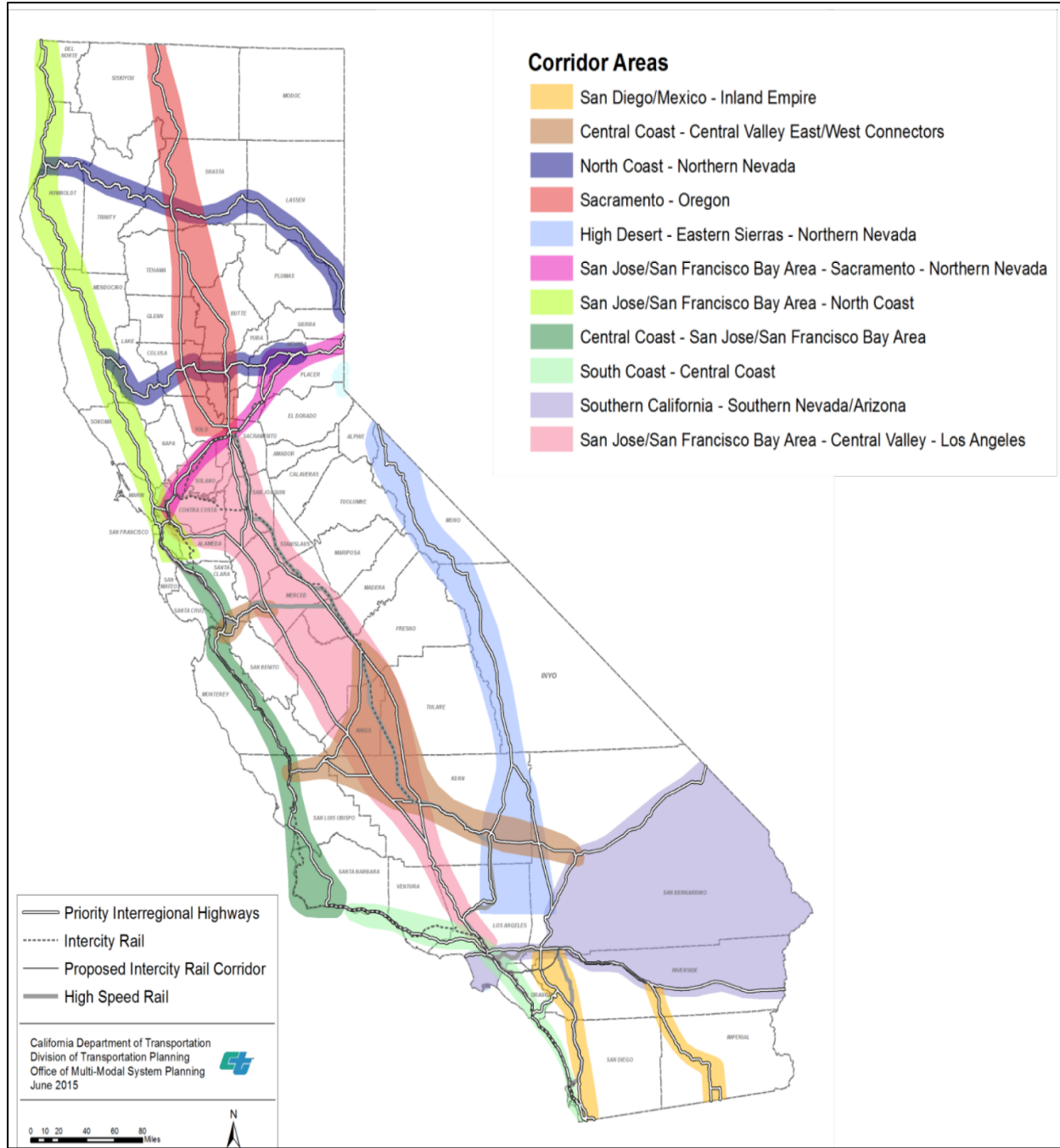
Interregional Transportation Strategic Plan (ITSP) 2015¹¹

The ITSP provides guidance for the identification and prioritization of interregional transportation improvements. Projects identified are eligible for Interregional Transportation Improvement Program (ITIP) funding. The 2015 ITSP expanded the analysis from focusing on ITIP investment in interregional highways and intercity rail to analyzing the entire interregional transportation system regardless of funding source. The purpose of the ITSP is to be a guiding document for all investments in the interregional transportation system. The 11 ITSP Strategic Interregional Corridors comprise a subset of legislatively designated interregional routes, known as the Interregional Road System (IRRS). California's IRRS includes key corridors for the movement of freight and people within the state and is currently considered Caltrans' priority for the allocation of interregional funds. **Figure 3A.3.**¹² shows all Strategic Interregional Corridor areas identified on California's Highway Freight Network.¹³

Although Caltrans has designated the Strategic Interregional Corridors for funding priority, funding has not kept pace with the costs of meeting growth demands and improving system performance and safety; the estimated cost to improve selected locations on this highway system in most of the 11 Strategic Interregional Corridors is in excess of \$10 billion.¹⁴ An analysis conducted by Caltrans for the 2015 Interregional Transportation Strategic Plan showed that "SR 99 and I-5 in the San Joaquin Valley, and I-10 between Palm Springs and Arizona, bear the greatest load of interregional freight trips (five-axle trucks) per facility than any other in the state outside of the major urban areas".¹⁵ These routes have higher than average volumes of large, long-haul trucks using all lanes for travel and passing, which creates potential safety and capacity problems for interregional travelers.

Trucking is the most commonly used mode for California's freight transportation and trucks transport almost all freight and services during some point within the supply chain. For this reason, the trucking industry is one of California's most valuable freight assets, particularly for the "first and last mile" of a trip. California must continue to develop, maintain, and operate a safe, efficient, and reliable freight transportation network to accommodate the truck volumes necessary to move freight within the state.

Figure 3A.3. Strategic Interregional Corridors



Source: Caltrans, Interregional Transportation Strategic Plan 2015

International Border Crossings

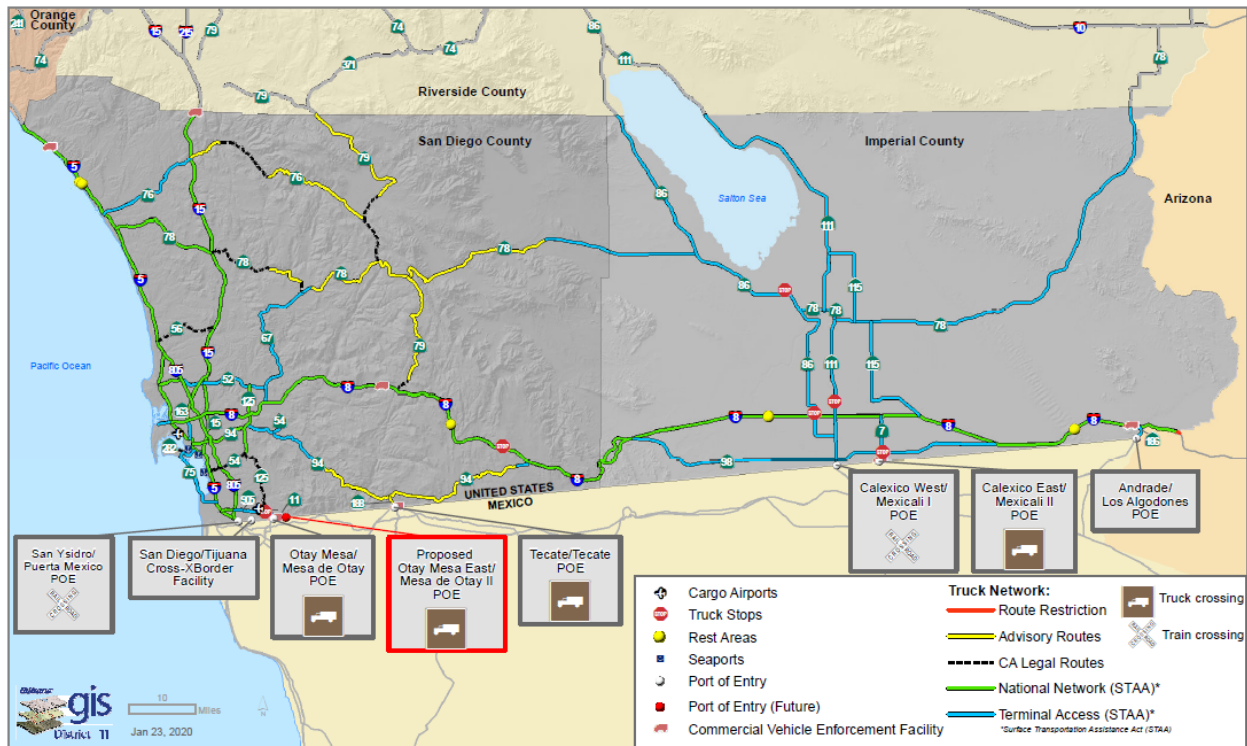
In 2019, US Congress approved the United States-Mexico-Canada Agreement (USMCA) signed by President Trump in 2020. The agreement updates the North American Free Trade Agreement (NAFTA), which governed more than \$1.2 trillion worth of trade among the three nations. The USMCA will create more balanced, reciprocal trade that supports high-paying jobs

for Americans and grows the North American economy. Some highlights of the agreement include:

- Creating a more level playing field for American workers, including improved rules of origin for automobiles, trucks, other products, and disciplines on currency manipulation.
- Benefiting American farmers, ranchers, and agribusinesses by modernizing and strengthening food and agriculture trade in North America.
- Supporting a 21st Century economy through new protections for U.S. intellectual property and ensuring opportunities for trade in U.S. services.¹⁶

California and Mexico share over 130 miles of international border, consisting of the southernmost portions of San Diego and Imperial Counties. According to the California Chamber of Commerce in 2018, Mexico was California's top trading partner and the U.S.'s second largest trading partner. The commercial land border ports of entry (POEs) are the main arteries for freight movements between the two nations. California's multimodal state freight system includes all of the existing and proposed commercial land border POEs between California and Mexico, which include Otay Mesa (SR 905), Otay Mesa East (SR 11)--a future commercial land border POE that is being developed, Tecate (SR 188 and SR 94) in San Diego County, and Calexico East (SR 7) in Imperial County. **Figure 3A.4** provides information for California-Mexico land border POEs.

Figure 3A.4. California-Mexico Land Border Ports of Entry



Source: Map created by Caltrans District 11, CFMP 2014

Otag Mesa POE in San Diego County and the Calexico East POE in Imperial County are the two main California-Mexico freight gateways. The Otag Mesa POE is the third busiest commercial land border POE on the U.S.-Mexico border by trade value and the busiest commercial land port in California. Major commodities transported between California and Mexico through the POE include plastic; rubber; pulp; paper; allied products; electronics; electrical machinery, equipment, and supplies; automobiles and light duty trucks; food; grain products; and farm products.¹⁷ A tolled highway (SR 11) will provide access to the future Otag Mesa East POE on the California side. Construction on the final segment of SR 11 is currently underway.¹⁸ This new POE will help reduce freight and passenger traffic congestion at the San Ysidro, Otag Mesa, and Tecate POEs, as well as provide additional capacity for future growth by providing a new alternative for freight operators traversing the California-Mexico border.

Native American Roadway Network

The 2016 American Community Survey 5-Year Estimates reported an estimated 728,094 American Indians residing in California (including Alaska Natives). This includes notable populations in every county within California. There are 110 federally-recognized Native American Tribal Governments statewide. Each of these governments are sovereign nations with authority over their respective Tribal lands. The Indian Reservation Roads (IRR) program, established in 1928, funds maintenance, construction, and improvement of IRR routes that do not receive state funding through federal-aid funding¹⁹ (CA IRR Tech Report). Currently, FHWA is assigned oversight of the IRR program and is responsible for determining available funding to

allocate to the Bureau of Indian Affairs (BIA) for projects on the IRR system (CA IRR Tech Report). Many of California's Tribal lands are accessed from or served directly by the SHS, including routes identified within the State Highway Freight Network. Future study is needed to determine what role the IRR system plays in the movement of freight to and from the Tribal lands of California, to identify which IRR routes (or portions of routes) are already on California State Freight Highway Network, to collect goods movement data on the IRR system, and to determine how the IRR system supports freight movement within the California as a whole.

Roadway Bridges

According to the Caltrans 2017 State Highway System Management Plan, California's SHS includes approximately 13,160 lane miles of bridges. These highway bridges have an average age of 45 years. Bridge health is critical to freight movement because bridge closures can redirect trips – lengthening travel time, wasting fuel, reducing efficiency, and delaying emergency deliveries and services. Detailed information about bridge performance and vertical clearance restrictions is presented in **Chapter 3B**.

Truck Parking

According to the FHWA report 'Jason's Law Truck Parking Survey Results and Comparative Analysis,' California is one of the states facing the most severe truck parking challenges and is one of three states with the lowest rates of commercial vehicle truck parking spaces per 100,000 miles of daily combination truck VMT.

California has high levels of truck parking in absolute terms but has low levels relative to truck VMT, NHS miles, and GDP; and also has notable shortages at private truck stops.²⁰ **Figure 3A.5** shows the locations of California truck parking lots and the approximate number of spaces available in each lot.

Figure 3A.5. California Truck Parking Locations



Source: Data from FHWA HEPGIS, National Truck Parking Dataset, US Census Bureau TIGER line 2018

According to the MAP-21 Jason's Law highway bill, DOTs are required to address the national truck parking shortage at public and private facilities along U.S. highways. FHWA conducted the first round of the Jason's Law Truck Parking survey in 2015.²¹ The survey identified several parking indicator metrics to evaluate the supply and demand for truck parking in each state. With 11,892 private and 1,252 public truck parking spaces, California ranked fifth among all states in terms of parking supply (see **Table 3A.5**). However, California has very high demand for truck parking, and about 40 percent of truck drivers indicated that they perceive a shortage of truck parking in the state. California ranked in the lower quartile among all states for five metrics:

- Public Spaces per 100K Daily Truck VMT
- Private Spaces per 100K Daily Truck VMT
- All Spaces per 100K Daily Truck VMT
- Public Spaces per 100 miles of NHS
- Spaces per Million GDP

The Federal Hours of Service (HOS) and Electronic Logging Devices (ELDs) requirements have further exacerbated the need for parking that is consistently available, safe, and provides basic amenities. Chapter 4A discusses HOS and ELD requirements in more detail.

In response to this critical need for additional truck parking, Caltrans initiated a truck parking advisory committee (TAC) in 2017 to identify needs and priority areas. The TAC consists of drivers, small and large fleets, beneficial cargo owners, and several CFAC members. Caltrans led a survey of TAC members, Caltrans Districts, and regional agencies. The survey results lacked detail on where the most critical truck parking needs are in the state. The survey highlighted the need for Global Positioning Systems (GPS) data or similar types of data to be able to determine exactly where drivers are experiencing shortages, where unauthorized and/or unsafe parking is occurring, and where demand for parking exists. Given this need for data, Caltrans initiated a comprehensive California statewide truck parking study to identify existing truck parking shortages and new potential locations, and to develop public and private partnerships for enhanced truck parking supply and dissemination of truck parking availability information. Caltrans plans to complete the study by Spring 2022.

Table 3A.3. Public and Private Trucking Related Units

Unit	Amount
Public Facilities	87
Public Truck Parking Spaces	1,252
Private Truck Stops	197
Private Truck Parking Spaces	11,892
Ratio of Private to Public Truck Parking Spaces	9.5 : 1
Total Truck Parking Spaces	13,144
Public Spaces per 100k Daily Truck VMT	5.1
Private Spaces per 100k Daily Truck VMT	48.6
All Spaces per 100k Daily Truck VMT	53.7
Public Spaces per 100 Miles of NHS	8.6
Private Spaces per 100 Miles of NHS	82.0
All Spaces per 100 Miles of NHS	90.6
Source: Jason's Law Truck Parking Survey Results	

Alternative Fueling Locations

At the national level, the FHWA has designated alternative fuel corridors to establish a national network of alternative fueling infrastructure along the National Highway System. As of 2018, FHWA has nominated 58 corridors including portions or segments of 84 Interstates and 43 US highways and state roads, covering more than 100,000 miles of the NHS throughout 44 states and the District of Columbia.²²

At FHWA's behest and owing in part to a statewide commitment to renewable energy and the reduction of greenhouse gas emissions, alternative fueling locations have proliferated throughout California, and many are available for use by trucks on California's Highway Freight Network. **Figure 3A.6** shows the locations of alternative fueling locations by fuel type. All are presumed to be available for use by trucks.

Weigh-In-Motion Scales and Truck Activity Monitoring System

As of 2019, California has 110 weigh-in-motion (WIM) scales in operation throughout the state. Weigh-in-Motion devices are designed to capture and record axle weights and gross vehicle weights as vehicles drive over a measurement site as opposed to requiring vehicles to come to a complete stop to measure their weight. California's WIM locations provide 24-hour traffic information, including axle weights and gross weights, axle spacing, vehicle classification, speed, and overall length. This data is subsequently used to inform pavement studies, highway monitoring and capacity studies, accident rate calculations, and load factor calculations for structures. **Figure 3A.7** shows the location of California's WIM locations.²³

Figure 3A.6. California Alternate Fuel Corridors and Fueling Stations



Source: Data from FHWA HEPGIS and U.S. Department of Energy Alternative Fuels Data Center
2018

Figure 3A.7. California Weigh-In-Motion Stations and Truck Activity Monitoring Stations



Source: Data from Caltrans Division of Traffic Operations 2018



Image: Freight Locomotives, BNSF & UPRR

Freight Rail Network

The freight railroad system in California is comprised of two Class I railroads and 28 Class III railroads, commonly referred to as “short line” railroads. This freight rail network supports the operations of industries throughout the state and links California with domestic, interregional, and international markets. Railroads are grouped into three classes, based on their annual operating revenue:

- Class I - \$447,621,226 or more
- Class II - Less than \$447,621,226, but in excess of \$35,809,698
- Class III - \$35,809,698 or less

In 2017, total operating revenue for Class I railroads was approximately \$70 billion.²⁴ In 2017, railroads handled 162.3 million tons of freight that originated in, terminated in, or moved through California by rail.²⁵ There are no Class II railroads operations in California at this time. **Figure 3A.9** shows California’s Class I and Class III freight railroads.

Figure 3A.9. Railroad Ownership in California



Source: Caltrans, State Rail Plan 2018

The two Class I railroads operating in California are the Union Pacific Railroad (UPRR) and the BNSF Railway Company (BNSF). UPRR is the largest railroad in California by number of employees, payroll, and track-miles in operation. UPRR operates an expansive network of rail lines that serves diverse regions of California, including the agriculturally rich San Joaquin Valley, the Port of Oakland, the San Francisco Bay Area, and the Los Angeles metropolitan area. UPRR also provides strategic freight rail movement to California's Central Coast as it parallels the US 101 corridor. For its carload services, UPRR operates two system classification yards at West Colton in Southern California and Roseville in Northern California, three regional yards in Lathrop (San Joaquin County), Commerce (Los Angeles County), and Yermo (San Bernardino County), and a rail port in Oakland (Alameda County). UPRR also has shared use of the on-dock rail terminals at the Port of Los Angeles (POLA) and Port of Long Beach (POLB) with BNSF. UPRR operates nearly 3,292 miles of track within California and handled over three million carloads in California in 2017.²⁶ **Table 3A.4** includes the key operating characteristics for UPRR.

The BNSF Railway Company is the largest intermodal carrier in the U.S. and is the product of mergers and acquisitions of nearly 400 different railroad lines, including two major railroads (Burlington Northern Railroad and the Atchison, Topeka and Santa Fe Railway). Within California, BNSF operates on more than 2,000 track miles. In 2017, there were nearly 2 million BNSF carloads originating and terminating in the state. Major BNSF freight hubs include 11 carload yards, five dedicated intermodal terminals, and the shared on-dock rail facilities at the POLA and POLB. Along with the on-dock terminals at the POLA and POLB, significant BNSF's intermodal facilities in California include off-dock terminals at the Hobart Yard near downtown Los Angeles, the San Bernardino Intermodal Yard, and the OIG near-dock terminal in Oakland. California serves as a gateway to BNSF's Transcontinental Corridor, which links the POLA and POLB with Chicago.²⁷ **Table 3A.4** includes the key operating characteristics for BNSF.

Table 3A.4. Class I Railroad Operating Characteristics in California

Name	Employees	Payroll (Millions of Dollars)	Tracks Miles Owned	Track Miles with Tracking Rights	Total Miles Operated	Originating Carloads	Terminating Carloads
BNSF	3,655	\$283.8	1,149	965	2,114	1,948,082	1,982,279
UPRR	4,783	\$462.8	2,773	515	3,292	1,537,094	1,594,670
Source: Caltrans California State Rail Plan 2018							

Short Line Rail

To shippers, the ability to use short line railroads means lower transportation costs, more flexible local service options, and a greatly expanded market reach for local products through their Class I railroad partners. Without short line railroads, businesses would be forced into more expensive truck transloads (freight transfer between modes or from smaller to larger trailers) that typically take place in large cities adding more trucks on an already congested metropolitan highway system. Short line railroads' direct access to industrial, mining,

commercial, and agricultural processing facilities enables the shipment of loads that are too heavy for trucks to transport over the roadway. For many companies, access to short line railroads is essential to their business viability.

California has 27 active short line railroads (two of which are primarily operating passenger trains). This includes 21 short lines and seven switching and terminal railroads which collectively operate over 1,600 route-miles. **Table 3A.5** lists California's short line and switching and terminal railroads.

Table 3A.5. Short Line Railroads in California

Local Railroads	Standard Carrier Alpha Code	Total Miles Operated
Arizona & California Railroad Company	ARZC	190 (84 in CA)
California Northern Railroad	CFNR	210
Central Oregon & Pacific Railroad	CORP	305 (56 in CA)
Fillmore and Western	FWRV	28
Goose Lake Railway	GOOS	55
Napa Valley Wine Train	NVRR	18
Northwestern Pacific Co.	NWP	63
Pacific Sun Railroad, LLC	PSRR	62
Sacramento Southern Railroad	SSR	3
Sacramento Valley Railroad	SAV	7
San Diego & Imperial Valley Railroad	SDIV	1
San Joaquin Valley Railroad Company	SJVR	297
San Francisco Bay Railroad	SFBR	7
Santa Cruz, Big Trees & Pacific Railway	SCBG	9
Saint Paul & Pacific Railroad	SP&P	32
Santa Maria Valley Railway	SMVRR	14
Sierra Northern Railway	SERA	68
Stockton Terminal and Eastern Railroad	STE	25
Trona Railway Company	TRC	31
Ventura County Railroad Company	VCRR	9
West Isle Line, Inc.	WFS	5
Central California Traction	CCT	96
Los Angeles Junction Railway Company	LAJ	64
Modesto & Empire Traction Company	MET	49
Oakland Terminal Railway	OTR	10
Pacific Harbor Line, Inc.	PHL	59
Richmond Pacific Railroad Corporation	RPRC	6
TOTAL		1,6158
Source: Caltrans, California State Rail Plan, 2018		

Passenger Rail Operating on Freight Rail lines

In addition to freight trains, the freight rail network also accommodates the operation of passenger trains throughout the state. In the past, the main freight rail lines had excess capacity to allow the use of passenger trains with little impact to the freight service. Passenger service volumes along these shared-use rail corridors have expanded, along with expansion of freight volumes, resulting in a primary railroad network that is more congested. Many current shared-track operations involve passenger services operation over tracks owned by BNSF and UPRR. These operations include all three State-supported routes (portions of the Pacific Surfliner, San Joaquin and Capitol Corridor) and the four Amtrak long-distance trains operating in the state, as well as several commuter services such as Metrolink, Caltrain, and the Altamont Corridor Express.

On-Dock and Near-Dock Rail

On-dock and near-dock rail facilities play an integral role in the movement of cargo from the dock to rail yards. On-dock facilities are located within a marine port terminal, allowing containers to be moved directly from the dock to the railcar. On-dock terminals handle a significant number of containers (1.84 million lifts in 2010) with volumes projected to reach 6.3 million lifts by 2035. Through its elimination of truck drayage, on-dock rail intermodal transfer is perhaps the most efficient way to handle trainloads of international intermodal containers. Near-dock terminals (facilities that are within a five-mile radius of the port terminal) are essential for providing additional container handling capacity that minimizes long-distance drayage trips. Off-dock intermodal facilities are rail yards located more than five miles from port terminals.

Off-dock intermodal facilities provide substantial capacity for handling port-related (international) containers as well as domestic containers (both transloaded international cargo and pure domestic cargo) and trailers. Containers that are transferred from ships to train via truck drayage are almost all routed to out-of-state locations. There is a concerted effort in California to reduce drayage trips to rail yards and to move the activity as close to the ports as possible.

Intermodal Rail Terminals

The freight rail network in California includes a number of significant intermodal rail terminals. Intermodal rail terminals are established to facilitate transfer of containers and trailers between modes (ship to rail, truck to rail, and vice versa). In California, the majority of intermodal rail traffic is associated with the Port of Oakland, POLA, and POLB; a sizeable but smaller volume is related to wholly USMCA traffic. Intermodal service is typically described as either container on flat car (COFC) or trailer on flat car (TOFC). In California, all primary intermodal corridors have sufficient vertical clearances for double-stack service. Double stacking is not possible with TOFC. This inability to double-stack is due to the lack of structural strength of truck trailers. **Table 3A.6** identifies the facility characteristics for the intermodal terminals within California.

Table 3A.6. Intermodal Rail Facility Characteristics

Name	Facility Type	Railroad	Existing Yard Capacity (Lifts)
City of Industry	Off-Dock	UPRR	232,000
East Los Angeles	Inland	UPRR	650,000
Hobart	Off-Dock	BNSF	1,700,000
Intermodal Container Transfer Facility (ICTF)	Near-Dock	UPRR	760,000
Los Angeles Transportation Center (LATC)	Off-Dock	UPRR	340,000
POLA-POLB On-Dock Intermodal Facilities	On-Dock	BNSF/UPRR	2,257,775
San Bernardino	Inland	BNSF	660,000
Lathrop	Inland	UPRR	270,000
Oakland International Gateway (OIG) – Joint Intermodal Terminal (JIT)	Near-Dock	BNSF	300,000
Rail port-Oakland	Near-Dock	UPRR	450,000
Stockton/Mariposa	Inland	BNSF	300,000
Total			7,619,775
Source: Caltrans California State Rail Plan, 2018			

Seaports

Seaports are the lynchpin of California’s international trade. They are California’s freight gateways to the world. California has 12 deep-water seaports that can accommodate transoceanic vessels, of which 11 are publicly owned and one, the Port of Benicia, is privately owned. This includes two inland ports that have access to the ocean via the Sacramento/San Joaquin Delta. Each port has different navigable channel and berth depths so the sizes of ships and ship draft that can be accommodated vary by port. All of the ports, with the exception of the Port of Humboldt, utilize on-dock or near-dock rail infrastructure in conjunction with their terminal operations.

The four largest deep-water seaports in California are Los Angeles, Long Beach, Oakland, and San Diego. All four seaports are included within the top 50 U.S. Containership Ports in 2018 (see **Table 3A.7**). In addition to containerized freight, these seaports handle a variety of cargo, including petroleum coke, crude oil, break bulk, bulk, heavy equipment, machinery, roll-on/roll-off cargos, and many others.

Table 3A.7. California's Four Top Ranking Containership Ports in North America, 2018

Port	Rank	Domestic	Export	Import	Total
Los Angeles	1	142,411	1,587,303	4,897,579	6,627,292
Long Beach	2	275,805	1,274,930	4,104,052	5,595,722
Oakland	7	178,781	746,294	949,730	1,812,566
San Diego	32	0	2,466	67,047	69,512
TOTAL		596,997	3,610,993	10,018,408	14,105,092
Source: U.S. Army Corps of Engineers – U.S. Waterborne Container Traffic by Port/Waterway in 2018					

The POLA, number one in national container volume, and the POLB, number two in national container volume, together make up the largest container port complex in the U.S. They are often referred to as the San Pedro Bay Ports. The San Pedro Bay Ports and the Port of Oakland—California's third largest seaport and the nation's seventh largest container port—have sufficient depths to accommodate the largest vessels currently in operation and even larger vessels that are being developed. The remaining seven deep-water seaports are smaller in size and scale, specializing in the transport of specific types of cargo such as dry bulk, break bulk, liquid bulk, construction materials, fresh fruit and produce, automobiles, or other commodities. **Table 3A.8** contains some key characteristics of each seaport.

Table 3A.8. Public and Private Deepwater Seaports

Seaport	Channel Depth	Acres	Rail Access	Highest Value Exports	Highest Value Imports
San Diego	42 feet	6,000*	On-Dock	Machinery, Metals, Autos/Parts, Heavy Equipment, Food Products	Vehicles, Perishables, Construction Materials, Heavy Equipment
Long Beach (POLB)	76 feet	3,520	On-Dock	Petroleum Coke and Bulk, Waste Paper, Chemicals, Scrap Metal	Crude Oil, Electronics, Plastics, Furniture, Clothing
Los Angeles (POLA)	53 feet	4,300	On-Dock	Wastepaper, Animal Feeds, Scrap Metal, Fabric, Soybeans	Furniture, Apparel, Automobile Parts, Electronic Products
Hueneme	35 feet	375	Near-Dock	Autos, Produce, General Cargo	Autos, Produce, Liquid Fertilizer, Bulk Liquid

Redwood City	30 feet	120	On-Dock	Iron Scrap	Aggregates, Sand, Gypsum
San Francisco	38-40 feet	1,000+	Near-Dock	Tallow, Vegetable Oil	Steel Products, Boats/ Yachts, Wind Turbines, Project Cargo, Aggregate, Sand
Oakland	50 feet	1,300	Near-Dock	Fruits and Nuts, Meats, Machinery, Wine and Spirits	Machinery, Electronics, Furniture, Plastic Ware, Tiles
Richmond	38 feet	200	Near-Dock	Vegetable Oils, Scrap Metal, Coke, Coal, Aggregate, Zinc, Lead	Autos, Petroleum (crude/ refined), Bauxite, Magnetite, Vegetable Oils
Stockton	35 feet	2,000	On-Dock	Iron Ore, Sulfur, Coal, Wheat, Rice, Machinery, Petroleum Coke, Safflower Seed	Liquid Fertilizer, Molasses, Bulk Fertilizer, Cement, Steel Products, Ammonia, Lumber
Benicia	38 feet	645	On-Dock	Petroleum Coke	Automobiles
West Sacramento	30 feet	480	On-Dock	Agricultural and Industrial Products	Agricultural and Industrial Products
Humboldt Bay	38 feet	-----	N/A	Logs, Wood Chips	Logs, Petroleum, Wood Chips
Source: Southern California Association of Governments – Comprehensive Regional Goods Movement Plan and Implementation Strategy, 2013 *Acreage includes land and water					

California's seaports are extraordinary multimodal places that have a tremendous mix of public and private entities, each with its own set of industry responsibilities. This requires efficient interaction between the public and private sectors to meet the needs of the ports. Additionally, the seaports and their intermodal connectors heavily support the movement of military and freight cargo. The Ports of Long Beach, San Diego, and Oakland are designated as Strategic Commercial Seaports. Ports of Los Angeles and Richmond are designated as Alternate Strategic Commercial Seaports. Port of Hueneme is designated as a Strategic Military Seaport. These Strategic Seaports are integral part of the National Port Readiness Network (NPRN)²⁸.

The strength of California's seaports depends on a complex public private partnership approach for investment in both capital and operational improvements within the seaport complex, including compliance with environmental and safety regulations. Generally, California's seaports are owned by public port authorities who develop port facilities which are then leased

to private marine terminal operators and stevedoring companies who load and unload cargo from ships. Marine terminals load and unload cargo from ships at-berth and then receive or discharge that cargo to and from landside trucking and rail operations. This requires a tremendous amount of coordination among all of the parties involved. All parties must work together toward improvements in efficiency and productivity to minimize delays in the supply-chain, stay competitive in both the national and global economies, and to reduce and eliminate the environmental and community impacts of freight from these critical freight facilities.

In addition to the 11 publicly owned deep water seaports, California has one private deep-water seaport, the Port of Benicia, and a multitude of privately owned and operated, both large and small scale, port and terminal facilities which help to facilitate maritime freight movement along California's coast, and to and from interstate and international markets. These private freight facilities handle a variety of cargo that include dry bulk materials, metals, bulk liquids, construction materials, vehicles, electronics, crude oil, petroleum products, and many others.

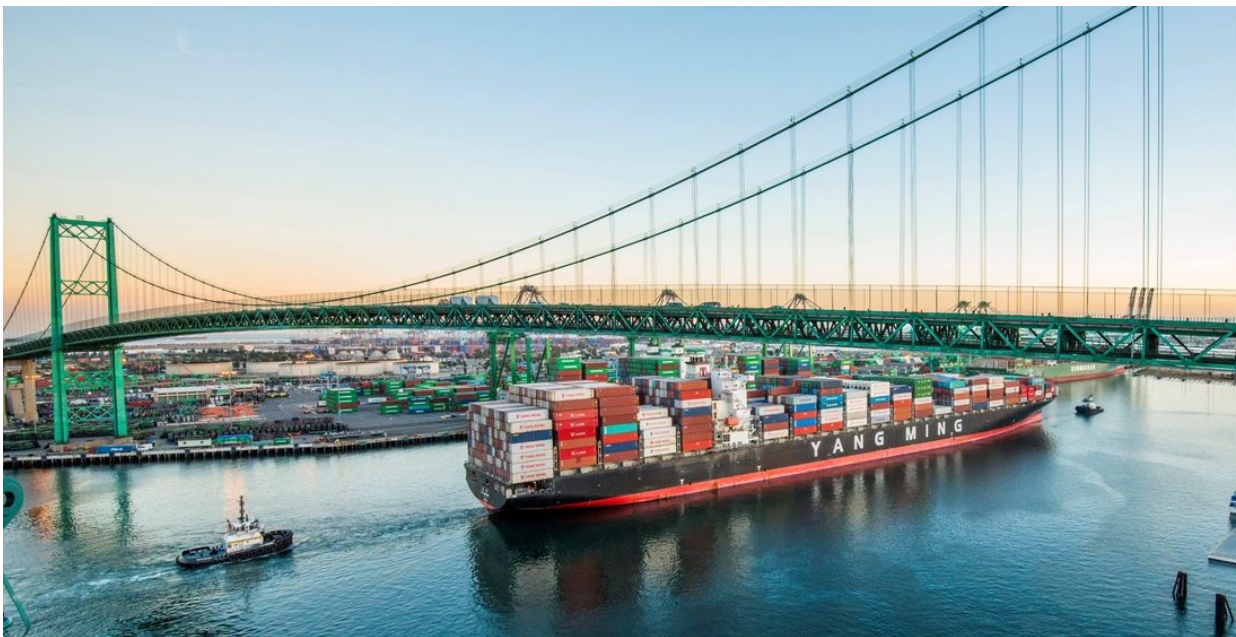


Image: Port of Long Beach, St. Thomas Bridge

Airports

There are more than 200 airports that participate in the movement of airfreight in the state of California. Air cargo is shipped both domestically within the U.S. and internationally to global markets. Air cargo is usually high-value and particularly time sensitive. The amount and value of freight transported through each airport differs dramatically. The California Multimodal State Freight system includes the 13 busiest airports with major cargo operations by volume as

detailed in **Table 3A.9.**²⁹ All but two of California’s largest airports with major cargo operations saw growth from 2013 to 2018. The total cargo operation by the top cargo airports increased by over 36 percent overall. The key challenges facing California’s air cargo include modal shifts to trucking, competition with airports at other states, the shifting of manufacturing from Asia back to North America (and Europe), and the alternative maritime shipping routes that influences supply chains for air cargo-related goods.

Table 3A.9. Major Cargo Operations Enplaned and Deplaned (Tons)

Airport	2017 National Rank	2018	2013	Percent Change
Los Angeles International (LAX)	6	2,443,946	1,916,718	28%
Ontario International (ONT)	10	826,399	460,537	79%
Metropolitan Oakland International (OAK)	11	670,332	555,589	21%
San Francisco International (SFO)	23	628,417	400,177	57%
San Diego International (SAN)	38	192,344	162,353	18%
Sacramento International (SMF)	46	127,107	74,329	71%
Sacramento Mather (MHR)	56	76,904	54,644	41%
Mineta San Jose International (SJC)	86	60,618	46,820	29%
Hollywood Burbank Bob Hope (BUR)		54,704	NA	-
Stockton Metropolitan (SCK)	74	44,754	NA	-
Long Beach (LGB)	107	23,799	26,378	-10%
John Wayne (SNA)		19,541	17,804	10%
Fresno-Yosemite International (FYI)	116	10,650	11,863	-10%
TOTAL		5,179,514	3,727,212	36%*
Source: Airport ranks from Federal Aviation Administration, 2018.				

According to the California Air Cargo Groundside Needs Study, “The numbers indicate that the top airports at which cargo activities are currently focused should have the individual capacity to address their own future cargo growth. Although some new development or redevelopment will eventually be needed, there are no specific projects currently identified by the airports as critical to accommodating long-term cargo growth.” While the capacity of California’s largest cargo airports appears to be able to handle modest increases in freight movement in the near-term, the importance of ground transport of freight to and from the cargo airports is a key consideration. Local roads provide access to airport cargo facilities and transportation to nearby cargo handling and transloading facilities is accomplished. Many of these roads were not designed to accommodate 53-foot trailers and are located in dense, high traffic areas that are dominated by passenger vehicles.³⁰

Pipeline Network

The U.S. EIA reports that California ranks fifth in the nation in crude oil production and ranks third (January 2017) in petroleum refining capacity, accounting for approximately five percent of production capacity and 10 percent of U.S. refining capacity.³¹ California's crude oil and refined petroleum network consists of crude oil and petroleum product pipelines, refineries, terminals, and petroleum ports. The crude oil pipelines connect California's production areas to the refining centers in Los Angeles, the Central Valley, and the San Francisco Bay Area. These refineries are then connected through petroleum product pipelines to refineries and terminals throughout the U.S. Most gasoline imports into California enter by ship via the San Pedro Bay Ports and the San Francisco Bay Area Ports.

According to the U.S. EIA, California is second in the nation in the use of natural gas.³² California's natural gas is largely delivered through the Western Region Natural Gas Pipeline Network.

The main conduits of natural gas to California are the El Paso Natural Gas Company system and the Transwestern Pipeline Company system in the southern regions of the state, and the Gas Transmission Northwest Company's interstate system in the northern regions of the state. The southern region systems originate in Texas and parallel each other as they traverse New Mexico and Arizona to deliver large portions of their capacity to California's largest natural gas companies at the California eastern border. The northern region system delivers Canadian natural gas through Washington and Oregon to California's northern border. California's natural gas network consists of pipelines, along with the processing plants, terminals, and storage facilities that support the transportation of this important energy resource. The intrastate transportation and distribution of natural gas in California is dominated by three main providers, the California Gas Transmission Company (CGT) (3,477 miles), the Southern California Gas Company (SoCal) (1,887 miles), and the San Diego Gas and Electric Company.

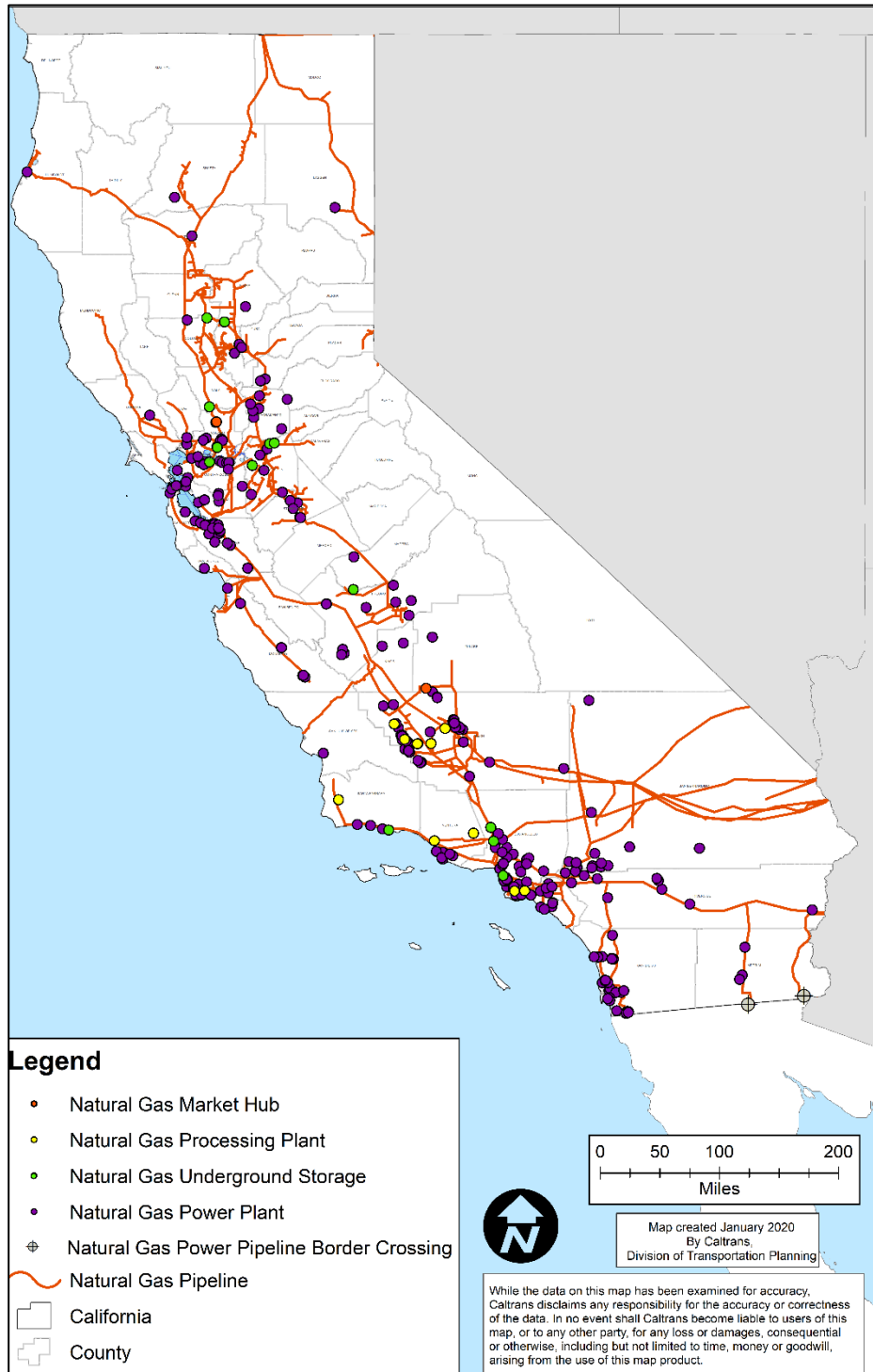
Future study is needed to determine which elements of the pipeline network should be included in the California Multimodal State Freight System. **Figure 3A.10** and **Figure 3A.11** depict California's crude oil and petroleum pipelines and facilities, and the natural gas pipelines and facilities.³³

Figure 3A.10. California Petroleum Pipelines and Facilities



Source: U.S. Energy Information Administration, 2018

Figure 3A.11. California Natural Gas Pipelines and Facilities



Source: U.S. Energy Information Administration, 2019

Warehousing and Distribution Facilities

The warehousing and distribution sectors are essential to supporting the efficient movement of freight within and through the state, and the success of these sectors directly impacts the economic competitiveness of the State and the nation. **Figure 3A.12** shows the concentration of warehouses and major wholesale distributions across the state. Southern California has by far the highest concentration of high cube and multi-purpose warehouses.

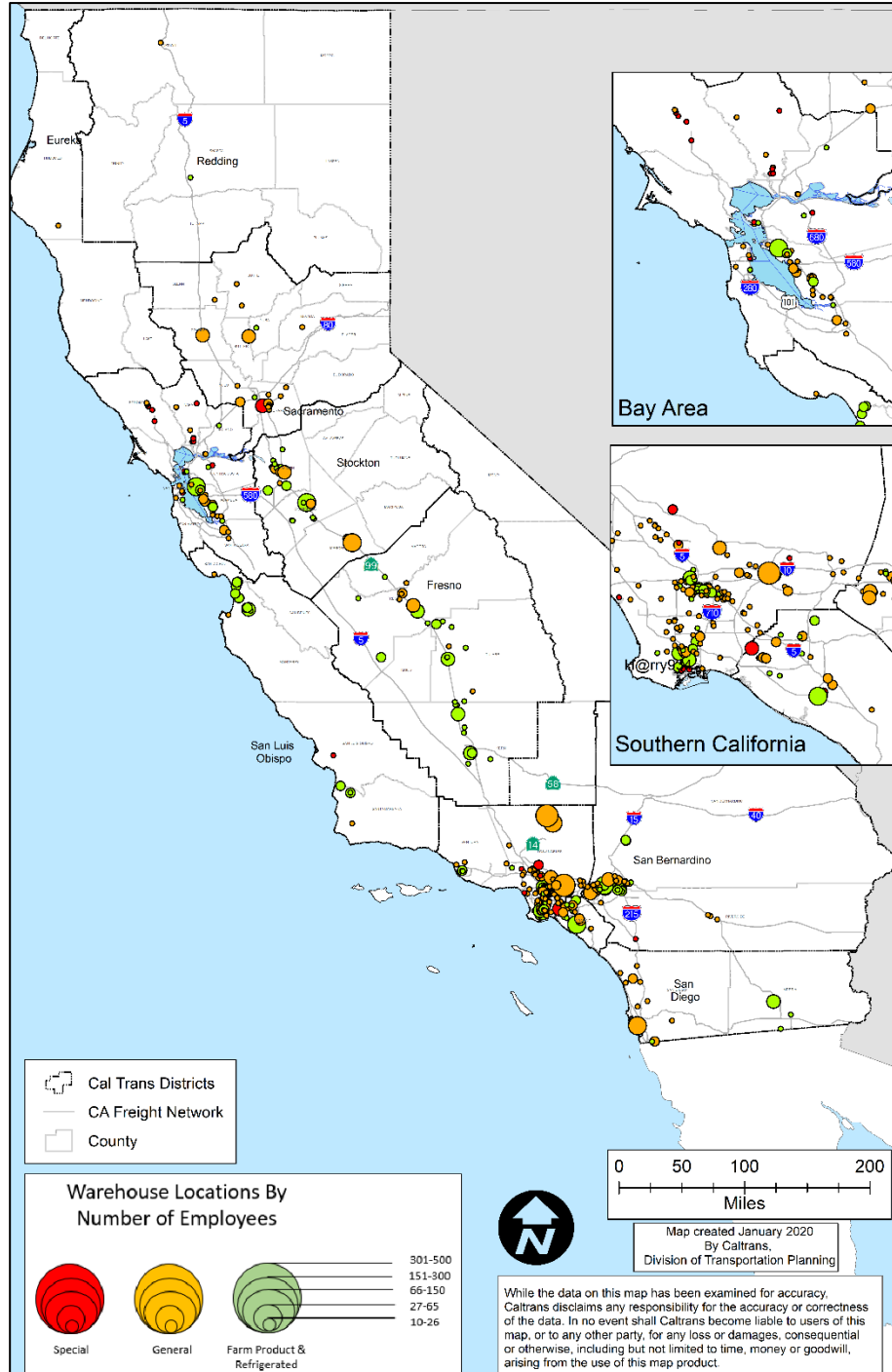
In the Southern California Association of Governments (SCAG), 'Industrial Warehousing in the SCAG Region' report, SCAG identifies itself as the 16th largest economy in the world with a regional gross product of approximately \$820 billion, and "goods movement-dependent industries make up about 35 percent of this total."³⁴ With one of the largest clusters of logistics centers in North America, the warehousing and distribution sector is particularly important to freight movement in Southern California, occupying approximately 1.17 billion square feet of existing warehousing land.³⁵ As of April 2018, there were approximately 34,000 warehouses in the SCAG region and 338 million square feet of undeveloped land that could be used to develop new warehouses and distribution centers.³⁶

While the majority share of California's warehousing and distribution activities occur in Southern California, specifically in the areas near the POLA and POLB, further east in the Inland Empire (San Bernardino and Riverside Counties), and near the POE by the California-Mexico Border, significant facilities in other parts of the state as well, particularly the northern San Joaquin Valley. More information on warehousing can be found in **Chapter 2 and Appendix C**.



Image: Amazon Fulfillment Center

Figure 3A.12. Major Warehouse and Distribution Centers in California



Source: Census Data, California Statewide Freight Forecasting Model database

Endnotes

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<https://www.eia.gov/tools/faqs/faq.php?id=46&t=8>
- ³³ U.S. Energy Information Administration, 2019 (<https://www.eia.gov/state/maps.php>)
- ³⁴ Southern California Association of Governments - Industrial Warehousing in the SCAG Region, 2018. http://www.scag.ca.gov/Documents/Task2_FacilityInventory.pdf
- ³⁵ Southern California Association of Governments - Industrial Warehousing in the SCAG Region, 2018. http://www.scag.ca.gov/Documents/Task2_FacilityInventory.pdf
- ³⁶ Southern California Association of Governments - Industrial Warehousing in the SCAG Region, 2018. http://www.scag.ca.gov/Documents/Task2_FacilityInventory.pdf

3.B. Multimodal Freight System Performance Assessment

Performance assessment is key to improving the transportation system. Tracking and analyzing the condition and performance of the freight system ensures that management, operations, and capital improvements are based on sound data and analysis. Assessment of the freight system's condition and performance includes a combination of quantitative and qualitative performance measures to inform and prioritize freight investments for decision makers. As required by the MAP-21 and FAST Acts, U.S. DOT has established a set of performance measures for use by state Departments of Transportation and MPOs to assess freight movement on the U.S. Interstate System.¹ These measures are highlighted to:

- Be inclusive of Federal required measures and tied directly to the goals and objectives of the CFMP;
- Measure, update, and track on a rolling basis based on available data sources; and
- Provide insights about the performance of the freight system as needed by its users (e.g., shippers, carriers).

Highway Assessment

Congestion and Bottleneck Assessment

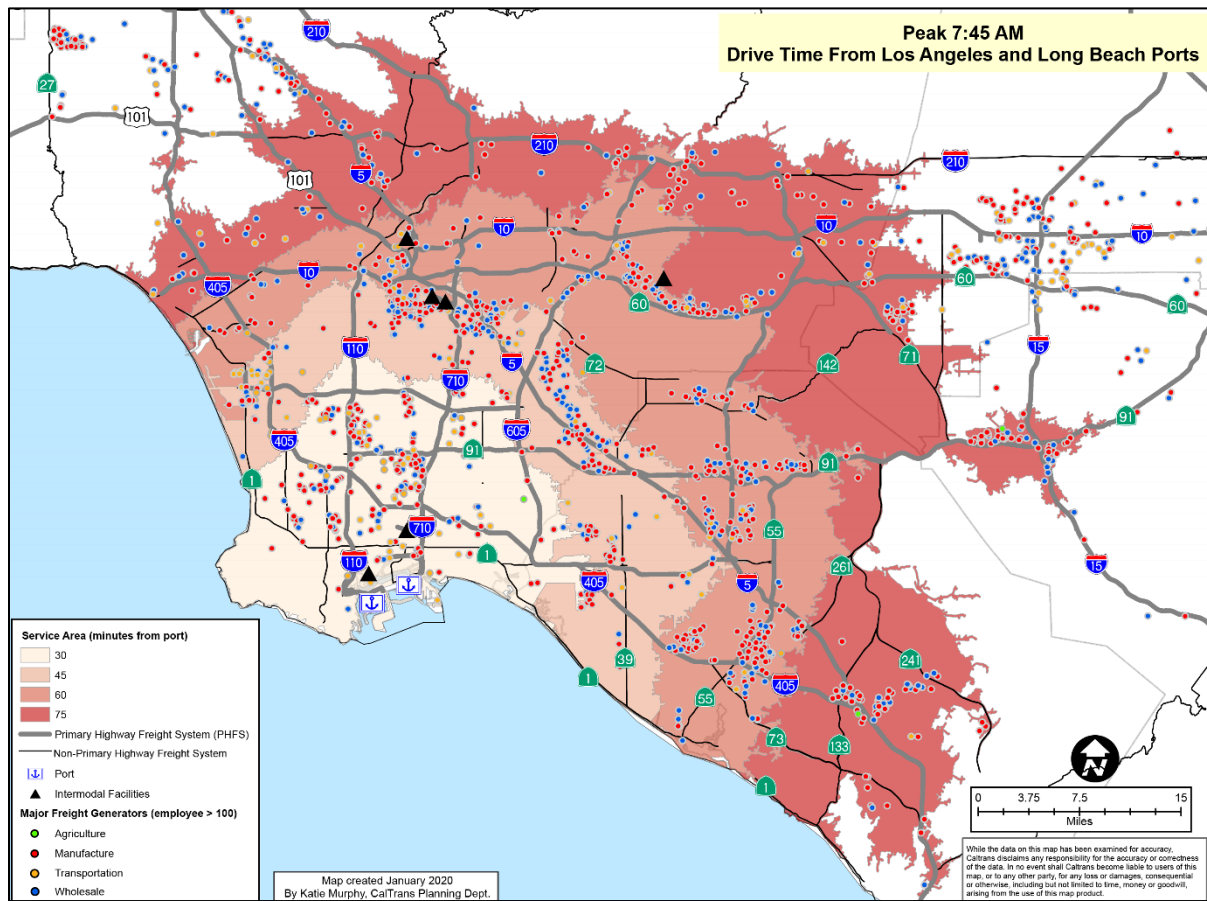
For many decades after the interstate highway system was completed, population and vehicle miles traveled continued to increase, while road and highway capacity increased only slightly. Today traffic congestion is chronic, affecting freight as well as passenger travel. The longer freight sits in traffic, the higher the prices of the delayed products and services. As previously mentioned, efficiency diminishes as the number of trips per day per truck is reduced, and same-day vehicle turnaround use is lost.

Excluding terrain and weather conditions, vehicle travel speed is a good indicator of congestion. The Federal Highway Administration (FHWA), in cooperation with private industry, measures the speed and travel time reliability of more than 500,000 trucks at 250 freight-significant highway infrastructure locations on an annual basis.² Average truck speeds generally drop below 55 miles per hour near major urban areas, and border crossings and gateways. Slower travel speeds increase truck turnaround times and reduce the number of truck trips per day, resulting in diminished efficiency and elevated costs. Additionally, when heavy-duty trucks operate at speeds below 40 mph, the rate for NO_x and CO₂ emission increases significantly, creating added environmental costs and burdens.³

Figures 3B.1.1 and 3B.1.2 show the impact of congestion on accessibility from the Ports of Long Beach and Los Angeles to various freight hubs (such as intermodal rail terminals and major primary industries with over 100 employees) by comparing morning peak and off-peak hour

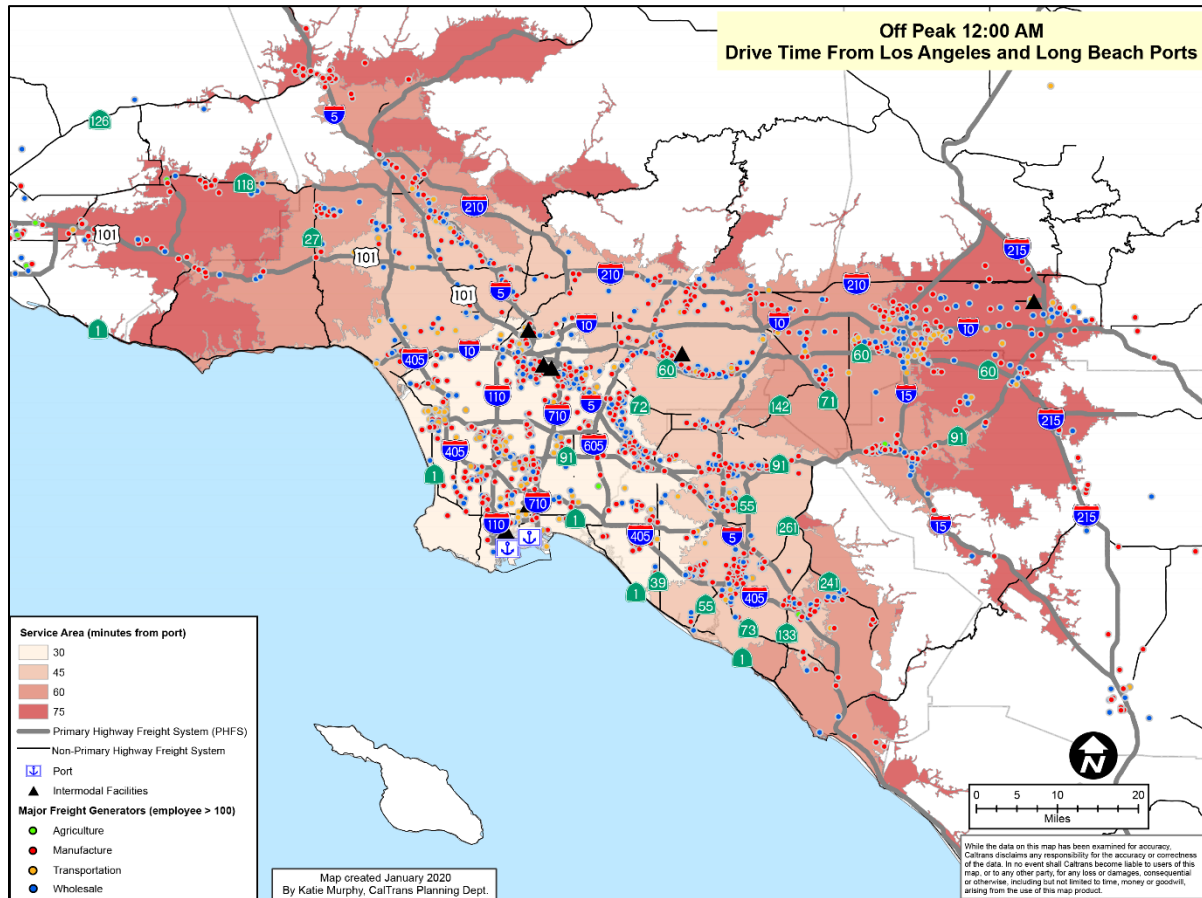
travel time (in minutes) to destinations throughout the region.⁴ Many destinations in the Los Angeles region take twice as long to reach during the peak hour compared to the off-peak hour, regardless of the direction of travel. **Figures 3B.2.1 and 3B.2.2** provide the same information from the Port of Oakland.

Figure 3B.1.1. Impact of Congestion on Accessibility from San Pedro Bay Ports to Major Destinations, 7:45 AM



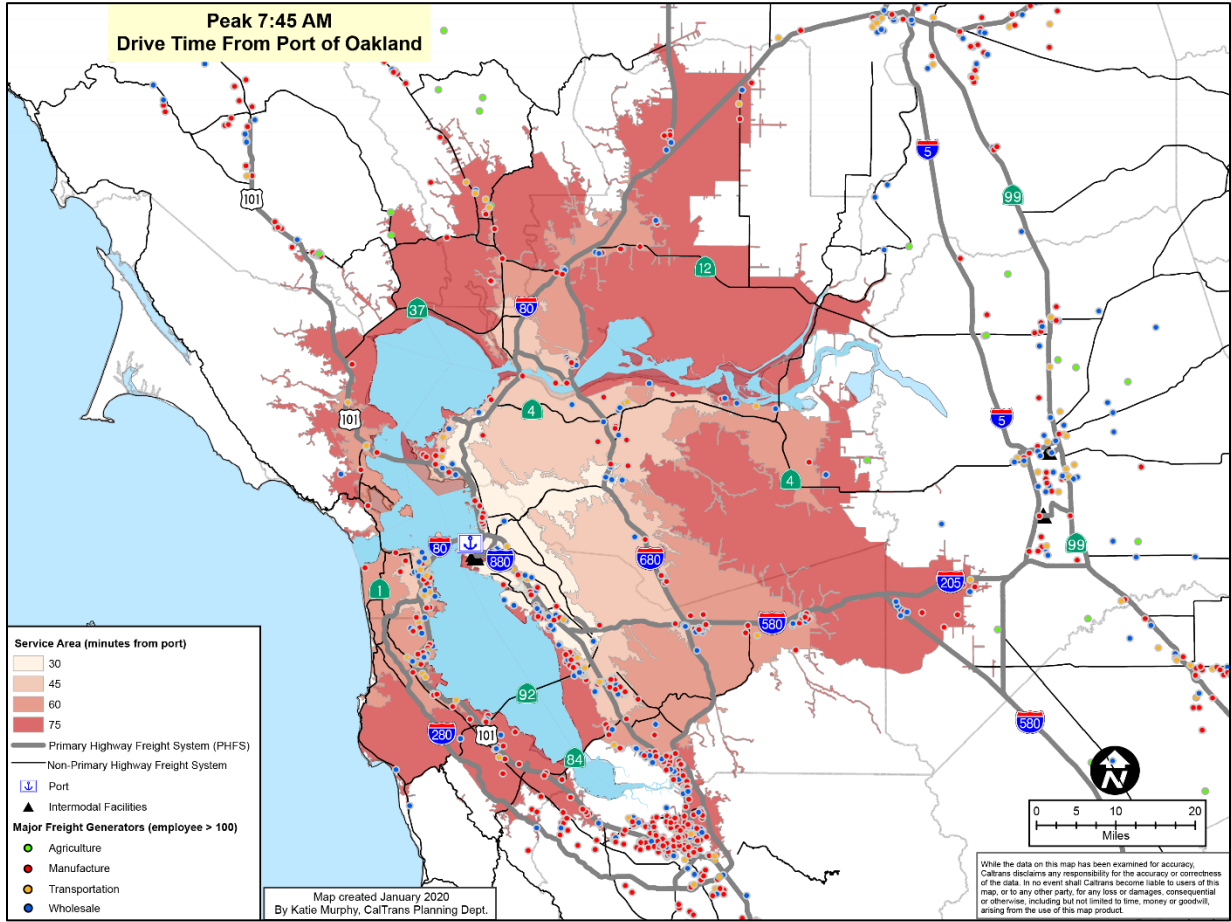
Source: Esri's 2018 historical traffic feeds based on HERE Data.⁵ Analysis and graphics by Caltrans Planning Division

Figure 3B.1.2. Impact of Congestion on Accessibility from San Pedro Bay Ports to Major Destinations, 12:00AM



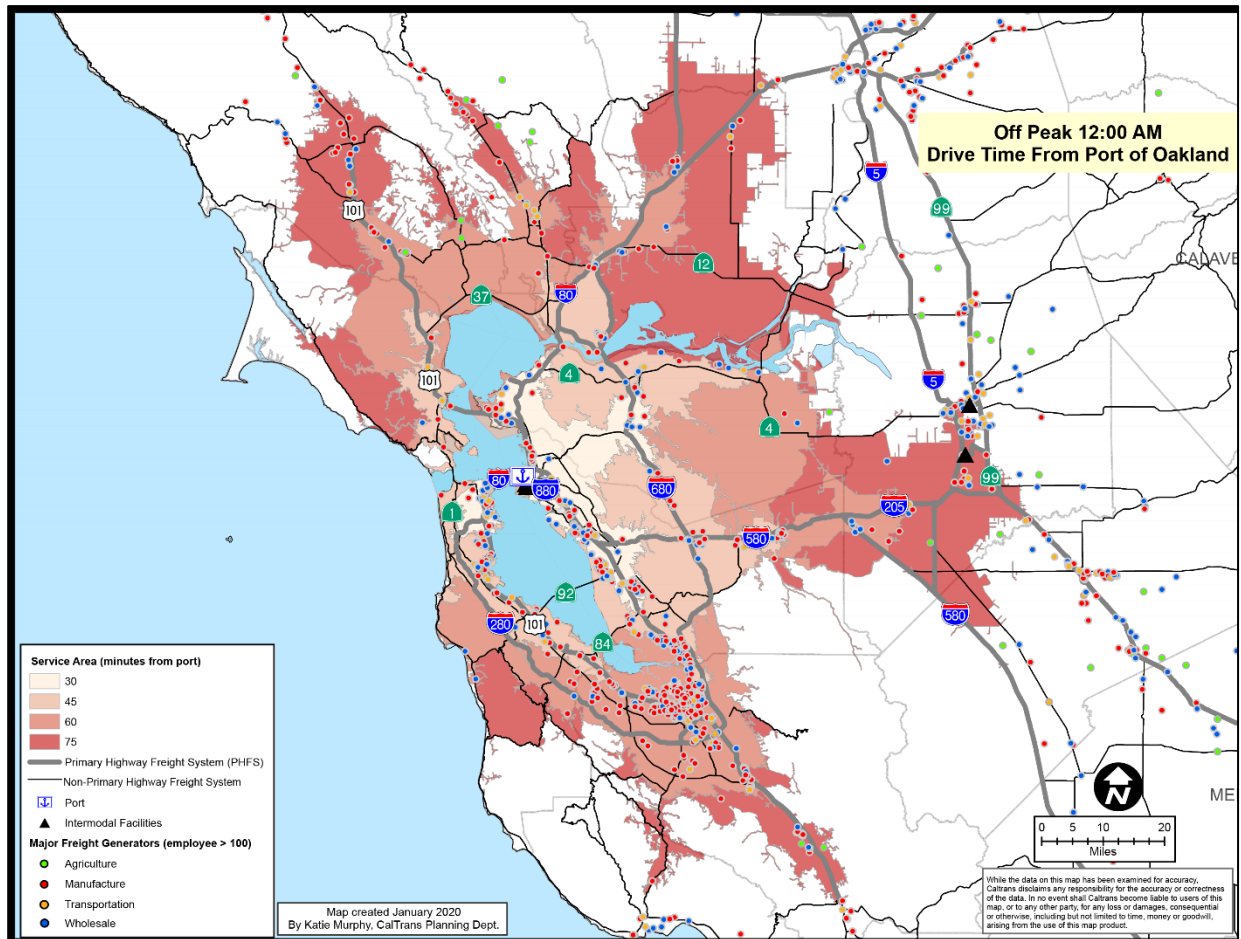
Source: Esri's 2018 historical traffic feeds based on HERE Data.⁶ Analysis and graphics by Caltrans Planning Division

Figure 3B.2.1. Impact of Congestion on Accessibility from Port of Oakland to Major Destinations, 7:45AM



Source: Esri's 2018 historical traffic feeds based on HERE Data.⁷ Analysis and graphics by Caltrans Planning Division

Figure 3B.2.2. Impact of Congestion on Accessibility from Port of Oakland to Major Destinations, 12:00AM



Source: Esri's 2018 historical traffic feeds based on HERE Data.⁸ Analysis and graphics by Caltrans Planning Division

Detailed lists of the most congested highway facilities due to high truck volume in Southern California, the San Francisco Bay Area, and the rest of the state are presented in the METTRANS report “Managing the Impacts of Freight in California 2018”.⁹

Congestion can be caused by several factors, including the number and width of lanes; the location, spacing, and type of interchanges; shoulder widths; pavement conditions; gaps in the freeway system; vehicle volume; mixed-mode user conflicts; roadway geometry; merges or weaving at transition ramps; steep grades; traffic incidents; road work; special events; and weather. Bottlenecks and chokepoints are common causes of congestion.

American Trucking Research Institute (ATRI) provides annual estimates of total cost of congestion on the trucking industry. In 2016, traffic congestion cost the trucking industry nearly \$74.5 billion including approximately \$5.06 billion for California. California ranked third among all states for total cost of congestion on the trucking industry after Texas and Florida. This

estimate is 6.4 percent higher than in the year 2015, ranking California second by states with largest increase in cost of congestion, after Texas. The Los Angeles/Long Beach/Anaheim metropolitan area accounted for 32 percent of this cost. Los Angeles ranked as the metropolitan area with the largest increase in cost of congestion relative to 2015 (about 12 percent).¹⁰

The 2018 ATRI Top 100 freight bottleneck locations included the following segments within California:¹¹

- #1 Los Angeles: SR 60 at SR 57
- #13 Los Angeles: I-710 at I-105
- #27 San Bernardino: I-10 at I-15
- #38 Oakland: I-880 at I-238
- #45 Corona: I-15 at SR 91
- #64 Los Angeles: I-110 at I-105
- #65 Oakland: I-80 at I-580/I-880

Infrastructure Assessment

Poor pavement and bridge conditions negatively affect truck operations. Infrastructure deterioration results in potential safety concerns, increased truck operating costs due to slower speeds, increased wear and tear on trucks, and damage to fragile goods. Poor condition of pavement and bridges also may result in weight restrictions that limit access for trucks. Trucks contribute to pavement and bridge structural deficiencies, which affect the ability of those bridges to carry heavy loads. High volume truck corridors have a higher potential for rapid infrastructure deterioration, and therefore higher preservation costs. The National Highway System (NHS) consists of 56,075 lane miles of pavement and 10,825 bridges totaling 234,285,883 square feet of bridge deck area in California. The California SHS includes all assets within the boundaries of the highway system including 49,644 lane miles of pavement and 13,160 bridges as identified in Transportation Management System (TMS) assets.¹²

According to the Caltrans 2015 State of the Pavement Report, distressed pavement is considered in poor condition when it has extensive cracks, is considered a “poor ride”, or both. Pavement in this category would trigger Capital Preventive Maintenance (CAPM) rehabilitation or reconstruction projects.¹³ Caltrans conducts an annual Pavement Condition Survey (PCS) “on more than 50,000 lane miles of pavement (265 State highways) which have a combined travel of 178 million vehicle miles.”¹⁴ **Table 3B.1** provides an inventory and detailed breakdown of the condition of pavements on the NHS and SHS in California by lane mile.¹⁵

Table 3B.1. Inventory and Conditions of NHS Pavements (State and Local) in CA, by Lane Mile

	Lanes Miles	Good	Fair	Poor
ALL NHS	36,649	44.0%	53.2%	2.7%
Interstate	14,159	44.9%	52.1%	3.1%
Non-interstate NHS	22,490	43.5%	54.0%	2.5%
Off the SHS (Local NHS)				
Pavements	18,427	4.6%	82.9%	12.5%
Total (State and Local NHS Pavements)				
ALL NHS	56,075	30.4%	63.5%	6.1%
Interstate	14,159	44.9%	52.1%	3.1%
Non-interstate NHS	41,917	25.5%	67.4%	7.1%
Source: California Transportation Asset Management Plan, 2018				

Distressed pavement is one of Caltrans' 2018 California Transportation Asset Management Plan (TAMP) performance measures and Caltrans has set a goal to bring 90 percent of the SHS's pavement to a good or fair condition by 2025.¹⁶ According to the 2018 TAMP, almost 95 percent of highway lane miles on the California SHS are in fair or good condition, meaning Caltrans has already surpassed its goal. Proactive maintenance is now paramount to ensuring that pavement conditions do not deteriorate. The other nearly six percent of highway lane miles on the California SHS are in poor condition and will require more substantial maintenance and rehabilitation to improve pavement conditions.¹⁷

Locally owned pavements on the NHS are those that are not on the California SHS but are owned and maintained by local and/or regional governments. Twelve of the state's twenty-one metropolitan planning organizations and regional transportation planning agencies that own and maintain parts of the NHS have a greater percentage of miles on the NHS in poor condition than in good condition, suggesting that greater local investment is needed to improve pavement conditions for these facilities. Detailed information about pavement conditions are available at 2018 California Transportation Asset Management Plan.¹⁸

According to the Caltrans 2017 State Highway System Management Plan, California's SHS includes 13,160 bridges. These highway bridges have an average age of 45 years, which increases their maintenance requirements.¹⁹ Bridge health is critical to freight movement because bridge closures can redirect trips: lengthening travel time, wasting fuel, reducing efficiency, and delaying emergency deliveries and services.

Table 3B.2 presents the inventory and condition of bridges on the SHS in California. It includes overall ratings for bridge decks, superstructures, and substructures on a scale from 0 (worst condition) to 9 (best condition). Overall, 3.3 percent of the bridges on NHS are in poor condition.²⁰

Table 3B.2. Inventory and Conditions of Bridges Weighted by Deck Area

Bridges on the SHS (State)					
	Count	Deck Area (sq. ft.)	Good	Fair	Poor
Total	13,160	245,756,328	74.9%	21.8%	3.3%
Source: California Transportation Asset Management Plan, 2018					

An alternative measure for bridge performance is to track the number of structurally deficient or functionally obsolete bridges. A structurally deficient bridge is one with routine maintenance concerns that do not pose a safety risk or one that is frequently flooded. A bridge is classified by the FHWA as functionally obsolete if it fails to meet design criteria either by its deck geometry, its load-carrying capacity, its vertical or horizontal clearances, or the approach roadway alignment to the bridge. According to the federal State Transportation Statistics document, in 2014, California had 6,807 structurally deficient/functionally obsolete bridges out of a total of 25,315 structures (27 percent), which constitutes an approximately 2 percent improvement from 2012.²¹

Further, another aspect of bridge performance for goods movement is the capacity for handling oversized loads, either by weight or dimension. When bridges cannot handle these permitted loads, freight routing is less efficient. The California Vehicle Code stipulates that no load is to exceed a height of 14 feet measured from the surface upon which the vehicle stands, except that a double-deck bus may not exceed a height of 14 feet, 3 inches. Despite this stipulation, there are several State routes that have vertical clearances of 14 feet or less, which means trucks with loads more than the vertical clearance must find alternate routes. **Table 3B.3** provides examples of vertical clearances on State routes that are 14 feet or less.²²

For these oversized and/or overweight loads, Caltrans has a special permitting system that identifies appropriate routes for a load, which might be significantly longer than another route. One such effort to reduce the number of these detours is Caltrans' Accelerated Bridge Program, which focuses on improving freight movement (extralegal trucks). The program aims to clear pinch points due to truck load and vertical clearance restrictions along primary highway freight corridors. These improvements will reduce unnecessary detours, which reduce impacts to neighborhoods and local streets, vehicles miles traveled, increase safety, and provide greater travel time reliability.

Table 3B.3. Vertical Clearances on the State Highway System of 14'-0" or less

Route	County	Postmile	Direction	Name	Vertical Clearance
I-5	San Diego	15.420	NB	Pershing Drive	13'-10"
SR-33	Ventura	18.231	NB	South Matilija Tunnel	13'-4"
SR-33	Ventura	18.811	NB	Middle Matilija Tunnel	13'-4"
SR-33	Ventura	18.846	NB	North Matilija Tunnel	13'-4"
SR-33	Ventura	18.846	SB	North Matilija Tunnel	13'-4"
SR-33	Ventura	18.811	SB	Middle Matilija Tunnel	13'-4"
SR-33	Ventura	18.231	SB	South Matilija Tunnel	13'-4"
I-110	Los Angeles	24.160	NB	College Street	13'-6"
I-110	Los Angeles	24.548	NB	Hill Street	13'-5"
SR-151	Shasta	5.508	EB	Coram Railroad Crossing	13'-9"
SR-151	Shasta	5.508	WB	Coram Railroad Crossing	13'-9"
I-238	Alameda	2.190	SB	Edenvale Railroad Crossing	14'-0"
Source: Caltrans, "Height & Low Clearances."					

Safety Assessment

Safety is Caltrans' top priority. By identifying incident trends, Caltrans and other infrastructure owners/operators can make the necessary infrastructure and operational improvements to enhance safety on the SHS. Additionally, improved technology can eliminate or reduce the severity of certain collisions.

In 2015, the California Highway Patrol (CHP) Statewide Integrated Traffic Records System (SWITRS) reported that out of the 4,764 drivers involved in fatal traffic collisions, 315 collisions involved trucks, and the truck driver was at fault in 74 incidents. This data indicates that automotive drivers involved in fatal collisions with trucks were far more likely to be at fault than the truck driver.²³

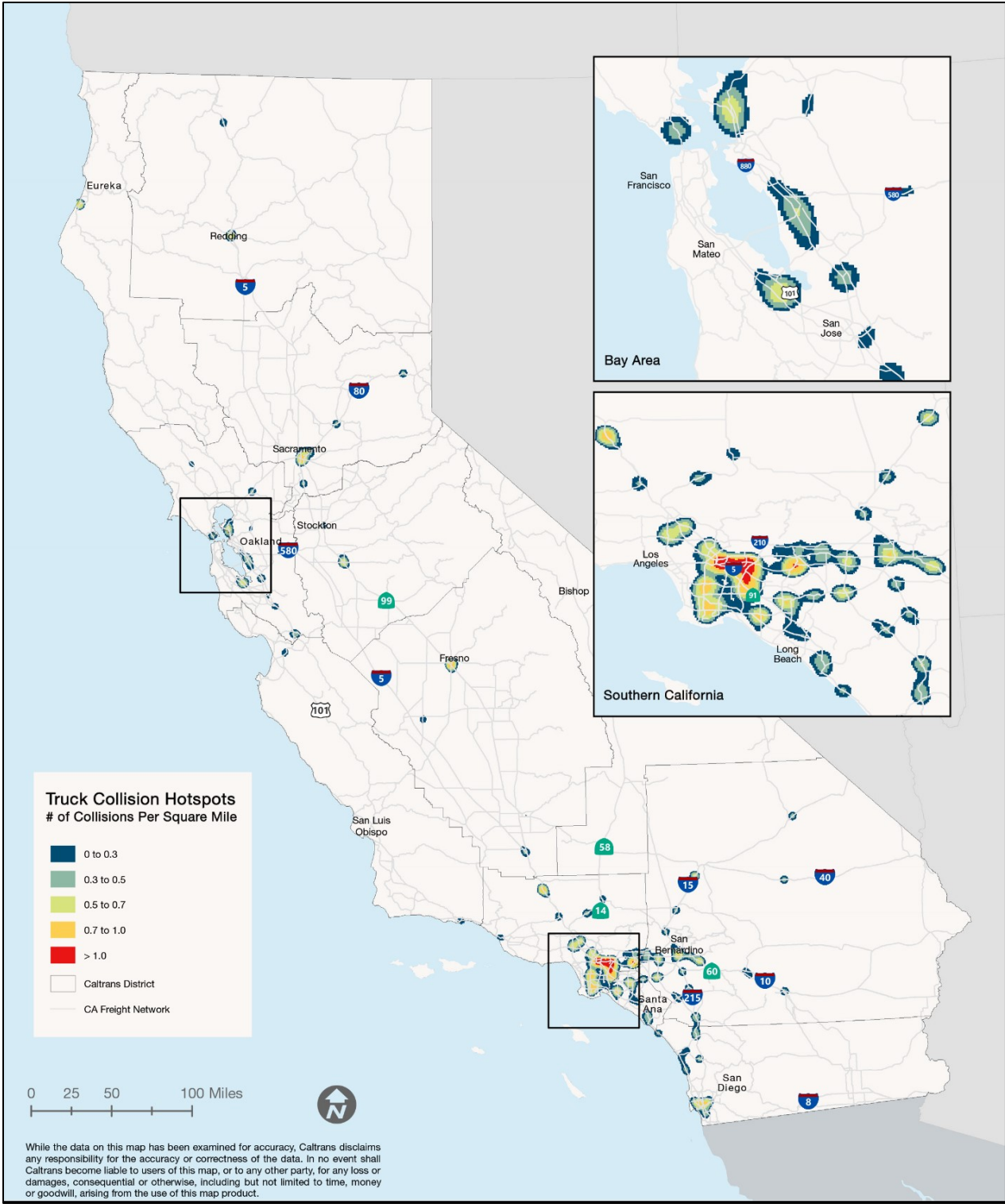
Of the total 329,509 injury collisions in 2015, 8,598 involved trucks. In 2,693 incidents, the truck driver was at fault. Drivers in passenger vehicles alone or pulling a trailer were at fault in 1,489 fatal and 114,433 injury collisions. Of the 2,693 collisions in which the truck driver was at fault, 1,153 occurred due to unsafe speed and 881 occurred due to unsafe lane changes or improper turning. The above statistics are represented in **Table 3B.4.**

Table 3B.4. Collision Statistics (Fatal and Injury)

Collision Statistics, Trucks and Passenger Cars Alone or Pulling a Trailer (2015)					
	Total Collisions	Involved	At Fault	Unsafe Speed	Unsafe Lane Changes
Trucks					
Fatal	4,764	315	74	-	-
Injury	329,509	8,598	2,693	1,153	881
Passenger Cars Alone or Pulling a Trailer					
Fatal	4,764	-	1,489	-	-
Injury	329,509	-	114,433	-	-
Source: California Highway Patrol (CHP) Statewide Integrated Traffic Records System (SWITRS) 2015					

Figure 3B.3 displays truck collision hot spots throughout California and clearly shows that the highest concentrations of truck collisions per square mile occur in the dense metropolitan centers of the Bay Area and Los Angeles.^{24,25} From 2013 to 2017, the number of collisions involving commercial trucks increased by four percent (75 in 2013 and 78 in 2017), although the number of commercial truck collisions resulting in a fatality decreased by eight percent (36 in 2013 and 33 in 2017). The number of commercial truck collisions resulting in an injury increased by 24 percent (34 in 2013 and 42 in 2017).

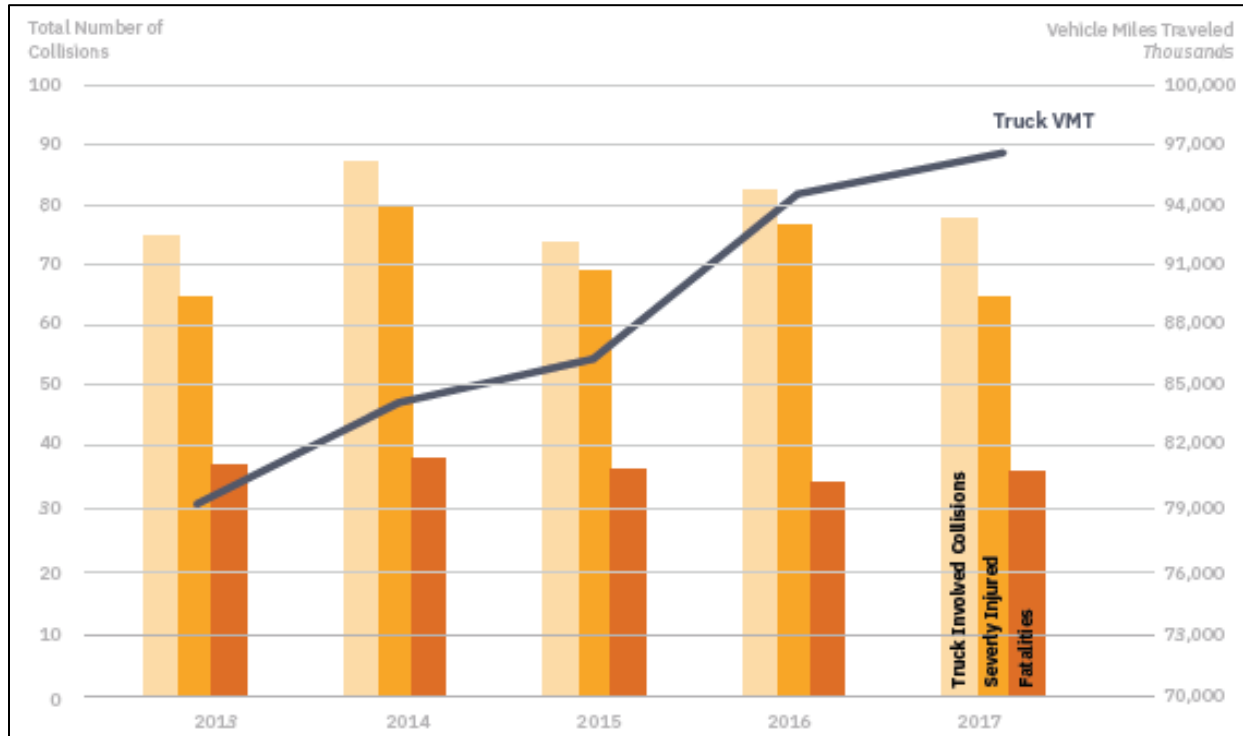
Figure 3B.3. Truck Collision Hot Spots



Source: Collision data from 2013-2017 SWITRS

During the same period, Truck VMT increased by 21 percent; therefore, the truck collision per million VMT decreased from 0.94 in 2013 to 0.81 in 2017 as shown in **Figure 3B.4**.²⁶

Figure 3B.4. Truck Collision by Severity and VMT Growth, 2013-2017²⁷



Source: Collision data from 2013-2017 SWITRS

Table 3B.5 shows the critical California highways with the highest combined truck-related fatalities and injuries from 2013 to 2017. The number of fatalities and injuries on these highways decreased by 17 percent during that period. As expected, most fatalities and injuries on multi-county corridors occurred in higher density areas:

- Along I-5, in Los Angeles and San Diego County (42)
- Along I-10 and I-15 in San Bernardino County (42)
- U.S. 101 in Santa Clara County (11)²⁸

Table 3B.5. California Critical Highway Truck-Related Fatalities and Severe Injuries, 2013-2017

Route	Corridor Length (Approx. Mile)	Total Fatalities/Injuries 2013-2017	Fatality/Injury Per Mile
SR 60	76	35	0.46
I-405	72.4	17	0.23
SR 91	59.0	12	0.20
I-210/SR 210	85	17	0.20
I-10/SR 10	243	38	0.16
I-15/SR 15	295.4	41	0.14
I-80	205.1	22	0.11
I-5	796.8	77	0.10
SR 99	424.9	20	0.05
US 101	1,540	48	0.03
SR 1	655.8	18	0.03
Total	4453.42	345	0.08
Source: Truck VMT estimates from EMFAC 2017 annual statewide database			

Freight Rail Assessment

The Class I railroads, Union Pacific Railroad (UPRR) and BNSF Railway (BNSF), own and operate 77 percent of the track mileage in the nation.²⁹ UPRR and BNSF control system maintenance and infrastructure and process over 3.4 million carloads originating and over 3.5 million carloads terminating in California per year.³⁰ Short line freight rail owners and operators tend to have fewer resources, however, it is common that short line railroads operate at slower speeds and have lighter rail car weights. This results in well maintained track mileage, but tracks are not built to FRA class 3 or higher track standards.

Rail Congestion and Bottlenecks/Chokepoint Assessment

Similar to roadway congestion, reduced track speed may be caused by bottlenecks and chokepoints are mainly caused by track capacity limitations, track structural strength, steep grades, track geometry, conflicts with passenger service, rail yard capacity, track class, and double-stack height limitations. The 2018 CSRP identified the following eight main line and intermodal bottlenecks and chokepoints:

- 1) BNSF San Bernardino – Los Angeles: San Bernardino via Fullerton and Riverside
- 2) BNSF Cajon: Barstow to Keenbrook
- 3) UPRR Sunset Route: Yuma Subdivision
- 4) UPRR Alhambra and Los Angeles:
- 5) UPRR Martinez: Oakland to Martinez
- 6) Southern Oakland Route: Oakland to Niles Junction
- 7) BNSF Main Line Stockton to Bakersfield: San Joaquin Corridor
- 8) UPRR Roseville to Reno over Donner Pass

Figure 3B.5.1. Heavy Rail Freight Traffic Corridor Bottlenecks in Southern California – Segments 1-4



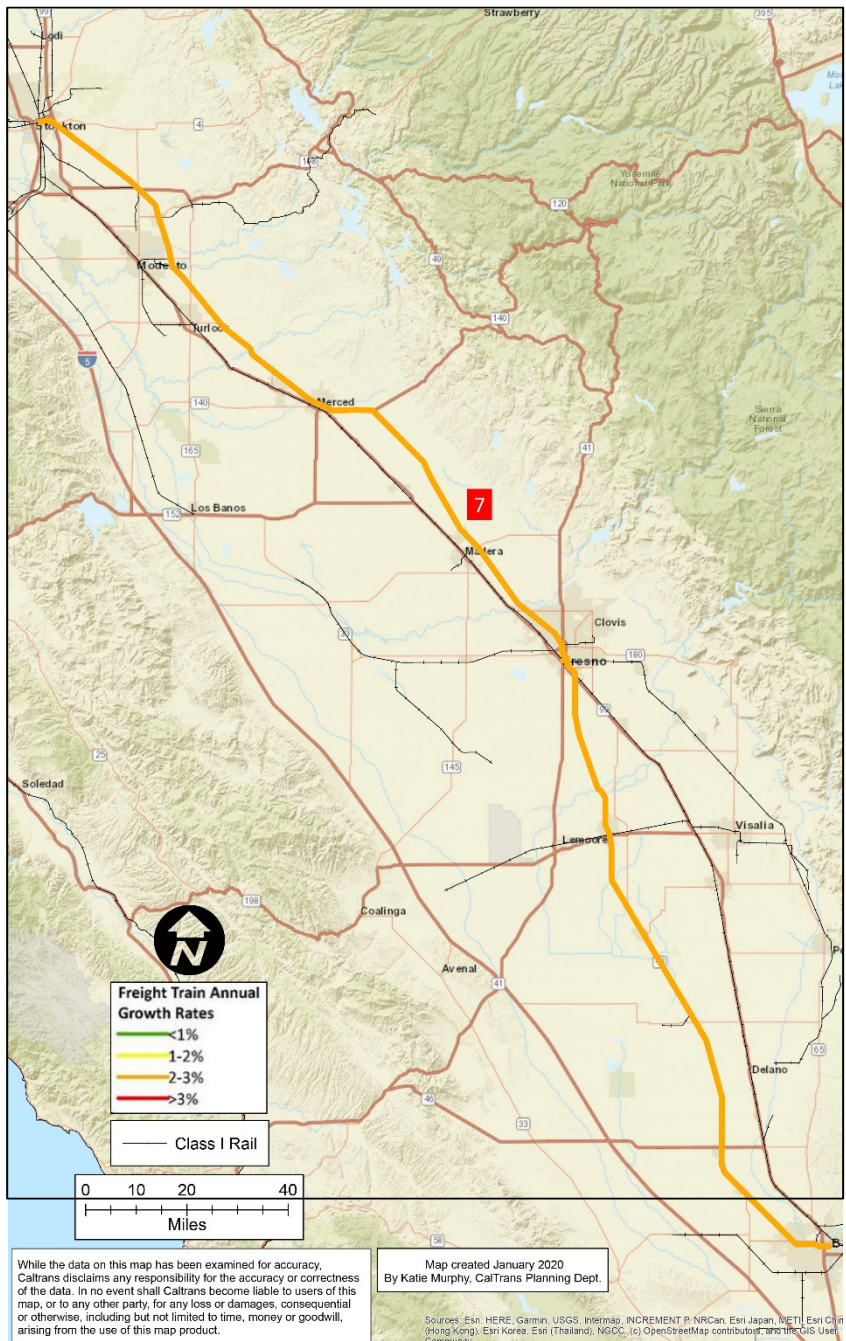
Source: Caltrans State Rail Plan, 2018

**Figure 3B.5.2. Heavy Rail Freight Traffic Corridor Bottlenecks in Northern California –
Segments 5 and 6**



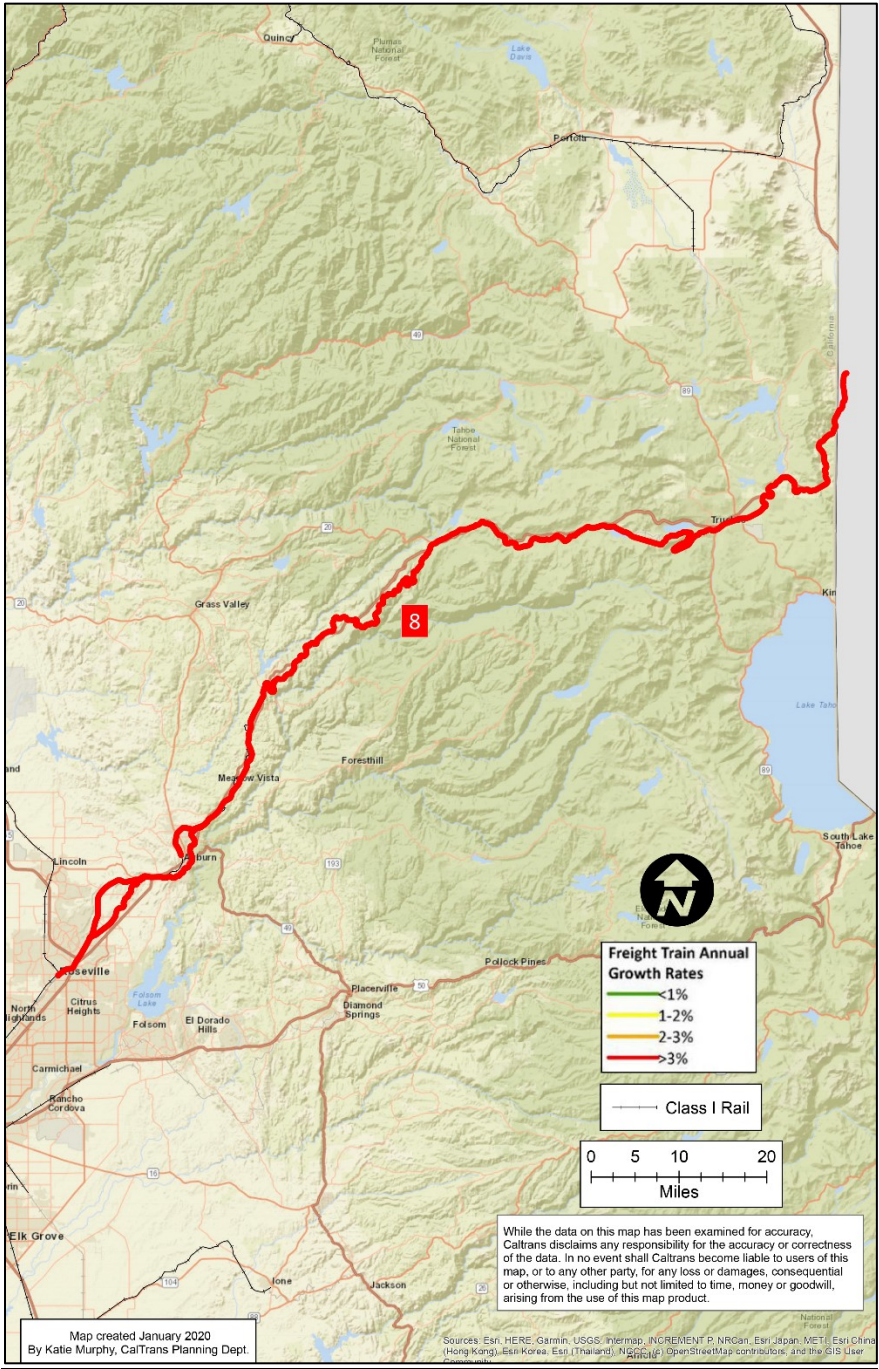
Source: Caltrans State Rail Plan, 2018

Figure 3B.5.3. Heavy Rail Freight Traffic Corridor Bottlenecks in Northern California
– Segment 7



Source: Caltrans State Rail Plan, 2018

Figure 3B.5.4. Heavy Rail Freight Traffic Corridor Bottlenecks in Northern California – Segment 8



Source: Caltrans State Rail Plan, 2018

The Federal Railroad Administration (FRA) categorizes all train tracks into six classes, segregated by maximum speed limits. **Table 3B.6** is a list of track miles by each category for California Class I railroads:

Table 3B.6. California Class I Railroads

Class	Maximum Speed Limit	Track Miles
Class 1	10 mph	38.5
Class 2	25 mph	380.2
Class 3	40 mph	794.8
Class 4	60 mph	10861.1
Class 5	80 mph	1167.2
Class 6	110 mph	none

Higher track speeds correlate to better system conditions and faster delivery times, typically equating to more efficient goods movement. Upgrading track and related facilities to enable higher travel speeds can be a valid infrastructure investment strategy, given a benefit/cost assessment that supports the action. Among the factors contributing to reduced speed are:

- Shared track with passenger train service
- Insufficient sidings
- Classification yard locations
- Heavy freight and/or vehicle traffic
- Steep terrain
- Curved rail geometry
- Tunnels
- Limited number of tracks
- Track gauge and tie/ballast strength

The 2018 CSRP identified the following segments of Class I railroads (**Table 3B.7**) that are restricted to speeds of 40 miles per hour or lower.

Table 3B.7. Class 1 Railroad Segments Restricted to Speeds of 40 mph or Lower

Route	Between	Mile Post	And	Mile Post	Miles	Owner of Track	No. of Tracks	Max. Speed
San Joaquin	Sacramento	89.1	Elvas	91.7	2.6	UPRR	2	35
Capitol Corridor	Rocklin	110.5	Roseville	106.4	4.1	UPRR	2	40
Capitol Corridor	Elvas	91.8	Sacramento	88.9	2.9	UPRR	2	35
Capitol Corridor	Sacramento	88.9	Sacramento River	88.5	0.4	UPRR	2	20
Capitol Corridor	Santa Clara	44.7	San Jose	47.5	2.8	PCJPB	3	40
Pacific Surfliner	Mission Tower	0.7	L.A. Union Station	0.0	1.4	LACMTA	5	25
Pacific Surfliner	Mission Tower	0.7	CP San Diego Jct.	0.9	0.2	LACMTA	2	25
Pacific Surfliner	San Juan Capistrano	197.2	Orange/San Diego County Line	207.4	10.2	OCTA	1	40
Source: California State Rail Plan, 2018								

Freight Rail Infrastructure Preservation

Double-stacking (when freight containers are stacked atop one another on rail cars) increases economic and energy efficiency; the 2018 CSRP states that “a double-stack container-trailer-freight rail car moves freight three to five times more fuel-efficiently than a truck.”³¹ Sufficient vertical clearance is needed for double-stack service, which is typically 19 feet for international cargo containers and 20 feet, 6 inches for domestic cargo containers. In California, all four of the following primary freight intermodal corridors have sufficient vertical clearances for double-stack service: BNSF Transcontinental, UP Sunset, UP Donner, and Tehachapi. Height limitations that preclude double-stacking along Class I and major Short Line railroad routes are listed in detail in the CSRP.

Track Weight Accommodation

According to the 2013 CSRP, in the mid-1990s, the standard railcar weight was increased from 263,000 to 286,000 pounds and became the applicable weight for all Class I railroads. A rail

line's ability to handle this weight is a function of track conditions, rail weight or gauge, and weight bearing structures such as bridges.³² Over 95 percent of California's Class I network is generally able to handle this standard weight, with only 1.2 percent of total miles (39 miles in Orange County) rated less than the standard. Weight data was not available for 120.5 miles of Class I track along the San Diego, Olive, and San Gabriel subdivisions.

Freight Rail Safety Assessment

California had 8,882 grade crossings in 2019³³ and 37 fatalities and 66 non-fatal injury collisions occurred at highway-rail grade crossings.³⁴ **Table 3B.8** summarizes highway-rail grade crossing collisions, fatalities, and injuries from 2014 to 2018.³⁵ This information was provided by the Federal Railroad Administration's Office of Safety Analysis, which does not differentiate between the number of freight and passenger train incidents.

Table 3B.8. Highway-Rail Grade Crossing Collisions, 2014-2018

Type & Highway User		2014	2015	2016	2017	2018
Train Struck Highway User	Car	38	46	51	68	65
	Trucks	28	37	38	24	46
	Pedestrian	36	35	50	45	52
	Other	6	7	11	6	5
	Subtotal	108	125	150	143	169
Highway user Struck Train	Car	15	14	13	12	15
	Trucks	4	8	3	6	2
	Pedestrian	-	1	1	2	2
	Other	-	2	1	3	1
	Subtotal	19	25	18	23	21
Total		127	150	168	166	190
Source: Federal Railroad Administration, Office of Safety Analysis, Total Causalities by State Report						

Short line railroads throughout California serve a critical role in keeping local communities connected to the national freight rail network. These lines tend to be products of Class I railroad spinoffs that faced years of deferred investment due to minimal traffic volume. Because of this, the short line rail industry faces significant challenges in upgrading its rail infrastructure. A short line's ability to haul the modern weighted 286,000-pound rail car can, in some cases, be the deciding factor if a new customer locates on its rail line. In addition, short lines on average operate their trains at much slower speeds because of the condition of the track and bridges. This can lead to increased wait times at crossings, emissions, and reduced utilization of crews and other railroad personnel. Generally, short line rail accommodates less weight than Class I rail. Though some short line railroads have excellent track conditions, the tie and ballast conditions of short line track are typically inferior to Class I track, and short lines often lack an active signaling system. Consequently, short line train speeds are generally lower

(typically 40 miles per hour or less for freight trains) and operations are less automated. Approximately one in five, 19 percent of tons and 18 percent of carloads, start their trips on a short line in California. Only 26 percent (270 miles) of reported short line mileage in California can accommodate the 286,000-pound maximum (CRSP 2018).

California short line railroads are facing pressure for investment to remain competitive with trucks, with short lines in other regions, and to maintain vital connectivity to Class 1 railroads.

Seaports

Marine Freight Infrastructure Preservation

Efficient inbound and outbound movement at California seaports is critical for the State's economic health. To preserve maritime transportation infrastructure, channels and harbors for all ports must be dredged and maintained to accommodate the size of ships that California ports are designed to handle. In addition to the California's 12 ports, there are 16 waterways that require minimum vessel depths. **Table 3B.9** indicates minimum channel depths as determined by the US Army Corp of Engineers (USACE), and actual channel depths as listed by the American Association of Port Authorities' (AAPA) Seaport Directory.³⁶

Table 3B.9. Minimum Seaport Channel Depth

Channel	USACE	AAPA
San Diego Harbor	39'	37'-47'
Long Beach Harbor	68'	76'
Los Angeles Harbor	57'	53'
Port Hueneme	39'	35' MLLW*
Redwood City Harbor	38'	30'
San Francisco Bay Entrance	47'	--**
San Francisco Harbor	45'	55'
Oakland Harbor	45'	50'
Richmond Harbor	47'	35'-38'
San Pablo Bay and Mare Island Strait	42'	--
Carquinez Strait	42'	--
Suisun Bay Channel	42'	--
San Joaquin River	40'	--
Stockton	40'	35'*
Sacramento River	34'	--
Humboldt Harbor and Bay	34'	--

Source: American Association of Port Authorities' (AAPA) Seaport Directory, 2018.

*mean lower low water (Figures are for planning purposes only and not intended for use in navigation decision making.) **These facilities are no longer with AAPA

The configurations of some California ports require vessels to heed minimum bridge clearances to avoid collisions. Vertical clearance is measured as the distance from the mean high-water level (high tide) to the bottom of the structural span.

Table 3B.10 shows minimum vertical bridge height information for major California seaport bridges.³⁷ Access to the inland ports of Stockton and West Sacramento may require navigation under smaller fixed bridges and draw bridges.

Table 3B.10. Major Bridge Vertical Clearances

Bridge	Vertical Clearance
San Diego – Coronado Bay	
West Span	156'
Middle Spans	175'-195'
East Span	214'
Vincent Thomas	
Middle Span	165'
Gerald Desmond	
Current	155'
New	205'
San Mateo – Hayward	135'
San Francisco – Oakland Bay	
West	204' -220'
East	112'
Golden Gate	
Center	225'
North Pier	213'
South Pier	211'
Richmond – San Rafael	
West Channel	185'
Carquinez	
North Span	146'
South Span	132'
Martinez UP Rail Bridge	135'
Rio Vista Bridge	146'
Source: NOAA Raster Chart Products	

Air Cargo Assessment

Of California's top 13 air cargo-carrying airports, 12 also have commercial passenger service, with Mather Airport in Sacramento as the exception. Runway pavement is regularly inspected by federal and state officials for conditions and other compliance measures. These assessments ensure California's runways are maintained in "good" condition or better. Airport

infrastructure, other than runways, is typically maintained by municipalities or regional airport systems. The California Air Cargo Groundside Needs Study³⁸ concluded that California airports have sufficient capacity to meet 2040 demand.

System Performance Monitoring

The National Highway Performance Program, which was established under MAP-21 and continued under the FAST Act, provides support for the condition and performance of the National Highway System (NHS), for the construction of new facilities on the NHS, and for ensuring that investments of Federal-aid funds in highway construction are directed to support progress toward the achievement of performance targets established in a state's asset management plan for the NHS.

Safety Measures

Safety Performance Management (SPM) is part of the overall Transportation Performance Management (TPM) program, which the FHWA defines as a strategic approach that uses system information to make investment and policy decision to achieve national performance goals. The Safety PM Final Rule supports the Highway Safety Improvement Program (HSIP), as it establishes safety performance measure requirements for the purpose of carrying out the HSIP and to assess fatalities and serious injuries on all public roads.

Caltrans, in cooperation with the Office of Traffic Safety (OTS), is required to set five annual Safety Performance Management Targets (SPMTs) for all public roads in California by August 31 of each year. This is pursuant to the MAP-21 Act, P.L. 112-141. The Safety Performance Management Final Rule adds Part 490 to Title 23 of the Code of Federal Regulations to implement the performance management requirements in 23 U.S.C. 150.

Caltrans set SPMTs for the 2019 calendar year by August 31, 2018. Caltrans and OTS have adopted aspirational goals consistent with the California Strategic Highway Safety Plan (SHSP) as follows:

Table 3B.11. Safety Measures (based on a 5-year rolling average)

	Data Source	Target 2019	Reduction 2019
Number of Fatalities	FARS	3,445.4	3%
Rate of Fatalities (per 100M VMT)	FARS & HPMS	0.995	3%
Number of Serious Injuries	SWITRS	12,688.1	1.5%
Rate of Serious Injuries (per 100M VMT)	SWITRS & HPMS	3.661	1.5%
Number of Non-Motorized Fatalities and Non-Motorized Severe Injuries	FARS & SWITRS	3,949.8	3% (Fatalities) 1.5% (Serious Injuries)
Source: California Department of Transportation and the Office of Traffic Safety, 2018			

States must establish statewide targets for each of the safety performance measures. Targets will be established annually, beginning in August 2017 for calendar year 2018 (and so forth). For three performance measures (number of fatalities, rate of fatalities and number of serious injuries), targets must be identical to the targets established for the National Highway Traffic Safety Administration (NHTSA) Highway Safety Grants program that is administered by OTS. The State Departments of Transportation must also coordinate with Metropolitan Planning Organizations (MPOs) in their states on establishment of targets, to the maximum extent practicable. States report targets to the FHWA in the HSIP report that are due in August of each year.

Infrastructure Measures

The Bridge and Pavement Performance Management Final Rule, which is codified in 23 Code of Federal Regulations Part 490, defines the following national performance measures for bridge and pavement:

Pavement Measures

- Percentage of Interstate pavements in Good condition
- Percentage of Interstate pavements in Poor condition
- Percentage of non-Interstate NHS pavements in Good condition
- Percentage of non-Interstate NHS pavements in Poor condition

Bridge Measures

- Percentage of NHS bridges in Good condition
- Percentage of NHS bridges in Poor condition

Table 3B.12. National Highway System Pavement and Bridge Performance Measures

	2-Year NHS Targets <i>(1/1/2018 to 12/31/2019)</i>		4-Year NHS Targets <i>(1/1/2018 to 12/31/2019)</i>	
NHS Pavement Condition	Poor	Good	Poor	Good
Interstate	45.1%	3.5%	44.5%	3.8%
Non-Interstate	28.2%	7.3%	29.9%	7.2%
NHS Bridge Condition	69.1%	4.6%	70.5%	4.4%
Source: Caltrans Letter to Regional Transportation Planning Agencies, May 21, 2018				

System and Freight Performance Monitoring

Truck Travel Time Reliability Index

Average travel time for a corridor does not provide travel time reliability information for individual trips along that corridor. Truckers, who may lose a competitive edge if shipments are late or too early, need to consistently predict actual arrival time. Truck Travel Time Reliability (TTTR) Index is the FHWA recommended metric to assess freight movement on NHPN.

This TTTR Index comes from the collection of travel time data on the heaviest traffic days and comparing those to average travel time. It is calculated for each segment and each peak period. Based on FHWA methodology, the TTTR index is generated by dividing the 95th percentile time by the normal time (50th percentile) for each segment. The TTTR Index is generated by multiplying each segment's largest ratio of the five periods by its length, then dividing the sum of all length-weighted segments by the total length of roadway. For example, if a trip usually takes 20 minutes, and the TTTR Index is 40 percent, an additional 8 minutes (20 minutes x 0.4 = 8 minutes, or 28 minutes total) should be allowed for that stretch to ensure on-time arrival over 95 percent of the time for that segment.

In February 2017, FHWA finalized the ruling for this performance measure and required state DOTs to report TTTR Index periodically. The average TTTR Index for the Interstate Highway network in California in 2018 was 1.69. In 2018, California Biennial Performance Report State Caltrans established 2- and 4-year targets to improve TTTR Index to 1.68 by 2020 and to 1.67 by 2022.

Table 3B.13. System and Freight Performance Measures

	2017 Baseline Data	2-Year Target	4-Year Target
% of Reliable Person-Miles Traveled on the Interstate	64.6%	65.1% (+0.5%)	65.6% (+1%)
% of Interstate System Mileage Providing Reliable Truck Travel Time (<i>Truck Travel Time Reliability Index</i>)	1.69	1.68 (-0.01)	1.67 (-0.02)
Source: NPMRDS Analytics Tool			

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Chapter 4: Future of Freight

A.Trends, Issues, and Opportunities

B.Freight Flows and Forecast

4.A. Trends, Issues, and Opportunities

California's goods movement sector is a dynamic sector that has dramatically changed and grown since the end of World War II. Major technological advancements, such as containerized cargo, automation, and open global markets, have contributed to the state's success as an international gateway, while population growth, high-tech manufacturing, and e-commerce have led to increases in domestic freight. Although environmental issues are still a critical concern in freight planning, the State has made significant strides towards addressing community impacts associated with moving goods. For example, when CARB met for its first time in 1968, the Los Angeles basin experienced 200 Stage 1 Smog Alerts that first year. By 1985, that number had fallen to 43. Since 2008, the only Stage 1 Smog Alerts issued have been because of wildfires. Even so, air quality attainment status continues to evade much of the state, thus driving transportation policy toward strategies that will further reduce air pollution and greenhouse gas (GHG) emissions from the transportation sector. As the world's fifth largest economy¹, California's economic health matters to the nation. This careful balance between environmental protection and commerce provides the backdrop for many of the trends that will be described in this chapter.

California has, and continues, to invest in infrastructure improvements to seaports, airports, rail facilities, and roads and bridges. These investments have improved freight fluidity and safety, reduced congestion for freight and passengers, significantly reduced emissions that impact health and contribute to GHG, and attracted industries to do business here, resulting in jobs and economic benefits.

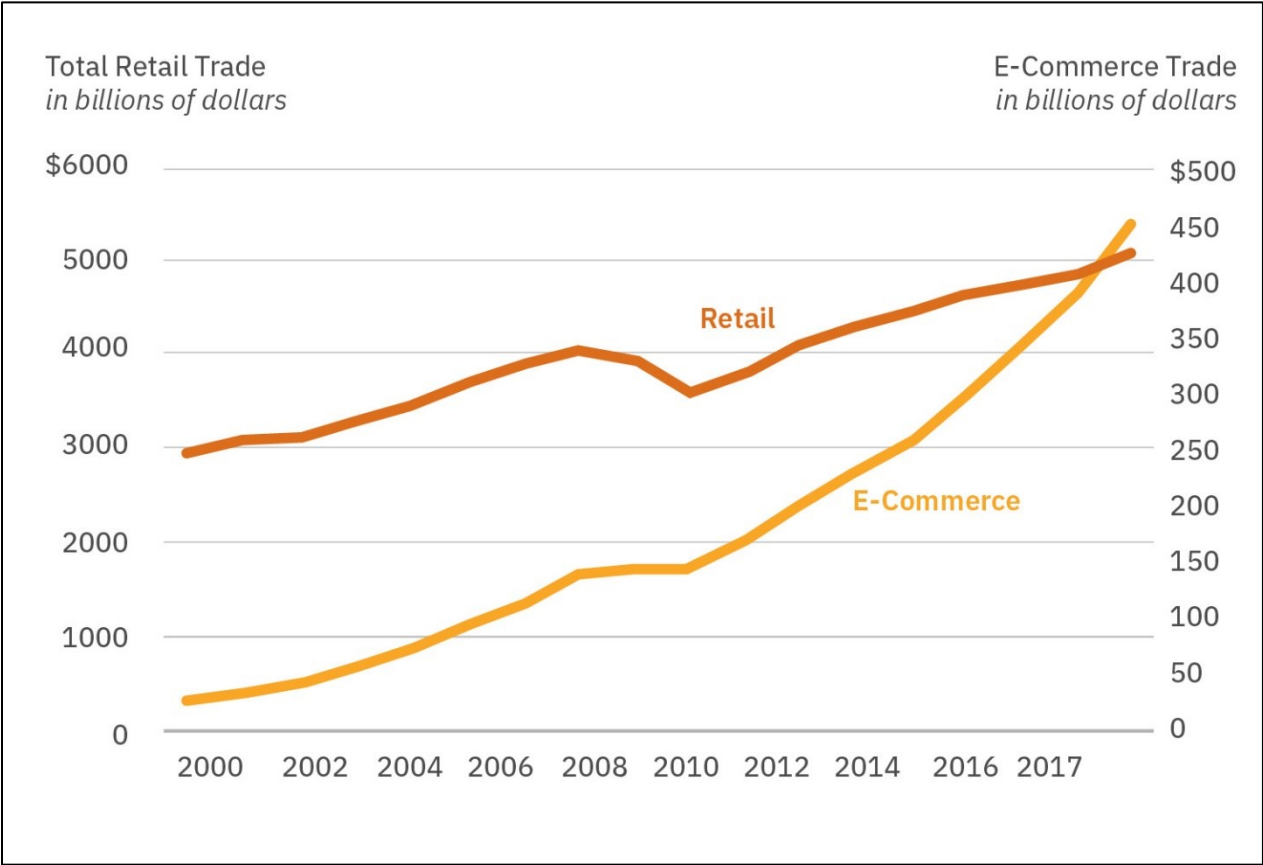
E-Commerce Consumer Trends

The trends with consumers and their buying behavior in California are like those in the rest of the country. E-commerce is growing in part because of the comfort that younger generations have with using online applications and websites. Millennials, notably, grew up with computers and smart phones that have transformed how they socialize, travel, communicate, and consume goods. A Boston Consulting Group (BCG) study found that there are differences in buying behavior and attitudes between Millennials and older populations, including Generation Xers and Baby Boomers.^{2, 3} Generational differences in buying products or rating purchased products are well-correlated with use of social media and the Internet. Millennials tend to shop online more than the traditional consumers, due to their social media and internet use.⁴ Companies that better understand the buying behavior and attitudes of Millennials have adapted their supply chains to meet their needs. Additionally, capturing older populations has partly been a function of providing faster delivery service, since Gen Xers and Baby Boomers grew up driving to the nearest retail store to purchase what they need when they needed it.

As ordering online has become faster and more convenient, growth in e-commerce has continued at a faster rate than traditional retail. As shown in the **Figure 4A.1**, total retail growth has increased from \$3 trillion to \$5 trillion over the past 17 years, whereas e-commerce has

gone from \$25 to \$450 billion in the same time period. This means that e-commerce as a share of total retail has grown 9 percent in 17 years. Even during the 2008 global recession, when total retail trade slowed and dipped, e-commerce grew, capturing an additional one percent of the total retail share. In 2018, e-commerce experienced 16 percent growth, a trend that is anticipated to continue through 2023.⁵

Figure 4A.1. Historical National Total and E-Commerce Retail Trade Sales, 2000-2017



Source: U.S. Census Bureau's 2017 Annual Retail Trade Survey

E-Commerce and Air Cargo Demand

One factor contributing to the rise of e-commerce, as opposed to traditional retail, is the large variety of goods available for same-day and next-day delivery. Greater emphasis is being placed on reliable deliveries throughout these networks as delivery windows continue to shrink.⁶ According to Caltrans' latest California Air Cargo Groundside Needs Study 2013, the cargo tonnage at airports is expected to grow at most airports by 2040, as shown in **Table 4A.1**. Since the completion of this study, e-commerce growth and demand for same-day and next-day delivery service has resulted in modest increases in air cargo at urban airports, such as San Francisco, San Jose, and Orange County. For example, over the past three years Amazon has opened nine Prime Now Hubs near urban centers and airports or seaports. This allows Amazon to respond within hours to customer orders. The nine hubs are clustered around Los Angeles, San Francisco, San Diego, Sacramento, and San Jose. The 45,300 square-foot Irvine facility in

Orange County began operating in 2015 less than two miles from John Wayne Airport. This trend could continue given the anticipated growth in e-commerce. First/last mile connections to airports may require additional improvements to accommodate this potential growth in air cargo.

Table 4A.1. Air Cargo Tonnage Trends (in thousands)

California's Top Air Cargo Airports	2013	2018	% Change from 2013	2040
Los Angeles International Airport (LAX)	1,917	2,444	28%	3,016
Ontario International Airport (ONT)	461	826	79%	972
Oakland International Airport (OAK)	556	670	21%	779
San Francisco International Airport (SFO)	400	628	57%	592
San Diego International Airport (SAN)	162	192	18%	278
Sacramento International Airport (SMF)	74	127	71%	90
Sacramento Mather Airport (MHR)	55	77	41%	69
San Jose International Airport (SJC)	47	61	29%	49
Hollywood Burbank Bob Hope Airport (BUR)	55	55	0%	72
Stockton Metropolitan (SCK)	NA	45	55%*	NA
Long Beach Airport (LGB)	26	24	-10%	20
Santa Ana (John Wayne) Airport (SNA)	18	20	10%	22
Fresno-Yosemite International (FYI)	12	11	-10%	16
Source: Historic data is provided by Caltrans Division of Aeronautics. 2040 estimates are reported from California Air Cargo Groundside Needs Study, Caltrans, 2013 *percentage change is from 2013 to 2018				

Independent Delivery Drivers: Transportation Network Companies

In addition to increased demand in the air cargo sector, Transportation Network Companies (TNCs) have become one of the mechanisms used by shippers to deliver goods between fulfillment centers/retail establishments and consumers. For example, over the past five to six years, Amazon has partnered with different delivery and courier services to reduce the delivery time on Amazon orders but has seen limited success. Due in part to complaints about missed delivery times, missing orders, and overall dissatisfaction with courier services, Amazon made the decision to alter last-mile, same-day delivery operations. In 2016, Amazon began contracting with its own drivers through a program called AmazonFlex.⁷ Like TNCs, independent owner-operators of light vehicles work for Amazon to make reliable, same-day delivery possible.

In response, others such as Walmart have contracted with both Uber (UberRUSH) and Lyft to provide delivery capabilities that compete with Amazon. Unlike the Uber and Lyft passenger services, they do not currently operate within the same market areas.⁸ For smaller, local businesses, Postmates.com and DoorDash.com act in a similar capacity. Independent owner-operators of passenger cars respond to online orders for goods that range from restaurant orders to groceries to home improvement products and deliver the items within an hour. These services allow local, non-Amazon retailers to better compete with the faster and more convenient delivery options that consumers are demanding.⁹

Land Use Trends

The advent of e-commerce has changed business as usual for the retail industry, resulting in the closing or restructuring of many traditional retail operators. Consequently, the space previously occupied by retail stores is often being repurposed to office, residential, and other uses. Major malls are closing in favor of other uses.

Large retailers, such as Sears, The Gap, JC Penney, and others have closed hundreds of stores over the past few years. Such closings could accelerate, as lease terms for big retailers are typically between 10 and 25 years. This means that many leases were negotiated before e-commerce really took off. In 2018, only 44 million square feet of retail space opened in the 54 largest U.S. markets, down 87 percent from 325 million in 2006, according to CoStar Group, Inc., a real-estate research firm.¹⁰ There will continue to be more of this trend, as the growth and demand for easy and convenient online shopping and merchandise returns continue.¹¹

The biggest unknown for cities and counties is the true impact of e-commerce on sales tax revenue, land use, and infrastructure. These trends will impact local sales tax revenues, traffic patterns, and occupancy of retail centers. Initial research indicates that e-commerce will reduce overall vehicle trips,¹² eliminate local sales staff jobs, and increase high-tech and warehouse jobs, but the impact on local sales and property tax revenues is not yet well-documented.¹³

Trends in E-Commerce Fulfillment and Distribution Centers

The Inland Empire, Bakersfield, and Stockton have all recently seen significant rise of industrial warehouse development and particularly development related to e-commerce distribution and fulfillment centers. This trend is best explained by exploring the keys to successful e-commerce businesses. According to Prologis, a major industrial warehouse developer/operator, warehousing needs for e-commerce requires three times more logistics space than traditional brick-and-mortar retailers.¹⁴ This need for space, predicated by consumer demand for a wider variety and selection of merchandise (i.e., more Stock Keeping Units, or SKUs) that can be delivered within two days, has led to the development of high-cubed, automated warehouses with minimum ceiling heights of 66 feet. The rise of e-commerce and the need for more logistics space, in lieu of retail space, is rapidly changing the real estate market. In traditional brick-and-mortar retail, the most desirable spaces are located in places with heavy foot-traffic. Successful e-commerce facilities, however, have a very different set of requirements. The most desirable locations for distribution center development have proximity to major urban

population centers, available land for the development of a minimum facility size of one million square feet, zoning that allows minimum building heights of 66 feet, good access to major transportation (road, rail, airports and seaports), an available workforce, and a business-friendly environment.

Another potential impact of a network reconfiguration is a rise in rent for facilities in infill markets, which have doubled in the last five years and are expected to continue to grow.¹⁵ The fulfillment centers are typically smaller, with average sizes between 50,000 and 500,000 square feet located in urban areas. Companies, such as Walmart, use their retail centers to fulfill orders. Others, including Amazon, rely on a network of local fulfillment centers to respond to same-day, next-day, and two-day demand. Amazon (at the time of this report) has 19 fulfillment centers operating in the State, and it ranked California as number 2 on its list of “Top 10 Most Entrepreneurial States.” More than 175,000 small and medium-sized businesses in California sell on Amazon.¹⁶

Emerging Technology Trends

3D Printing/Additive Manufacturing

As a subset of Additive Manufacturing, 3D printing refers to technologies that fabricate products by building up thin layers of material from three-dimensional, computer-aided designs. 3D printing uses machines to “print” successive layers of materials to create a full-range of products. 3D printing, often dubbed the Third Industrial Revolution,¹⁷ is anticipated to cause significant disruptions in both manufacturing and supply chains, including re-shoring manufacturing jobs back to the U.S., co-mingling of manufacturing, storing, and fulfilling orders under one roof, and encouraging local production and customization opportunities for everything from the latest tennis shoes to automobile parts – and all with zero waste. One potentially radical impact of 3D printing is that it may drive down the volume of finished goods shipments. In turn, the nature and destination of raw materials shipments might change dramatically. Businesses will have to figure out which products (or parts of products) can be printed and, accordingly, what manufacturing, assembly and shipment options need to be reinvented. Logistics service providers might offer customers 3D printing services at centralized warehouse locations connected to their shipping facilities. For example, instead of shipping a product from Cleveland to Seattle, a manufacturer might sell the rights to the digital model to a logistics company, which then prints the product in Seattle and delivers it to the customer.¹⁸ 3D printing can lead to more sustainable manufacturing – both economically and environmentally. The ability to print on-demand as orders are received could eliminate shipping costs of unsold goods, discarding unsold goods, and eliminating waste in the manufacturing process itself, which in turn would reduce the amount of energy consumed for both producing and transporting unwanted merchandise.

3D printing is scalable and can support the production of very small items, such as nuts and bolts, to very large-scale items such as houses. The process can occur in small spaces and could lead to the redevelopment of underutilized and antiquated industrial uses in key locations throughout California.

From 2015 to 2017, the 3D printing market growth rate more than doubled from 4.6 percent to 12.5 percent, and analysts at Deloitte estimate that 3D printing will continue to grow at an annual rate of 12.5 to 12.6 percent through 2020.¹⁹ This growth is significant; however, the importance for California is the flexibility and speed to market 3D printing technology. It allows specialized or additive parts to be generated onsite rather than ordering and waiting for those parts to arrive. The total impact on logistics and truck trips is not yet known, but since bulk material requires less space in a truck than manufactured parts, 3D printing may result in fewer truck trips.

Drone Delivery

Large and small delivery companies have been testing alternative delivery vehicles. For example, UPS, Amazon, and DHL have been testing drones since 2016, following a letter from Amazon to the FAA requesting permission to use drones for delivery. In its letter, Amazon stated that 80 percent of the packages that they ship weigh less than five pounds. In 2015, the FAA established a working group to investigate regulatory changes that would be needed to allow drone delivery, including requirements of drone operator's visual contact with the drone, flight height limits of 400 feet, flight prohibitions over government buildings and within five miles of an airport, sense and avoid capabilities, and drones' ability to be identified (which would require Section 336 of the FAA code to be lifted). In April of 2015, the FAA provided limited approval to Amazon for testing drone delivery, and in May 2018, additional approval was provided for a three-year testing period for using drones for deliveries, inspections, and other tasks.²⁰ Aside from the FAA regulations, limited battery life (approximately two hours) and efficient/accurate delivery drop-off pose additional challenges for the successful use of drones for package delivery. The practicality of full-scale drone deployment and use is unknown, but the FAA is evaluating regulatory changes that would support commercialization of drone delivery.

Automation and Supply Chain Analytics

The adoption of robotics and automation is growing rapidly. Robots have been used for the past 20 years on assembly lines in manufacturing, but as costs continue to have decreased and machine learning aided by computing power has increased, robots have become much more common. The advancement of robots through tools such as artificial intelligence (AI), which is the simulation of human intelligence and mimicry of human actions, has benefitted the entire supply chain by streamlining work and creating efficiencies. From warehouses to port complexes, robots and automation are being leveraged to address efficiency, cost, safety, and workforce availability challenges.

According to the 2018 MHI Annual Industry Report:

- Only 22 percent of the surveyed supply chain companies are currently using Internet of Things (IoT) technology, but that is likely to increase to 50 percent within two years and 79 percent within five years
- Currently, only 19 percent of surveyed companies say they are currently using predictive analytics, but over the next five years the adoption rate is expected to jump to 82 percent
- Although the current adoption rate for AI is only six percent among surveyed companies, that number should grow to about 47 percent by 2023.²¹

Warehouse and Manufacturing Automation

Collaborative robots, or “cobots,” are robots that are designed to operate collaboratively with humans. According to research by Interact Analysis, use of the cobot is predicted to grow by more than 60 percent in 2019, an industry value change from less than \$400 million in 2018 to nearly \$600 million in 2019.²² The growth is fueled by the wider availability of collaborative robots from mainstream industrial robot vendors, greater awareness among small- to medium-sized companies, and increasing adoption by major manufacturers and logistics firms.

Emerging automation technologies are enabling companies to make same-day deliveries easier. Not only does the system help retrieve and track thousands of different SKUs, but the robots also assist with providing real-time inventory and replenishment requests. This is important for California because these systems allow sellers to meet consumer demands within a smaller footprint and with less labor in a state where available industrial land and labor are costly.

Blockchain

Blockchain, defined as a system in which records of digital transactions are maintained securely across several computers linked in a peer-to-peer network, is also making its way into the supply chain. Two major challenges for blockchain continue to be:

- Integration of many different systems
- Trust

The use of blockchain applications, although growing more slowly than previously projected by industry leaders such as General Electric, continues to rise. In September 2018, Walmart announced the use of its Food Traceability Initiative, a blockchain technology platform developed by IBM to track food through the supply chain beginning with leafy greens. The globalization of food and lack of tracking that food throughout the supply chain has led to large-scale recalls of both contaminated and non-contaminated products because of the inability to differentiate between them. In response, global retailers have begun to employ technology to better track food and prevent full-scale recalls of products.

For California’s supply chain, additional deployments of blockchain could provide real-time information about how cargo is moving through the system. This would also allow truck drivers to plan arrival times, and terminal operators could reduce peak-hour congestion, truck idling at terminals, and reduce truck-turn times.

Automated Marine Terminals

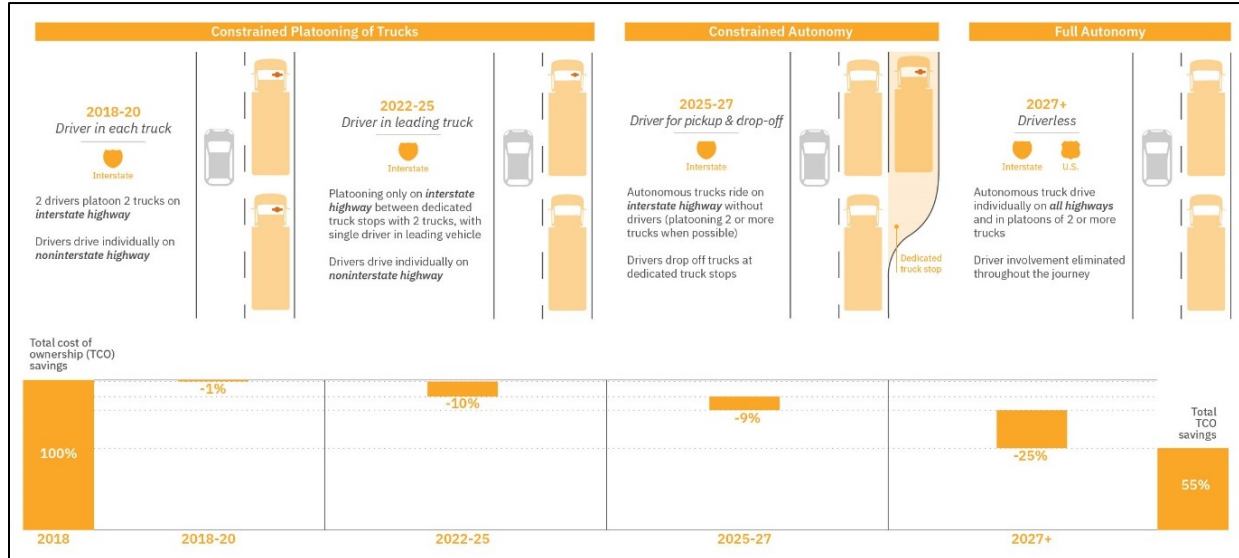
Automated marine terminals involve the use of automated Rail Mounted Gantries (RMG) and automated trucks. This technology can potentially move more goods while generating fewer emissions than traditional manned marine terminals. In addition to deploying electric and battery-operated equipment, this technology also processes trucks more quickly, resulting in less idling. However, quicker cargo processing at the terminals also potentially means more trucks are released at once into the surrounding roadway network and more demand is placed on the infrastructure beyond the ports. Currently, the POLA, POLB, and other California ports are not contemplating fully automated marine terminals. When and if automated marine terminal technology is adopted, close coordination will be necessary between the ports, Caltrans, and local jurisdictions.

Automated Rail Yards

Automated rail yards offer significant advantages, including decreased dwell times, increased safety, and increased throughput. However, due to complexities and cost of development, the implementation of automation in freight rail yards has been slower than in warehousing. Like marine terminals, automation of intermodal rail yards requires a significant amount of data to successfully plan, implement, and operate. One of the greatest challenges to designing an automated rail yard is developing the Terminal Operating System (TOS) that links equipment, computers, machines, and other elements via a single platform to provide real-time communication and information-sharing throughout the facility for operations, and the planning and monitoring of activities. Fully automated freight rail yards do not currently exist in California but may be deployed in the future.

Connected and Autonomous Trucks

Autonomous, or self-driving, vehicles are increasingly identified as a “disruptive trend.” Disruptive trends are defined as a trend that upends business as usual. It is anticipated that driverless technologies will create several societal benefits ranging from safety to productivity, but this technology will require workforce development for displaced drivers. McKinsey & Company, an American management consulting firm, recently published an in-depth article on the future of automated trucks. According to their research, they anticipate Level 4 (nearly fully autonomous trucks capable of operating within a constrained geo-fenced environment without a driver) will be deployed as early as 2025. **Figure 4A.2** depicts the anticipated timeframes for technology deployment based on this research. It is important to note that in California regulations allowing for the testing and deployment of autonomous motor trucks weighing less than 10,001 pounds (such as delivery vehicles) on public roads is allowed with an approved permit from the California Department of Motor Vehicles (DMV). The DMV began approving new applications for permits for these types of vehicles on January 16, 2020. The DMV’s regulations exclude the autonomous testing or deployment of vehicles weighing more than 10,001 pounds.²³

Figure 4A.2. Timeframes for Autonomous Truck Deployment

Truck Platooning

Connected trucks, also known as truck platooning, refers to the linking of two or more trucks in a convoy using technology to link and automate acceleration and deceleration of the connected trucks. The technology automatically sets and maintains close distance between each vehicle, allowing for fuel savings and increased safety.

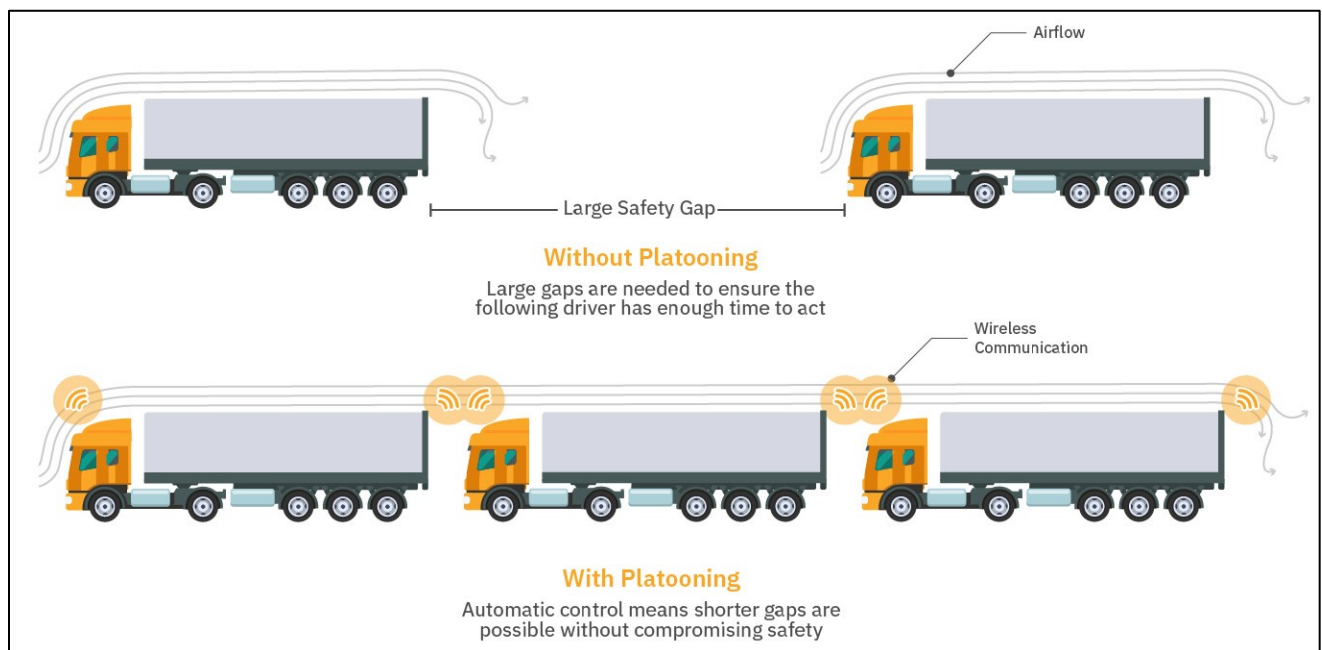
A truck platoon is a series of trucks following each other on the road, with acceleration and deacceleration controlled automatically (steering is typically still manual). When any truck's speed changes, the others behind it are instantly notified wirelessly, and those trucks respond immediately by following suit. This allows for much closer following distances, which reduces wind resistance and increases the number of trucks that can fit on the road at high speeds, thereby increasing roadway capacity. This also protects against rear-end crashes by automating brake reaction time.

Government and industry have worked closely on the permitting of platooning testing on public roads, and so far, the technology has been effective and safe. As of December 2018, California permits platooning for testing purposes, while 17 states (including neighboring Nevada and Oregon) permit it without limitations. Four other states (including neighboring Arizona) allow for limited commercial deployment. The most significant change to the rules is how closely trucks may follow one another.²⁴ Currently, there is no formal process for implementing new freight technologies. The Federal government is responsible for approving the technology, while the state is accountable for the actual implementation of the new technology.

The certification of vehicles is the responsibility of the original equipment manufacturer, but industry organizations are the ones that provide the recommendations for certification standards and practices. However, Driver Assisted Truck Platooning (DATP) in Nevada has been

classified as only Level 1 automation, which does not require special registration; other states are following suit. California, an early adopter of truck platooning demonstration projects, can capture the full benefits of DATP if the state continues to move towards enabling legislation to support implementation of this technology. The actual benefits of national truck platooning deployment are not yet fully understood because it is unclear how willing competing truck companies will be to connect with one another. However, fuel savings, based on recent truck platooning demonstrations conducted by UC Berkeley Institute of Transportation Studies Partners for Advanced Transportation Technology (PATH) at the Aerodynamics Laboratory in Canada, indicate potential net fuel efficiency gains for a three-truck platoon of 5.2-5.7 percent.²⁵ Enabling legislation in California would allow for the use of this technology, which, if deployed, would result in some emissions reductions.

Figure 4A.3. Truck Platooning Concept



Autonomous Trucks

Autonomous trucks differ from connected trucks since the entire system has an auto-pilot function, including steering. Embark, in partnership with Ryder, has been testing autonomous trucks between El Paso, Texas and Palm Springs, California. The focus has been on the freeway route, with the driver managing the local roadway driving. This accomplishment supports McKinsey and Company research, which anticipates deployment of Level 5 autonomous trucks as early as 2027, which will save the industry approximately 45 percent in operating costs per truck.²⁶ Fully autonomous trucks that do not have an operator on board could potentially not be subjected to Hours of Service (HOS) rules, and could potentially drive continuously until it requires fuel.

Issues

Automation

Jobs Automation

While the use of automation in warehouses, marine terminals, and trucking offers many benefits, their implementation also poses complex planning dilemmas. For example, although automated trucks may address major industry challenges, such as the national truck driver shortage, there is also the potential for unintended economic impacts of job loss if these workers are not transitioned into other jobs. As of 2018, the American Trucking Association (ATA) estimated that there is a shortage of 63,000 truck drivers, and by 2026, they project that the shortage will grow to 174,000 drivers.²⁷ Driver age requirements and anticipation of automated truck technologies are possible factors that are deterring the next generation from choosing truck driving as a career.

In California, a state Supreme Court decision (*Dynamex Operations West, Inc. v. Superior Court*), and later codified under AB 5, made it potentially more difficult for trucking companies to use owner-operators in the state, and some argue that the law effectively eliminates the practice. However, if California logistics companies were to rely solely on automated trucks, the state faces a potential loss of nearly 140,000 jobs.²⁸ Some of this loss will be absorbed through retirement, since half of the U.S. truck driver population is 55 years or older, but the other losses need to be considered and addressed.²⁹

Autonomous Vehicles/Connected Vehicles (AV/CV) Challenges

AV and CV technology will introduce several challenges, such as labor impacts and higher equipment costs, but the most significant challenge impacting deployment is liability. Currently, most highway collisions occur due to human error, but with driver-assisted and fully-automated vehicles, liability will become much more difficult to determine. Additionally, there is little legal precedent on the nature and extent of liability for unmanned vehicles, and therefore, claims by victims will take more time to resolve, if and when liability is determined. The practice and standards need to evolve to address maturing AV/CV technology.³⁰

Clean Energy Capacity and Infrastructure

There is a fine balance between equipment and infrastructure, as operators need available energy to fuel equipment, while energy providers require enough demand to support significant infrastructure investments. For example, large truck fleets enable manufacturers to achieve economies of scale when they order large quantities of alternatively fueled vehicles, which in turn, creates a guaranteed demand for alternative fuel, thus supporting infrastructure investments by the energy providers. These investments may also benefit other users, such as the general motoring population, taxi and TNC drivers, as well as transit providers. However, the cost of new equipment required to meet more stringent emissions standards is difficult for

smaller trucking companies to meet, and could result in the closure or relocation of small trucking firms if standards are enforced without assistance from public and private partners.

Electricity

California's electricity is generated and distributed to much of the state by Pacific Gas & Electric (PG&E) in Northern California region, Southern California Edison (SCE) in the Los Angeles region, and San Diego Gas & Electric (SDG&E) in the greater San Diego region. One significant concern raised during industry stakeholder interviews was the competitive advantages and disadvantages that electricity rates already pose for the state's seaports and industrial uses, and how much the gap could grow as the requirements for all-electric equipment go into effect. In 2018, the average rates for the top three providers in California were: SCE at 14.61¢/kWh, PG&E at 16.27¢/kWh, and SDG&E at 22.50¢/kWh. This significant rate discrepancy gives much of Southern California a competitive rate advantage over the Bay Area and San Diego Regions. This has been an ongoing issue for SDG&E for the past five years:

"Electric system average rates increased annually from 2013 to 2017; approximately 1% for SCE, 4% for PG&E, and 8% for SDG&E. The magnitude of these rate increases, especially in the case of SDG&E, underscores the need to consider cost implications in the policies and programs that keep California's grid green, safe, and resilient."³¹

Energy competitiveness may be more critical to the ports designated as Special Districts of the State of California, such as San Diego, Hueneme, Humboldt Bay, and Stockton as state entities, and for the Port of Benicia, a private port that does not receive municipal rates. Ports such as Long Beach, Los Angeles, and Oakland are city entities, so they receive lower rates than most others. For example, the Port of Los Angeles benefits from power provided by the City of Los Angeles Department of Water and Power (\$0.12-\$0.15 per kWh), and the Port of Long Beach receives the SCE municipal rate (\$0.04 to \$0.33 with an average of \$0.14/kWh). Both rates are nearly half of the cost of what the Port of San Diego pays (current rate of \$0.23 per kWh and proposed effective rate increase to \$1.00 per kWh), due to the higher SDG&E overall rate structure.³² Cold ironing, also called shore-to-ship power includes running vessel auxiliary power while at port, converting cargo handling equipment from diesel and natural gas to electric, and providing places at the ports for trucks to plug in. The cost of the energy to implement cold ironing could negatively impact California's smaller, niche ports. Demand charges are also being reconsidered in light of SB 100, which encourages more use of electricity and less use of fossil fuels. At present, high electricity use is penalized by rate increases as much as four times the base rates. Suggestions from industry interviews include having the CPUC revisit rate structures, identifying infrastructure investments to facilitate conversion of fuel sources for transportation, and developing policies and plans accordingly.

A recent issue associated with electricity is planned blackouts. Climate change has increased the frequency of wildfires in the state and has made the state vulnerable to wildfires that are caused by faulty or damaged electrical equipment. Six of the ten most destructive fires in California's history were started by electrical equipment. In response, electric companies are

shutting down the electric grids where high winds and other weather events occur, which could cause electrical equipment such as power lines to fall to the ground and create a spark, which could potentially cause a catastrophic wildfire. Electrical blackouts reduce the likelihood of a wildfire being started, however, blackouts disproportionately affect rural and poor neighborhoods. Planned electrical blackouts are projected to be a persistent issue until existing electrical infrastructure is upgraded possibly with underground power lines and the application of a “smart grid,” which would shut down the electrical grid automatically if a problem is detected.³³ Until these improvements are made, planned electrical blackouts are an issue that may affect the reliability of electricity as a source for freight NZE/ZEV vehicles and infrastructure in the years to come.

Charger standardization is another challenge for widespread adoption of electric medium- and heavy-duty trucks. Penske is focusing efforts to promote charging standards for heavy-duty vehicles through the “High Power Charging for Commercial Vehicles Task Force” and in 2018, the Society of Automotive Engineers published a recommended standard for plug-in charging of heavy-duty electric vehicles.³⁴

Natural Gas

Renewable Natural Gas (RNG) is one of the most promising, near-term, fully-renewable alternatives to conventional diesel fuel for Class 8 trucks. RNG-configured heavy-duty tractors combine strong pulling power and long range, so they compete operationally with comparable diesel-powered tractors while offering a lower emission profile. The cost of operation can be lower as well because RNG is growing in availability from sources within the United States, while diesel fuel is experiencing significant price increases due to changes in vessel fuel requirements. Renewable natural gas is a biogas, a form of methane derived from biomass, and upgraded to a quality similar to fossil natural gas (a methane concentration of 90 percent or higher). Many waste facilities and dairy farms power their fleets with renewable natural gas, and companies such as Kroger have been investing heavily in anaerobic digester equipment that is capable of digesting grocery waste into natural gas fuel and high-quality fertilizer. Digester equipment emissions are typically lower than fossil-based natural gas, although it is a higher emitter of pollutants than electric energy. The difference is that RNG is generally considered carbon-neutral because it does not introduce new carbon, but rather regenerates carbon needed for the next generation of plant life.

Hydrogen

Through the San Pedro Bay Ports’ Technology Advancement Program (TAP), Hydrogen Fuel Cell (HFC) trucks have been tested by willing partners. In 2018, CARB awarded \$41 million to the Port of Los Angeles to partner with Toyota to develop and demonstrate 10 ZE Class 8 fuel cell tractors using Kenworth’s T680 platform and to develop two new heavy-duty truck fueling stations. The Toyota fuel cell truck has an operational range of 300 miles. In addition to CARB’s award in 2018, Hyundai announced a planned deployment of 1,000 such trucks in Switzerland in 2019, and Toyota announced its development of a 300-mile range truck. High costs remain a considerable deployment constraint; hydrogen-fueled trucks cost three to four times more than diesel trucks and offer only one-third travel range. Despite this, hydrogen can be produced

from clean, renewable energy sources and does not emit harmful emissions when used as a transportation fuel. Furthermore, one of the benefits of HFC vehicles is they are quicker to refuel than other ZE alternatives, such as battery electric vehicles.

Labor Law Compliance

Federal Labor Laws (Hours of Service / Electronic Logging Devices)

The federal hours of service (HOS) rules (**Figure 4A.4**) updated on March 9, 2017, dictate the allowable driving time for commercial vehicle drivers. In 2018, full implementation of Electronic Logging Devices (ELD) to monitor and track HOS went into effect.

Drivers or carriers who violate the hours of service rules face serious penalties:

- Drivers may be placed out- of-service (shut down) at roadside until the driver has accumulated enough off-duty time to be back in compliance;
- State and local enforcement officials may assess fines;
- The driver's and carrier's scores under the Compliance, Safety, Accountability (CSA) enforcement program can go down, which could result in a variety of enforcement actions;
- The Federal Motor Carrier Safety Administration may levy civil penalties on the driver or carrier, ranging from several hundred dollars to many thousands of dollars per violation depending on the severity;
- The carrier's safety rating can be downgraded for a pattern of violations;
- Federal criminal penalties can be brought against carriers who knowingly and willfully allow or require HOS violations.

Prior to ELDs, drivers found alternative ways to comply, such as maintaining two log books or adjusting numbers in one log book to mitigate unanticipated delays that otherwise would have prevented them from meeting their estimated arrival time. With the implementation of ELDs, this is no longer an option. The unintended consequences include illegal and/or unsafe truck parking and the deployment of additional delivery trucks and drivers. For many companies, complying with the rules and delivering the goods on time means purchasing more trucks, hiring more drivers, and adding more trucks to the highways. The HOS and ELD rules have created truck parking issues throughout the nation, and changes to the rules should be closely monitored by the state as it moves towards the development of a truck parking study.

Figure 4A.4. Hours of Service Rules

<p>11-Hour Driving Limit</p> <p>May drive a maximum of 11 hours after 10 consecutive hours off duty.</p>	<p>14-Hour Driving Limit</p> <p>May not drive beyond the 14th consecutive hour after coming on duty, following 10 consecutive hours off duty. Off-duty time does not extend the 14-hour period.</p>
<p>Rest Breaks</p> <p>May drive only if 8 hours or less have passed since end of driver's last off-duty or sleeper berth period of at least 30 minutes.</p> <p>Does not apply to drivers using either of the short-haul exceptions in 395.1(e). [49 CFR 397.5 mandatory "in attendance" time may be included in break if no other duties performed]</p>	<p>60/70-Hour Driving Limit</p> <p>May not drive after 60/70 hours on duty in 7/8 consecutive days.</p> <p>A driver may restart a 7/8 consecutive day period after taking 34 or more consecutive hours off duty.</p>

California Labor Laws

During the industry outreach, several industry participants cited concerns about California's rest and break periods as they related to their drivers. While the reasoning behind these standards is obvious, concerns about Labor and Rest Mandates were among the primary issues cited by respondents to the American Truck Research Institute (ATRI) 2018 Survey.³⁵

Section 512, Meal Periods, of the California Labor Code reads, in part, as follows:

"(a) An employer may not employ an employee for a work period of more than five hours per day without providing the employee with a meal period of not less than 30 minutes, except that if the total work period per day of the employee is no more than six hours, the meal period may be waived by mutual consent of both the employer and employee. An employer may not employ an employee for a work period of more than 10 hours per day without providing the employee with a second meal period of not less than 30 minutes, except that if the total hours

worked is no more than 12 hours, the second meal period may be waived by mutual consent of the employer and the employee only if the first meal period was not waived. (b) Notwithstanding subdivision (a), the Industrial Welfare Commission may adopt a working condition order permitting a meal period to commence after six hours of work if the commission determines that the order is consistent with the health and welfare of the affected employees.”

On December 21, 2018 in response to a petition by the ATA, the Federal Motor Carrier Safety Association (FMCSA) pre-empted California Labor Law’s Meal and Rest Break Rules as they apply to “property-carrying commercial vehicle drivers covered by the FMCSA’s hours of service regulations.” Federal law provides for preemption of California’s law, as it was found to 1) provide no additional safety benefit, 2) be incompatible with federal regulations, and 3) cause an unreasonable burden on interstate commerce.

Federal and State Emission Regulation Compliance

More stringent standards in California than neighboring states impacts the competitiveness of California trucking. However, the demand for cleaner and more efficient means of goods movement are driving technological advancements. Truck vehicle miles traveled (VMT) increased from 85 to 98 million between 2014 and 2018. Vehicle Miles Traveled is projected to reach 119 million by 2040.³⁶ The growth in demand for trucking could exacerbate the truck driver shortage and result in longer delivery times and missed opportunities; however, it may also result in speedier implementation of autonomous trucks to address the long-haul segment. Additionally, an increasing number of truck trips, especially in urban areas where an increasing number of distribution/fulfillment centers are being constructed, could increase congestion. Short-haul truck trips in urban areas have increased by more than 17 percent per year since 2015.³⁷

While much of the conversation about the challenges of meeting emissions standards centers on trucking, marine facilities also face many of the same obstacles. The most significant new regulation facing vessel owners and operators is the full implementation of the International Maritime Organization (IMO) 2020 regulations that reduce sulfur oxide emission from 3.5 to 0.5 percent m/m. This rule is scheduled to go into effect on January 1, 2020. This change could cause significant increases in fuel costs, a cost that already equals 50 percent of all operating costs.

Freight Rail Challenges

Rail Cargo Transport Changes

Rail transport has experienced a shift in commodities and implementation of new regulations to address shipping growth of hazardous materials, such as crude oil and liquified natural gas.

Impacts and issues of these changes include the following:

- Decline in the transport of coal by rail has created additional capacity for moving intermodal containers by rail
- The truck driver shortage is creating capacity barriers on the railways as reflected in a 53 percent jump in rail spot rates in 2018 as compared to the same time in 2017³⁸
- The deadline for implementing positive train control was postponed from 2015 to December 31, 2018
- New rules implemented in 2015 improve the safety of transporting crude oil and other hazardous materials by rail. Improvements include enhanced tank car standards, new braking standards, new testing, and sampling requirements to determine product stability and new operational protocols, such as routing requirements, speed restrictions and information sharing with local jurisdictions³⁹

Short Haul Rail and Modal Shift

Use of short haul rail and inland waterways have had some success in California, but costs and operational issues have been persistent challenges. Both operations are limited to bulk cargo unless they have container moving equipment (lifting onto and off rail cars or barges to or from trucks). These extra handling points create competitive price and time advantages for trucking over rail and barge services for short-haul trips. However, with the shortage of truck drivers and the associated upward pressure on trucking rates, the three modes appear to be more closely priced. The following provides a list of impacts and issues associated with these two alternatives to trucking:

- Much of the freight rail infrastructure in urban areas near California's ports is shared with passenger rail, such as Caltrain and Metrolink. Demand for passenger rail is increasing with population growth, higher gas prices, and congestion, and the demand for freight service is increasing due to the shortage of truck drivers.
- Trucks provide the first/last mile connection for most goods moving by short-haul rail or by barge.
- Trucks typically retain a competitive time advantage over goods moved by rail or barge. Railed and barged goods must wait to be loaded with other goods destined for the same inland point, off-loaded at the intermodal yard or inland port, and picked up by a truck for delivery. Trucks provide a direct connection between the arrival and destination.
- Short haul rail, such as those to support an inland port, may require an operating subsidy to be price competitive with trucking. However, the subsidy cost might compare favorably with the debt service and ongoing maintenance costs for a capital project alternative, such as a dedicated truck lane. The permitting challenges may also be fewer and require less time to complete.

Air Cargo Challenges

Air cargo arriving at and departing from the State's airports have been exceeding the projected growth rate of less than three percent. In 2017, international air cargo grew by 9.7 percent, and in 2018, air cargo grew by 3.5 percent. The softer 2018 growth correlates with the potential risks of tariffs.

Impacts and issues of this trend include the following:

- Increased demand for air cargo at California's international airports due to e-commerce
- New technology platforms that employ solutions, such as blockchain, will improve the ease of streamlining online consumer orders across an omni-channel supply chain.
- Growth in air cargo from e-commerce will generate more truck trips to/from the air cargo terminals
- Access to and from air cargo facilities will become a critical first/last mile issue for many airports in California

Opportunities

Clean Trucks and Trucking Efficiencies

Clean Air Action Plans

The San Pedro Bay Ports led the nation by implementing the first Clean Truck Program in 2007 pursuant to adopted emissions reductions standards established in the Clean Air Action Plan (CAAP). CARB and the state's regional air districts implemented similar statewide targets. All agencies, in coordination with the U.S. EPA and the National Highway Traffic Safety Administration (NHTSA), worked toward setting new fuel efficiency standards for the next generation of heavy- and medium-duty trucks. The fuel efficiency standards and the State's emissions reduction targets correlated with the National Ambient Air Quality Standards (NAAQS). In 2017, the POLB and POLA and Los Angeles updated their CAAP, which set new targets for trucks and cargo handling equipment consistent with the CSFAP to reduce GHG from port-related sources to 40 percent below 1990 levels by 2030.

Additionally, the updated CAAP set new targets for the Ports' transition to meet NZE standards beginning in 2020. The Ports will begin assessing a fee on all drayage trucks that do not meet the NZE standard anticipated to be established by CARB in 2020. When the 2017 CAAP was adopted, additional goals set for ZE trucks were anticipated to result in full transition to NZE and ZE by 2036. These targets aligned with the Obama Administration's increasingly stringent NAAQS and fuel efficiency standards referred to as Phase I. Phase II of the emissions reductions were drafted and released for public review in 2016.

Most recently in 2018, the U.S. EPA, in partnership with the NHTSA, placed a hold on the implementation of the 2016 Phase II fuel efficiency standards. Following a letter from the Department of Energy in 2018, the two agencies not only paused the implementation of more stringent fuel efficiency standards, but also stated that a national fuel efficiency standard

should take precedence over state standards, such as the more stringent CARB emissions standards passed in 2018. CARB's stringent standards are a result of more stringent federal NAAQS for 8-hour ozone in 2023. CARB and the state's regional air resource boards have identified ZE implementation as the path necessary to attain NAAQS compliance. CARB's latest ZE targets are based on meeting NAAQS.

Truck Only Lanes

The separation of heavy vehicles and passenger vehicles decreases the risk of collisions.⁴⁰ Approximately 12 percent of passenger vehicle fatalities involve trucks. Speed limits for trucks and autos typically vary by 10 miles per hour in California, impacting the overall flow of freeways. Removing trucks from the general-purpose lanes would likely result in an overall increase in travel speeds, due in part to less merge/diverge conflicts and partly because of a moderation in overall corridor travel speeds. The speeds would also increase since large trucks take up more space; removing them may improve traffic flow.⁴¹

The trucking industry may also benefit from the reduced accident rates of a truck-only lane. Since there would not be the disturbances in this lane usually created by passenger vehicles, the trucks will need to brake, accelerate, and change lanes less often, creating smoother and more efficient travel. An addition of an extra lane will increase capacity, relieve congestion and lower travel times.

When there is a truck-only lane, platooning can be implemented. Platooning, with the aid of wireless communication technology and Dedicated Short-Range Communication (DSRC), reduces the distance between trucks, which in turn reduces wind resistance and increases capacity of a lane.⁴²

Connected Vehicles and Communication Technology

The current national framework for the connected vehicle (CV) environment envisions the use of DSRC, cellular (i.e., 3G, 4G, LTE, 5G), or potentially other types of radio communication between vehicles themselves and the surrounding infrastructure. While some of the anticipated applications for CV-instrumented corridors could conceivably utilize non-DSRC communication to realize functionality, DSRC is the only option that would have specific impacts to the infrastructure.

Roadside DSRC has been established by the United States Department of Transportation (U.S. DOT) as a specifically allocated set of channels and frequencies for use in the anticipated CV world. It is also central to a continuing series of field evaluations and pilot programs led by U.S. DOT. Recent estimates indicate that 20 percent of vehicles will be equipped with some form of CV technology by the year 2025. While other technologies could be implemented to achieve interconnectivity between vehicles, those that are included in the current U.S. DOT-sponsored CV program are the most promising ones for accomplishing nationally coordinated standards through non-proprietary (open) solutions.

For freeway and highway driving, on-board communications equipment would be integrated with application equipment and processors that would implement several envisioned application packages. Much of the enabling technology for the autonomous functions will reside in the vehicles and will include, ultimately, a wide variety of OEM on-board vehicle systems. This on-board equipment and technology will communicate with operation centers and remote application servers. The enabling architecture is expected to utilize cellular and DSRC communication.

Some or all of the proposed CV applications will require continuous DSRC coverage over the lengths of the most heavily used freeways and highways in the region (e.g., I-5 and SR 99). To enable this coverage, DSRC roadside installation sites would need to be implemented at regular intervals. Installation may also need to occur on connecting arterials to provide the degree of coverage necessary for some CV applications.

DSRC is capable of communicating with minimal latency over relatively short distances to ensure timely communication with vehicles. A dedicated DSRC installation would include (at minimum) a DSRC radio, pole, and cabinet. Alternative mounting options include existing light poles, catenary support structures, or signal pole standards. Existing Intelligent Transportation Systems (ITS) control cabinets can be used to house the DSRC equipment as well. The following list summarizes the typical DSRC field components (supporting systems, such as remote monitoring servers, are not included below):

- DSRC radio
- DSRC poles and mounting structures
- DSRC cabinet and equipment
- Communications, power conduit, and cabling
- Splice vaults and pull boxes

Freight Roadway Pricing Applications

There are two types of tolls: fixed and variable tolls. The fixed tolls are predetermined based on the distance covered, axle amount, and/or weight per axle of the vehicle, and do not change during the day. The variable tolls are dependent on features, but also change throughout the day either in response to current conditions or according to a predetermined schedule (i.e., by time of day).⁴³

California currently has no interstate system tolls that are dependent on the weight per axle of the vehicle. However, such a system of tolling would be an ideal method for mitigating the damage caused by heavy trucks. **Figure 4A.5** lists the states and facilities with toll rates based on per-axle weights.⁴⁴

Tolling can be used to fund road maintenance and generate revenue while providing greater travel reliability. Tolling also acts as a travel demand management strategy and therefore may reduce emissions. Discounted toll rates for low-emissions vehicles would encourage operators and fleet managers to invest in low-emissions vehicles and technologies.⁴⁵

The elasticities of toll-paying behavior are different for freight vehicles versus passenger cars. According to a project study jointly sponsored by the National Cooperative Freight Research Program and the National Cooperative Highway Research Program, only a small proportion of freight drivers are open to the idea of roadway tolling.

Truck Size and Weight Limitations Opportunities

In April 2016, FHWA completed an evaluation of truck size and weight limits established by Congress as part of the STAA. Currently, California is limited to 80,000 pounds on interstate highways, whereas Oregon and Nevada can allow up to 105,500 and 129,000 pounds, respectively, on designated corridors, thus retaining their established limits. In addition to weight, both states also allow longer trucks. Heavier and longer trucks cannot continue into California which require loads to be separated at the border in compliance with California's limits.⁴⁶ The 2016 FHWA Study resulted in no change to the federal law. The study evaluated a range of benefits and costs from fuel consumption and emissions reductions to safety, but no changes have been made to the federal size and weight limits. As U.S. regulatory agencies continue to investigate the safety and potential infrastructure-impact concerns, other countries such as the United Kingdom have increased its size and weight limit and documented a reduction of fatalities, due to freight-related accidents, by 35 percent.⁴⁷

Figure 4A.5. Interstate System Toll Roads in the United States



Port and Waterway Opportunities

Inland Ports

An inland port is a rail or a barge terminal that is linked to a major seaport. To attract customers, an inland port must address what segment(s) of the market would be served and a financially feasible business model that will overcome competitive advantages posed by trucking. The transload and local market segments are the most likely to take advantage of a well-located short haul rail-served inland port. By consolidating imports and exports and transporting them by rail to the seaport, inland ports could reduce peak hour truck traffic in the state's congested urban centers, create opportunities for inland logistics centers (similar to Centerpoint outside of Chicago, Illinois), and create more opportunities for off-peak delivery of goods from inland points to regional destinations. East Coast inland ports have demonstrated the feasibility of inland ports in the U.S., but in most cases, the state government has control over the ports and statewide economic development that allows for subsidization and streamlining of development. Arizona, Nevada, and Utah have all identified the potential for inland ports that serve the Ports of Oakland and Los Angeles/Long Beach, and the Utah Inland Port Authority recently released (November 2018) a request for proposals for a business plan.⁴⁸ Currently, the POLA and POLB are not considering inland ports, but rather have explored the concept of short-haul rail to move non-direct rail containers to staging/transfer locations inland, as discussed below.

Decentralization of goods in favor of storage at regional facilities has led to a significant decrease in average length-of-haul truck trips in favor of shorter truck trips. Since 2000, the average dry van truckload length-of-haul has declined from 800 to 500 miles.⁴⁹ California offers many location advantages over competitor states such as Utah, Nevada, and Arizona, including having the following: proximity to major population centers, major seaports and air cargo hubs, one of the nation's most efficient freight rail networks, high-tech research and development, internationally recognized universities, a ranking as the nation's top manufacturer, and proximity to Mexico's manufacturing and production centers that rely on U.S. exports and also produce key inputs to California's manufacturing activity. However, in the past two years, California lost a bid for the Tesla manufacturing plant and the Hyperloop One test site and fabrication plant to Nevada in large part due to labor costs, site development timeframes, and government incentives. California has also been losing international, containerized cargo market share for the past few years to East Coast and Gulf Coast ports. The development of inland ports could cluster several aspects of supply chains, which would increase efficiencies, decrease costs, and improve competitiveness. Three locations have been (or are being) investigated for inland port operations, as described below.

Stockton Area (Stanislaus County)

The area east of the Port of Oakland on the east side of the Altamont Pass (I-580) has been experiencing significant growth in logistics facilities for the past five years. Some of this growth is due to the high land values in the Bay Area, and some of this new development is in response to e-commerce.

Cities such as Stockton, Lathrop, French Camp, Tracy, Patterson, and Manteca provide good alternatives to the Bay Area, due to available developable industrial land, lower cost of housing, easy access to consumers in the Bay Area, as well as Portland, Oregon and Reno, Nevada, and national access to additional markets via the UPRR and BNSF rail corridors. In 2016, Shippers Transport Express (STE), a subsidiary of SSA Marine, opened an inland cargo depot in French Camp to minimize empty container moves to and from the Port of Oakland. This facility allows drivers to both drop off and pick up empty containers for customers in this area. This idea stemmed from SSA Marine's operations of dray-off yards at the Ports of Oakland and Long Beach. SSA operates empty yards near both ports that allow drivers to drop off and pick up containers during off-peak periods when the marine terminal gates are closed. Similarly, the inland cargo depots operate twenty-four hours a day, seven days a week and reduces the need for drivers to take empty containers back to the Port of Oakland or to go to the Port to pick up empty containers, drive them to warehouses in the Stockton area, and then drive them back to the port loaded. STE is considering expanding this facility for use by all ocean liners. If expanded, this facility could support an inland port concept. CenterPoint is currently developing a new logistics park adjacent to UPRR's Lathrop Intermodal Yard, and the Port of Stockton is in the process of requesting conveyance of the 500-acre Sharpe Army Depot. The conveyance could be the hub of an inland port, as it provides access to Class I railroad operators and resides adjacent to major industrial warehousing uses.

Bakersfield Area (Kern County)

Kern County is a growing logistics hub. In the past decade, 17 new, major warehouse and distribution centers were completed or are under construction with development occurring in Shafter, Bakersfield, Delano, and Tejon Ranch. Similar to Stockton, Shafter has access to both Class I railroad operators and has developed and owns a container yard similar to the STE yard in Stockton. It is currently being leased by BNSF as a construction staging area. However, the Shafter load matching model has morphed into a "virtual" container yard and is designed to save empty container hauls to/from the ports. The Wonderful Industrial Park development in Shafter is home to several importers including Target and Ross Dress-For-Less. The Ross facility has an agreement with the Wonderful Company, a major pistachios and almonds exporter, to use the same oceangoing carrier.

The hard-won agreement enables the nearby empty containers at Ross to be picked up by Wonderful for shipping back to the ports full of agricultural products, rather than traveling a 300-mile roundtrip to pick up an empty from the Los Angeles/Long Beach Ports. This coordination reduces operation costs, on-road emissions, and wear and tear on roads. It is anticipated that the City of Shafter container yard may yet be needed to support the virtual container yard by providing storage, trade and clean-out services for shipping containers or as an intermodal rail access node. The Kern region offers same-day delivery access to both the Bay Area and the Southern California regional populations, as well as to the Ports of Oakland, Los Angeles, Long Beach, San Diego and Hueneme. In addition, the Cities of Shafter and Bakersfield, and Kern County have environmentally cleared industrial development for logistics facilities on over 10 square miles in the Shafter/BFL International Airport area, and another 2.5 square miles along I-5 near the base of the Grapevine at the Tejon Ranch Commerce Center, the primary

gateway between Southern California and the Central Valley. Tejon also provides truck parking at two major truck stops allowing trucks to delay entry into Southern California and the ports until off-peak periods. Tejon Ranch followed suit with a master planned logistics park on nearly 1,500 acres. The region also provides truck parking at six other major truck stops near Tehachapi, Edison, Buttonwillow, Lost Hills, and North Shafter.

Inland Empire (San Bernardino/Riverside Counties)

The Inland Empire (IE), located east of the Ports of Los Angeles and Long Beach, has experienced significant growth in warehouse and logistics facilities over the past 20 years. The development was derived due to large acres of available farmland, access to both Class I railroad operators, the San Bernardino Intermodal Yard, Ontario Airport, the conversion of March Air Force Base to a cargo airport, and same-day access to major markets in Southern California, Nevada, and Arizona. In 2017, the City of Moreno Valley approved a 41 million square-foot logistics park. This new development does not have direct rail access; however, the region has been discussing the possibility of a logistics park of similar size that would be rail-served by both short-haul rail to/from the San Pedro Bay Ports of Long Beach/Los Angeles, as well as expand the IE's intermodal capacity to serve the rest of the nation. To date, no potential sites for such an inland port has been identified in the region.

In California, the Port of Stockton may have a future opportunity to develop a new intermodal rail yard on surplus government property, and this new facility could provide an inland port opportunity for the Port of Oakland. The U.S. Department of Defense has determined that the Sharpe Army Depot is no longer needed. Port of Stockton has requested conveyance of the 500-acre site with existing rail infrastructure that serves both Union Pacific Railroad (UPRR) and BNSF Railway. The site is south of a major UPS logistics facility and west of the UPRR Lathrop Intermodal Terminal and the CenterPoint Intermodal Center, a 190-acre logistics park.

Marine Highways

In 2007, the Energy Independence and Security Act (Energy Act), directed the United States Secretary of Transportation to establish a short sea transportation program and designate short sea shipping routes. The Maritime Administration (MARAD) implemented "America's Marine Highway Program" (the Program) pursuant to this mandate. The Program is intended to expand the use of our inland, Great Lakes Saint Lawrence Seaway System, intracoastal, and coastal waterways for the transportation of freight (loaded in containers and trailers) and passengers to mitigate landside congestion, reduce greenhouse gas emissions per ton-mile of freight moved, etc. U.S. DOT initiated a program to encourage the use of navigable waters to move goods and alleviate traffic and maintenance issues caused by trucks. California has access to two of the designated marine highways: (1) M-5 along the Pacific Coastline from San Diego to Seattle, and (2) the M-580 from Port of Oakland to the Sacramento River and San Joaquin River connecting to the Ports of Stockton and West Sacramento.

Marine-5 (M-5)

In 2014, the West Coast Corridor Coalition sponsored a study of M-5⁵⁰ to determine the market and operational feasibility of short-sea shipping between multiple pairs of West Coast ports, including the following:

- Port of San Diego → San-Pedro Bay
- Ports (Ports of Los Angeles and Long Beach)
- San-Pedro Bay Ports (Ports of Los Angeles and Long Beach) → Port of Hueneme
- Port of Oakland → Port of Redwood City
- San-Pedro Bay Ports (Ports of Los Angeles and Long Beach) → Port of Oakland
- San-Pedro Bay Ports → Pacific Northwest Ports (Ports of Seattle and Tacoma)
- Port of Humboldt Bay → Port of Crescent City
- Port of Oakland → Pacific Northwest Ports

The plan also identified the following key challenges to implementing this type of service:

- Shortage of efficient, right-sized vessels eligible to transport U.S. domestic cargoes
- Shortage of credible market data to identify cargoes available for Marine Highway services
- Lack of maritime entrepreneurs willing to take the risk of starting up a new service

Preliminary discussions regarding a barge service from Seattle to Portland occurred in 2018, and that same year, the Port of San Diego also received some interest from barge operators to provide a short-sea shipping alternative. However, at the time of this report, no official requests have been submitted to MARAD for consideration.

Marine 580 (M-580)

In February 2010, U.S. DOT awarded a \$30 million TIGER grant to the Ports of Oakland, Stockton, and West Sacramento to establish a container-on-barge service between the Central Valley and the San Francisco Bay area. The Port of West Sacramento received \$8.5 million for the purchase of a mobile harbor crane, which can load and unload shipping containers. The Port of Stockton received \$13 million for infrastructure and equipment, which it applied towards the purchase of two 140-ton mobile harbor cranes and infrastructure improvements at the Port to support the project. The Port of Stockton also purchased two barges to support the new service. The M-580⁵¹ barge service operated for 14 months as a pilot project with the intent of shifting truck trips to barge by using the M-580 inland waterway to move containers between the Ports of Oakland and Stockton. This barge service focused on reducing port trucks on the I-80, I-205, I-580, I-238, I-880, and I-980 corridors. Due to operational issues that led to significant cost overruns of approximately \$1 million per month, the service was cancelled.

Per the CSFAP, Caltrans is the implementing agency to Action 3.G: Inland Facility, Short-haul Rail Shuttle, and Inland Seaports Utilization with Less Impact on Nearby Communities. This action tasks Caltrans and Agency to “increase opportunity for use of short haul rail shuttles and waterways that lead to inland seaports and freight distribution hubs that will have less impact on nearby communities (CSFAP, Appendix C: State Agency Actions; Action 3, Sec. G)”.

Caltrans has recently started the M-580 Corridor Multimodal Freight Network Optimization Study to accomplish this task. The study will be completed by 2021.

Short-Haul Rail Access to Port of Humboldt

The Port of Humboldt Bay currently has little shipping activity. It is a deep-water port (35-38 feet) located between San Francisco, California (258 miles south) and Coos Bay, Oregon (180 miles north). There has not been rail service to the Port for over 20 years due to destruction of the previous railway line, which followed a North-South route to Napa. Currently, there are no plans to rebuild the route. Pacific Charter Financial Services Corporation, with the assistance of Humboldt Eastern Railroad LLC, is seeking to create an "American Gateway" with the construction of the Pacific Northwest Railroad rail lines, docks, and hub terminals. It is anticipated that the completion of the Pacific Northwest Railroad connection to the national rail network in the Central Valley near the towns of Red Bluff and Gerber will increase population and economic activity in Northern California. Such a rail connection would also provide access between Northern California and other major world regions along the Pacific Rim.

San Pedro Bay Ports' ZECMS Assessment (2009)

In 2009, the San Pedro Bay Ports of Long Beach and Los Angeles commissioned a study of Zero-Emission Container Mover Systems (ZECMS). The Ports officially issued a "Request for Concepts and Solutions," (RFCS) on June 3, 2009, outlining the goals and requirements of the project. The primary focus of this study was to explore new technology to move containers between docks and the Intermodal Container Transfer Facility (Union Pacific Intermodal Rail Yard), potentially eliminating thousands of short-haul diesel truck trips each day and reducing air pollution. Proposed technologies included electric guideways, zero-emission trucks, and electrified rail, all of which use electricity to power the movement of cargo, rather than diesel-fueled trucks. The project management team for the Request for Concepts and Solutions included representatives from both ports and the Alameda Corridor Transportation Authority (ACTA). The team also enlisted a panel of outside, independent experts, including the USC Keston Institute for Public Finance and Infrastructure Policy, to help evaluate concepts for the ZECMS.⁵² The final conclusion was that this type of technology or system is not viable for a variety of reasons.

Since this time, no additional off-road cargo moving systems have been considered by the two San Pedro Bay ports, and most recently, Los Angeles County Metropolitan Transportation Authority (Metro) selected an I-710 freeway improvement alternative that does not include a zero-emission freight corridor.

Emerging Opportunities

Hyperloop

While some companies are reacting to the increase in demand for same-day and next day deliveries using existing technologies, others are seeking a more efficient way to deliver orders with a short turn-around. In 2013, a new transportation system called Hyperloop was

introduced. Hyperloop consists of a hyperloop vehicle, or “pods,” that accelerate gradually via electric propulsion through a low-pressure tube.⁵³ In 2018, DP World and Virgin's Hyperloop One jointly created DP World Cargospeed, an international brand for Hyperloop-enabled cargo systems to move palletized cargo. DP World Cargospeed will focus on e-commerce. This new partnership was developed in anticipation of projections for a fourfold increase in global trade, which could spur demand for hyperloop technology by 2050.⁵⁴ Speed to market creates a competitive advantage for global trade and national, regional, and local distribution. The Hyperloop delivery system intends to deliver goods at air flight speeds at a cost closer to over-the-road trucking rates.⁵⁵

Hyperloop One, a California-based company, has identified ten initial Hyperloop One routes; however, of the four identified in the U.S., none of them are in California. The four U.S. routes are proposed in Texas, Colorado/Wyoming, Illinois/Indiana/Ohio/Pennsylvania, and Florida. Hyperloop One began initial testing in Los Angeles but eventually established its Apex Test and Safety site in Nevada. In May 2017, the company became the first in the world to test a full-scale Hyperloop that included vacuum, propulsion, levitation, sled, control systems, tube, and structures. Missouri completed the first hyperloop feasibility study for the I-70 corridor from St. Louis to Kansas City, a major freight route. Two Environmental Impact Statements (EIS) are being prepared for routes in Ohio and Colorado. Virgin Hyperloop has conferred extensively with the POLA over the last several years and is currently not proposing their system to serve the POLA-POLB.

Alternative and Renewable Fuels

At the state level, the CEC's Clean Transportation Program, formerly known as the Alternative and Renewable Fuel and Vehicle Technology Program, has provided significant investments in electric vehicle charging infrastructure and hydrogen refueling stations as well as innovation in medium- and heavy-duty advanced technology vehicles. The CEC has also invested in workforce training in cleaner transportation technologies. With up to \$100 million per year to promote accelerated development and deployment of advanced transportation and fuel technologies, the Clean Transportation Program provides for the following:

- Funded more than \$125 million to 54 zero and near-zero emission vehicle demonstration projects ranging from cargo handling equipment to medium- and heavy-duty trucks, including plug-in hybrids, battery-electrics, fuel cell, low NOx natural gas, and several biofuel platforms
- Funds the California Electric Vehicle Infrastructure Project (CALeVIP) that provides streamlined incentives for light-duty electric vehicle charging infrastructure, with funding targeted at regions that have low rates of infrastructure installation or lack adequate incentives from utilities and other sources
- Assesses electric charging infrastructure needs of the off-road, light-, medium-, and heavy-duty sectors in response to AB 2127 (Ting, Statutes of 2018), in collaboration with CARB and CPUC
- Provides funding for establishing a network of 100 publicly available hydrogen refueling stations throughout the state, and evaluates the factors affecting timely station

development, the time and public funding needed to reach the 100-station goal by 2024, and the ability of the hydrogen refueling network to serve the anticipated fuel cell electric vehicles projects by the end of 2024

Two noteworthy projects that have been funded through the CEC's Clean Energy Transportation Program include:

- **Charging Ahead: The Port Community Electric Vehicle Blueprint** - In 2019, through a grant from the Energy Commission, the Port of Long Beach developed a Port Community Electric Vehicle Blueprint, which supports implementation of the joint Clean Air Action Plan and identifies actions and milestones needed to implement and sustain an EV-ready community encompassing the Port of Long Beach and nearby visitor-serving areas. Through active engagement and input from diverse stakeholders, the Blueprint addresses opportunities to dramatically accelerate adoption of zero-emission on- and off-road equipment—both fuel cell and battery-electric vehicles—by structuring a framework for installing infrastructure required to support zero-emission vehicles operating at the port. Since port terminal operators rely on low-margin and high-volume movement of goods through ports in a global economy, it is paramount for tenants to have assurance that their investments in zero-emission vehicles are reliable and are industry-standardized technology.
- **Zero Emission Cargo Transport (ZECT) II Demonstration** - The South Coast Air Quality Management District, in partnership with U.S. Department of Energy and the Energy Commission, is currently demonstrating six hybrid hydrogen fuel cell, battery-electric powered Class 8 drayage trucks for operation in the San Pedro port complex region. In the future, the trucks will have the ability to fuel at a POLB hydrogen fueling station partially funded by the CEC.

Near-Zero and Zero-Emissions Technology

Truck technologies that provide ZE and NZE benefits while in operation and in electric mode include: Dual-Mode Hybrid Electric Vehicles (HEVs), Plug-In Hybrid Electric Vehicles (PHEVs), Range-Extended Electric Vehicles (REEVs) with integrated engine, REEVs with integrated fuel cell, Battery Electric Vehicles (BEVs), and range extenders utilizing roadway power. The market readiness of these truck options continues to evolve, and as batteries become lighter and the amount of energy they can store increases, ZE and NZE engines become a more viable alternative to internal combustion engine trucks. As alternative fueling infrastructure supports charging these batteries and as hydrogen and renewable natural gas fueling becomes more readily available, consumers and original equipment manufacturers (OEM) are anticipated to respond. An overview of the truck technology types under development can be found in the **Appendix G**.

California continues to see a trend in the accelerated deployment of zero and near-zero emission vehicles and equipment through regulatory actions, incentive programs, and voluntary adoption by companies that recognize the operational and environmental benefits of these technologies. The transition of the goods movement fleet from internal combustion engines to NZE/ZE engines will have major implications on freight mobility and the environment. For example:

- Amazon recently agreed to order 100,000 electric delivery vans from the manufacturer Rivian.⁵⁶
- FedEx has announced that it will add 1,000 electric delivery vans to its fleet.⁵⁷
- Anheuser-Bush has partnered with Nikola Motors to utilize hydrogen-powered heavy-duty trucks to deliver its products.⁵⁸

Adoption of ZE and NZE technology is also a trend in freight rail. Currently, line haul locomotives and switcher locomotives are powered by a diesel engine that drives an electric generator or alternator. Locomotives and railyards are a significant source of NOx, PM2.5, and GHG emissions. Due to historical land use planning, many railyards and tracks are located near residential areas, which exposes residents to harmful emissions. To reduce these emissions and meet GHG emission goals, CARB has developed and implemented a number of measures to understand and reduce locomotive and railyard emissions, including studies, regulations, enforceable agreements, and funding of clean technology. CARB also administers financial incentives for operators to adopt NZE/ZE locomotives and equipment.⁵⁹ In the absence of federal leadership, California will continue to be a leader in deploying NZE and ZE technologies in the freight rail sector.

The California Energy Commission is exploring grant funding opportunities for fuel cell technology demonstrations in locomotives and ocean-going vessels. Hydrogen fueling for these vehicles can help decarbonize historically challenging sectors.⁶⁰

Greener Technology Incentives

Similar to incentives afforded to buyers of clean automobiles, such as single-occupant use of HOV lanes, reduced and no-toll options can be applied to truck-only toll lanes. Caltrans and LA Metro studied multiple alternatives for the proposed I-710 Corridor Project from the southern terminus near the San Pedro Bay Ports to SR 60. The preferred alternative for the I-710 Freight Corridor project includes the I-710 Prototype Clean Truck Incentive Program which provides incentives to encourage fleet turnover to ZE and NZE freight technology. The air quality analysis for the recirculated draft EIR/ supplemental draft EIS indicated that the alternative would help improve air quality with the replacement of older trucks with new zero- and near-zero emission trucks.

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4.B. Freight Flows and Forecast

As of the second quarter of 2019, California had a Gross Domestic Product (GDP) of \$3.12 trillion¹. Compared to the top 10 world economies listed in **Table 4B.1²**, California's GDP would approximately rank fifth in the world. California is comprised of 12 percent of the nation's population, accounts for 14 percent of the nation's economic output and continues to be a leading force in the U.S. economy. California's diversified economy and its prosperity are tied to domestic trade, as well as to exports and imports of goods and services through the State's key multi-modal gateways.

In 2018 California added 186,807 people, bringing the total population to approximately 39.9 million³. Population growth was strongest in the more densely populated counties in the San Francisco Bay Area, the Central Valley, and Southern California. The Los Angeles-Inland Empire region is home to the second largest consumer market in the U.S. after the Greater Hudson Valley region in New York state. While imported consumer goods pass through the State to other parts of the U.S., most goods stay within the State and are used by California consumers.

In 2018, California exported \$178⁴ billion worth of goods, making it the second largest exporter behind Texas, and indicating a 3.6 percent increase from 2017. The value of California's exports equals to 10.7 percent of the nation's overall exports. In 2018, the imported goods valued about 2.5 times more than the exports. \$441 billion of goods entered through California's transportation gateways.

Table 4B.1. Top World Economies, 2019

Countries	Nominal GDP (\$)
United States	\$20.49 trillion
China	\$13.41 trillion
Japan	\$4.97 trillion
Germany	\$4 trillion
California*	\$3.12 trillion*
United Kingdom	\$2.83 trillion
France	\$2.78 trillion
India	\$2.72 trillion
Italy	\$2.07 trillion
Brazil	\$1.87 trillion
Canada	\$1.71 trillion
Source: International Monetary Fund	
*Source: Gross Domestic Product: Second Quarter 2019, California, Bureau of Economic Analysis, 2019	

From a global perspective, freight tonnage moving on the nation's transportation network will grow 40 percent in the next three decades, while the value of the freight will increase at a much faster pace. Total freight on all modes (including air, vessel, pipeline, rail, and trucks) is projected to reach 25 billion tons while the value is expected to grow to \$37 trillion.

Freight Flows and Forecasts

Forecasting domestic and international freight flows presents many challenges. Changes in manufacturing locations, global economic forces, competition, new technologies, political dynamics, regulations, trade agreements, the opening of new routes, and labor disputes can each affect freight transportation.

The FHWA in partnership with the Bureau of Transportation Statistics (BTS) developed the Freight Analysis Framework (FAF), a database and analytical tool, to assist transportation planners and engineers in improving the planning, operation, and management of the nation's freight transportation system.

The FAF is a commodity flow database that integrates data from a variety of sources including the Commodity Flow Survey (CFS) data, Census Foreign Trade Statistics, Economic Census data, USDA's Census of Agriculture, Port Import/Export Reporting Service (PIERS), Vehicle Inventory and Use Survey (VIUS), National Highway Planning Network (NHPN), Highway Performance Monitoring System (HPMS), U.S. Energy Information Administration (EIA), and other industrial data. The data is used to depict a comprehensive national picture of freight flows among states and major metropolitan areas by all freight modes. The FAF4 (Version 4) is the most current version of the database, and it is built upon the 2012 CFS; the 2012 CFS contains 132 areas, an increase of domestic regions from 123 areas in the 2007 CFS.

FAF4 forecasts are a reasonable exploration of current trends, but do not reflect major shifts in the national economy, future capacity limitations, or changes in transportation costs and technology. Simply stated, the data does offer insight into the economic impact of freight movements on a national scale and does not account for changes in the cost of transportation or advances in technology.

Data is available for the base year of 2012, the recent years of 2013 - 2017, forecasts from 2020 through 2045 in five-year intervals, and at the state level in the historic years of 1997 to 2007 in five-year intervals. It is important to note that both the 2015 base year and the 2045 forecast year use 2012 funding that are adjusted to the years 2015 and 2045. This allows for the comparison the real value of commodities across all years.

The FAF4 mode and value calculations are based on the following nine possible freight flows depicted in **Figure 4B.1**.

Figure 4B.1. Freight Flows From, To, Within, and Through California



Source: FHWA Freight Analysis Framework, adapted by Caltrans

Commodities

Before delving into specific flow data for California, it is important to highlight the diverse commodities that are being transported throughout the State. In order to wisely invest transportation funds in meeting freight transport needs and requirements, it is important to understand the type and weight of commodities moving through the transportation system. In addition, some commodities have higher values so, it is important to know which of these items will likely be more time-sensitive and impacted by issues such as congestion.

The following discussion refers to the intrastate, interstate, and international shipments of commodities that have an origin or final destinations in California. Intrastate flows originate in and are destined for California, interstate flows are between other U.S. states and California, and international flows are between MWRs and California.

Table 4B.2 shows the top ten commodities listed by weight for intrastate, interstate, and international flows originating from California. The top four 2015 California intrastate freight flows by weight include gravel, non-metallic mineral products, gasoline, and natural sands accounted for 46 percent of all intrastate commodity flows. Intrastate commodity flows are expected to increase in 2045 by approximately 295,644 kilotons, a 33 percent increase from 2015. The leading intrastate commodities forecasted for 2045 include gasoline (replacing gravel as number two), gravel, non-metallic mineral products, and other foodstuff (moving ahead of natural sands). These top four commodities comprise 48 percent of all intrastate tonnage, and the top ten commodities represent 77 percent of all 2045 intrastate tonnage.

The top four 2015 interstate commodities by weight include other foodstuffs, coal- not elsewhere classified (n.e.c.), motorized vehicles, and mixed freight that comprised over 42 percent of the interstate tonnage with California origins and other state destinations. The top ten commodities combined totaled 61,351 kilotons and represented more than 67 percent of the total weight transported. By 2045, the total tonnage is forecasted to increase by 59 percent. Other foodstuffs will continue to be the lead commodity, coal-n.e.c., motorized vehicles, and plastics/rubber will drop in ranking, and milled grains products and wood products will drop from the top ten list-making way for electronics and miscellaneous manufactured products. In addition, the total share of the top ten commodities by weight will grow to around 68 percent.

In terms of value, the top 10 commodities for intrastate (flow 5), interstate (flow 6), and international (flows 2 and 9) movement of goods destined for California for 2015 and the forecasted year of 2045 are identified in **Table 4B.3**.

In 2015, mixed freight, gasoline, and electronics were the top three California intrastate commodities by value, totaling \$295 billion (32 percent of all commodities). The top 10 commodities for this year totaled around \$603 billion (65 percent of all commodities). Between 2015 and 2045, California's total commodity values are expected to increase 58 percent to \$1.5 trillion. The top three commodities (mixed freight, gasoline, and electronic) maintained their

2015 ranking and their value increased to approximately \$252 billion (86 percent). Pharmaceuticals (gaining 44 percent increase in value) are expected move into the rank 4, textiles/leather and other agricultural products are expected to drop from the list, and machinery and transport equipment could rank among the top ten in 2045.

In 2015, the top ten categories represented over 65 percent of the total intrastate commodity value of shipments; in 2045, it will increase to 70 percent, making them important to consider as freight transportation decisions are made.

Table 4B.2. Top Ten Commodities Originating from California by Weight

2015 Top Ten	Weight (kilotons)	Top 10 (%)	All (%)	2045 Top Ten	Weight (kilotons)	Top 10 (%)	All (%)
Intrastate (CA to CA, Flow 5)							
Gravel	111,790	16%	12%	Gasoline	195,407	21%	16%
Nonmetal min. prods.	108,978	15%	12%	Gravel	139,732	15%	12%
Gasoline	106,785	15%	12%	Nonmetal min. prods.	129,110	14%	11%
Natural sands	91,458	13%	10%	Other foodstuffs	108,483	12%	9%
Waste/scrap	74,111	10%	8%	Natural sands	90,775	10%	8%
Other foodstuffs	72,196	10%	8%	Waste/scrap	82,860	9%	7%
Other ag prods.	42,427	6%	5%	Mixed freight	63,569	7%	5%
Coal-n.e.c.	41,550	6%	5%	Coal-n.e.c.	47,800	5%	4%
Mixed freight	36,640	5%	4%	Other ag prods.	39,595	4%	3%
Animal feed	21,205	3%	2%	Animal feed	28,375	3%	2%
Top Ten Total	707,141	100%	78%	Top Ten Total	925,706	100%	77%
All Commodity Total	904,887	128%	100%	All Commodity Total	1,200,531	130%	100%
Interstate (CA to Other U.S. States, Flow 6)							
Other foodstuffs	21,865	36%	24%	Other foodstuffs	38,454	39%	27%
Coal-n.e.c.	6,045	10%	7%	Mixed freight	9,107	9%	6%
Motorized vehicles	5,400	9%	6%	Nonmetal min. prods.	7,693	8%	5%
Mixed freight	5,239	9%	6%	Alcoholic beverages	7,675	8%	5%

Other ag prods.	5,061	8%	6%	Other ag prods.	7,127	7%	5%
Alcoholic beverages	5,054	8%	6%	Electronics	6,807	7%	5%
Nonmetal min. prods.	4,365	7%	5%	Motorized vehicles	6,391	6%	4%
Plastics/rubber	3,253	5%	4%	Coal-n.e.c.	5,826	6%	4%
Milled grain prods.	2,540	4%	3%	Misc. mfg. prods.	4,926	5%	3%
Wood prods.	2,528	4%	3%	Plastics/rubber	4,807	5%	3%
Top Ten Total	61,351	100%	67%	Top Ten Total	98,814	100%	68%
All Commodity Total	90,966	148%	100%	All Commodity Total	144,586	146%	100%
International (CA to MWRs, Flows 2 & 9)							
Coal-n.e.c.	7,632	24%	16%	Waste/scrap	65,254	45%	35%
Other ag prods.	6,386	20%	14%	Other ag prods.	17,666	12%	9%
Fuel oils	3,817	12%	8%	Fuel oils	14,356	10%	8%
Waste/scrap	3,362	10%	7%	Other foodstuffs	13,133	9%	7%
Other foodstuffs	2,686	8%	6%	Basic chemicals	8,551	6%	5%
Motorized vehicles	2,000	6%	4%	Metallic ores	6,230	4%	3%
Wood prods.	1,652	5%	4%	Animal feed	5,719	4%	3%
Plastics/rubber	1,577	5%	3%	Alcoholic beverages	5,251	4%	3%
Machinery	1,559	5%	3%	Plastics/rubber	4,706	3%	2%
Electronics	1,543	5%	3%	Coal	4,669	3%	2%
Top Ten Total	32,213	100%	68%	Top Ten Total	145,536	100%	77%
All Commodity Total	47,168	146%	100%	All Commodity Total	188,926	130%	100%
Source: Freight Analysis Framework Data Tabulation Tool 4.5							

Table 4B.3. Top Ten Commodities Flows Originating from California by Value

2015 Top Ten	Value (millions)	Top 10 (%)	All (%)	2045 Top Ten	Value (millions)	Top 10 (%)	All (%)
Intrastate (CA to CA, Flow 5)							
Mixed freight	\$118,624	20%	13%	Mixed freight	\$205,715	20%	14%
Gasoline	\$105,098	17%	11%	Gasoline	\$187,261	18%	13%
Electronics	\$71,127	12%	8%	Electronics	\$154,113	15%	11%
Motorized vehicles	\$69,125	11%	7%	Pharmaceuticals	\$105,245	10%	7%
Other foodstuffs	\$61,168	10%	7%	Other foodstuffs	\$93,349	9%	6%
Pharmaceuticals	\$46,214	8%	5%	Motorized vehicles	\$79,362	8%	5%
Other ag prods.	\$37,451	6%	4%	Machinery	\$65,277	6%	4%
Misc. mfg. prods.	\$33,305	6%	4%	Misc. mfg. prods.	\$53,493	5%	4%
Plastics/rubber	\$32,424	5%	3%	Plastics/rubber	\$46,165	4%	3%
Textiles/leather	\$28,553	5%	3%	Transport equip.	\$39,150	4%	3%
Top Ten Total	\$603,089	100%	65%	Top Ten Total	\$1,029,131	100%	70%
All Commodity Total	\$927,367	154%	100%	All Commodity Total	\$1,466,341	142%	100%
Interstate (CA to Other U.S. States, Flow 6)							
Electronics	\$101,782	26%	20%	Electronics	\$278,104	33%	27%
Motorized vehicles	\$54,122	14%	11%	Precision instruments	\$107,440	13%	11%
Misc. mfg. prods.	\$39,419	10%	8%	Pharmaceuticals	\$96,044	11%	9%
Precision instruments	\$35,137	9%	7%	Misc. mfg. prods.	\$79,250	9%	8%
Other foodstuffs	\$33,299	8%	7%	Motorized vehicles	\$64,370	8%	6%
Textiles/leather	\$32,162	8%	6%	Other foodstuffs	\$58,138	7%	6%
Pharmaceuticals	\$31,603	8%	6%	Mixed freight	\$48,208	6%	5%
Mixed freight	\$27,866	7%	6%	Transport equip.	\$40,143	5%	4%
Transport equip.	\$21,872	6%	4%	Machinery	\$38,102	5%	4%

Plastics/rubber	\$18,938	5%	4%	Textiles/leather	\$30,861	4%	3%
Top Ten Total	\$396,202	100%	78%	Top Ten Total	\$840,659	100%	83%
All Commodity Total	\$506,491	128%	100%	All Commodity Total	\$1,014,195	121%	100%
International (CA to MWRs, Flows 2 & 9)							
Electronics	\$40,837	31%	23%	Electronics	\$255,838	34%	28%
Precision instruments	\$16,323	13%	9%	Precision instruments	\$187,220	25%	20%
Machinery	\$15,771	12%	9%	Misc. mfg. prods.	\$67,608	9%	7%
Other ag prods.	\$14,014	11%	8%	Machinery	\$66,548	9%	7%
Misc. mfg. prods.	\$11,366	9%	7%	Other ag prods.	\$39,397	5%	4%
Motorized vehicles	\$8,007	6%	5%	Transport equip.	\$36,625	5%	4%
Transport equip.	\$7,587	6%	4%	Chemical prods.	\$27,482	4%	3%
Other foodstuffs	\$5,938	5%	3%	Pharmaceuticals	\$25,435	3%	3%
Waste/scrap	\$5,386	4%	3%	Mixed freight	\$23,830	3%	3%
Chemical prods.	\$5,220	4%	3%	Waste/scrap	\$23,784	3%	3%
Top Ten Total	\$130,449	100%	75%	Top Ten Total	\$753,768	100%	82%
All Commodity Total	\$174,351	134%	100%	All Commodity Total	\$913,904	121%	100%
Source: Freight Analysis Framework Data Tabulation Tool 4.5							

Flow 6 (interstate commodities) represents the value of goods originating in California and destined for other U.S. states. In 2015, electronics were among the top ten commodities by value and totaled to approximately \$396 billion. The top ten commodities accounted for around 78 percent of the value of all goods destined for other U.S. states from California. The top four commodities, electronics, motorized vehicles, miscellaneous manufacturing products, and precision instruments add up to approximately 46 percent of the total commodity value.

Between 2015 and 2045, the value of goods originating from California and flowing to other U.S. states is expected to increase 100 percent to \$1 trillion. The value of electronics is expected to grow by 173 percent by 2045 and remain the number one commodity. In 2015, the value of international goods originating in California and destined for MWR totaled approximately \$174 billion. Additionally, in 2015, electronics were the top international commodity valued at \$40 billion, comprising 31 percent of the top ten and 23 percent of the total commodity value.

Between 2015 and 2045, the value of international commodities is expected to increase from \$174 to \$914 billion, a 424 percent increase. Electronics and precision instruments are the top two commodities for both 2015 and the forecasted year of 2045, comprising 33 percent of all 2015 and 48 percent of all 2045 commodities. California businesses, industries, manufacturers, governments, and residents rely on the transportation system to support the movement of goods into and out of the State.

In 2015, the top interstate commodities (by weight) flowing into California included coal-n.e.c., crude petroleum, cereal grains, and other foodstuffs. These items totaled to 93,247 kilotons, comprised 74 percent of the top ten tonnages, and 52 percent of all commodity tonnage. **(Table 4B.4)** Interstate tonnage flowing into California is expected to increase 68 percent between 2015 and 2045. In 2045, it is projected that gasoline will overtake cereal grains as the third-ranking commodity by weight. Coal-n.e.c. accounted for approximately 35 percent of the top ten commodities and 25 percent of all commodities by weight in 2015. In 2045, coal-n.e.c is expected to hold the number one ranking, increase 125 percent, comprise 44 percent of the top ten commodities, and comprise 33 percent of all interstate commodities destined for California.

Table 4B.4. Top Ten Commodities Destined for California by Weight

2015 Top Ten	Weight (ktons)	Top 10 (%)	All (%)	2045 Top Ten	Weight (ktons)	Top 10 (%)	All (%)
Interstate (USA to CA, Flow 7)							
Coal-n.e.c.	44,684	35%	25%	Coal-n.e.c.	100,359	44%	33%
Crude petroleum	17,899	14%	10%	Crude petroleum	27,266	12%	9%
Cereal grains	17,435	14%	10%	Gasoline	25,567	11%	9%
Other foodstuffs	13,229	10%	7%	Other foodstuffs	20,150	9%	7%
Newsprint/paper	7,323	6%	4%	Cereal grains	16,310	7%	5%
Wood prods.	7,123	6%	4%	Plastics/rubber	8,352	4%	3%
Plastics/rubber	5,011	4%	3%	Mixed freight	8,121	4%	3%
Mixed freight	4,835	4%	3%	Milled grain prods.	7,427	3%	2%
Milled grain prods.	4,601	4%	3%	Base metals	7,087	3%	2%
Base metals	4,447	4%	2%	Wood prods.	6,538	3%	2%
Top Ten Total	126,586	100%	71%	Top Ten Total	227,178	100%	76%
All Commodity Total	178,821	141%	100%	All Commodity Total	299,648	132%	100%

International (MWRs to CA, Flows 1 & 8)							
Crude petroleum	48,546	50%	40%	Crude petroleum	45,792	24%	17%
Motorized vehicles	9,396	10%	8%	Other ag prods.	24,504	13%	9%
Electronics	8,195	8%	7%	Furniture	18,919	10%	7%
Nonmetal min. prods.	5,860	6%	5%	Other foodstuffs	17,684	9%	7%
Textiles/leather	5,453	6%	4%	Electronics	17,116	9%	6%
Other ag prods.	5,297	5%	4%	Motorized vehicles	14,653	8%	5%
Plastics/rubber	4,162	4%	3%	Plastics/rubber	13,314	7%	5%
Articles-base metal	3,593	4%	3%	Textiles/leather	13,100	7%	5%
Fuel oils	3,283	3%	3%	Nonmetal min. prods.	12,903	7%	5%
Gasoline	3,107	3%	3%	Base metals	9,157	5%	3%
Top Ten Total	96,894	100%	79%	Top Ten Total	187,143	100%	70%
All Commodity Total	122,342	126%	100%	All Commodity Total	269,027	144%	100%
Source: Freight Analysis Framework Data Tabulation Tool 4.5							

In 2015, international commodities flowing into California (both directly and indirectly) from MWRs to other U.S. states accounted for approximately 122,342 kilotons. The top ten commodities accounted for approximately 26 percent of all commodity tonnage. Crude petroleum ranked number one in 2015 and is forecasted to rank number one in 2045. In 2015, it accounted for 40 percent of all commodity tonnage and 50 percent the top ten commodity tonnage. While crude petroleum is expected to remain the leading commodity by weight in 2045, other agricultural products are forecasted to replace motorized vehicles in the second rank position. The top ten interstate and international commodities destined for California by value are displayed in **Table 4B.5**.

The value of international commodities destined for California both directly and indirectly (Flows 1 and 8) totaled \$418 billion in 2015. The top commodities included electronics, motorized vehicles, textiles/leather, and crude petroleum. These items comprised 67 percent of the total value and 78 percent of the top ten commodities. Between 2015 and 2045, the value of international commodities with a California destination is forecasted to increase from \$418 billion to \$1.4 trillion – a 236 percent increase. In 2045, electronics, motorized vehicles, and textiles/leather are expected to remain in the first three ranks respectfully, and machinery is expected to replace crude petroleum as rank 4.

Table 4B.5. Top Ten Commodities Destined for California by Value

2015 Top Ten	Value (millions)	Top 10 (%)	All (%)	2045 Top Ten	Value (millions)	Top 10 (%)	All (%)
Interstate (USA to CA, Flow 7)							
Electronics	\$48,363	20%	13%	Electronics	\$88,449	23%	14%
Misc. mfg. prods.	\$29,683	13%	8%	Machinery	\$41,779	11%	7%
Motorized vehicles	\$27,772	12%	7%	Misc. mfg. prods.	\$41,340	11%	7%
Textiles/leather	\$24,704	10%	6%	Pharmaceuticals	\$39,588	10%	6%
Mixed freight	\$19,086	8%	5%	Motorized vehicles	\$32,553	8%	5%
Plastics/rubber	\$18,519	8%	5%	Mixed freight	\$31,068	8%	5%
Other foodstuffs	\$18,148	8%	5%	Precision instruments	\$31,020	8%	5%
Pharmaceuticals	\$17,978	8%	5%	Coal-n.e.c.	\$29,409	7%	5%
Machinery	\$16,493	7%	4%	Plastics/rubber	\$28,932	7%	5%
Precision instruments	\$15,502	7%	4%	Transport equip.	\$28,583	7%	5%
Top Ten Total	\$236,246	100%	62%	Top Ten Total	\$392,722	100%	64%
All Commodity Total	\$382,673	162%	100%	All Commodity Total	\$617,204	157%	100%
International (MWRs to CA, Flows 1 & 8)							
Electronics	\$139,507	39%	33%	Electronics	\$556,140	46%	40%
Motorized vehicles	\$68,606	19%	0%	Motorized vehicles	\$137,515	11%	10%
Textiles/leather	\$36,600	10%	0%	Textiles/leather	\$125,406	10%	9%
Crude petroleum	\$34,121	10%	0%	Machinery	\$76,035	6%	5%
Machinery	\$17,334	5%	0%	Precision instruments	\$71,468	6%	5%
Misc. mfg. prods.	\$14,926	4%	0%	Misc. mfg. prods.	\$65,677	5%	5%
Precision instruments	\$13,330	4%	0%	Furniture	\$62,402	5%	4%
Plastics/rubber	\$11,589	3%	0%	Plastics/rubber	\$44,496	4%	3%
Furniture	\$10,809	3%	0%	Crude petroleum	\$30,501	3%	2%

Articles-base metal	\$8,383	2%	0%	Other ag prods.	\$28,654	2%	2%
Top Ten Total	\$355,206	100%	0%	Top Ten Total	\$1,198,293	100%	85%
All Commodity Total	\$417,524	118%	0%	All Commodity Total	\$1,404,791	117%	100%
Source: Freight Analysis Framework Data Tabulation Tool 4.5							

These top ten lists show that a commodity ranking high in weight does not necessarily rank high in value. In the competitive world, consideration of volume, weight, and value is crucial to maximizing effectiveness of the freight transportation system. Identifying potential damage and congestion along critical freight corridors due to volume and weight of transported commodities allows for proactive planning, operational design, construction, and maintenance of the national and statewide multimodal freight system.

California's Domestic Mode Shipments

When transporting commodities to, through, or within California, the mode of transportation is considered domestic. **Table 4B.6** shows total weight of shipments in 2015 and 2045 (forecasted) by flow (in kilotons), domestic mode, and total value coming into, traveling through, and leaving California.

For example, California domestic-only shipments include all shipments within the State (Flow 5) as well as U.S.-only interstate movements involving the State (Flows 6 and 7). Imports and exports originating from MWR destined for California or originating in California and destined for MWRs are represented by Flows 1 and 2. However, import shipments destined for California can also arrive indirectly through other U.S. states (Flow 8), and exports originating in California can leave the country from other U.S. states (Flow 9). In addition, there are shipments that are not destined for California but pass through the state, entering and exiting our ports as imports and exports (Flows 3 and 4).

From 2015 to 2045, the total tonnage of California domestic mode shipments was expected to increase from 1.4 trillion kilotons (in 2015) to 2.3 trillion kilotons (in 2045). The dollar value associated with these exchanged goods is anticipated to increase to approximately \$6.6 trillion (nearly 146 percent).

The majority of movements by both weight and value begin and end within California (Flow 5). In 2015, the total number of kilotons transported within California were 904,887 and are forecasted to reach 1,200,531 kilotons by 2045.

Trucking is currently the predominant mode of transportation for the State's freight shipments. By weight, trucks transport the largest amount of goods into, within, and out of the State. This is forecasted to remain the case through 2045. In 2015, pipelines transported the next highest volume of commodities, and it is expected to hold its rank into 2045. In percentage-wise, by

weight, both the air and multiple modes and mail categories are expected to increase by 140 percent between 2015 and 2045, perhaps due to growth in demand for e-commerce.

Table 4B.6. Domestic and International Shipments by Weight and Value

Flow 1. MWRs to CA	<u>2015</u>		<u>2045</u>		<u>Change 2015 to 2045</u>	
Mode	Weight	Value	Weight	Value	Weight	Value
	(ktons)	(million)	(ktons)	(million)	(ktons)	(million)
Air *	187	\$22,801	419	\$56,414	124%	147%
Multiple**	7,756	\$33,481	7,841	\$61,639	1%	84%
Non-Domestic Mode	41,296	\$28,834	38,811	\$25,852	-6%	-10%
Other and Unknown	11	\$1,531	2,305	\$11,959	20512%	681%
Pipeline	5,196	\$3,852	4,372	\$3,115	-16%	-19%
Rail	507	\$770	1,071	\$1,305	111%	69%
Truck	41,400	\$196,584	149,798	\$882,367	262%	349%
Water	6,903	\$9,059	11,483	\$11,254	66%	24%
Totals	103,256	\$296,912	216,100	\$1,053,905	109%	255%
Flow 2. California to MWRs						
Air *	190	\$24,929	530	\$93,093	179%	273%
Multiple**	1,982	\$3,942	13,209	\$7,479	566%	90%
Non-Domestic Mode	-	-	-	-	-	-
Other and Unknown	637	\$5,989	115	\$2,419	-82%	-60%
Pipeline	1,208	\$902	7,402	\$6,458	513%	616%
Rail	1,449	\$884	1,315	\$1,490	-9%	69%
Truck	25,963	\$83,335	131,866	\$531,074	408%	537%
Water	3,820	\$4,604	7,287	\$12,215	91%	165%
Totals	35,249	\$124,584	161,723	\$654,229	359%	425%
Flow 3. MWRs Through CA to Other U.S. States						

Air *	153	\$17,621	700	\$102,424	2%	481%
Multiple**	27,758	\$129,351	75,270	\$513,570	171%	297%
Non-Domestic Mode	0	\$0	0	\$0	-	-
Other and Unknown	1	\$142	234	\$6,129	36903%	4201%
Pipeline	529	\$386	633	\$472	20%	22%
Rail	5,126	\$10,903	5,447	\$25,133	6%	131%
Truck	4,227	\$21,493	10,227	\$73,778	142%	243%
Water	11	\$49	33	\$98	209%	99%
Totals	37,804	\$179,946	92,544	\$721,063	145%	301%
Flow 4. Other U.S. States, through CA to MWRs						
Air *	131	\$16,617	649	\$126,416	395%	661%
Multiple**	10,996	\$21,767	42,912	\$134,414	290%	518%
Non-Domestic Mode	0	\$0	0	\$0	-	-
Other and Unknown	35	\$121	169	\$2,823	379%	2235%
Pipeline	929	\$169	13,771	\$4,818	1382%	2752%
Rail	7,385	\$10,131	10,084	\$25,834	37%	155%
Truck	12,338	\$32,343	35,091	\$144,216	184%	346%
Water	13	\$29	52	\$54	289%	83%
Totals	31,828	\$81,178	102,728	\$438,575	223%	440%
Flow 5. Within CA						
Air	9	\$3,791	17	\$8,338	85%	120%
Multiple**	5,631	\$88,927	7,391	\$164,518	31%	85%
Non-Domestic Mode	-	-	-	-	-	-
Other and Unknown	-	-	-	-	-	-
Pipeline	87,139	\$70,441	149,125	\$125,927	71%	79%
Rail	12,437	\$4,137	17,704	\$7,247	42%	75%

Truck	788,775	\$746,689	1,016,622	\$1,148,730	29%	54%
Water	10,897	\$13,382	9,673	\$11,581	-11%	-13%
Totals	904,887	\$927,367	1,200,531	\$1,466,341	33%	58%
Flow 6. CA to Other U.S. States						
Air	214	\$28,857	447	\$79,723	109%	176%
Multiple**	8,725	\$158,026	14,940	\$340,937	71%	116%
Non-Domestic Mode	-	-	-	-	-	-
Other and Unknown	-	-	-	-	-	-
Pipeline	4,637	\$2,542	4,474	\$2,621	-4%	3%
Rail	10,887	\$13,446	17,308	\$22,109	59%	64%
Truck	66,303	\$303,283	107,014	\$568,008	61%	87%
Water	200	\$337	404	\$796	102%	136%
Totals	90,966	\$506,491	144,586	\$1,014,195	59%	100%
Flow 7. Other U.S. States to CA						
Air *	168	\$13,927	245	\$30,866	46%	122%
Multiple**	17,884	\$112,478	29,514	\$177,174	65%	58%
Non-Domestic Mode	-	-	-	-	0%	0%
Other and Unknown	-	-	-	-	0%	0%
Pipeline	42,791	\$10,871	96,275	\$24,455	125%	125%
Rail	41,983	\$21,079	61,541	\$35,857	47%	70%
Truck	59,429	\$213,190	86,067	\$331,442	45%	55%
Water	16,565	\$11,126	26,006	\$17,409	57%	56%
Totals	178,820	\$382,673	299,648	\$617,204	68%	61%
Flow 8. MWRs, through Other U.S. States, to CA						
Air *	261	\$47,753	833	\$151,609	219%	217%
Multiple**	4,750	\$25,263	14,575	\$75,888	207%	200%

Non-Domestic Mode	-	-	-	-	-	-
Other and Unknown	4	\$276	355	\$2,580	9125%	834%
Pipeline	126	\$13	159	\$78	25%	512%
Rail	8,398	\$25,926	19,142	\$56,252	128%	117%
Truck	5,537	\$21,365	17,717	\$64,339	220%	201%
Water	11	\$15	146	\$140	1200%	810%
Totals	19,087	\$120,612	52,926	\$350,886	177%	191%
Flow 9. CA, through Other U.S. States, to MWRs						
Air *	144	\$19,304	735	\$122,494	409%	535%
Multiple**	1,179	\$3,366	1,193	\$10,923	1%	225%
Non-Domestic Mode	-	-	-	-	-	-
Other and Unknown	21	\$875	339	\$3,353	1506%	283%
Pipeline	23	\$23	1	\$4	-94%	-81%
Rail	1,949	\$3,053	3,878	\$22,122	99%	625%
Truck	8,306	\$21,988	20,343	\$99,679	145%	353%
Water	296	\$1,159	714	\$1,099	141%	-5%
Totals	11,918	\$49,767	27,202	\$259,675	128%	422%
Source: Freight Analysis Framework Data Tabulation Tool 4.5						

California Intrastate Freight Flows

Table 4B.7 displays the intrastate freight flows between California's six domestic FAF regions, Fresno – Madera, Los Angeles – Long Beach, Sacramento – Roseville, San Diego – Carlsbad – San Marcos, San Jose – San Francisco, and the remainder of California. In 2015, Los Angeles – Long Beach (LALB) was the strongest generator of shipments (389,538 kilotons) and the largest recipient of shipments (389,900 kilotons). Approximately 90 percent of goods originating in the LALB region stay within the LALB region. By 2045, an increase in total shipments of 572,818 kilotons is forecasted from the LALB region.

Table 4B.7. California Intrastate Freight (Flow 5)

		2015		2045		Change 2015 to 2045	
From	California Regions To	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)
Fresno - Madera CSA*	Fresno, Madera	23,002	\$9,564	25,634	\$11,955	11%	25%
	Los Angeles, Long Beach	1,513	\$4,094	2,408	\$5,019	59%	23%
	Remainder of CA	10,754	\$10,281	14,386	\$13,851	34%	35%
	Sacramento, Roseville	393	\$916	598	\$1,122	52%	22%
	San Diego, Carlsbad, San Marcos	90	\$358	198	\$531	120%	49%
	San Jose, San Francisco, Oakland	3,535	\$4,534	4,736	\$5,808	34%	28%
Subtotal		39,286	\$29,747	47,959	\$38,287	22%	29%
Los Angeles - Long Beach CSA	Fresno, Madera	2,514	\$3,904	3,389	\$5,312	35%	36%
	Los Angeles, Long Beach	351,283	\$412,674	524,934	\$709,321	49%	72%
	Remainder of CA	12,769	\$24,255	13,214	\$35,670	3%	47%
	Sacramento, Roseville	2,335	\$6,905	2,508	\$9,347	7%	35%
	San Diego, Carlsbad, San Marcos	11,874	\$33,996	19,341	\$54,553	63%	60%
	San Jose, San Francisco, Oakland	8,763	\$28,781	9,432	\$42,086	8%	46%
Subtotal		389,538	\$510,516	572,818	\$856,289	47%	68%
Remainder of CA	Fresno, Madera	13,888	\$7,715	16,330	\$9,796	18%	27%
	Los Angeles, Long Beach	27,648	\$22,564	36,308	\$35,137	31%	56%
	Remainder of CA	123,742	\$49,061	156,452	\$66,353	26%	35%
	Sacramento, Roseville	7,217	\$6,740	8,338	\$9,394	16%	39%
	San Diego, Carlsbad, San Marcos	941	\$1,415	1,568	\$2,603	67%	84%

	San Jose, San Francisco, Oakland	18,960	\$15,219	22,140	\$22,094	17%	45%
Subtotal		192,396	\$102,713	241,136	\$145,377	25%	42%
Sacramento - Roseville CSA	Fresno, Madera	1,153	\$1,479	1,360	\$2,731	18%	85%
	Los Angeles, Long Beach	986	\$2,693	1,413	\$4,175	43%	55%
	Remainder of CA	7,326	\$9,051	9,356	\$12,995	28%	44%
	Sacramento, Roseville	38,049	\$21,600	44,205	\$28,066	16%	30%
	San Diego, Carlsbad, San Marcos	59	\$264	84	\$359	42%	36%
	San Jose, San Francisco, Oakland	9,126	\$16,825	11,653	\$25,345	28%	51%
Subtotal		56,699	\$51,912	68,071	\$73,671	20%	42%
San Diego - Carlsbad - San Marcos MSA**	Fresno, Madera	127	\$246	153	\$527	21%	114%
	Los Angeles, Long Beach	1,751	\$10,526	3,301	\$19,901	89%	89%
	Remainder of CA	286	\$1,281	340	\$1,811	19%	41%
	Sacramento, Roseville	34	\$223	48	\$411	42%	84%
	San Diego, Carlsbad, San Marcos	36,139	\$28,336	39,883	\$42,027	10%	48%
	San Jose, San Francisco, Oakland	247	\$2,720	340	\$4,606	38%	69%
Subtotal		38,584	\$43,332	44,065	\$69,282	14%	60%
San Jose - San Francisco - Oakland CSA	Fresno, Madera	2,326	\$4,757	3,115	\$7,848	34%	65%
	Los Angeles, Long Beach	6,719	\$20,397	11,984	\$40,504	78%	99%
	Remainder of CA	23,237	\$24,180	27,966	\$33,252	20%	38%
	Sacramento, Roseville	8,309	\$11,869	11,696	\$18,985	41%	60%
	San Diego, Carlsbad, San Marcos	257	\$2,808	446	\$5,036	73%	79%
	San Jose, San Francisco, Oakland	147,537	\$125,137	171,274	\$177,811	16%	42%

Subtotal	188,385	\$189,148	226,481	\$283,435	20%	50%
Grand Totals	904,887	\$927,367	1,200,531	\$1,466,341	33%	58%
* CSA- Combined Statistical Area; ** MSA- Metropolitan Statistical Area; Source: Freight Analysis Framework Data Tabulation Tool 4.5						

The next largest California shipment generator in 2015 was the San Jose -San Francisco – Oakland (SJSFO) region, with 188,385 kilotons of shipments. By 2045, shipment volume from SJSFO is projected to increase to 226,481 kilotons (20 percent increase). This will also increase value to \$283 billion (50 percent increase).

California's Domestic Interstate Freight Flows

Domestic flows from California to other U.S. states are identified in **Table 4B.8** (Flow 6) and domestic flows from other U.S. states to California are represented in **Table 4B.9** (Flow 7). In 2015, 34 percent of all domestic commodities by weight (31,076 kilotons) flowed from California (**Table 4B.8**) to Nevada, Arizona, and Texas. In 2045, these states are expected to maintain their top 3 rankings, see an increase of 44,511 kilotons, and comprise approximately 31 percent of the total weight of all domestic flows from California to other U.S. states.

Table 4B.8. Domestic Freight Flows from California to Other U.S. States (Flow 6)

Other U.S. States	<u>2015</u>		<u>2045</u>		<u>Change 2015 to 2045</u>	
	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)
Alabama	678	\$4,507	1,287	\$9,480	90%	110%
Alaska	57	\$847	113	\$1,940	99%	129%
Arizona	11,563	\$39,022	15,983	\$68,907	38%	77%
Arkansas	260	\$2,651	519	\$5,083	100%	92%
Colorado	2,563	\$16,529	3,907	\$29,109	52%	76%
Connecticut	647	\$6,151	1,241	\$12,115	92%	97%
Delaware	43	\$1,041	147	\$2,917	242%	180%
Florida	2,666	\$22,571	4,284	\$40,969	61%	82%

Georgia	2,536	\$15,904	4,801	\$31,360	89%	97%
Hawaii	1,259	\$4,750	2,037	\$9,159	62%	93%
Idaho	1,718	\$7,096	2,299	\$10,481	34%	48%
Illinois	5,560	\$18,314	7,751	\$36,922	39%	102%
Indiana	1,037	\$9,582	2,132	\$21,665	106%	126%
Iowa	581	\$4,233	864	\$6,822	49%	61%
Kansas	903	\$5,792	1,596	\$10,709	77%	85%
Kentucky	1,123	\$6,711	2,252	\$16,700	101%	149%
Louisiana	355	\$5,265	733	\$13,855	106%	163%
Maine	216	\$1,673	379	\$3,028	75%	81%
Maryland	574	\$6,727	1,169	\$16,326	104%	143%
Massachusetts	679	\$9,828	1,453	\$21,031	114%	114%
Michigan	1,031	\$9,023	2,450	\$23,718	137%	163%
Minnesota	1,724	\$8,278	2,944	\$18,566	71%	124%
Mississippi	315	\$5,037	680	\$14,411	116%	186%
Missouri	1,093	\$7,150	2,171	\$14,917	99%	109%
Montana	587	\$3,081	841	\$4,779	43%	55%
Nebraska	612	\$2,304	926	\$4,307	51%	87%
Nevada	10,451	\$25,160	14,829	\$41,334	42%	64%
New Hampshire	41	\$844	98	\$2,343	140%	178%
New Jersey	1,358	\$13,565	2,464	\$28,852	82%	113%
New Mexico	1,147	\$5,487	1,970	\$9,963	72%	82%
New York	1,768	\$17,455	3,733	\$43,166	111%	147%
North Carolina	914	\$9,617	1,605	\$19,339	76%	101%
North Dakota	134	\$1,018	246	\$1,832	84%	80%
Ohio	1,894	\$18,013	4,217	\$38,532	123%	114%

Oklahoma	871	\$3,902	1,359	\$7,247	56%	86%
Oregon	5,695	\$22,439	8,005	\$42,750	41%	91%
Pennsylvania	2,206	\$18,429	3,852	\$42,012	75%	128%
Rhode Island	70	\$646	179	\$1,533	154%	137%
South Carolina	954	\$4,862	1,848	\$11,200	94%	130%
South Dakota	49	\$683	89	\$1,532	82%	124%
Tennessee	1,124	\$11,097	2,009	\$29,018	79%	161%
Texas	9,063	\$58,755	13,699	\$119,744	51%	104%
Utah	4,351	\$19,401	6,413	\$29,587	47%	53%
Vermont	26	\$379	52	\$731	103%	93%
Virginia	1,382	\$8,944	2,395	\$22,852	73%	156%
Washington	5,535	\$30,649	7,999	\$49,047	45%	60%
Washington DC	28	\$363	113	\$1,424	302%	292%
West Virginia	53	\$780	104	\$1,944	94%	149%
Wisconsin	1,208	\$8,775	1,961	\$17,106	62%	95%
Wyoming	266	\$1,162	388	\$1,831	46%	58%
Grand Total	90,966	\$506,491	144,586	\$1,014,195	59%	100%
Source: Freight Analysis Framework Data Tabulation Tool 4.5						

Table 4B.9 (Flow 7) shows freight flows to California from other states. In 2015, Arizona, Oregon, and Nebraska transported the most commodities by weight at approximately 68,250 kilotons. The 2045 forecast predicts that the exports by weight from these top three U.S. states will increase by approximately 87 percent and are likely to remain California's top domestic exporters.

Table 4B.9. Domestic Freight Flows from Other U.S. States to California (Flow 7)

Other U.S. States	<u>2015</u>		<u>2045</u>		<u>Change 2015 to 2045</u>	
	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)
Alabama	1,763	\$4,642	2,178	\$7,110	24%	53%
Alaska	16,246	\$11,038	25,994	\$17,739	60%	61%
Arizona	23,823	\$20,815	51,978	\$40,792	118%	96%
Arkansas	1,429	\$3,065	1,831	\$4,364	28%	42%
Colorado	1,574	\$7,050	2,428	\$11,706	54%	66%
Connecticut	293	\$5,052	379	\$7,269	30%	44%
Delaware	98	\$563	96	\$720	-1%	28%
Florida	1,294	\$10,282	1,866	\$17,639	44%	72%
Georgia	2,020	\$10,235	2,116	\$20,127	5%	97%
Hawaii	992	\$1,182	3,405	\$3,449	243%	192%
Idaho	2,193	\$2,722	3,365	\$4,667	53%	71%
Illinois	3,904	\$18,573	5,740	\$27,486	47%	48%
Indiana	1,448	\$9,092	2,149	\$13,967	48%	54%
Iowa	3,503	\$5,267	7,932	\$10,028	126%	90%
Kansas	1,438	\$5,364	2,011	\$9,107	40%	70%
Kentucky	1,607	\$10,587	2,104	\$12,983	31%	23%
Louisiana	2,688	\$3,580	3,751	\$5,238	40%	46%
Maine	90	\$494	101	\$652	12%	32%
Maryland	434	\$4,494	433	\$4,501	0%	0%
Massachusetts	764	\$8,603	1,013	\$13,428	33%	56%
Michigan	1,522	\$10,241	1,795	\$14,762	18%	44%
Minnesota	2,575	\$8,879	2,942	\$14,378	14%	62%

Mississippi	635	\$3,071	1,035	\$5,204	63%	69%
Missouri	1,544	\$6,130	2,126	\$8,993	38%	47%
Montana	874	\$1,214	1,177	\$1,299	35%	7%
Nebraska	20,778	\$8,545	34,502	\$18,882	66%	121%
Nevada	17,450	\$17,377	33,014	\$30,750	89%	77%
New Hampshire	77	\$1,469	121	\$2,604	57%	77%
New Jersey	2,285	\$17,052	2,741	\$23,237	20%	36%
New Mexico	596	\$1,480	750	\$2,708	26%	83%
New York	1,507	\$18,138	1,809	\$22,947	20%	27%
North Carolina	1,239	\$9,324	1,746	\$13,053	41%	40%
North Dakota	1,947	\$1,669	1,944	\$1,808	0%	8%
Ohio	2,277	\$14,173	3,167	\$22,490	39%	59%
Oklahoma	2,047	\$4,233	3,188	\$9,226	56%	118%
Oregon	23,649	\$17,274	41,036	\$26,545	74%	54%
Pennsylvania	2,058	\$11,575	2,632	\$17,131	28%	48%
Rhode Island	84	\$782	82	\$987	-2%	26%
South Carolina	527	\$3,021	728	\$4,259	38%	41%
South Dakota	919	\$1,339	5,045	\$4,940	449%	269%
Tennessee	1,603	\$12,253	2,126	\$18,269	33%	49%
Texas	9,984	\$32,210	15,912	\$59,554	59%	85%
Utah	5,641	\$8,658	6,043	\$14,254	7%	65%
Vermont	95	\$649	174	\$1,092	84%	68%
Virginia	556	\$4,914	722	\$6,464	30%	32%
Washington	5,292	\$13,471	7,089	\$21,736	34%	61%
Washington DC	7	\$51	9	\$81	40%	60%
West Virginia	130	\$638	128	\$625	-1%	-2%

Wisconsin	2,224	\$9,669	2,946	\$15,091	33%	56%
Wyoming	1,102	\$477	2,051	\$865	86%	82%
Grand Total	178,821	\$382,673	299,648	\$617,204	68%	61%
Source: Freight Analysis Framework Data Tabulation Tool 4.5						

International Freight Flows

Export and Import Flows Destined for California

This section addresses foreign shipments (directly and indirectly) destined for California (**Table 4B.10**, Flows 1 and 8), and export shipments originating in California and destined (directly and indirectly) for MWRs (**Table 4B.13**, Flows 2 and 9). MWR goods that are shipped directly to California (or the reverse) are considered direct shipments. Commodities originating in a MWR, passing through California, with a destination of other U.S. states (or the reverse) are considered indirect shipments.

International shipments arrive in California by various modes, however a vast majority of these shipments enter California via cargo ships. In 2015, approximately 104,637 kilotons (86 percent) of the total international (imports) shipments (Flow 1 and 8) to California arrived by ship (**Table 4B.10**). By 2045, shipments via cargo ships are expected to decrease by 54 percent.

Table 4B.10. Total Import Flows from Major World Regions to California (Flows 1 & 8)

Major World Regions (International Origins)	<u>2015</u>		<u>2045</u>		<u>Change 2015 to 2045</u>	
	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)
Africa	3,582	\$3,489	8,021	\$10,337	124%	196%
Canada	10,521	\$28,750	27,230	\$71,372	159%	148%
Eastern Asia	34,835	\$206,290	94,446	\$781,529	171%	279%
Europe	7,175	\$35,976	15,711	\$129,931	119%	261%
Mexico	9,475	\$46,899	34,615	\$161,993	265%	245%
Rest of Americas	22,406	\$21,087	28,539	\$35,904	27%	70%
South East Asia & Oceania	6,791	\$48,987	24,782	\$166,908	265%	241%
South West & Central Asia	27,558	\$26,046	35,682	\$46,817	29%	80%

Total	122,342	\$417,524	269,027	\$1,404,791	120%	236%
Import Modes (MWRs to CA)						
Air (include truck-air)	803	\$107,676	3,139	\$410,796	291%	282%
Multiple modes & mail	351	\$5,143	628	\$15,423	79%	200%
Other and unknown	15	\$1,807	2,660	\$14,540	17599%	705%
Pipeline	126	\$13	158	\$78	25%	511%
Rail	6,995	\$22,507	14,892	\$44,081	113%	96%
Truck	9,416	\$42,564	33,404	\$156,048	255%	267%
Water	104,637	\$237,814	214,145	\$763,826	105%	221%
Total	122,342	\$417,524	269,027	\$1,404,791	120%	236%
Source: Freight Analysis Framework Data Tabulation Tool 4.5						

Most goods arriving by ship are break bulk (goods that must be loaded individually), or containerized, goods in shipping containers. These goods are transferred to other modes of transportation in order to be distributed throughout California and beyond. As shown in the domestic modes portion of **Table 4B.11**, a large shift occurs at the ports where shipments are transferred to trucks, pipelines, and other modes.

Table 4B.11. Major World Regional Flows Destined for California (Flow 1)

	<u>2015</u>		<u>2045</u>		<u>Change 2015 to 2045</u>	
Major World Regions (International Destination)	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)
Africa	3,511	\$3,132	7,892	\$8,082	125%	158%
Canada	2,015	\$1,730	7,248	\$3,003	260%	74%
Eastern Asia	30,495	\$158,343	83,257	\$631,479	173%	299%
Europe	6,286	\$28,165	11,835	\$99,859	88%	255%
Mexico	5,824	\$25,665	23,270	\$109,174	300%	325%
Rest of Americas	21,782	\$19,234	25,255	\$25,860	16%	34%

South East Asia & Oceania	6,087	\$36,352	22,225	\$134,754	265%	271%
South West & Central Asia	27,254	\$24,291	35,119	\$41,694	29%	72%
Total	103,255	\$296,912	216,100	\$1,053,905	109%	255%
Import Mode International Mode						
Air (include truck-air)	541	\$59,914	2,305	\$259,161	326%	333%
Multiple modes & mail	81	\$911	295	\$4,616	263%	407%
Other and unknown	11	\$1,531	2,305	\$11,959	20512%	681%
Rail	15	\$12	104	\$67	588%	477%
Truck	4,757	\$23,337	18,274	\$97,439	284%	318%
Water	97,850	\$211,207	192,817	\$680,663	97%	222%
Total	103,255	\$296,912	216,100	\$1,053,905	109%	255%
Domestic Mode CA (Intrastate Mode)						
Air (include truck-air)	187	\$22,801	419	\$56,414	124%	147%
Multiple modes & mail	7,756	\$33,481	7,841	\$61,639	1%	84%
No domestic mode	41,296	\$28,834	38,811	\$25,852	-6%	-10%
Other and unknown	11	\$1,531	2,305	\$11,959	20512%	681%
Pipeline	5,196	\$3,852	4,372	\$3,115	-16%	-19%
Rail	507	\$770	1,071	\$1,305	111%	69%
Truck	41,400	\$196,584	149,798	\$882,367	262%	349%
Water	6,903	\$9,059	11,483	\$11,254	66%	24%
Total	103,255	\$296,912	216,100	\$1,053,905	109%	255%
Source: Freight Analysis Framework Data Tabulation Tool 4.5						

Time-sensitive shipments of high value are flown into various California international airports, primarily Los Angeles International Airport (LAX). **Table 4B.10** illustrates that between 2015 and 2045, international flows from MWRs into California (imports) via air cargo (by weight) are forecast to increase from 803 kilotons to nearly 3,139 kilotons (over 291 percent) and is expected to increase 282 percent in value (from \$108 billion to \$411 billion). In terms of value,

air shipments are expected to be the fastest-growing mode of imported cargo into California. In 2015, air cargo accounted for 26 percent of the value of international cargo into the region, and in 2045 that share is expected to increase to 29 percent.

International freight arriving into California through ground transportation import modes must come from either Mexico or Canada. In 2015, approximately 13 percent combined weight from these border countries (about 16,411 kilotons) was imported into the U.S. by rail and truck. In 2045, the share will reach about 18 percent (to over 48,297 kilotons).

The total value of 2015 outbound shipments from California by all modes to Canada and Mexico was \$49 billion (**Table 4B.13**), and inbound shipments from those countries to California were worth \$75.7 billion (**Table 4B.10**). By 2045, outbound shipments are projected to grow over 424 percent to \$913.9 billion and inbound shipments by over 70 percent to \$1.4 trillion.

California's largest international trading region, both import and export, by weight and value is Eastern Asia – and this trend is forecasted to continue into 2045 (**see Tables 4B.10 and 4B.13**). It is estimated that by 2045, commodities by weight from Mexico (import) to California will surpass the volume from Canada and the rest of the U.S. (**Table 4B.10**).

International flows into California by weight are projected to grow by over 109 percent; from 103,255 kilotons in 2015 to 216,100 kilotons in 2045 (**Table 4B.11**). The value of international shipments arriving directly into California between 2015 and 2045 is projected to increase by 255 percent. As represented in **Table 4B.12** (Flow 8), in 2015 and beyond, Texas, Washington, and Michigan lead the U.S. in transported weight of foreign commodities destined for California. Texas, Michigan, and Illinois lead by value.

Table 4B.12. Domestic Flows from MWRs, Through Other U.S. States, to CA (Flow 8)

	<u>2015</u>		<u>2045</u>		<u>Change 2015 to 2045</u>	
	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)
Other U.S. States						
Alabama	18.616	\$362.903	330.439	\$623.253	1675%	72%
Alaska	17.472	\$8,510.732	58.705	\$19,143.914	236%	125%
Arizona	870.277	\$1,613.361	3,097.612	\$7,514.698	256%	366%
Arkansas	0.001	\$0.032	0.002	\$0.042	380%	30%
Colorado	0.378	\$31.271	1.821	\$112.885	382%	261%
Connecticut	0.014	\$14.316	0.007	\$0.589	-49%	-96%
Delaware	59.524	\$67.505	30.613	\$25.026	-49%	-63%

Florida	889.022	\$4,970.630	1,980.358	\$17,151.069	123%	245%
Georgia	407.613	\$2,621.852	1,759.809	\$13,101.100	332%	400%
Hawaii	21.267	\$105.900	92.666	\$475.262	336%	349%
Idaho	1,578.923	\$637.468	3,153.624	\$1,636.009	100%	157%
Illinois	236.030	\$14,028.057	1,269.942	\$37,107.759	438%	165%
Indiana	0.091	\$8.395	0.743	\$120.861	714%	1340%
Iowa	0.003	\$0.028	0.003	\$0.084	13%	198%
Kansas	0.002	\$0.818	-	\$0.300	-100%	-63%
Kentucky	44.703	\$8,351.962	150.043	\$36,099.119	236%	332%
Louisiana	60.868	\$115.908	421.609	\$829.871	593%	616%
Maine	48.788	\$350.833	118.591	\$715.171	143%	104%
Maryland	177.369	\$788.545	505.895	\$2,923.721	185%	271%
Massachusetts	32.863	\$630.573	156.933	\$1,344.729	378%	113%
Michigan	2,224.849	\$15,091.735	5,420.123	\$34,111.177	144%	126%
Minnesota	19.802	\$32.686	67.001	\$97.430	238%	198%
Mississippi	1.192	\$11.964	33.746	\$148.482	2732%	1141%
Missouri	0.139	\$25.499	1.102	\$17.248	691%	-32%
Montana	793.747	\$862.298	1,687.374	\$2,348.960	113%	172%
Nebraska	0.007	\$0.443	2.293	\$8.017	35172%	1711%
Nevada	0.579	\$13.879	0.699	\$18.308	21%	32%
New Hampshire	0.012	\$3.148	-	\$0.000	-100%	-100%
New Jersey	1,563.670	\$7,486.355	4,446.506	\$20,980.662	184%	180%
New Mexico	11.122	\$402.745	47.944	\$476.285	331%	18%
New York	894.133	\$9,430.187	2,453.527	\$33,451.760	174%	255%
North Carolina	299.383	\$666.977	871.048	\$2,403.278	191%	260%
North Dakota	116.700	\$259.826	317.935	\$1,034.394	172%	298%

Ohio	0.400	\$6.011	46.155	\$577.282	11436%	9503%
Oklahoma	0.015	\$0.796	0.164	\$9.943	968%	1149%
Oregon	337.217	\$3,465.995	811.997	\$7,544.361	141%	118%
Pennsylvania	328.170	\$813.684	764.407	\$1,649.618	133%	103%
Rhode Island	6.276	\$82.572	6.275	\$67.012	0%	-19%
South Carolina	201.084	\$922.835	1,980.526	\$3,747.054	885%	306%
Tennessee	43.191	\$8,831.297	121.477	\$27,710.160	181%	214%
Texas	3,942.507	\$23,201.418	11,841.971	\$57,898.948	200%	150%
Utah	0.501	\$24.139	6.215	\$123.360	1141%	411%
Vermont	2.731	\$14.928	4.165	\$33.816	53%	127%
Virginia	237.290	\$1,019.246	1,170.836	\$3,149.412	393%	209%
Washington	3,598.318	\$4,674.579	7,692.245	\$14,344.180	114%	207%
Washington DC	0.574	\$53.103	0.108	\$3.527	-81%	-93%
West Virginia	0.002	\$0.039	-	-	-100%	-100%
Wisconsin	0.063	\$2.470	1.222	\$5.623	1849%	128%
Total	19,087.498	\$120,611.942	52,926.474	\$350,885.760	177%	191%
Included to the thousandths decimal place to capture the weight and value that did not display during rounding; Source: Freight Analysis Framework Data Tabulation Tool 4.5						

From California to MWRs (**Table 4B.13**), Eastern Asia led other world regions in 2015 with \$52.4 billion for approximately 30 percent of the total value followed distantly by Europe (18 percent) and Mexico (17 percent) by value. Total export flows are forecasted to increase by 2045 in value by 424 percent and weight by 301 percent.

Table 4B.13. Total California Origin Flows to Major World Region (Flows 2 & 9)

	<u>2015</u>		<u>2045</u>		<u>Change 2015 to 2045</u>	
Major World Regions (International Destinations)	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)

Africa	317	\$1,192	1,242	\$7,596	291%	537%
Canada	7,033	\$19,339	20,213	\$82,921	187%	329%
Eastern Asia	13,737	\$52,400	88,514	\$294,504	544%	462%
Europe	5,641	\$31,952	9,082	\$189,322	61%	493%
Mexico	8,862	\$29,691	26,235	\$105,564	196%	256%
Rest of Americas	4,654	\$10,224	19,149	\$56,575	311%	453%
South East Asia & Oceania	4,544	\$16,985	16,935	\$101,566	273%	498%
South West & Central Asia	2,377	\$12,569	7,556	\$75,857	218%	504%
Total	47,168	\$174,351	188,926	\$913,904	301%	424%
Export Modes (CA to MWRs)						
Air (include truck-air)	596	\$76,279	3,245	\$504,929	444%	562%
Multiple modes & mail	41	\$264	114	\$560	181%	112%
Other and unknown	658	\$6,863	454	\$5,772	-31%	-16%
Pipeline	12	\$2	9	\$9	-24%	301%
Rail	1,772	\$1,832	3,036	\$6,008	71%	228%
Truck	10,870	\$35,240	31,176	\$144,824	187%	311%
Water	33,219	\$53,870	150,891	\$251,803	354%	367%
Total	47,168	\$174,351	188,926	\$913,904	301%	424%
Source: Freight Analysis Framework Data Tabulation Tool 4.5						

Regarding exports originating in California and exiting to foreign lands through other states (**Table 4B.14**, Flow 9), most of the weight will continue to be transported through Texas, Washington, and Michigan. California commodities, flowing through other states, destined for MWRs account for approximately 72 percent of the total commodity value. In 2015, Texas, Michigan, New York, Washington, Tennessee, and Florida were the leading states for this freight flow.

Table 4B.14. Domestic Flows from CA, Through Other U.S. States, to MWRs (Flow 9)

Other U.S. States	<u>2015</u>		<u>2045</u>		<u>Change 2015 to 2045</u>	
	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)
Alabama	1.038	\$103.410	174.516	\$1,217.519	16719%	1077%
Alaska	27.180	\$1,861.459	66.654	\$7,505.277	145%	303%
Arizona	559.504	\$1,218.103	1,100.279	\$5,048.292	97%	314%
Arkansas	0.002	\$0.407	-	\$0.000	-100%	-100%
Colorado	0.012	\$2.064	0.143	\$21.573	1101%	945%
Connecticut	-	\$0.016	0.002	\$0.601	*	3749%
Delaware	2.758	\$16.168	8.143	\$70.454	195%	336%
Florida	327.638	\$4,154.061	556.225	\$23,484.458	70%	465%
Georgia	122.811	\$564.405	195.649	\$2,109.632	59%	274%
Hawaii	6.706	\$148.056	40.804	\$1,179.830	508%	697%
Idaho	129.388	\$164.850	340.956	\$557.236	164%	238%
Illinois	12.766	\$586.531	44.948	\$3,792.196	252%	547%
Indiana	0.391	\$412.421	0.896	\$844.836	129%	105%
Kansas	-	\$0.068	-	-	*	-100%
Kentucky	28.418	\$3,800.599	84.707	\$16,446.678	198%	333%
Louisiana	78.391	\$32.763	15.279	\$1,232.950	-81%	3663%
Maine	23.759	\$61.699	51.837	\$261.940	118%	325%
Maryland	16.743	\$125.991	38.002	\$271.418	127%	115%
Massachusetts	1.733	\$18.088	6.160	\$563.955	256%	3018%
Michigan	2,736.978	\$6,847.718	7,930.373	\$31,446.772	190%	359%
Minnesota	16.644	\$83.776	47.764	\$448.887	187%	436%
Mississippi	36.070	\$5.025	9.515	\$7.219	-74%	44%

Missouri	0.000	\$0.149	0.000	\$0.740	-100%	398%
Montana	784.844	\$1,421.098	2,239.204	\$7,457.326	185%	425%
Nebraska	-	\$0.950	-	\$3.035	*	219%
Nevada	2.705	\$168.086	14.792	\$1,104.731	447%	557%
New Hampshire	0.108	\$0.388	0.000	\$0.021	-100%	-94%
New Jersey	219.575	\$375.234	69.886	\$2,744.247	-68%	631%
New Mexico	12.429	\$167.354	0.486	\$16,466.416	-96%	9739%
New York	634.231	\$5,862.656	2,440.141	\$45,246.586	285%	672%
North Carolina	21.895	\$319.404	20.153	\$166.007	-8%	-48%
North Dakota	147.205	\$293.432	617.366	\$1,494.815	319%	409%
Ohio	12.135	\$45.764	1.247	\$58.075	-90%	27%
Oklahoma	0.009	\$0.386	0.000	\$0.001	-100%	-100%
Oregon	8.810	\$112.919	74.851	\$170.175	750%	51%
Pennsylvania	55.650	\$576.215	56.712	\$14,358.299	2%	2392%
Rhode Island	0.003	\$0.011	-	\$0.076	-100%	594%
South Carolina	60.076	\$736.443	218.284	\$3,043.249	263%	313%
South Dakota	0.807	\$28.373	1.105	\$121.210	37%	327%
Tennessee	23.253	\$4,262.343	103.742	\$21,409.974	346%	402%
Texas	3,494.133	\$9,729.702	4,308.766	\$29,611.959	23%	204%
Utah	0.149	\$12.221	1.843	\$91.294	1136%	647%
Vermont	1.960	\$13.019	13.356	\$66.126	581%	408%
Virginia	168.881	\$513.093	151.713	\$2,051.848	-10%	300%
Washington	2,139.375	\$4,842.067	6,140.864	\$17,079.003	187%	253%
Washington DC	0.862	\$71.275	15.019	\$412.054	1643%	478%
West Virginia	-	\$0.000	-	\$0.012	*	*
Wisconsin	0.028	\$6.571	0.003	\$6.404	-89%	-3%

Total	11,918.05	\$49,766.828	27,202.39	\$259,675.405	128%	422%
Included to the thousandths decimal place to capture the weight and value that did not display during rounding *Undefined: percent increase from a base of 0 is expressed by infinity Source: Freight Analysis Framework Data Tabulation Tool 4.5						

Forecasted international flows by weight into California (**Table 4B.10**, Flows 1 and 8) in the domestic mode show around 40 percent more commodities imported into California than leaving the State for foreign destinations (**Table 4B.13**, Flows 2 and 9) in 2045. The weight of California exports is expected to increase much faster than imports destined for California over the forecast period (301 percent versus around 120 percent). However, the value of these imports will increase to \$1.4 trillion, while exports will only reach \$913.9 billion. Therefore, a large trade imbalance is forecast to remain in the future.

Exports and Imports Through, Not Destined for, California

This section provides information regarding international shipments that are either destined for or originate within the rest of the U.S. and are heading to or departing from the eight MWRs using California's ports of entry/exit (i.e., through shipments). To a large extent, this can be considered discretionary trade that could go to/from other states without traversing California. This trade is an important component of the California's freight sector as it supports thousands of jobs at seaport, railroad, trucking, transloading, and warehousing facilities. Although these shipments are not destined for California, some processing or repacking of freight containers may occur here. As displayed in **Table 4B.15** (flow 3), shipments from MWRs, through California, to the other states are expected to increase in weight by 145 percent from 37,804 kilotons to 92,544 kilotons. Goods from MWRs destined for other states through California ports arriving in waterborne vessels (international modes) were 35,795 kilotons in 2015 and it is expected to climb to 86,279 kilotons by year 2045. It is important to note that some ports, such as the POLB and POLA, compute freight flows specific to their operations and may not be consistent with outputs from the FAF.

Table 4B.15. Major World Region Flows Destined for Other U.S. States, Through California (Flow 3)

Major World Regions (International Origins)	<u>2015</u>		<u>2045</u>		<u>Change 2015 to 2045</u>	
	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)
Africa	54	\$181	125	\$354	133%	95%
Canada	89	\$180	7	\$595	-92%	231%

Eastern Asia	28,432	\$132,060	67,504	\$529,527	137%	301%
Europe	1,942	\$7,585	3,353	\$27,540	73%	263%
Mexico	1,859	\$13,838	5,546	\$39,202	198%	183%
Rest of Americas	721	\$1,182	2,804	\$5,807	289%	391%
South East Asia & Oceania	3,648	\$19,568	11,314	\$97,776	210%	400%
South West & Central Asia	1,060	\$5,351	1,890	\$20,802	78%	289%
Total	37,804	\$179,946	92,544	\$721,603	145%	301%
International Modes (MWRs to CA)						
Air (include truck-air)	166	\$19,320	750	\$110,401	352%	471%
Multiple modes & mail	27	\$429	112	\$1,922	320%	348%
Other and unknown	1	\$142	234	\$6,129	36903%	4201%
Rail	38	\$21	14	\$6	-64%	-73%
Truck	1,778	\$13,310	5,154	\$36,519	190%	174%
Water	35,795	\$146,723	86,279	\$566,627	141%	286%
Total	37,804	\$179,946	92,544	\$721,603	145%	301%
Domestic Modes (CA to Other U.S. States)						
Air (include truck-air)	153	\$17,621	700	\$102,424	358%	481%
Multiple modes & mail	27,758	\$129,351	75,270	\$513,570	171%	297%
Other and unknown	1	\$142	234	\$6,129	36903%	4201%
Pipeline	529	\$386	633	\$472	20%	22%
Rail	5,126	\$10,903	5,447	\$25,133	6%	131%
Truck	4,227	\$21,493	10,227	\$73,778	142%	243%
Water	11	\$49	33	\$98	209%	99%
Total	37,804	\$179,946	92,544	\$721,603	145%	301%
Source: Freight Analysis Framework Data Tabulation Tool 4.5						

Exports from other states traveling through California to MWRs are estimated to increase by over 223 percent from 31,828 kilotons to 102,728 kilotons (**Table 4B.16**, Flow 4). Value figures between 2015 and 2045 in the export direction are forecasted to increase by approximately 440 percent from around \$81 billion to nearly \$439 billion, while in the reverse direction (**Table 4B.15**), an increase in import value of 301 percent from \$179.9 billion to \$721.6 billion has been forecasted. In terms of value, international movements traveling through California in transit for other states will be approximately 61 percent more than the export flows of other states traveling through California to MWRs by 2045.

Table 4B.16. Exports from Other U.S. States, Through CA, to Major World Regions (Flow 4)

	<u>2015</u>		<u>2045</u>		<u>Change 2015 to 2045</u>	
	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)	Weight (ktons)	Value (millions)
Domestic Modes (Other U.S. States to CA)						
Air (include truck-air)	131	\$16,617	649	\$126,416	395%	661%
Multiple modes & mail	10,996	\$21,767	42,912	\$134,414	290%	518%
Other and unknown	35	\$121	169	\$2,823	379%	2235%
Pipeline	929	\$169	13,771	\$4,818	1382%	2752%
Rail	7,385	\$10,131	10,084	\$25,834	37%	155%
Truck	12,338	\$32,343	35,091	\$144,216	184%	346%
Water	13	\$29	52	\$54	289%	83%
Total	31,828	\$81,178	102,728	\$438,575	223%	440%
International Mode (CA to MWRs)						
Air (include truck-air)	136	\$18,218	663	\$128,130	388%	603%
Multiple modes & mail	0	\$0	1	\$5	828%	987%
Other and unknown	35	\$121	169	\$2,823	379%	2235%
Pipeline	929	\$169	13,767	\$4,768	1382%	2728%
Rail	362	\$183	628	\$537	73%	194%
Truck	947	\$5,101	2,588	\$16,456	173%	223%
Water	29,418	\$57,386	84,911	\$285,857	189%	398%

Total	31,828	\$81,178	102,728	\$438,575	223%	440%
Major World Regions (Destinations)						
Africa	61	\$257	196	\$4,273	224%	1560%
Canada	1	\$28	47	\$1,503	6826%	5222%
Eastern Asia	21,246	\$52,564	62,550	\$245,789	194%	368%
Europe	298	\$4,880	907	\$31,857	204%	553%
Mexico	4,378	\$5,829	17,063	\$24,086	290%	313%
Rest of Americas	299	\$861	1,391	\$7,447	366%	765%
South East Asia & Oceania	5,274	\$14,998	18,854	\$112,879	257%	653%
South West & Central Asia	272	\$1,760	1,719	\$10,742	532%	510%
Total	31,828	\$81,178	102,728	\$438,575	223%	440%
Source: Freight Analysis Framework Data Tabulation Tool 4.5						

Domestic Freight Modes and Commodities

Domestic Trucking Cargo

The highway network is the largest component of California's freight network in terms of infrastructure, tonnage shipped, and value shipped. It provides first- and last-mile connections to other modes in addition to supporting California's key industries. Trucks are by far the single most-used mode (between air, train, marine, and pipelines) to move freight. By 2040, tonnage for trucking is forecast to grow by 30 percent. Transportation funds should be invested in key freight corridors to address anticipated growth of freight tonnage on California's highways.

Linking State and local transportation investments, especially in freight transportation infrastructure, to economic development is vital for the regional, local, and overall State economy, as well as for keeping businesses in and attracting them to California. Adequate transportation is one of several key factors considered in site location decisions (e.g., utilities, work-force skills, and tax structure). These factors affect an area's business costs, markets, and overall competitiveness for attracting business investment. All businesses need some level of transportation access to labor, materials, and customers to work and survive. As such, transportation is a factor that influences the ability of local and regional economic development agencies to increase their areas' business attractions, expansions, retentions, and startups. Investments in transportation services and infrastructure may contribute to the economic vibrancy of a region by:

- reducing business operating costs and increasing business productivity;

- expanding the size of labor markets; and
- increasing business access to needed labor, supplies, services, and materials.

In 2015, 911 million tons of freight moved over California’s highway system by truck, valued at \$1.2 trillion. Gravel (about 12 percent), non-metallic mineral products, and other foodstuffs are top commodities by weight. Mixed freight (which includes consumer goods, grocery, supplies and food for restaurants and fast food, hardware, plumbing or office supplies, and other miscellaneous products), motorized vehicles, and electronics were the top three commodities by value carried by truck.

By 2040, it is forecasted that California’s highway system will carry more than 1.2 billion tons of freight annually, valued at \$1.9 trillion – an increase of 26 percent by tonnage and 52 percent by value increase from 2015. California is an attractive global gateway because of its geographic position, large population, and robust, vast transportation system. The State must continue to improve this system and minimize costs to stay ahead of increasing competition and support economic growth. Failure to maintain and invest in infrastructure will put California and the rest of the nation, which depends on our gateways, at a competitive disadvantage at a time when production and the supply chain offer greater geographic flexibility.

Domestic Rail Cargo

Rail transportation is not economically competitive for short-distance, small, and high-value shipments. Although the cost of transporting goods by rail is lower, access to rail terminals for loading/unloading and travel time reliability are deterrents for shippers for domestic shipments within California. In 2015, about 3 percent of domestic goods movement, slightly short of a quarter million tons, was transported via rail system (including multi-modal rail) in California. Major commodities included the following: gravel, nonmetal, mineral products, natural sands, building stone, Coal-n.e.c (other coal and petroleum product that is not elsewhere classified, such as liquefied natural gas or propane or butane, petroleum coke or asphalt).

Development of inland ports in the Central Valley may improve the accessibility and frequency of trains within California regions. It could potentially increase the opportunity for shippers to use rail instead of trucks, or a combination of rail and truck for their local shipments. This could reduce congestion on the highway network as well.

Domestic Waterborne Cargo

California does not have significant waterway system for domestic goods movement. As discussed in **Chapter 3**, there are ongoing feasibility studies to evaluate Marine Highway M5 and M580 to increase the volume and diversity of goods carried by the domestic waterway system. These corridors are not currently cost effective for shippers as compared to trucking cost. In 2015, a total of 8,000 kilotons of gasoline, fuel oils, and crude petroleum were transported between seaports in California. This trend is expected to continue until the M-580 and M-5 corridors are established as strong, economically viable alternative modes in the region.

Domestic Air Cargo

With an increase in e-commerce activity over the years, the private freight sector has seen a dramatic increase in business, creating a unique landscape for the air transport sector. High-value, time-sensitive commodities have also been shipped more frequently via mail carriers by air. Top commodities include pharmaceuticals, electronics, precision instruments, transportation equipment, textiles, and leather.

With growth in high-value commodities placing more capacity constraints on the California air freight network, there is increasing need to invest in first- and last-mile projects to the airports with the greatest freight movement, including Los Angeles (LAX), Ontario (ONT), Oakland (OAK), and San Francisco (SFO). For example, in 2017, cargo facilities at LAX generated 1,888 trips between 8am and 9am, 2,376 trips between 11am and 12pm, and 2,870 trips between 5pm and 6pm.⁵ This constitutes significant traffic, and accounts for about 12-14 percent of the total LAX trip generation during these peak hours. In 2015, California ranked first in the nation in transporting electronics and electronic equipment by air, with over \$20 billion. Domestic air cargo is projected to nearly double by 2040.⁶

Pipelines

Crude Oil

The U.S. Energy Information Administration (EIA) reported that in October of 2017, California was one of the nation's top producers of crude oil and ranked third in petroleum refining capacity, accounting for approximately one-tenth of the U.S. production and refining capacity. California's crude oil and refined petroleum network consists of crude oil and petroleum product pipelines, refineries, terminals, and petroleum ports. The crude oil pipelines connect California's production areas to refining centers in Los Angeles, the Central Valley, and the San Francisco Bay Area. These refineries are then connected through petroleum product pipelines to refineries and terminals throughout the US. Most of the gasoline imported into California enters by ship via the San Pedro Bay Ports and the San Francisco Bay Area Ports.

California has the third-largest share of petroleum reserves and is the third-largest producer of petroleum among the 50 states, after Texas and North Dakota. Petroleum reservoirs in the geologic basins along California's Pacific Coast and in the Central Valley contain major crude oil reserves; the most prolific oil-producing area in the state is the San Joaquin basin, located in the southern half of the Central Valley. Even though California's crude oil production has declined overall in the past 30 years, the state still is one of the top producers of crude oil in the nation, accounting for about 6 percent of total US production in 2016. California refiners also process large volumes of Alaskan and foreign crude oil received at the state's ports. Crude oil production in California and Alaska has declined, and California refineries have become increasingly dependent on imports to meet the state's needs.

Natural Gas

California is second in the nation in the use of natural gas. California's natural gas output equals about one-tenth of state demand. Almost two-thirds of California households use natural gas

for home heating, and about half of California's utility-scale net electricity generation is fueled by natural gas.

As presented in **Chapter 3**, California's natural gas network consists of pipelines, along with the processing plants, terminals, and storage facilities that support the transportation of this important energy resource. In 2017, the estimated natural gas gathering and transmission pipeline in California totaled approximately 12,516 miles. California has 14 natural gas storage fields that help stabilize supply; together the fields have an annual storage capacity of about 600 billion cubic feet of natural gas and a typical working natural gas capacity of about 375 billion cubic feet.

California's natural gas is largely delivered through the Western Region Natural Gas Pipeline Network. The main conduits of natural gas to California are the El Paso Natural Gas Company system and Transwestern Pipeline Company system in the southern regions of the State, and the Gas Transmission Northwest Company's interstate system in the northern regions of the State.

The southern region systems originate in Texas and parallel each other as they traverse New Mexico and Arizona to deliver large portions of their capacity to California's largest natural gas companies at the State's eastern border. The northern region system delivers Canadian natural gas through Washington and Oregon to California's northern border. In 2011, natural gas supplies began arriving via the Ruby Pipeline, which runs from Wyoming to Oregon, directly linking natural gas produced in the Rocky Mountain region to markets in Northern California. Although a small amount of natural gas is exported to Mexico, almost all the natural gas delivered to California is used within the state or is placed in storage.

Conclusion

California's economy is freight transportation-dependent. Despite California's excellent rail, marine, highway, and air connections to national and international destinations, projected growth in freight, even with currently planned improvements, will strain the capacity of the transportation system and potentially increase community and environmental impacts. Investment in our transportation infrastructure is needed to remain competitive with other states and countries that are investing in their transportation networks and reducing impacts to California's environment and communities. Along with the system investments, mitigation, and implementation of best practices will be necessary.

The FAF freight data and forecasts strongly indicate that freight moved on trucks is expected to increase for the foreseeable future. The value of shipments is expected to grow over two times as fast as their weight; thus, the cost of trucks delayed by congestion will rise accordingly. Trucks unable to meet shipment schedules will directly affect regional and state economic development and competitiveness. On the other hand, it takes several thousand passenger vehicles passing over a given segment of roadway to do the same damage as one fully loaded, heavy-duty 5-axle truck. Understanding that there will be more truck trips on California highways will inform decision-makers of needed infrastructure improvements, such as

strengthening pavement design standards, constructing dedicated truck facilities, shortening pavement maintenance schedules, and effecting modal shifts to avoid highway impacts.

Endnotes

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<https://www.bea.gov/system/files/2019-11/qgdpstate1119.pdf>
- ² World Economic Outlook Database, International Monetary Fund, 2019
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- ³ E-1 Population Estimates for Cities, Counties, and the State — January 1, 2018 and 2019, California Department of Finance, 2019
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- ⁴ State Exports from California, United State Census Bureau, 2019
<https://www.census.gov/foreign-trade/statistics/state/data/ca.html>
- ⁵ “2018 Traffic Generation Report.” Studies and Reports, Los Angeles World Airports
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- ⁶ Freight Analysis Framework Data Tabulation Tool 4.5, extracted on February 13, 2020
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Chapter 5: Environmental Challenges, Opportunities, and Engagement

- A. Environmental Impacts
- B. Partnerships and Engagement

5.A. Environmental Impacts

California's freight network is a vital engine for the State's economy. California's supply chain network also provides significant benefits to the nation with goods moving through California gateways to each Congressional District in the country¹. California's deep-water ports serve a substantial share of all marine cargo deliveries to the United States (U.S.), which are transferred and distributed through California to the rest of the nation. California airports are also major air cargo destinations for the country. The freeway and railway networks serve substantial shares of freight entering the southern and northern borders of the U.S., as well as marine ports and airports. The preeminence of California's ports of entry, and proximity to supply chains from the Pacific Rim, ensure that the State enjoys disproportionate economic benefits from trade into, and out of the U.S. compared with other states.

Although California's robust freight sector provide significant benefits to communities, regions, and the State, it also negatively contributes to environmental impacts, primarily in the form of emissions and noise. Similar to large, heavy-duty vehicles (trucks, trains, and cargo handling equipment), smaller equipment (individual refrigeration units on truck trailers, forklifts, and onboard ship equipment) traditionally use diesel fuel. The emissions generated by diesel fuel consumption include diesel particulate matter (DPM), other particulate matter (PM), nitrogen oxides (NOx), sulfur oxides (SOx), and other air pollutants which can cause health and environmental challenges. Reduction of non-exhaust particulate matter such as brake, tire, and road wear and road dust may become a more crucial factor in emission reduction efforts². The reduction of emissions from the freight sector, including but not limited to, greenhouse gases, toxins, and criteria pollutants, are needed to meet state mandates, federal air quality standards, and to reduce community health risks.

Freight Affected Communities

Community impacts from the freight industry, such as emissions and noise, have been longstanding issues. Emissions are the primary freight-related impact of concern for communities near freight facilities due to the potential for significant negative health impacts.

The freight industry is widely distributed within California along and near truck and rail corridors, rail yards, warehouse districts, sea and airports, intermodal transfer facilities, agricultural processing plants, and industrial and manufacturing facilities. While negative impacts of the freight affect all residents, children, the elderly, pregnant women, and those in poor health are particularly impacted. Communities in close proximity to freeway and railroad facilities disproportionately experience the harmful health effects.

or a statewide approach to understanding how and the extent of these impacts, a combination of CalEnviroScreen evaluations of disadvantaged communities and air basin data was used since location specific data for freight related networks and facilities are not consistently available throughout the state.

Disadvantaged Communities

Disadvantaged communities refer to the areas throughout California which disproportionately experience hardships relating to economic, health, and environmental equity. These areas have high poverty rates, high unemployment, suffer from air and water pollution as well as the presence of hazardous wastes, and the high rates of asthma and heart disease. Programs funded through proceeds from the State's Greenhouse Gas Reduction Fund (GGRF), use the definition of disadvantaged communities defined by the California Environmental Protection Agency (CalEPA) in accordance with SB 535³ (De Leon Chapter 830, Statutes of 2012). CalEPA uses the CalEnviroScreen tool to assess areas that are disproportionately affected by multiple types of pollution and areas with vulnerable populations. CalEnviroScreen includes numerous indicators in two broad categories – “burden of pollution,” which includes exposures and environmental effects, and “population characteristics,” which includes sensitive populations and socioeconomic factors. Additional information regarding CalEnviroScreen for all census tracts, including those defined as SB 535 disadvantaged communities, can be found on the CalEPA website.

The CalEnviroScreen formula calculates a score based on the pollution burden and population characteristics. The Census Tracts in the top 25 percent of the CalEnviroScreen score are considered disadvantaged (**Table 5A.1**). CalEnviroScreen includes pollution and environmental effects that are less directly associated with freight and logistics including the following:

- Exposures
 - Pesticide Use
 - Drinking Water Contaminants
- Environmental Effects
 - Groundwater Threats
 - Cleanup Sites
 - Impaired Bodies of Water

To determine the disadvantaged communities with the highest rate of exposure to freight-related emissions, the top 25 percent of tracts were evaluated to determine how many are located within California air basins that are considered nonattainment areas and do not conform to State air quality standards for pollutants that have a known negative impact on human health. These pollutants include particulates (PM_{2.5} and PM₁₀), carbon monoxide, NO_x, and SO_x. Because the transportation sector, inclusive of freight, is the primary emitter within these air basins, many of the disadvantaged communities within these air basins are affected by freight. As of June 2017, all California air basins are in attainment for carbon monoxide, NO_x, SO_x. However, many air basins are in nonattainment for ozone and particulate emissions. Nanoparticles (< PM_{2.5} or ultrafine) have been linked to lung damage and disease. **Table 5A.2**

provides a list of air basins that are in nonattainment for particulate emissions (PM_{2.5} and PM₁₀).⁴

Table 5A.1. CalEnviroScreen Top 25 Percent Disadvantaged Census Tracts by Air Basin

Air Basin	Number of Census Tracts
South Coast	1,326
San Joaquin Valley	410
San Francisco Bay Area	106
Sacramento Valley	54*
San Diego	37
Salton Sea	23
Mojave Desert	14
South Central Coast	8
North Central Coast	5
Total	1,983
Source: California Office of Environmental Health Hazard Assessment	
*Sacramento Valley's attainment is mixed, meaning at least some of the counties within it are in nonattainment.	

The majority of California's air basins are in nonattainment for PM_{2.5} and PM₁₀, both of which are generated in large quantities by the freight industry. All of the CalEnviroScreen top 25 percent disadvantaged Census Tracts are located within a nonattainment air basin, and therefore are likely to experience some level of freight-related pollution burden.⁵

The following five counties have the largest share of top 25 percent disadvantaged Census Tracts based on CalEnviroScreen:

- Los Angeles (51 percent of Tracts)
- San Bernardino (8 percent of Tracts)
- Fresno (6 percent of Tracts)
- Riverside (5 percent of Tracts)
- San Joaquin (4 percent of Tracts)

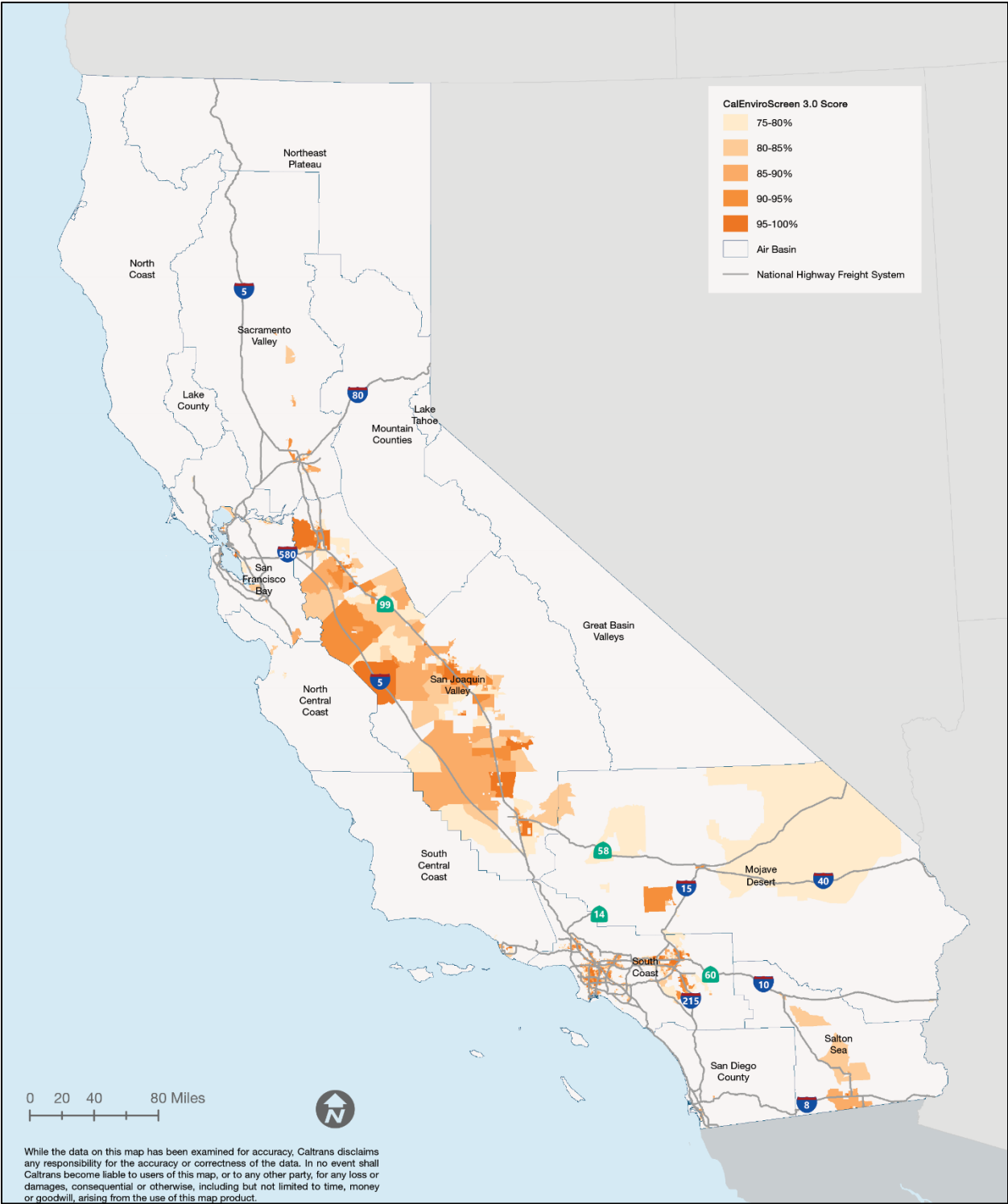
These disadvantaged communities are affected by emissions from the transportation sector, inclusive of the freight network. These communities tend to have a greater share of households living in poverty, greater unemployment, lower educational attainment, more linguistic isolation, and more housing burdened than other communities in the state.

Table 5A.2. California Particulate Emissions Nonattainment by Air Basin

Air Basin	PM2.5	PM10
North Coast	✓	≠
San Francisco Bay Area	✗	✗
North Central Coast	✗	✗
South Central Coast	✗	✗
South Coast	✗	✗
Northeast Plateau	✓	≠
Sacramento Valley	≠	✗
San Joaquin Valley	✗	✗
Great Basin Valleys	✗	✗
Mojave Desert	✗	✗
San Diego	✗	✗
Mountain Counties	✗	✗
Lake County	✓	✓
Lake Tahoe	✗	✗
Salton Sea	✗	✗
Source: Air Quality and Land Use Handbook, California Air Resources Board (2005)		

✓	Attainment
≠	Mixed (attainment is not uniform for all counties in the basin)
✗	Non-attainment

Figure 5A.1. CalEnviroScreen Top 25 Percent Disadvantaged Census Tracts by Air Basin



Source: California Office of Environmental Health Hazard Assessment, CalEnviroScreen 3.0, 2017

Emissions

California has implemented legislation to reduce greenhouse gas emissions (GHG), including AB 32⁶ and SB 350.⁷ AB 32 established GHG emissions reduction target of 15 percent below 1990 levels by 2020. SB 350, SB 32⁸ and Executive Order (EO) B-30-15⁹ furthered the GHG reduction goal by setting a new target of 40 percent below 1990 levels by 2030.

In addition, EO N-19-19¹⁰ leverages California's pension investments, transportation systems and purchasing power to strengthen and advance the State's climate leadership and resiliency, with the objective to reduce GHG emissions and mitigate the effects of climate change. Two important bills were also signed into law to strengthen emission standards for trucks, semis and other high-pollution vehicles. The first bill, SB 210 by Senator Connie Leyva (D-Chino) requires CARB to develop and implement a Heavy-Duty Inspection and Maintenance Program for non-gasoline, heavy-duty trucks.¹¹ This will be the first 'smog check' program of its kind in the nation. The second bill, SB 44 by Senator Nancy Skinner (D-Berkeley) requires CARB to create a comprehensive plan for reducing GHG emissions from medium and heavy-duty vehicles.¹²

In addition to the statewide targets, many regional air quality districts and local agencies have their own GHG emissions thresholds for environmental review, as well as, GHG emissions targets. For the purposes of the CFMP, this section focuses only on the State targets¹³ and specifically, on reducing carbon emitted from fossil fuels, as well as renewable natural gas. CARB strategies focus on electricity and hydrogen as the future energy sources for transportation. The California Sustainable Freight Action Plan (CSFAP) indicates two targets to help achieve the GHG emissions reductions as summarized in **Table 5A.3**.

Table 5A.3. GHG Emission Reductions Targets

Type	Description	Target/Metrics	Target Date
System Efficiency	Improve freight efficiency relative to goods and services produced (NAICS 48-49)	25% efficiency gain Speed, reliability, delay reductions, etc. GDP/CO2	2030
Transition to Zero-Emission (ZE) Vehicles	Deploy ZE freight vehicles and equipment capable of ZE operations	100,000 pieces of ZE equipment	2030
Source: California Sustainable Freight Action Plan (2016)			

Air Quality

Oxides of nitrogen (NO_x) are a group of gases that, with prolonged exposure, can cause respiratory illnesses, such as asthma, and worsen existing health conditions. Mobile sources have been found to be the largest emitters of NO_x, and medium- and heavy-duty vehicles are responsible for 35% of all NO_x emissions.¹⁴ Diesel exhaust from ships, trains, trucks, and cargo handling equipment contain particulates, sulfur dioxide, carbon monoxide, hydrocarbons, and various air toxics. DPM has been identified to increase risk of lung cancer and respiratory disease in exposed populations, DPM levels vary regionally due to the non-uniform distribution of sources throughout the state and in aggregate, and DPM contributes about eight percent of PM_{2.5} in California ambient air. Higher concentrations of diesel emissions occur in and around ports, rail yards, warehouses, and high-volume roadways when located near densely populated urban areas, these urban areas experience greater health consequences. Diesel exhaust also contributes to environmental degradation in the form of haze and reduced visibility in outdoor areas. This is particularly an issue in the San Joaquin Valley and Southern California regions, where particles and gases from diesel emissions absorb and scatter sunlight. Furthermore, a primary component of DPM, black carbon, is the second largest contributor to climate change.

Particulate Matter causes the majority of health problems in persons living in areas with poor air quality. These communities experience higher rates of asthma, cardio-vascular problems, and other ailments.

Noise and Vibration

Freight operations rely on multiple modes of transportation and a variety of cargo handling equipment (CHE) at seaports, airports, intermodal rail yards, warehouses, distribution centers, etc. These activities often generate noise and vibrations from diesel engines of trucks, CHE and locomotives, loading and unloading containers, coupling and de-coupling rail cars, etc. Both at the federal level and at the state level, noise and vibration impacts are identified during the project development process and mitigated to the extent possible. Under the National Environmental Policy Act (NEPA), the Federal Transit Administration established the guidelines for assessing noise for rail, Federal Aviation Administration for air, and Federal Highway Administration for roadway activities. In addition to NEPA, major airports and seaports in California have established thresholds of significance pursuant to the California Environmental Quality Act (CEQA) aimed at minimizing community impacts.

The true impacts of noise vary, but the latest research shows that long-term impacts of noise can alter how the brain processes speech and increases difficulty in distinguishing speech sounds. In young children, this can impair cognitive development. Excessive noise can also create stress and reduce sleep resulting in hypertension, ischemic heart disease, and psychological disorders. Noise has also been linked to birth defects resulting from vasoconstriction in the mother that reduces oxygen and nutrition to the fetus. This research notes differences in intermittent noise and constant noise, low tones and high tones, as well as the times of day that noise occurs. Some freight-related noise impacts are intermittent, such as

blowing train horns at at-grade rail/road crossings, coupling/de-coupling rail cars in rail yards located near residential neighborhoods, and loading and unloading trucks at warehouses near residential neighborhoods.

These impacts can be reduced or mitigated by creating adequate separation between land uses when developing new communities, limiting hours of operations for existing freight facilities located near residential areas, and constructing grade separations to minimize the sounds of train horns.

Analytical Approach

This analysis is based on readily available data to allow for the ongoing monitoring of economic and environmental sustainability of the freight network and its effects on California communities. To understand the benefits and impacts geographically, three metrics have been calculated and mapped.

Metrix 1 - Freight-Related Job Distribution

Data from the U.S. Census Bureau's County Business Patterns data for the following sectors are summarized by county and broken into sectors using North American Industry Classification System (NAICS) codes.¹⁵ While the data captures most of the freight sector jobs and mostly excludes other non-freight industries, there is not a one-to-one correlation between NAICS sectors and freight-related jobs. The sectors used for this analysis that directly or indirectly use the freight network included the following (job data obtained for 2010 and 2015):

- Primary: NAICS Sectors 11 [Agriculture], 21 [Mining, Oil & Gas Extraction], 23 [Construction], 31-33 [Manufacturing], 44-45 [Retail Trade]
- Wholesale Trade: NAICS Sector 42
- Transportation & Utilities: NAICS Sectors 22 [Utilities], 48-49 [Transportation & Warehousing]

Metrix 2 - Tons of Freight Related Emissions Per Day

Freight emissions data were obtained from CARB estimated annual average emissions estimates for stationary and mobile sources and are summarized by county. The following pollution source categories were selected, as they are either directly related to transportation or rely heavily on the freight network, which makes up a disproportionately large share of the total pollutant emissions from the transportation sector as a whole:

- Industrial Processes
 - Chemical
 - Electronics
 - Food and Agriculture
 - Glass and Related Product
 - Metal
 - Other Industrial
 - Wood and Paper
- On-Road Trucks

- Light-Duty Trucks
- Medium-Duty Trucks
- Heavy-Duty Trucks

Emissions data were obtained for 2010 and 2015 and projected for 2035.

Metrix 3 - Freight-Related Emissions per Freight-Related Jobs

Freight emissions per freight jobs were calculated by dividing tons of freight-related emissions per day by the number of freight related jobs in a county for 2010 and 2015. This metric links the economic benefit of freight (jobs) to the negative externalities (emissions) to investigate how benefits and externalities are distributed throughout the state.

Freight-Related Job Distribution

Most (81 percent) freight and logistics-related jobs in California are located within counties that are in nonattainment for PM_{2.5} and have a substantial portion of the CalEnviroScreen disadvantaged communities. As part of the South Coast Air Basin, Los Angeles County contains 51 percent of the top 25 percent disadvantaged Census Tracts and more than a quarter of all freight related jobs in California – a greater portion than any other county. Given that the South Coast Air Basin is in nonattainment for PM_{2.5} and PM₁₀, residents of Los Angeles County are likely exposed to a considerable amount of freight-related pollution.

Figure 5A.2 illustrates the distribution of freight jobs by county for 2010, 2015, and the net change between the two years. The greatest freight employment concentration in 2015 was found in 11 counties that had 100,000 or more freight-related jobs. Much of the growth in freight-related jobs from 2010 to 2015 occurred outside of the top 11 counties, except for San Mateo County, which experienced a 40 percent increase in freight-related jobs over that period. Five counties that were not in the top 11 in 2015 experienced between 45 percent and 60 percent growth in freight employment from 2010 to 2015. Of those counties, only Madera County is currently in nonattainment for PM_{2.5} and PM₁₀.

Tons of Freight Related Emissions Per Day

Freight-related emissions are mapped by county for 2010, 2015, and the net change between the years in **Figure 5A.3**. The counties with the largest share of freight-related emissions are also those in nonattainment areas with larger shares of CalEnviroScreen disadvantaged communities. Los Angeles County has the highest freight-related emissions of any county in California. Unfortunately, geography and a pervasive inversion layer that traps ozone in California's valleys creates the perfect environment for the formation of smog. Given these conditions, achieving complete attainment conditions requires extensive and continuous effort.

Freight-Related Emissions per Freight-Related Job

Pollution burden per freight job is another indicator of the balance between the benefits (jobs) of freight and logistics, and the negative impacts (emissions). Freight jobs are more likely to

create negative impact in non-attainment areas than other places. However, it is possible to gain economic benefit from freight jobs without impacting communities. For example, a majority of the San Joaquin Valley is in PM and Ozone nonattainment areas. Although, the number of freight jobs within the region have been increasing, causing the reduction of emissions per freight job between 2010 and 2015, larger efforts are still needed to substantially decrease emissions from the freight sector including greater transition to cleaner and more efficient infrastructure and equipment.

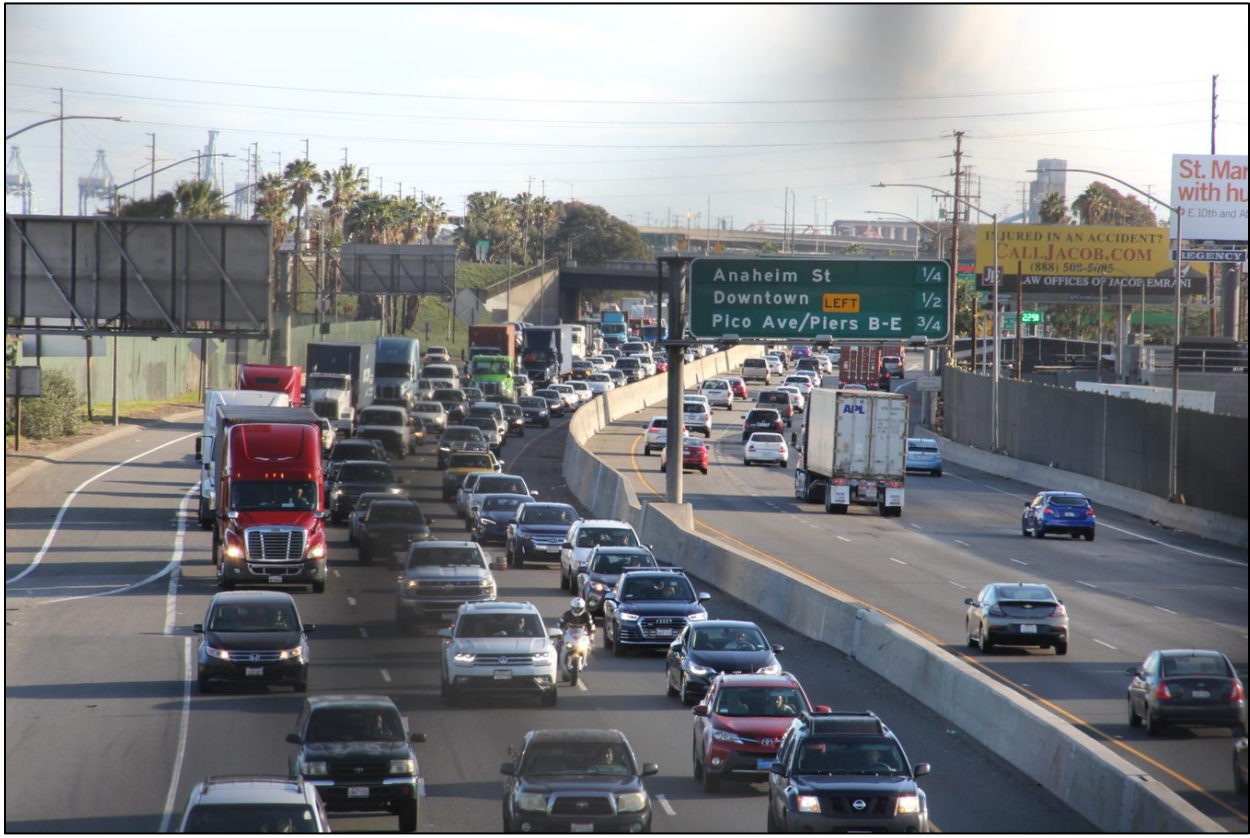


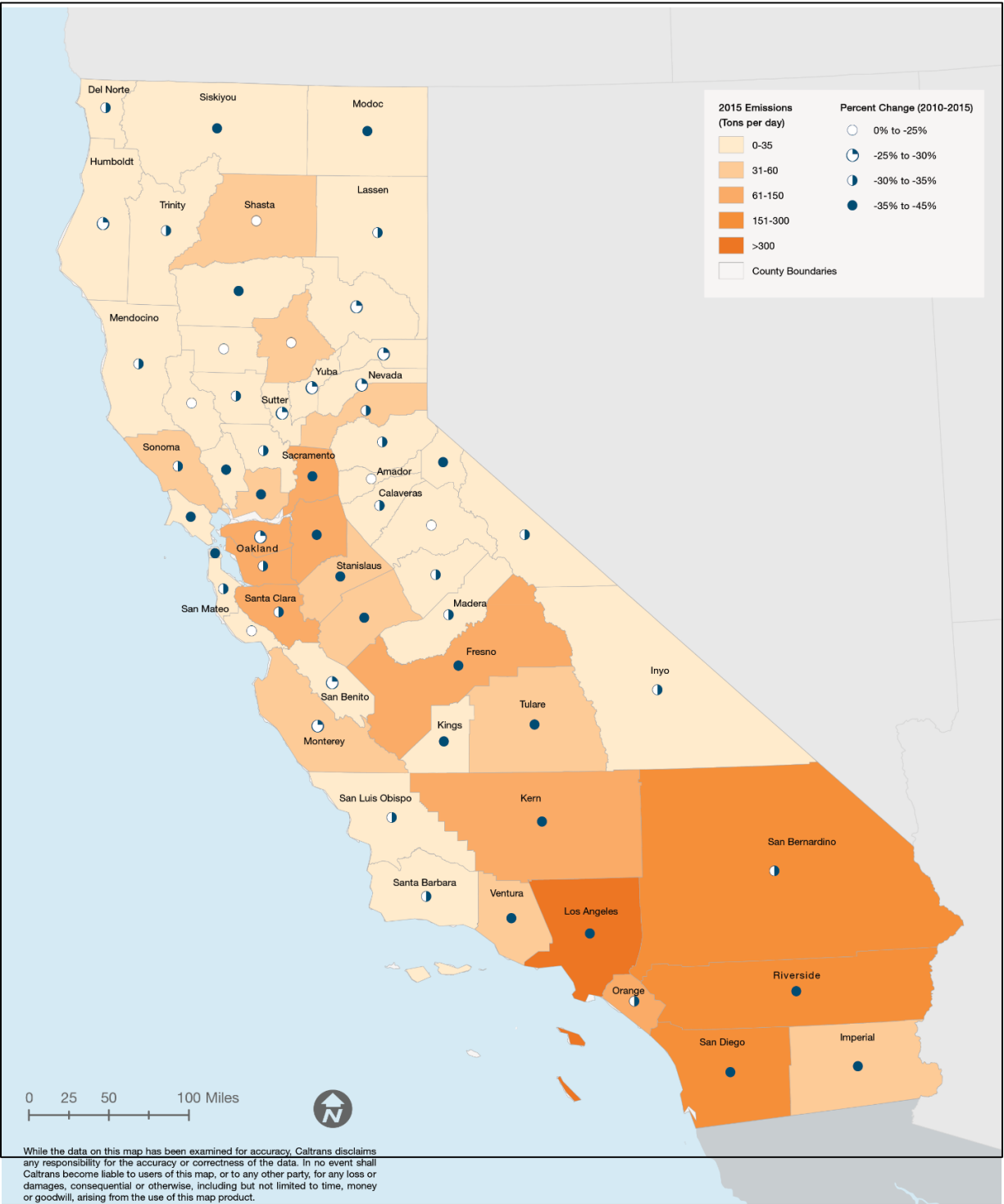
Image: 710 Freeway, Los Angeles, California

Figure 5A.2. Distribution of Freight Jobs by County, 2010-2015



Source: Census Data, 2010-2015, California Statewide Freight Forecasting model data base, Fehr and Peers

Figure 5A.3. Freight-Related Emissions by County, 2010-2015



Source: California Air Resource Board, EMFAC 2017, Analysis and summaries by Fehr & Peers

Ongoing Progress for a Healthier California

CARB, various State, and regional agencies, in collaboration with freight partners and stakeholders, continue to implement broad air quality improvement programs through a combination of regulations, incentives, and policies designed to support the transformation of the freight system and reduce community impacts from freight operations in California. These ongoing freight sustainability initiatives focus on emissions reductions through a program of data collection, emissions monitoring, technology advancement, and technology replacement. The following describes some ongoing freight initiatives and key progress.

Cap and Trade Program

CARB oversees the California Cap and Trade program, a system designed to reduce the amount of GHG emissions that are released into the atmosphere by corporate operations (the “cap”). The “trade” part of the system allows companies to buy and sell their emissions allowances, which incentivizes companies to decrease emissions where possible and to sell the extra credits. Each year, the emissions cap is split into allowances that CARB distributes (one allowance equals to one ton of emissions) to companies for free or by auction. The cap total declines every year, which gives an incentive for companies to find ways to continue to decrease its emission totals.¹⁶

Since 2017, CARB has used Cap and Trade dollars to implement over \$3 billion worth of projects spanning 60 programs. The programs vary from, focusing on the reduction of climate pollution, building affordable housing, to protecting communities from wildfires. Currently, over 60 percent of all investments fund projects that help low-income and communities disproportionately burdened by pollution.

CARB Community Air Protection Program

In 2018, in support of AB 617 (Assembly Bill 617) (C. Garcia, Chapter 136, Statutes of 2017), CARB created the Community Air Protection Program (CAPP) focused on reducing emissions exposure in communities.¹⁷ The program intends to collect emissions data in these communities for statewide planning initiatives. **Table 5A.4** shows the milestones listed on the program’s webpage.¹⁸

Table 5A.4. AB 617 Summary of Milestones

Summary of Milestones	
July 2017	AB 617 signed by Governor Edmund G Brown Jr.
By Late 2018	Air districts form community steering committees for first year communities and begin to develop the community emissions reduction programs.
By January 2019	Air districts develop expedited schedules for implementing best available retrofit control technology, which must be implemented by the end of 2023.
By July 2019	Air districts deploy monitoring in first-year communities selected for community air monitoring systems.
By September 2019	Air districts adopt programs in the first-year communities selected for community emissions reduction programs.
October 2019	Adoption of the West Oakland Community Action Plan ¹⁹
By December 2019 & annually thereafter	The California Air Resources Board selects additional communities for air monitoring and community emissions reduction programs. The Board considers air districts community emissions reduction programs.
By October 2020	Air districts provide annual reports for first-year communities selected for community emissions reduction programs.
By January 2021 & annually thereafter	Within one year after the selection of additional communities, air districts adopt community emissions reduction programs.
By September 2023	The California Air Resources Board updates the Statewide Strategy, which is required to be updated once every five-years.
Source: CARB Community Air Protection Program	

CAPP's focus is to reduce exposure in communities most impacted by air pollution, including community air monitoring and community emissions reduction programs. There is appropriated incentive funding to deploy cleaner technologies in these communities, as well as grants to support community participation in the AB 617 process. AB 617 also includes new requirements for accelerated retrofit of pollution controls on industrial sources, increased penalty fees, and greater transparency and availability of air quality and emissions data, which will help advance air pollution control efforts throughout the state.²⁰ CARB intends to use this information in its planning decisions. The freight regulatory program proposed by CARB aims to address emissions generated by freight-related operations throughout the state through a series of local and state programs that include indirect source rules as an element.²¹ In 2018, CARB began moving forward with a plan to transition cargo handling equipment at facilities in impacted areas to ZE. CARB recently awarded \$110 million to help industry convert CHE to ZE equipment. CARB's path forward for freight presented in March 2018 lists four strategies to protect communities near freight facilities:

- Tighten CARB rules and add facility infrastructure and compliance requirements
- Pursue stricter federal and international standards
- Support district facility-based measures and port initiatives

- Coordinate and expand incentives for freight transition to ZE operations

The most significant implementation challenge of an indirect source rule that includes thousands of privately-owned industrial warehousing facilities, will be regulation enforcement throughout the state, including ways to regulate out-of-state trucks and trucks registered in Mexico and/or Canada. While California has one of the strictest air quality frameworks, the U.S. EPA is also considering regulations that would prevent individual states from mandating emission standards that are more stringent than the federal emissions standards.

CARB Air Quality and Land Use Handbook

The connection between location and exposure impacts prompted CARB to develop recommendations for locating new sensitive land uses in its Air Quality and Land Use Handbook. This handbook includes recommendations for minimum distances of sensitive land uses – such as residences, schools, day care centers, playgrounds, and medical facilities – from highways and high-traffic roads, distribution centers, rail yards, and port facilities. Based on pollution exposure risk, the handbook defines minimum distance recommendations for sensitive land use categories for the following freight related emissions sources.

To define freight-related communities, the handbook siting recommendations can be used to define buffer distances from known freight-related emissions sources to determine the size and characteristics of the communities located within the buffer area. This analysis can be used to evaluate the communities that experience the most direct impact of freight. Development and transportation projects can be weighed against the economic opportunities provided.

San Pedro Bay Ports Clean Air Action Plan

The San Pedro Bay Ports, comprised of both Ports of Long Beach (POLB) and Los Angeles (POLA), developed a Clean Air Action Plan (CAAP) which initiated a menu of strategies to reduce emissions generated by port activities. One of those strategies is an emissions reduction of select criteria pollutants. The CAAP set 2023 as the target year in which DPM, NO_x, and SO_x should fall compared to 2005 levels. Every year since 2006, the two ports have prepared an emissions inventory to monitor and measure annual progress towards the CAAP 2023 goals. **Table 5A.5** summarizes the total reduction for each type of emissions and illustrates positive progress the ports are making to meeting the 2023 targets.

Table 5A.5. San Pedro Bay Ports Emissions Reductions Compared to 2023 Goal

Criteria Pollutant	2023 Goal	POLA (2017)	POLB (2018)
DPM	77%	87%	87%
NO _x	59%	60%	56%
SO _x	93%	98%	97%
Source: Port of Los Angeles 2017 Air Quality Report Card and Port of Long Beach 2018 Air Emissions Inventory			

San Pedro Bay Ports Technology Advancement Program (TAP)

The TAP, founded by POLB and POLA, in collaboration with SCAG, Metro, SCAQMD, and CARB, has provided support to original equipment manufacturers (OEM) for more than a decade. TAP has led to the deployment of cleaner equipment by providing funding, research, and testing support for over 30 projects spanning test cycle development, hybrid and alternative fuel technology demonstrations, and ZE equipment operation. Through these initiatives, major OEMs have invested in, and developed commercially available clean equipment, such as electric, hybrid, hydrogen and natural gas trucks, and CHE.

POLB Community Grants Program

The POLB Community Grants program, an unprecedented effort to lessen freight effects on local communities, began in 2009 with an investment of \$17.4 million to fund three different program initiatives: Community Health, Facility Improvements, and Community Infrastructure. To date, the community-based grants have funded a variety of community betterments, such as asthma vans providing mobile medical services, tree planting, double-paned windows, and upgrades to heating ventilation

Over the next 12 to 15 years, POLB plans to invest an additional \$46.4 million toward more of these projects that reduce impacts on air quality, traffic, noise, and water quality.

Port of Oakland

The Port of Oakland began collecting data and monitoring emissions generated by a variety of sources in 2005. Pursuant to reducing port-generated emissions, the Port is actively managing three key programs:

- Seaport Air Quality 2020 and Beyond Plan
- Comprehensive Truck Management Plan (CTMP)
- Port of Oakland Shore Power Program

The Seaport Air Quality 2020 and Beyond Plan envisions a zero-emissions operation for the Port of Oakland. Example of projects envisioned in the plan include converting the port's fleet vehicles and equipment to zero-emission, identifying cleaner fuels and renewable power sources, installing electric infrastructure at container terminals, and monitoring fuel consumption, operations, and performance. This is the successor to the Maritime Air Quality Improvement Plan (MAQIP) that was adopted prior to 2010.

Both the CTMP and the Shore to Ship Power program are key elements of the overall Seaport Air Quality and Beyond Plan 2020. These programs address the deep concerns of the community, including minimizing emissions from ocean-going vessels, the removal of trucks from residential areas for air quality reasons, and minimizing noise, improving safety, and mitigating roadway maintenance impacts.

Future Considerations

While California has some of the most vigorous environmental standards in the nation because of its shared values in protecting communities and natural resources, more efforts are needed. Early collaboration between regulators and the target industries can help mitigate the uncertainty regarding the roll-out of zero-emission vehicle guidelines and specific benchmarks for the implementation of sustainable actions. Notice of available funding for zero-emission and low-emission vehicles to private industry should be communicated more vehemently and earlier in the process.

There are marked improvements to California's environment in part due to enacted regulations and policies. CARB's Statewide Freight Emission Inventory highlights the State's air quality improvements which are contributed to the holistic advances in cleaner fuels and technologies that have been regulated by public entities and adopted by private enterprises.²² **Table 5A.6** shows a decline in all emissions types to 2015, but also projects an uptick in emissions by 2035. This upswing points to the need for continued commitment to cleaner energy, new technologies, and public and private dedication and responsibility for California's environmental health.

Table 5A.6. Freight Emissions Statewide Forecast

Emissions	2000	2005	2010	2015	2020	2025	2030	2035
NOx (tons/day)	1,246.84	1,250.93	870.00	618.98	499.65	433.60	449.60	450.63
PM2.5 (tons/day)	48.17	51.41	28.95	15.75	10.49	8.31	8.62	9.21
SOx (tons/day)	118.45	146.92	15.45	5.65	6.46	7.43	8.55	9.56
GHG (MMT CO2E/Year)	39.41	45.40	37.78	36.85	39.34	39.43	39.90	41.09
Source: CARB Staff Presentation								

Despite the progress, California looks to new regulations to further improve environmental health. There are wide-ranging, upcoming regulations that can further contribute to cleaner air for Californians. These freight-focused regulations include ZE and cleaner combustion requirements across trucking, rail, and maritime freight industries. The following regulations are currently proposed and will not be implemented until the CARB Board votes to approve the measures.

Truck Sales Requirements (Advanced Clean Trucks)

The proposed Advanced Clean Truck Regulation is part of a holistic approach to accelerate a large-scale transition of ZE medium-and heavy-duty vehicles from Class 2B to Class 8. The proposal is subject to change until the CARB Board makes a final decision, expected in 2020. The proposed regulation has two components including a manufacturer sales requirement, and a reporting requirement.

Ships At-Berth

CARB's existing regulation for ships at berth at California ports requires three types of vessel fleets to control emissions during 70 percent of their visits now, rising to 80 percent by 2020. The new regulation under development would capture more vessel visits, more vessel types, and more ports and marine terminals. The additional vessel types include tankers such as oil tankers, and roll-on, roll-off vessels carrying automobiles. The new rule is also designed to hold terminals, ports, and technology providers accountable for doing their part to successfully reduce emissions at berth, in addition to the vessel fleets that are responsible under the existing rule.

Locomotive

Evaluate and potentially develop new regulations to require operators to limit idling of all combustion-powered vehicles and mobile equipment operating at rail yards and other locations, as well as reducing emissions from stationary locomotive operations (e.g., maintenance and testing). The scope could include both freight and passenger rail activities in, and around intermodal, classification, and maintenance rail yards, at seaports, at warehouses, on sidings, at passenger rail stations, and at maintenance and service locations. Compliance options might include operational practices, installation of idle-limiting technology, emission capture and control technology, or other effective techniques. Locomotives with ZE capability could be exempt if operators show that ZE operation is maximized.

Truck Omnibus

This will focus on regulatory concepts to reduce NOx emissions from new on-road heavy-duty vehicles greater than 10,000 pounds gross vehicle weight rating.

Truck Inspection and Maintenance

SB 210 (Levy, 2019) requires the implementation of a pilot program that will develop and demonstrate technology to bring heavy-duty trucks into an inspection and maintenance program. A Heavy-Duty Vehicle Inspection and Maintenance (HD I/M) program would ensure that emissions from heavy-duty vehicles operating in California rarely exceed the NOx and PM emissions levels established by CARB.

Drayage Trucks

A new drayage truck regulation would establish a schedule for phasing in the use of ZE technology. Options to be considered include, but are not limited to, requirements for full ZE technology (e.g., a battery or fuel-cell electric short-haul truck) and ZE mile capability (e.g., a natural gas-electric hybrid that could drive interstate but switch to zero-emission electric mode while operating in impacted communities, potentially via geofencing).

Cargo Handling Equipment

The regulatory amendments would propose an implementation schedule for new equipment and facility infrastructure requirements, with effective dates beginning in 2026. In this potential action, all mobile equipment at ports and rail yards, including but not limited to, diesel, gasoline, natural gas, and propane-fueled equipment, would be subject to new requirements.

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5.B. Partnerships & Engagement

This section provides a summary of stakeholder input collected through an online survey, one-on-one interviews with freight industry representatives, focus groups, public workshops and events, and at the 2017 California Freight Symposium. Among the biggest concerns of those contacted were economic competitiveness, emerging technologies, workforce recruitment and retention, environmental impacts, and new projects types the respondents could expect to see:

Stakeholder contacts included the following:

- A targeted online survey.
- Industry focus groups attended by industry, trade association representatives and regional public agencies.
- Individual in-person or telephone interviews with representatives of ports, railroads, the trucking industry, and an industrial development firm.
- Break-out sessions and workshops at CFAC meetings throughout the development of the CFMP.
- Public workshops held in West Sacramento and Diamond Bar.
- Four Tribal Listening Sessions held in Northern, Central, and Southern California.
- Public outreach events held in various parts of the state at existing public events including communities identified under AB 617.
- Digital Outreach via Facebook (social media) that directed the public to an online survey.

Details of the stakeholder outreach and engagement process are provided in **Appendix H** along with more detailed descriptions of results. The conversations that occurred during the industry workshops, public meetings, and one-on-one meetings illuminated different areas of importance. Participating members of the industry focused on the economic viability to continue operating in California; residents and community members focused on environmental issues and congestion; and public agencies focused on infrastructure planning, policies, and programming. Our findings are categorized into these general topics:

- Competitiveness
- Technologies
- Workforce
- Environmental Impacts
- Projects

Competitiveness

California's economic competitiveness relies upon the expedient and reliable movement of goods, with no particular funding preference given to freight delivery modes via air, sea, or land. Although California has a substantial share of the nation's market for shipping and logistics, the state could increase its competitiveness by better integrating its varying priorities. Many of the strategies to improve California's competitiveness also improve other facets of the freight

industry. For information regarding California competitiveness, please refer to **Chapter 2** and **Appendix C**.

Partnership

State agencies can work together to streamline CEQA compliance and offer grants or incentives for compliance with CARB regulations. Furthermore, cooperative efforts to lower the cost of living, primarily housing, can serve as an incentive to recruit and retain a workforce. In partnership with the public education system, private companies can recruit and train a qualified workforce. Furthermore, the State can explore ways to decrease speed differentials between commercial trucks and passenger vehicles and increase weight limits. Increased collaboration on statewide and regional economic development efforts have a ripple effect, inspiring implementation of more efficient and sustainable practices.

Reliability

Reliable infrastructure is necessary for logistics facilities to function properly. The freight system relies on the State to provide adequate facilities for travel and rest as well as signage and travel time. The State can also ensure excellent roadway and highway pavement conditions with the goal of easing urban and highway congestion. This has the potential not only to increase the State's competitiveness by increasing productivity and reliability, but also improves conditions for the state's workforce.

One example of a multifaceted approach to increase California's competitiveness would be to implement more efficient technology to help lower costs. However, this would also likely require making changes to electric power rate structures to make predicting the cost of electricity feasible and reliable.

Seaports

According to focus group participants, a focus on performance goals could help increase economic competitiveness of California's seaports. Electrification of port equipment and drayage tractors will require substantial investment in the electric power infrastructure. Although it reduces GHG emissions significantly, shore power infrastructure is costly to construct and operate. Finding ways to collaboratively design strategies between State regulations and privately-held interests can help improve port competitiveness. Some such strategies include prioritizing and incentivizing industrial buildings near ports and markets through streamlined permitting and financial assistance for private industries who invest in ports, especially as they relate to ZEVs.

Technologies

Investing in new and innovative technologies can increase California's competitive edge within the freight sector by making travel times more reliable, decreasing fuel costs, and improving efficiency. New environmental beneficial technologies also have the potential to lessen the

environmental impacts of the industry and make it a more desirable profession to the workforce. The State can play a significant role in providing or incentivizing infrastructure development, particularly electric power and alternative fuels infrastructure that is otherwise holding back technology adoption. The State can also lead research and development through special study contracts and create specific, internal programs to the effort. Moreover, the outcomes from research can inform the private industry on which technologies to adopt without needing to spend resources on technologies that may not pan out, therefore increasing competitiveness of California's private entities.

Truck Platooning and Autonomous Vehicles

Truck platooning and the use of autonomous vehicles have the potential to eliminate driver-caused errors, increase safety, decrease travel times, and decrease fuel usage. Despite this, many private sector stakeholders are hesitant to adopt platooning, expressing that the fuel savings benefits need to be studied further. This may be due to the possibility that platooning meets significant barriers in urban areas and last-mile deliveries. Smooth transitions between long-haul and shorter distance deliveries would need to be clearly defined and coordinated, as automobile and light-duty truck entrances and exits onto roadways may disrupt platoons. In addition to the obstacle posed by heavily urbanized areas, loss of communications in hilly or mountainous areas can affect performance so investments need to be made to increase service reliability.

Some regard the use of autonomous vehicles as a possible solution to the driver shortage. The State of California is a major fleet operator and could use its State vehicle fleet to test new technologies. The potential for autonomous trucking may be limited to designated corridors, such as where dedicated lanes are provided.

Port Terminal Automation

Port terminal automation speeds up operations at the ports, which makes loading and offloading cargo safer, faster, creates more efficient use of space at ports and on ships, and decreases the time spent moving goods. Use of automated, remotely automated, or manned new types of cargo handling equipment have the potential for increasing the velocity of containers. For ports to continue making investments in automation, some stakeholders expressed that the State should incentivize terminal operators to simultaneously pursue automation and ZE technologies. However, other stakeholders felt that port automation technologies will have too much impact on the freight workforce and should be used only in agreement with labor unions. Initiatives to retrain the existing workforce and focus on advancing skills should be highly considered.

Information Technologies

One critical item identified was the need for improved network cell phone connection and infrastructure. In the northern regions of California, for example, there is a lack of available cell reception, due to greater distances between cell phone towers and dispersed populations. Possible solutions include maintaining up-to-date and accurate information on navigation systems and social media feeds, promoting 1-800-427-ROAD (7623), developing mobile

applications to help notify drivers of problems on the road, increasing broadband availability and ITS applications (such as CMS), and developing maps specific to trucks for appropriate alternative route options during traffic incidents and road closures.

Another need in the information technology sector is further development and refinement of terminal appointment systems, which have made positive differences at ports and receivers. This would greatly increase worker productivity and reduce emissions from idling vehicles.

Even though the industry relies on broad access to industry data, stakeholders typically do not share their proprietary information for competitive reasons. IT experts from private industry, various ports, retailers, and cyber security firms should convene to develop a protocol for sharing data across networks, while also ensuring privacy of confidential data and proprietary information.

Mandated Technology

The mandated use of Electronic Logging Devices (ELDs) was intended to increase safety by requiring truckers to stop and rest after a certain number of hours on the road. Mandated use of ELDs, in addition to adherence to company policies, sometimes cause drivers to operate during congested times or during incidents, meaning added delay on local and state roadway systems. For example, if a driver has driven for the maximum amount of time allowed by law, then they must stop and take a break to maintain in good standing with their company and the law. This can force drivers to stop against their better judgement, instead of allowing them to continue past a section of highway or city known for congestion. The driver, then at the end of the break period, will need to continue on to their destination, regardless of traffic conditions. This causes added congestion onto the highways and delays for truckers. Drivers face harsh penalties for non-compliance with ELD mandates and to avoid fines, they may speed which impacts public safety. ELD mandates also decrease driver productivity because the clock, which counts towards total driving hours, cannot be stopped between non-driving activities, such as loading, unloading, or other responsibilities.

Easing restrictions or amending existing regulations may alleviate the disconnect between ELD mandates and business operations to increase the safety of the traveling public, while also ensuring economic competitiveness of California's freight system and safe working conditions for drivers.

Technology Grant Programs

To remain competitive, funding opportunities should be expanded and shared widely so more private businesses can take advantage of them. Although grant funding is sometimes the condition on which new technologies are implemented, many private organizations, especially smaller ones, do not have grant writers or grant administrators to help with the process.

New regulations that will require replacing older equipment with cleaner ones are attainable, but these regulations add business costs and uncertainties contributing to decisions to expand or relocate outside of California. Those who participated in focus groups felt the State should

continue to encourage private investment in new and better chassis, global positioning systems (GPS), and related communications and dispatching technologies.

Technology research, development, and implementation play an important role in emissions compliance and environmental benefits. There is a push in the industry to reduce emissions through hybridization. For example, BNSF has obtained grant funding for a demonstration between Stockton and Fresno in which low-emissions or zero-emissions drayage equipment will be part of new terminal projects. Railroads will likely pursue some level of terminal equipment automation. Short line railroads have benefited from Carl Moyer grants and other funding for locomotive replacement, but more help is needed to meet technology needs.

Implementation of New Technologies

Often, emerging technologies serve as the key to lessening the environmental impacts of freight activities. Even so, alternative fuel infrastructure often lags vehicle technology, creating a barrier to achieving GHG reduction targets. For example, while there may be an increase in the number of electric trucks, there are very few places to charge them. Increasing use of alternative fuels (natural gas, hydrogen, electric power) and creating more infrastructure to support its use could, in turn, reduce congestion and transit time. Additionally, less conventional approaches to improve efficiency, such as truck platooning, also have advantages that are often overlooked and would greatly lessen the environmental impacts of goods movement.

Workforce

There is a national shortage of qualified truck drivers. The truck driver shortage is a special workforce issue and a factor in all other categories— competitiveness, sustainability, and technology. This issue was raised in every outreach forum and survey. Although this problem is less prevalent in California than in other parts of the country, the outreach phase of the CFMP yielded a variety of solutions to increase the number of skilled drivers to meet the growing demand in our state.

Barriers to Entry for Potential Drivers

The largest barrier to entry for new drivers entering the trucking profession is the cost of trucking school. Drivers must often go into debt to attend driver school. Furthermore, insurance companies require two years of experience before they will cover a driver, but a new driver is unable to gain any experience without first having insurance.

The State has already begun addressing this issue by building a connection between education and the private sector through training offered at public colleges and job placement services for graduates. For example, Long Beach City College offers a program to prepare students for a commercial driver's license (CDL) and place them with Harbor Trucking Association members.

These efforts can be augmented by increasing the number of these programs available throughout the state and offering more grant and scholarship programs to incentivize students to choose trucking as a career. Private sector companies can increase participation in job

training programs in partnership with universities and offer scholarship programs of their own. Additionally, the public secondary education system can emphasize the value of hands-on professions and trades, rather than solely focused on a four-year college.

Working Conditions and Compensation

Another strategy for strengthening the trucking workforce focuses on driver retention. Trucking often requires long hours at night, early mornings, and time away from home for drivers. The private and/or public sector need to provide safe and legal options for truck parking, so drivers can take breaks between assignments and comply with the regulations for mandatory rest periods. Not only would an increase in truck parking make roads safer, but it also would reduce the number of drivers being ticketed or towed for taking breaks in prohibited areas.

Freight operations is an industry rife with intense competition that holds down rates and wages. Drivers often face a lack of competitive pay compared to other industries. One way the state can ease the financial pressure placed on drivers is to increase the amount of affordable housing options within California to help compensate for the competitive wages offered by the industry.

Driver Productivity

A third strategy for meeting demand for qualified drivers is to maximize productivity of the existing workforce. Driver productivity is often lost to urban traffic and highway congestion. Similarly, longer port turn times force drivers to sit idly while making little progress on their deliveries. Recently, there has been an adverse impact on driver productivity due to complexities of empty container and chassis returns, the limitations of current appointment systems, and the reduced opportunity to make dual moves (which have reportedly declined from 81 percent to 19 percent). By better coordinating deliveries with off-peak hours, tracking chassis and containers, and strengthening the appointment system, the capacity of the existing workforce can be better harnessed.

Environmental Impacts

Environmental responsibility is a crucial consideration and one that cuts across a range of other issues. Some stakeholders view a conflict between environmental responsibility and the need for employment and earnings security. However, there are many ways in which the State can marry environmental conservation efforts with other policies to implement the shared vision for a thriving transportation system.

Funding

Many freight industry stakeholders expressed concern about the cost of regulation compliance cutting into profit margins and losing business to other states with lower environmental standards. To maintain its current freight industry market share, the State can increase the number of grant and incentive programs to support ZE compliance. This could take the form of providing subsidies or incentives for state regulatory compliance, grants for the implementation of ZE technologies or assistance with the costs, or labor supply and costs of retraining. By better aligning the available funding and financing to what the industry needs, the State may more effectively work with trucking companies of all sizes to meet its goals.

Another key funding priority is increased railroad infrastructure. Short line rail lines have the ability to ease highway congestion through modal shift. However, short line railroads would benefit from increased local and state recognition and cooperation. Achieving the expected public benefits of modal shift will require public financial support, including a strong partnership with CARB.

Projects

Freight infrastructure improvements should focus on maintenance, safety, freight rates per mile, system continuity, system redundancy, and pavement condition improvements. To serve the interests of all users, freight stakeholders should use an integrated approach assessing the needs of the freight system and when developing multi-faceted projects that encourage cross-collaboration with public and private partners.

The best resource available to measure progress and rate achievements is the CFAC and its members. The CFAC should encourage the freight industry to actively participate in CFAC meetings and collaborate with its members to support and inform decisions that yield the highest returns.

Trucking Projects

Often, the projects that have the largest, positive impact on freight are those which focus on bottleneck relief, such as truck climbing lanes, passing lanes on rural routes, interchange and entrance/exit geometry improvements, filling capacity gaps in major routes (e.g. SR 99), adding weigh stations and WIM scales, and improving connectivity of east-west connectors between U.S. 101, SR 99 and I-5.

As previously mentioned, California has a shortfall of truck parking, which is needed to operate a safe highway system for passenger vehicles, truckers and the environment. Many truck drivers resort to parking in non-sanctioned areas due to overcrowded, sparse truck parking. To alleviate this, the State should determine where truck parking, rest stops, and truck stops are needed and start a program to provide them by both private and public sectors. The State should also locate and mark safe stopping spots for mandated breaks and consider identifying, marking, and creating legal parking spots on Caltrans' right-of-way when private sector options are not available. The upcoming Statewide Truck Parking Study will help identify unmet parking demand and areas where additional parking is needed.

Seaport Projects

Some members of the CFAC felt that one of the best strategies to ensure that California's seaports continue to be accessible and competitive would be by maintaining the channel depths. The CFAC members also mentioned providing more funding for wharfs, fendering, dredging, and wider turning basins to handle larger ships and the effects of climate change. Other important freight projects are port-rail projects that aid to shift truck trips from off-dock railyards to on-dock railyards.

Additionally, interagency efforts could find a way to streamline infrastructure projects that do not pose negative impacts on communities. The State should consider alternative growth projections that assess not only impacts of tariffs and trading partners, but also technological advancements. The push for ZEV and electrification entails a need for significant private investment. But this may not be supported by private companies due to uncertainty over future regulations, long lead times, and business conditions in California which discourages capital investment. Incentives or funding from the public sector, or a public-private partnership may be necessary to implement California's vision for port projects.

Railroad Projects

The Class I railroads have built a strong relationship with Caltrans and other agencies on rail transportation within California. With the development of the California High-Speed Rail, additional freight capacity may be available as passenger rail shifts to dedicated passenger tracks, allowing for a higher volume of freight to move along non-passenger tracks. Reducing capital project costs, barriers, and delays that can increase time and decrease reliability for deliveries of goods as well as working with public groups and private enterprises to find common ground for projects that have merit in increasing competitiveness without sacrificing public good.

Native American and Tribal Groups Freight Connections

California is home to more than 100 federally recognized Native American tribes and approximately 80 informal tribes and individuals. Many of the federally recognized tribes own tribal lands officially designated as reservations or Rancherias. As with all communities, Native American communities rely on the freight system to obtain goods and services and to export products. This chapter presents background information and connections between tribal lands and peoples and the California freight system.

Tribal Lands and Proximity to Freight Facilities

Great expanses of California are regarded as Native American ancestral lands, which contain important locations of historical significance, including sacred burial grounds, traditional foods, materials, and cultural resources. Currently, federally recognized tribal land is fractioned throughout the state, but is most heavily concentrated in areas south and east of Los Angeles County and the Northern California Coast. San Diego County is home to 17 Tribal governments—the most in one county in the contiguous U.S. There are 16 federally recognized tribes located in Riverside and San Bernardino counties that are within the SCAG metropolitan planning region.

Not all tribes have reservations or rancherias. In general, most tribal lands are located in rural areas.

The SHS provides vital access and connectivity for tribal lands; however, given the rural location of most reservations and rancherias and the roadway geometric restrictions of some rural highways, some state highways and many local roads that provide access to tribal lands do not allow passage by full-size, fifty-three-foot truck trailers - the standard “big rig.” Having to divide large truckloads of goods into smaller trucks can add cost and time to tribal shipment deliveries, resulting in increased business and consumer prices. Terminal access routes and last-mile freight connections are vital to tribal governments engaging in economic development.

Many tribal lands are within proximity of or intersect with the California SHS. Of the federally recognized tribes in California, 100 of these have trust land within five miles of the SHS. Seventy-eight percent of the recognized tribes on tribal land are within two miles of the SHS, and 35 percent of the tribal governments have trust land that intersects with the SHS.

Improving freight infrastructure access between State Highway thoroughfares and local tribal service roads is crucial. The handful of existing programs dedicated to tribal governments for accessibility projects are listed in the Federal and State Recognized Tribes. Continued partnerships with tribes, Caltrans, and local agencies will play a key role in enabling the necessary access and economic development to help alleviate high unemployment in tribal areas.

In its comments to the USDOT regarding the proposed National Primary Freight Network, the CalSTA recommended that the federal freight planning guidance include roadway connections between trust lands and the federally designated freight network. Federal guidance regarding the designation of the rural and urban connectors has been issued. To be consistent with the pending federal designation process, Caltrans will engage in the designation of tribal freight connectors at the same time the rural and urban connectors are identified. In many cases, it is likely that the tribal and rural connectors will use the same routes.

As with many neighborhoods adjacent to any major truck route or rail line in North America, California tribes may also be negatively impacted by freight activity without benefitting from the movement of freight in their communities. However, through better consultation process, detrimental impacts may be avoided or mitigated.

Tribal Consultation Process and Guidance

As sovereign powers, the governments of federally recognized Tribes are entitled to consultation with the California State government on matters affecting their respective Tribal lands, cultural heritage sites, and other issues of significance to them as outlined through AB 52.¹ Caltrans Director’s Policy (DP-19), “Working with Native American Communities,” guides Caltrans’ relationship with tribes, requiring the Department to “recognize and respect important California Native American rights, sites, traditions, and practices.” Tribal consultation is a vital step in the transportation planning process.

As a part of the CFMP outreach efforts, Caltrans' staff participated in four "tribal listening sessions" in various locations within California and received input from 40 Native American tribes at those sessions. The listening sessions were organized to engage with tribal representatives and others regarding several major plans in development by Caltrans, including the CFMP. The tribal representatives provided invaluable insight into transportation needs and tribal consultation protocol. During these sessions, participants expressed the desire for earlier and more substantive consultation. Some stated that tribal consultation should be a more open process. Participants generally agreed that further work should also be done to create partnerships between tribes and regional agencies on funding and project development.

Caltrans shall work to improve the consultation process and build stronger partnerships with Native American communities. This consultation process will emphasize two-way collaboration, communication, education, and timely notice. Prior to the listening sessions, two representatives from the Native American community were invited to serve as members of the CFAC. In addition, Caltrans freight planning staff regularly participates in Native American Advisory Committee (NAAC) meetings.

To further engage regional partners, regional and State agencies should include Native American tribal transportation needs, including a freight project list, in Regional Transportation Plans (RTP) and other planning documents. Nearby planned projects should involve consultation in the form of input to the planned freight project (including railroad crossings, bridge rehabilitation, and roadway expansion) location and design to minimize negative tribal impacts. Although the consultation process adds steps to project planning and development, it can ultimately result in greater benefits by leveraging local knowledge. These benefits include, but are not limited to, preservation of cultural sites, greater community input and buy-in, transportation efficiency improvements, and expansion of multimodal transportation services for tribes. Consultation with tribes is therefore not only an obligation, but an asset to Caltrans' planning and project development efforts.

Freight Transportation Planning Activities for Tribal Needs

Statewide Tribal freight needs typically encompass project coordination and financial assistance with mutually beneficial transportation endeavors, such as roadway access, operations, maintenance, and safety. The Caltrans Native American Liaison Branch, created in 1999, serves as intermediaries between Tribal governments and other third parties to promote government-to-government relations regarding Tribal transportation needs. Early in its development, it was identified that there was no formal access to data on tribal transportation facilities in California. This information is critical for Tribal governments to determine current and long-range transportation needs, and to secure resources needed to improve them.

Over the past 20 years, several achievements within the branch include establishment of proper framework to access more funding for roadside safety improvements, roadway access, operations and maintenance facility needs. The first collaborative effort involved 77 Tribal participants to document new roads and bridge inventory data that were proposed for inclusion into the federal inventory. A second effort was completed in 2010 to develop a Statewide

Transportation Needs Assessment to determine Tribal employment conditions, issues and concerns. An ongoing outreach effort has been made to provide technical assistance to Tribal governments in California through several public outreach activities and workshops conducted between 2008 and 2018.

Even through the concerted efforts to improve access to funding, it was noted that the 108 federally recognized tribes in California only received 1.88 percent of the available Indian Reservations Roads (IRR) funds. As a result, several actions have been identified that are currently being drafted in the California Transportation Plan 2050, which combines efforts with the States' goals for sustainability, inclusion of multimodal facilities, such as bike and pedestrian access, as well as the ability to remain economically competitive, among others. In 2019, Caltrans began a special research study to develop a Tribal Transportation Safety Assessments that identify vehicular traffic, pedestrian, and rural safety needs supported by the California Strategic Highway Safety Plan (SHSP). This study is anticipated to be completed in 2021.

Tribal Transportation Planning is now a part of the Federal Statewide Transportation Improvement Program (FSTIP), involving the coordination of Metropolitan Planning Organizations (MPOs) to identify where investments are needed on or near reservations or rancherias. The outcomes of the study will improve the written documentation and data collection that may help Tribal governments pursue further ongoing transportation funding. The overall coordination effort may help elevate Tribal transportation and offer new opportunities for state, MPO, and Tribal governments to identify innovative partnership opportunities.

Once the Tribal Transportation Safety Assessments are completed, Caltrans staff will work with Tribal consultants, applying appropriate Tribal consultation customs, to promote innovative projects such as alternative fuel infrastructure funding, roadside rest area and truck parking facilities, economic partnership developments, and etcetera. The completed safety assessments may lead to future freight funding projects that comply with Federal and State requirements and employ trained Tribal members, thereby increasing the access, efficiency, and economic viability of the SHS adjacent to Native American Tribal reservations and rancherias.

Endnotes

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- ¹ “Assembly Bill No. 52.” *Bill Text - AB-52 Native Americans: California Environmental Quality Act.*,
https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB52.

Chapter 6: Implementation

A. Strategies and Objectives

B. Freight Investments

6.A. Strategies and Objectives

While the freight transportation system is the backbone of California’s economy, its unintended societal and environmental consequences are significant. As such, the implementation of the CFMP must not only focus on improving goods movement, but also on improving the quality of life for Californians.

This chapter serves as the implementation portion of the CFMP. The beginning of this chapter outlines several programs, policies, and operational improvements to support and achieve the CFMP’s seven goals and corresponding objectives identified in **Chapter 1**. Additionally, this chapter will review the freight investment strategy approach which highlights region-based strategies that clearly articulate the funding priorities for the seven core regions in California.

As described in **Chapter 1**, the CFMP goals and objectives were created through a rigorous consensus-driven process with the CFAC, which is comprised of freight leaders and stakeholders from both the public and private sectors throughout the State. This chapter builds upon that effort and identifies several strategies that are intended to help the State reach these goals and objectives. Many of these strategies are already in progress and are led by various public and private agencies and entities, while others have yet to begin.

Identifying roles, responsibilities, performance metrics, and targets assigned to these strategies have yet to be determined. These efforts will be a future endeavor considered by the CFAC and should be completed after FHWA’s approval of the CFMP. These strategies are intended to act as a starting point for discussion amongst freight stakeholders on the types of strategies to pursue to meet the seven goals of the CFMP.

Goal 1 - Multimodal Mobility

Strategic investments to maintain, enhance, and modernize the multimodal freight transportation system to optimize integrated network efficiency, improve travel time reliability, and to achieve congestion reduction.

Objective MM-1: Identify causes and solutions to freight bottlenecks

Objective also supports: Economic prosperity, environmental stewardship, safety and resiliency, connectivity and accessibility

Strategy MM-1-A: Create multimodal freight bottleneck list for priority corridors

- Eliminate bottlenecks along California’s key multimodal trade corridors. MM-1-A would begin with a quantitative identification of bottlenecks along each corridor – regardless of mode. Additionally, the analysis would identify interconnected bottlenecks, which should be treated as one large bottleneck needing a solution. Along each facility, bottlenecks could be prioritized based on factors such as congestion, reliability, and safety.

Strategy MM-1-B: Conduct alternatives analysis – Determine if the highway build-out is the best solution

- When conducting freight corridor major investment studies, include an analysis of an alternative to a highway project, such as the feasibility of a rail project or another strategic investment.

Objective MM-2: Invest strategically to optimize system performance

Objective also supports: Economic prosperity, safety and resiliency, asset management, connectivity and accessibility

Strategy MM-2-A: Identify the most congested freight corridors and facilities; prioritize for improvement

- Using a common set of performance measures, identify the State’s most congested freight corridors. Once the initial quantitative analysis is complete, this strategy could employ a GIS-driven Jenks Natural Breaks Classification to identify the most congested segments. When this process is completed, overlay the Caltrans freight project list and identify nearby freight facilities impacted by (or potentially causing) the congestion.

Strategy MM-2-B: Conduct dedicated truck lane feasibility study

- Investigate the feasibility of developing dedicated freight lanes, including truck-only toll or truck bypass lanes. Separating trucks from automobile traffic may reduce congestion, especially near border crossing areas. If tolls become a reliable source of funding, revenues from tolling could systematically be reinvested to improve transportation infrastructure facilities and mass transit systems that improve traffic flows and minimize traffic conflicts. Dedicated freight lanes may reduce congestion and bottlenecks, enhance access and mobility, contribute to reliability and efficiency, reduce environmental impacts, facilitate intermodal integration; and - most importantly - enhance safety by separating trucks from passenger cars, thereby reducing traffic conflicts, related congestion, and maximizing the efficiency of freight movement.

Strategy MM-2-C: Explore variable tolling for passenger vehicles and trucks to maximize peak capacity

- Conduct a feasibility study to determine the viability of the identified congested corridors (MM-2-A) and bottlenecks (MM-1-A) for a variable tolling pilot project. By varying toll prices based on congestion levels, Caltrans could use economics as a demand management tool. Effectively, tolls may allow passenger and/or freight vehicles to purchase travel reliability within the corridors.

Objective MM-3: Develop, manage, and operate an efficient, integrated freight system

Objective also supports: Economic prosperity, environmental sustainability, safety and resiliency, and asset management

Strategy MM-3-A: Implement detection on priority corridors to identify problem areas across modes, particularly targeted to truck data

- Evaluate the existing ITS network, identify system gaps, determine priority improvements, and develop an implementation strategy. Valuable information regarding truck trips and techniques to improve freight efficiencies can be gained using roadside technology. Caltrans and its partners should support deployment of truck trip planning software and technology such as real-time traveler information systems, marine terminal appointment and reservation systems, load matching at inland hubs, and truck stop reservation systems. By integrating ITS into rest areas, traffic information can be pushed to travelers providing smart truck parking and/or reservation systems.

Strategy MM-3-B: Construct railroad grade separations at high volume roadway crossings where feasible; prioritize crossings that facilitate the movement of trucks

- Develop a statewide inventory of priority grade separation locations, estimate the cost of construction, quantify all eligible funding available for constructing grade separations, identify the funding gap, develop an implementation strategy, allocate and leverage State and local freight funds, and advocate for additional federal and private funding.

Strategy MM-3-C: Implement systems management approach and active traffic management (ATM) technologies to support efficient and safe freight operations

- Develop an ATM plan to improve trip reliability, safety, and throughput of the surface transportation system by deploying operational strategies that dynamically manage and control travel and available capacity, based on prevailing and anticipated conditions. Examples of ATM technologies: adaptive ramp metering, adaptive traffic signal controls, dynamic lane reversals, shoulder lanes, and speed limits.

Strategy MM-3-D: Expand freight travel information availability

- Broadcast freight travel information widely to the trucking community. This could include the expansion of the Smart Truck Parking (STP) pilot along I-5. Similarly, Caltrans could develop a program to share real-time traffic data with carrier company dispatchers and increase the number of dynamic messaging signs statewide.

Strategy MM-3-E: Give priority in the freight plan to projects implementing state-of-the-art and demonstration technologies

- Increase the focus on pilot and demonstration projects to help mitigate the impacts of freight travel on California's residents. Such projects could entail supply chain digitization and its integration with freight ITS. Likewise, freight mobility challenges in the State are so significant that traditional improvements alone are not going to meet future challenges.

Strategy MM-3-F: Support pilot projects for autonomous truck platooning both on open road and in transition zones

- Implement pilot projects, such as autonomous truck platoons, as a potential part of a future solution. As the magnitude of future freight challenges continue to grow in California, traditional roadway projects will not be able to keep up with the demand. However, to be successful, these pilot projects must take place both in rural and urban corridors.

Strategy MM-3-G: Coordinate with other states and regions to improve multi-jurisdictional freight corridors to reduce delay, increase speed, improve reliability, and improve safety:

- Lead the development of a multi-state/multi-jurisdictional freight group under the Western Association of State Highway and Transportation Officials (WASHTO) umbrella. Other AASHTO regions have organized and regularly convene these groups as a vehicle to secure federal discretionary funding on multi-jurisdictional freight projects.

Objective MM-4: Identify causes and solutions to freight rail network improvements bottlenecks

Objective also supports: Economic prosperity, environmental stewardship, healthy communities, safety and resiliency, connectivity and accessibility

Strategy MM-4-A: Identify freight rail projects and funding strategies that create freight rail efficiencies

- Work with seaports, terminal operators, rail carriers, shippers, regional agencies, and communities to support efforts to improve rail operational efficiency through practices such as technology improvements, facilitation of longer trains, and partnerships with Class I railroads to implement mainline improvements. This action will require investment leveraging and is suitable for public-private partnerships.

Strategy MM-4-B: Identify projects that reduce freight/passenger rail conflict

- Invest in shared rail corridor improvements to minimize delay to both freight and passengers. In most cases, the Class I corridors in California are owned by either the UPRR or BNSF, but in some cases, the rail infrastructures are owned by public entities, such as the Alameda Corridor Transportation Authority (ACTA), Los Angeles- San Diego- San Luis Obispo (LOSSAN), and Caltrain. Mutual solutions, such as double tracking in key areas, may create win-win scenarios. The focus should be to minimize conflicts and delay in high-priority corridors. Further discussion of freight and passenger rail conflicts and opportunities is included in the California State Rail Plan.

Objective MM-5: Identify freight rail network operational improvements and mode shift options

Objective also supports: Economic prosperity, environmental stewardship, healthy communities, safety and resiliency, asset management, connectivity and accessibility

Strategy MM-5-A: Support short line railroad improvements through infrastructure upgrades and advanced technologies

- Short line railroads are often overlooked as transport solutions. This strategy would develop a short line rail improvement plan to encourage track upgrades, industrial rail access improvements, advanced technologies, and clean alternative energy considerations to improve system efficiency (increase speeds, reduce emissions), and to promote cost-effective shifts of truck to rail. It would also assist shippers in obtaining access and improved services through development of new rail spurs.

Strategy MM-5-B: Support tax credits and/or loan programs for short line railroads

- The State of California could consider a state tax credit or loan program to help offset the maintenance and expansion costs of short line railroads. These costs often exceed the financial capacity of short lines, and as a consequence, over the long-term service degrades.

Strategy MM-5-C: Preservation of rail lines and rail right-of-way for potential future capacity

- Develop a program that mirrors the National Trail System's railbanking program.

Goal 2 - Economic Prosperity

Grow the economic competitiveness of California's freight sector through increased system efficiency, productivity, and workforce preparation.

Objective EP-1: Promote economic development by investing in freight infrastructure projects and operational improvements

Objective also supports: Multimodal mobility, safety and resiliency, asset management, connectivity and accessibility

Strategy EP-1-A: Reduce transportation costs by eliminating bottlenecks and recurrent delay, making operational improvements, and accelerating rapid incident response on priority freight corridors

- Enhance existing incident management program to clear incidents quickly and to re-route traffic when necessary. These tactics should be employed with new operational ATM improvements detailed in Strategy MM-3-C.

Strategy EP-1-B: Collaborate with freight industry to identify critical projects and develop strategic investment strategies, including public-private partnerships

- Identify mega-projects that are critical to the State's economy but cannot be completed through existing funding streams – either because of cost or eligibility issues. Work with the CFAC to develop these projects and identify/position them for public-private partnerships.

Strategy EP-1-C: Create incentives to attract private investment in innovative, transformative, new technological goods movement systems through pilot programs or major emerging projects:

- Advocate for incentive programs that position the state as a natural choice for private sector transportation innovation projects

Strategy EP-1-D: Measure throughput of pass-through freight and identify friction points

- Undertake a commodity flow study to understand how pass-through cargo traverses the State. Combine this analysis with freight congestion and bottleneck analysis, the cost of pass-through freight can be measured. California serves as a global gateway for the United States. While this has resulted in significant economic growth for the State, the volume of freight moving through California is significant – as well as the corresponding negative externalities. To mitigate these impacts, Caltrans can undertake a commodity flow study to understand how pass-through cargo traverses the State. When this analysis is combined with freight congestion and bottleneck analysis, the cost of pass-through freight can be measured.

Strategy EP-1-E: Advocate for additional funding appropriations for freight infrastructure investments and operational improvements

- Actively engage and encourage Caltrans public and private sector partners to advocate for increased freight funding levels and for project level appropriations. When appropriate, Caltrans should actively participate and champion these efforts.

Objective EP-2: Promote freight projects that enhance economic activity, freight mobility, unique capabilities, reliability, system resiliency, and global competitiveness

Objective also supports: Multimodal mobility, safety and resiliency, connectivity and accessibility

Strategy EP-2-A: Encourage the creation of regional freight advisory committees at regional/county transportation agencies

- Encourage/support the development of regional Freight Advisory Committees designed to support each region's perspective freight issues and to feed issues to the CFAC.

Strategy EP-2-B: Support funding to completion and then funding and partnership with GOBiz to implement CSFAP Action Item 6.A. "Competitiveness Data Development and Utilization."

- There is a need for data and information to support the freight transportation system's competitiveness and to set the State's competitiveness target or targets. The type of information needed includes a suite of quantitative metrics to measure and track California's freight industry competitiveness, analyses of the costs and benefits of State actions, and an ongoing benchmarking of the State's freight industry

Objective EP-3: Increase workforce availability and training*Objective also supports: Connectivity and accessibility**Strategy EP-3-A: Identify and actively advocate for workforce mobility, accessibility, and training needs and job training programs through collaboration with the freight industry and California's higher education system*

- Facilitate an ongoing dialog between the CFAC and the California Workforce Development Board. By creating a two-way dialog among State agencies, it can help inform the future workforce development programs focused on the freight industry. Undertake a series of mobility studies to uncover gaps in workforce accessibility. This effort could be paired with travel demand management strategies to reduce the impact of passenger vehicles on freight flows near major logistics centers.
- Expand the availability of training programs or degrees at the community college and university level, such as but not limited to: logistics, global supply chain management, supply chain technology, and logistics management.
- Encourage tech transfer from California's world-class research universities to support freight technology development. New discoveries can be made by continuing to fund cutting-edge sustainable freight transportation research from the talented, high-skilled knowledge base that exists in California through programs such as UC-Davis STEPS and USC METRANS, for example.

Objective EP-4: Promote the State's competitive logistics advantages*Objective also supports: Multimodal mobility, connectivity and accessibility**Strategy EP-4-A: Identify incentives for the retention, expansion, and new development of logistics industry facilities (warehouses)*

- Develop a comprehensive assessment of available State and local economic development incentives. The focus of this assessment will be to evaluate the current practices of Caltrans and how they fit within the bigger picture of economic development.

EP-5: Identify the needs and gaps of the agricultural goods movement system to improve the safe and efficient movement of agricultural goods to, from, and through California

- EP-5-B: Partner with local and regional agencies' in the development of local and regional goods movement plans and studies.

Goal 3 - Environmental Stewardship

Support strategies that reduce, avoid and/or mitigate adverse environmental impacts from the freight transportation system.

Objective ES-1: Continue to integrate environmental health considerations into freight planning, development, implementation, and operations of projects as feasible

Objective also supports: Economic prosperity, safety and resiliency, and connectivity and accessibility

Strategy ES-1-A: Promote the use of sustainable pavement types that enhance the movement of goods while reducing environmental impacts

- Wherever feasible, implement the use of sustainable pavement types that reduce impacts on the environment, re-charge the State’s aquifers, mitigate the negative impacts of seasonal drought, and reduce runoff.

Strategy ES-1-B: Encourage freight mode shift to rail and water to reduce VMT and GHG emissions from roadway freight transport where and when viable

- Support the State Rail Plan by prioritizing projects that promote mode shift to rail.
- Support intermodal facilities throughout the State in accordance with the State Rail Plan to create efficient mode transfer points and increased access to the rail and marine freight transportation network.

Objective ES-2: Minimize, and where possible, eliminate toxic air contaminants, criteria pollutants and GHGs emitted from freight vehicles, equipment, and operations.

Objective also supports: Safety and resiliency, economic prosperity

Strategy ES-2-A: Develop a standardized performance-based metric used for monitoring and reducing GHG emissions and criteria pollutants of freight vehicles, equipment, and operations

- Freight fleets operating from public and private organizations use differing approaches to measuring performance-based metrics for emissions. By standardizing this requirement, outcomes will remain consistent while reducing the costs incurred through labor intensive corrections and regulatory fines.

Strategy ES-2-B: Standardize medium and heavy-duty vehicle and equipment charging standards and protocols

- Promote standardized near zero and zero emission technologies, that promotes operator and public safety and avoids costs and confusion associated with having numerous charging standards. Consider lessons learned from the deployment of light-duty plug-in electric vehicle/plug-in hybrid electric vehicles. Standardized charging protocols and infrastructure can reduce costs associated with the deployment of zero-emission vehicles and accelerate the deployment of the vehicles.

Strategy ES-2-C: Decarbonize the commercial freight fleet

- Help establish proof of concept of zero-emission commercial freight vehicles by employing such technology where feasible within the State of California’s fleet.

- While transitioning to a fully, renewable energy grid, facilitate access to low-carbon fuel options such as renewable diesel in the interim.

Strategy ES-2-D: Explore decarbonization of last mile delivery to decrease the freight system's impact on air quality in dense urban environments

- Work with local governments to encourage strong parking pricing programs in the urban core to limit competition for curbside commercial freight parking; the intent of this action is to reduce VMT and emissions generated by "cruising for parking" and engine idling activities. This promotes better curb space utilization.
- Consider utilizing congestion pricing in dense urbanized areas to create low-, or zero-emission zones to manage demand for cleaner last mile delivery.
- Support research and funding for emerging forms and infrastructure for low-carbon last mile delivery, such as cargo bike delivery programs and drones.
- Support research on emerging efficient forms of last-mile delivery management, such as various distribution warehouse location models to reduce VMT and trips; off-hour deliveries; consolidation centers; efficient siting of lockers and pickup points. Create a set of statewide development standards for urban areas to proactively facilitate more efficient last-mile deliveries. These standards would likely recommend the developer considers any of the following, for example: building a centralized delivery location, secure storage room, lockers, enforcement techniques and a smart loading dock appointment system.

Objective ES-3: Promote land use planning practices that prioritize mitigation of negative freight project impacts upon the environment.

Objective also supports: Healthy communities

Strategy ES-3-A: Support freight technology development and fuels data collection and analysis

- Encourage better data collection methods and coordination efforts with partner agencies with robust resources dedicated to this effort, such as the California Energy Commission (CEC), California Air Resources Board (CARB), research institutes such as the University of California System, and the Transportation Research Board (TRB). This work will help uncover best practices and the pros and cons of various technologies to inform policy makers. Innovations in the freight industry are closely tied to the private sector and their protected data; thus, strong public-private, as well as interagency collaboration, is necessary to gain adequate insight to the industry's research and development of sustainable technologies and clean fuels.

Strategy ES-3-B: Promote the use of low-carbon renewable fuels development and support fuel efficiency and emissions reduction requirements for moving goods to support prosperity by sustainable means, by decreasing GHG consumption while increasing goods movement

- Encourage the development and availability of renewable energy resources and low-carbon fuel to result in enhanced low-emission diesel requirements.

Strategy ES-3-C: Promote land uses that are conducive to protecting the environment while supporting freight operations

- Work with local economic development and planning agencies to identify locations along rail spurs and inland waterway routes to create shovel-ready development opportunities for freight intensive uses. When siting future freight uses in these areas, focus should be given to locating the highest and best use of these strategic locations.
- Promote mixed-use development, support consolidation centers and proximate and co-location of producers and shippers to reduce freight movement. Work with local governments and its land use agencies to identify various freight efficient land use decisions. To accomplish this strategy, changes to long-range planning documents and current planning (zoning) will have to be considered. Encourage the development of urban consolidation centers.
- Encourage land use planning that provides an adequate supply of housing for the freight workforce, and plan for housing that is proximate to freight related job centers. Related to strategy EP-3-B.
- Collaborate with CARB to utilize their freight handbook document that identifies best practices for the siting, design, and operation of freight facilities that minimizes exposure to air toxins, incorporates the use of clean technologies and alternative fueling infrastructure, and maximizes the capacity of transportation infrastructure.

Strategy ES-3-D: Create incentives to attract private investment in innovative, transformative, new technological goods movement systems through pilot programs or major energy projects

- Advocate for incentive programs that position the State as a natural choice for private sector transportation innovation projects. s

Strategy ES-3-E: Incentivize freight projects that minimize GHG, criteria pollutants, and other emissions

- Increase the importance of minimizing emissions as part of future freight project evaluation processes. This could be accomplished by putting more weight on performance measures that align with the air quality State Implementation Plan

Goal 4 - Healthy Communities

Enhance community health and well-being by mitigating the negative impacts of the goods movement system across California's communities.

Objective HC-1: Prioritize social equity for freight-related projects by developing alternative methods that avoid or mitigate negative impacts on or near existing communities adjacent to high-volume freight routes and facilities

Objective also supports: Environmental Stewardship and Economic Prosperity

Strategy HC-1-A: Implement projects in freight corridors that are specifically targeted to avoiding, reducing, or mitigating freight impacts on the environment and communities

- Incorporate public health data sources when analyzing a freight project’s potential impact. Direct the Local Development Intergovernmental Review Process to request and comment on this analysis when reviewing freight projects, using a health equity lens.
- Prioritize projects that will facilitate a reduction in GHG emissions and criteria pollutants in communities disproportionately burdened by pollution, as identified using the Cal Enviro Screen.
- Strategically plan for and/or divert heavily used freight routes to alternative routes that are further removed from residential neighborhoods.
- Develop environmentally conscious and coordinated land use policies in conjunction with freight goods movement plans, e.g. to reduce conflicts by establishing buffers between industrial and sensitive land uses, influencing location and design decisions through zoning tools, preserving existing industrial land uses, and promoting context-sensitive solutions for site and building design.

Objective HC-2: Conduct meaningful outreach and coordination efforts with other agencies focused on environmental justice communities disproportionately burdened by the freight transportation system in urban areas and rural areas by identifying and documenting their needs.

Objective also supports: Environmental Stewardship

Strategy HC-2-A: Partner with metropolitan planning agencies, tribal organizations and community groups to identify conveniently located and accessible public facility venues and relevant times for hosting engaging public workshops

- Work with key community stakeholders to plan outreach opportunities that are convenient, accessible and timely for stakeholders. Collaborate where possible with existing community events so that stakeholder time is respected.
- Contract local community-based organizations to staff the outreach process when possible. Write contracts so that food and childcare services are offered to outreach attendees during the meeting to increase convenience for stakeholders to attend.
- Document conversations and feedback from public workshops to identify barriers and resulting recommendations for mitigation methods to reduce negative effects of freight impacted communities.
- Implement findings in planning activities.

Strategy HC-2-B: Establish development standards to avoid and mitigate environmental and social impacts of freight on communities

- Work with State agencies and professional organizations such as the American Planning Association, Transportation Research Board, and/or the Urban Land Institute, and utilize

existing plans and guides to develop a freight land use design guide. This guidebook would help local communities implement standards that minimize the environmental impacts of freight. These standards may include providing appropriate buffers, designating truck routes to avoid residential neighborhoods, implementing multimodal safety measures to reduce intermodal conflicts on roadways, requiring the use of cleaner trucks (highest EPA standard available at time of development approval), etc.

Strategy HC-2-C: Leverage partnerships to strengthen the outreach process

- Partner with community-based leaders of environmental justice communities to conduct and assess the economic, environmental and social impacts of freight to these communities.
- Partner with private freight stakeholders to not only bring reliable service of goods to a spectrum of geographies, but also to facilitate symbiotic relationships with affected communities, particularly those that may be disadvantaged and lacking in resources and/or employment opportunities.

Objective HC-3: Promote noise and other pollution abatement strategies associated with the movement of goods alongside residential areas and sensitive habitat near freight corridors

Objective also supports: Environmental Stewardship

Strategy HC-3-A: Promote abatement best practices in freight projects

- Work with local governments to encourage fixed, time-based vehicle size restrictions in their curbside parking. By prioritizing different modes or movements by the time of day, an urban core can strategically address curbside parking demand to, in turn, reduce VMT and emissions generated by “cruising for parking” and engine idling activities.

Goal 5 - Safety and Resiliency

Reduce freight-related deaths/injuries and improve system resilience by addressing infrastructure vulnerabilities associated with security threats, effects of climate change impacts, and natural disasters.

Objective SR-1: Reduce rates of incidents, collisions, fatalities, and serious injuries associated with freight movements

Objective also supports: Multimodal mobility

Strategy SR-1-A: Expand the system of truck parking facilities

- Execute the recommendations from the 2020/21 California Truck Parking Study to expand existing public and private sector truck parking facilities and the development of new parking facilities in strategic locations.

Strategy SR-1-B: Promote public-private partnership for implementation of truck stop and shipping terminal vehicle charging or charge-in-motion

- Support ARB, PUC, and Energy Commission efforts to work with electric utilities, technology providers, truck stops (and NATSO), and freight terminals to employ electric charging terminals along key freight corridors. Likewise, Caltrans should continue to study inductive charging opportunities within its right-of-way.

Strategy SR-1-C: Develop design guidelines for truck routes that consider other modes

- Utilizing logistics land use guides, develop a context-sensitive roadway design document that supplements Caltrans' Complete Streets guidance.

Strategy SR-1-D: Prioritize projects that address high-crash, truck-involved locations

- Collaborate with California Highway Patrol and use a common set of performance measures to identify commercial vehicle crash hot-spots statewide. Use this information to improve State and regional prioritization efforts and to focus safety-related funding efforts.

Objective SR-2: Utilize technology to provide for the resilience and security of the freight transportation system

Objective also supports: Multimodal mobility, economic prosperity, asset management

Strategy SR-2-A: Expand the number and scope of cargo security screenings

- Work with State and Federal homeland security partners to ensure that future transportation design decisions near sea, air, and land ports of entry account future space requirements for cargo screening facilities.

Strategy SR-2-B: Ensure consistent and effective safety and security requirements at all California ports

- Ensure consistent and effective safety and security requirements at all California ports
- Strengthen partnership between State, federal, and private stakeholders to ensure the safe and secure access of goods moving to and from the State's sea, air, and land ports of entry.

Strategy SR-2-C: Identify alternate freight routes to maintain freight movement at times of disruption by disaster

- Conduct an alternative routes study to ensure continuity of freight movement during and immediately following a disaster. This study would include bringing critical trade lanes online and ensuring relief materials reach California's residents and businesses. Existing evacuation routes and plans must be integrated into the proposed alternative routes study.

Strategy SR-2-D: Support V2V and V2I communication alerts on congestion and safety hazards

- Monitor technological innovations and invest appropriately in V2V and V2I infrastructure that will allow freight users advanced information on congestion, safety hazards, and traffic information (i.e. red light count down, speed limits, etc.). This information can help truck drivers make active choices about how they select their route and how they operate their commercial vehicles.

Strategy SR-2-E: Promote technology to support monitoring of truck parking locations and areas where rail traffic commonly stops

- Increase transportation security and decrease theft by placing cameras and other technologies in truck parking areas and near rail locations where intermodal trains frequently stop.

Strategy SR-2-F: Support the creation and development of a freight technology research center to advance research in innovative freight practices and incubate innovations to meet future demand

- Support the creation of a freight technology research center at the university level, or within a State agency department, to undertake freight related research and development.

Objective SR-3: Develop freight resiliency strategic plan

Objective also supports: Economic prosperity, environmental stewardship

Strategy SR-3-A: Develop resiliency vision, goals, and objectives

- Work with agency partners to develop a vision for a resilient freight system. This vision would be supported by goals and a series of objectives. The Freight Resiliency Strategic Plan would focus on identifying future issues as it relates to national disasters, sea-level rise, and the individual resiliency of major trade lanes in California.
- Collaborate with State, regional, and local agencies to leverage funding opportunities for implementation of climate resiliency work, adaptation plans, climate action plans, and/or master plans to increase resiliency of assets against climate related events.

Strategy SR-3-B: Identification of high priority safety concerns, critical infrastructure, and aspects of the State's key supply chains that have resiliency concerns

- Increase the resiliency of California's key industry supply chains. Identify and prioritize improvements to improve safety and keep business moving – these improvements could include rebuilding, strengthening, or improving facilities.

Strategy SR-3-C: Incorporate resilience strategies contained in port plans prepared pursuant to coastal commission guidelines

- Work with the State’s port authorities to incorporate resiliency strategies as part of Caltrans roadway improvement plans – in particular, assist ports in preparing for increased sea levels.
- Collaborate with partners to develop Vehicle Grid Integration as a resiliency strategy. This capability allows for battery-electric vehicles and other equipment to communicate with the grid when charging, especially in places where trucks are likely to plug-in for extended sessions like truck parking sites. This is also a technology that could promote resiliency for equipment like electric-powered Transport Refrigerator Units, particularly when shore powering at port terminals and warehouses.

Goal 6 - Asset Management

Maintain and preserve infrastructure assets using cost-beneficial treatment as indicated in the State Highway System Management Plan (SHSMP), per the federal FAST Act, Streets and Highway Code §164.6, and Caltrans Director’s Policy 35 Transportation Asset Management (DP-35), and other applicable state and federal statutes and regulations.

Objective AM-1: Apply preventive maintenance and rehabilitation strategies using sustainable best practices

Objective also supports: Multimodal Mobility, Safety and Resiliency, Connectivity and Accessibility

Strategy AM-1-A: Ensure adequate and sustainable funding for preservation and modernization of the freight system

- Conduct a study to explore the long-term maintenance and operational costs of the existing freight system. The results of this study should be integrated into long-term planning and funding strategies for the State. Expand scope of freight system rehabilitation projects to include facility modernization, where possible and merited, to increase range of available funding sources.

Strategy AM-1-B: Identify maintenance and preservation needs on priority freight corridors

- The maintenance and operation study identified in Strategy AM-1-A should use the corridors established in Strategy MM-1-A to focus investment in high priority trade lanes that support the California economy.

Strategy AM-1-C: Expand truck scale technology use: automated or technologically assisted weight enforcement (infrared cameras); expand weigh-in-motion (WIM) deployment

- Identify locations for new installations of WIM stations throughout the State and prioritize implementation. Caltrans uses advanced technology along highways to create efficiencies in freight movement and fulfill federal mandates for traffic. Weigh-in-motion devices verify compliance with weight requirements electronically without having to pull trucks out of and back into traffic at truck scale locations. Delays occur as trucks often queue at the scales to wait for weighing and verification. Technologies allowing trucks to bypass additional stops create a more efficient system.
- Currently, WIM systems are lacking near many port locations and in some areas where new corridors are growing. Truck scale technology allows for efficient use of static scales and enforcement personnel without affecting the flow of traffic. In addition to improving safety, the technology helps reduce overloading and subsequent pavement damage.

Strategy AM-1-D: Fortified bridges and pavement design standards to accommodate heavy freight travel

- Identify bridge rehabilitation and replacement needs and adapt the current bridge asset management program to focus on key freight corridors. All bridges along primary freight routes will be identified and separated by the various network categories for performance measurement. Assess freight bridge conditions and barriers to freight. Weight and dynamics of heavy-duty trucks, outdated design methods, poor quality materials, and unsuitable construction and maintenance practices are known to reduce pavement longevity. Newer, longer-lasting materials and improved technologies are regularly being developed internally and externally. Pavement technological advances to increase durability and safety and to reduce road noise and friction will improve system efficiencies, cost savings, and environmental impacts. The use of new, better-performing materials will enhance the life of the transportation process.

Strategy AM-1-E: Preservation of unique freight corridors and passageways

- *Identify system assets that provide unique capabilities to the freight system, such as the ability to move non-containerized cargo, HAZMAT cargo, oversized/overweight cargo, or cross-border freight and prioritize projects to protect those assets, as long as they still serve a need or alternatives to replacements are too costly.*

Goal 7 - Connectivity and Accessibility

Provide transportation choices and improve system connectivity for all freight modes.

Objective CA-1: Support research, demonstration, development, and deployment of innovative technologies

Objective also supports: Multimodal mobility, economic prosperity, environmental stewardship, safety and resiliency, and asset management

Strategy CA-1-A: Freight plan priority for projects implementing state-of-the-art and demonstration technologies

- Increase the focus on prioritizing pilot and demonstration projects to help mitigate the impacts of freight travel on California’s residents. Likewise, freight mobility challenges in the State are so significant that traditional improvements alone are not going to meet future challenges.

Strategy CA-1-B: Support pilot projects for autonomous truck platooning both on open road and in transition zones

- Implement pilot projects, such as autonomous truck platoons, as a potential part of a future solution. As the magnitude of future freight challenges continue to grow in California, traditional roadway projects will not be able to keep up with the demand. However, to be successful, these pilot projects must take place both in rural and urban corridors.

Strategy CA-1-C: Support the creation and development of a freight technology research center to advance research in innovative freight practices and incubate innovations to meet future demand

- Support the creation of a freight technology research center at the university level, or within a state agency department, to undertake freight related research and development.

Objective CA-2: Promote innovative technologies and practices utilizing real-time information to move freight on all modes more efficiently

Objective also supports: Multimodal mobility, economic prosperity, safety and resiliency

Strategy CA-2-A: Research opportunities for freight technologies

- Develop a freight technology research center within a state agency or university to help incubate innovations needed to meet future demand. Future freight technologies will be key to solving the significant freight challenges that await California in the future.

Objective CA-3: Coordinate with local and regional partners on freight facilities, siting, design, and operations

Objective also supports: Multimodal mobility, economic prosperity, environmental stewardship, safety and resiliency, asset management

Strategy CA-3-A: Freight transportation, transportation planning, and land use planning coordination

- Promote good project design that helps avoid community concerns and lengthy and potentially contentious approval processes for new and expanded freight facilities. Work with local agencies to avoid incompatible land uses and transportation alternatives that conflict with existing or future freight facilities. Tools, such as GIS, can assist with many facets of planning. With current accurate information, layers of data superimposed on each other can provide a visual idea of current and future scenarios. Freight can have negative impacts on communities, and the development of incompatible land use near large freight generators can influence the efficient flow of freight.

Objective CA-4: Utilize inland port facility, short-haul rail shuttle, and inland seaports to lessen impacts on nearby communities

Objective also supports: Multimodal mobility, economic prosperity, environmental stewardship, safety and resiliency, asset management

Strategy CA-5-A: Develop a competitive metric identifying the cost of transporting goods grown or manufactured in California to a common destination versus peer regions/states

- Create a goods movement competitiveness metric identifying a single product and comparing the transportation costs of the product from California to its most common destinations with those of competing states.

Objective CA-5: Improve truck trip planning, coordination, operational, and management

Objective also supports: Multimodal mobility, economic prosperity, environmental stewardship, safety and resiliency, asset management

Strategy CA-6-A: Measure throughput of pass-through freight and identify externalities, such as impacts on communities and air quality

- Explore avoidance incentives or disincentives at highly impacted areas that aim to limit pass-through traffic, thus allowing local businesses to operate more efficiently and minimizing impacts on local communities. While California sees significant economic benefit (such as jobs, sales tax) by serving as the nation's global gateway, there is an associated cost exerted by the significant pass-through freight moving by truck and train on the State and its residents. The resulted increase in congestion levels and emissions can be mitigated by requiring clean truck and locomotive technologies and off-peak operations.

Strategy CA-6-B: Support off-hour delivery/pick-up strategy development

Most urban truck traffic occurs during the busiest and most congested times of the day. Shifting last-mile cargo pick-up and delivery to off-peak hours alleviates congestion within urban boundaries.

6.B. Freight Investments

As a part of the implementation of the CFMP 2020, input from previous chapters help inform the most critical future freight investments necessary for California to meet the everchanging demands of tomorrow. This has resulted in the development of the Regional Freight Investment Strategies (FIS).

Understanding the context of a region is helpful in assessing how California should strategically invest in its freight system. California is one of the largest states in terms of land mass, spans several climate zones and is host to various economic sectors; therefore, the freight system is influenced by each regions' unique attributes and competitive strengths. As such, this CFMP analyzes California's freight system from seven regional perspectives, highlighting the unique context and freight needs of each of these regions. In alignment with state policy including California's "Regions Rise Together" initiative and stakeholder input from the CFAC, the boundaries of the CFMP regions are conceptualized to generally align with California freight flows to best address the unique context of California's regional communities and economies.¹

Table 6.B.1 describes how California's counties are divided among the seven CFMP regions, and **Figure 6.B.1** is a map that illustrates the borders of the CFMP regions. Each of the following perspectives are comprised of two sections—1) a regional narrative; 2) policies and programs.

Table 6.B.1. The CFMP Freight Investment Strategy Regions by County

CFMP Region	County	Caltrans District of County
Northern California	Del Norte	All counties in District 1
	Humboldt	
	Lake	
	Mendocino	
	Lassen	All counties in District 2
	Modoc	
	Plumas	
	Shasta	
	Siskiyou	
	Tehama	
	Trinity	
	Butte	A portion of counties in District 3
	Colusa	
	Glenn	
	Nevada	
	Sierra	
	Yuba	

CFMP Region	County	Caltrans District of County
Central Sierra	El Dorado within Tahoe Regional Planning Agency (TRPA) boundary	A portion of counties in District 3
	Placer within the TRPA boundary	
	Inyo	All counties in District 9, with the exception of the eastern portion of Kern County
	Mono	
	Alpine	A portion of counties in District 10
	Amador	
	Calaveras	
	Mariposa	
	Tuolumne	
Bay Area	Alameda	All counties in District 4
	Contra Costa	
	Marin	
	Napa	
	San Francisco	
	San Mateo	
	Santa Clara	
	Solano	
	Sonoma	
Central Valley	El Dorado (minus portion in TRPA boundary)	A portion of counties in District 3
	Placer (minus portion in TRPA boundary)	
	Sacramento	
	Sutter	
	Yolo	
	Fresno	All counties in District 6
	The western portion of Kern County	
	Kings	
	Madera	
	Tulare	
	The eastern portion of Kern County	A portion of District 9
	Merced	A portion of counties in District 10
	San Joaquin	
	Stanislaus	
Central Coast	Monterey	All counties in District 5

CFMP Region	County	Caltrans District of County
	San Benito	
	Santa Barbara	
	San Luis Obispo	
	Santa Cruz	
Los Angeles and Inland Empire	Los Angeles	All counties in District 7
	Ventura	
	Riverside	All counties in District 8
	San Bernardino	
	Orange	The county in District 12
San Diego Border	Imperial	All counties in District 11
	San Diego	

State Overview and Themes

Home to nearly 40 million people, California is one of the largest economies in the world. As the population grows and businesses continue to thrive, the demand for goods will continue to stretch and challenge the built environment, the natural environment, and our communities. Future freight investments in California should aim to accomplish all the seven goals highlighted throughout the CFMP through strong partnerships between private and public stakeholders, businesses, and advocacy groups.

While most regional freight investment strategies identified in this chapter are authored by the regions and identify the most critical freight priorities in alignment with regional policies, context, and needs, many of those projects of regional importance also align closely with State policies. From the high-level State perspective, freight projects should also leverage efforts to address impacts of climate change. As a leader in sustainable freight activities, California strives to evolve and grow its freight industry while simultaneously reducing any negative externalities that could exacerbate climate change impacts. This is a vital consideration, especially for projects that may increase VMT. To mitigate our greatest freight challenges, the State's most critical freight investments should be consistent and aligned with at least one the following four themes:

Improving Port Access Reliability

With some of the busiest maritime port complexes in the nation, imports from the Pacific Rim to California and national markets are a significant economic engine for California. With one of the largest concentrations of warehouses and distribution centers in the nation, California's transportation network must be reliable, efficient, and cost effective for operators to ensure continued competitiveness. This is especially critical for California's export-dependent industries. As one of the largest exporters of high-value electronic goods in the nation, and one of the largest exporters of agricultural goods in the world, California's competitiveness in the

world and national markets depend on the intricate and interdependent roles of the public and private sectors working cohesively to move goods to, through, and from the ports.

Border Efficiency

Mexico is California's largest trading partner, and trade between the two partners will continue to grow as manufacturers' supply chains continue to integrate the unique workforce skillsets, economies, and resources from both sides of the border. This continued growth will also affect the border's infrastructure. Capacity expansion, existing system integration, and efficiency activities will need to address how they will not only mitigate impacts to, but also enhance, the surrounding environment and communities.

Inter- and Intra-State Freight Movement and Resiliency

California is a large and diverse state and serves as a gateway for goods entering the nation. In addition to California markets, goods traveling within the state make their way on the intra-state transportation network to the rest of the nation, as well as Mexico and Canada. Improving the inter- and intra-state freight network is a critical component to increase the state's economic competitiveness. Critical freight corridors, such as I-5, I-10, I-15, I-80, SR 99 and others, connect the largest metropolitan areas within the state and serve as the pillars supporting goods movement between regions and other states. Improvements to these pillars will increase travel reliability, reduce congestion, and enable more volume and value of goods to move into and through the state. With continued increase in severity and frequency of climate change related events, California must plan for efficient and cost-effective routes to ensure the resilience of the freight system in the face of such disastrous climate events.

Figure 6.B.1. Map of CFMP Freight Investment Strategy Regions relative to Key Freight Routes in California



Source: Caltrans

Sustainability and Innovations

As the world’s innovation epicenter, California has been at the forefront in countless sectors to deliver ideas, products, and services that have tremendous impact to the world. Within California’s freight sector, innovative practices and technologies continue to be developed. With adoption of the CSFAP, EO N-19-19, and other climate change resilience initiatives, combined with local and regional policies, California is committed to enhance all aspects of freight in a manner that will advance the triple bottom line--its economy, its people, and the natural environment. Initiatives such as workforce and community development, environment improvement programs, freight intelligent transportation systems, renewable energy infrastructure, and smart land use decisions are only the first of many new norms that complement the State’s thriving freight sector. As freight investments continue, each investment decision should strongly consider how a project may integrate transformative ideas to increase the amplitude of benefits for the state’s people, economy, and environment; “transformative” meaning of having a quality that catalyzes change in the freight system to make it become more sustainable. In alignment with this principle, the following types of projects are examples of those that may provide added benefits to the freight transportation system but also enhance California’s economic competitiveness while protecting its community and environmental assets.

Alternative Fuel Corridors to Support Zero- and Near-Zero Emission (ZE/NZE) Freight Vehicles, Equipment, and Infrastructure

Clean Truck Corridors – Investments in corridor infrastructure that supports corridor deployment of ZE/NZE freight vehicles, specifically, for medium- and heavy-duty vehicles. This could potentially include using managed lanes or tolling systems to prioritize “clean” heavy duty trucks. These corridors should also have adequate access to alternative refueling stations for battery- and hydrogen-power medium- and heavy-duty vehicles.

Marine Highways - Move goods along waterways between ports and terminals along the Pacific Coast (M-5) and to inland ports (M-580). Modal shift to marine highways can provide VMT reduction benefits. Marine highway efforts should also be paired with low-emission vessels and cargo handling equipment to maximize emissions reductions and take full advantage of modal shift.

Port Infrastructure and Equipment – Deploy ZE/NZE vehicles, cargo handling equipment, and infrastructure at the ports that help meet State and port emission reduction goals.

Short Line and Other ZE/NZE Rail Projects - Move goods to and from ports and freight facilities to nearby locations or to further inland Class I railroads. Rail projects can help reduce VMT, improve efficiency of the freight system, and reduce emissions—especially if ZE/NZE locomotives, cargo handling equipment, and other infrastructure are used.

Truck Parking ZE/NZE Infrastructure – Install ZE/NZE charging and/or plug-in infrastructure at facilities where trucks are parked. Safety Roadside Rest Areas and truck stops may be prime areas for infrastructure investment since it already accommodates geometrics and design

standards for Class VIII trucks. These locations are also located where drivers tend to park for long periods of time to meet HOS regulations and could plug in and/or charge their vehicles, making these locations ideal for Vehicle Grid Integration charging technology.

Intelligent Transportation Systems (ITS) and Software Solutions that Support Efficient Freight Movement

Border Wait Times – ITS projects near the USA/Mexico border that provide real-time border crossing wait time information to drivers to help make better routing decisions and reduce idling time.

Vehicle and Container Location and Condition Monitoring Systems - Systems that provide real-time information about the position of vehicles via location enabled smart devices and truck OEM on-board hardware. Information can be accessed by the web. Sensors on the vehicle can also provide real-time information about the condition of the cargo shipment, container door-lock status, and adherence to the planned route. U.S. Customs service providers can estimate vehicle arrival times and prepare documentation prior to arrival, thus decreasing truck waiting times. Port gate operators can send estimated arrival updates to trucks in the case of cargo ship delays.

Eco Routing - Dynamic software that determines the eco-friendliest route for truck drivers and fleet operation managers. Routes can be optimized based on minimizing emissions or fuel consumption, and can adapt based on real-time, historical, and predicted traffic and environmental data.

Freight Signal Priority (FSP) – ITS technology that enables freight vehicles to receive priority for green lights at signalized intersections under appropriate traffic conditions, which can help reduce emissions and increase throughput. An example of FSP is the San Diego Port Tenants Association implementation of FSP at roadway intersections near the port, funded by CEC.

Truck Parking Information and Reservation Systems – Traveler information that provides real-time parking availability to truck drivers to reduce time searching for parking and help drivers locate safe parking alternatives. These systems may also be used to reserve truck parking spaces for a specific vehicle at a specific time and to reserve a time to load or unload the freight. These systems contribute to efficiency performance by maximizing truck loading dock spaces in dense urban areas where parking spaces are limited. These systems also allow truck drivers to find safe parking zones and avoid unsafe or unauthorized zones.

Truck Platooning – As mentioned earlier, truck platooning refers to the linking of two or more trucks in a convoy using technology to link and automate acceleration and deceleration of the connected trucks. The technology automatically sets and maintains close distance between each vehicle allowing for fuel savings and increased safety. California has been a leader in platooning deployment and demonstration projects.

Traffic Control and Monitoring Systems - Systems that control and manage traffic flow by providing information to traffic authorities and logistics service providers regarding collisions, congestion, traffic flow speed, and vehicles. Technologies such as “smart” traffic lights, license plate recognition cameras, and speed cameras are included. Such systems can send updates about vehicle arrival time and delays, improving the efficiency of truck, port, terminal, and warehouse operations. The environmental performance of the transportation operations is increased by decreasing transport time and vehicle idling.

Weigh-in-Motion (WIM) Systems - Systems that ensure vehicles are not overloaded beyond maximum allowable weights. They are used to determine the weight of the vehicles as they move past sensors. Removing overweight vehicles from roadways increases safety and decreases damage to pavement and structures. WIM systems also improve highway system performance by eliminating or reducing truck stop times at static weight-controlling stations. WIM systems can help reduce the risk of accidents by identifying overweight vehicles and flagging them for enforcement action. Broad application of WIM monitoring can provide a wealth of traffic operations data across a wide area or along an extended corridor.

Railroad Management and Operations - ITS train applications that benefit protection controls for both interstate and state networks and improve network capacity, operational flexibility, service availability, travel times, safety, system reliability, and security. Control and dispatch centers are able to schedule more trains on the same area of track and ‘fleet trains’ heading in the same direction by spacing them more closely while still providing safe stopping distances. Developments in this area highlight the need for interoperability with road-based ITS technology, particularly at railway crossings.

Rail Crossing Safety Systems - Systems that expand the use of ITS to improve rail crossing safety, including low-cost solutions that augment more traditional treatments for crossings, such as signs, flashing lights, and boom gates. The use of short-range communications between oncoming trains and vehicles or roadside installations to warn motor vehicle drivers will likely require integration with other auto and truck-based ITS technologies.

Northern California

Section 1. Regional Overview

The Northern California Region (NCR) abuts Oregon’s southern border and northwestern Nevada. The region follows the northern boundaries of the Sacramento Valley and Bay Area Regions and follows the western boundary of the North Pacific coastline. The NCR coincides with the combined counties of Del Norte, Humboldt, Lake, Mendocino (Caltrans District 1), Lassen, Modoc, Plumas, Shasta, Siskiyou, Tehama, Trinity (Caltrans District 2), and Colusa, Butte, Glenn, Nevada, Sierra, Yuba (Caltrans District 3) and is approximately 28 percent of the state’s total land area.² Much of the land is publicly owned by the Federal and State government.

The NCR supports national, State, and regional economies and the quality of life of the people living there. The dense forests that cover Northern California are national, State, and regional

assets that draw tourists to the region, provide the timber needed for construction, and add dollars to the economies. California's top five timber producers--Humboldt, Mendocino, Siskiyou, Shasta, and Plumas Counties--are all located within this region. Together in 2017, these five counties produced a combined total of 891.2 million board feet of timber valued at \$294.3 million, comprising approximately 68 percent of the State's total timber production.³ Even though the region is still the State's largest timber producer, logging has decreased significantly from peak production several decades ago. This area also produces wine, grapes, orchard fruits, dairy, and cattle for feeding the global population.

Tourism is a significant economic generator for the NCR. Travel spending benefits this region through direct impacts (employment and earnings linked to travel expense made by the traveler at the establishment), indirect impacts (employment and earnings linked with the industries that supply goods and services (e.g., hotels, car rentals, ski resorts), and induced impacts (employment and earnings linked to the purchase of food, lodging, and transportation for the travelers and the travel industry employees). It is important to note that the direct travel impacts of recreation and tourism in the NCR benefits the state and local economies. During the summer season, traffic volumes climb nearly 25-50 percent on many of the regional highways, impacting trucking on rural freight highways. National and international travelers to the state partake in the natural beauty of the national and State parks in the region to swim, hike, camp and engage in a multitude of winter related outdoor activities. These attractions create additional traffic (e.g., trailers, recreational vehicles) that can impede freight trucks on priority freight routes.

Table 6.B.2. Northern California Regional Overview

Counties	Distinguishing Characteristics
Butte	According to the Butte County General Plan 2030, the county generates most of its economic vitality through agriculture directly through crop revenue and indirectly through industrial, manufacturing, transportation, warehousing, and on-to-sale sector jobs like construction, wholesale and retail. Butte County is nationally ranked for its agricultural products in rice, walnuts, prunes and plums. According to the United States Department of Agriculture, the 2012 Census of Agriculture noted that Butte County is ranked in the top ten in the nation in walnut, prune, and plum production.
Colusa	Agriculture (ranching and farming) and recreation play significant roles for Colusa County's economy. The county's transportation network provides access to camping, fishing, boating, and bird watching at East Park Reservoir and access to the Mendocino Off-Highway Vehicle (OHV) Corridor that connects Fouts Springs/ Davis Flat OHV Staging Area and the Middle Creek OHV Staging Area. Many visitors en route to Mendocino National Forest travel through Colusa County. In this agriculture-dominant county, rice and almonds are the main crops.

Counties	Distinguishing Characteristics
Del Norte	<p>Del Norte County is known for giant Coastal Redwoods. Crescent City, the county's only incorporated city, is home to the Crescent City Harbor and Pelican Bay State Prison. Cattle, milk, and nursery products are the county's primary commodities. The county's topography is comprised of coastline, rugged mountainous terrain, and redwood forests. Two major rivers, the Smith and the Klamath, flow through the county and empty into the Pacific Ocean. The Yurok Tribe, Resighini Rancheria, Tolowa Dee-ni' Nation and Elk Valley Rancheria are the four federally recognized tribes residing in the area. Commercial fishing and tourism are the Crescent City Harbor's primary economic activities and represent a significant sector of the county's economy.</p>
Glenn	<p>Glenn County, located approximately 75 miles north of Sacramento, is one of the smallest California counties. The Grindstone Indian Rancheria, the county's only federally recognized Tribal Government, is located to the southwest near the city of Orland. Travel in the county is primarily automobile-oriented due to the rural nature of the local communities, low development densities, and limited options for using non-auto modes of travel. The county's largest industries are agriculture, forestry, fishing and hunting, retail trade, health care, and social assistance.</p>
Humboldt	<p>Humboldt County's mild summer and proximity to the Pacific Ocean, redwood forests, and hiking and biking trails, make it an ideal tourist location--especially for those trying to escape the summer heat. The county has the longest California coastline and is home to the Port of Humboldt Bay. Natural resources industries, including lumber, forestry products, and agriculture are key to the county's economy. This county is the state's largest supplier of timber, producing 289 million board feet valued \$120.8 million, which equates to 32 percent of the county's agricultural value and 28 percent of the state's total timber value in 2017.⁴ Other top commodities include cattle and calves, milk products, and nursery products. Commercial fishing is another industry that supports the regional economy. Eureka has over 200 commercial fishing vessels listed as the home port, approximately 130 commercial fishing boats are berthed at the Eureka Public Marina, and annually over 500 boats from other West Coast ports utilize the harbor.⁵ Eight Native American Reservations and Rancherias reside in the county: Bear River Band of Rohnerville Rancheria, Big Lagoon Rancheria, Blue Lake Rancheria, Hoopa Valley Tribe, Karuk Tribe, Trinidad Rancheria, Wiyot Tribe, and the Yurok Tribe. The nearest designated metropolitan area is located more than 150 miles away. All goods movement that travels through the county moves by trucks utilizing the SHS and local roads.</p>

Counties	Distinguishing Characteristics
Lake	Lake County is situated within the Pacific Coastal Mountain Range between Mendocino and Sonoma Counties to the west, and Glenn, Colusa, Yolo and Napa Counties to the east and south. The county consists largely of mountainous terrain, Clear Lake (largest freshwater lake in the state), and resource lands (surrounding the lake). Lake County is home to the world's largest complex of geothermal power plants, and it has the cleanest air in the state. Lake County has a limited economy. In 2015, approximately 25 percent of the population lived at or below the poverty level and around 27 percent of the residents needed social assistance. ⁶ Agriculture plays a significant role in its economy, as Lake is the largest supplier of premium fresh pears in California. Other commodities include wine grapes, wine, English walnuts, cattle, and calves.
Lassen	Government agencies manage approximately 63 percent of Lassen County's land. Diverse natural settings include Lassen Volcanic National Park, Lassen National Forest, Sierra Nevada mountains, high desert areas, and several lakes. Eagle Lake is the second-largest natural lake in California. Hay (primarily alfalfa) and livestock have long been the principal agricultural commodities while some logging operations remain.
Mendocino	Mendocino County is known for its distinctive coastline and forest lands. Its main commodities are wine grapes, wine, timber (44 percent of the county's agriculture value), Bartlett pears, cattle, and calves. In 2017, the county ranked second in the State for timber production producing 120.5 million board feet of timber valued at \$60 million. ⁷ Mendocino County consistently maintained a median household income of roughly \$20,000 less than the State's rate, and the county's poverty rate consistently remained higher than the statewide average between 2007 and 2016. ⁸
Nevada	Cattle, heifers, and steers accounted for one-third of the Nevada County's agriculture production value in 2010. Pasture/rangeland, wine grapes, timber, and manufacturing are other major economic generators.
Modoc	Approximately 90 percent of the land in Modoc is National Forest and wilderness. This county has a combination of high desert terrain, spectacular mountain ranges, green fertile valleys, wetlands, crystal clear lakes and streams, the Warner Mountain Wilderness area, and Lava Beds National Monument. The principal crop is alfalfa hay.

Counties	Distinguishing Characteristics
Plumas	Plumas County boasts 100-plus lakes, more than 1,000 miles of rivers and streams, and over a million acres of National Forest – providing a multitude of outdoor adventure opportunities year-round. Top commodities include timber (44 percent of the county’s agriculture value), livestock, and alfalfa and meadow hay. The county is ranked fifth in the state for timber production. In 2015, the county produced 117.4 million board feet of timber valued at \$23 million.
Sierra	Divided by the Pacific Crest, this rural county’s largest industries involve construction and wood products. Crops grown in this county include alfalfa hay, barley, Christmas trees, forestry, timber, hay, grass hay, meadow oats, and rye.
Shasta	Recreation is Shasta County’s primary economic activity, with the top tourist attractions being Shasta Lake, Lassen Volcanic National Park, Whiskeytown National Recreation Area, and the Sundial Bridge. Main commerce includes timber (33 percent of the county’s agriculture value), cattle, hay, nursery stock, and wild rice. In 2017, the county was ranked fourth in the state for timber production and produced 155.7 million board feet of timber valued at \$42 million. ⁹
Siskiyou	Siskiyou County is located in the Shasta Cascade Region, home to Mount Shasta (the 5 th highest peak in the State). More than 60 percent of its land is managed by federal and state agencies. Tourism play a significant role in the county’s economy and employment. “The Siskiyou County Visitors Bureau estimates that the county provides opportunities and services for nearly 400,000 people annually.” ¹⁰ The county’s agriculture consists primarily of livestock grazing and field crops, such as strawberries. Strawberry plants are the top commodity in this county, followed by timber, hay, steers and heifers, raspberry plants, and wheat. In 2017, the county ranked third in the state for timber production and produced 208.8 million board feet of timber valued at \$48.5 million. ¹¹
Tehama	Tehama County is bisected by I-5 and the Sacramento River. By far, the primary commodity is walnuts, followed by olive products, almonds, and prunes. Other regional commodities include honey and bee products, milk, timber and livestock. Many of the goods from this area are shipped international in over 50 countries. Between 2016 and 2017 agricultural production increased in Tehama County by almost 14 %. ¹²

Counties	Distinguishing Characteristics
Trinity	Trinity County's rugged topography is comprised of the Trinity Alps, South Fork Mountain and other ridges of the Klamath Mountains and Coastal Range, and the County is carved by the deep canyons and valleys of the Trinity, Van Duzen, and Eel Rivers. This county is extremely rural and has no incorporated cities or towns. Most people, goods, and commodities that enter and leave the county utilize the SHS. The county's economy and employment are reliant on natural resources, mining, construction, manufacturing, trade, transportation and utilities. Over 70 percent of the land in Trinity County is owned by the Federal government and is not subject to property taxes. The top commodities include forest products as well as cattle and calves.
Yuba	Home to Beale Air Force Base, Yuba County's main industries involve steel and wood product manufacturing and publications. Agricultural production for the county includes walnuts, almonds, timber, fruit, nuts, cattle, calves, and milk. Rice has the highest crop value, followed by walnuts.

Primary Truck Routes

Interstate Routes (I/U.S.)

I-5

Principal north-south freight corridor that spans the West Coast, originating at the nation's busiest international border crossing at San Ysidro (San Diego, CA), and culminating at Blaine, Washington near the Canadian border. This critical interstate is designated as part of the federal nation network, National Highway System (NHS), Interstate System, STAA, National Scenic Byway, Intermodal Corridor of Economic Significance, and the California Freeway and Expressway System. Furthermore, I-5 connects major population centers of the western United States (e.g., Cities of San Diego, Santa Ana, Anaheim, Los Angeles, Sacramento, Portland, and Seattle) and serves as a nexus of international trade with the Pacific Rim, North America, and Latin America. I-5 also plays a significant role in the NCR as it is the region's only interstate route and provides critical access to the NCR rural freight highways (SRs 3, 20, 32, 36, 44, 89, 96, 97, 99, 151, 162, 263, 265, 273, and 299).

U.S. 97

Major north-south interregional corridor that begins at its junction with I-5 (near the City of Weed, CA) then proceeds north through central Oregon, Washington, and the Canadian Province of British Columbia. At the British Columbia/Yukon Territory Border, U.S. 97 becomes SR 1 and terminates in Anchorage, Alaska. Truckers utilize this corridor as an alternative to I-5 (especially when I-5 is closed due to weather events) due to fewer grades, which allow trucks to

consume less fuel and achieve faster travel times to many destinations in Oregon. Trucks represent 11 percent of the total Annual Average Daily Traffic (AADT) at the southern end of the route and 28 percent of the total AADT at the northerly end of the route. Total truck volumes range from 989 -1166 trucks daily with the majority being larger (5+ axle) trucks.

U.S. 101

Major north-south national, inter-/intra-regional freight corridor linking California's North Coast, Oregon, and Washington and all California's coastal cities. Its proximity to two of the nation's largest metropolitan areas (Los Angeles and the Bay Area) makes it an essential corridor for national and international goods movement, commerce, trade, and other important industrial activities. This route is part of the NHS and the California Freeway and Expressway System and serves as the primary interregional corridor for goods movement between the NCR and the Bay Area. This corridor is also a vital lifeline for the rural Northern California communities because it serves as the region's primary freight, recreation, and emergency evacuation route. U.S. 101 serves the Port of Humboldt (via SR 255) and trucking operations that serve residents and businesses, and it is utilized to transport agriculture, lumber, and other goods produced in the corridor to market or to the Port of Humboldt for shipment out of the region. Except for a five-mile gap (HUM/MEN County line to Richardson Grove State Park), U.S. 101 is a National Network (STAA) route that provides access for industry-standard STAA trucks. Because of this gap, truckers must unload their cargo in the Bay Area (approximately 150 miles south of Eureka) and transfer it from the single industry-standard freight trucks to multiple California legal trucks to move cargo into and through the NCR.

U.S. 199

Important east-west rural highway for the interregional movement of goods (primarily forest-related products), recreational travel, and the interstate movement of goods between California (U.S. 101 north of Crescent City) and Oregon (I-5 at Grants Pass). This corridor traverses Jedediah Smith Redwoods State Park, is part of the Redwood National and State Park System, and follows the wild and scenic Smith River. U.S. 199 is designated as a Forest Service Scenic Byway through the Smith River National Recreational Area (most of the length of this route).

U.S. 395

Principal north-south freight corridor beginning in San Bernardino County and continues to the California/Oregon State Line. U.S. 395 is a critical connection for freight in Northern California between SR 36 in Susanville and Reno, NV, and serves as part of the SR 299/44/36/U.S. 97 corridor between the Pacific Coast (Port of Humboldt) and Reno, NV. The Sierra Army Depot is the largest military storage facility in the nation and is accessed from U.S. 395 south of Susanville.

State Routes (SR)

SR 20 (SR 29/53/49/I-80)

Critical east-west interregional freight corridor beginning at the Pacific Coast near Fort Bragg, continuing eastward across the northern Central Valley, and connecting with I-80 in the Sierras. This route connects four important interregional corridors; I-5 (upper Central Valley); U.S. 101 (California's North Coast); SR 99 (entire Central Valley); and SR 70 (western Sierra). This critical corridor also serves recreational travel for the Sierra Nevada Mountains to the North Coast, and it is the "crossroads" or "hub" for agricultural and goods movement in the North Central Valley and through the Yuba City/ Marysville urbanized areas (for connections to SR 99 and SR 70). This corridor is also an important regional route serving the rural communities of Mendocino and Lake Counties.

SR 44

State Route 44 traverses northcentral California through the northern Sacramento Valley. It begins at the junctions of SRs 273 and 299 in Redding, connects to SR 89 near the Sierra Nevada Mountain range, and ends at SR 36 (Lassen County). SR 44 serves as part of the SR 299/44/36/U.S. 395 corridor between the Pacific Coast (Port of Humboldt) and Reno, NV.

SR 49

North-south interregional route that serves many historic mining communities of the California Gold Rush. This rural highway begins at Oakhurst (Madera County) and continues generally northwest through the counties of Tuolumne, Calaveras, Amador, El Dorado, Placer, Nevada, Yuba, Sierra, and Plumas where it ends at its junction with SR 70 (in Vinton). State Route 49 acts as a "Main Street" throughout the Sierra Nevada Foothills and functions as an important last-mile connector for local goods movement.

SR 70

Rural minor arterial highway beginning at SR 99 (Sutter County near Catlett Road in Marysville) and ending at U.S. 395 (Hallelujah Junction). This route crosses SR 49, SR 89, SR 149, SR 191, SR 284, and U.S. 395, and serves the long-distance movement of people and goods.

SR 89

North-south interregional mountain highway beginning at I-5 (Mount Shasta) and ending at U.S. 395 (near Coleville). This 243-mile long corridor provides access and serves as a major thoroughfare for many small communities in northeastern California and provides access to tourists and service providers (hotels, resorts, parks, restaurants) to major recreational attractions and resource areas. Tahoe Basin industries are dependent on this route to provide access for the delivery of goods and services. This corridor also provides lifeline access to Sierra and Alpine Counties and linkages between I-5 and SR 36, SR 44, SR 70, and SR 299. Portions of SR 89 in Siskiyou and Shasta Counties are part of the detour when I-5 is closed through the Sacramento River Canyon.

SR 99

Critical north-south interregional freight corridor and an important highway for California's economy. This corridor serves as a major farm to market route for most of the agricultural products from the Central Valley. Most of the commercial and personal travel between the

cities within the Central Valley use SR 99. This route also serves as the main access route for smaller urban areas to urban services available in the larger urbanized areas.

SR 197

North-south two-lane minor arterial serves regional and interregional traffic and provides for local access and the movement of goods between the U.S. 101 (at Fort Dick) and U.S. 199 (near Hiouchi). This route allows for the movement of extra-legal loads and is ultimately expected to be designated as an STAA truck route between U.S. 101 and the SR 197/ U.S. 199 junction.

SR 255 (Arcata to Samoa Peninsula)

Key intermodal route that connects the Port of Humboldt Bay to U.S. 101.

SR 299

Major east-west interregional freight corridor connecting the Port of Humboldt (via SR 255 and U.S. 101) and other Northern California industries to two major north-south corridors (U.S. 101 and I-5). It is also part of the corridor that connects the Pacific Coast to Reno, NV (via SR 299/44/36/U.S. 395). The route serves a variety of traffic, including local (intra-regional), recreational, commuter, and commercial. It is classified as a National Forest Scenic Byway and part of the California Freeway and Expressway System (U.S. 101 to I-5), and it is heavily utilized for recreational access to and along the Trinity River. This critical freight corridor provides for the interregional movement of goods (commerce, timber, nursery, greenhouse products, dairy products, cattle, hay, pasture and range, wine grapes, forest products, colony of bees, strawberries, rice and alfalfa, livestock, potatoes, and vegetables), and it links rural communities and small urban areas across the northern part of the state to national and international markets.

Freight Rail

Class I Railroads

Two Class I railroads, UPRR and BNSF, provide freight rail services within the NCR. The main UPRR route runs north and south through Caltrans District 2 and the center of Redding, paralleling the I-5 corridor. It connects service with main east-west corridors at Seattle, Portland, Oakland, and Los Angeles. BNSF has a route (using some UPRR-trackage rights) in District 2 that serves as a primary unit and manifest (mixed car/cargo) freight. Major commodities shipped in the region include tomato products, olives, rice, cheese, frozen foods, beer, wine, and wheat with some stone, petroleum products, lumber products, and chemicals.

Short Line Railroads

The North Coast Railroad Authority (NCRA) owns the Northwestern Pacific (NWP) Railroad short line (which partially parallels U.S. 101) from Korbel (Humboldt County) to Healdsburg (Sonoma County) and has an operating easement from Healdsburg to Lombard (Napa County). Senate Bill 1029 (2018) began the process of transferring the southern operating easement to the Sonoma-Marín Area Rail Transit; and railbanking of the northern portion of the right-of-way. A proposal for an east-west connection from the Port of Humboldt Bay to the national rail system is being considered. Other rail services in the region include:

- Service in Tehama County, provided by the California Northern Railroad (CFNR) and UPRR, is focused on heavy or bulky freight materials produced locally and shipped regionally.
- Rail tracks from Lassen County transport lumber products and perlite to Oregon.
- Several rail spurs in Shasta County exist for freight loading/unloading.
- Central Oregon and Pacific Railroad (CORP) is a Class II railroad out of Eugene, Oregon that interfaces with the UPRR at Black Butte and Montague in California. Lumber and related products are its primary carload business.
- Although the Skunk Train between Fort Bragg and Willits is currently exclusively passenger service, it could resume freight service in the future.

Seaports

Maritime facilities exist in all three coastal counties of Del Norte, Humboldt, and Mendocino. The once-bustling Port of Humboldt Bay is California's northernmost deep-water shipping port and the only port between San Francisco (225 nautical miles south) and Coos Bay, Oregon (156 nautical miles north). Over the years, logging restrictions, natural events, and competition have dramatically lowered the port's activity levels. Canada and China are the Port's main trading partners.

Marine transport is constrained due to channel depths in the North Bay Channel of Humboldt Bay, which affects the navigability of the Bay for deep-draft vessels common on the Pacific Ocean shipping lanes. Harbor deepening projects will allow the Port to accommodate large Panamax vessels. Forest products dominate both exports and imports, but petroleum products are also imported. Approximately 90 percent of Humboldt County's gasoline and diesel, as well as about 70 percent used by Del Norte, Trinity, and Mendocino Counties, is imported into Humboldt Bay, and over half of the fresh oysters consumed in California are grown in the bay. The Port also serves cruise ships, Navy vessels, the U.S. Coast Guard, and commercial fishing. The long-term economic well-being of the Port of Humboldt depends to a considerable extent upon market competitiveness and efficient connections to inland areas by truck transportation. The challenge of a drastically-reduced timber industry, competition from other seaports, continued expense of dredging, and deteriorating infrastructure makes it difficult for Humboldt Bay to reclaim a thriving status. Businesses that entice imports and create wanted exports will increase demand for port services. If these businesses are revived, truck and port rail access would also need attention.

In Del Norte County, the City of Crescent City owns and maintains a harbor with a commercial fishing fleet and public-access docks. The Crescent City Harbor cannot accommodate large container ships, but it is the only "harbor of refuge" between Humboldt Bay and Coos Bay. Most docks at Crescent City Harbor were destroyed by surges from the 2011 Japan tsunami. A tidal gauge was installed in the Crescent City boat basin in 1934. Since its installation, Crescent City has been hit by 34 tsunamis, large and small. In Mendocino County, maritime services for commercial fishing, the U.S. Coast Guard, and private vessels are provided by Noyo and Point Arena Harbors.

Air Cargo

Although the smaller airports of the NCR do not have the same economic impact as the large Southern California and Bay Area airports (which move more than 90 percent of the state's airborne freight), these smaller airports do play an important role by handling cargo like mail and parcels for remote rural communities. Rural airports connect smaller communities to larger global markets as well as play other vital roles – especially in emergencies (e.g., critical medicine and organ transport and disaster response). Uncharacteristic of a traditional truck, sea, and rail freight, commodities transported by aircraft tend to be light-weight, of high-value, time-sensitive, and traveling a long distance.

There are fifty public use airports spread throughout the region, but only three scheduled service commercial airports – Redding Municipal, Jack McNamara, and Arcata. The closest international airports are Sacramento International Airport in California, Rogue Valley International-Medford Airport in Oregon, and the Reno-Tahoe International Airport in Nevada. Virtually all airports move light cargo and/or serve as delivery transfer locations; however, the following list contains the more prominent cargo-carrying airports in the region.

Airports

Redding Municipal Airport handles most of the regional cargo and is at the center of airfreight and package movement activity. Federal Express (FedEx), United Parcel Service (UPS), and United States Postal Service (USPS) serve this airport using heavy and light trucks, air freight, and charter air services.

Jack McNamara Field/Del Norte County Airport is served by FedEx and SkyWest, making it an important cargo hub for the area.

Murray Field and Redwood Coast Airports are run by Humboldt County Public Works. In 2013, Murray Field, Humboldt County's main cargo airport and sole base of operations for FedEx air cargo operations, transported over 860 metric tons of cargo. The Redwood Coast (formerly known as the Arcata-Eureka Airport) is classified by the Federal Aviation Administration (FAA) as a primary commercial service airport and designated as an international Port of Entry. This airport captures only cargo transported on passenger airline flights. Total air cargo handled at Murray Field and California Redwood Coast-Humboldt County Airport is down by 32 percent in the last decade – a loss of an average of 1,599 pounds of cargo a day. Air cargo at the airports peaked in 2007, with an average of 5,100 pounds per day. By 2016 that number had fallen to an average of 3,400 pounds per day.¹³

Ukiah Airport provides recreational flying, pilot training, charter, fuel, maintenance, corporate, small business, air freight (scheduled FedEx and UPS flights), and courier services.

Section 2. Policies, Programs, and Major Freight Infrastructure Investments

The seventeen counties of the NCR have common transportation, growth, and land use issues, and as such, can benefit from a well-formulated and unified strategies that can be advocated to implementing agencies and the public. In the NCR where small communities are scattered across large expanses, undeveloped forest, foothills, mountains, and coastal lands, trucks are the primary freight mode. Truck drivers must travel further distances, consume more fuel, and incur greater transport costs to move goods into or out of this region. Further, truckers have difficulty finding parking and other services as many of these rural communities are separated by 100 miles or more and many do not offer any services

State highways connect communities to each other and to major population centers of the state. Therefore, it is not unusual for a single state highway to serve as a community's primary freight route, "Main Street," and an emergency evacuation route. However, many of these freight routes do not have parallel and connecting routes that can serve as alternative passages for trucking. Many of these alternate options are local roads or highways that were not designed to carry larger vehicles.

The NCR's steep and unpredictable terrain creates challenges for developing surface roads, which end up meandering along narrow, winding, steep passageways that are not ideal for large truck transport. Many of the roads in the NCR were constructed post World War I, have not been upgraded to current highway standards, and are deteriorating. In 1997, Congress began allowing heavier truck weights with no maintenance funding increase, and as a result, many rural highways in this region have significantly deteriorated. The 2012 Statewide Transportation System Needs Assessment identifies Lake and Mendocino Counties as having a "poor" Pavement Condition Index rating, and the region's remaining nine counties are in the "at-risk" category. Funding levels for bridge maintenance, repair, and replacement has also dwindled, leaving many bridges throughout the region with maintenance concerns or without meeting current FHWA design criteria standards. More than 36 bridges along I-5 do not meet the new minimum vertical clearance standard of 16 feet above the roadway and over 24 lack weight capacity for full permit loads.

In 1982, Congress passed the STAA of 1982 that established national standards for truck widths and lengths and linked those standards to the designation of the National Network. However, many rural freight corridors either have not been updated to meet the national standards or have segments (network gaps) that have not been upgraded. Ensuring that all main freight highways are upgraded to national standards, thereby allowing access to industry-standard freight trucks, will enhance regional livelihood and increased the NCR's competitiveness. The non-STAA highways and highway segments result in chokepoints that prevent freight industry-standard trucks from accessing the region. This results in truckers having to make more trips using smaller California Legal trucks that are not equipped with clean technologies to move the same amount of goods. Simply put, with STAA access, manufacturers and industries would be able to transport more goods, utilize clean technologies, while making fewer trips (hence reducing VMT).

The NCR is also an important thoroughfare for freight, with trucks being the primary mode due to their flexibility and ability to serve as the “first and last mile” for other modes. Several projects to ease horizontal and vertical roadway alignments--allowing for STAA access--and expanded trade opportunities within and beyond the state are planned or underway. It is also critical to find stable funding to maintain roadways that handle heavy trucks and equipment in adequate condition.

Similar to many regions in California, the NCR is heavily impacted by wildfires. In addition to supporting freight movement, the rural freight highways also act as regional and local evacuation routes as well as access routes for CalFire and Forest Service trucks to quickly reach areas to combat wildfires and stage firefighter camps. With new State regulations, controlled burns will be more frequent, requiring more CalFire and Forest Service access. Prescribed forest thinning will likely increase logging activity and associated logging vehicle traffic within this region. Power and water utility trucks also require rapid access to its facilities during the fire season. It is anticipated that climate change will result in longer fire seasons which will require larger firefighting equipment to use outdated rural highways that may not be able to accommodate.

To support the region’s freight vision, below are a list of strategies that the region is working to implement:

- Focus freight planning and funding efforts on the critical freight backbone network for the region (e.g., SR 99 Tehama Expressway, Lake Britton Bridge (SR 89), Pit River Bridge (I-5 over Shasta Lake), Whiskey Creek Rehab (includes Shasta Divide Climbing and Bike Lane), Strategic Interregional Corridor Opening to STAA (299-44-36-395) projects).
- Fund near-term projects and develop actions to support those longer-term priority projects that are characterized as not fitting the short-term criteria but are highly important to this region and cannot be funded under traditional funding programs.
- Encourage regional partners to pursue Project Approval and Environmental Document (PAED) on priority projects in preparation for competitive funding programs.
- Improve passing opportunities (e.g., truck climbing lanes) or physical restrictions like narrow and winding roadways, substandard vertical and horizontal road alignments, and weight restrictions where feasible and practical.
- Address significant conflicts between local and interregional travel (“Main Streets” as highways).
- Asset Management.
- Improve deteriorated roadways.
- Improve truck parking and service opportunities.
- Complete the California Freeway and Expressway System on critical rural freight routes.
- Upgrade key supporting routes that serve as alternatives or redundant options to the State Freight Network, by bringing them to facility concept.
- Realign and widen highways at select locations to allow the passage of industry-standard STAA trucks, thereby opening the entire priority interregional corridor for STAA access (e.g., U.S. 101 Corridor, SR 44 Corridor (SR 299/44/36/U.S. 395)).

- Identify and provide improved detours that can be utilized during road closures and inclement weather (e.g., detours around the Siskiyou Mountains and Sacramento River Canyon).
- Remove gaps in the transportation system (e.g., complete I-5 to 6-lanes within the Redding/Anderson area) to accommodate freight flows.
- Expand the use of Intelligent Transportation Systems (ITS) to enhance early warning and real-time information for pre-trip and in-route traveling.
- Encourage truck climbing lanes where feasible and practical.
- Improve the freight transportation system to accommodate emergency response vehicles.

Central Sierra Region

Section 1. Regional Overview

The Central Sierra Region (CSR) is comprised of the TRPA boundaries within Placer and El Dorado Counties (Caltrans District 3), Inyo and Mono Counties (District 9), and Alpine, Amador, Calaveras, Mariposa, and Tuolumne Counties (District 10).

The western slope of the Sierra Nevada encompasses some of the oldest transportation routes in California. Many of the highway alignments follow routes developed during the Gold Rush, and subsequently developed as private toll roads until the establishment of the SHS in the early twentieth century. Many of these original routes provided access to markets for the various primary extractive industries in the region—mining and quarrying, logging, and to a lesser extent, farming and ranching. It was after World War I that trucking displaced rail as the primary transport mode of these goods. With time, the region shifted from a shipper of goods to a receiver. Although some extractive mineral operations remain in operation, gold mining essentially ceased with the executive order to close the mines during World War II; logging declined as global markets expanded in the 1980s; and although farming and ranching continued, there has been little impetus or opportunity to increase or preserve market share relative to other agricultural regions. During the period following the 1970s, population growth in the region increased largely due to migration from other areas which may contribute to the region's above average median age compared to the State's.

Tourism and recreation were components of the local economy as far back as the nineteenth century with Yosemite Valley, businesses aligned with tourism have boomed since World War II. The CSR's travel industry is comprised of retail and services including lodging establishments, gas stations, retail stores, restaurants, and other business that offer services that support recreation and tourism. Income from tourism benefits the region directly (employment and earnings linked to spending from travelers at establishments), indirect impacts (employment and earnings linked with the industries that supply goods and services (e.g., hotels, car rentals, ski resorts), and induced impacts (employment and earnings linked to the purchase of food, lodging, and transportation for the travelers and the travel industry employees). It is important to note that the direct travel impacts of recreation and tourism in the CSR benefits the state and local economies. For example, in 2018, approximately \$357 million in state and local taxes

were generated by direct travel spending (e.g., fuel, food, services, and lodging). Please see **Table 6.B.3.** for direct travel impacts by county in 2018.

Table 6.B.3. Direct Travel Impacts by County (2018)

County	Spending		Employment (Jobs)	Tax Revenue		
	Total	Destination (\$Millions)		Local (mil, USD)	State (mil, USD)	Total (mil, USD)
Alpine	35	35	271	1	1	2
Amador	150	143	2,137	5	7	12
Calaveras	205	196	2,752	5	9	15
El Dorado *	1,040	986	12,392	44	46	90
Inyo	246	242	2,462	10	9	19
Mariposa	473	470	4,122	21	14	35
Mono	608	605	5,608	36	19	55
Placer *	1,413	1,328	14,487	44	64	109
Tuolumne	264	254	2,396	9	12	20
Total	4,434	4,259	46,627	175	181	357
*Represents the entire county Source: Dean Runyan Associates, Inc. (2019). 2010-2018 California Travel Impacts, Sacramento, CA: State of California						

The travel industry relies on freight moved by trucks along the SHS to provide fuel to the gas stations, produce to the stores, and supplies to the hotels. A reliable and connected freight transportation system is critical to supporting this region.

While tourism is a significant economic generator, it has also shaped the regional land use and demographics over the decades. Travelers captivated by the region's beauty perceive this area to be more affordable and offering a better quality of life for the elderly than the highly populated urban areas. Affluent city dwellers relocate to the CSR with the expectation that they will have the same access to goods and services that they had in urban, but usually discover that access to medical services and other goods and services are significantly diminished in these rural areas – forcing these often-elderly drivers to maneuver local rural highways for lengthy trips to access critical services.

Table 6.B.4. below describes the distinguishing characteristics of each county in the Central Sierra region:

Table 6.B.4. Central Sierra Regional Overview

County	Distinguishing Characteristics
Tahoe Basin Counties	<p>The Lake Tahoe Basin (the Basin) is located in the Sierra Nevada Mountain Range, running along the eastern portion of California in El Dorado and Placer Counties and is centered by Lake Tahoe, consisting of 71 shoreline miles (42 miles in California and 29 in Nevada). Planning and land use operations are handled jointly by the State of California, the State of Nevada, TRPA, the Tahoe Transportation District (TTD), and other special interest groups focusing on watershed protection, environmental and animal preservation. The Basin is heavily reliant on tourism, which often peaks in the summer and winter months due to the large number of resorts and outdoor based activities in the area.</p>
Alpine	<p>Alpine County is located in the Sierra Nevada Mountains in eastern California. It is approximately 30 miles south of South Lake Tahoe, 85 miles south of Reno, Nevada, and 120 miles east of Sacramento. Recreation and the tourism comprise a large part of the economy and employment. The County's rugged terrain and its remote location make it an ideal area for recreational travel. However, the harsh winter weather and heavy snowfall often result in winter closures of the roads serving it. Roughly 95% of the County's land is publicly owned and designated wilderness areas or open spaces, making it a prime location for fishing, skiing, hiking, hunting, and bicycling.¹⁴</p>
Amador	<p>Amador County is located approximately 35-miles southeast of Sacramento on the western slope of the Sierra Nevada mountain range. The county has a diverse topography with elevations in the Foothills at around 250 feet to approximately 9,000 feet above sea level in the mountainous regions. Amador's economy was hit hard by the last economic recession, resulting in approximately 3.5% of its population (1,350 residents) moving out of the county between 2010 and 2013.¹⁵ Like Alpine County, Amador's economy is heavily reliant of recreation and tourism. Amador's economy is also supported by the Mule State Prison, wineries in the Shenandoah Valley, and mineral resources industries near Ione.</p>
Calaveras	<p>Tourist attractions in the Calaveras County range from gold-panning and winetasting to skiing, camping, hiking, fishing, cavern-exploring, and bicycling. According to the Calaveras Visitors Bureau, over a million visitors visit the county annually, and tourism supports 2,400 jobs in the county and contributes nearly \$6 million in state and local taxes¹⁶. Future employment</p>

	growth is expected to occur in sectors such as construction, leisure and hospitality, education and healthcare, and government services.
Mariposa	Recreation associated with Yosemite National Park and government services are the primary industries in Mariposa County. Combined, the leisure and government sectors employ nearly 4,000 people, and more than half work in or around Yosemite, either maintaining the park or serving the millions of tourists that visit each year.
Tuolumne	Tuolumne County is a destination for tourism from outside the region. Most travelers use the state highways to access the county. State Park destinations include Columbia State Park, Railtown 189, and Yosemite National Park. "According to Yosemite National Park in 2015, there were approximately 1.2 million visitors using the Big Oak Flat Entrance to Yosemite along SR 120. The Tuolumne County Visitors Bureau estimates that visitors to Tuolumne County added approximately \$205 million to the local economy in 2014 ¹⁷ ."
Inyo	Inyo County, located in the easternmost portion of central California, spans the southeastern length of Sierra Nevada Mountains between Bishop and just north of Walker Pass. It borders the State of Nevada (east), Mono County (north) and San Bernardino and Kern Counties (south). The county is comprised of the low desert of Death Valley, the high desert of the Owens Valley and the dramatic escarpment of the eastern High Sierra including Mt. Whitney (14,495 feet). The City of Bishop is the only incorporated city. Other major communities within the county include Big Pine, Independence, Lone Pine, and Shoshone. ¹⁸ Domestic and international tourism is the major economic activity in the region with over 13 million visitors annually to the region. Although development is limited since much of the land is publicly owned (2 percent private ownership), in 2018, agriculture production was \$21,499,000. Other natural resource-related industries, including renewable energy and mining depend on the highway system for production and maintenance access.
Mono	Mono County's population in 2007 was estimated to be 13,985 persons; 7,650 persons (54 percent) in Mammoth Lakes and 6,425 persons (46 percent) in the unincorporated portion of the County. ¹⁹ Mono County is home to Mammoth Mountain Ski Area, which attracts hundreds of thousands of visitors each year. The county is also a popular destination for summer recreation destinations including the eastern entrance to Yosemite National Park, Inyo National Forest, and Mono Lake. Although development is limited due to much of the land being public (7 percent private ownership), 2018 agriculture production was \$32,347,000. Other natural

	resource-related industries, including renewable energy and mining also rely on the highway system for production and maintenance access.
Source: Caltrans (2019)	

Truck Routes

Interstate Routes (I/U.S.)

U.S. 6

Interregional route that links California with other economic hubs in the western United States. It provides access to commercial, residential, agricultural, and recreational lands, and serves as the “Main Street” for the communities of Chalfant and Benton. This route is part of the Strategic Highway Corridor Network (STRAHNET), which is a network of highways that provide the military with continuity and emergency capabilities for defense. Most of the freight on U.S. 6 flows between Southern California, northern Nevada, and Idaho. The Eastern Sierra Corridor Freight Study (2019) estimates that the Annual Average Daily Truck Traffic (AADTT) for truck traffic will grow from 37% to 58% by 2040. During the inclement weather conditions, U.S. 6 serves as a detour for U.S. 395.

U.S. 50

East-west highway from its junction with I-80 (Yolo County) through Sacramento County, and into the State of Nevada (via El Dorado County). Within the Tahoe Basin, US 50 serves as the main commercial thoroughfare for the communities of South Lake Tahoe and Meyers. The route is heavily congested during the summer and winter peak tourism months. Tahoe Basin industries are dependent on this route to provide access for the delivery of goods and services.

U.S. 395

Principal north-south freight corridor beginning in San Bernardino County and continues to the California/Oregon State Line. This corridor provides a consistent high level of service and lifeline accessibility for rural communities and for interregional and interstate movement of people, goods, and recreational travel along the eastern slope of the Sierra Nevada Mountains in both Inyo and Mono counties. Approximately 60 percent of the annual average daily traffic (AADT) is attributed to recreational activities and 20 percent is attributed to goods movement. The Eastern Sierra Corridor Freight Study (2019) estimates that the AADT for truck and five or more axle truck categories to grow from 37% - 59% by 2040. U.S. 395 also serves as “Main Street” to many communities in the Eastern Sierra including Lone Pine, Bishop, and Bridgeport. U.S. 395 provides critical links to U.S. 6 and I-80 to the north and SR 14 to the south.

State Routes (SR)

SR 49

North-south interregional route that serves many historic mining communities of the California gold rush. This rural highway begins at Oakhurst (Madera County) and continues generally

northwest through the counties of Tuolumne, Calaveras, Amador, El Dorado, Placer, Nevada, Yuba, Sierra, and Plumas, where it ends at its junction with SR 70 in Vinton. SR 49 acts as a “Main Street” throughout the Sierra Nevada foothills and functions as an important “last mile” connector for local goods movement.

SR 88

East-west Trans-Sierra route connecting Stockton, CA to the State of Nevada, and is an important route for the importation of alfalfa from Nevada to California dairies. The route is the southernmost year-round highway until SR 58 over Tehachapi Pass in Kern County. Although SR 88 is a Surface Transportation Assistance Act (STAA) of 1982 route to the City of Jackson, it serves as an alternative route during intermittent winter closures of I-80 and U.S. 50.

SR 89

North-south interregional mountain highway that begins at I-5 in Mount Shasta and ends at U.S. 395 near Coleville (Mono County). This 243-mile long corridor provides access and serves as a major thoroughfare for many small communities in northeastern California and provides access to major recreational attractions and resource areas. Tahoe Basin industries are dependent on this route to provide access for the delivery of goods and services. This route provides lifeline access to Sierra and Alpine Counties and provides a linkage between I-5 and routes SR 36, SR 44, SR 70, and SR 299. During the winter, portions of SR 89 are closed between Lassen National Park and Monitor Pass.

SR 120

East-west highway that connects I-5 east of the Bay Area to U.S. 6 north of Bishop. This route was the first highway to connect to Yosemite National Park, and it is one of the original state highways constructed prior to World War I. Although an important truck freight route into Tuolumne County, freight crossing Tioga Pass is restricted by the park.

SR 267

East-west 11-mile long undivided two-lane mountain highway that connects I-80 in Truckee (Nevada County) to the North Shore of Lake Tahoe in Kings Beach (Placer County). This corridor provides access to recreational, residential, commercial, and industrial uses. Facilities along the SR 267 corridor include the Truckee Tahoe Airport and the primary administrative offices of the Town of Truckee. Recreational sites include the Northstar California ski and year-round resort, and the Martis Creek Lake recreation area.

Freight Rail

Historically, there were several logging railroads in the Mother Lode. Currently, there is one Class III short line that serves Tuolumne County from Stanislaus County paralleling the Stanislaus River. The Sierra Railroad provides both recreational and freight services between Oakdale and Standard on an irregular schedule.

Air Cargo

Bishop Eastern Sierra Regional Airport expects commercial designation by Fall, 2020, but no freight service is yet available.

Section 2. Corridor Strategies

Unlike the densely populated urbanized areas of the state, where manufacturers and industries are located near large highways and interstates, and freight providers have modal choices (shipping, rail, air cargo); the rural communities within the CSR are isolated from each other and the rest of the state by miles and mountains and are heavily reliant on trucks for moving freight and do not have direct connections to major freeways, interstates, or major population centers. For example, of the seven counties (Alpine, Amador, Calaveras, Inyo, Mariposa, Mono, Tuolumne) and partial counties of Tahoe Basin (El Dorado and Placer) that comprise this region, only Placer County has direct access to an interstate route (I-80).

Furthermore, many of the highways that serve the CSR were constructed decades ago. Most of the highway construction dates from the interwar period and has rarely been upgraded. Subsequently, these routes have truck weight and length restrictions that have not been upgraded to Surface Transportation Assistance Act (STAA) of 1982 standards that are required to accommodate standard freight industry trucks. These restrictions limit accessibility to this region to smaller non-standard trucks and result in more freight trips, vehicle miles traveled, and greater transportation and product costs. The non-STAA highways and highway segments result in choke points that prevent freight industry standard trucks from accessing the region. As a result, truckers must make more trips using smaller California Legal trucks that are not equipped with clean technologies to move the same amount of goods. Simply put, with STAA access, manufactures and industries would be able to move more goods, and utilize clean technologies, with fewer trips while decreasing VMT.

A key consideration of the transportation system is to provide an efficient modern truck connection between the cities and towns of the region with the larger freight hubs and to provide a continuous STAA route, as well as a connection for last mile service. A secondary consideration is to develop an interconnected network by providing a north-south connection along SR 49 consistent with its inclusion in the National Highway System.

For the routes that may have zero-emission or near zero-emission trucks, accessibility to charging stations remains a challenge. Millions of visitors are drawn to this Region to view the beauty of the rugged mountains, hike mountain trails, and to fish the rivers and lakes. The same geographic features that make this area a tourist favorite also make it difficult to move freight and maintain the transportation system. The steep and unpredictable terrain creates challenges for developing surface roads, which often follow narrow, winding, steep river valleys and mountain passes that are not ideal for large truck transport. During winter months, these mountainous highways are susceptible to closures due to landslides, slippages, flooding, and snow cutting off rural communities from the rest of the state. Truck drivers that serve this region must travel further distances, consume more fuel, and incur greater transport costs to move goods into or out of this region. Truck drivers have difficulty finding truck parking, due to

narrow highway shoulders, few turnouts, and lack or limited services offered by these isolated communities.

The CSR is heavily impacted by wildfires, which requires regional highways to not only support freight movement but also act as evacuation routes and a way for CalFire and Forest Service trucks to quickly access areas to combat wildfires and stage firefighter camps. With new State regulations, controlled burns will be more frequent, again requiring CalFire and Forest Service access. Prescribed forest thinning will likely increase logging activity in the Central Sierra with associated logging vehicle traffic. Power and water utility trucks also require rapid access to their facilities during fire season. With climate change, fire seasons are getting longer, causing more frequent demand for larger firefighting equipment. The increased demand makes highway improvements for freight traffic even more important.

Trucking Strategies

- Improve passing opportunities or physical restrictions on narrow, winding roadways, and substandard vertical and horizontal road alignments.
- Address significant conflicts between local and interregional travel (“Main Streets” as highways).
- Implement or update Intelligent Transportation Systems (ITS).
- Improve deteriorated roadway.
- Improve truck parking and service opportunities.
- Upgrade freight corridors to accommodate STAA trucks.
- Complete the California Freeway and Expressway System.
- Upgrade highways to four-lanes where feasible and practical.
- Encourage truck climbing lane where feasible and practical.
- Improve the freight transportation system to accommodate emergency response vehicles and evacuation route.

Bay Area

Section 1. Regional Overview

The San Francisco Bay Area Region (Bay Area) is home to approximately 7.7 million people. The regional goods movement infrastructure includes the nation’s eighth largest container port (the Port of Oakland) and several specialized seaports; two of the most active air cargo airports in the Western U.S., San Francisco International Airport (SFO), and Oakland International Airport (OAK); major rail lines and rail terminals; and highways that carry some of the highest volumes of trucks in California. A significant share of the regional economy is associated with goods movement-dependent industries. This includes industries that either produce goods for sale, or for whom transportation access to markets is a critical aspect of their business operations, such as the construction industry.

Economics of Goods Movement in the Bay Area

In the Bay Area, goods movement-dependent industries account for \$487 billion in total output (50 percent of total regional output) and provided almost 1.1 million jobs (32 percent of total regional employment).²⁰ The large difference between the shares of industrial output and shares of employment provided by goods movement-dependent industries in the Bay Area is due to two factors: manufacturing in the Bay Area has shifted increasingly toward high-value products that do not use labor-intensive production processes such as biotechnology products; and many high-tech product manufacturers have shifted its production activities offshore but have kept their value-added design and development activities in the Bay Area.

The Port of Oakland has three core businesses: operation and management of the seaport, OAK (airport), and commercial real estate along the waterfront (Jack London Square). The Port of Oakland maintains the highest export ratio of any port on the West Coast and generally retains a 50/50 balance of import and export container volume throughput. In 2010, the Port of Oakland commissioned an economic study that revealed the Port of Oakland and its partners provided approximately 73,600 jobs in the region and was tied to nearly 827,000 jobs nationwide through direct, indirect, and induced employment. Nearly one in five direct jobs created by the Port of Oakland is held by an Oakland resident, and the jobs associated with the Port of Oakland paid 10 percent above the regional average.²¹ The Port of Oakland paid over \$56 million in taxes, which had a multiplier effect on the economy of over \$230 million. Transportation sectors (truck, rail, and “other”) were responsible for creating more than 76 percent of the 10,900 direct jobs, with warehousing and storage, government, and construction industries making up the rest. The indirect and induced jobs are mostly in the services sector and government.

Local Goods Movement System

The Bay Area goods movement system consists of a series of interconnected infrastructure components, including highways, rail lines and rail terminals, airports, ports and warehouse and distribution facilities. While the system is often described in terms of its modal components, it must function as an integrated whole with efficient intermodal connections.

Global Gateways

The global gateways of the Bay Area freight transportation system include the major maritime facilities at the Port of Oakland, as well as the smaller Ports of Richmond, Benicia, San Francisco and Redwood City, and the major international airports of San Francisco, San Jose and Oakland, which handle international as well as domestic air cargo.

The Port of Oakland expects continued growth in exports. On the import side, the Port of Oakland faces some significant obstacles to growth, as well as some landside challenges that need to be addressed, including impacts on neighborhoods nearby. While the Port of Oakland is

“Big Ship Ready,” the sudden surge in larger post-Panamax ships may create unintended consequences not only for the portside operations, but also landside operations.

OAK and SFO currently do not face significant capacity constraints or issues, though local access routes can be improved. One of the critical needs at OAK is the building of a dike in the area of the airport used most for air cargo movements to prevent runway flooding, which could grow more critical in the future as a result of climate change impacts. Likewise, SFO faces vulnerabilities from sea level rise. San Jose International Airport does not face present capacity constraints but is locked into a limited land footprint without expansion opportunities, should need arise. The biggest immediate need facing the region’s airports is improved roadway access. All three airports experience significant peak-hour congestion and reliability issues on the major truck routes leading to the airports (U.S. 101 and I-880), as well as on local access routes. The Bay Area also features numerous General Aviation airport facilities that significantly contribute to the economic well-being of the region.

Interregional and Intra-regional Corridors

The inter- and intra-regional corridors consist of primary highways and rail lines that serve to connect the global gateways of the central Bay Area to the rest of the State and other domestic markets. This network provides primary access to major facilities, such as the Port of Oakland and the international airports of San Francisco, San Jose and Oakland, rail yards, distribution centers, and warehouse/industrial districts. Key interregional and intra-regional truck corridors in the Bay Area include I-80, I-580, I-880, I-238 and I-680; U.S. 101; and limited segments of SR 92 (San Mateo Bridge), SR 152, SR 4, SR 12 and SR 37. Most of these corridors carry between 5,000 and 15,000 trucks per day on average, performing both long-haul and short-haul truck moves. Key segments of I-880 and I-580/I-238 connecting the Port of Oakland to the San Joaquin Valley, however, carry between 15,000 and 37,000 trucks per day on average.

Traffic congestion is one of the most prominent issues in the Bay Area. Truck delays increase the costs of goods movement and also can result in increased truck emissions. Congestion is particularly problematic for truckers because it impacts on-time performance and, in some cases, shippers may be penalized for poor reliability of service. To help address these issues, various freeway interchange, auxiliary lane, corridor capacity enhancement, and operations improvement projects have been identified in these major freight corridors.

Two Class I rail carriers, UPRR and BNSF Railway, operate in the Bay Area. The UPRR maintains and manages the Martinez Subdivision, Niles Subdivision, Coast Subdivision, Oakland Subdivision, Warm Springs Subdivision and the Tracy Subdivision. BNSF operates the Stockton Subdivision. Many passenger rail services also operate on these lines, including Amtrak (Capitol Corridor, San Joaquin, California Zephyr, and Coast Starlight), Caltrain, and the Altamont Commuter Express.

Local Streets and Roads

The local goods movement system that moves freight to and from its origins and destinations is a vital function of goods movement. Last-mile connectors, local streets that provide the critical connections between major freight facilities, and the interregional and intraregional corridors are becoming increasingly important with the growing use of e-commerce and the shift towards a knowledge-based economy. Major arterial truck routes often are used as alternatives to congested freeways for city-to-city truck movements. Farm-to-market roads in the rural parts of the region also are a vital part of the local goods movement system and serve important economic functions. The key issues identified with local streets and roads include connectivity gaps, modal conflicts, land use conflicts and truck parking issues.

Environmental and Community Issues

Port of Oakland

Queuing and congestion lead to many air quality and health impacts for neighborhoods nearby the Port. Emissions, noise, and light from port operations can adversely affect the health and wellbeing of residents. The Port of Oakland contributed about 29 percent of the pollution to the West Oakland community, with the rest being contributed by other local sources in and around West Oakland. This suggests that solutions that address local sources of pollution, as well port-related emission reductions strategies, will be important to implement. In addition, the operational issues and grade crossing issues discussed previously also generate a variety of secondary issues for the Port and the nearby West Oakland community. Over the past decade, through the Port of Oakland's Seaport Air Quality 2020 and Beyond Plan (the successor to the Maritime Air Quality Improvement Program), diesel particulate matter has been reduced by 81 percent. Truck diesel emissions are down 98 percent and ship emissions dropped 78 percent. Further, AB 617 (2017) directs air regulators to identify communities with a high cumulative pollution exposure burden and to work with communities to develop solutions. The Bay Area Air Quality Management District (BAAQMD) prepared the West Oakland Community Action Plan²² in 2019, which lays out a series of measures to be implemented over the next five years by state, regional, and local agencies to reduce pollution in the community.

Rail System

The rail system also has significant impact on communities. At-grade crossings introduce safety concerns (risk of derailment, emergency response time) and traffic delay issues to the overall transportation system. Crossing safety and traffic delay (including to buses) are related to both roadway traffic volumes and the number of trains using the route. Train horn regulation also creates noise impacts on adjacent communities. To mitigate these impacts, targeted safety improvements have been identified such as grade crossing improvements at Jack London Square in Oakland, Emeryville, and Berkeley, and establishment of Railroad Quiet Zones in Fremont.

Major Trends Influencing Goods Movement in the Bay Area

In recent years the Bay Area is planning for compact development in Priority Development Areas adjacent to transit. This can create redevelopment pressure in older industrial centers, leading to conflicts between goods movement and passenger transportation modes on congested roadways and rail lines. As land values have risen, much of the region's distribution network for serving consumer demands has moved to the northern San Joaquin Valley and northern Nevada. This is exacerbating congestion and safety conditions on the region's interregional highways.

Within the region, there is also an urgent need to address environmental justice issues while reducing pollutant emissions. Along with the region's concern over housing affordability comes an overarching concern about equity in land use and transportation decisions. The region's major goods movement corridors and facilities tend to be concentrated in close proximity to communities which are disproportionately low income and/or communities of color and where environmental justice concerns are significant. Continued investment in goods movement in these corridors must minimize impacts on these communities. At a broader level, the region continues to pursue strategies to address climate change and environmental sustainability goals as a core component of its transportation plans. This will require new approaches and new technologies for goods movement.

Section 2. Policies, Programs, and Major Freight Infrastructure Investments

Goods Movement Planning in the Bay Area

In 2016, MTC adopted the San Francisco Bay Area Goods Movement Plan, which identified five key goals:

- Reduce environmental and community impacts and improve the quality of life in communities most affected by goods movement.
- Provide safe, reliable, efficient and well-maintained freight movement facilities.
- Promote innovative technology strategies to improve efficiency.
- Preserve and strengthen a multi-modal system that supports freight movement and is coordinated with passenger transportation systems and local land use decisions.
- Increase economic growth and prosperity.

To implement the plan, MTC adopted a near-term (10 year) goods movement investment strategy in 2018. The investment strategy identified three main focus areas to achieve regional goods movement goals: Roadways, Railways, and Community Protection. The investment strategy was designed to help the region in the following ways:

1. **Deliver projects that can improve mobility and economic vitality.** The strategy will help implement projects and programs crucial to achieving the performance targets in MTC's Regional Transportation Plan/Sustainable Communities Strategy, *Plan Bay Area 2040*, including reducing delay on the regional freight network, increasing middle-wage jobs, and reducing per capita GHG emissions.

2. **Address community and environmental concerns of freight.** The strategy also sets forth a commitment to reduce impacts of pollution on communities, mitigate emissions from existing technologies, and adopt cleaner technologies. These efforts would be led by the BAAQMD, in coordination with MTC, Alameda County Transportation Commission (ACTC), Port of Oakland, and public health and environmental groups.
3. **Enable the region to coordinate and compete for state and federal fund sources.** Over the past couple years, three new major state and federal funding programs with a direct nexus to freight have been initiated. These include the National Highway Freight Program, the National Significant Freight and Highway Projects Discretionary Program (FASTLANE/INFRA), and the SB 1 TCEP. Staff estimates that the region is positioned to receive over \$1 billion in funding over the next 10 years from these funding sources alone.

Example Freight Infrastructure Investments

Port of Oakland

Access to and from the Port presents significant challenges. The most significant constraint, aside from long wait times at container terminal gates, is the impact of at-grade railroad crossings in the Port, specifically on Maritime Street, where both at-grade crossings can simultaneously be blocked by one train and result in significant truck queues. The Global Opportunities at the Port of Oakland (GoPort) project will reduce emissions from idling trucks, increase port operational efficiency, and provide significantly improved truck and rail access. The proposed grade separation and roadway reconfiguration of 7th Street from Maritime Street to Navy Roadway would eliminate the at-grade crossing of Maritime Street near 7th Street and improve operations. A third gateway to the Port, Adeline Street, features a bridge that is structurally obsolete and has grades that are not safe for trucks to traverse. Further, expanded intermodal rail terminal capacity and improvements on the rail mainlines accessing the Port, increased nearby transload warehousing capacity, and other improvements are proposed as part of the Oakland Army Base Redevelopment Project that still needs additional funding.

Equipment-based and non-equipment-based emission reduction projects have been identified for the Port of Oakland. This includes upgrade to ZE/NZE equipment, port electrical grid improvements, facility upgrades, emission reductions, and extended gate hours/days.

Mainline Rail

The UPRR Martinez Subdivision between Richmond and Oakland is the most constrained segment in the region. Adding more trains to this segment of the network may result in unstable operating conditions seriously degrading Amtrak's Capitol Corridor's on-time performance, as well as intermodal and unit trains moving to and from the Port of Oakland. In Solano County, there are a number of locations where switching operations that are necessary to access industrial customers have to take place on the mainline due to insufficient industrial

spurs and leads. This has the effect of reducing capacity and increasing travel times for both passenger and freight trains.

The Industrial Parkway Connection, Shinn Connection and new wye connections at Lathrop and Stockton Junctions are all expected to improve connectivity of the system. Likewise, targeted operational improvements such as the City of Hercules Third Track, upgrade of the water side drill track to 3 mainlines between Port and Bancroft, and track improvements to Coast Subdivision will improve system capacity and operation.

Central Valley

The Sacramento-San Joaquin River Valley and its networks of surrounding gateway passes and connecting routes make up the Central Valley Corridor (Valley), which has long been acknowledged as a critical goods movement corridor in California. This vast corridor is served by portions of Caltrans Districts 3, 6, 9, and 10. The region includes over half the State's geography (33 of 58 counties), is the fastest growing (twice the state average rate), and in 2019 became the second most populous region in California, surpassing the San Francisco Bay Area.²³ Past planning efforts created a logical, cohesive, and integrated goods movement system in the Central Valley.

There are three general types of freight movements in the region—the export of agricultural goods and products to the rest of the world; the import of finished goods from major urban and manufacturing centers into the cities and towns of the region; and the interstate and international transport from other regions through the Valley. The pattern is further complicated by the relocation of warehousing and distribution centers from the urban areas along the Coast into the Valley to take advantage of lower property values and wages, and by the local freight movements from farms to processing centers and local markets. Although the dominant transport mode is trucking, rail, maritime, and air transport all have their roles within the region.

I-5, SR 99, and BNSF/UPRR rail mainlines provide the backbone for goods movement to major gateways in Southern California, the Bay Area, and out of the state. In addition, the region features an extensive cross-valley connector system including routes such as SR 20, I-80, SR 120, SR 4, I-205, SR 165, SR 198, SR 41, SR 46, SR 58, SR 132, SR 108 and others, as well as a system of inland waterway/ports and short-haul rail. The Central and Southern Valley reported that goods movement-dependent industries (including agriculture/dairy/ranching/forestry, food processing, construction, energy production, and transportation/logistics) accounted for more than 564,000 jobs and \$56 billion in economic output in 2010, with over 463 million tons of goods moved into, out of, and within the region. This is expected to grow to more than 800 million tons by 2040. The corridor includes the three largest agriculture-producing counties in the nation and is becoming a major logistics complex with expanding numbers of mega-distribution centers and new manufacturing/processing facilities.

Projects to enhance goods movement in the Central Valley Corridor may benefit regions outside the Central Valley as well. Approximately half of all trucks with five or more axles moving through the Valley on I-5 (approximately 6,000 daily) originate from or travel to destinations outside the region.²⁴ Although heavy trucks comprise about 11 percent of volumes on I-5, many of the gateway and cross-valley connector routes have truck volumes of greater than 30 percent.²⁵

Sustainable technologies, programs, and policies in the Central Valley Corridor have some of the greatest potential to advance a number of targets in the CSFAP:

- Improve system efficiency, i.e. truck platooning, load matching, increase diversion of freight from truck to more efficient modes such as rail, shorter routes, etc.
- Transition to low- and zero-emission technology, i.e. hydrogen, electric, etc.
- Increase competitiveness and economic growth - lower export shipping costs for agriculture, and other products to improve the state economy while improving jobs/housing balance for disadvantaged communities.

Document Structure

The Central Valley region FIS is comprised of two parts due to the large size of its geographical area—1) the Northern Central Valley, and then 2) the Mid and Southern Central Valley. Each part has two sections—1) a regional overview narrative, and 2) a description of policies, programs, and major freight infrastructure investments.

Part 1. Northern Central Valley

Part 1. Section 1. Regional Overview

The Sacramento Region is a crossroads for freight moving into and out of California. The Northern Central Valley region includes the interior coastal range to the west, flat agricultural land across the valley, and foothills, river canyons, and the Sierra Nevada Mountains. The region, located north of San Joaquin County and northeast of the Bay Area, covers the counties of El Dorado, Placer, Sacramento, Sutter, Yolo, and Yuba. The region has a diverse range of industrial uses, with distribution and warehousing representing nearly 80 percent of the total industrial inventory between the Bay Area, Monterey, and San Joaquin regions. The region also is home to the J.T. Davis Rail Yard in Roseville, which is the largest intermodal rail facility in the West Coast. Similar to San Joaquin County, I-5 and SR 99 are the key north-south truck routes throughout the SACOG region.

Highways

Trucks are the primary mode, hauling approximately 68 percent of all regional commodity tons moving through the region and over 95 percent of all goods with an origin or a destination within the region. There are several major state routes that are designated as “Goods Movement Priority Corridors” by Caltrans District 3:

- I-5 Seattle, Portland, Los Angeles and serving Sacramento International Airport

- I-80 Salt Lake City, Reno, San Francisco Bay Area
- SR 99 San Joaquin and Upper Sacramento Valleys

During the winter months, approximately \$5.5 to \$7.6 million-dollar value per ton per hour are lost when trucks are delayed on I-80 from passing over Donner Pass between Sacramento and Reno.²⁶

SACOG's Rural Urban Connection Strategy (RUCS) effort also noted that agricultural commodity processing is largely performed by large-scale processors in the San Joaquin Valley, and these commodities travel almost exclusively by truck. The lack of processing capacity requires small and medium-sized farming and ranching operations to drive longer distances to markets and has been identified by SACOG as an issue that affects local growers' ability to offer greater diversity of products in the marketplace. Developing a new infrastructure of processing facilities to serve the region's local marketplace has been recommended by SACOG as a strategy that could increase and extend the market viability of these value-added products and reduce truck VMT.

The Caltrans District 3 Goods Movement Study found that bottlenecks are concentrated around the U.S. 50/SR 99 Interchange in East Sacramento, on I-5 in downtown Sacramento, on I-5 south of I-80, at the junction of U.S. 50 and SR 16, at the junction of I-80 and SR 99, and along SR 99 in Elk Grove.²⁷ These bottleneck locations are all within a 15-mile radius of downtown Sacramento.

California Trucking Association outreach participants in the Goods Movement Study indicated that interchanges at I-80/Mace, I-80/U.S.50, and I-80/SR 51 are the worst freight bottleneck locations in the Sacramento area.

Major Road Truck Network

After 2012, SACOG began to inventory and map the region's goods movement network and trucking routes. This effort identified the STAA routes, California legal routes, and local restricted or recommended routes. These routes were mapped with the intensity of trucking in the region, measured in trucks per acre. The study found that STAA trucks and 48-foot and longer semi-trailers were using secondary highways and arterials in the region--despite their lack of ability to handle the dimensions of the longer vehicles. Often, industries are located in areas where longer STAA trucks do not have access to complete STAA routes/networks—areas such as the east side of Woodland, West Sacramento, North Sacramento, and the Richards Boulevard area, South Sacramento, and Galt.

Air Cargo

Sacramento International Airport and Sacramento Mather Airport are among the top ten air cargo carrying airports in the state.

- Sacramento International Airport (SMF) is located 12 miles northwest of downtown Sacramento on I-5. In 2012, SMF had an estimated 4,718 annual freighter operations and handled over 68,500 metric tons of cargo. Federal Express (FedEx) operates wide-body and feeder aircraft through SMF.
- Sacramento Mather Airport (MHR) is approximately 14 miles east of downtown Sacramento south of U.S. 50 and is Sacramento County's designated airport to capture regional air cargo growth. MHR had an estimated 4,741 freighter operations and handled almost 43,000 metric tons of cargo in 2012. United Parcel Service operates a 20,000-square-foot facility at MHR. The airport has 66 acres of existing and designated land for additional warehouse, office, auto parking, and trucking operations areas.

Inland Ports

Port of West Sacramento

This inland bulk port is located 4.7 miles west of downtown Sacramento near U.S. 50 in Yolo County. The Sacramento Deep Water Ship Channel (DWSC) runs 43 miles from Antioch (in Contra Costa County) near the mouth of the Sacramento River, ending at the harbor of West Sacramento. The Port can accommodate five ships at berth simultaneously. North Terminal cargo facilities are currently leased and operated by SSA Marine. There are over 300 acres of vacant, developable property surrounding the North Terminal that is currently managed by the Port.

Rail

Four freight railroad systems operate in the Region:

- UPRR, the largest Class I freight railroad in the U.S., it operates 3,267 miles of track in California. The J. R. Davis Yard, located in the City of Roseville in Placer County, is the largest classification yard on the West Coast. Approximately 98 percent of all UPRR traffic in Northern California is moved through this yard.
- BNSF Railway, the largest Class I intermodal container carrier in North America and the largest grain-hauling railroad in the U.S. In California, BNSF operates over 2,130 miles of track—1,155 miles of which are owned by BNSF with 975 miles of through trackage rights.
- Sierra Northern Railway (SERA), the Class III regional railroad operates between Woodland and the Port of West Sacramento and interchanges with BNSF and UPRR. Typical commodities hauled include wood products, bulk commodities, agricultural and food products, as well as chemicals and steel.
- California Northern Railroad (CFNR), the Class III short-line railroad operates two lines on tracks in District 3: between Davis in Yolo County and Tehama in Tehama County (District 2), and between Wyo and Hamilton City in Glenn County. CFNR carries mostly food-related commodities along with some stone, petroleum products, and chemicals.

According to the FAF database, rail tonnages traveling through the region are expected to grow from just over 30 million annual tons in 2011 to nearly 48 million tons by 2035 (approximately two percent per year).²⁸

Part 1. Section 2: Policies, Programs, And Major Freight Infrastructure Investments

Regional Policies and Programs

SACOG looks to grow its multibillion-dollar agricultural economy; and recognizes growth depends on rural roads, highways, and freeways, as trucks are the main form of transportation for agriculture in the region. The RUCS project seeks to better understand how trucks and other traffic are utilizing designated trucking routes and other roads in the region to guide strategic investments in the area and better plan for maintenance and upgrades.

SACOG's MTP/SCS invests nearly \$2 billion of the Plan's road capacity budget in projects that will primarily be carried out by Caltrans for state highway investments. The investment focus is on new managed lanes, auxiliary lanes, and interchanges along the freeway system. Collectively, these investments serve travel between activity centers and accommodate trucks for inter-regional goods movement. Fixing bottlenecks along trucking corridors is important for effective movement of goods throughout the region and for traffic management, as each truck represents the traffic-generating equivalent of two to four automobiles in stop-and-go traffic. The MTP/SCS includes the following freight supportive policies and are consistent with California Sustainable Freight Action Plan Principles:

- SACOG should continue to inform local governments and businesses about a regional strategy for siting industry and warehousing with good freight access.
- Consider strategies to green the system, such as quieter pavements, cleaner vehicles, and lower energy equipment where cost effective, and consider regional funding contributions to help cover the incremental cost.
- SACOG should study, consult with, and help coordinate local agency activities to provide for smoother movement of freight through and throughout the region.
- SACOG intends to preserve some capacity on major freeways within the region for freight and other interregional traffic by providing additional capacity for local and regional traffic on major arterials running parallel to the major freeways.

SACOG also programs Federal and State funding for freight supportive projects in the Metropolitan Transportation Improvement Program (MTIP) and State Transportation Improvement Program (STIP) through regional funding rounds. SACOG assists project sponsors to objectively assess their funding applications against a variety of project selection criteria using SACOG's Project Performance Assessment (PPA) tool to analyze transportation investments at the project level. The tool specifically analyzes the following freight supportive metrics based on the project characteristics and footprint.

- Improve Goods Movement, including Farm-To-Market Travel, in and through the Region
 - Does the project serve, or connect to, a corridor used by goods movement? Indicator: Commercial VMT/ Total VMT
 - Does the project serve a facility that is congested for freight and goods movement travel? Indicator: Commercial Congested VMT(CVMT)/Commercial VMT
 - Does the project serve an area with freight-dependent jobs? Indicator: Percent of jobs in freight-dependent industries

Example Freight Infrastructure Investments

Identify a complete network of STAA routes to the Port

A SACOG inventory of STAA routes around the Port found that the network was not complete. Ensuring there is a complete network of access roads to and from the Port for STAA trucks is important to facilitate continued growth of Port activities.

SR 99 and I-5

SR 99 and I-5 are two north-south corridors that cross through the Mega-region. Coordinating improvements to SR 99 and I-5 could better support truck flows. This may include truck-only toll lanes on SR 99 to allow for smoother speeds and truck platooning, safety increases, and extra capacity. Simultaneously, facilitating truck movement between SR 99 and I-5 would help reduce congestion throughout the Mega-region, as SR 99 was not originally designed to Interstate standards and passes through several major urban areas.

Port of West Sacramento Unit Train Landing Track

The Port of West Sacramento is working with UPRR, Sierra Northern Railroads, and Cemex to support unit trains to increase competitiveness and rail transport ability. The track improvements needed for unit train service to the Port require construction of a \$1.8M unit train landing track along Industrial Blvd. There are over 300 acres of vacant, developable property surrounding the North Terminal that currently is managed by the Port of West Sacramento. The Port is experiencing some growth after a decade of financial troubles, investments with lower than expected return, and challenging projects. The current strategy includes attracting green industries; deepening the channel to 35 feet along its entire length; and reinitiating the Marine Highway project--establishing a marine highway from the Port of Oakland to West Sacramento that can divert a significant number of trucks off I-580.

Part 2. Mid and Southern Central Valley

Part 2. Section 1. Regional Overview

Local Goods Movement System

Highways

SR 132

The SR 132 corridor is the primary east/west highway and freight corridor between the City of Modesto and I-580. The route serves Beard's Tract, an industrial area east of Modesto, but does not conform to STAA standards. Along its western portion, SR 132 has become a major truck connector route between I-5 and SR 99. Approximately 8.2 million tons of freight use the SR 132 Corridor annually. The route serves to transport agricultural goods produced in Stanislaus County out to the Bay Area and the Port of Oakland, such as various nuts, vegetables, and fruits that are in high demand both domestically and internationally.

SR 108/120

Existing SR 108/120 is a vital east-west, inter-regional corridor that connects the heart of the Central Valley to the Sierra Nevada mountains all the way to the Nevada border. It begins from the backbone of the state near SR 99 and traverses through Stanislaus County and the Cities of Modesto, Riverbank and Oakdale and continues as SR 120 through the rural counties of Tuolumne, Mariposa and Mono to the Nevada border.

The corridor combining SR 108 and SR 120 is an important freight corridor route into Tuolumne County. Throughout much of Stanislaus County it is a two-lane conventional highway traversing the core of downtown Modesto, Riverbank and Oakdale. Travelers would benefit if the route bypassed the three cities. The North County Corridor (NCC) Project is an integrated freeway/expressway project that would relieve traffic congestion and improve east-west freight mobility in Stanislaus County, and the cities of Oakdale, Riverbank, and Modesto. The project will relocate SR 108 on a new alignment (while the existing SR 108 would be relinquished to the respective public agency as a local roadway) and will connect SR 108 near the City of Modesto to SR 120 near the City of Oakdale. The enhanced connectivity would generate substantial travel time savings, improve safety, reduce emissions, reduce vehicle operating costs, and overall improve quality of life for communities in the region. Implementation of NCC would support efficient movement of goods by providing a new west-east transportation facility that will reduce the number of conflict areas with non-motorized traffic, increase the average operating speeds, and improve travel time reliability. The project would also improve goods movement efficiency at a regional level, which would strengthen the agricultural and general economy of Stanislaus County.

Crows Landing Road

Crows Landing Road is more than 20 miles long, passing through a rural residential area and providing access to and from I-5 and SR 99 to several medium and large farms and dairy and food processing firms. Traffic volumes vary across the connector, with AADT of 2,500 near I-5 and 30,000 near Shackelford. Both the I-5 and SR 99 interchanges are grade-separated.

Mitchell Road

Mitchell Road is approximately 4.8 miles in length, bridging SR 99 and SR 132 and providing access to the Modesto City-County Airport and nearby industrial land uses, including several distribution warehouses and food processing firms. South of the airport area, Mitchell Road

passes through residential and commercial land uses in the City of Ceres. The road is generally two lanes in each direction with a center turn lane. Mitchell Road provides direct access for trucks with origins or destinations south of Modesto to reach the airport industrial zone from SR 99.

Air Cargo

Stockton Municipal Airport and Lathrop Intermodal Yard

Complicating the truck traffic at the Roth Road and Lathrop Intermodal Yard is the movement of airfreight associated with Amazon at the Stockton Municipal Airport that employ Airport Way to move parcels and packages to or from their fulfillment centers in Tracy and Patterson. Currently, Amazon runs three daily round trip flights through Stockton Municipal Airport.

Ports

Port of Stockton

The Port of Stockton is the largest bulk shipping port on the West Coast. A record volume of goods moved in and out of the Port in 2017, and only slowed down with the imposition of tariffs. Efforts have been underway to diversify the Port's cargo handling to include shipping containers as part of the re-implementation of the M-580 marine highway.

Port of Oakland

The Port of Oakland, the largest container port near the region, is responsible for loading and offloading 99 percent of all containerized goods moving through Northern California. It is unclear what the volume of imports arriving at the Port circulate within the Bay Area and the number that move out into the hinterland or move interstate. However, there is increasing growth in trucking companies, transloading, and warehousing in San Joaquin and Stanislaus in the communities of Tracy, Lathrop, Stockton, and Patterson. Many of the projects improving interchanges, grade separations, or last mile connectors on route such as I-5, I-205, I-580, SR 120, and SR 99 reflect this change. An example of this is the City of Manteca's proposed McKinley Avenue interchange project on SR 120, that should enhance truck access from SR 120 to Roth Road to nearby warehousing.

Rail

Major Lines, Facilities and Planned Improvements

Within the context of the northern San Joaquin Valley, the major rail freight facilities are located in Stockton and Modesto. There are three facilities associated with the BNSF: the Mormon Yard located in Stockton, the Mariposa Intermodal Yard located southeast of Stockton, and the Beard's Tract/ Valley lift facility in Empire, east of Modesto. There are two additional facilities associated with the UPRR: the Stockton Yard and the Lathrop Intermodal Yard. A planned expansion of the Lathrop Intermodal Yard has led to plans for several operational improvements and upgrades at Roth Road beginning at the ramp with I-5, with STAA improvements at the intersection with Airport Road, and a grade separation. Efforts are

underway to address a rail bottleneck at the Stockton Tower Interlink where the two Class I railroads intersect.

Southern Gateways/Connectors

The I-5 Tejon Pass gateway connects the two largest CFMP regions in the state and is the primary highway corridor between Southern California and the Bay Area. It has the highest percent trucks for Caltrans high-volume truck count locations - with 10,000+ trucks per day and 10 percent-plus trucks - seeing more than 13,000 trucks daily, comprising 30 percent of all traffic. By comparison, the SR 710 at SR 405 in Southern California saw 16,000 trucks, comprising 28 percent of the traffic.²⁹

Southern California and San Diego are the top origins and destinations for Central Valley goods. The two regions make up 56 percent of California's population, 87 percent of containerized port traffic in California, and more than 30 percent of national container traffic.^{30,31} Still, while there are out-of-state rail services in the Central Valley, there are almost no rail freight services between the Central Valley and Southern California.

SR 58 runs through the Tehachapi Pass and connects I-15/I-40 (near Barstow) to I-5 in the Central Valley. SR 58 has experienced a one-thousand-trucks-per-day increase since 2011 and has 25 percent more truck traffic than I-80 over Donner Pass. A safety truck-passing-lane project is needed on eastbound SR 58 near SR 223. By 2022, the entirety of SR 58 will be four lanes except for a seven-mile segment between I-5 and the west edge of Bakersfield at Stockdale Highway. In addition, the SR 58/14 corridor provides for important freight transport resiliency when I-5's Tejon Pass is closed due to severe climate conditions.

As freight related cost in the Inland Empire increase, the South-Central Valley is experiencing spillover growth from Southern California. Amazon has built fulfillment centers in Fresno and Bakersfield, and Walmart is building a grocery distribution center in Shafter. With more than 12 square miles of vacant industrial land in the Shafter/BFL International Airport, Delano and Tejon Ranch, the region is poised to receive additional mega distribution centers.

Throughout the South Central Valley, numerous cross-valley connectors on the STAA truck network connect to additional gateways including but not limited to SRs 152, 33, 180, 168, 41, 43, 46, 145, 198, 65, 137, 269, 58, 119, 184, 223, 166, 14, 395 and major local roads serving regional traffic, such as Avenue 7/West Nees Avenue, 6th/Corcoran Avenue, 7th Standard Road, Stockdale Highway, others. These routes provide important, last-mile connectors to major agriculture and other resource development areas, as well as connections to neighboring regions. For example, SR 46 provides an important connection for Salinas Valley produce to the UPRR refrigerated intermodal facility in Delano.

Rail

Thirty miles northwest of Tejon Pass, along the Sierras, is the Tehachapi Pass gateway. The pass features the only BNSF/UPRR corridor connecting the Central Valley and Southern California.

Nearly all rail freight shipments on this route are connecting to out-of-state destinations in the Midwest. In this connecting corridor, Rio Tinto -- a borax mining operation -- has daily BNSF unit train service to/from the POLA. If a rail freight shuttle from the Central Valley could connect to this service in Mojave, at a competitive rate, the potential for a diversion of Central Valley truck freight -- one of the largest movements within the State -- to rail might be possible. Potential emission savings and wear and tear on roadways could be leveraged as a state incentive for the project, similar to a state-subsidized, container unit train service in Norfolk, VA.

In addition, the early operating segment of the High-Speed Rail Project may free up capacity on the BNSF mainline between Merced and Bakersfield, providing an opportunity for containerized freight shuttle services from Merced, with possible stops at container loading ramps in Fresno and Shafter connecting to the Rio-Tinto unit train in Mojave. Fresno has the only intermodal container rail yard operating in the South-Central Valley; however, Delano, has the UPRR Cold Connect (refrigerated unit train service) operating between California and New York exporting produce to the East Coast via rail.

Part 2. Section 2. Mid and Southern Central Valley Corridor Policies, Programs, Infrastructure Investments

Corridor-wide system components

The 2017 I-5/99 Goods Movement Study looked at several region-wide programs along the backbone of the South-Central Valley corridor and identified the following investment areas:

- Shovel-ready projects,
- Connector projects,
- ITS – technological improvements, and
- A truck platooning demonstration project.

These investment areas were further broken down into project types that have both benefit and applicability throughout the Central Valley Corridor region.

The list has been modified to be more inclusive of the entire 5-district region.

1. *Roadway pavement and bridge maintenance.
2. *Overweight/oversize policy to allow heavier/longer trucks on I-5 in both directions between San Joaquin and Kern counties.
3. *Truck-only toll Lanes on I-5 between the I-5 and the I-205 junction in San Joaquin County, and the I-5 and SR 99 junction in Kern County.
4. *Truck climbing lanes at steep locations such as Altamont, Pacheco and Tehachapi passes.
5. Capital projects for bottlenecks congestion relief.
6. *Operational projects for bottlenecks congestion relief.
7. Connector, capital, and operational projects for improved accessibility.
8. Interchange reconfiguration program for key freight access interchanges with inadequate design.

9. *Capital projects for safety hotspots alleviation.
10. *Operational projects for safety hotspots alleviation.
11. *Container depot service near Stockton for the Port of Oakland and in Shafter for the Ports of Long Beach and Los Angeles.
12. *Short-haul rail/unit train service between the SJV and Port of Oakland.
13. *Short-haul rail/unit train service between SJV and ports of Long Beach/Los Angeles.
14. *Caltrans' truck parking information system on I-5.
15. *Truck platooning – Pilot on I-5.
16. Neighboring region/out-of-state STAA connector corridor capital, operational, safety improvements (i.e. I-80, SR 58, SR 89/44/395/14 Central Valley bypass, others).
17. *Transition to low- and zero-emission technology -- RNG, hydrogen, electric, etc.

Of the 17 project types above, over half are sustainable freight projects (indicated by an *). It is important to note that in disadvantaged communities, one of the primary strategies to improve the communities is to provide diverse economic opportunities and improve the jobs housing balance within the region.

Central Coast Region

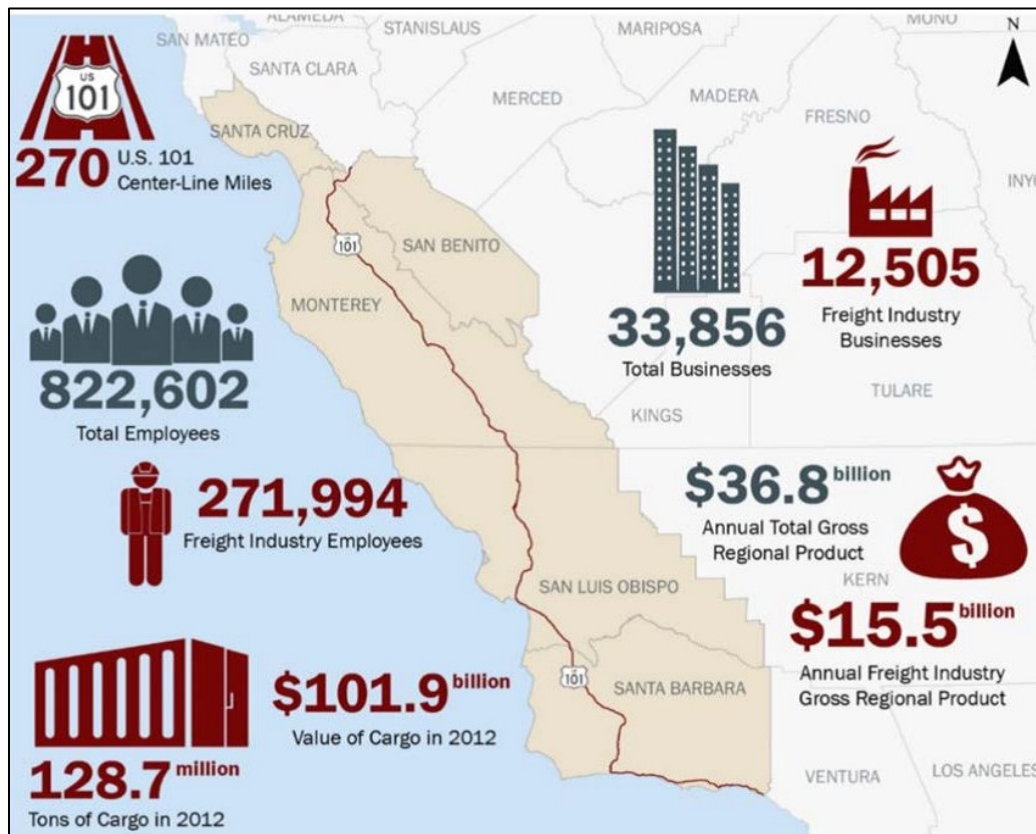
Section 1. Corridor Overview

The Central Coast region includes Santa Barbara, San Luis Obispo, Monterey, San Benito, and Santa Cruz counties. The region is known for its fresh produce and wine grape production. The region is home to major industries in agriculture, manufacturing, food processing, and other freight-related business clusters.

U.S. 101 is the primary freight transportation route and economic asset for the Central Coast region and serves a vital function along the central coast as an alternate route to I-5 during weather-related closures at the Grapevine in Southern California. Routes that provide east-west interregional connectivity include SR 166, SR 41/SR 46, and SR 156/SR 152. Similar to U.S. 101, these routes are high-volume truck routes and critical to freight goods movement.

The Central Coast Region also has two Class III Short Lines, the privately-owned Santa Maria Valley Railroad (SMVRR) and the Santa Cruz Branch Rail Line. The SMVRR system consists of 14 miles of main line track interchanging with the UPRR railroad in Guadalupe and serves Santa Maria and Santa Maria Valley. The Santa Cruz Branch Rail Line is owned by Santa Cruz County Regional Transportation Commission (SCCRTC) and operated by Progressive Rail for freight and excursion passenger service. Freight service on the Santa Cruz Branch Line operates near Watsonville, connecting to the UPRR main line in Pajaro. In general, railroads in the region tend to move goods such as lumber, coal, construction materials, fertilizer, and steel.

In 2016, goods movement-dependent industries accounted for approximately 33 percent of the jobs in the region. Goods movement-dependent industries accounted for more than \$13 billion of the \$52.4 billion gross regional product (GRP). These industries are highly reliant on U.S. 101 for local shipments as well as to provide a connection to surrounding regions that allow goods to travel throughout the United States and the world.

Figure 6B.2. Freight-Related Statistics, U.S. 101 Central Coast California

Source: U.S. DOT Bureau of Transportation Statistics using the following data set years-- employees (2013); cargo tons/value (2012); businesses (2011); gross regional product (2009)

Table 6.B.5 provides a summary of key socio-economic and infrastructure characteristics in the corridor that drive the movement of goods.

Table 6.B.5. Central Coast California Summary Economic Profile by County

Description	Monterey	San Benito	Santa Cruz	San Luis Obispo	Santa Barbara
Population (2010)	415,057	55,269	262,382	269,593	423,895
Population (2035)	495,086	81,332	308,582	315,636	507,482
Goods Movement Dependent Industry Employment (2013)	96,170	8,978a	40,410b	46,242c	80,194

Description	Monterey	San Benito	Santa Cruz	San Luis Obispo	Santa Barbara
Total GRP (2009)	\$16,016	No Data	\$9,122	\$9,577	\$17,732
Key Industries	Agriculture (salad, wine), retail, manufacturing (includes food products)	Retail, manufacturing (includes food products), agriculture	Retail, construction, manufacturing (includes food products), agriculture	Retail, construction, manufacturing (includes food products)	Retail, manufacturing (includes food products), agriculture
Key Trading Partners	San Joaquin Valley, Southern California, San Francisco Bay Area	San Francisco Bay Area	San Francisco Bay Area	San Joaquin Valley, Southern California, San Francisco Bay Area	San Joaquin Valley, Southern California, San Francisco Bay Area
Major Connecting Roads to U.S. 101	SR 156	SR 152 (some truck restrictions) SR 129 SR 156	SR 17/I-880 SR 1/SR 129	SR 46 SR 41 SR 1 SR 166	SR 135 SR 154 SR 246 SR 1
Source: Analysis conducted by AMBAG, 2019					

Agriculture

The agriculture industry accounts for over 60 million tons of freight per year in the region. The Central Coast is notable for producing over 80 percent of the nation's lettuce, leading to its reputation as the "Salad Bowl of the World". It is also a major producer of broccoli, strawberries, and other specialty vegetables and fruits. Wine production is also prevalent in the Central Coast.

InfoUSA data shows high concentrations of agriculture businesses along the U.S. 101 corridor, with key clusters located around Salinas, south of Watsonville, Soledad, Santa Maria, and Paso Robles. Apart from U.S. 101, SRs 166, 41/46, and 156/152 are major interregional connecting routes between the Central Coast and the Central Valley that support these businesses, and therefore their conditions must continue to be maintained or improved to ensure efficient delivery of goods to market.

Manufacturing

Manufacturing is a diverse industry in the region, with key manufacturing clusters in Santa Cruz, Paso Robles, San Luis Obispo, Santa Maria, and Santa Barbara. Food manufacturing, which

includes wine production, is a particularly important component of manufacturing in the region. The key food manufacturing clusters are also located along the U.S. 101 corridor.

Transportation and Warehousing

Throughout the region, freight transportation is conducted mainly through trucking and rail, with connections to other modes in neighboring regions. Transportation and warehousing businesses are concentrated in areas that generally overlap agriculture and manufacturing clusters. Key clusters are in the Salinas Valley, northern U.S. 101, Paso Robles, San Luis Obispo, Santa Maria, and Santa Barbara. Truck connections include U.S. 101, SR 166, SR 41/SR 46, and SR 156/SR 152.

Freight Rail

Along the Central Coast Region, UPRR owns and operates the Class I rail system from Santa Barbara in the south, through Salinas, and continuing north into the Bay Area. Total freight rail outflow and inflow ranges upwards of 750 thousand tons within Caltrans District 5.

There is no east to west freight rail route connection between Caltrans Districts 5 (Central Coast) and 6 (Central Valley), which means there is absolute reliance on trucks for goods movement between these regions. With the Central Coast region agricultural sector growing, the Central Valley expanding its mega-distributions centers, and population growth occurring throughout both regions, we can anticipate significant truck volume increases on the SR 166, SR 41/SR 46, and SR 156/SR 152 corridors. Over the coming decades, mode shift from truck to rail freight will become increasingly important to offset GHG emissions and truck traffic congestion on the key east-west routes providing interregional connectivity.

Goods Movement Flows

Transporting goods in, out, and through the Central Coast region is heavily dependent on trucking. Approximately 75 percent of all shipments, measured by both tons and value, move by truck. The region imports higher priced consumer goods and specialty products while exporting relatively lower value agricultural products and some manufactured goods, mostly tied to the agricultural industry. In the Central Coast region, freight is projected to grow 3.3 percent a year by value between 2012 and 2040. More information can be found in **Figure 6B.2**.

By value, inbound shipments to the study region represented accounting for approximately 64 percent of the total value of goods in 2012. Outbound shipments accounted for approximately 35 percent, with intraregional shipments accounting for one percent. 2040 projections show that over 68 percent of the total value of goods moved in the region will come through inbound shipments, 31 percent through outbound shipments, and approximately one percent in intraregional trade.

Figure 6B.3. Central Coast Agriculture Production

Source: Data from ESRI Business Analyst; mapped by Cambridge Systematics (2019)

Domestic shipments are the dominant type of movement by both value and weight. By weight in 2012, imports and exports combined only accounted for five percent of shipments. By value, imports and exports accounted for less than four percent of shipments. The dominance of domestic shipments is projected to continue in 2040.

Figure 6B.3 shows the mode split for shipments into, out of, and within the study region in 2012. Measured by value, trucking was the dominant mode in 2012, accounting for 74 percent

of total shipments. Multiple Modes and Mail was the second highest mode, accounting for 13.3 percent of shipments. This reflects the use of multimodal and parcel services to carry higher value, lower weight shipments, as well as a continuing trend towards containerization (for intermodal truck-rail shipping). This also is seen in the lower share of goods moved by carload rail (only 1.8 percent), which typically carries lower value, bulk goods such as construction material, minerals, or waste/scrap.

In the Central Coast region, electronics (9.7 percent), machinery (9.4 percent) and mixed freight (7.6 percent) comprised the top three commodities moved by value and accounted for 27 percent of all shipments, which represents a strong consumer base, and high-tech and defense sector in the region. Commodities directly related to agriculture include other agricultural products (6.1 percent) and other foodstuffs (5.8 percent).

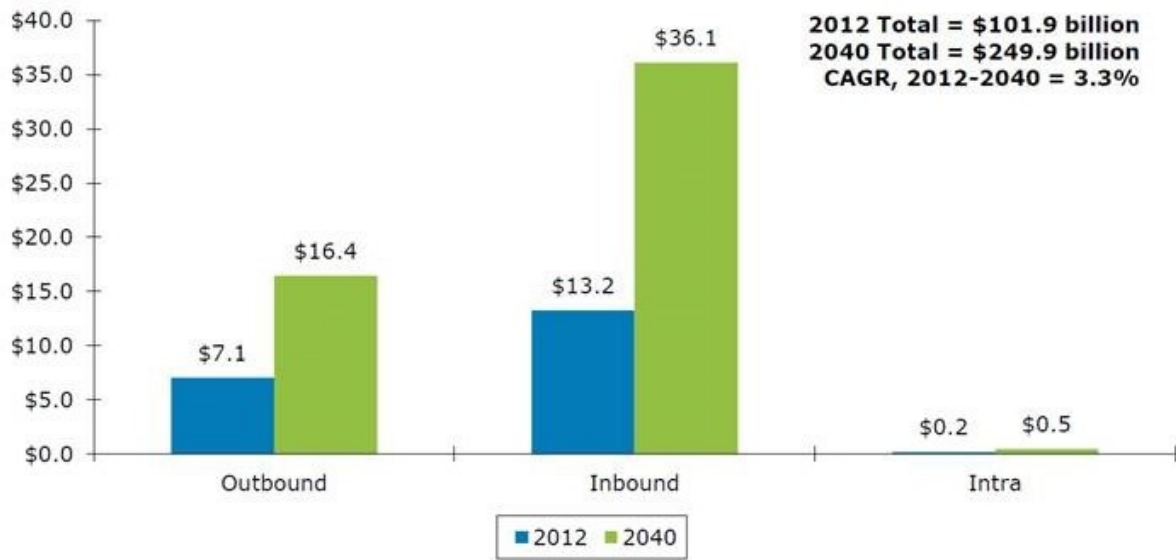
Trends

Over the next several decades, the Central Coast region can expect to see significant trends that hinder freight movement. Challenges to freight movement include population increases, changes in consumer demand (e-commerce shopping), and a significant increase in goods movement flow.

Population trends are a key driver of freight demand in any region, since the rate of growth or decline of the population impacts the volume of goods shipments required for consumption by local residents. The population of the five-county Central Coast region of California was approximately 1.4 million in 2010 (2010 Census). In total, the population of the five-county region grew by 5.1 percent from 2000 to 2010, or by nearly 70,000 people, which is about one-half the rate of the State's overall population growth. By 2040, the population of the region is expected to grow approximately 30 percent above 2010's levels, leading to an increase the number of trucks on the roads.³²

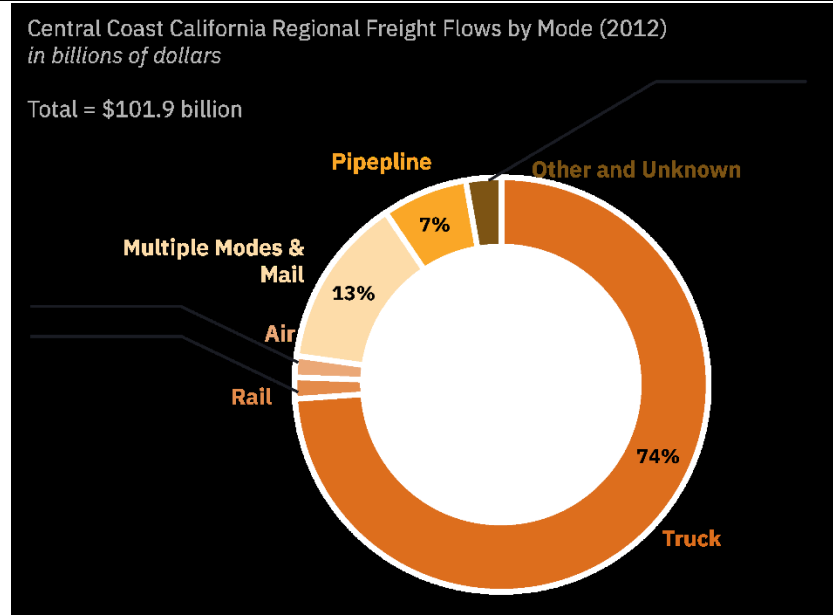
Not only is volume of goods increasing but also the frequency of demand. The rate of growth in demand for consumer products is related to population growth but also to income growth for families. For example, San Luis Obispo County median household income increased from \$57,365 in 2010 to \$67,175 in 2017 (2010 census) at a 17 percent increase over eight years. While median household incomes vary county by county, increases are trending upwards throughout the entire Central Coast region. This is an important trend to monitor and analyze moving forward as the growth in online e-commerce shopping is increasing the demand for freight shipments of parcels and other personal deliveries at a higher rate than population growth alone would suggest. These types of deliveries to local residences and businesses often place additional demand on transportation infrastructure that is not commonly used by freight, including local roads and neighborhood streets, all interconnected to the state highway system.

Figure 6B.4. Central Coast California Regional Freight Flows by Direction of Movement (2012 and 2040)



Source: AMBAG, "Central Coast California Commercial Flows Study," (2012); data from Federal Highway Administration, Freight Analysis Framework 3 (2012). Additional analysis by Cambridge Systematics (2012)

Figure 6B.5. Central Coast California Regional Freight Flows by Mode (2012)



Source: AMBAG, "Central Coast California Commercial Flows Study," (2012)

The increase in goods movement flow as noted previously is also a factor in transportation infrastructure challenges and needs in the Central Coast region. In 2012, freight tonnage flowed

primarily inbound and outbound at 62 and 60 million tons. The Central Coast region is trending to double tonnage by 2040 to a total approximate sum of 209 million tons, again by a near balanced outbound and inbound goods movement flow. At nearly a 63 percent increase in tonnage goods movement flow, the Central Coast region's transportation infrastructure is expected to be significantly impacted. Freight flows predominately by truck through the U.S. 101 which goes north to the Bay Area (Caltrans District 4) and south to the greater Los Angeles area (Caltrans District 7). SR 166, SR 41/SR 46, SR 156/SR 152 are east-west interregional connectors that are high-volume truck routes and critical to freight goods movement.

Section 2: Policies, Programs and Major Freight Infrastructure Investments

The policies that are proposed within the Central Coast region strategize to increase the accessibility and mobility of people and freight while reducing truck delay, enhance the integration and connectivity of the transportation system across and between modes, and identify and construct projects to improve freight movement, including rail and highway projects, and projects to improve ground access to airports and rail terminals in the region. The Central Coast region plans to regularly collect and update information on freight and goods movement and facility needs, with special focus on the critical U.S. 101 corridor. Policies also include consideration of freight and goods movement in the design and planning of all projects, creating plans for intermodal connectivity, and striving to reduce and mitigate environmental, social, health, and economic impacts from goods movement operations.

The Central Coast has many broad long-term needs for the freight infrastructure system that will help the region to support the 2019 CFMP vision. Below are a number of regional freight needs:

- Congestion relief and freeway conversion on U.S. 101. This corridor, U.S. 101, is the primary artery running north-south through the region and provides direct connectivity to major markets and intermodal facilities in the Los Angeles and San Francisco Bay Area regions.
- Improved east-west connections between U.S. 101 and I-5 in the Central Valley along SR 166, SR 41/SR 46, SR 156/SR 152, including improvements such as completing the SR 46 4-lane divided expressway conversion from U.S. 101 to I-5 and installing truck climbing and passing lanes to improve driver safety. Additionally, SR 25 is important in connecting more remote agricultural areas of southern San Benito County and will provide greater connectivity U.S. 101 for goods movement. The expressway conversion are critical improvements for the region.
- Improve at-grade highway interchanges and intersections. Some highway interchanges and at-grade intersections present challenges for trucks along the U.S. 101 Corridor. Highway interchanges, especially with SR 156 and SR 41/SR 46, are some of the most congested locations on U.S. 101. Additionally, at-grade intersections present challenges for safety of the traveling public (not just for trucks). As volumes increase on U.S. 101, the importance of freeway conversion becomes even more critical.

- Addressing truck parking issues. A lack of legal and safe truck parking has been identified in numerous plans as a challenge for commercial vehicle movements along the U.S. 101 Corridor and connected routes, such as SR 46.
- Ramp metering on U.S. 101 and key east-west routes in or adjacent to urban locations, emphasizing on-ramps that are particularly congested during peak harvest season times.
- Seek to add additional electronic changeable message signs along U.S. 101 and key east-west routes. Signs would be integrated with Caltrans District 5 Traffic Management Center. Closely linked with the need for CMS is the addition of Closed-Circuit Television (CCTV) monitoring cameras along U.S. 101 and key east-west intersecting routes to fill gaps in the existing CCTV network.
- Continued improvement to freight rail infrastructure including the development of truck-to-rail facilities near agricultural harvesting and/or packaging areas.
- At the local level, support expansion of the number of jurisdictions and municipalities with designated truck routes and improve truck route education amongst drivers to better guide truck movement to and from U.S. 101.
- Employ wayfinding tools to help truck drivers find fueling stations, parking locations, key freight origins and destinations, or other truck related infrastructure located in local municipalities.
- Truck driver training and labor policy improvements to alleviate the truck driver shortage.
- Agricultural worker housing and improved labor policies to reduce VMT associated with transportation of agricultural workers to and from the crop locations.
- Improve freight data availability. Caltrans truck counts are the only reliable source of information for truck movements in the California Central Coast, and they do not contain the detail needed to fully understand the movements of goods. Specifically, there is a need for regular surveys of freight movement on intersecting truck routes that go to and from I- 5. Also, additional data is needed on seasonality trends.

Figure 6B.6. Central Coast Key Highway Freight Routes

Source: AMBAG data, prepared by Cambridge Systematics

Los Angeles/Inland Empire

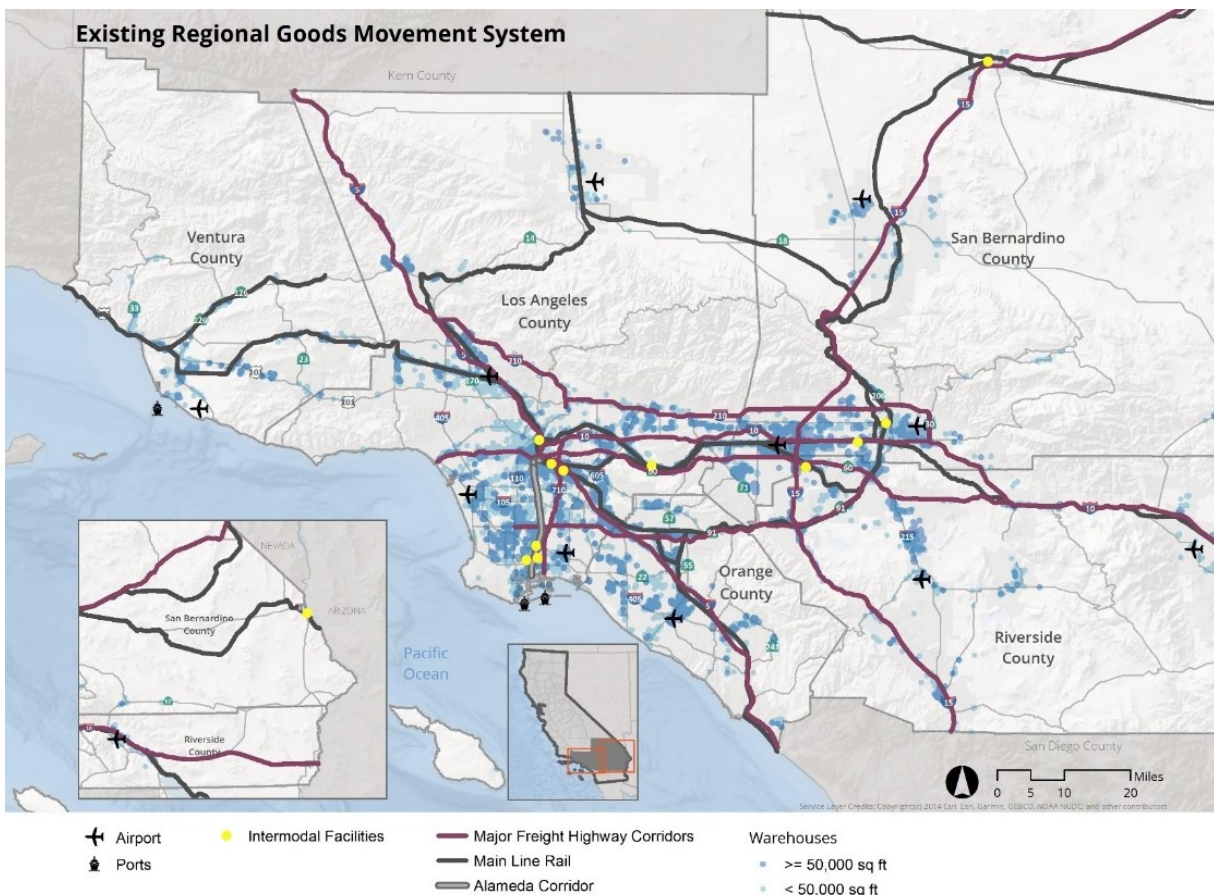
Section 1. Corridor Overview

Goods movement is essential to support the economy and quality of life in the Los Angeles/Inland Empire Trade Corridor comprising the counties of Los Angeles, Orange, Riverside, San Bernardino, and Ventura. The region's extensive goods movement system is a multimodal, coordinated network that includes deep-water marine ports, Class I rail lines, interstate highways, state routes and local connector roads, air cargo facilities, intermodal facilities, and industrial warehouse and distribution clusters. In 2016, nearly 1.8 billion tons of

goods valued at over \$2 trillion moved across the region's transportation system—serving local, state, national, and international consumer markets. The Ports of Long Beach and Los Angeles represent the largest container-based port complex in the U.S. for both imports and exports.

The industries and businesses in this region are world leaders in commerce and represent a major exchange point for international trade as businesses from across the globe trade via its seaport, airport, and highway facilities. Goods movement is woven into the fabric of life in the Corridor, but it still faces serious challenges that will require considerable collaboration and investment to remain a cornerstone of the local, regional, state, and national economy.

Figure 6B.7. Existing Regional Goods Movement System



Source: Map by SCAG (2019); data from CoStar

The Los Angeles/Inland Empire Trade Corridor partner agencies have established a vision for a regional goods movement system that is consistent with the CFMP vision and goals, as well as with the CSFAP principles. Additionally, the vision is a critical component of the Southern California Association of Government's (SCAG's) adopted Regional Transportation Plan and Sustainable Communities Strategy (RTP/SCS) and serves as the foundation of the Corridor's Freight Investment Strategy.

Investment That Targets Key Industries to Support and Sustain the Economy

In 2016, goods movement-dependent industries (manufacturing, construction, retail trade, wholesale trade, and transportation and warehousing) employed 2.3 million people in the SCAG region reflecting 37 percent of all employees and contributed over \$335 billion to Gross Regional Product (GRP), reflecting nearly 30 percent of all industries. Additionally, trade through Southern California's container ports supported nearly 3 million jobs throughout the U.S. The Corridor Freight Investment Strategy ensures that local and regional businesses have access to transportation services and facilities necessary to support growth by targeting investments in key corridors where these industries are located. The Los Angeles/Inland Empire Freight Investment Strategy promotes improvements in logistics system efficiency that will help contain rising costs of goods and services. This freight investment strategy also ensures that the region will continue to be a leading trade gateway for imports and exports to the Pacific Rim by supporting improvements in the marine terminals, intermodal terminals, railroad mainlines, roadway access routes to the seaports and airports, and industrial warehouse and distribution facilities.

Addressing Growth Through Multimodal Solutions, Freight System Efficiency, Safety and Operational Improvements

The Los Angeles/Inland Empire Investment Strategy includes projects and initiatives to promote the fluid movement of goods consistent with user expectations for a world-class transportation system that emphasizes multimodal solutions. The Los Angeles/Inland Empire Freight Investment Strategy supports rail mainline investments so that the regional rail system can accommodate the projected doubling of volumes without increasing delay and includes investments in highway and local access and connector improvements that eliminate truck VHT. The Los Angeles/Inland Empire Freight Investment Strategy also includes creative approaches to shared use corridors through increased separation of passenger and freight activities where possible, leading to a safer, more efficient transportation system.

Expanding the Goods Movement System While Providing for A Healthy Environment and Livable Communities

The Los Angeles/Inland Empire Freight Investment Strategy includes a strong commitment to reduced emissions from transportation sources by establishing a roadmap for the broad deployment of ZE/NZE transportation technologies. The development of a world-class ZE/NZE freight transportation system is necessary to maintain economic growth in the region, to sustain quality of life, and to meet federal and State air quality requirements.

The region has already made substantial progress on air quality, reducing 8-hour ozone levels by 40 percent since 1990 and particulate matter (PM) 2.5 emissions by over 50 percent, all while the population has increased by 20 percent—fully understanding that further progress is necessary. The Los Angeles/Inland Empire Freight Investment Strategy sets forth an aggressive technology development and deployment program to achieve this objective. The Los Angeles/Inland Empire Freight Investment Strategy also includes efforts to mitigate

neighborhood and community impacts to the maximum extent possible. The region has a rich history of working with various partners and stakeholders to lead the State's advancements towards ZE/NZE initiatives including:

- San Pedro Bay Ports Clean Air Action Plan (CAAP): The CAAP, updated in 2017, identifies strategies to reduce pollution from every source – ships, trucks, trains, harbor craft (such as tugs and workboats), and cargo-handling equipment (such as cranes and yard tractors). Since 2005, these strategies have resulted in emission reductions exceeding 85 percent for particulate matter, 50 percent for nitrogen oxides, and 95 percent for sulfur oxides.
- Clean Truck Program: This is a strategy in the CAAP to help reduce pollution from on-road drayage trucks, which mandates that any new truck registered within the Port Drayage Truck Registry after October 1, 2018 must be a model year 2014 or newer. Trucks must also be compliant with CARB Drayage Truck Regulation and Truck and Bus Regulation.
- CAAP Technology Advancement Program (TAP): The TAP is a key component of the CAAP that provides grant funds to defray the cost of testing new and emerging clean technologies, with the goal of accelerating their entry into the market so the entire industry has cleaner vehicles and equipment for moving cargo. Applicants for the TAP funding must show their projects have a high probability of reducing emissions of key pollutants and are likely to earn verification from the California Air Resources Board (CARB) confirming the technology achieves its stated pollution control goals. Projects must also show a strong business case for their commercial success. TAP's benefits include:
 - Identifying promising clean technology.
 - Helping to fund demonstration projects.
 - Accelerating government approval and market availability to industry.
- The Pacific Ports Clean Air Collaborative (PPCAC): The PPCAC has been working with numerous global stakeholders with the goal to share information, collaborate on common air and environmental issues, and work jointly to develop and evaluate potential port policies and mitigation measures.
- The Regional ZE Collaborative: The Collaborative comprising numerous stakeholders has been focused on efforts to share information and to jointly seek grant funding for supporting research and demonstration of ZE technologies.
- I-10 Multi-State Truck Parking Availability Systems Pilot Project: This project involves California, Arizona, New Mexico, and Texas, and is one of the CSFAP's identified pilot projects. The project's intent is to inform truck drivers of parking availability to provide better planning and scheduling of shipments.
- Other examples include: Port of Los Angeles Freight Advanced Traveler Information System (FRATIS) for optimizing truck movements, Drayage Freight and Logistics Exchange (DrayFLEX) which entails an enhancement of FRATIS, Port of Los Angeles Eco-Drive which is a connected (vehicle-to-infrastructure) demonstration project, Port of Los Angeles Port Optimizer™ serving as an information portal to digitize maritime shipping data for cargo

owners and supply chain stakeholders, Port of Los Angeles/Long Beach Advanced Transportation Management Information System (ATMIS) to improve roadway vehicular traffic and incident management within the Ports and their surrounding area.

Key Goods Movement Functions in The Economy

Goods movement is what economists refer to as a derived demand – the demand for goods movement is an outgrowth of overall economic activity. The goods movement system supports regional industries and global supply chains that trade in international, domestic, and local markets. To understand what drives demand for goods movement in the region, it is useful to think of four major functions supported by goods movement.

Provides Access to International Gateways

Southern California is the nation’s premier international gateway for imports and exports. The nation’s largest port complex, a large regional consumer market, and a vast supply of warehouse and distribution facilities have made it one of the nation’s largest centers for distribution of imported consumer products, while also serving as the largest container-based export market. The importance of the region’s gateways in connecting consumer goods manufactured in Asia with U.S. markets has been well-documented, and the overall importance of the system in supporting the flows of containerized goods continues to grow. In 2018, maritime and air cargo valued at \$543 billion moved through the Los Angeles Customs District. Nationwide, the POLA-POLB container volumes generate 2.7 million jobs and originate from or are destined for every region and congressional district in the U.S. Combined, the region’s three seaports (Port of Los Angeles, Port of Long Beach, and Port of Hueneme) and two international airports (Los Angeles International and Ontario International) make significant contributions to the regional and state economy.

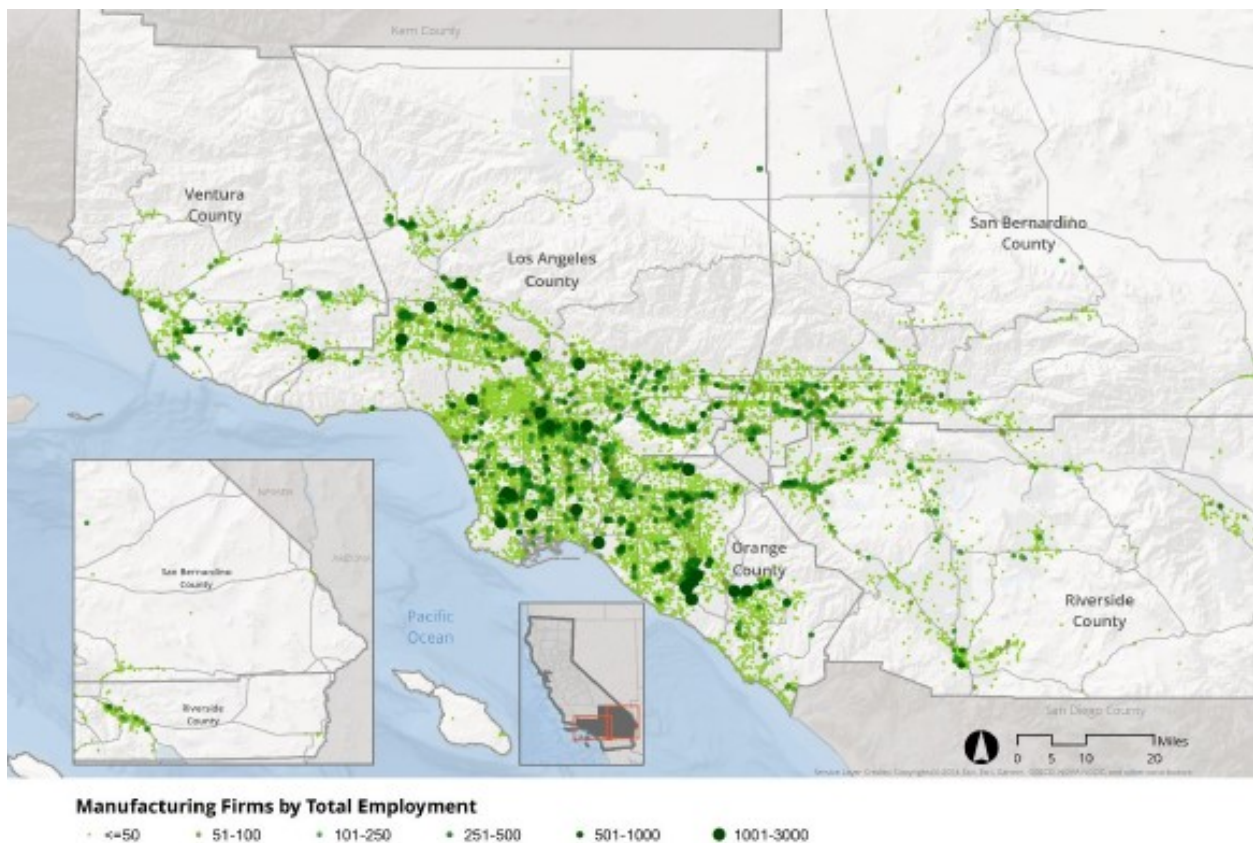
National and Regional Benefits to Rural Communities and U.S. Exports

While the POLA-POLB is widely acknowledged as the dominant U.S. port for containerized imports, it also serves as a leading export gateway, supporting goods produced in and exported from states across the continental U.S., thereby connecting rural areas to global markets. This is notable for top agricultural product exports from the Ports including frozen meat, cotton, fruit, nuts, soybeans, and hay. When combining product items such as frozen beef and pork, bales of cotton, pistachios, almonds, grapes, oranges, lemons, limes, soybeans, alfalfa, and other varieties of hay, the POLA-POLB exported 7.3 million metric tons with a value of \$10.6 billion in 2018. This ranked third against other major commodity category exports, only trailing machinery and parts (\$17.5 billion) and electric machinery and components (\$16.8 billion). Agricultural product exports support the economies of rural communities within many states in the U.S., notably California, the Southwest, Southeast, and Midwest regions, as well as the Northwest and Northeast.

Supports Regional Manufacturing Activities

Even at the height of the Great Recession, the U.S. remained the world's largest manufacturing economy, and Southern California continued to be a critical manufacturing hub. The Southern California region is the second largest manufacturing center in the country, trailing only the State of California as a whole. In 2016, manufacturing activities contributed approximately \$112 billion to the region's GRP with regional manufacturers trading in both international and domestic markets. The region's manufacturing sector is highly diverse with computer and electronic products, chemicals, transportation equipment, fabricated metal products, processed food, and machinery manufacturing. Higher-value, time-sensitive products, like computers and electronics, rely heavily on the region's truck and air cargo systems while bulk and heavy-weight products that are less time sensitive, such as chemicals and fabricated metals, generally use a mix of trucking and rail to move products.

Figure 6B.8. Manufacturing Firms in the Region



Source: Map by SCAG; data from InfoGroup

Serves the Needs of Local Businesses and Residents

Like most metropolitan areas of this size, a substantial majority of the region's goods movement activity is associated with local pickup and delivery, construction, utility, agriculture, and other services. Virtually all of this local activity takes place using trucks. As the region's population continues to grow, particularly on the eastern ends where land is less scarce, the

demands for consumer products distributed through the region's large wholesale and retail trade sector will continue to fuel growth in local distribution and service trucking. Another component of the local distribution and service function is the movement of materials and equipment to/from construction sites. In 2016, construction-related activities employed 325,000 people in the region and contributed \$43 billion to GRP.

Supports A Thriving Logistics Industry

In the Los Angeles/Inland Empire region, the logistics industry (which includes transportation, warehousing, distribution, and logistics services) has become an important component of the economy. Collectively, these industries rely on all components of the region's transportation system – ocean shipping and air freight (for international supply chains), trucking (for intra-regional shipments and drayage moves), and industrial warehousing and distribution (to support both international trade and local delivery of consumer goods). In 2016, transportation and warehousing activities provided nearly 300,000 jobs in the region and accounted for \$35 billion of GRP.

The Goods Movement System

The goods movement system in the Los Angeles/Inland Empire region is a complex series of interconnected infrastructure components that must operate as an integrated whole to serve the goods movement functions from a user perspective. Costs, throughput, velocity, and reliability of goods movement are driven by the end-to-end performance of this system. International trade and e-commerce have recently expanded the need for more fulfillment, sortation and local distribution centers, with closer proximity to major urban centers. Consumers now expect digital orders to be delivered within a day or less, and return policies to allow for unwanted items, increasing trip patterns across the system exponentially. The variety of modal alternatives, access to key goods movement centers, connections to markets and suppliers, and the quality of intermodal connections make Southern California an attractive center for goods movement activities.

The region's goods movement system, including many elements that share throughput with passenger traffic, is owned and operated by a mix of public and private sector entities. Understanding the interactions among the diverse mix of owners, operators, and users is critical to how the goods movement system functions.

Seaports

The region is home to three deep-water ports: the Ports of Los Angeles and Long Beach (San Pedro Bay Ports), and the Port of Hueneme in Ventura County. The Ports of Los Angeles and Long Beach are the two largest container ports (by volume) in the United States. Combined, the San Pedro Bay Ports in 2018 were the world's ninth busiest container port. The Port of Hueneme has developed a competitive focus on automotive and fresh fruit products with \$10 billion in total trade.

Containerized trade between the U.S. and Asia constitutes the majority of international cargo transiting the SCAG region, with approximately 35 percent of all containers in the U.S. moving through the San Pedro Bay Ports. About 40 percent of all U.S. imports and 25 percent of all U.S. exports move through the POLA-POLB. Despite some modest shifts recently in container volumes to other U.S., Canadian and Mexican ports, the San Pedro Bay Ports witnessed an all-time containerized cargo high during 2018 with a throughput of 17.6 million twenty-foot equivalent units (TEUs), and \$370 billion in trade value. Total container capacity is expected to double this amount to 34 million TEUs by 2035.

Imports, which constitute most of the containers that move through the San Pedro Bay Ports, may be categorized as local or discretionary. Local containerized traffic is that which is ultimately consumed in a geographical area local to the San Pedro Bay Ports (Southern California, Southern Nevada, Arizona, New Mexico, and southern portions of Utah and Colorado). Discretionary containerized traffic is that which moves to/from the POLA-POLB via rail, directly via on-dock and off-dock railyards, or indirectly via transload facilities. Recent analysis indicates that local traffic carrying containerized imports accounts for approximately 35 percent of San Pedro Bay Ports' total import-related traffic. The other 65 percent is assumed to be discretionary traffic, routed through the San Pedro Bay Ports for economic reasons. The San Pedro Bay Ports have long worked with regional and state transportation planning organizations to identify and promote projects that will alleviate congestion to and from port areas and improve air quality in the region. The POLB also serves as a national strategic seaport in the National Port Readiness Network and would be expected to move military/supplies for national emergencies and/or humanitarian efforts.

Airports

There are six airports that provide air cargo services in the region. Collectively, these airports handled nearly 3.3 million tons of air cargo in 2018. Los Angeles International Airport (LAX) and Ontario International Airport (ONT) handled approximately 97 percent of the region's international and domestic air cargo during 2018, including international goods valued at \$120 billion. LAX ranked 3rd in the U.S. for imports during 2018. Most of the remaining air cargo moves through Bob Hope (BUR), Long Beach (LGB), John Wayne (SNA), and Palm Springs International Airport (PSP). The share handled by the remaining airports combined was less than 3 percent in 2018.

Air cargo handled at the region's airports is served by a mix of commercial passenger carriers (often, referred to as "belly cargo"), integrated carriers (such as Federal Express (FedEx) and United Parcel Service (UPS)) which provide integrated air and truck service, and air cargo carriers. Both LAX and ONT provide all three of these types of air cargo carriage. Air cargo can be broken down by freight or mail with most freight products and components including high-value and/or time-sensitive shipments. Air cargo tonnage for international and domestic cargo is forecast to grow by over 140 percent to 7.8 million tons by 2045.

Rail

Critical to the growth of the economy, the BNSF and UPRR, the region's two Class I railroads, carry international and domestic cargo to and from distant parts of the country. The BNSF mainline operates on the Transcontinental Line (Cajon and San Bernardino Subdivisions). The UPRR operates on the Coast Line, Saugus Line through Santa Clarita, Alhambra and LA Subdivisions, and Yuma Subdivision to El Paso.

Both railroads operate on the Alameda Corridor that connects directly to the San Pedro Bay Ports as well as on the Alameda Corridor-East designated by Congress and the State of California. The San Pedro Bay Ports also provide several on-dock rail terminals along with six major intermodal terminals operated by BNSF and UPRR outside of the POLA-POLB. Within the Los Angeles/Inland Empire region, there are three Class III railroads: Pacific Harbor Line (PHL), serving the POLA-POLB, Los Angeles Junction Railway (LAJ) and the Ventura County Railroad (VCRR) that provide short-haul services.

Both UPRR and BNSF move container, automobile, liquid bulk, dry bulk, and break-bulk cargo inbound and outbound from the POLA-POLB. In addition to these intermodal terminals, there are railyards in the region that serve carload traffic of various types. UPRR also has a large carload freight classification yard at West Colton (at the east end of the Alhambra Subdivision). A large UPRR auto unloading terminal is located at Mira Loma (midway between Pomona and West Riverside on the Los Angeles Subdivision). BNSF also has an automobile facility located at the City of San Bernardino off of the San Bernardino Subdivision line.

Various shared-use agreements via trackage rights exist for both passenger and freight rail service, with the predominant mainline operations being owned and operated by freight rail operators. Growth in freight rail traffic is forecast to double over the next few decades.

Highways and Connectors

By 2035, the POLA-POLB is projected to handle about 34 million TEUs, which will generate close to 120,000 truck trips/day (from 68,000 in 2018) and further strain the nation's most important freight gateway. To put this volume in perspective, this amount of truck trips requires about 14 lanes of freeways. Additionally, 35 percent of all U.S. waterborne containers move by rail on the Alameda Corridor (part of the U.S. Department of Transportation – DOT designated National Multi-Modal Freight Network), or by truck on the I-710, I-110, and SR 47, all of which are important NHFN/ routes. The I-710 alone moves about 15 percent of all U.S. waterborne containers. The I-710 freeway offers direct access to the San Pedro Bay Port complex, as well as to points north and to almost every major east-west highway corridor, acting as a primary access route to the Gateway Cities subregion and Inland Empire. There are three bridges connecting the freeway system to Terminal Island: Vincent Thomas Bridge on the west, Commodore Schuyler F. Heim Bridge on the north, and Gerald Desmond Bridge on the east. The primary access route to the Port of Hueneme (the third international seaport in the SCAG region) is U.S. 101, along with the secondary routes of SR 126 and SR 1. As specified in the City of Oxnard's General Plan, the preferred arterial access route for trucks is Hueneme Road and Rice Avenue.

Two of the largest air cargo facilities at LAX are the Imperial Cargo Complex and the Century Cargo Complex. These facilities are located along West Century Boulevard and Imperial Highway, which, along with La Cienega Boulevard (connecting Century Boulevard and Imperial Highway), were identified by the Los Angeles Department of Transportation as the major arterial truck routes serving air cargo at LAX. Major freeway connections are provided by I-405 and I-105.

Sections of I-10, I-15, I-110, I-605, I-710, SR 57, SR 60, SR 78, SR 91, which carry the highest volumes of truck traffic in the region, averaged more than 25,000 trucks per day in 2016. Other major components of the regional highway network also serve significant numbers of trucks. These include I-5, I-215, I-405, and I-210. More than 20,000 trucks per day travel on some sections, such as SR 58 and I-40, among others, that reflect 50 percent of total traffic carrying agricultural goods. These roads carry a mix of cargo loads, including local, domestic, and international. The arterial roadway system also plays a critical role in goods movement, providing first and last-mile connections to regional ports, manufacturing facilities, intermodal terminals, warehousing and distribution centers, and retail outlets.

Industrial Warehouse and Distribution Space

Since the 2016 RTP/SCS, the Los Angeles/Inland Empire region has witnessed continued growth in warehousing, distribution, cold storage, and truck terminal facilities, with the square footage of facility space exceeding 1.2 billion. The mix of building sizes remains skewed to larger footprints with every two out of three buildings being greater than 50,000 square feet.³³ Industrial warehouse and distribution facilities have witnessed sustained growth in construction, with lease rates near all-time highs, and vacancy rates remaining near historic lows. The majority of the growth continues to occur in the Inland Empire as the counties of Riverside and San Bernardino have the most developable land zoned for industrial uses.

The industrial warehouse and distribution centers in the region are connection points for all modes of transportation and provide necessary services to stock inventory, transload and interchange transitional cargo, fulfill orders, perform value-added services such as just-in-time delivery, among others. Many of the region's warehouse and distribution facilities are clustered along key goods movement highway corridors such as:

- I-405 provides access to clusters of air cargo facilities where sorting and consolidation/de-consolidation activities occur near LAX;
- I-710 provides access to logistics service providers, truck terminals, and transload facilities serving goods movement industry near the San Pedro Bay Ports, as well as provides connections to the warehouse concentrations in Downtown Los Angeles and East Los Angeles, and intermodal rail yards. Approximately 15 percent of the region's warehousing space is located within a five-mile corridor along I-710;
- I-5 provides access to warehouse clusters in the Gateway Cities subregion and in areas in northern Orange County (such as warehousing clusters in Anaheim); and

- East-west corridors, including SR 60 and I-10, provide access to major warehouse clusters in the San Gabriel Valley (especially in the City of Industry) and the Inland Empire (including major concentrations in Ontario, Fontana, Mira Loma, Moreno Valley, SR 91, and I-215); SR 60 is a primary access route to many of these locations with over 50 percent of the region's warehouse space located in a corridor within five miles of the highway.

Section 2. Policies, Programs, and Major Freight Infrastructure Investments

Key regional policies, programs, and major freight infrastructure investments that support California's vision and goals are organized as follows:

- Roadway access to major goods.
- Movement facilities.
- Freight corridor system.
- Off-dock and near-dock intermodal yard projects.
- Mainline rail.
- On-dock rail.
- Rail access improvements to Port of Long Beach and Port of Los Angeles.
- Rail-highway grade separations (particularly on the Alameda Corridor-East).
- Bottleneck relief projects.
- Technology and other goods movement initiatives.

The CFMP 2020 goals are closely tied with one another, as each goal's expected benefits will lead to cumulative improvements across the region. Economic competitiveness is a product of speed and throughput, which is directly connected with congestion relief, safety and security, infrastructure preservation, and technology adoption. Environmental stewardship continues to play an important role for all goods movement in the Los Angeles/Inland Empire region as all stakeholders remain committed to a cooperative, close working relationship with the Governor of California and its State agencies. The region is the largest within the State and U.S. serving the needs of millions of households, business establishments, and government and non-profit organizations. This Regional Investment Strategy provides a range of thoughtful and carefully considered policies, programs, and freight infrastructure investments ranging from supporting the testing and deployment of the newest ZE/NZE technologies for vehicles, equipment and infrastructure, to planning, developing and building critical freight components to garner operational efficiencies and increase the throughput of goods movement throughout Southern California and the rest of the U.S.

The policies, programs, and freight infrastructure investments provide for operations, maintenance, and preservation of the system. Through the alignment of the region's vision, SCAG's RTP/SCS, POLA-POLB CAAP and TAP, among other plans and programs, including countless coordinated engagements with County Transportation Commissions (CTCs) and member agencies, the region's policies, programs, and freight investments are strongly aligned with those of the CFMP, and will support the objectives within, and principles of the CSFAP.

San Diego - Imperial Counties Border

Section 1. Corridor Overview

Situated between major production, trade, and population centers, San Diego and Imperial Counties depend on an integrated transportation network to effectively move people and goods within and through the region to the rest of the nation and around the world. Due to the interdependent nature of its binational economies, the Border Corridor's globally competitive business environment hosts a manufacturing sector that is one of the world's strongest cross-border supply chains, with a combined gross domestic product of approximately \$253 billion dollars for San Diego and Imperial Counties in 2018.³⁴

This Border region therefore connects some of the largest supply chains in the nation by bridging the major goods movement hubs in Southern California – the California-Baja California border region, the Ports of San Diego, Los Angeles, and Long Beach, and the Inland Empire distribution centers. For these connections to thrive, the freight transportation system in this Border Corridor includes interstate and state highways, Class I freight rail operations, short line railroads (most freight operations occur on tracks shared with passenger rail services), airport cargo systems, the Port of San Diego (with two working marine terminals), and the Otay Mesa, Tecate, and Calexico East commercial border crossings, which are described in detail below.

Air Cargo

Owned and operated by the San Diego County Regional Airport Authority, San Diego International Airport (SDIA) is the busiest single runway airport in the nation and second in the world behind Gatwick Airport near London. SDIA is one of three commercial airports, along with McClellan–Palomar and Imperial County airports, within the region. SDIA, which processes most of the Border Corridor's air cargo, handled more than 171,000 metric tons of air cargo in 2016. In 2018, SDIA handled approximately 192,351 metric tons and is projected to handle 335,400 metric tons in 2050, which equates to an average increase of approximately 1.8% per year. BAX Global, DHL, Federal Express (FedEx), and United Parcel Service (UPS) are the four all-cargo airlines that serve SDIA. Currently, air cargo capacity at SDIA is constrained by limited infrastructure, as well as first and last mile connections. Opportunities to leverage growth through the border-adjacent Tijuana International Airport, including the proposed Matrix air cargo and logistics park, could help alleviate some demand in the San Diego region.

The Imperial County Airport provides air service for private, commercial passenger, and freight transportation. Currently, freight is transported through the courier services of FedEx and UPS. At the Imperial County Airport, there are daily scheduled airline flights, air cargo, military operations, Department of Homeland Security aircraft, as well as several business jets and private general aviation flights. The Calexico International Airport also facilitates cross-border and international travel, with U.S. Customs and Border Protection (CBP) Inspection Officers based at the airport. The Holtville Airstrip is currently closed to civil aircraft operations but does have future economic development potential for a future regional air cargo and passenger facility. In 2007, the Imperial County Airport Feasibility and Site Analysis Study identified the

Holtville Airstrip as a feasible regional airport facility. Since 2017, Imperial Valley stakeholders are pursuing the opportunity of a new regional airport facility.

Land Ports of Entry

Currently, the seven land Ports of Entry (POEs) in the Border region serve more than 154 million people and represent over \$75 billion dollars in cross-border trade annually, including over \$24 billion dollars' worth of goods crossing southbound.^{35,36} A new POE, Otay Mesa East, is under development and several are undergoing expansion and improvement. Otay Mesa and Calexico East currently handle 99 percent (by value) of all border commercial shipments. The Otay Mesa POE is a multi-modal land POE which processes commercial vehicles, passenger vehicles, and pedestrians. Otay Mesa is the busiest commercial facility on the California-Baja California, Mexico international border handling the second-highest volume of trucks, and the third highest dollar value of bilateral trade among all U.S.-Mexico land POEs (\$46.7 billion). In 2018, the Otay Mesa POE handled more than 962,000 trucks, 29,000 buses, more than 13.3 million passengers in personal vehicles, and 3.4 million pedestrians crossing northbound into the U.S.

In Imperial County, the Calexico East POE is the principal gateway for trade by truck in Imperial Valley and the second busiest commercial POE on the California-Baja California border. In 2018, Calexico East processed \$6.6 billion in exports and \$10.2 billion in imports, ranking seventh among the U.S.-Mexico commercial border crossings in terms of trade value carried by truck. The same year, the POE processed more than 376,000 trucks, nearly 6.5 million passengers in personal vehicles, and more than 300,000 pedestrians northbound into the U.S.

Maritime

San Diego Bay is a natural, deep-water harbor located approximately 96 nautical miles southeast of the Port of Los Angeles and less than 20 miles north of the United States-Mexico International Border. Location, deep-water berths, and proximity to highways and rail earned the Port a designation as one of 17 "strategic ports" by the U.S. DOT, Maritime Administration. San Diego serves one of the largest U.S. Navy fleets and is home to the only major shipyard on the west coast of the U.S.

The Port of San Diego's maritime facilities include one cruise ship terminal and two cargo terminals: Tenth Avenue Marine Terminal (TAMT) and National City Marine Terminal (NCMT). In 2017, the two terminals handled about 1.5 million in short tons of cargo. Built in the 1950s, the TAMT is a general cargo terminal that supports cool-frozen food storage, break bulk, dry-liquid bulk, small container operations, and construction materials. The NCMT is a primary maritime POE for imported automobiles and lumber, with the capacity to handle 500,000 motor vehicles for distribution by rail and truck throughout the nation.

The Port's maritime capacity at TAMT is growing as a result of a U.S. DOT Transportation Investments Generating Economic Recovery (TIGER) grant project that was awarded to the Port in 2015 and will be completed in 2020. This project will modernize TAMT by supporting modern, clean, and efficient technology while increasing cargo operations. The port has already

added one break bulk liner service to Europe and a bulk service from Mexico because of that grant project and additional liner services are likely. The National City Balanced Plan will restructure the layout of the NCMT and surrounding area in order to increase community amenities and increase efficiencies in the marine terminal. Challenges for the marine terminals include optimizing their limited terminal space and deploying cutting-edge ZE/NZE infrastructure and equipment to meet State environmental requirements. Growth in maritime volumes must be complemented by enhanced terminal capabilities, such as additional on-dock rail, and improved highway access. The Port's proximity to the communities of Barrio Logan and West National City necessitates context-sensitive community improvements to support Port access projects.

Pipeline (Petroleum)

In the San Diego region, Kinder Morgan Energy Partners (a private company) is the key provider of bulk freight transport by pipeline. The pipeline network runs between Orange, California and the Kinder Morgan Terminal in San Diego (Mission Valley). The 66-acre terminal has capacity to distribute significant amounts of petroleum products by truck on the I-5, I-8, I-805, I-15 freeways. The volume of petroleum products shipped by pipeline in the region is projected to continually increase. Improved truck access to this pipeline terminal could ensure the efficient delivery of petroleum products.

Imperial County has a major petroleum products pipeline, which consists of a 20" diameter petroleum products pipeline from the Los Angeles Basin to Yuma, Arizona. Also, from this main pipeline, a 10" pipeline extends southwest from a connection at Niland to a petroleum products terminal in the City of Imperial. This pipeline also provides aviation fuel to the El Centro Naval Air Facility via another extension.

Rail

BNSF Railway and UPRR, two Class I railroads, operate in the Corridor. BNSF serves the Port of San Diego providing primarily automobile rail service north and south along the coast, interfacing in Los Angeles with a primary California freight rail corridor for BNSF – the Transcontinental (Transcon) Route – eastward to Chicago, Memphis, and Kansas City. UPRR serves the Imperial Valley near Plaster City, moving commodity, bulk, and mixed cargo eastward to Salt Lake City, Dallas, and Chicago. In addition, the Border region has two operating short line railroads – the Pacific Sun Railroad (PSRR) and the San Diego and Imperial Valley Railroad (SDIV) - and the proposed rehabilitation of the Baja California Railroad (BJRR).

The region's rail operators handled commodities such as motor vehicles, lumber, chemicals, petroleum, agricultural products, cement, and aggregate. Freight capacity is constrained by limited infrastructure and sharing of track with passenger operations including Amtrak, Metrolink, COASTER, SPRINT, and the San Diego Trolley.

Imperial County is served by rail connections from Mexico, Riverside County, and Arizona. Commodity flows by rail account for about 3% of total commodity flows in the county. The

UPRR owns and operates a line originating at the Calexico West POE, extending north to El Centro and ultimately connecting with other UPRR tracks at Niland, heading north to Riverside County and southeast to Arizona (Sunset Line). UPRR also owns and operates the section between Plaster City and El Centro. That section is in service and connects with other UPRR lines at El Centro. Finally, the Carrizo Gorge Railway (CZRY) owns the rights to operate on a small section of tracks in the western portion of the county between the San Diego County line and Plaster City. This section of the rail line is currently closed for operations; however, there are potential operators and investors exploring opportunities to re-open the line for freight movement between the San Diego-Tijuana region to and through the Imperial-Mexicali region. At the Calexico West POE, the rail line processed \$136 million in trade with Mexico in 2018. Currently, at the Calexico West POE/UPRR Rail Yard CBP staff is scheduled from 3:00am to 11:00am. The peak period of rail border travel occurs between 4:00am and 6:00am Monday through Friday.

Roads/Highways

Most freight in the Border Corridor travels by truck. Congested freeways and highways slow the movement of freight, particularly at major freight hubs including POE crossings and the Port of San Diego. Major east-west routes include I-8 (from coastal San Diego to the Arizona border), SR 52, SR 54, SR 76, SR 78, SR 94, SR 98, and SR 905. Major north-south routes include I-5 (United States/Mexico Border north through San Diego County, up the entire West Coast to the Canadian Border), I-15 (a northeast route that continues to the Canadian Border with Montana), I-805, SR 86, SR 111, and SR 125. Routes primarily connecting POEs are I-5, I-805, SR 7, SR 11 (under construction for future connection to the planned Otay Mesa East POE), SR 188, and SR 905.

The Imperial County freight highway network provides an interregional connection for shipping and logistics that handles approximately 97 percent of total commodity flows across the county. There are four major north-south corridors handling freight within the county: Forrester Road, from I-8 to SR 78/86 in Westmorland; SR 7 from the Calexico East Port of Entry to I-8 Freeway; SR 111 from the Calexico West Port of Entry to SR 86 in Riverside County; and SR 86, from SR 111 to Riverside County where it connects with I-10. Additionally, there are two major east-west corridors for trucks: I-8 freeway which originates in San Diego County through Imperial to the California/Arizona Border; and SR 98 which parallels I-8 through most of the southern part of the county. The Imperial freight highway system facilitates the movement of goods from the international border with Mexico and \$2 billion in agricultural products from Imperial County through to Coachella Valley in Riverside County with connections west to the Los Angeles/Long Beach Seaports and other key distribution centers throughout California.

Section 2. Policies, Programs, And Major Freight Infrastructure Investments

The California – Baja California border region is one of the most important and dynamic economic zones in North America. However, demand is growing at a pace that will outstrip supply at the California-Mexico border crossings. While the crossings are a critical element of the bi-national region's economic integration and competitiveness, growing demand has led to

greater congestion at border crossings and increased delay and unreliable crossing times for cars, trucks, and pedestrians at California-Baja California ports of entry. These delays and uncertainty at the border have the potential to reduce economic competitiveness and attractiveness of California to businesses, which can translate into lower levels of economic activity and growth.

Policymakers face the complex task of enhancing mobility for residents, workers, and businesses while at the same time supporting international trade by improving the efficiency of regional airports, seaports, and land-border crossings. To assist in this task, identifying types of infrastructure investments that will best contribute to economic growth is important. To enhance efficiency at the international trade gateways, the strategies adopted should address the growing needs to limit congestion and waiting times. Businesses can be enabled to take advantage of scale economies as well as agglomeration economies from consolidation of related production and warehousing facilities. Ultimately, a more efficient and improved border-region transportation system will support California's sustainability and trade growth.

In order to address the unique needs of this region, the San Diego Association of Governments (SANDAG) San Diego Forward: The 2019 Federal Regional Transportation Plan (RTP) and the Southern California Association of Governments (SCAG) 2016-2040 RTP/Sustainable Communities Strategy (SCS) form the foundation of this Border Corridor Freight Investment Strategy. Both of these documents review our goods movement system in detail, but this Freight Investment Strategy focuses on a few key points, including:

- How goods movement contributes to the regional economy.
- Goods movement planning is driven by sophisticated logistical practices that involve lean delivery approaches.
- There are both inherent conflicts and synergies between personal travel and the movement of goods (e.g., they often share the same assets at the same time, and operations have to be planned carefully).
- The movement of goods has to be planned and managed, so operations are sustainable.

Whenever and wherever possible, this Freight Investment Strategy strives to balance the need for mobility, reliability, and speed, the capacity for growth and innovation, economic competitiveness goals, and the importance of clean air and healthy communities.

The Border region agencies have also been some of the first to integrate sustainable efforts into their freight strategies and projects. Caltrans District 11, in partnership with SANDAG, Imperial County Transportation Commission, SCAG, and other stakeholders, is making progress in implementing the initial phases of their Advanced Technology Corridors at Border Ports of Entry pilot project. These initial phases focus on installing equipment to measure southbound border wait times and displaying this information through an advanced traveler information system in order to better manage commercial and passenger vehicle traffic at the border. Caltrans District 11 and SANDAG will be installing air monitoring equipment to track progress in improving air quality in border communities. In addition, the San Diego Port Tenants Association, through a

California Energy Commission grant, recently transitioned some of their fleet to ZE/NZE vehicles and is currently implementing a freight signal prioritization (FSP) pilot project along Harbor Drive. The Port of San Diego is hoping to expand this FSP project to adjacent areas of Harbor Drive and is currently working with the AB 617 Portside Steering Committee on strategies to improve air quality in the surrounding communities. After hosting a truck parking summit in 2018, the Port of San Diego, Caltrans District 11, and SANDAG are also looking into potential truck parking opportunities.

Examples of regional policies and programs are shown in **Table 6.B.6**. As SANDAG and SCAG are in the midst of updating their respective RTP/SCS documents, these and any new freight policies and investments will be updated through the CFMP amendment process in order to capture the latest adopted strategies.

Table 6.B.6. Regional Policies and Programs by County

Regional Policy/Program	County
Collaborate with U.S. and Mexican agencies, community members, commercial industry representatives, and additional stakeholders on freight projects and policies	San Diego/ Imperial
Collaborate with stakeholders, including community members, public agencies, and commercial industry representatives on the implementation of air quality improvement programs	San Diego/ Imperial
Collect or procure freight origin-destination data to determine intraregional and interregional flows and better inform planning decisions	San Diego/ Imperial
Develop a curbside and sidewalk management strategy for urban deliveries	San Diego
Encourage context-sensitive community improvements that support access to freight hubs	San Diego/ Imperial
Update SANDAG's Freight Gateway Study with the latest freight data, trends, and innovations	San Diego/ Imperial
Develop and implement truck parking strategies	San Diego/Imperial
Encourage operational improvements to better manage vehicle and rail traffic in the region	San Diego/Imperial
Expand ZE/NZE infrastructure	San Diego/Imperial
Source: Caltrans	

Endnotes

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<https://www.portofoakland.com/community/economic-impact/powering-jobs/>
- ²²Bay Area Air Quality Management District: West Oakland Community Action Plan.
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³⁶Note: The 154 million people value is derived from the 77 million people that crossed northbound in 2018 (assumed that those crossing return), and the \$75 billion trade value includes truck and rail.